OPERATION AND MAINTEANCE MANUAL

FOR

CIC ZERO CARBON BUILDING

AT

SHEUNG YEE ROAD,

KOWLOON BAY, KOWLOON

KRUEGER ENGINEERING (ASIA) LTD

MAY 2012

Content

1. GENERAL INFORMATION

Project Title:	Zero-Carbon Building at Sheung Yee Road, Kowloon Bay, Kowloon
Site Address:	Lot No. GLA-NK786, Junction of Sheung Yuet Road,Kowloon Bay, Hong Kong
Sub-Contractor:	Krueger Engineering (Asia) Ltd.
Telephone no.:	2860 7333
Project Completion:	22 June 2012
Maintenance Duration:	12 Months

2. DESCRIPTION OF SITE/ BUILDING

The project is a zero-carbon demonstration building with sustainable building and system design. The site is located at lot no. GLA-NK786, junction of Sheung Yuet Road, Kowloon Bay, Hong Kong.

The building comprises of the following:
- Basement level (B/F) for mechanical and electrical plantroom;
- Ground floor (G/F) with office area and multi-purpose room;
- Mezzanine floor (M/F) with exhibition area;
- Roof with PV panels;
- Landscape area with covered walkway and eco-cafe.

3. OPERATION AND MAINTEANCE OF SYSTEM

3.1. Main Chiller Plant

3.1.1. System Description

Combined Cooling, Heat & Power (CCHP) system uses biodiesel to generate both electrical and thermal energy to run the chiller system and meet the building cooling and electrical loads. The system is renewable as the fuel is biodiesel.

In this design, a new approach towards chilled water production in a building has been adopted. The technique is 'energy grading': ranking the full range of possible renewable sources against end-use energy needs, to generate a checklist of building design priorities. The key issue is to match the lowest possible grade of source against the grade of the end demand.

Energy grading highlights interesting issues, like the inherent inefficiency of many conventional systems that consume high-grade energy and deliver only low-grade energy to building users. In this design, the inefficiency of energy penalties of using high grade energy is reflected in the form of electricity for chilled water production and dehumidification. Waste heat generated is utilized as a by-product of the generator to meet these demands.

The central cooling plant consists of absorption chiller (by CCHP Contractor) operating alongside with water-cooled electric chiller (by this Contractor). Absorption chiller absorbs the waste heat from the generator and produce chilled water. Minimal electricity demand is required in this process. The absorption chiller and electric chillers deal with the cooling load provided by underfloor air conditioning and ceiling air supply.

Chilled water circuit from absorption chillers and electric chiller feed a constant temperature loop (11°C) to air handling unit coils and a higher temperature (16°C) to chilled beams. Chilled water circuit consists of duty and standby pumps. The chiller plant is located in the basement. Chilled water is distributed to the centralized air conditioning system of the entire building and the amount of chilled water supply is varied in accordance with the actual cooling demand for energy saving during part-load operation.

Central control & monitoring system (CCMS) is provided by CCHP Contractor. It mainly controls and monitors the combined cooling, heat & power (CCHP) plant, the central cooling and heat rejection system as well as chilled water and hot water distribution

system. It aims to ensure optimum operation of every equipment of the central cooling system in responding to actual building cooling load and electricity demand.

The chilled water system shall consist of three numbers of 78.3 kW scroll type water-cooled chiller , using environmental friendly refrigerant R407c, and 4 numbers of variable speed chilled water pump, 3 duty and 1 standby, located at basement chiller plant room. Make-up water to the system shall be provided from a package type pressurized make-up tank. Water treatment facilities will be provided via a chemical dosing system in the chiller plant room.

For the chilled water system control, differential bypass arrangement for chilled water flow control is provided, a two-way modulating by-pass valve is installed between the common chilled water supply and return headers. The by-pass valve is controlled by pressure differential sensor across the main chilled water supply and return headers in order to maintain a pre-set differential pressure across the system.

The system cooling demand can be calculated by a stand-alone DDC controller utilizing input data of chilled water flow rate, supply and return chilled water temperature. The chilled water plant shall operate under the control of Central Control and Monitoring System (CCMS).

3.1.2. Water Cooled Chiller

(Please refer to Operation and Maintenance Manual from Trane)

TRANE®

Installation
Operation
Maintenance

Genie

CGWP Small Scroll Chiller
Cabinet Water Cooled Cold Generator
10~100 Tons

CGWP-SVX01B-EN

TRANE

Contents

Introduction

Foreword

The aim of this document is to set out the rules for the installation, set-up, operation and maintenance of this type of Trane water cooled liquid chillers.
The maintenance operations required to insure that this machine operates reliably throughout its full service life are not exhaustively described. Only the services of a qualified technician employed by a reputable service company can ensure that the machine operates durably and reliably.

Warranty

The warranty is void if the equipment is modified without the written approval of Trane, if the operating limits are exceeded or if the control system or the electrical wiring is modified.

Damage due to misuse, lack of maintenance or failure to comply with the manufacturer's instructions or recommendations is not covered by the warranty obligation.

Acceptance on delivery

All air-conditioning units are shipped to their installation site on a wooden skid.
All machines reach final destination completely connected and assembled ready for immediate start-up.

Please check that the unit has not in any way been damaged during transport, as soon as it arrives on site. If damage is observed, or even on suspicion of damage: Carry out instructions for notification of damage in transport, and warn your Trane Agency.

Caution:
Failure to conform to the above rules will result in loss of insurance coverage.

General

About this manual:
"Caution" and "Warning" messages appear at the appropriate place throughout this manual. Your personal safety and the proper operation of this machine require that you follow them carefully.
Trane Taiwan assumes no liability for installation or servicing performed by unqualified personnel.

Refrigerant

The refrigerant provided by the constructor meets all the requirements of our units.
When using recycled or reprocessed refrigerant, it is advisable to ensure its quality is equivalent to that of a new refrigerant.
For this, it is necessary to have a precise analysis made by a specialized laboratory. If this condition is not respected, the constructor warranty could be cancelled.

TRANE

Product Nomenclature

CGWP	010	5	C	D	R	N	N	N	A
1,2,3,4	5,6,7	8	9	10	11	12	13	14	15

DIGIT 1,2,3,4 – Chiller Type

CGWP = Water-cooled Scroll Chiller

DIGIT 5,6,7 – Model(nominal cooling capacity)

010
012
015
020
025
030
040
050
060
080
090
100

DIGIT 8 – Voltage

1 = 220V/60Hz/1Ph (Model 010 only)
2 = 220V/60Hz/3Ph
3 = 380V/60Hz/3Ph
4 = 440V/60Hz/3Ph
5 = 380V/50Hz/3Ph
6 = 400V/50Hz/3Ph
7 = 415V/50Hz/3Ph

DIGIT 9 – Development Sequence

C = Third

DIGIT 10 – Number of Compressors

D = Dual Compressors (010~030, 2circuits)
F = Four Compressors (040~100, 2circuits)

DIGIT 11 – Water Connection

R = Right Hand Side (standard)
L = Left Hand Side (010~060 only)

DIGIT 12 – Control

N = Traditional Electrical Control (Standard)
U = Microprocessor

DIGIT 13 – Future Use

N = No (Standard)

DIGIT 14 – Options

N = No (Standard)
S = Spring Isolator

DIGIT 15 – Design Sequence

A = First

Installation

Unit nameplate

The unit nameplate gives the complete model reference numbers.
The unit power rating is shown, and power supplies should not deviate by more than 10% from the rated power.
The customer's electrical installation must be able to withstand this current.(Figure 1)

Installation instructions

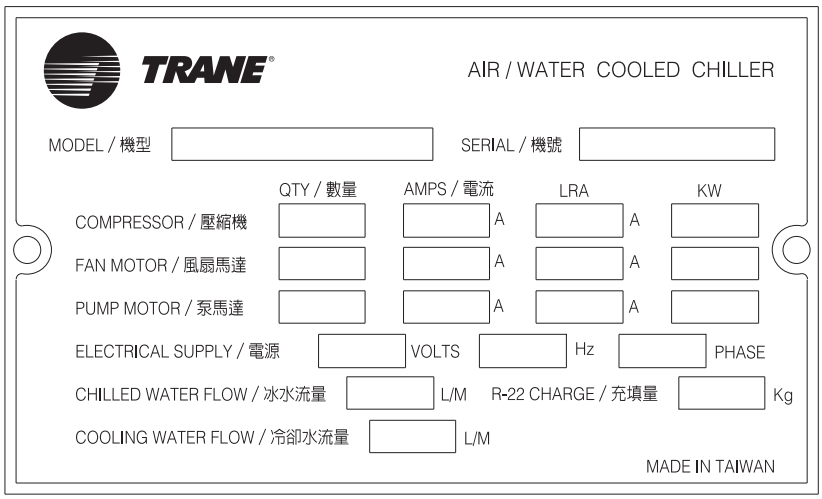
Foundations

No special foundations are required, provided the supporting surface is flat and level, and can withstand the weight of the unit.

Clearance

Insure there is sufficient clearance around the unit to allow maintenance operations to take place without obstruction.

Figure 1: Unit Nameplate



Handling

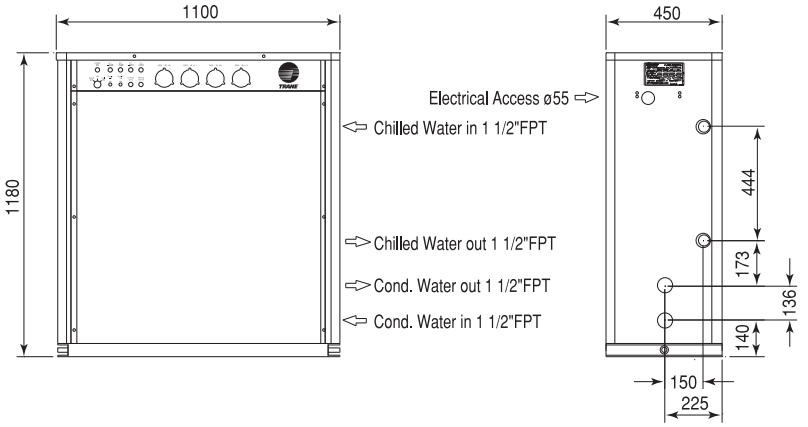
Handling with suitable equipment.
The dimensions and weights are shown in figure 2~3.

Weight for handling

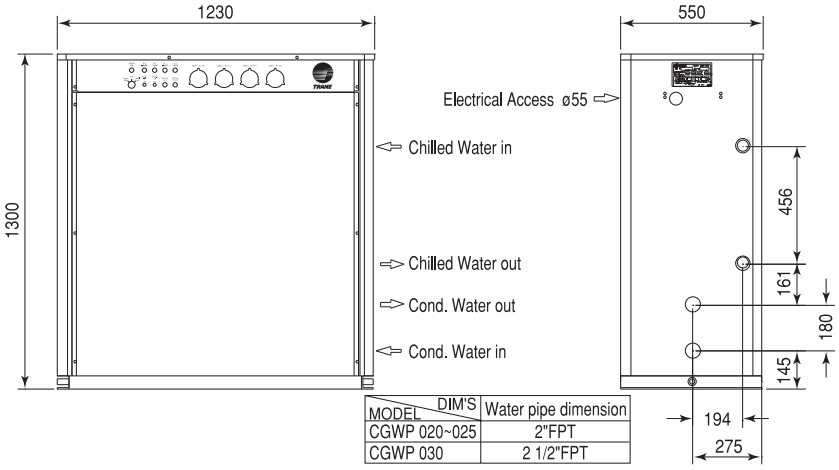
Dim's / Model	weight (kg)
010	285
012	325
015	365
020	500
025	540
030	580
040	980
050	1060
060	1140
080	1900
090	2000
100	2100

Figure 2: Dimensions of CGWP010~030 (Dual Compressors)

CGWP010~015



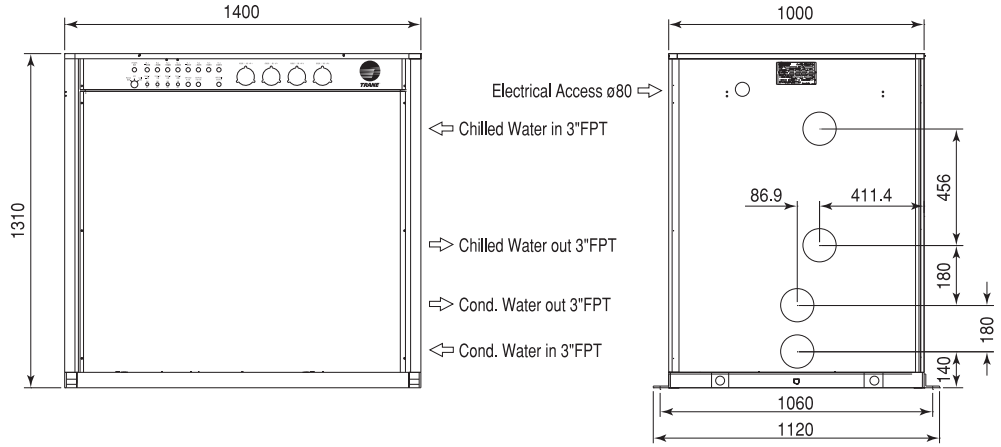
CGWP020~030



MODEL \ DIM'S	Water pipe dimension
CGWP 020~025	2"FPT
CGWP 030	2 1/2"FPT

Figure 3: Dimensions of CGWP040~100 (Four Compressors)

CGWP040~060



CGWP080~100

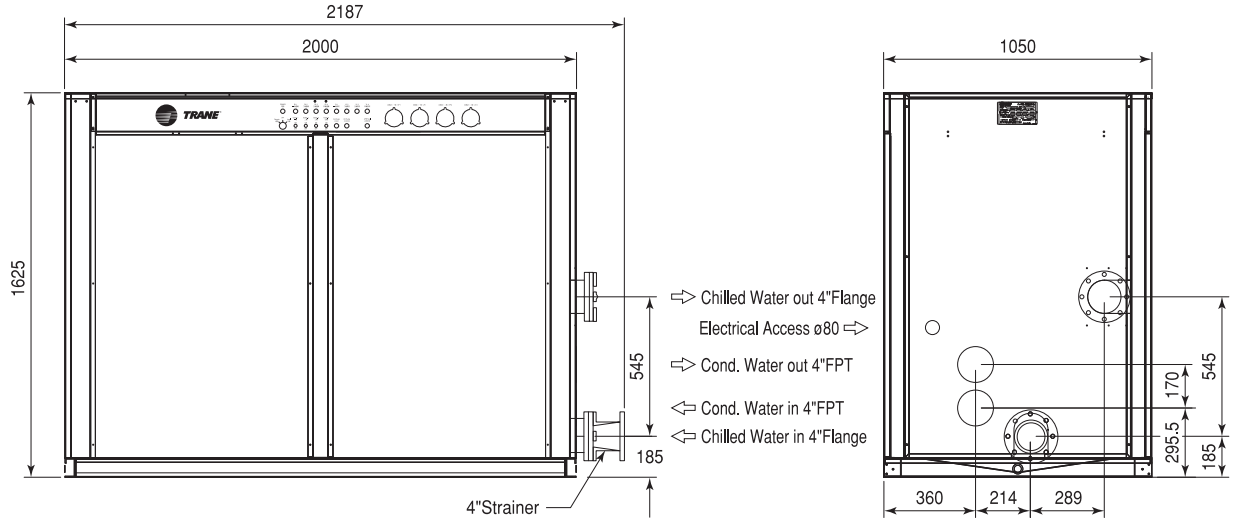


Figure 4: Inlet / Outlet Piping Recommendation
CGWP010~030

Moel \ DIM'S	A	B
CGWP 010~015	1160	400
CGWP 020~030	1190	500

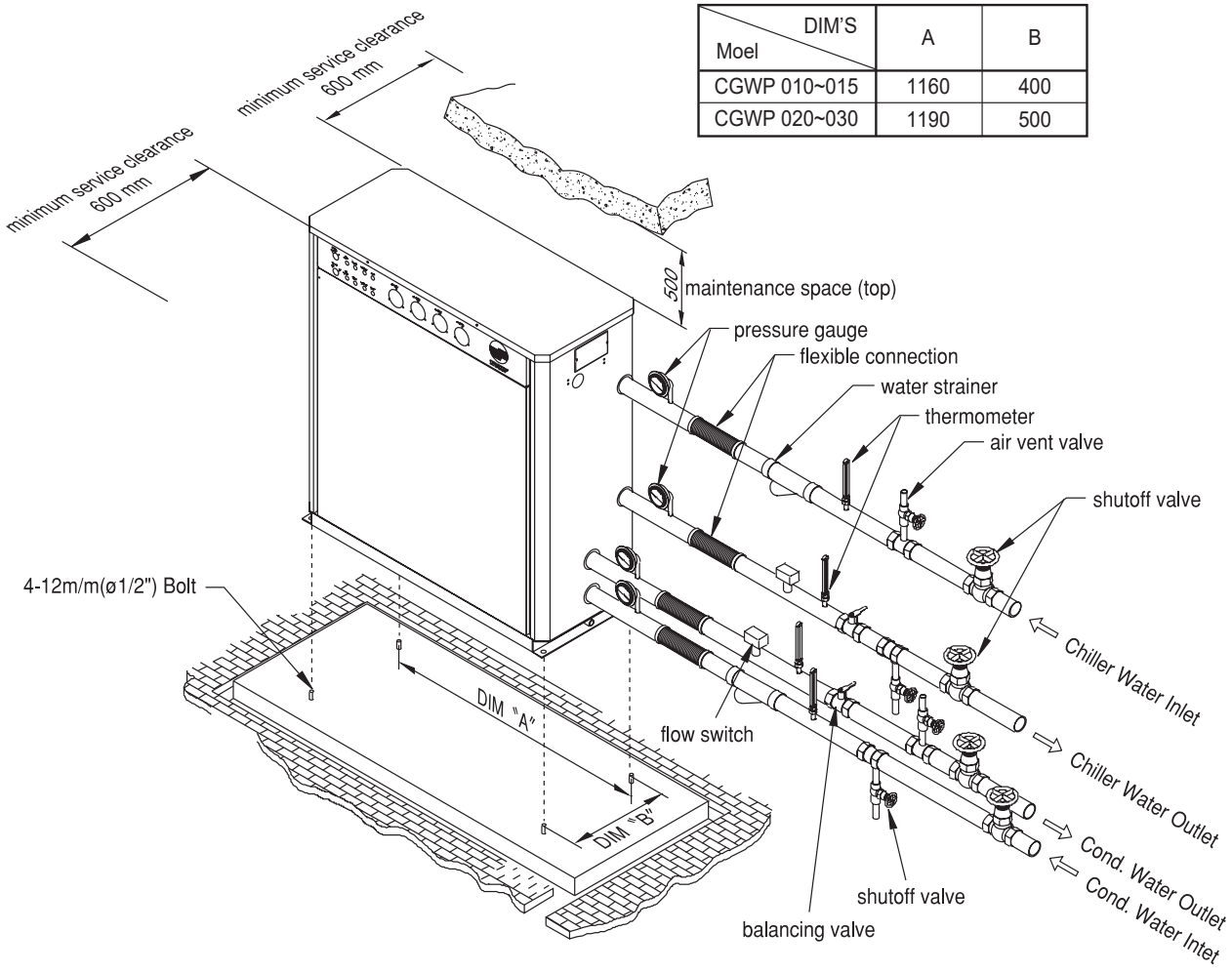


Figure 5: Inlet / Outlet Piping Recommendation
CGWP040~060

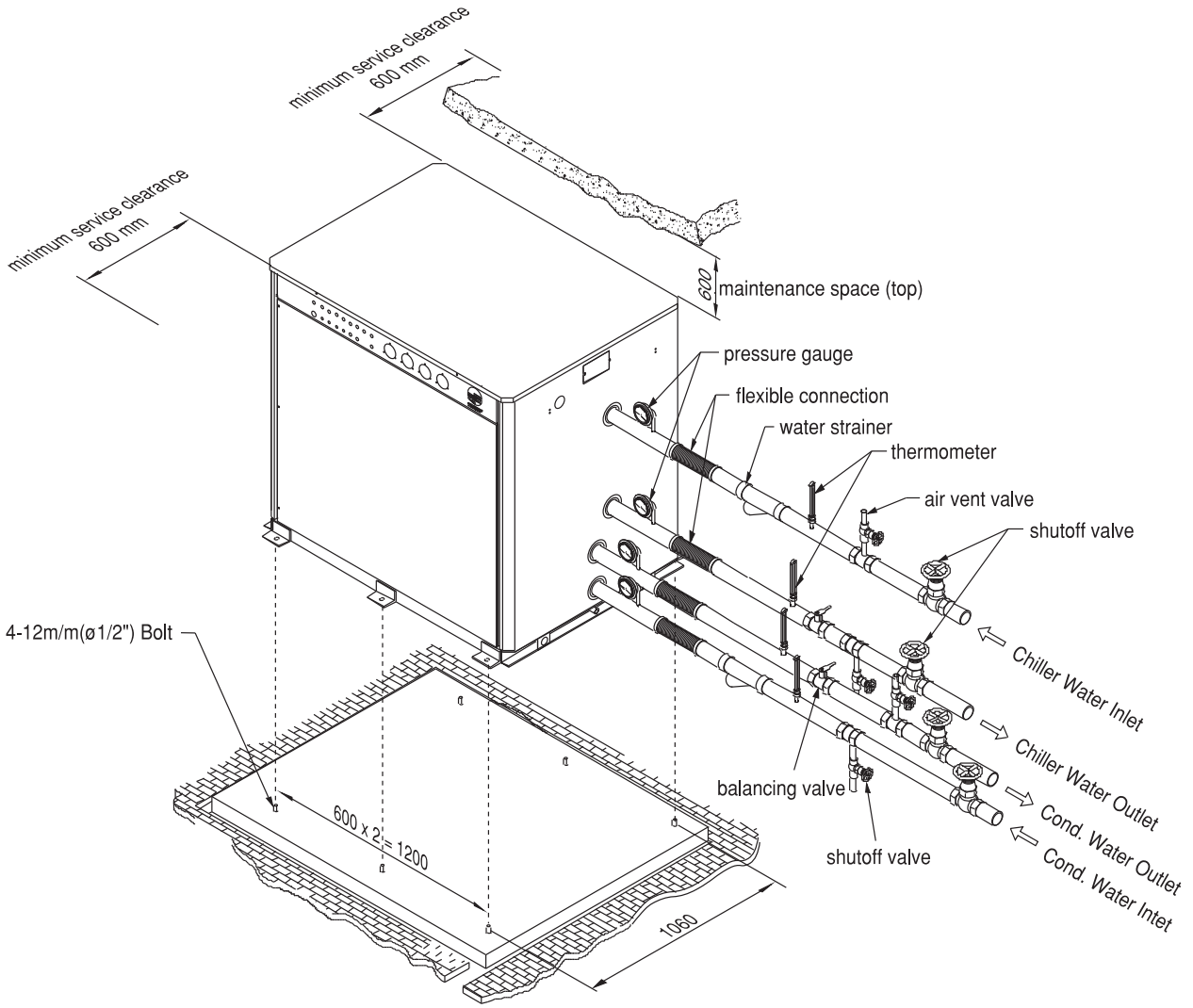


Figure 6: Inlet / Outlet Piping Recommendation
CGWP080~100

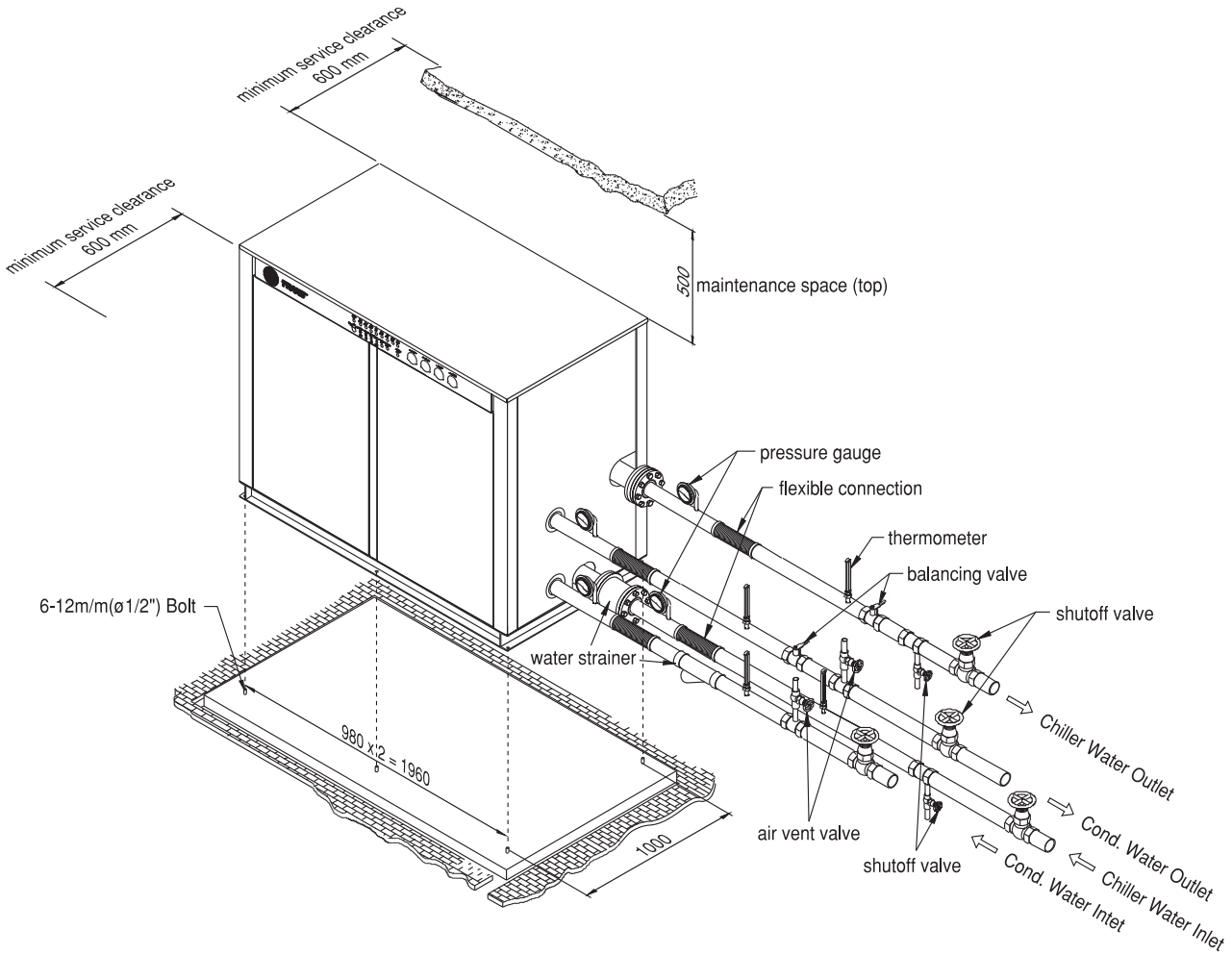
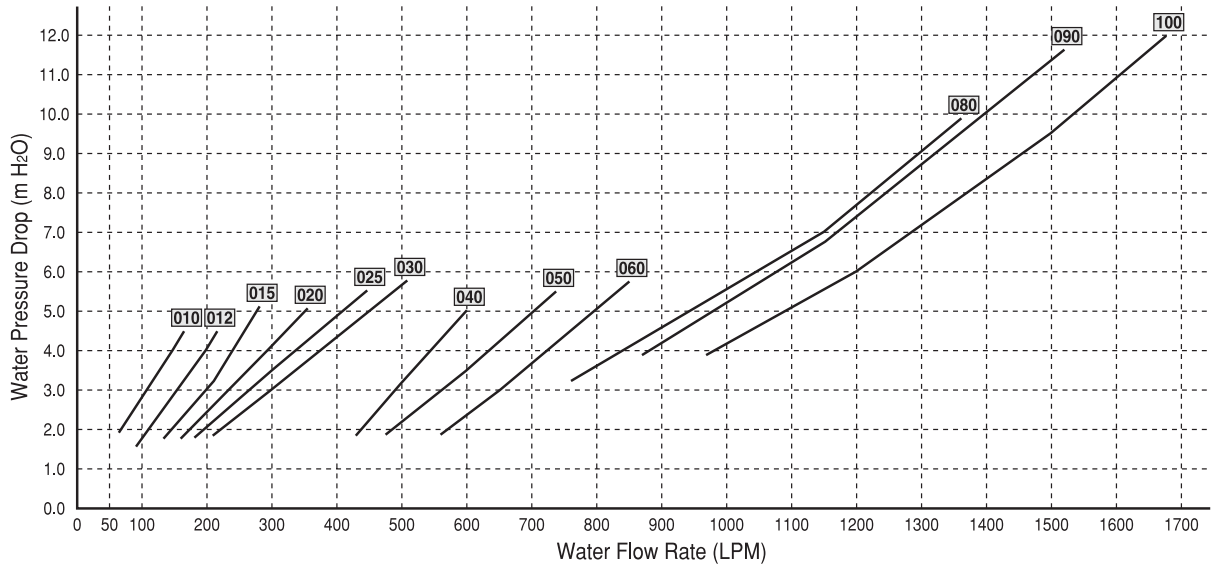
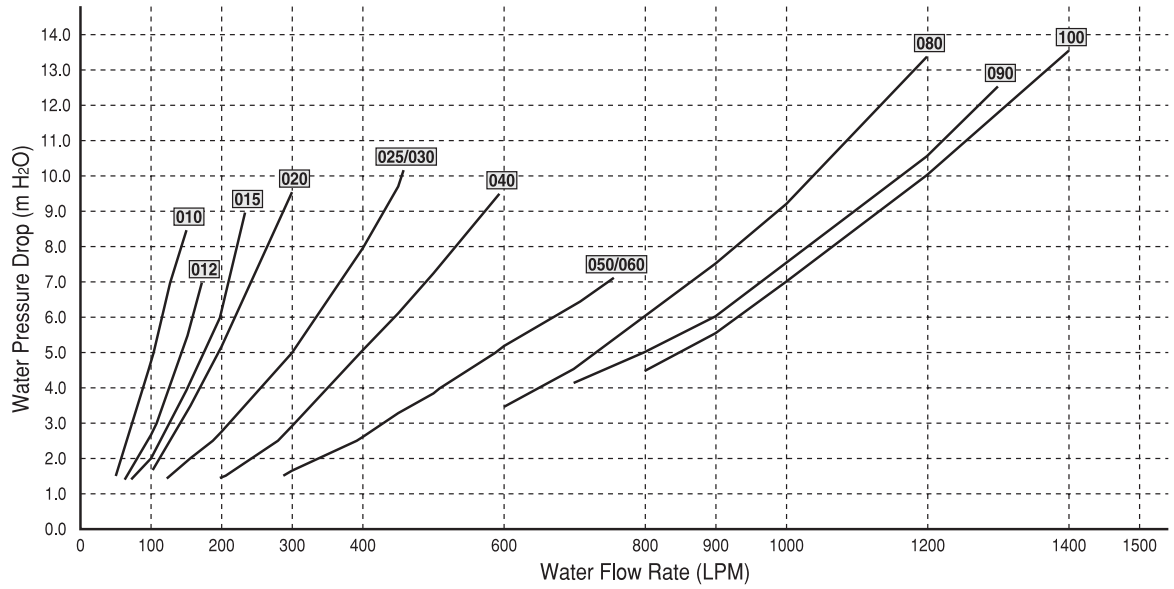


Figure 7: Water Flow Rate - Pressure Drop Chart

flow rate of condenser water - pressure drop



flow rate of chilled water - pressure drop



Unit Piping

General Water Piping Recommendations
Make water piping connections to evaporator and condenser(s). Isolate and support piping to prevent stress on the unit. Use flanged ells or spool-places to facilitate service procedures. Construct piping according to local and national codes. Insulate and flush piping before connecting to unit.

Caution:
To prevent equipment damage, bypass the unit if using an acidic flushing agent.

Use a pipe sealant or teflon tape on all water connections. Minimize heat gain and prevent condensation by insulating all chilled water piping.

Caution:
To prevent damage to water piping, do not over tighten connections.

Water to evaporator connection

Install water circulation pump upstream of the evaporator, insuring that the evaporator is under positive pressure.

The following recommendations refer to Figure 4~6.

1. Pressure gauges: shows entering and leaving water pressure. Shut off valves should be provided on water inlets and outlets.
2. Thermometers: indicate chilled water entering and leaving temperatures.
3. Balancing valve: controls water flow.
4. Shut off valves: isolate chillers and water circuiting pump during maintenance operations.
5. Water strainer: reduce fouling problem of heat exchanger. (Factory provided, field install)

Caution:
All installation must be equipped with strainer provided by factory in order that only clean water enters into exchangers.

Insure that all chilled water pipes are fully insulated, in order to prevent frost damage.

Flow-Sensing Devices
If "loss of water-flow" protection is desired, use a field-installed flow switch or differential pressure switch with a pump interlock to sense system water flow. To provide chiller protection, install and wire the flow switch in series with the chilled water pump interlock for the chilled water circuits (refer to "Electrical Wiring"). Specific connection and schematic wiring diagrams shipped with the unit.

Flow switches must stop or prevent compressor operation if chilled water flow drops off drastically. Follow the manufacturer's recommendation for selection and installation procedures. General guidelines for flow switch installation are outlined below:

1. Mount the switch upright with a minimum of 5 pipe diameters straight, horizontal run on each side. Do not install close to elbows, orifices or valves.

Note:
The arrow on the switch must point in the direction of water flow.

2. To prevent switch fluttering, vent all air from the water piping systems.

Minimum water capacity
Minimum volume of water is depending on the type of application. Consult your Trane Agency. If necessary a buffer tank should be fitted. Safety and control devices will only operate correctly if there is sufficient water in the system.

Condenser Water Piping

Condenser Water Connection.
Condenser piping components generally function identically to those in the evaporator piping system. Refer to "Evaporator Piping". In addition, cooling tower systems may include a manual or automatic bypass valve that can alter water flow rate to maintain condensing pressure. Well (city) water condensing systems should include a pressure reducing valve and a water regulating valve.

The pressure reducing valve should be installed to reduce water pressure entering the condenser. This is required only if water pressure exceeds 300 psig. This is necessary to prevent damage to the disc and seat of the water regulating valve that can be caused by excessive pressure drop through the valve.

Caution:
To prevent condenser or regulating valve damage, do not exceed 300 psig condensing water pressure.

The optional water regulating valve maintains condensing pressure and temperature by throttling water flow leaving the condenser in response to compressor discharge pressure. Adjust the regulating valve for proper operation during unit start-up.

This valve is not used in cooling tower applications. Cooling towers, however, may require the use of a three-way, pilot-operated regulating/bypass valve to maintain balance between cooling tower water temperature and condensing pressure. Note the use of plugged tees in the system. This provides access for chemical cleaning of the condenser tubes. Condenser piping must be in accordance with all applicable local and national codes.

Water pressure drop of condenser and evaporator
The pressure drop data of condenser and evaporator are illustrated in figure 7.

Condenser Drains.
The condenser shells can be drained by removing the drain plugs from the bottom of the condenser heads.

Water Treatment

Using untreated or improperly treated water in these units may result in inefficient operation and possible tube damage. Consult a qualified water treatment specialist to determine whether treatment is needed.

Caution:
The use of improperly treated or untreated water in this equipment may result in scaling, erosion, corrosion, algae or slime. The services of a qualified water treatment specialist should be engaged to determine what treatment, if any, is advisable. The Trane Company warranty specifically excludes liability for corrosion, erosion or deterioration of Trane equipment. Trane assumes no responsibilities for the results of the use of untreated or improperly treated water, or saline or brackish water.

Water Pressure Relief Valves
Install a water pressure relief valve in the condenser and evaporator leaving chilled water piping. Water vessels with dose-coupled shutoff valves have a high potential for hydrostatic pressure buildup on a water temperature increase. Refer to applicable codes for relief valve installation guidelines.

Caution:
To prevent damage, install pressure relief valve in both evaporator and condenser water systems.

Electrical Wiring

General Recommendations

The wiring procedures described in this portion of the manual must be accomplished to obtain proper operation. Electrical wiring instructions for all optional features and equipment are described in the "Optional Electrical Wiring" sections of this manual.

Warning:
To prevent injury or death, disconnect electrical power source before completing connections to the unit.

All wiring must comply with local requirements. The installer must provide proper sized system interconnecting and power supply wiring with appropriate fused disconnect switches. Type and locations of disconnects must comply with all applicable codes.

Caution:
To prevent corrosion and overheating at terminal connections, use copper conductors sized based on nameplate RLA.

Caution:
All wiring must comply with applicable local and national codes.

Caution:
Type and location of fused disconnect switches must comply with applicable local and national codes.

Electrical connection locations are shown in Figures 8~14. Minimum circuit amperage, recommended fuse sizes and other unit electrical data are provided in Tables 2~3 and on the unit nameplate.

Unit Power Supply

the installer must connect appropriate line power supply (with fused disconnects) to the terminal block or non-fused, unit-mounted disconnect in the power section of the unit control panel. Refer to Figures 8~14 Field wiring diagrams, electrical schematics and component location drawings are also attached to the inside of the control panel door.

The unit power fused disconnect switch(es) should be located in the general area of the unit to comply with local codes. The unit disconnect can be used as an emergency shutdown device.

Figure 8: Electrical Wiring Diagram – CGWP010~030

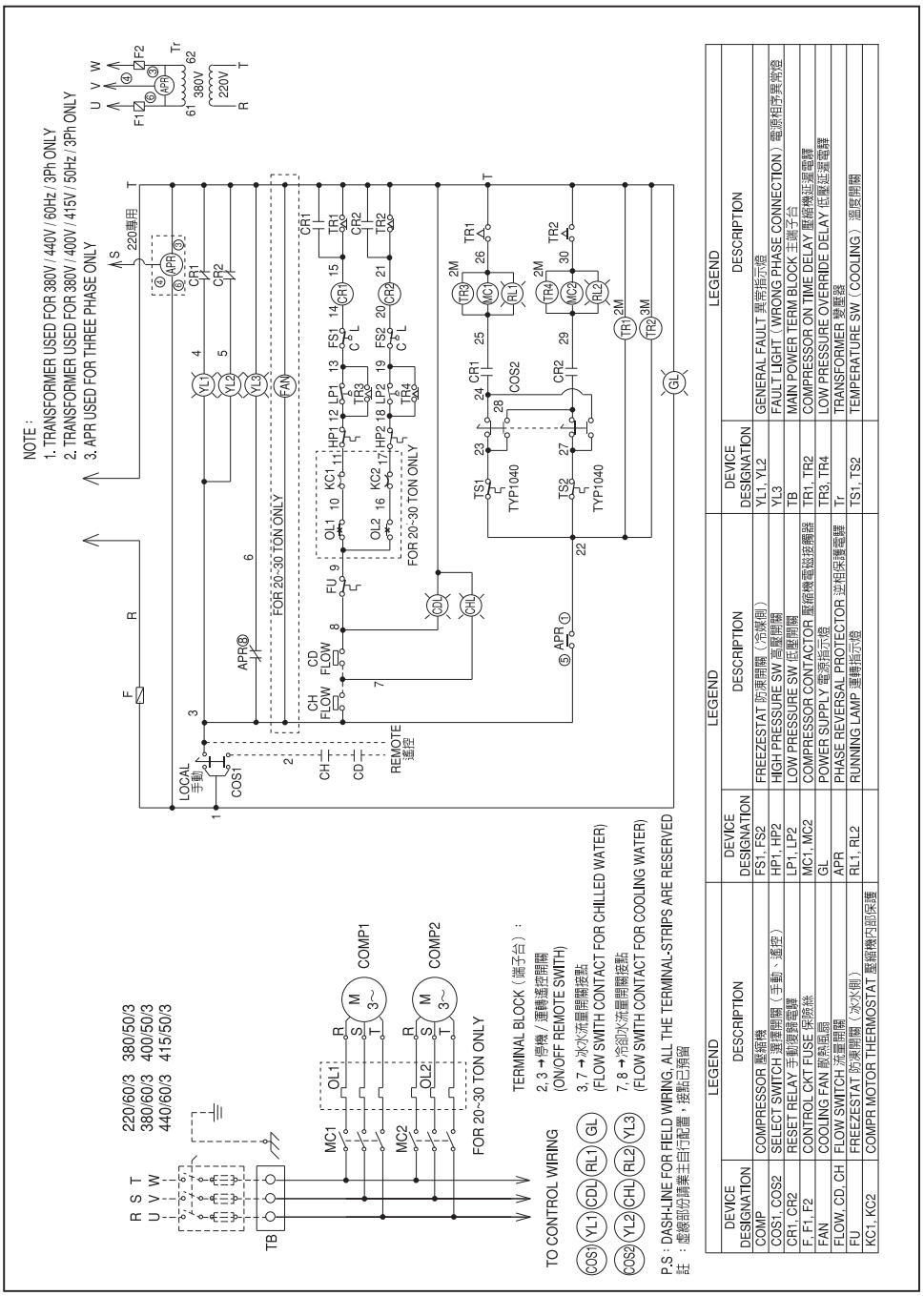


Figure 9: Electrical Wiring Diagram (1) – CGWP040~100

LEGEND	
DEVICE DESIGNATION	DESCRIPTION
APR	逆相保護電驛 Phase reversal protector
COMP	壓縮機 Compressor
COS	選擇開關 Select switch
CR	輔助電驛 Relay
CDFS	冷卻水流量開關 Condensing water flow switch
CHFS	冰水流量開關 Chiller water flow switch
CDL	冷卻水流量指示燈 Condensing water flow indication LED
CHL	冰水流量指示燈 Chiller water flow indication LED
FS1/2	防凍開關（冷媒側）Freezestat (Refrigerant)
FU1/2	防凍開關（冰水側）Freezestat (Water)
GL	運轉指示燈 Running light
GR	棘輪電驛 Gear relay
HP1, HP2	高壓開關 High pressure switch
KC1 / 2 / 3 / 4	壓縮機內部保護 Compressor motor thermostat
LP1, LP2	低壓開關 Low pressure switch
MC1 / 2 / 3 / 4	壓縮機電磁接觸器 Compressor contactor
MT-P1 / 2 / 3 / 4	壓縮機保護模組 Compressor motor protection module
OL1 / 2 / 3 / 4	壓縮機過載保護 Compressor overload relay
RL1 / 2 / 3 / 4	運轉指示燈 Running lamp
SW1 / 2 / 3 / 4	壓縮機 ON / OFF 開關 Compressor ON / OFF switch
TB	主端子台 Main power terminal block
TR1 / 2 / 3 / 4 / 5 / 6	壓縮機延遲電驛 Compressor on time delay
TS1 / 2 / 3 / 4	溫度開關 Temperature switch (Cooling)
YL1 / 2 / 3 / 4	壓縮機異常指示燈 Compressor fault light
YL5	電源相序異常指示燈 Fault light (Wrong phase)

壓縮機位置圖

正面

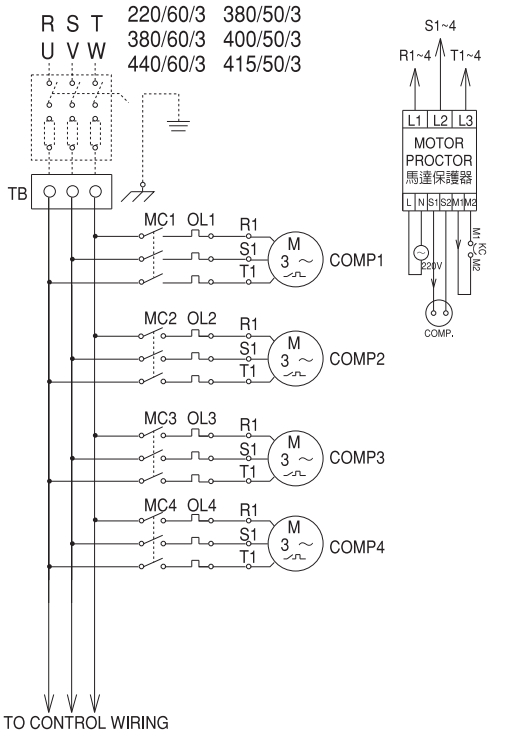


Figure 10: Electrical Wiring Diagram (2) – CGWP040~060

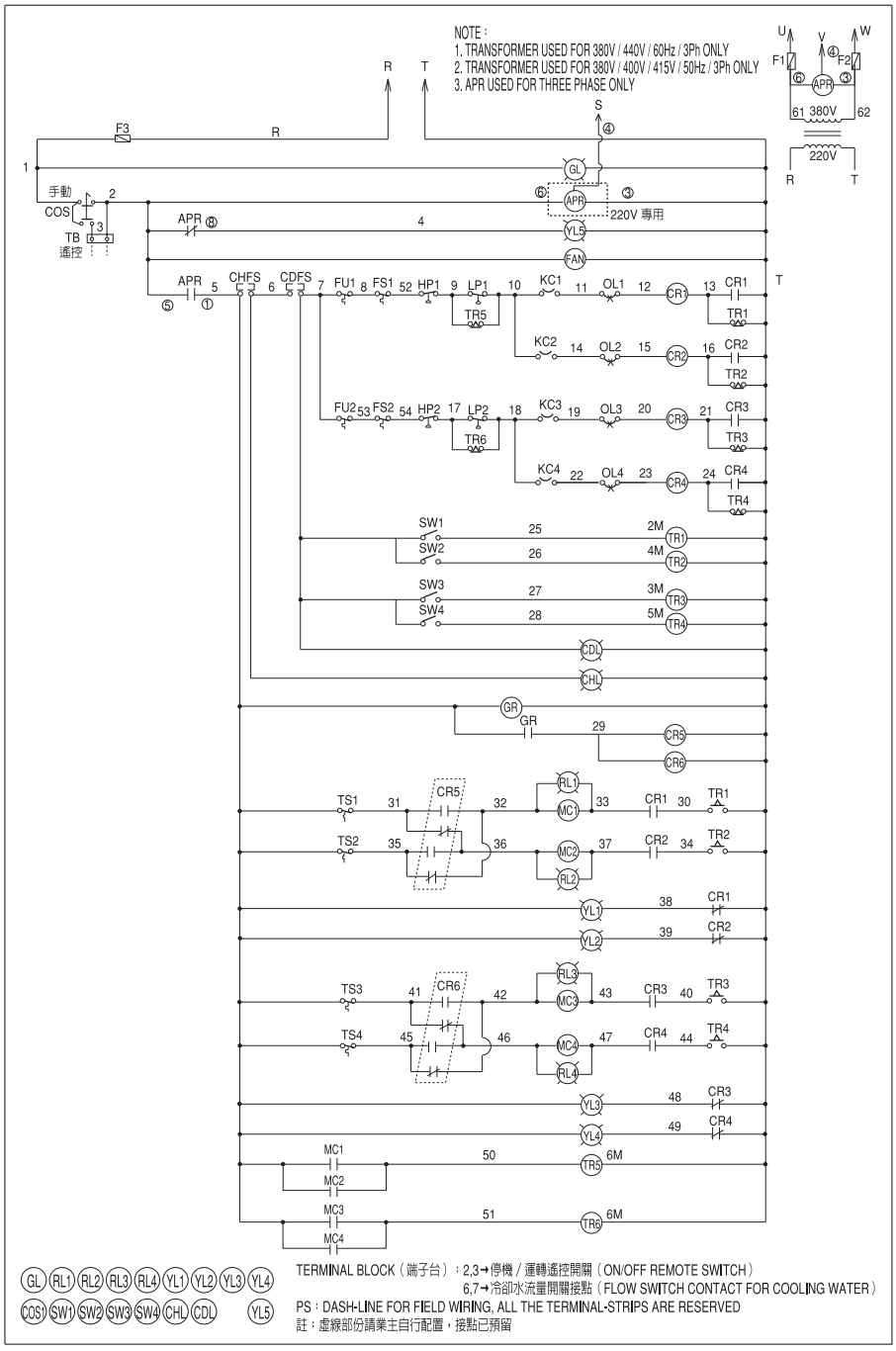


Figure 11: Electrical Wiring Diagram (3) – CGWP080~100

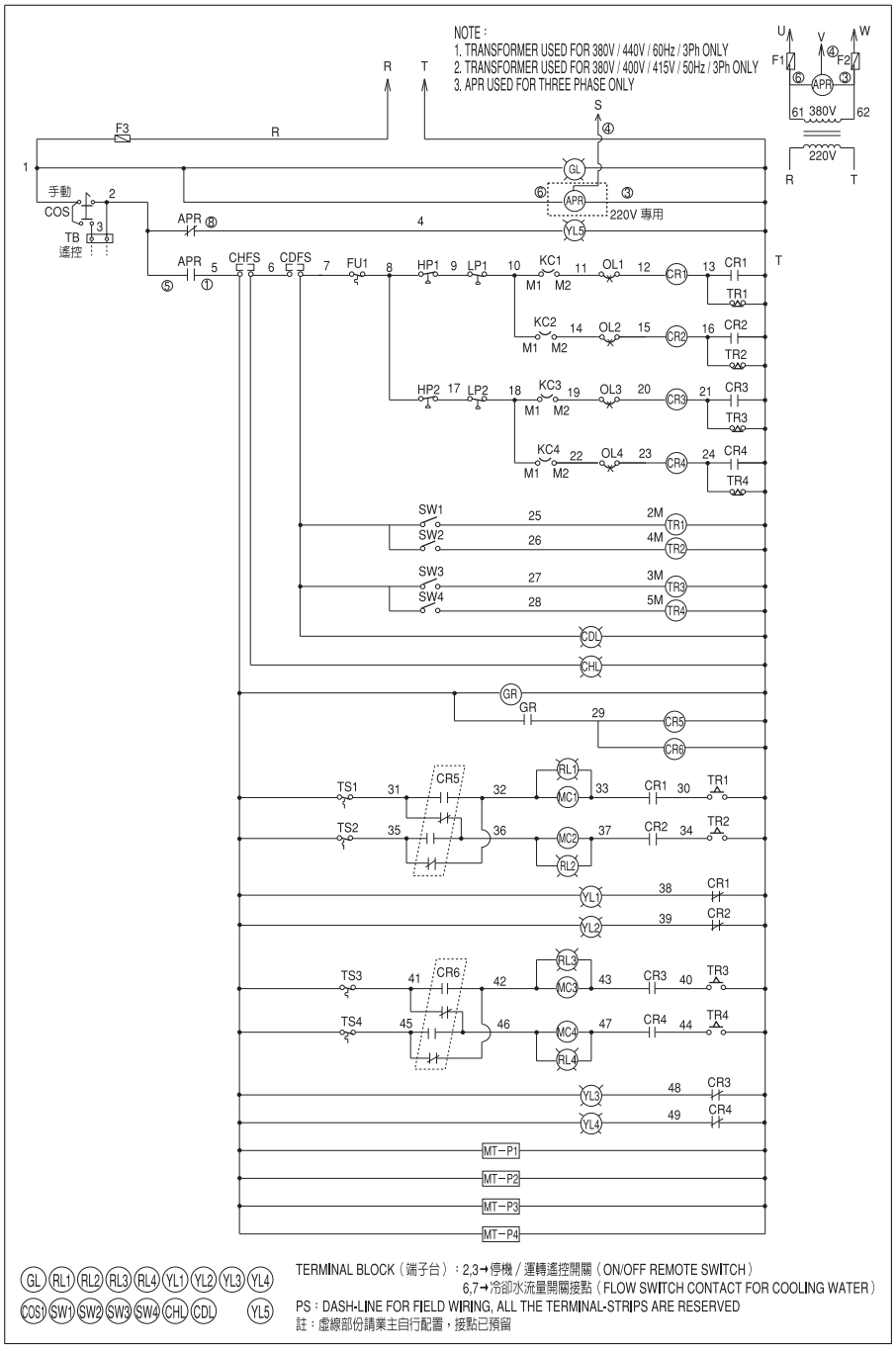
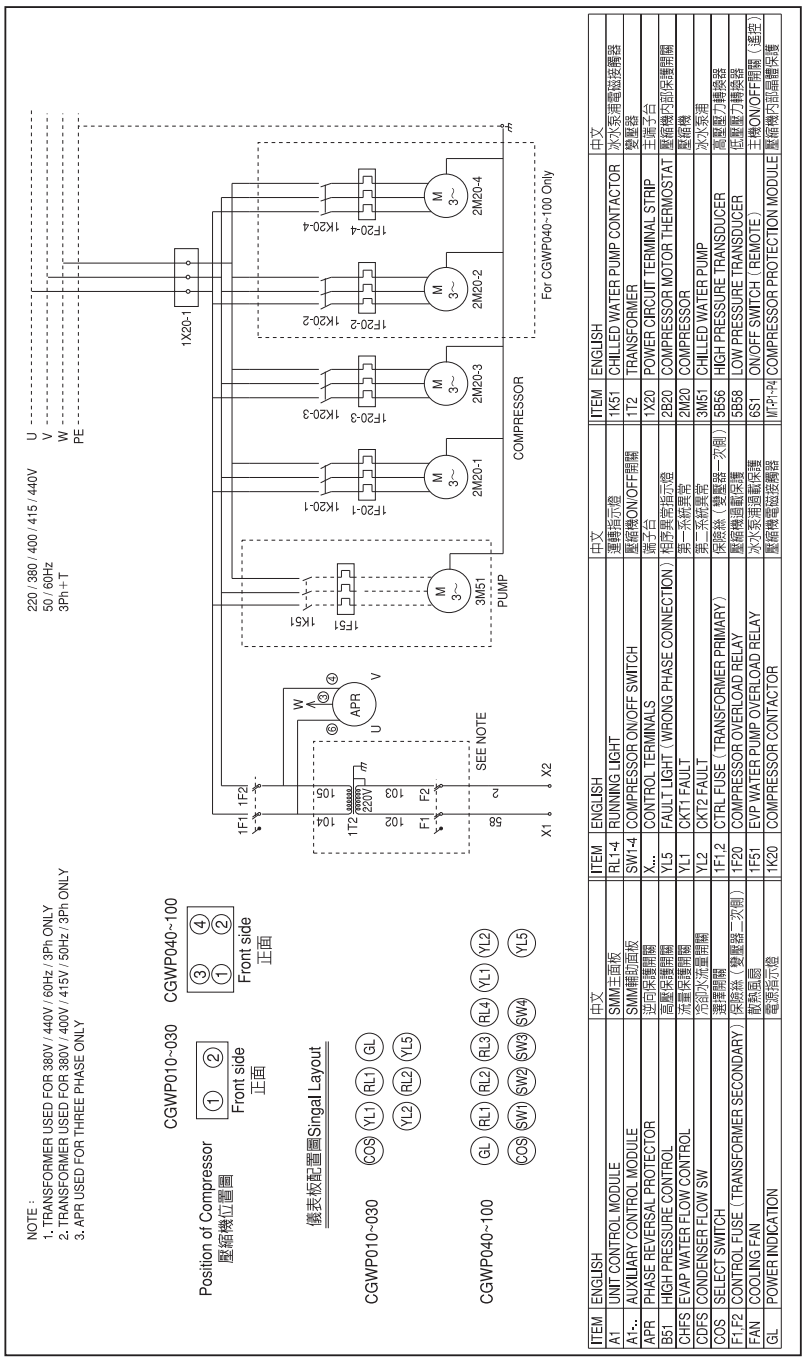


Figure 12: Electrical Wiring Diagram (1)– CGWP + SMM



ITEM	ENGLISH	中文	ITEM	ENGLISH	中文	ITEM	ENGLISH	中文
A1	UNIT CONTROL MODULE	SMM主面板	RL1-4	RUNNING LIGHT	運轉指示燈	1K51	CHILLED WATER PUMP CONTACTOR	冰水泵浦電磁接觸器
A1-..	AUXILIARY CONTROL MODULE	SMM輔助面板	SW1-4	COMPRESSOR ON/OFF SWITCH	壓縮機ON/OFF開關	1T2	TRANSFORMER	變壓器
APR	PHASE REVERSAL PROTECTOR	逆向保護開關	X...	CONTROL TERMINALS	端子台	1X20	POWER CIRCUIT TERMINAL STRIP	主端子台
B51	HIGH PRESSURE CONTROL	高壓保護開關	YL5	FAULT LIGHT（WRONG PHASE CONNECTION）	相序保護指示燈	2B20	COMPRESSOR MOTOR THERMOSTAT	壓縮機內部保護開關
CHFS	EVAP WATER FLOW CONTROL	流量保護開關	YL1	CKT1 FAULT	第一系統異常	2M20	COMPRESSOR	壓縮機
CDFS	CONDENSER FLOW SW	冷卻水流量開關	YL2	CKT2 FAULT	第二系統異常	3M51	CHILLED WATER PUMP	冰水泵用
COS	SELECT SWITCH	選擇開關	1F1,2	CTRL FUSE（TRANSFORMER PRIMARY）	保險絲（變壓器一次側）	5B56	HIGH PRESSURE TRANSDUCER	高壓壓力轉換器
F1,F2	CONTROL FUSE（TRANSFORMER SECONDARY）	保險絲（變壓器二次側）	1F20	COMPRESSOR OVERLOAD RELAY	壓縮機過載保護	5B58	LOW PRESSURE TRANSDUCER	低壓壓力轉換器
FAN	COOLING FAN	散熱風扇	1F51	EVP WATER PUMP OVERLOAD RELAY	冰水泵用過載保護	6S1	ON/OFF SWITCH（REMOTE）	主機ON/OFF開關（遙控）
GL	POWER INDICATION	電源指示燈	1K20	COMPRESSOR CONTACTOR	壓縮機電磁接觸器	M1-P1-P4	COMPRESSOR PROTECTION MODULE	壓縮機內部晶體保護

Figure 13: Electrical Wiring Diagram (2) – CGWP + SMM

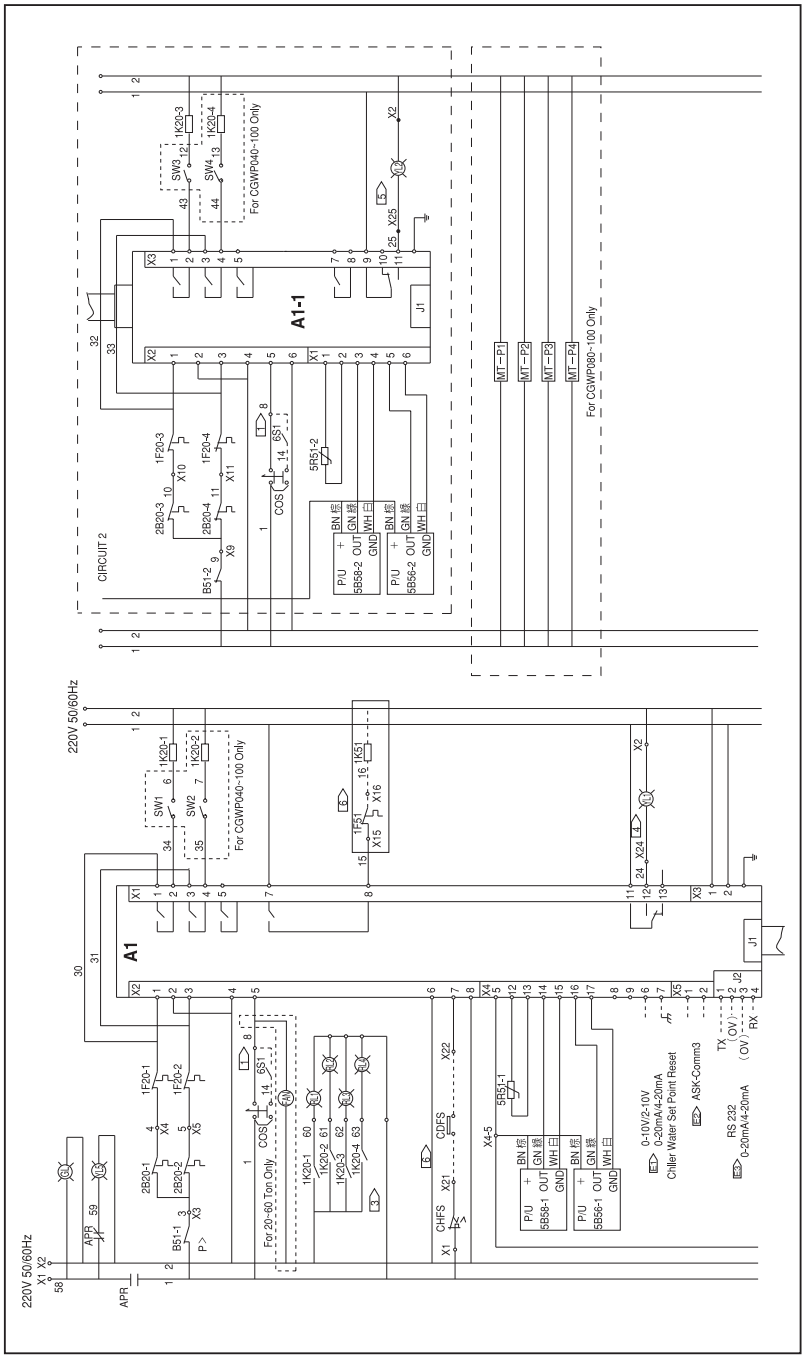
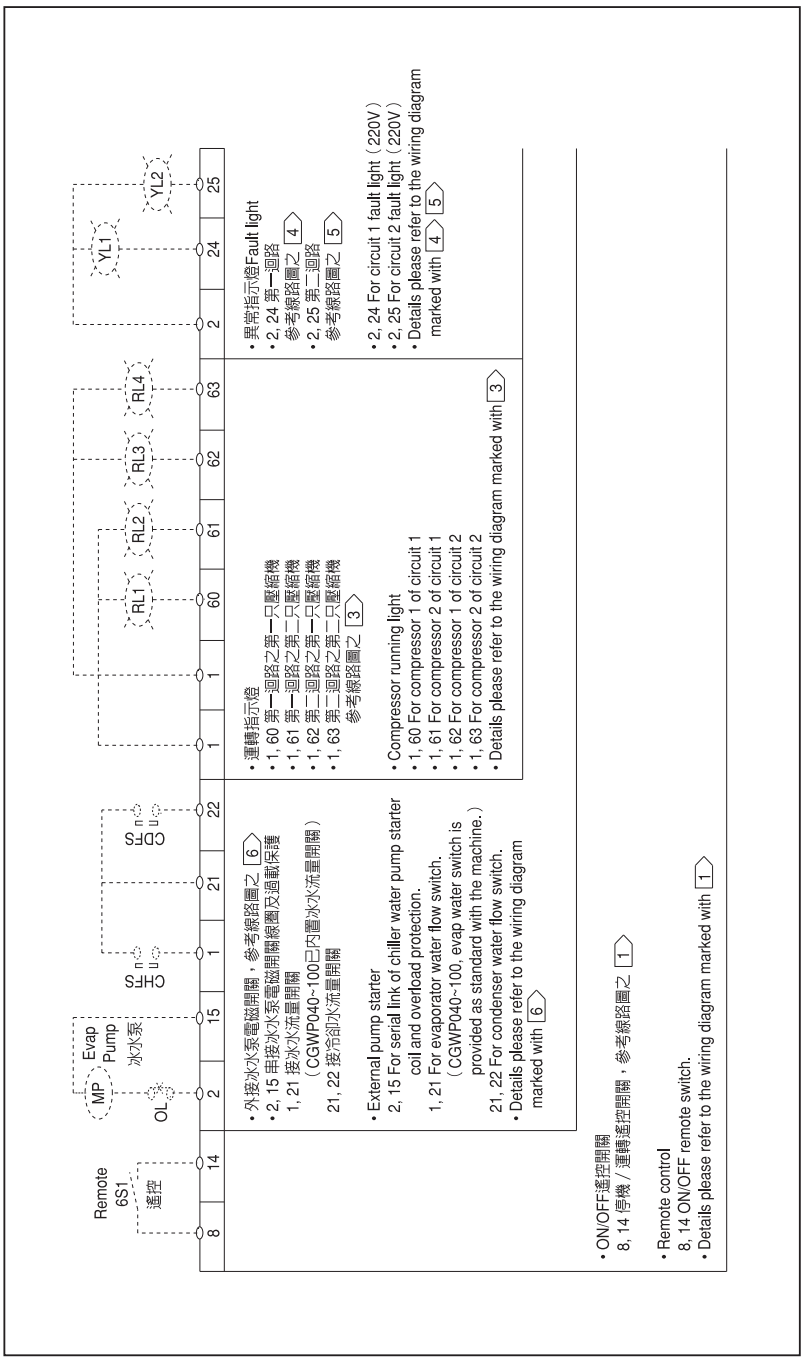


Figure 14: The wiring of terminations for customer use is demonstrated as below – CGWP + SMM



TRANE

General Start-Up

Preparation

Before starting up the system, carry out the following checks and operations:

1. Before making any electrical connection, insure that the insulation of all power supply terminals to ground complies with standards and regulations in force. Check the insulation of all electric motors using 500VDC megohmeter. Do not start up the equipment if the insulation of motor is less than 2MΩ.
2. Check all of the terminals of electrical connection are sound and clean.
3. Insure all water and refrigerant valves are in service positions.
4. Reset all of the controlling device set manually. All of the original setting values of protecting switches are shown in table 1.
5. Check the fixing of capillary tubes in order to avoid the damage of vibration and wear while the equipment running.
6. Insure that the pipe system is well established and the hydraulic test had been done.

The general characteristics of this equipment are listed in table 2(60Hz) and table 3(50Hz).

Teat Run

1. If there is any abnormal noise happening at starting, shut down immediately and recheck it.
2. Turn on the main power switch. Measure the current of each phase.
3. Phase imbalance calculation.
   Imbalance of electrical voltage existing in power source will cause abnormal heat accumulation in motor winding. The phase imbalance is defined and calculated as

$$\bar{x}=\frac{x_1+x_2+x_3}{3} \qquad dev=\frac{Max(\bar{x}-x_n)}{\bar{x}} \quad n=1, 2, 3$$

   where x_1, x_2, x_3 are electrical voltage or current readings from power source.

Caution:
Phase imbalance of voltage from power source should be less than 2%, imbalance of current should be limited in 20%.

4. The running current of compressor shall close to the data listed in table 2(60Hz) and table 3(50Hz).
5. The power consumption of compressor should close to rated input power.
6. If the equipment is operated under the situation far away from standard, compared the measured power with table 4(60Hz) and table 5(50Hz). Further check should be made if the deviations are over excessively.
7. Investigate the pressure drops of water line both at evaporator and condenser. The pressure drop data is illustrated in figure 7.

Running

After test running has finished, the equipment can run automatically.

System Superheat

Normal superheat for each circuit is 5~7˚C at full load. If superheat is not within this range, adjust expansion valve superheat setting. Allow 5~10 minutes between adjustments for the expansion valve to stabilize on each new setting.

System Subcooling

Normal subcooling for each circuit is 5~10˚C at full load. If subcooling for either circuit is not in this range check superheat for the circuit and adjust, if required. If superheat is normal but subcooling is not, contact a qualified service technician.

Table 1:Setting Points of Protecting Switches

Control Description	Electrical Designation	Contacts Open	Contacts Close (Reset)
Discharge Pressure	HP1, HP2	350 ± 7 Psig	250 ± 20 Psig
Suction Pressure	LP1, LP2	45 ± 4 Psig	60 ± 4 Psig
Anti-Freeze (refrigerant side)-Model 010~060 only	FS1, FS2	-3˚C ± 2.0˚C	3˚C ± 2.0˚C
Anti-Freeze (water side)	FU1, FU2	1.8˚C ± 1.5˚C	7˚C ± 1.5˚C
CGWP010~030			
Time Relay of Compressor #1	TR1	Normally Open, Time Closed	2 mins
Time Relay of Compressor #2	TR2	Normally Open, Time Closed	3 mins
Time Relay of Low Pressure	TR3/4	Normally Open, Time Closed	2 mins
Temperature Switch	TS1/2	10˚C / 9.5˚C	13˚C / 12.5˚C
CGWP040~100			
Time Relay of Compressor #1	TR1	Normally Open, Time Closed	2 mins
Time Relay of Compressor #2	TR2	Normally Open, Time Closed	4 mins
Time Relay of Compressor #3	TR3	Normally Open, Time Closed	3 mins
Time Relay of Compressor #4	TR4	Normally Open, Time Closed	5 mins
Time Relay of Low Pressure-Model 040~060 only	TR5/6	Normally Open, Time Closed	6 mins
Temperature Switch	TS1/2/3/4	11˚C / 10.5˚C / 10˚C / 9.5˚C	14˚C / 13.5˚C / 13˚C / 12.5˚C

Table 2: CGWP General Characteristic(60Hz)

Item \ Model		010		012	015	020	025	030	040	050	060	080	090	100
Capacity (kW)		35.15		42.18	52.72	70.29	87.87	105.44	140.60	175.75	210.90	281.20	316.35	351.50
Compressor		Scroll												
Tons/Tons		5/5		6/6	7.5/7.5	10/10	10/15	15/15	(10+10)/(10+10)	(10+15)/(10+15)	(15+15)/(15+15)	(20+20)/(20+20)	(25+25)/(20+20)	(25+25)/(25+25)
Circuit		2		2	2	2	2	2	2	2	2	2	2	2
Load (%)		100-50-0		100-50-0	100-50-0	100-50-0	100-60-0	100-50-0	100-75-50-25-0	100-80-60-30-0	100-75-50-25-0	100-75-50-25-0	100-80-60-30-0	100-75-50-25-0
Volt-Phase		220V-1PH-60Hz	220V/380V/440V-3Ph-60Hz											
Input (kW)		8.76	8.17	9.53	12.80	16.50	21.10	25.20	33.00	42.20	50.40	68.00	76.00	85.00
RLA (A)	220V	45	28.2	32.2	43.2	60.0	75.0	90.0	120.0	150.0	180.0	208.0	235.6	263.2
	380V	-	16.4	18.6	25.0	35.0	43.0	52.0	70.0	86.0	104.0	120.1	136.1	152.0
	440V	-	14.1	16.1	21.6	30.0	38.0	45.0	60.0	76.0	90.0	104.0	117.8	131.6
LRA (A)	220V	158	99	113	151	295	450	465	355	525	555	616	730	757
	380V	-	59	65	88	175	253	261	210	296	313	350	403	419
	440V	-	50	57	76	135	190	198	165	228	243	293	355	369
Evap.	Type	Brazed plate heat exchanger										Shell and tube		
	Water Flow (LPM)	100		120	150	200	250	300	400	500	600	800	900	1000
	WPD (mH_2O)	4.6		4.2	4.5	5.3	4.2	5.5	5.3	4.2	5.5	6.0	6.0	7.0
Cond.	Type	Shell and tube												
	Water Flow (LPM)	120		144	180	240	300	360	480	600	720	960	1080	1200
	WPD (mH_2O)	2.0		2.2	2.0	2.5	3.2	3.7	2.5	3.2	3.7	5.0	6.0	6.0
Refrigerant		R-22												
R-22 Charge (kg)		4.0/4.0		4.5/4.5	5.0/5.0	5.5/5.5	5.5/7.5	7.5/7.5	12/12	15/15	18/18	28/28	35/28	35/35
Oil Charge(L)〔SUNISO 4GS〕		3.3		3.6	8.3	7.6	10.4	13.2	15.2	20.8	26.4	32.0	32.0	32.0
Dimension	Type	Powder paint housing												
	Length (mm)	1100				1230			1400			2000		
	Depth (mm)	450				550			1120			1050		
	Height (mm)	1180				1300			1310			1625		
Operating Weight (kg)		285		325	365	500	540	580	980	1060	1140	1900	2000	2100
Protection		H/L pressure switches, Freezestat, Fusible plug, Overload, Adjustable temperature switch, Phase reversal switch.												
Evap. Water Pipe in/out		1 1/2"FPT				2"FPT		2 1/2"FPT	3"FPT			4"Flange		
Cond. Water Pipe in/out		1 1/2"FPT				2"FPT		2 1/2"FPT	3"FPT			4"FPT		

NOTE：1. Cooling capacity rated conditions

a. Chiller water inlet/outlet temperature = 12˚C/7˚C.

b. Condenser water inlet/outlet temperature = 30˚C/35˚C.

2. Tolerance of the data as above is ± 5% according with Standard ARI 590.

Table 3: CGWP General Characteristic(50Hz)

Item \ Model		010	012	015	020	025	030	040	050	060	080	090	100
Capacity (kW)		29.29	35.15	43.93	58.58	73.23	87.87	117.17	146.46	175.75	239.10	265.90	296.40
Compressor		Scroll											
Tons/Tons		5/5	6/6	7.5/7.5	10/10	10/15	15/15	(10+10)/(10+10)	(10+15)/(10+15)	(15+15)/(15+15)	(20+20)/(20+20)	(25+25)/(20+20)	(25+25)/(25+25)
Circuit		2	2	2	2	2	2	2	2	2	2	2	2
Load (%)		100-50-0	100-50-0	100-50-0	100-50-0	100-60-0	100-50-0	100-75-50-25-0	100-80-60-30-0	100-75-50-25-0	100-75-50-25-0	100-80-60-30-0	100-75-50-25-0
Volt-Phase		380V/400V/415V-3Ph-50Hz											
Input (kW)		6.94	8.10	11.06	14.03	17.94	21.42	28.05	35.87	42.84	56.40	63.00	70.50
RLA (A)	380V	14.1	16.1	21.6	30.0	38.0	45.0	60.0	76.0	90.0	100.8	114.3	127.8
	400V	13.4	15.3	20.5	28.5	36.1	42.8	57.0	72.2	85.6	95.6	108.3	121.1
	415V	12.9	14.7	19.8	27.5	34.8	41.2	55.0	69.6	82.4	92.1	100.0	116.7
LRA (A)	380V	50	57	76	135	190	198	165	228	243	290	352	366
	400V	50	57	76	135	190	198	165	228	243	290	352	366
	415V	50	57	76	135	190	198	165	228	243	290	352	366
Evap.	Type	Brazed plate heat exchanger									Shell and tube		
	Water Flow (LPM)	86	103	129	172	215	257	344	430	514	681	756	840
	WPD (mH_2O)	3.6	2.6	3.0	3.4	2.7	3.6	3.4	2.7	3.6	4.2	4.6	4.9
Cond.	Type	Shell and tube											
	Water Flow (LPM)	100	120	150	200	250	300	400	500	600	817	907	1000
	WPD (mH_2O)	2.6	2.1	2.1	2.4	2.8	2.9	2.4	2.8	2.9	3.5	4.1	4.2
Refrigerant		R-22											
R-22 Charge (kg)		4.0/4.0	4.5/4.5	5.0/5.0	5.5/5.5	5.5/7.5	7.5/7.5	12/12	15/15	18/18	28/28	35/28	35/35
Oil Charge(L)〔SUNISO 4GS〕		3.3	3.6	8.3	7.6	10.4	13.2	15.2	20.8	26.4	32.0	32.0	32.0
Dimension	Type	Powder paint housing											
	Length (mm)	1100			1230			1400			2000		
	Depth (mm)	450			550			1120			1050		
	Height (mm)	1180			1300			1310			1625		
Operating Weight (kg)		285	325	365	500	540	580	980	1060	1140	1900	2000	2100
Protection		H/L pressure switches, Freezestat, Fusible plug, Overload, Adjustable temperature switch, Phase reversal switch.											
Evap. Water Pipe in/out		1 1/2"FPT			2"FPT		2 1/2"FPT	3"FPT			4"Flange		
Cond. Water Pipe in/out		1 1/2"FPT			2"FPT		2 1/2"FPT	3"FPT			4"FPT		

NOTE：1. Cooling capacity rated conditions

a. Chiller water inlet/outlet temperature = 12˚C/7˚C.

b. Condenser water inlet/outlet temperature = 30˚C/35˚C.

2. Tolerance of the data as above is ± 5% according with Standard ARI 590.

Table 4: CGWP Performane Data (60Hz)

Model	EW(°C) / LW(°C) / kW	25		30		32		35		40	
		Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input
CGWP010	5	34.17	7.22	32.91	7.93	32.23	8.31	31.40	8.78	29.91	9.61
LPME:100	7	36.61	7.39	35.15	8.17	34.57	8.48	33.70	8.94	32.08	9.79
LPMC:120	9	39.11	7.55	37.63	8.32	37.07	8.62	36.19	9.08	34.46	9.95
	11	41.69	7.72	40.22	8.47	39.65	8.78	38.79	9.23	37.05	10.13
CGWP012	5	41.36	8.38	39.80	9.29	39.01	9.75	38.01	10.33	36.26	11.39
LPME:120	7	43.94	8.56	42.18	9.53	41.29	10.02	40.44	10.49	38.62	11.56
LPMC:144	9	46.66	8.75	44.85	9.71	44.16	10.08	43.09	10.65	41.18	11.74
	11	49.53	8.96	47.67	9.89	46.93	10.27	45.83	10.82	43.89	11.94
CGWP015	5	51.68	11.38	49.55	12.53	48.56	13.07	47.22	13.79	44.92	15.11
LPME:150	7	55.08	11.61	52.72	12.80	51.78	13.29	50.37	14.01	47.94	15.34
LPMC:180	9	58.54	11.85	56.10	13.03	55.17	13.49	53.70	14.21	51.16	15.57
	11	62.11	12.10	59.63	13.26	58.64	13.73	57.18	14.42	54.56	15.82
CGWP020	5	68.73	14.56	66.27	16.25	65.29	16.93	63.81	17.96	61.12	19.90
LPME:200	7	72.83	14.81	70.29	16.50	69.28	17.17	67.72	18.23	64.95	20.15
LPMC:240	9	76.91	15.08	74.32	16.75	73.28	17.40	71.70	18.47	68.82	20.41
	11	81.31	15.34	78.65	16.99	77.17	17.66	75.90	18.73	72.90	20.68
CGWP025	5	85.75	18.76	82.61	20.77	81.35	21.57	79.44	22.80	76.04	25.08
LPME:250	7	90.87	19.24	87.87	21.10	86.55	21.90	84.54	23.15	81.01	25.42
LPMC:300	9	96.65	19.43	93.11	21.42	91.73	22.21	89.64	23.48	85.92	25.79
	11	102.36	19.77	98.85	21.75	96.80	22.56	95.20	23.85	91.32	26.16
CGWP030	5	102.77	22.51	98.94	24.79	97.41	25.70	95.06	27.09	90.96	29.67
LPME:300	7	108.92	23.21	105.44	25.20	103.82	26.11	101.36	27.52	97.07	30.09
LPMC:360	9	116.40	23.33	111.89	25.59	110.19	26.50	107.58	27.94	103.02	30.56
	11	123.43	23.74	119.05	26.00	116.43	26.92	114.51	28.40	109.76	31.02
CGWP040	5	137.27	29.62	131.41	32.48	128.98	33.75	125.24	35.77	118.77	39.48
LPME:400	7	146.84	30.11	140.60	33.00	138.02	34.29	134.10	36.33	127.22	40.07
LPMC:480	9	156.71	30.60	150.09	33.55	147.37	34.84	143.18	36.90	135.97	40.67
	11	166.87	31.12	159.89	34.10	157.01	35.41	152.56	37.48	144.94	41.28
CGWP050	5	172.01	37.92	164.55	41.55	161.49	43.13	156.81	45.66	148.74	50.28
LPME:500	7	183.64	38.52	175.75	42.20	172.51	43.81	167.58	46.38	159.08	51.03
LPMC:600	9	195.63	39.13	187.31	42.87	183.89	44.50	178.70	47.10	169.77	51.81
	11	207.98	39.76	199.23	43.56	195.63	45.21	190.16	47.83	180.79	52.59
CGWP060	5	206.57	45.38	197.49	49.64	193.78	51.51	188.13	54.48	178.51	59.88
LPME:600	7	220.45	46.06	210.90	50.40	207.00	52.28	201.03	53.30	190.90	60.77
LPMC:720	9	234.80	46.75	224.74	51.17	220.63	53.08	214.36	56.13	203.72	61.66
	11	249.55	47.47	238.99	51.95	234.69	53.99	228.10	56.98	216.91	62.57
CGWP080	5	275.00	60.20	261.40	67.10	256.00	69.80	247.80	74.00	234.20	80.80
LPME:800	7	294.00	61.40	281.30	68.00	275.00	71.00	266.80	75.10	253.20	82.00
LPMC:960	9	313.00	62.50	299.40	69.40	294.00	72.10	285.80	76.30	272.20	83.10
	11	332.00	63.70	318.40	70.60	313.00	73.30	304.80	77.40	291.30	84.30
CGWP090	5	309.30	67.30	294.10	75.00	287.90	78.00	278.80	82.70	263.50	90.30
LPME:900	7	330.70	68.60	316.50	76.00	309.30	79.30	300.20	83.90	284.90	91.60
LPMC:1080	9	352.10	69.90	336.80	77.60	330.70	80.60	321.60	85.20	306.30	92.90
	11	373.50	71.20	358.20	78.90	352.10	81.90	343.00	86.50	327.70	94.20
CGWP100	5	343.70	75.30	326.70	83.90	319.90	87.30	309.70	92.40	292.80	101.00
LPME:1000	7	367.50	76.70	351.60	85.00	343.70	88.70	333.50	93.90	316.50	102.50
LPMC:1200	9	391.30	78.20	374.30	86.70	367.50	90.20	357.30	95.30	340.30	103.90
	11	415.00	79.60	398.00	88.20	391.20	91.60	381.10	96.80	364.10	105.40

NOTE：EW-Condenser water inlet temperature. LW-Chiller water outlet temperature.

LPME-Rated water flow rate of evaporator (LPM) LPMC-Rated water flow rate of condenser.

Table 5: CGWP Performane Data (50Hz)

Model	LW(°C) \ EW(°C) kW	25		30		32		35		40	
		Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input
CGWP010	5	28.48	6.14	27.43	6.74	26.86	7.06	26.17	7.46	24.93	8.17
LPME:86	7	30.51	6.28	29.29	6.94	28.81	7.21	28.08	7.60	26.73	8.32
LPMC:100	9	32.59	6.42	31.36	7.07	30.89	7.33	30.16	7.72	28.72	8.46
	11	34.74	6.56	33.52	7.20	33.04	7.46	32.33	7.85	30.88	8.61
CGWP012	5	34.47	7.12	33.17	7.90	32.51	8.29	31.68	8.78	30.22	9.68
LPME:103	7	36.62	7.28	35.15	8.10	34.41	8.52	33.70	8.92	32.18	9.83
LPMC:120	9	38.88	7.44	37.38	8.25	36.80	8.57	35.91	9.05	34.32	9.98
	11	41.28	7.62	39.73	8.41	39.11	8.73	38.19	9.20	36.58	10.15
CGWP015	5	43.07	9.84	41.29	10.82	40.47	11.28	39.35	11.89	37.43	13.01
LPME:129	7	45.90	10.04	43.93	11.06	43.15	11.47	41.98	12.08	39.95	13.21
LPMC:150	9	48.78	10.24	46.75	11.25	45.98	11.64	44.75	12.25	42.63	13.40
	11	51.76	10.46	49.69	11.44	48.87	11.84	47.65	12.43	45.47	13.62
CGWP020	5	57.28	12.38	55.23	13.81	54.41	14.39	53.18	15.27	50.93	16.92
LPME:172	7	60.69	12.59	58.58	14.03	57.73	14.59	56.43	15.50	54.13	17.13
LPMC:200	9	64.09	12.82	61.93	14.24	61.07	14.79	59.75	15.70	57.35	17.35
	11	67.76	13.04	65.54	14.44	64.31	15.01	63.25	15.92	60.75	17.58
CGWP025	5	71.46	15.95	68.84	17.65	67.79	18.33	66.20	19.38	63.37	21.32
LPME:215	7	75.73	16.35	73.23	17.94	72.13	18.62	70.45	19.68	67.51	21.61
LPMC:250	9	80.54	16.52	77.59	18.21	76.44	18.88	74.70	19.96	71.60	21.92
	11	85.30	16.80	82.38	18.49	80.67	19.18	79.33	20.27	76.10	22.24
CGWP030	5	85.64	19.13	82.45	21.07	81.18	21.85	79.22	23.03	75.80	25.22
LPME:257	7	90.77	19.73	87.87	21.42	86.52	22.19	84.47	23.39	80.89	25.58
LPMC:300	9	97.00	19.83	93.24	21.75	91.83	22.53	89.65	23.75	85.85	25.98
	11	102.86	20.18	99.21	22.10	97.03	22.88	95.43	24.14	91.47	26.37
CGWP040	5	114.40	25.18	109.51	27.61	107.48	28.69	104.37	30.41	98.98	33.56
LPME:344	7	122.37	25.59	117.17	28.05	115.02	29.15	111.75	30.88	106.02	34.06
LPMC:400	9	130.59	26.01	125.08	28.52	122.80	29.61	119.32	31.36	113.31	34.57
	11	139.06	26.45	133.24	28.98	130.84	30.10	127.13	31.86	120.78	35.08
CGWP050	5	143.34	32.24	137.13	35.32	134.57	36.66	130.67	38.81	123.95	42.74
LPME:430	7	153.03	32.74	146.46	35.87	143.76	37.24	139.65	39.42	132.56	43.38
LPMC:500	9	163.03	33.26	156.09	36.44	153.24	37.82	148.92	40.03	141.48	44.04
	11	173.32	33.80	166.03	37.02	163.03	38.43	158.46	40.66	150.66	44.70
CGWP060	5	172.14	38.58	164.58	42.20	161.48	43.78	156.78	46.31	148.76	50.90
LPME:514	7	183.70	39.15	175.75	42.84	172.50	44.44	167.52	47.00	159.08	51.65
LPMC:600	9	195.67	39.74	187.29	43.49	183.86	45.12	178.63	47.71	169.77	52.41
	11	207.96	40.35	199.16	44.16	195.58	45.89	190.08	48.43	180.76	53.18
CGWP080	5	233.80	50.00	222.20	55.70	217.60	57.90	210.60	61.40	199.10	67.10
LPME:681	7	249.90	51.00	239.10	56.40	233.80	58.90	226.80	62.30	215.20	68.10
LPMC:817	9	266.10	51.90	254.50	57.60	249.90	59.80	242.90	63.30	231.40	69.00
	11	282.20	52.90	270.60	58.60	266.10	60.80	259.10	64.20	247.60	70.00
CGWP090	5	259.80	55.80	247.00	62.20	241.80	64.70	234.20	68.60	221.30	74.80
LPME:756	7	277.80	56.90	265.90	63.00	259.80	65.70	252.20	69.50	239.30	75.90
LPMC:907	9	295.80	57.90	282.90	64.30	277.80	66.80	270.10	70.60	257.30	77.00
	11	313.70	59.00	300.90	65.40	295.80	67.90	288.10	71.70	275.30	78.10
CGWP100	5	289.70	62.50	275.40	69.60	269.70	72.50	261.10	76.70	246.80	83.80
LPME:840	7	309.80	63.70	296.40	70.50	289.70	73.60	281.10	77.90	266.80	85.10
LPMC:1000	9	329.90	64.90	315.50	72.00	309.80	74.90	301.20	79.10	286.90	86.20
	11	349.80	66.10	335.50	73.20	329.80	76.00	321.30	80.30	306.90	87.50

NOTE：EW-Condenser water inlet temperature. LW-Chiller water outlet temperature.
LPME-Rated water flow rate of evaporator (LPM) LPMC-Rated water flow rate of condenser.

Troubleshooting and Maintenance

Periodic Maintenance

Perform all maintenance procedures and inspections at the recommended intervals. This will prolong the life of the equipment and reduce the possibility of costly equipment failures.

Use an "Operator's Log" such as the one at the back of this manual to record a weekly "operating conditions history" for this unit. The operating log for this unit can be a valuable diagnostic tool for service personnel. By noticing trends in the operating conditions, the operator can often foresee and prevent problem situations before they become serious.

If the unit does not operate properly during maintenance inspections, refer to "Problem diagnosis".

Weekly Maintenance

Once the unit been operating for about 10 minutes and the system has stabilized, check operating conditions and complete the checkout procedures that follow.

1. Check suction pressure and discharge pressure at the gauges on the unit.
2. Check the liquid line sight glasses.
3. If operating pressures and sight glass conditions seem to indicate refrigerant shortage, measure system superheat and system subcooling.
4. If operating conditions indicate an overcharge, slowly (to minimize oil loss) remove refrigerant at the liquid line service valve. Do not discharge refrigerant into the atmosphere.

Caution:

To prevent injury due to frostbite, avoid skin contact with refrigerant.

5. Inspect the entire system for unusual conditions. Use an operating log such as that shown at the end of this manual to record a weekly operating conditions history for the unit. A complete operating log is a valuable diagnostic tool for service people.

Monthly Maintenance

1. Perform all weekly maintenance procedures.
2. Measure and record system superheat.
3. Measure and record system subcooling.

Annual Maintenance

1. Perform all weekly and monthly maintenance procedures.
2. Have a qualified service technician check the setting and function of each control and inspect the condition of and replace compressor and control contactors if needed.
3. If chiller is not piped to drain facilities, make sure drain is clear to carry away system water.
4. Drain water from condenser and evaporator and associated piping systems. Inspect all piping components for leakage, damage, etc. Clean out any in-line water strainers.
5. Inspect evaporator and condenser tubes and clean, if needed. Refer to "Maintenance Procedures" as following.
6. Clean and repaint any corroded surface.
7. Inspect the expansion valve sensing bulbs for cleanliness. Clean if required. Sensing bulbs must make good contact with suction lines and be properly insulated.

Maintenance Procedures

This section describes specific maintenance procedures which must be performed as a part of the normal maintenance program for this unit. Be certain that electrical power to the unit is disconnected before performing these procedures.

Caution:
To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

Cleaning the Condenser

Water available for condensing frequently contains minerals or other contaminants that collect on the inside of the condenser tubes as carbonate scale. Scale accumulation will accelerate with high condensing temperatures and use of water with high mineral content. Cooling towers collect dust and foreign material which also deposits on the condenser tubes, forming sludge.

To maintain maximum efficiency, the condenser must remain as free of these deposits as possible. Even a very thin layer on the inside tube surfaces reduces the heat transfer ability of the condenser. Indications of scale deposits are decreased water flow through condenser, reduced temperature differential between entering and leaving condensing water and abnormally high condensing temperatures.

There are two accepted methods of cleaning condenser tubes. They are mechanical cleaning and chemical cleaning.

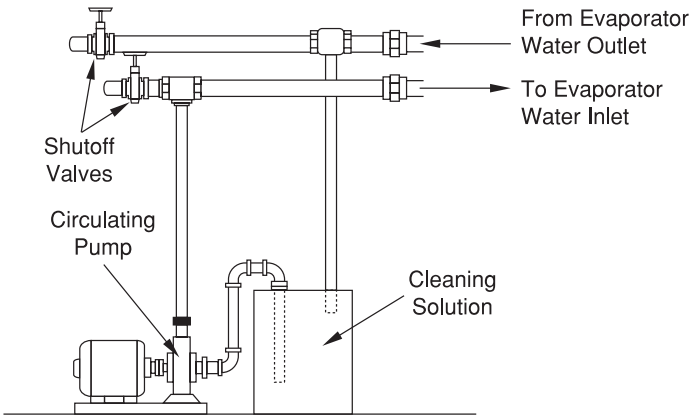
Chemical Cleaning

Chemical cleaning is the most satisfactory method of cleaning scale from condenser tubes. With this treatment, scale is dissolved and flushed away by circulating a chemical solution through the tubes and headers.

Internal condenser components are composed of copper, steel and cast iron. With this information, water treatment firms will be able to recommend a suitable chemical for this purpose. If water treatment is not available, consult a chemical supply house.

Figure 15 illustrates a typical chemical cleaning arrangement. All materials used in the chemical (external) circulating system, quantity of cleaning material, duration of cleaning and any safety precautions relative to the handling of the cleaning agent must be provided or approved by the supplier of the cleaning agent.

Figure 15: Typical Circulating Arrangement for Chemical Cleaning of Condenser and Evaporator



Mechanical Cleaning

The mechanical cleaning method is used primarily to remove sludge and other loose material from the condenser tubes. Use the following procedure.

1. Turn off chiller and condenser water supply.
2. Break piping connections at the unions.
3. Remove the frame casing .
   Please be noted use a brand new packing for re-assembling condenser heads.
4. Remove the condenser heads.
5. Run a round nylon brush from end to end through the tubes to loosen deposits.
6. Flush the tubes with water. Then inspect tubes for scale accumulation. If there is no scale in the tubes reassemble condenser and piping.
7. If there is scale in the tubes, proceed with the chemical cleaning procedure.

Problem Diagnosis

A. Compressor neither starts nor hums

Symptom	Recommended action
1. No power	a. Check for disconnect switch open b. Check for blown fuse
2. Unit locked out by reversal relay	Check the phase sequence
3. No call for cooling	a. Check for defective thermostat b. Broken or improper control wiring
4. Unit locked out by reset relay (CR1, CR2, CR3, CR4)	Check the protective devices as below and find out the reasons; Flow S/W; O.L.; KC; HP; LP; FS.
5. Compressor contactor will not close	a. Check for open reset relay (CR1, CR2, CR3, CR4) b. Check for defective thermostat
6. Compressor winding thermostat open	a. Check compressor amp. draw b. See 〝compressor winding thermostat open〞

B. Compressor hums, but will not start

Symptom	Recommended action
1. Low voltage at compressor	a. Check for low line voltage b. Check for defective compressor contactors
2. Defective compressor	a. Check for open motor winding b. Check for excessive amp. draw on all phases

C. 2nd. stage compressor fails to start

Symptom	Recommended action
1. Time delay contacts fail to close	Replace time delay relay
2. No call for cooling	a. Check for defective thermostat b. Check for improper control wiring
3. Locked out by reset relay	See Symptom A.
4. Compressor contactor will not close	See Symptom A.

D. Compressor runs continuously

Symptom	Recommended action
1. Unit undersized for load	Check cause of excessive load
2. Thermostat set point too low	Re-adjust thermostat setting
3. 〝Welded〞 contacts on compressor contactor	Repair or replace contactors
4. Leaky valves in compressor (indicated by abnormally low discharge and high suction pressure)	Replace compressor
5. Refrigerant shortage (as indicated by reduced capacity, high superheat, low subcooling and low suction pressure)	Find and repair leak Recharge system

E. Compressor motor winding thermostat open

Symptom	Recommended action
1. Excessive load on evaporator	a. Check for excessive water flow b. Check for high return water temp
2. Lack of motor cooling	a. Check for improper expansion valve setting or faulty expansion valve b. Check for restriction in liquid line
3. Improper voltage at compressor	Check for low or imbalanced line voltage. loose power wiring or defective compressor contactor.

F. Noisy compressor

Symptom	Recommended action
1. Damaged internal parts	Replace compressor
2. Liquid flood back (abnormally cold suction line and low superheat)	Check and adjust superheat
3. Liquid refrigerant in compressor at start-up	Check for refrigerant overcharge

G. System short of capacity

Symptom	Recommended action
1. Low charge	Add refrigerant
2. Clogged filter drier	Replace filter drier
3. Incorrect expansion valve setting	Readjust expansion valve
4. Expansion valve stuck or obstructed	Replace expansion valve
5. Low evaporator water flow	Check strainers. Adjust water flow
6. Non-condensibles in the system	Evacuate and recharge system

H. Suction pressure too low

Symptom	Recommended action
1. Short of refrigerant	Find and repair leak; recharge system
2. Thermostat set too low	Readjust thermostat
3. Low water flow	Check strainers and adjust balancing valve
4. Clogged filter drier	Replace
5. Expansion valve faulty	Replace

I. Suction pressure too high

Symptom	Recommended action
1. Excessive cooling load	Check for cause of excessive load
2. Expansion valve overfeeding	a. Verify remote bulb is properly attached b. Adjust superheat setting
3. Suction valve broken (i.e. noisy compressor)	Replace compressor

J. Discharge pressure too low

Symptom	Recommended action
1. Shortage of refrigerant	Find and repair leak
2. Broken or leaky compressor discharge valve	Replace compressor

K. Discharge pressure too high

Symptom	Recommended action
1. Condenser water flow restricted	Check water flow, clean condenser
2. Air or non-condensible gas in system	Evacuate and recharge system
3. Refrigerant overcharge	Recover excess refrigerant
4. Excessive system load	Check cause

Hardware

- When the jumper is in position 1, the auxiliary module is used to control the circuit 2.
- Position 2 : disable.
- Position 3 : disable.
- When the jumper is in position 4, the auxiliary module is used to allow to display the evaporator and condenser inlet water temperatures.

Figure 16: Base Module

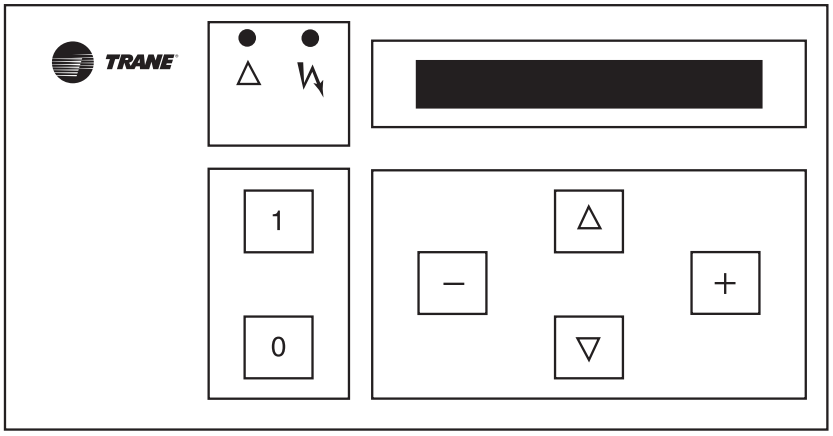
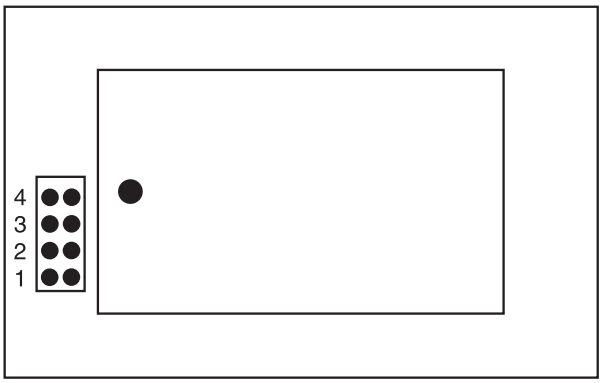


Figure 17: Auxiliary Module



Operation of the module

Function of keys 0 and 1

The key 1 is used to allow the start of the compressor.
The key 0 is used to stop the chiller.
When the operator press on key 0, the following message appears:
A operator stop

How to reset the SMM?

Press 3 times on the key ▽
the following message appears

＊＊＊＊ C ＊＊＊＊

Press 1 time on the key ＋
Press 1 time on the key ▽
The following message appears

C 02	NO

Press on the key ＋
The following message appears

C 02	CLEAR

Press 1 time on the key △ during 5 seconds.
The hour and the leaving chilled water temperatures are displayed.
The orange LED is switched off.

Notes

If one of the following faults is displayed:
M comp A1 fault
M comp A2 fault
M comp B1 fault
M comp B2 fault
the corresponding overload relays must be reset before to reset the SMM.

How to have access to the menu A?

Press 1 time on the key ▽
The following message appears

＊＊＊＊ A ＊＊＊＊

Press 1 time on the key ＋
Chilled water set point is displayed.

A01	Value ˚C

To have access to the following information, press the key ▽
To exit the menu press the key △ during a few seconds.

Information contained in the menu A

A01 Active water setpoint
A02 Evaporator water outlet mix temperature
A03 Circuit 1 evaporator water outlet temperature
A04 Circuit 2 evaporator water outlet temperature
A05 Air temperature
A06 Number of compressor A1 operating hours
A07 Number of compressor A1 starts
A08 Number of compressor B1 operating hours
A09 Number of compressor B1 starts
A10 Number of compressor A2 operating hours
A11 Number of compressor A2 starts
A12 Number of compressor B2 operating hours
A13 Number of compressor B2 starts

How to have access to the menu B?

Press twice on the key ▽
The following message appears

＊＊＊＊ B ＊＊＊＊

Press 1 time on the key ＋
The leaving chilled water temperature set point value is displayed.
To change the value, press on the keys ＋ or －
To have access to the following parameters, press on the key ▽
To change the value of these parameters, press on the keys ＋ or －
To exit this menu, press the key △ during a few seconds.

Parameters which can be modified in the menu B

B01 Evaporator outlet temperature setpoint
Setting -26.0˚C to 30.0˚C by 0.1˚C increment. Default value 6.0.
B02 Hot water outlet temperature setpoint
Setting 20.0˚C to 60.0˚C by 0.1˚C increment. Default value 45.0.
B03 Auxiliary water outlet temperature setpoint
Setting -26.0˚C to 60.0˚C by 0.1˚C increment. Default value 6.0.
B04 Circuit 1 ON validation
Enabled circuit: Enable. Disabled circuit: Disable. Default value: Enable
B05 Circuit 2 ON validation
Enabled circuit: Enable. Disabled circuit: Disable. Default value: Enable
B06 Operating mode
Cooling mode: Cooling Heating mode: Heating
Serial link control: Extern Default value: Cooling

B07 Remote control validation
Remote control: Remote
Local control: Local
Default value: Local
B08 Auxiliary setpoint validation
Enabled circuit: Enable. Disabled circuit: Disable.
Default value: Disable
B09 Current date display
B091 day-setting 1 to 31
B092 month-setting 1 to 12
B093 year-setting 00 to 99.
B10 Current hour display
B101 hour-setting 00 to 23
B102 Minutes-setting 00 to 59
B103 Seconds-setting 00 to 59.
B11 Set this parameter at 0,0˚C
B12 Set this parameter at 0,0˚C
B13 Set this parameter at 0,0˚C

How to have access to the menu C ?

Press 3 times on the key ▽
The following message appears

＊＊＊＊ C ＊＊＊＊

Press 1 time on the key ＋
The last fault is displayed.
Press successively on the key ＋ to display the last 20 faults
Press successively on the key － to display the last fault.
To exit this menu, press during a few seconds on the key △.
This menu is used also to reset the SMM (see parapragh How to reset the SMM?)

How to have access to the menu D?

Press 4 times on the key ▽
The following message appears

＊＊＊＊ D ＊＊＊＊

Press 1 time on the key ＋
The following message appears

D 01	None

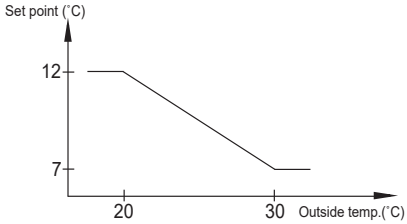
To change the value, press on the keys ＋ or －
To have access to the following parameters, press on the key ▽
To change the values of these parameters, press on the keys ＋ or －.
To exit this menu, press on the key △ during a few seconds.

Parameters which can be modified in the menu D

D01 Cooling setpoint reset type
None: None-On air: Air-On water: Ret. Wat.-Default value: None
D02 Cooling reset starting value
Setting 2˚C to 55˚C by 0.1˚C increment. Default value 20.0.
D03 Cooling reset value range
Setting 2˚C to 20˚C by 0.1˚C increment. Default value 10.0.
D04 Cooling reset range
Setting -15˚C to 15˚C by 0.1˚C increment. Default value 5.0.
D05 Heating setpoint reset type
None: None-On air: Air-On water: Ret. Wat.-Default value: None
D06 Heating reset starting value
Setting 2˚C to 55˚C by 0.1˚C increment. Default value 20.0.
D07 Heating reset value range
Setting 2˚C to 20˚C by 0.1˚C increment. Default value 10.0.
D08 Heating reset range
Setting -15˚C to 15˚C by 0.1˚C increment. Default value 5.0.

Example of programmation of the chilled water temperature set point in function of the air temperature

Expected operation



Values to be programmed

Parameter	Value
B01	12,0
D01	Air
D02	20,0
D03	10,0
D04	-5,0

D09 Generic input type

0..10 Volts	0..10V
2..10 Volts	2..10V
0.20mA	0..20mA
4..20mA	4..20mA
Default value	0..10V

10V or 20 mA lead to a chilled water temperature set point reset of 20˚C.
D10 Evaporator pump stop timer
Setting 1 to 10 mn by 1 mn increment. Default value 1.
D11 Evaporator water pump automatical cleaning

None	None
6 hours	6H
12 hours	12H
24 hours	24H
48 hours	48H
Default value	None

D12 compressor lead-lag

Increasing fix	1-2
Decreasing fix	2-1
Start and hour balancing	Auto
Automatic inversion at each star	TRANE
Default value	TRANE

The parameters D13 and D14 are used to determine the conditions under which the fault relays switch on.

D13 Default 1 report type

		Displayed value
Unit or circuit 1 manual reset defaulbit	bit 0	1
Unit or circuit 2 manual reset default	bit 1	2
Unit or circuit 1 automatic reset default	bit 2	4
Unit or circuit 2 automatic reset default	bit 3	8
Circuit 1 not available or in limit	bit 4	16
Circuit 2 not available or in limit	bit 5	32
Informational default on unit	bit 6	64
Default value	1	

D14 Default 2 report type

		Displayed value
Unit or circuit 1 manual reset default	bit 0	1
Unit or circuit 2 manual reset default	bit 1	2
Unit or circuit 1 automatic reset default	bit 2	4
Unit or circuit 2 automatic reset default	bit 3	8
Circuit 1 not available or in limit	bit 4	16
Circuit 2 not available or in limit	bit 5	32
Informational default on unit	bit 6	64
Default value	2	

Example:

on a 2 circuit unit, we wish that the fault relay 1 (D13) switches on if a manual or an automatic reset fault occur. i.e.in the cases corresponding to the dits 0, 1, 2 and 3. In this case, we have to display the value 15 (1+2+4+8)

D15 Serial link address

setting 0 to 62. Default value 0.

Use

For comfort type application, increasing the reset point when the air temperature decreases allows to obtain better C.O.P. at part load, so to decrease the energy consumption.

How to have access to the menu E?

Press 5 times on the key ▽

The following message appears

＊＊＊＊ E ＊＊＊＊

Press 1 time on the key +

The saturated refrigerant temperature inside circuit 1 evaporator is displayed.

E01	Value ˚C

To have access to the following information, press on the key ▽

To exit this menu, press on the key △ during a few seconds.

information contained in the menu E

E01 Circuit 1 evaporator saturated temperature
E02 Circuit 1 evaporator saturated pressure
E03 Circuit 1 condenser saturated temperature
E04 Circuit 1 condenser saturated pressure
E05 Circuit 2 evaporator saturated temperature
E06 Circuit 2 evaporator saturated pressure
E07 Circuit 2 condenser saturated temperature
E08 Circuit 2 condenser saturated pressure
E09 Evaporator water inlet temperature
E10 Condenser water outlet temperature
E11 Condenser water inlet temperature

TRANE

Explanation of the fault codes

Displayed messages	Description	Action
I Service demand	Service request on the unit: one of the compressor configurated as presently has reached the value 1	Contact Trane Service Agency
I E2P par.chg	When powering-up the module, one or more of the operating parameters in E2PROM was incorrect and has been corrected (default value). Check the configuration.	Check the configuration
I XRAM par.chg	When powering-up the module, one or more of the operating parameters in XRAM was incorrect and has been corrected (default value). Check the configuration.	Check the configuration
I E2P par.prog.	When powering-up the module, all the operating parameters in EPROM were incorrect and have beem replaced by their default value. Make the configuration.	Check the configuration
A User ckt1 stop	Circuit 1 is forced to stop due to the operator's configuration(menu B04)	For info only. No necessary action
A User ckt2 stop	Circuit 2 is forced to stop due to the operator's configuration(menu B05)	For info only. No necessary action
A Ext. ckt1 stop	Circuit 1 is forced to stop due to an external cause, by the O/I input Auto/Stop 1.	For info only. No necessary action
A Ext. ckt2 stop	Circuit 2 is forced to stop due to an external cause, by the O/I input Auto/Stop 2.	For info only. No necessary action
A Rem. ckt1 stop	Circuit 1 is forced to stop by the serial link.	For info only. No necessary action
A Rem. ckt2 stop	Circuit 2 is forced to stop by the serial link.	For info only. No necessary action
A User unit stop	Unit is forced to stop due to the operator's configuration. On single circuit units, this message is displayed if circuit 1 is devalidated (menu B04). On dual circuit this message is displayed if both circuits 1 and 2 are devalidated (menu B04 and menu B05)	For info only. No necessary action
A Ext. unit stop	Unit is forced to stop due to an external causes. On single circuit units, this message is displayed if circuit 1 is devalidated (O/I input Auto-Stop 1)On dual circuit units, this message is displayed if both circuits 1 and 2 are devalidated (O/I input Auto/Stop 1 and Auto/stop 2).	For info only. No necessary action
A Rem. unit stop	Unit is forced to stop by the serial link. On single circuit units, this message is displayed if circuit 1 is devalidated by the serial link. On dual circuit units, this message is displayed if both circuits 1 and 2 are devalidated by the serial link.	For info only. No necessary action
A Operator stop	The unit is stopped by the operator who has prshed key 0.	For info only. No necessary action
I E2prom fault	A default occured when writing information in E2PROM.The value in memory may not be right and thus corrected at next powering-up.	Switch off the SMM during 5 seconds
A Ckt1 limiting	One of the compressors of circuit 1 is prevented to start because one of the limitation is active (evaporator 1 outlet water temperature below the evaporator outlet water temperature low setpoint, evaporator 1 refrigerant temperature below the refrigerant temperature low setpoint, evaporator outlet temperature too high).	For info only. No necessary action
A Ckt2 limiting	One of the compressors of circuit 2 is prevented to start because one of the limitation is active (evaporator 2 outlet water temperature below the evaporator outlet water temperature low setpoint, evaporator 2 refrigerant temperature below the refrigerant temperature low setpoint, evaporator outlet water temperature too high). NB: this message can be displayed on 3 compressor units but without any influence on the operation of circuit 2.	For info only. No necessary action
A Ckt1 HP limit.	The condenser side refrigerant pressure on circuit 1 is too high, and the system reduces the number of compressors in operation until its complete stop if necessary.	Check condenser cleaning and fan state.
A Ckt2 HP limit.	The condenser side refrigerant pressure on circuit 2 is too high, and the system reduces the number of compressors in operation until its complete stop if necessary.	Check condenser cleaning and fan state.
A Low ambience	The outdoor air temperature is lower than the low ambient setpoint.	For info only. No necessary action
A Ckt1 defrost	Circuit 1 is de-icing and thus preventing the operation of circuit 2 (if present)	For info only. No necessary action
A Ckt2 defrost	Circuit 2 is de-icing and thus preventing the operation of circuit 1	For info only. No necessary action
A EVP water flow	Loss of evaporator water flow during more than 2 sec. If one of the compressor was operating, then the default LED is lit, if not, it is not lit.	Check chilled water pump state.
A Sensor 4 main	The customer analogical in put is configurated as 2..10V or 4..20 mA and the signal is lower than 1V or 2 mA.	Check configuration of parameter D09 and analogic inlet.
A Sensor 1 I/O 2	Sensor 1 (air temperature) of module I/O 2 is out of range (short circuit < 40˚C, or circuit open > 80˚C).	Change the sensor.

Displayed messages	Description	Action
A Sensor 1 I/O 3	Sensor 1 (condenser water outlet temperature) of module I/O 3 is out of range (short circuit < 40˚C, or circuit open > 80˚C).	Change the sensor.
A Sensor 1 I/O 4	Sensor 1 (evaporator water inlet temperature) of module I/O 4 is out of range (short circuit < 40˚C, or circuit open > 80˚C).	Change the sensor.
A Sensor 1 main	Sensor 1 (evaporator 1 water outlet temperature) of the main module is out of range (short circuit < 40˚C, or circuit open > 80˚C).	Change the sensor.
A Sensor 2 main	Sensor 2 (evaporator 1 refrigerant saturated temperature) of the main module is out of range (short circuit < 40˚C, or circuit open > 80˚C).	Change the sensor.
A Sensor 3 main	Sensor 3 (evaporator 1 refrigerant saturated temperature) of the main module is out of range (short circuit < 40˚C, or circuit open > 80˚C).	Change the sensor.
A Sensor 1 I/O 1	Sensor 1 (evaporator 2 water outlet temperature) of module I/O 1 is out of range (short circuit < 40˚C, or circuit open > 80˚C).	Change the sensor.
A Sensor 2 I/O 1	Sensor 2 (evaporator 2 refrigerant saturated temperature) of module I/O 1 is out of range (short circuit < 40˚C, or circuit open > 80˚C).	Change the sensor.
A Sensor 3 I/O 1	Sensor 3 (evaporator 2 refrigerant saturated temperature) of module I/O 1 is out of range (short circuit < 40˚C, or circuit open > 80˚C).	Change the sensor.
A Com I/O 1	The main module does not communicate anymore with module I/O 1. Check the link wiring with this module as well as its address (circuit 2 board)	Check the link wiring
A Com I/O 2	The main module does not communicate anymore with module I/O 2. Check the link wiring with this module as well as its address (air-cooled unit board)	Check the link wiring
A Com I/O 3	The main module does not communicate anymore with module I/O 3. Check the link wiring with this module as well as its address (reversible unit board)	Check the link wiring
A Com I/O 4	The main module does not communicate anymore with module I/O 4. Check the link wiring with this module as well as its address (option doard)	Check the link wiring
M Low ref.ckt1	Evaporator 1 refrigerant saturated temperature has overtaken the refrigerant low remperature setpoint.	Check expansion valve state and refrigerant load
M Low ref.ckt2	Evaporator 2 refrigerant saturated temperature has overtaken the refrigerant low remperature setpoint.	Check expansion valve state and refrigerant load
M Low water ckt1	Evaporator 1 water outlet temperature has overtaken the evaporator water low temperature setpoint.	Check chilled water flow
M Low water ckt2	Evaporator 2 water outlet temperature has overtaken the evaporator water low temperature setpoint.	Check chilled water flow
M Pressure ckt1	Circuit 1 has been put in consecutive stand-by too near: thus it is stopped.	Check condenser cleanliness
M Pressure ckt2	Circuit 2 has been put in consecutive stand-by too near: thus it is stopped.	Check condenser cleanliness
M Discharge ckt1	One of the circuit 1 compressors has operated during a too long period with a high discharge temperature: thus it is stopped.	Check refrigerant load
M Discharge ckt2	One of the circuit 2 compressors has operated during a too long period with a high discharge temperature: thus it is stopped.	Check refrigerant load
M Comp. A1 fault	The compressor A1 default I/O input shows a default.	Reset the overload relay of compressor A1
M Comp. B1 fault	The compressor B1 default I/O input shows a default.	Reset the overload relay of compressor B1
M Comp. A2 fault	The compressor A2 default I/O input shows a default.	Reset the overload relay of compressor A2
M Comp. B2 fault	The compressor B1 default I/O input shows a default.	Reset the overload relay of compressor B2
M ckt1 fault	The compressor A1 and B1 default I/O inputs simultaneously show a default.	Reset pressostat HP, circuit 1
M ckt2 fault	The compressor A2 (and B2 if present) default I/O inputs simultaneously show a default.	Reset pressostat HP, circuit 2
M Unit fault	All the present compressor default I/O inputs simultaneouslyshow a default.	Reset pressostats and thermal relays

Note：

The first letter of the displayed message indicates the type of default

I：for information

A：automatic reset default

M：manual reset defauit

Table 6: Operator's Maintenance Log

DATE	WEEKLY MAINTENANCE INSPECTION													
	COMPRESSOR(S)						SIGHT GLASS/MOISTURE INDICATOR				WATER TEMP. (˚F)			
	CIRCUIT 1			CIRCUIT 2 (2)			CIRCUIT 1		CIRCUIT 2 (2)		EVAP.		COND. (4)	
	OIL LEVEL	SUCT.(3) PRESS.	DSCHG. PRESS.	OIL LEVEL	SUCT. PRESS.	DSCHG. PRESS.	REFRIG. CONDITION	MOISTURE LEVEL	REFRIG. CONDITION	MOISTURE LEVEL	ENT.	LVG.	ENT.	LVG.
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
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	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				

Notes:

1. Performing inspection at least once per week for operating unit.
2. Dual circuited unit only.
3. Record operating pressure in psig if pressure gauges are available.

Table 7: Operator's Maintenance Log

DATE	WEEKLY MAINTENANCE INSPECTION													
	COMPRESSOR(S)						SIGHT GLASS/MOISTURE INDICATOR				WATER TEMP. (˚F)			
	CIRCUIT 1			CIRCUIT 2 (2)			CIRCUIT 1		CIRCUIT 2 (2)		EVAP.		COND. (4)	
	OIL LEVEL	SUCT.(3) PRESS.	DSCHG. PRESS.	OIL LEVEL	SUCT. PRESS.	DSCHG. PRESS.	REFRIG. CONDITION	MOISTURE LEVEL	REFRIG. CONDITION	MOISTURE LEVEL	ENT.	LVG.	ENT.	LVG.
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
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	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				
	❑ OK ❑ LOW			❑ OK ❑ LOW			❑ OK ❑ BUBBLES	❑ DRY ❑ WET	❑ OK ❑ BUBBLES	❑ DRY ❑ WET				

Notes:

1. Performing inspection at least once per week for operating unit.
2. Dual circuited unit only.
3. Record operating pressure in psig if pressure gauges are available.

TRANE

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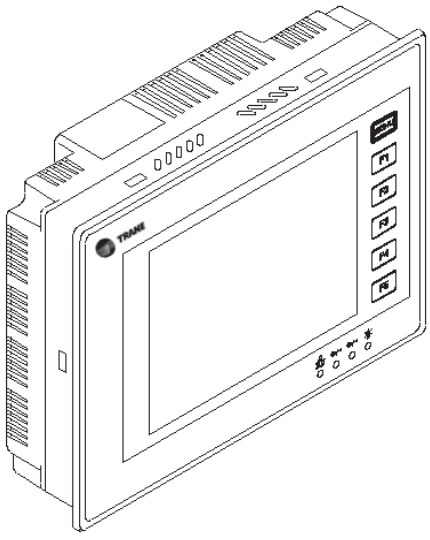
FM : 38631
ISO 9001 Qualified factory - Trane Taiwan

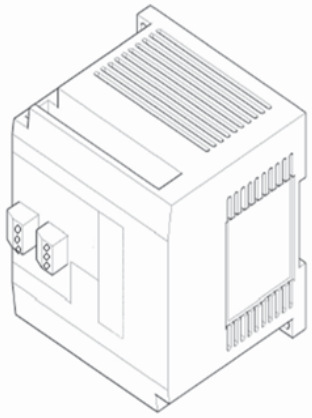
Literature Order Number	CGWP-SVX01B-EN-1003
File Number	CGWP-IOM-2
Supersedes	CGWP-SVX01A-EN-0701
Stocking location	Taipei, Taiwan

Operation Instruction EB-CMPN-10

Library	Service Literature
Product	Scroll Chiller
Model	--
Literature Type	Operation Instruction
Sequence	A
Date	2010.01.
File No.	EB-CMPN-10-A_EN
Supersedes	New

Operation Instruction of Programmable Logic Controller (PLC) with Human Machine Interface (HMI) for Scroll Chiller





Contents

HARDWARE

The components of controller include

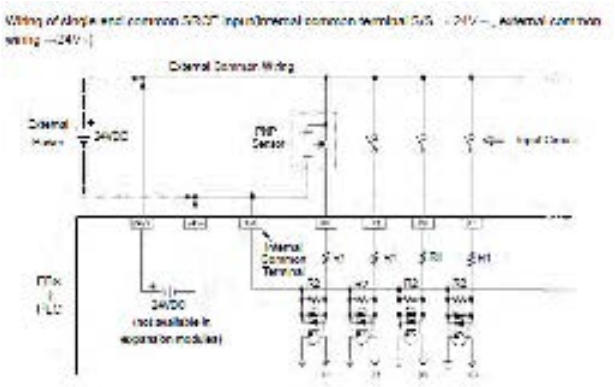
Programmable Logic Controller Main Unit (PLC)
Temperature Input Module (Pt100)
Communication Board (RS-485, two ports)
Human Machine Interface (HMI)
Program (software) and Wiring

PLC Main Unit

Power input: 110~240VAC
Digital input
Digital output
Built-in serial communication port (Port 0): for program downloading and communication with HMI in short distance. All communication ports are with TX (transmit) and RX (receive) display (LED). TX and RX flash when in normal communication.
Expansion module or board can be mounted to achieve various functions.

Digital Input

Total 14 points, designated by X00~X13,detected by 24Vdc, to sense the on/off status of the inputs, typical wiring scheme as the figure at right. The functions of the digital inputs are described as below. The PLC upper part corresponding LED will turn on if the digital input are sensed as close (on).



- X00 [Remote Start / Stop (REMOTE)]
  Hard wired with the switch to turn on and off chiller. Effective when the start source set as **Remote**. Chiller starts when the start source set as Remote and X00 is on. Chiller does not care X00 if start source set as Local. See screen [USER SETTING – 2]

- X01 [external alarm (ALARM)]
  Hard wired with the external alarm switch to stop the unit in emergency. OFF=alarm, ON=normal.

- X02 [ice making (ICE)]
  Hard wired with the ice making switch. OFF=chilled water application, ON=making ice. When the chiller starts, relating setting allowed, and X02 ON, chiller will make ice at

full capacity until X02 breaks or the chilled entering water temperature reaches set point. See screen [USER SETTING – 4]

- X03 [evaporator normal (CHFS)]
  Hard wired with chilled water flow switch, chilled pump contactor normal open contact, or chilled water pump overload relay, etc., to make sure the evaporator water flow normal. OFF=fault, ON=normal.

- X04 [condenser normal (CDFS or KF1+KF2+KF3+KF4)]
  Water cooled model: Hard wired in series with cooling water flow switch, cooling water pump contactor normal open contact, cooling water pump overload relay, or pump overheat thermostat, etc., to make sure the condenser water flow normal.
  Air cooled model: Hard wired in series with condenser fan overheat thermostat, or condenser fan motor overload relay, etc., to make sure the condenser fan motor normal. OFF=fault, ON=normal.

- X05 [power supply normal (APR)]
  Series wired with power supply detection device, for example, phase checking relay, voltage high relay, voltage low relay, etc., to make sure the power supply correct. OFF=fault, ON=normal.

- X06 [Circuit 1 high pressure normal (HP1)]
  Wired with refrigerant circuit 1 high pressure cutout, OFF=fault, ON=normal.

- X07 [Circuit 1 low pressure and temperature normal (LP1+FS1)]
  Wired with refrigerant circuit 1 low pressure cutout and freezestat. OFF=fault, ON=normal.

- X08 [Compressor 1A normal (KC1+OL1)]
  Wired with the circuit 1, first compressor thermostat and overload relay. OFF=fault, ON=normal.

- X09 [Compressor 1B normal (KC2+OL2)]
  Wired with circuit 1, second compressor thermostat and overload relay. OFF=fault, ON=normal.

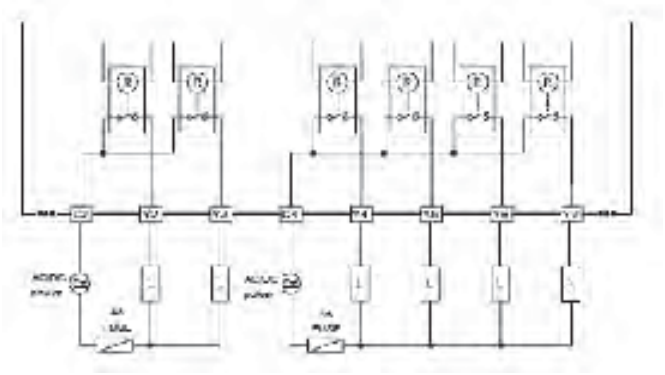
- X10 [Circuit 2 high pressure normal (HP2)]
  Wired with refrigerant circuit 2 high pressure cutout, OFF=fault, ON=normal.

- X11 [Circuit 2 low pressure and temperature normal (LP2+FS2)]
  Wired with refrigerant circuit 2 low pressure cutout and freezestat. OFF=fault, ON=normal.

- X12 [Compressor 2A normal (KC3+OL3)]
  Wired with the circuit 2, first compressor thermostat and overload relay. OFF=fault, ON=normal.

- X13 [Compressor 2B normal (KC4+OL4)]
  Wired with the circuit 2, second compressor thermostat and overload relay. OFF=fault, ON=normal

Digital Output (Relay Output)



Total 10 outputs, designated by Y0~Y9, are dry contact without voltage in PLC. External wiring with power is necessary to activate the devices. Typical wiring is as the figure at right. The functions of the digital outputs are described as below. The PLC lower part corresponding LED will turn on if the digital outputs are energized (on).

- Y00 [chiller running status (RUN)]
- Y01 [chiller fault status (FAULT)]
- Y02 [pump start (PUMP)]
- Y03 [cooling tower fan start / condenser fan 1st stage (CT or FAN1)]
  - Water cool model : to start the cooling tower fan motor
  - Air cool model: to start the first stage condenser fan motor
- Y04 [compressor 1A start (CMP 1A)]
- Y05 [compressor 1B start (CMP 1B)]
- Y06 [compressor 2A start (CMP 2A)]
- Y07 [compressor 2B start (CMP 2B)]
- Y08 [condenser fan 2nd stage (FAN2)]
- Y09 [condenser fan 3rd stage (FAN 3)]

Temperature Input Module

The module can be wired to maximum six Pt100 temperature sensors (3 wire type, DIN, α=0.00385), designated by P0~P5.

- P0 [Chilled Leaving Water Temperature, circuit 1 (CL LWT – 1)]

- P1 [Chilled Leaving Water Temperature, circuit 2 (CL LWT – 2)]
- P2 [Ambient Temperature (AMB)](Optional)
- P3 [Chilled Entering Water Temperature (CL EWT)] (Optional)
- P4 [Cooling Leaving Water Temperature (HT LWT)] (Optional)
- P5 [Cooling Entering water temperature (HT EWT)] (Optional)

Serial Communication Board

The unit is equipped with 2 serial communication ports, designated by Port 1 and Port 2. TX and RX lamps besides each port can indicate the communication status. TX and RX lamps flash in normal communication. Protocol can be set as FATEK or MODBUS (RTU slave). MODBUS protocol is universally adoptive most of BAS system in the market place.

- Port 1: RS-485 interface, 3-pin removable plug, factory set as FATEK protocol
- Port 2 :RS-485 interface, 3-pin removable plug, factory set as MODBUS protocol

Analog Input Module (Optional)

The unit can be optionally equipped with AI module and maximum wired to six analog signal, designated by I0~I5. I2 to I5 is to be wired with refrigerant pressure transducers with 4~20mA signal.

- I0 [Not Used]
- I1 [Not Used]
- I2 [Circuit 1 High Pressure]
- I3 [Circuit 1 Low Pressure]
- I4 [Circuit 2 High Pressure]
- I5 [Circuit 2 Low Pressure]

Human Machine Interface

- 5.7” STN LCD touch screen display
- Mono, 16 shades of blue, display resolution 320x240
- 1 menu keypad and 5 keypads (F1~F5)
- Front panel seal: IP65 /NEMA 4
- Operation temperature 0~50˚C, relative humidity 20~90%
- 24VDC power supply
- 2 communication ports
  - COM1: RS-232 and RS-485 interface, D9 female connector.

- COM2: RS-232, RS-422, and RS-485 interface, D25 female connector.

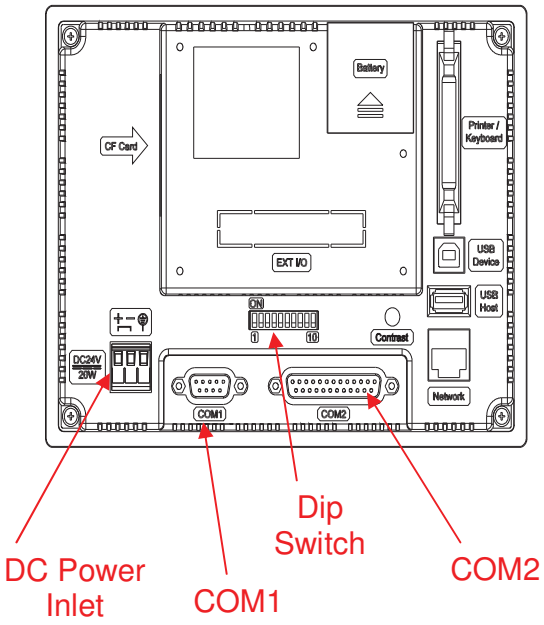
- 4 lamp indicators
  - Power lamp: light when power on.
  - COM1 lamp: COM1 lamp flashes when COM1 port is communicating with controller normally. COM1 lamp flashes slowly when COM1 port loses communicating with controller. [Not Used]
  - COM2 lamp: COM2 lamp flashes when COM2 port is communicating with controller normally. COM2 lamp flashes slowly when COM2 port loses communicating with controller.
  - Network lamp. [Not used.]
- Communication between HMI and PLC
  - Distance between HMI and PLC less than 5m: HMI uses COM2 to communicate with **PLC port 0**.
  - Distance between HMI and PLC 4~500m: HMI uses COM2 to communicate with PLC **port 1**.
- Description of HMI Dip Switches

Dip Switches		Function
SW1		**Reserved**
SW2		**Reserved**
SW3	**SW4**	**Operation Mode**
ON	ON	Runs user application
ON	OFF	Runs burn-in test program
OFF	ON	Updates BIOS
OFF	OFF	Runs bench test program
SW5		**Communication Parameters**
ON		HMI uses parameters defined on the Configuration Screen for controller communication
OFF		HMI uses parameters defined in application program for controller communication
SW6		**Password**
ON		HMI asks the operator to enter a password after power-on self-test
OFF		No password is required to start HMI
SW7		**System Menu**
ON		HMI displays System Menu.
OFF		HMI runs user application without displaying System Menu.
SW8		**Default user level**
ON		The default user level is set to 1 if HMI requires no password to start its application.
OFF		The default user level is set to 9 if HMI requires no password to start its application.

SW9 ON	**COM1 Port** For RS485 this switch has to be set ON.
SW10 ON OFF	**COM2 Port** For RS485 this switch has to be set ON. For RS422 this switch has to be set OFF.

Factory default setting:

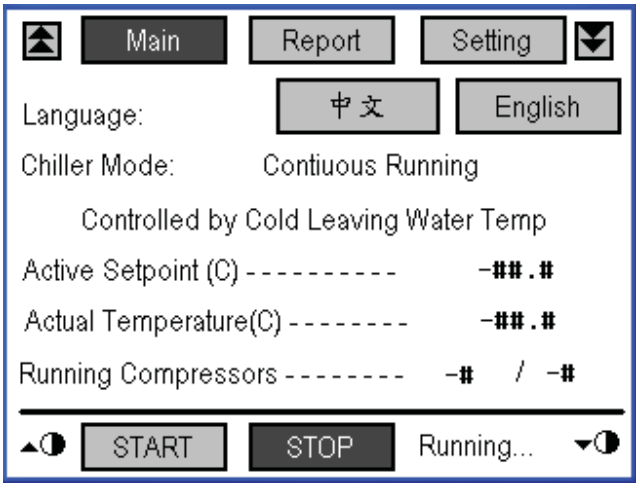
- SW01=ON
- SW02=ON
- SW03=ON
- SW04=ON
- SW05=OFF
- SW06=OFF
- SW07=OFF
- SW08=OFF
- SW09=ON
- SW10=ON



MESSAGE

HMI is touch screen liquid crystal display (LCD). Touch screen to switch screen or adjust parameters.

Screen [Main -1] (start up screen)



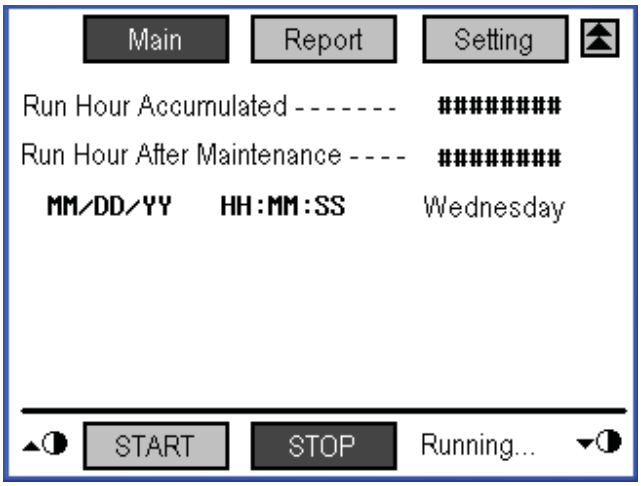
- Touch panel 中文 and **English** to change the language to traditional Chinese or English.
- Display chiller status, message may be
  - Wrong configuration setting...(1)
  - Stop by external fault...(2)
  - Stop by local panel ...(3)
  - Stop by remote switch...(4)
  - Running with fault...(5)
  - Stop by chiller fault...(6)
  - Running normal...(7)
  - Running by timer /schedule...(8)
  - Stop by timer /schedule...(9)
  - Running part capacity...(10)
  - Waiting making ice…(11)
- Display the chiller capacity control source, message may be
  - Control by chilled leaving water temperature
  - Control by chilled entering water temperature
  - Control by cooling leaving water temperature
  - Control by cooling entering water temperature
  - Ice making
- Display active set point and actual temperature
- Display quantity of running compressor / total compressor
- Touch panel "**START**" and "**STOP**" to start and stop the chiller if set as **Local**. Panel "START" and "STOP" are disabled if set chiller start as Remote. See screen [USER SETTING – 2]
- Touch panel "**Main**", "**Report**", "**Setting**", "▲ ", "▼ ",to switch screen. Touch panel "▲ ",to switch to [**TRANE**] screen.

Screen [TRANE]

- Come up with TRANE brand in the screen.
- Touch panel "**X**" returns the previous screen.

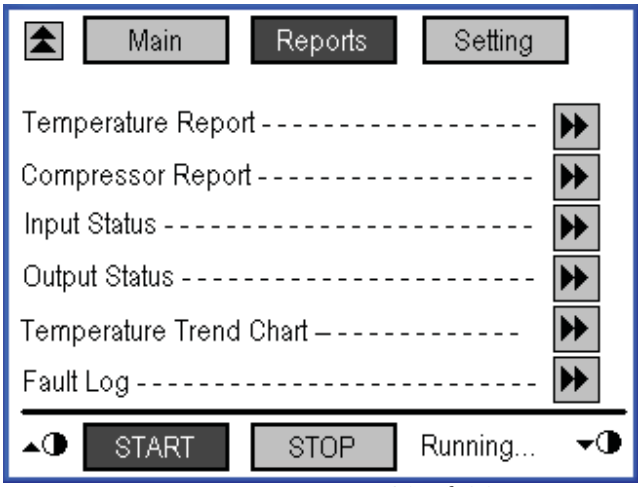
Screen [Main – 2]

- Display
  - Chiller run hour accumulated
  - Chiller run hour after maintenance
- Display
  - Date (month /day /year)
  - Time (hour: minute: second)
  - Day of week
- Display cause of wrong configuration setting, if any.
- Touch panel "**Main**", "**Report**", "**Setting**", and " ▲ " to switch screen.

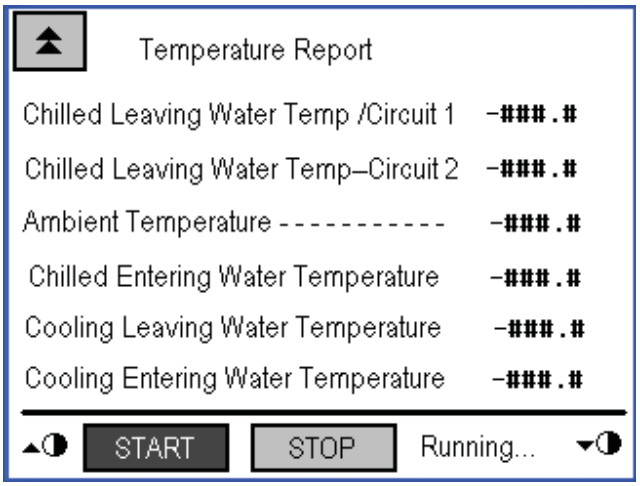


Screen [Reports]

- Touch panel "► " to switch screen to:
  - [Temperature Report]
  - [Compressor Report]
  - [Digital Input Status]
  - [Digital Output Status]
  - [Temperature Trend]
  - [Fault Log]
- Touch panel "**Main**", "**Report**", "**Setting**", " ▲ " to switch screen.



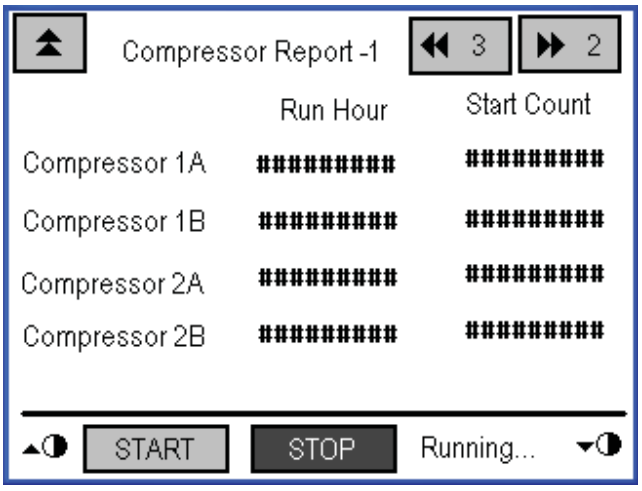
Screen [Temperature Report]



- Display temperatures if the sensors are installed.
  - Chilled Leaving Water Temperature – Circuit 1
  - Chilled Leaving Water Temperature – Circuit 2
  - Ambient Temperature (Optional)
  - Chilled Entering Water Temperature (Optional)
  - WC model : Cooling Leaving Water Temperature or
    AC model: Condenser coil temperature – circuit 1 (optional)
  - Water cool model : Cooling Entering Water Temperature or
    Air cool model: Condenser coil temperature – circuit 2 (optional)

- Touch panel " ▲ " to switch to screen [Reports].

Screen [Compressor Report -1]

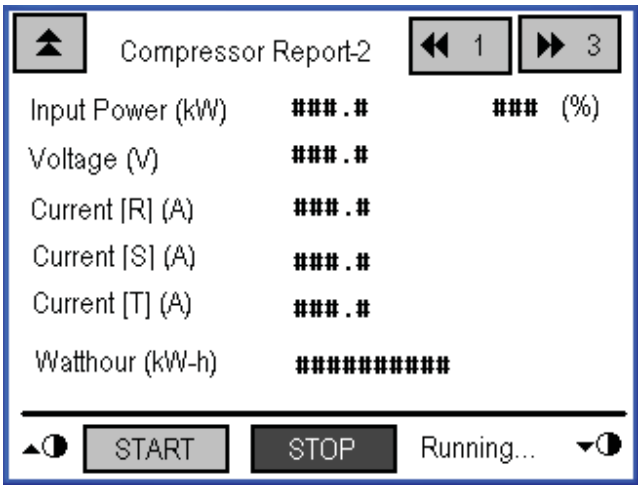


- Display compressor information if the compressor is installed.
  - Compressor 1A run hour accumulated
  - Compressor 1B run hour accumulated
  - Compressor 2A run hour accumulated
  - Compressor 2B run hour accumulated
  - Compressor 1A start count
  - Compressor 1B start count
  - Compressor 2A start count
  - Compressor 2B start count

    ❖ 1 and 2 are designated for the refrigerant circuit. A and B are designated for the first and second compressor of the tandem system.

- Touch panel " ▲ " to switch to screen [Reports].

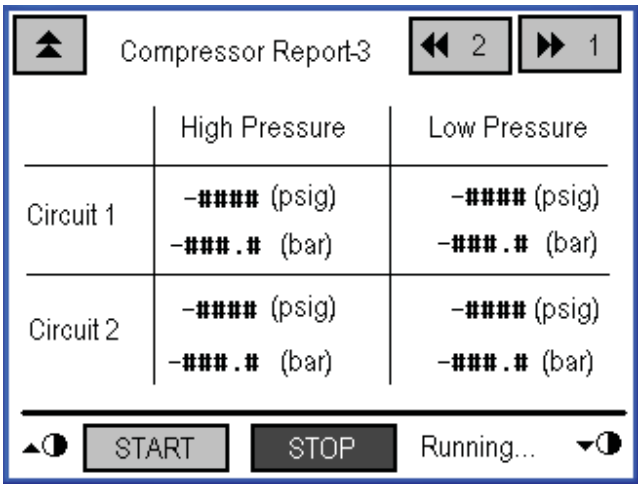
Screen [Compressor Report - 2]



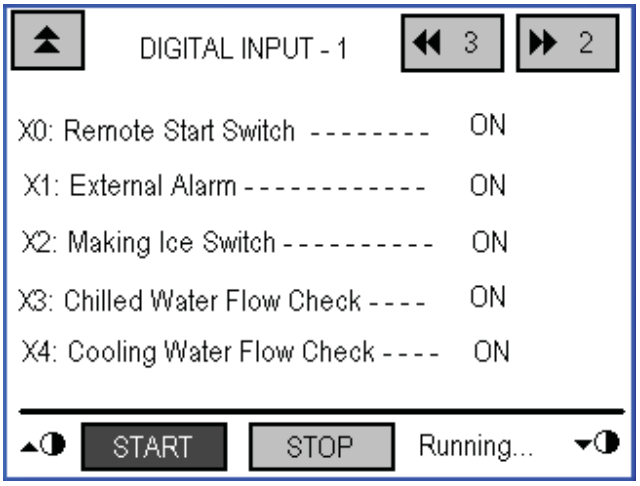
- Display total power consumption (kW) if optional power module (FP610) is installed.
- Display power supply voltage (V) if optional power module installed.
- Display phase current (A) if optional power module installed.
- Display consumed watthour (kW-h) if optional power module installed.
- The communication setting of the power module FP610 should be the same as PLC port 4,
    - Addr = 1
    - Baud = 9600
    - Frame = N.8.2
    - Ct depend on the actual current transformer ratio. For example, set Ct = 40 if 200/5/1T.
    - rESEt = to reset the kW-h.
- Touch panel ”▲” to switch to screen [Report].

Screen [Compressor Report - 3]

- Display refrigerant pressure in psig and bar if optional AI module and pressure transducer are installed.
    - Circuit 1 High Pressure (psig, bar)
    - Circuit 1 Low Pressure (psig, bar)
    - Circuit 2 High Pressure (psig, bar)
    - Circuit 2 Low Pressure (psig, bar)



Screen [DIGITAL INPUT -1]



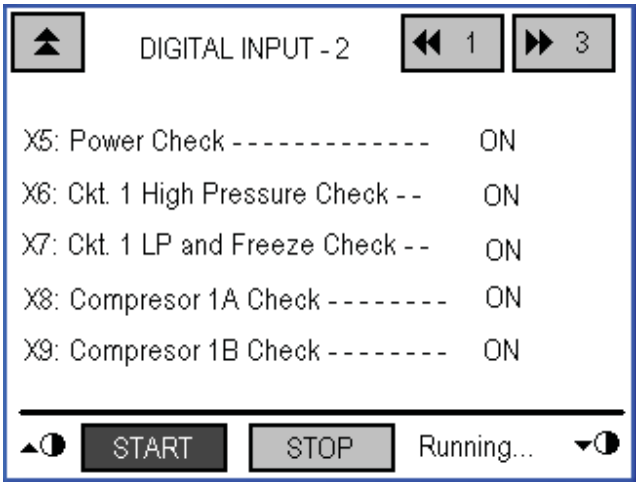
- Display the descriptions and status of digital inputs. Status can be observed also by the LED on the upper part of PLC IN(X).

<< Note: Fault or normal depends on the digital input status and configuration. >>

  - X00 -- REMOTE, wired with remote start switch, OFF=stop, ON=start.
  - X01 -- External Alarm, OFF=fault, ON=normal.
  - X02 -- (ICE), OFF=chilled water, ON=make ice.
  - X03 -- chilled water flow switch (CHFS), OFF=fault, ON=normal.
  - X04 -- cooling water flow switch (CDFS)(WC model) , or condenser fan thermostat (KF)(AC model). OFF=fault, ON=normal.

- Touch panel "▲" to switch to screen [Reports]. Touch panel "◄" and "► " to switch to other screen [DIGITAL INPUT].

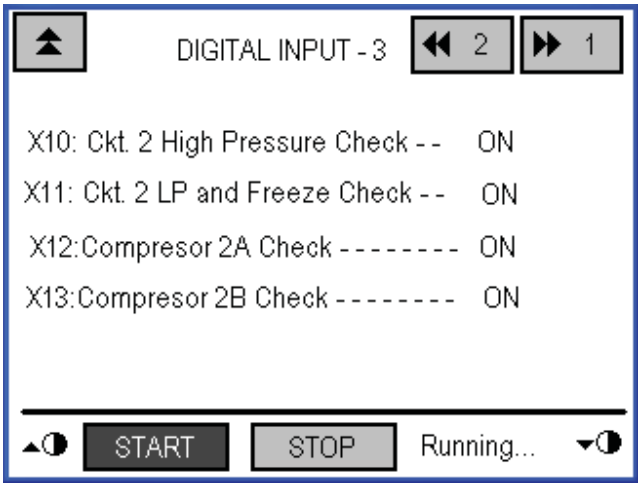
Screen [DIGITAL INPUT -2]



- Display the descriptions and status of digital inputs. (cont.)
  - X05 – power supply (APR), wired with phase check relay, OFF=fault, ON=normal.
  - X06 – circuit 1 high pressure (HP1), wired with high pressure cutout. OFF=fault, ON=normal
  - X07 – circuit 1 low pressure and temperature (LP1 and FS1), wired with low pressure cutout and freezestat. OFF=fault, ON=normal.
  - X08 – circuit 1, first compressor (CMP 1A), wired with compressor thermostat and overload relay (KC1 and OL1). OFF=fault, ON=normal.
  - X09 -- circuit 1, second compressor (CMP 1B), wired with compressor thermostat and overload relay (KC2 and OL2). OFF=fault, ON=normal.

- Touch panel "▲" to switch to screen [REPORT]. Touch panel "◄" and "► " to switch to other screen [DIGITAL INPUT].

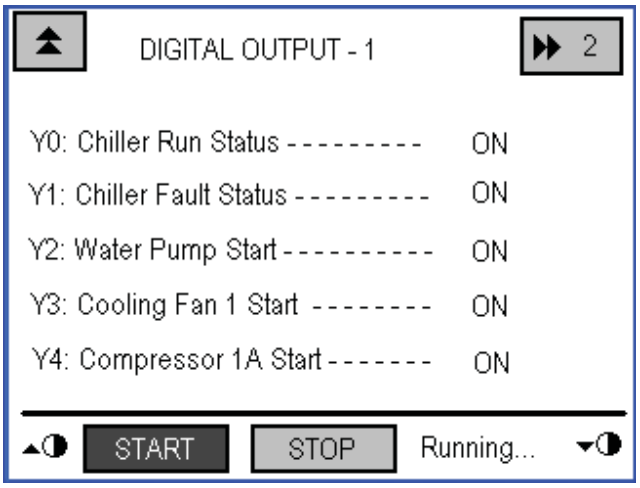
Screen [DIGITAL INPUT -3]



- Display the descriptions and status of digital inputs. (cont.)
  - X10 -- circuit 2 high pressure (HP2),wired with high pressure cutout. OFF=fault, ON=normal.
  - X11 -- circuit 2 low pressure and temperature (LP2 and FS2), wired with low pressure cutout and freezestat. OFF=fault, ON=normal.
  - X12 -- circuit 2, first compressor (CMP 2A), wired with compressor thermostat and overload relay (KC3 and OL3). OFF=fault, ON=normal.
  - X13 -- circuit 2, second compressor (CMP 2B), wired with compressor thermostat and overload relay (KC4 and OL4). OFF=fault, ON=normal.

- Touch panel "▲ " to switch to screen [REPORT]. Touch panel"◄" and "► " to switch to other screen [DIGITAL INPUT].

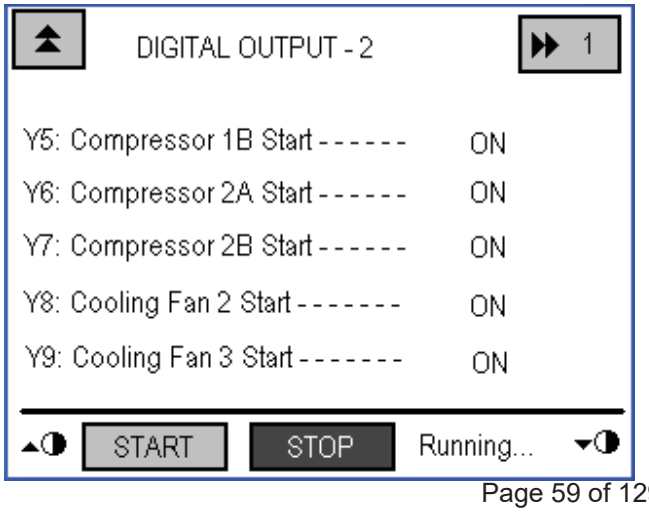
Screen [DIGITAL OUTPUT - 1]



- Display the descriptions and status of digital outputs. Status can be observed also by the LED on the lower part of PLC OUT(Y).
  - Y0 – Run Status (RUN)
  - Y1 – Fault Status (FAULT)
  - Y2 – water pump start (PUMP)
  - Y3 – cooling tower fan motor start (WC model), or condenser fan motor first stage (AC model) (CT / FAN 1)
  - Y4 – compressor 1A start (CMP 1A)

- Touch panel " ▲ " to switch to screen [Reports]. Touch panel " ◄" and "► " to switch to other screen [DIGITAL OUTPUT].

Screen [DIGITAL OUTPUT - 2]

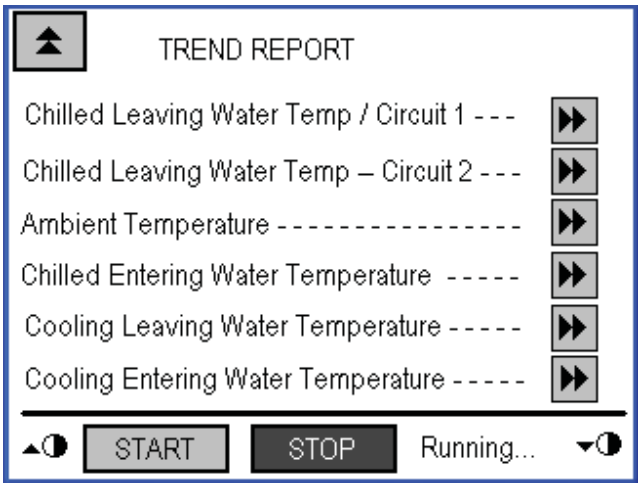


- Display the descriptions and status of digital outputs. (cont.):
  - Y5 – compressor 1B start (CMP 1B)
  - Y6 -- compressor 2A start (CMP 2A)

- Y7 – compressor 2B start (CMP 2B)
- Y8 – condenser fan second stage start (FAN 2) (AC model)
- Y9 -- condenser fan third stage start (FAN 3) (AC model)

- Touch panel "▲" to switch to screen [REPORT]. Touch panel "◄" and "►" to switch to other screen [DIGITAL OUTPUT].

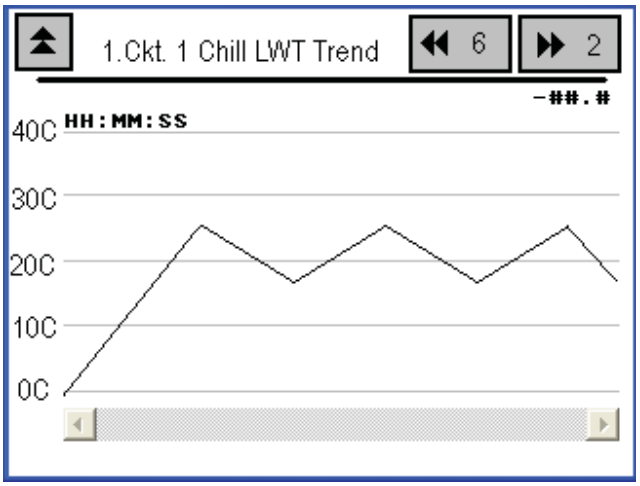
Screen [TREND REPORT]



- Touch panel "►" to switch to the corresponding trend chart screen
  - Circuit 1 Chilled Leaving Water Temperature Trend Chart
  - Circuit 2 Chilled Leaving Water Temperature Trend Chart
  - Ambient Temperature Trend Chart
  - Chilled Entering Water Temperature Trend Chart
  - Cooling Leaving Water Temperature Trend Chart (WC model) or Circuit 1 Condenser Coil Temperature Trend Chart (AC model)
  - Cooling Entering Water Temperature Trend Chart (WC model) or Circuit 2 Condenser Coil Temperature Trend Chart (AC model)

- Touch panel "▲" to switch to screen [Reports].

Screen [Circuit 1 Chilled LWT Trend] as an example of trend chart:



Screen [Circuit 2 Chilled LWT Trend]

Screen [Ambient Temperature trend]

Screen [Chilled EWT Trend]

Screen [Cooling LWT Trend] (WC model) or [Circuit 1 Coil Temperature trend] (AC model)

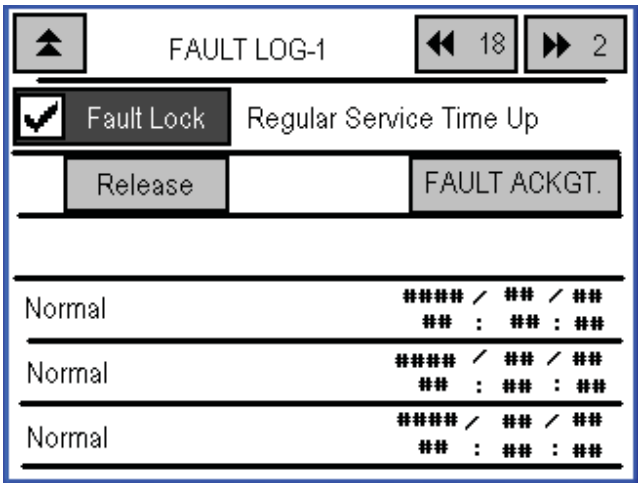
Screen [Cooling EWT Trend] (WC model) or [Circuit 2 Coil Temperature Trend] (AC model)

An example of a temperature trend shown as the figure at the right side.

- Touch the slide below to see the trend.

- Touch panel "▲" to switch to screen [TREND]. Touch panel "◄" and "►" to switch to other screen [TREND].

Screen [FAULT LOG - 1]



- Log 100 records of fault events, happened year, month, day, hour, minute, and second. Fault events include
  - Power supply fault (1)
  - Chilled water flow fault (2)
  - Cooling water flow fault (3)
  - Circuit 1 high pressure fault (4)
  - Circuit 2 high pressure fault (5)
  - Compressor 1A Fault (6)
  - Compressor 1B Fault (7)
  - Compressor 2A Fault (8)
  - Compressor 2B Fault (9)
  - External Alarm Fault (10)
  - Circuit 1 chilled leaving water temperature low fault (11)
  - Circuit 2 chilled leaving water temperature low Fault (12)
  - Cooling water temperature high fault (13)
  - P0 temperature sensor fault (14)
  - P1 temperature sensor fault (15)
  - P2 temperature sensor fault (16)
  - P3 temperature sensor fault (17)
  - P4 temperature sensor fault (18)
  - P5 temperature sensor fault (19)
  - Condenser fan motor fault (20)
  - Circuit 1 low pressure or antifreeze fault (21)
  - Circuit 2 low pressure or antifreeze fault (22)
  - Service time up (24)

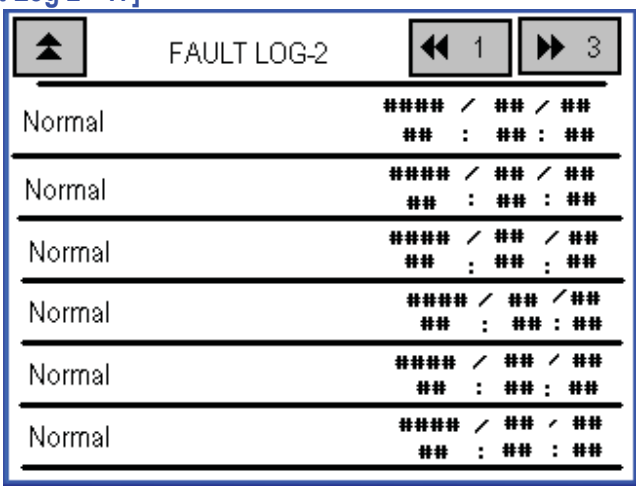
- HMI switches to [Fault Log – 1] every time fault happened. "**Fault Acknowledgement**" on the panel must be touched to be able to switch to other screen.

- Chiller resumes to normal if the protection switch resets. It's occasional fault. When 3 faults of the same kind happened in lock time, preset as 60minutes, this is a continuous fault and chiller locked. Manual reset at panel is necessary to resume function. Find and solve the problem and touch panel "**Release**" to resume normal operation.

- Touch panel "▲" to switch to screen [Report]. Touch panel "◄" and "►" to switch to other screen [FAULT LOG].

Screen [Fault Log - 2] as an example of **Screen [Fault Log 2 - 17]**

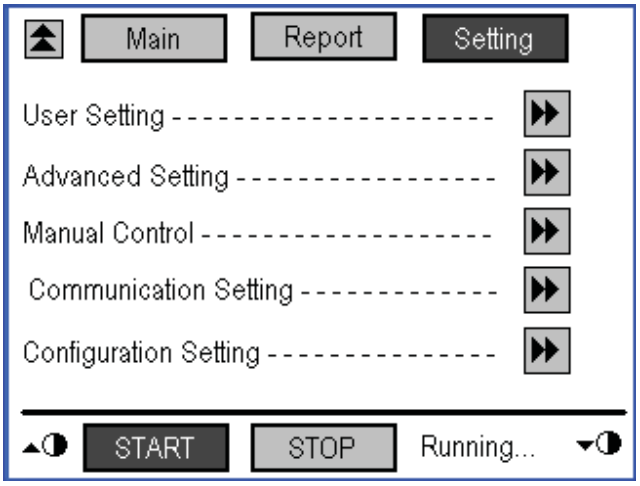
- Touch panel "▲" to switch to screen [Reports]. Touch panel "◀" and "▶" to switch to other screen [FAULT LOG].



SETTING

HMI is touch screen liquid crystal display (LCD). Touch screen to switch screen or adjust parameters.

Screen [Setting]

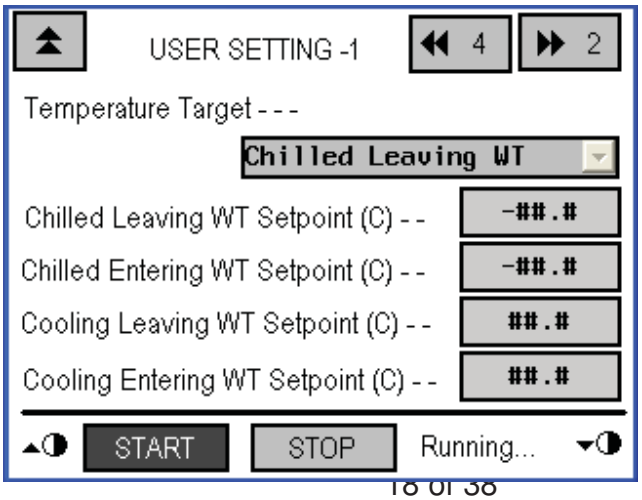


- Touch panel "▶ " to switch screen to:
  - [User Setting]
    << level 3 password required, preset **12345678**>>
  - [Advanced Setting]
    << level 2 password required, preset **88615458**>>
  - [Manual Control]
    << level 2 password required, preset **88615458** >>
  - [Communication Setting]
    <<level 2 password required, preset **88615458** >>
  - [Configuration Setting]
    <<level 1 password required, preset **34641010**>>

<< Note: Configuration setting is allowed only when chiller stops. Configuration setting relates to chiller design, only trained professional is allowed to adjust. >>

- Touch panel "**Main**", "**Report**", "**Setting**", "▲ " to switch screen.

Screen [USER SETTING - 1]

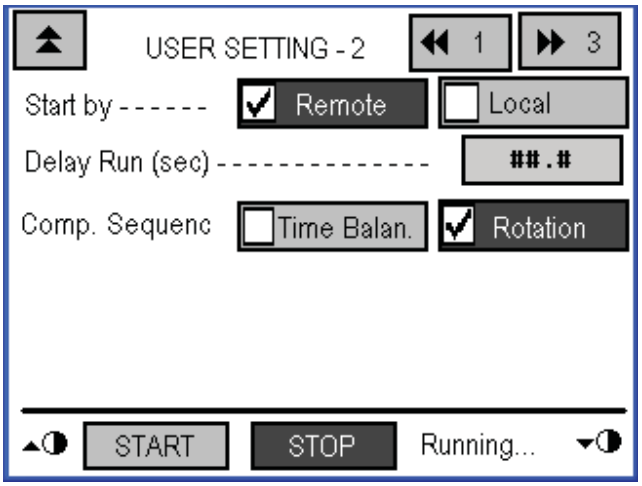


- To set the temperature source to add or remove running compressor.
  - Chilled Leaving Water Temperature [Preset]
  - Chilled Entering Water Temperature
  - Cooling Leaving Water Temperature
  - Cooling Entering Water Temperature

- To set the corresponding temperature set point,
  - Chilled LWT Set Point [preset 7.0°C]
  - Chilled EWT Set Point [preset 12.0°C]
  - Cooling LWT Set Point [preset 35.0°C]
  - Cooling EWT Set Point [preset 30.0°C]

- Touch panel "▲" to switch to screen [Setting]. Touch panel "◄" and "►" to switch to other screen [USER SETTING].

Screen [USER SETTING - 2]



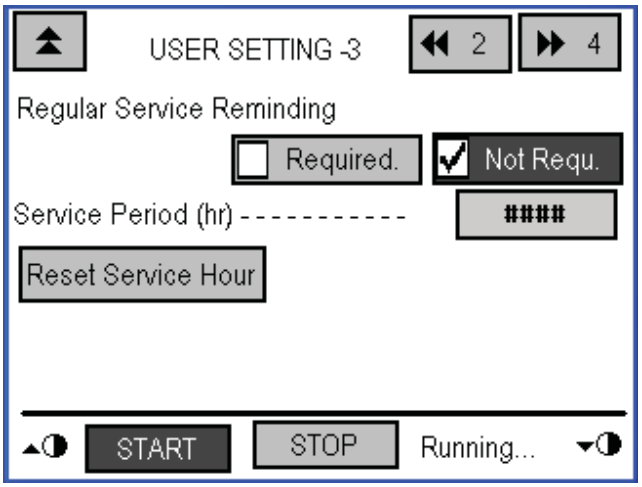
- To set the chiller start by
  - **Local Panel**–touch panel START and STOP to start or stop the chiller,
  - **Remote Switch** – connect or disconnect digital input (X0) to start or stop the chiller. [preset]

- To set the chiller delay start time in second [preset 3.0 second]

- To set the compressor cycling as
  - **Rotation** [preset]: Compressors run in rotational sequence, 1A→2A→1B→2B→1A… . First-start-fist-stop for better temperature control and higher part load efficiency.
  - **Time Balance**: Compressors run in sequence to balance the compressor running hour. The compressor with shortest accumulated run hour will start first. The compressor with longest accumulated run hour will stop first.

- Touch panel "▲" to switch to screen [SETTING]. Touch panel "◄" and "►" to switch to other screen [USER SETTING].

Screen [USER SETTING - 3]

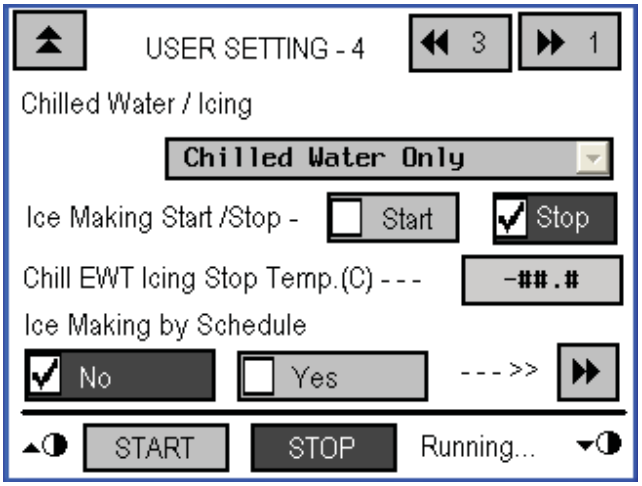


- To set the regular maintenance reminding required or not required. To set the regular maintenance hour [preset 3000 hour] if reminding required. Whenever run hour after service greater than the set hour, a message appears in the fault log.

- After finishing the regular maintenance, touch panel “Reset Service Hour” to reset the after service run hour.

- Touch panel ”▲” to switch to screen [Setting]. Touch panel ”◄” and ”►” to switch to other screen [USER SETTING].

Screen [USER SETTING - 4]



- To set chiller function as
  - **Chilled water only** [preset]
  - **Chilled water and making ice**: (after icing finished, change to chilled water mode)
  - **Ice making only**: (after icing finished, chiller stop)

- Touch panel “start” and “stop” to start and stop the ice making sequence if set as making ice capability.

- Making ice sequence will stop when the entering water temperature is lower than the termination temperature [preset - 7.0°C] or the digital input X2 is open.

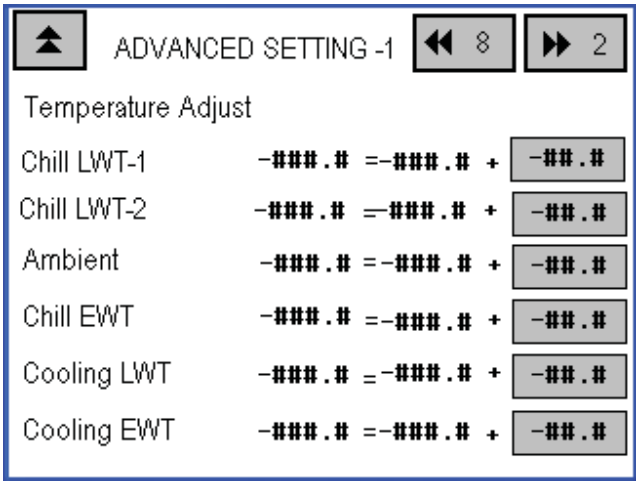
- To enter the making ice sequence, all the conditions below must be met.
  - Chiller start
  - Set as brine
  - Water freeze cutout set temperature must be lower than set point at least 2°C
  - Set as making ice only or chilled water and making ice
  - Digital input X2 (ICE) is ON
  - Touch panel “start” to make ice

- Making ice sequence terminates if any of the below conditions happens.
  - Chiller stop
  - Digital input X2 is OFF
  - Touch panel ”stop” making ice
  - Water entering temperature is lower than the icing termination temperature.

- If the making ice sequence is expected only in some period, touch panel “schedule making ice” to activate the schedule icing. Further setting 7 schedules in a week is necessary.

- Touch panel ”▲” to switch to screen [Setting]. Touch panel ”◄” and ”►” to switch to other screen [USER SETTING].

Screen [ADVANCED SETTING - 1]

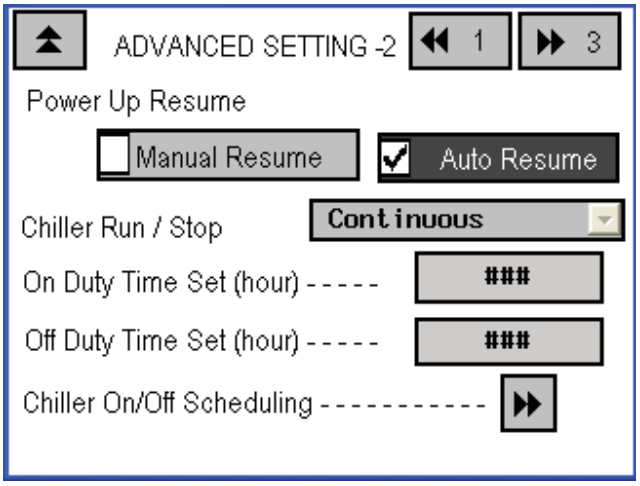


- Temperature readings can be offset for calibration purpose. [preset 0.0°C]. The equation reads as

  display value = sensor value + offset value.

- Touch panel "▲" to switch to screen [Setting]. Touch panel "◄" and "►" to switch to other screen [Advanced Setting].

Screen [ADVANCED SETTING - 2]



- If the chiller is set as start /stop by **Local**, the power up sequence can be set as
  - **Manual Resume**: after power down and up, chiller stop and button START must be touched to re-start.
  - **Auto Resume**: after power down and up, chiller restore to the status before power down.

<<Note: This setting is ineffective if chiller stop/start set as Remote. Chiller stop/start according to the remote switch status.>>

- If the chiller is set as start /stop by local panel, chiller Run /Stop can be further set as
  - **Continuous** [preset]
  - **By Timer**: (chiller runs for the hours set by On Duty Time, then stops for hours set by Off Duty Time, then runs for the hours set by On Duty Time, periodically)
  - **By Schedule**: (chiller runs according to 7 time schedules)

<<**Note**: This setting is ineffective if chiller stop/start set as Remote. Chiller stops and starts according to the remote switch status>>

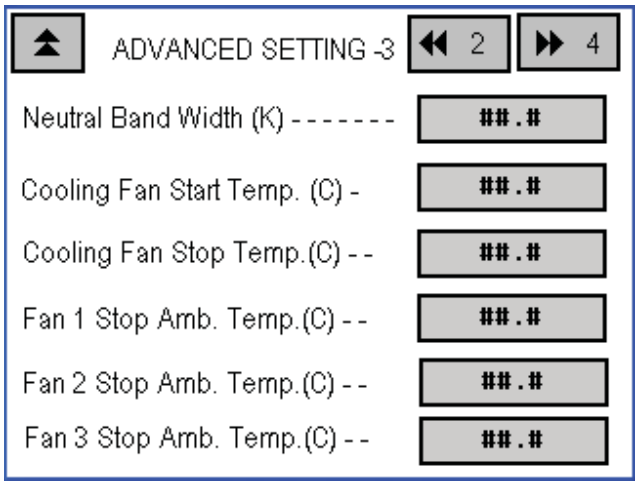
- On Duty Hour [preset 12] and Off Duty Hour [preset 12] can be further set if run/stop set as by timer.

- Touch panel "►" on the right of chiller on/off scheduling, or screen **Advance Setting-7**, to set the chiller run schedules.

<<**Note**: This setting is ineffective if chiller stop/start set as Remote. Chiller stops and starts according to the remote switch status>>

- Touch panel " ▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [Advanced Setting].

Screen [ADVANCED SETTING - 3]



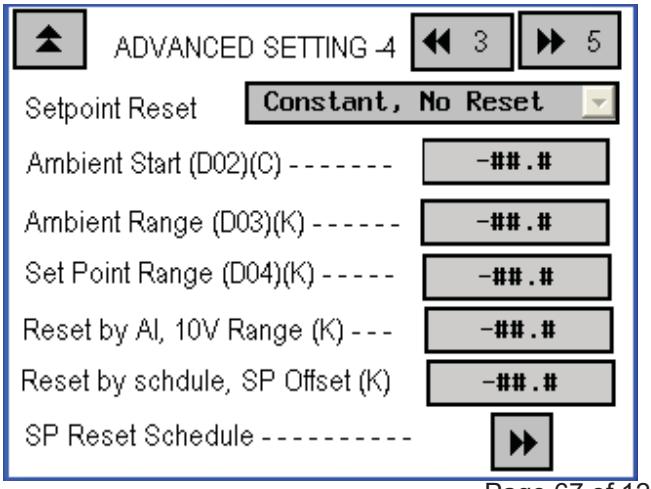
- If the actual temperature is within neutral band, controller does not increase or decrease the running compressor quantity.
    - Neutral band high limit = Set point + Neutral Band Width /2
    - Neutral band low limit = Set point - Neutral Band Width /2

  Neutral Band Width minimum value recommended is
    - 5.0°K (1 compressor model) [preset 6.0°K]
    - 3.0°K (2 compressor model) [preset 4.0°K]
    - 2.0°K (3 compressor model) [preset 3.0°K]
    - 1.4°K (4 compressor model) [preset 2.0°K], to avoid frequent compressor cycling.

- For water cooled unit, cooling tower fan motor can be activated according to cooling entering water temperature if unit configured and installed with sensor. Cooling tower fan motor starts if the cooling entering water temperature higher than Cooling Fan Start Temperature. Cooling tower fan motor stops if the cooling entering water temperature is lower than Cooling Fan Stop Temperature. Cooling tower fan motor remains unchanged in the temperature between.

- For air cooled unit, cooling tower fan motor can be stopped according to ambient temperature if unit configured and installed with ambient temperature sensor. Condenser fan motor stops if the ambient temperature is lower than Fan Stop Amb. Temp. Condenser fans motor starts as logic and Ambient higher than "Stop Amb. Temp. plus 1.0".
    - Fan 1 Stop Ambient Temperature is preset as 16.0°C
    - Fan 2 Stop Ambient Temperature is preset as 12.0°C
    - Fan 3 Stop Ambient Temperature is preset as 8.0°C
- Touch panel " ▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [Advanced Setting].

Screen [ADVANCED SETTING - 4]



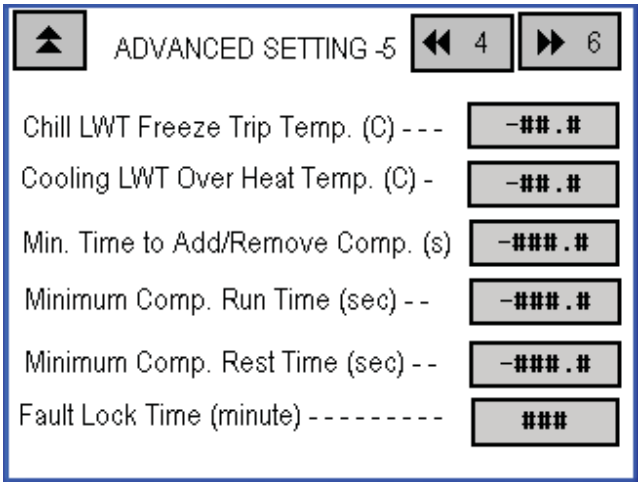
- Temperature set point can be reset as
    - **Constant, No reset** [preset]
    - **By ambient temperature**
    - **By schedule**

- If the Set Point Reset is set as by Ambient Temperature, additional 3 parameters are required:
  - Ambient Start temperature (D02) [preset 20.0°C],
  - Ambient temperature range (D03) [preset 10.0°K],
  - Set Point Range (D04) [preset 5.0°K],
  - Ambient temperature sensor is required to be installed
  - $Setpoint_{new} = Setpoint_{original} + (AMB - D02) * (D04) / (D03)$

- If the Set Point Reset is set as by Schedule, additional parameter
  - Reset by Schedule, SP Offset temperature [preset 5.0°K] is required.
  - $Setpoint_{new} = Setpoint_{original}$ + SP Offset , if current time is within the schedule,
  - $Setpoint_{new} = Setpoint_{original}$, if current time is not within the schedule.
  - Touch panel "►" to screen [Advanced Setting – 9] to set the schedule.

- Touch panel "▲" to switch to screen [Setting]. Touch panel "◄" and "►" to switch to other screen [Advanced Setting].

Screen [ADVANCED SETTING - 5]



- Chilled Leaving Water Temperature Freeze Trip Temperature [preset 2.0°C] to protect the water freeze in evaporator.
  - Minimum value =1.0°C (normal water) or -20.0°C(brine)
  - Reset temperature = trip temperature + 2.0°C
  - The chilled leaving water temperature set point is recommended to be set not lower than trip temperature plus half of Neutral Band to prevent frequent trips.
  - The chilled entering water temperature set point is the minimum LWT set point plus Neutral Band.
- Cooling Leaving Water Temperature Over Heat Temperature can be set for water cooled model configured with cooling LWT sensor. [preset 40.0°C]
  - Maximum value = 41.0C
  - Reset temperature = trip temperature - 2.0°C
  - Cooling Leaving Water Temperature Set Point maximum = Trip Temperature - (Neutral Band /2)

- The compressor operation parameters can be set
  - Minimum Time interval to Add or Remove Running Compressor [preset 60 seconds]
  - Minimum Compressor Run Time [preset 180 seconds]
  - Minimum Compressor Rest Time [preset 180 seconds]

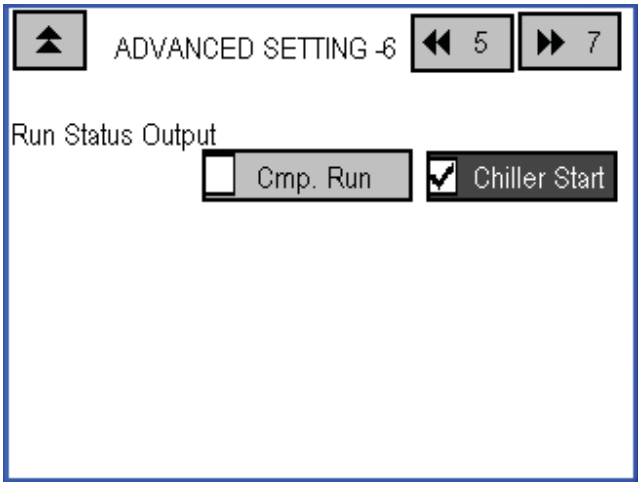
- Chiller resumes operation after occasional cutout switch trips and resets to normal state. If the same trips happen 3 times in **Fault Lock Time** interval [preset 60 minutes], chiller will stops the trip related operation and waits for the operator to touch panel "**Release**" to resume operation.

- Touch panel " ▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [Advanced Setting].

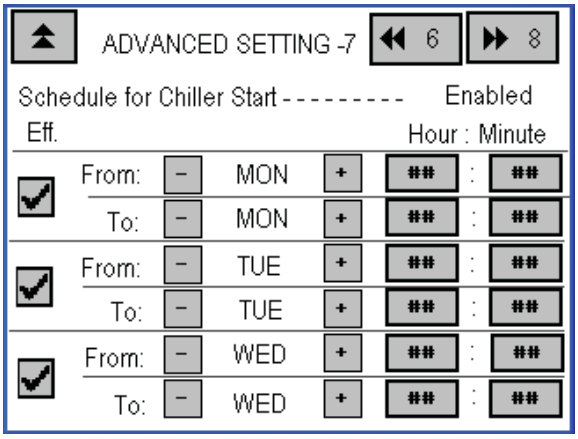
Screen [ADVANCED SETTING - 6]

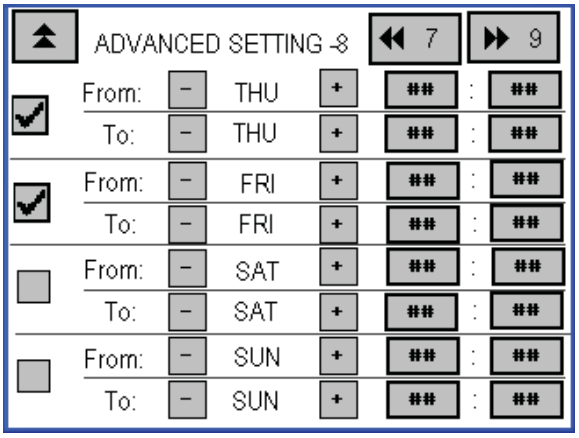
- The Run Status digital output can be set as,
  - **Compressor Run**, the digital output will be ON if any compressor runs.
  - **Chiller Start**, the digital output will be ON if chiller starts.

- Touch panel " ▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [Advanced Setting].



Screen [ADVANCED SETTING - 7] and [ADVANCED SETTING - 8]





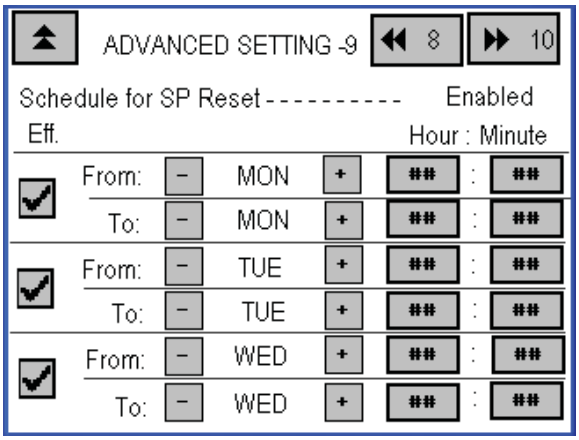
7 schedules in a week can be set in these two screens to start the chiller if chiller start set as by schedule.

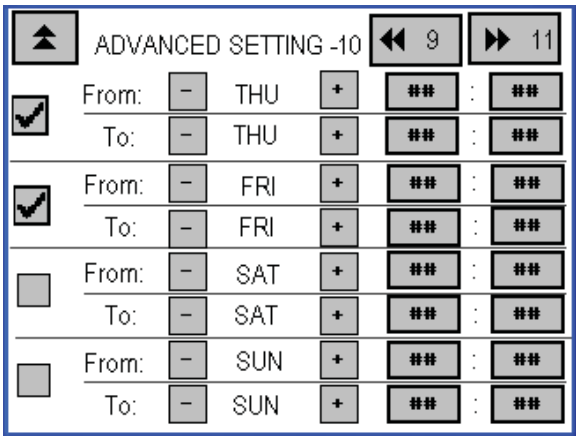
<< **Note**: This setting is not effective if chiller stop /start set as Remote. Chiller stops and starts according to the remote switch status. >>

- Touch panel block (☑, ☐) under **Effective** to check or uncheck to make the schedule effective or ineffective.
- Touch panel "**+**" and "**-**" to change the day of the week.
- Touch the number under **Hour: Minute** to set the time.
- Chiller starts if current time is between **From** and **To**.

- Touch panel " ▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [Advanced Setting].

Screen [ADVANCED SETTING - 9] and [ADVANCED SETTING - 10]



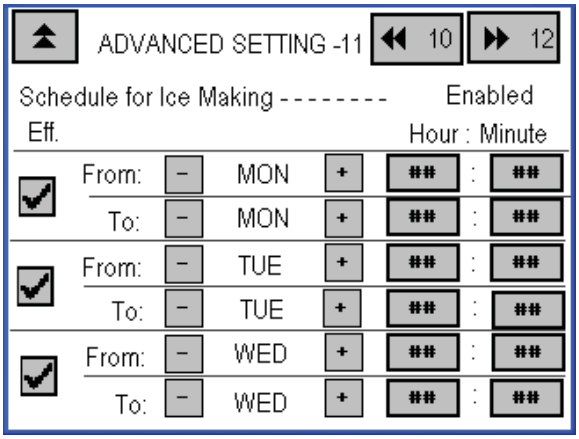


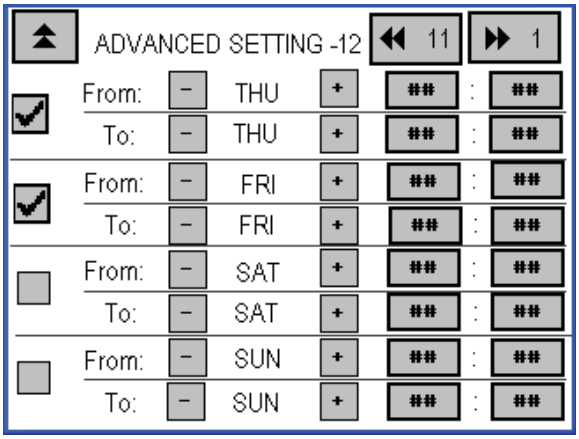
7 schedules in a week can be set in these two screens to offset the water temperature set point if chiller set point reset set as by schedule. $Setpoint_{new}$ = $Setpoint_{original}$ + SP Offset , if current time is within **From** and **To**.

<< Operation and procedure is the same as [Advanced Setting - 7] and [Advanced Setting - 8] >>

- Touch panel " ▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [Advanced Setting].

Screen [ADVANCED SETTING - 11] and [ADVANCED SETTING - 12]





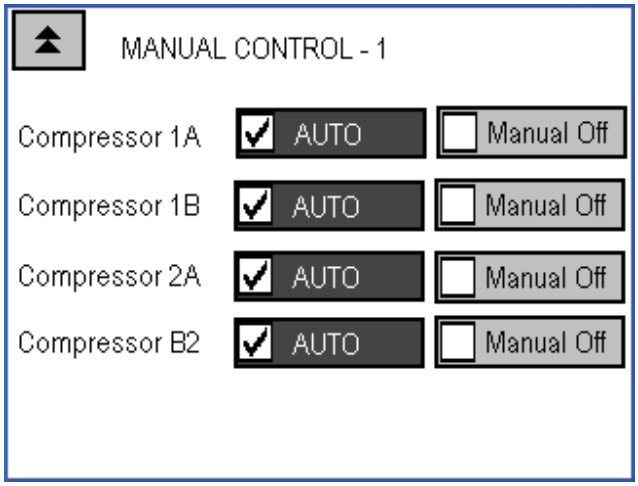
7 schedules in a week can be set in these two screens to make ice if ice making is set as by schedule.

<< Operation and procedure is the same as [Advanced Setting -7] and [Advanced Setting -8] >>

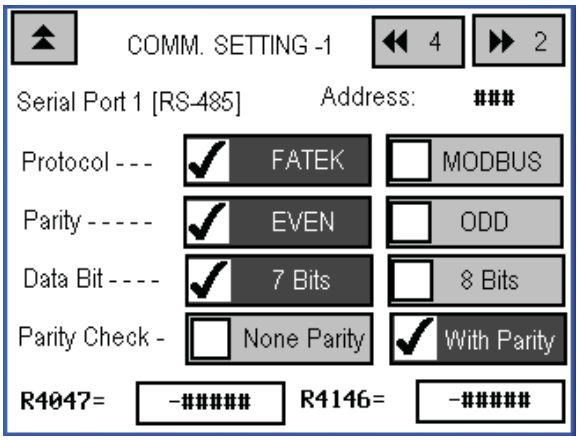
- Touch panel " ▲ " to switch to screen [Setting]. Touch panel " ◀ " and " ▶ " to switch to other screen [Advanced Setting].

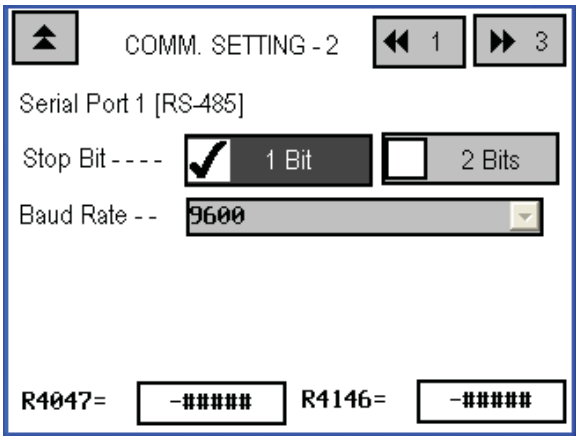
Screen [MANUAL CONTROL -1]

- Touch panel " AUTO" or " Manual Off", to set the compressor as
  - **AUTO** -- staging according to controller logic, or
  - **Manual Off** -- override the compressor off
- Touch panel " ▲ ", to switch to screen [Setting].



Screen [COMM. SETTING - 1] and [COMM. SETTING - 2]





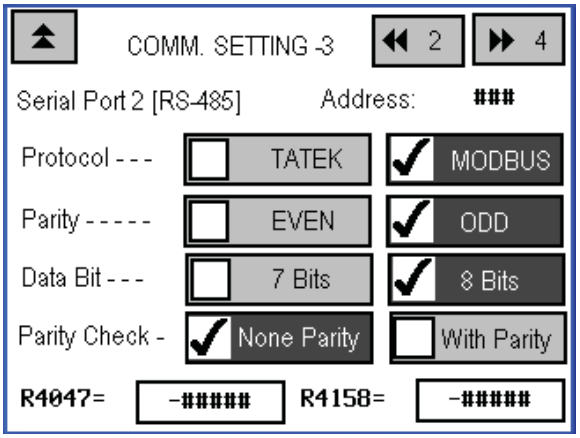
Port 1 is designed to communication with HMI for distance about 5~500m.

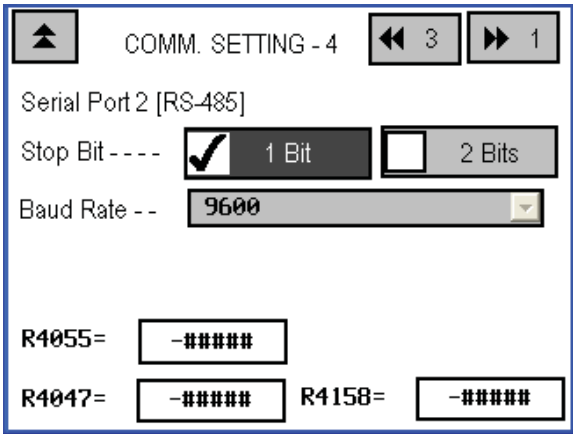
- Port 1 serial communication with RS-485 interface, the protocol and frame can be set as
  - Protocol: TATEK (preset) or MODBUS RTU
  - Parity: EVEN (preset) or ODD
  - Data Length: 7 Bits (preset) or 8 Bits
  - Parity Check: None Parity or With Parity (preset)
  - Stop Bit: 1 Bit (preset) or 2 Bits
  - Baud Rate [preset 9600bps]

- Preset PLC unit Address is 10. Switch to screen [Comm. Setting – 4] to change the address.

- Touch panel "▲" to switch to screen [Setting]. Touch panel "◄" and "►" to switch to other screen [Comm. Setting].

Screen [COMM. SETTING - 3] and [COMM. SETTING - 4]





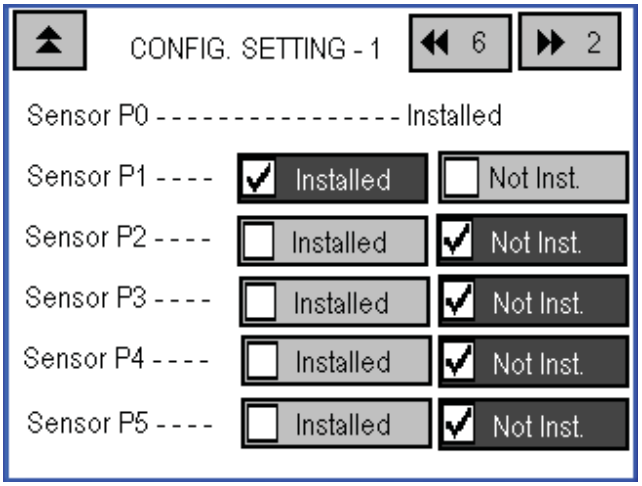
Port 2 is designed to communication with SCADA (Supervisory Control and Data Acquisition) for distance about 5~500m.

- Port 2 serial communication with RS-485 interface, the protocol and frame can be set as
  - Protocol: TATEK or MODBUS RTU (preset)
  - Parity: EVEN (preset) or ODD
  - Data Length: 7 Bits or 8 Bits (preset)
  - Parity Check: None Parity (preset) or With Parity
  - Stop Bit: 1 Bit (preset) or 2 Bits
  - Baud Rate [preset 9600bps]

- To change the preset address, switch to screen [communication Setting – 4], re-enter the right side number of "**R4055=**" with the new address added with 21760.

- Touch panel " ▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [Comm. Setting].

Screen [CONFIG. SETTING - 1]

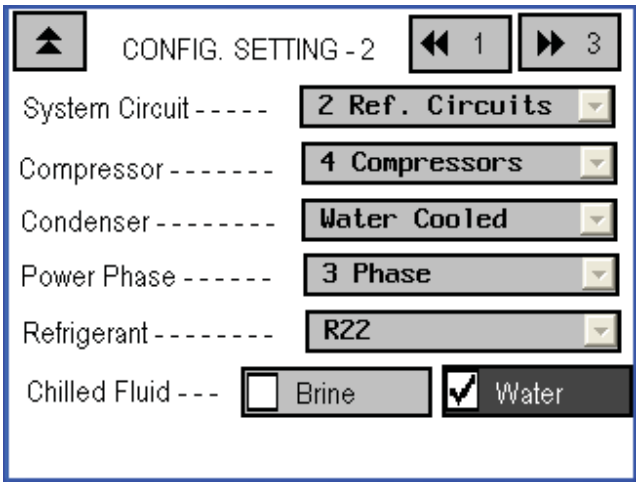


- The sensors are Pt100, 3 wires, DIN, 485 curve.

- Touch panel " **Installed**" or " **Not Inst.**" to configure whether temperatures sensors are installed or not.
  - Sensor P0 for the circuit 1 chilled leaving water temperature must be configured.
  - Sensor P1 for the circuit 2 chilled leaving water temperature.
  - Sensor P2 for the ambient temperature.
  - Sensor P3 for the chilled entering water temperature.
  - Sensor P4 for the cooling leaving water temperature (WC model) or circuit 1 condenser coil temperature (AC model)
  - Sensor P5 for the cooling entering water temperature (WC model) or circuit 2 condenser coil temperature (AC model)

- Touch panel " ▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [CONFIG. SETTING].

Screen [CONFIG. SETTING - 2]



- Set the System Circuit of refrigerant according to the actual model as
  - 1 Ref. Circuit
  - 2 Ref. Circuits [preset]

- Set the quantity of Compressor according to the actual model as
  - 1 Compressor
  - 2 Compressors
  - 3 Compressors
  - 4 Compressors [preset]

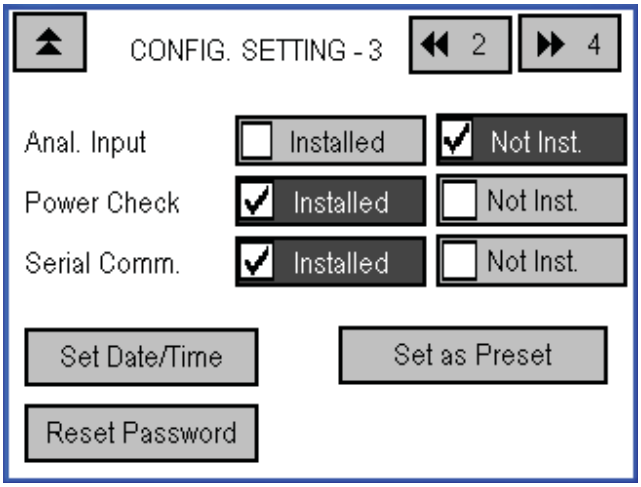
- Set the Condenser according to the actual model as
  - Air Cooled [preset]
  - Water Cooled

- Set the Power Phase according to the actual model as
  - Single Phase
  - 3 Phase

- Touch panel "**Brine**" or " **Water**" to set the Chilled Fluid according to the actual application.

- Touch panel "▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [CONFIG. SETTING].

Screen [CONFIG. SETTING - 3]



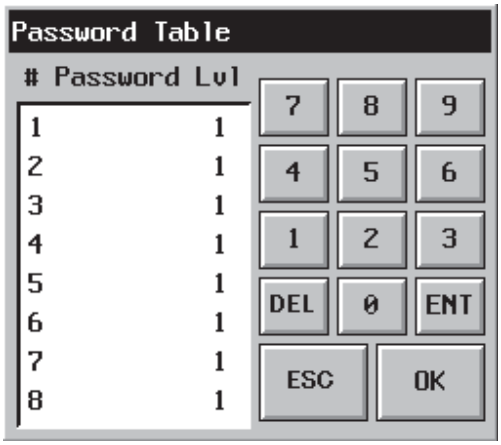
- Touch panel "**Installed**" or " **Not Inst.**" to configure whether the Analog Input module is installed or not.
- Touch panel "**Installed**" or " **Not Inst.**" to configure whether the Power Check relay is installed or not.

- Touch panel "**Installed**" or " **Not Inst.**" to configure whether the Serial Communication board is installed or not.

- Touch panel "**Set Date/Time.**" to set the current date and time.

- Touch panel "**Set as Preset**" to set the parameters as factory preset.

- Touch panel "**Reset Password**" and the Password Table appears to change the factory preset password.



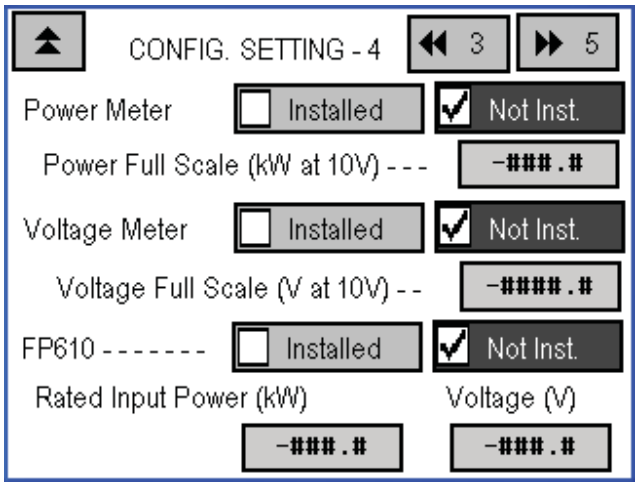
  - **34641010** is a primary level (level 1) password for configuration setting.

  - **88615458** is a secondary level (level 2) password for advanced setting.

  - **12345678** for users with typical setting (level 3).

- Touch panel "▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [CONFIG. SETTING].

Screen [CONFIG. SETTING - 4]



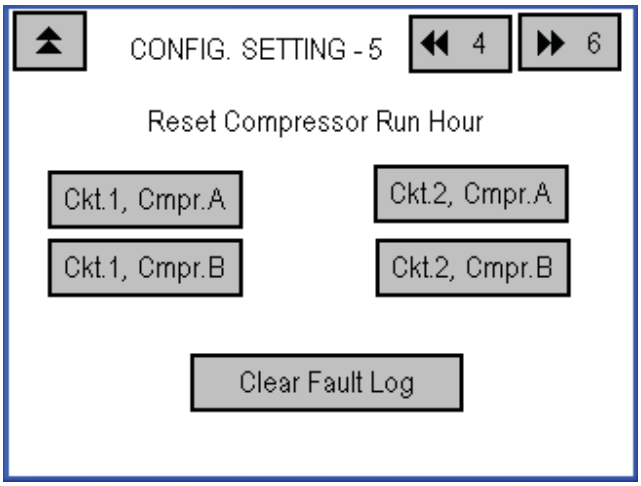
- Touch panel "**Installed**" or " **Not Inst.**" to configure whether the Power Meter is installed or not.
- Touch panel " **Installed**" or " **Not Inst.**" to configure whether the Voltage Meter is installed or not.

<< Note: the functions of power meter and voltage meter operation are replaced by the following FP610 multi function power module. >>

- Touch panel "**Installed**" or " **Not Inst.**" to configure whether the FP610 multi function power module is installed or not.
  - Rated Input Power in kW must be entered to calculate the percentage of power consumption.
  - Rated supply Voltage in V must be entered to judge whether the actual supply voltage is within the range of ±10%.

- Touch panel "▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [CONFIG. SETTING].

Screen [CONFIG. SETTING - 5]

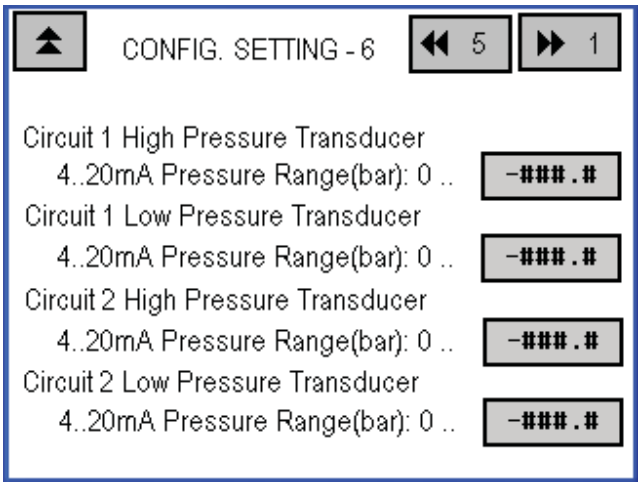


- Touch panel "**Ckt 1, Cmpr. A**" to reset the run hour and start count of compressor A, circuit 1.
- Touch panel "**Ckt 1, Cmpr. B**" to reset the run hour and start count of compressor B, circuit 1.
- Touch panel "**Ckt 2, Cmpr. A**" to reset the run hour and start count of compressor A, circuit 2.
- Touch panel "**Ckt 2, Cmpr. B**" to reset the run hour and start count of compressor B, circuit 2.
- Touch panel "**Clear Fault Log**" to clear the fault log.

- Touch panel " ▲ " to switch to screen [Setting]. Touch panel "◄" and "► " to switch to other screen [CONFIG. SETTING].

Screen [CONFIG. SETTING - 6]

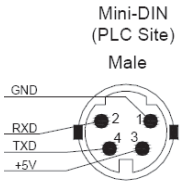
- Enter the pressure range corresponding to 4 to 20 mA analog current output of the refrigerant pressure transducers. Enter zero if the pressure transducer is not installed.



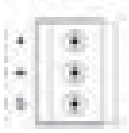
COMMUNICATION

PLC can be maximally equipped with 4 serial communication ports. Various messages can be transmitted and received through 2 or 4 wires to achieve remote supervisory and monitoring with easy wiring.

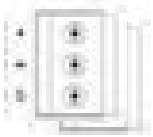
- Port 0 is for program downloading and communicating with HMI in short distance. Pin assignment as following.
  Pin 1 = GND
  Pin 2 = RXD
  Pin 3 = +5V
  Pin 4 = TXD



- Port 1 is RS-485 interface, 3P pluggable terminal, designed to be communicated with HMI for distance 5 to 500m. Pin assignment as following.
  Pin 1 = +
  Pin 2 = -
  Pin 3 = GND

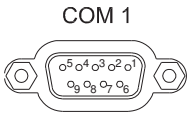


- Port 2 is RS-485 interface, 3P pluggable terminal, designed to be communicate with SCADA.
  Pin 1 = +
  Pin 2 = -
  Pin 3 = GND

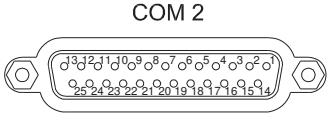


HMI has two communication ports, COM 1 and COM 2.

- COM 1 is a 9-pin female connector used to connect a controller via RS232, or RS485.
  Pin 1 = RS485 +
  Pin 2 = RS232 RXD
  Pin 3 = RS232 TXD
  Pin 5 = Signal ground
  Pin 6 = RS485 −
  Pin 7 = RS232 RTS
  Pin 8 = RS232 CTS
  Pin 9 = Optional; +5V@100mA output



- COM 2 is a 25-pin female connector used to connect a controller via RS232, RS422, or RS485.
  Pin 2 = RS232 TXD
  Pin 3 = RS232 RXD
  Pin 4 = RS232 RTS
  Pin 5 = RS232 CTS
  Pin 7 = Signal ground
  Pin 8 = Optional; +5V@100mA output
  Pin 12 = RS422 CTS+
  Pin 13 = RS422 CTS−



Pin 14 = RS422 TX+ (RS485+)
Pin 15 = RS422 TX− (RS485−)
Pin 16 = RS422 RX+
Pin 17 = RS422 RX−
Pin 23 = RS422 RTS+
Pin 24 = RS422 RTS−

Communication wiring and topology should follow the rules of the interface for better communication quality.

Register Table

Register Address			Unit	Description	Read /Write	Remark
Fatek	ModBus					
	5 Code	6 Code				
Y0	00001	000001	--	Run Status, 0=Stop, 1=Start	R	
Y1	00002	000002	--	Fault Status, 0=Normal, 1=Fault	R	
Y2	00003	000003	--	Water Pump, 0=Stop, 1=Start	R	
Y3	00004	000004	--	Fan 1, 0=Stop, 1=Start	R	
Y4	00005	000005	--	Compressor 1A, 0=Stop, 1=Start	R	
Y5	00006	000006	--	Compressor 1B, 0=Stop, 1=Start	R	
Y6	00007	000007	--	Compressor 2A, 0=Stop, 1=Start	R	
Y7	00008	000008	--	Compressor 2B, 0=Stop, 1=Start	R	
Y8	00009	000009	--	Fan 2, 0=Stop, 1=Start	R	
Y9	00010	000010	--	Fan 3, 0=Stop, 1=Start	R	
X0	01001	001001	--	Remote Start, 0=Stop, 1=Start	R	
X1	01002	001002	--	External Alarm, 0=Fault, 1=Normal	R	
X2	01003	001003	--	Ice Making, 0=Stop, 1=Start	R	
X3	01004	001004	--	Chilled Water Flow, 0=Fault, 1=Normal	R	
X4	01005	001005	--	Cooling Water Flow or Condenser Fan Overheat, 0=Fault, 1=Normal	R	
X5	01006	001006	--	Power Supply, 0=Fault, 1=Normal	R	
X6	01007	001007	--	Circuit 1 High Pressure, 0=Fault, 1=Normal	R	
X7	01008	001008	--	Circuit 1 Low Pressure and Antifreeze 0=Fault, 1=Normal	R	
X8	01009	001009	--	Compressor 1A, 0=Fault, 1=Normal	R	
X9	01010	001010	--	Compressor 1B, 0=Fault, 1=Normal	R	
X10	01011	001011	--	Circuit 2 High Pressure, 0=Fault, 1=Normal	R	
X11	01012	001012	--	Circuit 1 Low Pressure and Antifreeze, 0=Fault, 1=Normal	R	
X12	01013	001013	--	Compressor 2A, 0=Fault, 1=Normal	R	

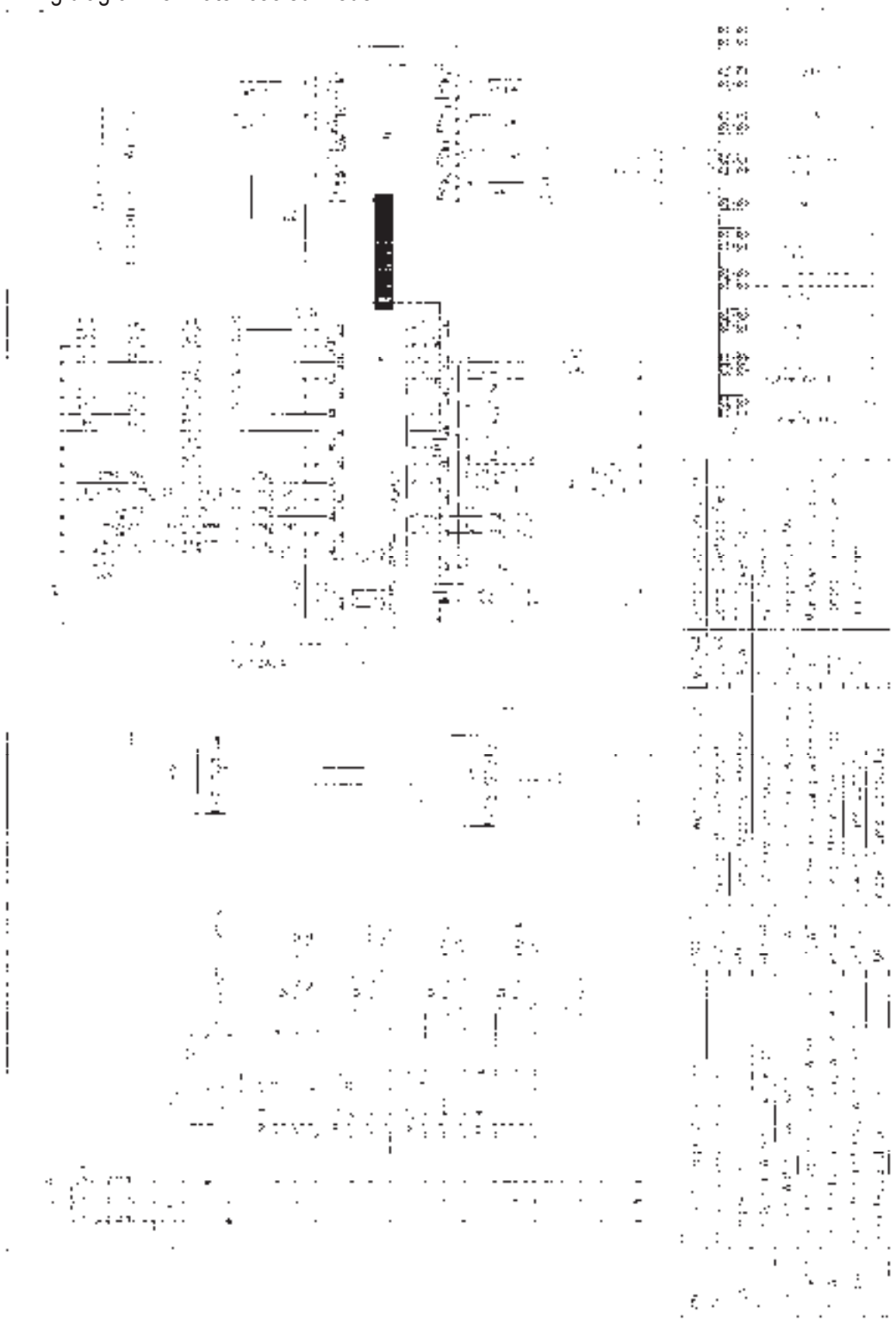
X13	01014	001014	--	Compressor 2A, 0=Fault, 1=Normal	R	
M920*	02921	002921	--	0= start by local HMI (register), 1= start by remote switch (hard wired)	R/W	
M1000	03001	003001	--	0=local HMI stop, 1=local HMI start	R/W	
R920	40921	400921	hr	Chiller run hour	R	
R1000	41001	401001	--	Chiller status	R	
			1=stop by fault setting			
			2=stop by external alarm			
			3=stop by local HMI			
			4=stop by remote switch			
			5=running with fault			
			6=stop by fault			
			7=continuous running			
			8=running by timer /schedule			
			9=stop by timer /schedule			
			10=running with partial capacity			
R1001	41002	401002	0.1C	Active set point temperature	R	
R1002	41003	401003	0.1C	Active actual temperature	R	
R1003	41004	401004	--	Occasional fault	R	
			0= chiller stop			
			1= power supply fault			
			2= chilled water flow fault			
			3= cooling water flow fault			
			4= circuit 1 high pressure fault			
			5= circuit 2 high pressure fault			
			6= compressor 1A fault			
			7= compressor 1B fault			
			8= compressor 2A fault			
			9= compressor 2B fault			
			10= external alarm fault			
			11= circuit 1 chilled water temperature low fault			
			12= circuit 2 chilled water temperature low fault			
			13= cooling water temperature high fault			
			14= temperature sensor P0 fault			
			15= temperature sensor P1 fault			
			16= temperature sensor P2 fault			
			17= temperature sensor P3 fault			
			18= temperature sensor P4 fault			
			19= temperature sensor P5 fault			
			20= condenser fan fault			
			21= circuit 1 low pressure or antifreeze fault			

			22= circuit 2 low pressure or antifreeze fault			
			23= Not Used			
			24= Service time up			
R1004	41005	401005	--	Continuous fault	R	
			0= Normal			
			1= power supply continuous fault			
			2= chilled water flow continuous fault			
			3= cooling water flow continuous fault			
			4= circuit 1 high pressure continuous fault			
			5= circuit 2 high pressure continuous fault			
			6= compressor 1A continuous fault			
			7= compressor 1B continuous fault			
			8= compressor 2A continuous fault			
			9= compressor 2B continuous fault			
			10= external alarm continuous fault			
			11= circuit 1 chilled water temperature low continuous fault			
			12= circuit 2 chilled water temperature low continuous fault			
			13= cooling water temperature high continuous fault			
			14= temperature sensor P0 continuous fault			
			15= temperature sensor P1 continuous fault			
			16= temperature sensor P2 continuous fault			
			17= temperature sensor P3 continuous fault			
			18= temperature sensor P4 continuous fault			
			19= temperature sensor P5 continuous fault			
			20= condenser fan continuous fault			
			21= circuit 1 low pressure or antifreeze continuous fault			
			22= circuit 2 low pressure or antifreeze continuous fault			
			23=None			
			24=None			
R1005	41006	401006	--	running compressor quantity	R	
R1006	41007	401007	0.1C	Circuit 1 chilled leaving water temperature	R	
R1007	41008	401008	0.1C	Circuit 2 chilled leaving water temperature	R	optional
R1008	41009	401009	0.1C	Ambient temperature	R	optional
R1009	41010	401010	0.1C	Chilled entering water temperature	R	optional
R1010	41011	401011	0.1C	Cooling leaving water temperature	R	optional
R1011	41012	401012	0.1C	Cooling entering water temperature	R	optional
R1012	41013	401013	0.1C	Chilled LWT set point	R/W	
R1013	41014	401014	0.1C	Chilled EWT set point	R/W	
R1014	41015	401015	0.1C	Cooling LWT set point	R/W	

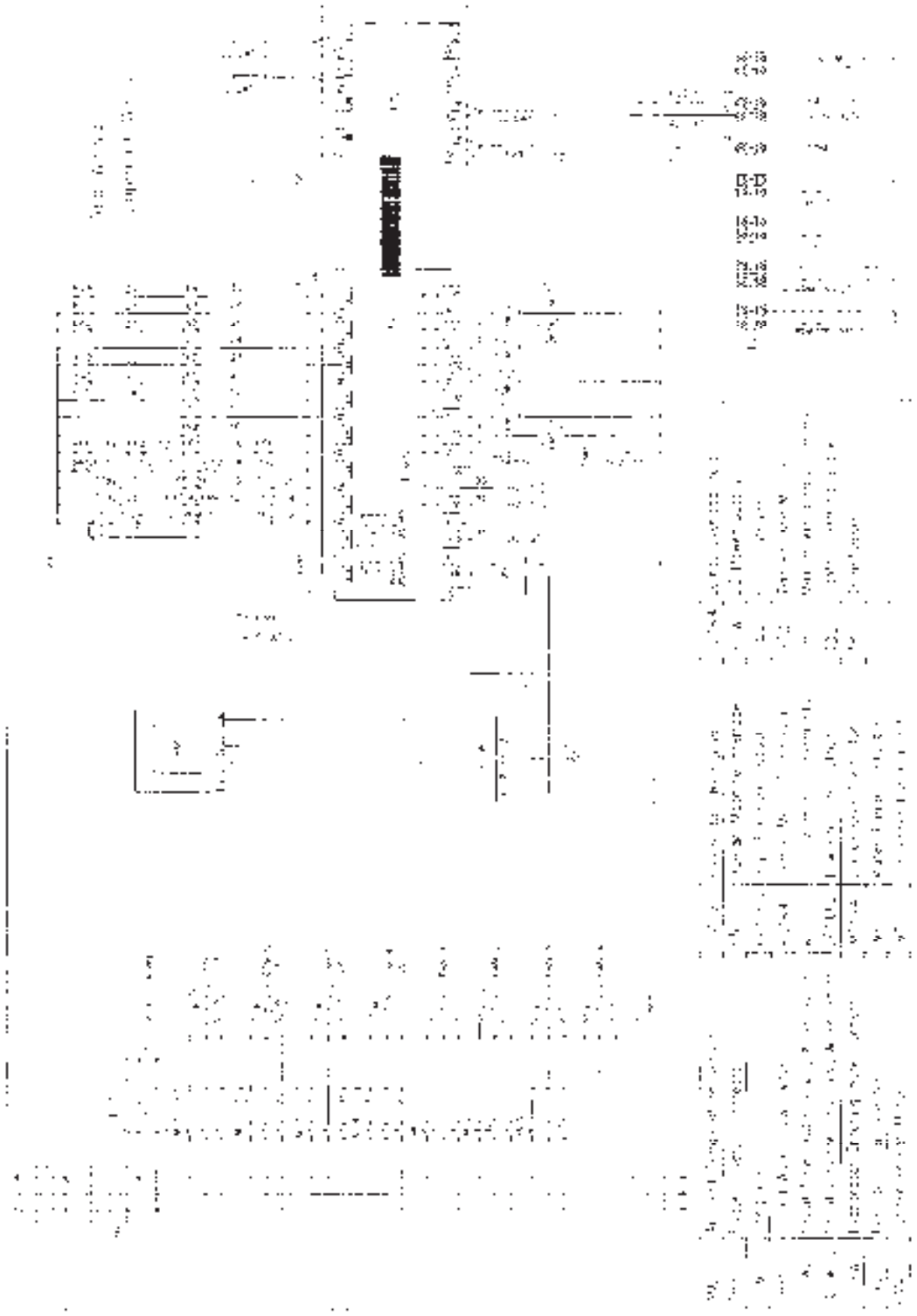
R1015	41016	401016	0.1C	Cooling EWT set point	R/W	
R1016	41017	401017	0.1kW	Input power	R	optional
R1017	41018	401018	V	Supply voltage	R	optional
R1018	41019	401019		Current (R)	R	optional
R1019	41020	401020		Current (S)	R	optional
R1020	41021	401021		Current (T)	R	optional
R1021	41022	401022	%	input power percentage	R	optional
R1022	41023	401023	kWh	watthour	R	optional
R1023	41024	401024	kWh	watthour	R	optional
R1024	41025	401025	0.1bar	Circuit 1 high pressure	R	optional
R1025	41026	401026	0.1bar	Circuit 1 low pressure	R	optional
R1026	41027	401027	0.1bar	Circuit 2 high pressure	R	optional
R1027	41028	401028	0.1bar	Circuit 2 low pressure	R	optional

WIRING

Typical wiring diagram for water-cooled model.



Typical wiring diagram for air-cooled model.



3.2. Heat Rejection Plant

3.2.1. System Description

Two numbers of 175kW cooling tower, with blowthrough and counterflow design, horizontal single air side entry and vertical air discharge, are provided at the upper part of mezzanine floor.

The heat rejection system shall consist of two numbers of 175kW cooling tower and three numbers condensing water pump, 2 duty and 1 standby, located at basement chiller plant room. This system combines with one number of 175kW cooling tower and 2 numbers of condensing water pump from CCHP system as a complete circuit. Make-up water to the system shall be provided from a package type pressurized make-up tank. Water treatment facilities will be provided via a chemical dosing system in the chiller plant room.

The system heat rejection demand can be calculated by a stand-alone DDC controller utilising input data of condensing water flowrate, supply and return condensing water temperature. The cooling tower plant shall operate under the control of Central Control and Monitoring System (CCMS).

3.2.2. Cooling Tower

(Please refer to Operation and Maintenance Manual from BAC)

Series V and Low Profile Series V Cooling Towers

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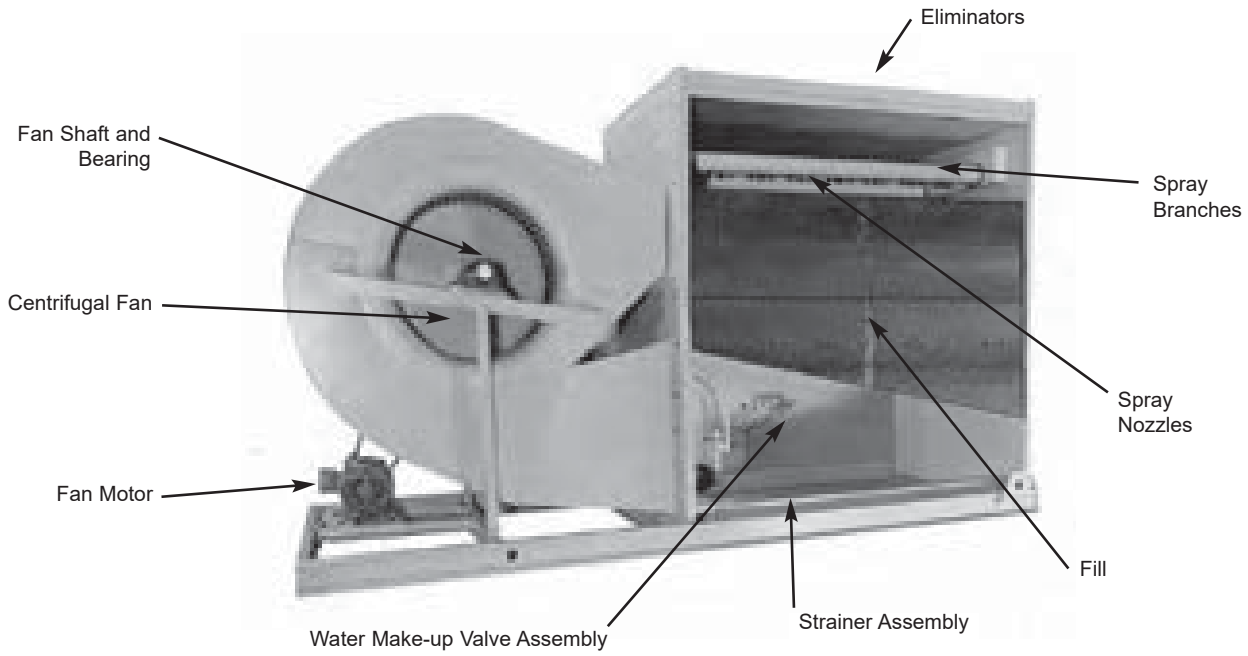


Figure 1 - VTL Low Profile Series V Cooling Tower

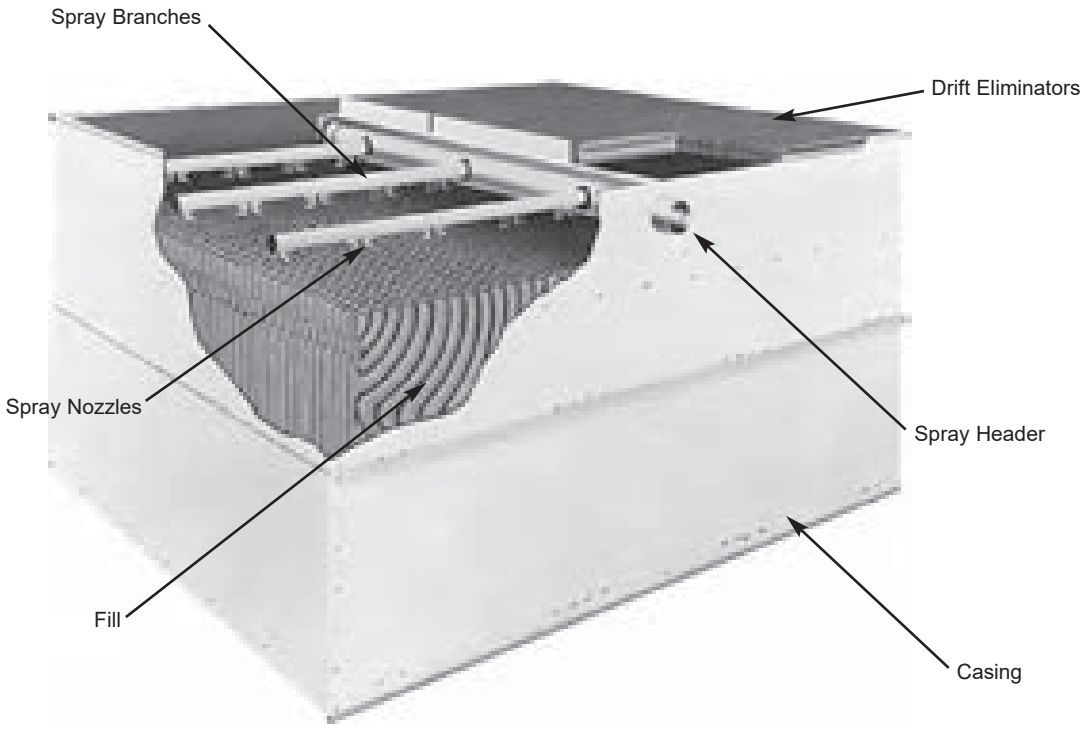


Figure 2a - Heat Transfer Casing Section for VT0 and VT1 Cooling Towers

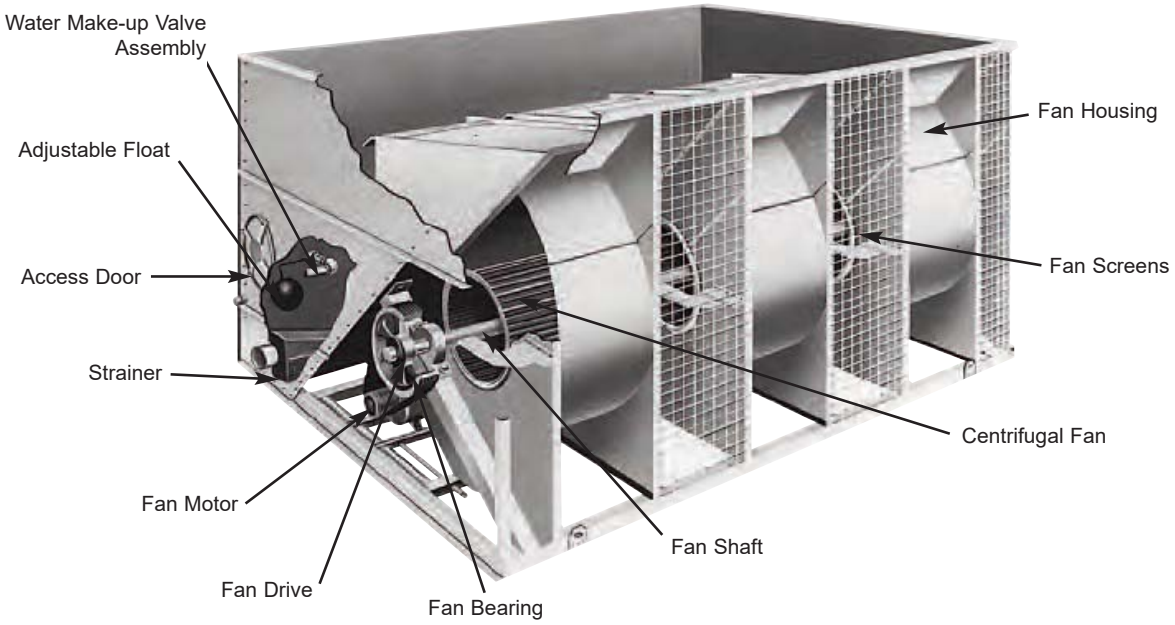


Figure 2b - Basin Section for VT0 and VT1 Cooling Towers

Table 1: Recommended Maintenance Services[1]

Type Service	Start-Up	Monthly	Quarterly	Annually	Shutdown
Inspect and clean as necessary:					
Inspect general condition of the unit[2] and check unit for unusual noise or vibration	X	X			
Clean and flush basin	X	X			X
Inspect spray nozzles	X	X			X
Clean basin strainer	X	X			X
Drain basin and piping					X
Check and adjust water level in basin	X	X			
Check operation of make-up valve	X	X			
Check and adjust bleed rate	X	X			
Inspect heat transfer section	X	X			
Inspect protective finish				X	
Mechanical equipment system:					
Check belt condition	X	X			
Adjust belt tension[3]	X		X		
Lubricate fan shaft bearings	X		X		X
Lubricate motor base adjusting nut	X		X		X
Check drive alignment				X	
Check motor voltage and current	X		X		
Check fan bearing locking collars	X		X		
Check fan motors for proper rotation	X				
Check fans for rotation without obstruction	X		X		

WARNING: Do not perform any service on or near the fans, motors, drives, or inside the unit without first ensuring that the fans and the pumps are disconnected and locked out.

NOTES:

1. Recommended service intervals are for typical installations. Different environmental conditions may dictate more frequent servicing.
2. When operating in ambient temperatures below freezing, the tower should be inspected more frequently. Refer to “Cold Weather Operation” on Page N102 for more details.
3. Tension on new belts must be readjusted after the first 24 hours of operation and quarterly, thereafter.

Operation and Maintenance

Initial and Seasonal Start-up

General

- If the unit is mounted on vibration isolators or isolation rails, refer to the vibration isolation manufacturer’s guidelines before loading/unloading weight from the unit.
- Verify fan and system pump motors are disconnected and locked out.
- Conduct external inspection of the equipment. Check for leaks, corrosion, and any structural damage.
- Inspect piping and connections.

Cleaning

- Drain the cold water basin with the strainers in place.
- Remove all dirt and debris from the fan guards.
- Clean all mechanical components.
- Flush the cold water basin interior to remove any accumulated dirt and debris.
- Remove, clean, and replace the strainers.

Inspection

WARNING: Do not perform any service on or near the fans, motors, drives, or inside the unit without first ensuring that the fans and the pumps are disconnected and locked out.

- At seasonal start-up or after prolonged shutdown, check the motor insulation with an insulation tester prior to the motor start-up.
- Prior to the seasonal start-up, check and adjust the belt tension. At the initial start-up, the belt tension may not require adjustment as the drive will be properly tensioned at the factory prior to shipment.
- Start the fan motors and check for proper fan rotation.
- Run the fans in manual mode for several minutes to check for any unusual noise or vibrations.
- Check that the float operated make-up valve is operating freely.

WARNING: Check to ensure the controls for the fan motors are set to allow a maximum of 6 on-off cycles per hour.

Figure 3 - Water Make-up Valve Assembly

Start-up

***WARNING*: Do not perform any service on or near the fans, motors, and drives, or inside the unit without first ensuring that the fans and the pumps are disconnected and locked out.**

- Prior to seasonal start-up, lubricate the motor base adjusting screws (see Figure 6 on Page N55) and the fan shaft bearings. At initial start-up, no bearing lubrication is required since the bearings are factory lubricated prior to shipment.
- Fill the cold water basin with fresh water to the overflow level via the make-up valve.
  - o Water treatment for new installations: Initiate the biocide water treatment program at this time. Refer to “Biological Control” on Page N106 for more details.
  - o Water treatment for seasonal start-up or after a shutdown period in excess of 3 days: Resume the biocide treatment program and administer a shock treatment of appropriate biocides prior to operating the fans. This will eliminate accumulated biological contaminants. Refer to “Biological Control” on Page N106 for more details.
- Set the make-up valve float so the water shuts off at the overflow level.
- Start the system pump. See “Water Distribution System” on Page N56 for more details.
- Open the valve in the tower bleed line, and adjust the bleed by closing or opening the valve.
- Once the unit is operating, check the current and voltage of all three phases (legs) of the fan motors with a heat load on the tower under warm ambient conditions. The current must not exceed the nameplate ratings.
- Check the operation of the optional vibration cutout switch.

After 24 hours of operation under thermal load, perform the following services:

- Check the tower for any unusual noise or vibrations.
- Check the operating water level in the cold water basin.
- Adjust make-up valve if necessary.
- Check the belt tension and readjust if necessary.

Extended Shutdown

WARNING: Do not perform any service on or near the fans, motors, and drives, or inside the unit without first ensuring that the fans and the pumps are disconnected and locked out.

Perform the following services whenever the cooling tower is shutdown in excess of 3 days:

- If the unit is mounted on vibration isolators or isolation rails, refer to the manufacturer’s guidelines before loading/unloading weight from the unit.

- Drain the cold water basin and all the piping that will be exposed to freezing temperatures. Heat trace and insulate all exposed piping.
- Clean all debris, such as leaves and dirt, from the interior and exterior of the unit.
- Clean and flush the cold water basin with the basin strainers in place.
- Leave the cold water basin drain open so rain and melting snow will drain from the tower.
- Clean the basin strainer and re-install.
- Lubricate the fan shaft bearings, motor base, and motor base adjusting screw.
- Close the shut off valve in the make-up water line (supplied by others), and drain all exposed make-up water piping. Heat trace and insulate all exposed piping.
- Inspect the protective finish on the unit. Clean and refinish as required. Refer to “Corrosion Protection” on Page N104 for more details.
- Secure the fan motors starting device in the “OFF” position to ensure personal safety in case of future inspection or service.

Detailed Component Maintenance Procedures

Cold Water Basin

As water circulating though the cooling tower is cooled, it collects in the cold water basin and passes through the suction strainer into the system. The cold water basin is constructed from one of the following materials of construction and the following maintenance applies to all basin materials of construction:

- Galvanized steel
- Thermosetting Hybrid Polymer
- Type 304 stainless steel

Water Levels

Table 2: Cold Water Basin Water Levels

Model Number	At Overflow Level (in.)	At Operating Level (in.)
VTL	10”	5-1/2”
VT0-12 to VT0-116	18-1/2”	13-3/8”
VT0-132 to VT0-176	21-1/2”	16-5/8”
VT1-N-xxx	31”	17”
VT1-xxx	24-1/2”	14”

- The make-up valve controls the operating level, which is maintained at the levels shown in Table 2.
- The operating water level in the cold water basin will vary with system thermal load (evaporation rate), the bleed rate employed, and the make-up water supply pressure.
- Check the operating water level monthly, and readjust the float when necessary to maintain the recommended operating level.

Inspection and Maintenance

WARNING: Openings and/or submerged obstructions may exist in the bottom of the cold water basin. Use caution when walking inside this equipment.

- Inspect the cold water basin regularly. Remove trash or debris accumulated in the basin or on the strainer.
- Quarterly, or more often if necessary, drain, clean, and flush the entire cold water basin with fresh water. This will remove the silt and sediment, which normally collects in the basin during operation. If not removed, sediment can become corrosive and cause deterioration of the protective finish of metallic basins.
- When flushing the basin, leave the strainers in place to prevent the sediment from re-entering the system.
- Remove the strainers after the basin has been flushed.
- Clean and replace the strainers before refilling the basin with fresh water.
- Adjust the float to maintain the design operating level. See Table 2: “Cold Water Basin Water Levels.”

Fan

Series V and Low Profile Series V Cooling Towers use centrifugal fans. Thoroughly inspect the fans for damaged or deteriorated fan blades and replace the fan as required.

Inspection and Maintenance

- If the unit is already in operation, while the fans are still running, check for any unusual noise or vibration.
- With the fans off and the motor locked out and tagged, check the general condition of the fans:
  - Inspect for any loose or missing bolts in the locking collar and fan shaft bearings.
- **Rotation**: Turn the fan shift by hand to ensure that the fan moves freely with no rough spots, binding or other malfunctions that could cause vibration or fan motor overload.
- **Direction of Rotation:** On initial start-up, or if the fan motor has been rewired, bump the fan motor and note the direction of rotation.
- **Operation**: On initial start-up, run the fan in the manual position for several minutes and check for any unusual noises or vibration.

Fan Drive System

Inspection and Maintenance

- These drives require a periodic check of the belt condition and, when necessary, tension adjustment. The recommended service intervals are as follows:
  - **Initial Start-up**: Servicing is not required prior to initial tower start-up. The drive has been tensioned and aligned at the factory.
  - **Seasonal Start-up**: Readjust the belt tension.
  - **Operation**: After the first 24 hours of operation, readjust the belt tension on a new unit start-up or installation of a new belt. Thereafter, check the belt condition monthly, and adjust tension as necessary. Readjust tension at least once every 3 months.
- Belt tension check:
  - Place a straight edge along the belt from sheave to sheave as shown in Figure 4a, or use a tape measure as shown in Figure 4b, to measure belt deflection.
  - Apply a moderate force by hand (approximately 15 lbs/6.8 kg) evenly across the width of the belt in the center of the span between the sheaves.
  - There is adequate belt tension if the belt deflects between 1/4” and 3/8” as shown in Figures 4a and 4b.

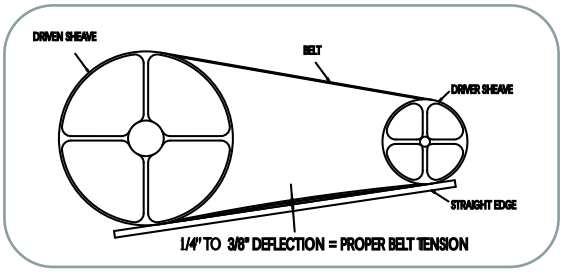


Figure 4a

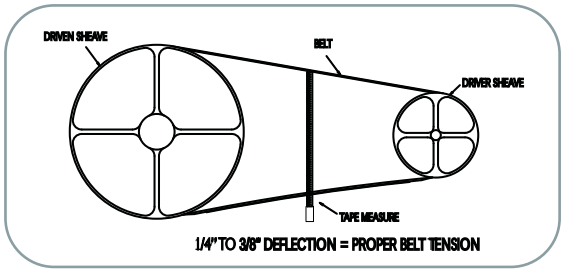


Figure 4b

Belt Tension

- Belt tension adjustment (if required):
  - Loosen the lock nut on the motor base adjusting screw.
  - Turn the motor base adjusting screw clockwise to tension the belt, or counterclockwise to relieve belt tension. During adjustment of belt tension, rotate the drives several times by hand to evenly distribute the tension throughout the belt.
- When the belt is properly tensioned, retighten the lock nut on the motor base adjusting screw.

NOTE: There should be no “chirp” or “squeal” when the fan motor is started.

Alignment:

- Check the drive alignment annually to ensure maximum belt life.
- Drive alignment check and adjustment:
  - Place a straight edge across the driver and the driven sheaves as shown in Figure 5.
  - The straight edge should contact all four points as shown in Figure 5 indicating proper drive alignment.
  - There should be no more than 1/16” deviation from four points of contact.
  - In case of realignment, loosen the motor sheave and align it with the fan sheave. Allow 1/4” for draw-up as the bushing screw is retightened.

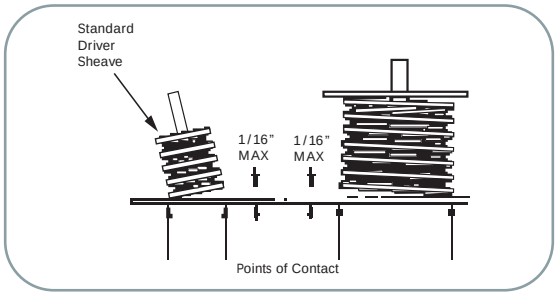


Figure 5 - Standard Drive Alignment

Fan Motors

Series V Cooling Towers and Low Profile Cooling Towers use cooling tower duty, premium efficient, totally enclosed, single-speed, single-winding, reversible ball bearing type motor(s).

Inspection and Maintenance

- Clean the outside of the motor at least quarterly to ensure proper motor cooling.
- After prolonged shutdowns, check the motor insulation with an insulation tester prior to restarting the motor.

Adjustable Motor Base

Coat the motor base slides and adjusting screws (see Figure 6) every 3 months using good quality corrosion inhibiting grease such as one recommended for lubricating the fan shaft bearings.

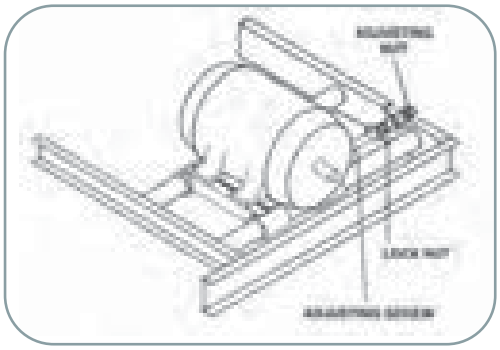


Figure 6 - Adjustable Motor Base

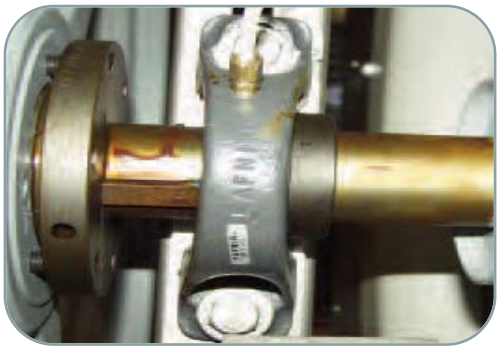


Figure 7 - Ball Bearing

Fan Shaft Bearings

The fan shafts are supported by ball bearings (see Figure 7). Each bearing is equipped with a lubrication fitting and locking collar.

Ball Bearings

Under normal operating conditions, the bearings should be greased every 2,000 operating hours or at least quarterly. The bearings should also be greased at seasonal start-up and shutdown. **Only lubricate the bearings with one of the following water resistant inhibited greases which are good for ambient temperatures ranging from -65°F (-53.9°C) to 250°F (121.1°C):**

Amoco - Rycon Premium #3	Exxon - Polyrex® EM	Shell - Alvania #3
Chevron - SRI	Exxon - Unirex N™	Shell - Dolium “R”
Citgo - Polyurea MP2™	MobilGrease® - AW2	SKF - LGHP2™
Conoco - Polyurea 2™	Shell - Alvania RL3™	Unocal 76 - Unilife Grease™

Only lubricate the bearings with a hand grease gun. Do not use high pressure grease guns since they may rupture the bearing seals. When lubricating, purge the old grease from the bearing by gradually adding grease until a bead of new grease appears at the seal.

Sleeve Bearings

Prior to start-up and during the first week of operation, the bearing oil cup (see Figure 8) must be refilled with an industrial-type mineral oil (see Table 3) to saturate the felt wick in the bearing reservoir. After the initial start-up, fill the bearing oil cup every 1,000 operating hours or at least every six months. When ambient temperatures below 0˚F are expected, a light oil must be used. With such light oils, the bearing oil cup should be checked and refilled several times during the first several hours of operation until the bearings reach operating temperature.

Table 3: Sleeve Bearing Lubricants

Temp Ambient	BAC P/N	Texaco	EXXON
70˚F to 100˚F 30˚F to 70˚F	582628PI	Regal R & O 320 Regal R & O 150	Teresstic 220 Teresstic 100
5˚F to 30˚F -25˚F to 5˚F	582627PI	Regal R & O 32 Capella 32	Teresstic 32

Caution: Do not use oils containing detergents for bearing lubrication. Detergent oils will remove the graphite in the bearing sleeve and cause bearing failure. Also, do not disturb bearing alignment by tightening the bearing cap adjustment on a new unit as it is torque-adjusted at the factory.

Figure 8 - Sleeve Bearing

Locking Collars

Each eccentric locking collar should be checked quarterly to ensure that the inner bearing race is secured to the fan shaft. The locking collar can be set using the following procedure (see Figure 9):

- Loosen the set screw.
- Using a drift pin or center punch, tap the collar (in the hole provided) tangentially in the direction of rotation while holding the shaft.
- Retighten the set screw.

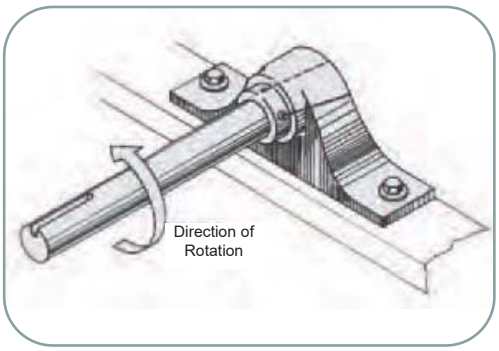


Figure 9 - Locking Collar Assembly

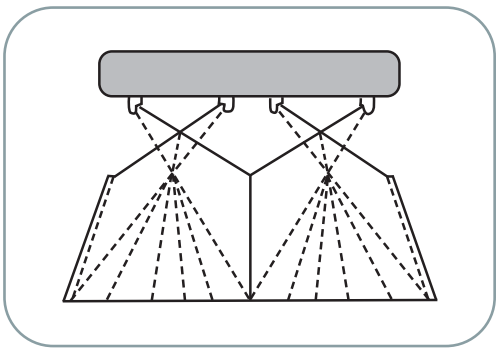


Figure 10 - Nozzle Spray Pattern

Water Distribution System

The hot water is distributed through a corrosion resistant polyvinyl chloride (PVC) spray distribution system. The drift eliminators are also made of PVC, which require no protection against rot, decay, rust, or biological attack.

The spray nozzles and heat transfer section should be inspected and cleaned each month. The inspection procedure is as follows:

- Shut off the fan, lock out and tag out the fan motor, but leave the system pump running.
- Remove the drift eliminators to allow a clear view of the spray distribution system and nozzle patterns.
- Check to see if the nozzles are all spraying consistently and producing the spray pattern in Figure 10.

- Quarterly or more often as required, turn off the system pump. Flush any dirt or debris from the water distribution system to prevent clogged nozzles. If necessary, remove the nozzle and the grommet for cleaning. To remove, grasp the nozzle and pull while twisting. Replace any damaged nozzles.
- Inspect the fill surface for bent edges or scale build-up.

Caution: Don't use steam or high pressure water to clean PVC eliminators or materials other than steel.

Water Level Control

There are two types of water level controls used on BAC units:

- Mechanical make-up valve assembly
- Optional electric water level control package

The Series V water make-up valve assembly is located within easy reach from the access door at the connection end of the unit.

Mechanical Make-up Valve Assembly

A float-operated mechanical water make-up assembly is furnished as standard equipment on the unit. The standard make-up assembly consists of a corrosion resistant make-up valve connected to a float arm assembly actuated by a polystyrene-filled plastic float. The float is mounted on an all-thread rod held in place by wing nuts. The cold water basin operating water level can be adjusted by repositioning the float and all-thread rod using the wing nuts provided.

NOTE: If the unit has been ordered with the optional electric water level control package or is intended for remote sump application, a mechanical water make-up valve will not be provided.

Inspection and Maintenance:

- Inspect the make-up valve assembly monthly and adjust if necessary.
- Inspect the valve annually for leakage. Replace the valve seat if necessary.
- Maintain the make-up water supply pressure between 15 psig and 50 psig for proper operation. BAC recommends a surge protector (provided by others) for pressures over 50 psig.
- Set the initial basin water level by adjusting the wing nuts, so that the make-up valve is completely closed when the water level in the cold water basin is at the overflow connection.
- With the design thermal load and the average water pressure (15 to 50 psig) at the valve, the above setting will produce operating water levels as stated in Table 2 on Page N53.
- If the thermal load is less than the design load at the time of unit start-up, the procedure may produce operating levels greater than those shown in Table 2. If operating levels are higher than specified, readjust the float in order to attain the recommended operating level.
- Closely monitor the water level in the cold water basin and adjust the level if necessary during the first 24 hours of operation.
- Operating at the recommended water level will ensure that the unit basin contains sufficient water volume to prevent air entrainment in the circulating pump during system start-up and provides sufficient excess basin capacity to accept the total system pull-down volume.

Optional Electric Water Level Control Package

As an option, an electric water level control package is available in lieu of the mechanical make-up assembly. The package consists of a probe-type liquid level control assembly and a slow-closing solenoid valve. Stainless steel electrodes, factory-set at predetermined lengths, extend from an electrode holder into the cold water basin.

Inspection and Maintenance:

- Clean the stainless steel electrodes periodically to prevent accumulations of scale, corrosion, sludge or biological growth, which could interfere with the electrical circuit.
- The water level is maintained at the recommended operating level regardless of the system thermal load. Therefore, it is not recommended that the operating level be adjusted.
- During the start-up of units equipped with the electric water level control package, by-pass the control unit in order to fill the unit to the overflow connection.

Recommended Spare Parts

BAC parts are the “Perfect Fit” for your cooling tower. These parts are specifically designed, engineered and manufactured to work in a cooling tower environment. They are the right parts, at competitive pricing levels, and BAC offers the best deliveries in the industry.

BAC stocks most common repair and retrofit parts in our Parts Depot℠ and can ship other parts, often overnight, from any of our three manufacturing facilities strategically located in California, Delaware, and Illinois. In addition, most BAC Representatives maintain a local inventory of commonly used parts.

Even with this fast delivery capability, it is still recommended that certain essential, emergency repair parts be maintained in your local inventory, to minimize any potential downtime.

Basic Recommended Spare Parts

Bearing set

Float valve or repair kit

Float ball

Solenoid valve (if unit is equipped with electric water level control)

Powerband or set of belts

Spray nozzle kit with grommets

Basin heater and low water cut out

Door gasket

Strainer (inlet and suction)

Fan and sheave bushings

Pump seal and gasket kit for coil products

Automatic bearing greaser refill kit

Parts to Consider if Extended Downtime is a Concern

Spray pump for coil products

Fan or fan wheel

Fan shaft

Sheave set

Fan motor

3.3. Water Distribution System

3.3.1. System Description

The chiller water distribution system automatically supplies adequate chilled water flow to the primary handling unit, air handling units and chilled beams according to the differential pressure of chilled water distribution loop. The chilled water pumps, 3 duty and 1 standby, operate in variable speed and in parallel to meet with partial load chilled water flow requirement. The chilled water distribution system co-ordinates with the central chiller plant dynamically.

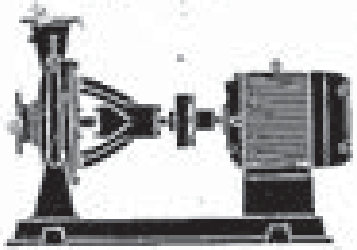
The condensing water system consists of 2 numbers 8.4l/s water pumps from CCHP system; 1 number 8.4l/s and 2 numbers 4.2l/s water pumps from AC system. The condensing water pumps deliver condensing water between cooling towers and both absorption chiller and electric chillers. The 5 condensing water pumps operate in constant spend in parallel to meet with the chiller operation. Condensing water flows through differential by-pass pipe according to the condensing water temperature

Flow sensor, electromagnetic flow meter and pressure sensors monitor flow direction and pressure of chilled water and condensing water de-coupler pipe. The monitoring parameters repeat to DDC for monitoring and chiller sequencing control operation.

Booster water pump system is a packaged pneumatic booster pump unit. The unit consists of pneumatic vessel, pumps and associated control systems. An integrated control panel is provided for monitoring and control purpose. Control and monitoring device includes high/low pressure cut-out, low pressure alarm, main on lamp, manual duty selector switch, and high pressure alarm.

3.3.2. Water Pumps

(Please refer to Operation and Maintenance Manual from DP)



Instructions for the Installation, Operation and Maintenance of LDP Centrifugal Pumps

Installation

Make sure that the base-plate lies perfectly horizontal. Then it must be grouted in. Large base-plates must be supported on wedges and then cast with cement. The foundation bolts should not be tightened until after the cement has hardened completely. At that time the pump shaft should rotate as easily as before. If run by direct drive, pump and motor shafts must be aligned exactly. The two coupling halves should lie parallel as otherwise the bearings will run hot and the buffers will wear prematurely.

If driven by belt, the pump should be aligned parallel to the motor shaft. The gear ration should not exceed 1 to 6.

Suction piping

The suction piping must be perfectly air-tight and should rise gradually toward the pump so that no air pockets are formed. Avoid sharp bends in the piping. The diameter of the suction pipe should not be smaller than the suction branch of the pump. If long suction pipes are necessary, they should be bigger in order to reduce friction losses. The speed of flow in the suction piping should not exceed 2 m/sec. The total suction head (static suction head plus friction losses in the suction piping) should not exceed 7.5 m. We recommend testing the suction pipe for leaks with a pressure of 2 or 3 atmospheres.

For horizontal connection of suction piping with a larger diameter than the suction branch of the pump, eccentric tapers (flat side on top) must be used as adaptors, to insure that no air pockets are formed and that the top line of the pipe lies flat. If connected vertically, concentric tapers may be used. A foot valve should be installed at the intake of the suction pipe to allow priming. The foot valve should be installed at least 20 cm above the bottom of the well and be adequately immersed to avoid air being drawn into the circuit. The size of the foot valve should be such that the flow does not exceed 2 m/sec. Do not install a sluice valve in the suction piping. For flooded suction a foot valve is not required, but a sluice valve should be installed in the intake piping as near the pump as possible.

Delivery piping

The diameter of the delivery piping must be at least as great as that of the delivery branch of the pump, and where relatively long runs are involved, a larger diameter should be chosen to avoid excessive friction losses. If the discharge head is more than 10 m and extensive pipework is installed, it is essential to insert a non-return valve with by-pass to protect pump and foot valve from the effect of water hammer, which might occur if the pump is shut down suddenly. To allow adjustment of pump output, a discharge sluice valve should be fitted directly behind the delivery branch.

After connecting the pipework, check the coupling and realign the pump to the motor, if necessary.

DP® DRAKOS-POLEMIS INC
Pump Manufacturers

Starting

Please make sure that the pump is never started dry. First check that the pump shaft rotates easily and that the direction of rotation coincides with the direction indicated by the arrow on the pump. If the pump has not been used for a long period of time and the shaft does not rotate forwards or backwards, remove the gland screws and if necessary the buffer or fill the pump with warm water. In case of doubt please contact our works.

Remove any air from pump and suction piping and prime the pump. During priming turn the shaft a few times by hand. After priming check whether the water in the open filler funnel remains at a constant level; it must not sink. Then close the funnel tightly and start the pump. The stuffing box should be tightened so that it drips slightly. If it is tightened too much, the pump will become overheated, power consumption will rise and the shaft will wear more quickly.

If the motor ratings have been selected very exactly, start the pump with closed sluice valve only. Open the valve slowly when the pump is running and adjust it so that the motor is not overcharged.

Maintenance

a) Periodically check the smooth running of the pump, the indications of pressure gauge, vacuum gauge, flow meter if fitted, ammeter for motor power consumption and compare them to later readings taken under the same conditions. A significant deviation indicates the need for a general inspection.

b) The shaft rotates in grease "lubricated-for-life" ball bearings with two seals - Type 2RS. Relubrication in service is not required.

c) Periodically inspect the stuffing box and adjust it with the pump in operation tightening the gland nuts so that there is sufficient leakage to lubricate the packing.
Do not over-tighten the stuffing box. Excessive pressure can wear out packing prematurely and seriously damage the shaft.
When, after adjusting several times, the packing has been compressed to the point that the gland is about to contact the upper face of stuffing box, remove the old packing rings and replace with new rings. If there are bad score marks on the shaft or shaft sleeve in the packing chamber replace the damaged part. Install packing rings 180° apart, for each successive packing ring installed.
We recommend you to have a stock of packings. Replacement packings can be purchased at our works.

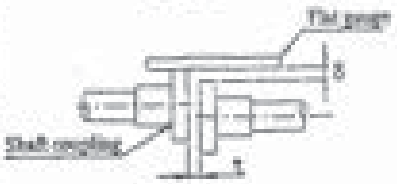
d) Mechanical seal needs no supervision or adjustment. In case of damage must be replaced. It is a component of high accuracy so it must be carefully assembled, specially not injure the sealing faces. Surfaces in contact must be cleaned with a soft piece of cloth.

e) If there is danger of frost empty the pump completely.

Shaft coupling deflection allowance

Unit : mm

Shaft Coupling	δ
Flexible shaft coupling	10/100
Gear coupling	10/100



Measure this value in two vertical and lateral directions respectively.

Location of faults

Before shipment each pump is tested for smooth operation, performance and power consumption. For this reason the cause for pump failure can usually be found in the local conditions.

Pump does not deliver	**Cause**	**Remedy**
	a) wrong rotation	change motor connections
	b) suction pipe and pump insufficiently primed or foot-valve leaking	re-prime pump and check foot-valve
	c) leak or air pocket in suction piping or shaft seal leaking	check suction piping and shaft seal, re-prime pump
	d) speed too low	check motor connections, voltage and speed
	e) suction lift excessive	lower pump
	f) system head higher than total head of pump	check suction and discharge head, contact our works

---

Pump does not operate at full capacity	**Cause**	**Remedy**
	a) suction strainer clogged	clean strainer, keep strainer free from debris
	b) suction strainer insufficiently immersed, air drawn into pump	lengthen suction piping or reduce output of pump to correspond with inflow of water, watch maximum suction lift
	c) pump or piping clogged	clean pump/piping
	d) delivery head higher than anticipated	verify actual delivery head, contact our works

---

Pump absorbs too much power	**Cause**	**Remedy**
	a) system head less than anticipated, output and power consumption greater	throttle delivery sluice valve
	b) stuffing box too tight or packing has become too hard as shown by overheating	loosen stuffing box screws, replace packing

---

Pump does not run smoothly or bearings become warm	**Cause**	**Remedy**
	a) base-plate misshapen during assembly. Coupling halves do not fit together exactly	compensate for misshapen base-plate by putting thin tin sheets underneath pump or motor feet
	b) worn buffers	as above, replace buffers
	c) bearings over-lubricated	remove superfluous grease, if necessary wash bearing with petroleum and re-lubricate

If faults cannot be rectified please contact our works

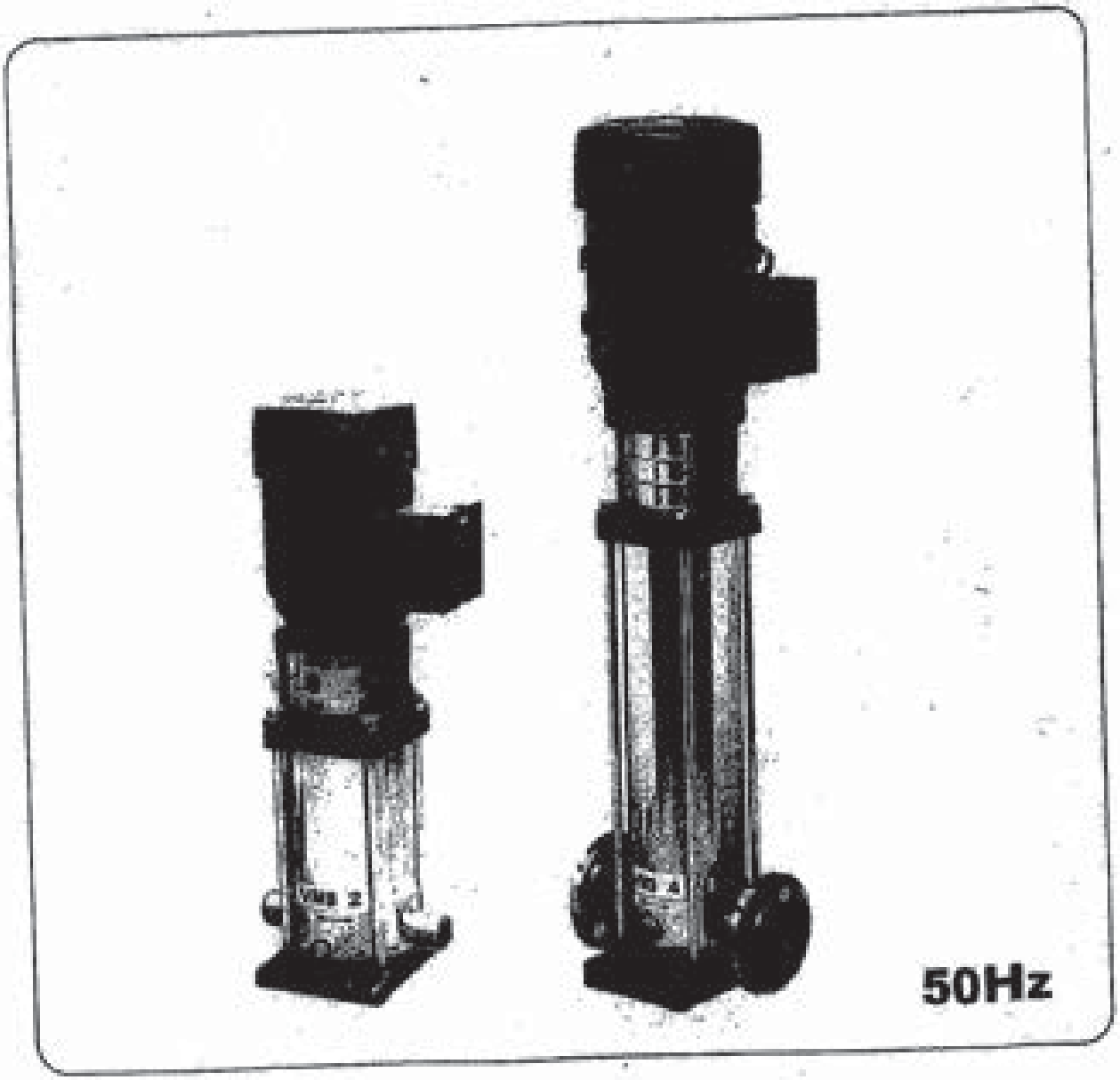
Please note:
When ordering spare parts be sure to indicate the factory number of the pump which can be found on the delivery branch of the pump.

DP DRAKOS-POLEMIS INC
Pump Manufacturers

SV / MSV

Vertical Stainless Steel Multistage Centrifugal Pump

Installation and operating Instructions



Before beginning installation procedures,these installation and Operating instructions should be studied carefully.The installation and operation should also be in accordance with local regulations and accepted codes of good practice.

1. Applications

VMS multistage in-line centrifugal pumps,types, are designed for the following applications:

Pumped Liquids

Thin,non-explosive liquids,not containing solid particles or fibres.The liquid must not attack the pump materials chemically.

When pumping liquids with a density and/or viscosity higher than that of water,motors with correspondingly higher outputs must be used,if required.

SV/MSV

For liquid transfer,circulation and pressure boosting of cold or hot clean water,

Typical applications:

- Municipal water supply and pressure boosting
- Domestic water supply
- Boiler feed and condensate systems
- Cooling water systems
- Irrigation and dewatering
- Fire fighting
- Washing plants and washdown

2. Technical Data

3.1 Ambient Temperature
Maximum+40℃

3.2 Liquid Temperature
-15℃to+120℃

3.3 Minimum Inlet Pressure
According to the NPSH curve

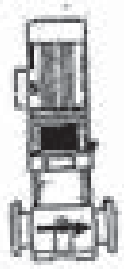
3.4 Electrical Data
See motor nameplate.

3.5 Dimensions and Weights
see catalogue

3.Installation

The pump should be installed with the motor shaft vertical,see fig.1.Ensure that an adequate supply of cool air reaches the motor cooling fan.
Arrows on the pump base show the direction of flow of liquid thrugh the pump.

Fig.1
Counter flanges,gaskets,bolts,PJE and CLAMP coupling sets are available as accessories and have to be ordered separately.



PJE and CLAMP coupling sets are available with threaded sockets or sockets for welding. Isolating valves should be fitted either side of the pump to prevent the system being drained if it is necessary to clean,repair or replace the pump.

Install the pipes so that air locks are avoided,especially on the suction side of the pump.Correct pipework shown in fig.2.

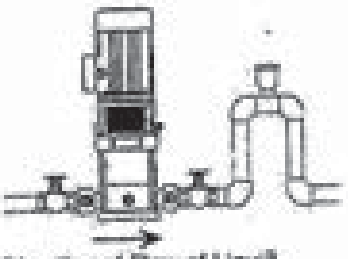
Fig.2

The pipes should be fitted so that any tension caused by variations in temperature does not affect the pump.
If the pumps are installed in long pipes,these should be adequately supported before and after the pump.
If there is any risk of the pump being choked by stones,leaves,twigs,etc.,measures should be taken to prevent this, A strainer can for instance be fitted to the suction pipe.
In the case of installations in which the discharge pipe has been installed horizontally,or it slopes downwards away from the pump,which can or must be drained in certain periods,the pump should be protected against dry-running.This can be done by fitting a loop with a vacuum valve close to the pump,see Fig.3.
The highest point of the loop should at least be flush with the lower edge of the pump motor.
The discharge pipe can then be drained independently of the pump and vice versa.

Fig.3

The pump is not allowed to run against a closed discharge valve as this will cause an increase in temperature / formation of steam in the pump which may cause damage to the pump.

If there is any danger of the pump running against a closed discharge valve,a minimum liquid flow through the pump should be ensured by connecting a bypass/ adrain to the discharge pipe.The drain can for instance be connected to a tank..



Direction of Flow of Liquid

Minimum Flow Rates for MSV

Type	Liquid Temperature	
	-15°C to + 80°C	+80°C to + 120°C
SVI MSV2	0.2m³/h	0.5m³/h
SVI MSV4	0.4m³/h	1m³/h
SVI MSV6	0.8m³/h	2m³/h
SVI MSV 16	1.6m³/h	4m³/h
SVI MSV 32	3.2m³/h	8m³/h
SVI MSV 42	4.2m³/h	10.6m³/h
SVI MSV 65	6.5m³/h	16.2m³/h
SVI MSV 85	8.5m³/h	21.2m³/h

4. Electrical Connections

Before removing the terminal box cover and before any removal / dismantlig of the pump,make sure that the electricity supply has been switched off.

The electrical connections should be carried out by an authorized electrician in accordance with local regulations.
The pump must be connected to an external switch.
The operating voltage and frequency are marked on the nameplate.Make sure that the motor is suitable for the electricity supply on which it will be used.
Single-phase motors incorporate a thermal switch and require no additional motor protection.
Three-phase motors must be connected to a motor starter.The terminal box can be turned to four positions,in 90° steps.If necessary,remove the coupling guards by means of a screwdriver. Do not remove the coupling.
Remove the bolts securing to the motor the coupling

Turn the motor to the required position.Replace and tighten the bolts.Replace the coupling guards.
The electrical connection should be carried out as shown in the diagram inside the terminal box cover.

⚠ **Do not start the pump until it has been filled with liquid.**

5.Start-Up

⚠ **Do not start the pump until it has been primed and vented.**

5.1 Priming

Closed systems or open systems where the liquid level is above the pump inlet:

Close the discharge isolating valve and loosen the vent screw in the pump head.

⚠ **Pay attention to the direction of the vent hole and take care to ensure that the escaping water does not cause injury to persons or damage to the motor or other components.In hot water installations, special attention should be paid to the risk of injury caused by scalding hot water.**

Slowly open the isolating valve in the suction pipe until a steady stream of liquid runs out the vent hole.
Tighten the vent screw and completely open the isolating valve(s).

Open systems where the liquid level is below the pump inlet:

The suction pipe and the pump must be filled with liquid and vented before the pump is started.

5.2 Checking Direction of Rotation

Do not start the pump to check direction of rotation until it has been filled with liquid.

⚠ **The direction of rotation should not be checked with the motor alone,as an adjustment of the shaft position is required when the coupling has been removed.**

The correct direction of rotation is shown by arrows on the pump head and/or on the motor fan cover.

5.3 Starting

Before starting the pump,completely open the isolating valve on the suction side of the pump and leave the discharge isolating valve almost closed.
Start the pump.
Vent the pump during starting by loosening the vent screw in the pump head until a steady stream of liquid runs out the vent hole,see figs.5 and 6.

⚠ **Pay attention to the direction of the vent hole and take care to ensure that the escaping water does not cause injury to persons or damage to the motor or other components. In hot water installations,special attention should be paid to the risk of injury caused by scalding hot water.**

When the piping system has been filled with liquid, slowly open the discharge isolating valve until it is completely open.
When pumping liquides containing air,it is advisable to vent the pump regularly.To vent the pump,loosen the vent screw in the pump head during opetation.

5.4 Frequency of Starts and Stops

Motors smaller than 4KW should not start more than 100 times per hour.
Other motors should not start more than 20 times per hour.

6. Maintenance

⚠ **Before starting work on the pump,make sure that no power is supplied to the pump and that it cannot be accidentally switched on.**

Pump bearings and shaft seal are maintenance-free. If the pump is to be drained for a long period of inactivity,remove one of the coupling guards to inject a few drops of silicone oil on the shaft between the pump head and the coupling.This will prevent the shaft seal faces from sticking.

Motor Bearings:

Motors with are not fitted with grease nipples are maintenance-free.
Motors fitted with grease nipples should be lubricated with a high-temperature lithium-based grease.
In the case of seasonal operation (motor is idle for more than 6 months of the year),it is recommended to grease the motor when the pump is taken out of operation.

7. Frost Protection

Pumps which are not being used during periods of frost should be drained to avoid damage.
Drain the pump by loosening the vent screw in the pump head and by removing the drain plug from the base.

⚠ **Care must be taken to ensure that the escaping water does not cause injury to persons or damage to the motor or other components.In hot water installations,special attention should be paid to the risk**

of injury caused by scalding hot water.
Do not tighten the vent screw and replace the drain plug until the pump is to be used again.
Before replacing the drain plug in the base,screw the bypass valve out against the stop.
Fit the drain plug by tightening the large union nut fol-lowed by the bypass valve.

8. Fault Finding Chart

⚠ **Before removing the terminal box cover and before any removal / dismantling of the pump,make sure that the electricity supply has been switched off.**

Fault	Cause
1.Motor does not run when started.	a) Supply failure. b) Fuses blown. c) Motor starter overload has tripped out. d) Main contacts in motor starter are not making contact or the coil is faulty. e) Control circuit fuses are defective. f) Motor is defective.
2.Motor starter overload trips out immediately when supply is switched on.	a) One fuse is blown.. b) Contacts in motor starter overload are faulty. c) Cable connection is loose or faulty. d) Motor winding is defective. e) Pump mechanically blocked. f) Overload setting too low.
3.Motor starter overload trips out occasionally.	a) Overload setting too low. b) Low voltage at peak times.
4.Mortor starter has not tripped out but the pump does not run.	a) Check 1 a), b), d) and e).
5.Pump capacity not constant.	a) Pump inlet pressure is too low. b) Suction pipe / pump partly blocked by impurities. c) Pump draws in air.
6.Pump runs but gives no water.	a) Suction pipe / pump blocked by impurities. b) Foot or non-return valve blocked in closed position. c) Leakage in suction pipe. d) Air in suction pipe or pump. e) Motor rotates in the wrong direction.
7.Pump runs backwards when switched off.	a) Leakage in suction pipe. b) Foot or non-return valve defective. c) Foot valve blocked in open or partly open position. d) Non-return valve leaks or is blocked in partly open position.
8.Leakage in shaft seal.	a) Pump shaft position is incorrect. b) Shaft seal is defective.
9.Noise.	a) Cavitation occurs in the pump. b) Pump does not rotate freely(frictional resistance) because of incorrect pump shaft opsition.

9. Service

⚠ If a pump has been used for a liquid which is injurious to health or toxic,the pump will be classified as contaminated.

CIMM

WATER PRESSURE VESSEL

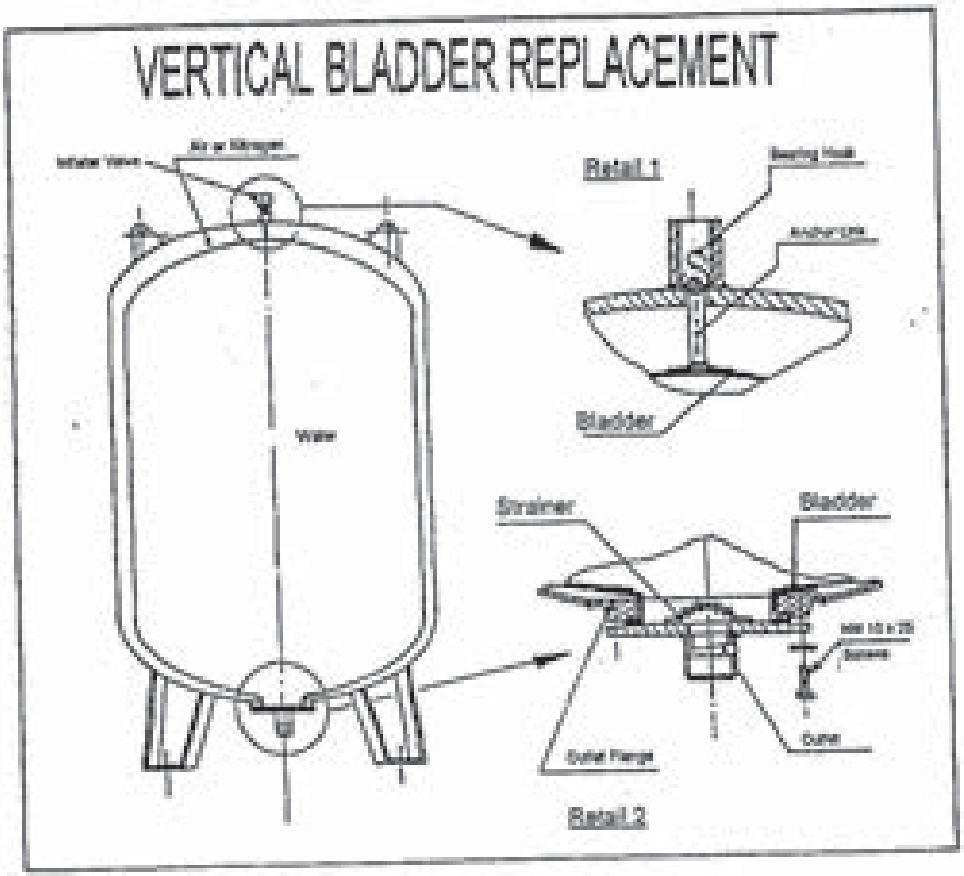
OPERATION AND MAINTENANCE MANUAL

INSTRUCTIONS FOR REPLACING A VERTICAL BLADDER VESSEL

1 Isolate the vessel from the water main by closing the valve which is situated below or near the outlet.

2 Blow down the water which is inside the bladder by opening the lower level gauge valve together with the drain valve under it. If possible, crack the outlet flange to reduce draining time.

3 Blow down the air contained in the vessel by opening the upper level gauge keeping open the drain valve.



WARNING: Before proceeding with the opening of the vessel, check that no pressure remains inside. Examine the pressure gauge and listen for air movement at the opening valves.

Continue ...

4 Remove the manhole cover. Do this by progressively un-screwing the nuts in star pattern. This should loose the bladder outlet for removal.

5 At the top of the vessel, take off the inflater system. The bearing hook should be now visible, put it up and remove the Anchor link; remove the bladder from the bottom of the vessel.

6 Clean and Dry the inside of the vessel.

7 Get a long cord through the upper hole of the vessel. This one must come out again by the outlet.

8 Tie up this cord to the anchor link of the bladder.

9 Roll up the bladder in its longitudinal way and enter it into the vessel by using the cord. When the anchor link goes out the upper hole of the vessel, get through the bearing hook into the anchor link according to the Retail 1

10 Verify that the bladder is not twisted in the inside of the vessel and fit the flange of the bladder into the outlet flange according to Retail 2

11 Put on the water outlet with HM 10 x 25 screws, and screw down the inflater system on the upper part.

12 When all is satisfied, precharged the vessel according to the manufacture's instructions/recommendations.

13 After pre-charging the vessel, perform an air leakage test by using soapy water on all joints.

● STARTING OPERATION OF A WATER PRESSURE VESSEL

pressure vessels are supplied without initial air charge pressure. Pre-inflation should only be made after the following preparatory operations:-

- Check connection of the unit to the hydraulic circuit, and close the valve which permits to isolate the vessel from the installation. This isolating valve must be imperatively fitted up in all cases.

a) Determine the initial air charge pressure without water in the vessel, according to selected pump starting pressure. Where conditions are particularly favourable, the initial air charge pressure can be equal to starting pressure less 0.5 bars (7psi). It is advisable to consult us before attempting any air charge pressure.

b) Pressurize the vessel with air or nitrogen, via the inflater valve, from a portable compressor or cylinder, until the calculated pre-inflation pressure is reached.

c) Open the valve isolating the vessel from the installation, only when the MAIN PIPE is filled up with water.

CAUTION: If pump is started and the main gate valve is opened, and the main pipe is not filled with water this could rupture the interchangeable bladder when water & air set into the vessel all of the sudden.

d) Start the pump. Pressurized water will now penetrate in the bladder and air pressure will increase. Adjust the manostat so that it stops the pump at the desired cut-out pressure.

PRESSURE VESSEL MONITORING

If during inspection the interchangeable bladder is found to be damaged and needs to be replaced, closed the valves isolating the pressure vessel(s) from the installation (the MAIN, that is). Then all the pumps must be shut off until problem is rectified.

MAINTENANCE AND FAULT FINDING INSTRUCTIONS

No specific maintenance is necessary with pressure vessel as there are no mechanical moving parts.

There should be no or little rise. A significant rise indicates an air loss which must be investigated.

● RECOMMENDED SPARE PARTS AND LUBRICANTS

A spare part of interchangeable horizontal/vertical Butyl bladders is recommended.

Recommended lubricants are not necessary for pressure vessels as there are no mechanical moving parts.

3.4. Air Conditioning System

3.4.1. System Description

Air conditioning system is part of the hybrid ventilation system. Hybrid ventilation system consists of 3 operating modes based on different outdoor conditions, namely natural ventilation, free cooling and air conditioning mode. The following table describes operating principles and corresponding conditions for the 3 ventilation modes. The climate and the outdoor air conditions determine the operation mode of the hybrid ventilation system. For example, when the outdoor air is cool and dry enough, natural ventilation can be adopted. However, if the outdoor air is hot and humid, air conditioning system should be turned on to provide a comfort indoor environment.

Operation Mode	Operating Principle	Operating Conditions
Natural ventilation	Natural ventilation is fully utilization of outdoor fresh air to condition the indoor area. The fresh air intake will be came from the lower floor of the building and then exhaust at building high level by means of stack effect inside the building.	This mode will be operated in moderate climate period
Free cooling	Free cooling is a kind of partial mechanical ventilation. Fresh air intake will be came from outdoor and then supply to interior via AHU. The supply air flow rate and chilled water supply will be varied according to instantaneous cooling load requirement.	This mode will be operated in between summer and moderate climate period whilst natural ventilation period; Poor outdoor air quality; Cold winter period
Air conditioning	Air conditioning is supply of cool air from the central air conditioning plants. Minimum fresh air will be supplied to maintain acceptable indoor air quality. Chilled water will be supplied to suit instantaneous cooling load requirements.	This mode will be operated in hot seasons whilst outdoor condition not suitable for both free cooling and natural ventilation.

The MVAC system shall be capable to change-over to different hybrid ventilation mode in responding to indoor and outdoor environment condition. Automatic control of operation status of air-conditioning equipment and window actuators is required. Initial setpoint of various parameters and equipment operation status requirement in different modes are as follows:

Operation Mode	Setpoints for each operating mode	AHU Operation Status	Window Openings Status
Natural ventilation	Room RH ≤ 80% Outdoor RH = 40% - 70% Outdoor temp. < 25°C Outdoor wind speed < 8m/s	Off	Open
Free cooling	Room RH ≤ 80% Outdoor RH = 40% - 70% Outdoor temp. < 25°C Outdoor wind speed ≥ 8m/s (maintain for more than 30 min.)	On	Close
Air conditioning	Room RH > 80% Outdoor RH = <40% or >70% Outdoor temp. ≥ 25°C	On	Close

Air conditioning system mainly consists of chilled water pipes, primary handling unit (PAU), air handling units (AHUs), underfloor air supply, variable air volume (VAV) box, passive chilled beam and split type AC unit.

(i) Eco-office/ Meeting Room/ Executive Rooms/ Model Room/ Exhibition Area/ Display Area:

Radiant cooling from passive chilled beam together with underfloor air supply is used. During AC operation, underfloor air supply is in priority, while chilled beam serve as supplementary cooling when peak cooling load occur.

Motorized valves are provided to control the chilled water flowrate of the chilled beam, so as to control the cooling capacity in responding to the cooling load requirement. Condensation sensor will be installed at the surface of chilled beam to monitor if condensation occurs. Motorized valve will be closed to stop the chilled water circulation in case condensation is detected.

Carbon dioxide (CO2) monitoring DDC sensors are provided to control the amount of fresh air in the variable air volume system of air handling unit. Duct type carbon dioxide monitoring DDC sensor is installed in the return air duct to the AHU. Modulating volume control dampers are installed at the fresh air intake and return air duct of the AHU.

Fresh air will be dehumidified by the waste-heat driven desiccant dehumidification wheel integrated in the PAU. Desiccant dehumidification wheel absorbs moisture in fresh air by using desiccant, which can be re-activated by hot water (waste heat

generated by bio-diesel generator). The desiccant dehumidification system shall be capable of continuously operating under the appropriate site conditions. This provides better humidity control to minimize the risk of condensation on the chilled beam.

The actuation of probe type smoke detector at air duct transmits a signal to trip the supply air fan as per FSD requirements. The supply air fan shall also be tripped by manual override Ventilation/Air-Conditioning (VAC) control.

(ii) Eco-home:
Displacement ventilation will be adopted in eco-home with the displacement air columns integrated with the interior design. Air supply from the displacement air columns will be at low pressure and relatively high temperature (18°C) to avoid draft and cold feet.

Carbon dioxide (CO2) monitoring DDC sensors are provided to control the amount of fresh air in the variable air volume system of air handling unit. Duct type carbon dioxide monitoring DDC sensor is installed in the return air duct to the AHU. Modulating volume control dampers are installed at the fresh air intake and return air duct of the AHU.

(iii) Multi-purpose room:
Variable air flow air handling unit is provided to serve the multi function room and floor supply system with high level return is adopted. Supply air plenum underneath the raised floor and terminated with VAV box at different zone. The whole raised floor is used as supply air plenum. The temperature sensors are provided at different zones to control the VAV flow rates.

Carbon dioxide (CO2) monitoring DDC sensors are provided to control the amount of fresh air in the variable air volume system of air handling unit. Duct type carbon dioxide monitoring DDC sensor is installed in the return air duct to the AHU. Modulating volume control damper are installed at the fresh air intake and return air duct of the AHU.
Fresh air intake to the AHU is via the earth cooling tube, which allows heat transfer between soil and fresh air. This serves as pre-cooling during the period when ambient air temperature is higher than 28°C. Bypass duct is also installed for fresh air ducting into the AHU directly without passing through the earth cooling tube when the outdoor temperature is lower than the soil temperature.

Fresh air intake is controlled by the modulating volume control dampers to attain the designated CO2 concentration of the relevant air-conditioned space. The modulating

volume control dampers are controlled based on the deviation of the return CO2 concentration from the set point as detected by duct mounted carbon dioxide DDC sensor.

Duct type temperature DDC sensor is installed in the fresh air duct to the AHU. The outdoor air temperature and the return air temperature are compared and analyzed regularly in the DDC. If the outdoor air temperature is detected to be lower than the return air temperature by a certain pre-set value, the DDC shall override the control signal from the CO2 sensor to actuate the fresh air volume control damper to the position for drawing in the designed fresh air flow as specified on the Equipment Schedule. (i.e. the max fresh air flow)

The actuation of probe type smoke detector at air duct transmits a signal to trip the supply air fan as per FSD requirements. The supply air fan shall also be tripped by manual override Ventilation/Air-Conditioning (VAC) control.

(iv) Sever room and TBE room:
Sever room is provided for housing computer rack and sever equipment, which shall be maintained at desirable temperature and humidity all the time to ensure normal operation of the sever equipment. While TBE equipments are also operated under well air-conditioning environment. Standalone split type AC units are provided and allow 24-hr operation to both rooms.

3.4.2. Air Handling Unit/ Primary Air Unit

(Please refer to Operation and Maintenance Manual from Saiver)

3.4.3. Desiccant Wheel

(Please refer to Operation and Maintenance Manual from Bry-Air)

3.4.4. Variable Air Volume Control Box

(Please refer to Operation and Maintenance Manual from Sunrise)

3.4.5. Chilled Beam

3.4.5.1. Operation Instructions

- Check pipework properly connected to coil
- Check none of non-factory item placed above fin

3.4.5.2. Maintenance Instructions

- Clean coil and fin by vacuum cleaner
- Clean surface by damp sponge

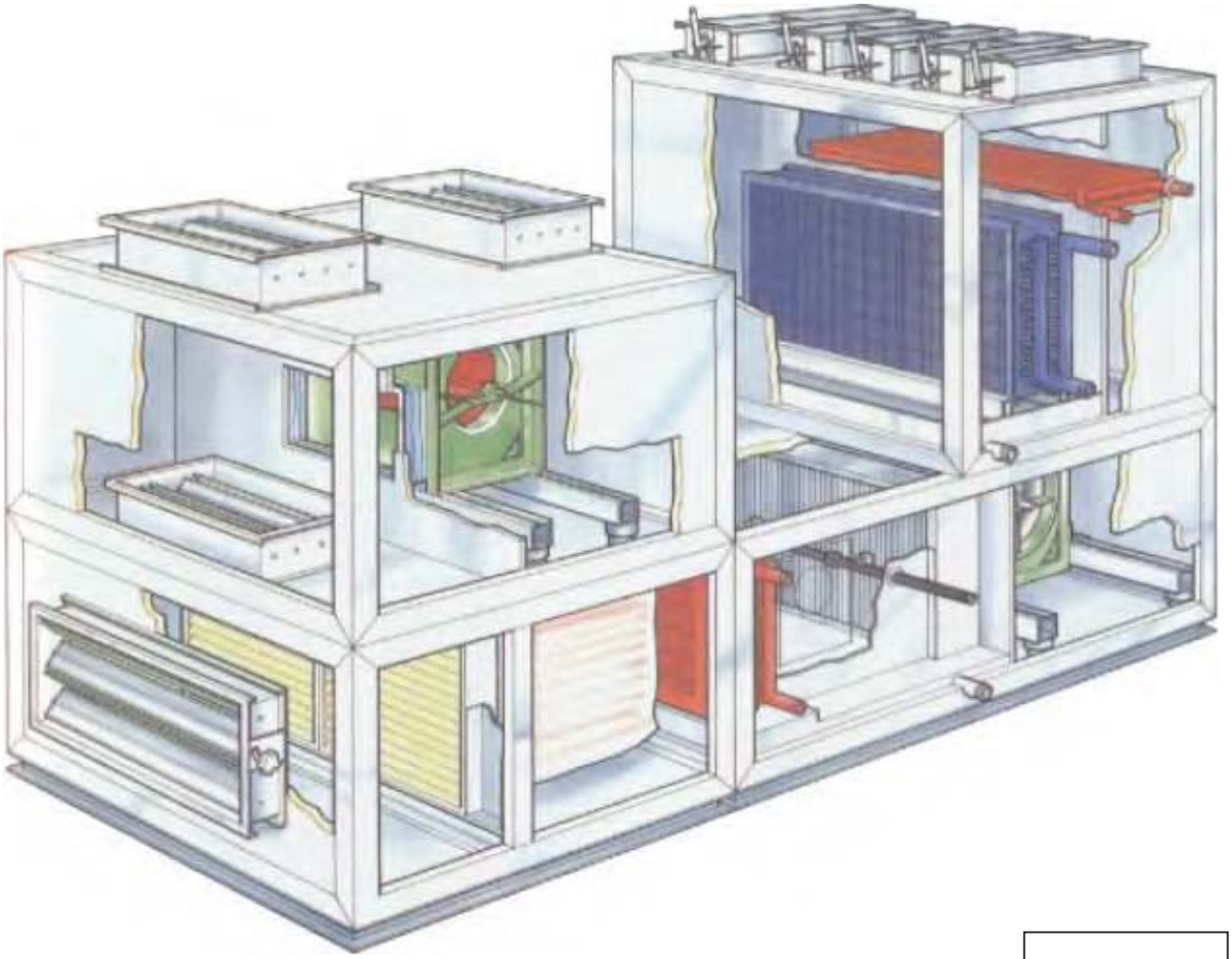
3.4.6. Split Type A/C Unit

(Please refer to Operation and Maintenance Manual from Daikin)

COSTRUZIONI AREAULICHE
Via M. da Besozzo 16 Monza (MI) 20052
Tel. 039 - 2025660 Fax 039 - 2025668

Installation, Operation and Maintenance Manual

- **Safety**
- **Troubleshooting**



12/06

INDEX

1. INSTALLATION, OPERATION AND MAINTENANCE MANUAL

1.1. SHIPPING

Units are normally shipped Ex-Works. They are inspected prior to despatch for goods condition and carefully loaded in containers with no crating/boxing. Hence, in case of transit damage, the forwarder must be informed immediately. All claims must be directed to the forwarding/insurance agents and SAIVER take no responsibility.

When units are shipped FOB port, they are either containerised or crated and delivered FOB to forwarders. Immediately upon receipt on site, inspection should be made and any damages must be reported by telex to SAIVER as well as to the forwarding/insuring agents within 24 hrs of receipt.

1.2. OFF LOADING

Special care must be taken to ensure that units are offloaded from the containers. Rough handling can result in damage to aluminium frame work and double skin panels. It is possible to lift the sections by slings or by forklift.

Slings, preferable nylon, must be place around the structural base frame as shown in fig 1.2-1.

fig 1.2-1

fig 1.2-2

fig 1.2-3

Before lifting the section, It must be ensured that the slings are properly located so they don't slide from their slot (see fig 1.2-2 and fig 1.2-3).

If everything is all right, then the section can be elevated and taken away (see fig 1.2-4).

fig 1.2-4

In the case in which is utilised a lifting tube, it must be inserted into the specific hole as shown in fig 1.2-5.

fig 1.2-5

Then the sling, which is equipped with a particular loop, must be connected to the tube as shown in fig 1.2-6 and fig 1.2-7.

fig 1.2-6

fig 1.2-7

After that, the section can be lifted (see fig 1.2-8 and fig 1.2-9).

fig 1.2-8

fig 1.2-9

It is necessary to utilise slings opportunely sized on the ground of the section weight.

The larger and heavier units should be lifted using a forklift with sufficiently long extended forks to prevent damaging the underside of the unit.

It is strongly recommended that offloading and installation operation are carried out by specialists with necessary equipment and proper tools. SAIVER cannot accept responsibility for any damage sustained during offloading and installation.

1.3. SHORT DELIVERY/DEFECTS

All items must be checked against purchase order, SAIVER drawing and the packing list for correctness and any claims for non compliance or short supply or any manufacturing defects must be reported to SAIVER by telex within three days of receipt.

1.4. INSTALLATION

Prior to installation, it must be ensured that adequate access exists for connecting all supplies, disposal of condensate/overflows, inspection, maintenance and for replacement of renewal parts such as filters, belts, bearings etc.
Installation of units must be in accordance with good engineering practise. Structural base for the units must be level and rigid.

Further it must be ensured that the base is high enough from the floor to allow the installation of condensate drain with necessary trap for easy flow as show in fig 1.4-1. It is suggested to take advice for locating the suspension points for ceiling hung units.

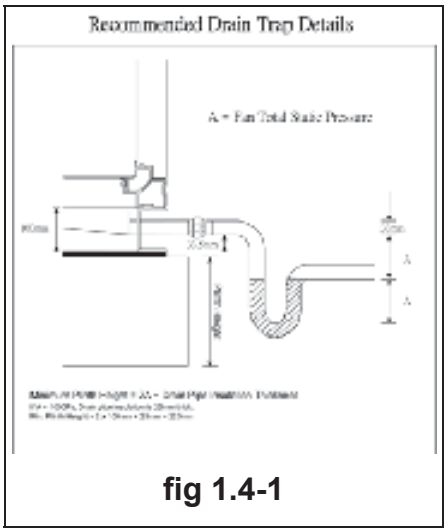


fig 1.4-1

1.5. ASSEMBLY

Units are normally designed to make best use of containers (shipping) volume in two or more sections depending on the design of units. However all the sections are externally marked and their sequence of assembly can be easily identified from the enclosed drawings.
Once all the sections are located, they can be easily aligned and locked together.

First of all, between the sides of the sections that shall be connected, it must be inserted a continuous foam gasket for airtight seal as illustrated in fig 1.5-1.

Push the sections towards one another, making sure that they are lined up with one another.

Consequently the sections are locked together by stainless steel bolts located in factory predrilled assembly holes (see fig 1.5-2 and fig 1.5-3) into the corner brackets on the inside of the frame. Make sure that they are firmly in position.

Necessary stainless steel bolts and foam gaskets are supplied in a bag, normally located within the respective section.

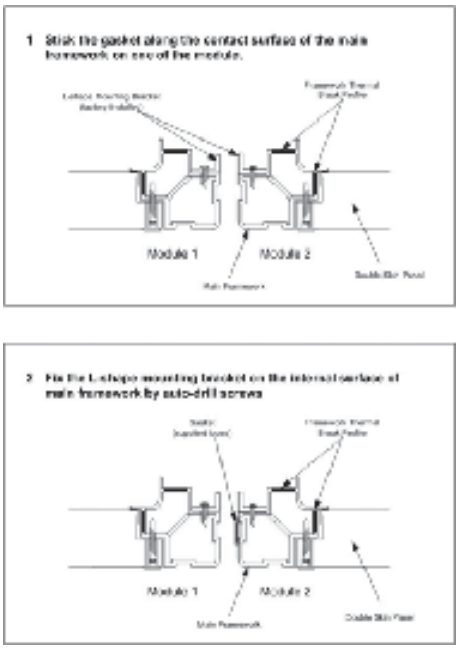


fig 1.5-2

fig 1.5-3

It must be noted that, during installation and assembly, there is a possibility of misalignment if individual sections are not carefully handled. Do not use excessive force to align because it may deform the aluminium structural framework.

In the case it is not possible to access the inside of the casing, the connection can be made either by opening an inspection door or by removing a wall panel.

While SAIVER take no responsibility for consequences due to mishandling etc, will try to assist to ensure that units are properly installed. In case services of factory personnel are required for assembly the same can be provided at extra cost.

1.6. SETTING UP OF COMPONENTS

Duct connection: when duct flanges are connected to damper frames, it must be ensured that the fixing bolts are of correct length and do not obstruct the movement of damper lever/linkages.

1.6..1. DAMPERS

All dampers must be checked for free movement prior to proceeding further.

1) *Manually operated dampers* can be adjusted to obtain the required airflow, by loosening the bakelite knob and then turning the control lever. Bakelite knob must be tightened after setting up at the desired location on locking quadrant.

2) *Motorised dampers* are supplied with the linkage rod for connection to the actuator. It must be ensured that the actuator motors (not supplied by SAIVER) are rigidly fixed to the structural framework of the unit and not to the double skinned panels. Care must be taken to ensure that the actuator does not attempt to push the damper beyond fully open or fully closed positions.

1.6..2. FILTERS

Check the type and quality of filters is in accordance with the drawing.

1) *Panel Filters*: with flat or corrugated media are normally fitted within the unit prior to shipping.

2) *Bag Filters*: along with *pre-Filters* (if any) are normally shipped in closed carton boxes, as supplied by filter manufacturer, to avoid any collection of dust and loss of efficiency prior to commissioning. Each Bag Filter is housed within a special holding frame with necessary locking spring to ensure proper sealing. A bank of such special frames (quantity depends on the type and air flow) is assembled within the peripheral aluminium framework of each Bag Filter Section. Entire assembly along with Pre-Filter must be locked with four springs to ensure no leakage of air.

3) *Automating roll Filters* have two headers, one houses the clean spool, while the other dirty spool, which is driven by a geared motor and chain drive actuated by differential pressure (D.P.) switch. Normally filter media and D.P. switch are supplied loose for site installation. For assembly, filter media roll is mounted on the clean spool header, taken along the guide channel through working section and locked to the dirty (driving) spool. D.P. switch must be installed and connected to the control panel as shown in the circuit diagram.

4) *Absolute Filters* are shipped in sealed carton boxes, as supplied by filter manufacturer. They are housed in a special purpose made of aluminium frame with corner brackets and locking devices for each cell. While assembly special care must be taken to ensure that each filter cell is properly seated within the assembly frame and perfectly sealed against the neoprene foam gasket with no possibility of air leakage.

5) *Other type of Filters* such as Actuated Carbon, inertial (sand) Filters, if installed, will be supplied with manufacturer's instructions along with the units.

1.6..3. HEAT EXCHANGER COILS

All coils are leak tested and checked prior to assembly. Fins are checked for proper condition prior to shipping. However during handling and installation they might be slightly bent and hence they must be checked and combed out if necessary. Do not remove plastic protective covers from the header connections until the system is ready for hook up. System layout should take into consideration of possible coil withdrawal. All connecting pipework must be properly insulated.

1) *Water Coils*: system design, pipe connections and valve arrangement must be in accordance with good engineering practice. Flow and return connections are clearly identified on the unit panels and pipe work must be connected accordingly, preferably through flexible couplings to avoid transmission of any vibration from the piping to coil. Excessive tightening torque might damage the coils. Pipework must be supported independently to the coil and/or the unit.

Use a pipe wrench to restrain the pipe connections of the heat exchanger when tightening the external pipe connections (see fig 1.6-1).

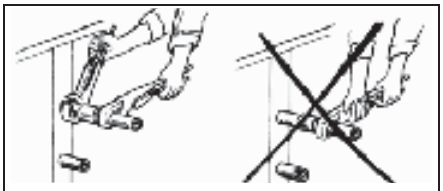


fig 1.6-1

Plugged drain and vents are provided for each coil and their use must be limited to the respective coil. They must not be used for draining or venting the other part of the system. Sufficient antifreeze chemicals must be added to the circulating water in cooling coils, when there is a possibility of they being exposed to temperatures below 2°C.

It is recommended that the water flow is shut off when the fan is switched off.

Normally, each heating coil should be provided with its own circulation pump. This ensures an even circulation of the water in the air heater, regardless of the position of the control valve; and provides the following important benefit:
appreciably less risk of freezing, due to the fact that the water velocity in the coil is always sufficiently high.

2) *Direct Expansion Coils*: all direct expansion coils will be supplied with a refrigerant distributor suitable for brazed connections. No expansion valves are supplied by SAIVER. The refrigerant pipe work must be design and installed in accordance with good engineering practise and include necessary shut-off devices, dehydrators, solenoid valves, oil traps etc. Selection, sizing, installation and setting of thermostatic expansion valve should be in accordance with the recommendation of Condensing Unit manufacturer. Flow of nitrogen gas must be maintained through the coil while brazing to avoid formation of oxide film inside, which might clog the suction strainers affecting on the system operation adversely.

3) *Steam Coils*: these are similar to that of water coils, but in addition special care in take for collection and disposal of condensate within the coils. Condensate connections to the steam trap must be of same size as the coil outlet. Care must be taken to prevent entry of condensate in the main into the coil by trapping it independently on a coil bypass. The steam trap is normally sized 3 times the design flow.

4) *Condensate Drains*: All chilled water coils must be individually trapped and connected to drain with adequate pitch for easy flow. It is recommended to install a trap as shown in fig 1.4-1. Depending on the ambient temperature and plant location, it is recommended to insulate the condensate drain pipework.

5) *Electric Heater Batteries*: If not properly wired and controlled electric Heater Batteries can be dangerous by causing serious injury or fires or even DEATH.

Electric Heater Batteries are supplied in the form of sheathed elements assemble in aluminium framework. Double skinned panels are normally drilled for cable entry. Prior to connecting, heater battery assembly must be checked for conformity to local regulations. All wiring must be in accordance with local standards. In order to protect the elements from overheating and possible START OF FIRE, an airflow switch with necessary control must be installed to cut the power supply OFF to the heater elements.

Heater Battery must be interlocked with fan motor. Power supply must be SWITCHED OFF prior to removal of access door and not be switched ON until the access cover is replaced.

1.6..4. HUMIDIFIERS

Check the type of humidifier and ensure that the necessary Water/Steam/Electric power supplies are available for connection.

1) *Electric Pan Humidifier* contains an electric resistance or a bank of resistance in the form of sheathed elements, normally suitable for 3 phase power supply. All wiring must be carried out in accordance with local standards with necessary controls. Connect water supply with shut-off valves. Ensure that overflow is connected to the drainage with a necessary trap.

Important

Check and clean if necessary the terminal screws etc, to ensure that there is no short circuiting between the resistance and the cover plate or the humidifier body.

2) *Steam (Pan) Humidifier* must be connected to the steam supply with shut-off valves, inlet strainer, solenoid valve etc. Condesate drain must be complete with a trap.

3) *Steam (Injection) Humidifier* is normally supplied with inlet strainer, modulating valve, condensate trap, steam injection manifold with condensate collector and discharge pipe. Ensure that the supply steam pressure is maintained within the limits marked on the modulating valve assembly and connected with a shut-off valve.

4) *Air Washer* is a closed circuit humidification system complete with water sump, inlet strainer, centrifugal pump assembly, isolating valves, water distribution system made of nylon tubes and self cleaning adjustable nozzles. Feed/Make-up water supply must be connected to the float valve with a shut-off valve. Overflow and drain connection must be complete with a trap. A common drain line may be used for overflow and drain connections, provided a shut-off valve is installed to isolate the drain connection. Connect power supply to the pump motor in accordance with local standards with necessary controls. Check the pump impeller for free rotation.

5) *Electronic Steam Humidifiers* are packaged type and manufactured by others. Please refer to manufacturer instructions for details on installation and maintenance.

6) *Eliminators*: There is a remote possibility of eliminator blades being displaced from their position during the transit/installation. In case of such occurrence, they must be set in position, which is a simple operation. Further it must be ensured that no foreign matter obstruct the airflow through the eliminator.

1.6..5. SUPPLY AND RETURN FAN ASSEMBLIES

Anti-vibration mounts, on which fan & motor assembly is suspended, are locked prior to shipping to avoid damage during transit (see fig 1.6-1). Once the unit is in position and fan outlet is connected to ductwork, A.V. Mounts must be released.

fig 1.6-2

Check the type and voltage of motor. If information is made available, cable entry holes through the double skinned panels can be factory drilled. However it is a simply operation to carry out the same on site, but ensure that no holes drilled and no connections are made through access door. It is recommended to use flexible armoured conduit between the panel and motor terminal box. All conduiting/wiring must be carried out in accordance with local standards.
Check the type of start (direct on line/star delta) meets with the local electrical regulations. Provide starter/controls/overload protecting devices/interlocks as required. Manufacturer instruction, which are supplied along with the motor, must be carefully studied and followed. Duct work must be connected and insulated in accordance with good engineering practise. Depending on specified noise levels, attenuators are to be selected and installed as per the recommendations of acoustic specialists. It is recommended to protect all lining and attenuation materials with smooth perforated metallic sheets to avoid migration of fibres into occupied areas/blockage and subsequent replacement of filters frequently.

Belt driven fans must be checked as illustrated in **Chapter 3.4**.

1.6..6. ROOF CANOPY

Normally roof canopy is supplied loose to avoid damage during transit for assembly and installation on site. When units are supplied with bottom inlet and/or discharge, it must be ensured that proper flashing is carried out around base frame to avoid possible ingress of water.

1.7. DRIVE

1.7..1. BELT TENSION

The belts must be correctly tensioned to ensure good contact with the pulley. If insufficiently tensioned, the belts may slip, and if excessively tensioned, the motor and fan bearings may be overloaded.

When correctly tensioned (see fig 1.7-1), the belt deflection L will be 15 mm per metre of distance between centres c/c when a force P_1 (N) is applied and $P < P_1 < 1.5\ P$, where the force P is dependent on the belt type as shown in Table A.

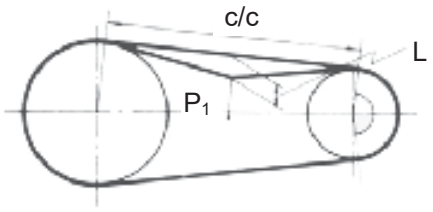


fig 1.7-1

The deflection should be measured preferable by means of tensiometer.

Table A

Belt section	diameter of smaller pulley (mm)	Force P 0 ÷ 10 m/s (N)	Force P 10 ÷ 20 m/s (N)	Force P 20 ÷ 30 m/s (N)
SPZ	67 ÷ 95	12 ÷ 18	10 ÷ 16	8 ÷ 14
	> 96	19 ÷ 26	17 ÷ 24	15 ÷ 22
SPA	100 ÷ 140	22 ÷ 32	18 ÷ 26	15 ÷ 22
	> 141	33 ÷ 48	27 ÷ 40	23 ÷ 34
SPB	160 ÷ 265	38 ÷ 56	32 ÷ 50	28 ÷ 42
	> 266	57 ÷ 72	51 ÷ 64	43 ÷ 58
SPC	224 ÷ 355	72 ÷ 102	60 ÷ 90	50 ÷ 80
	> 356	103 ÷ 132	91 ÷ 120	81 ÷ 110

1.7..2. CHANGE OF PULLEYS

SAIVER take no responsibility for the consequences, if the pulleys are changed without their written consent.

1.8. MAINTENANCE

In general air handling unit do not require special attention other then routine cleaning and maintenance work. Following is the recommended schedule of maintenance, when units operate at normal conditions (10 hours per day, 6 days a week). However actual conditions of use/operation will dictate the interval of checking/replacement of the bearings, filters, belts etc.

1.8..1. ONCE IN A WEEK

- Check filter condition at weekly intervals. Clean, wash or renew/replace if necessary.

1.8..2. ONCE IN A MONTH

- Check fan belt tension and adjust if necessary.
- Check all bolts and nuts and tighten if necessary
- Check the condition of spray nozzles and float valve in air washer.
- Check the condition of drain for free flow.
- Check the condition of resistance in electric pan humidifier.
- Check the condition of access door hinges and lubricate if necessary.

1.8..3. ONCE IN THREE MONTHS

- Check the fan motor running current.
- Check function controls and their effect on AHU components.
- Check fan and motor bearings and lubricate if necessary
- Check electric heater battery elements.
- Add water and flush condensate drain pan, trap and drain line.
- Check circulating pump and motor in air washer.
- Check the condition of inlet strainers.
- Check the condition of chilled/hot water.
- Add chemicals if necessary.

1.8..4. ONCE IN A YEAR (PREFERABLY AT THE START OF SEASON)

- Check the operation of dampers.
- Check the filter frame for proper sealing.
- Replace synthetic media in panel filters.
- Check the access doors for easy operation and proper locking.
- Check the controls and operation of Roll Filters.
- Check the coils and fin condition. Wash with water spray, if necessary.
- Check the condition of all insulating, regulating valves etc in the system.
- Vent the water coils.
- Check motor and fan bearing lubrication.
- Replace belts.
- Check all wiring, controls, isolating devices, terminal connections etc.

While attending to the above maintenance schedules, following must be noted.

1.8..5. FILTERS

It is important to check the condition of filters once a week. When the pressure drop across the filter exceed the maximum pressure drop given in SAIVER drawing, the filter must be attended immediately. Dirty filters reduces the air flow and hence the capacity. *Do not operate the system without filters.* In case the media is synthetic or metallic, they can be cleaned or washed. However it is recommended to replace synthetic media once in every year and metallic media once in every two years. Other filters such as Throw Away Panels, Bag, Absolute, Roll Filters must be replaced with new cells of identical media and efficiency.

1.8..6. HEAT EXCHANGER COILS

It is recommended to drain the water when the system is shut down. In case required coils can be withdrawn as follows:

- Disconnect the coil from the water connection.
- Remove the side (Doubled Skin) panel.
- Remove the bolts by which coil frame is fixed to the unit frame.

- Withdraw the coils. coil can be reinstalled by the following the above procedure in reverse.

1.8..7. SUPPLY AND RETURN FAN SECTIONS

Bearing lubrication

Normally fans are fitted with grease packed ball bearings Series: SY and type: UCP with minimum anticipated running life of (see Table B):

Table B

Fan with speed up to 1000 RPM	25000 hrs
Fan with speed between 1500 ÷ 2000 RPM	20000 hrs
Fan with speed between 2000 ÷ 3000 RPM	15000 hrs

Fans normally installed for high pressure /heavy duty application will have Series: 2300 ball bearings housed in plummer block type: SNA. The recommended intervals are as follow (see Table C)

Table C

BEARING HOUSING	FAN SPEED (RPM)					
	500	1000	1500	2000	2500	3000
SNA 607	25	25	18	17	13	10
SNA 608	25	25	18	15	12	9
SNA 609	25	25	18	14	11	8
SNA 610	25	21	16	12	8	5
SNA 611	25	18	15	11	7	3
SNA 612	25	17	13	9	4	-
SNA 613	25	17	12	8	2	-
SNA 615	25	15	10	5	1	-
SNA 616	25	13	8	2	-	-
SNA 617	25	12	6	1	-	-

(hrs x 1000)

Impeller removal

For some reason, if it is required to take the impeller out for cleaning, following procedure is recommended:

Forward Curved Fan

- Loosen motor mounting bolts and remove the motor.
- Remove belts and bearings.
- Loosen the fan fixing screw and withdraw the shaft.
- Unbolt the flexible connection on fan discharge.
- Turn the fan assembly by 90.
- Take out the impeller from the fan discharge opening. Handle carefully while cleaning, to avoid any damage to blades.

Backward Curved Fan

- Loosen motor mounting bolts and remove the motor.
- Remove belts and bearings.
- Unbolt and remove the flange of bearing supporting ring frame.
- Remove the aluminium inlet cone.
- Withdraw the impeller along with the shaft.
- Inlet cones and impellers are made of aluminium. They must be handled carefully.

1.8..8. CLEANING OF DOUBLED SKIN PANELS

All panels are double skinned and they can be easily detached from the framework by removing screw with simple hand tools. They can be cleaned or washed. However it must be ensured that they are completely dry prior to refixing. Do not drop any heavy weights or sharp edge tools etc. It might damage the plasticised finish or puncture the aluminium panels.

NOTE

If any further information is required, please contact SAIVER, who will be very pleased to assist.

2. SAFETY

The SAIVER air handling units can be considered a safe machinery.

By means of the compliance statement of the EEC and of the symbol “CE” on the unit, it is guaranteed that the SAIVER air handling units fulfil the provisions for the essential health and safety requirements laid down in Annex I of Machinery Directive 98/37/CE .

The “CE” mark appears on every identification label of the unit (see fig 2.1-1).

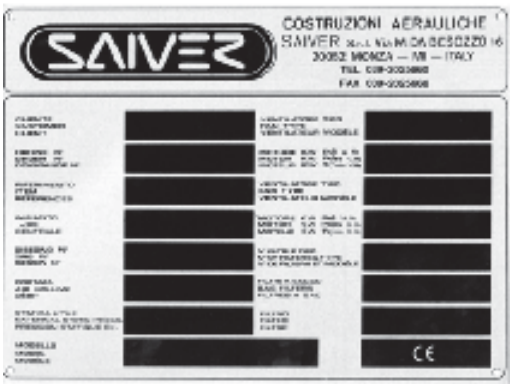


fig. 2.1-1

In spite of all that, the unit could represent a danger, if it is utilised or serviced not properly by staff not sufficiently trained.
We, like manufacturer of the unit, intend to explain to the user, by an exhaustive chapter, the concept of safety referring to air handling unit and to inform him of possible dangers and consequent measures.
Observe also the general standards for the safety and the accidents’ prevention coming from the following indications!

2.1. TERMINOLOGY

It is considered “danger zone” internal area of the unit close to the movement parts and the electrical parts.
In order to be able to access to these areas, it is necessary to provide oneself with the proper key tool to deactivate the safety devices.

The operators are responsible for transport, installation, start up, service and maintenance, including cleaning and troubles repair.

2.2. OPERATION SAFETY

SAIVER air handling units are safe because they are built in accordance with good engineering practise.
Nevertheless, the units could represent a hazard if they are used, by an untrained staff, improperly or not in conformity with general provisions. The more common hazards are:

- danger to operator's safety.
- damages to the unit.
- possibility to compromise the efficiency of unit work.

2.3. USE OF THE UNIT IN CONFORMITY TO GENERAL PROVISIONS

SAIVER air handling units are able to fan, to heat, to cool, to filter, to humidify.
Any other use is considered not in conformity with general provisions. The manufacturer is not responsible for damages resulting; the user will be the only responsible.

In order to use the unit according to general provisions proper instructions of installation, exercise and transport must be observed.

Installation and start up of the unit must satisfy the national standards having legal course in the country of the user. ***The user is responsible for compliance with standards.***

Besides, it must be avoided any type of work that may compromise safety.

Arbitrary transformations of the unit by user or operator are not allowed and exclude the warranty of the manufacturer for the damages to things and persons.

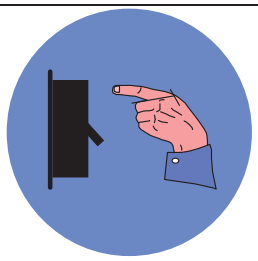
2.4. MEASURES OF THE USER/OPERATOR, OBSERVATION OF THE SIGNPOSTS (WARNINGS)

Signposts are placed on the unit, showing:

1) prohibition to repair or adjust during motion (fig 2.4-1)
2) obligation to turn off the power before opening the access door (fig 2.4-2)
3) warning of coming into contact with electrical parts (fig 2.4-3)

DON'T REPAIR OR ADJUST DURING THE MOVEMENT

fig 2.4-1



TURN OFF THE POWER BEFORE OPENING

fig 2.4-2

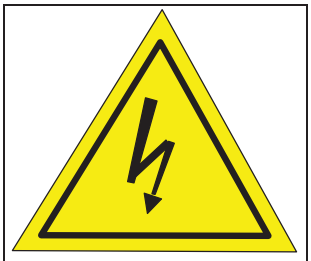


fig 2.4-3

This signpost and the other warnings regarding the unit must be absolutely observed.

2.5. STAFF TRAINING

The unit can be started up and serviced (routine maintenance + corrective maintenance) only by authorised and trained staff. This staff must be informed about possible hazards regarding:

- electrical connections
- piping connections
- ducting connections
- start up

These operations can be executed only by trained persons.

People who, on behalf of the user, attend to control and to the extraordinary/ordinary maintenance of the unit.

It is necessary to establish and to respect the responsibilities for control and maintenance to guaranty safety, without confusing competencies.

2.6. USE OF THE UNIT

The unit can be started up only by means of proper safety devices.

The installer is obliged to install the unit according to installation plans and conditions.

Only authorised persons must operate on the unit.

The staff in charge is obliged to signal immediately to the user any changes that may compromise safety. For this reason it is necessary to inspect for eventual anomalies or damages at least once a week.
The user or operator never must dismount and deactivate safety devices; if these would be removed for extra maintenance, at the end of operations they must be reinstalled.

For all operations of extra maintenance, the power source must be locked out.

2.7. BEHAVIOUR IN CASE OF DAMAGES

If it is necessary to make maintenance, the fan must be switch off, isolated and allowed to rundown.

2.8. MEASURES TAKEN BY MANUFACTURER:

Essential Health & Safety requirements laid down in annexe I of EEC MACHINERY DIRECTIVE 98/37/EC		
Applicable points of EEC MACHINERY DIRECTIVE	**Measures taken:**	**Ref. to harmonised procedure**
1.1.4 Lighting	Inspection zone in order to provide maintenance and start-up provided with lighting	UNI EN 292
1.1.5 Design of a unit in order to handling	Design of a multi-section unit with basement for lifting by forklift or rope; locking of vibration isolators during transport	UNI EN 292
1.3.2 Risk of breakage during functioning	Operation conditions stated on the as-built drawing; frequency of maintenance listed in the instruction handbook	UNI EN 292
1.3.3 Risk due to surfaces and projection of objects	Casing tested till 400 mm of pressure, fan dimensioning within operation limits, mesh for no ducted fan and warnings described in the maintenance and operation handbook	UNI EN 292
1.3.4 Risk due to surfaces,	Sharp corner of extruded alu-	UNI EN 292

edges and corners	minium profiles rounded off to 6mm ray	
1.3.7 Prevention measures against moving elements 1.3.8 Estimated prevention measures against moving elements 1..41.1 General requirements 1.4.2.1 Fixed protection	Access door open able with a special tool ; written warning fitted on the access door. Optional measures are to be required during commercial agreement and stated on the as-built drawing	UNI EN 292
1.5.1 Risk due to electric power	Wiring diagrams inside motor terminal box. (see also paragraph 2.9)	UNI EN 292 CEI EN 60204-1
1.5.6 Risk of fire	Fire-retardant polyurethane or mineral wool panels type sandwich	UNI EN 292
1.5.7 Risk of explosion	Should any risk of explosive atmosphere, supply of electric motor and explosion-proof fan occur	UNI EN 292
1.5.8 Risk due to noise	Noise level stated on the as-built drawing data sheet. Should not such noise meet given conditions, both required for machine room and other room, measures will be taken as follows: - additional insulation into section - silencer on the supply fan section	UNI EN 292
1.5.9 Risk of vibration	Fans and motors mounted on basement isolated by vibration isolators and flexible connections on fans	UNI EN 292
1.5.14 Risk of being imprisoned inside the unit	Access door provided with hinges which allow opening from the inside	UNI EN 292
1.6.1 Maintenance of the unit	See Installation, Use and Maintenance handbook	UNI EN 292
1.6.4 Workman corrective maintenance	Design according to SOP 003; see chapter “Safety” in the handbook for a safety maintenance	UNI EN 292
1.7.0 Warning device	Written warning in proximity to electrical and rotating parts	UNI EN 292
1.7.2 Warning about further risks	Written warnings near pipe connections	UNI EN 292
1.7.3 Marking	Marking on metal name plate displayed on the outside the fan	UNI EN 292

	section access door. Operation conditions and overall dimensions stated on the as-built drawing.	
1.7.4 Information for use	Installation, Use and Maintenance handbook, As-built drawings and possible attached schemes form an integral part of 'Information for use'.	UNI EN 292

2.9. PREVENTION MEASURES ARE TO TAKEN BY INSTALLER OR THE PERSON IN CHARGE OF INSTALLING CONTROL AND START-UP DEVICES

Essential Health & Safety requirements laid down in annexe I of EEC MACHINERY DIRECTIVE 98/37/EC		
Applicable points in EEC MACHINERY DIRECTIVE	**Measures to take:**	**Ref. to harmonised procedure**
1.2.1 Safety and reliability of control system 1.2.2 Control device	Control system, Start-up and Stopping according to standards in force	UNI EN 292 CEI EN 60204-1
1.2.3 Start-up 1.2.4 Emergency stopping device		
1.2.5 Operation modal selector switch	Should not start-up and stopping devices be in proximity to the unit, it shall be provide with an additional lockable isolating switch placed outside the air handling unit, near the fan section access door in order to guarantee safe maintenance.	UNI EN 292 CEI EN 60204-1
1.5.1 Risk due to electrical power	Grounding of an electric motor according to standards in force	UNI EN 292 CEI EN 60204-1

2.10. RECOMMENDED SAFETY PRACTISES

This publication explains the proper use and installation of centrifugal fans in order to warm operating and maintenance personnel of the commonly recognised dangers associated with this equipment. In addition to following the manufacturer's installation instructions, care must be taken to ensure compliance with federal, state and local rules, regulations codes and standards.

2.10..1. PERSONNEL SAFETY ACCESSORIES

Centrifugal fans in air handling unit are located inside a casing opportunely sealed so accessibility to these fans is occasional or infrequent. For this reason, protective devices are offered as optional accessories only at specific user's request.
However as in the case with other machinery involving moving parts, common sense and caution will preserve personal safety.

The available guarding devices are:

1) *Lockout switches* and suitable warnings. In such cases, maintenance personnel should engage the lockout switch before undertaking any maintenance or repairs.

2) *Inlet and outlet guards*. Centrifugal fans are usually connected directly to ductwork which will prevent the contact with the internal moving parts. In case there is an exposed inlet or outlet which could represent a danger, It can be installed a suitable guard as the one represented in fig 2.10-1.

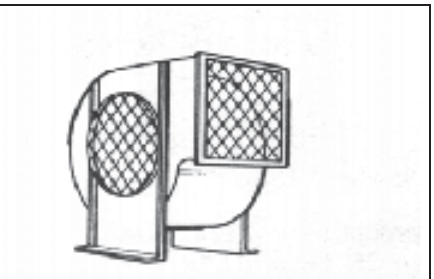


fig 2.10-1: inlet or outlet guard on centrifugal fan

3) *Drive guards*. A typical centrifugal fan drive guard may vary with the arrangement.
Safety guards shall be used when drive systems are accessible to personnel (see fig 2.10-2).In restricted areas, omission of the back cover may be acceptable.

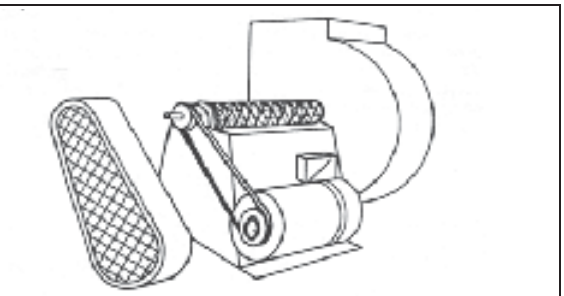


fig 2.10-2: drive guard- centrifugal fan

2.10..2. THE HIDDEN DANGER

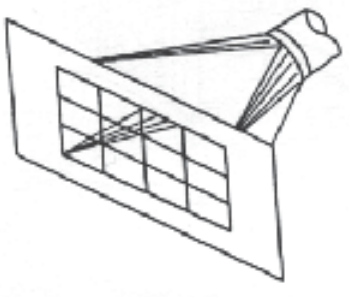


fig 2.10-3: special purpose intake screen

In addition to the dangers of rotating machinery, fans present another potential danger by virtue of their ability to draw in loose material. Solid objects passing through a fan represent potentially dangerous projectiles. Solid objects can cause fan failure by physically damaging the impeller blades.
Whatever there is the possibility of solid objects being drawn into a remote intake, the intake shall be guarded at all this times. In the event the guard is removed for any reason, the fan must be disconnected and locked out.

Where fans are installed over an occupied area, safety guards should be provided to prevent dropped objects from entering this area during installation and maintenance.

Access doors to a fan or duct system should not be opened with the fan in operation or coasting to a stop. Power shall be locked out prior to access into a fan or ductwork. Even when locked out electrically, fans may cause injury or damage if the impeller is subject to "wind milling". The impeller should be secured to physically restrict rotational movement.
On the downstream (or pressure) side of the system, realising the door with the system in operation may result in an explosive opening. On the upstream (or suction) side the inflow may be sufficient to draw in tools and clothing, etc, and create a danger.
The access door in air handling unit is always locked out by a special lock and to open the door it is necessary a key so it is impossible to open it by chance.

The stroboscopic effect of certain lights in combination with certain fan speeds may cause a rotating assembly to appear stopped.

2.10..3. START UP CHECK LIST

Before putting any fan into operation the manufacturers' instructions must be followed. In addition, the following check list must be completed.

- There is possibility of collection of debris such as duct/insulation materials, tapes etc used during installation of the system. Hence it must be ensured that all the sections of the unit are thoroughly cleaned. In case units are supplied with per-aluman panels, polythene protective film must be peeled off and it must be ensured that no traces of film is left loose within the unit.

- Ensure all panels, if removed during installation, are in position.

- Ensure all electrical wiring in carried out to local standards and all components are provided with safety, protecting and isolating devices.

- Remove all filters including panel filters: install low efficiency filters such as gauze bags or a set of throw away type filters.

- Ensure all dampers are opened.

- Check water/steam/refrigerant coil connection for any leaks. Ensure that all the air in the system and coil is vented out. Check coil face free from debris.

- Add water in the condensate drain pan to prime the trap and ensure free flow of water into the drain.

- Ensure that minimum water levels are maintained in electrical Pan Humidifier/Air Washers.

Fan start up

1) Screw out security nuts of antivibration mounts.
2) Lock out the primary and secondary power sources.
3) A complete inspection shall be made of all the ductwork and the interior of the fan. Make certain there is no foreign material which can be drawn into or blown through the fan or ductwork. Eyes should be protected against undetected foreign material through the use of safety goggles or other appropriate means.
4) Make sure the foundation or mounting arrangement and the duct connection are adequately designed in accordance with recognised acceptable engineering practises and with the fan manufacturer's recommendations.
5) Check and tighten all hold-down (securing) bolts.
6) Check the fan assembly and bearings for proper grounding to prevent static electricity discharge.
7) Spin the impeller to determine whether it rotates freely and is not grossly out of balance.
8) Inspect impeller for proper rotation for the fan design.
9) Check all set screws and tighten, if necessary.

10) Check belt drive or coupling alignment; use recommended belt tension.
11) Check the belt drive for proper sheave selection and make sure they are not reversed (excessive speeds could develop).
12) Properly secure all safety guards.
13) Secure all access door to the fan and ductwork.
14) Momentarily energise the fan to check the direction of rotation.
15) Switch on the electrical supply and allow the fan to reach full speed.
16) Check the oil level of bearings. Add sufficient lubricants

Check carefully for:

a) Excessive vibration
b) Unusual noise
c) Proper belt alignment
d) Proper lubrication
e) Proper amperage and voltage values

If any problem is indicated, SWITCH OFF IMMEDIATELY.
Lock out the electrical supply, secure the fan impeller if there is a potential for windmilling (impeller turning due to a draft through the system).Check carefully for the cause of the trouble and correct as necessary.

Even if the fan appears to be operating satisfactory, shut down after a brief period and recheck items 5) through 12) as the initial start up may have loosened the bolts and set screws.

- After ensuring that there are no leaks between joints of section and system is clean, stop the fan. Dispose off low efficiency filters. Install Panel/Bag/Absolute filters, as supplied.

- Restart the fan. In case of a stand-by fan and motor are supplied, ensure that no short circuiting of air occurs.

- In case fan is connected to a stand by motor for automatic change over, do not touch the terminal of stand by motor, even though motor is idle. Ensure that belts are removed and the power is isolated.

- Adjust dampers position to obtain the rated air volume.

- In case fans are supplied with variable pitch pulley (up to 7.5 kW), adjust the same to the desired position.

- Ensure that the air volume are within the specified limits.

- Check the motor current and ensure the same is within the rated (name plate) data.

- Check ON-OFF temperature across coils and adjust water/steam flows accordingly. Check the functioning of controls.

- Check the functioning of humidifier by adjusting the humidistat control.

- Check the operation of heater batteries by adjusting thermostat. Check the functioning of controls such as air flow switch, fan interlock, over heat protection etc.

- Check the pressure drop across the filters and ensure that the same is within the limits.

The fan has been put into operation but, during the first eight hours of running, it should be periodically observed and checked for excessive vibration and noise. At this time checks should also be made of motor input current and motor and bearing temperatures to ensure that they do not exceed manufacturer's recommendations.

After eight hours of satisfactory operation, the fan should be shut down to check the following items and adjust, if necessary (lock-out power).

1) All set screws and hold-down bolts
2) Drive coupling alignment
3) Belt drive alignment
4) Bearing housing temperature
5) Belt drive tension

After twenty-four hours of satisfactory operation the fan should be shut down (locked out) and the drive belt tension should be readjusted to recommended tension.

2.10..4. AFTER 2 WEEKS OPERATION

After start up and initial operation of approximately 2 weeks, it is recommended to have the following checks.

- Bearings temperature immediately after stoppage. This is not to exceed 70°C; Lubricate if necessary.

- Belt tension.

- Pulley alignment.

- Motor running current.

- Filter condition.

- Condensate and drain to see flow.

- Operation of controls.

2.10..5. WARNING SIGNS

A preventive maintenance program is an important aspect of an effective safety program. Investigate any changes to the fan. Refer to Chapter 3 *“troubleshooting”,* for a more detailed explanation of investigating procedures. Consult your manufacturer or other qualified consultant with question concerning changes observed during periodic inspections.

1) *Excessive vibration:* if excessive vibration is observed stop the fan until the cause is corrected. Check for material build-up on impeller. Generally this will show up as material flaking off the fan impeller and causing an imbalance which may lead to fatigue failure of the impeller.

2) *Noise:* changes to the sound level may indicate troubleshooting is needed.

3) *High motor temperatures:* check that cooling air to the motor has not been deviated or blocked by dirty guards or similar obstacles. Check the input amperage. An increase in amperage may indicate that some major changes has been made in the system.

4) *High bearing temperatures:* this condition is usually caused by improper lubrication; this can be either "over", "under" or "unsuitable" lubrication. In any case if the cause of the trouble is not easily seen, experienced personnel must examine the equipment before it is put back in operation.

2.10..6. ROUTINE MAINTENANCE

Maintenance should be performed by experienced and trained personnel. Do not attempt maintenance unless the electrical supply has been locked out or tagged out and the impeller has been secured.

a) Under normal circumstances, handling clean air, the system should require *cleaning* only about once a year. However, *the fan and the system should be checked at regular intervals* to detect any unusual accumulation.

b) *The fan impeller should be* especially *checked for build-up of material* or *dirt* which may cause an imbalance with resulting undue wear on bearings and belt drives. A regular maintenance program should be established as needed to prevent material build up.

c) *Periodic inspection of the rotating assembly* must be made to detect any indication of weakening of the rotor because of corrosion, erosion, or metal fatigue.

3. TROUBLESHOOTING

A preventive maintenance program is an important aspect of an effective safety program. It is fundamental to keep any part of the system controlled in order to point out promptly any changes to the right working.
In any case it is suitable to consult the manufacturer or other qualified consultant with question concerning changes observed during periodic inspections.

3.1. PROCEDURE FOR TROUBLESHOOTING

1) Look in the ***"Master Troubleshooting Chart"*** for an index tag which corresponds to with the apparent problem.
2) Check each of the probable causes listed.
3) If the cause of the trouble is not found proceed through the ***"System Checklist".***
4) If the problem has still not be solved, it is now advisable to contact the representative of fan manufacturer. He should be given the results of the *"System Checklist"* and some ***"additional information"*** which are particularly interesting for the manufacturer.
5) The fan manufacturer or his representative will analyse the information submitted (as outlined on page 31).With this information and, if necessary, an on-site inspection he should be able to explain why the system is not achieving its design performance and may recommend changes in the system or the fan installation which will overcome the problem.

3.2. SAFETY PRECAUTION

Before checking the fan and system it will be necessary to shut down the fan. During inspection the fan must be electrically isolated and all disconnect switches and others controls locked in the "OFF" position. Where this in location remote from the fan, prominent "DO NOT START" signs should also be in place.

3.3. MASTER TROUBLESHOOTING CHART

See **Appendix**

3.4. SYSTEM CHECKLIST

Poor system performance may arise from a number of causes including:

- improper installation or assembly of the fan
- damage in handling or transit
- system design error
- deterioration of the system
- faulty controls
- poor fan selection
- a combination of several factor

A systematic check of items listed should identify the problem or problems and allow suitable corrective action to be taken.

SYSTEM CHECKLIST

A) While the impeller is coasting to a stop, see if it is rotating in the proper direction (see fig 3.4-1)

B) Make certain the impeller is of the correct rotation for the housing and not installed backwards. [Fan manufacturer describe the *rotation of centrifugal fan impeller* as being "clockwise" or "counterclockwise" when viewing the DRIVE SIDE (see AMCA Standards 2406)].

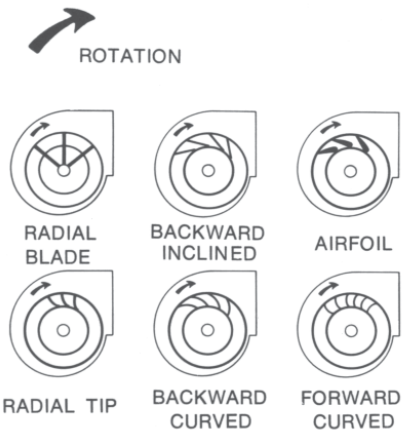


fig 3.4-1: type of centrifugal fan impeller

C) If the fan is belt driven:

1) are the drive pulley (motor sheave) and the driven pulley (fan sheave) in alignment ? Improper alignment of the sheave can cause excessive power (high amperage) and squealing belts (see fig 3.4-2).

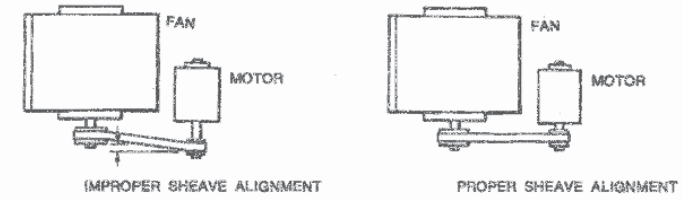


fig 3.4-2

2) are the belts loose ? Loose belts can cause slipping, leading to squealing and/or low fan speed along with hot sheaves, bearings, shafts and motor. Belts should be tensioned to the belt manufacturer's recommendations. Tension of the drive belts should be adjusted for stretching after the first forty-eight hours of operation. Caution! excessive belt tension will reduce fan and motor bearing life (see fig 3.4-3).

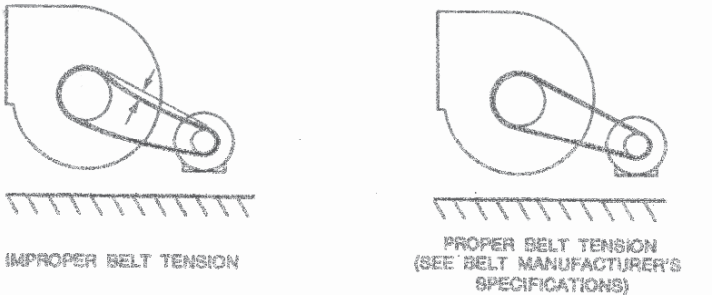


fig 3.4-3

3) are the belts and/or sheaves worn ? If so, an immediate replacement could save down time at a later date. Replacement belts should be a new set of *matched* belts.

D) Check the flow surfaces (passages between the inlets, impeller blades and inside of housing) for cleanliness. A millimetre build-up of dirt on the flow surfaces could impair fan performance.

E) Are there any gouges, tears, holes, erosion or corrosion in the impeller blades, rims or backplate; inlet and/or housing ? If so, report the approximate size and location to the fan manufacturer.

F) Is any foreign matter trapped in the impeller, housing or ductwork (loose insulation, papers, ice, etc) ? If so, remove.

G) Are coils, heaters, filters, ducts, etc dirt laden ? If so, clean or replace. Remove any non-essential obstruction to flow in elbows, shutters, transformations, dampers, bird-screens, etc.

H) Have all the parts supplied with the fan been installed ?

I) Are there any obstruction to flow near the fan inlets ? Objects such as pipes, ductwork, columns, belt guards, belt drives, etc could adversely affect the output of the fan.

J) Are the fan outlet connections correctly designed and installed ? Duct takeoffs, or obstructions in the fan outlet could adversely affect the output of the fan.

K) See fig 3.4-4 for typical inlet-impeller relationships. A few simple measurements as indicated on fig 3.4-4 can tell the manufacturer if a problem exists in this area (several measurement should be taken around the entire inlet circumference).

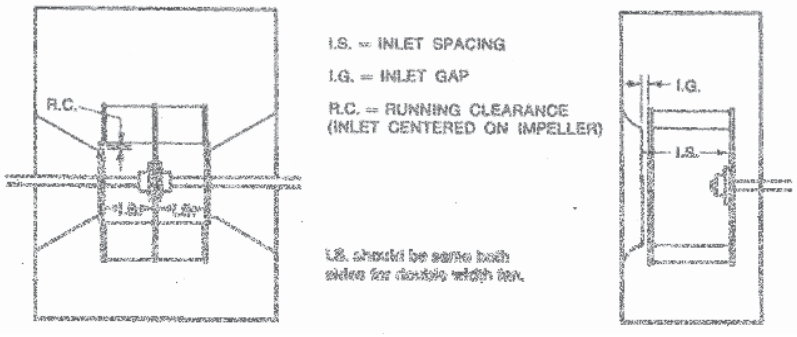


fig 3.4-4: typical inlet-impeller relationships

D) Are turning vanes installed in elbows close to the fan inlet or discharge ?

E) If the fan is equipped with variable inlet vane or inlet damper control, check the operation as follows:

1) Do not rely on the control arm position alone for locating the position of the vane/damper blades without first checking visually to see that the vane/damper position agrees with the position of the control arm.
2) If the unit is double width fan equipped with variable inlet vanes or damper control, both inlet vanes/dampers must be synchronised (the inlet vanes/dampers must be in the same relative position with respect to the impeller on both inlets). If the inlet vanes/dampers are not synchronised, there will be an unbalance flow between inlets resulting in deficient air performance, unbalance thrust on bearing and/or a surge condition in the fan.
3) Make certain that variable inlet vanes are of the proper rotation with respect to the impeller. As the vanes close, they should cause the entering air to spin in the same direction as the impeller.
4) Are the inlet vanes/dampers correctly positioned for the designed operating conditions ? If not, the desired pressure-volume of the fan will not be realised (see fig 3.4-5).

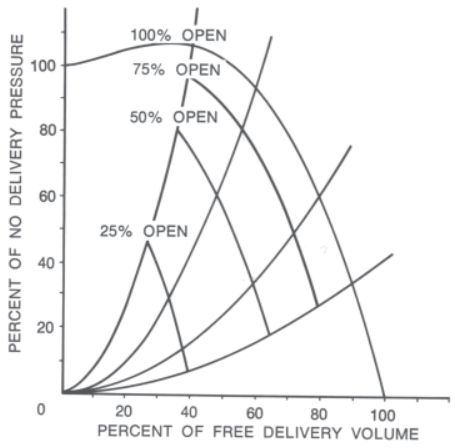


fig 3.4-5: typical normalised inlet vane control pressure volume curve

D) Insp

ect any ductwork or plenums approaching the fan inlets for the possibility of inducing swirl of air into the inlet (see fig 3.4-6).

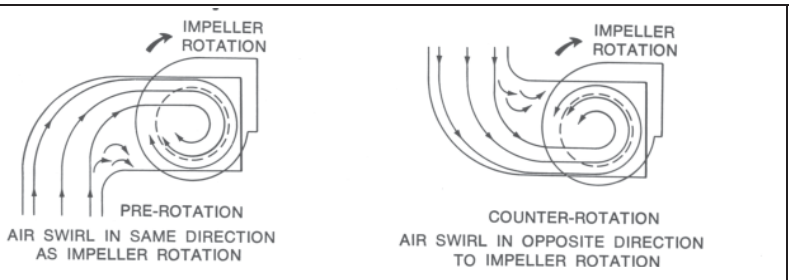


fig 3.4-6: typical forced inlet vortex

After completing the above steps and securing the fan, remove all OUT signs on disconnected switches and override systems and put the unit back into operation.

D) Inspect the entire system including the fan, fan plenum and all ductwork for leaks. Leaks may be detected by sound, smoke, feel, soapy solution, etc. Some common leak sources are access doors, coils, duct seams, fan outlet connection etc which must be sealed.

3.5. ADDITIONAL INFORMATION (FAN MANUFACTURER'S ANALYSIS)

If the cause of the trouble has still not be found after completing the "system checklist", the fan manufacturer should be consulted.

The fan manufacturer will review the information provided concerning the system and apply his own special knowledge and experience to the problem.

To make a complete analysis of the problem, in addition to the results of the "system checklist", the manufacturer will need:

A) Complete plans (drawings) including all ductwork, location, size, model and manufacturer of all fans, motors, coils, dampers, etc. with all pertinent dimensions for the complete system as actually installed. The original engineering drawings may not be representative of the actual installation.

B) If the problem is failure of the process or system to achieve design performance the measured performance figures and design performance figures should be supplied.

C) A copy of the system design calculations.

D) A copy of the specifications and any addendum.

E) If a separate air performance test has been conducted on the installed fan, a statement of measured fan performance along with a copy of the test data, the type of test and instrumentation, and the location of the flow rate pressure determination should be supplied.

A statement of fan performance should contain:

1) fan total pressure rise or fan static pressure
2) flow rate
3) power (amperage)
4) fan speed
5) gas density

Among other actions he will:

1) Access the probable accuracy of the field performance measurements.
2) Check whether the fan selection is correct for the application.
3) Examine the system drawings (plans) in order to individualise any eventual change in the system performance curve in respect to the system design calculations or the original fan selection.
4) Make the appropriate corrections.

3.6. CONCLUSION

By intelligent application of the procedures outlined in this manual it should be possible to find the cause of performance problem in any air moving system.

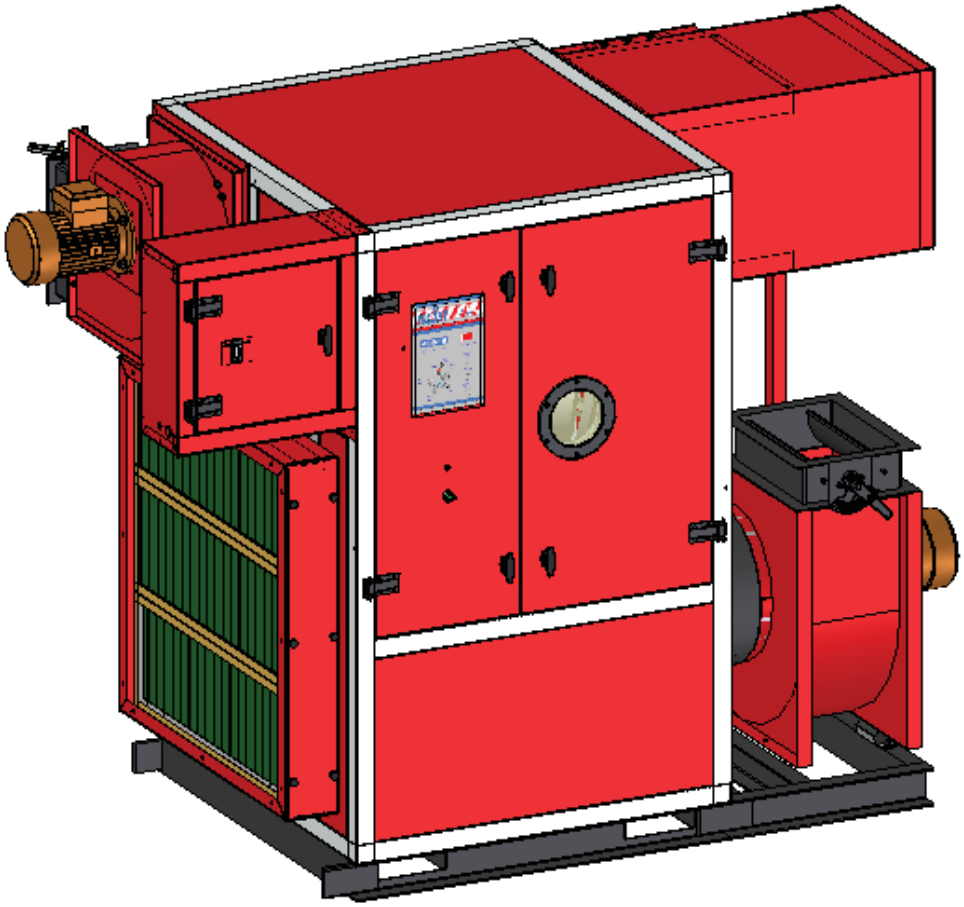
Identification of problem associated directly with the fan may require the assistance of the fan manufacturer.

Recognition of the cause of the trouble will usually be a major step towards curing it. Corrective measures may include alterations to the system, modification to the fan outlet or inlet connections, adjustments to the fan etc. in many cases an increase in the fan speed may be decided upon but it is extremely important that the fan shall not be operated above its catalogued maximum speed or the maximum speed recommended by the manufacturer.

The information obtained through the checklists in this manual should also help in allocating responsibility for the necessary corrective action. In most cases, if the troubleshooting procedure has been followed carefully and impartially it will be apparent whether the system has been built and installed in accordance with the design drawings, whether the fan was properly selected, or the fan is not performing up it its published ratings.

FLC 系列工业除湿器

安装、操作和维护手册



目录

前言

祝贺您购买了 Bry-Air FLC 除湿器。该除湿器是空气干燥的最佳设备；然而，只有在正确的安装、操作和维护条件下，该产品才能发挥其最佳性能。

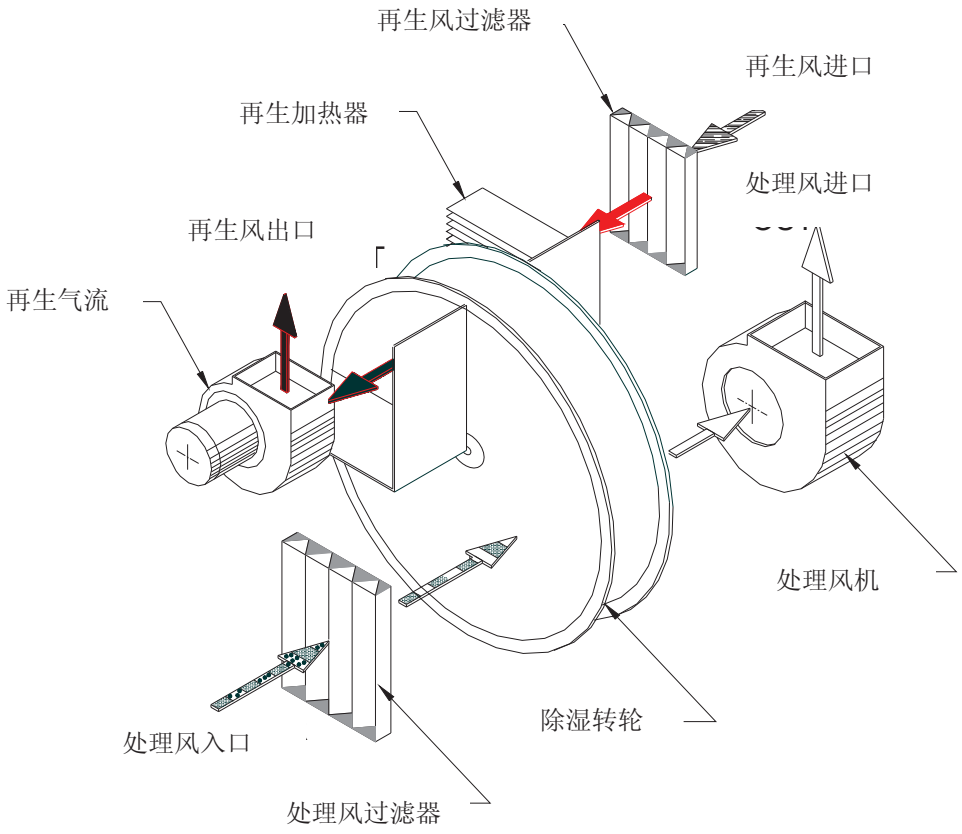
本手册可帮助您熟悉了解该除湿器，实现成功的安装、操作和维护。最终的满意度取决于安装质量和对本手册的全面理解。FLC 除湿器工程原理经实验验证，生产工艺及产品功能均通过严格的质量检验.

操作原理

Bry-Air 除湿器的功能是去除空气中的水份（汽态）。这是通过气流在密封流道中暴露于吸附介质（干燥剂）中得以实现。干燥剂吸附水份以后，在高温下暴露在第二股气流中（再生）。水份被带走后准备再次吸收水份,再生与处理持续进行,从而实现持续的干燥过程。这是一个持续的过程，从而可实现持续干燥过程。

两股气流（过程和再生）由密封条隔开，密封条与转轮接触。图“A”说明了气流形式。

FLC 除湿器的设计中，两股气流以相反方向流动（逆流），从而实现了设备能量效率的最大化。



安装说明

除湿器的正确安装对其发挥最佳使用效果和性能非常重要。

检查：
彻底检查除湿器内外，确保装运中无任何损坏。（如果发现任何损坏，应立即向运输公司索赔！）

组装机器
小心水平放好除湿器。设备必须有充分支撑以防结构底板出现不必要的弯曲。吊耳下必须有支撑，这是最低要求。连接管道工程前应清除所有的外部包装或包装板条。最低间隙、保养和管道连接要求请参见本手册后面的设备外形图。

电气
必须严格遵守所有当地和国家法规，必须遵循所有的良好电气惯例，以获得最佳安装效果。

设备电力布线必须采用合适的尺寸，达到设备铭牌上的最低安培数要求。如果您的供电中配备有切断装置，您应将其安装在本机附近，以保安全, 便于维护。

现场接线前必须检查并彻底理解设备接线图。（参见本手册后面的电气示意图）。

检查电源，确保供电电压符合设备铭牌上的要求。电压不当可能导致电机和控制器严重损坏。

管道工程
本系统的管道工程要求较传统的空调系统更为严格。**除湿器的所有逆回风管道都必须实现气密和汽密。**这对达到除湿性能极为重要。即使除湿器能够去除水份，但如果水份通过管道中的泄漏处进入干燥气流，也会影响设备的正常性能。通气管道必须有正确的尺寸，保证最低压损，防止其超过额外机外余压。要确保再生风出口气流排空气不得进入处理风或再生风进口。如果设备在室内安装，则再生风出口的出气口应用管道连接到室外。机外余压请参见设备外形图。

操作说明

启动

现在已经完成安装，并且已经遵守了所有的建议和说明。以下概要说明了启动和调节 FLC 除湿器的正确程序。

说明： 启动除湿器前，应检查确保出风口调节阀门至少部分打开。

此时可使用“自动/手动”选择开关启动除湿器。自动/手动选择开关可根据自动或手动湿度控制需要置于自动或手动位置。“自动”操作需要连接一个湿度控制装置，如恒湿器。这将启动除湿器，给风机、转轮和再生加热器通电。如果未检查过风扇旋转，此时可进行检查，以确保风扇旋转方向正确。

电加热再生控制：

配备电加热再生的除湿器设备集成了一个压差开关和两个可调限温装置。所有三个装置必须通电后才能启动再生加热器。一个限温装置自动复位，另一个需手动复位。手动复位限温装置可能必须复位后才能启动。

再活化限温装置仅为安全装置，并非操作控制装置！如果加热器出现通－断循环，则必须调节自动复位限温装置至较高的设定值，直到加热器持续打开（设定值比加热器后的再生风温度高 10-15° C）。手动复位限温装置为故障安全装置，设定值应比自动复位限温装置高出 20° C。

说明： 恒温器上的刻度指示仅供参考。实际设定值可能稍有不同。检查校准时，应向较低设定方向转动手柄，直到加热器关闭，然后增加设定值至加热器打开。最终设定温度应较此高出 15° C。

本手册的气流章节提供了调节通过除湿器气流的信息。这极为重要，因为要根据设计空气量选择电加热器以实现正确的升温。请参考本手册中的除湿器设置表或系统流程示意图了解正确的再生温度。风量正确时, 温度可达该值，在再生入口处的干球温度测试端口加以测量。理想温度为 150°–160° C。

说明：提交设定值前应确保有充足的再生风量。

气流

FLC 除湿器再生风,处理风两股气流，完全分开，相互密封。这样就不再需要“平衡”气流。建议使用压力计确定通过除湿器的正确气风量。可简单的通过测量经过转轮的压差来确定风量。

按设备附带的除湿器设置表或流程图上的值来调节压力值。

转轮旋转

转轮旋转通过一个固定速度齿轮电机和链轮来实现。无需调节。

性能测试

说明：开始性能测试前，除湿器应在正确的再生温度和风量下运行至少一个小时。除湿器设置表或流程图提供了温度和压力值的必要信息。

下列程序简述了除湿器测试的步骤：

1. 使用一个 300°C 温度计或其它温度传感器检查再生进气温度。
2. 使用一个 100°C 温度计或其它温度传感器检查再活化出口温度。
3. 记录处理风进口的湿球*和干球温度。使用两个经过校准的 50° C温度计同时记录读数。
4. 使用步骤 3 中同样的温度计记录处理风出口的湿球*和干球温度。

* 最适于现场使用的温度计为杆长 200mm 的双金属刻度型温度计。湿球和干球温度计应相互匹配，刻度不小于 0.5°C。湿球温度计要有全长保护套。保护套应紧贴温度计杆。如有可能，用冷却至 5°C 的蒸馏水湿润保护套。记录湿球温度时，应将湿球温度计置于气流中（速率约为 5 m/s）进行观察，直到获得最低的稳定温度。有必要记录两次或多次读数，以检验正确的湿球温度。

在极低的湿度（低于 2°C WB）下，可能难于精确应用上述程序。此时也可使用其它仪器记录湿度读数，进行性能测试。重要的是要使用精确的装置来获得精确的干燥器性能评估。在 10%-20%相对湿度以下时，多数相对湿度传感器并不精确。此时建议使用实验室级的露点传感器以获得精确的湿度读数。

如果对 Bry-Air 除湿器的性能有任何疑问，请完整填写本手册中的除湿器测试报告表，并联系 Bry-Air 工厂或当地销售代表。我们将分析系统问题，并及时给出正确建议。

维护说明

机柜

系统采用压缩闭锁扣件密封前维护面板和电气控制面板。所有后面板和过滤器检修均使用手动有头螺钉扣件。维护结束后应紧固所有检修盖、五金件和螺丝。小心切勿过度坚固造成面板变形。

检查和维护期间应注意检修盖垫圈的状况，确保密封良好。如有泄漏，必须密封，以实现正常的除湿器操作。

转轮

除湿器配备的转轮采用了当今最好的技术，理想状态下无需更换。由于干燥剂的特性，干燥剂可用作极好的过滤物质。干燥剂的使用寿命与通过干燥剂的空气中含有的污染物质直接相关。大气污染物、酸性气体/或汽流，和与转轮接触。虽然转轮是一种可清洁/可清洗的介质，但清洁时最好用低压压缩空气吹除灰尘，并在 170° C(最高)温度下再活化 15 分钟。虽然转子可以清洗，但我们建议不要清洗，因为清洗水中的杂质可能污染干燥剂。适当的过滤以及防止其与化学物质接触，这都会大大地延长干燥剂的使用寿命。检查转轮表面有无损坏。转轮应在轴上光滑得转动。

密封

隔开过程与再活化室的所有硅“A”密封，均是为 Bry-Air 专门制造。正常情况下，密封无需维护或更换。然而，如果出现损坏或怀疑有空气泄漏影响性能，则应更换密封：

密封检查计划：　　安装时
使用 1 星期后。
3 个月后。
其后每年检查一次，或在出现性能下降时进行。

驱动电机

转轮驱动电机为永久润滑，无需维护。

过滤器

过滤器维护间隔直接取决于进入除湿器的空气的清洁程度。我们建议制订计划，以保证在过滤器堵塞并影响系统工作前能够得到及时更换或清洁。随设备供应的过滤器是标准的可抛弃型免洗介质。有些情况下也可能是可清洁、可清洗过滤器。在任何情况下，至少必须使用 30% ASHRAE / E U-3 标准过滤，以保护转轮。

风机和电机维护说明

一般养护

1. 用户应制定明确的时间计划，检查所有转动部件和附件。检查频率取决于操作情况和地点。开始时应每星期进行检查，以确定检查计划。
2. 定线——轴承中的轴不得翘起。轴线不重合可能导致过热、磨损尘封、轴承故障和不平衡。
3. 五金——检查所有螺栓和固定螺丝的紧固。
4. 润滑——检查风机和电机轴承，如有必要加以润滑。小心切勿过度润滑以及损坏轴承密封。
5. 气流——确保进风或出风管道中无障碍物。
6. 轴承——高速风机上的轴承可能发热。因此，不要随意更换轴承，因为可能会烫伤。在轴台上放置一个高温计或接触温度计，测量温度。滚珠/轴台的运行温度可能达到 75° C，高于此温度时应查找过热原因。
7. 风机叶轮——检查叶轮叶片上有无累积的灰尘和尘土。用喷水、压缩空气或钢丝刷彻底清洁叶片。这样有助于防止出现不平衡的状况。如果叶片为铝制，小心不要损坏。盖住轴承，防止水进入轴台。叶轮应有定中心检查，以保证方向正确。除非事先获得 Bry-Air 同意，否则风机工作速度不得高于设计速度。

维护规程

拆卸转轮

按下列步骤拆卸转轮：

1. 取下设备检修盖(转轮侧)。
2. 摇动张紧链轮链轮齿，从转轮上取下，以松开链条。
3. 从主动链轮上取下链条。悬挂在转轮上。
4. 从转轮两侧取下轴的两个(2) 有头螺钉 。
5. 为避免损坏，在滑动取出转轮前，应在链条和轮缘间插入合适的软布和绳子。
6. 拉动绳子，将转轮直接向检修口处滑动。当支撑轴到达转轮密封边缘处时停止拉动。
7. 向上抬起转轮，从转轮上取下支撑轴。
8. 取下转轮。

用相反步骤重新安装好转轮。

更换转轮密封

1. 按上述步骤取下转轮。
2. 抓紧转轮密封，将其从分隔板上直接拉出。此时应已经取下整个密封。重复这一步骤，取下两侧的密封。

说明：四周和中间的密封条作为整体取下。

安装转轮密封

预装配

1. 将密封装在周边法兰上。将密封直接推向垂直面板，确保密封槽牢固安装在法兰上。
2. 小心切割密封长度至比标记长 6mm，从而保证啮合面的合适安装。
3. 切割周边/分隔法兰交叉处的沟槽。
4. 在啮合面用少量的 RTV 重新安装好周边密封。(从而粘结并密封接头。)
5. 把密封放在分隔析部分法兰上，在周边密封上标记重叠点。
6. 小心切割密封长度至比标记长 6mm，从而保证啮合面的合适安装。
7. 在啮合面用少量的 RTV 重新安装好周边密封。(从而粘结并密封接头。)
8. 在两侧重复上述步骤完成安装。

故障检修指南

FLC 系列除湿器

故障	可能问题	可能原因	纠正措施
设备停止(两个风扇均停止)	电源和控制故障	1. 主电源关闭 2. 控制电源关闭. a. 控制线路熔丝熔断 b. 控制变压器故障 c. 控制开关打开 d. 温度控制器到达设定值 e. 控制元件故障	1. 检查线路和主电源 2. 检查各部分 a. 更换保险丝 b. 更换变压器 c. 关闭或更换开关 d. 降低设定点 e. 检查并按要求修理或更换
一个风扇停止	电源或机械故障	1. 风机马达保险丝或断路器跳闸 2. 电机启动器接触不良 3. 电机过载 4. 电机烧坏 5. 风机驱动机械装置故障(固定螺丝、键等等)	1. 更换保险丝或断路器 2. 修理或更换 3. 复位或更换 4. 修理或更换 5. 按要求修理或更换
设备运行但湿度上升	潮湿空气过度渗透到受控空间中	1. 未经设备调节的补充空气过多 2. 受控空间外管道和/或空气处理设备泄漏 3. 对受控空间的检修口开口未密封 4. 空间未汽密	1. 减少补充空气 2. 密封泄漏 3. 关闭和/或密封 4. 用涂料和/或防潮层密封
	湿器控制故障	1. 恒湿器 a. 不当调节 b. 缺乏校准. c. 有缺陷	a. 重新调节 b. 重新校准 c. 更换
	处理或再生风量不足	1. 静压损失过多 a. 过滤器过脏 b. 挡风板关闭 c. 进气、出气口或管道中有障碍物 d. 转轮堵塞(通过转轮的高压下降)	1. 检查各部分 a. 清洁或更换 b. 复位 c. 清除障碍物 d. 更换转轮

故障检修指南
链条传动

普通症状	可能原因	纠正措施
链轮或滚筒磨损不对称	1. 轴不平行或不在同一平面上	1. 重新对准轴
滚筒板内侧或链轮齿侧齿廓磨损	1. 轴上链轮齿偏移(错列)或不平行	1. 重新对准链轮齿
链轮齿尖端磨损	1. 链条过长 2. 链轮切割不当	1. 更换链条 2. 更换正确的链轮
链轮齿磨损或钩住	1. 链轮齿未硬化	1. 更换硬化的链轮齿
链节板 边缘或侧面磨损	1. 链条与外盒或固定物接触	1. 增加外盒间隙或移开固定物
振动过度	1. 偏心过度或表面脱开链轮齿 2. 滚筒破损或缺失	1. 更换合适的链轮齿 2. 修理或更换链条
过早伸长	1. 润滑不足或受到污染或链条长度不足	1. 增加油量或重新设计
链条接头和油中出现红褐色氧化物	1. 润滑不足	1. 改善润滑
链条在链轮齿上跳动	1. 磨损达到垂直极限或安装时过松 2. 大型链轮齿上云母磨损	1. 调节中心或惰轮 2. 更换链条
链条部件破损	1. 驱动过载 2. 过松引起链条跳齿 3. 异物 4. 链条过速 5. 链轮齿不配 6. 润滑不足 7. 锈蚀	1. 重新设计或避免 2. 定期调节中心距离 3. 防止异物进入 4. 重新设计或避免 5. 更换 6. 正确润滑 7. 防止或使用不锈链条
噪音过大	1. 链条接触固定物 2. 润滑不足 3. 滚筒破损或缺失 4. 轴线不重合 5. 链条在链轮齿上跳动	1. 移开物体 2. 改善润滑 3. 修理或更换链条 4. 检查轴和链轮齿，重新对准 5. 调节中心距离

推荐备件
FLC 系列除湿器

种类	部件号	数量
电机，转轮驱动	10683	各 1
主动链轮	22130	各 1
转轮	11193	各 1
驱动齿	11058	各 4
转轮轴	11024	各 1
拉伸弹簧	11042	各 1
张力装置链轮	11056	各 1
主动链	10486	各 1
转轮密封	11005	1 批
检修门垫圈(两个)	11006	1 批
控制面板垫圈(两个)	11007	1 批
加热板垫圈	10678	1 批
过滤器门垫圈	10675	1 批
RTV 密封剂，管	11011	各 1
显示卡	22688	各 1
差压开关	11065	各 1
限温器 / 恒温器	11090	各 2
转轮故障限位开关	11067	各 1

说明：

1. 请致电 **BRY-AIR** 备件部门了解价格和交货信息。
2. 询问时请提供机器的序号。
3. 请参见设备电气材料单，了解电气部件更换信息。
4. 最低定购额为$ 30.00。

APPENDIX: MASTER TROUBLESHOOTING CHART

PROBLEM	SOURCE	PROBABLE CAUSE
NOISE	**A-1** IMPELLER HITTING INLET RING	a) impeller not centred in inlet ring b) inlet ring damaged c) crooked or damaged impeller d) shaft loose in bearing e) impeller loose on shaft f) bearing loose in bearing support
	A-2 IMPELLER HITTING CUT OFF	a) cut-off not secure in housing b) cut-off damaged c) cut-off improperly positioned
	A-3 DRIVE	a) sheave not tight on shaft (motor and/or fan) b) belts hitting belt tube c) belts too loose. Adjust for belt stretching after 48 hours operating d) belts too tight e) belts wrong section f) belts not "matched" in length on multi-belt drive g) variable pitch sheaves not adjusted so each groove has same pitch diameter (multi-belt drives) h) misaligned sheaves i) belts worn j) motor, motor base or fan not securely anchored k) belts oily or dirty l) improper drive selection
	A-4 COUPLING	a) coupling unbalanced, misaligned, loose or may need lubricant
	A-5 BEARING	a) defective bearing b) needs lubrication c) loose on bearing support d) loose on shaft e) seals misaligned f) foreign material inside bearing g) worn bearing h) fretting corrosion between inner race and shaf
	A-6 SHAFT SEAL SQUEAL	a) needs lubrication b) misaligned
PROBLEM	**SOURCE**	**PROBABLE CAUSE**

NOISE	**A-7** IMPELLER	a) loose on shaft b) defective impeller. *Do not run the fan. Contact manufacturer* c) unbalance d) coating loose e) worn as result of abrasive or corrosive material moving through flow passages
	A-8 HOUSING	a) foreign material in housing b) cut-off or other part loose (rattling during operation)
	A-9 ELECTRICAL	a) lead-in cable not secure b) AC hum in motor or relay c) starting relay chatter d) noisy motor bearings e) single phasing a 3 phase motor
	A-10 SHAFT	a) bent b) undersized. May cause noise at impeller, bearing or sheave. c) if more than two bearings are on shaft, they must be properly aligned.
	A-11 HIGH AIR VELOCITY	a) duct work too small for application b) fan selection too small for application c) register or grilles too small for application d) heating or cooling coils with insufficient face area for application
	A-12 OBSTRUCTION IN HIGH VELOCITY GAS STREAM MAY CAUSE RATTLE, OR PURE TONE WHISTLE	a) dampers b) registers c) grilles d) sharp elbows e) sudden expansion in duct work f) sudden contraction in duct work g) turning vanes
	A-13 PULSATION OR SURGE	a) restricted system causes to operate at poor point of rating b) fan too large for application c) ducts vibrate at same frequency as fan pulsation
	A-14 GAS VELOCITY THROUGH CRACKS, HOLES OR PAST OBSTRUCTIONS	a) leaks in duct work b) fins on coils c) register or grilles
PROBLEM	**SOURCE**	**PROBABLE CAUSE**
NOISE	**A-15** RATTLES AND/OR RUMBLES	a) vibrating duct work

		b) vibrating cabinet parts c) vibrating parts not isolated from building
INSUFFICIENT AIR FLOW	**B-1** FAN	a) forward curved impeller installed backwards b) fan running backwards c) cut-off missing or improperly installed d) impeller not centred with inlet collar(s) e) fan speed too slow
	B-2 DUCT SYSTEM	a) actual system is more restrictive (more resistance to flow) than expected b) dampers closed c) registers closed d) leaks in supply ducts e) insulating duct liner loose
	B-3 FILTERS	a) dirty or clogged
	B-4 COILS	a) dirty or clogged
	B-5 RECIRCULATION	a) internal cabinet leaks in bulkhead separating fan outlet (pressure zone) from fan inlets (suction zone) b) leaks around fan outlet at connection through cabinet bulkhead
	B-6 OBSTRUCTED FAN INLETS	a) elbows, cabinet walls or other obstructions restrict air flow. Inlet obstructions cause more restrictive systems but do not cause increased negative pressure readings near the fan inlet(s).Fan speed may be increased to counteract the effect of restricted fan inlet(s)
	B-7 NO STRAIGHT DUCT AT FAN OUTLET	a) fans which are normally used in duct system are tested with a length of straight duct at the fan outlet. If there is no straight duct at the fan outlet, decreased performance will result. If it is not practical to install a straight section of duct at the fan outlet, the fan speed may be increased to overcome this pressure loss.
	B-8 OBSTRUCTIONS IN HIGH VELOCITY AIR STREAM	a) obstruction near fan outlet b) sharp elbows near fan outlet c) improperly designed turning vanes d) projections, dampers or other obstruction in part of system where air velocity is high
PROBLEM	**SOURCE**	**PROBABLE CAUSE**
TOO MUCH AIR FLOW	**C-1** SYSTEM	a) oversized duct work b) access door open

		c) registers or grilles not installed d) dampers set to by-pass coils e) filter(s) not in place
	C-2 FAN	a) backward inclined impeller installed backwards (power will be high) b) fan speed too fast
STATIC PRESSURE WRONG	**D-1** SYSTEM, FAN OR INTERPRETATION OF MEASUREMENTS	general discussion: The velocity pressure at any point of measurement is a function of the velocity of the air or gas and its density. The static pressure at a point of measurement in the system is a function of system design (resistance to flow), air density and the amount of air flowing through the system. The static pressure measured in a "loose" or oversized system will be less than the static pressure in a "tight" or undersized system for the same flow rate. In most systems, pressure measurements are indicators of how the installation is operating. These measurements are the result of air flow and such are useful indicators in defining systems characteristics. Field static pressure measurements rarely correspond with laboratory static pressure measurements unless the fan inlet and fan outlet conditions of the installation are exactly the same as inlet and outlet conditions in the laboratory. Also see D-2 through D-6, E-2, F-1, and G-1, for specific cases.
static pressure low, flow rate high	**D-2** SYSTEM	a) system has less resistance to flow than expected. This is a common occurrence. Fan speed may be reduced to obtain desired flow rate. This will reduce power (operating cost).
	D-3 GAS DENSITY	a) pressure will be less with high temperature gases or high altitudes
	D-4 FAN	a) Backward inclined impeller installed backwards. Power will be high b) fan speed too high
PROBLEM	**SOURCE**	**PROBABLE CAUSE**
static pressure low, flow rate low	**D-5** SYSTEM	a) fan inlet and/or outlet conditions not same as tested. See general discussion (D-1). Also see B-1 through B-8.

static pressure high, flow rate low	**D-6** SYSTEM	a) obstruction in system b) dirty filters c) dirty coils d) system too restricted Also see B-1 through B-8.
POWER HIGH	**E-1** FAN	a) backward inclined impeller installed backwards b) fan speed too high
	E-2 SYSTEM	a) oversized duct work b) face and by-pass dampers oriented so coil dampers are open at the same time by-pass dampers are open c) filter(s) left out d) access door open
	E-3 GAS DENSITY	a) calculated horse power requirements based on light gas (e.g. high temperature) but actual gas is heavy (e.g. cold start up)
	E-4 FAN SELECTION	a) fan not operating at efficient point of rating. Fan size or type may not be best for application
FAN DOES NOT OPERATE	**F-1** ELECTRICAL OR MECHANICAL	Mechanical and electrical problems are usually straightforward and are normally analysed in a routine manner by service personnel. In this category are such item as: a) blown fuses b) broken belts c) loose pulleys d) electricity turned off e) impeller touching scroll f) wrong voltage g) motor too small and overload protector has broken circuit

PROBLEM	SOURCE	PROBABLE CAUSE
PREMATURE FAILURE	**G-1** BELTS, BEARINGS, SHEAVES, IMPELLER, HUBS, ETC.	general discussion: Each fan component is designed to operate satisfactory for a reasonable life time. Fan intended for heavy duty service are made especially for that type of service. For example, Class I fans are intended for operation below certain limits of pressure and outlet velocity. Class II fans are designed for higher operating limits (see AMCA standards 2408).Not all components are limited by the same factors, e.g. limiting factors may be power, round per minutes, temperature, impeller tip speed, torque, corrosive atmospheres, expected life, etc. Also see A-3, A-5, A-6.
	G-2 COUPLINGS	see item A-4
	G-3 SHAFT	also see A-10

CIC - Zero Carbon Building

Operation & Maintenance Manual

VAV BOX

Prepared By

SUNrise Air Conditioning Equipment Ltd.

Contents

Section 1

Operation

General Description
Operation
Installation
Calibrated Air Volume Range
List of Equipment

General Description

The VAV-5000 series variable air volume boxes are co-operated with Siemens 550-445 BACnet DDC controller (supplied by others) and temperature sensor (supplied by others) to achieve the operation of temperature control, and interfacing to Building Management System.

Operation

The VAV-5000 series single duct variable air volume boxes are designed for ease of operation. The SP-200 multi-point cross flow sensor at the inlet side of the VAV box is connected to the Siemens 550-445 BACnet DDC controller to calculate the airflow (i.e. cfm) through the box. The DDC controller modulates the damper position until the actual airflow corresponds to the input signal from the room temperature sensor. The minimum and maximum airflow limits are adjustable at the central workstation eliminating the need to access into the space.

Installation

The Siemens 550-445 BACnet DDC controllers and transformers are factory mounted inside the protective metal shroud of the VAV-5000 series single duct variable air volume box. The shroud cover is removable with metal screw.

The basic VAV-5000 series variable air volume boxes are light enough that they can be supported by the duct work in which they are installed. Where accessory modules / sections, such as multi-outlet attenuator, etc. are included, the boxes should be supported directly. Use the support method prescribed for rectangular duct in job specifications.

The boxes shall be mounted right side up. It should be level within +/- 10 degrees of horizontal, both parallel to the air flow and right angles to air flow. The control sides of the boxes are labeled with an arrow indication UP. Do not mount the control side of the boxes tight to a wall pipe, or any other obstruction. Allow sufficient room for access to the controls.

For optimum performance there should be a minimum of 4D of straight inlet duct, same size as inlet, between the inlet and transition, take off or fitting.

Calibrated Air Volume Range

The following air volume ranges are calibrated for optimum performance.

Unit Size	cfm		L/s	
	Min	Max	Min	Max
6”	66	450	31	212
8”	132	800	62	378
10”	221	1350	104	637
14”	439	3000	207	1416

List of Equipment

A. Cooling Only

1. VAV Box
   - Model : VAV-5000 series
   - Inlet size : 6”, 8”, 10” and 14”
   - Internal fiberglass insulation and perforated metal sheet lining
   - Integrated blade type damper and damper shaft
   - SP-200 Multi point cross flow sensor
   - Controller mounting panel c/w :
     a. Siemens 550-445 BACnet DDC controller (supplied by others)
     b. TR220/24 Transformer
   - J2 flange connection to multi-outlet attenuator

2. Multi-outlet attenuator
   - Model : MOA series
   - Outlet size : 5 x 6”, 5 x 8”
   - Internal fiberglass insulation and perforated metal sheet lining
   - Manual control damper
   - J2 flange connection to VAV box

Section 2

Maintenance

Cooling VAV Box

Maintenance

A. Cooling VAV Box

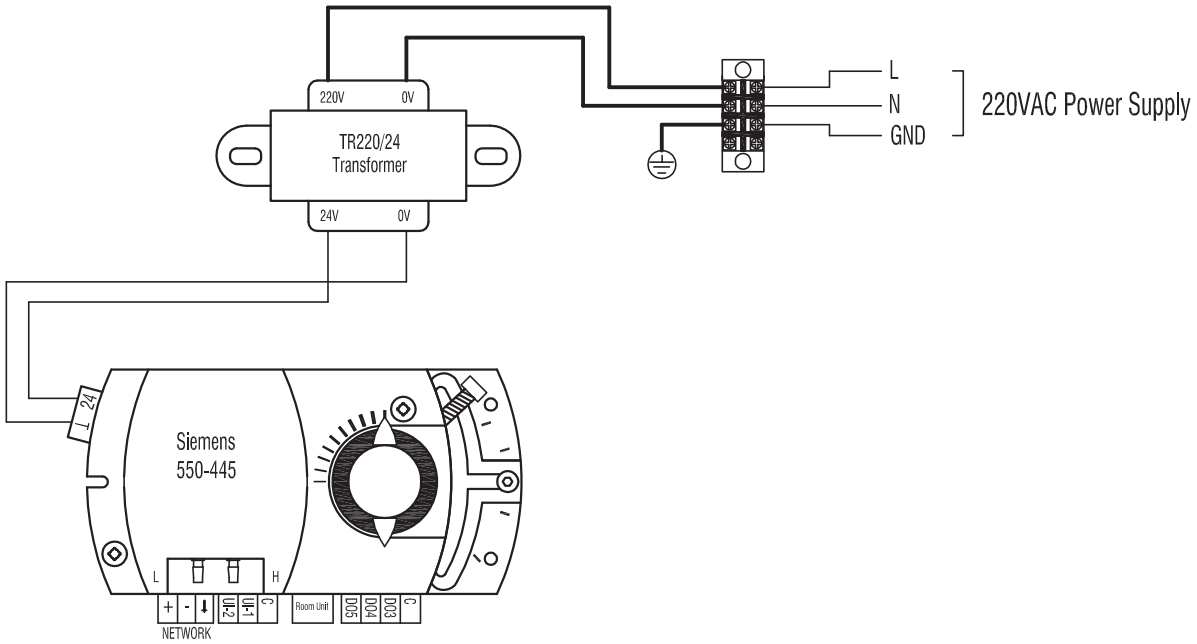
1. Quarterly Routine
   - Check the movement of air damper by means of adjusting the set point at the room temperature sensor or central workstation.

2. Yearly Routine
   - Perform the manual operation of the air damper by means of pressing the manual switch at the DDC controller.

Section 3

Wiring Diagram

Cooling VAV Box



CIC - Zero Carbon Building

VAV BOX CONTROL PANEL WIRING DIAGRAM (Cooling only)

Section 4

Catalogue

VAV-5000 Series Single Duct VAV Box

SUN

TERMINAL UNITS

"SUN" Pressure Independent type Single Duct VAV terminal unit is a factory build assembly, utilizing the latest developments in volume control. These units are designed to control the air flow rate of conditioned air into an occupied space in response to a control signal, usually a thermostat. the clean and efficient design of these single duct terminal units result in a system component which has minimal pressure drop reducing pressure drop reducing fan horsepower requirements, and low noise generation for quiet operation, A compact configuration makes this unit easier to use in today HVAC application.

Common Applications

Cooing application apply for interior zones where full shut-off of conditioned air delivery is allowable and no overheat heating

Cooling and heating application apply for exterior zone where convective and radiated heat losses create a nee for overheat heating

Features :

. Ranges from 31 l/s to 1888 l/s
Pressure Independent operation
Variable Air or Constant Air volume application
Electronic or Direct Digital Control
Factory calibration to job requirement
External mounted DDC controller panel
Connection bead offers a means secure flex duct connections
Full range of accessories (i.e. , coil , attenuator)

Construction

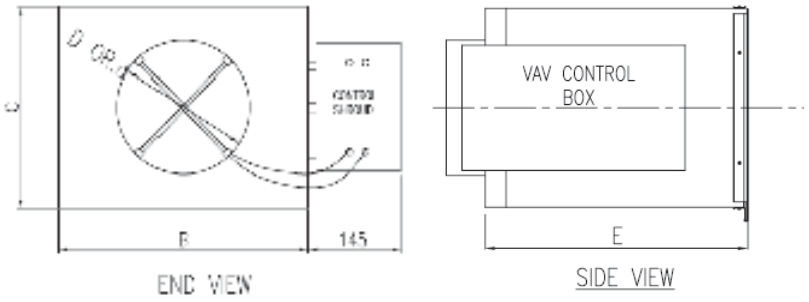
. 0.8 or 1.0 mm G.I construction
. 25 mm and 48 kg density fiberglass internal insulation, facing with marglass and perforated metal sheet protection. Meets requirements for BS 476 Part 6 and HKFSD regulation
. Blade type Damper constructed of two layers of heavy gauge galvanized steel with sandwich peripheral gasket
. Plated damper shaft is mounted in self-lubricated bearings
. UL 94 type pneumatic tubing
. Discharge complete with J2 flange and meet DW 142 requirement
. Special liner and insulation available

Model Number Selection

VAV
CAV
X000-SPL → Special requirements
E - Electrical Coil heater
W- Hot Water Coil
5 - BareBox only
8 - Controller supplied by SUN

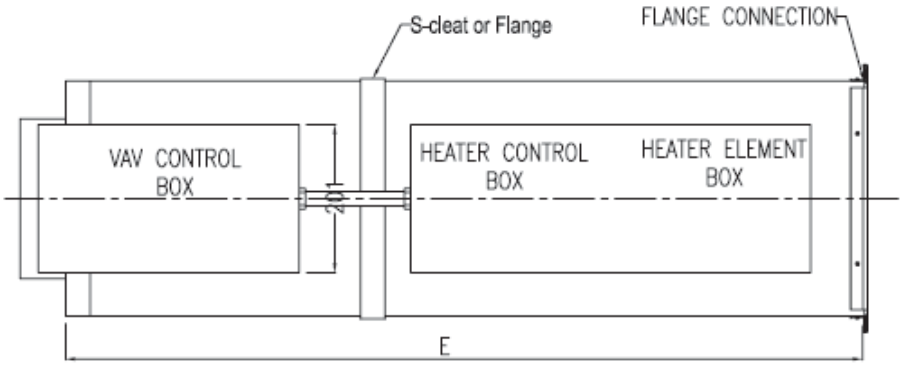
Dimensional Data

VAV Barebox Dimension



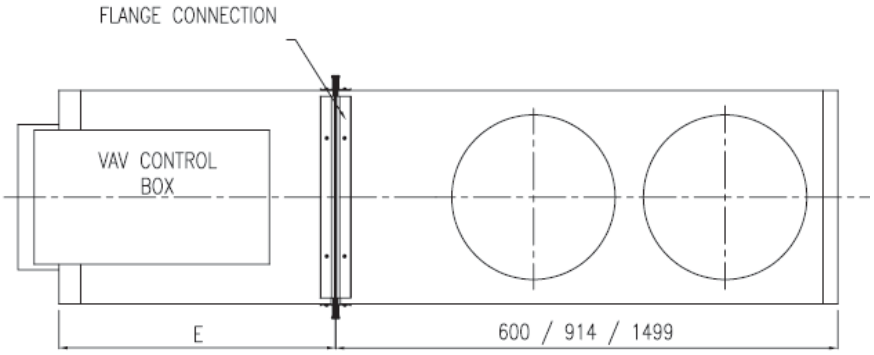
Inlet SIZE	SI UNITS IN MM				
	B	C	d	J	E
4	305	203	99	149	400
5	305	203	124	149	400
6	305	203	N/A	149	400
7	305	254	N/A	175	400
8	305	254	N/A	200	400
9	356	318	N/A	225	400
10	356	318	N/A	251	400
12	406	381	N/A	302	400
14	508	445	N/A	352	500
16	610	457	N/A	403	500

VAV Barebox with Electric Duct Heater Section Dimension



UNIT SIZE	SI UNITS IN MM				
	B	C	d	D	E
4	305	203	99	149	1150
5	305	203	124	149	1150
6	305	203	N/A	149	1150
7	305	254	N/A	175	1150
8	305	254	N/A	200	1150
9	356	318	N/A	225	1150
10	356	318	N/A	251	1150
12	406	381	N/A	302	1150
14	508	445	N/A	352	1250
16	610	457	N/A	403	1250

VAV Barebox with Multi-Outlet attenuator Section Dimension



Inlet SIZE	SI UNITS IN MM				
	B	C	d	J	E
4	305	203	99	149	400
5	305	203	124	149	400
6	305	203	N/A	149	400
7	305	254	N/A	175	400
8	305	254	N/A	200	400
9	356	318	N/A	225	400
10	356	318	N/A	251	400
12	406	381	N/A	302	400
14	508	445	N/A	352	500
16	610	457	N/A	403	500

Unit Configuration and Accessories

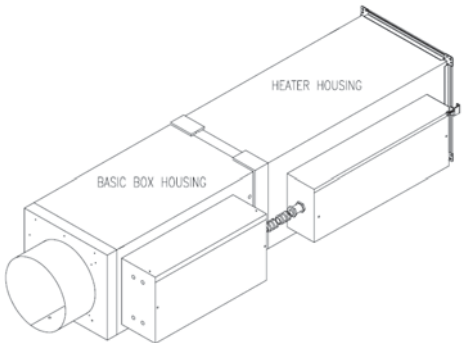
Single Duct VAV Size 4 to 16

. 12 point cross flow sensor
. 25 mm and 48 kg density with marglass and perforated metal sheet lining protection
. Zinc Coat Steel housing, mechanically sealed and gasketed, leak resistant construction
. Rectangular Discharge opening with J2 flange duct connection
. DDC controller shrould
. UL94-V2 type pneumatic tubing

Single Duct VAV Size 4 to 16 with Multi-outlet attenuator

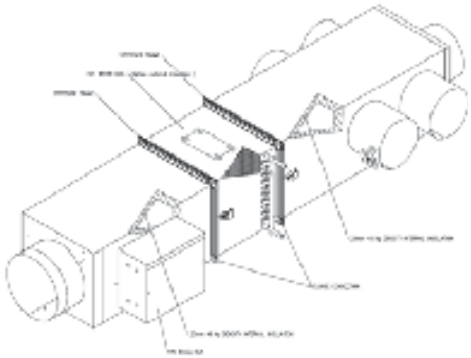
. 12 point cross flow sensor
. 25 mm and 48 kg density with marglass and perforated metal sheet lining protection
. Zinc Coat Steel housing, mechanically sealed and gasketed, leak resistant construction
. Rectangular Discharge opening with J2 flange duct connection
. DDC controller shrould
. UL94-V2 type pneumatic tubing
. 600 mm / 914 mm / 1510mm length multi-outlet attenuator
. All multi-outlet attenuator with internal insulation and perforated metal sheet protection

Single Duct VAV Size 4 to 16 with Electric Heater Section



. 12 point cross flow sensor
. 25 mm and 48 kg density with marglass and solid metal sheet lining protection
. Zinc Coat Steel housing, mechanically sealed and gasketed, leak resistant construction
. Slip and drive cleat between VAV and heater section
. DDC controller shrould
. UL94-V2 type pneumatic tubing
. Standard 750 mm length of Electric heater section
. Black heat type electric heater with manual reset type overheat switch (field adjustment)
. Rectangular Discharge opening with J2 flange duct connection

Single Duct VAV Size 4 to 16 with Hot water coil and MOA



. 12 point cross flow sensor
. 25 mm and 48 kg density with marglass and perforated metal sheet lining protection
. Zinc Coat Steel housing, mechanically sealed and gasketed, leak resistant construction
. J2 Flange connection between VAV and hot water coil and MOA section
. DDC controller shrould
. UL94-V2 type pneumatic tubing
. Copper tube and aluminum fin construction coil
. Optional external insulation with double skin protection for hot water coil section

Performance Data

Recommended Air Volume Flow Range

	Pneumatic	Electronic	DDC
Unit Size	Control		
	L/S	L/S	L/S
	Range	Range	Range
4	0-106	24 - 106	24 - 106
6	0-212	31 - 212	31 - 212
8	0-378	62 - 378	62 - 378
10	0-637	104 - 637	104 - 637
12	0-991	143 - 991	143 - 991
14	0-1510	207 - 1416	207 - 1416
16	0-1888	268 - 1888	268 - 1888

Note

Factory calibrated controls must be selected within the above flow limited. A minimum value of zero is also available.

Selection of air flow limits below the listed values is not recommended. **Stability and accuracy may not be acceptable at lower than recommended air flow limits**. The actual performance will vary depending on DDC controls supplied

Basic Box Casing and Damper Leakage

Unit Size	Casing Leakage l/s@ 500Pa		Damper Leakage l/s @ 500Pa
4	2		1
6	2		1
8	2		2
10	1		2
12	2		3
14	2		3
16	3		3

Performance Data

Performance Typical Selection Guide						
Unit Size	Air Flow	Min Operated	Pressure Drop (Pa)			
		Total Pressure (Pa)	Basic unit	with MOA	with EH sec	with 1 row HW
4	35	12	2	2	2	5
	59	32	2	2	2	7
	83	62	2	2	2	10
	106	102	2	2	2	12
6	71	12	2	2	2	10
	106	30	2	2	2	22
	142	52	2	2	2	37
	177	82	2	2	2	60
	212	114	2	2	2	82
8	189	17	2	2	2	20
	236	25	2	2	2	30
	283	37	2	2	2	40
	330	50	2	2	2	50
	378	62	2	2	2	62
10	260	15	2	2	2	20
	354	25	2	2	2	30
	448	37	2	2	2	45
	637	72	2	2	2	80
12	425	17	2	2	2	25
	566	27	2	2	2	40
	708	42	2	2	2	57
	850	60	2	2	2	77
	991	82	2	2	2	100
14	472	12	2	2	2	17
	708	25	2	2	2	30
	944	45	2	2	2	50
	1180	67	2	2	2	70
	1416	95	2	2	2	95
16	708	15	2	2	2	22
	944	25	2	2	2	37
	1180	40	2	2	2	52
	1416	55	2	2	2	70
	1652	75	2	2	2	92
	1888	97	2	2	2	114

Performance Note

All test data obtain accordance to following standard

ASHARE Standard 130 - 1996, Method of Testing for Rating Ducted Air Terminal Unit

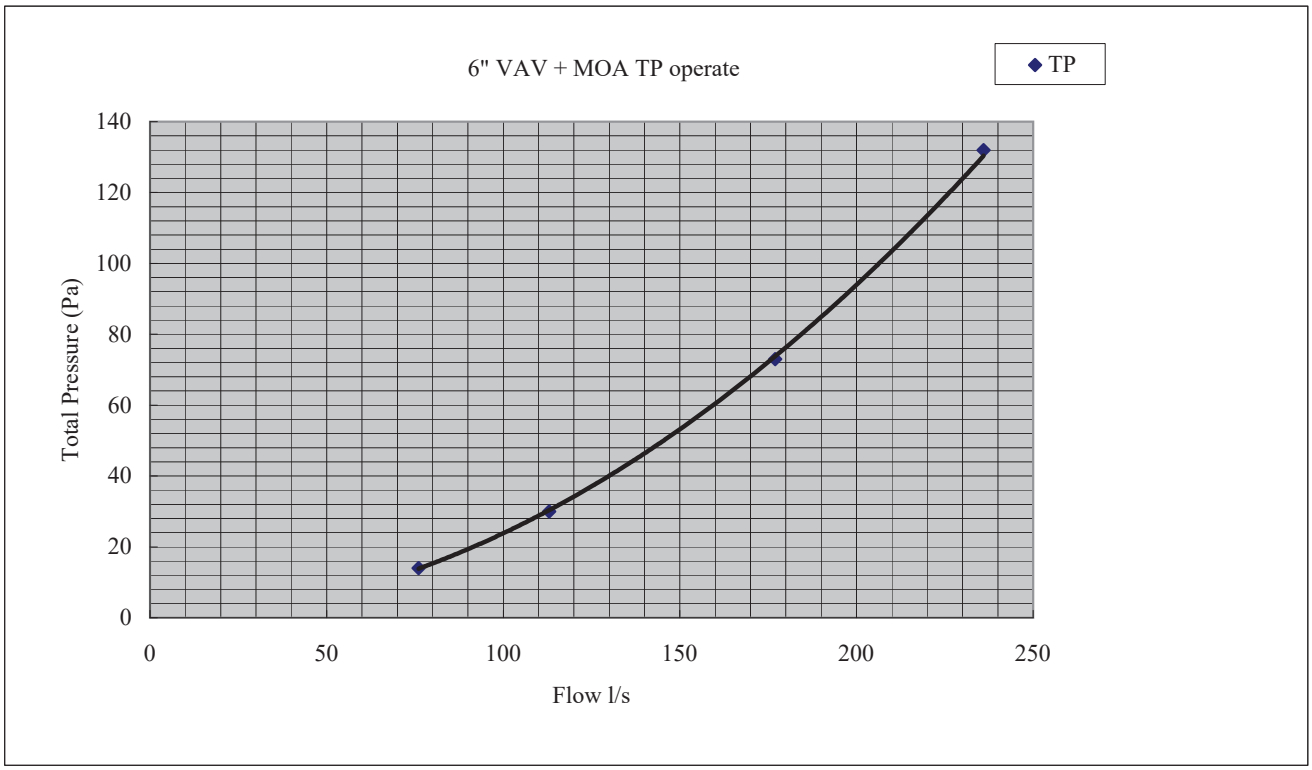
BS 4979 (1986) Methods for Aerodynamic testing of constant and variable dual or single duct box, single duct units and induction boxes for air distribution systems. British Standard Institution. London, UK

ISO 5220, (1981). Air distribution and air diffusion -- Aerodynamic testing and rating of constant and variable dual or single duct boxes and single duct units. International Organization for Standardization. Geneva, Switzerland

ISO 5221, (1984). Air distribution and air diffusion -- Rules to methods of measuring air flow rate in an air handling duct. International Organization for Standardization. Geneva, Switzerland

Performance Data (Total Pressure Vs Flow)

Size 6



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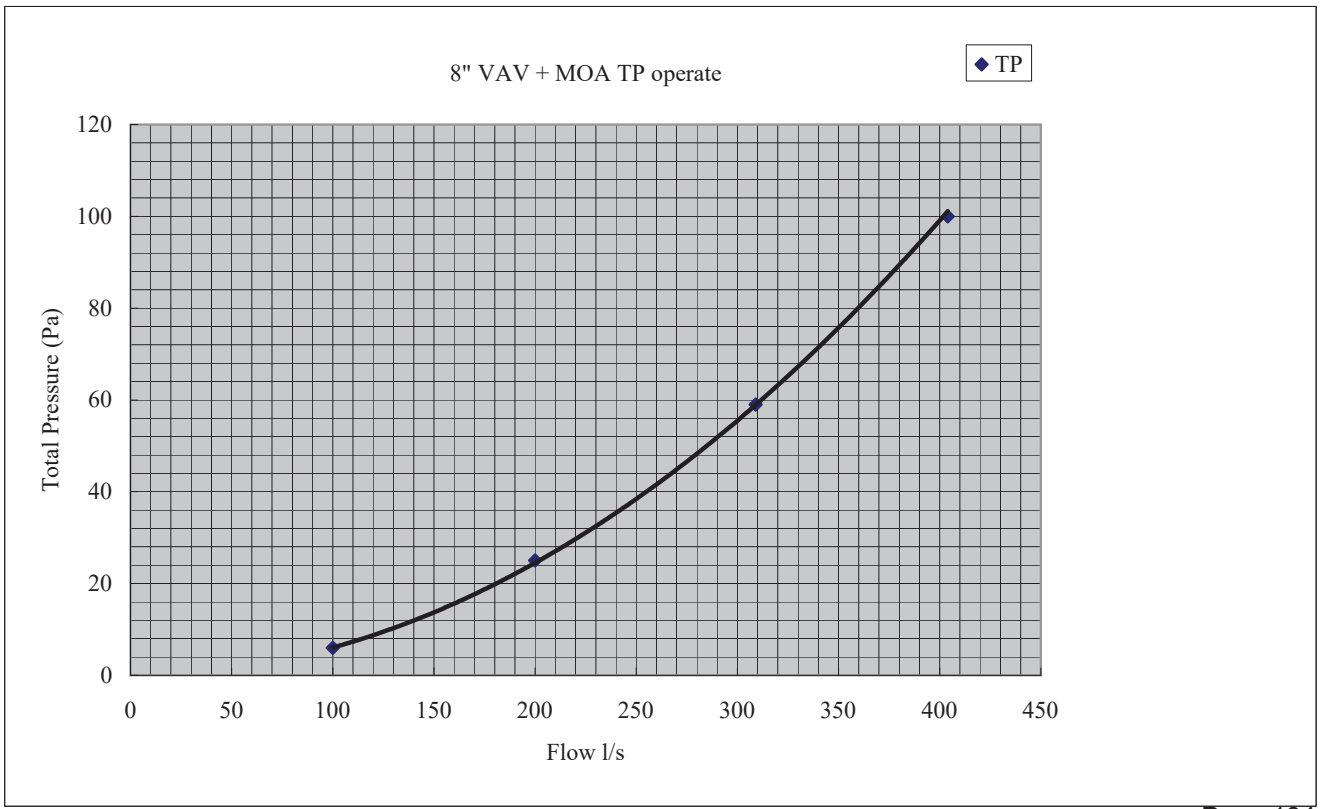
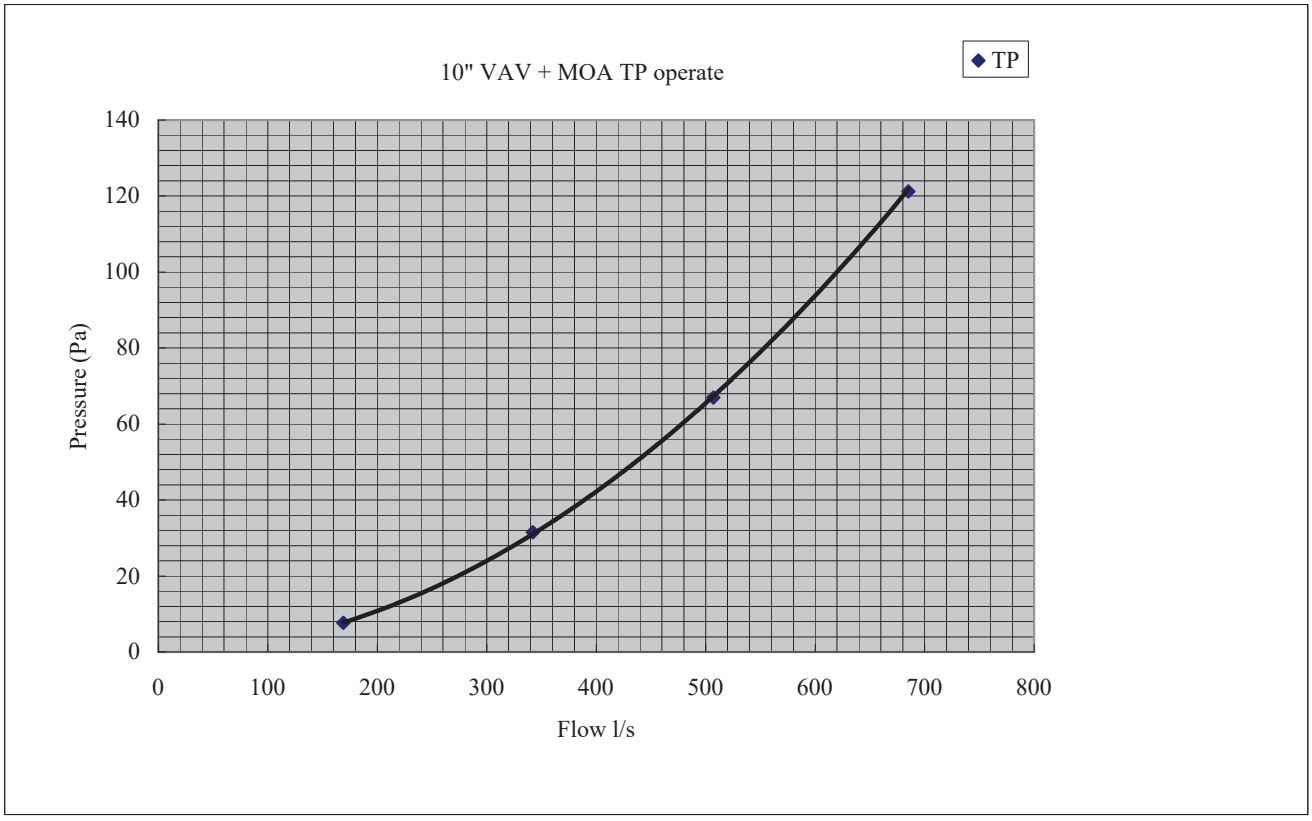
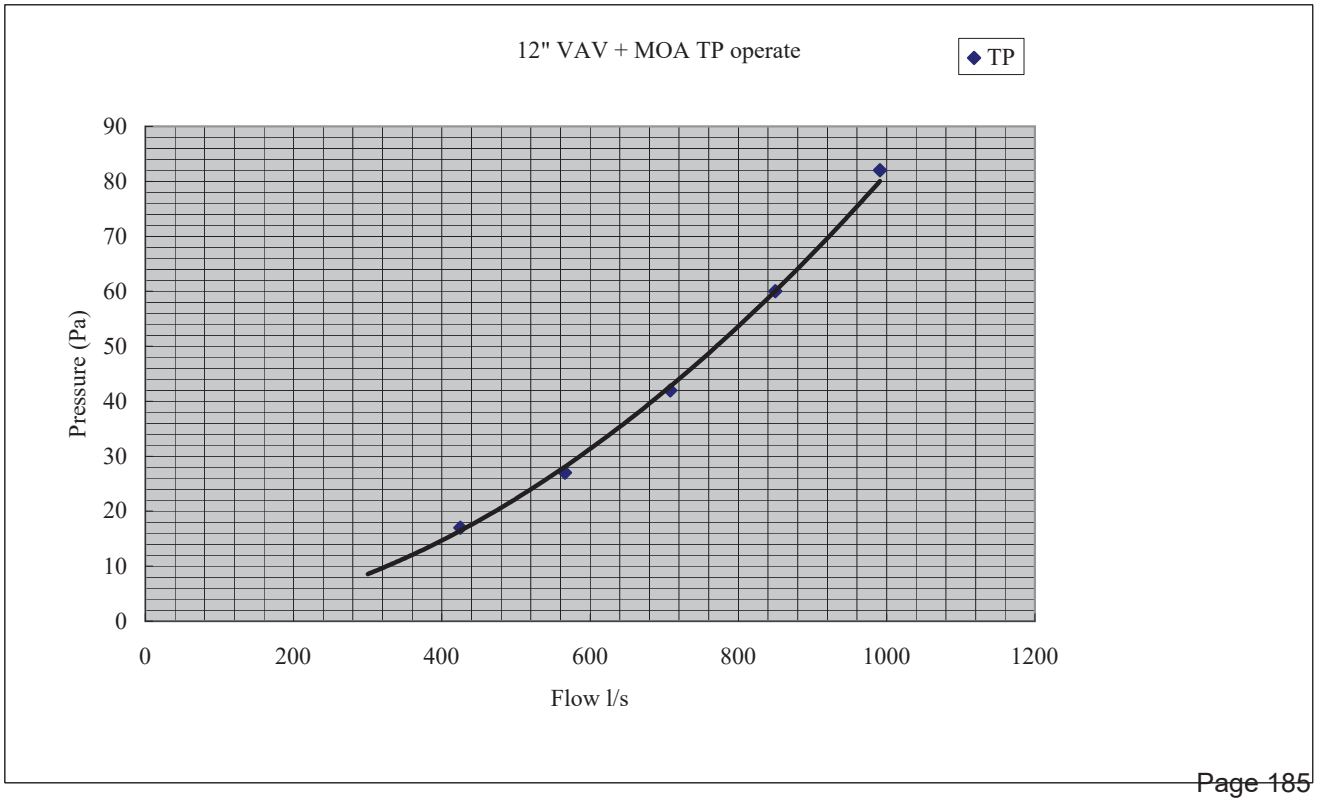


Performance Data (Total Pressure Vs Flow)

Size 10

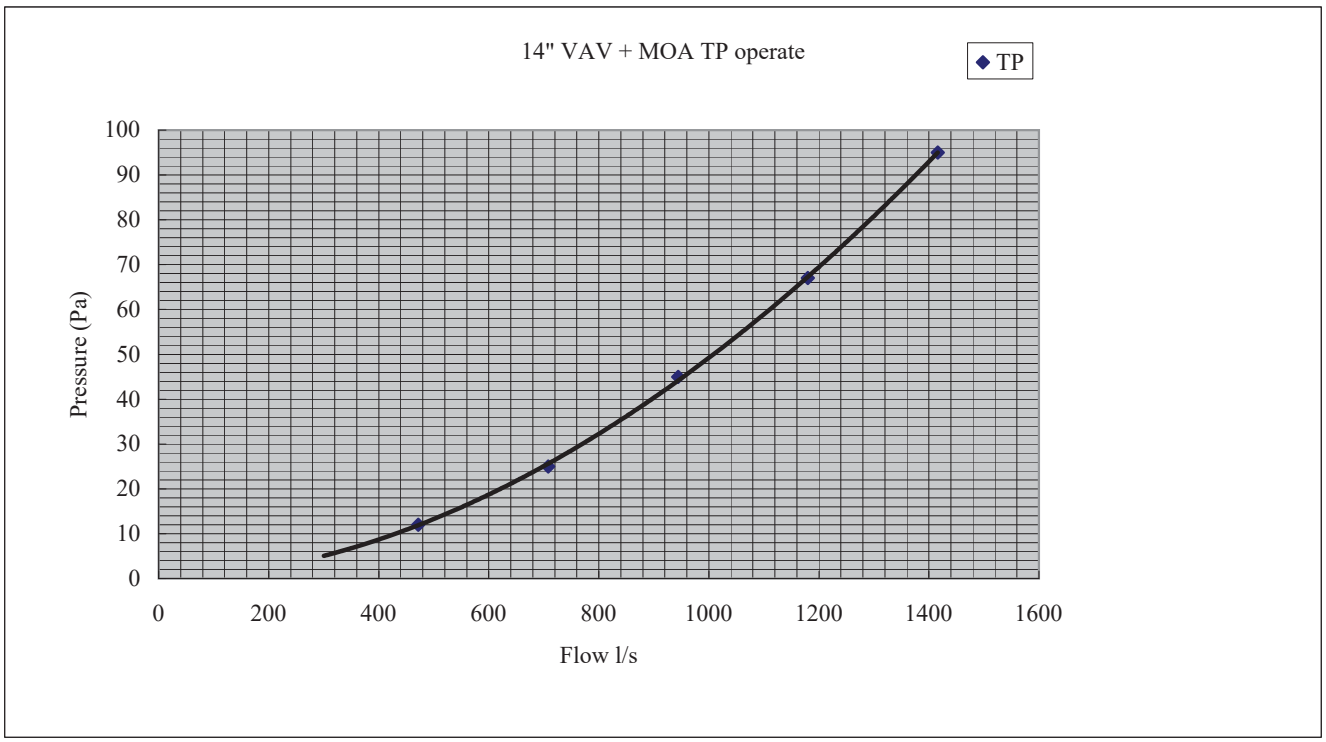


Size 12

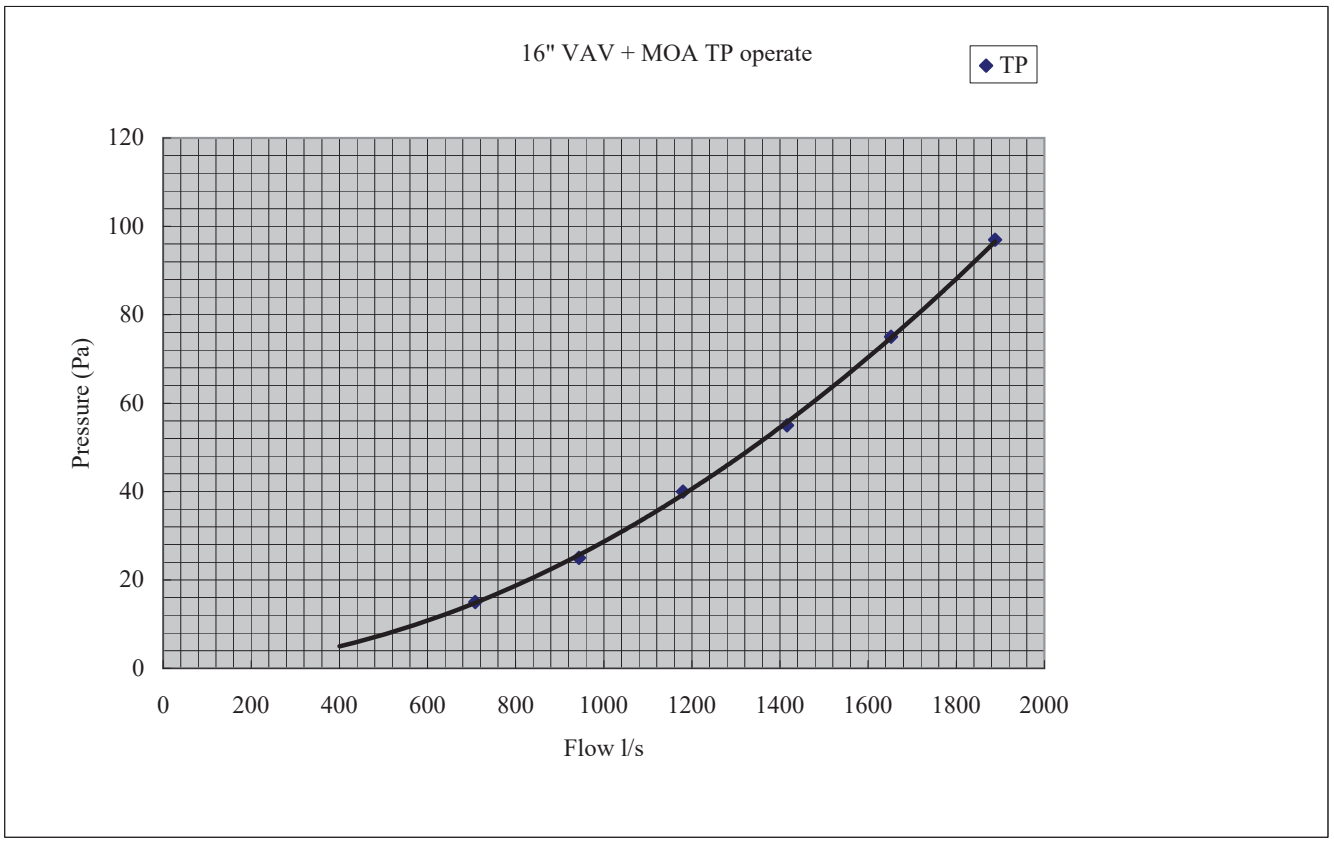


Performance Data (Total Pressure Vs Flow)

Size 14



Size 16



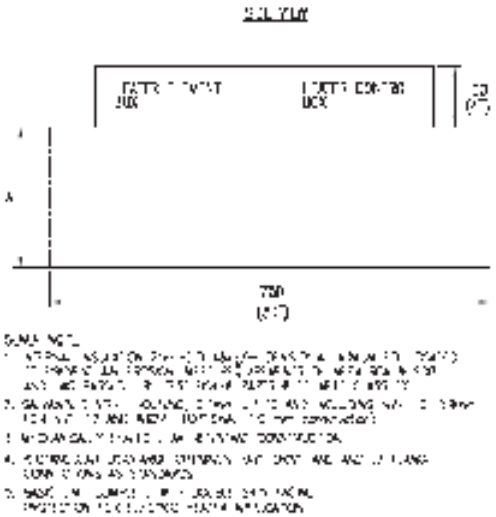
Performance Data

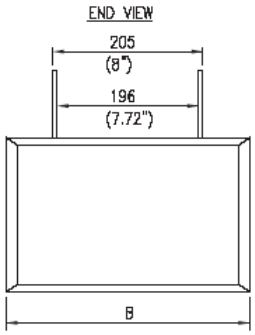
NC level Quick Selection Guide							
Basic unit							
Unit Size	Air Flow	Discharge NC			Radiated NC		
		125 Pa	375 Pa	750 Pa	125 Pa	375 Pa	750 Pa
4	35	< 20	< 20	< 20	< 20	< 20	< 20
	59	< 20	< 20	< 20	< 20	< 20	< 20
	83	< 20	< 20	22	< 20	< 20	21
	106	20	24	27	< 20	21	24
6	71	< 20	< 20	< 20	< 20	< 20	< 20
	106	< 20	< 20	21	< 20	< 20	21
	142	< 20	< 20	24	< 20	20	25
	177	< 20	21	27	< 20	23	27
	212	< 20	24	30	< 20	25	29
8	189	< 20	< 20	25	< 20	21	25
	236	< 20	20	28	< 20	23	28
	283	< 20	23	30	< 20	26	30
	330	< 20	24	32	20	27	32
	378	< 20	25	32	22	29	33
10	260	< 20	< 20	27	< 20	< 20	25
	354	< 20	20	28	< 20	< 20	27
	448	< 20	22	30	< 20	22	29
	637	< 20	25	33	< 20	25	32
12	425	< 20	23	31	< 20	21	28
	566	< 20	25	32	< 20	23	30
	708	< 20	26	34	< 20	25	31
	850	< 20	27	35	< 20	26	33
	991	< 20	28	35	< 20	28	34
14	472	< 20	22	31	< 20	21	28
	708	< 20	25	34	< 20	25	32
	944	< 20	27	36	21	29	35
	1180	< 20	29	38	24	32	37
	1416	< 20	30	39	27	35	40
16	708	< 20	22	30	< 20	23	30
	944	< 20	25	33	< 20	26	33
	1180	< 20	27	35	22	30	35
	1416	< 20	29	37	25	33	38
	1652	< 20	31	40	28	36	41
	1888	20	33	41	31	39	44

Performance Note

Radiated / Discharge NC values are calculated based on typical sound attenuation values outlined in Appendix E, ARI Standard 885-98 "

Accessories - Electric heater section





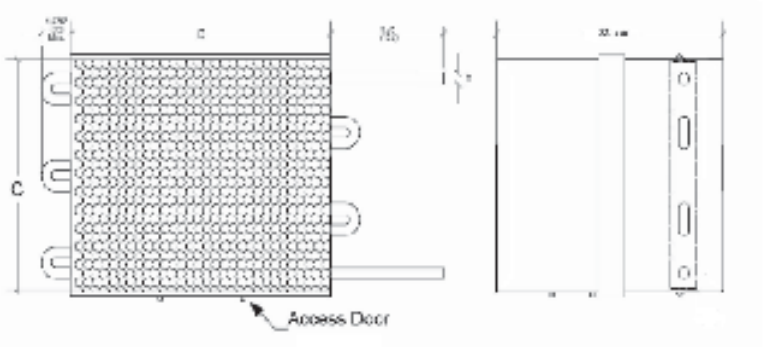
Heater Section size (mm)			
Unit	A	B	Length
6	305	203	750
8	305	254	750
10	356	318	750
12	406	381	750
14	508	445	750
16	610	447	750

Model Number Selection

EH-0X-XXX

- Heating Capacity
- Box Size
- Electrical heater

Accessories - Hot Water Coil section



Hot Water Coil Section size (mm)			
Unit	A	B	Length
6	305	203	300
8	305	254	300
10	356	318	300
12	406	381	300
14	508	445	300
16	610	447	300

General Note

1. Copper Tube, aluminium fin construction with G.I Casing
2. Optional external insulation protected by Double skin protection
3. Access panel

Model Number Selection

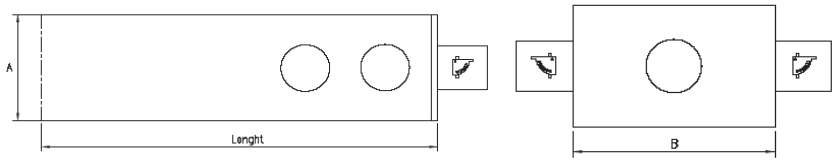
HW-0X-XXX

- Number of Row
- Box Size
- Hot water coil

SUN

TERMINAL UNITS

Accessories - Multi-outlet attenuator



MOA Section size (mm)			
Unit	A	B	Length
6	305	203	600 / 914
8	305	254	600 / 914
10	356	318	600 / 914
12	406	381	600 / 914
14	508	445	600 / 914
16	610	447	600 / 914

Model Number Selection

MOA-0X-XXX

- Standard (STD) / Perforated (PR) / Double Skin(DB)
- Box Size
- Multi-outlet attenuator

"SUN" Variable Air Volume Box are successful to fully integrated with the following DDC controller

TAC controls (Andover)

江森 (Johnson Controls)

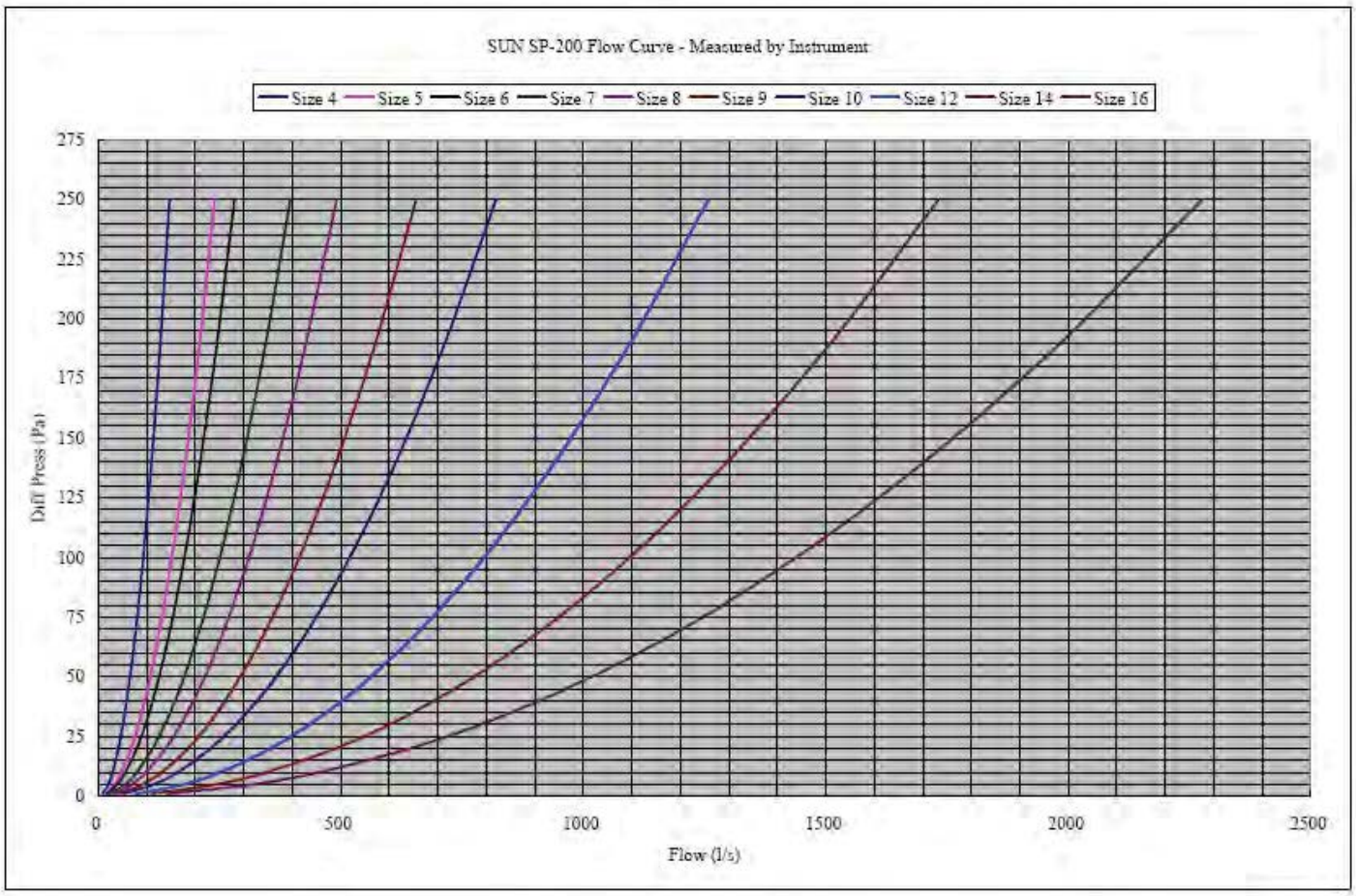
西門子 (Siemens)

Trend Controls (IQL-VAV)
Honeywell (W775)
Invernsys (MNB)

Flow Sensor Calibration curve for DDC controller "K" setting

Flow (Q) Measured by Instrument										
DP in Pa	Size in Inch									
	4	5	6	7	8	9	10	12	14	16
1	9	15	18	25	31	41	52	80	110	144
5	21	33	40	55	71	93	116	178	246	322
10	29	47	56	78	100	132	164	252	348	456
20	42	67	80	111	142	187	232	356	491	645
30	50	82	98	135	173	229	284	436	602	790
40	59	95	113	156	200	264	329	503	695	913
50	66	107	126	175	224	295	368	563	777	1020
60	72	117	138	192	245	324	403	616	851	1118
70	78	127	149	207	265	350	435	666	919	1207
80	83	135	159	221	283	374	465	712	983	1290
100	93	151	178	247	316	418	520	796	1099	1443
120	102	165	195	271	347	458	569	872	1204	1581
140	110	179	211	293	375	495	615	941	1300	1707
160	117	191	225	313	400	529	658	1006	1390	1825
180	125	202	239	332	424	561	698	1068	1474	1936
200	131	214	251	350	448	591	735	1125	1554	2041
250	147	239	281	391	500	661	822	1258	1738	2282

Flow (Q) Calculated by K-Value --> Q = K-Value * SQRT(DP)										
K-Value	9.3	15.1	17.8	24.7	31.6	41.8	52.0	79.6	109.9	144.3
DP in Pa	Size in Inch									
	4	5	6	7	8	9	10	12	14	16
1	9	15	18	25	32	42	52	80	110	144
5	21	34	40	55	71	94	116	178	246	323
10	29	48	56	78	100	132	164	252	347	456
20	42	68	80	111	142	187	233	356	491	645
30	51	83	97	135	173	229	285	436	602	790
40	59	95	113	156	200	264	329	503	695	913
50	66	107	126	175	224	295	368	563	777	1020
60	72	117	138	192	245	324	403	616	851	1118
70	78	126	149	207	265	350	435	666	919	1207
80	83	135	159	221	283	374	465	712	983	1291
100	93	151	178	247	316	418	520	796	1099	1443
120	102	165	195	271	347	458	570	872	1204	1581
140	110	179	211	293	374	495	615	941	1300	1707
160	118	191	225	313	400	529	658	1007	1390	1825
180	125	203	239	332	425	561	698	1068	1474	1936
200	131	214	252	350	448	591	735	1125	1554	2041
250	147	239	281	391	500	661	822	1258	1737	2281



Section 5

Spare Parts

Recommended

Recommended Spare Parts

Item	Model	Description
1	SP-200	Multi-point cross flow sensor, 6”, 8” ,10” & 14”
2	TR220 / 24	Transformer, 220Vac / 24Vac

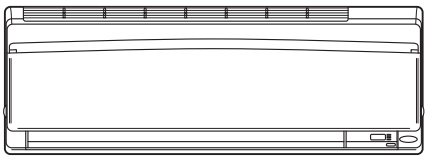
DAIKIN

INVERTER

DAIKIN ROOM AIR CONDITIONER

Operation Manual

MODELS **FTXS25EVMA** **FTKS25EVMA**
FTXS35EVMA **FTKS35EVMA**



CONTENTS

READ BEFORE OPERATION

OPERATION

CARE

TROUBLE SHOOTING

Safety precautions

- Keep this manual where the operator can easily find them.
- Read this manual attentively before starting up the unit.
- For safety reason the operator must read the following cautions carefully.
- This manual classifies precautions into WARNING and CAUTION. Be sure to follow all precautions below: they are all important for ensuring safety.

⚠ WARNING	⚠ CAUTION
If you do not follow these instructions exactly, the unit may cause property damage, personal injury or loss of life.	If you do not follow these instructions exactly, the unit may cause minor or moderate property damage or personal injury.

Never do.

Be sure to earth the air conditioner.

Never touch the air conditioner (including the remote controller) with a wet hand.

Be sure to follow the instructions.

Never cause the air conditioner (including the remote controller) to get wet.

⚠ WARNING

- In order to avoid fire, explosion or injury, do not operate the unit when harmful, among which flammable or corrosive gases, are detected near the unit.
- It is not good for health to expose your body to the air flow for a long time.
- Do not put a finger, a rod or other objects into the air outlet or inlet. As the fan is rotating at a high speed, it will cause injury.
- Do not attempt to repair, relocate, modify or reinstall the air conditioner by yourself. Incorrect work will cause electric shocks, fire etc.
  For repairs and reinstallation, consult your Daikin dealer for advice and information.

- The refrigerant used in the air conditioner is safe. Although leaks should not occur, if for some reason any refrigerant happens to leak into the room, make sure it does not come in contact with any flame as of gas heaters, kerosene heaters or gas range.
- If the air conditioner is not cooling (heating) properly, the refrigerant may be leaking, so call your dealer.
  When carrying out repairs accompanying adding refrigerant, check the content of the repairs with our service staff.
- Do not attempt to install the air conditioner by your self. Incorrect work will result in water leakage, electric shocks or fire. For installation, consult the dealer or a qualified technician.
- In order to avoid electric shock, fire or injury, if you detect any abnormally such as smell of fire, stop the operation and turn off the breaker. And call your dealer for instructions.
- Depending on the environment, an earth leakage breaker must be installed. Lack of an earth leakage breaker may result in electric shocks or fire.

⚠ CAUTION

- The air conditioner must be earthed. Incomplete earthing may result in electric shocks. Do not connect the earth line to a gas pipe, water pipe, lightning rod, or a telephone earth line.

- In order to avoid any quality deterioration, do not use the unit for cooling precision instruments, food, plants, animals or works of art.
- Never expose little children, plants or animals directly to the air flow.
- Do not place appliances which produce open fire in places exposed to the air flow from the unit or under the indoor unit. It may cause incomplete combustion or deformation of the unit due to the heat.

- Do not block air inlets nor outlets. Impaired air flow may result in insufficient performance or trouble.
- Do not stand or sit on the outdoor unit. Do not place any object on the unit to avoid injury, do not remove the fan guard.
- Do not place anything under the indoor or outdoor unit that must be kept away from moisture. In certain conditions, moisture in the air may condense and drip.
- After a long use, check the unit stand and fittings for damage.
- Do not touch the air inlet and aluminum fins of outdoor unit. It may cause injury.
- The appliance is not intended for use by young children or infirm persons without supervision.
- Young children shuld be supervised to ensure that they do not play with the appliance.

- To avoid oxygen deficiency, ventilate the room sufficiently if equipment with burner is used together with the air conditioner.
- Before cleaning, be sure to stop the operation, turn the breaker off or pull out the supply cord.
- Do not connect the air conditioner to a power supply different from the one as specified. It may cause trouble or fire.
- Arrange the drain hose to ensure smooth drainage. Incomplete draining may cause wetting of the building, furniture etc.
- Do not place objects in direct proximity of the outdoor unit and do not let leaves and other debris accumulate around the unit.
  Leaves are a hotbed for small animals which can enter the unit. Once in the unit, such animals can cause malfunctions, smoke or fire when making contact with electrical parts.

- Do not operate the air conditioner with wet hands.

- Do not wash the indoor unit with excessive water, only use a slightly wet cloth.
- Do not place things such as vessels containing water or anything else on top of the unit. Water may penetrate into the unit and degrade electrical insulations, resulting in an electric shock.

Installation site.

■ To install the air conditioner in the following types of environments, consult the dealer.
- Places with an oily ambient or where steam or soot occurs.
- Salty environment such as coastal areas.
- Places where sulfide gas occurs such as hot springs.
- Places where snow may block the outdoor unit.

The drain from the outdoor unit must be discharged to a place of good drainage.

Consider nuisance to your neighbours from noises.

■ For installation, choose a place as described below.
- A place solid enough to bear the weight of the unit which does not amplify the operation noise or vibration.
- A place from where the air discharged from the outdoor unit or the operation noise will not annoy your neighbours.

Electrical work.

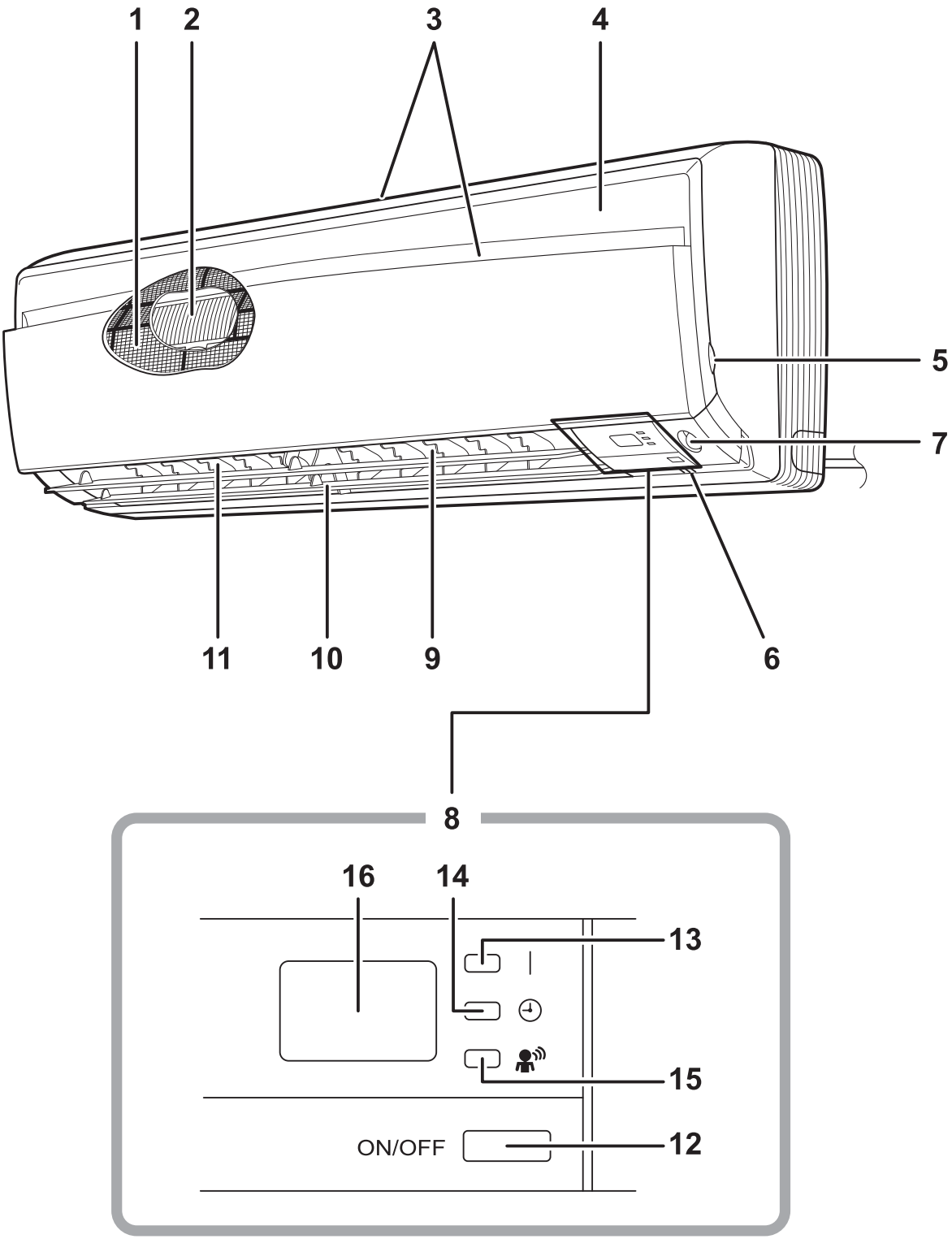
- For power supply, be sure to use a separate power circuit dedicated to the air conditioner.

System relocation.

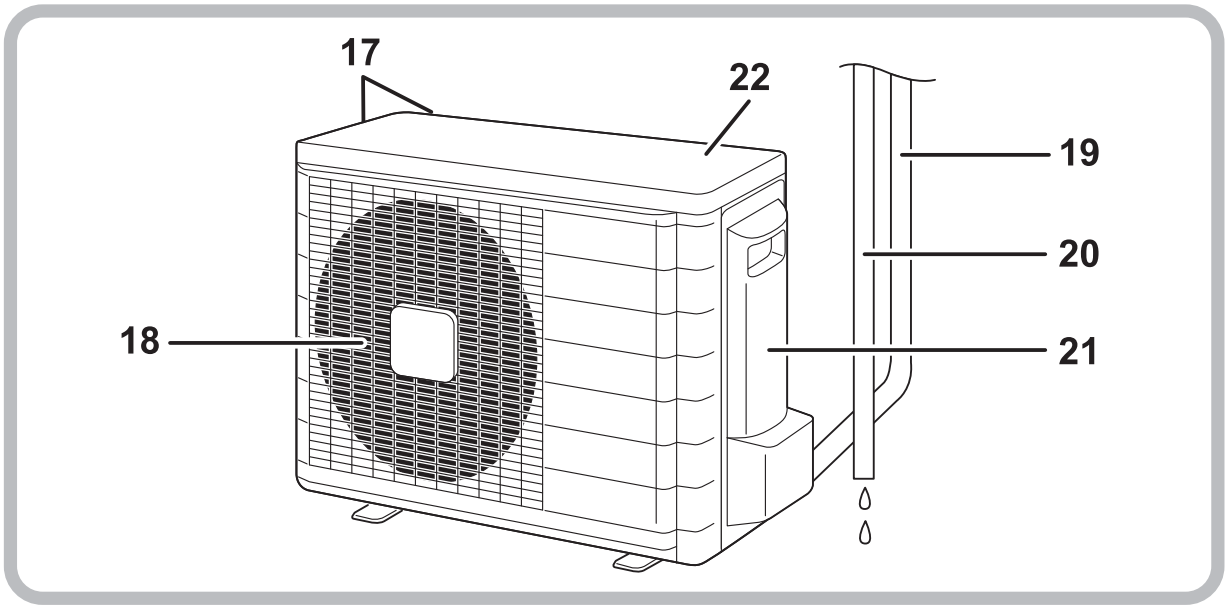
- Relocating the air conditioner requires specialized knowledge and skills. Please consult the dealer if relocation is necessary for moving or remodeling

Names of parts

■ Indoor Unit



■ Outdoor Unit



■ Indoor Unit

1. **Air filter**
2. **Titanium Apatite Photocatalytic Air-Purifying Filter:**
   - These filters are attached to the inside of the air filters.
3. **Air inlet**
4. **Front panel**
5. **Panel tab**
6. **Room temperature sensor:**
   - It senses the air temperature around the unit.
7. **INTELLIGENT EYE sensor:**
   - It detects the movements of people and automatically switches between normal operation and energy saving operation. (page 18.)
8. **Display**
9. **Air outlet**
10. **Flaps (horizontal blades):** (page 12.)
11. **Louvres (vertical blades):**
    - The louvres are inside of the air outlet. (page 13.)
12. **Indoor Unit ON/OFF switch:** (page 10.)
    - Push this switch once to start operation. Push once again to stop it.
    - The operation mode refers to the following table.

	Mode	Temperature setting	Air flow rate
FTK	COOL	22°C	AUTO
FTX	AUTO	25°C	AUTO

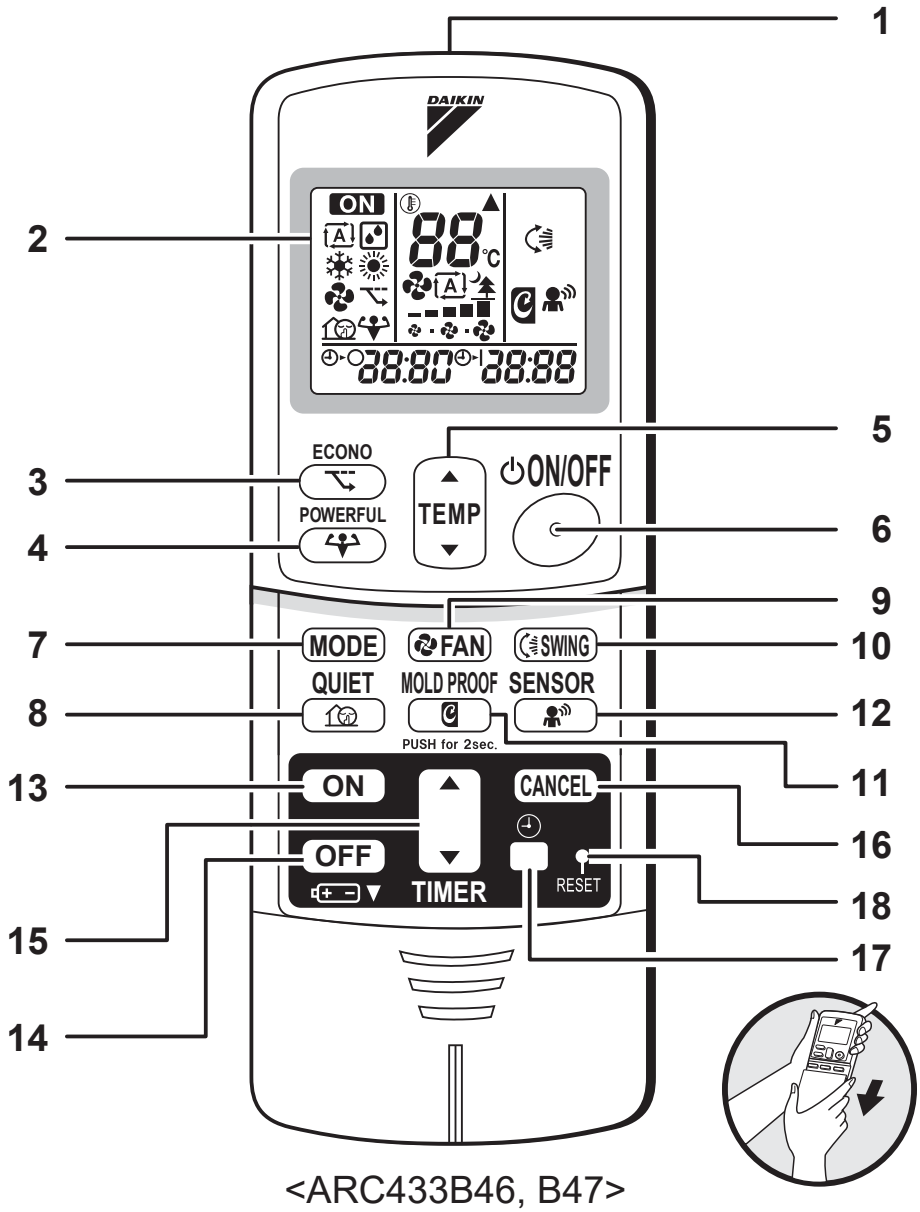
    - This switch is useful when the remote controller is missing.
13. **Operation lamp (green)**
14. **TIMER lamp (Yellow):** (page 20.)
15. **INTELLIGENT EYE lamp (green):** (page 18.)
16. **Signal receiver:**
    - It receives signals from the remote controller.
    - When the unit receives a signal, you will hear a short beep.
      - Operation start .....beep-beep
      - Settings changed.....beep
      - Operation stop .....beeeeep

■ Outdoor Unit

17. **Air inlet:** (Back and side)
18. **Air outlet**
19. **Refrigerant piping and inter-unit cable**
20. **Drain hose**
21. **Earth terminal:**
    - It is inside of this cover.
22. **Outside air temperature sensor:**
    - It senses the ambient temperature around the unit.

Appearance of the outdoor unit may differ from some models.

■ Remote Controller



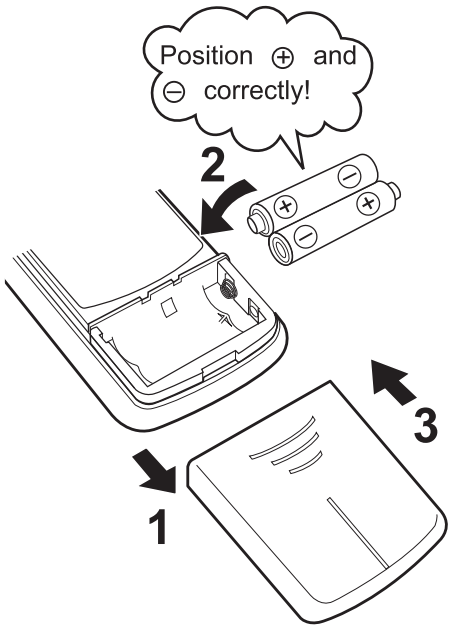
<ARC433B46, B47>

1. **Signal transmitter:**
   - It sends signals to the indoor unit.
2. **Display:**
   - It displays the current settings.
     (In this illustration, each section is shown with all its displays ON for the purpose of explanation.)
3. **ECONO button:**
   ECONO operation (page 16.)
4. **POWERFUL button:**
   POWERFUL operation (page 14.)
5. **TEMPERATURE adjustment buttons:**
   - It changes the temperature setting.
6. **ON/OFF button:**
   - Press this button once to start operation. Press once again to stop it.
7. **MODE selector button:**
   - It selects the operation mode. (AUTO/DRY/COOL/HEAT/FAN) (page 10.)
8. **QUIET button:** OUTDOOR UNIT QUIET operation (page 15.)
9. **FAN setting button:**
   - It selects the air flow rate setting.
10. **SWING button:** (page 12.)
11. **MOLD PROOF button:**
    - MOLD PROOF operation (page 17.)
12. **SENSOR button:** INTELLIGENT EYE operation (page 18.)
13. **ON TIMER button:** (page 21.)
14. **OFF TIMER button:** (page 20.)
15. **TIMER Setting button:**
    - It changes the time setting.
16. **TIMER CANCEL button:**
    - It cancels the timer setting.
17. **CLOCK button:** (page 9.)
18. **RESET button:**
    - Restart the unit if it freezes.
    - Use a thin object to push.

Preparation Before Operation

■ To set the batteries

1. **Slide the front cover to take it off.**
2. **Set two dry batteries (AAA).**
3. **Set the front cover as before.**



ATTENTION

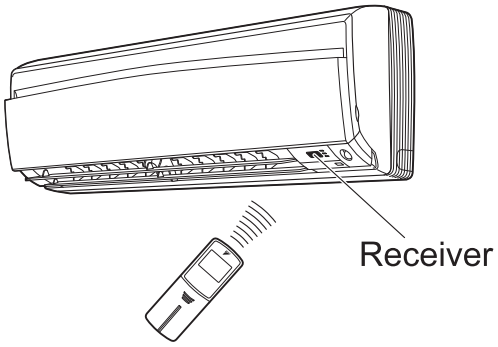
■ **About batteries**

- When replacing the batteries, use batteries of the same type, and replace the two old batteries together.
- When the system is not used for a long time, take the batteries out.
- We recommend replacing once a year, although if the remote controller display begins to fade or if reception deteriorates, please replace with new alkali batteries. Do not use manganese batteries.
- The attached batteries are provided for the initial use of the system.
  The usable period of the batteries may be short depending on the manufactured date of the air conditioner.

Preparation Before Operation

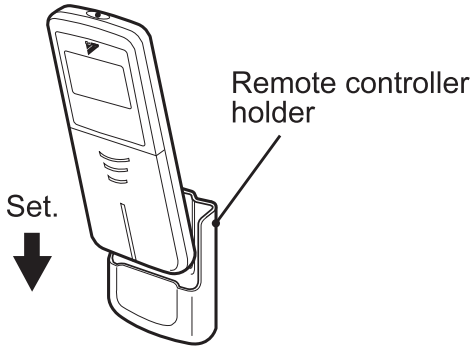
■ To operate the remote controller

- To use the remote controller, aim the transmitter at the indoor unit. If there is anything to block signals between the unit and the remote controller, such as a curtain, the unit will not operate.
- Do not drop the remote controller. Do not get it wet.
- The maximum distance for communication is about 7m.



■ To fix the remote controller holder on the wall

1. **Choose a place from where the signals reach the unit.**
2. **Fix the holder to a wall, a pillar, etc. with the screws supplied with the holder.**
3. **Place the remote controller in the remote controller holder.**



● To remove, pull it upwards.

ATTENTION

■ **About remote controller**

- Never expose the remote controller to direct sunlight.
- Dust on the signal transmitter or receiver will reduce the sensitivity. Wipe off dust with soft cloth.
- Signal communication may be disabled if an electronic-starter-type fluorescent lamp (such as inverter-type lamps) is in the room. Consult the shop if that is the case.
- If the remote control signals happen to operate another appliance, move that appliance to somewhere else, or consult the shop.

■ To set the clock

1. **Press “CLOCK button”.**

   0:00 is displayed.

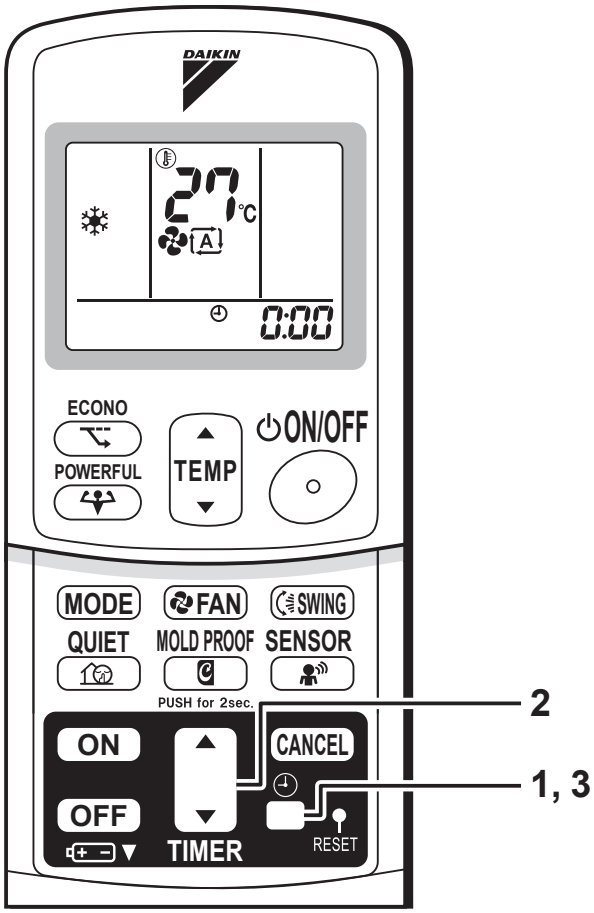
   ◷ blinks.

2. **Press “TIMER setting button” to set the clock to the present time.**

   Holding down “ ▲ ” or “ ▼ ” button rapidly increases or decreases the time display.

3. **Press “CLOCK button”.**

   : blinks.



■ Turn the breaker ON

- Turning ON the breaker opens the flap, then closes it again. (This is a normal procedure.)

NOTE

■ Tips for saving energy

- Be careful not to cool (heat) the room too much.
  Keeping the temperature setting at a moderate level helps save energy.
- Cover windows with a blind or a curtain.
  Blocking sunlight and air from outdoors increases the cooling (heating) effect.
- Clogged air filters cause inefficient operation and waste energy. Clean them once in about every two weeks.

Recommended temperature setting
For cooling:26°C – 28°C For heating:20°C – 24°C

■ Please note

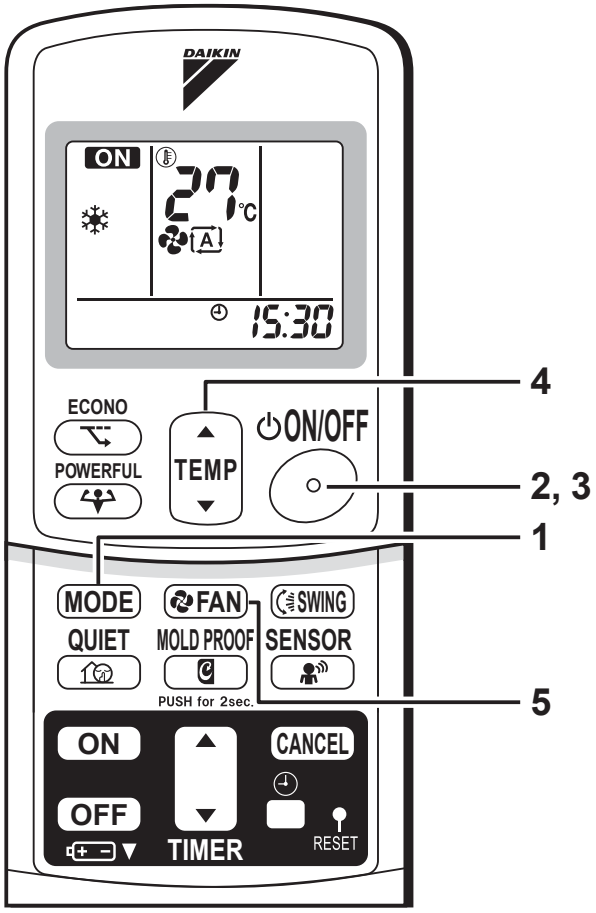
- The air conditioner always consumes 15-35 watts of electricity even while it is not operating.
- If you are not going to use the air conditioner for a long period, for example in spring or autumn, turn the breaker OFF.
- Use the air conditioner in the following conditions.

Mode	Operating conditions	If operation is continued out of this range
COOL	Outdoor temperature:10 to 46°C Indoor temperature: 18 to 32°C Indoor humidity: 80% max.	• A safety device may work to stop the operation. (In multi system, it may work to stop the operation of the outdoor unit only.) • Condensation may occur on the indoor unit and drip.
HEAT	Outdoor temperature:–10 to 20°C Indoor temperature: 10 to 30°C	• A safety device may work to stop the operation.
DRY	Outdoor temperature:10 to 46°C Indoor temperature: 18 to 32°C Indoor humidity: 80% max.	• A safety device may work to stop the operation. • Condensation may occur on the indoor unit and drip.

- Operation outside this humidity or temperature range may cause a safety device to disable the system.

AUTO · DRY · COOL · HEAT · FAN Operation

The air conditioner operates with the operation mode of your choice.
From the next time on, the air conditioner will operate with the same operation mode.



■ To start operation

1. Press “MODE selector button” and select a operation mode.

- Each pressing of the button advances the mode setting in sequence.

: AUTO

: DRY

: COOL

: HEAT

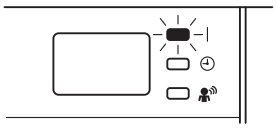
: FAN

<FTK>

<FTX>

2. Press “ON/OFF button” .

- The OPERATION lamp lights up.



■ To stop operation

3. Press “ON/OFF button” again.

- Then OPERATION lamp goes off.

■ To change the temperature setting

4. Press “TEMPERATURE adjustment button”.

DRY or FAN mode	AUTO or COOL or HEAT mode
The temperature setting is not variable.	Press “ ▲ ” to raise the temperature and press “ ▼ ” to lower the temperature.
	Set to the temperature you like. 

■ To change the air flow rate setting

5. Press “FAN setting button”.

DRY mode	AUTO or COOL or HEAT or FAN mode
The air flow rate setting is not variable.	Five levels of air flow rate setting from “ ” to “ ” plus “ ” “ ” are available. 

- Indoor unit quiet operation

  When the air flow is set to “ ”, the noise from the indoor unit will become quieter. Use this when making the noise quieter.

  The unit might lose capacity when the air flow rate is set to a weak level.

NOTE

■ **Note on HEAT operation**
- Since this air conditioner heats the room by taking heat from outdoor air to indoors, the heating capacity becomes smaller in lower outdoor temperatures. If the heating effect is insufficient, it is recommended to use another heating appliance in combination with the air conditioner.
- The heat pump system heats the room by circulating hot air around all parts of the room. After the start of heating operation, it takes some time before the room gets warmer.
- In heating operation, frost may occur on the outdoor unit and lower the heating capacity. In that case, the system switches into defrosting operation to take away the frost.
- During defrosting operation, hot air does not flow out of indoor unit.

■ **Note on COOL operation**
- This air conditioner cools the room by blowing the hot air in the room outside, so if the outside temperature is high, performance drops.

■ **Note on DRY operation**
- The computer chip works to rid the room of humidity while maintaining the temperature as much as possible. It automatically controls temperature and fan strength, so manual adjustment of these functions is unavailable.

■ **Note on AUTO operation**
- In AUTO operation, the system selects an appropriate operation mode (COOL or HEAT) based on the room temperature at the start of the operation.
- The system automatically reselects setting at a regular interval to bring the room temperature to user-setting level.
- If you do not like AUTO operation, you can manually select the operation mode and setting you like.

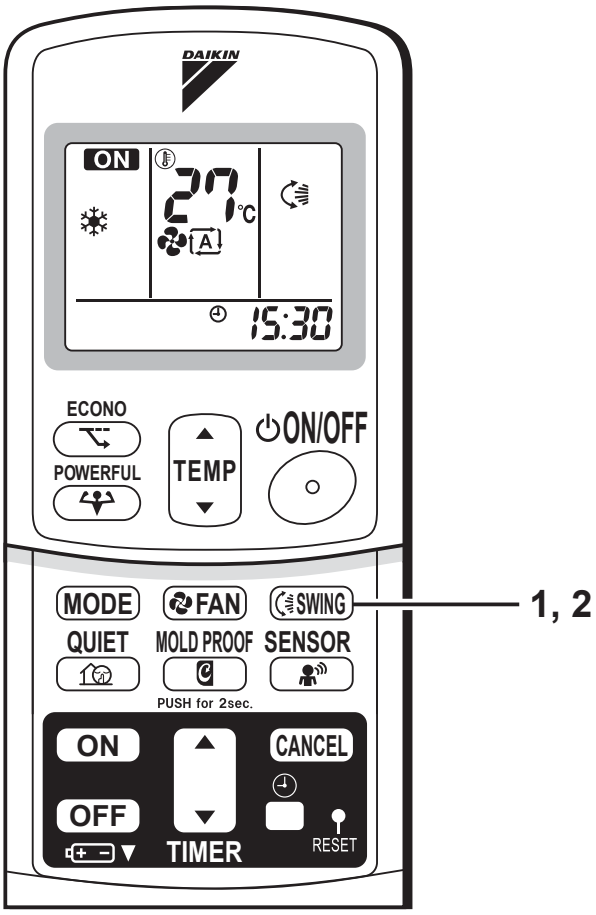
■ **Note on air flow rate setting**
- At smaller air flow rates, the cooling (heating) effect is also smaller.

Adjusting the Air Flow Direction

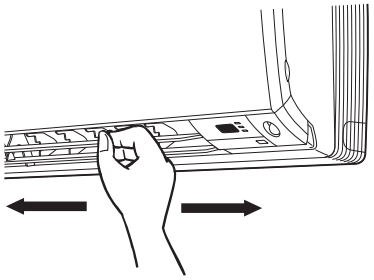
You can adjust the air flow direction to increase your comfort.

■ To adjust the horizontal blades (flaps)

1. **Press “SWING button”.**
   - “ ” is displayed on the LCD and the flaps will begin to swing.
2. **When the flaps have reached the desired position, press “SWING button” once more.**
   - The flaps will stop moving.
   - “ ” disappears from the LCD.



■ To adjust the vertical blades (louvres)

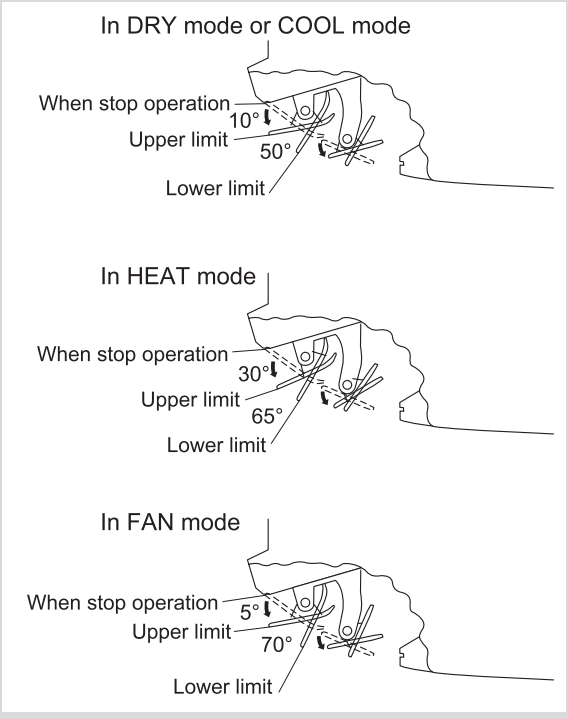


Hold the knob and move the louvres.
(You will find a knob on the left-side and the right-side blades.)

- When the unit is installed in the corner of a room, the direction of the louvers should be facing away from the wall.
  If they face the wall, the wall will block off the wind, causing the cooling (or heating) efficiency to drop.

Notes on flaps and louvres angles

- When " **SWING button** " is selected, the flaps swinging range depends on the operation mode. (See the figure.)
- If the unit is operated after being stopped with the flaps pointed down in cooling or dry operation, the flaps will automatically move to a horizontal position after about one hour to prevent condensation from forming on them.

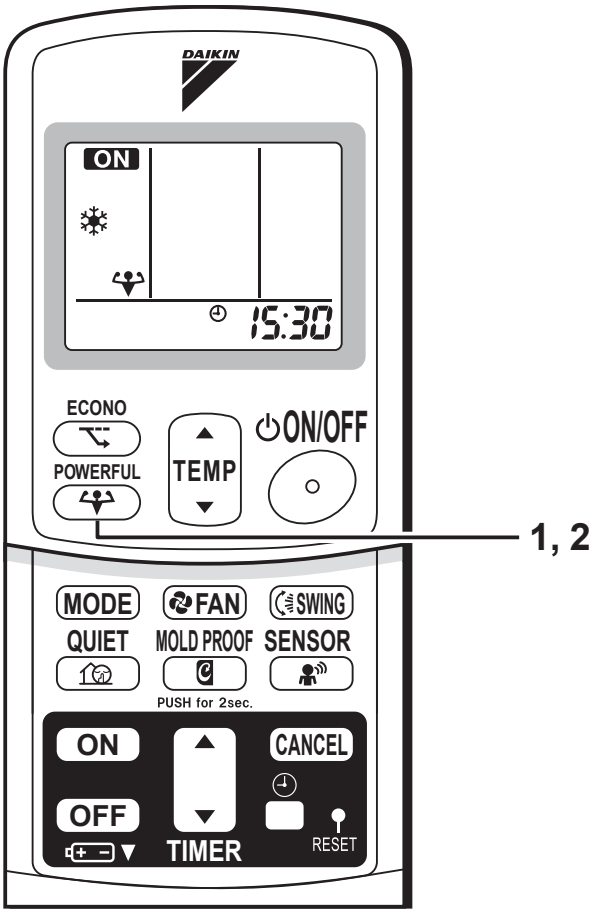


■ **ATTENTION**

- Always use a remote controller to adjust the flaps angle. If you attempt to move it forcibly with hand when it is swinging, the mechanism may be broken.
- Be careful when adjusting the louvres. Inside the air outlet, a fan is rotating at a high speed.

POWERFUL Operation

POWERFUL operation quickly maximizes the cooling (heating) effect in any operation mode. You can get the maximum capacity .



■ To start POWERFUL operation

1. **Press “POWERFUL button”.**
   - POWERFUL operation ends in 20 minutes. Then the system automatically operates again with the settings which were used before POWERFUL operation.
   - When using POWERFUL operation, there are some functions which are not available.
   - “ ” is displayed on the LCD.

■ To cancel POWERFUL operation

2. **Press “POWERFUL button” again.**
   - “ ” disappears from the LCD.

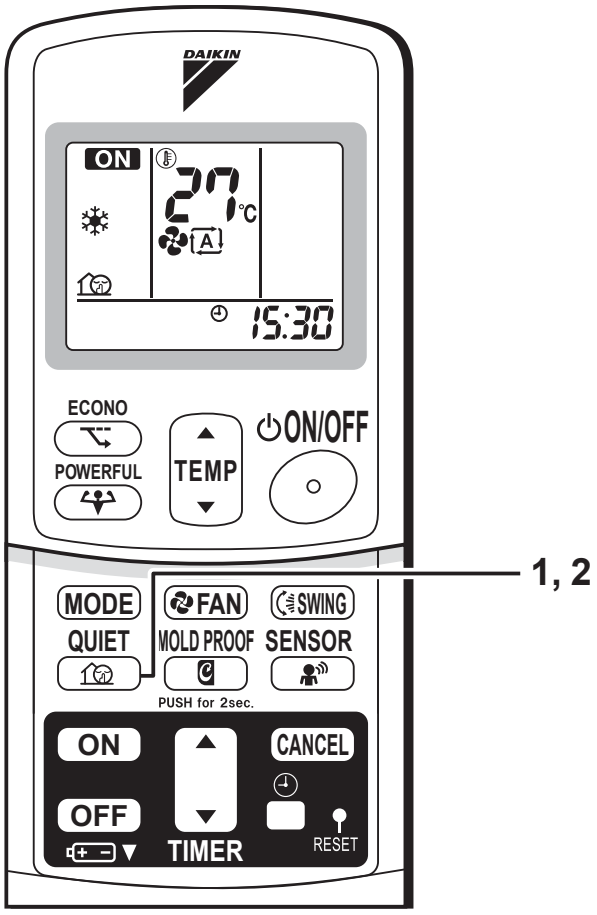
NOTE

■ **Notes on POWERFUL operation**

- POWERFUL Operation cannot be used together with ECONO or QUIET Operation. Priority is given to the function of whichever button is pressed last.
- POWERFUL Operation can only be set when the unit is running. Pressing the operation stop button causes the settings to be canceled, and the “ ” disappears from the LCD.
- **In COOL and HEAT mode**
  To maximize the cooling (heating) effect, the capacity of outdoor unit must be increased and the air flow rate be fixed to the maximum setting.
  The temperature and air flow settings are not variable.
- **In DRY mode**
  The temperature setting is lowered by 2.5°C and the air flow rate is slightly increased.
- **In FAN mode**
  The air flow rate is fixed to the maximum setting.
- **When using priority-room setting**
  See “Note for multi system”. (page 22.)

OUTDOOR UNIT QUIET Operation

OUTDOOR UNIT QUIET operation lowers the noise level of the outdoor unit by changing the frequency and fan speed on the outdoor unit. This function is convenient during night.



■ To start OUTDOOR UNIT QUIET operation

1. **Press "QUIET button".**
   - " " is displayed on the LCD.

■ To cancel OUTDOOR UNIT QUIET operation

2. **Press "QUIET button" again.**
   - " " disappears from the LCD.

NOTE

■ **Note on OUTDOOR UNIT QUIET operation**

- If using a multi system, this function will work only when the OUTDOOR UNIT QUIET operation is set on all operated indoor units.
- This function is available in COOL, HEAT, and AUTO modes. (This is not available in FAN and DRY mode.)
- POWERFUL operation and OUTDOOR UNIT QUIET operation cannot be used at the same time. Priority is given to the function of whichever button is pressed last.

ECONO Operation

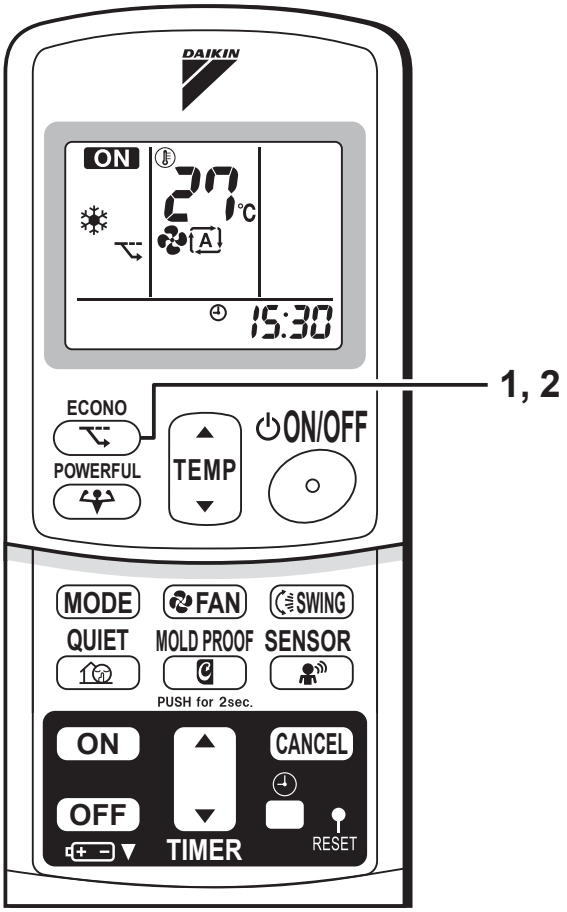
ECONO operation is a function which enables efficient operation by lowering the maximum power consumption value.

■ To start ECONO operation

1. **Press “ECONO button” .**
   - “ ⌥ ” is displayed on the LCD.

■ To cancel ECONO operation

2. **Press “ECONO button” again.**
   - “ ⌥ ” disappears from the LCD.



NOTE

- ECONO Operation can only be set when the unit is running. Pressing the operation stop button causes the settings to be canceled, and the “ ⌥ ” disappears from the LCD.
- ECONO operation is a function which enables efficient operation by limiting the power consumption of the outdoor unit (operating frequency).
- ECONO operation functions in AUTO, COOL, DRY, and HEAT modes.
- POWERFUL operation and ECONO operation cannot be used at the same time. Priority is given to the function of whichever button is pressed last.
- Power consumption may not drop even if ECONO operation is used, when the level of power consumption is already low.

MOLD PROOF Operation

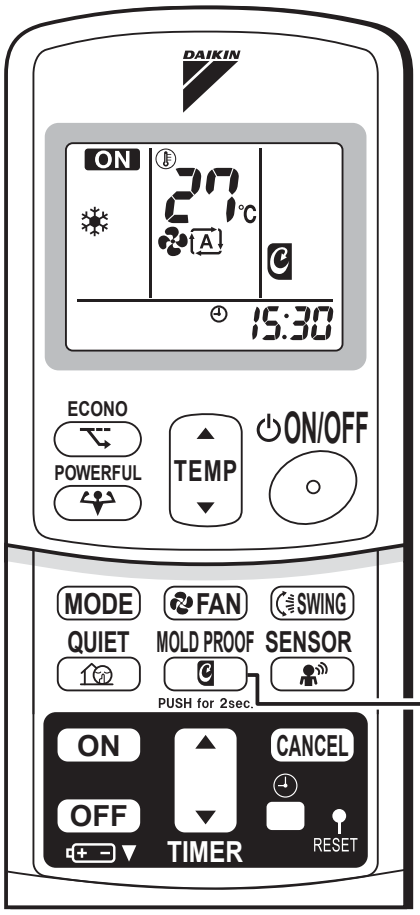
MOLD PROOF operation is a function which reduces the spread of mold by using Fan mode to lower the humidity inside the indoor unit.

■ To set MOLD PROOF operation

1. **Press and hold the MOLD PROOF button for two seconds.**
   - "C" is displayed on the LCD.

■ To cancel MOLD PROOF operation

2. **Press and hold the MOLD PROOF button for two seconds one more time.**
   - "C" disappears from the LCD.

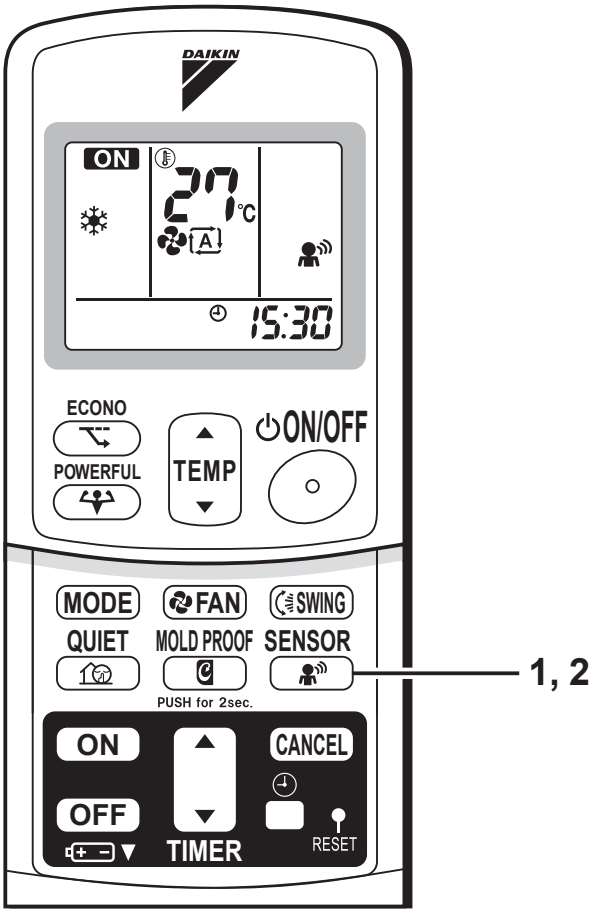


NOTE

- MOLD PROOF operation will operate for approximately one hour after dry or cooling mode is turned off.
- This function is not designed to remove existing dust or mold.
- MOLD PROOF operation is not available when the unit is turned off using the OFF TIMER.

INTELLIGENT EYE Operation

"INTELLIGENT EYE" is the infrared sensor which detects the human movement.



■ To start INTELLIGENT EYE operation

1. **Press "SENSOR button".**
   - "" is displayed on the LCD.

■ To cancel the INTELLIGENT EYE operation

2. **Press "SENSOR button" again.**
   - "" disappears from the LCD.

[EX.]

When somebody in the room

- **Normal operation**

⇩

When nobody in the room

- **20 min. after, start energy saving operation.**

⇩

Somebody back in the room

- **Back to normal operation.**

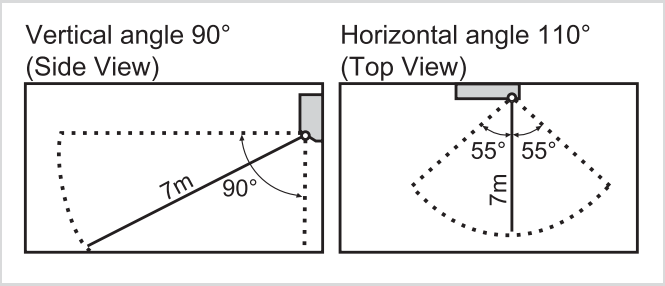
“INTELLIGENT EYE” is useful for Energy Saving

■ **Energy saving operation**

- Change the temperature –2°C in heating / +2°C in cooling / +2°C in dry mode from set temperature.
- Decrease the air flow rate slightly in fan operation. (In FAN mode only)

Notes on “INTELLIGENT EYE”

- Application range is as follows.



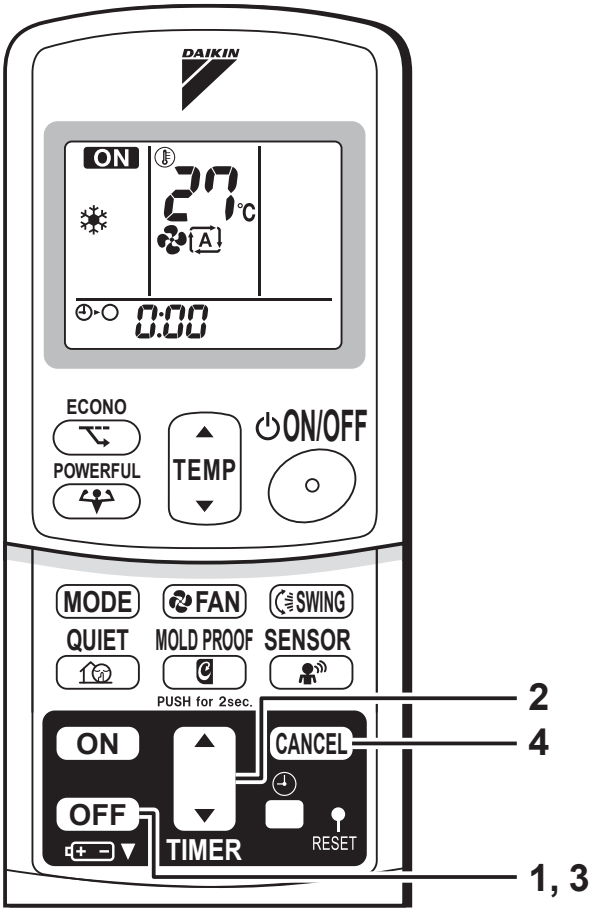
- Sensor may not detect moving objects further than 7m away. (Check the application range)
- Sensor detection sensitivity changes according to indoor unit location, the speed of passersby, temperature range, etc.
- The sensor also mistakenly detects pets, sunlight, fluttering curtains and light reflected off of mirrors as passersby.
- INTELLIGENT EYE operatipon will not go on during powerful operation.
- Night set mode (page 20.) will not go on during you use INTELLIGENT EYE operation.

⚠ CAUTION

- Do not place large objects near the sensor.
  Also keep heating units or humidifiers outside the sensor’s detection area. This sensor can detect objects it shouldn’t as well as not detect objects it should.
- Do not hit or violently push the INTELLIGENT EYE sensor. This can lead to damage and malfunction.

TIMER Operation

Timer functions are useful for automatically switching the air conditioner on or off at night or in the morning. You can also use OFF TIMER and ON TIMER in combination.



■ To use OFF TIMER operation

- Check that the clock is correct.
  If not, set the clock to the present time. (page 9.)

1. Press “OFF TIMER button”.

0:00 is displayed.

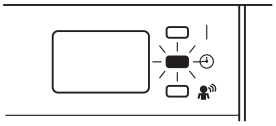
⏲ blinks.

2. Press “TIMER Setting button” until the time setting reaches the point you like.

- Every pressing of either button increases or decreases the time setting by 10 minutes. Holding down either button changes the setting rapidly.

3. Press “OFF TIMER button” again.

- The TIMER lamp lights up.



■ To cancel the OFF TIMER operation

4. Press “CANCEL button”.

- The TIMER lamp goes off.

NOTE

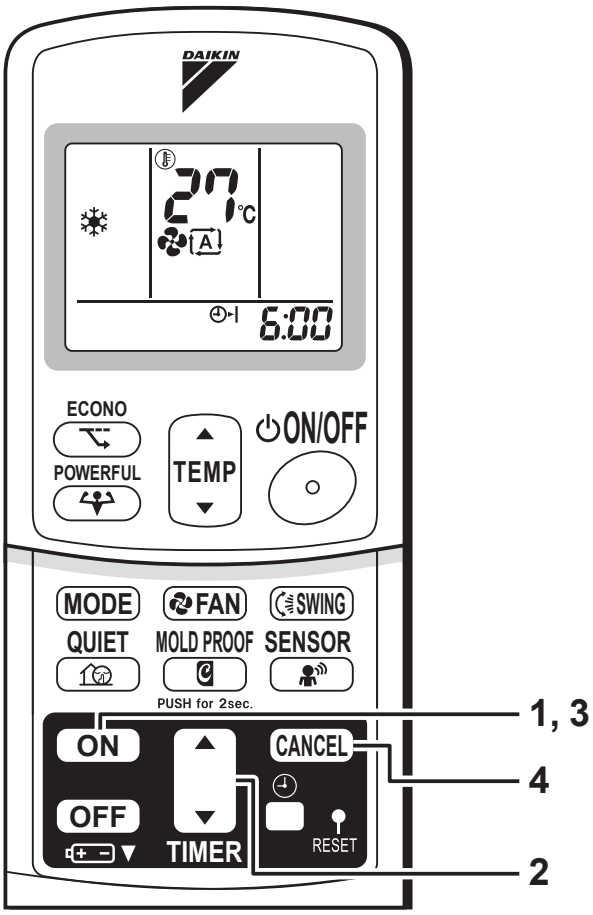
- When TIMER is set, the present time is not displayed.
- Once you set ON, OFF TIMER, the time setting is kept in the memory. (The memory is canceled when remote controller batteries are replaced.)
- When operating the unit via the ON/OFF Timer, the actual length of operation may vary from the time entered by the user. (Maximum approx. 10 minutes)

■ NIGHT SET MODE

When the OFF TIMER is set, the air conditioner automatically adjusts the temperature setting (0.5°C up in COOL, 2.0°C down in HEAT) to prevent excessive cooling (heating) for your pleasant sleep.

■ To use ON TIMER operation

- Check that the clock is correct. If not, set the clock to the present time (page 9.).



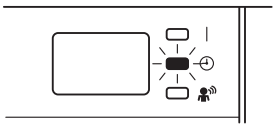
1. **Press “ON TIMER button”.**

   6:00 is displayed.

   ⏲▸| blinks.

2. **Press “TIMER Setting button” until the time setting reaches the point you like.**
   - Every pressing of either button increases or decreases the time setting by 10 minutes. Holding down either button changes the setting rapidly.

3. **Press “ON TIMER button” again.**
   - The TIMER lamp lights up.



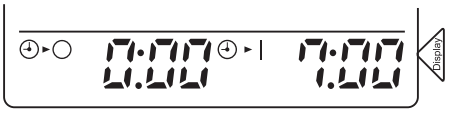
■ To cancel ON TIMER operation

4. **Press “CANCEL button”.**
   - The TIMER lamp goes off.

■ To combine ON TIMER and OFF TIMER

- A sample setting for combining the two timers is shown below.

(Example)
Present time: 11:00 p.m.
(The unit operating)
OFF TIMER at 0:00 a.m.
ON TIMER at 7:00 a.m.
) Combined



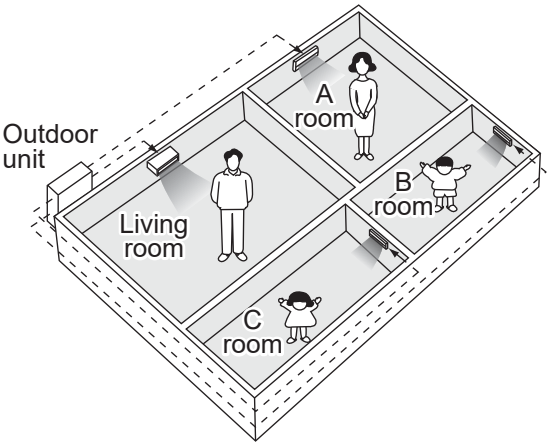
ATTENTION

■ In the following cases, set the timer again.
- After a breaker has turned OFF.
- After a power failure.
- After replacing batteries in the remote controller.

Note for Multi System

〈〈 What is a "Multi System"? 〉〉

This system has one outdoor unit connected to multiple indoor units.



■ Selecting the Operation Mode

1. With the Priority Room Setting present but inactive or not present.

When more than one indoor unit is operating, priority is given to the first unit that was turned on.
In this case, set the units that are turned on later to the same operation mode (*1) as the first unit.
Otherwise, they will enter the Standby Mode, and the operation lamp will flash; this does not indicate malfunction.

(*1)

- COOL, DRY and FAN mode may be used at the same time.
- AUTO mode automatically selects COOL mode or HEAT mode based on the room temperature. Therefore, AUTO mode is available when selecting the same operation mode as that of the room with the first unit to be turned on.

〈CAUTION〉

Normally, the operation mode in the room where the unit is first run is given priority, but the following situations are exceptions, so please keep this in mind.
If the operation mode of the first room is **FAN Mode**, then using **Heating Mode** in any room after this will give priority to **heating.** In this situation, the air conditioner running in FAN Mode will go on standby, and the operation lamp will flash.

2. With the Priority Room Setting active.

See "Priority Room Setting" on the next page.

■ NIGHT QUIET Mode (Available only for cooling operation)

NIGHT QUIET Mode requires initial programming during installation. Please consult your retailer or dealer for assistance. NIGHT QUIET Mode reduces the operation noise of the outdoor unit during the night time hours to prevent annoyance to neighbors.

- The NIGHT QUIET Mode is activated when the temperature drops 5°C or more below the highest temperature recorded that day. Therefore, when the temperature difference is less than 5°C, this function will not be activated.
- NIGHT QUIET Mode reduces slightly the cooling efficiency of the unit.

■ OUTDOOR UNIT QUIET Operation (page 15.)

1. With the Priority Room Setting present but inactive or not present.

When using the OUTDOOR UNIT QUIET operation feature with the Multi system, set all indoor units to OUTDOOR UNIT QUIET operation using their remote controllers.
When clearing OUTDOOR UNIT QUIET operation, clear one of the operating indoor units using their remote controller. However OUTDOOR UNIT QUIET operation display remains on the remote controller for other rooms. We recommend you release all rooms using their remote controllers.

2. With the Priority Room Setting active.

See "Priority Room Setting" on the next page.

■ Cooling / Heating Mode Lock (Available only for heat pump models)

The Cooling / Heating Mode Lock requires initial programming during installation.Please consult your retailer or dealer for assistance. The Cooling / Heating Mode Lock sets the unit forcibly to either Cooling or Heating Mode. This function is convenient when you wish to set all indoor units connected to the Multi system to the same operation mode.

■ Priority Room Setting

The Priority Room Setting requires initial programming during installation. Please consult your retailer or dealer for assistance.

The room designated as the Priority Room takes priority in the following situations;

1. Operation Mode Priority.

As the operation mode of the Priority Room takes precedence, the user can select a different operation mode from other rooms.

〈Example〉

* Room A is the Priority Room in the examples.

When COOL mode is selected in Room A while operating the following modes in Room B,C and D :

Operation mode in Room B, C and D	Status of Room B, C and D when the unit in Room A is in COOL mode
COOL or DRY or FAN	Current operation mode maintained
HEAT	The unit enters Standby Mode. Operation resumes when the Room A unit stops operating.
AUTO	If the unit is set to COOL mode, operation continues. If set to HEAT mode, it enters Standby Mode. Operation resumes when the Room A unit stops operating.

2. Priority when POWERFUL operation is used.

〈Example〉

* Room A is the Priority Room in the examples.

The indoor units in Rooms A,B,C and D are all operating. If the unit in Room A enters POWERFUL operation, operation capacity will be concentrated in Room A. In such a case, the cooling (heating) efficiency of the units in Rooms B,C and D may be slightly reduced.

3. Priority when using OUTDOOR UNIT QUIET operation.

〈Example〉

* Room A is the Priority Room in the examples.

Just by setting the unit in Room A to QUIET operation, the air conditioner starts OUTDOOR UNIT QUIET operation.

You don’t have to set all the operated indoor units to QUIET operation.

Care and Cleaning

⚠ CAUTION **Before cleaning, be sure to stop the operation and turn the breaker OFF.**

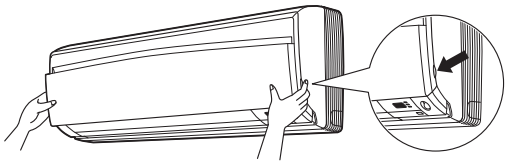
Units

■ Indoor unit, Outdoor unit and Remote controller

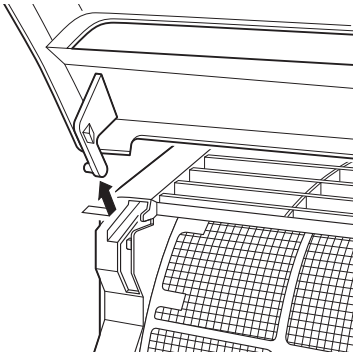
1. **Wipe them with dry soft cloth.**

■ Front panel

1. **Open the front panel.**
   - Hold the panel by the tabs on the two sides and lift it unitl it stops with a click.

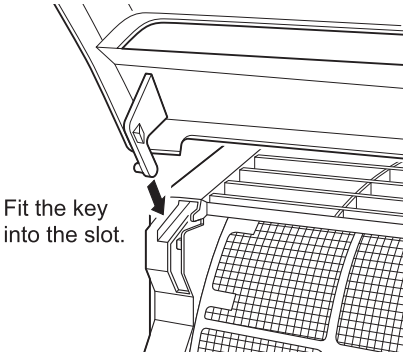


2. **Remove the front panel.**
   - Lift the front panel up, slide it slightly to the right, and remove it from the horizontal axle.



3. **Clean the front panel.**
   - Wipe it with a soft cloth soaked in water.
   - Only neutral detergent may be used.
   - In case of washing the panel with water, dry it with cloth, dry it up in the shade after washing.

4. **Attach the front panel.**
   - Set the 2 keys of the front panel into the slots and push them in all the way.
   - Close the front panel slowly and push the panel at the 3 points.
     (1 on each side and 1 in the middle.)

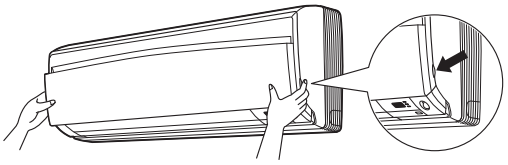


⚠ CAUTION

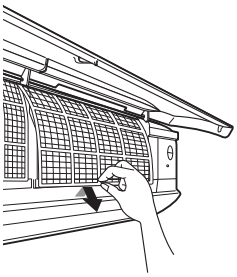
- Don't touch the metal parts of the indoor unit. If you touch those parts, this may cause an injury.
- When removing or attaching the front panel, use a robust and stable stool and watch your steps carefully.
- When removing or attaching the front panel, support the panel securely with hand to prevent it from falling.
- For cleaning, do not use hot water above 40°C, benzine, gasoline, thinner, nor other volatile oils, polishing compound, scrubbing brushes, nor other hand stuff.
- After cleaning, make sure that the front panel is securely fixed.

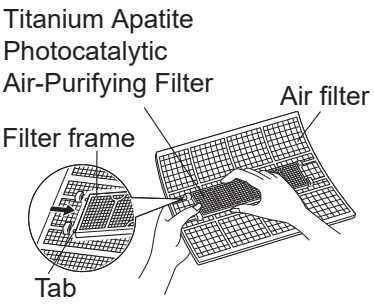
Filters

1. **Open the front panel. (page 24.)**
2. **Pull out the air filters.**
   - Push a little upwards the tab at the center of each air filter, then pull it down.

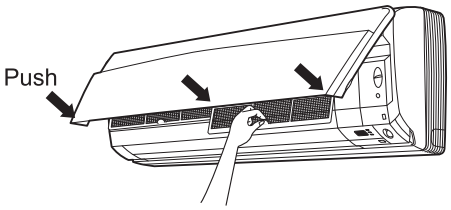


3. **Take off the Titanium Apatite Photocatalytic Air-Purifying Filter.**
   - Hold the recessed parts of the frame and unhook the four claws.
4. **Clean or replace each filter.**
   See figure.



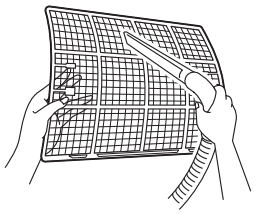


5. **Set the air filter and Titanium Apatite Photocatalytic Air-Purifying Filter as they were and close the front panel.**
   - Insert claws of the filters into slots of the front panel. Close the front panel slowly and push the panel at the 3 points. (1 on each side and 1 in the middle.)

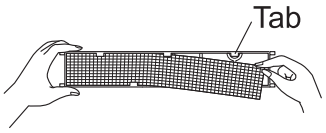


■ Air Filter

1. **Wash the air filters with water or clean them with vacuum cleaner.**
   - If the dust does not come off easily, wash them with neutral detergent thinned with lukewarm water, then dry them up in the shade.
   - It is recommended to clean the air filters every two weeks.



■ Titanium Apatite Photocatalytic Air-Purifying Filter.



The Titanium Apatite Photocatalytic Air-Purifying Filter can be renewed by washing it with water once every 6 months. We recommend replacing it once every 3 years.

[Maintenance]

1. **Remove dust with a vacuum cleaner and wash lightly with water.**
2. **If it is very dirty, soak it for 10 to 15 minutes in water mixed with a neutral cleaning agent.**
3. **Do not remove filter from frame when washing with water.**
4. **After washing, shake off remaining water and dry in the shade.**
5. **Since the material is made out of paper, do not wring out the filter when removing water from it.**

[Replacement]

1. **Remove the tabs on the filter frame and replace with a new filter.**
   - Dispose of the old filter as flammable waste.

NOTE

- Operation with dirty filters:
  (1) cannot deodorize the air. (2) cannot clean the air.
  (3) results in poor heating or cooling. (4) may cause odour.
- To order Titanium Apatite Photocatalytic Air-Purifying Filter contact to the service shop there you bought the air conditioner.
- Dispose of old filters as burnable waste.

Item	Part No.
Titanium Apatite Photocatalytic Air-Purifying Filter. (without frame) 1 set	KAF970A46

Check

Check that the base, stand and other fittings of the outdoor unit are not decayed or corroded.
Check that nothing blocks the air inlets and the outlets of the indoor unit and the outdoor unit.
Check that the drain comes smoothly out of the drain hose during COOL or DRY operation. • If no drain water is seen, water may be leaking from the indoor unit. Stop operation and consult the service shop if this is the case.

■ Before a long idle period

1. **Operate the “Fan only” for several hours on a fine day to dry out the inside.**
   - Press “MODE selector button” and select “Fan”operation.
   - Press “ON/OFF button” and start operation.
2. **After operation stops, turn off the breaker for the room air conditioner.**
3. **Clean the air filters and set them again.**
4. **Take out batteries from the remote controller.**
   - When a multi outdoor unit is connected, make sure the heating operation is not used at the other room before you use the fan operation. (page 22.)

Trouble Shooting

These cases are not troubles.

The following cases are not air conditioner troubles but have some reasons. You may just continue using it.

Case	Explanation
Operation does not start soon. • When ON/OFF button was pressed soon after operation was stopped. • When the mode was reselected.	• This is to protect the air conditioner. You should wait for about 3 minutes.
Hot air does not flow out soon after the start of heating operation.	• The air conditioner is warming up. You should wait for 1 to 4 minutes. (The system is designed to start discharging air only after it has reached a certain temperature.)
The heating operation stops suddenly and a flowing sound is heard.	• The system is taking away the frost on the outdoor unit. You should wait for about 3 to 8 minutes.
The outdoor unit emits water or steam.	■ In HEAT mode • The frost on the outdoor unit melts into water or steam when the air conditioner is in defrost operation. ■ In COOL or DRY mode • Moisture in the air condenses into water on the cool surface of outdoor unit piping and drips.
Mist comes out of the indoor unit.	■ This happens when the air in the room is cooled into mist by the cold air flow during cooling operation.
The indoor unit gives out odour.	■ This happens when smells of the room, furniture, or cigarettes are absorbed into the unit and discharged with the air flow. (If this happens, we recommend you to have the indoor unit washed by a technician. Consult the service shop where you bought the air conditioner.)
The outdoor fan rotates while the air conditioner is not in operation.	■ After operation is stopped: • The outdoor fan continues rotating for another 60 seconds for system protection. ■ While the air conditioner is not in operation: • When the outdoor temperature is very high, the outdoor fan starts rotating for system protection.
The operation stopped suddenly. (OPERATION lamp is on.)	■ For system protection, the air conditioner may stop operating on a sudden large voltage fluctuation. It automatically resumes operation in about 3 minutes.

Check again.

Please check again before calling a repair person.

Case	Check
The air conditioner does not operate. (OPERATION lamp is off.)	• Hasn't a breaker turned OFF or a fuse blown? • Isn't it a power failure? • Are batteries set in the remote controller? • Is the timer setting correct?
Cooling (Heating) effect is poor.	• Are the air filters clean? • Is there anything to block the air inlet or the outlet of the indoor and the outdoor units? • Is the temperature setting appropriate? • Are the windows and doors closed? • Are the air flow rate and the air direction set appropriately? • Is the unit set to the INTELLIGENT EYE mode? (page 18.)
Operation stops suddenly. (OPERATION lamp flashes.)	• Are the air filters clean? • Is there anything to block the air inlet or the outlet of the indoor and the outdoor units? Clean the air filters or take all obstacles away and turn the breaker OFF. Then turn it ON again and try operating the air conditioner with the remote controller. If the lamp still flashes, call the service shop where you bought the air conditioner. • Are operation modes all the same for indoor units connected to outdoor units in the **multi system?** If not, set all indoor units to the same operation mode and confirm that the lamps flash. Moreover, when the operation mode is in "AUTO", set all indoor unit operation modes to "COOL" or "HEAT" for a moment and check again that the lamps are normal. If the lamps stop flashing after the above steps, there is no malfunction. (page 22.)
An abnormal functioning happens during operation.	• The air conditioner may malfunction with lightning or radio waves. Turn the breaker OFF, turn it ON again and try operating the air conditioner with the remote controller.

Call the service shop immediately.

⚠ WARNING

■ When an abnormality (such as a burning smell) occurs, stop operation and turn the breaker OFF.
Continued operation in an abnormal condition may result in troubles, electric shocks or fire.
Consult the service shop where you bought the air conditioner.

■ Do not attempt to repair or modify the air conditioner by yourself.
Incorrect work may result in electric shocks or fire.
Consult the service shop where you bought the air conditioner.

If one of the following symptoms takes place, call the service shop immediately.

■ **The power cord is abnormally hot or damaged.** ■ **An abnormal sound is heard during operation.** ■ **The safety breaker, a fuse, or the earth leakage breaker cuts off the operation frequently.** ■ **A switch or a button often fails to work properly.** ■ **There is a burning smell.** ■ **Water leaks from the indoor unit.**	▶ Turn the breaker OFF and call the service shop.

■ After a power failure The air conditioner automatically resumes operation in about 3 minutes. You should just wait for a while.	■ Lightning If lightning may strike the neighbouring area, stop operation and turn the breaker OFF for system protection.

We recommend periodical maintenance.

In certain operating conditions, the inside of the air conditioner may get foul after several seasons of use, resulting in poor performance. It is recommended to have periodical maintenance by a specialist aside from regular cleaning by the user. For specialist maintenance, contact the service shop where you bought the air conditioner.
The maintenance cost must be born by the user.

MEMO

MEMO

MEMO

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Minato-ku, Tokyo, 108-0075 Japan
http://www.daikin.com/global/

Two-dimensional bar code is a code for manufacturing.

3.5. Mechanical Ventilation System

3.5.1. System Description

(i) E&M plant room or Equipment Rooms

Equipment Rooms including Chiller Plantroom, CHP room, Reclaimed Water System Room, Black & Gray Water System F.S. Pump Room, PD tank & Pump Room and etc. are mechanically ventilated by extract air fans controlled by thermostats completed with by-pass switches. Make-up is drawn in naturally through external louvers or door louvres except Chiller Plantroom, F.S. Pump Room and PD Tank & Pump Room where fresh air intake fan are provided.

(ii) Eco-toilet, Baby Care Room, and Pantry

Eco-Toilet 1, Baby Care Room and Pantry shall be ventilated by exhaust fans.

(iii) Eco-Office, Exhibition Area, Display Area, Multi-purpose Room, Air Tree

Ceiling fans are provided to enhance air movement and indoor thermal quality.

3.5.2. Ventilation Fan

3.5.2.3. Operation Instruction

(i) Preliminary Check

- Fans should rotate freely and in correct direction.
- For centrifugal fans, check drive belts/pulley alignment and tensioning of belt.
- Check the electrical wiring termination is correct and electrical connections are tight at the terminals.
- Check the associated dampers are set properly. The indication markets on the end of each damper shaft are aligned with the damper blade position. Ensure all dampers are closed before start-up.
- Switch the “Manual/Off/Auto” selection in the “Manual” position on the MCP.
- Release the emergency stop button and press the “On” button of the ventilation fan on the MCP panel.
- Check that the running ampere is within the design full load current.
- Check if there is no unusual noise or vibration transmitted from the equipment.

(ii) Manual Operation Procedures

1. To switch the AOM selector to “Manual” position on the LMCP.
2. Press “START” button in LMCP to operate the fan and the blue light (running status) is ON.
3. To shut down the fan, press “STOP” in the MCP and the blue light (running status) is OFF.

(iii) Automatic Mode Operation Procedures

1. To switch the AOM selection of the ventilation to “Auto” position and it will be operated in accordance with the preset time schedule.

2. Refer to BMS O&M manual for detail procedure.

3.5.2.4. Maintenance Instruction & Schedule

No maintenance work should be carried out without isolating the fan and its controls form electrical supply and allowing the impeller to come to rest.

(i) Monthly
- Check for unusual noise and vibration of fans and motors.
- Check conditions of flexible connections if necessary.
- Check pulley, belt wear and tension for centrifugal fan.
- For centrifugal fan, re-grease bearings if necessary.
- Clean impeller if necessary.

When cleaning the fan, high-pressure cleaning or strong dissolvent must not be used. Cleaning should be done without dislodging or damaging the impeller.

(ii) Quarterly
- Visually observe general condition and report.
- Note any abnormal noise.
- Observe any high temperature on moving part.
- Clean corrosion and touch-up paint.
- Ensure fan mounting is secured.
- Check flexible connections for leakage.
- Lubricate all lubrication points.

(iii) Half Yearly
- If the fan is exposed to the weather then both the internal and external surface should be checked for deterioration of finishes.
- To check the fan impellers are balanced it is essential that they are thoroughly inspected and all parts removed and checked for wear.

3.5.3. Ceiling Fan

(Please refer to Operation and Maintenance Manual from Big Ass Fans)

64 Operating the Fan

Heating Season

For maximum energy savings, Big Ass Fans should be operated continuously during the heating season and should not be operated in reverse (clockwise). Big Ass Fans are designed to operate efficiently at very low speeds, so turning the fan very slowly in the forward direction (counterclockwise) will provide enough air movement to circulate the hot air at the ceiling down to the floor without causing drafts. Follow the instructions below for proper fan operation:

1. Turn on the fan.
2. Verify that the fan is spinning in the counterclockwise direction (when viewed from below).
3. If the fan is not spinning counterclockwise, reverse the fan direction.

Optional Operating Instructions

Adjust the fan speed to the appropriate Starting Fan Speed listed in the table below.

Floor to Ceiling Height (ft)	Starting Fan Speed
< 40	4
≥ 40	6

Stand directly below the tips of the fan blades with hand outstretched. If you feel a draft, slightly turn down the fan speed (0.5). Repeat until the draft is no longer noticeable.

Cooling Season

The cooling effect created by the breeze from the Big Ass Fans keeps occupants comfortable when turning up the thermostat. The higher the thermostat setting is increased during the cooling season, the greater the energy savings. Every degree higher that the thermostat is reset reduces the energy consumed by the air conditioner by 1.5-2%. To minimize energy usage during the cooling season, Big Ass Fans should only be operated when building occupants are present.

1. Turn on the fan.
2. Verfify the fan is spinning in the counterclockwise direction (when viewed from below).
3. If the fan is not spinning counterclockwise, reverse the direction of the fan.

Optional Operating Instructions

Adjust the fan speed to the appropriate Starting Fan Speed listed in the table below.

Floor to Ceiling Height (ft)	Starting Fan Speed
< 40	3
≥ 40	4

Increase the speed of the fan until desired air speed or maximum fan speed is reached. In air conditioned facilities, increase the thermostat setpoint by 2-7°F to save energy.

User Servicing 65

Please take a few moments each year to perform the following preventive maintenance inspection to your fan to ensure its safe and efficient operation. If you have any questions, please contact Customer Service at 1-877-BIG- ANS. If you require assistance, please contact Field Service at 1-877-BIG-FANS to schedule a visit.

WARNING: Risk of fire, electric shock, or injury to persons during cleaning and user-maintenance! Disconnect the appliance from the power supply before servicing.

WARNING: Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device (such as a tag) to the service panel.

WARNING: When service or replacement of a component in the fan requires the removal or disconnection of a safety device, the safety device is to be reinstalled or remounted as previously installed.

Annual Preventive Maintenance

Note: Actual installation setup may differ from picture.

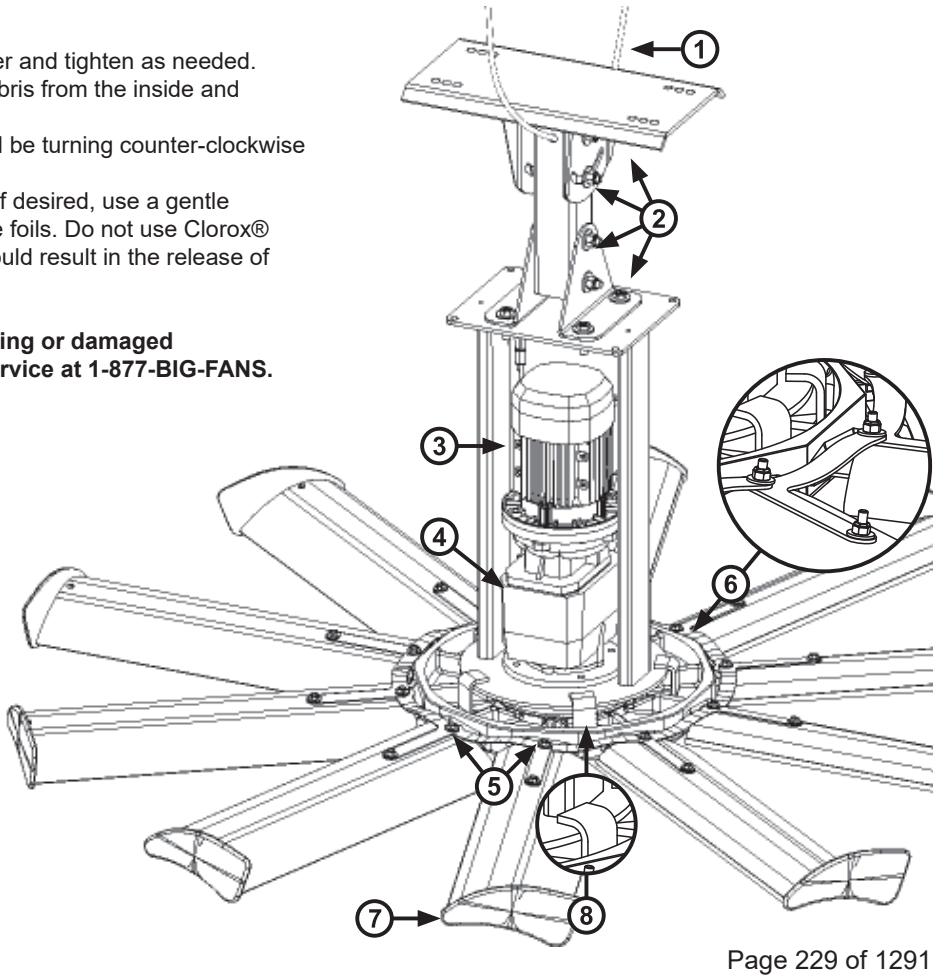
To be performed annually (see "Maintenance Checklist" in back of manual):

1. Check for the presence of the safety cable and shackle. The cable should be wrapped around the I-beam/angle irons leaving as little slack as possible. The shackle should be securely tightened and located on the topside of the I-beam/angle irons.
2. Ensure all mounting bolts (4x for direct mount installations and 12x for installations with extension tube) are present and torqued to 40 ft·lb (54.2 N·m).
3. Inspect motor terminations inside junction box and tighten if necessary.
4. Check gear reducer for oil leakage. If leakage is present, contact Customer Service at 1-877-BIG-FANS.
5. Ensure all bolts (20x) securing airfoils to fan are present and torqued to 29 ft·lb (39 N·m).
6. Ensure airfoils are secured to one another by airfoil retainers (10x).
7. Ensure bolts securing winglets to airfoils are securely tightened.
8. Ensure hub safety clips (6x) are present and torqued to 35 ft·lb (47 N·m). The bolts securing the safety clips to the hub are located on the faceplate underneath the fan.

Additional Considerations

- Check all connections in the fan controller and tighten as needed. Using a vacuum, remove all dust and debris from the inside and outside of the controller.
- Verify proper fan rotation. The fan should be turning counter-clockwise when viewed from the floo .
- Dust airfoils, motor, and motor housing. If desired, use a gentle cleaner or degreasing agent to polish the foils. Do not use Clorox® or other chlorine based cleaners! This could result in the release of toxic/fatal fumes.

WARNING: Do not operate a fan with missing or damaged components. Please contact Customer Service at 1-877-BIG-FANS.



66 Troubleshooting

WARNING: Risk of fire, electric shock, or injury to persons during cleaning and user-maintenance! Disconnect the appliance from the power supply before servicing.

WARNING: Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device (such as a tag) to the service panel.

WARNING: When service or replacement of a component in the fan requires the removal or disconnection of a safety device, the safety device is to be reinstalled or remounted as previously installed.

General Troubleshooting

The Fan Turning In The Wrong Direction (Single Fan Controller)

- The "3 Position Switch," located on the front of the control box, controls the direction of the fan's rotation. The fan must be rotating counterclockwise (when viewed from the floor) to be e fective. If the fan is not rotating in this direction, adjust the "3 Position Switch."

The Fan Turning In The Wrong Direction (Multi-Fan Controller)

- Turn the "3 Position Switch" to the OFF position. Wait for the fans to come to a complete stop. De-energize the controller and associated AC supply circuit. **Controller will display "F004" momentarily, indicating an undervoltage fault. Wait three minutes for internal DC bus voltage to fall to a safe level (darkened display LEDs are not an indication of safe voltage levels).** Refer to diagram on p. 61 to reverse phase rotations. *Note: Switching two leads on the AC supply side of the fan controller will not reverse fan rotations.*

Popping Noise Is Coming From The Fan

Airfoil popping comes from airfoils that are not tightened to the specified torque (see torque chart p. 5).

- Switch off power at service panel and lock service disconnecting means. If it cannot be locked, fasten a prominent warning device. Tighten airfoil fasteners to specified torque. If popping still occurs verify that the airfoils are not contacting each othe . If the airfoils are contacting each other, please contact Big Ass Fans Customer Service at 1-877-BIG-FANS.

The Fan Is Not Starting

- Make sure that all wires are securely connected.
- Make sure the "Disconnect Switch" and "3 Position Switch" are in the ON position.
- Verify that supply power is adequate and functional.
- Contact Customer Service at 1-877-BIG-FANS.

The Variable Frequency Drive (VFD) Generates Radio Frequency (RF) Noise

VFDs generate radio frequency noise in many ways, but this noise can be prevented by using the proper wiring practices outlined in the "Electrical Installation" section (p. 27).

- Do not run your VFD and sensitive equipment on the same power line.
- You need to install shielded cables, run leads in grounded metallic conduit, or use appropriate sized 4 conductor shielded cable for motor leads.
- Make sure that the motor's ground/ shield lead are terminated to the VFD's ground terminal, not the controller's ground lug.
- Ensure proper grounding at the motor, controller, and from the controller to the utility.
- Contact Customer Service at 1-877-BIG-FANS.

The Motor Makes Noise When You Speed Up The Fan

Audible high frequency noise is normal during fan operation. If this is less than desirable or you feel that the noise may be a result of mechanical failure, please contact us at 1-877-BIG-FANS.

Troubleshooting KBDA Controllers 67

CAUTION: Local and national regulations regarding entry into powered industrial control panels should be followed.

Fan Error Codes

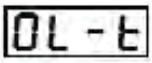
Drive Stopped
Indicates that the drive is in the Stop Mode. Function No. 4.03 set to "0001".

Function No. Example
A Function No. consists of a Group No. (digits on the left-side of the decimal point) and a Group Code No. (digits on the right side of the decimal point).

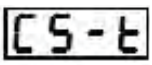
Motor Voltage Display
When the display is set to show Motor Voltage, the format will be "XXXu". Function No. 4.05 set to "0001".

Low Voltage Trip
Indicates that the AC line input voltage is below the Undervoltage Trip Point specified under "KBD Controller Specifications and Environmental Ratings" on p. 61

Overvoltage Trip
Indicates that the AC line input voltage is above the Overvoltage Trip Point specified under "KBD Controller Specifications and Environmental Ratings" on p. 61



Overload Trip (I^2t Timeout)
Indicates that the motor has been overloaded for an extended period of time.

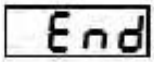


Current Source Trip
Indicates that the current signal output (from the IODA) has been opened.

AC Line Phase Loss Detection
Indicates that the drive has detected a loss of one of the phases in the 3-phase AC line input.

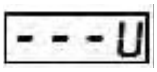
Keypad Communication Error
Indicates that the keypad failed to initialize when the drive is powered up. This is an abnormal condition. Contact Big Ass Fans Customer Service at 1-877-BIG-FANS.

IODA Error
Indicates that the drive has lost communication with the IODA.

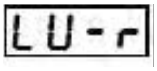


Parameter Changed
Momentarily flashes. Indicates that a parameter has been successfully changed

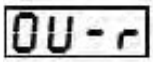
Motor Current Display
When the display is set to show Motor Current, the format will be "XX.XA". Function No. 4.04 set to "0001".



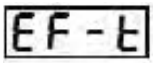
Bus Voltage Display
When the display is set to show Bus Voltage, the format will be "XXXU".



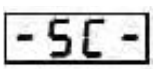
Low Voltage Recovery
Indicates that a Low Voltage Trip occurred and the AC line input voltage has returned to within normal operating range.



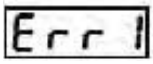
Overvoltage Recovery
Indicates that an Overvoltage Trip occurred and the AC line input voltage has returned to within normal operating range.



External Fault Trip
Indicates that an external fault has occurred at one of the MFITs of the IODA. Function Nos. 7.00-7.06 set to "0008".



Short Circuit Trip
Indicates that the drive detected a short circuit at the motor (phase-to-phase).



Data Enter Error
Indicates that the drive is in the Program Mode and a non-valid parameter change has been attempted.

Flash Memory Error
Indicates that a flash memory error on the drive has occurred. Contact Big Ass Fans Customer Service.

68 Troubleshooting Allen-Bradley Controllers

CAUTION: The following procedures require the fan controller to be under power. Precautions must be taken to ensure personal safety. Eye protection, insulated adjustment tools, and arc flash protection are recommended. Local and/or national regulations regarding entry into powered industrial control panels should be followed.

ATTENTION: If faults cannot be cleared, contact Big Ass Fans Customer Service.

Refer to Allen-Bradley "Quick Start Guide" (publication 22A-QS001C-MU-P-May 2003) or go to www.rockwellautomation.com for information regarding fault code retrieval.

The condition of the fan controller is constantly monitored. Any changes in the condition of the system will be indicated through the LED display on the front of the VFD. Any condition that results in the fan operating outside of pre-established limitations will result in a fault.

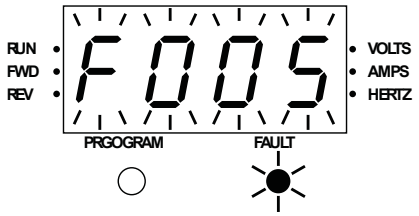
There are two types of faults, both of which will stop the fan:

- Type 1 - Auto Reset/Run. When this type of fault occurs, the controller will automatically reset the fault condition and attempt to restart after a period of five seconds. If the controller has made three restart attempts and the fault persists, the controller will trip on "F033," indicating that the controller has reached its restart attempt limit.
- Type 2 - Non-Resetable. This type of fault occurs due to improper wiring and/or motor failure. The cause of the fault must be corrected before the controller will run again.

Fault Indicators

When a fault has occurred, the LED display will flash the most recent fault that has occurred, and also flash the fault indicator LED.

Every time that the controller is powered down, the controller will record a "F004" Undervoltage fault in the fault buffer. If the fault is a re-occurring event or a type 2 fault, it will be possible to troubleshoot the system again when the controller is powered back up.



Automatically/Manually Clearing Faults

Automatically

As previously mentioned, Type 1 faults will clear automatically; however, the most recent 3 will be stored in the VFD's fault buffer. Refer to Powerflex "Quick Start Guide" to view fault bu fer contents.

Manually

To clear a Type 2 fault, remove power from the controller. Wait for the LEDs to darken before re-applying power. Controller can be restarted at this point; however, due to the nature of type 2 faults, the controller will more than likely trip immediately. This can be helpful in identifying which faults need to be addressed.

Type 1 Fault Descriptions and Corrective Measures

Listed below are the most common faults that will occur with the Big Ass Fans systems. Included in the description are the most common corrective measures and/or test procedures that will be required for the repair of the system.

F004 Under Voltage

DC Buss Voltage fell below the minimum value. Monitor the AC supply for low voltage and/or line interruptions. It is not uncommon for voltage levels in commercial and industrial areas to vary up to 10%. Power events exceeding 100 milliseconds in duration will usually result in this type of fault. Possible causes include large across-the-line starters, active power factor correction, large transformers coming online, welders, etc. Commonly referred to as a "brown out." The controller will also report this fault every time the unit is intentionally powered down.

Refer to the following section(s):
Power Requirements (p. 28)
Additional Input Power Considerations (p. 64)

F005 Over Voltage

DC Buss Voltage exceeded maximum value. Monitor the AC supply for high voltage transients and/or line interruptions. It is not uncommon for voltage levels in commercial and industrial areas to vary up to 10%. Power events exceeding 100 milliseconds in duration will usually result in this type of fault. Possible causes include active power factor correction, large transformers going offline, lightening strikes (direct hit or local to your power grid), phase-to-phase voltage imbalance, phase-to-ground voltages in excess of 125% nominal phase-to-phase voltage, "High leg" or "Wild leg," welders, foreign signal present on controller's AC Supply, motor regen, etc.

Type 1 Fault Descriptions and Corrective Measures (cont.)

Refer to the following section(s):
Power Requirements (p. 28)
Conduit and Piping Guidelines (p. 32)
Additional Input Power Considerations (p. 63)

The drive will also register a F005 fault if the fan tries to stop too quickly. Unless the drive has lost its programming, this cause of failure is unlikely. If the drive suffers from a F005 fault at any time other than when the operator has issued a stop command, then deceleration rates are not an issue. 6- to 14-ft fans will typically stop in approximately 20 seconds. 16- to 20-ft fans will typically stop in approximately 25 seconds. 24-ft fans will stop in approximately 30 seconds. **400-600V controller models may also experience a F005 fault if the motor leads are shorted or grounded out. If the drive experiences a short on the load side, the output drops off immediately. The resulting field collapse around the reactor coil can cause a voltage spike on the drives dc bus, which may hide the actual cause of failure.** If this fault occurs on a regular and repeated basis, i.e., within 5 minutes of fan startup, a technician may bypass the load reactor temporarily in order to get a legitimate fault code to appear on the VFD.

F006 Motor Stalled

Drive is unable to accelerate motor. Using a current clamp, monitor the motor(s) current at the moment of startup. If the measured value exceeds the motor FLA as listed on the controller's nameplate, the fan should be checked for mechanical binding. This fault will typically occur if the fan is being restricted from movement. Typically, the fan just will not turn at all before the fault is registered. This fault can also be caused by a foreign signal present on the controller's output/motor leads. An F006 fault may also be accompanied by an unstable frequency display on the VFD. This would indicate a corrupted motor feedback due to a foreign signal presence.

Refer to the following section(s):
Conduit and Piping Guidelines (p. 33)
Wiring the Motor (pp. 55-56)

F007 Motor Overload

Internal electronic overload trip. This fault indicates that the motor(s) running current has exceeded a pre-established limit. Possible causes include incorrect motor wiring, lack of motor ventilation (dirty motor heatsinks), shorted motor windings, mechanical binding or bearing failure, fan cavitation (check minimum ceiling clearance), incorrect fan gear ratio, controller / fan mismatch, and incorrect cable type.

ATTENTION: For multi-fan units, the included overload relays should be set to 115% of the motor's FLA rating. When an overload relay trips, the controller's run enable circuit is opened. The relay will have to be manually reset before fans can resume operation.

Electrical Motor Checks:
Using a current clamp, check the current draw on each motor phase. Current readings should not vary more than 10%, and should not exceed the FLA rating on the controller's nameplate. Variations would indicate the possibility of a partially shorted or fatigued motor winding and/or defective motor leads. Power down the system and wait for the drive's DC buss to discharge. Disconnect the output/ motor leads from controller. Using an ohmmeter, check resistance between phases T1-T2, T2-T3, and T1-T3.

Ohm readings should not vary more than 10-15%. Variations would indicate the possibility of a partially shorted or fatigued winding and/or defective motor leads.

Refer to the following section(s):
Power Wiring Guidelines (p. 32)
Conduit and Piping Guidelines (p. 33)
Additional Input Power Considerations (p. 64)

F008 Heatsink Overtemp

Heatsink temperature has exceeded a predefined value. Check the VFD for blocked or dirty heatsink fins. erify that, when the fan(s) are running, the VFD's internal cooling fan is operational (fan is located on bottom of drive chassis). Verify that the ambient temperature has not exceeded 40ºC (104ºF) for single fan units, 50ºC (122ºF) for multi-fan units.

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Type 2 Fault Descriptions and Corrective Measures

F003 Power Loss

DC Bus Voltage remained below 85% of nominal. This fault is similar to F004, indicating an undervoltage and/or power interruption. As a type 2, this fault will not reset automatically. F003 is a strong indicator of a maintained undervoltage and/or phase loss. Verify acceptable Line-to-Line voltage on the AC Supply. Verify that the input fuses in the fan controller are good.

Refer to the following section(s):
Power Requirements (p. 28)
Additional Input Power Considerations (p. 59)

F013, F038, F039, F040, F041, F042, F043

Ground Fault. A current path to ground has been detected on one or more of the VFD's output terminals. Possible causes include a legitimate short to ground in controller output/motor leads, short to ground internal of the motor, excessive ground leakage currents, and insulation breakdown of an unacceptable cable type.

Electrical Checks:
Power down the system and wait for the drive's DC buss to discharge. Disconnect the output/motor leads from controller. Using a megger set to the 1000V range, test resistance between T1, T2, T3 (all three tied together) and the controller's ground lug. Readings at or below 1.48 million ohms will indicate that the motor or cabling may be suffering from insulation breakdown. Proceeding further will require the motor to be disconnected from associated cabling with the jumpers and/or wire nuts removed. At the motor, using the 1000V range, check resistance between motor phases, and from each phase to ground. Readings at or below 1.48 million ohms will indicate that the motor may be suffering from insulation breakdown. The motor should be replaced at this time. If the motor resistance is found to be OK, this test should be repeated for the associated motor cabling.

Use of MC Cable or any other solid core wire will increase the chances of premature cable failure. Due to "skin effects," capacitive cable charging currents will typically be 50-75% higher than with other acceptable cable types. The VFD may perceive a ground fault due to excessive current circulating through the VFD's output filter section

A foreign signal presence on the output/motor leads can also give a false indication of a ground fault condition. If the motor is OK, and the cable has tested OK and is of an acceptable type, contact your Big Ass Fans representative to replace the VFD; the power section is defective.

Refer to the following sections(s):
Power Wiring Guidelines (p. 32)
Conduit and Piping Guidelines (p. 33)
General Grounding Requirements (p. 36)
Wiring the Motor (pp. 51-52)
Additional Input Power Considerations (p. 59)

F033 Auto Restart Tries

The drive has unsuccessfully attempted to reset a fault and resume running three times (programmed value is 3). This fault will be registered if the drive has attempted to reset a Type 1 fault three times. Cycle the controller power to clear this fault. If you experience difficulty in retrieving active fault codes, contact your Big Ass Fans representative for assistance. The auto-restart feature may have to be disabled to aid in troubleshooting.

F064 Drive Overload

Drive rating of 150% for one minute or 200% for three seconds has been exceeded. This fault indicates that the drive has attempted to deliver 150-200% of its rated electrical output. This fault will occasionally take precedence over F007. Solution includes the same course of action as stated for F007.

F070 Power Unit

Failure has been detected in the drive's power section. Verify compliance with installation recommendations. Cycle the controller power to clear this fault.

3.6. Electrical and Control Systems

3.6.1. System Description

The complete mechanical ventilation & air conditioning and installation is designed for operation under the supply system with nominal frequency of 50 Hz and nominal voltage of 380V, 3-phase and 220V, single phase within the variation limits as declared by the local Supply Companies.

3.6.2. Operation Instruction

(i) Preliminary Check

1. Obtain the following documents or information:
- Starter panel control wiring diagram.
- Information of starter type, size, etc.
- Specification of the panel.
- Electrical supply requirement.
2. Study the system and determine.
- Steps to be undertaken to set up the system for start-up.
- Required instruments.
- Required forms of test report.
- Location of the starter panel.
3. Instruments selection.
4. Obtain all necessary instruments.
5. Prepare a list of all instruments to be used.

(ii) Test Procedures

1. Visual Inspection

Before taking measurement and test of the installed panel, a visual inspection is required to avoid unnecessary operating faults due to personal negligence.

Follow the steps and record the results as suggested in accordance with the Pre-commissioning Checklist.

2. Insulation Test (Megger Test)

Insulation test is performed by applying a D.C. voltage of at least 500V between two terminals of phase-to-earth, phase-to-phase and phase-to neutral circuits, and measuring the insulation resistance.

The general procedure is as follows:
- Remove links and fuses in all tripping, control and alarm circuit.
- Test the insulation resistance between two different terminals.
- Record the results by using the Insulation Test Report.
- Any circuit of less than 1 megaohms at 500V D.C. should be investigated.
- Any measuring instrument or protective device, e.g. static relay, which may be damaged by application of such a voltage shall be disconnected at one or all terminals.

3. Functional Tests

The general procedure is as follows:
- To check the operational functions of the panel in accordance with the steps as listed in Functional Test Report for MCP.
- Record the above results in the report.
- To check the operational functions of motor starter in accordance with the steps as listed in Functional Test Report for Motor Starter.
- Record the results in the report.
- Repeat the above Procedure (III) to (IV) for other starter until all the starters of the same panel have been checked completed.

3.6.3. Maintenance Instruction and Schedule

- The local isolation of motors and control circuits.
- That there are no unshrouded live components within the panels.
- Control panels and switch gears are clean.
- The motor and surrounding areas are clean.
- There is no mechanical damage to switch gears.
- All connections are tight on busbars and wiring.
- The internal links on the starter are correct.
- All cover plates are fitted.
- The selectors are operated normally.
- The indicating lamps are operated normally.
- The voltmeters are operated normally.
- The ammeters are operated normally.
- The interlock mechanism of isolators and panels are operated properly.

3.7. Building Management System

(Please refer to separate booklet for Building Management System)

3.8. Project Dasher System

(Please refer to separate booklet for Project Dasher System)

Appendix

Appendix I – Technical Literature

Appendix II – As-fitted Drawings

Appendix III – Testing and Commissioning Records

Appendix IV – Spare Part List

Appendix V – Supplier Contact List

Appendix I – Technical Literature

1 Water Cooled Chiller
2 Cooling Tower
3 Chilled Water Pump
4 Condensing Water Pump
5 Packaged Pressurization Unit
6 Expansion Tank
7 Water Treatment
8 Air Handling Unit / Primary Air Unit
9 Desiccant Dehumidification Wheel
10 Chilled Beam
11 Direct Expansion Split Type A/C Unit
12 Variable Air Volume Box
13 In Line Duct Fan
14 Propeller Fan
15 Centrifugal Fan
16 Ceiling Fan
17 Black Steel Pipe
18 Black Steel Pipe Fittings
19 Galvanised Steel Pipe
20 Galvanised Steel Pipe Fittings
21 Copper Pipe
22 Copper Pipe Fittings
23 Pipework Phenolic Foam Insulation
24 Refrigerant Pipework Flexible Closed Cell Elastomeric Insulation
25 Butterfly Valve
26 Check Valve
27 Gate Valve
28 Globe Valve
29 Double Regulating Valve
30 Pressure Gauge

31 Temperature Gauge
32 Flexible Connector (Water Side)
33 Y Strainer
34 Automatic Air Vent
35 Test Plug (Water Side)
36 Fiberglass Water Tank
37 Water Level Switch
38 Bleed-off Controller
39 Galvanized Steel Ductwork
40 Duct Flexible Connector
41 Test Point (Air Side)
42 Fusible Link
43 Volume Control Damper
44 Non-Return Damper
45 Motorized Volume Control Damper
46 Fire Damper
47 Fire Damper (Curtain Type)
48 Fire and Smoke Damper
49 Activated Carbon Filter
50 Washable Filter
51 Bag Filter
52 Fire Resistance Sealant
53 Duct Sealant
54 Air Grille and Air Louvre
55 Ductwork Phenolic Foam Insulation
56 Duct Silencer
57 Vibration Isolator
58 Painting
59 Emergency Stop Button
60 Motor Control Panel

61 Frequency Inverter & Harmonic Filter

62 CCMS Digital Input / Output Cable

63 CCMS Analogue Input / Output Cable

64 CCMS LAN Cable

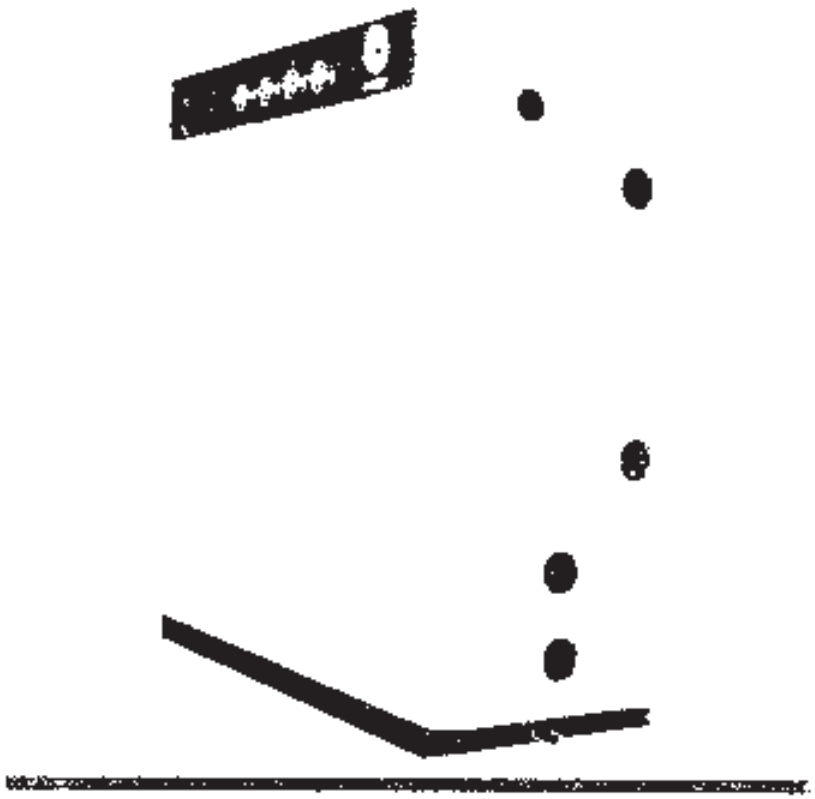
Technical Literature

1) Water Cooled Chiller

TRANE

Genie

CGWP Small Scroll Chiller
Cabinet Water Cooled Cold Generator
With Hot Water Application
20~60 Tons



January 2010

CGWP-PRC001-EN

Features and Benefits

High efficiency and low running noise

- Multi scroll compressors design achieve high running efficiency at partial and full load of system operation
- Outstanding vibration isolator design, fully enclosed by noise-absorption jacket
- At least 30% EER higher and 3~5 dBA noise lower than air-cooled chiller at the same running environment. Design for residential and light commercial especially.
- Shell and tube heat exchanger condenser, reserved tube refresh capacity by periodic maintenance.

Independent Operation, Service budget

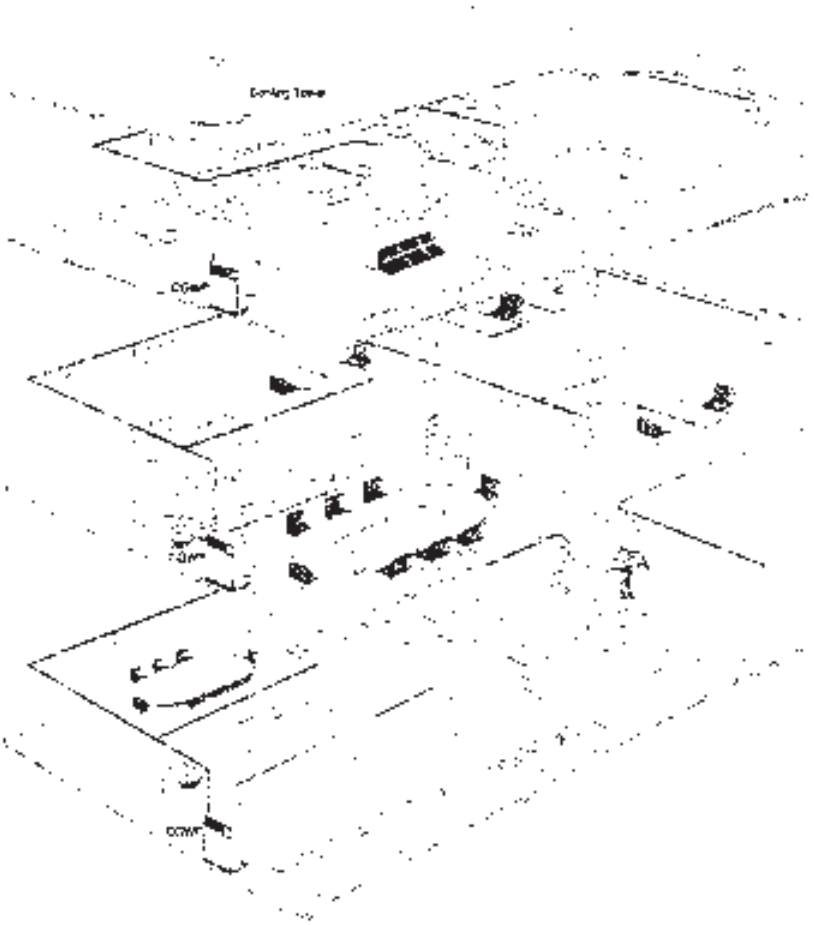
Multi-Chiller system is designed for separative cooling demand. Integrated condenser piping system and independent chilled water piping ensure the whole system in most cost effective and operating efficiency. Most of the operation and service fee can charge to individual owner directly

Compact system design and excellent appearance

- 1/4 volume reduction compared with existed version and compressors
- Compact in footprint. Easy for lifted by elevator and install in place where space is precious
- Powder painting enclosure, free of rust for longer than normal treatment.
- Deform free frame design and symmetric internal layout

No refrigerant piping around your living space

Chiller system delivers cooling capacity by water. With totally different design philosophy of direct expansion system like minisplit, water piping means steady, safty, healthy high efficiency, low piping layout limitation and problem free after system installation. Multi choice of indoor units (concealed,exposed,cassette) make the system complied with diversified interior decoration need.



Mechanical Specifications

High Reliability

- Scroll compressors and durable system components arranged by fully experienced chiller technology
- Complete circuits and protections avoid abnormal start up and operation
- Double anti-freeze protection
- Non-flammable insulation at concerned side.
- 100% factory inspection and running test before shipment.
- Manufacturing by ISO 9000 certified factory.

Minimum space needed and easy for maintenance

- Creative top hood access panel design cutshed the maintenance space need to 60 cm around chiller
- Lift the top panel can reach control and wiring board for electrical investigation and maintenance

▲ Top hood access panel

Compressor

Scroll compliance allows liquid and dirt to pass through without damaging compressor Suction gas cooled motor with protection against overheat and overload

Evaporator

Compact size SUS 316 brazed heat exchanger, suction piping insulate with 1/2" thickness PU. A 16-mesh Y strainer (factory provided, field installed) should be installed in the water inlet to prevent circuit blocked

Condenser

Seamless external enhanced copper tube in shell design, refrigerant side is tested at 34.5kg/cm²G (500psig) and 25kg/cm²G(375psig) for waterside

Refrigerant Circuit

Each refrigerant circuit is completely independent, includes thermal expansion valve, filter dryer, sight-glass, charging port, insulated suction line and pressure gauges.

Control

Safe, effective and reliable control system, only a minimal maintenance is required. Friendly interface makes job site wiring easy and neat. Phase reversal detection relay, contactor, and overload protectors are standard built-in components.

PLC Controller

- Design and manufactured with advanced technology Programmable Logic Controller (PLC) build in fully protective function and operation for scroll chiller
- Connectable with any Supervisory Control and Data Acquisition System (SCADA) with RS-485 interface and Modbus protocol
- Clear language message display on touch screen Human Machine Interface (HMI)

PLC with optional Hot Water Application

Additional temperature sensors can be selected to monitor the entering and leaving temperature of cooling water and chilled water. Cooling water temperature and thus the heating capacity can be set as the source for modulating compressor capacity.

Sound Attenuation

PE wavy foam lines panels as insulation to attenuate the chiller operation sound

Model Nomenclature & Dimensions

CGWP	060	5	C	F	R	P	N	N	A
1,2,3,4	5,6,7	8	9	10	11	12	13	14	15

Digit 1,2,3,4 – Chiller Type
CGWP = Water-cooled Scroll Chiller

Digit 5,6,7 – Model (nominal cooling capacity)
- 021
- 026
- 030
- 040
- 050
- 060

Digit 8 – Voltage
- 2 = 220V/60Hz/3Ph
- 3 = 380V/60Hz/3Ph
- 4 = 460V/60Hz/3Ph
- 5 = 380V/50Hz/3Ph
- 6 = 400V/50Hz/3Ph
- 7 = 415V/50Hz/3Ph

Digit 9 – Development Sequence
- C = R22
- D = R407C

Digit 10 – Number of Compressors
- D = Dual Compressors
- F = Four Compressors

Digit 11 – Water Connection
- R = Right Hand Side (Standard)
- L = Left Hand Side

Digit 12 – Control
- P = PLC controller with HMI (Standard)
- H = PLC controller with HMI and Hot Water Application
- N = Electro-Mechanical Control

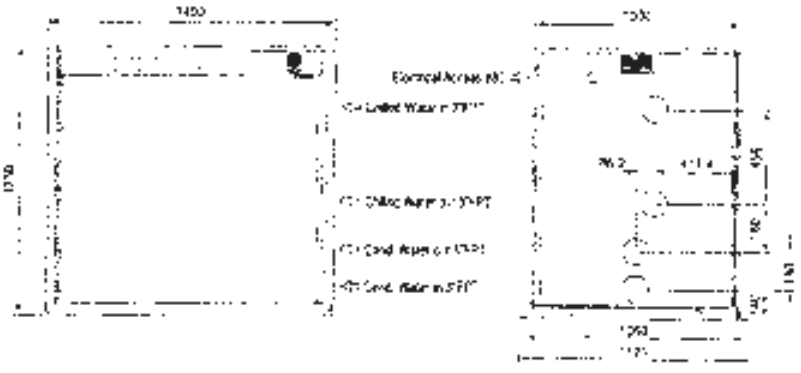
Digit 13 – Future Use
- N = No (Standard)

Digit 14 – Options
- N = No (Standard)
- S = Spring-isolator

Digit 15 – Area
- A = Taiwan
- B = Others

CGWP021~030

CGWP040~060



Performance Data (R22)

R22 / 60Hz

		25.0		30.0		32.0		35.0		40.0	
		Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input
CGWP021 LPME 200 LPMC 240	5.0	69.5	14.9	66.7	16.5	65.6	17.2	63.9	18.2	61.0	19.6
	7.0	72.5	15.0			68.5	17.3	67.8	18.3	66.0	19.9
	9.0	77.4	15.1	74.6	16.6	73.5	17.4	71.9	18.4	69.9	20.1
	11.0	83.4	15.4	79.6	16.9	77.4	17.6	75.7	18.6	72.9	20.2
CGWP026 LPME 250 LPMC 300	5.0	86.9	19.0	83.4	21.7	82.0	21.9	79.5	23.3	76.3	25.2
	7.0	91.9	19.2			86.5	22.1	84.8	23.4	81.9	25.6
	9.0	96.6	19.4	95.3	21.5	91.9	22.3	89.7	23.6	86.2	25.7
	11.0	101.7	19.5	99.2	21.6	96.8	22.5	94.7	23.8	91.1	25.9
CGWP030 LPME 300 LPMC 360	5.0	104.3	22.7	100.1	25.2	98.4	26.2	95.6	27.7	91.6	30.2
	7.0	110.2	22.9			104.3	26.4	101.7	27.9	97.5	30.5
	9.0	116.2	23.1	111.8	25.6	110.2	26.5	107.7	28.2	103.4	30.7
	11.0	122.1	23.3	117.8	25.8	116.1	26.9	113.6	28.4	109.4	30.9
CGWP040 LPME 450 LPMC 480	5.0	139.1	29.7	133.4	33.0	131.2	34.3	127.8	36.3	122.1	39.6
	7.0	147.0	30.0			139.1	34.6	135.7	36.6	130.0	39.9
	9.0	154.9	30.3	148.7	33.6	147.0	34.9	143.6	36.9	137.9	40.2
	11.0	162.8	30.5	157.1	33.9	154.9	35.2	151.5	37.1	145.8	40.4
CGWP050 LPME:500 LPMC:600	5.0	170.9	35.0	166.5	42.2	164.0	40.9	159.7	46.4	152.6	50.6
	7.0	183.7	35.3			173.9	41.3	169.6	46.8	162.5	51.0
	9.0	193.6	35.7	186.5	42.9	183.7	44.6	179.5	47.1	172.3	51.4
	11.0	203.6	36.1	196.4	43.3	193.6	45.0	189.0	47.6	182.3	51.7
CGWP060 LPME 600 LPMC 720	5.0	208.8	45.4	200.1	50.4	196.7	52.6	191.7	56.5	183.2	60.5
	7.0	220.5	45.8			208.6	52.9	203.5	56.9	195.0	60.9
	9.0	232.3	46.2	223.6	51.0	220.5	53.3	215.4	56.0	206.9	61.3
	11.0	244.2	46.7	236.7	51.7	232.3	53.7	227.2	58.1	218.7	61.6

R22 / 50Hz

		25.0		30.0		32.0		35.0		40.0	
		Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input	Cooling Capacity	Power Input
CGWP021 LPME 172 LPMC 200	5.0	58.0	12.8	55.6	14.0	54.6	14.6	53.2	15.4	50.9	16.8
	7.0	61.2	12.7			57.9	14.7	56.5	15.6	54.2	17.0
	9.0	64.5	12.9	62.6	14.0	61.4	14.8	59.9	15.7	57.5	17.1
	11.0	67.8	13.0	65.9	14.4	64.5	15.0	63.1	15.8	60.6	17.2
CGWP026 LPME.215 LPMC:257	5.0	72.4	16.1	69.5	17.9	68.3	18.7	66.5	19.7	63.6	21.5
	7.0	76.6	16.3			72.4	18.8	70.7	19.8	67.7	21.7
	9.0	80.7	16.5	77.7	18.2	76.5	19.0	74.8	20.0	71.6	21.8
	11.0	84.8	16.6	81.8	18.4	80.7	19.1	78.9	20.2	75.5	22.0
CGWP030 LPME:257 LPMC:300	5.0	86.9	19.3	83.4	21.4	82.0	22.3	79.8	23.6	76.3	25.7
	7.0	91.9	19.5			86.9	22.5	84.9	23.7	81.3	25.9
	9.0	96.8	19.6	93.3	21.8	91.9	22.6	89.7	23.9	86.2	26.1
	11.0	101.7	19.8	98.2	22.0	96.8	22.8	94.7	24.1	91.1	26.3
CGWP040 LPME.344 LPMC.400	5.0	115.9	25.4	111.2	28.1	109.3	29.2	106.5	30.9	101.8	33.7
	7.0	122.5	25.5			115.9	29.4	113.1	31.1	108.3	33.9
	9.0	129.1	25.7	124.4	28.5	122.5	29.7	119.6	31.3	114.9	34.1
	11.0	135.7	26.0	130.9	28.8	129.1	29.9	126.2	31.6	121.5	34.4
CGWP050 LPME.430 LPMC 500	5.0	144.9	32.3	139.0	35.9	136.6	37.3	133.1	39.5	127.2	43.1
	7.0	153.1	32.6			144.9	37.6	141.3	39.8	135.4	43.4
	9.0	161.3	32.9	155.5	36.5	153.1	37.9	149.6	40.1	143.7	43.7
	11.0	169.6	33.2	163.7	36.8	161.3	38.2	157.8	40.4	151.9	44.0
CGWP060 LPME:514 LPMC:600	5.0	173.9	36.6	166.8	42.8	164.0	44.6	159.7	47.1	152.6	51.4
	7.0	183.7	38.9			173.9	44.9	169.6	47.5	162.5	51.8
	9.0	193.6	39.3	186.5	43.6	183.7	45.0	179.5	47.9	172.4	52.1
	11.0	203.6	39.7	196.4	43.9	193.6	45.4	189.3	48.2	182.3	52.5

NOTE CW-Condenser water inlet temperature LW-Chiller water outlet temperature
LPME-Rated water flow rate of evaporator (LPM) LPMC-Rated water flow rate of condenser

Performance Data (R407C)

R407C / 60Hz

Model	LWT (°C)	25.0 Cooling Capacity	25.0 Power Input	30.0 Cooling Capacity	30.0 Power Input	32.0 Cooling Capacity	32.0 Power Input	35.0 Cooling Capacity	35.0 Power Input	40.0 Cooling Capacity	40.0 Power Input
CGWP021 LPME.195 LPMC.230	5.0	66.0	14.9	60.4	16.5	62.0	17.2	60.7	18.0	58.0	19.8
	7.0	69.6	15.0			66.0	17.3	64.4	18.2	61.8	19.9
	9.0	73.5	15.1	70.0	16.8	69.8	17.4	68.2	19.4	65.5	20.1
	11.0	77.3	15.3	74.7	16.9	73.5	17.6	71.9	19.6	69.3	20.2
CGWP026 LPME.240 LPMC.290	5.0	82.6	19.0	79.2	21.1	77.9	21.9	75.9	23.2	72.5	25.3
	7.0	87.3	19.2			82.6	22.1	80.6	23.4	77.2	25.5
	9.0	92.0	19.4	88.6	21.6	87.3	22.3	85.2	23.6	81.6	25.7
	11.0	96.6	19.6	93.3	21.8	92.0	22.5	90.0	23.8	86.6	25.9
CGWP033 LPME.290 LPMC.350	5.0	99.1	22.7	95.1	26.2	93.5	26.2	91.0	27.7	87.0	30.2
	7.0	104.7	22.9			99.1	26.4	96.6	27.9	92.6	30.5
	9.0	110.4	23.1	106.3	25.0	104.7	26.6	102.2	25.2	98.2	30.7
	11.0	116.0	23.3	111.9	25.0	110.3	26.9	107.9	28.4	103.8	30.8
CGWP040 LPME.380 LPMC.460	5.0	132.1	28.7	126.7	43.1	124.6	34.3	121.4	36.2	116.0	39.6
	7.0	139.7	30.0			132.1	34.6	128.5	36.6	123.4	39.9
	9.0	147.2	30.3	141.7	33.4	139.7	34.9	136.4	36.9	131.0	40.2
	11.0	154.7	30.5	149.2	33.8	147.2	35.2	143.5	37.1	138.5	40.4
CGWP050 LPME.480 LPMC.580	5.0	165.2	36.0	158.5	42.2	155.6	43.9	151.7	46.4	145.0	50.6
	7.0	174.5	38.9			165.1	44.3	161.1	46.8	154.4	51.0
	9.0	183.9	38.7	177.2	42.9	174.5	44.6	170.5	47.1	163.8	51.4
	11.0	193.3	39.1	186.6	43.3	183.9	45.0	179.8	47.5	173.2	51.7
CGWP060 LPME.570 LPMC.690	5.0	198.2	45.4	190.1	50.4	186.9	52.4	182.1	55.5	174.0	60.3
	7.0	209.5	45.8			198.2	52.9	193.5	55.9	185.3	60.9
	9.0	220.7	46.2	212.6	51.1	209.5	53.3	204.6	56.3	196.6	61.3
	11.0	232.0	46.7	223.5	51.7	220.7	53.7	215.6	56.7	207.5	61.8

R407C / 50Hz

Model	LWT (°C)	25.0 Cooling Capacity	25.0 Power Input	30.0 Cooling Capacity	30.0 Power Input	32.0 Cooling Capacity	32.0 Power Input	35.0 Cooling Capacity	35.0 Power Input	40.0 Cooling Capacity	40.0 Power Input
CGWP021 LPME.162 LPMC.192	5.0	55.1	12.6	50.5	14.0	51.9	14.6	50.5	15.4	48.4	16.5
	7.0	58.1	12.7			55.0	14.7	53.7	15.6	51.5	17.0
	9.0	61.3	12.9	59.1	14.3	58.1	14.8	56.8	15.7	54.6	17.1
	11.0	64.4	13.0	62.2	14.4	61.3	15.0	59.9	15.8	57.8	17.2
CGWP026 LPME.200 LPMC.240	5.0	66.9	16.7	63.0	17.9	64.9	18.7	63.2	19.7	60.4	21.5
	7.0	72.8	16.9			66.0	18.8	67.2	19.9	64.3	21.7
	9.0	76.7	19.5	73.8	19.7	72.7	19.0	71.1	20.0	68.2	21.8
	11.0	80.6	15.6	77.7	18.4	76.7	19.1	75.0	20.2	72.1	22.0
CGWP033 LPME.244 LPMC.290	5.0	82.6	19.3	79.2	21.4	77.9	22.0	75.9	23.6	72.5	25.7
	7.0	87.3	19.5			82.6	22.2	80.6	23.7	77.2	25.9
	9.0	92.0	19.6	88.6	21.8	87.3	22.6	85.2	23.9	81.6	26.1
	11.0	96.6	19.8	93.3	22.0	92.0	22.8	90.0	24.1	86.6	26.1
CGWP040 LPME.320 LPMC.380	5.0	110.1	25.4	105.6	28.1	103.8	29.2	101.2	30.8	96.7	33.7
	7.0	116.4	25.5			110.1	29.4	107.4	31.1	102.9	33.9
	9.0	122.6	25.7	118.0	28.5	116.4	29.7	113.6	31.3	109.2	34.1
	11.0	128.9	26.0	124.4	28.8	122.6	29.9	119.9	31.6	115.4	34.4
CGWP050 LPME.405 LPMC.480	5.0	137.7	32.3	132.1	35.0	129.8	37.3	126.4	39.5	120.9	43.1
	7.0	145.4	32.6			137.7	37.6	134.3	39.8	128.6	43.4
	9.0	153.2	32.9	147.7	36.5	145.4	37.9	142.1	40.1	136.5	43.7
	11.0	161.1	33.2	155.5	36.8	153.2	38.2	149.9	40.4	144.3	44.0
CGWP060 LPME.488 LPMC.580	5.0	165.2	38.8	158.5	42.8	155.8	44.8	151.7	47.4	145.0	51.4
	7.0	174.5	38.9			165.1	44.9	161.1	47.5	154.4	51.5
	9.0	183.9	39.3	177.2	43.5	174.5	45.3	170.5	47.9	163.8	52.1
	11.0	193.3	39.7	186.6	43.9	183.9	45.7	179.8	48.2	173.2	52.5

NOTE : LWT Condenser water inlet temperature LWT Chiller water outlet temperature.
LPME Rated water flow rate of evaporator (LPM) LPMC Rated water flow rate of condenser

NA

General Characteristic

R22 / 60Hz

Item \ Model	CGWP021	CGWP026	CGWP030	CGWP040	CGWP050	CGWP060
Cooling Capacity (kW)	70.7	86.3	106.5	141.5	176.7	212.0
Heating Capacity (kW)	84.9	105.8	128.0	180.0	218.5	259.9
Circuit	2	2	2	2	2	2
Load (%)	100-50-0	100-50-0	100-50-0	100-75-50-25-0	100-80-60-30-0	100-75-50-25-0
Volt/Phase	220V/380V/460V/3Ph/60Hz					
Cooling Input (kW)	16.0	21.7	25.4	33.5	42.6	50.5
Heating Input (kW)	19.6	25.5	30.5	39.9	51.0	62.9
RLA (Cooling) 220V	60	75	90	120	150	180
380V	35	43	52	70	86	104
460V	30	36	45	60	76	90
RLA (Heating) 220V	72	90	108	144	180	216
380V	42	54	62	84	103	124
460V	36	45	54	72	91	108
LRA 220V	297	460	455	555	634	697
380V	175	251	261	310	396	312
460V	151	195	196	155	228	240
Evaporator Type	Brazed plate heat exchanger					
Water Flow (GPM)	200	250	300	400	500	600
WPD (m H2O)	3.7	4.0	5.2	5.0	4.0	5.2
Condenser Type	Shell and tube					
Water Flow (GPM)	250	300	384	480	600	720
WPD (m H2O)	2.9	3.5	4.9	3.4	4.1	2.2
Refrigerant	R22					
Refrigerant Charge (kg)	5.5+5.5	5.5+7.5	7.5+7.5	12.0+12.0	15.0+15.0	18.0+18.0
Oil Charge (L) (SUNISO 4GS)	4.8+3.8	3.8+6.6	6.6+6.6	7.6+7.6	10.4+10.4	13.2+13.2
Dimension Length (mm)	1230				1430	
Depth (mm)	950				770	
Height (mm)	1300				1350	
Operating Weight (kg)	500	540	580	920	1060	1140
Protection	HP, pressure cutout, Freezestat, Fusible plug, Overload, Adjustable temperature switch, Phase inversion switch					
Evap Water Pipe in/out	2" FPT		2 1/2" FPT		3" FPT	
Cond Water Pipe in/out	2" FPT		2 1/2" FPT		3" FPT	

R22 / 50Hz

Item \ Model	CGWP021	CGWP026	CGWP030	CGWP040	CGWP050	CGWP060
Cooling Capacity (kW)	58.9	72.6	88.7	117.6	147.2	176.7
Heating Capacity (kW)	71.1	89.4	107.1	142.5	178.6	215.0
Circuit	2	2	2	2	2	2
Load (%)	100-50-0	100-50-0	100-75-50-25-0		100-80-60-30-0	100-75-50-25-0
Volt/Phase	380V/400V/415V/3Ph/50Hz					
Cooling Input (kW)	14.2	18.1	21.6	28.3	36.2	43.2
Heating Input (kW)	17.0	21.7	25.9	33.9	42.4	51.8
RLA (Cooling) 380V	30	38	45	60	76	90
400V	28	36	43	57	72	85
415V	28	35	41	55	70	82
RLA (Heating) 380V	56	56	54	72	91	108
400V	50	50	52	68	86	102
415V	34	42	49	65	84	98
LRA 380V	135	190	158	165	226	265
400V	135	190	198	166	240	265
415V	135	190	198	166	278	265
Evaporator Type	Brazed plate heat exchanger					
Water Flow (GPM)	170	211	253	337	422	506
WPD (m H2O)	4.0	3.0	4.0	3.7	4.0	4.0
Condenser Type	Shell and tube					
Water Flow (GPM)	205	251	315	419	526	630
WPD (m H2O)	2.5	2.5	3.4	3.9	2.9	2.9
Refrigerant	R22					
Refrigerant Charge (kg)	5.5+5.5	5.5+7.5	7.5+7.5	12.0+12.0	15.0+15.0	18.0+18.0
Oil Charge (L) (SUNISO 4GS)	3.8+3.8	3.8+6.6	6.6+6.6	7.6+7.6	10.4+10.4	13.2+13.2
Dimension Length (mm)	1230				1430	
Depth (mm)	550				1130	
Height (mm)	1400				1350	
Operating Weight (kg)	500	540	580	920	1060	1140
Protection	HP, pressure cutout, Freezestat, Fusible plug, Overload, Adjustable temperature switch, Phase inversion switch					
Evap Water Pipe in/out	2" FPT		2 1/2" FPT		3" FPT	
Cond Water Pipe in/out	2" FPT		2 1/2" FPT		3" FPT	

NOTE : 1. Cooling capacity rated conditions : a. Chilled water inlet/outlet temperature=12°C/7°C, b. Cooling water inlet/outlet temperature=30°C/35°C.
2. Heating capacity rated conditions : a. Chilled water inlet/outlet temperature=12°C/7°C, b. Cooling water inlet/outlet temperature=20°C/45°C.
3. Tolerance of the data as above is ± 5% according to Standard ARI 590.

R407C / 60Hz

Item \ Model	CGWP021	CGWP026	CGWP030	CGWP040	CGWP050	CGWP060
Cooling Capacity (kW)	67.1	80.9	100.7	134.5	167.8	201.4
Heating Capacity (kW)	81.2	102.7	123.1	163.4	205.4	246.7
Circuit	2	2	2	2	2	2
Load (%)	100-50-0	100-60-0	100-50-0	100-75-50-25-0	100-80-60-30-0	100-75-50-25-0
Volt/Phase	220V/380V/460V 3Ph/60Hz					
Cooling Input (kW)	19.6	27.9	29.4	39.3	49.6	59.8
Heating Input (kW)	20.9	25.5	30.5	39.0	51.0	62.9
RLA (Cooling) 380V	60	75	90	120	150	184
RLA (Cooling) 460V	55	63	82	110	136	164
RLA (Cooling) 575V	36	45	56	70	86	104
RLA (Heating) 220V	72	90	105	143	180	216
RLA (Heating) 380V	42	52	62	85	103	124
RLA (Heating) 460V	35	43	54	72	91	108
LRA 220V	295	450	455	355	525	625
LRA 380V	175	264	267	210	299	374
LRA 460V	130	190	192	165	226	268
Evaporator Type	Brazed plate heat exchanger					
Evaporator Water Flow (LPM)	192	241	289	381	481	573
Evaporator WPD (m H2O)	4.8	3.2	6.8	4.6	3.7	4.8
Condenser Type	Shell and tube					
Condenser Water Flow (LPM)	240	302	362	480	603	725
Condenser WPD (m H2O)	2.7	3.3	3.8	3.2	3.8	2.9
Refrigerant	R407C					
Refrigerant Charge (kg)	6.5+6.5	5.5+7.5	7.5+7.5	12.0+12.0	15.0+15.0	18.0+18.0
Oil Charge (L) *OEM	3.0+3.0	3.8+6.6	6.6+6.6	7.6+7.6	*10.4+10.4	13.2+13.2
Dimension Length (mm)	1230				1400	
Dimension Depth (mm)	550				720	
Dimension Height (mm)	1300				1350	
Operating Weight (kg)	520	540	580	980	1060	1340
Protection	HP, pressure cutout, Freezestat, Fusible plug, Overload, Adjustable temperature switch, Phase reversal switch					
Evap. Water Pipe in/out	2" FPT		2 1/2" FPT		3" FPT	
Cond. Water Pipe in/out	2" FPT		2 1/2" FPT		3" FPT	

R407C / 50Hz

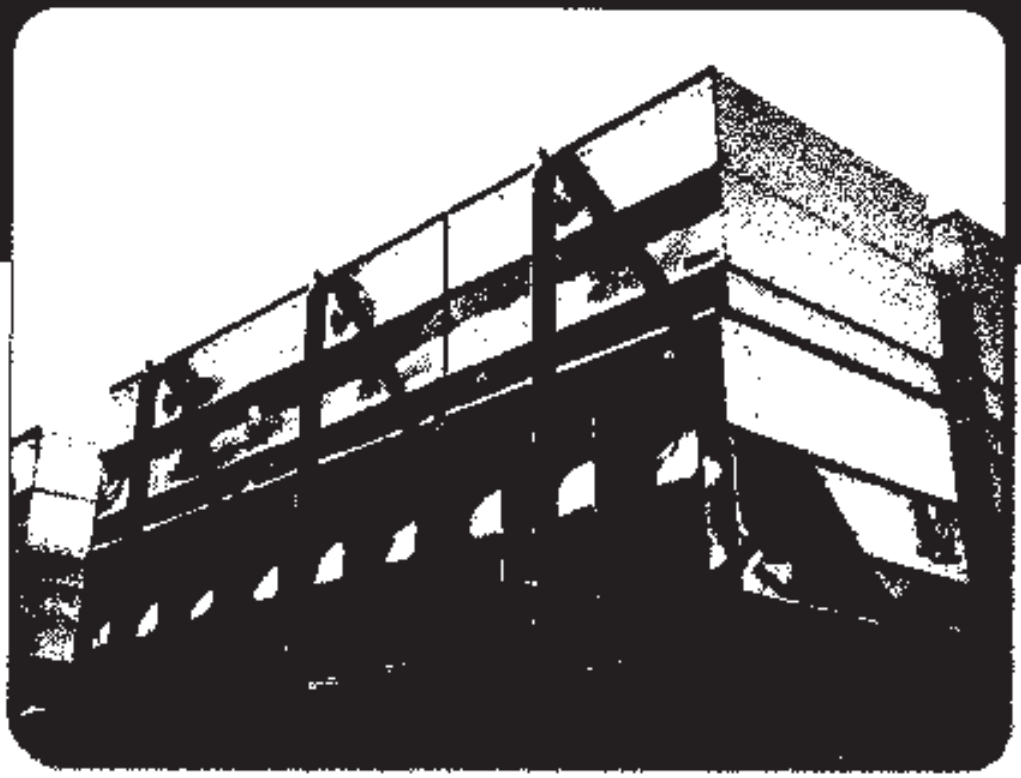
Item \ Model	CGWP021	CGWP026	CGWP030	CGWP040	CGWP050	CGWP060
Cooling Capacity (kW)	55.6	69.5	83.9	111.9	139.8	167.8
Heating Capacity (kW)	65.4	80.0	103.1	130.5	172.0	206.2
Circuit	2	2	2	2	2	2
Load (%)	100-50-0	100-60-0	100-50-0	100-75-50-25-0	100-80-60-30-0	100-75-50-25-0
Volt/Phase	380/400/415V-3PH-50Hz					
Cooling Input (kW)	14.2	18.1	21.6	28.3	36.2	43.2
Heating Input (kW)	17.0	21.2	25.9	30.9	43.4	51.8
RLA (Cooling) 380V	30	38	45	60	75	92
RLA (Cooling) 400V	29	35	43	57	72	86
RLA (Cooling) 415V	28	34	41	54	70	82
RLA (Heating) 380V	36	46	54	72	91	108
RLA (Heating) 400V	35	43	52	69	86	103
RLA (Heating) 415V	34	42	49	66	84	99
LRA 380V	195	195	195	155	278	243
LRA 400V	195	195	195	155	278	243
LRA 415V	195	195	195	155	278	243
Evaporator Type	Brazed plate heat exchanger					
Evaporator Water Flow (LPM)	191	231	241	321	401	481
Evaporator WPD (m H2O)	3.6	2.8	3.7	3.4	2.6	3.7
Condenser Type	Shell and tube					
Condenser Water Flow (LPM)	287	358	430	574	717	861
Condenser WPD (m H2O)	3.6	2.7	3.2	2.3	2.7	3.7
Refrigerant	R407C					
Refrigerant Charge (kg)	5.5+5.5	5.5+7.5	7.5+7.5	12.0+12.0	15.0+15.0	18.0+18.0
Oil Charge (L) *OEM	3.8+3.8	3.8+6.6	6.6+6.6	7.6+7.6	*10.4+10.4	13.2+13.2
Dimension Length (mm)	1230				1400	
Dimension Depth (mm)	550				720	
Dimension Height (mm)	1300				1350	
Operating Weight (kg)	500	540	580	980	1060	1340
Protection	HP, pressure cutout, Freezestat, Fusible plug, Overload, Adjustable temperature switch, Phase reversal switch					
Evap. Water Pipe in/out	2" FPT		2 1/2" FPT		3" FPT	
Cond. Water Pipe in/out	2" FPT		2 1/2" FPT		3" FPT	

NOTE : 1. Cooling capacity rated conditions : a. Chilled water inlet/outlet temperature=12°C/7°C, b. Cooling water inlet/outlet temperature=30°C/35°C
2. Heating capacity rated conditions : a. Chilled water inlet/outlet temperature=10°C/7°C, b. Cooling water inlet/outlet temperature=40°C/45°C
3. Tolerance of the data as above is ± 5% according to Standard ARI 590

Technical Literature

2) Cooling Tower

Series V
Cooling Towers



Product Detail

Series V Spotlight

D85

- Single Side Air Inlet
- Sound Sensitive Alternatives
- Suitable for Indoor or Outdoor Installations
- Low Profile Models Available
- BALTIGUARD™ PLUS Fan System
- High Temperature Applications

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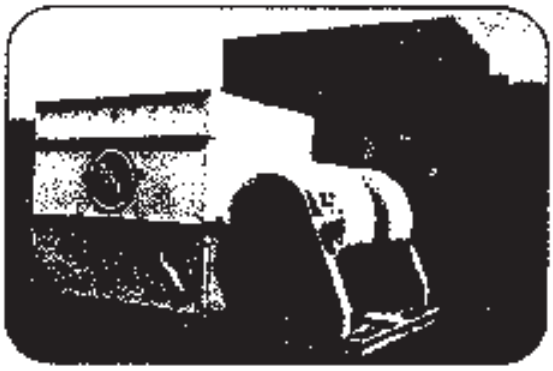
Benefits

Installation and Application Flexibility

- **Indoor Installations** - Centrifugal fans can overcome the static pressure imposed by external ductwork, allowing the Series V to be installed indoors.

- **Low Profile Models** - Motors and drives of low profile units are adjacent to the casing section for use in height sensitive installations. Low profile models are available in capacities from 16 to 272 nominal tons, which correspond to heights of 5' 1-1/4" and 8' 1-13/16", respectively.

- **High Temperature Applications** - A range of construction options are available to accommodate entering water temperatures of up to 170°F.



Low Profile Unit Shown in Contrast to a Standard Unit

Low Sound

- **Centrifugal Fan** - Centrifugal fans have inherently low sound characteristics.

- **Single Air Inlet** - Sound-sensitive areas can be accommodated by facing the quiet blank-off panel to the sound-sensitive direction.

- **Attenuation** - For extremely sound sensitive applications, factory designed tested/rated sound attenuation is available for both the air intake and discharge.

Low Energy Consumption

- **Evaporative Cooling Equipment** - Minimizes the energy consumption of the entire system because it provides lower condensing water temperatures. Owners save money while conserving natural resources and reducing environmental impact.

- **Motors** - Premium efficient/VFD duty motors are standard.

Low Installed Cost

- **Support** - All models mount directly on two parallel I-beams and ship complete with motors and drives factory-installed and aligned.

- **Modular Design** - Large models ship in multiple sections to minimize the size and weight of the heaviest lift, allowing for the use of smaller, less costly cranes.

Easy Maintenance

- **Internal Access** - The interior of the unit is easily accessible for adjusting the float valve, cleaning the strainer or flushing the basin.

The Water Level Control is Easily Reached from the Access Door

Reliable Year-Round Operation

- **V-Belt Drive** - The fans, motor, and drive system are located outside of the moist discharge airstream, protecting them from moisture, condensation and icing. Backed by a five-year fan drive and motor warranty, these units are suitable for year-round operation.

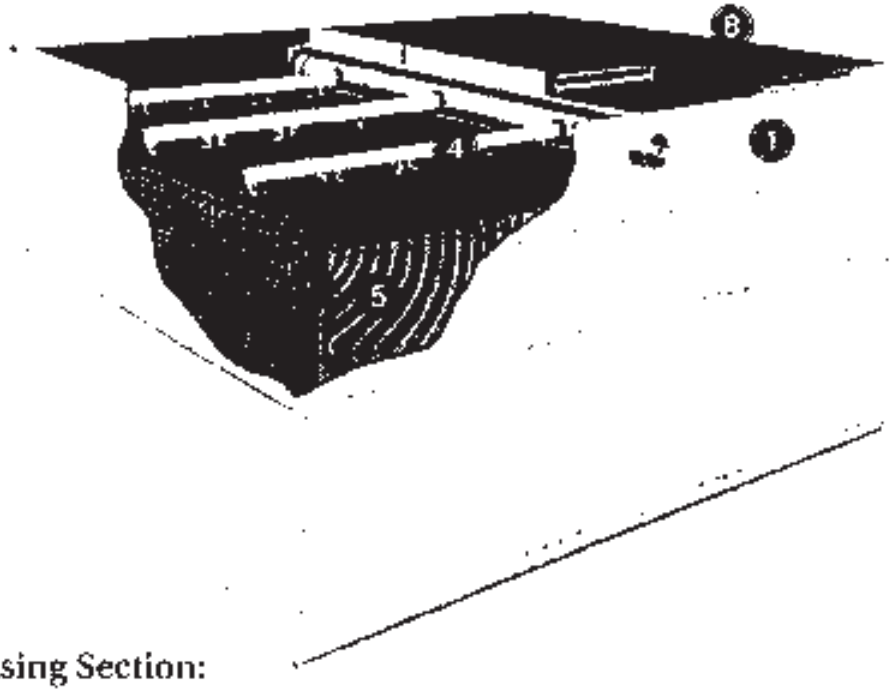
External V-Belt Drive System (Shown Here with Panel Removed)

Long Service Life

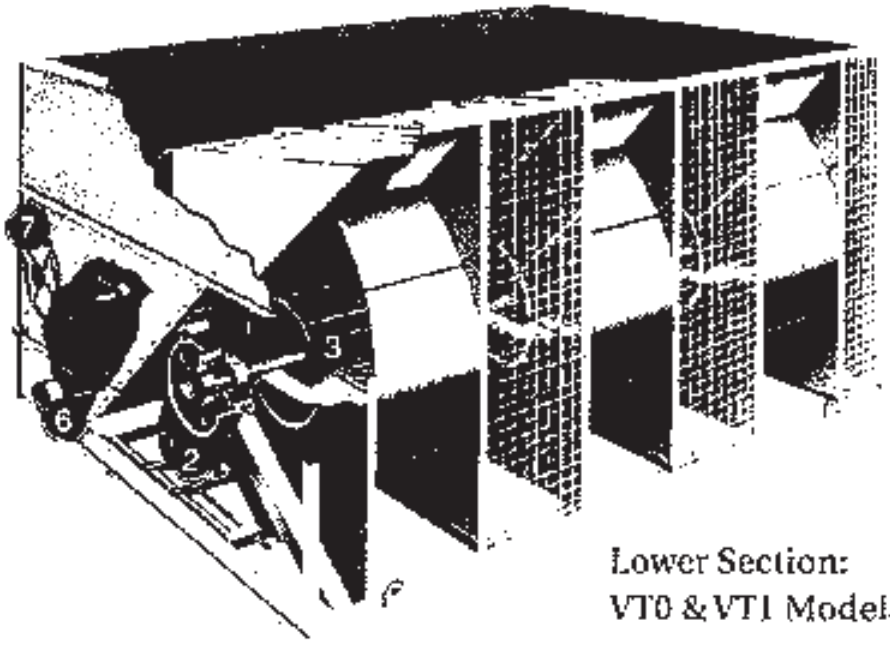
- **Materials of Construction** - Various materials are available to meet the corrosion resistance, unit operating life, and budgetary requirements of any project (see page D91 for construction options).

Construction Details

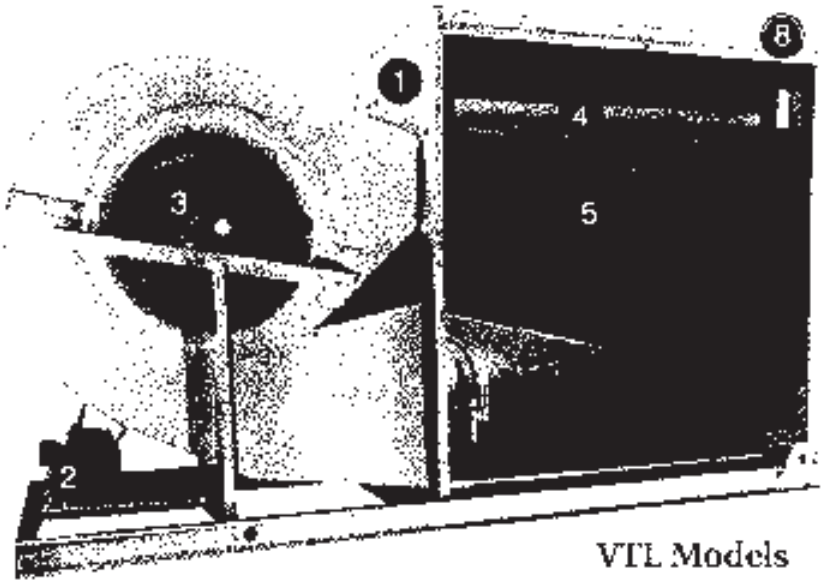
Series V



Casing Section:
VT0 & VT1 Models



Lower Section:
VT0 & VT1 Models



VTL Models

1 Heavy-Duty Construction

- G-235 (Z700 metric) hot-dip galvanized steel panels

2 Fan Drive System

- V-belt drive
- Heavy-duty bearings L_{10} 40,000 hours (280,000 hour average life)
- Premium efficient/VFD duty motors are standard
- Five-year motor and drive warranty

3 Low Sound Centrifugal Fan(s)

- Quiet operation

4 Water Distribution System

- Schedule 40 PVC spray header and branches
- Large orifice, non-clog nozzles
- Grommetted for easy removal

5 BACount® Fill

- Polyvinyl chloride (PVC)
- Impervious to rot, decay and biological attack
- Flame spread rating of 5 per ASTM E84

6 Strainer

- Anti-vortexing design to prevent air entrainment

7 Access Door

- Interior of unit is easily accessible

8 Drift Eliminators

- Polyvinyl chloride (PVC)
- Impervious to rot, decay and biological attack
- Flame spread rating of 5 per ASTM E84
- Assembled in easy to handle sections

Custom Features and Options

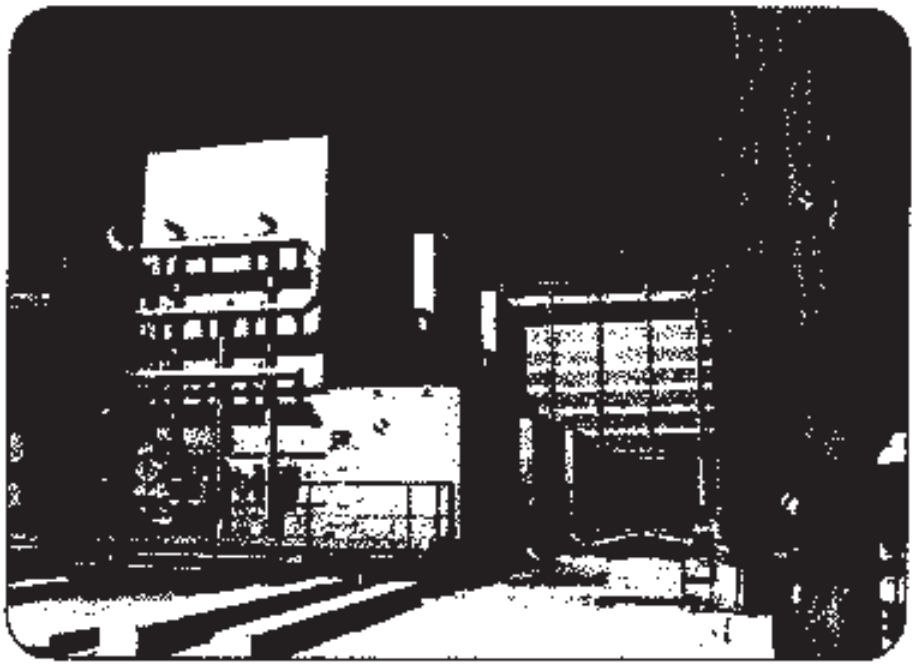
Construction Options

- **Standard Construction:**
  Steel panels and structural elements are constructed of heavy-gauge G-235 hot-dip galvanized steel.
- **Optional Thermosetting Hybrid Polymer:**
  A thermosetting hybrid polymer coating used to extend equipment life, is applied to select hot-dip galvanized steel components of the cooling tower. The thermosetting hybrid polymer has been tested to withstand 6000 hours in a 5% salt spray without blistering, chipping, or loss of adhesion.
- **Optional Stainless Steel Construction:**
  A variety of Stainless Steel options are available to meet your needs.

See page M20 for more details on the materials described above.

Fan Drive System

The fan drive system provides the cooling air necessary to reject unwanted heat from the system to the atmosphere. Dynamically balanced, forwardly curved, centrifugal fans driven by matched V-belts with taper lock sheaves designed for not less than 150% of the motor nameplate horsepower are standard on the Series V. Premium efficient cooling tower duty fan motors provide maximum performance for cooling tower service, and are backed by BAC's comprehensive five-year motor and fan drive warranty.



Unit with Intake and Discharge Attenuation

BALTIGUARD™ Fan System

BALTIGUARD™ Fan System

The BALTIGUARD™ Fan System consists of two standard single-speed fan motors and drive assemblies. One drive assembly is sized for full speed and load, and the other is sized for approximately 2/3 speed and consumes only 1/3 the design horsepower. This configuration allows the reserve capacity of a standby motor in the event of failure. As a minimum, approximately 70% capacity will be available from the low horsepower motor, even on a design wet-bulb day. Controls and wiring are the same as those required for a two-speed, two-winding motor. On some units the standby fan motor can be increased to the size of the main motor for 100% redundancy.

BALTIGUARD PLUS™ Fan System

The BALTIGUARD PLUS™ Fan System builds on the advantages of the BALTIGUARD™ Fan System by adding a VFD to one of the motors. For more information on the BALTIGUARD PLUS™ Fan System refer to page K1.

BALTIGUARD PLUS™ Fan System

Low Sound Alternatives

The low sound levels generated by Series V Cooling Towers make them suitable for most installations. For situations when one direction is particularly sound-sensitive, the unit can be oriented so that the side opposite the air inlet faces the sound-sensitive direction. The Series V is also available with factory designed, tested, and rated sound attenuation for both the air intake and discharge.

Accessories

External Access Options (VT0 and VT1 Models Only)

VT0 and VT1 models can be furnished with ladders extending from the top of the unit to the base, as well as safety cages, safety gates and handrail packages to meet OSHA requirements.

NOTE: *When these access options are employed, the tower must be equipped with steel drift eliminators.*

Vibration Cutout Switch

A factory mounted vibration cutout switch is available to effectively protect against equipment failure due to excessive vibration of the mechanical equipment system. BAC can provide either a mechanical or solid-state electronic vibration cutout switch in a NEMA 4 enclosure to ensure reliable protection. Additional contacts can be provided on either switch type to activate an alarm.

Vibration Cutout Switch

Basin Heaters

Cooling towers exposed to below freezing ambient temperatures require protection to prevent freezing of the water in the cold water basin when the unit is idle. Factory installed electric immersion heaters, which maintain +40°F (4.4°C) water temperature, are a simple and inexpensive way of providing such protection.

Heater kW Data

Model Number	0°F (-17.8°C) Ambient Heaters		-20°F (-29.0°C) Ambient Heaters	
	No. of Heaters	kW per Heater	No. of Heaters	kW per Heater
VTL-018-F thru 039-H	1	2	1	2
VTL-045-H thru 079-K	1	3	1	4
VTL-082-K thru 095-K	1	4	1	5
VTL-100-K thru 137-M	1	5	1	7
VTL-152-M thru 227-O	1	7	1	9
VTL-245-P thru 272-P	1	9	1	12
VTO-12-E thru 97-K	1	2	1	3
VTO-65-J thru 88-L	1	2	1	3
VTO-102-L thru 176-O	1	3	1	5
VT1-N209-P thru N255-P	1	5	1	7
VT1-N301-O thru N385-R	1	7	1	10
VT1-N418-P thru N513-P	2	5	2	7
VT1-275-P thru 415-R	1	8	1	10
VT1-416-O thru 600-P	1	12	2	7
VT1-550-P thru 830-R	2	8	2	10
VT1-825-P thru 1335-S	3	8	3	10

Electric Water Level Control Package

The electric water level control replaces the standard mechanical makeup valve when more precise water level control is required. This package consists of a conductance-actuated level control mounted in the basin and a solenoid activated valve in the make-up water line. The valve is slow closing to minimize water hammer.

Electric Water Level Control Package

Extended Lubrication Lines

Extended lubrication lines with grease fittings located outside the fan section are available for lubrication of the fan shaft bearings.

High Temperature Fill

Optional high temperature fill materials are available to increase the maximum allowable entering water temperature to 170°F (76.7°C). Refer to page D107 for more detailed information.

Bottom Screens (VT0 and VT1 Models Only)

Wire mesh screens are available factory-installed over the bottom openings to prevent unauthorized access.

Basin Sweeper Piping

Basin sweeper piping provides an effective method of preventing sediment from collecting in the cold water basin of the tower. A complete system, is provided in the tower basin for connection to side stream filtration equipment (by others). For more information on filtration systems see page M163

Solid Bottom Panels

Factory-installed bottom panels are required when intake air is ducted to the unit.

Discharge Hoods

Discharge hoods reduce the risk of recirculation in tight enclosures by increasing discharge air velocity, and can be used to elevate the tower discharge above adjacent walls to comply with layout guidelines.

Discharge Hoods

Equipment Controls

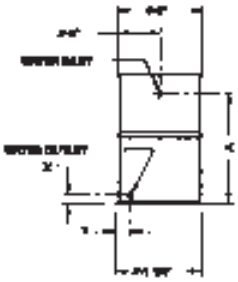
BAC control panels are specifically designed to work seamlessly with all BAC units and engineered to meet your particular application. For more on BAC Equipment Controls, see section K.

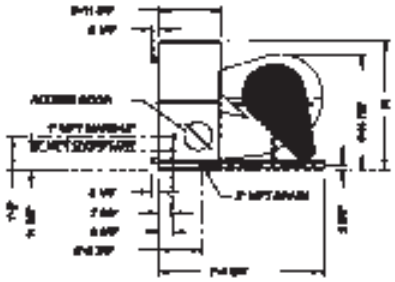
Factory Mutual Approval construction is available as an option.

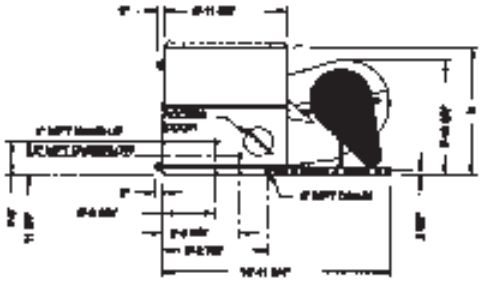
VTL Engineering Data

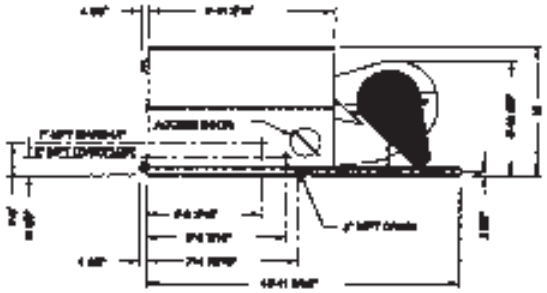
Do not use for construction. Refer to factory certified dimensions. This handbook includes data current at the time of publication, which should be reconfirmed at the time of purchase. Up-to-date engineering data, free product selection software, and more can be found at **www.BaltimoreAircoil.com**.

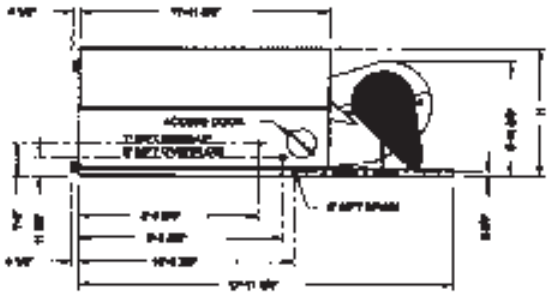
VTL Models





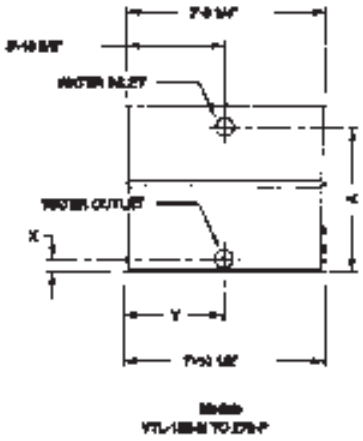


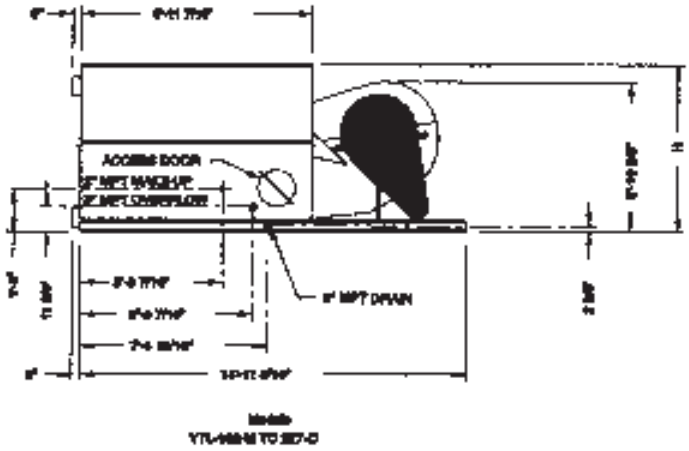


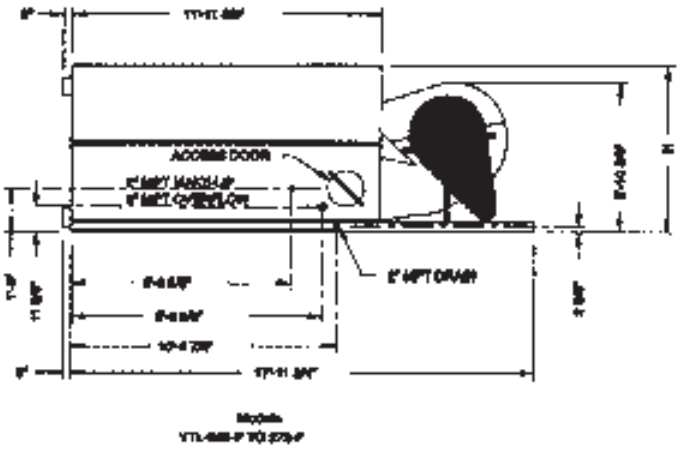


Model Number	Nominal Tonnage*	Motor HP	Airflow (CFM)	Weights (lbs) Operating	Shipping	Dimensions A	B	K	Y	Connections* Inlet	Outlet	Overflow
VTL-018-E	18	1.5	7,650	1,620	1,030	4'-0-3/4"	5'-1-1/4"	4-9/16"	7-3/4"	3"	3"	2"
VTL-021-F	21	2	8,150	1,660	1,140	4'-0-3/4"	5'-1-1/4"	4-9/16"	7-3/4"	3"	3"	2"
VTL-027-F	27	2	7,370	1,740	1,220	5'-7"	6'-6-1/4"	4-9/16"	7-3/4"	3"	3"	2"
VTL-030-G	30	3	9,270	1,770	1,250	5'-7"	6'-6-1/4"	4-9/16"	7-3/4"	3"	3"	2"
VTL-034-F	34	5	9,420	1,810	1,290	5'-7"	6'-6-1/4"	4-9/16"	7-3/4"	3"	3"	2"
VTL-039-K	39	5	7,860	1,910	1,390	4'-1-5/16"	5'-1-13/16"	4-9/16"	7-3/4"	3"	3"	2"
VTL-045-K	45	5	10,910	2,710	1,650	4'-0-3/4"	5'-1-1/4"	4-1/16"	7-3/4"	4"	4"	2"
VTL-051-G	51	3	13,350	2,810	1,750	5'-7"	6'-6-1/4"	4-1/16"	7-3/4"	4"	4"	2"
VTL-059-H	59	5	15,490	2,830	1,770	5'-7"	6'-6-1/4"	4-1/16"	7-3/4"	4"	4"	2"
VTL-068-J	66	7.5	17,210	2,900	1,840	5'-7"	6'-6-1/4"	4-1/16"	7-3/4"	4"	4"	2"
VTL-072-K	72	10	18,690	2,930	1,870	5'-7"	6'-6-1/4"	4-1/16"	7-3/4"	4"	4"	2"
VTL-079-K	79	10	17,500	3,100	2,040	4'-1-5/16"	5'-1-13/16"	4-1/16"	7-3/4"	4"	4"	2"
VTL-082-K	82	10	22,400	3,810	2,260	5'-7"	6'-6-1/4"	5-1/8"	8-13/16"	6"	6"	2"
VTL-092-L	92	15	24,920	3,940	2,390	5'-7"	6'-6-1/4"	5-1/8"	8-13/16"	6"	6"	2"
VTL-095-K	95	10	21,150	4,070	2,510	4'-1-5/16"	5'-1-13/16"	5-1/8"	8-13/16"	6"	6"	2"
VTL-103-K	103	10	24,990	4,740	2,080	5'-7"	6'-6-1/4"	5-1/8"	8-13/16"	6"	6"	3"
VTL-116-L	116	15	28,200	4,800	2,740	5'-7"	6'-6-1/4"	5-1/8"	8-13/16"	6"	6"	3"
VTL-126-M	126	20	30,700	4,870	2,750	5'-7"	6'-6-1/4"	5-1/8"	8-13/16"	6"	6"	3"
VTL-137-M	137	20	29,500	5,120	3,000	4'-1-5/16"	5'-1-13/16"	5-1/8"	8-13/16"	6"	6"	3"

See page D105 for Engineering Considerations.







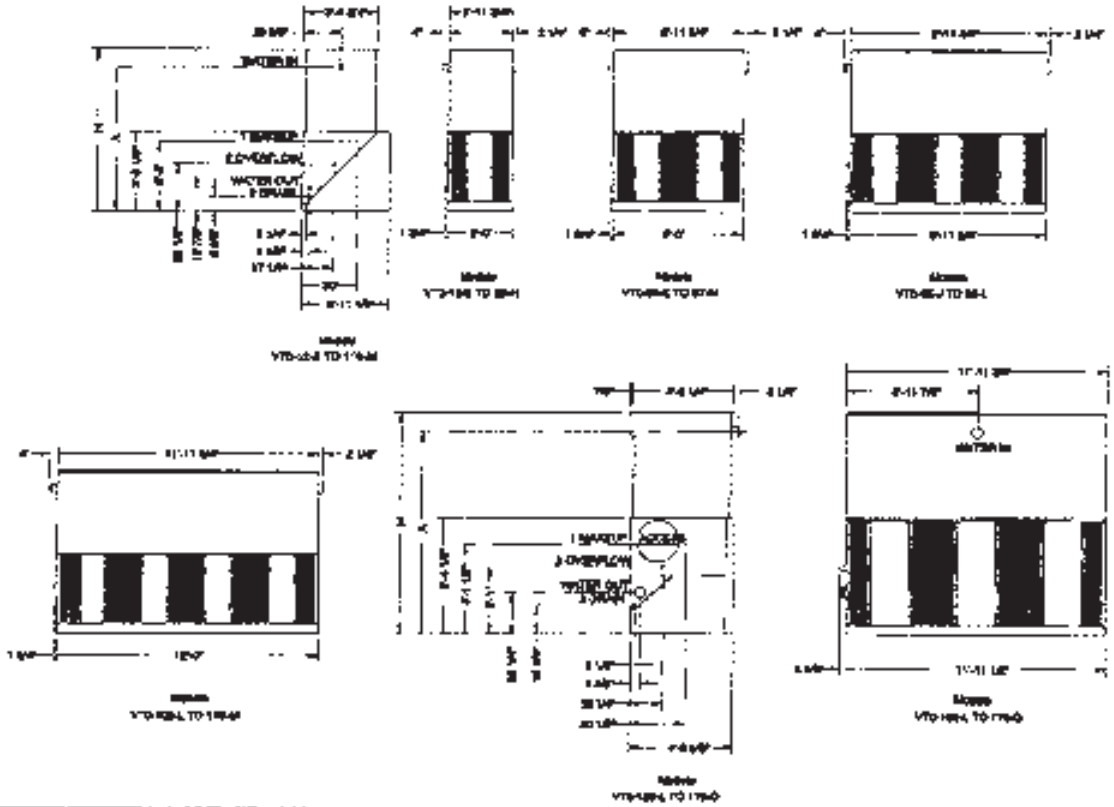
Model Number	Nominal Tonnage[1]	Motor HP	Airflow (CFM)	Weights (lbs) Operating	Shipping	Dimensions A	H	K	Y	Connections Inlet	Outlet	Overflow
VTL-152-M	152	20	45,870	8,540	5,440	4'-1-3/4"	5'-1-1/4"	6-1/8"	3'-11-1/4"	6"	6"	3"
VTL-171-M	171	15	32,940	6,870	3,650	5'-8"	6'-5-1/4"	6-1/8"	3'-11-1/4"	8"	8"	3"
VTL-185-M	185	20	43,150	8,960	3,820	5'-8"	6'-5-1/4"	6-1/8"	3'-11-1/4"	8"	8"	3"
VTL-198-M	198	25	46,090	7,000	3,650	5'-8"	6'-5-1/4"	6-1/8"	3'-11-1/4"	8"	8"	3"
VTL-209-M	209	30	47,630	7,040	3,900	5'-8"	6'-6-1/4"	6-1/8"	3'-11-1/4"	8"	8"	3"
VTL-227-M	227	30	46,550	7,470	4,300	7'-2-5/16"	6'-1-13/16"	6-1/8"	3'-11-1/4"	8"	8"	3"
VTL-245-P	245	40	58,820	8,970	4,790	5'-8"	6'-6-1/4"	6-1/8"	3'-11-1/4"	8"	8"	3"
VTL-272-P	272	40	56,760	9,490	5,310	7'-2-5/16"	6'-1-3/16"	6-1/8"	3'-11-1/4"	8"	8"	3"

Notes:

1. Operating weight is for the tower with the water level in the cold water basin at overflow.
2. Unless otherwise indicated, all connections 6" and smaller are MPT. Connections 8" and larger are beveled for welding.
3. Fan horsepower is at 0" external static pressure.
4. Nominal tons of cooling represents the capability to cool 3 GPM of water from a 95°F entering water temperature to a 85°F leaving water temperature at a 78°F entering wet-bulb temperature.

VT0 Engineering Data

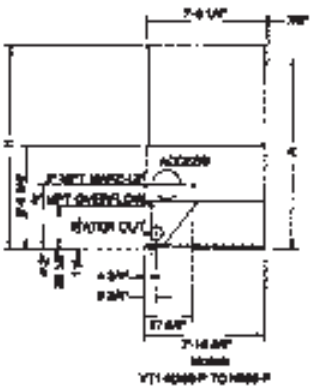
Do not use for construction. Refer to factory certified dimensions. This handbook includes data current at the time of publication, which should be reconfirmed at the time of purchase. Up-to-date engineering data, free product selection software, and more can be found at **www.BaltimoreAircoil.com**.

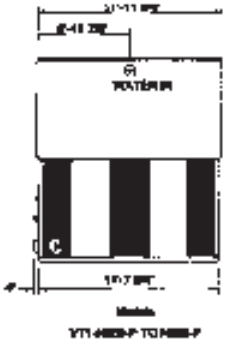


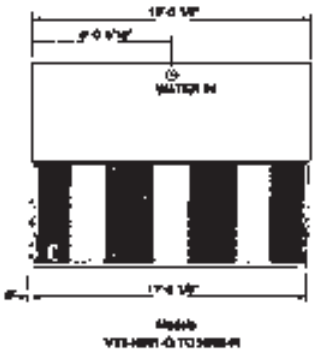
Model Number	Nominal Tonnage*	Motor HP*	Airflow (CFM)	Weights (lbs) Operating*	Weights (lbs) Shipping	Dimensions A	Dimensions K	Dimensions B	Connections Inlet	Connections Outlet	Connections Overflow
VTO-12-E	12	1.5	4,070	960	790	6'-7-7/8"	7'-6-1/8"	12-7/8"	3"	3"	2"
VTO-14-F	14	2	5,460	970	800	6'-7-7/8"	7'-6-1/8"	12-7/8"	3"	3"	2"
VTO-19-G	19	3	6,190	990	820	6'-7-7/8"	7'-6-1/8"	12-7/8"	3"	3"	2"
VTO-24-G	24	3	6,945	1,060	890	8'-1-7/8"	9'-0-1/8"	12-7/8"	3"	3"	2"
VTO-28-H	28	5	6,960	1,170	970	8'-1-7/8"	9'-0-1/8"	12-7/8"	3"	3"	2"
VTO-32-H	32	5	11,820	1,580	1,230	8'-1-7/8"	9'-0-1/8"	12-7/8"	3"	3"	2"
VTO-41-J	41	7.5	13,435	1,650	1,290	6'-7-7/8"	7'-6-1/8"	12-7/8"	3"	3"	2"
VTO-52-J	52	7.5	12,960	1,780	1,540	8'-1-7/8"	9'-0-1/8"	12-7/8"	3"	3"	2"
VTO-57-K	57	10	14,180	1,790	1,550	8'-1-7/8"	9'-0-1/8"	12-7/8"	3"	3"	2"
VTO-65-J	65	7.5	16,850	2,380	2,200	8'-1-7/8"	9'-0-1/8"	12-7/8"	4"	4"	2"
VTO-75-K	75	10	18,435	2,590	2,010	8'-1-7/8"	9'-0-1/8"	12-7/8"	4"	4"	2"
VTO-78-K	78	10	17,990	2,710	2,130	9'-7-1/8"	10'-6-1/8"	12-7/8"	4"	4"	2"
VTO-88-L	88	15	20,420	2,720	2,130	9'-7-1/8"	10'-6-1/8"	12-7/8"	4"	4"	2"
VTO-107-K	107	15	25,060	3,310	2,500	8'-1-7/8"	9'-0-1/8"	12-7/8"	4"	4"	2"
VTO-107-L	107	15	24,869	3,680	2,870	9'-7-1/8"	10'-6-1/8"	12-7/8"	4"	4"	2"
VTO-118-M	118	20	26,670	3,740	2,930	9'-7-1/8"	10'-6-1/8"	12-7/8"	4"	4"	2"
VTO-137-L	137	15	30,600	5,190	3,620	10'-9-7/8"	11'-9-1/8"	23-1/4	6"	6"	3"
VTO-145-M	145	20	33,630	5,200	3,630	10'-9-7/8"	11'-9-1/8"	23-1/4"	6"	6"	3"
VTO-155-N	155	25	35,240	5,253	3,583	10'-9-7/8"	11'-9-1/8"	23-1/4"	6"	6"	3"
VTO-166-N	166	25	35,265	5,692	4,289	12'-3-7/8"	13'-3-1/8"	23-1/4"	6"	6"	3"
VTO-176-O	176	30	37,530	5,680	4,310	12'-3-7/8"	13'-3-1/8"	23-1/4"	6"	6"	3"

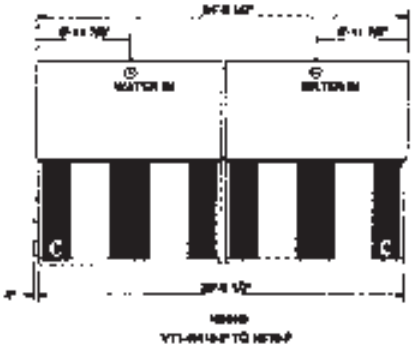
VT1 Engineering Data

Do not use for construction. Refer to factory certified dimensions. This handbook includes data current at the time of publication, which should be reconfirmed at the time of purchase. Up-to-date engineering data, free product selection software, and more can be found at **www.BaltimoreAircoil.com**.









Model Number	Approximate Operating	Motor HP	Airflow (CFM)	Weights (lbs) Operating	Shipping	Maximum Section	Dimensions A	B	C	Connections[1] Inlet	Outlet
VT1-N259-P	259	40	66,900	9,160	5,350	3,800	12' 7-5/8"	11' 9-1/8"	12"	8"	8"
VT1-N290-Q	290	30	53,100	9,490	5,660	3,110	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N340-P	340	40	57,950	9,680	5,850	3,300	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N255-P	255	40	55,900	10,980	6,550	2,300	13' 9 3/8"	14' 6 7/8"	12"	8"	8"
VT1-N301-Q	301	50	86,750	13,380	7,530	4,590	10' 7-5/8"	11' 3-3/8"	12"	8"	8"
VT1-N325-P	325	40	77,450	14,110	8,200	4,550	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N346-Q	346	50	83,050	14,150	8,300	4,590	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N370-P	370	50	80,450	15,130	9,250	4,690	13' 9-3/8"	14' 6-7/8"	12"	8"	8"
VT1-N395-P	396	60	84,750	15,250	9,400	4,710	13' 9-3/8"	14' 6-7/8"	12"	8"	8"
VT1-N418-P	418	(2) 40	120,600	18,490	10,680	6,580	10' 7 3/8"	11' 3 3/8"	11"	(2) 8"	10"
VT1-N446-Q	445	(2) 50	106,200	19,110	11,300	6,700	12' 4-5/8"	13' 2-1/8"	11"	(2) 8"	10"
VT1-N450-P	450	(2) 40	115,900	15,490	11,680	6,580	12' 4-5/8"	13' 2-1/8"	11"	(2) 8"	10"
VT1-N510-P	510	(2) 40	111,800	20,890	13,080	6,580	13' 9 3/8"	14' 6 7/8"	11"	(2) 8"	10"

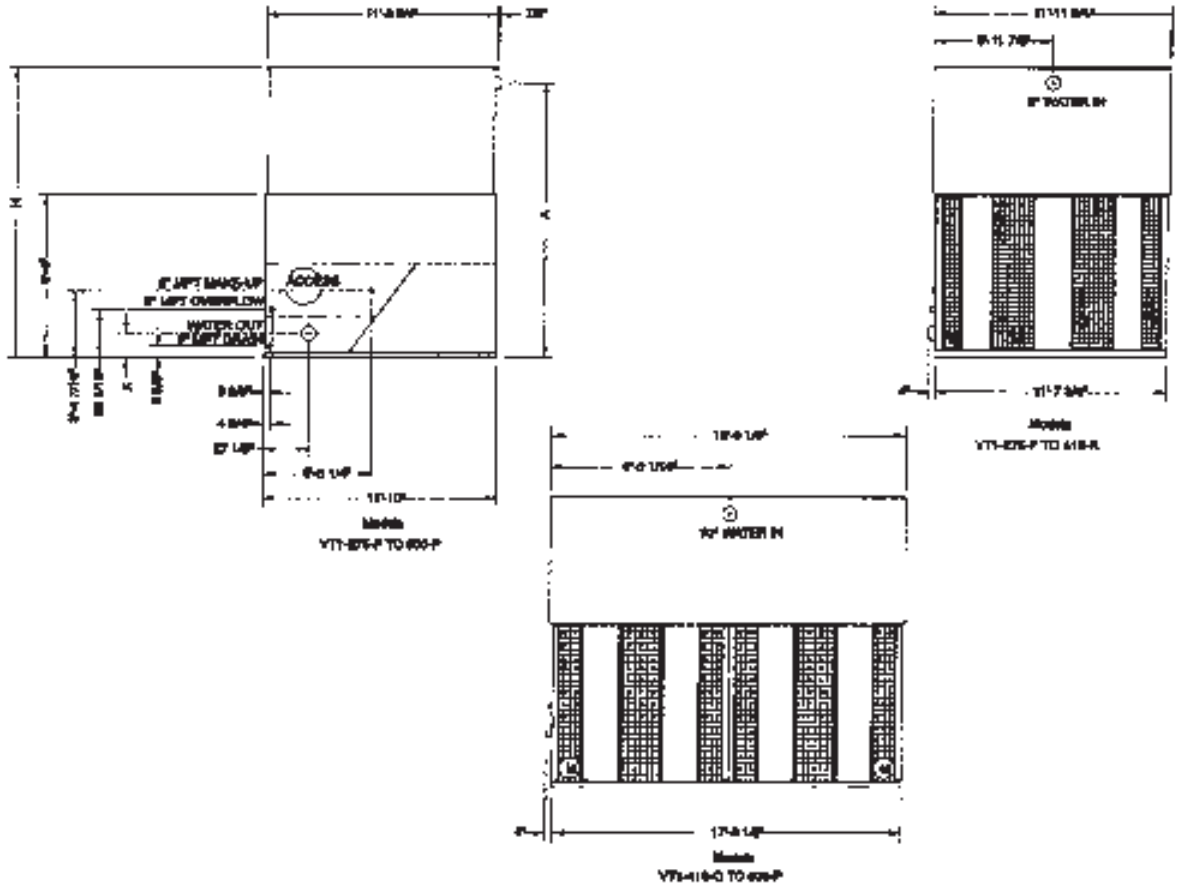
Notes:

1. Operating weight is for the tower with the water level in the cold water basin at overflow.
2. Unless otherwise indicated, all connections 6" and smaller are MPT. Connections 8" and larger are beveled for welding.
3. Fan horsepower is at 0" external static pressure.
4. Nominal fans all cooling components 3 GPM of water from a 95°F to 85°F at a 78°F entering wet bulb temperature.
5. Unit's casing section is the heaviest section.

VT1 Engineering Data

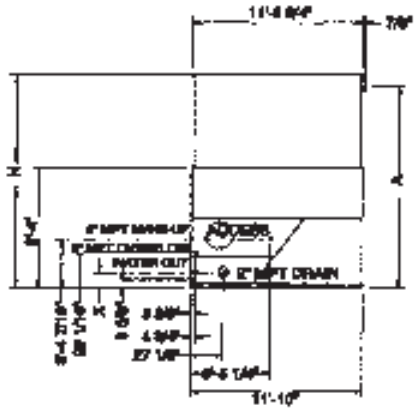
Do not use for construction. Refer to factory certified dimensions. This handbook includes data current at the time of publication, which should be reconfirmed at the time of purchase. Up-to-date engineering data, free product selection software, and more can be found at **www.BaltimoreAircoil.com**.

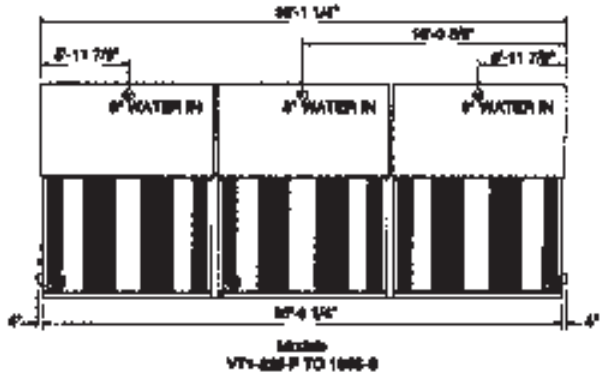
Series V



Model Number	Nominal Tonnage*	Motor HP	Airflow (CFM)	Weights (lbs) Operating	Weights (lbs) Shipping	Heaviest Section	Dimensions A	Dimensions H	Dimensions X	Connections Inlet	Connections Outlet	Connections Make-up
VT1-275-F	275	40	82,250	15,190	9,040	5,140	12'-2 7/8"	17'-10 3/8"	14'-3/8"	8"	5"	2"
VT1-307-O	307	30	74,950	15,780	8,530	4,950	11'-11 7/8"	14'-9 3/8"	14'-1/2"	8"	6"	2"
VT1-349-F	349	40	81,550	15,970	8,820	5,140	11'-11 7/8"	14'-9 3/8"	14'-1/2"	5"	8"	2"
VT1-375-F	375	40	79,900	16,940	9,790	5,140	15'-4 5/8"	16'-2 1/8"	14'-1/2"	5"	8"	2"
VT1-406-O	406	50	85,150	16,930	9,830	5,180	15'-4 5/8"	16'-2 1/8"	14'-1/2"	5"	8"	2"
VT1-416-R	416	60	90,250	17,100	9,950	5,300	15'-4 5/8"	16'-2 1/8"	14'-1/2"	8"	8"	2"
VT1-446-O	446	(2) 30	125,048	22,430	11,530	7,280	12'-1 7/8"	12'-10 5/8"	13'-1/2"	10"	10"	2"
VT1-478-N	478	(2) 25	116,550	23,800	12,700	7,240	13'-10 7/8"	14'-9 3/8"	13'-1/2"	10"	10"	2"
VT1-507-O	507	(2) 30	128,450	23,840	12,740	7,280	13'-10 7/8"	14'-9 3/8"	13'-1/2"	10"	10"	2"
VT1-560-O	560	(2) 30	139,750	25,080	14,180	7,280	15'-3 5/8"	16'-2 1/8"	13'-1/2"	10"	10"	2"
VT1-600-P	600	(2) 40	151,250	25,460	14,560	7,660	15'-3 5/8"	16'-2 1/8"	13'-1/2"	10"	10"	2"

See page D105 for Engineering Considerations.





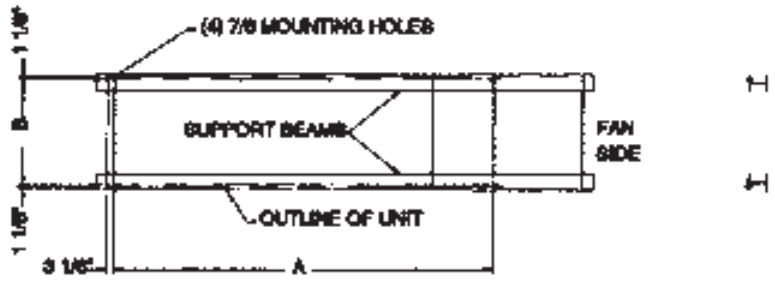
Model Number	Nominal Tonnage*	Motor HP	Airflow (CFM)	Weights (lbs) Operating	Shipping	Heaviest Section	Dimensions A	H	X	Connections Inlet	Outlet	Make-up
VT1-560-P	560	(2) 40	155,060	30,580	18,870	10,770	12' 2-7/8"	12' 10-5/8"	12'-1/2"	(2) 8"	12"	2"
VT1-680-P	680	(2) 40	160,100	32,150	17,520	10,770	13' 11-7/8"	14' 4-3/8"	12'-1/2"	(2) 8"	12"	2"
VT1-750-P	750	(2) 40	158,600	34,091	19,520	10,220	13' 4-5/8"	16' 2-1/8"	12'-1/2"	(2) 8"	12"	2"
VT1-800-P	800	(2) 50	170,300	34,170	19,600	10,300	13' 4-5/8"	16' 2-1/8"	12'-1/2"	(2) 8"	12"	2"
VT1-830-P	830	(2) 50	180,500	34,410	19,840	10,540	13' 4-5/8"	16' 2-1/8"	12'-1/2"	(2) 8"	12"	2"
VT1-825-P	825	(3) 40	247,590	45,980	24,000	15,200	12' 2-7/8"	12' 10-5/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-921-P	921	(3) 50	223,050	47,750	25,770	14,720	13' 11-7/8"	14' 9-3/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1020-P	1020	(3) 40	244,650	48,320	26,340	15,300	13' 11-7/8"	14' 9-3/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1125-P	1125	(3) 40	297,900	51,230	29,250	15,300	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1200-P	1200	(3) 50	256,650	50,350	29,370	15,420	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1245-P	1245	(3) 60	270,750	50,370	29,740	15,790	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1335-P	1335	(3) 75	290,550	51,770	29,790	15,840	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"

Notes:

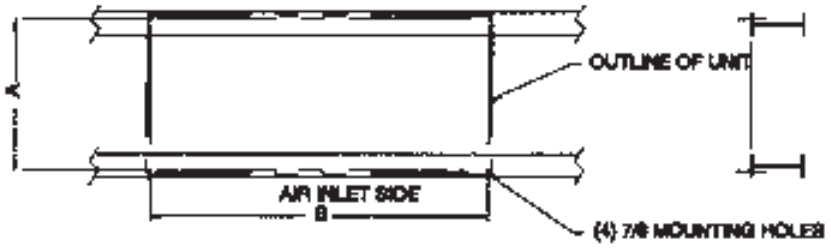
1. Operating weight is for tower with water level in the cold water basin at overflow.
2. Unless otherwise indicated, all connections 6" and smaller are MPT. Connections 8" and larger are beveled for welding.
3. Fan horsepower is at 0" external static pressure.
4. Fans on models VT1-416 through 600 must be cycled simultaneously for capacity control. For additional steps of control beyond on/off operation, a variable frequency drive, the BALTIGUARD™ Fan System, or two-speed motors are recommended.
5. Nominal tons of cooling represents 3 GPM of water from a 95°F to 85°F at a 78°F entering wet bulb temperature.

Structural Support

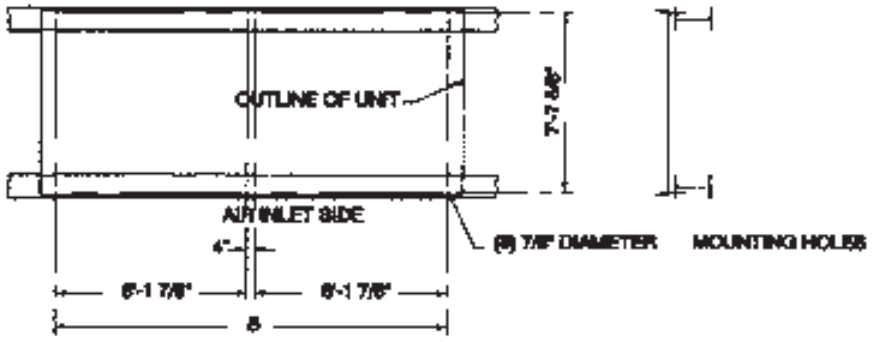
The recommended support arrangement for the Series V Cooling Tower consists of parallel I-beams running the full length of the unit, spaced as shown in the following drawing. Besides providing adequate support, the steel also serves to raise the unit above any solid foundation to ensure access to the bottom of the tower. To support a Series V Cooling Tower in an alternate steel support arrangement, consult your local BAC Representative.



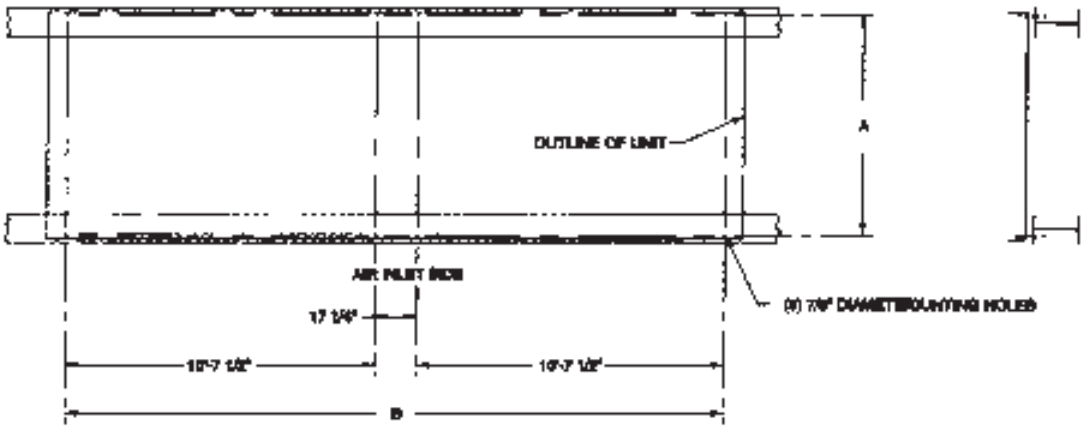
ALL VTL MODELS



ALL VTO MODELS & VTI-N309-P THRU N356-P & VTI-276-P THRU 416-R



ALL VTO MODELS & VTI-N501-Q THRU N510-P & VTI-416-P THRU 630-R



MODELS VTI-[illegible] THRU 1235-S

Model Number	A	B	Maximum Deflection*
VTL-016-E thru 038-H	3' 11"	4'-5"	1/4"
VTL-045-H thru 079-K	3' 11"	7' 11 1/2"	3/8"
VTL-082-K thru 095-K	3' 11"	10' 11-1/4"	1/2"
VTL-100-K thru 137-M	3' 11"	13' 11-1/2"	1/2"
VTL-152-M thru 227-O	5' 8-1/4"	20' 11-1/2"	1/2"
VTL-249-P thru 272-P	5' 8-1/4"	13' 11-1/2"	1/2"
VTI-12-E thru 28-H	5' 9-3/8"	2' 5 1/2"	3/32"
VTI-32-H thru 57-K	5' 9-3/8"	5' 5-1/2"	3/16"
VTI-65-J thru 83-L	5' 9-3/8"	8' 5-1/4"	3/16"
VTI-102-L thru 116-M	5' 9-3/8"	11' 5-1/2"	3/8"
VTI-132-L thru 178-O	4' 6-1/4"	11' 5 1/2"	3/8"
VTI-N209-P thru N245-P	7' 7 5/8"	10' 7-1/2"	3/8"
VTI-N301-O thru N365-R	7' 7 5/8"	16' 7 3/4"	1/2"
VTI-N415-P thru N510-P	7' 7 5/8"	22' 8-1/4"	1/2"
VTI-275-P thru 415-R	11' 7-1/4"	13' 7-1/2"	3/4"
VTI-416-O thru 600-P	11' 7 1/4"	16' 7-3/4"	1/2"
VTI-550-P thru 630-R	11' 7-1/4"	22' 5-1/4"	1/2"
VTI-825-P thru 1235-S	11' 7 1/4"	34' 8"	1/2"

Notes:

1. Support beams and anchor bolts are to be selected and installed by others.
2. All supporting steel must be level at the top.
3. Beams must be selected in accordance with accepted structural practice. The maximum allowable deflection of beams under unit shall be as specified in the table above.
4. All units can be furnished with an optional vibration isolation package, if required, to be installed between the tower and supporting steel. When determining the length of steel beams, allow for the length of vibration isolation rails, as they may be longer than the tower length shown above.
5. If point vibration isolation is used, the isolators must be located under the supporting steel, not between the support steel and the cooling tower.

Series V

Engineering Specifications

See our website at www.BaltimoreAircoil.com for an electronic copy of product engineering specifications.

1.0 Cooling Tower

1.1 General: Furnish and install factory assembled, forced-draft, centrifugal fan, counterflow cooling tower(s) with vertical air discharge conforming in all aspects to the specifications, schedules and as shown on the plans. Overall dimensions shall not exceed approximately ft (mm) long X ft (mm) wide X ft (mm) high. The total connected fan horsepower shall not exceed HP (kW). The cooling tower(s) shall be Baltimore Aircoil Model .

1.2 Thermal Capacity: The cooling tower(s) shall be warranted by the manufacturer to cool USGPM (l/s) of water from °F (°C) to °F (°C) at °F (°C) entering wet bulb temperature. Additionally, the thermal performance shall be certified by the Cooling Technology Institute in accordance with CTI Certification Standard STD-201. Lacking such certification, a field acceptance test shall be conducted within the warranty period in accordance with CTI Acceptance Test Code ATC-105, by the Cooling Technology Institute or other qualified independent third party testing agency. A manufacturer's performance guarantee or performance bond without CTI Certification or independent field thermal performance test shall not be acceptable.

1.3 Corrosion Resistant Construction: Unless otherwise noted in this specification, all steel panels and structural members shall be constructed of heavy-gauge G-235 (Z700 metric) hot-dip galvanized steel.

1.4 Quality Assurance: The manufacturer shall have a Management System certified by an accredited registrar as complying with the requirements of ISO 9001 to ensure consistent quality of products and services. Manufacturers that are not ISO 9001 certified shall not be acceptable.

2.0 Construction Details

2.1 Structure (VTC/I models): The cooling tower shall be constructed of heavy-gauge steel utilizing double brake flanges for maximum strength and rigidity and reliable sealing of watertight joints. The fill shall be removable from the basin section to facilitate shipping and handling. The fan(s) and fan drive system, including the fan motor, shall be factory mounted and aligned and located in the dry entering airstream to ensure reliable operation and ease of maintenance.

2.1 Structure (VTL models): The cooling tower shall be constructed of heavy gauge steel utilizing double brake flanges for maximum strength and rigidity and reliable sealing of watertight joints. The unit shall be of unitary design to minimize rigging requirements. The fan(s) and fan drive system, including the fan motor, shall be factory mounted and aligned and located in the dry entering airstream to ensure reliable operation and ease of maintenance.

2.2 Fill: The fill shall be formed from self extinguishing (per UL94 HB and UL94 V-0 testing) polyvinyl chloride (PVC) having a flame spread rating of 5 per ASTM E84 and shall be impervious to rot, decay, and fungus or biological attack. The fill shall be manufactured and performance tested by the cooling tower manufacturer to assure single source responsibility and control of the final product.

2.3 Water Distribution System: Water shall be distributed evenly over the fill by a water distribution system consisting of a header and spray branches of Schedule 40 PVC pipe with large orifice, non-clog plastic distribution nozzles. The branches and spray nozzles shall be held in place by snap-in rubber grommets allowing quick removal of individual nozzles or complete branches for cleaning or flushing.

2.4 Cold Water Basin: The cold water basin shall be provided with large area lift out strainers with perforated openings sized smaller than the water distribution system nozzles and an anti-vortexing device to prevent air entrainment. The strainer and anti-vortexing device shall be constructed of the same material as the basin to prevent dissimilar metal corrosion. Standard basin accessories shall include a corrosion resistant make-up valve with large diameter polystyrene filled plastic float for easy adjustment of the operating water level.

3.0 Mechanical Equipment

3.1 Fan(s): Fan(s) shall be dynamically balanced, forwardly curved, centrifugal type selected to provide optimum thermal performance with minimal sound levels. Fan housings shall have curved inlet rings for efficient air entry and four-sided rectangular discharge cowls shall extend into the basin to increase fan efficiency and prevent water from splashing into the fans.

3.2 Bearings: Fan(s) and shaft(s) shall be supported by heavy-duty, self-aligning, relubricatable bearings with cast iron housings, designed for a minimum L_{10} life of 40,000 hours (280,000 Hr. Avg. Life).

3.3 Fan Drive: The fan(s) shall be driven by matched V belts with taper lock sheaves designed for not less than 150% of the motor nameplate horsepower. Motor shall be located on a heavy-duty motor base, adjustable by a single threaded bolt-and-nut arrangement. Removable steel screens or panels shall protect the fan drive and all moving parts.

3.4 Fan Motor: Furnish HP, RPM totally Enclosed, squirrel cage, ball bearing type fan motors suitable for outdoor service. Fan motor(s) shall be premium efficient, inverter-duty type designed per NEMA Standard MG1, Section IV, and Part 31 suitable for volt, hertz, and phase electrical service.

3.5 Mechanical Equipment Warranty: The fan(s), fan shaft(s), bearings, mechanical equipment support and fan motor shall be warranted against defects in materials and workmanship for a period of five (5) years from date of shipment.

4.0 Drift Eliminators

4.1 Drift Eliminators: Eliminators shall be constructed of specially formulated PVC and be removable in easily handled sections. They shall have a minimum of three changes in air direction.

5.0 Access

5.1 Basin Access: Access doors shall be provided for easy access to the make-up water assembly and suction strainer for routine maintenance.

6.0 Sound

6.1 Sound Level: To maintain the quality of the local environment, the maximum sound pressure levels (dB) measured 50 ft from the cooling tower operating at full fan speed shall not exceed the sound levels detailed below.

Location	63	125	250	500	1000	2000	4000	8000	dB(A)
Discharge									
Air Inlet									
Casing Face									
Blank Off									

7.0 Accessories

7.1 Basin Heater(s). The cooling tower cold water basin shall be provided with electric heater(s) to prevent freezing in low ambient conditions. The heater(s) shall be selected to maintain 40 F (4.4°C) basin water temperatures at ° F ambient. The heater(s) shall be V phase/ Hz electric and shall be provided with low water cutout and thermostat.

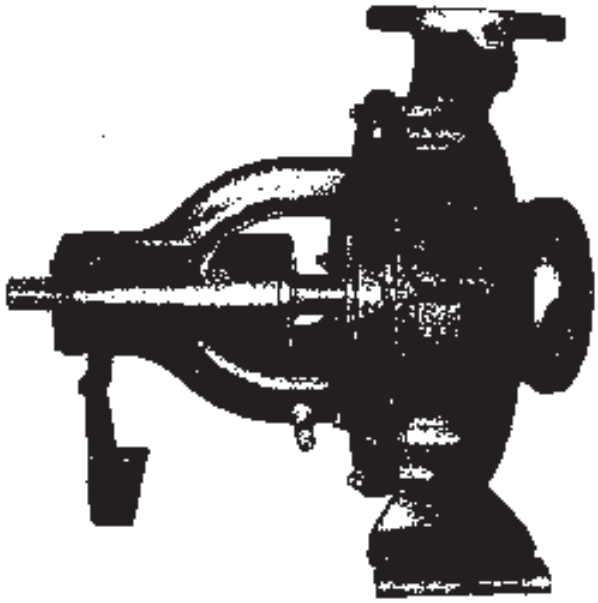
7.2 Vibration Cutout Switch: Provide mechanical local reset vibration switch. The mechanical vibration cut out switch will be guaranteed to trip at a point so as not to cause damage to the cooling tower. To ensure this, the trip point will be a frequency range of 0 to 3 600 RPM and a trip point of 0.2 to 2.0 g's.

Technical Literature

3) Chilled Water Pump

CENTRIFUGAL PUMPS FOR LOW AND MEDIUM PRESSURE

TYPE LDP 3
DIN 24255



Applications

Pumping of clean or turbid liquids free from large solids such as water, fuels, oil, brine, alkaline solutions and mild acids.
Water supply, booster pumping stations, air conditioning installations, irrigation, industrial and agricultural applications, public services etc.

Hydraulic data

- Capacity up to 550 m³/h
- Total head up to 150m
- Temperature up to 105° C
- Max. working pressure up to 16 bar

Design

Single-stage, end - suction volute design with vertically arranged radial discharge branch. Single entry, closed impeller. Heavy duty ball bearings with two seals, "oil lubricated", in sturdily constructed housing flanged to pump casing.

Maintenance is very easy, the impeller shaft and other rotating parts being removeable with no need to disconnect the suction or delivery pipes.

The use of an extension coupling enalbes a pump to be dismantled without removing either the driver or the pump casing.
Maximum interchangeability of components. Identical parts can be used with various sizes of pumps which greatly simplifies and reduces stock of spare parts.

MEMBER OF Europump

DRAKOS - POLEMIS S.A.
PUMP MANUFACTURERS
Kryoneri - Athens - Greece

SPECIFICATIONS

Sealing arrangements

- Pumps are supplied as standard with a conventional packed gland
- Lantern ring for water sealing and packing lubrication
- For special purposes, mechanical seal and wearing rings can be used

Materials

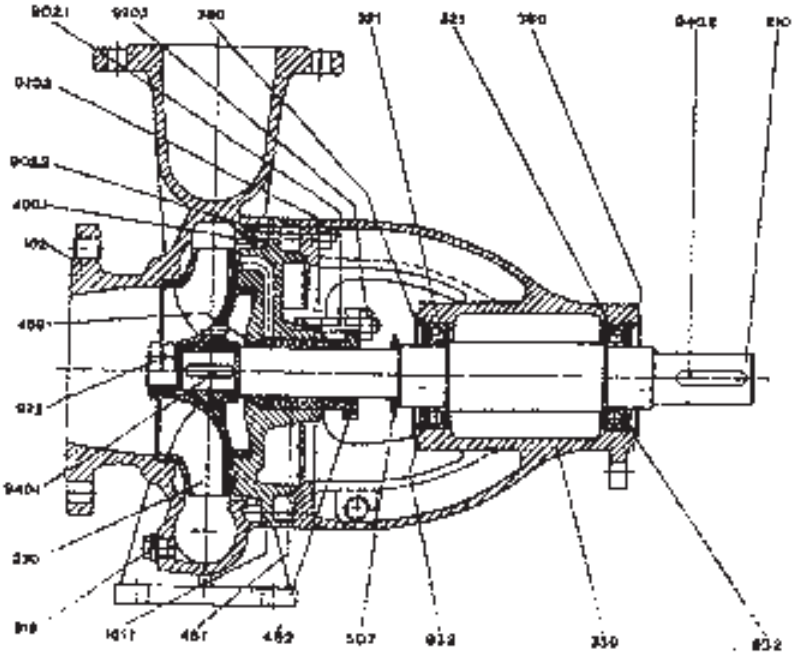
Standard design

Casing	Cast iron
Impeller	Cast iron
Shaft	Steel

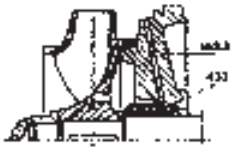
Special design

Casing	Bronze, Stainless steel
Impeller	Bronze, Stainless steel
Wearing rings	Bronze, Stainless steel
Shaft	Corrosion-resistant steel / Stainless steel

SECTIONAL VIEW



Form 0

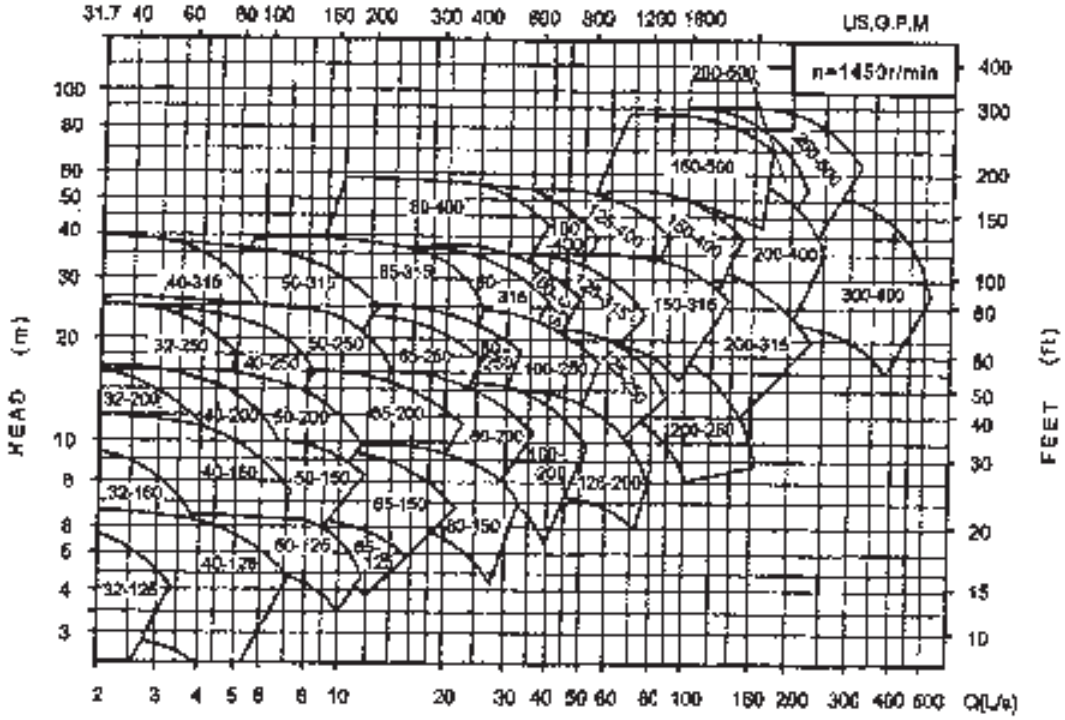


Form 1

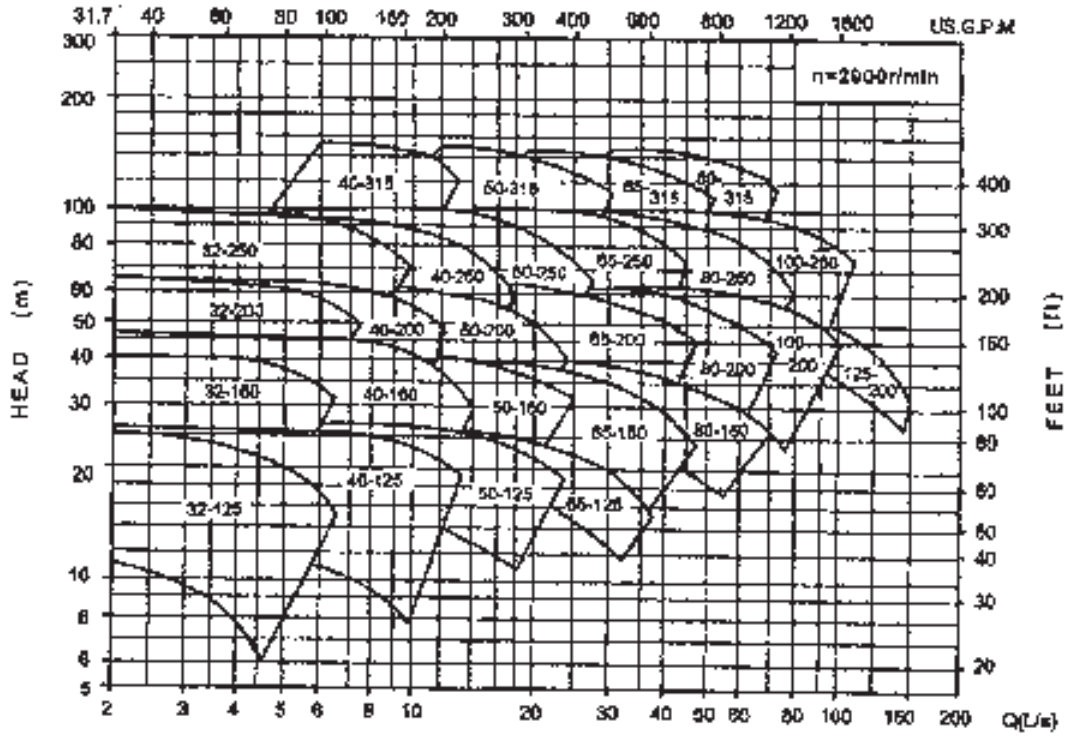
Europump Number	Part Name	Europump Number	Part Name
102	Casing	459	Stuffing box bushing
161.1	Casing cover	461	Stuffing box packing
162.2	Casing cover for mechanical seal	507	Deflector
210	Shaft	902.1	Gland stud
230	Impeller	902.2	Stud for casing
321	Ball bearing	918	Drain plug
330	Bearing bracket	920.1	Gland stud nut
360	Bearing cover	920.2	Nut for casing
400.1	Gasket for casing cover	922	Impeller nut
433	Mechanical seal	940.1	Key for impeller
452	Stuffing box gland	940.2	Key for coupling

SELECTION CHART

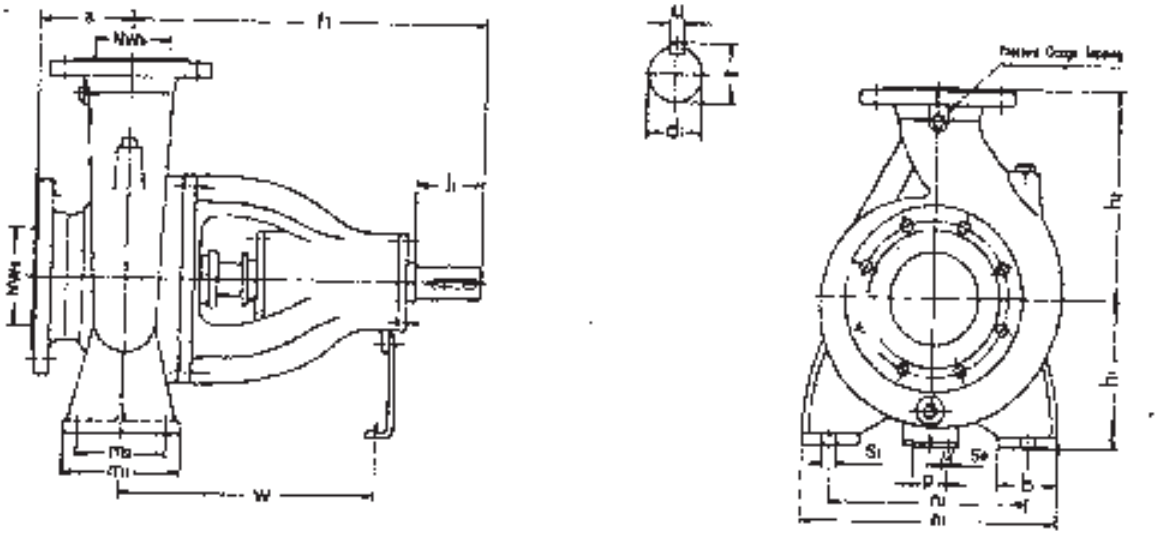
n=1450r/min



n=2900r/min



DIMENSIONS



DIMENSIONS (in millimeters)

SIZE	SUC	DEL	Length		Height		Feet & Support					Mounting details				Shaft end			
	NWs	NWd	a	f1	h1	h2	b	m1	w	p	S2	m2	n1	n2	bolt size	d1	l1	t	u
32-125	50	32	80	360	112	140	50	100	287	100	14	70	190	140	M 12	24	50	27	8
32-160	50	32	80	360	132	160	50	100	287	100	14	70	240	190	M 12	24	50	27	8
32-200	50	32	80	360	160	180	50	100	287	110	14	70	240	190	M 12	24	50	27	8
32-250	50	32	100	360	180	225	65	125	287	110	14	95	320	250	M 12	24	50	27	8
40-125	65	40	80	360	132	160	50	100	287	100	14	70	240	190	M 12	24	50	27	8
40-160	65	40	80	360	132	160	50	100	287	100	14	70	240	190	M 12	24	50	27	8
40-200	65	40	100	360	160	180	50	100	287	110	14	70	265	212	M 12	24	50	27	8
40-250	65	40	100	360	180	225	65	125	287	110	14	95	320	250	M 12	24	50	27	8
40-315	65	40	125	470	200	225	65	125	342	110	14	95	345	280	M 12	32	80	35	10
50-125	65	50	100	360	132	160	50	100	287	100	14	70	240	190	M 12	24	50	27	8
50-160	65	50	100	360	160	180	50	100	287	110	14	70	265	212	M 12	24	50	27	8
50-200	65	50	100	360	160	200	50	100	287	110	14	70	265	212	M 12	24	50	27	8
50-250	65	50	100	360	180	225	65	125	287	110	14	95	320	250	M 12	24	50	27	8
50-315	65	50	125	470	225	280	65	125	342	110	14	95	345	280	M 12	32	80	35	10
65-125	80	65	100	360	160	180	65	125	287	110	14	95	280	212	M 12	24	50	27	8
65-160	80	65	100	360	180	200	65	125	287	110	14	95	280	212	M 12	24	50	27	8
65-200	80	65	100	360	180	225	65	125	287	110	14	95	320	250	M 12	24	50	27	8
65-250	80	65	100	470	200	250	80	160	342	110	14	120	380	290	M 16	32	80	35	10
65-315	80	65	125	470	225	280	80	160	342	110	14	120	400	315	M 16	32	80	35	10
80-160	100	80	125	470	180	225	80	125	287	110	14	95	320	250	M 12	24	50	27	8
80-200	100	80	125	470	180	250	65	125	342	110	14	95	345	280	M 12	32	80	35	10
80-250	100	80	125	470	200	280	80	160	342	110	14	120	400	315	M 16	32	80	35	10
80-315	100	80	125	470	250	315	80	160	342	110	14	120	400	315	M 16	32	80	35	10
80-400	100	80	125	632	280	355	95	160	368	110	14	120	440	340	M 16	42	110	45	12
100-200	125	100	125	470	200	280	80	160	342	110	14	120	360	280	M 16	32	80	35	10
100-250	125	100	140	470	225	280	80	160	342	110	14	120	400	315	M 16	32	80	35	10
100-315	125	100	140	470	250	315	80	160	342	110	14	120	400	315	M 16	32	80	35	10
100-400	125	100	140	630	280	355	100	200	360	110	14	150	500	400	M 20	42	110	45	12
125-200	150	125	140	470	250	315	80	160	342	110	14	120	400	315	M 16	32	80	35	10
125-250	150	125	140	470	250	355	80	160	342	110	14	120	400	315	M 16	32	80	35	10
125-315	150	125	140	530	280	355	100	200	370	110	14	150	500	400	M 20	42	110	45	12
125-400	150	125	140	630	315	400	100	200	370	110	14	150	500	400	M 20	42	110	45	12
125-500	150	125	180	880	375	500	100	200	500	140	14	150	650	450	M 20	55	110	59	16
150-200	200	150	160	495	280	400	100	200	367	110	14	150	550	400	M 20	32	80	35	10
150-250	200	150	160	530	280	355	100	200	370	110	14	150	460	360	M 20	42	110	45	12
150-315	200	150	160	530	280	400	100	200	370	110	14	150	560	450	M 20	42	110	45	12
150-400	200	150	160	530	315	450	100	200	370	110	14	150	550	450	M 20	42	110	45	12
150-500	200	150	180	670	375	500	100	200	500	140	15	150	650	450	M 20	55	110	59	16
200-250	250	200	180	646	320	400	100	200	369	110	15	150	650	450	M 20	42	110	45	12
200-315	250	200	200	670	355	450	100	200	500	110	15	150	550	450	M 20	48	110	52	14
200-400	250	200	200	670	356	500	100	200	500	110	15	150	550	450	M 20	48	110	52	14
200-500	250	200	240	783	425	545	150	300	534	140	23	240	720	600	M 20	70	140	75	20
250-500	300	250	240	783	425	545	150	300	534	140	23	240	720	600	M 20	70	140	75	20
300-400	350	300	280	783	500	650	150	300	550	140	23	200	800	680	M 20	70	140	74.5	20

- Pump sizes 32-250, 40-315, 50-315, 65-400, 80-400, 100-160, 125-200, 150-200 and 150-250 are not provided for by the DIN Standards.
① Back pull-out distance required between motor shaft end and pump shaft.

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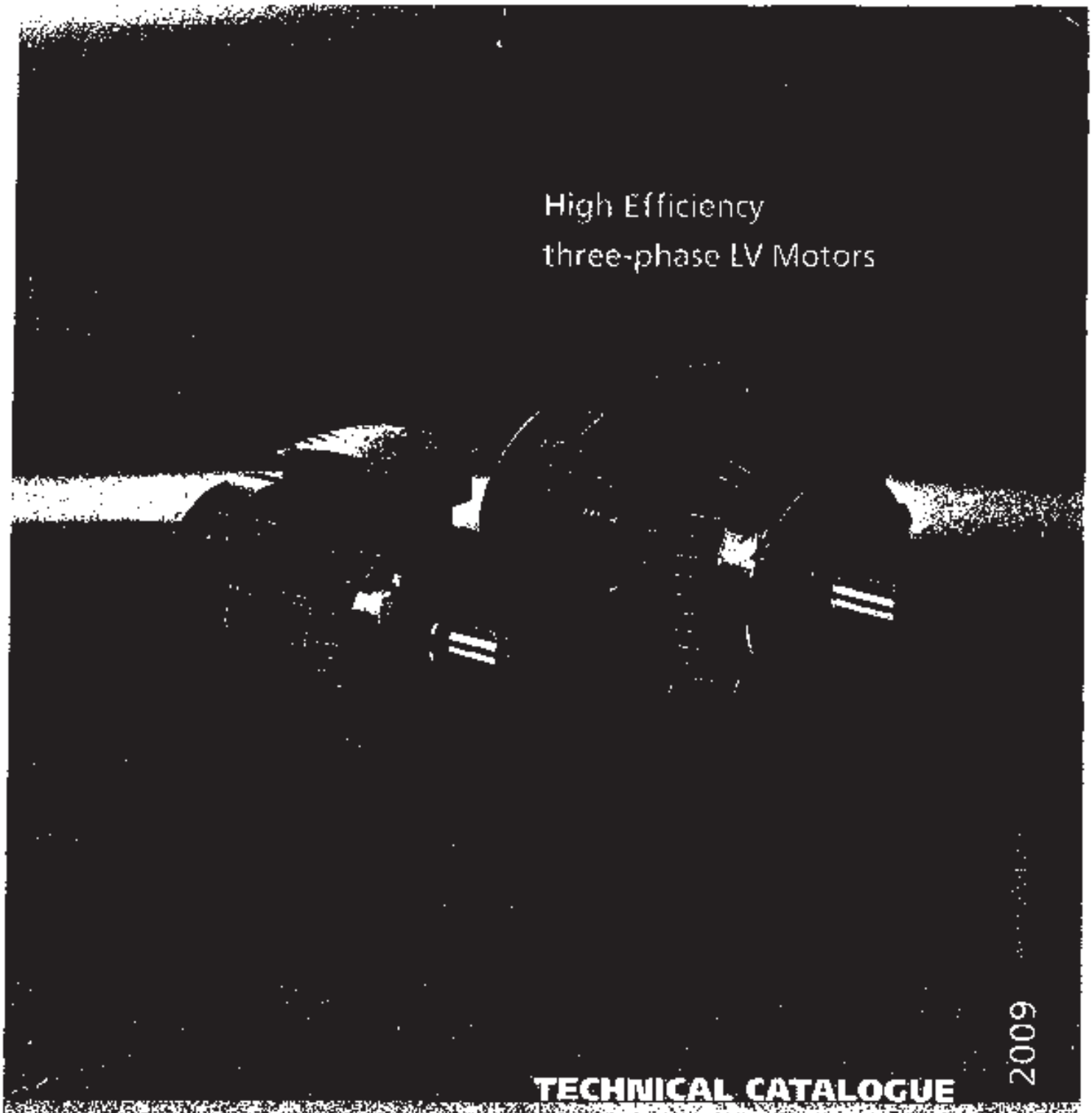
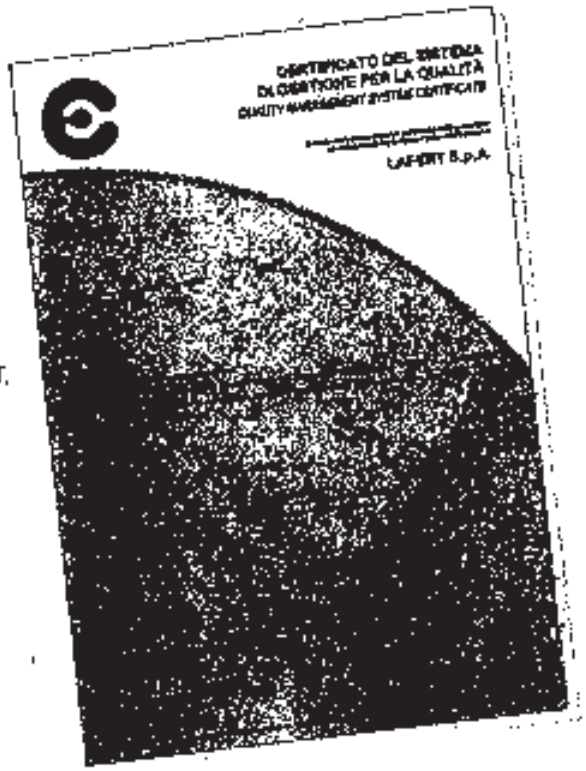

High Efficiency
three-phase LV Motors
TECHNICAL CATALOGUE
2009

AEG

STANDARDS AND REGULATIONS



The strictness of our quality control assures the flawless operation and reliability of our products.
That our quality scale fulfils your demands is confirmed by the certificate awarded by the CERMET, a Certification body authorized by SINCERT.

CE Marking
Our motors comply with the requirements of the following international standard:
IEC 60034

as well as with the following European Directives: Low Voltage Directive 2006/95/EC, the EMC-Directive 2004/108/EC and Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) 2002/95/EC.

The above named products comply with the requirements of the EC Directive Machines 2006/42/EC. In accordance with this Directive induction motors are components and intended solely for integration into other machines.
Commissioning is forbidden until conformity of the end product with this Directive is proved!

The CE symbol was applied for the first time in 1995.

The safety instructions in the Operation Manual of the manufacturer and EN 60204-1 have to be observed.

EFF2 EFF1

IE1 IE2

Efficiency values according to CEMEP Voluntary Agreement.
Efficiency testing method IEC 60034-2:1996

Harmonized efficiencies to IEC 60034-30:2008 - IE1 and IE2 code.
Efficiency testing method IEC 60034-2-1:2007

MEPS- Compliant

All standard three-phase motors with standard rating included in this catalogue comply with efficiency class IE1 and bear the corresponding label on the rating plate.
For efficiency at 50%, 75% and full load, please refer to the electrical data tables.

Efficiency classes of motors according to CEMEP - 1998

The voluntary agreement between the European committee of manufacturers of electric drive systems CEMEP and the European Commission defined three efficiency classes:

- **EFF3 = Motors with a low efficiency level**
- **EFF2 = Motors with improved efficiency level**
- **EFF1 = Motors with a high efficiency level**

The agreed minimum levels of the respective classes are based on efficiency measurements according to the old EN 60034-2:1996.

Method for determining the efficiency of motors

The method for measuring the efficiency of asynchronous AC motors was revised with the new IEC 60034-2-1:2007 standard. The new method significantly improves the accuracy under defined laboratory conditions. It will replace the EN 60034-2:1996.

The new IEC 60034-2-1 is applicable as of now. The old edition (EN 60034-2) will become obsolete in November 2010. By this deadline at the latest all motors must be evaluated with this new method.

As a direct comparison using the same motor, it is expected that the efficiency levels measured according to the new method are up to a few percentage points below the efficiency levels determined using the old method. For a transition period, many manufactures are therefore going to specify both efficiency levels in their catalogues.

New international efficiency classes of motors - IE Code

The new IEC 60034-30:2008 defines worldwide the efficiency classes of motors.

- **IE1 = Standard Efficiency (comparable to EFF2)**
- **IE2 = High Efficiency (comparable to EFF1)**
- **IE3 = Premium Efficiency**

From 2009 motors can be offered with the new classes (IE1, IE2 and IE3). The old European designations (EFF3, EFF2 and EFF1) will not become void, but will disappear from the market.

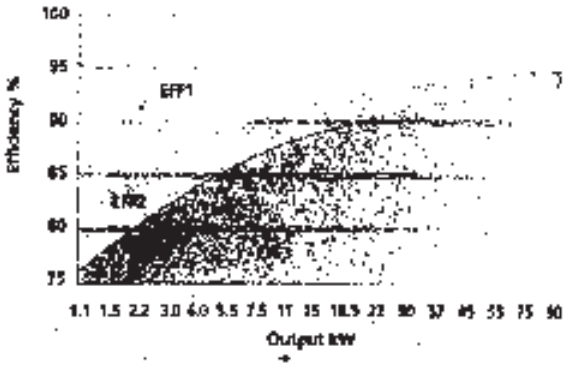
The efficiency levels according to IEC 60034-30 are measured based on the test methods defined in IEC 60034-2-1:2007.

The IEC 60034-30 only defines requirements of efficiency classes and aims to create provisions for international consistency. It does not define which motors must be supplied with which efficiency level. This is left to respective regional legislation.

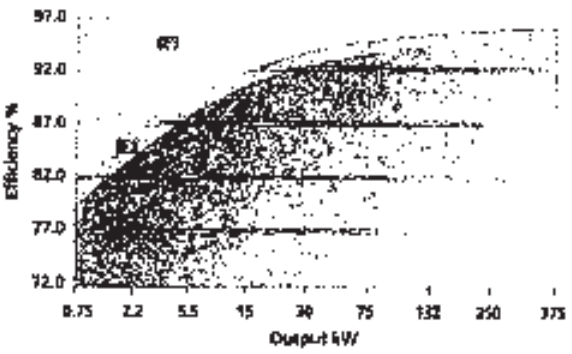
Output	2 poles		4 poles	
kW	Eff2/Eff3	Eff1/Eff2	Eff2/Eff3	Eff1/Eff2
1.1	76.2	82.8	76.2	83.8
1.5	78.5	84.1	78.5	85.0
2.2	81.0	85.6	81.0	86.4
3	82.6	86.7	82.6	87.4
4	84.2	87.6	84.2	88.3
5.5	85.7	88.6	85.7	89.2
7.5	87.0	89.5	87.0	90.1
11	88.4	90.5	88.4	91.0
15	89.4	91.3	89.4	91.8
18.5	90.0	91.8	90.0	92.2
22	90.5	92.2	90.5	92.6
30	91.4	92.9	91.4	93.2
37	92.0	93.3	92.0	93.6
45	92.5	93.7	92.5	93.9
55	93.0	94.0	93.0	94.2
75	93.6	94.6	93.6	94.7
90	93.9	95.0	93.9	95.0

Efficiency values according to CEMEP *Voluntary Agreement*.
Efficiency standard calculation: IEC 60034-2;1996

EFF Classes - 4 poles



IE Classes - 4 poles



Output	IE1 code Standard Efficiency			IE2 code High Efficiency			IE3 code Premium Efficiency		
kW	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles
0.75	72.1	72.1	70.0	77.4	79.6	75.9	80.7	82.5	78.9
1.1	75.0	75.0	72.9	79.6	81.4	78.1	82.7	84.1	81.0
1.5	77.2	77.2	75.2	81.3	82.8	79.8	84.2	85.3	82.5
2.2	79.7	79.7	77.7	83.2	84.3	81.8	85.9	86.7	84.3
3	81.5	81.5	79.7	84.6	85.5	83.3	87.1	87.7	85.6
4	83.1	83.1	81.4	85.8	86.6	84.6	88.1	88.6	86.8
5.5	84.7	84.7	83.1	87.0	87.7	86.0	89.2	89.6	88.0
7.5	86.0	86.0	84.7	88.1	88.7	87.2	90.1	90.4	89.1
11	87.6	87.6	86.4	89.4	89.8	88.7	91.2	91.4	90.3
15	88.7	88.7	87.7	90.3	90.6	89.7	91.9	92.1	91.2
18.5	89.3	89.3	88.6	90.9	91.2	90.4	92.4	92.6	91.7
22	89.9	89.9	89.2	91.3	91.6	90.9	92.7	93.0	92.2
30	90.7	90.7	90.2	92.0	92.3	91.7	93.3	93.6	92.9
37	91.2	91.2	90.8	92.5	92.7	92.2	93.7	93.9	93.3
45	91.7	91.7	91.4	92.9	93.1	92.7	94.0	94.2	93.7
55	92.1	92.1	91.9	93.2	93.5	93.1	94.3	94.6	94.1
75	92.7	92.7	92.6	93.8	94.0	93.7	94.7	95.0	94.6
90	93.0	93.0	92.9	94.1	94.2	94.0	95.0	95.2	94.9
110	93.3	93.3	93.3	94.3	94.5	94.3	95.2	95.4	95.1
132	93.5	93.5	93.5	94.6	94.7	94.6	95.4	95.6	95.4
160	93.7	93.8	93.8	94.8	94.9	94.8	95.6	95.8	95.6
200	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
250	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
315	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
355	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
375	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8

Efficiency values according to IEC 60034-30:2008
Efficiency standard calculation: IEC 60034-2-1;2007

The motors comply with the relevant standards and regulations, especially:

Title	IEC	EU CENELEC	D DIN/VDE	I CEI/UNEL	GB BS	F NFC	E UNE
Electrical							
General stipulations for electrical machines	60034-1	EN 60034-1	DIN EN 60034-1	CEI EN 60034-1	4999-1 4999-69	51-200 51-111	UNE EN 60034-1
Rotating electrical machines, methods for determining losses and efficiency using tests	60034-2	HD 53.2	DIN EN 60034-2	CEI EN 60034-2	4999-34	51-112	UNE EN 60034-2
Standard method for determing losses and efficiency from tests	60034-2-1						
Efficiency classes of single speed, three-phase, cage-induction motors (IE-code)	60034-30						
Terminal markings and direction of rotation of rotating electrical machines	60034-8	HD 53.8 S4	DIN VDE 0530-8	CEI EN 60034-8	4999-3	51-118	20113-8-96
Starting performance	60034-12	EN 60034-12	DIN EN 60034-12	CEI EN 60034-12	4999-142		UNE EN 60034-12
Standard voltages	60038	HD 472 S1	DIN IEC 60038	CEI 8-6			
Insulating materials	60085		DIN IEC 60085	CEI EN 60085			
Mechanical							
Dimensions and output ratings	60072		DIN EN 50347	UNEL 13113			
Mounting dimensions and relationship frame sizes-output ratings, IM B3	60072		DIN 42673-1	UNEL 13113	4999-10 51-110	51-105 51-104	UNE EN 50347 1980
Mounting dimensions and relationship frame sizes-output ratings, IM B5	60072		DIN 42677-1	UNEL 13117		20106-2-74	
Mounting dimensions and relationship frame sizes-output ratings, IM B14	60072		DIN 42677-1	UNEL 13118	4999-10 51-110	51-105 51-104	UNE EN 50347
Cylindrical shaft ends for electric motors	60072	HD 231	DIN 748-3	UNEL 13502	4999-10	51-111	
Degrees of protection	60034-5	EN 60034-5	DIN EN 60034-5	CEI EN 60034-5	4999-20	EN60034-5	20111-5
Methods of cooling	60034-6	EN 60034-6	DIN EN 60034-6	CEI EN 60034-6	4999-21		EN 60034-6
Mounting arrangements	60034-7	EN 60034-7	DIN EN 60034-7	CEI EN 60034-7	4999-22	51-117	EN 60034-7
Noise limits	60034-9	EN 60034-9	DIN EN 60034-9	CEI EN 60034-9	4999-51	51-119	EN 60034-9
Mechanical vibration	60034-14	EN60034-14	DIN EN 60034-14	CEI EN 60034-14	4999-50	51-111	EN 60034-14
Mounting flanges			DIN 42948	UNEL 13501			
Tolerances of mounting and shaft extensions			DIN 42955	UNEL 13501/ 13502			
Classification of environmental conditions	60721-2-1		DIN IEC 60721-2-1	CEI EN 60721-1			
Mechanical vibration; balancing	ISO 8821		DIN ISO 8821				

Motors to special regulations:

- Motors with UL, CSA and cURus approval (performance data on request)

Three-phase motors
high efficiency

IE2
EFF 1

For mains voltage
400 V - 50 Hz

High efficiency motors, IE2 code
Efficiency testing method IEC 60034-2-1:2007

High efficiency motors, Eff1
Efficiency testing method IEC 60034-2:1996

Temperature rise to class B

Type	kW	HP	min⁻¹	M_N Nm	Eff1η 75%	Eff1η 100%	IE2η 75%	IE2η 100%	cos φ	I_N 400V	I_A/I_N	M_A/M_N	M_K/M_N	M_K/M_N	J 10^{-4}kgm²	kg
3000 min⁻¹ (2 poles)																
AMHN 80Z AA	2	0.75	1.0	2900	2.5	82.0	81.5	80.5	80.5	0.77	1.7	7.0	3.6	3.4	3.6	0.72	11.5
AMHE 80Z 9A	2	1.1	1.5	2880	3.6	84.0	83.8	82.8	82.7	0.72	2.5	6.8	3.6	3.4	3.6	0.89	9.5
AMHE 90S AA	2	1.5	2	2880	5.0	83.4	84.1	82.8	83.0	0.80	3.2	8.1	3.6	3.1	4.0	1.56	14.0
AMHE 90L CA	2	2.2	3	2860	7.3	85.2	85.6	85.0	84.8	0.85	4.4	8.5	3.5	3.2	3.7	2.8	16.0
AMHE 100L AA	2	3	4	2920	9.8	86.2	86.7	85.8	85.9	0.84	5.9	12.3	4.2	4.7	6.3	4.05	22.8
AMHE 112M AA	2	4	5.5	2940	13.0	88.9	88.9	87.7	87.6	0.86	7.5	12.5	4.3	2.2	4.5	8.58	33.6
AMHE 112M BA	2*	5.5	7.5	2920	18.0	88.1	88.6	87.	87.8	0.88	10.1	8.9	3.0	2.1	3.2	8.58	34.0
AMHE 132S ZA	2	5.5	7.5	2900	18.1	88.6	88.6	88.0	87.9	0.90	10.0	7.6	2.8	2.3	3.3	14.0	46.0
AMHE 132S YA	2	7.5	10	2900	24.7	89.5	89.5	88.6	88.4	0.90	13.5	7.9	3.0	2.5	3.5	20.5	53.0
AMHE 160M YA	2	11	15	2930	35.9	90.7	90.7	90.2	89.8	0.88	20.4	7.3	2.4	2.2	3.*	51.75	87.8
AMHE 160M ZA	2	15	20	2930	48.9	91.6	91.6	90.9	90.6	0.86	27.5	7.6	2.5	2.3	3.1	64.0	104.0
AMHE 160L ZA	2	18.5	25	2930	60.3	92.0	92.0	91.5	91.2	0.86	33.5	7.5	2.8	2.6	3.4	64.0	105.0
AMHR 180M ZG	2	22	30	2930	71.7	92.5	92.5	91.8	91.5	0.87	39.5	7.7	2.5	2.3	3.2	70	135
AMHE 200L PG	2	30	40	2945	97.3	93.1	93.1	92.4	92.2	0.89	52.5	7.8	2.1	1.9	2.8	330	220
AMHE 200L RG	2	37	50	2950	119.8	93.4	93.6	92.9	92.7	0.89	65	7.6	2.2	2.0	2.8	156	240
AMHE 225M PG	2	45	60	2950	145.7	94.1	94.2	93.7	93.5	0.88	78	7.9	2.5	1.9	2.9	270	345
AMHR 250M PG	2	55	75	2955	177.7	94.2	94.3	93.9	93.8	0.89	94	7.7	2.4	1.8	3.0	424	410
AMHE 280S G	2	75	100	2960	242.0	94.9	94.6	94.3	94.0	0.90	127	7.8	2.2	2.0	3.0	700	570
AMHE 280M G	2	90	125	2960	290.4	95.0	95.0	94.3	94.5	0.90	152	7.8	2.2	2.0	3.0	800	660
AMHE 315S G	2	110	150	2978	352.7	95.4	95.8	94.5	94.8	0.90	184	7.8	2.2	1.8	2.9	1400	900
AMHE 315M G	2	132	180	2978	423.3	95.4	95.8	94.8	95.1	0.90	221	7.8	2.2	1.8	2.9	1700	1000
AMHE 315M RG	2	150	200	2980	512.7	95.9	96.3	95.1	95.4	0.91	264	7.8	2.0	1.7	2.75	2600	1100
AMHE 315L G	2	200	270	2978	641.3	95.2	96.4	95.4	95.7	0.91	329	7.7	1.85	1.6	2.5	2800	1300

* Higher output (progressive motor)

Please note that the efficiency values are not comparable without knowing the testing method.

Three-phase motors designed for range of rated voltage 380-420 V ± 5% - 50 Hz

EFF2

For mains voltage to IEC 60038 400 V ± 10% - 50 Hz

Standard efficiency motors, EFF2
Efficiency testing method IEC 60034-2:1996

Temperature rise to class B

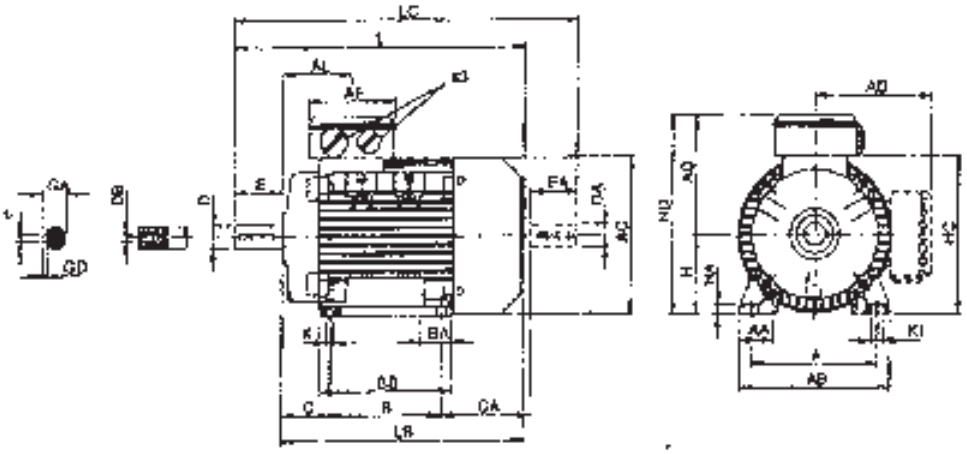
Type		kW	HP	n_N min^{-1}	M_N Nm	EFF2 η 50%	75%	100%	cos φ	I_N 400V	380-420V	I_A/I_N	M_A/M_N	M_K/M_N	M_K/M_N	J 10^{-4} kgm^2	kg
1500 min^{-1} (4 poles)																	
AM 56Z AA	4	0.06	0.08	1300	0.4	42	44	48	0.70	0.28	0.32	2.6	2.1	2.0	2.1	0.14	2.7
AM 56Z BA	4	0.09	0.12	1330	0.6	48	47	51	0.74	0.35	0.40	2.5	2.2	2.1	2.2	0.16	2.9
AM 63Z AA	4	0.12	0.16	1350	0.8	46	50	57	0.66	0.59	0.55	2.4	2.0	1.9	2.0	0.25	3.3
AM 63Z BA	4	0.18	0.25	1330	1.3	47	50	58	0.70	0.65	0.70	2.3	1.9	1.8	1.9	0.27	4.1
AM 63Z CA	4*	0.25	0.33	1360	1.8	49	52.5	58	0.74	0.85	0.90	2.7	2.2	2.0	2.1	0.30	4.7
AM 71Z AA	4	0.25	0.33	1340	1.8	55	59	64	0.66	0.9	1.00	3.2	1.9	1.8	2.0	0.70	5.7
AM 71Z BA	4	0.37	0.50	1370	2.6	60	63	67	0.67	1.2	1.25	3.3	2.2	2.1	2.2	0.82	6.0
AM 71Z CA	4*	0.55 *	0.75	1380	3.8	63	64	69	0.68	1.7	1.80	3.6	2.4	2.3	2.4	0.95	7.3
AM 80Z AA	4	0.55	0.75	1400	3.8	67.0	69.0	70.0	0.72	1.6	1.7	3.6	2.6	2.5	2.6	1.58	8.2
AM 80Z BA	4	0.75	1.0	1410	5.1	62.5	69.0	70.6	0.71	2.2	2.3	4.4	2.8	2.7	2.8	2.00	9.3
AM 80Z CA	4*	1.1 *	1.5 *	1385	7.6	74.1	78.4	75.9	0.77	2.8	2.9	4.4	2.5	2.5	2.6	2.41	10.6
AM 90S AA	4	1.1	1.5	1400	7.5	69.6	75.4	76.5	0.76	2.7	2.9	5.2	2.5	2.4	2.8	2.5	12.5
AM 90L BA	4	1.5	2.0	1400	10.2	75.6	78.7	78.6	0.77	3.6	3.7	5.7	2.8	2.6	3.0	3.13	14.5
AM 90L CA	4	1.8 *	2.5 *	1380	12.5	75.1	77.8	77.3	0.80	4.2	4.3	5.5	2.7	2.5	2.9	3.13	14.5
AM 90L DA	4*	2.2 *	3.0 *	1400	15.0	76.3	79.2	79.3	0.75	5.3	5.5	4.8	2.9	2.8	3.2	4.05	17
AM 100L AA	4	2.2	3.0	1435	14.6	77.5	80.2	81.0	0.74	5.4	5.6	5.3	2.5	2.4	2.7	4.6	19.5
AM 100L BA	4	3	4.0	1425	20.1	81.7	83.4	82.8	0.76	6.8	6.9	4.6	2.4	2.3	2.5	5.58	22.5
AM 100L CA	4*	4 *	5.5 *	1430	27.3	82.1	83.0	81.6	0.78	9.2	9.3	5.0	2.6	2.4	2.9	6.05	25
AM 112M AA	4	4	5.5	1430	26.7	84.5	85.3	84.2	0.81	8.5	8.8	6.9	2.7	2.6	2.8	12.2	29.5
AM 112M BA	4*	5.5 *	7.5 *	1430	36.7	85.9	86.2	85.2	0.83	11.4	11.7	6.5	2.2	2.0	2.9	15.2	34
AM 132S ZA	4	5.5	7.5	1430	36.7	85.6	86.6	85.7	0.82	11.3	11.7	5.8	3.0	2.7	3.0	22.40	41.9
AM 132M ZA	4	7.5	10.0	1440	49.7	87.7	88.1	87.4	0.82	15.1	15.5	6.8	3.1	2.7	3.1	29.15	51.0
AM 132M BA	4	9.2	12.5	1440	61.0	87.3	88.1	87.2	0.86	17.7	17.8	8.0	3.5	3.2	3.5	37.25	65.0
AM 132M TA	4*	11 *	15.0 *	1440	72.9	87.5	87.9	88.5	0.85	21.1	21.5	8.3	3.1	3.0	3.3	37.25	65.0
AM 160M XA	4	11	15	1460	71.9	88.4	89.2	88.6	0.80	22.5	24.0	6.5	2.5	2.3	2.8	81.25	68.5
AM 160L XA	4	15	20	1460	98.1	89.6	90.3	89.5	0.81	30.0	31.5	6.5	2.6	2.4	2.8	105.75	106.5
AM 160L ZA	4*	18.5	25	1450	121.8	89.6	90.5	90.0	0.81	37.0	39.0	6.7	2.4	2.2	2.6	130.9	135.5
AM 160L RA	4*	22 *	30 *	1460	143.9	89.8	90.8	90.5	0.81	44.0	46.0	6.5	2.4	2.2	2.6	136	124.5
AM 180M XG	4	18.5	25	1460	121.0	90.0	90.8	90.3	0.84	35.5	36.5	7.2	2.7	2.2	3.0	305	550
AM 180L XG	4	22	30	1460	143.9	90.4	91.1	90.5	0.84	42.0	43.5	7.3	2.7	2.2	3.0	318	160
AM 180L RG	4*	30 *	40 *	1455	196.9	90.4	91.4	91.4	0.82	58.0	60.0	7.8	3.0	2.4	3.2	150	175
AM 200L NG	4	30	40	1465	195.6	90.5	91.6	91.5	0.84	56.5	58.5	7.0	2.4	1.8	2.6	195	225
AM 200L PG	4*	37 *	50 *	1465	241.2	91.7	92.4	92.4	0.83	69.5	71.5	7.4	2.6	2.0	2.8	248	255
AM 225S NG	4	37	50	1475	239.5	90.8	92.1	92.2	0.84	69.5	71.5	7.5	2.3	2.0	2.9	356	290
AM 225M NG	4	45	60	1475	291.3	91.7	92.7	92.6	0.86	81.5	85.0	7.8	2.3	2.0	2.9	451	330
AM 250M NG	4	55	75	1475	356.1	92.6	93.3	93.1	0.84	103	107	6.5	3.5	2.1	2.4	640	385
AM 250M KG	4*	75	100	1470	487.2	92.3	93.4	93.6	0.87	142	146	7.3	3.9	2.3	2.7	812	440
AMHE 280S G	4	75	100	1475	485.6	93.5	94.8	94.7	0.87	134	138	7.4	2.4	1.6	2.7	1400	570
AMHE 280M G	4	90	125	1475	582.7	93.8	95.1	95	0.87	157	165	7.4	2.5	2.0	2.8	1600	660
AMHE 315S G	4	110	150	1480	709.8	94.0	95.5	95.6	0.87	191	201	7.7	2.4	2.0	2.6	3200	800
AMHE 315M G	4	132	180	1482	850.6	94.2	95.6	95.8	0.87	229	241	7.7	2.4	2.0	2.6	3700	1000
AMHE 315M BG	4	160	220	1487	1027.5	94.7	95.7	95.9	0.88	274	288	7.8	2.4	2.0	2.7	4700	1100
AMHE 315L G	4	200	270	1485	1286.1	95.0	95.8	96	0.88	342	360	7.6	2.3	1.9	2.6	5500	1300

1) Temperature rise to class F

* Higher output (progressive motor)

High efficiency motors - IE2 code/EFF1 from 280 to 315 frame size

THREE-PHASE FRAME SIZE 56 - 160 IM B3
ALUMINIUM ALLOY FRAME



IEC DIN	H h	A b	B a	C m	K1) s	AB f	BB e	CA	AD2) g	HD2)	AC m	HC g	HA
56	56	90	71	36	6	109	90	65	98	154	112	110	8
63	63	100	80	40	7	126	100	72	103	166	125	125	8
71	71	112	90	45	7	144	109	83	113	183	142	142	9
80	80	125	100	50	10	163	125	96	139	210	160	162	9.5
90S	90	140	100	56	10	170	150	116	148	236	180	181	11
90L	90	140	125	56	10	170	150	91	148	238	180	181	11
100L	100	160	140	63	11	197	166	110	155	255	196	198	12
112M	112	190	140	70	12.5	220	175	126	171	283	225	226	15
132S	132	216	140	89	12	256	180	131	195	327	248	261	17
132M	132	216	178	89	12	256	218	136	195	327	248	261	17
132M 9	132	216	178	89	12	256	218	166	195	327	248	251	17
160M	160	254	210	108	14	320	270	180	238	398	317	316	23
160L	160	254	254	108	14	320	310	180	238	398	317	316	23

IEC DIN	K1 c	k k	LB	LC k	AL	AF	BA m	AA n	D/DA d/d	E/EA M	F/FA u/u	GD	GA/GC t/t	DB 3) d/d
56	12	193	170	211	63	93	22	22	9	20	3	3	10.2	M3
63	12	213	193	236	66	93	26	26	11	23	4	4	12.5	M4
71	17	245	215	278	75	93	22	30	14	30	5	5	16	M5
80	14	272	232	319	79	110	28.5	36.5	19	40	6	5	21.5	M6
90S	15	317	267	372	85	110	28/53	37	24	50	8	7	27	M8
90L	15	317	267	372	85	110	28/53	37	24	50	8	7	27	M8
100L	17	356	306	433	91	110	38	44	28	60	8	7	31	M10
112M	19	388	328	456	91.5	110	46	48	28	60	8	7	31	M10
132S	20	442	362	523	100	133	45	59	38	80	10	8	41	M12
132M	20	482	402	561	120	133	45	59	38	80	10	8	41	M12
132M 9	20	500	420	599	120	133	45	59	38	80	10	8	41	M12
160M	28	608	498	718	146	150	64	76	42	110	12	8	45	M16
160L	18	652	542	762	168	150	65	76	42	110	12	8	45	M16

1) Clearance hole for screw
2) Maximum dimension
3) Centering holes in shaft extensions to DIN 332 part 2
4) Only for MT A2*

THREE-PHASE FRAME SIZE 180 - 315 IM B3
CAST IRON FRAME

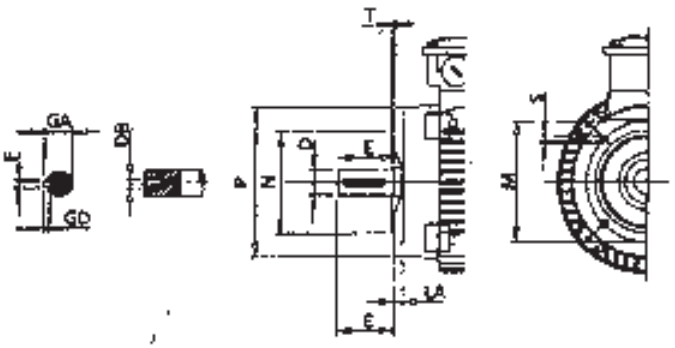
	IEC DIN	H h	A b	B a	C w	K* s	AB f	BB e	CA	AD* g	HD*	AC	HC m	HA g	K1 x
180M		180	279	241	121	12	330	316	256	255	445	355	380	15	18
180L		180	279	279	121	12	330	316	238	251	443	355	380	15	18
200L		200	318	305	133	16	380	380	297	300	530	370	398	18	18
225S	2 - 4/2	225	356	286	149	16	420	375	318	357	582	443	447	22	18.5
	≥4	225	356	286	149	16	420	375	318	357	582	443	447	22	18.5
225M	2 - 4/2	225	356	311	149	16	420	375	308	357	582	443	447	22	18.5
	≥4	225	356	311	149	16	420	375	318	357	582	443	447	22	18.5
250M	2 - 4/2	250	406	349	168	20	500	425	321	385	635	494	500	45	28
	≥4	250	406	349	168	20	500	425	321	385	635	494	500	45	28
280S	2 - 4/2	280	457	368	190	20	560	490	357	419	699	494	564	50	28
	≥4	280	457	368	190	20	560	490	357	419	699	494	564	50	28
280M	2 - 4/2	280	457	419	190	20	560	500	357	419	699	494	564	50	28
	≥4	280	457	419	190	20	560	500	357	419	699	494	564	50	28
315S YE	2 - 4/2	315	508	406	216	24	630	534	433	510	874	640	666	37	28
	≥4	315	508	406	216	24	630	533	433	510	874	640	666	37	28
315S ZE	2 - 4/2	315	508	406	216	24	630	533	438	510	874	640	666	37	28
	≥4	315	508	406	216	24	630	533	438	510	874	640	666	37	28
315M	2 - 4/2	315	508	457	216	24	630	533	387	510	874	640	666	37	28
	≥4	315	508	457	216	24	630	533	387	510	874	640	666	37	28
315L	2 - 4/2	315	508	508	216	24	630	583	336	510	874	640	666	37	28
	≥4	315	508	508	216	24	630	583	386	510	874	640	666	37	28

	IEC DIN	L k	LB	LC l1	AL	AF	BA m	AA n	D/DA d/d1	E/EA d/l1	F/FA d/u	GD	GA/GC t/t1	Db* d1/d
180M		717	602	838	360.5	180	91	66	48	110	14	9	51.5	M16
180L		717	602	838	360.5	180	91	66	48	110	14	9	51.5	M16
200L		779	669	885	385.5	265	90	79	55	110	16	10	59	M20
225S	2 - 4/2	857.5	747.5	973	304.5	265	95	90	55	110	16	10	59	M20
	≥4	887.5	747.5	1033	304.5	265	95	90	60	140	18	11	64	M20
225M	2 - 4/2	857.5	747.5	973	304.5	265	95	90	55	110	16	10	59	M20
	≥4	887.5	747.5	1033	304.5	265	95	90	60	140	18	11	64	M20
250M	2 - 4/2	970	830	1118	342.5	265	120	135	60	140	18	11	64	M20
	≥4	970	830	1118	342.5	265	120	135	65	140	18	11	69	M20
280S	2 - 4/2	1036	896	1195	374	265	135	122	65	140	18	11	69	M20
	≥4	1036	896	1195	374	265	135	122	75	140	20	12	79.5	M20
280M	2 - 4/2	1087	947	1245	358	265	135	122	65	140	18	11	69	M20
	≥4	1087	947	1245	358	265	135	122	75	140	20	12	79.5	M20
315S YE	2 - 4/2	1150	1010	1440	439	300	123	110	65	140	18	11	69	M20
	≥4	1220	1050	1400	439	300	123	110	80	170	22	14	85	M20
315S ZE	2 - 4/2	1190	1050	1340	439	300	123	110	65	140	18	11	69	M20
	≥4	1220	1050	1400	439	300	123	110	80	170	22	14	85	M20
315M	2 - 4/2	1190	1050	1340	439	300	123	110	65	140	18	11	69	M20
	≥4	1220	1050	1400	439	300	123	110	80	170	22	14	85	M20
315L	2 - 4/2	1240	1100	1390	464	300	123	110	65	140	18	11	69	M20
	≥4	1270	1100	1450	464	300	123	110	80	170	22	14	85	M20

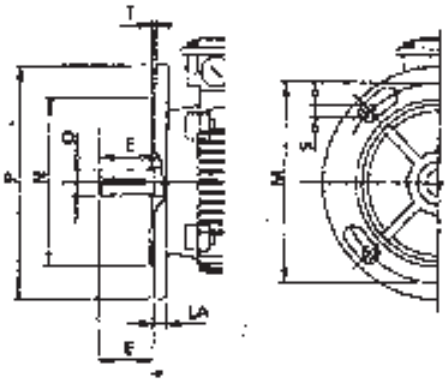
1): Clearance hole for screw
2): Maximum dimension
3): Centering holes in shaft extensions to DIN 332 part 2
4): Only for MT A2*

THREE-PHASE FRAME SIZE 56 - 160 IM B14, IM B5
ALUMINIUM ALLOY FRAME

IM B14

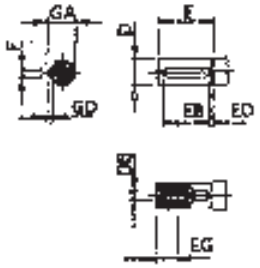


IM B5



IEC / DIN	P	N	LA	M	T	ST	P	N	LA	M	T	ST	M	N	P	T	LA	ST
	a_2	b_1	c_1	e_1	f_1	s_2	a_1	b_1	c_1	e_1	f_1	s_1	e_1	b_1	a_1	f_2	c_1	s_1
56	80	50		65	3	M5	105	70	6	85	2.5	M6	100	80	120	2.5	5.5	M6
63	90	60	9	75	2.5	M5	120	80	8	100	2.5	M6	115	95	140	3	9	M8
71	105	70	11	85	2.5	M5	140	95	8	115	2.5	M8	130	110	160	3.5	10	M8
80	120	80	8	100	3	M6	160	110	8.5	130	3.5	M8	165	130	200	3.5	10	M10
90S-L	140	95	10	115	3	M8	160	110	9	130	3.5	M8	165	130	200	3.5	12	M10
100L	160	110	10	130	3.5	M8	200	130	12	165	3.5	M10	215	180	250	4	14	M12
112M	160	110	10	130	3.5	M8	200	130	12	165	3.5	M10	215	180	250	4	14	M12
132S-M	200	130	30	165	3.5	M10	250	180	12	215	4	M12	265	230	300	4	14	M12
160M-L	250	180	12	215	4	M12	300	230	12	265	5	M16	300	250	250	5	15	M16

1) Clearance hole for screw. Hole has standard for size 132 to 160.

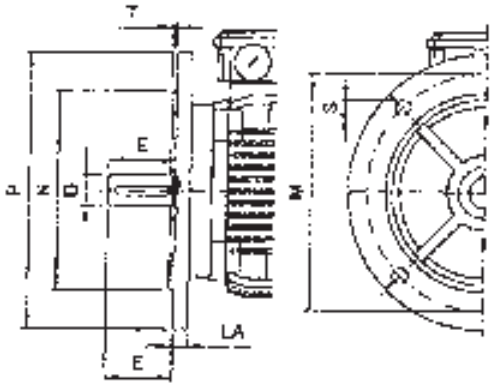


IEC / DIN	D d	E l	F h9 u	GD t	GA t	DB[1] d_2	EG	EB	ED
56	9 j6	20	3	3	10.2	M3	10	15	2.5
63	11 j6	23	4	4	12.5	M4	10	15	4
71	14 j6	30	5	5	16	M5	12.5	20	4
80	19 j6	40	6	6	21.5	M6	16	30	4
90S-L	24 j6	50	8	7	27	M8	19	40	4
100L	28 j6	60	8	7	31	M10	22	50	4
112M	28 j6	60	8	7	31	M10	22	50	4
132S-M	38 k6	80	10	8	41	M12	28	70	4
160M-L	42 k6	110	12	8	45	M16	36	100	4

1) Centering holes in shaft extension to DIN 332 part 2

THREE-PHASE FRAME SIZE 180 - 315 IM B5
CAST IRON FRAME

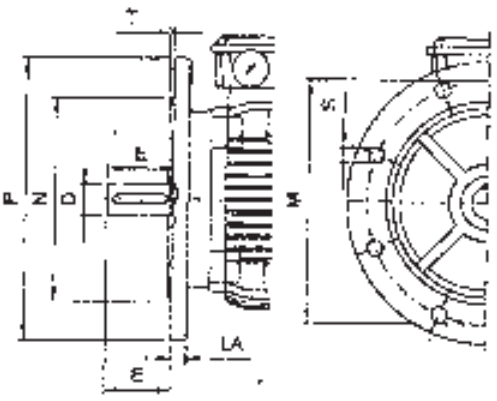
IM B5 - 180/200



IEC / DIN	M a_1	N b_1	P a_1	T t_1	LA c_1	S[1] s_1
180M/L	300	250	350	5	15	M16
200L	350	300	400	5	15	M16

1) Clearance hole for screw

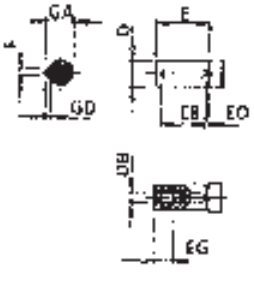
IM B5 - 225/315



IEC / DIN	M a_1	N b_1	P a_1	T t_1	LA c_1	S[1] s_1
225S/M	400	350	450	5	16	M15
250M	500	450	550	5	18	M16
280S/M	500	450	550	5	18	M16
315S/M/L	600	550	660	6	22	M20

1) Clearance hole for screw

IEC / DIN	Poles	D d	E l	F h9 d_1	GD	GA t_1	DB[2] d_2	EG	EB	ED
180M/L		48 k6	110	14	9	51.5	M16	36	100	5
200L		55 m6	110	16	10	59	M20	42	100	5
225S	2 - 4/2	55 m6	110	16	10	59	M20	42	100	5
	≥4	60 m6	140	18	11	64	M20	42	110	20
225M	2 - 4/2	55 m6	110	16	10	59	M20	42	100	5
	≥4	60 m6	140	18	11	64	M20	42	110	20
250M	2 - 4/2	60 m6	140	18	11	64	M20	42	110	20
	≥4	65 m6	140	18	11	69	M20	42	110	20
280S	2 - 4/2	65 m6	140	18	11	69	M20	42	125	10
	≥4	75 m6	140	20	12	79.5	M20	42	125	10
280M	2 - 4/2	65 m6	140	18	11	69	M20	42	125	10
	≥4	75 m6	140	20	12	79.5	M20	42	125	10
315S/M/L	2 - 4/2	65 m6	140	18	11	69	M20	42	125	10
	≥4	80 m6	170	22	14	85	M20	50	160	5



2) Centering holes in shaft extension in DIN 332 part 2

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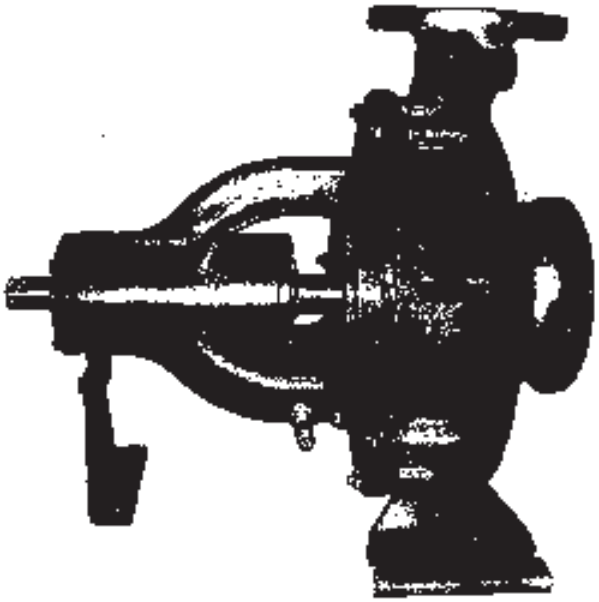
LAFERTGROUP

Technical Literature

4) Condensing Water Pump

CENTRIFUGAL PUMPS FOR LOW AND MEDIUM PRESSURE

TYPE LDP 3
DIN 24255



Applications

Pumping of clean or turbid liquids free from large solids such as water, fuels, oil, brine, alkaline solutions and mild acids.
Water supply, booster pumping stations, air conditioning installations, irrigation, industrial and agricultural applications, public services etc.

Hydraulic data

- Capacity up to 550 m³/h
- Total head up to 150m
- Temperature up to 105° C
- Max. working pressure up to 16 bar

Design

Single-stage, end - suction volute design with vertically arranged radial discharge branch. Single entry, closed impeller. Heavy duty ball bearings with two seals, "oil lubricated", in sturdily constructed housing flanged to pump casing.

Maintenance is very easy, the impeller shaft and other rotating parts being removable with no need to disconnect the suction or delivery pipes.

The use of an extension coupling enables a pump to be dismantled without removing either the driver or the pump casing.
Maximum interchangeability of components. Identical parts can be used with various sizes of pumps which greatly simplifies and reduces stock of spare parts.

MEMBER OF Europump

DRAKOS - POLEMIS S.A.
PUMP MANUFACTURERS
Kryoneri - Athens - Greece

SPECIFICATIONS

Sealing arrangements

- Pumps are supplied as standard with a conventional packed gland
- Lantern ring for water sealing and packing lubrication
- For special purposes, mechanical seal and wearing rings can be used

Materials

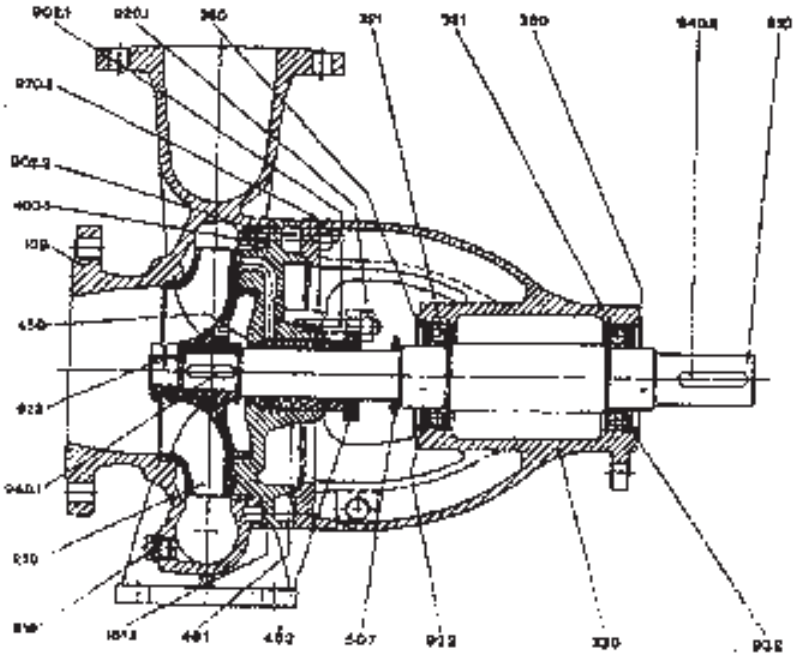
Standard design

Casing	Cast iron
Impeller	Cast Iron
Shaft	Steel

Special design

Casing	Bronze, Stainless steel
Impeller	Bronze, Stakless steel
Wearing rings	Bronze, Stainless steel
Shaft	Corrosion-resistant steel / Stainless steel

SECTIONAL VIEW



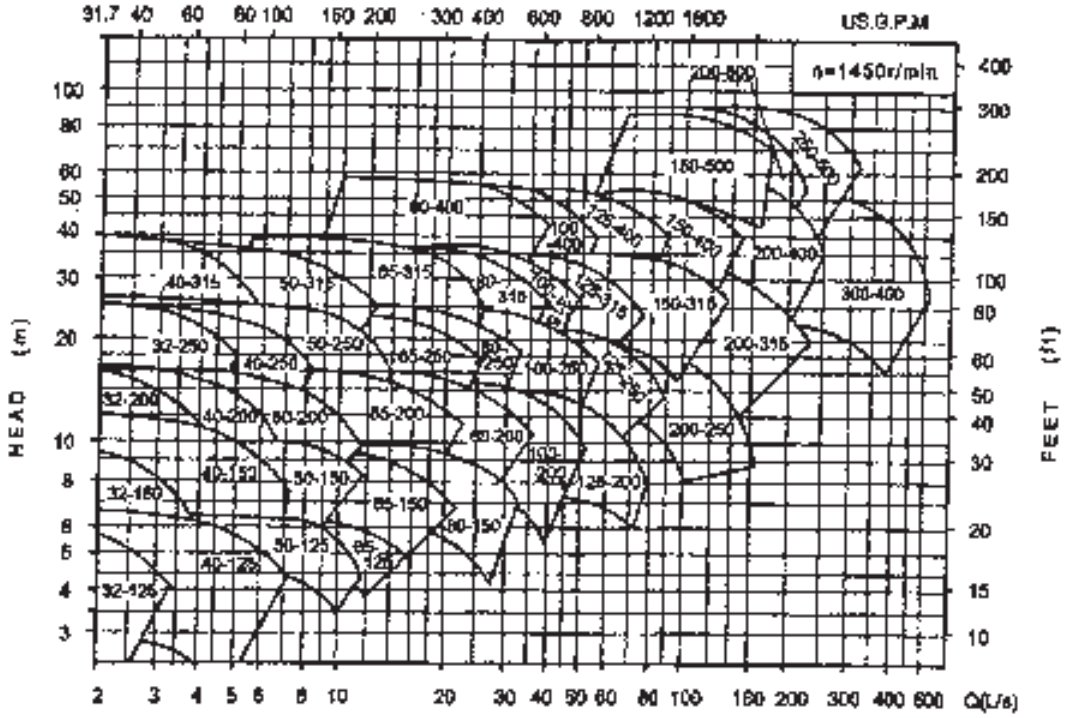
Form 0

Form 1

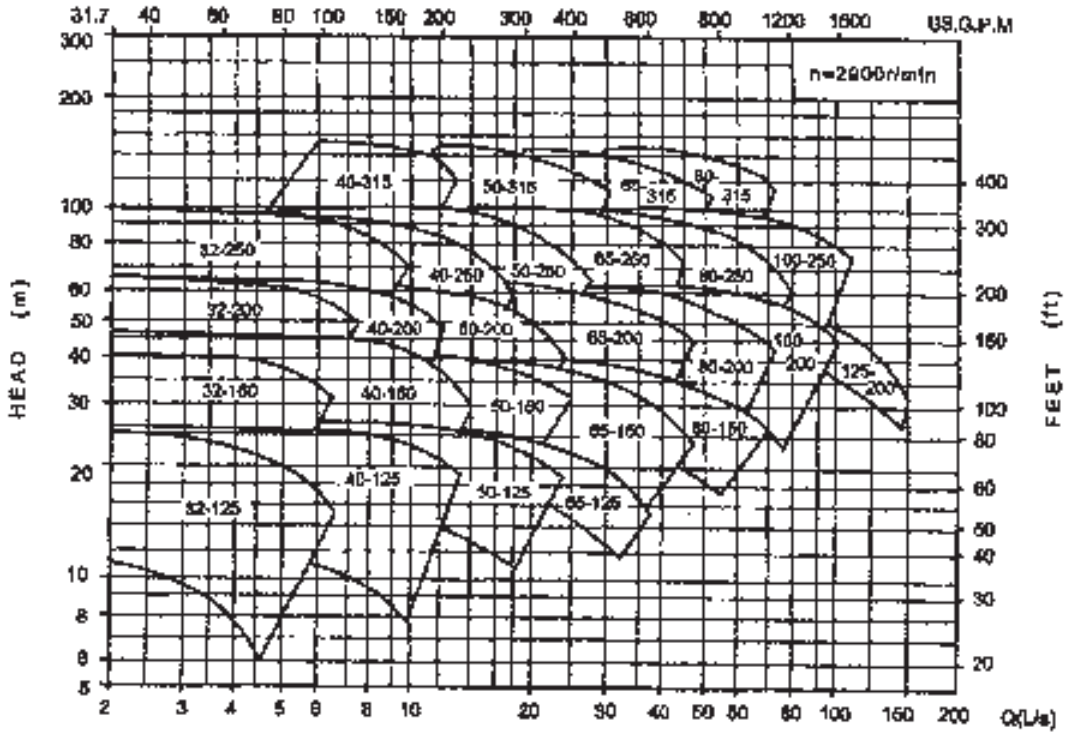
Europump Number	Part Name	Europump Number	Part Name
102	Casing	459	Stuffing box bushing
161.1	Casing cover	461	Stuffing box packing
162.2	Casing cover for mechanical seal	507	Deflector
210	Shaft	902.1	Gland stud
230	Impeller	902.2	Stud for casing
321	Ball bearing	918	Drain plug
330	Bearing bracket	920.1	Gland stud nut
380	Bearing cover	920.2	Nut for casing
400.1	Gasket for casing cover	922	Impeller nut
433	Mechanical seal	940.1	Key for impeller
452	Stuffing box gland	940.2	Key for coupling

SELECTION CHART

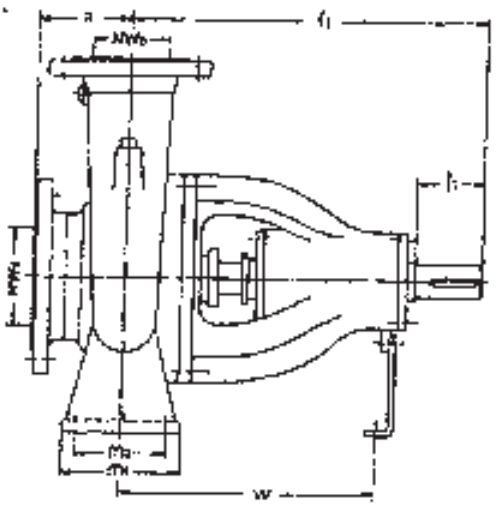
n=1450r/min

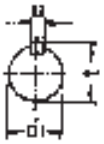


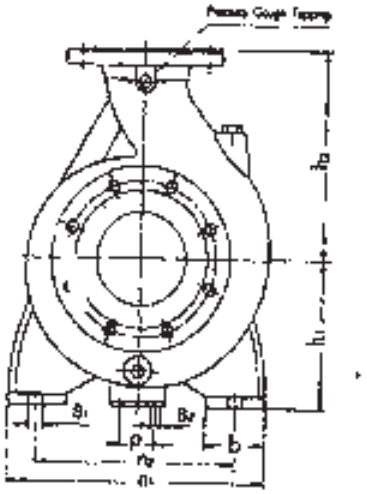
n=2900r/min



DIMENSIONS







DIMENSIONS (in millimeters)

SIZE	SUC	DEL	Length		Height		Feet & Support					Mounting details				Shaft end			
	NWs	NWD	a	f1	h1	h2	b	da	w	p	Sz	m2	m1	n1	bolt size	d1	l1	t	u
32-125	50	32	80	360	112	140	50	100	267	100	14	70	190	140	M 12	24	50	27	8
32-160	50	32	80	380	132	160	50	100	287	100	14	70	240	180	M 12	24	50	27	8
32-200	50	32	80	380	160	160	50	100	287	110	14	70	240	190	M 12	24	50	27	8
32-250	50	32	100	380	180	225	65	125	287	110	14	95	320	250	M 12	24	50	27	8
40-125	65	40	80	360	112	140	50	100	267	100	14	70	210	160	M 12	24	50	27	8
40-160	65	40	80	380	132	160	50	100	267	100	14	70	240	180	M 12	24	50	27	8
40-200	65	40	100	380	160	160	50	100	287	110	14	70	265	212	M 12	24	50	27	8
40-250	65	40	100	380	180	225	65	125	287	110	14	95	320	250	M 12	24	50	27	8
40-315	65	40	125	470	200	225	65	125	342	110	14	95	345	280	M 12	32	80	35	10
50-125	65	50	100	360	132	160	50	100	267	100	14	70	240	180	M 12	24	50	27	8
50-160	65	50	100	380	160	160	50	100	267	110	14	70	265	212	M 12	24	50	27	8
50-200	65	50	100	380	180	200	50	100	287	110	14	70	265	212	M 12	24	50	27	8
50-250	65	50	100	380	180	225	65	125	287	110	14	95	320	250	M 12	24	50	27	8
50-315	65	50	125	470	225	280	65	125	342	110	14	95	345	280	M 12	32	80	35	10
65-125	80	65	100	380	160	180	65	125	267	110	14	95	280	212	M 12	24	50	27	8
65-160	80	65	100	380	180	200	65	125	287	110	14	95	280	212	M 12	24	50	27	8
65-200	80	65	100	380	180	225	65	125	287	110	14	95	320	250	M 12	24	50	27	8
65-250	80	65	100	470	200	250	80	160	342	110	14	120	360	280	M 16	32	80	35	10
65-315	80	65	125	470	225	280	80	160	342	110	14	120	400	315	M 16	32	80	35	10
80-160	100	80	125	380	180	225	65	125	287	110	14	95	320	250	M 12	24	50	27	8
80-200	100	80	125	470	180	250	65	125	342	110	14	95	345	280	M 12	32	80	35	10
80-250	100	80	125	470	200	280	80	160	342	110	14	120	400	315	M 16	32	80	35	10
80-315	100	80	125	470	250	315	80	160	342	110	14	120	400	315	M 16	32	80	35	10
80-400	100	80	125	632	280	355	65	160	369	110	14	120	440	340	M 16	42	110	45	12
100-200	125	100	125	470	200	280	80	160	342	110	14	120	360	280	M 16	32	80	35	10
100-250	125	100	140	470	225	280	80	160	342	110	14	120	400	315	M 16	32	80	35	10
100-315	125	100	140	470	250	315	90	160	342	110	14	120	400	315	M 16	32	80	35	10
100-400	125	100	140	630	280	355	100	200	360	110	14	160	500	400	M 20	42	110	45	12
125-200	150	125	140	470	250	315	80	160	342	110	14	120	400	315	M 16	32	80	35	10
125-250	150	125	140	470	250	355	80	160	342	110	14	120	400	315	M 16	32	80	35	10
125-315	150	125	140	530	280	355	100	200	370	110	14	150	500	400	M 20	42	110	45	12
125-400	150	125	140	630	315	400	100	200	370	110	14	150	500	400	M 20	42	110	45	12
125-500	150	125	180	690	375	500	100	200	500	140	14	150	550	450	M 20	55	110	59	16
150-200	200	150	160	495	280	400	100	200	387	110	14	150	550	400	M 20	32	80	35	10
150-250	200	150	160	530	280	355	100	200	370	110	14	150	450	350	M 20	42	110	45	12
150-315	200	150	160	630	280	400	100	200	370	110	14	150	550	450	M 20	42	110	45	12
150-400	200	150	160	630	315	450	100	200	370	110	14	150	550	450	M 20	42	110	45	12
150-500	200	150	160	670	375	500	100	200	500	140	15	150	550	450	M 20	55	110	59	16
200-250	250	200	180	548	280	400	100	200	389	110	15	150	550	450	M 20	42	110	45	12
200-315	250	200	200	670	356	450	100	200	500	110	15	150	550	450	M 20	48	110	52	14
200-400	250	200	200	670	356	500	100	200	500	110	15	150	550	450	M 20	48	110	52	14
200-500	250	200	240	783	425	545	150	300	534	140	23	240	720	600	M 20	70	140	75	20
250-500	300	250	240	783	425	545	150	300	534	140	23	240	720	600	M 20	70	140	75	20
300-400	350	300	280	783	500	600	150	300	556	140	23	260	600	660	M 20	70	140	74.5	20

- Pump sizes 32-250, 40-315, 50-315, 65-400, 80-400, 100-160, 125-200, 150-200 and 150-250 are not provided for by the DIN Standards.
① Back pull-out distance required between motor shaft end and pump shaft.

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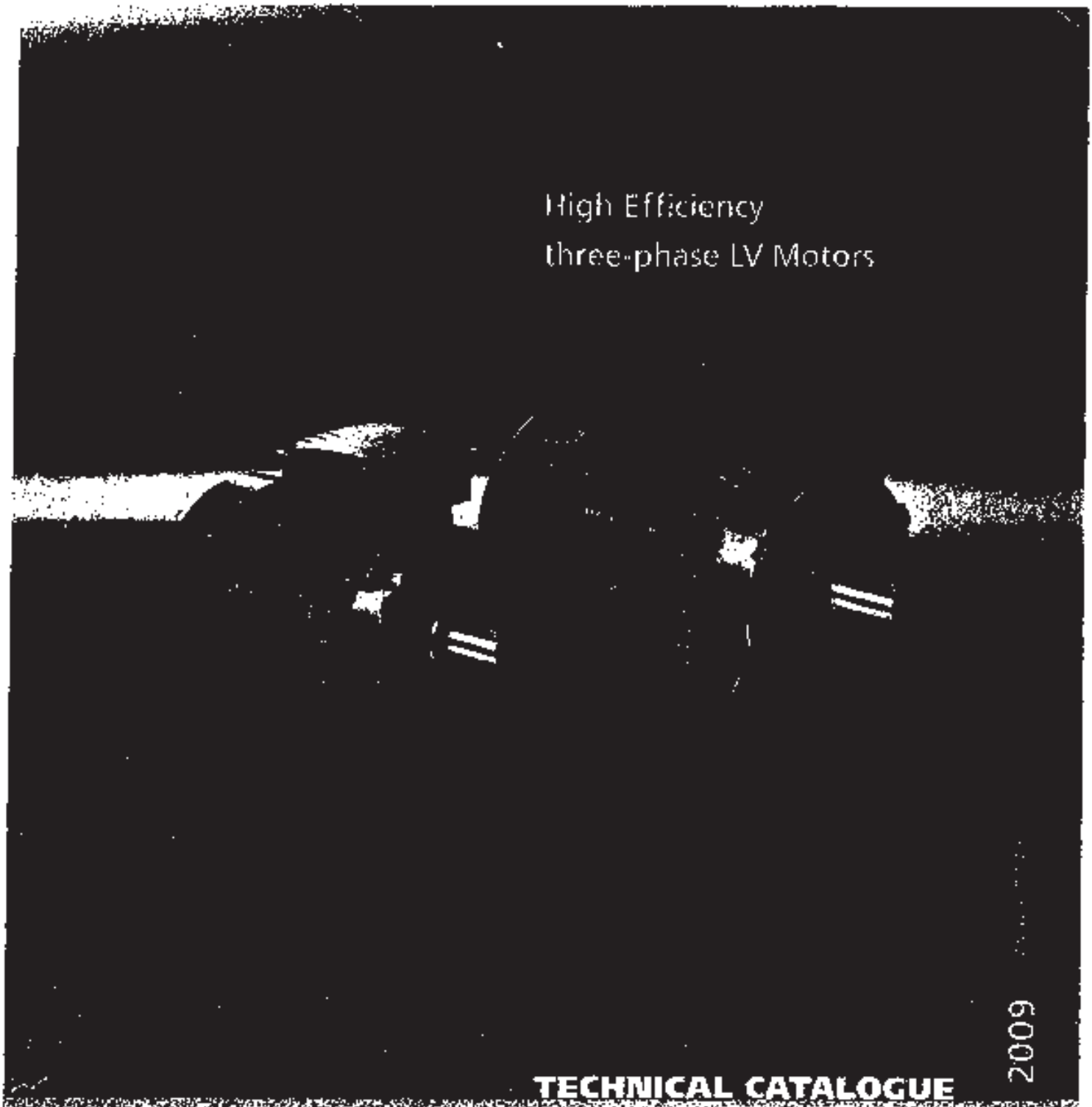


High Efficiency three-phase LV Motors

2009

TECHNICAL CATALOGUE

AEG

Efficiency classes of motors according to CEMEP - 1998

The voluntary agreement between the European committee of manufacturers of electric drive systems CEMEP and the European Commission defined three efficiency classes:

- **EFF3 = Motors with a low efficiency level**
- **EFF2 = Motors with improved efficiency level**
- **EFF1 = Motors with a high efficiency level**

The agreed minimum levels of the respective classes are based on efficiency measurements according to the old EN 60034-2:1996.

Method for determining the efficiency of motors

The method for measuring the efficiency of asynchronous AC motors was revised with the new IEC 60034-2-1:2007 standard. The new method significantly improves the accuracy under defined laboratory conditions. It will replace the EN 60034-2:1996.

The new IEC 60034-2-1 is applicable as of now. The old edition (EN 60034-2) will become obsolete in November 2010. By this deadline at the latest all motors must be evaluated with this new method.

As a direct comparison using the same motor, it is expected that the efficiency levels measured according to the new method are up to a few percentage points below the efficiency levels determined using the old method. For a transition period, many manufactures are therefore going to specify both efficiency levels in their catalogues.

New international efficiency classes of motors - IE Code

The new IEC 60034-30:2008 defines worldwide the efficiency classes of motors.

- **IE1 = Standard Efficiency (comparable to EFF2)**
- **IE2 = High Efficiency (comparable to EFF1)**
- **IE3 = Premium Efficiency**

From 2009 motors can be offered with the new classes (IE1, IE2 and IE3). The old European designations (EFF3, EFF2 and EFF1) will not become void, but will disappear from the market.

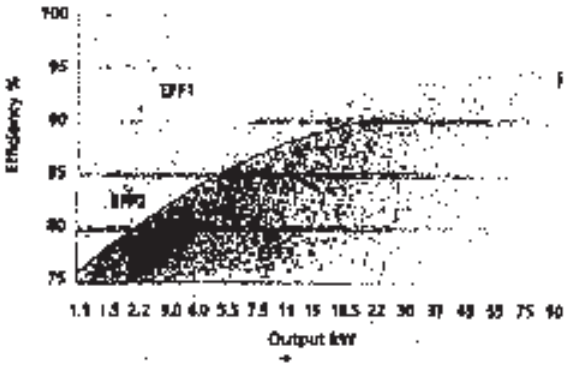
The efficiency levels according to IEC 60034-30 are measured based on the test methods defined in IEC 60034-2-1:2007.

The IEC 60034-30 only defines requirements of efficiency classes and aims to create provisions for international consistency. It does not define which motors must be supplied with which efficiency level. This is left to respective regional legislation.

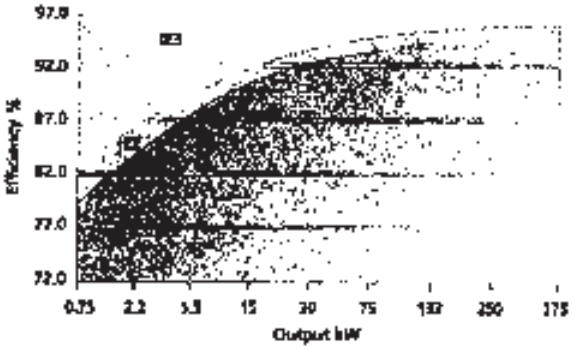
Output	2 poles		4 poles	
kW	Eff2/Eff3	Eff1/Eff2	Eff2/Eff3	Eff1/Eff2
1.1	76.2	82.8	76.2	83.8
1.5	78.5	84.1	78.5	85.0
2.2	81.0	85.6	81.0	86.4
3	82.6	86.7	82.6	87.4
4	84.2	87.6	84.2	88.3
5.5	85.7	88.6	85.7	89.2
7.5	87.0	89.5	87.0	90.1
11	88.4	90.5	88.4	91.0
15	89.4	91.3	89.4	91.8
18.5	90.0	91.8	90.0	92.2
22	90.5	92.2	90.5	92.6
30	91.4	92.9	91.4	93.2
37	92.0	93.3	92.0	93.6
45	92.5	93.7	92.5	93.9
55	93.0	94.0	93.0	94.2
75	93.6	94.6	93.6	94.7
90	93.9	95.0	93.9	95.0

Efficiency values according to CEMEP *Voluntary Agreement*.
Efficiency standard calculation: IEC 60034-2;1996

EFF Classes - 4 poles



IE Classes - 4 poles



Output	IE1 code Standard Efficiency			IE2 code High Efficiency			IE3 code Premium Efficiency		
kW	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles
0.75	72.1	72.1	70.0	77.4	79.6	75.9	80.7	82.5	78.9
1.1	75.0	75.0	72.9	79.6	81.4	78.1	82.7	84.1	81.0
1.5	77.2	77.2	75.2	81.3	82.8	79.8	84.2	85.3	82.5
2.2	79.7	79.7	77.7	83.2	84.3	81.8	85.9	86.7	84.3
3	81.5	81.5	79.7	84.6	85.5	83.3	87.1	87.7	85.6
4	83.1	83.1	81.4	85.8	86.6	84.6	88.1	88.6	86.8
5.5	84.7	84.7	83.1	87.0	87.7	86.0	89.2	89.6	88.0
7.5	86.0	86.0	84.7	88.1	88.7	87.2	90.1	90.4	89.1
11	87.6	87.6	86.4	89.4	89.8	88.7	91.2	91.4	90.3
15	88.7	88.7	87.7	90.3	90.6	89.7	91.9	92.1	91.2
18.5	89.3	89.3	88.6	90.9	91.2	90.4	92.4	92.6	91.7
22	89.9	89.9	89.2	91.3	91.6	90.9	92.7	93.0	92.2
30	90.7	90.7	90.2	92.0	92.3	91.7	93.3	93.6	92.9
37	91.2	91.2	90.8	92.5	92.7	92.2	93.7	93.9	93.3
45	91.7	91.7	91.4	92.9	93.1	92.7	94.0	94.2	93.7
55	92.1	92.1	91.9	93.2	93.5	93.1	94.3	94.6	94.1
75	92.7	92.7	92.6	93.8	94.0	93.7	94.7	95.0	94.6
90	93.0	93.0	92.9	94.1	94.2	94.0	95.0	95.2	94.9
110	93.3	93.3	93.3	94.3	94.5	94.3	95.2	95.4	95.1
132	93.5	93.5	93.5	94.6	94.7	94.6	95.4	95.6	95.4
160	93.7	93.8	93.8	94.8	94.9	94.8	95.6	95.8	95.6
200	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
250	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
315	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
355	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
375	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8

Efficiency values according to IEC 60034-30:2008
Efficiency standard calculation: IEC 60034-2-1;2007

The motors comply with the relevant standards and regulations, especially:

Title	IEC	EU CENELEC	D DIN/VDE	I CEI/UNEL	GB BS	F NFC	E UNE
Electrical							
General stipulations for electrical machines	60034-1	EN 60034-1	DIN EN 60034-1	CEI EN 60034-1	4999-1 4999-69	51-200 51-111	UNE EN 60034-1
Rotating electrical machines: methods for determining losses and efficiency using tests	60034-2	HD 53.2	DIN EN 60034-2	CEI EN 60034-2	4999-34	51-112	UNE EN 60034-2
Standard method for determining losses and efficiency from tests	60034-2-1						
Efficiency classes of single speed, three-phase, cage-induction motors (IE-code)	60034-30						
Terminal markings and direction of rotation of rotating electrical machines	60034-8	HD 53.8.S4	DIN VDE 0530-8	CEI EN 60034-8	4999-3	51-118	20113-6-96
Starting performance	60034-12	EN 60034-12	DIN EN 60034-12	CEI EN 60034-12	4999-112		UNE EN 60034-12
Standard voltages	60038	HD 472 S1	DIN IEC 60038	CEI 8-6			
Insulating materials	60085		DIN IEC 60085	CEI EN 60085			
Mechanical							
Dimensions and output ratings	60072		DIN EN 50347	UNEL 13113			
Mounting dimensions and relationship frame sizes-output ratings, IM B3	60072		DIN 42673-1	UNEL 13113	4999-10 51-110	51-105 51-104	UNE EN 50347 1980
Mounting dimensions and relationship frame sizes-output ratings, IM B5	60072		DIN 42677-1	UNEL 13117		20106-2-74	
Mounting dimensions and relationship frame sizes-output ratings, IM B14	60072		DIN 42677-1	UNEL 13118	4999-10 51-110	51-105 51-104	UNE EN 50347
Cylindrical shaft ends for electric motors	60072	HD 231	DIN 748-3	UNEL 13502	4999-10	51-111	
Degrees of protection	60034-5	EN 60034-5	DIN EN 60034-5	CEI EN 60034-5	4999-20	EN60034-5	20111-5
Methods of cooling	60034-6	EN 60034-6	DIN EN 60034-6	CEI EN 60034-6	4999-21		EN 60034-6
Mounting arrangements	60034-7	EN 60034-7	DIN EN 60034-7	CEI EN 60034-7	4999-22	51-117	EN 60034-7
Noise limits	60034-9	EN 60034-9	DIN EN 60034-9	CEI EN 60034-9	4999-51	51-119	EN 60034-9
Mechanical vibration	60034-14	EN60034-14	DIN EN 60034-14	CEI EN 60034-14	4999-50	51-111	EN 60034-14
Mounting flanges			DIN 42948	UNEL 13501			
Tolerances of mounting and shaft extensions			DIN 42955	UNEL 13501/ 13502			
Classification of environmental conditions	60721-2-1		DIN IEC 60721-2-1	CEI EN 60721-1			
Mechanical vibration; balancing	ISO 8821		DIN ISO 8821				

Motors to special regulations:

- Motors with UL, CSA and cURus approval (performance data on request)

Three-phase motors
high efficiency

IE2
EFF 1

For mains voltage
400 V - 50 Hz

High efficiency motors, IE2 code
Efficiency testing method IEC 60034-2-1:2007

High efficiency motors, Eff1
Efficiency testing method IEC 60034-2:1996

Temperature rise to class B

Type	kW	HP	min⁻¹	M_N Nm	Eff1η 75%	Eff1η 100%	IE2η 75%	IE2η 100%	cos φ	I_N 400V	I_A/I_N	M_A/M_N	M_B/M_N	M_L/M_N	J 10^{-4}kgm²	kg
3000 min⁻¹ (2 poles)																
AMHE 80Z AA	2	0.75	1.0	2900	2.5	82.0	81.5	80.8	80.5	0.77	1.7	7.0	3.6	3.4	3.6	0.72	11.5
AMHE 80Z BA	2	1.1	1.5	2880	3.6	84.0	83.8	82.8	82.7	0.77	2.5	6.8	3.6	3.4	3.6	0.89	9.5
AMHE 90S AA	2	1.5	2	2830	5.0	83.4	84.1	82.8	83.0	0.80	3.2	8.1	3.6	3.1	4.0	1.56	14.0
AMHE 90L CA	2	2.2	3	2860	7.3	85.8	85.6	85.0	84.8	0.85	4.6	8.5	3.5	3.2	3.7	1.8	16.0
AMHE 100L AA	2	3	4	2920	9.8	86.2	86.7	85.8	85.9	0.84	5.9	12.3	4.2	4.7	6.3	4.05	22.8
AMHE 112M AA	2	4	5.5	2940	13.0	88.0	88.9	87.7	87.6	0.86	7.5	12.5	4.8	3.2	4.5	6.56	33.6
AMHE 112M BA	2*	5.5	7.5	2920	18.0	88.6	88.6	87.	87.6	0.88	10.1	8.9	3.0	2.1	3.2	8.58	34.0
AMHE 132S ZA	2	5.5	7.5	2900	18.1	88.6	88.6	88.0	87.9	0.90	10.0	7.6	2.8	2.3	3.3	14.0	46.0
AMHE 132S DA	2	7.5	10	2900	24.7	89.5	89.5	89.6	89.4	0.90	13.5	7.9	3.0	2.5	3.5	20.5	53.0
AMHE 160M ZA	2	11	15	2930	35.9	90.7	90.7	90.2	89.8	0.86	20.4	7.3	2.4	2.2	3.1	51.75	87.8
AMHE 160M DA	2	15	20	2930	48.9	91.6	91.6	90.9	90.6	0.86	27.5	7.6	2.5	2.3	3.1	64.0	104.0
AMHE 160L ZA	2	18.5	25	2930	60.3	92.0	92.0	91.5	91.2	0.86	33.5	7.9	2.8	2.6	3.4	64.0	105.0
AMHE 180M ZG	2	22	30	2930	71.7	92.5	92.5	91.8	91.5	0.87	39.5	7.7	2.5	2.3	3.2	70	135
AMHE 200L PG	2	30	40	2945	97.3	93.1	93.1	92.4	92.2	0.89	52.5	7.8	2.1	1.9	2.8	130	220
AMHE 200L BG	2	37	50	2950	119.8	93.4	93.6	92.9	92.7	0.89	65	7.6	2.2	2.0	2.8	156	240
AMHE 225M PG	2	45	60	2960	145.7	94.1	94.2	93.7	93.5	0.88	78	7.9	2.5	1.9	2.9	270	315
AMHE 250M PG	2	55	75	2955	177.7	94.2	94.3	93.9	93.8	0.89	94	7.7	2.4	1.8	3.0	424	410
AMHE 280S G	2	75	100	2960	242.0	94.9	94.6	94.3	94.0	0.90	127	7.8	2.2	2.0	3.0	700	570
AMHE 280M G	2	90	125	2960	290.4	95.0	95.0	94.3	94.5	0.90	152	7.8	2.2	2.0	3.0	800	660
AMHE 315S G	2	110	150	2978	352.7	95.4	95.8	94.5	94.6	0.90	184	7.8	2.2	1.8	2.9	1400	800
AMHE 315M G	2	132	180	2978	423.3	95.4	95.8	94.8	95.1	0.90	221	7.8	2.2	1.8	2.9	1700	1000
AMHE 315M RG	2	160	220	2980	512.7	95.8	96.3	95.1	95.4	0.91	264	7.8	2.0	1.7	2.75	2600	1100
AMHE 315L G	2	200	270	2978	641.3	96.2	96.4	95.4	95.7	0.91	329	7.7	1.85	1.6	2.5	2800	1300

* Higher output (progressive motor)

Please note that the efficiency values are not comparable without knowing the testing method.

Three-phase motors designed for range of rated voltage 380-420 V ± 5% - 50 Hz

EFF2

For mains voltage to IEC 60038 400 V ± 10% - 50 Hz

Standard efficiency motors, EFF2
Efficiency testing method IEC 60034-2:1996

Temperature rise to class B

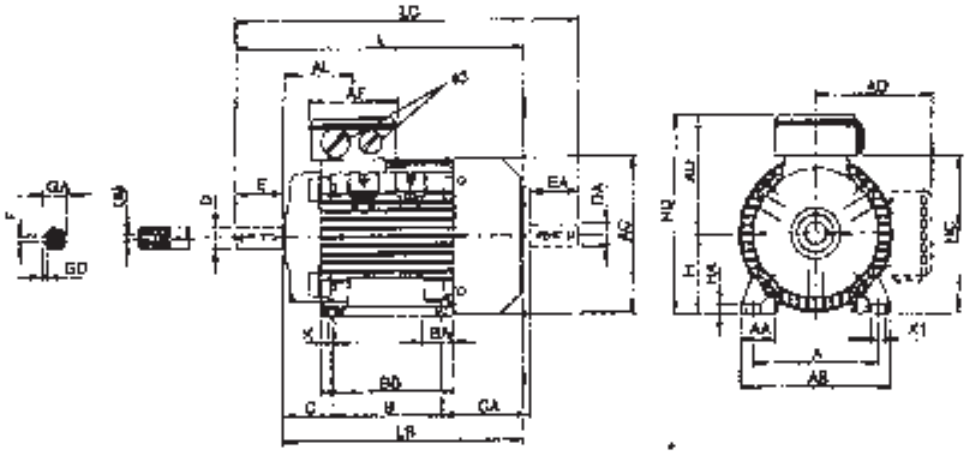
Type	kW	HP	min⁻¹	M_N Nm	EFF2 η 50%	75%	100%	cos φ	I_A/I_N 400V	380-420V	M_A/M_N	M_K/M_N	M_B/M_N	J 10^{-4} kgm²	kg
1500 min⁻¹ (4 poles)															
AM 56Z AA	4	0.06	0.08	1300	0.4	42	44	42	0.70	0.28	0.32	2.6	2.1	2.0	2.1	0.14	2.7
AM 56Z BA	4	0.09	0.12	1330	0.6	43	47	51	0.74	0.35	0.40	2.5	2.2	2.1	2.2	0.16	2.9
AM 63Z AA	4	0.12	0.16	1350	0.8	46	50	57	0.65	0.50	0.55	2.4	2.0	1.9	2.0	0.25	3.3
AM 63Z BA	4	0.18	0.25	1350	1.3	47	50	58	0.70	0.65	0.70	2.3	1.9	1.8	1.9	0.27	4.1
AM 63Z CA	4*	0.25	0.33	1360	1.8	49	52.5	58	0.74	0.85	0.90	2.7	2.2	2.0	2.1	0.30	4.2
AM 71Z AA	4	0.25	0.33	1340	1.8	55	59	64	0.66	0.9	1.00	3.2	1.9	1.8	2.0	0.70	5.7
AM 71Z BA	4	0.37	0.50	1370	2.6	60	63	67	0.67	1.2	1.25	3.3	2.2	2.1	2.2	0.82	6.0
AM 71Z CA	4*	0.55 *	0.75	1380	3.8	64	66	68	0.68	1.7	1.80	3.6	2.4	2.3	2.4	0.95	7.3
AM 80Z AA	4	0.55	0.75	1400	3.8	67.0	68.0	70.0	0.72	1.6	1.7	3.6	2.6	2.5	2.6	1.58	8.2
AM 80Z BA	4	0.75	1.0	1410	5.1	62.5	69.0	70.6	0.71	2.2	2.3	4.4	2.6	2.3	2.6	2.00	9.3
AM 80Z CA	4*	1.1 *	1.5 *	1385	7.6	74.1	76.4	75.9	0.77	2.6	2.8	4.4	2.5	2.5	2.6	2.41	10.6
AM 90S AA	4	1.1	1.5	1400	7.5	68.6	75.4	76.5	0.78	2.7	2.9	5.2	2.5	2.4	2.8	2.5	12.5
AM 90L BA	4	1.5	2.0	1400	10.2	75.6	78.7	78.6	0.77	3.6	3.7	5.7	2.8	2.6	3.0	3.13	14.5
AM 90L CA	4	1.8 *	2.5 *	1380	12.5	75.1	77.6	77.3	0.80	4.2	4.3	5.5	2.7	2.5	2.9	3.13	14.5
AM 90L DA	4*	2.2 *	3.0 *	1400	15.0	76.3	79.3	79.3	0.75	5.3	5.5	4.8	2.9	2.8	3.2	4.05	17
AM 100L AA	4	2.2	3.0	1435	14.6	77.5	80.7	81.0	0.74	5.4	5.6	5.9	2.5	2.4	2.7	4.6	19.5
AM 100L BA	4	3	4.0	1425	20.1	81.7	83.4	82.8	0.76	6.8	6.9	4.6	2.4	2.3	2.5	5.58	22.5
AM 100L CA	4*	4 *	5.5 *	1400	27.3	82.1	83.0	81.6	0.78	9.2	9.3	6.0	2.6	2.4	2.9	6.05	25
AM 112M AA	4	4	5.5	1430	26.7	84.5	85.3	84.2	0.81	8.5	8.6	6.3	2.1	2.0	2.8	12.2	29.5
AM 112M BA	4*	5.5 *	7.5 *	1430	36.7	85.9	86.2	85.2	0.83	11.4	11.7	6.5	2.2	2.0	2.9	15.2	34
AM 132S ZA	4	5.5	7.5	1430	36.7	85.6	86.6	85.7	0.82	11.3	11.7	5.8	3.0	2.7	3.0	22.40	41.9
AM 132M ZA	4	7.5	10.0	1440	49.7	87.2	88.1	87.4	0.82	15.1	15.5	6.8	3.1	2.7	3.1	29.25	51.0
AM 132M BA	4	9.2	12.5	1440	61.0	87.3	88.1	87.2	0.86	17.7	17.8	8.0	3.5	3.2	3.5	37.25	65.0
AM 132M DA	4*	11 *	15.0 *	1440	72.9	87.5	87.9	86.5	0.85	21.1	21.5	8.3	3.1	3.0	3.3	37.25	65.0
AM 160M XA	4	11	15	1450	71.9	88.4	89.2	88.6	0.80	22.5	24.0	6.5	2.5	2.3	2.8	81.25	88.5
AM 160L XA	4	15	20	1460	98.1	89.6	90.2	89.5	0.81	30.0	31.5	6.5	2.6	2.4	2.8	105.75	106.5
AM 180L ZA	4*	18.5	25	1450	121.8	89.6	90.5	90.0	0.81	37.0	39.0	6.7	2.4	2.2	2.6	120.9	115.5
AM 160L RA	4*	22 *	30 *	1460	143.9	89.8	90.8	90.5	0.81	44.0	46.0	6.5	2.4	2.2	2.6	136	124.5
AM 180M XG	4	18.5	25	1460	121.0	90.0	90.8	90.3	0.84	35.5	36.5	7.2	2.7	2.2	3.0	105	150
AM 180L XG	4	22	30	1460	143.9	90.4	91.1	90.5	0.84	42.0	43.5	7.3	2.7	2.2	3.0	118	160
AM 180L RG	4*	30 *	40 *	1455	196.9	90.4	91.4	91.4	0.82	58.0	60.0	7.8	3.0	2.4	3.2	150	175
AM 200L KG	4	30	40	1465	195.6	90.5	91.6	91.5	0.84	58.5	58.5	7.0	2.4	1.8	2.6	195	225
AM 200L PG	4*	37 *	50 *	1466	241.2	91.7	92.4	92.4	0.83	69.5	71.5	7.4	2.6	2.0	2.8	248	255
AM 225S NG	4	37	50	1475	239.5	90.8	92.1	92.2	0.84	68.5	71.5	7.5	2.3	2.0	2.9	356	290
AM 225M NG	4	45	60	1475	291.3	91.7	92.7	92.6	0.86	81.5	85.0	7.6	2.3	2.0	2.9	461	330
AM 250M MG	4	55	75	1475	356.1	92.6	93.3	93.1	0.84	103	107	6.5	3.5	2.1	2.4	640	385
AM 250M KG	4*	75	100	1470	487.2	92.9	93.4	93.6	0.82	142	146	7.3	3.9	2.3	2.7	812	440
AMHE 280S G	4	75	100	1475	485.6	93.5	94.8	94.7	0.87	131	138	7.4	2.4	1.9	2.7	1400	570
AMHE 280M G	4	90	125	1475	582.7	93.8	95.1	95	0.87	157	165	7.4	2.5	2.0	2.8	1600	660
AMHE 315S G	4	110	150	1480	709.8	94.0	95.5	95.6	0.87	191	201	7.7	2.4	2.0	2.6	3200	800
AMHE 315M G	4	132	180	1482	850.6	94.2	95.6	95.8	0.87	229	241	7.7	2.4	2.0	2.6	3700	1000
AMHE 315M BG	4	160	220	1487	1027.5	94.7	95.7	95.9	0.88	274	288	7.8	2.4	2.0	2.7	4700	1100
AMHE 315L G	4	200	270	1485	1286.1	95.0	95.8	96	0.88	342	360	7.6	2.3	1.9	2.6	5500	1300

1) Temperature rise to class F

* Higher output (progressive motor)

High efficiency motors - IE2 code/EFF1 from 280 to 315 frame size

THREE-PHASE FRAME SIZE 56 - 160 IM B3
ALUMINIUM ALLOY FRAME



	IEC DIN	H h	A b	B a	C w	K[1] s	AB f	BB e	CA	AD[2] B[2]	HD[2]	AC m	BC g	HA
56		56	90	71	36	6	109	90	65	98	154	112	110	8
63		63	100	80	40	7	126	100	72	103	166	125	125	8
71		71	112	90	45	7	144	109	83	112	183	142	147	9
80		80	125	100	50	10	153	125	89	139	219	160	162	9.5
90S		90	140	100	56	10	170	150	106	148	238	180	181	11
90L		90	140	125	56	10	170	150	91	148	238	180	181	11
100L		100	160	140	63	11	192	166	110	155	255	156	198	12
112M		112	190	140	70	12.5	220	175	126	171	283	225	226	15
132S		132	216	140	89	12	256	180	134	195	327	248	261	17
132M		132	216	178	89	12	256	218	106	195	327	248	261	17
132M 4P		132	216	178	89	12	256	218	166	195	327	248	261	17
160M		160	254	210	108	14	320	270	180	238	398	317	316	23
160L		160	254	254	108	14	320	310	180	238	398	317	316	23

	IEC DIN	Kt c	L k	LB	LC ℓ₁	AL	AF	BA m	AA n	D/DA d/d₁	E/EA l/l₁	F/FA u/u₁	GD	GA/GC t/t₁	DB[3] d₂/d₇
56		17	190	170	211	63	93	22	22	9	20	3	3	10.2	M3
63		12	213	193	238	66	93	26	26	11	23	4	4	12.5	M4
71		17	245	245	278	75	93	22	30	14	30	5	5	16	M5
80		14	272	232	319	79	110	28.5	34.5	19	40	6	6	21.5	M6
90S		15	317	267	372	85	110	28/53	37	24	50	8	7	27	M8
90L		15	317	267	372	85	110	28/53	37	24	50	8	7	27	M8
100L		17	386	306	433	94	110	38	44	28	60	8	7	31	M10
112M		19	388	328	456	95.5	110	46	48	28	60	8	7	31	M10
132S		20	442	362	523	100	133	45	59	38	80	10	8	41	M12
132M		20	482	402	563	120	133	45	59	38	80	10	8	41	M12
132M 4P		20	500	420	593	120	133	45	59	38	80	10	8	41	M12
160M		18	608	458	718	146	150	65	75	42	110	12	8	45	M16
160L		18	652	542	762	168	159	65	76	42	110	12	8	45	M16

1) Clearance hole for screw
2) Maximum dimension
3) Centering holes in shaft extensions to DIN 332 part 2
4) Only for MT A2*

THREE-PHASE FRAME SIZE 180 - 315 IM B3
CAST IRON FRAME

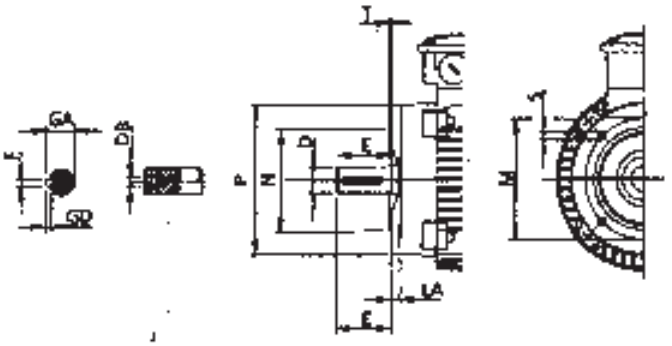
	IEC DIN	H h	A b	B a	C w	K* t	AB f	BB e	CA	AD* g*	HD*	AC	HC m*	HA g	K1 c
180M		180	279	241	121	12	330	316	256	263	443	355	360	15	18
180L		180	279	279	121	12	330	316	298	263	443	355	360	15	18
200L		200	318	305	133	15	380	360	337	300	530	379	394	18	18
225S	2 - 4/2	225	356	286	149	16	420	375	318	369	582	443	447	22	FB 5
	≥4	225	356	286	149	16	420	375	318	357	582	443	447	22	18 5
225M	2 - 4/2	225	356	311	149	16	420	375	318	357	582	443	447	22	18 5
	≥4	225	356	311	149	16	420	375	318	357	582	443	447	22	18 5
250M	2 - 4/2	250	406	349	168	20	500	425	321	385	635	494	500	45	28
	≥4	250	406	349	168	20	500	425	321	385	635	494	500	45	28
280S	2 - 4/2	280	457	368	190	20	560	450	357	419	699	494	564	50	28
	≥4	280	457	368	190	20	560	450	357	419	699	494	564	50	28
280M	2 - 4/2	280	457	419	190	20	560	500	357	419	699	494	564	50	28
	≥4	280	457	419	190	20	560	500	357	419	699	494	564	50	28
315S YE	2 - 4/2	315	508	406	216	24	630	533	438	510	874	640	665	37	28
	≥4	315	508	406	216	24	630	533	438	510	874	640	666	37	28
315S ZE	2 - 4/2	315	508	406	216	24	630	533	438	510	874	640	666	37	28
	≥4	315	508	406	216	24	630	533	438	510	874	640	665	37	28
315M	2 - 4/2	315	508	457	216	24	630	533	387	510	874	640	666	37	28
	≥4	315	508	457	216	24	630	533	387	510	874	640	666	37	28
315L	2 - 4/2	315	508	508	216	24	630	583	386	510	874	640	666	37	28
	≥4	315	508	508	216	24	630	583	386	510	874	640	666	37	28

	IEC DIN	L k	LB	LC k*	AL	AP	BA m	AA n	D/DA d/d*	F/EA f/n	F/EA e/n*	GD	GA/GC t/t*	DB 1) d/d
180M		712	602	838	260.5	180	91	66	48	110	14	9	51.5	M16
180L		712	602	838	260.5	180	91	66	48	110	14	9	51.5	M16
200L		779	660	895	286.5	265	90	79	55	110	16	10	59	M20
225S	2 - 4/2	867.5	747.5	993	304.5	265	95	90	55	110	16	10	59	M20
	≥4	867.5	747.5	1033	304.5	265	95	90	60	140	18	11	64	M20
225M	2 - 4/2	867.5	747.5	993	304.5	265	95	90	55	110	16	10	59	M20
	≥4	867.5	747.5	1033	304.5	265	95	90	60	140	18	11	64	M20
250M	2 - 4/2	970	830	1118	342.5	265	120	135	60	140	18	11	64	M20
	≥4	970	830	1116	342.5	265	120	135	65	140	18	11	69	M20
280S	2 - 4/2	1036	896	1195	374	265	135	122	65	140	18	11	69	M20
	≥4	1036	896	1195	374	265	135	122	75	140	20	12	79.5	M20
280M	2 - 4/2	1087	947	1246	358	265	135	122	65	140	18	11	69	M20
	≥4	1087	947	1246	358	265	135	122	75	140	20	12	79.5	M20
315S YE	2 - 4/2	1190	1050	1340	439	300	123	110	65	140	18	11	69	M20
	≥4	1220	1050	1400	439	300	123	130	80	170	22	14	85	M20
315S ZE	2 - 4/2	1190	1050	1340	439	300	123	110	65	140	18	11	69	M20
	≥4	1220	1050	1400	439	300	123	110	80	170	22	14	85	M20
315M	2 - 4/2	1190	1050	1340	439	300	123	110	65	140	18	11	69	M20
	≥4	1220	1050	1400	439	300	123	110	80	170	22	14	85	M20
315L	2 - 4/2	1240	1100	1390	454	300	123	110	65	140	18	11	69	M20
	≥4	1270	1100	1450	454	300	123	110	80	170	22	14	85	M20

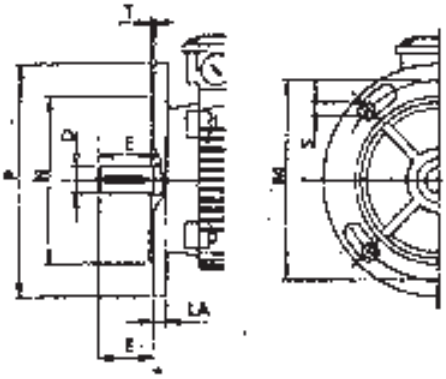
1) Clearance hole for screw
2) Maximum dimension
3) Centering holes at shaft extension to DIN 332 part 2
4) Only for MT 2/*

THREE-PHASE FRAME SIZE 56 - 160 IM B14, IM B5
ALUMINIUM ALLOY FRAME

IM B14

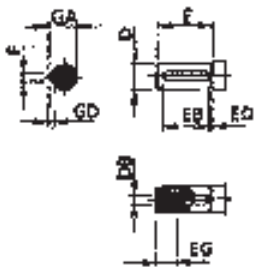


IM B5



IEC DIN	P a_1	N b_1	LA c_1	M e_1	T f_1	S[1] s_1	P a_2	N b_1	LA c_1	M e_1	T f_1	S[1] s_1	M e_1	N b_1	P a_1	T f_1	LA c_1	S[1] s_1
56	80	50		65	3	M5	105	70	6	85	2.5	M6	100	80	120	2.5	9.5	M6
63	90	60	9	75	2.5	M5	120	80	8	100	2.5	M6	115	95	140	3	9	M8
71	105	70	11	85	2.5	M6	140	95	8	115	2.5	M8	130	110	160	3.5	10	M8
80	120	80	8	100	3	M6	160	110	8.5	130	3.5	M8	165	130	200	3.5	10	M10
90S-L	140	95	10	115	3	M8	160	110	9	130	3.5	M8	165	130	200	3.5	12	M10
100L	160	110	10	130	3.5	M8	200	130	12	165	3.5	M10	215	180	250	4	14	M12
112M	160	110	10	130	3.5	M8	200	130	12	165	3.5	M10	215	180	250	4	14	M12
132S-M	200	130	30	165	3.5	M10	250	180	12	215	4	M12	265	230	300	4	14	M12
160M-L	250	180	12	215	4	M12	300	230	12	265	5	M16	300	250	350	5	15	M16

1) Clearance hole for screw. Hole has standard for size 132 to 160

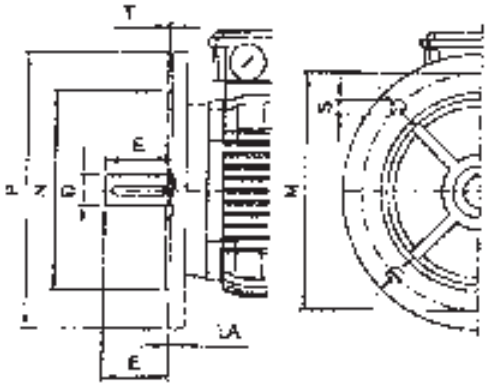


IEC DIN	D d	E l	F[1] d_1	GD t	GA t	DB[1] d_2	EB	EG	ED
56	9 j6	20	3	3	10.2	M3	10	15	2.5
63	11 j6	23	4	4	12.5	M4	10	15	4
71	14 j6	30	5	5	16	M5	12.5	20	6
80	19 j6	40	6	6	21.5	M6	16	30	4
90S-L	24 j6	50	8	7	27	M8	19	40	4
100L	28 j6	60	8	7	31	M10	22	50	4
112M	28 j6	60	8	7	31	M10	22	50	4
132S-M	38 k6	80	10	8	41	M12	28	70	4
160M-L	42 k6	110	12	8	45	M16	36	100	4

1) Centering holes in shaft extension to DIN 332 part 2

THREE-PHASE FRAME SIZE 180 - 315 IM B5
CAST IRON FRAME

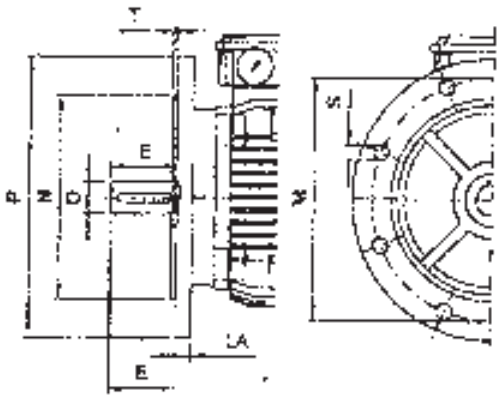
IM B5 - 180/200



IEC / DIN	M	N	P	T	LA	SU
	e_1	b_1	a_1	f_1	c_1	s_1
180M/L	300	250	350	5	13	M16
200L	350	300	400	5	15	M16

1) Clearance hole for screw

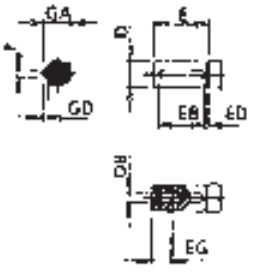
IM B5 - 225/315



IEC / DIN	M	N	P	T	LA	SU
	e_1	b_1	a_1	f_1	c_1	s_1
225S/M	400	350	450	5	18	M15
250M	500	450	550	5	18	M15
280S/M	500	450	550	5	18	M16
315S/M/L	600	550	660	6	22	M20

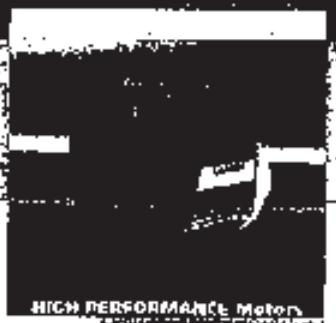
1) Clearance hole for screw

IEC / DIN	Poles	D d	E l	F h9 u	GD	GA t	DBU d_b	EG	EB	ED
180M/L		48 k6	110	14	9	51.5	M16	36	100	5
200L		55 m6	110	16	10	59	M20	42	100	5
225S	2 - 4/2	55 m6	110	16	11	59	M20	42	100	5
	≥ 4	60 m6	140	18	11	64	M20	42	110	20
225M	2 - 4/2	55 m6	110	16	10	59	M20	42	100	5
	≥ 4	60 m6	140	18	11	64	M20	42	110	20
250M	2 - 4/2	60 m6	140	18	11	64	M20	42	110	20
	≥ 4	65 m6	140	18	11	69	M20	42	110	20
280S	2 - 4/2	65 m6	140	18	11	69	M20	42	125	10
	≥ 4	75 m6	140	20	12	79.5	M20	42	125	10
280M	2 - 4/2	65 m6	140	18	11	69	M20	42	125	10
	≥ 4	75 m6	140	20	12	79.5	M20	42	125	10
315S/M/L	2 - 4/2	65 m6	140	18	11	69	M20	42	125	10
	≥ 4	80 m6	170	22	14	85	M20	50	160	5



2) Centering holes in shaft extension to DIN 332 part 2

Branches & Partners



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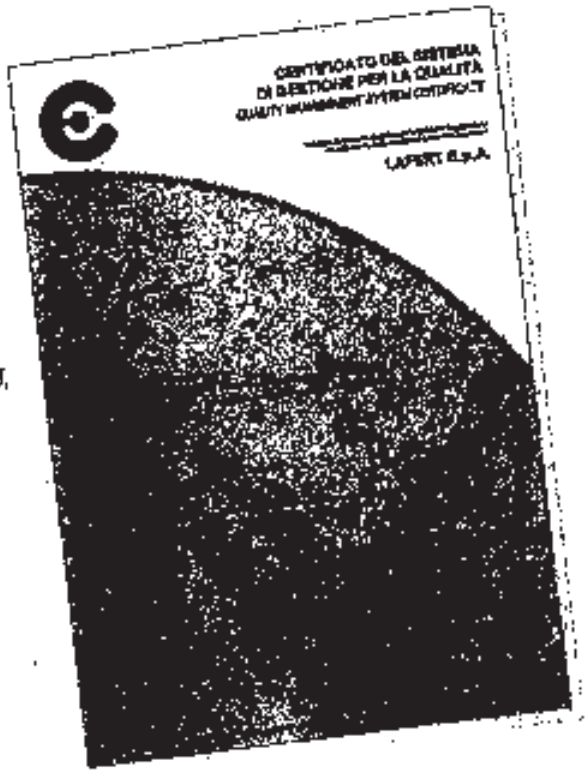
LAFERT GROUP

STANDARDS AND REGULATIONS



The strictness of our quality control assures the flawless operation and reliability of our products.
That our quality scale fulfils your demands is confirmed by the certificate awarded by the CERMET, a Certification body authorized by SINCERT

CE Marking
Our motors comply with the requirements of the following international standard:
IEC 60034

as well as with the following European Directives: Low Voltage Directive 2006/95/EC, the EMC-Directive 2004/108/EC and Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) 2002/95/EC.

The above named products comply with the requirements of the EC Directive Machines 2006/42/EC. In accordance with this Directive induction motors are components and intended solely for integration into other machines.
Commissioning is forbidden until conformity of the end product with this Directive is proved!

The CE symbol was applied for the first time in 1995.

The safety instructions in the Operation Manual of the manufacturer and EN 60204-1 have to be observed.

EFF 2 EFF 1

IE1 IE2

Efficiency values according to CEMEP Voluntary Agreement.
Efficiency testing method IEC 60034-2;1996

Harmonized efficiencies to IEC 60034-30;2008 - IE1 and IE2 code.
Efficiency testing method IEC 60034-2-1;2007

MEPS- Compliant

All standard three-phase motors with standard rating included in this catalogue comply with efficiency class IE1 and bear the corresponding label on the rating plate.
For efficiency at 50%, 75% and full load, please refer to the electrical data tables.

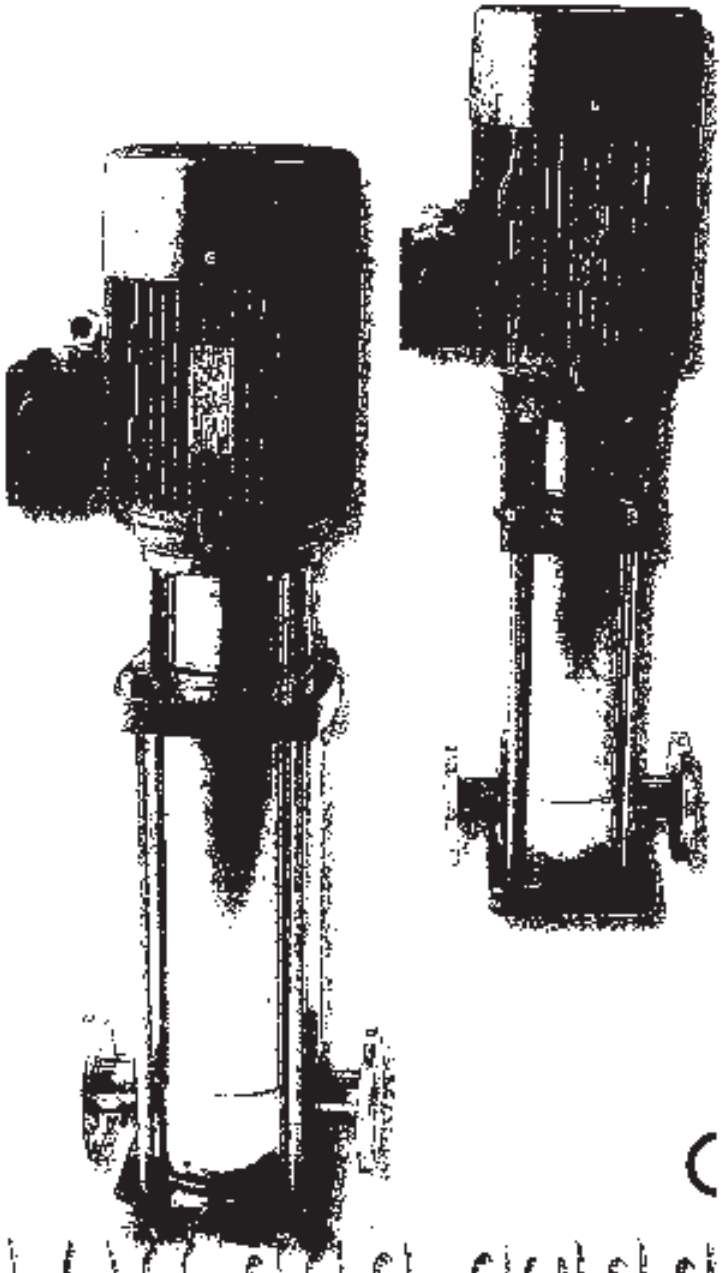
Technical Literature

5) Packaged Pressurization Unit

VERTICAL MULTI STAGE CENTRIFUGAL PUMPS

SV/MSV/MSVF/MSVS

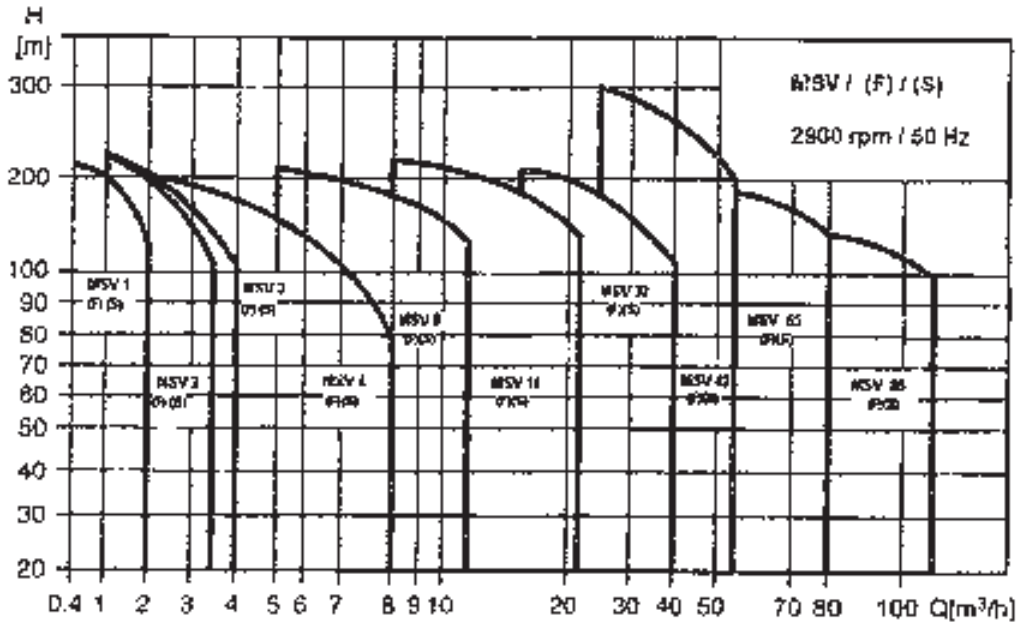
ΜΕΛΟΣ ΤΟΥ Europump



CE

STAINLESS STEEL

DRAKOS - POLEMIS HMP PUMPS



APPLICATIONS

- Booster Sets
- Water treatment
- Air - conditioning
- Irrigation
- Water transfer
- Marine applications
- SPRINKLER installations
- Washing systems
- Boiler feed
- Fountain
- Fire fighting
- Flushing Water

OPERATION CONDITIONS

- Capacity up to110 m3/h at 2850 rpm.
- Head up to 305 m at 2850 rpm.
- Capacity up to 55 m3/h at 1450 rpm.
- Head up to 77 m at 1450 rpm.
- Max. working pressure: 30 bars
- Max. liquid temperature: -15 °C to +120 °C

PUMP

MSV / (F) / (S) are vertical multistage centrifugal pumps, suitable for clean water , according to the international standards.

Suction and discharge ports are IN - LINE arrangement, threaded or flanged

Suction and discharge casings are made of cast iron for MSVF type, of AISI 304 stainless steel for MSV type and of AISI316 for MSVS and SV type.

Pump casing consists of a number of modules stages, held together by tie bolts.

The base plate and the pump head are made of cast iron, all impellers are balanced. Mechanical seal is according to DIN 24960 (carbon/silicon carbide). The pump is sealed with O-rings.

PUMP SIZE		DIN FLANGE	THREATED SOCKET
SV / MSV / (F) / (S)	2	DN 24	Ø 32 mm
SV / MSV / (F) / (S)	4	DN 32	Ø 32 mm
SV / MSV / (F) / (S)	8	DN 40	Ø 50 mm
SV / MSV / (F) / (S)	16	DN 50	Ø 50 mm
SV / MSV / (F) / (S)	32	DN 65	-
SV / MSV / (F) / (S)	42	DN 80	-
SV / MSV / (F) / (S)	65	DN 100	-
SV / MSV / (F) / (S)	85	DN 100	-

SPECIAL APPLICATIONS

- Dry running protection and lack of of phase.

ELECTRIC MOTOR

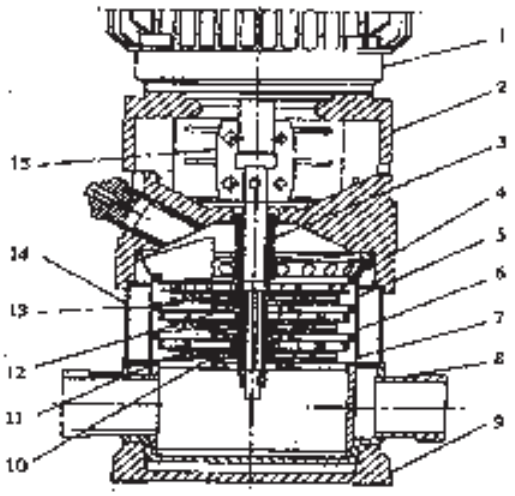
Specially developed three - phase motor.

- 2850 rpm and 1450 rpm 50Hz.
- 3600 rpm and 1800 rpm 60Hz.

TEFC, IP 55. Insulation Class F. Mounting V1 / B14 direction of rotation clock - wise as seen from the top of the electric motor.

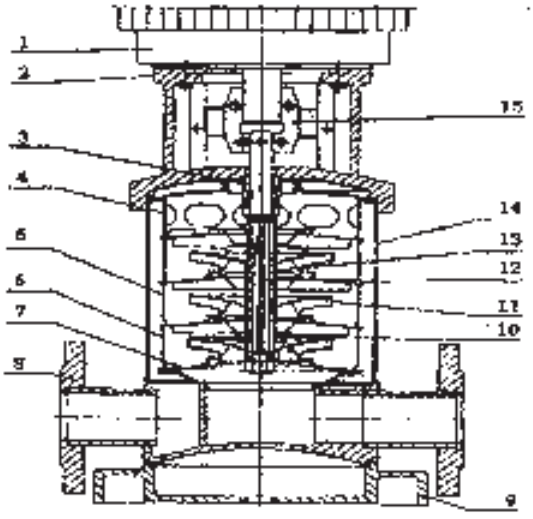
SECTIONAL DRAWINGS

SV / MSV 2 SV / MSV 4



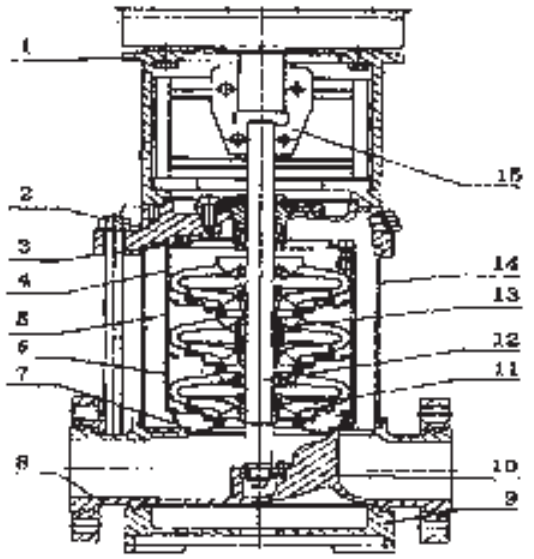
No	NAME	MATERIAL	AISI / ASTM
1	Electric Motor		
2	Pump Head	Cast Iron	ASTM26B
3	Mechanical seal		
4	Water - out guide vane	Stainless steel	AISI304
5	Support guide vane	Stainless steel	AISI304
6	Guide vane	Stainless steel	AISI304
7	Inducer	Stainless steel	AISI304
9	Base frame	Cast Iron	ASTM25B
10	Bearing		
11	Impeller	Stainless steel	AISI304
12	Shaft	Stainless steel	AISI316
13	Impeller separating sleeve	Stainless steel	AISI304
14	Pressure - resistant cylinder	Stainless steel	AISI304
15	Coupling	Cast Iron	
	Rubber parts	FPM	
	SV / MSV		
8	Suction / discharge casing	Stainless steel	AISI304
	MSV-F		
8	Suction / discharge casing	Cast Iron	ASTM25B

SV / MSV 8 SV / MSV 16



No	NAME	MATERIAL	AISI / ASTM
1	Electric Motor		
2	Pump Head	Cast Iron	ASTM25B
3	Mechanical seal		
4	Water - out guide vane	Stainless steel	AISI304
5	Support guide vane	Stainless steel	AISI304
6	Guide vane	Stainless steel	AISI304
7	Inducer	Stainless steel	AISI304
9	Base frame	Cast Iron	ASTM25B
10	Bearing		
11	Impeller	Stainless steel	AISI304
12	Shaft	Stainless steel	AISI316
13	Impeller separating sleeve	Stainless steel	AISI304
14	Pressure - resistant cylinder	Stainless steel	AISI304
15	Coupling	Cast iron	
	Rubber parts	FPM	
	SV / MSV		
8	Suction / discharge casing	Stainless steel	AISI304
	MSV-F		
8	Suction / discharge casing	Cast Iron	ASTM25B

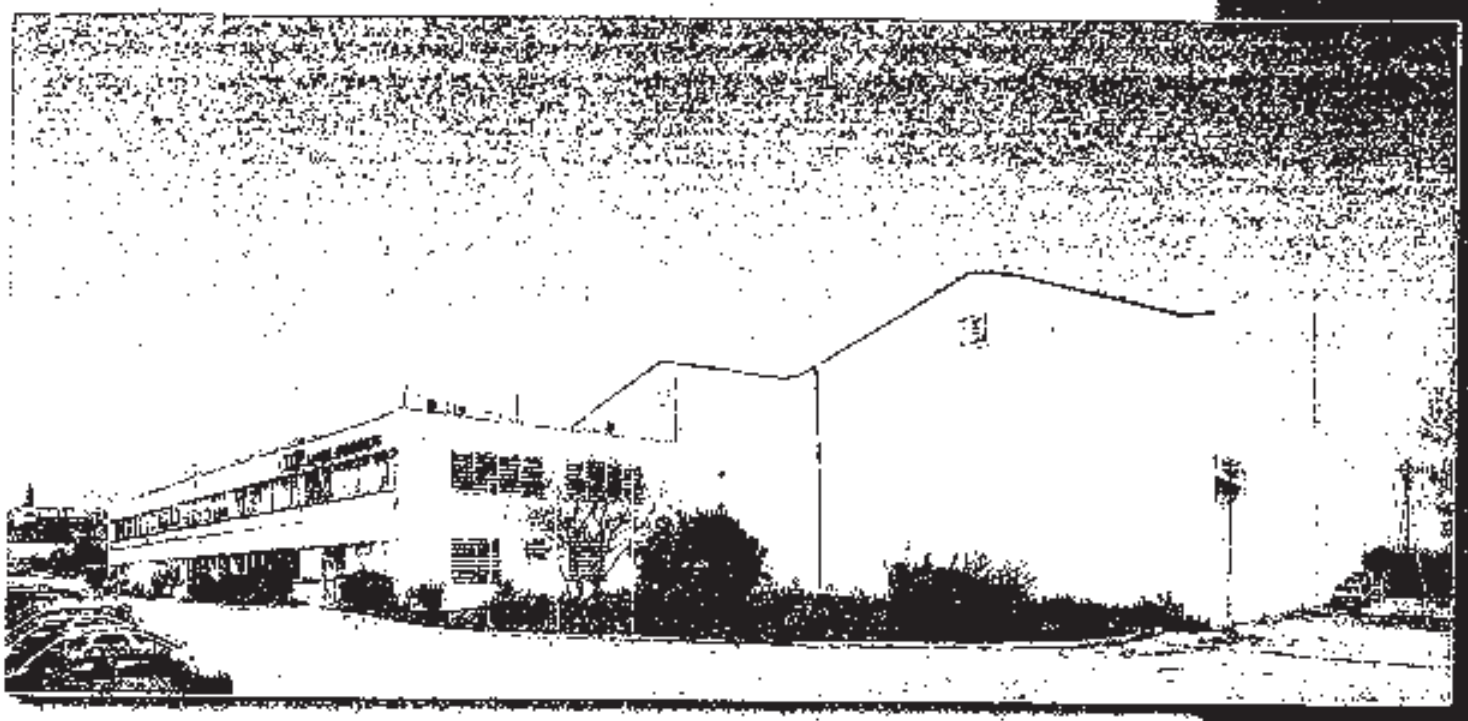
SV / MSV 32/42 SV / MSV 65/85



No	NAME	MATERIAL	AISI / ASTM
1	Bracket	Cast Iron	ASTM25B
2	Pump Head	Cast Iron	ASTM25B
3	Mechanical seal		
4	Water - out guide vane	Stainless steel	AISI304
5	Support guide vane	Stainless steel	AISI304
6	Guide vane	Stainless steel	AISI304
7	Inducer	Stainless steel	AISI304
9	Base frame	Cast Iron	ASTM25B
10	Bottom Bearing		
11	Impeller	Stainless steel	AISI304
12	Shaft	Stainless steel	AISI316
13	Intermediate - shaft sleeve	Ceramic	
14	Pressure - resistant cylinder	Stainless steel	AISI304
15	Coupling	Cast Iron	
	Rubber parts	FPM	
	SV / MSV		
8	Suction / discharge casing	Stainless steel	AISI304
	MSV-F		
8	Suction / discharge casing	Cast Iron	ASTM25B

Note: For MSV-S 'IN - LINE' section is manufactured in stainless steel AISI 316

No job is too big to do,
no job is too small
to take



VRM.011.32005.BIN

DRAKOS - POLEMIS | DNP PUMPS

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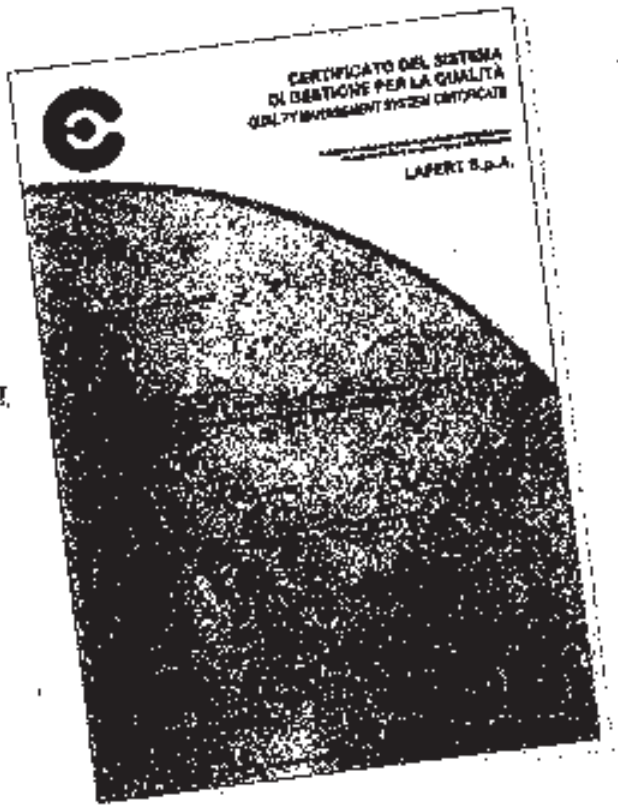
D4

High Efficiency three-phase LV Motors

TECHNICAL CATALOGUE 2009

AEG

STANDARDS AND REGULATIONS



The strictness of our quality control assures the flawless operation and reliability of our products.
That our quality scale fulfils your demands is confirmed by the certificate awarded by the CERMET, a Certification body authorized by SINCERT.

CE Marking
Our motors comply with the requirements of the following international standard:
IEC 60034

as well as with the following European Directives: Low Voltage Directive 2006/95/EC, the EMC-Directive 2004/108/EC and Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) 2002/95/EC.

The above named products comply with the requirements of the EC Directive Machines 2006/42/EC. In accordance with this Directive induction motors are components and intended solely for integration into other machines.
Commissioning is forbidden until conformity of the end product with this Directive is proved!

The CE symbol was applied for the first time in 1995.

The safety instructions in the Operation Manual of the manufacturer and EN 60204-1 have to be observed.

EFF2 EFF1

Efficiency values according to CEMEP Voluntary Agreement.
Efficiency testing method IEC 60034-2;1996

IE1 IE2

Harmonized efficiencies to IEC 60034-30;2008 - IE1 and IE2 code.
Efficiency testing method IEC 60034-2-1;2007

MEPS- Compliant

All standard three-phase motors with standard rating included in this catalogue comply with efficiency class IE1 and bear the corresponding label on the rating plate.
For efficiency at 50%, 75% and full load, please refer to the electrical data tables.

Efficiency classes of motors according to CEMEP - 1998

The voluntary agreement between the European committee of manufacturers of electric drive systems CEMEP and the European Commission defined three efficiency classes:

- **EFF3 = Motors with a low efficiency level**
- **EFF2 = Motors with improved efficiency level**
- **EFF1 = Motors with a high efficiency level**

The agreed minimum levels of the respective classes are based on efficiency measurements according to the old EN 60034-2:1996.

Method for determining the efficiency of motors

The method for measuring the efficiency of asynchronous AC motors was revised with the new IEC 60034-2-1:2007 standard. The new method significantly improves the accuracy under defined laboratory conditions. It will replace the EN 60034-2:1996.

The new IEC 60034-2-1 is applicable as of now. The old edition (EN 60034-2) will become obsolete in November 2010. By this deadline at the latest all motors must be evaluated with this new method.

As a direct comparison using the same motor, it is expected that the efficiency levels measured according to the new method are up to a few percentage points below the efficiency levels determined using the old method. For a transition period, many manufactures are therefore going to specify both efficiency levels in their catalogues.

New International efficiency classes of motors - IE Code

The new IEC 60034-30:2008 defines worldwide the efficiency classes of motors.

- **IE1 = Standard Efficiency (comparable to EFF2)**
- **IE2 = High Efficiency (comparable to EFF1)**
- **IE3 = Premium Efficiency**

From 2009 motors can be offered with the new classes (IE1, IE2 and IE3). The old European designations (EFF3, EFF2 and EFF1) will not become void, but will disappear from the market.

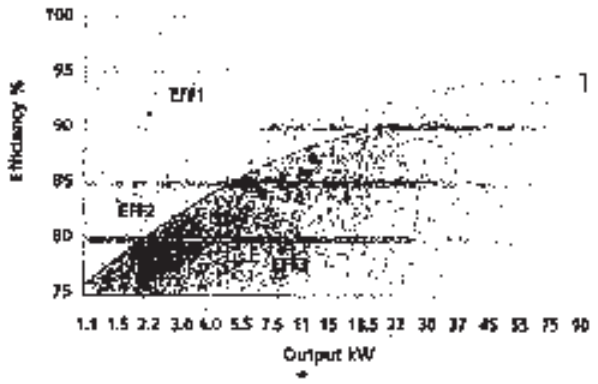
The efficiency levels according to IEC 60034-30 are measured based on the test methods defined in IEC 60034-2-1:2007.

The IEC 60034-30 only defines requirements of efficiency classes and aims to create provisions for international consistency. It does not define which motors must be supplied with which efficiency level. This is left to respective regional legislation.

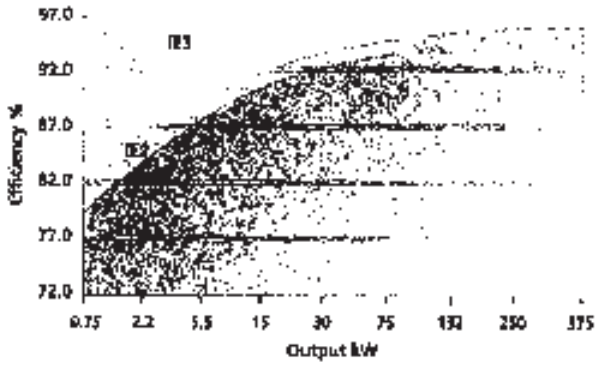
Output	2 poles		4 poles	
kW	Eff2/Eff3	Eff1/Eff2	Eff2/Eff3	Eff1/Eff2
1.1	76.2	82.8	76.2	83.8
1.5	78.5	84.1	78.5	85.0
2.2	81.0	85.6	81.0	86.4
3	82.6	86.7	82.6	87.4
4	84.2	87.6	84.2	88.3
5.5	85.7	88.6	85.7	89.2
7.5	87.0	89.5	87.0	90.1
11	88.4	90.5	88.4	91.0
15	89.4	91.3	89.4	91.8
18.5	90.0	91.8	90.0	92.2
22	90.5	92.2	90.5	92.6
30	91.4	92.9	91.4	93.2
37	92.0	93.3	92.0	93.6
45	92.5	93.7	92.5	93.9
55	93.0	94.0	93.0	94.2
75	93.6	94.6	93.6	94.7
90	93.9	95.0	93.9	95.0

Efficiency values according to CEMEP *Voluntary Agreement*.
Efficiency standard calculation: IEC 60034-2;1996

EFF Classes - 4 poles



IE Classes - 4 poles



Output	IE1 code Standard Efficiency			IE2 code High Efficiency			IE3 code Premium Efficiency		
kW	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles
0.75	72.1	72.1	70.0	77.4	79.6	75.9	80.7	82.5	78.9
1.1	75.0	75.0	72.9	79.6	81.4	78.1	82.7	84.1	81.0
1.5	77.2	77.2	75.2	81.3	82.8	79.8	84.2	85.3	82.5
2.2	79.7	79.7	77.7	83.2	84.3	81.8	85.9	86.7	84.3
3	81.5	81.5	79.7	84.6	85.5	83.3	87.1	87.7	85.6
4	83.1	83.1	81.4	85.8	86.6	84.6	88.1	88.6	86.8
5.5	84.7	84.7	83.1	87.0	87.7	86.0	89.2	89.6	88.0
7.5	86.0	86.0	84.7	88.1	88.7	87.2	90.1	90.4	89.1
11	87.6	87.6	86.4	89.4	89.8	88.7	91.2	91.4	90.3
15	88.7	88.7	87.7	90.3	90.6	89.7	91.9	92.1	91.2
18.5	89.3	89.3	88.6	90.9	91.2	90.4	92.4	92.6	91.7
22	89.9	89.9	89.2	91.3	91.6	90.9	92.7	93.0	92.2
30	90.7	90.7	90.2	92.0	92.3	91.7	93.3	93.6	92.9
37	91.2	91.2	90.8	92.5	92.7	92.2	93.7	93.9	93.3
45	91.7	91.7	91.4	92.9	93.1	92.7	94.0	94.2	93.7
55	92.1	92.1	91.9	93.2	93.5	93.1	94.3	94.6	94.1
75	92.7	92.7	92.6	93.8	94.0	93.7	94.7	95.0	94.6
90	93.0	93.0	92.9	94.1	94.2	94.0	95.0	95.2	94.9
110	93.3	93.3	93.3	94.3	94.5	94.3	95.2	95.4	95.1
132	93.5	93.5	93.5	94.6	94.7	94.6	95.4	95.6	95.4
160	93.7	93.8	93.8	94.8	94.9	94.8	95.6	95.8	95.6
200	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
250	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
315	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
355	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
375	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8

Efficiency values according to IEC 60034-30:2008
Efficiency standard calculation: IEC 60034-2-1;2007

The motors comply with the relevant standards and regulations, especially:

Title	IEC	EU CENELEC	D DIN/VDE	I CEI/UNEL	GB BS	F NFC	E UNE
Electrical							
General stipulations for electrical machines	60034-1	EN 60034-1	DIN EN 60034-1	CEI EN 60034-1	4999-1 4999-69	51-200 51-111	UNE EN 60034-1
Rotating electrical machines: methods for determining losses and efficiency using tests	60034-2	HD 53 2	DIN EN 60034-2	CEI EN 60034-2	4999-34	51-112	UNE EN 60034-2
Standard method for determining losses and efficiency from tests	60034-2-1						
Efficiency classes of single speed, three-phase, cage-induction motors (IE-code)	60034-30						
Terminal markings and direction of rotation of rotating electrical machines	60034-8	HD 53 8 S4	DIN VDE 0530-8	CEI EN 60034-8	4999-3	51-118	20113-8-96
Starting performance	60034-12	EN 60034-12	DIN EN 60034-12	CEI EN 60034-12	4999-112		UNE EN 60034-12
Standard voltages	60038	HD 472 S1	DIN IEC 60038	CEI 8-6			
Insulating materials	60085		DIN IEC 60085	CEI EN 60085			
Mechanical							
Dimensions and output ratings	60072		DIN EN 50347	UNEL 13113			
Mounting dimensions and relationship frame sizes-output ratings, IM B3	60072		DIN 42673-1	UNEL 13113	4999-10 51-110	51-105 51-104	UNE EN 50347 1980
Mounting dimensions and relationship frame sizes-output ratings, IM B5	60072		DIN 42677-1	UNEL 13117		20106-2-74	
Mounting dimensions and relationship frame sizes-output ratings, IM B14	60072		DIN 42677-1	UNEL 13118	4999-10 51-110	51-105 51-104	UNE EN 50347
Cylindrical shaft ends for electric motors	60072	HD 231	DIN 748-3	UNEL 13502	4999-10	51-111	
Degrees of protection	60034-5	EN 60034-5	DIN EN 60034-5	CEI EN 60034-5	4999-20	EN60034-5	20171-5
Methods of cooling	60034-6	EN 60034-6	DIN EN 60034-6	CEI EN 60034-6	4999-21		EN 60034-6
Mounting arrangements	60034-7	EN 60034-7	DIN EN 60034-7	CEI EN 60034-7	4999-22	51-117	EN 60034-7
Noise limits	60034-9	EN 60034-9	DIN EN 60034-9	CEI EN 60034-9	4999-51	51-119	EN 60034-9
Mechanical vibration	60034-14	EN60034-14	DIN EN 60034-14	CEI EN 60034-14	4999-50	51-111	EN 60034-14
Mounting flanges			DIN 42948	UNEL 13501			
Tolerances of mounting and shaft extensions			DIN 42955	UNEL 13501/ 13502			
Classification of environmental conditions	60721-2-1		DIN IEC 60721-2-1	CEI EN 60721-1			
Mechanical vibration; balancing	ISO 8821		DIN ISO 8821				

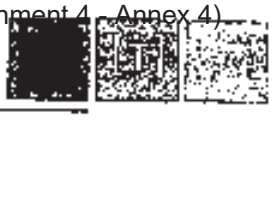
Motors to special regulations:

- Motors with UL, CSA and cURus approval (performance data on request)

Three-phase motors
high efficiency

IE2
EFF 1

For mains voltage
400 V - 50 Hz



High efficiency motors, IE2 code
Efficiency testing method IEC 60034-2-1;2007

High efficiency motors, Eff1
Efficiency testing method IEC 60034-2;1996

Temperature rise to class B

Type	kW	HP	min⁻¹	M_n Nm	Eff1 η 75%	Eff1 η 100%	IE2 η 75%	IE2 η 100%	cos φ	I_n 400V	I_A/I_N	M_A/M_N	M_B/M_N	M_K/M_N	J 10^{-4} kgm²	kg
3000 min⁻¹ (2 poles)																
AMHE 80Z AA	2	0.75	1.0	2900	2.5	82.0	81.5	80.8	80.5	0.77	1.7	7.0	3.6	3.4	3.6	0.72	11.5
AMHE 80Z BA	2	1.1	1.5	2880	3.6	84.0	83.8	82.8	82.7	0.77	2.5	6.8	3.6	3.4	3.6	0.89	9.5
AMHE 90S AA	2	1.5	2	2880	5.0	83.4	84.1	82.8	83.0	0.80	3.2	8.1	3.6	3.1	4.0	1.56	14.0
AMHE 90L CA	2	2.2	3	2860	7.3	85.8	85.6	85.0	84.8	0.85	4.4	8.5	3.5	3.2	3.7	1.6	16.5
AMHE 100L AA	2	3	4	2920	9.8	86.2	86.7	85.8	85.9	0.84	5.9	12.3	4.2	4.7	6.3	4.05	22.8
AMHE 112M AA	2	4	5.5	2940	13.0	88.9	88.9	87.7	87.6	0.86	7.5	12.5	4.3	2.2	4.5	8.58	33.6
AMHE 112M BA	2*	5.5	7.5	2920	18.0	88.1	88.6	87.	87.8	0.88	10.1	8.9	3.0	2.1	3.2	8.58	34.0
AMHE 132S ZA	2	5.5	7.5	2900	18.1	88.6	88.6	88.0	87.9	0.90	10.0	7.6	2.8	2.3	3.3	14.0	46.0
AMHE 132S TA	2	7.5	10	2900	24.7	89.5	89.5	88.8	88.4	0.90	13.5	7.9	3.0	2.5	3.5	20.5	53.0
AMHE 160M YA	2	11	15	2930	35.9	90.7	90.7	90.2	89.8	0.85	20.4	7.3	2.4	2.2	3.1	51.75	87.8
AMHE 160M ZA	2	15	20	2930	48.9	91.6	91.6	90.9	90.6	0.86	27.5	7.6	2.5	2.3	3.1	64.0	104.0
AMHE 160L ZA	2	18.5	25	2930	60.3	92.0	92.0	91.5	91.2	0.86	33.5	7.9	2.8	2.6	3.4	64.0	105.0
AMHE 180M ZG	2	22	30	2930	71.7	92.5	92.5	91.8	91.5	0.87	39.5	7.7	2.4	2.3	3.2	70	135
AMHE 200L AG	2	30	40	2945	97.3	93.1	93.1	92.4	92.2	0.89	52.5	7.8	2.1	1.9	2.8	130	220
AMHE 200L BG	2	37	50	2950	119.8	93.4	93.6	92.9	92.7	0.89	65	7.6	2.2	2.0	2.8	156	240
AMHE 225M AG	2	45	60	2950	145.7	94.1	94.2	93.7	93.5	0.88	78	7.9	2.5	1.9	2.9	220	315
AMHE 250M AG	2	55	75	2955	177.7	94.2	94.3	93.9	93.8	0.89	94	7.7	2.4	1.8	3.0	424	410
AMHE 280S G	2	75	100	2960	242.0	94.9	94.6	94.3	94.0	0.90	127	7.8	2.2	2.0	3.0	700	570
AMHE 280M G	2	90	125	2960	290.4	95.0	95.0	94.3	94.5	0.90	152	7.8	2.2	2.0	3.0	800	660
AMHE 315S G	2	110	150	2978	352.7	95.4	95.6	94.5	94.8	0.90	184	7.8	2.2	1.8	2.9	1400	800
AMHE 315M G	2	132	180	2978	423.3	95.4	95.8	94.8	95.1	0.90	221	7.8	2.2	1.8	2.9	1700	1000
AMHE 315M RG	2	160	220	2980	512.7	95.9	96.3	95.1	95.4	0.91	264	7.8	2.0	1.7	2.75	2600	1100
AMHE 315L G	2	200	270	2978	641.3	96.2	96.4	95.4	95.7	0.91	329	7.2	1.85	1.6	2.5	2800	1300

* Higher output (progressive motor)

Please note that the efficiency values are not comparable without knowing the testing method.

Three-phase motors designed for range of rated voltage 380-420 V ± 5% - 50 Hz

EFF2

For mains voltage to IEC 60038 400 V ± 10% - 50 Hz

Standard efficiency motors, EFF2
Efficiency testing method IEC 60034-2;1996

Temperature rise to class B

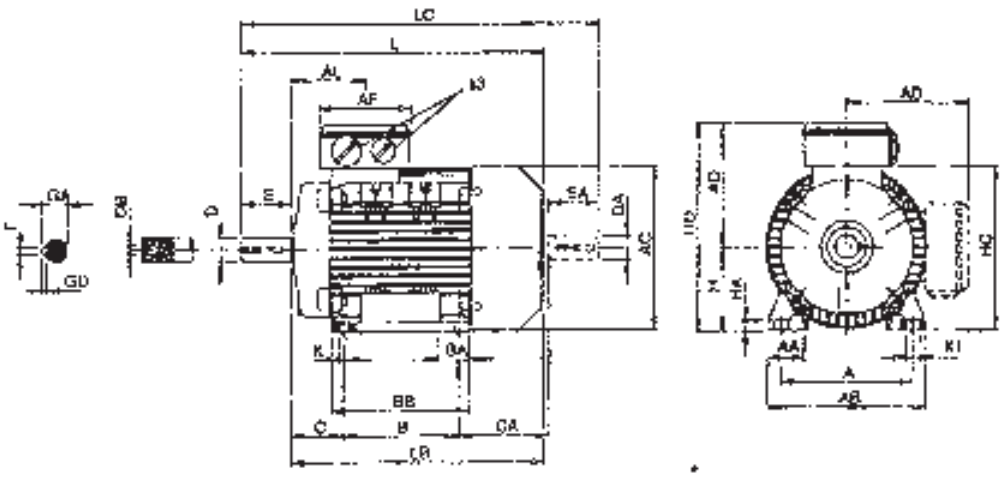
Type	kW	HP	min⁻¹	M_N Nm	EFF2 η 50%	75%	100%	cos φ	I_N 400V	380-420V	I_A/I_N	M_A/M_N	M_B/M_N	M_K/M_N	J 10^{-4} kgm²	kg
1500 min⁻¹ (4 poles)																
AM 56Z AA	4	0.06	0.08	1300	0.4	42	44	48	0.70	0.28	0.32	2.6	2.1	2.0	2.1	0.14	2.7
AM 56Z BA	4	0.09	0.12	1330	0.6	43	47	51	0.74	0.35	0.40	2.5	2.2	2.1	2.2	0.16	2.9
AM 63Z AA	4	0.12	0.16	1350	0.8	46	50	57	0.65	0.50	0.55	2.4	2.0	1.9	2.0	0.25	3.3
AM 63Z BA	4	0.18	0.25	1330	1.3	47	50	58	0.70	0.65	0.70	2.3	1.9	1.8	1.9	0.27	4.1
AM 63Z CA	4*	0.25	0.33	1360	1.8	49	52.5	58	0.74	0.85	0.90	2.7	2.2	2.0	2.1	0.30	4.2
AM 71Z AA	4	0.25	0.33	1340	1.8	55	59	64	0.66	0.9	1.00	3.7	1.9	1.8	2.0	0.70	5.7
AM 71Z BA	4	0.37	0.50	1370	2.6	60	63	67	0.67	1.2	1.25	3.3	2.2	2.1	2.2	0.82	6.0
AM 71Z CA	4*	0.55 *	0.75	1380	3.8	63	64	69	0.68	1.7	1.80	3.6	2.4	2.3	2.4	0.95	7.3
AM 80Z AA	4	0.55	0.75	1400	3.8	67.0	69.0	70.0	0.72	1.6	1.7	3.6	2.6	2.5	2.6	1.58	8.2
AM 80Z BA	4	0.75	1.0	1410	5.1	62.5	60.0	70.6	0.71	2.2	2.3	4.4	2.8	2.3	2.8	2.00	9.3
AM 80Z CA	4*	1.1 *	1.5 *	1385	7.6	74.1	76.4	75.9	0.77	2.8	2.9	4.4	2.5	2.5	2.6	2.41	10.6
AM 90S AA	4	1.1	1.5	1400	7.5	69.6	75.4	76.5	0.78	2.7	2.9	5.2	2.5	2.4	2.8	2.5	12.5
AM 90L BA	4	1.5	2.0	1400	10.2	75.6	78.7	78.6	0.77	3.6	3.7	5.7	2.8	2.6	3.0	3.13	14.5
AM 90L CA	4	1.8 *	2.5 *	1380	12.5	75.1	77.8	77.3	0.80	4.3	4.9	5.5	2.7	2.5	2.9	3.33	14.5
AM 90L DA	4*	2.2 *	3.0 *	1400	15.0	76.3	79.3	79.3	0.75	5.3	5.5	4.8	2.9	2.8	3.2	4.06	17
AM 100L AA	4	2.2	3.0	1435	14.6	77.5	80.2	81.0	0.74	5.4	5.6	5.3	2.5	2.4	2.7	4.6	19.5
AM 100L BA	4	3	4.0	1425	20.1	81.7	83.4	82.8	0.75	6.8	6.9	4.6	2.4	2.3	2.5	5.58	22.5
AM 100L CA	4*	4 *	5.5 *	1400	27.3	82.1	83.0	81.6	0.78	9.2	9.3	6.0	2.6	2.4	2.9	6.05	25
AM 112M AA	4	4	5.5	1430	26.7	84.5	85.3	84.2	0.81	8.5	8.8	6.3	2.2	2.0	2.8	12.2	29.5
AM 112M BA	4*	5.5 *	7.5 *	1430	36.7	85.9	85.2	85.2	0.83	11.4	11.7	6.5	2.2	2.0	2.9	15.2	34
AM 132S ZA	4	5.5	7.5	1430	36.7	85.6	86.6	85.7	0.82	11.3	11.7	5.8	3.0	2.7	3.0	22.40	41.9
AM 132M ZA	4	7.5	10.0	1440	49.7	87.7	88.1	87.4	0.82	15.1	15.5	6.8	3.1	2.7	3.1	23.25	51.0
AM 132M BA	4	9.2	12.5	1440	61.0	87.3	88.1	87.2	0.86	17.7	17.8	8.0	3.5	3.2	3.5	37.75	65.0
AM 132M TA	4*	11 *	15.0 *	1440	72.9	87.5	87.9	88.5	0.85	21.1	21.5	8.3	3.1	3.0	3.3	37.25	65.0
AM 160M XA	4	11	15	1460	71.9	88.4	89.2	88.6	0.80	22.5	24.0	6.5	2.5	2.3	2.8	81.25	88.5
AM 160L XA	4	15	20	1460	98.1	89.6	90.3	89.5	0.81	30.0	31.5	6.5	2.6	2.4	2.8	105.75	106.5
AM 160L ZA	4*	18.5	25	1450	121.8	89.6	90.5	90.0	0.83	37.0	39.0	6.7	2.4	2.2	2.6	120.9	115.5
AM 160L RA	4*	22 *	30 *	1460	143.9	89.8	90.8	90.5	0.81	44.0	46.0	6.5	2.4	2.2	2.6	136	124.5
AM 180M XG	4	18.5	25	1460	121.0	90.0	90.8	90.3	0.84	35.5	36.5	7.2	2.7	2.2	3.0	105	150
AM 180L XG	4	22	30	1460	143.9	90.4	91.1	90.5	0.84	42.0	43.5	7.3	2.7	2.2	3.0	118	160
AM 180L RG	4*	30 *	40 *	1455	196.9	90.4	91.4	91.4	0.82	58.0	60.0	7.8	3.0	2.4	3.2	150	175
AM 200L NG	4	30	40	1465	195.6	90.5	91.6	91.5	0.84	56.5	58.5	7.0	2.4	1.8	2.6	195	225
AM 200L PG	4*	37 *	50 *	1465	241.2	91.7	92.4	92.4	0.83	69.5	71.5	7.4	2.6	2.0	2.8	248	255
AM 225S NG	4	37	50	1475	239.5	90.8	92.1	92.2	0.84	69.5	71.5	7.5	2.3	2.0	2.9	356	290
AM 225M NG	4	45	60	1475	291.3	91.7	92.7	92.6	0.86	81.5	85.0	7.6	2.3	2.0	2.9	461	330
AM 250M NG	4	55	75	1475	356.1	92.6	93.3	93.1	0.84	103	107	6.5	3.5	2.1	2.4	640	385
AM 250M KG	4*	75	100	1470	487.2	92.3	93.4	93.6	0.82	142	146	7.3	3.9	2.3	2.7	812	440
AMHE 280S G	4	75	100	1475	485.6	93.5	94.8	94.7	0.87	131	138	7.4	2.4	1.9	2.7	1400	570
AMHE 280M G	4	90	125	1475	582.7	93.8	95.1	95	0.87	157	165	7.4	2.5	2.0	2.8	1600	660
AMHE 315S G	4	110	150	1480	709.8	94.0	95.5	95.6	0.87	191	201	7.7	2.4	2.0	2.6	3200	800
AMHE 315M G	4	132	180	1482	850.6	94.2	95.6	95.8	0.87	229	241	7.7	2.4	2.0	2.6	3700	1000
AMHE 315M RG	4	160	220	1487	1027.5	94.7	96.2	95.9	0.88	274	288	7.8	2.4	2.0	2.7	4700	1100
AMHE 315L G	4	200	270	1485	1286.1	95.0	95.8	96	0.88	342	360	7.6	2.3	1.9	2.6	5500	1300

1) Temperature rise to class F

* Higher output (progressive motor)

High efficiency motors - IE2 code/EFF1 from 280 to 315 frame size

THREE-PHASE FRAME SIZE 56 - 160 IM B3
ALUMINIUM ALLOY FRAME



IEC / DIN	H h	A b	B a	C we	K[1] s	AB f	BB e	CA	AD[2] g	HD[2]	AC th	HC g	HA
56	56	90	71	36	5	109	90	65	98	154	117	110	8
63	63	100	80	40	7	126	105	72	103	166	125	123	8
71	71	112	90	45	7	144	109	89	112	183	142	142	9
80	80	125	100	50	10	161	125	89	139	219	160	162	9.5
90S	90	140	100	56	10	170	150	116	148	238	180	181	11
90L	90	140	125	56	10	170	150	91	148	238	180	181	11
100L	100	160	140	63	11	192	166	110	155	255	196	196	12
112M	112	190	140	70	12.5	220	175	120	171	284	225	226	15
132S	132	216	140	89	12	256	180	134	195	327	248	264	17
132M	132	216	178	89	12	256	218	135	195	327	248	264	17
132M [4]	132	216	178	89	12	256	218	166	195	327	248	251	17
160M	160	254	210	108	14	320	270	180	238	398	317	316	23
160L	160	254	254	108	14	320	310	180	238	398	317	316	23

IEC / DIN	K1 c	L k	LB	LC ki	AL	AF	BA m	AA n	D/DA d/d1	E/EA M1	F/FA u/u1	GD	GA/GC t/t1	DB [3] d2/d3
56	12	190	170	211	63	93	22	37	9	20	3	3	10.2	M3
63	12	213	190	238	66	93	26	26	11	23	4	4	12.5	M4
71	17	245	215	278	75	93	22	30	14	30	5	5	16	M5
80	14	272	232	319	79	110	28.5	34.5	19	40	6	5	21.5	M6
90S	15	317	257	377	85	110	28/53	37	24	50	8	7	27	M8
90L	15	317	267	377	85	110	28/53	37	24	50	8	7	27	M8
100L	17	366	306	434	91	110	38	44	28	60	8	7	31	M10
112M	15	388	328	456	91.5	110	46	48	28	60	8	7	31	M10
132S	20	442	362	523	100	133	45	59	38	80	10	8	41	M12
132M	20	482	402	563	120	133	45	59	38	80	10	8	41	M12
132M [4]	20	530	470	593	120	133	45	59	38	80	10	8	41	M12
160M	18	608	498	718	146	150	65	76	42	110	12	8	45	M16
160L	18	652	542	762	168	150	86	76	42	110	12	8	45	M16

1) Clearance hole for screw
2) Maximum dimension
3) Centering holes in shaft extension to DIN 332 part 2
4) Only for MT AZ

THREE-PHASE FRAME SIZE 180 - 315 IM B3
CAST IRON FRAME

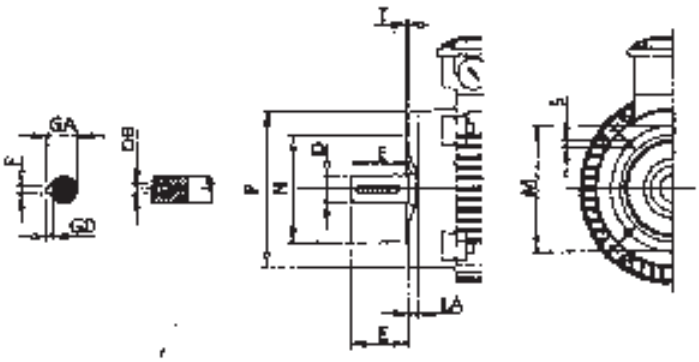
	IEC DIN	H h	A b	B a	C xx	K* s	AB f	BB e	CA	AD* gg	HD*	AC	HC hh	HA g	K1 c
180M		180	279	241	121	12	330	316	256	261	444	155	350	15	18
180L		180	279	279	121	12	330	316	216	263	443	355	350	15	18
200L		200	318	305	133	16	380	360	237	330	530	379	398	18	18
225S	2 - 4/2	225	356	286	149	16	420	375	318	357	582	443	447	22	18.5
	≥4	225	356	286	149	16	420	375	318	353	582	443	447	22	18.5
225M	2 - 4/2	225	355	311	149	16	420	375	318	357	582	443	447	22	18.5
	≥4	225	355	311	149	16	420	375	318	357	582	443	447	22	18.5
250M	2 - 4/2	250	406	349	168	20	500	425	321	385	635	494	500	45	28
	≥4	250	406	349	168	20	500	425	321	395	635	494	500	45	28
280S	2 - 4/2	280	457	368	190	20	560	450	357	419	699	494	564	50	28
	≥4	280	457	368	190	20	560	450	357	419	699	494	564	50	28
280M	2 - 4/2	280	457	419	190	20	560	500	357	439	699	494	564	50	28
	≥4	280	457	419	190	20	560	500	357	419	699	494	564	50	28
315S YE	2 - 4/2	315	508	406	216	24	630	533	438	510	874	640	666	37	28
	≥4	315	508	406	216	24	630	533	438	510	874	640	666	37	28
315S ZE	2 - 4/2	315	508	406	216	24	630	533	438	510	874	640	666	37	28
	≥4	315	508	406	216	24	630	533	438	510	874	640	666	37	28
315M	2 - 4/2	315	508	457	216	24	630	533	387	510	874	640	666	37	28
	≥4	315	508	457	216	24	630	533	387	510	874	640	666	37	28
315L	2 - 4/2	315	508	508	216	24	630	583	386	510	874	640	666	37	28
	≥4	315	508	508	216	24	630	583	386	510	874	640	666	37	28

	IEC DIN	L k	LB	LC kk	AL	AF	BA m	AA n	D/DA d/d1	E/EA l/l1	F/FA v/v1	GD	GA/GC t/t1	DB** da/d2
180M		312	602	838	260.5	180	91	56	48	110	14	9	51.5	M16
180L		312	602	838	260.5	180	91	65	48	110	14	9	51.5	M16
200L		379	669	895	285.5	265	90	75	55	110	16	10	59	M20
225S	2 - 4/2	867.5	747.5	973	304.5	255	95	80	55	110	16	10	59	M20
	≥4	887.5	747.5	1033	304.5	265	95	80	60	140	18	11	64	M20
225M	2 - 4/2	857.5	747.5	973	304.5	265	95	90	55	110	16	10	59	M20
	>4	887.5	747.5	1033	304.5	265	95	90	60	140	18	11	64	M20
250M	2 - 4/2	970	830	1118	342.5	265	120	135	60	140	18	11	64	M20
	≥4	970	830	1118	342.5	265	120	135	65	140	18	11	69	M20
280S	2 - 4/2	1016	896	1165	374	265	135	122	65	140	18	11	69	M20
	≥4	1036	896	1185	374	265	135	122	75	140	20	12	79.5	M20
280M	2 - 4/2	1087	947	1248	258	265	135	122	65	140	18	11	69	M20
	≥4	1087	947	1245	258	265	135	122	75	140	20	12	79.5	M20
315S YE	2 - 4/2	1190	1050	1340	439	300	123	110	65	140	18	11	69	M20
	≥4	1210	1050	1400	439	300	123	110	80	170	22	14	85	M20
315S ZE	2 - 4/2	1190	1050	1340	439	300	123	110	65	140	18	11	69	M20
	≥4	1220	1050	1400	439	300	123	110	80	170	22	14	85	M20
315M	2 - 4/2	1190	1050	1340	439	300	123	110	65	140	18	11	69	M20
	≥4	1220	1050	1400	439	300	123	110	80	170	22	14	85	M20
315L	2 - 4/2	1240	1100	1390	464	300	123	110	65	140	18	11	69	M20
	≥4	1270	1100	1450	464	300	123	110	80	170	22	14	85	M20

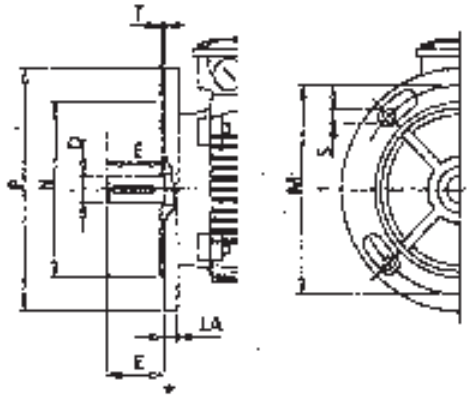
1) Clearance hole for screw
2) Maximum dimension
3) Centering holes in shaft extensions to DIN 332 part 2
4) Only for MT AZ

THREE-PHASE FRAME SIZE 56 - 160 IM B14, IM B5
ALUMINIUM ALLOY FRAME

IM B14

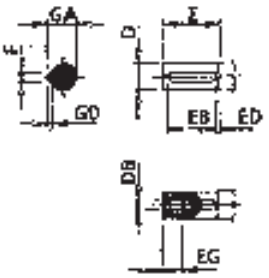


IM B5



IEC / DIN	Square flange B14 P	N	LA	M	T	S[1]	Square flange B14 P	N	LA	M	T	S[1]	Round flange B5 M	N	P	T	LA	S[1]
	a_1	b_1	c_1	e_1	f_1	s_1	a_2	b_1	c_1	e_1	f_1	s_2	e_1	b_1	a_1	f_1	c_1	s_1
56	80	50		65	3	M5	105	70	8	85	2.5	M6	100	80	120	2.5	5.5	M6
63	90	60	9	75	2.5	M5	120	80	8	100	2.5	M6	115	95	140	3	9	M8
71	105	70	11	85	2.5	M6	140	95	8	115	2.5	M8	130	110	160	3.5	10	M8
80	120	80	8	100	3	M6	160	110	8.5	130	3.5	M8	165	130	200	3.5	10	M10
90S-L	140	95	10	115	3	M8	160	110	9	130	3.5	M8	165	130	200	3.5	12	M10
100L	160	110	10	130	3.5	M8	200	130	12	165	3.5	M10	215	180	250	4	14	M12
112M	160	110	10	130	3.5	M8	200	130	12	165	3.5	M10	215	180	250	4	14	M12
132S-M	200	130	30	165	3.5	M10	250	180	12	215	4	M12	265	230	300	4	14	M12
160M-L	250	180	12	215	4	M12	300	230	12	265	5	M16	300	250	350	5	19	M16

[1] Clearance hole for screw. Holes has standard for size 132 to 160.

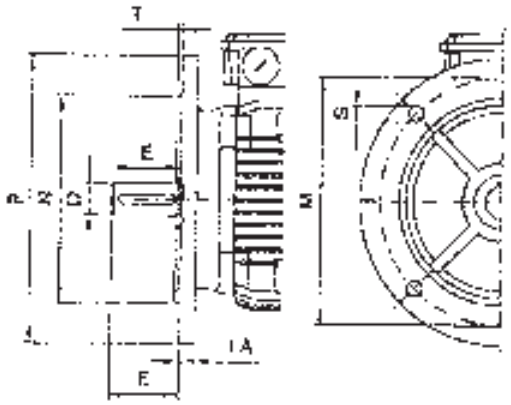


IEC / DIN	D d	E l	F h9 d	GD	GA t	DB[1] d_2	EG	EB	ED
56	9 j6	20	3	3	10.2	M3	10	15	2.5
63	11 j6	23	4	4	12.5	M4	10	15	4
71	14 j6	30	5	5	16	M5	12.5	20	4
80	19 j6	40	6	6	21.5	M6	16	30	4
90S-L	24 j6	50	8	7	27	M8	19	40	4
100L	28 j6	60	8	7	31	M10	22	50	4
112M	28 j6	60	8	7	31	M10	22	50	4
132S-M	38 k6	80	10	8	41	M12	28	70	4
160M-L	42 k6	110	12	8	45	M16	36	100	4

[1] Centering holes in shaft extension to DIN 332 part 2.

THREE-PHASE FRAME SIZE 180 - 315 IM B5
CAST IRON FRAME

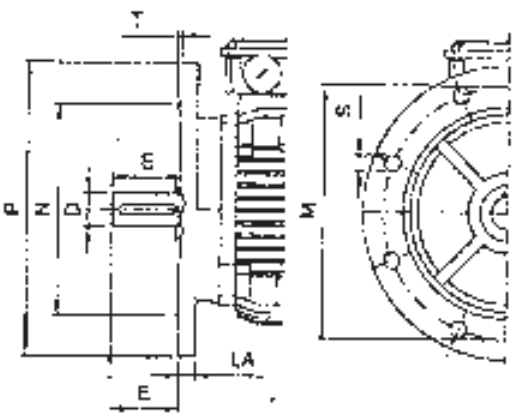
IM B5 - 180/200



IEC / DIN	M e_1	N b_1	P a_1	T f_1	LA c_1	SU s_1
180M/L	300	250	350	5	13	M15
200L	350	300	400	5	15	M16

1) Clearance hole for screw

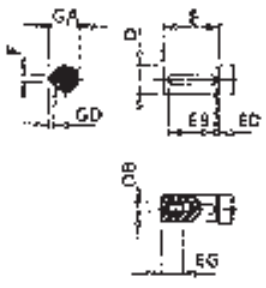
IM B5 - 225/315



IEC / DIN	M a_1	N b_1	P a_1	T f_1	LA c_1	SU s_1
225S/M	400	350	450	5	18	M16
250M	500	450	550	5	18	M16
280S/M	500	450	550	5	18	M16
315S/M/L	600	550	660	6	22	M20

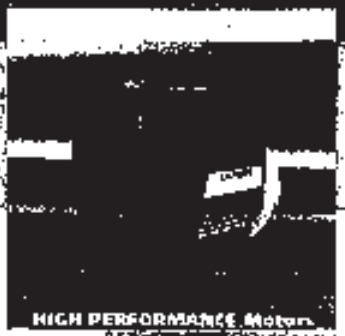
1) Clearance hole for screw

IEC / DIN	Poles	D d	E l	F h9 u	GD	GA t	DB2) d_2	EG	EB	ED
180M/L		48 k6	110	14	9	51.5	M16	36	100	5
200L		55 m6	110	16	10	59	M20	42	100	5
225S	2 - 4/2	55 m6	110	16	10	59	M20	42	100	5
	≥4	60 m6	140	18	11	64	M20	42	110	20
225M	2 - 4/2	55 m6	110	16	10	59	M20	42	100	5
	≥4	60 m6	140	18	11	64	M20	42	110	20
250M	2 - 4/2	60 m6	140	18	11	64	M20	42	110	20
	≥4	65 m6	140	18	11	69	M20	42	110	20
280S	2 - 4/2	65 m6	140	18	11	69	M20	42	125	10
	≥4	75 m6	140	20	12	79.5	M20	42	125	10
280M	2 - 4/2	65 m6	140	18	11	69	M20	42	125	10
	≥4	75 m6	140	20	12	79.5	M20	42	125	10
315S/M/L	2 - 4/2	65 m6	140	18	11	69	M20	42	125	10
	≥4	80 m6	170	22	14	85	M20	50	160	5



2) Centering holes in shaft extension to DIN 332 part 2

Branches & Partners



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Technical Literature

6) Expansion Tank

CATALOGO PRODOTTI

PRODUCTS CATALOGUE
PRODUKT KATALOG
CATALOGUE DE PRODUITS
CATÁLOGO DE LOS PRODUCTOS

新法機械有限公司
NEW WAY ENGINEERING CO., LTD.
香港九龍新蒲崗六合街8號六合工業大廈22字樓F座
FLAT F, 22/F., LUK HOP INDUSTRIAL BUILDING,
8 LUK HOP STREET, SAN PO KONG, KOWLOON, H.K.
Tel : 2325 6892, 2325 7196 Fax No.: (852) 2322 1768
E-mail : info@newway.com.hk

CIMM®
MADE IN EUROPE

AUTOCLAVI A MEMBRANA INTERCAMBIABILE - INTERCHANGEABLE MEMBRANE SURGE TANKS
AUSWECHSELBARE MEMBRANE SCHWANKUNG BEHÄLTER - AUTOCLAVES A VESSIE INTERCHANGEABLE
ACUMULADORES HIDRONEUMÁTICOS A MEMBRANA INTERCAMBIABLE
Serie AFE CE

Marcati CE in conformità alla Direttiva - *CE marked according to Directive - Mit CE markierung gemäß den Vorschriften Avec la marque CE selon la Directive - Con la marca del CE de acuerdo a Normativa: PED 97/23/CE*

Pressione max di esercizio *(Maximum working pressure - Maximaler Betriebsdruck - Pression maximale d'exercice - Presión máxima de ejercicio)*	10 bar
Temperatura di esercizio *(Working temperature - Betriebstemperatur - Température d'exercice - Temperatura de trabajo)*	-10°C +100°C
Finitura esterna colore - *(External finishing colour Externe beendenfarbe - Couleur de finition externe - Acabado exterior color)*	Blu/blue/blau/bleu/azul RAL 5015
Membrana in gomma - *(Rubber membrane Membrane gemäß - Vessie en caoutchouc - Membrana de goma)*	EPDM

UTILIZZO - *Use - Anwendung – Utilisation - Uso:*

Circuiti acqua calda e fredda sanitaria, autoclave di pressurizzazione acqua calda e fredda - *Hot and cold sanitary water circuits pressurizing surge tanks Heiße und kalte gesundheitliche Wasserstromkreise - Circuits eau chaude et froide sanitaire, autoclave de pressurisation eau chaude et froide Circuitos agua caliente y fría sanitaria, autoclave de presurización agua caliente y fría.*

AFE CE 50÷100

AFE CE 60 ÷ 300

con tirante
with tie rod - mit schraube
avec tirant - con esparrago

AFE CE

MODELLO *Model Modell Modèle Modelo*	CODICE *Code Code Code Còdigo*	ALTEZZA *Height Höhe Hauteur Altura* (H) mm	DIAMETRO *Diameter Durchmesser Diamètre Diàmetro* (D) mm	ATTACCO *Connection Anschluß Raccordement Conexiòn* (Ø)	PRESSIONE di precarica standard *Standard pre-loading pressure Standard vordruck Pression de prègonflage standard Presiòn de precarga standard* bar	IMBALLO *Packing Verpackung Emballage Embalaje* mm
35	620035	470	380	M1" Gas	1,5	390x390x485
50	620050	720	380	M1" Gas	1,5	410x410x720
60	620060	830	380	M1" Gas	1,5	410x410x800
80	620080	760	460	M1" Gas	1,5	470x470x780
100	620100	880	460	M1" Gas	1,5	470x470x890
con tirante di fissaggio membrana - *with membrane fixing tie rod - mit membran zugstange-schraube - avec tirant de fixation vessie - con esperrago de fijación membrana*						
60	620060/010	830	380	M1" Gas	1,5	410x410x800
80	620080/010	760	460	M1" Gas	1,5	470x470x780
100	620100/010	880	460	M1" Gas	1,5	470x470x890
150	620150	1030	510	M1" Gas	2,5	520x520x1040
200	620200/020	1070	590	M1 1/4" Gas	2,5	600x600x1110
300	620300	1250	650	M1 1/4" Gas	2,5	660x660x1320

Pressure Vessel Model & Capacity

Marcati CE in conformità alla Direttiva - *CE marked according to Directive - Mit CE markierung gemäß den Vorschriften Avec la marque CE selon la Directive - Con la marca del CE de acuerdo a Normativa: PED 97/23/CE*

Pressione di precarica standard *(Standard pre-loading pressure Standard Vordruck - Pression de précharge standard - Presión de precarga standard)* 2,5 bar

Temperatura di esercizio *(Working temperature - Betriebstemperatur - Température d'exercice - Temperatura de trabajo)* -10°C +100°C mod. 500 / -10°C +50°C mod. 750÷5000

UTILIZZO - *Use - Anwendung – Utilisation - Uso:*

Circuiti acqua calda e fredda sanitaria, autoclave di pressurizzazione acqua calda e fredda - *Hot and cold sanitary water circuits pressurizing surge tanks Heiße und kalte gesundheitliche Wasserstromkreise - Circuits eau chaude et froide sanitaire, autoclave de pressurisation eau chaude et froide Circuitos agua caliente y fría sanitaria, autoclave de presurización agua caliente y fría.*

AFE CE 500

AFE CE 750 d.750

AFE CE 750÷1500

AFE CE 2000÷5000

AFE CE

MODELLO *Model Modell Modèle Modelo*	CODICE *Code Code Code Còdigo*	ALTEZZA *Height Höhe Hauteur Altura* (H) mm	DIAMETRO *Diameter Durchmesser Diamètre Diàmetro* (D) mm	ATTACCO *Connection Anschluß Raccordement Conexiòn* (Ø)	MEMBRANA in gomma *Rubber membrane Membrane gemäß Vessie ed caotchouce Membrana de goma*	PRESSIONE max *Maximum working pressure Maximaler Betriebsdruck Pression maximale d'exercice Presiòn màxima de ejercicio* bar	IMBALLO *Packing Verpackung Emballage Embalaje* mm
Finitura esterna colore *(External finishing colour - Externe beendenfarbe - Couleur de finition externe - Acabado exterior color)* Blu/blue/blau/bleu RAL 5015							
500	620500	1600	750	M1 1/4" Gas	EPDM	*10*	770X770X1630
750	620750	1820	800	F2" Gas	EPDM	*10*	pallet 800x800
750	620750/001	2045	750	F2" Gas	EPDM	*8*	pallet 800x800
1000	621000/020	2130	800	F2 1/2" Gas	EPDM	*10*	pallet 800x800
1500	621500	2130	1000	F2 1/2" Gas	EPDM	*10*	pallet 1200x1000
Finitura esterna colore *(External finishing colour - Externe beendenfarbe - Couleur de finition externe - Acabado exterior color)* Bianco/white/weiss/blanc/blanco RAL 9010							
2000	622000	2550	1100	DN 65	BUTYL	*10*	1170x2740x1250 cassa in legno -wooden box
2500	622500	2845	1100	DN 65	BUTYL	*10*	1180x3080x1250 cassa in legno -wooden box
3000	623000	2930	1250	DN 65	BUTYL	*10*	1430x3080x1490 cassa in legno -wooden box
4000	624000	3030	1450	DN 65	BUTYL	*10*	1570x3160x1640 cassa in legno -wooden box
5000	625000	3780	1450	DN 65	BUTYL	*10*	1620x4070x1700 cassa in legno -wooden box

Technical Literature

7) Water Treatment

LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

Date: November 2, 2011 Ref.: SB437 PH

CIC ZERO CARBON BUILDING

KOWLOON BAY

COMPREHENSIVE WATER TREATMENT PROGRAMME FOR HVAC WATER SYSTEMS

Prepared by: LeBLANC WATER TREATMENT & CHEMICALS LTD

Flat C, 15/F, Superluck Industrial Centre, Phase 2, No.57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong
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LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

TABLE OF CONTENT

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LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

1. SYSTEM INFORMATION

Parameters	Cooling Tower Water System	Chilled Water System
No. of System	One (1)	One (1)
System Capacity	4 x 150 kW	4 x 60 TR
System Water Flowrate	3 x 8.4 L/s	4 x 3.6 L/s
Peak Evaporation Rate (E)	3 x 0.0756 L/s (assume 0.9%)	N/A
Peak Drift Rate (D)	3 x 0.000168 L/s (0.002%)	N/A
Concentration Cycle (CC)	7	N/A
Peak Bleed-off Rate (B) = [E/(CC – 1)] – D	3 x 0.012432 L/s (0.148%)	N/A
Est. Water Volume	6 m^3	3 m^3
Est. Make-up Water (M) = E + B + D	3 x 0.0882 L/s (0.95256 m^3/hr)	4 x 0.09 L/min
Operating Hour / Day	16	16
Annual Operating Month	12	12
Source Water	Citywater	Citywater

2. OBJECTIVES

A complete water treatment program has three main objectives

a) Inhibit micro-organism growth.

b) Control corrosion of metal.

c) Prevent formation of scale

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3. THREE STEPS OF WATER TREATMENT PROGRAM

3.1 Initial Chemical Cleaning:

After installation of the water pipe work, physical cleaning is impossible to remove the foreign materials such as grease, dust and mill scale. Even after water flushing, contaminants such as iron oxide and grease cannot be removed completely. For this reason, chemical cleaning is introduced. Acidic Detergent and Defoamer are served to remove rust scale, oil, silt & sludge.

Start water pump to conduct water flushing first to remove large suspended solids and dirt prior to the chemical cleaning. The procedures of the chemical cleaning are as follows:

a) Collect water samples from the make-up water tank and each water system before chemical cleaning.

b) Test the pH value, T.D.S. and metal content of the above water samples on site. The results will then be as a reference.

c) Apply the cleaning chemicals into the make-up water tank. Then drain some of the system water so that the make-up water with the cleaning chemicals will be fed into the system gradually.

d) Water test to confirm the concentration of chemical solution is within the control range.

e) Circulating the chemical solution in the system for 24 hours. While cleaning, water sample will be taken for analysis so that the pH value shall be kept not less than 5.5.

f) After cleaning, the whole system fluid is drained at the lowest point rapidly.

g) Refill and flush the system with city water 3 – 4 times until the system water quality meet with the city water standard.

h) Collect water samples to our laboratory for complete analysis and issue a fully water analysis report to consultant and engineer for reference.

The following chemicals are proposed for the initial chemical cleaning:

Chemical	Function	Dosage for Initial Chemical Cleaning	Quantity Required	
			Cooling Tower Water System	Chilled Water System
'AQUAMAG' AD 50	Acidic Detergent	0.25% Solution (please see the data sheet of AD 50 attached in section 9)	6 m^3 x 0.25% **15 Litres**	3 m^3 x 0.25% **7.5 Litres**
'AQUAMAG' Defoamer	Anti-Foam	10% of AD50 Dosage (please see the data sheet of AD 50 attached in section 9)	6 m^3 x 0.25% x 10% **= 1.5 Litres**	3 m^3 x 0.25% x 10% **= 0.75 Litres**

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3.2 Initial Treatment:

After initial cleaning, ionic detergents level shall be checked at this stage just to make sure initial cleaning chemicals have been bled off and no residues inside the system water affecting the subsequent passivation. Hence, corrosion inhibitor and biocide shall be applied to the system at double dosage for a period of 2 to 4 days. This ensures complete passivation of the freshly exposed metal surface, all other control tolerances (such as pH value & turbidity, etc.) shall also be monitored. The procedures of initial treatment are as follows:

a) Dose the corrosion inhibitor and biocide into the system directly.

b) Start circulation of the condensing water for 2 to 4 days.

c) Periodically, check the treatment chemical level and pH, TDS and other parameters. Adjust the chemical dosage to keep the chemical content within the proper range and maintain this concentration during the passivation period. This ensures complete passivation of the freshly exposed metal surface.

d) Collect water sample after passivation to our laboratory for complete analysis and issue a full analysis water report for consulting engineer's reference.

The following chemicals are proposed for the initial treatment:

Function	Cooling Tower Water System	Chilled Water System
Anti-corrosion	NALCO 3DT229 (formulation of zinc, orthophosphate and phosphonate)	'AQUAMAG' CT 400 (formulation of nitrites)
Anti-scaling	NALCO 3DT204 (formulation of high stress polymer)	
Bio-activity Reporter	NALCO 3DTBR06 (formulation of microbial monitor)	N.A.
Board Spectrum Bacterial Control	NALCO 7330 (formulation of isothiazolones)	NALCO 7330 (formulation of isothiazolones)
Legionella Control	NALCO STABREX ST70 (stabilized bromine)	N.A.

N.A. Not Applicable

Notes: Please see section 3.3 for the calculation on chemical dosage and consumption.

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3.3 Maintenance Treatment (12 months):

The on-going step in the total water treatment programme is the maintenance programme. Due to the water loss of the system, corrosion inhibitor and biocides must be introduced into the system to compensate the loss of chemicals regularly. In additions, the dosage of the treatment chemicals shall be adjusted periodically according to the treatment result, the result of water analysis, the change of system loading and etc.

3.3.1. For Cooling Tower Water System:

The maintenance water treatment programme for the cooling tower water systems complies with the requirements mentioned on the 'Code of Practice for Water-Cooled Air Conditioning System' 2006 Edition. The water treatment programme should include:

- The application of treatment chemicals (at least three types) to control corrosion, scaling, microbial growth including legionella bacterial contaminates.
- Regular monitoring of specific water quality parameters.
- Routine and preventive maintenance and
- Emergency decontamination procedures.

a) Treatment Chemicals

The treatment chemicals listed in the table below are applied to suppress corrosion, scaling, microbial growth including legionella bacterial contaminates.

Function	Product Name	Chemical Formulation	Dosage	Dosing Method
Anti-Corrosion	NALCO 3DT229	Zinc orthophosphate and phosphonate	Keep 5-6 mg/L as product in system water	NALCO 3D TRASAR 3d30 Controller monitors the actual chemical concentration in the system water and activates chemical metering pump to dose the chemical when the chemical level drops
Anti Scaling	NALCO 3DT204	High stress polymer	Keep 50 – 100 mg/L as product in system water	NALCO 3D TRASAR 3d30 Controller monitors the actual chemical concentration in the system water and activates chemical metering pump to dose the chemical when the chemical level drops
Bioactivity Reporter	NALCO 3DTBR06	Microbial monitor	Keep 20 ppb-70 ppb as product in system water.	NALCO 3D TRASAR 3d30 Controller monitors the actual chemical concentration in the system water and activates chemical metering pump to dose the chemical when the chemical level drops
Biocide 1	NALCO STABREX ST70	Stabilized bromine	Generally keep 100 mg/L as product in system water when give approximately 0.5 – 1.0 ppm as free chlorine in system water.	NALCO 3D TRASAR 3d30 Controller monitors the actual chemical concentration in the system water and activates chemical metering pump to dose the chemical when the chemical level drops or bioactivity is high
Biocide 2	NALCO 7330	Isothiazolone	Shot dose 100 mg/L as product weekly	NALCO 3D TRASAR 3d30 Controller is pulse input that activates the chemical metering pump to dose the chemical according to the timer setting.

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b) *Calculation of Chemical Consumption*

Peak make-up rate = 0.95256 m^3 /hr; Daily Operation = 16 hr; Monthly Operation = 30 days; System Water Volume = 6 m³ and Concentration Cycle = 7.

i) *Monthly Consumption of **NALCO 3DT229**.*

Product Dosage = Maintain 50 ml/m^3 as product in system water

$$\text{Monthly Dosage} = \frac{\text{Product Dosage} \times \text{Monthly Water Consumption}}{\text{Concentration Cycle}}$$

$$= \frac{50 \times 0.95256 \times 16 \times 30}{7}$$

= 3265.92 mL ≈ **4 L**

ii) *Monthly Consumption of **NALCO 3DT204**.*

Product Dosage = Maintain 50 ml/m^3 as product in system water

$$\text{Monthly Dosage} = \frac{\text{Product Dosage} \times \text{Monthly Water Consumption}}{\text{Concentration Cycle}}$$

$$= \frac{50 \times 0.95256 \times 16 \times 30}{7}$$

= 3265.92 mL ≈ **4 L**

iii) *Monthly Consumption of **NALCO 3DTBR06**:*

Product Dosage = Maintain 0.02 ml/m^3 as product in system water

$$\text{Monthly Dosage} = \frac{\text{Product Dosage} \times \text{Monthly Water Consumption}}{\text{Concentration Cycle}}$$

$$= \frac{0.02 \times 0.95256 \times 16 \times 30}{7}$$

= 1.306 mL ≈ **2 mL**

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v) *Monthly Consumption of* ***NALCO STABREX ST70.***

Product Dosage = Maintain 100 ml/m³ as product in system water
(approximately give 0.5 – 1 ppm free residual chlorine)

$$\text{Monthly Dosage} = \frac{\text{Product Dosage} \times \text{Monthly Water Consumption}}{\text{Concentration Cycle}}$$

= 100 x 0.95256 x 16 x 30 ÷ 7

= 6531.84 mL ≈ **7 L**

vi) *Monthly Consumption of* ***NALCO 7330:***

Product Dosage = Shot dose 100 ml/m³ as product into system water bi-weekly

Monthly Dosage = 100 x 6 x 2 times/month = 1200 ml ≈ **2 L**

Summary Table of the Monthly Consumption of Treatment Chemical:

Chemical	Monthly Dosage (Consumption)
NALCO 3DT229	*4 L*
NALCO 3DT204	*4 L*
NALCO 3DTBR06	*2 mL*
NALCO STABREX ST70	*7 L*
NALCO 7330	*2 L*

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c) *Regular Monitoring of Specific Water Quality Parameters*

i. For Cooling Tower System Quality

Parameters	Recommended Range	Bi-weekly Check On-site	Monthly Laboratory Check	Testing Method
pH Value	7.0 - 8.5	√	√	US EPA 9045 C
Suspended Solids	< 180 ppm		√	APHA 2540 D
Total Dissolved Solids	< 1500 ppm	√	√	APHA 2540 C
Total Hardness	< 500 ppm	√	√	APHA 2340 C
Total Iron	< 1.0 mg/l		√	MN Test Kit #914017
Total Copper	< 0.2 mg/l			MN Test Kit #914034
*Total Bacterial Count	< 10^5 cfu/ml		√	APHA 9215 B
Chlorides	< 200 mg/l	√	√	PACKTEST Test Kit DC 534
BOD_5	< 200 ppm		√	APHA 5210 B
COD	< 500 ppm		√	APHA 5220 D in House Method-Hach
NALCO 3DT229	50 - 100 ml/m³ as product	Continuous monitoring by NALCO 3D TRASAR 5500 Controller		N.A
NALCO 3DT204	50 - 100 ml/m³ as product			N.A
NALCO Bio-Index	< 1.6			N.A
NALCO STABREX ST70 (as free residual chlorine)	0.5 - 1.0 ppm			Test Kit
*Legionella Bacteria Testing (Quarterly Test)	Not Detected	Quarterly Tested		AS NZ 3896

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ii) For Bleed-Off Water Quality

Parameters	Water Quality Objectives	Quarterly On-site Check	Quarterly Laboratory Check	Testing Method
Water Temperature		✓		By Thermometer
BOD_5	< 10 ppm		✓	APHA 5210 B
COD			✓	APHA 5220 D in House Method-Hach
Suspended Solids	< 10 ppm		✓	APHA 2540 D
Dissolved Oxygen	> 2 ppm	✓		APHA 4511 OG
Ammonical N			✓	APHA 4500 NH_3
Threshold Odour No.			✓	APHA 2150 B
Colour			✓	APHA 2120 B
Turbidity			✓	APHA 2130 B
Synthetic Detergents			✓	APHA 5540 B, C, D
*E. Coli			✓	DoE Section 7.8 & 7.9 plus in-situ urease test

Notes :

- Legionella bacteria testing shall be carried out quarterly. Analytical method is AS 3896 (AS - Australia Standard) and the practical quantitation limit is 10 cfu / ml
- APHA-American Public Health Association, American Water Works Association and Water Environment Federation, Standard Methods for the Examination of Water and Wastewater APHA-AWWA-WEF, USA.
- The testing of Total Bacteria Count, Legionella Bacteria and E. Coli shall be carried out by our appointed laboratory which is accredited by Hong Kong Laboratory Accreditation Scheme
- DoE, Department of the Environment (1994), the Microbiology of Water Part I, Drinking Water, U.K

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d) Routine and Preventive Maintenance

Biweekly technical visit shall be conducted. The scope of the technical visit shall include but not limit to the following

i) Visual check for any abnormal operation or condition of the cooling tower water systems such as overflow, excess drift, biological growth contamination (e.g. algae) and etc.

ii) Check the water quality, such as pH value, T.D.S and treatment chemicals' concentration.

iii) Chemical refill according to the water consumption of the system.

iv) Adjust the setting of NALCO 3D TRASAR controller and chemical dosing equipment.

v) Clean and calibrate NALCO 3D TRASAR sensors monthly

vi) Shot dose biocides if needed.

vii) Inform to the plant-in-charge for any advice on the system water quality

viii) Collect samples of cooling tower water and bleed-off water for complete water analysis.

ix) Issue fully water analysis report with recommendation to consultant and engineer monthly.

x) Collect water samples for testing of Legionella bacteria quarterly

xi) Collect bleed off water samples for testing quarterly

xii) Carry out on-line disinfection when legionella count is detected as ≥ 10cfu/ml and < 1,000 cfu/ml or TBC test result is ≥ 100,000cfu/ml and < 5,000,000cfu/ml

xiii) Carry out cleaning, desludging and disinfection programme **Half-Yearly**. This programme is also needed to be carried out immediately when :

- Legionella count is still detected as ≥100cfu/ml and < 1,000 cfu/ml after on-line disinfection;
- TBC testing result is still ≥ 500,000cfu/ml and < 5,000,000 cfu/ml after on-line disinfection
- Cooling tower water system is contaminated, which cause adverse influence to cooling water quality and cooling tower thermal performance
- Cooling tower system has been infected or may have been infected by an adjacent cooling tower which has been suspected as a source of a case of Legionnaires' disease.

<u>The Procedures of the On-Line Disinfection are as follows:</u>

i) Dose 100ml/m^3 of a bio-dispersant into the system water and circulate through the system for at least one hour prior to the addition of a biocide.

ii) Dose 200 ml/m^3 of NALCO STABREX ST70 into the system water and circulate through the system for another four hours.

iii) Return the system to normal operation after circulation completed.

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The Cleaning, Disludging and Disinfection Procedures are as follows:-

i. Chlorinate the water and circulates for four hours, maintaining a minimum level of free residual chlorine at 5 ppm through the entire cooling tower water circuit with the pH value maintained between 6-7; *(by Water Treatment Specialist)*

ii. Drain the entire water circuit, including the make-up tank. *(by Others)*

iii. Manually clean the tower sump, fill, eliminator, make-up tank and the water circuit system. Accessible areas of the towers and its pack shall be adequately washed. Cleaning methods which create excessive spray such as high pressure water jetting shall be avoided as far as possible. Staff involve in water jetting shall be adequately trained, wear suitable respiratory protective equipment such as a cartridge respirator containing a particulate filter of appropriate efficiency. The hands of these staff should be washed and thoroughly dried before eating, drinking and smoking; *(by Others)*

iv. Refill with water; *(by Others)*

v. Rechlorinate and recirculate for at least six hours, maintaining a minimum level of free residual chlorine at 5 ppm; *(by Water Treatment Specialist)*

vi. Drain and flush the system; *(by Others)*

vii. Refill with water and dose with the appropriate start-up level of treatment chemicals. Finally recommission the system. *(by Water Treatment Specialist)*

Salt volume test should be carried out to confirm system volume. Just for rough estimation, the amount of sodium hypochlorite solution required can be calculated as below.

Presume Water Volume		40 m^3
Free Residue Chlorine 【OCl】	=	5 ppm
Molecular Weight of NaOCl	=	74.5
Molecular Weight of 【OCl】		51.5
Concentration (w/v) of Commercial NaOCl	=	8%
∴ Kg of NaOCl Sol.	=	$\frac{40\ m^3 \times 0.005\ g/m^3 - 8\%}{51.5 \div 74.5}$
		3.6 Kg
		4 Kg

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e) Summary of Routine Inspection Checklist of the Fresh Water Cooling Tower System

Item	Procedures	Inspection Frequency	Carried Out By
1	Check condenser water pumps	Weekly	P
2	Check cooling water supply	Monthly	W
3	Check internal surfaces of cooling tower, condenser for scale, dust, sludge and biofilm accumulation	Monthly	P & W
4	Check cooling water for clarity, odour, surface debris and temperature	Weekly	W
5	Check strainers	Weekly	P
6	Check drains	Weekly	P
7	Check float valves	Weekly	P
8	Check water treatment dosing equipment and satisfactorily function	Weekly	P & W
9	Check water treatment chemicals for adequacy and safety	Weekly	P & W
10	Check condition, clean rust of fill pack, tubes	Monthly	P
11	Check condition, clean rust of drift eliminators	Monthly	P
12	Check condition, cleanliness of distribution troughs, spray nozzles and water	Monthly	P
13	Check fans, bearing and belt/pulley	Weekly	P
14	Check water level of basin	Weekly	P
15	Check blow off valve	Weekly	P
16	Check for system pressure and examine for cooling tower	Monthly	P
17	Check strainers and air screens	Weekly	P

P Plant Attendants
W Water Treatment Specialist

f) Summary of Preventive Maintenance Checklist of the Fresh Water Cooling Tower System

Item	Procedures	Maintenance Frequency	Carried Out By
1	Tighten all fasteners	Every 6 months	P
2	Clean strainers	Weekly	P
3	Clean water basin and all internal surfaces of cooling towers	Every 6 months	P
4	Adjust and lubricate bearings and pump motor	Quarterly	P
5	Adjust and lubricate fans and fan motors	Quarterly	P
6	Remove and clean valves and fits for cleaning	Every 6 months	P
7	Adjust and lubricate valves	Quarterly	P
8	Clean water distribution pipework and spray nozzles	Quarterly	P
9	Remove and clean sump heater for cleaning	Every 6 months	P
10	Cleaning, Desludging and Disinfection of the cooling tower water system	Every 6 months	P & W

P Plant Attendants
W Water Treatment Specialist

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g) *Emergency Decontamination Procedure*

Under the following circumstances, emergency decontamination of water-cooled air conditioning system shall be carried out.

i) If legionella bacteria is detected to be 1,000 cfu/ml or more ; or

ii) If the heterotrophic colony count is detected to be 5,000,000 cfu/ml or more, or

iii) If on-line disinfection, as well as cleaning and disinfection are not effective in controlling legionella and heterotrophic colony count in cooling tower water.

The procedures for emergency decontamination are as follows:

a) Take water samples for laboratory investigation before any further action *(by Water Treatment Specialist)*

b) Prohibit entering the vicinity of cooling towers). *(by Others)*

c) Circulate biodispersant throughout the system before disinfection. *(by Water Treatment Specialist)*

d) Add sodium hypochlorite to the system water to obtain a measured concentration of 50 mg/L (ppm) of free chlorine at pH 7.0 -7.6. *(by Water Treatment Specialist)*

e) Circulate the system water with the fans off for a period of at least 6 hours. *(by Others)*

f) Maintain the free chlorine level at an absolute minimum of 20 mg/L (ppm) at all times. *(by Water Treatment Specialist)*

g) After 6 hours, de-chlorinate and drain the system *(by Others)*

h) Clean thoroughly the basin, fill, drift eliminator, fan and water distribution system. *(by Others)*

i) Refill with fresh water and add sodium hypochlorite. *(by Others)*

j) Recirculate without using the fan, at 20 mg/L (ppm) of free available chlorine for another 6 hours. *(by Water Treatment Specialist)*

k) De-chlorinate and drain the system *(by Others)*

l) Refill, recirculate and take water samples for testing. *(by Water Treatment Specialist)*

m) Re-commission system when Legionella and HCC levels are detected within acceptable range. *(by Water Treatment Specialist)*

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3.3.2. **For Chilled Water System**

The maintenance water treatment programme for the chilled / hot water systems shall include:

- The application of treatment chemicals (at least two types) to control corrosion, scaling and biofouling.
- Regular monitoring of specific water quality parameters and
- Routine maintenance.

a) Treatment Chemicals

The following chemicals are proposed for suppressing corrosion, scaling and microbial growth:

Function	Product Name	Chemical Formulation	Dosage	Dosing Method	On Site Checking
Corrosion Inhibitor	***'AQUAMAG' CT 400***	Sodium Nitrite	3 l·m^3 of system volume (Keep 400-600 ppm as NO_2 in system water)	Chemical metering pump controlled by 24 hrs timer	Test Kit Available
Biocide	***NALCO 7330***	Isothiazolones	Shot dose 100 ml m^3 as product monthly	Manual	Test Kit Available

b) Calculation of Chemical Consumption

Estimated System Volume = 3 m^3.
Estimated Make-up Rate = 4 x 0.05 l·min.
Daily Operation = 16 hr.
Monthly Operation = 30 days.

i. For Chemical CT 400:

1st Time Dosage

Product Dosage = Initial Dose 3 l·m^3 into system water
= 3 l·m^3 x 3 m^3
= **10 Litres**

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Monthly Consumption

Maintenance Dosage – Dose 1 L/m³ into system water

Monthly Dosage – Product Dosage x Monthly System Water Leakage

= 1 L/m³ x 4 x 0.09 L/min x 60 x 16 x 30 ÷ 1000 L/m³

10.368 Litres ***11 Litres***

ii. *For Chemical **NALCO 7330***

Product Dosage : Shot dose 100 mL/m³ as product into system water

Dosage Frequency : 1 time/month

Monthly Dosage – 100 ml/m³ x 3 m³

.. ***0.3 Litre***

c) Routine Monitoring of Specific Water Quality

Parameters	Control Range	Testing Method
pH Value	8.0 - 9.5	US EPA 9045 C
Turbidity (FTU Scale)	< 10 units	APHA 2130B
Total Dissolved Solids	< 2000 ppm	APHA 2540 C
Total Iron Increment	< 1.0 ppm	"MN" Test Kit #914017
Total Copper Increment	< 0.1 ppm	"MN" Test Kit #914034
Total Bacterial Count	< 10 /ml	APHA 9215 B
Chlorides	< 100 ppm	"PALINTEST" Test Kit DC 534
CT 400 (Nitrite)	400 – 600 ppm	MN" Test Kit #91311

d) Routine and Preventive Maintenance

To supply sufficient chemicals and provide bi-weekly (2 times per month) technical visit to treat the above mentioned water system against corrosion, scaling and biofouling.

i. On-site testing of system water quality

ii. Check for normal operation of dosing equipment if installed.

iii) Rectify system water quality to the control range if necessary.

iv) Refill chemicals if necessary

v) Adjust chemical dosage if necessary.

vi) Collect water samples for complete analysis.

vii) Advise plant attendants on treatment programme.

viii) Issue water analysis report monthly.

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4. LIST OF PERSONAL PROTECTION EQUIPMENT

Item	Job	Potential Hazard	Respirator and Clothing
1	Testing and commissioning	Aerosol	Half face piece capable of filtering smaller than 5um particulates, ordinary work clothing
2	Inspection	Aerosol	Half face piece, capable of filtering smaller than 5µm particulates, ordinary work clothing
3	Water sampling	Aerosol	Half face piece, capable of filtering smaller than 5µm particulates, ordinary work clothing
4	High pressure spraying	Aerosol	Respirator as above, waterproof overalls gloves, boots, goggles or face shield
5	Chemical treatment with sodium hypochlorite solution in ventilated space	Spray mist and very low concentration chlorine	Half face piece acid gas and particulate respirator, goggles or face shield, overalls, gloves, and boots
6	As above confined space	Unknown chlorine concentration, high mist, possible lack of oxygen	To comply with the requirement under the Factories and Industrial Undertakings (Confined Spaces) Regulation

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5. COOLING TOWER WATER MONITORING & CONTROL EQUIPMENT

NALCO 3D TRASAR 5500 system is proposed for the whole water treatment program of the cooling tower water system. The 3D TRASAR system monitors and controls the water quality on a real time basis.

Conductivity Control:

The built-in conductivity sensor of 3D TRASAR 5500 Controller monitors the conductivity of the cooling water continuously. If the conductivity is beyond the pre-set control level, 3D TRASAR activates the bleed-off valve to bleed off the system water till the conductivity is back to the control range.

Corrosion Control:

3D TRASAR Corrosion Control combines sophisticated control technology with an innovative, reversion-resistance, dual-functioning corrosion inhibitor ***Phosphino Succinic Oligomer*** (PSO). This unique NALCO innovation delivers better corrosion and scale inhibition over a wide range of operating conditions. This technology is designed to:

a) *Compensate for variations in makeup orthophosphate levels by combining superior chemistry with superior control.*

b) ***Prevent phosphate deposition with reversion-resistance chemistries.***

c) ***Continually monitor corrosion rates online and detect upsets conditions and document results.***

d) *Reduce downtime and maintenance costs by preventing costly corrosion*

Scale Control:

3D TRASAR Scale Control couples the power of the NALCO 3D TRASAR 5500 Controller with an innovative ***"tagged" high stress dispersant polymer***. The chemical "tag" attached to the molecule -- essentially a barcode scanned by the 3D TRASAR controller – reports the performance of the polymer. ***The level of the active polymer in the system is being continuously monitored.*** As operational parameters change, ***3D TRASAR controller takes appropriate corrective actions to maintain proper polymer actives in the system.*** This technology is designed to:

a) ***Optimize water and chemical use by actively managing the system based on the stresses placed upon it.***

b) ***Improve throughput by maintaining equipment at peak efficiency, even as operational factors vary.***

c) *Reduce downtime and maintenance costs by preventing mineral scale and particulate fouling.*

Bio-Control:

3D TRASAR 5500 controller is an entirely new, innovative approach to bio-population control. A fluorescent 'bio-reporter' is introduced into the cooling system. The bio-reporter reacts, enzymatically with microbes. The reaction changes the bio-reporter fluorescent signature. 3D TRASAR Bio-control measures the reacted and unreacted bio-reporter, generates the NALCO Bio-Index and adjusts biocide feed to optimize control.

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NALCO 3D TRASAR 3500 treatment system is proposed for the whole water treatment program of the cooling tower water system. **The whole set of NALCO 3D TRASAR Treatment System consists of:-**

a)	**NALCO 3D TRASAR Controller** Model: 3500 w wireless modem & SIM card for NALCO 360 24 7 monitoring service	One (1) no
b)	**Chemical Metering Pump** Mode: "IWAKI" ESB16VC-230-N1 Max. Output: 3.9 L/Hr Discharge Pressure: max. 7 Bars	Ten (10) nos. (2 pumps per chemical: 1 duty & 1 standby)
c)	**Chemical Storage Tank** Materials: P.E Capacity: 100 L c/w outer leak proof tank & electrode type level sensor	Five (5) nos
d)	**Chemical Metering Pump Control Panel** Metrix IP54 mild steel w. powder coating c/w MCB, level controllers, relays, indications and etc	One (1) no.

The above equipment is neatly mounted on a stainless steel supporting frame except for the chemicals storage tanks which are free stand on the floor.

6. CHILLED WATER CHEMICAL DOSING EQUIPMENT

The automatic chemical dosing device consists of:

a)	Chemical Metering Pump		2 nos.
	Model	: "IWAKI" ESB16VH230N1	(For CT400 only: 1 duty & 1 standby)
	Country of Origin	: Japan	
	Max. Output	: 3.9 L/Hr @ 100 psi	
	Electrical	: 220 V, 1 phase, 50 Hz	
b)	Chemical Storage Tanks		1 no.
	Material	: P.E.	
	Capacity	: 100 Litres	
	c/w outer leak proof tank & electrode type level sensor		
c)	Control Panel (Metrix IP 54) Material: Mild Steel w. powder coating c/w: MCB, level controllers, relays, indications and etc.		1 no
d)	PVC Ø 1/2" pipes, fittings and accessories for installation of 10m length chemical injection pipework		1 lot

One (1) set of automatic chemical dosing device is required.

Only CT400 will be dosed by chemical metering pump which is controlled by timer. For biocide NALCO 7330, it will be dosed manually during the routine technical visit service.

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7. JOB REFERENCE LIST

Project Name Customer	Year	System Capacity	Remarks
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
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Project Name Customer	Year	System Capacity	Remarks
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8. List of Compliance to G.S.

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PART F

ACMV SYSTEM WATER TREATMENT

F.1 GENERAL

Water treatment for air conditioning water systems as follows shall be carried out to maintain water in proper "balance" condition (pH, hardness, total dissolved solids, total alkalinity, etc.) and to comply with the "COP" issued by EMSD for requirement not indicated in the General Specification:-

F.1.1 Treatment of sea water for condenser cooling to kill or inhibit marine growth and to inhibit the formation of scale, slime and foam in the pumps, pipework and condensers;

F.1.2 Treatment of water being circulated between condensers and cooling towers including the water in the tower.

(a) To inhibit corrosion, scaling, slime and foam formation, and

(b) To sterilize the water to prevent biofouling and the growth of pathological bacteria such as Legionella Pneumophila.

F.1.3 Treatment of chilled water or low pressure hot water in circulation system to inhibit corrosion, formation of foam, scale and slime in the pipework and evaporator tubes.

The design, installation, commissioning, testing and operation of the water treatment system shall be carried out by a water treatment specialist who has at least five years local water treatment experience in compliance with the Particular Specification, this General Specification, the relevant parts of the Code of Practice for Water-cooled Air Conditioning Systems issued by the Electrical & Mechanical Services Department, the Code of Practice for Prevention of Legionnaires' Disease compiled by the Prevention of Legionnaires' Disease Committee, other currently in force Legislation and Subsidiary Legislation in Hong Kong and subject to the approval of the Architect.

F.2 FORM OF WATER TREATMENT

Where the types of treatment and plant are fully detailed in the Particular Specification, the Contractor shall install the plant and equipment as required.

Where no system or treatment is specifically detailed in the Particular Specification, the Contractor shall provide a basic system in accordance with Clauses F1, F.4, F.5 or F.7 as appropriate.

The Contractor shall submit drawings and technical information detailing the set-up of the proposed water treatment equipment, the type of chemicals used and the treatment proposal to the Architect for approval prior to ordering of the equipment.

The water treatment proposal shall include water specification, method of analysis and testing recommended by water treatment specialist together with the testing report format. Bacteria count and identification of existence of pathological bacteria such as Legionella Pneumophila shall be included in the water analysis for cooling tower.

The Contractor shall supply the necessary labour, testing equipment and chemicals for testing and commissioning, pre-cleaning and day-to-day water treatment of the systems within the Contract Period. In addition, the Contractor shall also allow for continuing the treatment for the whole of the 12 months contract maintenance period (including costs for the sampling exercises and laboratory tests required) until the Maintenance Certificate is issued.

During the above period, the Contractor shall employ the water treatment specialist to carry out at least one on-site water treatment service and water analysis for each month to prove that the performance of the treatment system is satisfactory and conforming with the approved treatment proposal. Reports of such tests, related treatment, consumption of chemicals etc. shall be forwarded to the Architect each month.

F.3 SEA WATER TREATMENT BY ELECTROCHLORINATOR

Systems designed for the injection of sodium hypochlorite solution produced on-site by an electrochlorinator shall only be installed by the Contractor where required and fully detailed in the Particular Specification. Such system shall take water under pressure upstream of the main sea water pump (usually in pump chamber) and after passing through the electrochlorinator, inject the solution back into the pump inlet side immediately after the first (primary) sea water inlet valve from the sea. The operation of the electrochlorinator shall be interlocked to work or stop as the seawater pumps.

The resulting concentration of free chlorine residue at this point shall be between 1 ppm minimum and 6 ppm maximum. Facilities shall also be provided at the same point to input a superchange of concentrated liquid sodium hypochlorite or other suitable chemical to achieve periodic "super-chlorination" of the system.

The water to the electrochlorinator equipment must be passed through coarse and fine strainers installed in its supply pipework, to ensure minimum fouling up of the equipment cells. Duplicate electrochlorinator plant shall be provided to ensure continued treatment when one unit is "off-line" for maintenance.

The electrodes shall be made of high corrosion resistant material, in particular, anodes shall be made of titanium substrate coated with protective oxide.

Integral safety facilities in the electrolytic cells such as water flow switch and cell voltage imbalance detector shall be provided to prevent build-up of hydrogen gas by-product. Vent and other necessary facilities shall be provided to dilute and disperse the hydrogen gas from the degas tank or degas cyclone to outdoor safely according to the requirements specified in the Particular Specification and the Fire Services Department's statutory requirements.

An adequate electrical supply point will be made available to the equipment plant room by others. The electrical supply requirement and its connection to the electrochlorinator shall be carried out by the Contractor.

F.4 SEA WATER TREATMENT BY BIOCIDES

Where no other system is specified and unless otherwise instructed by the Architect, this method shall be included by the Contractor as the basic form of treatment for condenser cooling sea water applications.

F.4.1 Basic Requirements

The biocides used shall inhibit the growth of marine organisms throughout the system. It shall also inhibit the formation of scale and slime by acting as an efficient dispersant. This shall be achieved by the appropriate biocide treatment being carried out at 2 to 3 day intervals such that on these occasions the whole system shall contain a 6-ppm concentration of biocide solution for approximate 1 hour, which is sufficient to kill all organisms. Continuous dosages shall not be applied at lower ppm levels lest they allow the organisms to build up immunity.

The specifications of the biocidal and dispersing agents for sea water condenser cooling systems shall have the following properties -

- Strong biocidal properties;
- Dispersing effect on deposits;
- Filming properties providing a protective film to internal of pipework;
- pH value of 6.8;
- Specific gravity of 0.98;
- Non-flammable;
- Easily dosed by chemical metering pump with or without dilution; and
- Being sufficiently bio-degradable such that they do not cause environmental difficulties for the marine life. In that respect they must be of a type acceptable and approved by the HKSAR Environmental Protection Department or relevant Government Authorities.

F.4.2 System Sizing and Design

Advice of the approved water treatment specialist shall be sought on the dosages required, together with calculation, for a specified systems water volume.

In some cases where fixed sea water pumped quantities apply, metering pumps can be set for a particular input rate to achieve the appropriate dosage and duration. In such cases it is usually possible to pump biocide direct from its supply container.

Where variable sea water pumping flow exists, then the metering pump pumps concerned shall have the facility to automatically vary the amounts of chemicals dosing in proportion with the actual sea water flow. This can be achieved by metering pumps which can respond to the reading of a flow meter measuring the total sea water flow. Variable chemical pumping rates shall be required where a number of sea water pumps are "stage" controlled or where individual sea water pumps are of "variable speed" control.

For stage controlled sea water pumps, sets of sea water pumps can be supplied with fixed biocide input from one metering pump per main sea water pump with inlet before the pump and as near as possible to the primary inlet sea water gate valve. Such metering pumps would be controlled from the individual pump circuit such that they only operate when their respective pump is operated.

Sets of pumps can also be supplied with a single source variable duty metering pump controlled from a flow metering device placed after the main header outlet. In such cases the chemical injection shall be distributed to all pump inlets via solenoid valves with each controlled to open when their respective main sea water pump is switched on.

F.4.3 Flow Measurement and Control

The flow measuring device shall be of a low flow interference inserted velocity - static differential headed type as described in more details in Section C.11.

The unit shall be inserted through and across the centre of the pipe in which the fluid flow is to be measured. It shall be inserted with water tight glands not less than a length of 12 pipe diameters downstream from any bend or other turbulence creating feature. The position chosen shall also be one that best assures an even velocity cross section flow of the fluid to be measured.

F.4.4 Biocide Storage

Apart from the necessity to periodically replenish the biocide supply, the installation shall otherwise be capable of catering for minimum 4 weeks unmanned automatic operation. Chemical tanks shall be provided to the following specification.

F.4.5 Chemical Tanks

The Contractor shall supply and install two nos. made of chemical mixing tanks of ultra violet resistant round moulded fibre glass or polyethylene. Each tank shall not be less than 150 litre capacity.

The tanks shall be completed with cover of high rigidity fibre glass or polyethylene having suitable moulded recessed or other approved arrangements to support mountings of metering pump, agitator and liquid level controller switch.

The tanks shall be graduated in 10 litre steps.

The tanks shall be suitable for mixing the chemicals specified and though normally operated at approximately ambient plantroom temperatures, they shall nevertheless be suitable for solutions at temperatures of up to 40°C.

Each tank shall have a strong flat bottom providing adequate support when full such that the outer perimeter of the tank shall not be forced up by water pressure causing the bottom to bulge.

F.4.6 Chemical Tube Connection to the Circulation System

Unless otherwise instructed by the Architect, the Contractor shall allow for drilling and tapping into the delivery pipe at points near to the sea water intake and installing a suitable sized PVC valve completed with connectors for attachment of the chemical tubes from the metering pumps.

F.4.7 Make Up Water Supply to Chemical Tanks

Unless otherwise specified, this shall take the form of an 15 mm bib tap situated over each chemical tank. The Contractor shall provide a suitable supply to these bib taps with pipework securely fixed to the walls. A 25 mm mains valve supply will be provided by others within a 30 metres pipe run of the tanks. The Contractor shall also supply sufficient lengths of chemical resistant flexible hose from bib taps to the tanks to facilitate the filling operation.

F.4.8 Chemical Metering Pump

In conjunction with the chemical tanks, the Contractor shall provide panel or tank-top mounted high efficiency metering pumps one per tank capable of pumping from 2 litres to 90 litres of solution each in 1 hour. Metering pumps exceeding 90 litres hour will be considered subject to approval by the Architect. Chemical pump shall have on-off switch and protection fuse.

The pumps shall be suitable for 100 : 1 output range facilitated by means of independently variable stroke length and stroke frequency.

Pump housings shall be of corrosion resistant glass fibre reinforced polypropylene and all electrical electronics components shall be encapsulated. If necessary, anti-siphon pressure release valve mechanisms shall be provided to ensure anti-siphon protection plus priming ease, even under pressure.

The pumps shall have an acrylic polypropylene pump head, PVC polypropylene fittings, ceramic valve balls, metal reinforced Teflon diaphragm, Teflon seal rings and liquidform face, anti-siphon mechanism. The discharge tubes shall be 10 mm internal diameter and of suitable PVC to transport the solutions involved.

The pump suctions shall be mounted into the tank using an uPVC suction tube assembly that will prevent the suction tube becoming wrapped around the agitator shaft. The end of the pump suction tube shall not extend beyond the bottom of the uPVC tube shield.

F.4.9 Chemical Tank Agitator

The Contractor shall supply and install into the provisions made on the chemical mixing tank cover one agitator assembly per mixing tank.

Fans shall consist of a fractional HP motor driving a stainless steel shaft and neoprene with bronze hub impeller. The shaft shall be of suitable length to suit the depth of the solution in the mixing tank.

The motor casing and screws shall be manufactured in non ferrous metal.

F.4.10 Chemical Tank Liquid Level Switch

In order to prevent the metering pump and agitator from running if the chemical solution drops below a preset low level, the Contractor shall supply and install into each tank cover a suitable liquid level switch and control system. A visual and audio alarm shall also be provided at the control indication panel.

The level switch shall be contained in a corrosion resistant assembly of glass reinforced polypropylene. It shall have PVC float tube, foamed polypropylene float and encapsulated reed switch.

In each case, there shall be a float protector to prevent false actuation due to turbulence. An extra low voltage transformer shall be incorporated to provide the supply to the reed switch for safety.

The liquid level switch casing shall be manufactured from corrosion resistance material.

F.4.11 Electricity Supply

Unless otherwise specified, the electricity supply for the metering pumps, agitators and level switch assemblies shall be operated with 220 V single phase 50 Hz supply and connected by the Contractor from the supply point within the plant room to the water treatment equipment.

F.5 COOLING TOWER/CONDENSER COOLING WATER TREATMENT BY CHEMICAL AGENTS

Where no other system is specified in the Particular Specification, this method shall be included for by the Contractor as the basic form of treatment for water recirculation between cooling tower and condenser applications. The minimum provisions shall be as follows:-

F.5.1 Pre-cleaning and Flushing Out Operation:

(a) The entire cooling tower condenser cooling water system shall be flushed out using appropriate chemical dispersant, detergent and de-foamer of type and strength recommended by a reputable chemical water treatment manufacturer and guaranteed in writing by that company as suitable in every respect for the application in question.

(b) The chemicals shall remain in the system for 48-72 hours including a minimum of 24 hours with the pumped circulation in operation, unless otherwise recommended by the supplier with free technical support accepted by the Architect.

(c) The system shall then be completely drained and flushed until tests at all drain points show that traces of suspended matter have been substantially removed to the Architect's approval.

(d) The system water shall be completely drained as rapid as possible and the Contractor shall provide temporary 50 mm valve drain outlets on all points where the main pipework is 50 mm or over.

(e) The Contractor shall ascertain that there is adequate drainage nearby to discharge to by large hose in order to ensure flooding of low level areas will not occur. It is the responsibility of the Contractor to ensure that the discharge to the building drainage system and public sewer are in full compliance with the requirements of the Drainage Services Department and the Environmental Protection Department. If pre-treatment is required, Clause F.10 shall be referred.

(b) Subsequent to the flushing out operations, the large drain down points shall be reduced to 15 mm valves or cocks of the sizes as indicated on the Contract Drawings. The system shall be refilled and flushed as necessary to achieve the required water quality level.

F.5.2 Chemical Treatment to Prevent Corrosion, Sludge Formation and Microbiological Activity (Open System)

The chemical agent employed shall be a combination of chemicals which will provide corrosion protection, scaling and microbiological inhibition to the metal pipe lines and the construction material within condensers and cooling towers.

The chemical agent shall be non-flammable liquid chemicals such as molybdate or phosphate based agent blended with anti-foulant and amine based biocide. The agent shall be guaranteed by the chemical manufacturer as suitable in every respect for the application.

F.5.3 Chemical Dosage System

The chemical dosage system shall be a fully automatic system comprising the following minimum equipment:-

(a) Chemical metering pump as specified in Clause F.4.8 and control panel constructed to IP 54 to BS EN 60529:1992 completed with system status indication, visual and audio alarm, timer, etc. as required to facilitate ease of operation and maintenance of the water treatment system;

(b) Chemical tanks as specified in Clause F.4.9; and

(c) Chemical tank liquid level switch as specified in Clause F.4.10.

F.6 COOLING TOWER/CONDENSER COOLING WATER TREATMENT BY OZONE

This method of water treatment for fresh (including well water) or sea water circulating between cooling tower and condenser shall only be installed by the Contractor where required and fully detailed in the Particular Specification. The minimum provisions shall be as follows:-

F.6.1 Pre-cleaning and Flushing Out Operation

As specified in Clause F.5.1.

F 6.2 Ozone Generator System for Cooling Water Treatment

The ozone generation system shall include all major ozone generating equipment, circulating pumps, interconnecting piping, pipe fittings, enclosure, wiring, accessories, controls and instrumentation to form a compatible and complete working system. Weather-proof enclosure with self-contained lighting and ventilation shall be provided for the system that is susceptible to weather or outdoor conditions.

A complete ozone piping system separated from the main cooling tower condenser cooling water system shall be provided to take water from the recirculating pump discharge side of the cooling water circuit, through the in-line ozone injector contactor for ozone dosing, a solid separator and then recirculated into the sump of the water cooling tower or tank. The system operation and ozone dosing shall be fully automatic with programmable direct digital real time control incorporated. Multiple injection points shall be adopted for cooling systems with turnover rate not more than four times per hour.

Unless otherwise specified, the Contractor shall be fully responsible for the design of the system, selection of equipment and ozone dosage rate for the particular fresh/sea water cooling water system with specific recirculation rate and system volume. The ozone dosage rate shall not be less than 0.5 mg/l in any case. The system shall be suitably oversized to satisfy the ozone demand at the initial stage for cleaning and descaling of the cooling water system for a period of not more than two weeks' period. Detailed system design and equipment selection proposal with all relevant design criteria, data, parameter, calculations and system schematic diagrams shall be submitted to the Architect for approval before placing order and actual commencement of installation works.

Each ozone generation system shall be constructed in modular form which shall comprise major equipment modules of pressure swing absorption type oxygen generator, high frequency ozone generator, ozone injector contactor, solid particle separator, circulating pumps, pipings, pipe fittings, all necessary accessories, wiring, controls and instrumentation. The modular enclosure shall be designed for ease of maintenance and safe operation with demountable panels, hinged doors, visual panels and adequate electrical segregation for the high voltage section.

The ozone generation system shall be easily connected to ozone-in-air monitor and other control instrument for automatic stopping and control of the entire system. Visual and audio alarm shall be incorporated as specified. Ozone-in-air monitors shall be fixed at locations as indicated in the Contract Drawings if specified in the Particular Specification and properly connected to the ozone generation system.

All components in contact with ozone produced shall be made of ozone resistant material designed for continuous and prolonged usage without deterioration or damage. Unless otherwise specified in the Particular Specification, all system components in contact with ozonated water shall be made of stainless steel to AISI 316. In particular, Teflon tubing shall be used for connecting ozone generator and in-line injector. Polythe tubing for oxygen conveying pipe, uPVC piping and fittings for other interconnecting pipework.

Major ozone generating equipment shall comprise, inter alia, the following components:-

(a) Pressure Swing Absorption Oxygen Generator

The oxygen generator comprises a built-in oil-free compressor for air compression, air dryer pre-chiller, an automatic high efficient desiccant air dryer with microporous drying agent, a nitrogen absorption tank to produce constant and stable supply of oxygen with purity 85% ± 5%. Regeneration shall be accomplished by heating the desiccant material and purging it with a small flow of dried air to expel moisture when they are saturated with moisture.

A dewpoint monitoring system shall be incorporated, which comprises a control unit and measuring probe situated within the pipework leading from the air dryer to the ozone generator. The monitoring system shall automatically stop the ozone production with an visual and audible alarm in case of an increase in dewpoint over a preset value in order to prevent failure or damage to the ozone generator.

Air dryer pre-chiller shall reduce the incoming air temperature to approximately 10°C or other optimum operating temperature recommended by the manufacturer to suit the type of desiccant used.

(b) Ozone Generator

The ozone generator unit shall comprise independent solid-state high frequency ozone generator modules, air-cooled plate type and constructed of either sandwich heat dissipating structure with ceramic coated steel plate discharge electrodes or cylindrical concentric ozone generating tube.

Each module shall be equipped with built-in safety circuit to give visual and audible alarm and to switch off the generator when abnormal operation of the generator occurs. Relevant type-test or factory test certificates of the generator's high voltage transformer section as listed below shall be submitted for verification of safe operation:-

(ii) Voltage ratio and phase relationship test;
(iii) Induced over-voltage withstand test;
(iii) Insulation resistance test; and
(iv) High voltage withstand test.

Minimum safety controls shall be provided as follows:-

- Door mechanically interlocked with the main isolating switch;
- Over current cut-out;
- High temperature cut-out;
- Low air flow or low cooling water cut-out as appropriate;
- High dew point cut-out;
- High/low voltage cut-out;
- External fault cut-out if external devices connected; and
- Isolation of power supply when panel doors or side panels are opened.

Unless otherwise specified, water-cooled type ozone generator shall be offered. air-cooled type modules shall only be offered for low capacity ozone generator unit as specified in the Particular Specification. The cooling water shall be taken from the chilled water system of the building as indicated in the Contract Drawings or at nearest A/C plant room. Pressure reducing valve, regulating valve and connecting chilled water piping shall be provided to maintain the design constant operating conditions of the modules.

(c) In-line Injector Contactor

The in-line injector shall be venturi type completed with double check valves fabricated of Kynar or products having equivalent functions or performance.

(d) Solid Particle Separator

The separator shall be fabricated of Noryl plastic or products having equivalent functions or performance selected to suit system flow rate and requirements.

(e) Circulating Pump

The circulating pump shall be compatible with the ozone system and supplied by the same ozone equipment supplier. The pump shall comply with relevant sections of this General Specification.

(f) Test Kit and Ozone Monitoring Equipment

Sampling points in the system together with a complete set of test kit for residual ozone testing shall be provided to facilitate daily inspection and assessment of ozone content.

A portable ozone-in-air monitor with range 0-9.5 ppm and 4-digit LCD shall also be provided.

The above test kit and monitor shall be handed over to the operating staff prior to the expiry of contract maintenance period.

(g) On Site Operational Training

Familiarization of equipment and on-site training of the whole ozone water treatment system shall comply with the requirements in Clause F.9. In addition, a competent specialist of the ozone system shall hold the on-site training of the water treatment system.

F.7 CLOSE CIRCUIT CHILLED WATER OR LOW PRESSURE HOT WATER HEATING SYSTEMS TREATMENT BY CHEMICAL AGENTS

Where no other system is specified in the Particular Specification, this method shall be included for by the Contractor as the basic form of water treatment for the close circuit chilled water or hot water heating system applications.

The minimum provisions shall be as follows:-

F.7.1 Pre-cleaning and Flushing Out Operations

As specified in Clause F.5.1.

F.7.2 Chemical Treatment to Prevent Corrosion, Scaling and Sludge Formation

The chemical agent shall be a combination of chemicals guaranteed by the manufacturer as appropriate in every respect to prevent corrosion, scaling and sludge formation.

The agent should be liquid chemicals such as molybdate or nitrite based agent blended with corrosion inhibitor which can provide such protection to the metal of closed circuit pipe lines, system and equipment.

Chemicals used within chilled water or low pressure hot water (LPHW) heating system shall, unless otherwise recommended by the supplier with full technical support and accepted by the Architect, have the following characteristics:-

- Suitable for the application, system operation conditions and fluid;
- Non-flammable; and
- Low toxicity.

F.7.3 Chemical Dosage Equipment

As specified in Clause F.5.3.

F.8 WATER TESTING EQUIPMENT

Unless otherwise specified in the Particular Specification, water testing equipment corresponding to the type of water treatment system and chemical used shall be provided to monitor and verify the performance of the water treatment system offered and shall be handed over to the operation and maintenance staff prior to the expiry of contract maintenance period.

The equipment shall be of portable type suitable for field sampling and testing. For chlorine residual concentration testing, pilam tablets and colour disc shall be provided. For pH value testing, pH meter or phenol red solution and colour disc shall be provided. Other relevant test kits shall include but not limited to total dissolved solid and corrosion inhibitor level tester.

F.9 TRAINING, OPERATION AND MAINTENANCE FACILITIES

No matter which type of water treatment system is offered, adequate on-site operational training and demonstration of the water treatment system shall be provided to the operation and maintenance staff prior to handover of the system or after completion of the installation. It shall include but not limit to the following:-

F.9.1 Familiarisation of equipment and system including function of each dosing chemical.

F.9.2 Water treatment equipment set-up/adjustment.

F.9.3 On-site training of water sampling and testing, equipment and system operation and maintenance procedures.

F.9.4 Precautions in handling the chemicals and the remedial actions following a spillage and accidental human contact.

Competent persons from the approved water treatment specialist and equipment suppliers shall conduct the on-site training with full day manual training. The exact training requirement shall be submitted by the Contractor to the Architect for endorsement.

The Contractor shall provide prominent warning notices, goggles, gloves and necessary accessories for handling the chemicals.

Sufficient number of sampling points in the pipework or equipment for water analysis, routine inspection and testing shall be provided.

F.10 PRE-TREATMENT FOR DUMPING OF CHEMICAL WASTES

All chemical wastes generated by the Contractor shall be handled, collected and disposed of in accordance with the Waste Disposal (Chemical Waste) (General) Regulation. The Contractor shall register as a Chemical Waste Producer with the Environmental Protection Department and the wastes be collected by a licensed Chemical Waste Collector for disposal at an approved facility.

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9. SUPPLEMENTARY INFORMATION

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LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

9.1. Chemical Catalogues & MSDS

Flat C, 15/F, Superlink Industrial Centre, Phase 2, No.57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong
Tel: 852-2408 2570 Fax: 852-2438 1740 Email: [illegible]

AQUAMAG

AD-50

DESCRIPTION

AD-50 AN INHIBITED ACID DETERGENT TO REMOVE THE SCALE AND RUST FROM STAINLESS STEEL ALUMINIUM AND MOST COMMON METAL. IT ALSO CONTAINS DISPERSANT AND SURFACTANT TO REMOVE OIL AND GREASE.

GENERAL SPECIFICATION

- APPEARANCE : COLOURLESS LIQUID
- SPECIFIC GRAVITY : 1.22
- pH AS SUPPLIED : 1

DIRECTIONS

- USE 0.5 - 2% OF SOLUTION FOR CIRCULATION TO REMOVE SCALE AND RUST FROM STAINLESS STEEL SURFACES.
- FOR ALUMINIUM & COPPER ALLOYS, AD-50 MAY BE DILUTED TO 0.25% - 0.5% FOR CIP CLEANING.
- RINSE WELL WITH WATER AFTER APPLICATION.

PRODUCT BENEFITS

- CONCENTRATED ONE STEP CLEANER
- INHIBITED FORMULATION FOR MOST METAL
- REMOVE OXIDES AND STUBBORN STAINS RAPIDLY.
- NO HEAT REQUIRED

AQUAMAG

AD-50

SAFETY & HANDLING

- AVOID CONTACT WITH SKIN OR EYES.
- DO NOT INHALE OR SWALLOW.
- WEAR EYE GOGGLE AND RUBBER GLOVES WHEN HANDLING.
- IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN OR EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. FOR EYES, GET MEDICAL ATTENTION.
- DO NOT STORE WITH FOOD
- CLOSE CONTAINER SECURELY AFTER USE

PACKING

20 LTRS PLASTIC DRUM

acc@pta
Leading Force in Protection
QUAY WEST, TRAFFORD WHARF ROAD,
MANCHESTER, M17 1HH,
UNITED KINGDOM.
TEL: +44 (0) 161 848 2100

LOCAL DISTRIBUTOR:
LeBLANC WATER TREATMENT & CHEMICALS LTD,
FLAT E, 15/F., SUPERLUCK INDUSTRIAL CENTRE, PHASE 2,
NO. 57 SHA TSUI ROAD, TSUEN WAN, N.T., HONG KONG.
TEL: (852) 2408 2000 FAX: (852) 2408 1744
EMAIL: info@leb-anc.com.hk

LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

MATERIAL SAFETY DATA SHEET

SECTION I IDENTIFICATION OF PRODUCT

MANUFACTURER'S NAME	LeBLANC WATER TREATMENT & CHEMICALS LIMITED
EMERGENCY TELEPHONE NO	(852) 2408 2000 FLAT C, 15/F., SUPERLUCK INDUSTRIAL CENTRE, PHASE 2, 57 SHA TSUI ROAD, TSUEN WAN, N.T., HONG KONG.
TRADE NAME AND SYNONYMS	AQUAMAG AC 50
CHEMICAL NAME AND SYNONYMS	

SECTION II HAZARDOUS COMPONENTS OF MIXTURES

COMPONENT	%	THRESHOLD LIMIT VALUE (UNITS)
Phosphoric Acid and Detergent		Not Established

SECTION III PHYSICAL DATA

APPEARANCE AND ODOR	Colourless liquid, irritating	pH (1Vol %)	1.0
BOILING POINT		SPECIFIC GRAVITY (WATER = 1)	1.22
SOLUBILITY IN WATER	Complete	EVAPORATION RATE (ETHYL ETHER = 1)	

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (SPECIFY METHOD) (DEGREES C.)	None	FIRE-EXTINGUISHING MEDIA	Water
SPECIAL FIRE-FIGHTING PROCEDURES	Care should be taken when adding water to concentrated solutions because of the danger of spattering. Wear full protective clothing.		
UNUSUAL FIRE AND EXPLOSION HAZARDS	Non-combustible. In contact with water may generate sufficient heat to ignite combustible materials. Contact with aluminum, tin, zinc can generate hydrogen gas which can give rise to an explosion.		

SECTION V REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATIBILITY (MATERIALS TO AVOID)
Organic materials. Metals such as aluminum, tin or zinc react evolving hydrogen.

HAZARDOUS DECOMPOSITION PRODUCTS
Hydrogen from metals mentioned above.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

READ THE BACK

Flat C, 15/F., Superluck Industrial Centre, Phase 2, No.57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong
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LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

MATERIAL SAFETY DATA SHEET – AQUAMAG AD 50 (Continued)

SECTION VI HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE

Not Established

EFFECTS OF OVEREXPOSURE

Strong acid - can cause severe burns to the skin and eyes.

EMERGENCY AND FIRST AID PROCEDURES

Skin - flush thoroughly with water. Acid burns should have immediate medical attention. Eyes - flush with plenty of water for at least 15 minutes get medical attention immediately, because of risk of permanent eye damage Ingestion - give 3 or 4 glasses of milk or water. DO NOT induce vomiting - call physician immediately.

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Small amounts should be swept up immediately. Large amounts should be salvaged.

WASTE DISPOSAL METHOD

Observe local, provincial and federal regulations, and do not contaminate streams, lakes or ponds. Neutralize with dilute solutions of alkali.

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE)

Provide adequate ventilation. Wear respirator against acidic mists.

PROTECTIVE GLOVES

Rubber

EYE PROTECTION

Tight-fitting chemical goggles

OTHER PROTECTIVE EQUIPMENT

Rubber shoes and protective clothing

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

DO NOT TAKE INTERNALLY. Danger-extremely corrosive-causes severe burns. Avoid contact with eyes, skin or clothing. Store away from organic materials and metals such as aluminum, tin or zinc Store in a cool dry place. Keep container tightly closed when not in use.

OTHER PRECAUTIONS

When preparing solutions always add AD 50 slowly to surface of liquid in small quantities to avoid violent spattering. Keep solution well agitated.

DATE June 1995

To the best of our knowledge the information contained herein or presented in our Product Data Sheet is true and accurate

Any recommendations suggestions or plans of action are made without warranty or guarantee, since the conditions of use are beyond our control We accept no liability for the safe or unsafe use storage or handling of any of our products The responsibility for personal injury or damages related to the application of this product after delivery rests solely with the purchaser

Flat C, 15/F., Superma's Industrial Centre, Phase 2, No. 57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong
Tel: (852) 2408 2006 Fax: (852) 2408 1740 Email: info@leblanc.com.hk

AQUAMAG

DEFOAMER

DESCRIPTION

DEFOAMER IS AN MODIFIED SILOXANES BASED EMULSION TO QUENCH, PREVENT OR CONTROL FOAMING IN AQUEOUS SYSTEM. THE SPECIAL COMBINATION OF ACTIVE INGREDIENTS PROVIDES DEFOAMER WITH EXCELLENT STABILITY IN ALKALINE OR ELECTROLYTE-RICH MEDIA, EVEN AT ELEVATED TEMPERATURE. DUE TO ITS GOOD DISPERSIBILITY, DEFOAMER CAN BE USED AS DELIVERED.

GENERAL SPECIFICATION

- APPEARANCE : WHITE, OPAQUE LIQUID
- ACTIVE CONTENT : 10%
- SPECIFIC GRAVITY : 0.995±
- VISCOSITY : MEDIUM
- pH AS SUPPLIED : 7

* all figures approximate

DIRECTIONS

- ALTHOUGH IT IS EFFECTIVE IN SUPPRESSING OR CONTROLLING FOAM, DEFOAMER IS MOST EFFECTIVE IN PREVENTING FOAM FORMATION.
- THE ACTUAL CONCENTRATION DEPENDS ON THE TEMPERATURE, COMPOSITION, VISCOSITY AND AGITATION OF THE FOAMING SYSTEM. A STARTING CONCENTRATION OF 3% OF THE CONCENTRATION OF LOWER WASH IS RECOMMENDED.

AQUAMAG

DEFOAMER

PRODUCT BENEFITS

- MOST EFFECTIVE ANTIFOAM EMULSION
- SPECIALLY FOR AQUEOUS SYSTEM
- SUPERIOR STORAGE STABILITY
- ENVIRONMENTAL FRIENDLY

SAFETY & HANDLING

- AVOID CONTACT WITH SKIN OR EYES
- AVOID CONTACT WITH ACIDS AND COMBUSTIBLE MATERIALS
- DO NOT INHALE OR SWALLOW
- WEAR EYE GOGGLE AND RUBBER GLOVES WHEN HANDLING
- IN CASE OF CONTACT IMMEDIATELY FLUSH SKIN OR EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES FOR EYES, GET MEDICAL ATTENTION
- STORE IN A TIGHTLY SEALED CONTAINER
- STORE IN A DRY, COOL AND WELL VENTILATED AREA.

PACKING

25 LBS PLASTIC DRUM

acc@pta
Energy & Chemical Technologies
QUAY WEST, TRAFFORD WHARF ROAD,
MANCHESTER, M17 1HH,
UNITED KINGDOM
TEL +44 (0) 161 249 2100

LOCAL DISTRIBUTOR:
LeBLANC WATER TREATMENT & CHEMICALS LTD.
FLAT C, 15/F., SUPERLUCK INDUSTRIAL CENTRE, PHASE 2,
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TEL. (852) 2408 2000 FAX: (852) 2409 1740
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LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

MATERIAL SAFETY DATA SHEET

SECTION I IDENTIFICATION OF PRODUCT

MANUFACTURER'S NAME	LeBLANC WATER TREATMENT & CHEMICALS LIMITED
EMERGENCY TELEPHONE NO	(852) 2408 2000 FLAT C, 15/F., SUPERLUCK INDUSTRIAL CENTRE, PHASE 2, 57 SHA TSUI ROAD, TSUEN WAN, N.T., HONG KONG.
TRADE NAME AND SYNONYMS	**AQUAMAG DEFOAMER**
CHEMICAL NAME AND SYNONYMS	

SECTION II HAZARDOUS COMPONENTS OF MIXTURES

COMPONENT	%	THRESHOLD LIMIT VALUE (UNITS)
Siloxanes Based Emulsion	10%	Not Established

SECTION III PHYSICAL DATA

APPEARANCE AND ODOR	White opaque liquid. pH = 7		
BOILING POINT		SPECIFIC GRAVITY (WATER = 1	0.9958
SOLUBILITY IN WATER	Complete	EVAPORATION RATE (ETHYL ETHER = 1)	

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (SPECIFY METHOD) (DEGREES C)	None	FIRE-EXTINGUISHING MEDIA	Water
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

SECTION V REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	
INCOMPATIBILITY (MATERIALS TO AVOID)	None		
HAZARDOUS DECOMPOSITION PRODUCTS	None		
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

READ THE BACK

Flat C, 15/F., Superluck Industrial Centre, Phase 2, No.57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong
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LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

MATERIAL SAFETY DATA SHEET - AQUAMAG DEFOAMER (Continued)

SECTION VI HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Not Established

EFFECTS OF OVEREXPOSURE

EMERGENCY AND FIRST AID PROCEDURES
Skin - flush thoroughly with water. Eyes - flush with plenty of water for at least 15 minutes get medical attention immediately, because of risk of permanent eye damage. Ingestion - give 3 or 4 glasses of milk or water DO NOT induce vomiting - call physician immediately.

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Small amounts should be swept up immediately. Large amounts should be salvaged

WASTE DISPOSAL METHOD
Observe local provincial and federal regulations, and do not contaminate streams, lakes or ponds. Neutralize with dilute solutions of acid

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE)
Provide adequate ventilation

PROTECTIVE GLOVES
Rubber

EYE PROTECTION
Tight-fitting chemical goggles

OTHER PROTECTIVE EQUIPMENT
Rubber shoes and protective clothing

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
DO NOT TAKE INTERNALLY. Avoid contact with eyes, skin or clothing Store away from organic materials. Store in a cool dry place. Keep container tightly closed when not in use.

OTHER PRECAUTIONS

DATE June 1995

Flat C, 15/F, Superlink Industrial Centre, Phase 2, No 57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong
Tel: (852) 2408 2008 Fax: (852) 2408 1748 Email: leblanc@leblanc.com.hk

NALCO

Product Bulletin

3D TRASAR® 3DT229

Corrosion Inhibitor

PRODUCT DESCRIPTION AND APPLICATION

3D TRASAR *products are part of an innovative water treatment program that uses proven technology to prevent operational problems.* ***3D TRASAR*** *compensates for both routine and special causes of system variation.*
3D TRASAR *programs provide a return on your investment through their unique control and diagnostic capabilities.*

3D TRASAR 3DT229 is a multifunctional scale and corrosion inhibitor with Nalco **3D TRASAR** technology for industrial open recirculating cooling water systems. **3DT229** is designed for use as corrosion control supplemental product to be used along with dispersant polymer. This product is most effective in cooling systems with corrosive water and low to medium hardness and/or alkalinity. **3DT229** will provide protection over a wide range of operating conditions.

3DT229 can provide the following benefits in customer systems:

Management of cooling system operation based on the operational stresses placed upon it.
Extended tube bundle and equipment life due to reduced corrosion and scale.
Reduced energy costs due to cleaner heat transfer surfaces.

This product contains zinc which may be regulated by a site NPDES permit, the Canadian Provincial Permit to Discharge Water and Waste, or the Municipal Sewer Discharge guidelines.

PHYSICAL & CHEMICAL PROPERTIES

These properties are typical. Refer to the Material Safety Data Sheet (MSDS), SECTION 9, for the most current data.

Appearance	Light yellow
Odor	None
Form	Liquid
Density @ 60°F (16°C)	11.2 - 11.6 lb/gal (1.35 - 1.39 kg/L)
Specific Gravity @ 60°F (16°C)	1.35 - 1.39
pH (neat)	<1.0
Viscosity @ 73°F (23°C)	20 cp
Freeze Point	<-25°F (<-32°C)
Flash Point (PMCC)	None
Freeze-Thaw Recovery	Complete
Vapor Pressure	Not Available
VOC Content	0% calculated
Solubility in Water	Complete

ACTIVE CONSTITUENTS

Component	Function
Zinc	Cathodic Corrosion Inhibitor
Orthophosphate	Anodic Corrosion Inhibitor
Phosphonate (PSO)	$CaCO_3$ Scale Inhibitor
	Cathodic Corrosion Inhibitor

REGULATORY APPROVALS

3DT229 is intended for industrial use only. It must not be fed to potable water systems. At this time there are no Canadian Approvals for **3DT229**. Refer to the Material Safety Data Sheet (MSDS), SECTION 15 for the most recent information on approvals.

MATERIALS OF COMPATIBILITY

Compatible	Not Compatible
Buna-N	Aluminum
Hypalon	Brass
Neoprene	Carbon Steel
Polyethylene	Nickel
Polypropylene	Stainless Steel 304
Polyurethane	Stainless Steel 316
PVC	Plasite 4005
Teflon	Plasite 6000
Vinyl	Plasite 7122
Viton	

DOSAGE AND FEEDING

For complete dosage and feeding recommendations, consult your Nalco sales engineer.

ENVIRONMENTAL AND TOXICITY DATA

Biological Oxygen Demand (5-day BOD_5)	7 ppm
Chemical Oxygen Demand (COD)	110,000 ppm
Total Organic Carbon (TOC)	30,000 ppm

Refer to SECTIONS 11 and 12 of the Material Safety Data Sheet for all available mammalian and aquatic toxicity information.

3DT229 contains zinc, which is considered a priority pollutant. It must be used in accordance with the site NPDES permit, the Canadian Provincial Permit to Discharge Water and Waste, or the Municipal Sewer Discharge guidelines.

SAFETY AND HANDLING

3DT229 is an acidic product, and may cause skin and eye irritation. Chemical-resistant gloves and safety goggles
should be worn when handling **3DT229**. Read SECTION 8 of the Material Safety Data Sheet for specific personal protective
equipment, and SECTION 3 for health effects information.

3DT229 should be stored in a location where the product temperature can be kept in a range between 32°F (0°C) and 120°F (49°C). In cold climates, heat tracing and insulation of exposed containers and transfer lines may be necessary.

STORAGE

3DT229 contains a reportable quantity (RQ) substance. All storage vessels of **3DT229** must be in secondary
containment if the storage capacity exceeds the RQ of 7,920 pounds (3,593 Kgs). Refer to the Material Safety Data Sheet (MSDS), SECTION 7, for the most current data. Recommended in-plant storage limit is one year.

REMARKS

If you need assistance or more information on this product, please call your nearest Nalco Representative. For more news about Nalco Company, visit our website at www.nalco.com.

For **Medical and Transportation Emergencies** involving Nalco products, please see the Material Safety Data Sheet for the phone number.

ADDITIONAL INFORMATION

3D TRASAR, A-Z-LITE, TRASAR, NALCO, and the Logo are registered trademarks of Nalco Company. (10-25-2006)

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT229

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: 3D TRASAR® 3DT229

Date issued: 11/08/2005

COMPANY IDENTIFICATION

CHINA	NALCO INDUSTRIAL SERVICES (SUZHOU) CO LTD	TEL 86-512-66256201	FAX 86-512-66256135
INDIA	NALCO INDIA LIMITED	TEL 91-33-22172066	FAX 91-33-22256356
INDONESIA	PT NALCO INDONESIA	TEL 62-21-8753175	FAX 62-21-8753167
KOREA	NALCO KOREA LIMITED	TEL 82-2-799 6961	FAX 82-2-795 3140
MALAYSIA	NALCO INDUSTRIAL SERVICES (M) SDN BHD	TEL 603-5569 4118	FAX 603 5569 5855
THE PHILIPPINES	NALCO PHILIPPINES INC	TEL 63 49 545 1550	FAX 63 49 5453443
SINGAPORE	NALCO PACIFIC PTE LTD	TEL 65-6861-401*	FAX 65-6862 0855
THAILAND	NALCO INDUSTRIAL SERVICES (THAILAND) CO LTD	TEL 66-38-965-150	FAX 66-38-965-166

See Section 16 for address information

EMERGENCY TELEPHONE NUMBER(S) : **See section 16, for Emergency Telephone Numbers.**

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL DESCRIPTION: Phosphonic acid, zinc chloride, polymer, water

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

CHEMICAL NAME	CAS NO	% (w/w)
Zinc Chloride	7646-85-7	10.0 - 30.0
Phosphonic Acid	7664-38-2	10.0 - 30.0
Other ingredients determined not to be hazardous		to 100%

3. HAZARDS IDENTIFICATION

HUMAN HEALTH HAZARDS - ACUTE

EYE CONTACT
Corrosive. Will cause eye burns and permanent tissue damage.

SKIN CONTACT
May cause severe irritation or tissue damage depending on the length of exposure and the type of first aid administered.

INGESTION
Not a likely route of exposure. Corrosive, causes chemical burns to the mouth, throat and stomach.

INHALATION
Not a likely route of exposure. Elevated temperatures or mechanical action may form vapors, mists or fumes which may be irritating to the eyes, nose, throat and lungs.

HUMAN HEALTH HAZARDS - CHRONIC
No adverse effects expected other than those mentioned above.

ENVIRONMENTAL HAZARDS
Keep out of waterways. Spilled product may pose a risk to the aquatic ecosystem if released.

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT229

4. FIRST AID MEASURES

EYE CONTACT
Get immediate medical attention. PROMPT ACTION IS ESSENTIAL IN CASE OF CONTACT Immediately flush eye with water for at least 15 minutes while holding eyelids open

SKIN CONTACT
Get immediate medical attention. Immediately flush with plenty of water for at least 15 minutes For a large splash: flood body under a shower Remove contaminated clothing Wash off affected area immediately with plenty of water Contaminated clothing shoes and leather goods must be discarded or cleaned before re-use.

INGESTION
Get immediate medical attention DO NOT INDUCE VOMITING If conscious washout mouth and give water to drink

INHALATION
Remove to fresh air, treat symptomatically If symptoms develop, seek medical advice

NOTE TO PHYSICIAN
Probable mucosal damage may contraindicate the use of gastric lavage Based on the individual reactions of the patient the physician's judgement should be used to control symptoms and clinical condition

5. FIRE FIGHTING MEASURES

FLASH POINT Not flammable

EXTINGUISHING MEDIA
This product would not be expected to burn unless all the water is boiled away The remaining organics may be ignitable Use extinguishing media appropriate for surrounding fire

FIRE AND EXPLOSION HAZARD
May evolve oxides of carbon (COx) under fire conditions May evolve oxides of phosphorus (POx) under fire conditions. May evolve oxides of nitrogen (NOx) under fire conditions May evolve ammonia (NH4) under fire conditions

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING
In case of fire wear a full face positive-pressure self contained breathing apparatus and protective suit

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS
Restrict access to area as appropriate until clean-up operations are complete Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection) Stop or reduce any leaks if it is safe to do so Ventilate spill area if possible Ensure clean-up is conducted by trained personnel only Do not touch spilled material. Have emergency equipment for fires spills leaks, etc) readily available Notify appropriate government occupational health and safety and environmental authorities

METHODS FOR CLEANING UP
SMALL SPILLS Soak up spill with absorbent material Place residues in a suitable covered, properly labeled container. Wash affected area. LARGE SPILLS. Contain liquid using absorbent material by digging trenches or by diking Reclaim into recovery or salvage drums or tank truck for proper disposal Clean contaminated surfaces with water or aqueous cleaning agents Contact an approved waste hauler for disposal of contaminated recovered material Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT229

ENVIRONMENTAL PRECAUTIONS
Prevent material from entering sewers or waterways. Spilled product may pose a risk to the aquatic ecosystem if released. If drains, streams, soil or sewers become contaminated, notify local authority.

7. HANDLING AND STORAGE

HANDLING
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Do not breathe vapors/gases/dust. Keep the containers closed when not in use. Have emergency equipment for fires, spills, leaks, etc. readily available. Ensure all containers are labelled.

STORAGE CONDITIONS
Store in suitable labelled containers. Store the containers tightly closed. Store separately from bases.

SENSITIVITY TO STATIC DISCHARGE
Not expected to be sensitive to static discharge.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

OCCUPATIONAL EXPOSURE LIMITS	TWA ppm	TWA mg/m3	STEL ppm	STEL mg/m3
ACGIH TLV				
PHOSPHORIC ACID		1		3
ZINC CHLORIDE FUME		1		2
CHINA				
PHOSPHORIC ACID		1		3
ZINC CHLORIDE FUME		1		2
Hong Kong				
PHOSPHORIC ACID		1		3
ZINC CHLORIDE FUME		1		2
Indonesia				
PHOSPHORIC ACID		1		3
ZINC CHLORIDE FUME		1		2
JAPAN				
PHOSPHORIC ACID		1		
KOREA				
PHOSPHORIC ACID		1		3
ZINC CHLORIDE FUME		1		2
MALAYSIA				
PHOSPHORIC ACID		1		
ZINC CHLORIDE FUME		1		
OSHA PEL				
PHOSPHORIC ACID		1		3
ZINC CHLORIDE FUME		1		2
THE PHILIPPINES				
PHOSPHORIC ACID		1		
ZINC CHLORIDE FUME		1		
SINGAPORE				
PHOSPHORIC ACID		1		3
ZINC CHLORIDE FUME		1		2
Taiwan				
PHOSPHORIC ACID		1		
ZINC CHLORIDE FUME		1		
THAILAND				
PHOSPHORIC ACID		1		
ZINC CHLORIDE FUME		1		

MONITORING MEASURES

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT229

A small volume of air is drawn through an absorbant or barrier to trap the substance(s) which can then be desorbed or removed and analyzed as referenced below:

Substance(s)	Method	Analysis	Absorbant
Phosphoric Acid	US NIOSH 7903	Ion chromatography	Silica gel

ENGINEERING MEASURES
The use of local exhaust ventilation is recommended to control emissions near the source. Laboratory samples should be handled in a fumehood. Provide mechanical ventilation of confined spaces.

PERSONAL PROTECTION

GENERAL ADVICE
The use and choice of personal protection equipment is related to the hazard of the product, the workplace and the way the product is handled. In general, we recommend as a minimum precaution that safety glasses with side-shields and workclothes protecting arms, legs and body be used. In addition, any person visiting an area where this product is handled should at least wear safety glasses with side-shields.

RESPIRATORY PROTECTION
An approved respirator must be worn if the occupational exposure limit is likely to be exceeded. An organic vapor/acid gas cartridge with dust/mist prefilter may be used. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION
Neoprene gloves, nitrile gloves. Gloves should be replaced immediately if signs of degradation are observed.

SKIN PROTECTION
Wear chemical resistant apron, chemical splash goggles, impervious gloves and boots. A full slicker suit is recommended if gross exposure is possible.

EYE PROTECTION
Wear a face shield with chemical splash goggles.

HYGIENE RECOMMENDATIONS
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

ENVIRONMENTAL EXPOSURE CONTROL PRECAUTIONS
Consider the provision of containment around storage vessels.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Clear Amber
ODOR	None
FLASH POINT	Not flammable
SPECIFIC GRAVITY	1.33 - 1.41 @ 25 °C
SOLUBILITY IN WATER	Complete

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY
Stable under normal conditions

HAZARDOUS POLYMERIZATION
Hazardous polymerization will not occur

CONDITIONS TO AVOID
Freezing temperatures

MATERIALS TO AVOID
Contact with strong alkalies (e.g. ammonia and its solutions, carbonates, sodium hydroxide (caustic), potassium hydroxide, calcium hydroxide (lime), cyanide, sulfide, hypochlorites, chlorites) may generate heat, spattering or boiling and toxic vapors

HAZARDOUS DECOMPOSITION PRODUCTS
Under fire conditions.
Oxides of phosphorus
Oxides of carbon
Oxides of nitrogen
Ammonia

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY DATA
No toxicity studies have been conducted on this product.

SENSITIZATION
This product is not expected to be a sensitizer

CARCINOGENICITY
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), or the American Conference of Governmental Industrial Hygienists (ACGIH)

HUMAN HAZARD CHARACTERIZATION
Based on our hazard characterization, the potential human hazard is: High

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS
No toxicity studies have been conducted on this product

MOBILITY AND BIOACCUMULATION POTENTIAL
This preparation or material is not expected to bioaccumulate

ENVIRONMENTAL HAZARD CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Moderate

13. DISPOSAL CONSIDERATIONS

Hazardous wastes must be transported by a licensed hazardous waste transporter and disposed of or treated in a properly licensed hazardous waste treatment, storage, disposal or recycling facility. Consult local, state, and federal regulations for specific requirements

Empty drums should be taken for recycling, recovery or disposal through a suitably qualified or licensed contractor.

NATIONAL REGULATIONS: CHINA
Comply with local regulations

NATIONAL REGULATIONS: INDIA
Dispose of unused product in accordance with the "Hazardous Wastes (Management and Handling) Rules 1989" and local and State legislation, as applicable.

NATIONAL REGULATIONS: INDONESIA
Dispose of unused product in accordance with "Government Regulation No 19/1994 On the Treatment of Dangerous And Toxic Waste" (and amendments) as applicable

NATIONAL REGULATIONS: KOREA
Waste disposal should comply with the Waste Control Act

NATIONAL REGULATIONS: MALAYSIA
Dispose of in accordance with the Environmental Quality (Scheduled Wastes) Regulation 1989 and other guidelines issued by DOE and/or local authorities

NATIONAL REGULATIONS: PHILIPPINES
Dispose of in accordance with Presidential Decree No. 984-1976 ("The Pollution Control Law"); DENR Department Administrative Order No 29-92 ("The Implementing Rules or Regulations of RA6969") and Presidential Decree No 825

NATIONAL REGULATIONS: SINGAPORE
Dispose of waste in accordance with the Environmental Health Act (Chapter 95, Rg 11) Environmental Public Health (Toxic Industrial Waste) Regulations 1990 Ed

NATIONAL REGULATIONS: THAILAND
Dispose of hazardous waste in accordance with the "The Notification of the Ministry of Industry No. 66 B.E. 2450, subject: Disposal of Wastes or Unusable Materials", "The Notification of the Ministry of Industry No. 18 B.E. 2535, subject: Disposal of Wastes or Unusable Materials"

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties and mode of transportation. Typical Proper Shipping Names for this product are as follows:

LAND TRANSPORT

Proper Shipping Name	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Technical Name(s)	PHOSPHORIC ACID, ZINC CHLORIDE
UN/ID No	UN 3264
Hazard Class - Primary	8
Packing Group	III
HAZCHEM CODE:	2X

NATIONAL REGULATIONS: CHINA
Comply with local regulations

NATIONAL REGULATIONS: INDIA
Transport in accordance with the Central Motor Vehicles Rules 1989

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT229

NATIONAL REGULATIONS INDONESIA
Transport in accordance with all government regulations including "Regulation of the Minister of Health No 453/Man Kes/PER/XI/1983

NATIONAL REGULATIONS KOREA
..and transport should comply with the Ministerial Decree of Toxic Chemicals Control Law and the Regulations Regarding the Fire Fighting Techniques Standards as applicable

NATIONAL REGULATIONS MALAYSIA
There are no regulations specifically governing the transport of chemicals Use best practice

NATIONAL REGULATIONS, PHILIPPINES
Transport in accordance with the following legislation (as applicable) Presidential Decree No 1185 1977 ("Fire Code of the Philippines") and implementing rules and regulations Presidential Decree No 856 1975 ("Code of Sanitation"). Republic Act No 6969, 1990 ("Toxic Substances and Hazardous and Nuclear Wastes Control Act") and implementing rules and regulations.

NATIONAL REGULATIONS SINGAPORE
Land Transport complies with the Environmental Pollution Control (Hazardous Substances) Regulations 1996, which follows the "Specification for Caution Labelling for Hazardous Substances" - Singapore Standard 286 (1984).

NATIONAL REGULATIONS THAILAND
The product should be transported in accordance with "Hazardous Substances Acts B E 2535", "Notification of Ministry of Public Health Re. Label and Level of Toxicity of Dangerous Articles Which are Under the Responsibility of Food and Drug Administration 2534 (If applicable)" and "Notification of Land Transportation Department Subject : Label of truck which contain hazardous materia . Notification date . 14 November B E 2543 (14 November 2000)"

AIR TRANSPORT (ICAO/IATA)

Proper Shipping Name	CORROSIVE LIQUID ACIDIC INORGANIC N O S
Technical Name(s)	PHOSPHORIC ACID, ZINC CHLORIDE
UN/ID No	UN 3264
Hazard Class - Primary	8
Packing Group	III
IATA Cargo Packing Instructions	820
IATA Cargo Aircraft Limit	60 L
IATA Passenger Packing Instructions	Y818 / 818
IATA Passenger Aircraft Limit	1 L / 5 L

MARINE TRANSPORT (IMDG/IMO)

Proper Shipping Name	CORROSIVE LIQUID, ACIDIC, INORGANIC N.O.S
Technical Name(s)	PHOSPHORIC ACID, ZINC CHLORIDE
UN/ID No	UN 3264
Hazard Class - Primary	8
Packing Group	III
EmS-Nr.	F-A S-B

15. REGULATORY INFORMATION

NATIONAL REGULATIONS, EUROPE AND MALAYSIA

European:

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT229

HAZARD SYMBOLS

CLASSIFICATION CORROSIVE / C DANGEROUS FOR THE ENVIRONMENT / N

Contains: Phosphoric Acid Zinc Chloride

RISK PHRASES

R34 Causes burns
R51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Malaysian:

HAZARD SYMBOLS:

CLASSIFICATION CORROSIVE / C

Contains Phosphoric Acid, Zinc Chloride

RISK PHRASES:

R34 Causes burns

SAFETY PHRASES:

S24/25 Avoid contact with skin and eyes
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S36/37/39 Wear suitable protective clothing, gloves and eye/face protection.
S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)
S57 Use appropriate containment to avoid environmental contamination

INTERNATIONAL REGULATIONS :

NFPA RATING
HEALTH 3 FLAMMABILITY 1 INSTABILITY 0 OTHER -
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme

INTERNATIONAL CHEMICAL CONTROL LAWS :

TOXIC SUBSTANCES CONTROL ACT (TSCA)
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

EUROPE
The substance(s) in this preparation are included in or exempted from the EINECS or ELINCS inventories

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)
The substances in this preparation are listed on the Domestic Substances List (DSL), are exempt, or have been reported in accordance with the New Substances Notification Regulations

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Ministry of International Trade & Industry List (MITI)

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

THE PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippine Inventory of Chemicals & Chemical Substances (PICCS)

CHINA
All substances in this product comply with the Chemical Control Law and are listed on the Inventory of Existing Chemical Substances China (IECSC.

16. OTHER INFORMATION

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

ADDRESSES AND CONTACT POINTS:

NALCO INDUSTRIAL SERVICES (SUZHOU) CO LTD. 88 Ta Yuan Road, Suzhou New Development Zone Jiangsu 215011 PRC Contact Sam Chen 86-512-68255001

NALCO INDIA LIMITED 20/A Park St. Calcutta 700016 India

PT NALCO INDONESIA, Jl Pahlawan Desa Karang Asem Timur, Citeureup Bogor, Indonesia

NALCO KOREA LIMITED. 11th F, 63BLOG, 60, Yoido-dong Young Deung Po-Gu, Seou, Korea

NALCO INDUSTRIAL SERVICES MALAYSIA SDN BHD: No 1, Jalan Jurutrancang U1/21 Seksyen U1, Hicom-Glenmarie Industrial Park, 40150 Shah Alam, Selangor Darul Ehsan, Malaysia

NALCO PHILIPPINES INC. Barrio Real, Calamba, Laguna Philippines

NALCO PACIFIC PTE LTD 21 Gul Lane Jurong Town, Singapore 629416

NALCO INDUSTRIAL SERVICES (THAILAND) CO LTD. Rayong Plant 109/19 M00 4, Eastern Seaboard Industrial Estate, Soi ESIE 6 T Pluakdaeng, A. Pluakdaeng Rayong 21140 Thailand

EMERGENCY TELEPHONE NUMBER(S):

CHINA: **512-68255001**

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT229

KOREA:	02-789-6961
INDIA:	0-33-6740395
INDONESIA:	62-21-8753175
MALAYSIA:	603-5569 4118
THE PHILIPPINES:	63-49-5451550
SINGAPORE:	65-6861-4011
THAILAND:	38-955-160

Prepared By Nalco Asia Pacific, Safety Health and Environment (SHE) Specialist
Date Issued: 11-Aug-05
Replaces: -

Product Bulletin

3D TRASAR® 3DT204

Multifunctional Cooling Water Treatment

PRODUCT DESCRIPTION AND APPLICATION

3D TRASAR products are part of an innovative water treatment program that uses proven technology to prevent operational problems. **3D TRASAR** compensates for both routine and special causes of system variation. **3D TRASAR** programs provide a return on your investment through their unique control and diagnostic capabilities.

3D TRASAR 3DT204 is a balanced blend of a yellow-metal corrosion inhibitor and a scale and silt dispersant designed for use in open recirculating water systems.

3DT204 contains:

- Tagged High Stress Polymer (tagged-HSP) dispersant
- Benzotriazole (BZT) for copper corrosion inhibition.

When used as the dispersant portion of a two- or three-product **3D TRASAR** program, **3DT204** provides superior dispersancy and calcium phosphate scale control due to its ability to control treatment based on polymer actives.

This product must be fed as one part of a multiproduct, integrated **3D TRASAR** program for cooling water systems.

PHYSICAL & CHEMICAL PROPERTIES

These properties are typical. Refer to the Material Safety Data Sheet (MSDS), SECTION 9, for the most current data.

Form	Liquid
Density	10.1 lb/gal (1.23 kg/L)
Specific Gravity @ 77°F (25°C)	1.23
pH (Neat)	12.6
Freeze-Thaw Recovery	Complete
Flash Point	Not Applicable
Odor	None
Freeze Point	4°F (-15°C)
Solubility in Water	Complete
Appearance	Clear-to-Hazy Yellow/Amber
Viscosity @ 77°F (25°C)	150 cp

ACTIVE CONSTITUENTS

Active	Function
Tagged High Stress Polymer (THSP)	Dispersant
Sodium Benzotriazole	Copper Corrosion Inhibitor

REGULATORY APPROVALS

Please refer to the Material Safety Data Sheet (MSDS), SECTION 15, for the most recent approval information. This product is intended for industrial use only. It must not be fed to potable water systems of any type.

MATERIALS OF COMPATIBILITY

The following data is for the product as supplied and should be useful in specifying materials of construction of tanks, pumps, valves, piping, etc. used for storing, feeding, or transporting material.

Compatible	Not Compatible
304 Stainless Steel	Brass
Viton	Neoprene
EPDM	Buna-N
Polyethylene	Polyurethane
Polypropylene	Hypalon
CPVC	
Plasite 4300	
Plasite 7122	

DOSAGE AND FEEDING

For complete dosage and feeding recommendations, consult your Nalco Sales Engineer.

ENVIRONMENTAL AND TOXICITY DATA

Biological Oxygen Demand (5-day BOD_5)	Not Available
Chemical Oxygen Demand (COD)	Not Available
Total Organic Carbon (TOC)	Not Available

Refer to the Material Safety Data Sheet (MSDS) SECTIONS 11 and 12 for available mammalian and aquatic toxicity information.

SAFETY AND HANDLING

3DT204 is an alkaline product. Read SECTION 8 of the Material Safety Data Sheet for specific personal protective equipment (PPE) recommendations and SECTION 3 for health effects information.

STORAGE

3DT204 should be stored in a location where the product temperature can be kept in a range between 32°F (0°C) and 120°F (49°C). The recommended in-plant storage limit for **3DT204** is one year.

Refer to the Material Safety Data Sheet (MSDS) SECTION 7. for the most current data.

3DT204 contains a reportable quantity (RQ) substance. All storage vessels of **3DT204** must be in secondary containment if the storage capacity exceeds the RQ of 26,790 lb (12,150 kg).

REMARKS

If you need assistance or more information on this product, please call your nearest Nalco Representative. For more news about Nalco Company, vis t our website at www.nalco.com.

For **Medical and Transportation Emergencies** involving Nalco products, please see the Material Safety Data Sheet for the phone number.

ADDITIONAL INFORMATION

3D TRASAR, TRASAR, NALCO and the Logo are registered trademarks of Nalco Company. 12-6-2006.

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT204

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: 3D TRASAR ® 3DT204

Date issued: 11/08/2005

COMPANY IDENTIFICATION

CHINA	NALCO INDUSTRIAL SERVICES (SUZHOU) CO LTD	TEL 86-512-65255001	FAX 86-512-65261130
INDIA	NALCO INDIA LIMITED	TEL 91-33-22172056	FAX 91-33-2229[illegible]
INDONESIA	PT NALCO INDONESIA	TEL 62-21-8753175	FAX 62-21-8753167
KOREA	NALCO KOREA LIMITED	TEL 82-2-785-6861	FAX 82-2-785-3140
MALAYSIA	NALCO INDUSTRIAL SERVICES MALAYSIA SDN BHD	TEL 603-5569 4178	FAX 603-5569 5986
THE PHILIPPINES	NALCO PHILIPPINES INC	TEL 63-49-5451550	FAX 63-49-(45)3442
SINGAPORE	NALCO PACIFIC PTE LTD	TEL 65-6561-4011	FAX 65 6362 0650
THAILAND	NALCO INDUSTRIAL SERVICES (THAILAND) CO LTD	TEL 66-38-955 160	FAX 66-38-955-165

See Section 16 for address information

EMERGENCY TELEPHONE NUMBER(S) : See section 16. for Emergency Telephone Numbers.

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL DESCRIPTION: Polymer, substituted triazole, sodium hydroxide, water

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 16 for the nature of the hazard(s).

CHEMICAL NAME	CAS NO	% (w/w)
Sodium Hydroxide	1310-73-2	1.0 - 5.0
Other ingredients determined not to be hazardous, including water		to 100

3. HAZARDS IDENTIFICATION

HUMAN HEALTH HAZARDS - ACUTE

EYE CONTACT
Corrosive. Will cause eye burns and permanent tissue damage.

SKIN CONTACT
May cause severe irritation or tissue damage depending on the length of exposure and the type of first aid administered.

INGESTION
Corrosive, causes chemical burns to the mouth, throat and stomach.

INHALATION
Not a likely route of exposure. Elevated temperatures or mechanical action may form vapors, mists or fumes which may be irritating to the eyes, nose, throat and lungs.

HUMAN HEALTH HAZARDS - CHRONIC
No adverse effects expected other than those mentioned above.

4. FIRST AID MEASURES

EYE CONTACT

Get immediate medical attention. PROMPT ACTION IS ESSENTIAL IN CASE OF CONTACT Immediately flush eye with water for at least 15 minutes while holding eyelids open.

SKIN CONTACT
Get immediate medical attention. Immediately flush with plenty of water for at least 15 minutes For a large splash, flood body under a shower Remove contaminated clothing Wash off affected area immediately with plenty of water Contaminated clothing, shoes, and leather goods must be discarded or cleaned before re-use

INGESTION
Get immediate medical attention DO NOT INDUCE VOMITING If conscious, washout mouth and give water to drink.

INHALATION
Remove to fresh air treat symptomatically If symptoms develop, seek medical advice.

NOTE TO PHYSICIAN
Probable mucosal damage may contraindicate the use of gastric lavage. Based on the individual reactions of the patient, the physician s judgement should be used to control symptoms and clinical condition

5. FIRE FIGHTING MEASURES

FLASH POINT Not flammable

EXTINGUISHING MEDIA
This product would not be expected to burn unless all the water is boiled away The remaining organics may be ignitable. Use extinguishing media appropriate for surrounding fire.

FIRE AND EXPLOSION HAZARD
May evolve oxides of carbon (COx) under fire conditions May evolve oxides of nitrogen (NOx) and sulfur (SOx) under fire conditions

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING
In case of fire wear a full face positive-pressure self contained breathing apparatus and protective suit

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS
Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Stop or reduce any leaks if it is safe to do so. Ventilate spill area if possible Ensure clean-up is conducted by trained personnel only Do not touch spilled material Have emergency equipment (for fires, spills, leaks, etc) readily available Notify appropriate government occupational health and safety and environmental authorities

METHODS FOR CLEANING UP
SMALL SPILLS: Soak up spill with absorbent material Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS Contain liquid using absorbent material by digging trenches or by diking Reclaim into recovery or salvage drums or tank truck for proper disposal Clean contaminated surfaces with water or aqueous cleaning agents. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS
Prevent material from entering sewers or waterways

7. HANDLING AND STORAGE

HANDLING
Do not get in eyes, on skin, or clothing. Do not take internally. Use with adequate ventilation. Avoid generating aerosols and mists. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labeled.

STORAGE CONDITIONS
Store in suitable labelled containers. Store the containers tightly closed

SENSITIVITY TO STATIC DISCHARGE
Not expected to be sensitive to static discharge

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below

OCCUPATIONAL EXPOSURE LIMITS	TWA mg/m3	STEL mg/m3		PEAK / ceiling mg/m3
ARGENTINA				
SODIUM HYDROXIDE		2	ceiling	
CHINA				
SODIUM HYDROXIDE				3
Hong Kong				
SODIUM HYDROXIDE				2
INDONESIA				
SODIUM HYDROXIDE				2
JAPAN				
SODIUM HYDROXIDE				2
KOREA				
SODIUM HYDROXIDE				2
MALAYSIA				
SODIUM HYDROXIDE				2
OSHA PEL				
SODIUM HYDROXIDE				2
THE PHILIPPINES				
SODIUM HYDROXIDE	2			
SINGAPORE				
SODIUM HYDROXIDE		2		
Taiwan				
SODIUM HYDROXIDE	2			
THAILAND				
SODIUM HYDROXIDE	2			

MONITORING MEASURES
A small volume of air is drawn through an absorbant or barrier to trap the substance(s) which can then be desorbed or removed and analyzed as referenced below

Substance(s)	Method	Analysis	Absorbant
Sodium Hydroxide	US NIOSH 7401	Titration	PTFE filter

ENGINEERING MEASURES
General ventilation is recommended. Use local exhaust ventilation if necessary to control airborne mist and vapor

PERSONAL PROTECTION

GENERAL ADVICE

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT204

The use and choice of personal protection equipment is related to the hazard of the product, the workplace and the way the product is handled. In general, we recommend as a minimum precaution that safety glasses with side-shields and workclothes protecting arms, legs and body be used. In addition any person visiting an area where this product is handled should at least wear safety glasses with side-shields.

RESPIRATORY PROTECTION
An approved respirator must be worn if the occupational exposure limit is likely to be exceeded. An organic vapor cartridge with dust/mist prefilter or supplied air may be used. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION
Nitrile gloves. Gloves should be replaced immediately if signs of degradation are observed.

SKIN PROTECTION
Wear chemical resistant apron, chemical splash goggles, impervious gloves and boots. A full slicker suit is recommended if gross exposure is possible.

EYE PROTECTION
Wear a face shield with chemical splash goggles.

HYGIENE RECOMMENDATIONS
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Clear Hazy Yellow
ODOR	None
FLASH POINT	Not flammable
SPECIFIC GRAVITY	1.33 @ 25 °C
SOLUBILITY IN WATER	Complete
pH (100%)	12.6
VISCOSITY	150 cPs @ 25 °C

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY
Stable under normal conditions.

HAZARDOUS POLYMERIZATION
Hazardous polymerization will not occur.

CONDITIONS TO AVOID
Freezing temperatures.

MATERIALS TO AVOID
Contact with strong acids (e.g. sulfuric, phosphoric, nitric, hydrochloric, chromic, sulfonic) may generate heat, splattering or boiling and toxic vapors.

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT204

HAZARDOUS DECOMPOSITION PRODUCTS
Under fire conditions: Oxides of carbon
Oxides of sulfur
Oxides of nitrogen

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY DATA
No toxicity studies have been conducted on this product.

SENSITIZATION
This product is not expected to be a sensitizer

CARCINOGENICITY
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH)

HUMAN HAZARD CHARACTERIZATION
Based on our hazard characterization, the potential human hazard is: High

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS
No toxicity studies have been conducted on this product

MOBILITY AND BIOACCUMULATION POTENTIAL
This preparation or material is not expected to bioaccumulate.

ENVIRONMENTAL HAZARD CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Low

13. DISPOSAL CONSIDERATIONS

Hazardous wastes must be transported by a licensed hazardous waste transporter and disposed of or treated in a properly licensed hazardous waste treatment, storage, disposal or recycling facility. Consult local, state, and federal regulations for specific requirements

Empty drums should be taken for recycling, recovery or disposal through a suitably qualified or licensed contractor

NATIONAL REGULATIONS, CHINA
Comply with local regulations

NATIONAL REGULATIONS, INDIA
Dispose of unused product in accordance with the "Hazardous Wastes (Management and Handling) Rules 1989" and local and State legislation, as applicable

NATIONAL REGULATIONS, INDONESIA
Dispose of unused product in accordance with "Government Regulation No 19/1994 On the Treatment of Dangerous And Toxic Waste" (and amendments) as applicable

NATIONAL REGULATIONS, KOREA
Waste disposal should comply with the Waste Control Act

NATIONAL REGULATIONS, MALAYSIA
Dispose of in accordance with the Environmental Quality (Scheduled Wastes) Regulation 1989 and other guidelines issued by DOE and/or local authorities.

NATIONAL REGULATIONS PHILIPPINES
Dispose of in accordance with Presidential Decree No. 984-1976 ("The Pollution Control Law"); DENR Department Administrative Order No 29-92 (The implementing Rules or Regulations of RA6969"); and Presidential Decree No 825

NATIONAL REGULATIONS SINGAPORE
Dispose of waste in accordance with the Environmental Health Act (Chapter 95, Rg 11); Environmental Public Health (Toxic Industrial Waste) Regulations 1990 Ed

NATIONAL REGULATIONS, THAILAND
Dispose of hazardous waste in accordance with the "The Notification of the Ministry of Industry No. 6B E. 2450 subject: Disposal of Wastes or Unusable Materials ", "The Notification of the Ministry of Industry No. 15 E. 2451 subject: Disposal of Wastes or Unusable Materials "

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows:

LAND TRANSPORT

Proper Shipping Name	SODIUM HYDROXIDE SOLUTION
UN/ID No	UN 1824
Hazard Class - Primary	8
Packing Group	III
HAZCHEM CODE	2R

NATIONAL REGULATIONS CHINA
Comply with local regulations

NATIONAL REGULATIONS INDIA
Transport in accordance with the Central Motor Vehicles Rules 1989.

NATIONAL REGULATIONS INDONESIA
Transport in accordance with all government regulations including "Regulation of the Minister of Health No 453/Men Kes/PER/XI/1983

NATIONAL REGULATIONS KOREA
Land transport should comply with the Ministerial Decree of Toxic Chemicals Control Law and the Regulations Regarding the Fire Fighting Technologies Standards as applicable

NATIONAL REGULATIONS, MALAYSIA
There are no regulations specifically governing the transport of chemicals. Use best practice.

NATIONAL REGULATIONS, PHILIPPINES
Transport in accordance with the following legislation (as applicable): Presidential Decree No. 1185, 1977 ("Fire Code of the Philippines") and implementing rules and regulations; Presidential Decree No. 856, 1975 ("Code of Sanitation"); Republic Act No 6969, 1990 (Toxic Substances and Hazardous and Nuclear Wastes Control Act") and implementing rules and regulations

NATIONAL REGULATIONS SINGAPORE

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT204

Land Transport complies with the Environmental Pollution Control (Hazardous Substances) Regulations 1999 which follows the 'Specification for Caution Labeling for Hazardous Substances' - Singapore Standard 285 (1984).

NATIONAL REGULATIONS, THAILAND
The product should be transported in accordance with 'Hazardous Substances Acts B.E 2535', 'Notification of Ministry of Public Health Re: Label and Level of Toxicity of Dangerous Articles Which are Under the Responsibility of Food and Drug Administration 2534 (If applicable)' and 'Notification of Land Transportation Department, Subject: Label of truck which contain hazardous materia. Notification date: 14 November B.E 2543 (14 November 2000)'.

AIR TRANSPORT (ICAO/IATA)

Proper Shipping Name	SODIUM HYDROXIDE SOLUTION
UN/ID No	UN 1824
Hazard Class - Primary	8
Packing Group	III
IATA Cargo Packing Instructions	812
IATA Cargo Aircraft Limit	60 L
IATA Passenger Packing Instructions	Y819 / 819
IATA Passenger Aircraft Limit	1 L / 5 L

MARINE TRANSPORT (IMDG/IMO)

Proper Shipping Name	SODIUM HYDROXIDE SOLUTION
UN/ID No	UN 1824
Hazard Class - Primary	8
Packing Group	III
EmS-No	F-A, S-B

15. REGULATORY INFORMATION

NATIONAL REGULATIONS, EUROPE AND MALAYSIA

European:

HAZARD SYMBOLS

CLASSIFICATION: CORROSIVE / C

Contains: Sodium Hydroxide

RISK PHRASES

R34 Causes burns

Malaysian:

HAZARD SYMBOLS

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT

3D TRASAR® 3DT204

CLASSIFICATION. CORROSIVE / C

Contains: Sodium Hydroxide

RISK PHRASES

R34 Causes burns

SAFETY PHRASES

S24/25 Avoid contact with skin and eyes
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S36/37/39 Wear suitable protective clothing, gloves and eye/face protection
S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)

INTERNATIONAL REGULATIONS :

NFPA RATING
HEALTH 3 FLAMMABILITY 1 INSTABILITY : 0 OTHER -
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme

INTERNATIONAL CHEMICAL CONTROL LAWS :

TOXIC SUBSTANCES CONTROL ACT (TSCA)
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710).

EUROPE
The substance(s) in this preparation are included in or exempted from the EINECS or ELINCS inventories.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)
This product contains substance(s) which are found on the Non-Domestic Substances List (NDSL), or are not in compliance with the Canadian Environmental Protection Act (CEPA) and may require additional review.

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL).

CHINA
All substances in this product comply with the Chemical Control Law and are listed on the Inventory of Existing Chemical Substances China (IECSC).

16. OTHER INFORMATION

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures

should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

ADDRESSES AND CONTACT POINTS:

NALCO INDUSTRIAL SERVICES (SUZHOU) CO LTD: 88 Ta Yuan Road, Suzhou New Development Zone, Jiangsu 215011 PRC Contact: Sam Chen, 86-512-68255001

NALCO INDIA LIMITED: 20/A Park St, Calcutta 700016 India

PT NALCO INDONESIA: Jl. Pahlawan, Desa Karang Asem Timur, Citeureup, Bogor, Indonesia

NALCO KOREA LIMITED: 11th Fl, 63BLDG, 60, Yoido-dong Young Deung Po-Gu, Seoul, Korea

NALCO INDUSTRIAL SERVICES MALAYSIA SDN BHD: No 1, Jalan Jururancang U1/21, Seksyen U1, Hicom-Glenmarie Industrial Park, 40150 Shah Alam, Selangor Darul Ehsan, Malaysia

NALCO PHILIPPINES INC: Barrio Real, Calamba, Laguna, Philippines

NALCO PACIFIC PTE LTD: 21 Gul Lane, Jurong Town, Singapore 629416

NALCO INDUSTRIAL SERVICES (THAILAND) CO LTD: Rayong Plant, 109/19 M00 4, Eastern Seaboard Industrial Estate, Soi ESIE 6, T. Pluakdaeng, A. Pluakdaeng Rayong 21140 Thailand

EMERGENCY TELEPHONE NUMBER(S):

CHINA:	**512-68255001**
KOREA:	**02-789-6961**
INDIA:	**0-33-6740395**
INDONESIA:	**62-21-8753175**
MALAYSIA:	**603-5569 4118**
THE PHILIPPINES:	**63-49-5451550**
SINGAPORE:	**65-6861-4011**
THAILAND:	**38-955-160**

Prepared By Nalco Asia Pacific, Safety, Health and Environment (SHE) Specialist
Date issued: 11-Aug-05
Replaces: -

Product Bulletin

3D TRASAR® 3DTBR06

BioReporter 0.6% Liquid
Reagent for Microbio Control in Cooling Water

PRODUCT DESCRIPTION AND APPLICATION

3DTBR06 is a proprietary reagent used to monitor the microbiological health of the cooling water system, including both planktonic and sessile bacteria. The "health" of a cooling water system, determined automatically with the use of **3DTBR06**, is then reported back to the central 3D TRASAR 5000 unit that analyzes and interprets the information. The 3D TRASAR 5000 controller will subsequently provide an automated, demand-based biocide response for optimized control of microbial activity in an open recirculating water system.

3DTBR06 is used in conjunction with the "intelligent" sensors of 3D TRASAR 5000 that read and interpret live data and, using proprietary algorithms, provide for real-time response in a fully automated fashion.

The greatest benefit of **3DTBR06** is that it **directly** monitors the total health of the system, not just planktonic populations or the amount of biocide in the system. Use of the 3D TRASAR 5000 technology will enable biocide feed on demand. More is fed during peak microbiological activity and less is fed when microbiological activity is low. It responds to a wide spectrum of microbes. This means microbial activity is treated before it forms biofilm deposits (in existing clean systems). In systems with biofilm accumulation, 3D TRASAR Microbio Control should be used together with a biodetergent to improve and track biofilm remediation, as part of cooling water control best practices. **3DTBR06** will respond immediately (within minutes) to stresses such as open deadlegs or process contamination. Use of **3DTBR06** will contribute to reduced corrosion, reduced phosphate reversion, and reduced environmental impact.

PHYSICAL & CHEMICAL PROPERTIES

Refer to SECTION 9 of the Material Safety Data Sheet (MSDS) for the most current data. These properties are typical.

Form	Liquid
Appearance	Dark blue, Opaque
Specific Gravity @ 21°C (70°F)	1.00
Solubility in Water	Complete
VOC Content	0.00%
Odor	None

ACTIVE CONSTITUENTS

Active	Function
BioReporter	Monitor microbial activity

REGULATORY APPROVALS

3DTBR06 is not a biocide and, therefore, is not regulated by the U.S. EPA under The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). Refer to the Material Safety Data Sheet (MSDS), SECTION 15 for the most recent information on approvals.

MATERIALS OF COMPATIBILITY

Compatible*	Not Compatible*
304 Stainless Steel (RCC® 9014)	Neoprene O-rings
Brass	
Viton O-rings	
Buna-N O-rings	
Polyurethane O-rings	
Hypalon O-rings	
EPDM O-rings	
Polyethylene piping (rigid)	
Polypropylene piping (rigid)	
CPVC piping (rigid)	
Coated steel drum (phenolic, RCC® 635)	
PORTA-FEED® Liner (RCC® 9036)	
Blue Plastic Drum (HDPE, RCC® 625)	
Plaslite 4300 Liner (vinyl ester resin)	
Plaslite 7122 Liner (epoxy phenolic)	

*The material compatible test data are from the formulation without EDTA.

DOSAGE AND FEEDING

PRODUCT PACKAGING

Package Code	Description	Weights
11	5 Gal Pail	42 lbs

PRODUCT FEEDING & DOSAGE

3DTBR06 is suitable for small cooling water systems (< 12,000 gallons). For larger systems (>12,000 gallons), solid BioReporter (3DTBR8, 3DTBR20, and 3DTBR40) are strongly recommended.

BioReporter	Cooling Tower System Size (Gallons)	Not Exceed (Gallons)
3DTBR06 (0.6% active)	< 12,000	30,000
3DTBR8 (8% active)	12,000 - 30,000	60,000
3DTBR20 (20% active)	30,000 - 60,000	250,000
3DTBR40 (40% active)	>60,000	N/A

Initial Start-Up

When starting up 3D TRASAR BioIndex control, wait until the total residual oxidant in the system is less than 0.1 ppm as measured by the Hach DPD test. The Bioreporter should be fed into a well-mixed region of the recirculating water, distant from the feed point of the halogen. The Bioreporter should not be introduced into the system shortly before the 3D TRASAR fluorometer. The 3D TRASAR controller will bring the BioReporter concentration to setpoint (initial setpoint should be higher than 20 ppb) automatically on startup.

Subsequent (On-Going) Maintenance
After the initial dose, 3D TRASAR will control the BioReporter pump so as to discharge the appropriate amount into the system to maintain the setpoint. Normally, the active level in the system is kept at 20 ppb and the control is completely automated.

Pump Selection
For system sizes, **1000-3000 gal**, the recommendation is to use the Grundfos pump, part number 6008506.
For system sizes, **3000-12000 gal**, the recommendation is to use the Iwaki pump, part number 141-PJ4035.88.

ENVIRONMENTAL AND TOXICITY DATA

Refer to the Material Safety Data Sheet (MSDS), SECTIONS 11 and 12, for the most current data.

SAFETY AND HANDLING

Handling: Do not get in eyes, on skin, or on clothing. Do not take internally. Since 3DTBR06 is a strong dye, be careful on the disposal.
Refer to the Material Safety Data Sheet (MSDS), SECTIONS 3 and 8, for the most current data.

STORAGE

The recommended storage limit for 3DTBR06 is six months. Refer to the Material Safety Data Sheet (MSDS), SECTION 7, for the most current data.

REMARKS

If you need assistance or more information on this product, please call your nearest Nalco Representative.
For more news about Nalco Company, visit our website at www.nalco.com.

For **Medical and Transportation Emergencies** involving Nalco products, please see the Material Safety Data Sheet for the phone number.

ADDITIONAL INFORMATION

3D TRASAR, TRASAR, Nalco and the Logo are registered trademarks of Nalco Company (4-22-2009)

Nalco Pacific PTE. LTD * 31 Bull Lane * Jurong Town * Singapore 2263

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SAFETY DATA SHEET

PRODUCT
3D TRASAR® 3DTBR06

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME	3D TRASAR® 3DTBR06
OTHER MEANS OF IDENTIFICATION	Not applicable
RECOMMENDED USE AND RESTRICTIONS	DIAGNOSTIC TRACER CHEMICAL. Refer to available product literature or ask your local Sales Representative for restrictions on use and dose limits.
COMPANY IDENTIFICATION	NALCO JAPAN COMPANY LTD Shinagawa Center Building 10th Floor, 23-17, Takanawa 3-chome, Tokyo, 108-0074 JAPAN TEL: 03-5447-6833 FAX: 03-5447-0860
EMERGENCY TELEPHONE NUMBER(S)	0120-029-686

2. HAZARDS IDENTIFICATION

CLASSIFICATION

Not a dangerous substance according to GHS.

GHS LABEL ELEMENTS

PRECAUTIONARY STATEMENTS

Prevention:
Keep only in original container.
Use personal protective equipment as required.
Wash hands thoroughly after handling.

Response:
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If skin irritation occurs: Get medical advice/ attention.

Storage:
Store in accordance with local regulations.

Disposal:
Dispose of contents/container in accordance with local/regional/national/international regulations.

OTHER HAZARDS
None known

3. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE / PREPARATION :
Preparation

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SAFETY DATA SHEET

PRODUCT
3D TRASAR® 3DTBR06

CHEMICAL NATURE
Soluble salt(s), Water

CHEMICAL NAME	CAS NO	% (w/w)
Nitrilotriacetic acid	Proprietary	<= 0.1

The balance of the substances in this product are not classified as hazardous or are present below hazard cut-off limits

4. FIRST AID MEASURES

INHALATION
Remove to fresh air, treat symptomatically. If symptoms develop, seek medical advice.

SKIN CONTACT
Flush affected area with water. If symptoms develop, seek medical advice.

EYE CONTACT
Flush affected area with water. If symptoms develop, seek medical advice.

INGESTION
DO NOT INDUCE VOMITING. If conscious, washout mouth and give water to drink. If symptoms persist, call a physician.

MOST IMPORTANT SYMPTOMS/ EFFECTS
A review of available data does not identify any symptoms from exposure not previously mentioned.

NOTE TO PHYSICIAN
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
Not expected to burn. Use extinguishing media appropriate for surrounding fire.

UNSUITABLE EXTINGUISHING MEDIA
Not applicable.

FIRE AND EXPLOSION HAZARD
Not flammable or combustible.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS
Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Stop or reduce any leaks if it is safe to do so. Ventilate spill area if possible.

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SAFETY DATA SHEET

PRODUCT
3D TRASAR® 3DTBR06

ENVIRONMENTAL PRECAUTIONS
Do not contaminate surface water.

METHODS FOR CLEANING UP
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Clean contaminated surfaces with water or aqueous cleaning agents. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

7. HANDLING AND STORAGE

PRECAUTIONS FOR SAFE HANDLING
ENGINEERING MEASURES: Do not get in eyes, on skin, on clothing. Do not take internally. Do not breathe vapors/gases/dust. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labeled. VENTILATION: Use with adequate ventilation. PRECAUTIONARY MEASURES: None. SAFE HANDLING: None.

SUITABLE STORAGE CONDITIONS
ENGINEERING MEASURES: None. SUITABLE STORAGE MEASURES: Store in suitable labeled containers. Store the containers tightly closed.

SUITABLE CONSTRUCTION MATERIAL
Stainless Steel 304, Brass, Buna-N, Polyurethane, Polypropylene, Polyethylene, PVC, 100% phenolic resin liner, EPDM, HDPE (high density polyethylene), Epoxy phenolic resin, Chlorosulfonated polyethylene rubber, Fluoroelastomer

UNSUITABLE CONSTRUCTION MATERIAL
Neoprene

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

CONTROL PARAMETERS

OCCUPATIONAL EXPOSURE LIMITS

This product does not contain any substance that has an established exposure limit.

APPROPRIATE ENGINEERING CONTROLS
General ventilation is recommended.

PERSONAL PROTECTION

GENERAL ADVICE
The use and choice of personal protection equipment is related to the hazard of the product, the workplace and the way the product is handled. In general, we recommend as a minimum precaution that safety glasses with side-shields and workclothes protecting arms, legs and body be used. In addition any person visiting an area where this product is handled should at least wear safety glasses with side-shields.

RESPIRATORY PROTECTION
Respiratory protection is not normally needed.

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PRODUCT
3D TRASAR® 3DTBR06

EYE PROTECTION
Wear safety glasses with side-shields.

HAND PROTECTION
Nitrile gloves. PVC gloves. Rubber gloves.

SKIN PROTECTION
Wear standard protective clothing.

HYGIENE RECOMMENDATIONS
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Dark Blue
ODOR	None
ODOR THRESHOLD	No data available.
pH	No data available.
MELTING POINT / FREEZING POINT	No data available.
INITIAL BOILING POINT / BOILING POINT	No data available.
FLASH POINT	Not flammable
EVAPORATION RATE	No data available.
FLAMMABILITY (solid, gas)	No data available.
LOWER EXPLOSION LIMIT	No data available.
UPPER EXPLOSION LIMIT	No data available.
VAPOR PRESSURE	No data available.
VAPOR DENSITY	No data available.
SPECIFIC GRAVITY	1.0 (25.0 °C)
DENSITY	No data available.
SOLUBILITY IN WATER	Complete
OCTANOL/WATER COEFFICIENT (log Kow)	No data available.
AUTOIGNITION TEMPERATURE	No data available.
DECOMPOSITION TEMPERATURE	No data available.
VISCOSITY	No data available.

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY
Stable under normal conditions.

HAZARDOUS REACTIONS
Hazardous polymerization will not occur.

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SAFETY DATA SHEET

PRODUCT
3D TRASAR® 3DTBR06

CONDITIONS TO AVOID
Extremes of temperature

INCOMPATIBLE MATERIALS
None known

HAZARDOUS DECOMPOSITION PRODUCTS
Under fire conditions: None known

11. TOXICOLOGICAL INFORMATION

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE

PRIMARY ROUTES OF EXPOSURE
Eye, Skin

Refer to the sections below for details of health effects via each route.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT AND LONG TERM EXPOSURE

ACUTE TOXICITY DATA
No adverse effects expected.

SKIN CORROSION / IRRITATION
May cause irritation with prolonged contact.

SERIOUS EYE DAMAGE / IRRITATION
May cause irritation with prolonged contact.

RESPIRATORY / SKIN SENSITIZATION
This product is not expected to be a sensitizer.

GERM CELL MUTAGENICITY
Not expected to be a mutagen.

CARCINOGENICITY
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

REPRODUCTIVE TOXICITY
No reproductive toxic effects expected.

SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE
No adverse effects expected.

SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE
No adverse effects expected.

ASPIRATION HAZARD
No aspiration toxicity classification

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SAFETY DATA SHEET

PRODUCT
3D TRASAR® 3DTBR06

NUMERICAL MEASURES OF TOXICITY

ACUTE TOXICITY DATA
No toxicity studies have been conducted on this product.

HUMAN HAZARD CHARACTERIZATION
Based on our hazard characterization, the potential human hazard is: Low

12. ECOLOGICAL INFORMATION

ECOTOXICITY

No toxicity studies have been conducted on this product.

PERSISTENCY AND DEGRADATION
Greater than 95% of this product consists of inorganic substances for which a biodegradation value is not applicable.

MOBILITY
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages:

Air	Water	Soil/Sediment
<5%	30 - 50%	50 - 70%

The portion in water is expected to be soluble or dispersible.

BIOACCUMULATION POTENTIAL
This preparation or material is not expected to bioaccumulate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Low

OTHER INFORMATION
No data available.

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHODS
Dispose of wastes in an approved waste treatment / disposal site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage.

DISPOSAL CONSIDERATIONS
Triple rinse (or equivalent) all containers and offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

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SAFETY DATA SHEET

PRODUCT
3D TRASAR® 3DTBR06

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

INTERNATIONAL REGULATIONS

AIR TRANSPORT (ICAO/IATA)

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

MARINE TRANSPORT (IMDG/IMO)

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Marine Pollutant : No

NATIONAL REGULATIONS, JAPAN

FIRE SERVICE LAW:
Not applicable

POISONOUS AND DELETERIOUS SUBSTANCES CONTROL LAW
Not applicable

Safe delivery practices
Avoid direct sunlight. Periodically check there are no leaks. Ensure all goods on the truck are immobilized to avoid falling, turning over and damage.

15. REGULATORY INFORMATION

NATIONAL REGULATIONS, JAPAN

VESSEL SAFETY LAW JAPAN
Not applicable

AVIATION LAW JAPAN
Not applicable

MARINE POLLUTION PREVENTION LAW
Not applicable

EXPLOSIVE CONTROL LAW
Not applicable

FIRE SERVICE LAW:
Not applicable

POISONOUS AND DELETERIOUS SUBSTANCES CONTROL LAW
Not applicable

HIGH PRESSURE GAS LAW

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SAFETY DATA SHEET

PRODUCT
3D TRASAR® 3DTBR06

Not applicable

POISON LAW AND WASTE DISPOSAL LAW
Not applicable

INDUSTRIAL SAFETY AND HEALTH LAW
The product is classified under the ISHL regulations as follows:

Regulation	Substance
Prohibited Substances	None
Hazardous Substances Subject to Labelling Requirements	None
Mutagens, Existing Chemicals	None
Mutagens, New Chemicals	None
Organic Solvents Class 1	None
Organic Solvents Class 2	None
Organic Solvents Class 3	None
Designated Substances Class 1	None
Designated Substances Class 2	None
Designated Substances Class 3	None
Article 28 Carcinogens	None
Prevention of Lead	None
Prevention of Tetra Alkyl Lead	None
ISHL Article 38-3 Specified Chemical Substances	None
MSDS Table 3-1	None
MSDS Table 9	None
Corrosive liquid Article 326	None

POLLUTANT RELEASE AND TRANSFER REGISTER
This product contains the following Class 1 and Class 2 components:
Class 1: none
Class 2: none

CHEMICAL SUBSTANCES CONTROL LAW (CSCL)
This product contains the following substances listed in the regulation. Additional components may be unintentionally present at trace levels.

Kashin-Hou Law Class 1	: none
Kashin-Hou Law Class 2	: none
Type 2 Monitoring Chemicals (Designated substances)	: Nitrilotriacetic acid
Type 1 Monitoring Chemicals	: none
Type III Monitoring Chemicals	: none

INTERNATIONAL CHEMICAL CONTROL LAWS

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CANADA
The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

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SAFETY DATA SHEET

PRODUCT
3D TRASAR® 3DTBR06

CHINA
This product contains substance(s) which are not in compliance with the Provisions on the Environmental Administration of New Chemical Substances and may require additional review.

EUROPE
The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

KOREA
This product contains substance(s) which are not in compliance with the Toxic Chemical Control Law (TCCL) and may require additional review.

NEW ZEALAND
All substances in this product comply with the Hazardous Substances and New Organisms (HSNO) Act 1996,and are listed on or are exempt from the New Zealand Inventory of Chemicals.

PHILIPPINES
This product contains substance(s) which are not in compliance with the Republic Act 6969 (RA 6969) and may require additional review.

UNITED STATES
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

16. OTHER INFORMATION

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version),
Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

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SAFETY DATA SHEET

PRODUCT
3D TRASAR® 3DTBR06

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH,
(TOMES CPS ™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight™ (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

REVISED INFORMATION: Significant changes to regulatory or health information for this revision is indicated by a bar in the left-hand margin of the SDS.

First issue :	22.10.2010
Date issued :	02.11.2010
Version Number :	1.0
Prepared By:	Nalco Asia Pacific, Safety, Health and Environment (SHE) Specialist

NALCO

Product Bulletin

STA·BR·EX® ST70

Microorganism Control Chemical

PRODUCT DESCRIPTION AND APPLICATION

General Description

Nalco's **STA·BR·EX ST70** is a liquid biocide best described as an aqueous, one-drum, all-bromine stabilized product that is already active and ready to feed. **STA·BR·EX ST70** is used to control bacteria and other organisms in recirculating cooling water, pasteurizers, air washers and other heat transfer systems. It should be considered for use wherever chlorine bleach, chlorine gas, bromine tablets and other chlorine-based products are used.

Program Benefits

STA·BR·EX ST70 is a part of a BIO-MANAGE® service program that helps provide microorganism control and clean systems. BIO-MANAGE is an approach to controlling biological fouling in industrial water systems that emphasizes system surveys, understanding the root cause of microbial growth and biofilm formation, and using an Engineering Approach to develop comprehensive programs for biological control. When an antimicrobial product such as **STA·BR·EX ST70** is used as part of BIO-MANAGE, greater efficacy and efficiency can be gained and this should lead to greater satisfaction for our customers.

STA·BR·EX ST70 is stabilized, which provides the features of stable long-term storage, improved biological deposit penetration, improved compatibility with other treatment chemicals, lower production of disinfection by-product, and low volatility for improved usage. The stabilizer is sulfamate ($H_2NSO_3^-$).

Other Benefits:

- **STA·BR·EX ST70** is a stable liquid bromine biocide in one package for easy dosing and control. Unlike liquid chlorine bleach, it does not lose its activity in a matter of days (see Figure 1). It reduces operator time and makes dosing easy.
- **STA·BR·EX ST70** kills bacteria and helps prevent slime problems. Combined with Nalco services, it helps keep heat exchangers and tower fill clean for low maintenance and cost-efficient operation.

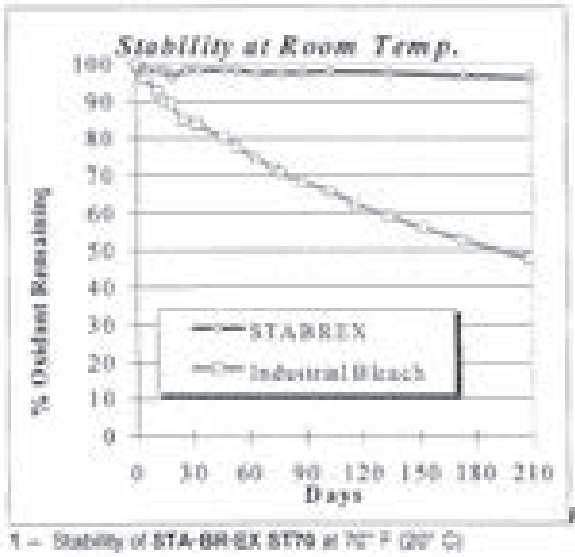

Figure 1 – Stability of **STA·BR·EX ST70** at 70° F (20° C)

- Because **STA-BR-EX ST70** is bromine-based, it will work effectively in systems where chlorine is challenged by amine or ammonia contamination.
- **STA-BR-EX ST70** has low volatility that reduces product loss from the cooling tower. This results in more active product retained in the system to kill microorganisms. Equipment lasts longer because STA-BR-EX significantly reduces vapor-phase corrosion.
- **STA-BR-EX ST70** is packaged and delivered in PORTA-FEED® units. Nalco's delivery specialist does all of the chemical handling. Operators have less chance of exposure and a safer work environment.
- **STA-BR-EX ST70** generates less disinfection by-products as measured by the concentration of Adsorbable Organic Halide (AOX).

PHYSICAL & CHEMICAL PROPERTIES

Refer to SECTION 9 of the MSDS for the most current data. These properties are typical.

Form	Liquid
Color	Clear yellow to amber
Density	11.1 lb/gal [1.34 kg/l]
Specific Gravity @ 77°F [25°C]	1.34
pH (neat)	13.2
Freeze-Thaw Recovery	Complete
Freeze Point	16°F [-9°C]
Viscosity @ 20°F [-7°C]	21 cp
@ 75°F [24°C]	7 cp
Flash Point (PMCC)	> 200°F [93°C]
Odor	No odor, slight bromine odor when added to water

ACTIVE CONSTITUENTS

Sodium Hypochlorite	6.36 % as available chlorine
Sodium Bromide	9.23 % as NaBr

REGULATORY APPROVALS

STA-BR-EX ST70 must be applied according to appropriate national and local regulations.

As with all biocides applied in the United States, **STA-BR-EX ST70** is regulated by the U.S. EPA under The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). It is a violation of federal law to use this product or any biocide in a manner inconsistent with its product label.

U.S. EPA Registration Number 1706-179 is approval for STA-BR-EX ST70 use in:

- Cooling ponds
- Reservoirs
- Decorative fountains
- Heat transfer systems (such as evaporative condensers, hydrostatic sterilizers and retorts, dairy sweetwater systems, and once-through cooling water systems)
- Industrial and commercial recirculating cooling water systems
- Industrial pasteurizers (such as food, beverage and industrial process pasteurizers)
- Air washers
- Pulp and paper mill influent water systems (but note this use is not currently authorized in California)

STA-BR-EX ST70 is not approved for use in potable water, swimming pools or spas.

MATERIALS OF COMPATIBILITY

The following Materials of Compatibility information is available for the neat product exposed to containers, pumps, and feed lines:

Compatible	Not Compatible
Titanium	Brass
Vinyl	Carbon Steel
Polyethylene	Stainless Steel 304
Polypropylene	Stainless Steel 316
PVC	Buna-N
Hypalon	Aluminum
Viton	EPDM
Teflon	Plaste 9570
Kynar	Silicone
Chlorobutyl Rubber	
Derakane 411-45	
Derakane 470-36	
Polyurethane	
Neoprene	

Note: Do not use any metals except titanium on any parts that come in direct contact with product in its neat form.

DOSAGE AND FEEDING

The specific dosage of **STA-BR-EX ST70** will vary depending on the characteristics of your system and the BIO-MANAGE objective for your microbio control program. Typically, a dose of 0.5 to 2.0 ppm total residual halogen as chlorine is effective. However, the effective dose can range from a detectable total residual of 0.05 ppm up to 4.0 ppm as chlorine, the US EPA application maximum.

ENVIRONMENTAL AND TOXICITY DATA

Biological Oxygen Demand (5-day BOD_5) Not Applicable
Chemical Oxygen Demand (COD) Not Applicable
Total Organic Carbon (TOC) Not Applicable
Refer to MSDS, SECTIONS 11 and 12, for all mammalian and aquatic information.

If fed beyond the product label recommendations, this product may be toxic to fish. Do not discharge into lakes, streams, waterways, ponds or public waters unless in accordance with an NPDES permit. For guidance, contact your Nalco representative, your regional office of the EPA, or your local Environmental authority.

SAFETY AND HANDLING

Read and follow the label and MSDS for complete handling information before using this product.

STORAGE

STA-BR-EX ST70 has a freeze point of 15°F (-9°C) and should be stored appropriately. Recommended in-plant storage is six months.

REMARKS

If you need assistance or more information on this product, please call your nearest Nalco Representative. For more news about Nalco Company, visit our website at www.nalco.com.

For **Medical and Transportation Emergencies** involving Nalco products, please see the Material Safety Data Sheet for the phone number.

ADDITIONAL INFORMATION

PORTA-FEED, BIO-MANAGE, STA-BR-EX and NALCO are registered trademarks of Ondeo Nalco Company. (9-03)

Nalco Pacific PTE. LTD. * 21 Old Lane * Jurong Town * Singapore 2263

Subsidiaries and Affiliates in Principal Locations Around the World

NALCO

SAFETY DATA SHEET

PRODUCT

STABREX® ST70

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : **STABREX® ST70**

APPLICATION : MICROORGANISM CONTROL CHEMICAL

COMPANY IDENTIFICATION :

CHINA :	NALCO INDUSTRIAL SERVICES (SUZHOU) CO LTD	TEL:	86-512-68255001	FAX:	86-512-68255130
INDIA :	NLC NALCO INDIA LIMITED	TEL:	9133 2874 0398	FAX:	91-33-22296858
INDONESIA :	PT. NALCO INDONESIA	TEL:	62-21-8753175	FAX:	62-21-8753187
MALAYSIA :	NALCO INDUSTRIAL SERVICES MALAYSIA SDN BHD	TEL:	603-5569 4118	FAX:	603-5569 5955
PHILIPPINES :	NALCO PHILIPPINES INC.	TEL:	63-49-5451050	FAX:	63-49-5453442
SINGAPORE :	NALCO PACIFIC PTE LTD	TEL:	65- 6505-6868	FAX:	65-6862 0850
THAILAND :	NALCO INDUSTRIAL SERVICES (THAILAND) CO LTD	TEL:	66-38-955-150	FAX:	66-38-955-156

Date issued : 29.10.2009
Version Number : 1.3

See Section 16 for address information.

EMERGENCY TELEPHONE NUMBER(S) : For local telephone numbers, refer to Section 16.
International Emergency Number: + 65 6542 9595

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

CHEMICAL NAME	CAS NO	% (w/w)
Sodium Hypochlorite	7681-52-9	5 - 10
Sodium Hydroxide	1310-73-2	1 - 5

The balance of the substances in this product are not classified as hazardous or are present below hazard cut-off limits

3. HAZARDS IDENTIFICATION

HUMAN HEALTH HAZARDS - ACUTE

EYE CONTACT
Corrosive. Will cause eye burns and permanent tissue damage.

SKIN CONTACT
Causes skin burns. May cause severe irritation or tissue damage depending on the length of exposure and the type of first aid administered.

INGESTION
Corrosive, causes burns to gastro-intestinal tract. Nausea, vomiting and stomach pain may occur. In severe cases blood may be vomited.

INHALATION
Corrosive to respiratory system.

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SAFETY DATA SHEET

PRODUCT

STABREX® ST70

HUMAN HEALTH HAZARDS - CHRONIC :
No adverse effects expected other than those mentioned above.

ENVIRONMENTAL HAZARDS :
This product may pose a risk to the aquatic ecosystem if released.

PHYSICAL AND CHEMICAL HAZARDS :
Contact with acids liberates toxic gas.

4. FIRST AID MEASURES

EYE CONTACT :
PROMPT ACTION IS ESSENTIAL IN CASE OF CONTACT. Immediately flush eye with water for at least 15 minutes while holding eyelids open. If only one eye is affected be sure to use care not to contaminate the other eye with the run-off. Get immediate medical attention.

SKIN CONTACT :
PROMPT ACTION IS ESSENTIAL IN CASE OF CONTACT. Immediately flush with plenty of water for at least 15 minutes. For a large splash, flood body under a shower. Remove contaminated clothing. Wash off affected area immediately with plenty of water. Get immediate medical attention. Contaminated clothing, shoes, and leather goods must be discarded or cleaned before re-use.

INGESTION :
Get immediate medical attention. DO NOT INDUCE VOMITING. Do not give anything to drink.

INHALATION :
Remove to fresh air, treat symptomatically. If symptoms develop, seek medical advice.

NOTE TO PHYSICIAN :
Probable mucosal damage may contraindicate the use of gastric lavage. Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT : Not flammable

EXTINGUISHING MEDIA :
Not expected to burn. Use extinguishing media appropriate for surrounding fire.

FIRE AND EXPLOSION HAZARD :
May evolve hydrogen bromide and bromine under fire conditions. May evolve HCl under fire conditions. May evolve chlorine under fire conditions. May evolve oxides of nitrogen (NOx) and sulfur (SOx) under fire conditions. Contact with reactive metals (e.g. aluminum) may result in the generation of flammable hydrogen gas.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

SENSITIVITY TO STATIC DISCHARGE :
Not expected to be sensitive to static discharge.

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SAFETY DATA SHEET

PRODUCT

STABREX® ST70

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Ensure clean-up is conducted by trained personnel only. Do not touch spilled material. Stop or reduce any leaks if it is safe to do so. Ventilate spill area if possible. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Notify appropriate government, occupational health and safety and environmental authorities.

METHODS FOR CLEANING UP :
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Clean contaminated surfaces with water or aqueous cleaning agents. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations). Do not clean up spills with sawdust, cotton waste or other combustible absorbent materials.

ENVIRONMENTAL PRECAUTIONS :
This product is toxic to fish and other water organisms. Do not discharge directly into lakes, ponds, streams, waterways or public water supplies. If drains, streams, soil or sewers become contaminated, notify local authority.

7. HANDLING AND STORAGE

HANDLING :
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Avoid generating aerosols and mists. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available.

STORAGE CONDITIONS :
Store upright. Containers require venting bungs to avoid over pressure. Store the containers tightly closed. Store separately from acids. Store in a cool well ventilated area away from direct sunlight.

SUITABLE CONSTRUCTION MATERIAL :
Polyethylene, Polypropylene. Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use., HDPE (high density polyethylene), Neoprene, PVC, Polyurethane, Hypalon, Viton

UNSUITABLE CONSTRUCTION MATERIAL :
Brass, Buna-N, EPDM, Stainless Steel 316L, Stainless Steel 304, Mild steel, 100% phenolic resin liner, Epoxy phenolic resin

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

Country/Source	Substance(s)	Category	ppm	mg/m3
CHINA	Sodium Hydroxide	MAC		2

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HONG KONG	Sodium Hydroxide	CEILING	2
INDIA	Sodium Hydroxide	CEILING	2
INDONESIA	Sodium Hydroxide	Ceiling	2
JAPAN	Sodium Hydroxide	CEILING	2
MALAYSIA	Sodium Hydroxide	CEILING	2
PHILIPPINES	Sodium Hydroxide	TWA	2
SINGAPORE	Sodium Hydroxide	STEL	2
THAILAND	Sodium Hydroxide	TWA	2
USA	Sodium Hydroxide	ACGIH Ceiling OSHA Z1 PEL	2 2

* A skin notation refers to the potential significant contribution to overall exposure by the cutaneous route, including mucous membranes and the eyes.

MONITORING MEASURES :
A small volume of air is drawn through an absorbant or barrier to trap the substance(s) which can then be desorbed or removed and analyzed as referenced below:

Substance(s)	Method	Analysis	Absorbant
Sodium Hydroxide	US NIOSH 7401	Titration	PTFE filter

ENGINEERING MEASURES :
General ventilation is recommended. Use local exhaust ventilation if necessary to control airborne mist and vapor.

PERSONAL PROTECTION

GENERAL ADVICE :
The use and choice of personal protection equipment is related to the hazard of the product, the workplace and the way the product is handled. In general, we recommend as a minimum precaution that safety glasses with side-shields and workclothes protecting arms, legs and body be used. In addition any person visiting an area where this product is handled should at least wear safety glasses with side-shields.

RESPIRATORY PROTECTION :
If significant mists, vapors or aerosols are generated an approved respirator is recommended. Consider the use of filter type: inorganic vapor cartridge with a Particulate pre-filter. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION :
Neoprene Nitrile Natural rubber PVC Gloves should be replaced immediately if signs of degradation are observed. Breakthrough time not determined as preparation, consult PPE manufacturers.

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SKIN PROTECTION :
Wear chemical resistant apron, chemical splash goggles, impervious gloves and boots. A full slicker suit is recommended if gross exposure is possible.

EYE PROTECTION :
Wear a face shield with chemical splash goggles.

HYGIENE RECOMMENDATIONS :
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Clear Light yellow
ODOR	None
pH (100.0 %)	13.0
VAPOR PRESSURE	No data available.
VAPOR DENSITY	No data available.
SPECIFIC GRAVITY	1.32 - 1.36 (25.0 °C)
DENSITY	No data available.
SOLUBILITY IN WATER	Complete
FREEZING POINT	-6.2 °C
BOILING POINT	No data available.
FLASH POINT	Not flammable
LOWER EXPLOSION LIMIT	No data available.
UPPER EXPLOSION LIMIT	No data available.
AUTOIGNITION TEMPERATURE	No data available.

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
Extremes of temperature. Heat and light which can accelerate decomposition. Freezing temperatures.

MATERIALS TO AVOID :
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors. Contact with strong acids (e.g. sulfuric, phosphoric, nitric, hydrochloric, chromic, sulfonic) may generate heat, spattering or boiling and toxic vapors. Contact with organic materials (e.g. rags, sawdust, hydrocarbon oils or solvents) and avoid reducing agents (e.g. hydrazine, sulfites, sulfide, aluminum or magnesium dust) which can generate heat, fires, explosions and the release of toxic fumes. Do not mix with any sodium hypochlorite or bleach product. Resulting mixture will result

in a violent exothermic reaction releasing large amounts of nitrogen gas and liquid sulfuric acid. Contact with reactive metals (e.g. aluminum) may result in the generation of flammable hydrogen gas.

HAZARDOUS DECOMPOSITION PRODUCTS :
Under fire conditions: Chlorine gas, HCl, Bromine, Hydrogen bromide, Oxides of nitrogen, Oxides of sulfur

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY DATA :
No toxicity studies have been conducted on this product.

SENSITIZATION :
This product is not expected to be a sensitizer.

CARCINOGENICITY :
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

For additional information on the hazard of the preparation, please consult section 2 and 12.

HUMAN HAZARD CHARACTERIZATION :
Based on our hazard characterization, the potential human hazard is: High

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :
The following results are for the product.

ACUTE FISH RESULTS :

Species	Exposure	LC50	Test Descriptor
Rainbow Trout	96 hrs	4.5 mg/l	Product
Fathead Minnow	96 hrs	8.3 mg/l	Product
Sheepshead Minnow	96 hrs	16 mg/l	Product

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	LC50	EC50	Test Descriptor
Daphnia magna	48 hrs	4.3 mg/l	4.2 mg/l	Product
Ceriodaphnia dubia	48 hrs	1.6 mg/l		Product
Mysid Shrimp (Mysidopsis bahia)	96 hrs	27 mg/l		Product

AQUATIC PLANT RESULTS :

Species	Exposure	EC50/LC50	NOEC	Test Descriptor
Green Algae (Pseudokirchneriella subcapitata, previously Selenastrum capricornutum)	72 hrs	3.66 mg/l	2.5 mg/l	Product

CHRONIC FISH RESULTS :

Species	Exposure	EC25 / IC25	LOEC	Test Descriptor
Fathead Minnow	7 Days	3.34 mg/l	5 mg/l	Product

CHRONIC INVERTEBRATE RESULTS :

Species	Test Type	EC25 / IC25	End Point	Test Descriptor
Ceriodaphnia dubia	3 Brood	15.6 mg/l	Reproduction	Product

ADDITIONAL ECOLOGICAL DATA
AOX information: Product contains no organic halogens.

MOBILITY AND BIOACCUMULATION POTENTIAL :
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages:

Air	Water	Soil/Sediment
<5%	30 - 50%	30 - 50%

The portion in water is expected to be soluble or dispersible.

This preparation or material is not expected to bioaccumulate.

ENVIRONMENTAL HAZARD CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Moderate

13. DISPOSAL CONSIDERATIONS

Hazardous wastes must be transported by a licensed hazardous waste transporter and disposed of or treated in a properly licensed hazardous waste treatment, storage, disposal or recycling facility. Consult local, state, and federal regulations for specific requirements.

Empty drums should be taken for recycling, recovery, or disposal through a suitably qualified or licensed contractor.

NATIONAL REGULATIONS, CHINA
Comply with local regulations.

NATIONAL REGULATIONS, INDIA
Dispose of unused product in accordance with the "Hazardous Wastes (Management and Handling) Rules 1989" and local and State legislation, as applicable.

NATIONAL REGULATIONS, INDONESIA
Dispose of unused product in accordance with "Government Regulation No 85/1999 on Amendment of Government Regulation No. 18/1999 regarding Hazardous and Toxic Waste Management", which also replaces Government Regulation No. 19/1994 and No.12/1995, (and amendments) as applicable.

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NATIONAL REGULATIONS, MALAYSIA
Dispose of in accordance with the Environmental Quality (Scheduled Wastes) Regulation 1989 and other guidelines issued by DOE and/or local authorities.

NATIONAL REGULATIONS, PHILIPPINES
Dispose of in accordance with Presidential Decree No. 984-1976 ("The Pollution Control Law"); DENR Department Administrative Order No.29-92 ("The Implementing Rules or Regulations of RA6969") and Presidential Decree No.825.

NATIONAL REGULATIONS, SINGAPORE
Dispose of waste in accordance with the Environmental Health Act (Chapter 95, Rg 11), Environmental Public Health (Toxic Industrial Waste) Regulations 1990 Ed.

NATIONAL REGULATIONS, THAILAND
Dispose of hazardous waste in accordance with the " The Notification of the Ministry of Industry B.E. 2548, subject : Disposal of Wastes or Unusable Materials".

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT

Proper Shipping Name :	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.
Technical Name(s) :	Sodium Hydroxide, Sodium Hypochlorite
UN/ID No :	UN 3266
Hazard Class - Primary :	8
Packing Group :	II
HAZCHEM CODE :	2X

NATIONAL REGULATIONS, CHINA
Comply with local regulations.

NATIONAL REGULATIONS, INDIA
Transport in accordance with the Central Motor Vehicles Rules 1989.

NATIONAL REGULATIONS, INDONESIA
Transport in accordance with all government regulations, including "Regulation of the Minister of Transportation No. 69/1993 on Land Transportation".

NATIONAL REGULATIONS, MALAYSIA
There are no regulations specifically governing the transport of chemicals. Use best practice.

NATIONAL REGULATIONS, PHILIPPINES
Transport in accordance with the following legislation (as applicable): Presidential Decree No. 1185, 1977 ("Fire Code of the Philippines") and implementing rules and regulations; Presidential Decree No. 856, 1975 ("Code of Sanitation"); Republic Act No 6969, 1990 ("Toxic Substances and Hazardous and Nuclear Wastes Control Act") and implementing rules and regulations.

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NATIONAL REGULATIONS, SINGAPORE
Land Transport complies with the Environmental Pollution Control (Hazardous Substances) Regulations 1999, which follows the "Specification for Caution Labelling for Hazardous Substances" - Singapore Standard 286 (1984).

NATIONAL REGULATIONS, THAILAND
The product should be transported in accordance with "Hazardous Substances Acts B.E.2535", "Notification of Ministry of Public Health Re: Label and Level of Toxicity of Dangerous Articles Which are Under the Responsibility of Food and Drug Administration 2534 (If applicable)" and "Notification of Land Transportation Department, Subject : Label of truck which contain hazardous material, Notification date : 14 November B.E.2543 (14 November 2000)".

AIR TRANSPORT (ICAO/IATA)

Proper Shipping Name :	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.
Technical Name(s) :	Sodium Hydroxide, Sodium Hypochlorite
UN/ID No :	UN 3266
Hazard Class - Primary :	8
Packing Group :	II
IATA Cargo Packing Instructions :	812
IATA Cargo Aircraft Limit :	30 L (Max net quantity per package)
IATA Passenger Packing Instructions :	Y808 / 808
IATA Passenger Aircraft Limit :	0.5 L / 1 L

MARINE TRANSPORT (IMDG/IMO)

Proper Shipping Name :	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.
Technical Name(s) :	Sodium Hydroxide, Sodium Hypochlorite
UN/ID No :	UN 3266
Hazard Class - Primary :	8
Packing Group :	II
EmS-Nr. :	F-A, S-B

15. REGULATORY INFORMATION

NATIONAL REGULATIONS EUROPE :

HAZARD SYMBOLS

CORROSIVE

Contains: Sodium Hydroxide Sodium Hypochlorite

RISK PHRASES
R31 - Contact with acids liberates toxic gas.

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STABREX® ST70

R34 - Causes burns.

NATIONAL REGULATIONS, MALAYSIA :

HAZARD SYMBOLS

CORROSIVE

Contains:..Sodium Hydroxide Sodium Hypochlorite

RISK PHRASES
R31 - Contact with acids liberates toxic gas.
R34 - Causes burns.

SAFETY PHRASES
S24/25 - Avoid contact with skin and eyes.
S26 - In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36/37/39 - Wear suitable protective clothing, gloves and eye/face protection.
S45 - In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

INTERNATIONAL REGULATIONS

NFPA RATING

HEALTH :	3	FLAMMABILITY :	0	INSTABILITY :	0	OTHER :

0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme

INTERNATIONAL CHEMICAL CONTROL LAWS

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

UNITED STATES :
This product is exempted under TSCA and regulated under FIFRA. The inerts are on the Inventory List.

CANADA :
Substances regulated under the Pest Control Products Act are exempt from CEPA New Substance Notification requirements.

EUROPE
The substance(s) in this preparation are included in or exempted from the EINECS or ELINCS inventories.

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JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on the Inventory of Existing Chemical Substances China (IECSC).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL).

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

NEW ZEALAND
All substances in this product comply with the Hazardous Substances and New Organisms (HSNO) Act 1996,and are listed on or are exempt from the New Zealand Inventory of Chemicals.

16. OTHER INFORMATION

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

NALCO INDUSTRIAL SERVICES (SUZHOU) CO LTD; 88 Ta Yuan Road, Suzhou New Development Zone, Jiangsu 215011 PRC

NLC NALCO INDIA LIMITED; 20/A Park St, Culcutta 700016 India

PT. NALCO INDONESIA; Jl. Pahlawan, Desa Karang Asem Timur, Citeureup, Bogor, Indonesia

NALCO INDUSTRIAL SERVICES MALAYSIA SDN BHD; No 1, Jalan Jururancang U1/21, Seksyen U1, Hicom-Glenmarie Industrial Park, 40150 Shah Alam, Selangor Darul Ehsan, Malaysia

NALCO PHILIPPINES INC ; Barrio Real, Calamba, Laguna, Philippines

NALCO PACIFIC PTE LTD; 21 Gul Lane, Singapore 629416

NALCO INDUSTRIAL SERVICES (THAILAND) CO LTD; Rayong Plant, 109/19 M00 4, Eastern Seaboard Industrial Estate, Soi ESIE 6, T. Pluakdaeng, A. Pluakdaeng Rayong 21140 Thailand

EMERGENCY TELEPHONE NUMBER(S) :

CHINA :	**00800253787747 and 0065 6542 9595**
INDIA :	**+65 6542 9596**
INDONESIA :	**+65 6542 9595**
MALAYSIA :	**03 5569 4054**

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PRODUCT

STABREX® ST70

PHILIPPINES :	1800 10 8421250
SINGAPORE :	6542 9595
THAILAND :	02-104-0545

REVISED INFORMATION: Significant changes to regulatory or health information for this revision is indicated by a bar in the left-hand margin of the SDS.

Prepared By: Nalco Asia Pacific, Safety, Health and Environment (SHE) Specialist

NALCO® 7330

Cooling Water Treatment Biocide

NALCO

Product Bulletin

PRODUCT DESCRIPTION AND APPLICATION

NALCO 7330 is a broad-spectrum, non-oxidizing biocide approved for use in recirculating cooling towers, closed loop cooling systems, air washers and brewery pasteurizers.

PHYSICAL & CHEMICAL PROPERTIES

These properties are typical. Refer to the Material Safety Data Sheet (MSDS), SECTION 9, for the most current data.

Form:	Liquid
Color:	Pale Yellow to Green
Odor:	Mild
Solubility in Water:	Complete
Density:	8.6 lb/gal
Specific Gravity:	1.03
pH (Neat):	3.0-5.0
Freeze-Thaw Recovery:	Complete
Freeze Point:	-4°C (25°F)
Flash Point (PMCC):	None (TCC)

ACTIVE CONSTITUENTS

Component	Function
5-chloro-2-methyl-4-isothiazolin-3-one	Biocide
2-methyl-4-isothiazolin-3-one	Biocide

REGULATORY APPROVALS

NALCO 7330 must be applied according to appropriate national and local regulations.

NALCO 7330 is registered for use in the United States. As with all biocides applied in the United States, **NALCO 7330** is regulated by the U.S. EPA under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). It is a violation of federal law to use this product or any biocide in a manner inconsistent with its product label.

MATERIALS OF COMPATIBILITY

Compatible	Not Compatible
Buna-N	Aluminum
Hypalon	Brass
Plaslte 4005	Carbon Steel
Polyethylene	Neoprene
Polyvinyl chloride (PVC)	Nickel
Stainless Steel 316L	Plaslte 6000
Teflon	Plaslte 7122
Vinyl Tubing	Stainless Steel 304

DOSAGE AND FEEDING

NALCO 7330 should be fed via a closed feed system (a closed feed system being defined as a system in which fluid is moved from a closed storage vessel into a treated media without exposure to the atmosphere). For complete dosage and feeding recommendations, consult your Nalco representative.

ENVIRONMENTAL AND TOXICITY DATA

Biological Oxygen Demand (5-day BOD_5)	Not Available
Chemical Oxygen Demand (COD)	20,000 ppm
Total Organic Carbon (TOC)	7,850 ppm

Refer to SECTIONS 11 and 12 of the Material Safety Data Sheet for all available mammalian and aquatic toxicity information.

SAFETY AND HANDLING

NALCO 7330 is a **CORROSIVE MATERIAL** that may cause allergic skin reactions. All precautions described in SECTION 4 of the Material Safety Data Sheet must be strictly followed when handling **NALCO 7330**.

STORAGE

The recommended in-plant storage limit for **NALCO 7330** is six months.

REMARKS

If you need assistance or more information on this product, please call your nearest Nalco Representative. For more news about Nalco Company, visit our website at www.nalco.com.

For **Medical and Transportation Emergencies** involving Nalco products, please see the Material Safety Data Sheet for the phone number.

ADDITIONAL INFORMATION

NALCO is a registered trademark of Nalco Company (7/16/04)

Nalco Pacific Pte Ltd 2 International Business Park • #02-20 The Strategy Tower 2 • Singapore 609930

MATERIAL SAFETY DATA SHEET

PRODUCT

NALCO 7330

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : NALCO 7330

APPLICATION : BIOCIDE

Date issued : 02/12/2004

COMPANY IDENTIFICATION

CHINA:	NALCO INDUSTRIAL SERVICES (SUZHOU) CO. LTD	TEL: 86-512-68256001	FAX: 86-512-68256130
INDIA:	NALCO INDIA LIMITED	TEL: 91-33-22172066	FAX: 91-33-22296858
INDONESIA:	PT NALCO INDONESIA	TEL: 62-21-8753175	FAX: 62-21-8753187
KOREA:	NALCO KOREA LIMITED	TEL: 82-2-789-6961	FAX: 82-2-786-3143
MALAYSIA:	NALCO INDUSTRIAL SERVICES MALAYSIA SDN BHD	TEL: 603-5569 4118	FAX: 603-5569 5955
PHILIPPINES:	NALCO PHILIPPINES INC	TEL: 63-49-5451550	FAX: 63-49-5453442
SINGAPORE:	NALCO PACIFIC PTE LTD	TEL: 65-6861-4011	FAX: 65-6862 0850
THAILAND:	NALCO INDUSTRIAL SERVICES (THAILAND) CO. LTD	TEL: 66-38-955-160	FAX: 66-38-955-166

See Section 16 for address information.

EMERGENCY TELEPHONE NUMBER(S) : See section 16, for Emergency Telephone Numbers.

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL DESCRIPTION : Water, substituted isothiazoline.

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

CHEMICAL NAME	CAS NO	% (w/w)
5-chloro-2-methyl-4-isothiazolin-3-one	26172-55-4	1.1
2-methyl-4-isothiazolin-3-one	2682-20-4	0.1 - 1

3. HAZARDS IDENTIFICATION

HUMAN HEALTH HAZARDS - ACUTE

EYE CONTACT
Corrosive. Will cause eye burns and permanent tissue damage.

SKIN CONTACT
May cause severe irritation or tissue damage depending on the length of exposure and the type of first aid administered. Skin irritation effects can be delayed for hours. Repeated or prolonged contact may cause skin sensitization.

INGESTION
Not a likely route of exposure. Corrosive; causes chemical burns to the mouth, throat and stomach.

INHALATION
Not a likely route of exposure. Irritating, in high concentrations, to the eyes, nose, throat and lungs.

HUMAN HEALTH HAZARDS - CHRONIC
No adverse effects expected other than those mentioned above.

4. FIRST AID MEASURES

EYE CONTACT
Get immediate medical attention. PROMPT ACTION IS ESSENTIAL IN CASE OF CONTACT. Immediately flush eye with water for at least 15 minutes while holding eyelids open. If only one eye is affected be sure to use care not to contaminate the other eye with the run-off.

SKIN CONTACT
Get immediate medical attention. Remove contaminated clothing and wash before reuse. Immediately flush with plenty of water for at least 15 minutes. For a large splash, flood body under a shower. Contaminated leather articles such as shoes or belts must be discarded.

INGESTION
DO NOT INDUCE VOMITING. Get immediate medical attention. If conscious, washout mouth and give water to drink.

INHALATION
Remove to fresh air, treat symptomatically. Artificial respiration and/or oxygen may be necessary. Get medical attention.

NOTE TO PHYSICIAN
Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsions may be needed. Skin burns and corrosion may be delayed for several hours. 1% hydrocortizon cream may be used to alleviate symptoms.

5. FIRE FIGHTING MEASURES

FLASH POINT : Not flammable

EXTINGUISHING MEDIA
Not expected to burn. Use extinguishing media appropriate for surrounding fire.

FIRE AND EXPLOSION HAZARD
Not flammable or combustible. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of nitrogen (NOx) and sulfur (SOx) under fire conditions. May evolve HCl under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS
Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Stop or reduce any leaks if it is safe to do so. Ventilate spill area if possible. Ensure clean-up is conducted by trained personnel only. Do not touch spilled material. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Notify appropriate government, occupational health and safety and environmental authorities.

METHODS FOR CLEANING UP
Cover drains to stop contamination of waterways. Dike and absorb with inert material (e.g. dry earth, sand), shovel all contaminated solids into a pail or drum then seal for disposal. DO NOT add deactivation solution to the waste container to deactivate the absorbed material. Treat spill residue, contaminated surfaces and equipments with 10 times as much deactivation solution as estimated residual spill and wait 30 minutes, or until the reaction has subsided. Rinse thoroughly with clean water. DO NOT use deactivation solution on skin, eyes or clothing. DEACTIVATION SOLUTION - prepare a fresh solution of 5% sodium bicarbonate and 5% sodium hypochlorite in water (i.e. add 50 grams of sodium bicarbonate per 1 liter of household bleach, seal container then shake well for 1 minute) away from the immediate area of spill. Prepare 10 times the estimated volume of the residual spill.

The materials and equipment for preparing solutions should be kept available for use in areas where spills may occur. Contact approved waste hauler for disposal of contaminated recovered material. Dispose of materials in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS
This product is toxic to fish and other water organisms. Do not discharge directly into lakes, ponds, streams, waterways or public water supplies. Do not contaminate water by cleaning of equipment or disposal of wastes.

7. HANDLING AND STORAGE

HANDLING
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Ensure all containers are labelled. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Avoid generating aerosols and mists. Skin irritation effects can be delayed for hours. Treat all wetting of the skin and/or clothes which occurs during handling as contact with the product and administer first aid immediately.

STORAGE CONDITIONS
Store in suitable labelled containers. Store the containers tightly closed. Store separately from oxidizers. Protect product from freezing.

SUITABLE CONSTRUCTION MATERIAL
PVC, Teflon, Crosslinked high density polyethylene, Polyethylene, Stainless Steel 304, Stainless Steel 316L, Hastelloy C-276, Plexiglass, Kalrez, EPDM, Aflax

UNSUITABLE CONSTRUCTION MATERIAL
Copper, Brass, Buna-N, Polyurethane, Hypalon, Viton, Neoprene, aluminium, Ethylene propylene, Mild steel, Polypropylene

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

Manufacturer's
Recommendation :
Substance(s)

5-Chloro-2-Methyl-4-Isothiazolin-3-one	TWA: 0.1000 mg/m3 STEL: 0.30000 mg/m3

ENGINEERING MEASURES
Use a closed dosing system. Use local exhaust ventilation if necessary to control airborne mist and vapor.

PERSONAL PROTECTION

GENERAL ADVICE
The use and choice of personal protection equipment is related to the hazard of the product, the workplace and the way the product is handled. In general, we recommend as a minimum precaution that safety glasses with side-shields and workclothes protecting arms, legs and body be used. In addition any person visiting an area where this product is handled should at least wear safety glasses with side-shields.

RESPIRATORY PROTECTION
An approved respirator must be worn if the occupational exposure limit is likely to be exceeded. An organic vapor cartridge with dust/mist prefilter or supplied air may be used. In event of emergency or planned entry into

unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION
Nitrile gloves, Butyl gloves, Viton(tm) gloves.

SKIN PROTECTION
Wear impervious apron and boots. A full slicker suit is recommended if gross exposure is possible.

EYE PROTECTION
Wear a face shield with chemical splash goggles.

HYGIENE RECOMMENDATIONS
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals.When handling this product never eat, drink or smoke.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Light yellow Green
ODOR	Mild
Flash Point	Not flammable
SPECIFIC GRAVITY	1.03 @ 15 °C
SOLUBILITY IN WATER	Complete
pH (100%)	3 - 5
MELTING POINT	-4 °C
VOC CONTENT	0.8 %

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY
Stable under normal conditions.

HAZARDOUS POLYMERIZATION
Hazardous polymerization will not occur.

CONDITIONS TO AVOID
Freezing temperatures.

MATERIALS TO AVOID
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS
Under fire conditions: Oxides of carbon
Oxides of sulfur
Oxides of nitrogen
HCl

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY DATA
The following results are for the product along with results on the hazardous components.

ACUTE ORAL TOXICITY :

Species	LD50	Test Descriptor
Rat	3810 mg/kg	Product

ACUTE DERMAL TOXICITY :

Species	LD50	Test Descriptor
Rabbit	>5000 mg/kg	Product

ACUTE INHALATION TOXICITY :

Species	LC50	Test Descriptor
Rat	13.7 mg/kg	Product

PRIMARY SKIN IRRITATION :

Draize Score	Test Descriptor
>5.1,<6.5 /8.0	Product

PRIMARY EYE IRRITATION :

Draize Score	Test Descriptor
>80/110.0	Product

PRIMARY SKIN IRRITATION : A 1.5% active solution is corrosive to skin, a 0.6% active solution is a severe skin irritant, a 0.3% active solution is a moderate skin irritant and a 0.06% active solution is a non-irritant.

PRIMARY EYE IRRITATION : A 1.5% active solution is corrosive to the eyes, a 0.3% active solution is an eye irritant and 0.06% active solution is a non-irritant.

SENSITIZATION
A Guinea pig (Buehler Technique) sensitization study with an induction dosage of 90 ppm of active ingredients followed by an insult of 429 ppm of active ingredients was positive. A human repeated insult patch study of 28 ppm active ingredients followed by an insult of 56 ppm of active ingredients resulted in no effect to the subjects tested.

CHRONIC TOXICITY DATA
A 90-day dietary study in dogs of 840 ppm of isothiazolinone resulted in no mortalities or pathological findings. A 90-day dermal study in rabbits of 0.4 mg/kg/day of isothiazolinone resulted in irritation but no pathological effects. A 30-month skin painting study with mice using 400 ppm isothiazolinone three times per week showed no increased tumor frequency over control. A teratology study with rabbits and rats was negative using dosages of 1.5 to 15 mg/kg isothiazolinone. Mutagenicity results have been equivocal.

CARCINOGENICITY
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS
The following results are for the product along with results on the active substances.

ACUTE FISH RESULTS :

Species	Exposure	LC50	Tested Substance
Sheepshead Minnow	96.00 hrs	32 mg/l	Product
Bluegill Sunfish	96 hrs	18.67 mg/l	Product
Fathead Minnow	144 hrs	8 mg/l	Product
Rainbow Trout	96 hrs	12.57 mg/l	Product

Rating : Slightly toxic

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	LC50	Tested Substance
Mysid Shrimp (A. bahia)	96.00 hrs	18 mg/l	Product
Ceriodaphnia dubia	48 hrs	15 mg/l	Product
Daphnia magna	48 hrs	8.7 - 13 mg/l	Product

Rating : Slightly toxic

AVIAN RESULTS :

Species	Exposure	LC50	Tested Substance
Bobwhite Quail		97 mg/kg	Product
Pekin Duck	8.00 Days	560 mg/kg	Active Substance

PERSISTENCY AND DEGRADATION

Total Organic Carbon (TOC): 7,580 mg/L

Chemical Oxygen Demand (COD): 20,000 mg/L

The degradation of the major active substance begins with ring opening and elimination of chloride ion. Degradation leads to the formation of a variety of small organic acids, methylamine, carbon dioxide and elemental sulfur. The half life of each active substance is dependent upon the initial concentration.

MOBILITY AND BIOACCUMULATION POTENTIAL

The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite (TM) , provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models. If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages: < 5%; 30 - 50%; 50 - 70%. The portion in water is expected to be soluble or dispersible. Discharge in minor quantity into adapted biological units of sewage treatment plants is not expected to affect the efficiency of the activated sludge process.

This preparation or material is not expected to bioaccumulate.

13. DISPOSAL CONSIDERATIONS

Hazardous wastes must be transported by a licensed hazardous waste transporter and disposed of or treated in a properly licensed hazardous waste treatment, storage, disposal or recycling facility. Consult local, state, and federal regulations for specific requirements.

Empty drums should be taken for recycling, recovery, or disposal through a suitably qualified or licensed contractor.

NATIONAL REGULATIONS, CHINA
Comply with local regulations.

NATIONAL REGULATIONS, INDIA
Dispose of unused product in accordance with the "Hazardous Wastes (Management and Handling) Rules 1989" and local and State legislation, as applicable.

NATIONAL REGULATIONS, INDONESIA
Dispose of unused product in accordance with "Government Regulation No.19/1994 On the Treatment of Dangerous And Toxic Waste" (and amendments) as applicable.

NATIONAL REGULATIONS, KOREA
Waste disposal should comply with the Waste Control Act.

NATIONAL REGULATIONS, MALAYSIA
Dispose of in accordance with the Environmental Quality (Scheduled Wastes) Regulation 1989 and other guidelines issued by DOE and/or local authorities.

NATIONAL REGULATIONS, PHILIPPINES
Dispose of in accordance with Presidential Decree No. 984-1976 ("The Pollution Control Law"); DENR Department Administrative Order No.29-92 ("The Implementing Rules or Regulations of RA6969") and Presidential Decree No.825.

NATIONAL REGULATIONS, SINGAPORE
Dispose of waste in accordance with the Environmental Health Act (Chapter 95, Rg 11), Environmental Public Health (Toxic Industrial Waste) Regulations 1990 Ed.

NATIONAL REGULATIONS, THAILAND
Dispose of hazardous waste in accordance with the "The Notification of the Ministry of Industry No. 6B.E. 2450, subject : Disposal of Wastes or Unusable Materials ", "The Notification of the Ministry of Industry No. 18.E. 2451, subject : Disposal of Wastes or Unusable Materials ".

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are:

LAND TRANSPORT

Proper Shipping Name	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical Name(s)	ISOTHIAZOLINONE MICROBIOCIDE
UN/ID No	UN 3265
Hazard Class - Primary	8
Packing Group	II
HAZCHEM CODE	2X

NATIONAL REGULATIONS, CHINA
Comply with local regulations.

NATIONAL REGULATIONS, INDIA
Transport in accordance with the Central Motor Vehicles Rules 1989.

NATIONAL REGULATIONS, INDONESIA
Transport in accordance with all government regulations, including "Regulation of the Minister of Health No.453/Man.Kes/PER/XI/1983.

NATIONAL REGULATIONS, KOREA
Land transport should comply with the Ministerial Decree of Toxic Chemicals Control Law and the Regulations Regarding the Fire Fighting Techniques Standards, as applicable.

NATIONAL REGULATIONS, MALAYSIA
There are no regulations specifically governing the transport of chemicals. Use best practice.

NATIONAL REGULATIONS, PHILIPPINES
Transport in accordance with the following legislation (as applicable): Presidential Decree No. 1185, 1977 ("Fire Code of the Philippines") and implementing rules and regulations; Presidential Decree No. 856, 1975 ("Code of Sanitation"); Republic Act No 6969, 1990 ("Toxic Substances and Hazardous and Nuclear Wastes Control Act") and implementing rules and regulations.

NATIONAL REGULATIONS, SINGAPORE
Land Transport complies with the Environmental Pollution Control (Hazardous Substances) Regulations 1999, which follows the "Specification for Caution Labelling for Hazardous Substances" - Singapore Standard 286 (1984).

NATIONAL REGULATIONS, THAILAND
The product should be transported in accordance with "Hazardous Substances Acts B.E.2535", "Notification of Ministry of Public Health Re:Label and level of Toxicity of Dangerous Articles Which are Under the Responsibility of Food and Drug Administration 2534 (if applicable)" and "Notification of land transportation department, subject: label of truck which contain hazardous material, Notification date: 14 November B.E.2543 (14 November 2000)".

AIR TRANSPORT (ICAO/IATA)

Proper Shipping Name	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical Name(s)	ISOTHIAZOLINONE MICROBIOCIDE
UN/ID No	UN 3265
Hazard Class - Primary	8
Packing Group	II
IATA Cargo Packing Instructions	820
IATA Cargo Aircraft Limit	60 L
IATA Passenger Packing Instructions	Y818 / 818
IATA Passenger Aircraft Limit	1 L / 5 L

MARINE TRANSPORT (IMDG/IMO)

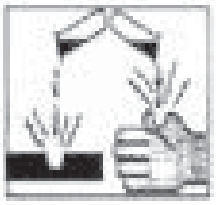
Proper Shipping Name	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical Name(s)	ISOTHIAZOLINONE MICROBIOCIDE
UN/ID No	UN 3265
Hazard Class - Primary	8
Packing Group	II
EmS-Nr.	8-15

15. REGULATORY INFORMATION

NATIONAL REGULATIONS, EUROPE AND MALAYSIA

European:

HAZARD SYMBOLS:



MATERIAL SAFETY DATA SHEET

NALCO

PRODUCT

NALCO 7330

CLASSIFICATION: Corrosive. / C

Contains: 2-methyl-4-isothiazolin-3-one, 5-chloro-2-methyl-4-isothiazolin-3-one

RISK PHRASES:

R34 Causes burns.
R43 May cause sensitization by skin contact.

Malaysian:

HAZARD SYMBOLS:

CLASSIFICATION: Corrosive / C

Contains: 2-methyl-4-isothiazolin-3-one, 5-chloro-2-methyl-4-isothiazolin-3-one

RISK PHRASES:

R34 Causes burns.
R43 May cause sensitization by skin contact.

SAFETY PHRASES:

S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S28 After contact with skin, wash immediately with plenty of water.
S37/39 Wear suitable gloves and eye/face protection.
S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

INTERNATIONAL REGULATIONS :

FOOD AND DRUG ADMINISTRATION (FDA) Federal Food, Drug and Cosmetic Act :
When use situations necessitate compliance with FDA regulations, this product is acceptable under: 21 CFR 176.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 176.180 Components of paper and paperboard in contact with dry foods, and 21 CFR 176.300 - Slimicides

NFPA 704M / HMIS RATING
HEALTH : 3 FLAMMABILITY : 1 REACTIVITY : 0 OTHER : -
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme

INTERNATIONAL CHEMICAL CONTROL LAWS :

TOXIC SUBSTANCES CONTROL ACT (TSCA)
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

EUROPE

The substances in this preparation are included in or exempted from the EINECS or ELINCS inventories.

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS) and are listed on the Australian Inventory of Chemical Substances (AICS).

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)
The substances in this preparation are listed on the Domestic Substances List (DSL), are exempt, or have been reported in accordance with the New Substances Notification Regulations.

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Ministry of International Trade & Industry List (MITI).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

THE PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippine Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

ADDRESSES AND CONTACT POINTS:

NALCO INDUSTRIAL SERVICES (SUZHOU) CO. LTD; 88 Ta Yuan Road, Suzhou New Development Zone, Jiangsu 215011 PRC

NALCO INDIA LIMITED; 20/A Park St, Culcutta 700016 India

PT NALCO INDONESIA; Jl. Pahlawan, Desa Karang Asem Timur, Citeureup, Bogor, Indonesia

NALCO KOREA LIMITED; 11th Fl, 63BLDG, 60, Yoido-dong Young Deung Po-Gu, Seoul, Korea

NALCO INDUSTRIAL SERVICES MALAYSIA SDN BHD; No 1, Jalan Jururancang U1/21, Seksyen U1, Hicom-Glenmarie Industrial Park, 40150 Shah Alam, Selangor Darul Ehsan, Malaysia

NALCO PHILIPPINES INC; Barrio Real, Calamba, Laguna, Philippines

NALCO PACIFIC PTE LTD; 21 Gul Lane, Jurong Town, Singapore 629416

NALCO INDUSTRIAL SERVICES (THAILAND) CO., LTD; Rayong Plant, 109/19 M00 4, Eastern Seaboard Industrial Estate, Soi ESIE 6, T. Pluakdaeng, A. Pluakdaeng Rayong 21140 Thailand

EMERGENCY TELEPHONE NUMBER(S):

CHINA:	**512-68255001**
KOREA:	**02-789-6961**
INDIA:	**0-33-6740395**

MATERIAL SAFETY DATA SHEET

PRODUCT

NALCO 7330

INDONESIA:	62-21-8753175
MALAYSIA:	603-5569 4118
THE PHILIPPINES:	63-49-5451550
SINGAPORE:	65-6861-4011
THAILAND:	38-555-160

Prepared By Nalco Asia Pacific SHE, Product Safety Specialist
Date issued: 02-Dec-04
Replaces: 28-Jan-03

AQUAMAG

CT 400

DESCRIPTION

CT 400 IS A NITRITE-BORATE COMPOUND USED FOR CLOSED RECIRCULATING WATER SYSTEM. AVOID PITTING CORROSION EFFECTIVELY.

GENERAL SPECIFICATION

- APPEARANCE : PALE YELLOW LIQUID
- SPECIFIC GRAVITY : 1.08
- pH AS SUPPLIED : 8.5-9.0

* all figures approximate

DIRECTIONS

- CLEAN UP THE SYSTEM WITH DISPERSANTS AND NON-IONIC DETERGENTS, TO REMOVE OIL, GREASE, DIRT, SCALE, RUST ETC. THE FLUID SHOULD KEEP AT NEAR NEUTRAL.
- INITIAL DOSAGE OF 3 LITRES PER TON WATER CAPACITY. MAINTAIN THIS CONCENTRATION FOR AT LEAST TWO WEEKS THUS THE NITRITE SHOULD BE 600 ppm OR ABOVE, pH AT 8.5 OR ABOVE.
- MAINTENANCE DOSAGE BY KEEPING NITRITE VALUE AT 800-1000 ppm FOR HOT WATER SYSTEM, 400-600 ppm FOR CHILLED WATER SYSTEM.
- MAINTAIN THE pH OF THE SYSTEM WATER AT 8.5-9.0. ACTUAL PRODUCT CONSUMPTION WILL DEPEND ON LEAKAGE, AIR INGRESSION OR BACTERIAL GROWTH CONTROL.

AQUAMAG

CT 400

PRODUCT BENEFITS

- WIDE RANGE OF TEMPERATURE APPLICATION FROM 5℃ TO 85℃.
- EFFECTIVE CONTROL CORROSION AGAINST PITTING AT A RANGE OF 400-2000 ppm NITRITE, DEPENDS ON TEMPERATURE OF OPERATION.
- MAY BE DOSED DIRECT FROM DRUM.
- LIQUID PRODUCT FOR EASE OF USE.

SAFETY & HANDLING

- AVOID CONTACT WITH SKIN OR EYES.
- DO NOT INHALE OR SWALLOW.
- WEAR EYE GOGGLE AND RUBBER GLOVES WHEN HANDLING.
- IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN OR EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. FOR EYES, GET MEDICAL ATTENTION.
- DO NOT STORE WITH FOOD.
- CLOSE CONTAINER SECURELY AFTER USE.

PACKING

25 LTS/PLASTIC DRUM

acc@pta
Leading eChemical Procurement
QUAY WEST, TRAFFORD WHARF ROAD,
MANCHESTER, M17 1HH,
UNITED KINGDOM.
TEL: +44 (0) 161 240 2100

LOCAL DISTRIBUTOR:
LeBLANC WATER TREATMENT & CHEMICALS LTD.
FLAT C, 15/F., SUPERLUCK INDUSTRIAL CENTRE, PHASE 2,
NO. 57 SHA TSUI ROAD, TSUEN WAN, N.T., HONG KONG.
TEL: (852) 2408 2000 FAX: (852) 2408 1740
EMAIL: info@leblanc.com.hk

AQUAMAG

Material Safety Data Sheet

CT 400

Date issued: 01-06-2009

1. IDENTIFICATION OF THE PREPARATION AND OF THE COMPANY

Product Name:	AQUAMAG CT 400
Application:	Closed circuit scale corrosion inhibitor
Company Identification:	Accepta Ltd Quay West Trafford Wharf Road Manchester M17 1HH United Kingdom
Office telephone number:	+44 (0) 161 240 2100
Office fax number:	+44 (0) 870 135 6389
Emergency Telephone Number:	+44 (0) 161 240 2100

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL DESCRIPTION:
Disodium metasilicate, Sodium nitrite, Water, Sodium nitrate, Borate.

HAZARDOUS INGREDIENTS:

CAS NO.	EINECS NO.	CHEMICAL NAME	WT %	SYMBOL	R-PHRASES
7632-00-0	2315559	Sodium nitrite	4-6	O,T,N	8,25,50
6834-92-2	2299129	Disodium metasilicate	1-4	C	34, 37
7631-99-4	2315543	Sodium nitrate	1-5	O	8

3. HAZARD IDENTIFICATION

This product is classified as dangerous (European Directive 1999/45/EC).
HUMAN HEALTH HAZARDS – ACUTE:
INHALATION: May cause irritation of mucous membranes.
SKIN CONTACT: Can cause moderate irritation.
EYE CONTACT: Can cause moderate irritation.

INGESTION: Harmful if swallowed. There may be irritation to the gastro-intestinal tract with nausea and vomiting. Components of the product create formation of methaemoglobin. Pregnant women are particularly sensitive to methemoglobinemia. May cause a decrease in blood pressure and cyanosis.

HUMAN HEALTH HAZARDS – CHRONIC : Repeated ingestion of small amounts of sodium nitrite causes drops in blood pressure, rapid pulse, headaches and visual disturbances. It may also react with organic amines in the body to form carcinogenic nitrosamines.
ENVIRONMENTAL HAZARDS: Harmful to aquatic organisms.
PHYSICAL AND CHEMICAL HAZARDS : Contact with acids liberates toxic gas.
If product is allowed to dry, the sodium nitrite is an oxidizing agent and can initiate the combustion of other materials.

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Material Safety Data Sheet

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Date issued: 01-06-2009

4. FIRST AID MEASURES

INHALATION: Remove to fresh air, rest, treat symptomatically. Obtain medical attention.

SKIN CONTACT: Remove contaminated clothing. Wash off affected area immediately with plenty of water. If skin irritation persists, obtain medical attention.

EYE CONTACT: Obtain medical attention immediately. Immediately gently irrigate with clean water for at least 15 minutes. Move eyeball and keep eyelids wide open and apart whilst irrigating.

INGESTION: Seek medical advice immediately, showing the label and / or SDS. **Do not induce vomiting without medical advice.** If conscious wash out mouth and give one glass of water to drink.

ATTATIONAL INFORMATION : If unconscious do not give anything by mouth, place in the recovery position, check breathing and pulse. If necessary give artificial respiration.

5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Not expected to burn. Use extinguishing media appropriate for surrounding fire.

FIRE AND EXPLOSION HAZARD: May evolve oxides of nitrogen under fire conditions.
If product is allowed to dry, the sodium nitrite is an oxidizing agent and can initiate the combustion of other materials.
SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING: In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS: Do not breathe vapour. Avoid contact with skin and eyes. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water. Ensure adequate ventilation. Use personal protective equipment recommended in Section 8.

ENVIRONMENTAL PRECAUTIONS: Do not allow to enter sewers or water courses. If spillage does enter sewers or water courses, immediately inform the appropriate water authorities.

METHODS FOR CLEANING UP:
Contain and absorb with sand or vermiculite and mix well. Collect up and remove to a safe place until disposal. Wash site of spillage thoroughly with water. Assistance can be obtained from waste disposal companies. Do not use cotton waste, sawdust or other combustible substances as absorbent materials, these may ignite when dried out.
Please refer to Section 13 for disposal considerations.

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7. HANDLING AND STORAGE

HANDLING: Avoid contact with skin and eyes. Do not take internally. Use with adequate ventilation. Avoid generating aerosols and mists. Use personal protective equipment recommended in Section 8.

STORAGE CONDITIONS: Protect from freezing. Keep container tightly closed in a cool, well-ventilated place. Store separately from acids, Organic materials and reducing agents. Storage for more than two years is not recommended.

CONSTRUCTION MATERIAL COMPATIBILITY: Compatible with:
Equipment for storage and application should be constructed from stainless steel, polypropylene, polyethylene, PVC acrylic resin, polyvinylidene difluoride, butyl rubber, nitrile rubber, natural rubber, neoprene or ethylene propylene rubber. Avoid use of aluminium, copper, Zinc and their alloys, brass and galvanized metals.

8. EXPOSURE CONTROL / PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS: None
ENGINEERING MEASURES : Use general ventilation with local exhaust ventilation.
RESPIRATORY PROTECTION: If significant mists, vapours or aerosols are generated an approved respirator is recommended, filter-type AP.
HAND PROTECTION: PVC gloves, Nitrile gloves, Neoprene gloves. Most glove materials are of low chemicals resistance. Replace gloves regularly.
SKIN PROTECTION: Standard protective clothing.
EYE PROTECTION: Chemical splash goggles.
HYGIENE RECOMMENDATIONS : Keep an eye wash fountain available. Keep a safety shower available. Wash hands during breaks and at end of the shift. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

9. PHYSICAL AND CHEMICAL PROPERTIES

NOTE: These physical properties are typical values for this product

FORM:Liquid
COLOUR : Pale Yellow
ODOUR: Slight
VALUE UNIT TEST METHOD
BOILING POINT : 100 °C
FLASH POINT : NA
VAPOUR PRESSURE same as water
RELATIVE DENSITY : 1.095 – 1.125 (20°C)
SOLUBILITY IN WATER : Complete
pH : 11.3 – 11.8

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10. STABILITY AND REACTIVITY

STABILITY: Stable under ambient conditions.

CONDITIONS TO AVOID: Freezing temperatures.

MATERIALS TO AVOID: Acid, Organic materials and reducing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: May evolve oxides of nitrogen under fire conditions.

11. TOXICOLOGICAL INFORMATION

Please refer to section 3 for hazards identification.
ACUTE TOXICITY DATA :
ACUTE LETHALITY VALUES :
Oral (rat) LD50 = = 2000 mg/kg (OECD 423).
PRIMARY (DRAIZE TEST) SKIN/EYE:
Primary skin irritation : 0.5 / 8.0
Primary eyes irritation : 16.7/110.0
CHRONIC TOXICITY DATA : Repeated ingestion of small amount of sodium nitrite causes drops in blood pressure, rapid pulse, headaches and visual disturbances. It may also react with organic amines in the body to form carcinogenic nitrosamines.

12. ECOLOGICAL INFORMATION

PERSISTENCY AND DEGRADATION :
Biological Oxygen Demand (BOD 5) = 703 mg/l
Chemical Oxygen Demand (COD) : 23300 mg/l

ECOTOXICOLOGICAL EFFECTS :
EC50/48H/Daphnia magna (Water Flea) = 670 mg/l
NOEC/48H/Daphnia magna (Water Flea) = 400 mg/l
LC 50/96H/Oncorhynchus Mykiss (Rainbow Trout) = 57 mg/l
NOEC/96H/Oncorhynchus mykiss (Rainbow Trout) = < 40 mg/l
LC50/96H/Scophthalmus maximus = > 2000 mg/l (PARCOM)
NOEC/96H/Scophthalmus maximus = 2000 mg/l (PARCOM)

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13. DISPOSAL CONSIDERATIONS

Via authorized contractor. If this product becomes a waste, the final user must define and assign the appropriate European Waste Catalogue code. Ensure compliance with EC, national and local regulations.
Empty uncleaned packages of this product should be treated as hazardous waste.

NATIONAL REGULATIONS UK

In accordance with the Environmental Protection (Duty of Care) Regulations 1991, Special Waste Regulations 1996 apply.

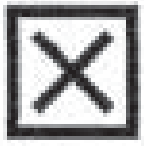
NATIONAL REGULATIONS AUSTRIA : Waste Code: 59305

14. TRANSPORT INFORMATION

Class: Not regulated

15. REGULATORY INFORMATION

CLASSIFICATION:
HAZARD SYMBOL: Harmful



Xn, HARMFUL
Contains: Sodium nitrite
RISK PHRASES: R22 Harmful if swallowed. R52 Harmful to aquatic organisms.
SAFETY PHRASES: S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28 After contact with skin, wash immediately with plenty of water. S36/37/39 Wear suitable protective clothing, gloves and eye/face protection. S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S61 Avoid release to the environment. Refer to special instructions/ Safety Data Sheets.
NATIONAL REGULATIONS GERMANY
VbF-Klasse: None
WHG-WGK : 2 Classification according VwVwS v. 17.05.99, Anhang 4
StörfallV./ 12BImSchV Liste d Anh.II) :-
TA-Luft:
Berufsgenossensch. Vorschriften: Take notice of UVV-Chemie
Hinweise zur Beschäftigungsbeschränkung : Observe § 15 of regulations for hazardous substances.
NATIONAL REGULATIONS UK COSHH regulations apply.

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Material Safety Data Sheet

CT 400

Date issued: 01-06-2009

16. OTHER INFORMATION

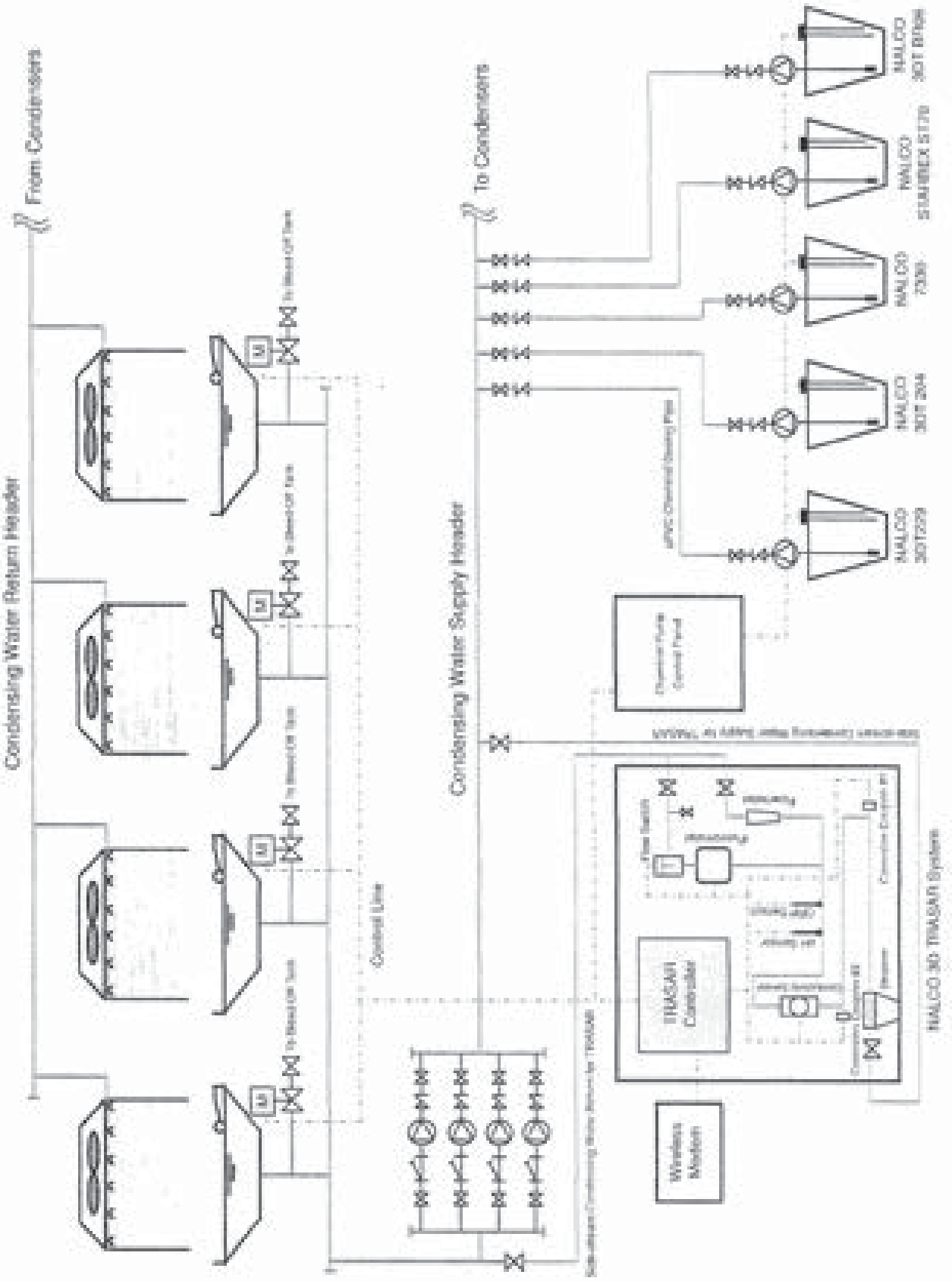
Emergency Telephone Number +44 (0) 161 240 2100

Local Distributor :
LeBLANC Water Treatment & Chemicals Ltd.
Flat C, 15/F., Superluck Industrial Centre, Phase 2,
No. 57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong.
Tel. : (852)2408 2000 Fax : (852) 2408 1740 E-Mail : info@leblanc.com.hk

LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

9.2. Equipment Brochure & Catalogues

Flat C, 15/F., Superluck Industrial Centre, Phase 2, No.57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong
Tel.: (852) 2408 2000 Fax: (852) 2436 1740 Email: [redacted]

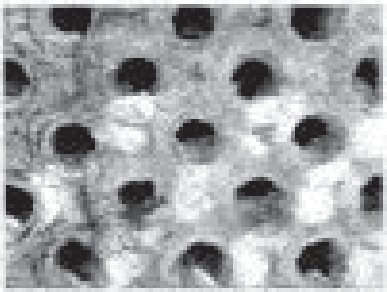


Typical Schematic Diagram of NALCO 3D TRASAR Treatment System

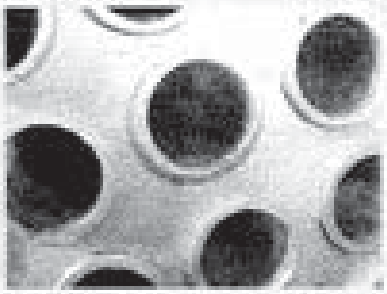
NALCO

3D TRASAR® Technology

A Comprehensive Approach to Management for Cooling Systems



Prior to using 3D TRASAR Scale Control, the exchanger needed cleaning during every turnaround.



Note the dramatic improvement in the same exchanger, opened for inspection during the first turnaround following implementation of the 3D TRASAR Scale Control Program.

In today's tough economic environment, your time, energy and budget are under tremendous pressure. Intense competition, along with corporate expectations of increased production, profitability, and operating cost reduction, heightens the attention paid to how well your utility operations function. You can't afford to be sidetracked by costly cooling water problems.

Nalco is ready to help meet the added demands placed on your utility operations. Nalco has developed the most sophisticated system of continuous, on-line, remote-accessible, cooling water treatment and performance monitoring on the market today: **3D TRASAR technology**.

What is the 3D TRASAR program?

The 3D TRASAR program provides a comprehensive solution to cooling system problems. Cooling systems are routinely pushed to capacity. When stressed to their technical limits, upset conditions result in expensive operational problems: scale, corrosion and fouling. 3D TRASAR technology measures key system parameters, detects upsets, takes appropriate corrective action and communicates with system users. It provides reliability under high stress operating conditions and delivers the lowest possible Total Cost of Operation (TCO) for your cooling operation.

3D TRASAR Programs are ideal when:

- Equipment reliability is paramount
- Upsets and process leaks threaten system degradation
- Hardness variation is common
- Phosphate concentrations are variable
- System loading varies
- Gray water is used as makeup
- pH control is poor
- Biocide feed is inconsistent
- Bio-populations vary or the system is prone to microbial contamination

Figure 1 shows how a high stress condition results in system degradation. In this case, an increase in pH was caused by a failure of an acid feed system. The treatment polymer was consumed. Note that the system began to foul some time **after** the loss of pH control. Once the system was scaled, only an expensive acid cleaning could bring it back to its previous efficiency.

If 3D TRASAR technology had been in control, the pH increase and polymer consumption would have been detected. The program would have taken action to reduce the stress on the system, preventing the fouling. Following this, an e-mail or digital page would have been sent to system operators, informing them of the upset and the actions taken to correct it. All of this would have occurred **before** fouling affected system performance. In contrast, when stress is low, 3D TRASAR technology adjusts the conductivity and treatment dosage to maximize efficiency (Figure 2).

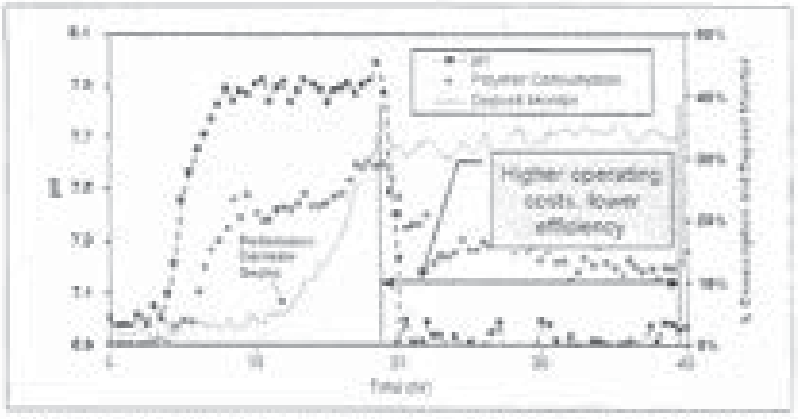


Figure 1 – *Effects of a pH excursion on a cooling water system without 3D TRASAR control*

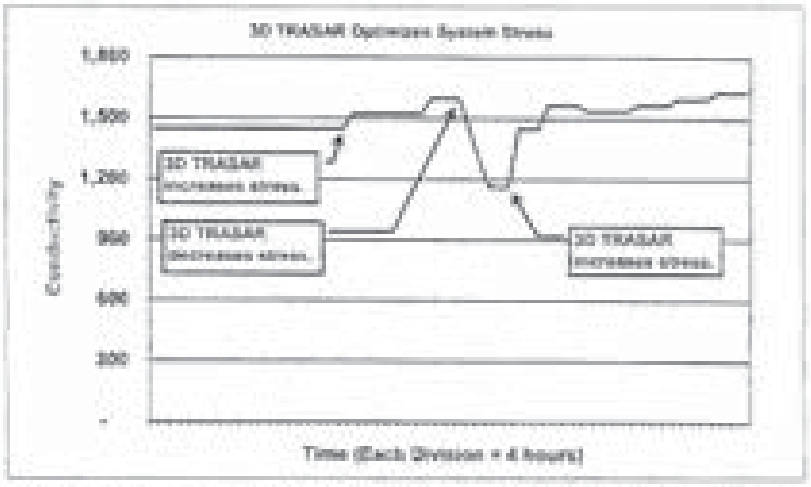


Figure 2 – *In the case, 3D TRASAR detected low stress and increased the conductivity set-point to maximize cycles of concentration. When an upset condition was detected — an event that increased system stress — 3D TRASAR decreased the conductivity set-point, relieving the stress on the system and preventing an operational problem. When the upset condition was corrected, 3D TRASAR detected a low stress condition and increased the conductivity set-point, again maximizing efficiency and minimizing operating costs.*

3D TRASAR technology detects and responds to system stresses

3D TRASAR technology responds to stresses that affect your system's performance. For example, changes in holding time index (HTI), oxidant concentration, turbidity, water chemistry and heat load. The program continuously manages your cooling system based on the measured operational stresses placed upon it. 3D TRASAR technology is an environmentally responsible solution to cooling system problems. It can eliminate the use of zinc and molybdate in many applications by employing innovative chemistries and advanced control technology.

How is This an Improvement Over Traditional Programs?

Nalco has built on the power of TRASAR® technology to add a new dimension to cooling water treatment control. With cooling systems operating at their technical limits, preventing today's operational problems presents real technical challenges.

3D TRASAR technology is designed specifically to deal with these kinds of challenges. Whether it's a sudden influx of microorganisms from a system leak, changes in makeup water turbidity or acid in-leakage from a process heat exchanger, 3D TRASAR technology takes action and brings the system back into control before a costly compromise in system performance occurs. In contrast, all other control systems rely on "expected" or "typical" conditions and cannot respond to changes without operator involvement.

3D TRASAR technology communicates system status, upset conditions and actions taken

The 3D TRASAR program provides easy-to-use, two-way communications. When upsets are detected or control actions taken, the NALCO 3DT-5000 controller informs operators, allowing them to take further corrective action. Alerts are sent via text message or through an extranet, 3D TRASAR WEB.

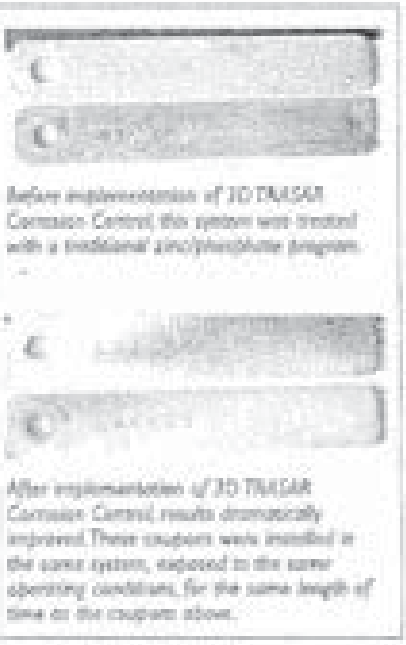
A sophisticated communications suite delivers the right information to the right people instantly. 3D TRASAR WEB allows the user to make adjustments to the 3D TRASAR controllers remotely, to see — at a glance — the interrelationships between all system parameters, to provide information quickly when troubleshooting a problem, and to show "cause and effect" when a control action is taken. For customers with multiple installations, the program allows review of all systems from one location, in one consistent format.

3D TRASAR Corrosion Control

3D TRASAR Corrosion Control combines sophisticated control technology with an innovative, new scale-resistant, dual-functioning corrosion inhibitor, Phosphino Succinic Oligomer (PSO). This unique Nalco innovation delivers better corrosion and scale inhibition — over a wider range of operating conditions — than any other product on the market. Even under varying water quality conditions, 3D TRASAR Corrosion Control delivers reliability under stress.

Use 3D TRASAR Corrosion Control to:

- Compensate for variations in makeup orthophosphate levels by combining superior chemistry with superior control.
- Prevent phosphate deposition with reversion-resistant chemistries.
- Reduce downtime and maintenance costs by preventing costly corrosion.
- Continually monitor corrosion rates online and detect upset conditions and excursion events.



Before implementation of 3D TRASAR Corrosion Control, this system was treated with a traditional zinc/phosphate program.

After implementation of 3D TRASAR Corrosion Control, results dramatically improved. These coupons were installed in the same system, exposed to the same operating conditions, for the same length of time as the coupons above.

3D TRASAR Scale Control

3D TRASAR Scale Control couples the power of the NALCO 3DT-5000 Controller with an innovative "tagged" high stress dispersant polymer. The chemical "tag" attached to the molecule – essentially a barcode scanned by the 3D TRASAR controller – reports the performance of the polymer. As conditions change, the NALCO 3DT-5000 controller changes cooling system operation to compensate.

Use 3D TRASAR Scale Control to:

- Optimize water and chemical use by actively managing the system based on the stresses placed upon it.
- Improve throughput by maintaining equipment at peak efficiency, even as operational factors vary.
- Reduce downtime and maintenance costs by preventing mineral scale and particulate fouling.
- Increase asset life and maintain asset reliability by preventing degradation during upsets and process leaks.

The NALCO 3DT-5000 controller continuously monitors the level of active polymer in the system. As operational parameters change, 3D TRASAR Scale Control takes appropriate corrective actions to maintain proper polymer actives in the system.

3D TRASAR Bio-Control

3D TRASAR Bio-Control is an entirely new, innovative approach to bio-population control. A fluorescent "bio-reporter" is introduced into the cooling system. The bio-reporter reacts, enzymatically, with microbes. The reaction changes the bio-reporter's fluorescent signature. 3D TRASAR Bio-Control measures the reacted and unreacted bio-reporter, generates the Nalco Bio-Index and adjusts biocide feed to optimize control. 3D TRASAR Bio-Control is the only bio-control system available that adjusts system operation in response to changes in bio-activity. This unique Nalco innovation delivers comprehensive, continuous control of both, vessels and planktonic bio-populations.

Use 3D TRASAR Bio-Control to:

- Compensate for variations in makeup bio-populations.
- Prevent under-deposit corrosion by controlling sessile bio-populations.
- Optimize water and chemical use by actively managing the system based on the actual bio-activity present.
- Reduce downtime and maintenance costs by preventing corrosion and fouling associated with bio-activity.

A Case Study

System stresses vary greatly from system to system. Some are limited by water chemistry. Increasing cycles of concentration can increase real potential for scaling or corrosion. Others are limited by system operations. High exchanger temperatures present serious treatment challenges. In some, control systems designed to manage one aspect of cooling system operation can adversely impact other areas.

Oxidant feed is necessary to control the microbial population in most cooling systems. But high oxidant concentrations can have an adverse effect on copper heat exchangers. The two requirements — oxidant feed and low corrosion rates — must be reconciled. **3D TRASAR** technology provides the necessary control to meet both needs.

The data in Figure 3 was collected at a large manufacturing site. With every spike in Oxidation-Reduction Potential (ORP), a corresponding spike in copper corrosion rate was detected. Using **3D TRASAR** technology, oxidant feed and control was improved, reducing both the ORP spikes and the copper corrosion rate.

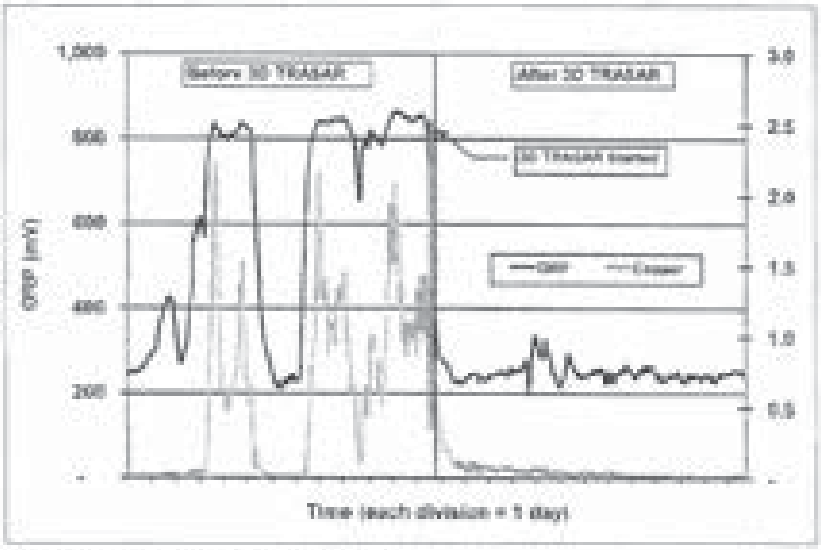


Figure 3 – ORP before and after 3D TRASAR

News Release

NALCO

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1601 West Diehl Road
Naperville, IL 60563-1198
www.nalco.com

Media Contact: John Schoen
630 305 1147
jschoen@nalco.com

Investor Contact: Mike Bushman
630 305 1029
mbushman@nalco.com

Date: June 24, 2008

Nalco Wins Presidential Green Chemistry Challenge Award for 3D TRASAR Technology

(Naperville, Ill.) Nalco Company (NYSE:NLC), has won a 2008 Presidential Green Chemistry Challenge Award for its 3D TRASAR® Technology for Cooling Water. The Company will accept the award in the area of "greener reaction conditions" during a ceremony at the National Academy of Sciences in Washington, D.C., this evening.

Since 1996, the Presidential Green Chemistry Challenge Award has been given by the United States Environmental Protection Agency for outstanding chemical technologies that incorporate the principles of green chemistry into chemical design, manufacture and use. An independent panel of experts convened by the American Chemical Society selected the winners from nearly 100 nominations.

Cooling water touches many facets of human life, including cooling for comfort in commercial buildings and cooling industrial processes. Cooling systems require treatment programs to control microbial growth, mineral deposits and corrosion. Nalco developed 3D TRASAR technology for on-line monitoring of the condition of cooling water and to respond continuously for ensuring its suitability through treatment programs for maximum utilization. The technique saves water and energy, optimizes the use of water-treatment chemicals, reduces air and wastewater emissions, and extends equipment life. Further, a 3D TRASAR equipped cooling system operates closer to its capabilities by virtue of having eliminated the system variability and thereby offering savings in energy costs to the user.

In 2007, more than 5,000 customer locations in the United States, Canada and Europe used 3D TRASAR technology for their cooling systems, saving an estimated 40.2 billion gallons of water. That's equal to the annual domestic water use for the combined populations of Atlanta, Boston and Denver.

Besides cooling water applications, the 3D TRASAR platform has been expanded to control and optimize conditions in reverse osmosis systems and process applications for a broad range of industrial and institutional customers. Successful extended trials are also underway for boiler operations. More information about 3D TRASAR technology is available at www.nalco.com/3DTRASAR.

This marks the second time Nalco has been honored with the Presidential Green Chemistry Challenge Award. In 1999 Nalco was selected in the greener reaction conditions category for Ultimer® polymers. Ultimer polymers are manufactured in water-based salt solutions, eliminating the release of five million pounds of oil into the

environment annually. In addition, the manufacturing process utilizes a waste by-product (ammonium sulfate) from another industrial process.

About Nalco

Nalco is the world's leading water treatment and process improvement company, delivering significant environmental, social and economic performance benefits to our customers. We help our customers reduce energy, water and other natural resource consumption, enhance air quality, minimize environmental releases and improve productivity and end products while boosting the bottom line. Together our comprehensive solutions contribute to the sustainable development of customer operations. More than 11,500 Nalco employees operate in 130 countries supported by a comprehensive network of manufacturing facilities, sales offices and research centers to serve a broad range of end markets. In 2007, Nalco achieved sales of more than $3.9 billion. For more information visit www.nalco.com.

NALCO

3D TRASAR® Technology for Cooling Water Series Bulletin

- *3D TRASAR (5500 Series)*
- *3D TRASAR Starter (3500 Series)*
- *3D TRASAR mini (2500 Series)*

Nalco's innovative 3D TRASAR Technology for Cooling Water contributes to the sustainable development of operations, improves finished product performance, and optimizes operational efficiency. It is also a 2008 winner of the Presidential Green Chemistry Challenge award.

3D TRASAR programs integrate the world's most advanced monitoring, automated control, leading-edge chemistries and instant communication to deliver sustainable development. 3D TRASAR technology continuously measures key system parameters, detects upsets, takes appropriate corrective action and communicates with system users. 3D TRASAR programs minimize total cost of operation (TCO) and prevent operational problems.

3D TRASAR Scale Control continuously monitors the scaling potential of cooling water systems by maximizing cycles of concentration, and its control action prevents system degradation. This saves both water and chemicals.

3D TRASAR Corrosion Control continuously monitors corrosion trends, alerting customers and Nalco Sales Engineers regarding any abnormal corrosion conditions.

3D TRASAR Bio-Control applies biocide based on the measured bioactivity in the cooling system. 3D TRASAR bio-control measures and controls both sessile and planktonic bio-activity, a capability unique to 3D TRASAR technology.

The 3D TRASAR system is a complete water treatment control and monitoring system available in 3 configurations:

- 3D TRASAR (5500 Series)
- 3D TRASAR Starter (3500 Series)
- 3D TRASAR mini** (2500 Series)

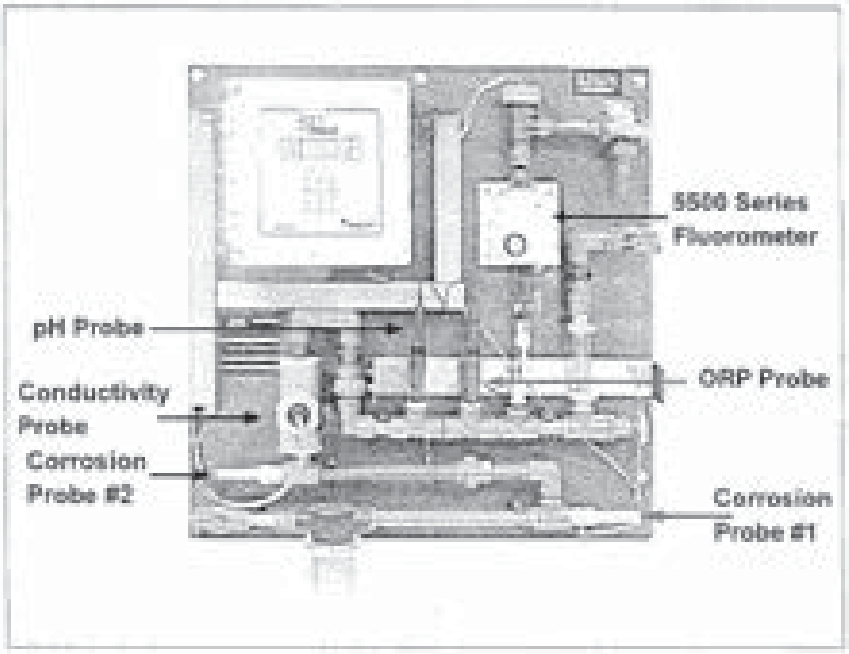
**Currently available only in Asia

Bulletin 8.3015

The **3D TRASAR 5500** utilizes state-of-the-art optical fluorescence sensing to monitor and control chemical feed. The central component of the system is a rugged 6-channel fluorometer that measures:

- TRASAR® #2 Chemical Residuals
- Polymer Chemical Residuals
- Background Fluorescence
- 2x Bio-Reporter
- Cell Fouling
- Turbidity

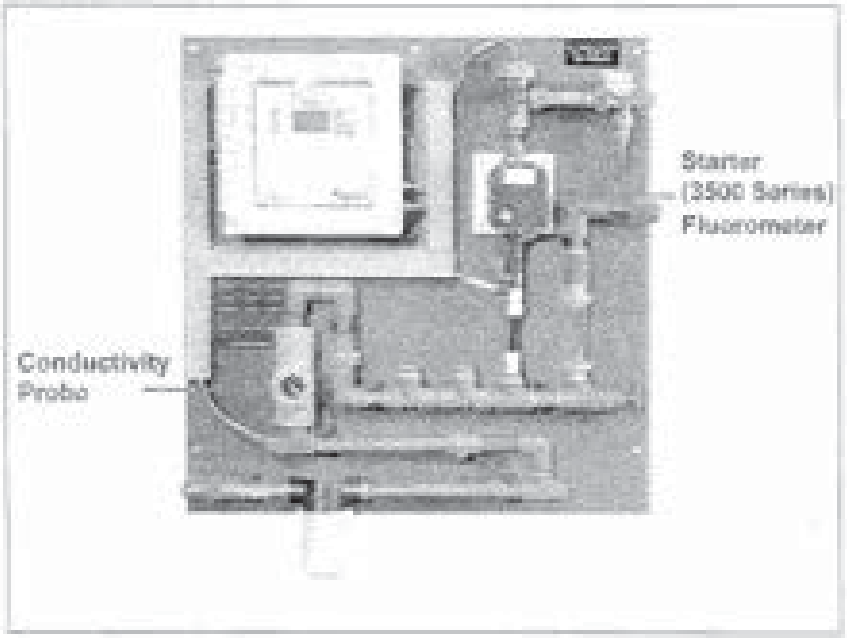
3D TRASAR 5500 has TRASAR technology, conductivity control, pH, ORP, corrosion control and web-based accessibility as a standard offering, which provides a complete water treatment control and monitoring system.



The **3D TRASAR Starter 3500** utilizes proven TRASAR technology to monitor and control chemical feed.

- TRASAR #2 Chemical Residuals
- Cell Fouling
- Turbidity

3D TRASAR Starter 3500 delivers TRASAR technology, conductivity control, web accessibility and reporting capabilities in one easy-to-install package. It is customizable to meet specific user needs, yet offers the flexibility for future upgrades to utilize all features of 3D TRASAR 5500 Series offerings. Features of the 3D TRASAR 5500 are available

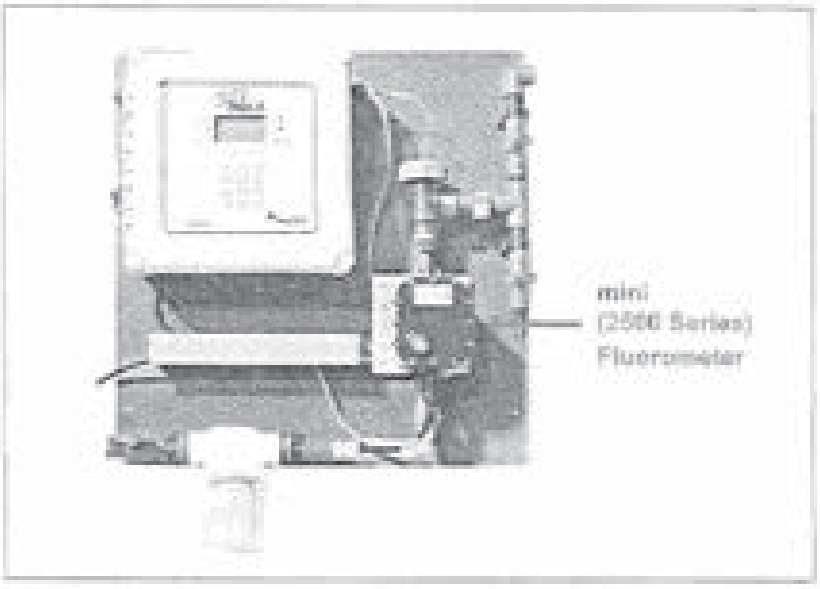


as upgrades to the 3D TRASAR Starter 3500.

The **3D TRASAR mini 2500** utilizes proven TRASAR technology to monitor and control chemical feed. The 3D TRASAR mini 2500 contains a 2-channel fluorometer that measures the following:

- TRASAR #2 Chemical Residuals
- Cell Fouling

3D TRASAR mini 2500 series is our latest offering. It is designed for customers who will not need all the features available with the 3D TRASAR 5500 or 3500 applications. This simple and compact design makes the TRASAR technology user friendly. The 3D TRASAR mini cannot be upgraded to a 3500 or 5500; therefore, it addresses the needs of only a selective market.



Support

A 3D TRASAR Starter Fluorometer can be upgraded to a 3D TRASAR 5500 series by ordering a Fluorometer Upgrade Package, Nalco Part Number: 060-TR3200.88. If you have any questions please contact your Nalco Sales Engineer. In North America, you can contact the Nalco Global Equipment Solutions Help Desk at 1-800-323-8483.

	3D TRASAR 5500	3D TRASAR Starter 3500	3D TRASAR mini 2500
TRASAR Control – (Inhibitor Dosage Control)	X	X	X
Tagged Polymer Control – (Scale Inhibitor Dosage Control)	X	O[1]	
Analog Modem – (Remote access and monitoring)	X	X	
Local Wireless Gateway – (Remote monitoring)	X	X	O
Web Accessibility	X	X	X
Conductivity Measurement and Control	X	X	
pH Measurement and Control	X	O	
ORP Measurement and Control	X	O	
Available Relays/Decade Timers	7	7	3
3D TRASAR Scale Control	X	O[1]	
3D TRASAR Bio-Control	X	O[1]	
Nalco Corrosion Measurement	X	O	

O – Optional Upgrade
O[1] – Optional, Available with Fluorometer Upgrade (Part No. 060-TR3200.88)

NALCO COMPANY OPERATIONS

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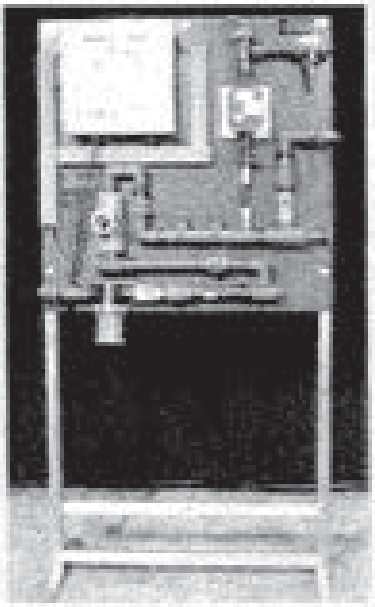
NALCO

3D TRASAR® Systems

Delivering Sustainable Development



3D TRASAR Starter

Nalco's innovative 3D TRASAR technology for cooling water contributes to the sustainable development of your operations, improves finished product performance and optimizes operational efficiency.

Nalco was the recipient of the 2008 Presidential Green Chemistry Challenge Award for its 3D TRASAR technology for cooling water. 3D TRASAR programs integrate the world's most advanced thinking in monitoring, automated control, leading-edge chemistries and instant communications to deliver sustainable development.

The 3D TRASAR system is a complete water treatment control and monitoring system available in two configurations:

- 3D TRASAR Full
- 3D TRASAR Starter

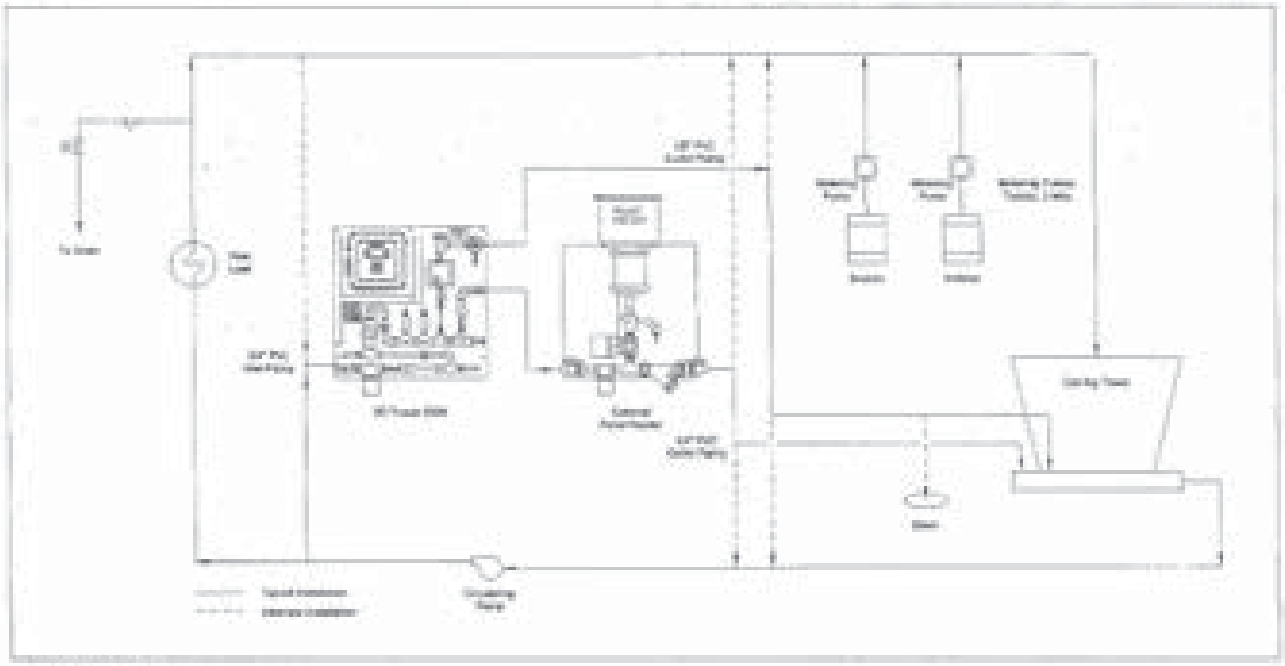
3D TRASAR technology continuously measures key system parameters, detects upsets, takes appropriate corrective action and communicates with system users. 3D TRASAR programs minimize total cost of operation (TCO) and prevents operational problems.

3D TRASAR Starter makes the elite 3D TRASAR technology more accessible. Customizable to meet specific user needs, 3D TRASAR Starter delivers TRASAR technology, conductivity control, web accessibility and new, easy reporting capabilities in one, easy to install package. 3D TRASAR Starter can be easily upgraded to full 3D TRASAR capability as needs and requirements change.

3D TRASAR Scale Control continuously monitors the scaling potential of your cooling water. By maximizing cycles of concentration, you save water and chemicals. Control action prevents system degradation.

Table 1 – Fully upgradable and customizable, 3D TRASAR Starter makes the elite technology more accessible.

	3D TRASAR Starter	3D TRASAR Full
3D TRASAR Fluorometer	X	X
Modem	X	X
Web Accessibility	X	X
Conductivity Measurement and Control	X	X
pH Measurement and Control		X
ORP Measurement and Control		X
Biocide Timers	X	X
Nalco Scale Control		X
Nalco Bio-Control		X
Nalco Corrosion Monitoring		X



Typical Installation

3D TRASAR Corrosion Monitoring continuously monitors corrosion trends, alerting you and your Nalco Sales Engineer to any abnormal corrosion conditions.

3D TRASAR Bio-Control applies biocide based on the measured bio-activity in your cooling system. 3D TRASAR Bio-Control measures and controls both sessile and planktonic bio-activity, a capability unique to 3D TRASAR technology.

Feed and Control Methods

Cycles of Concentration

- 3D TRASAR Full: On/Off based on conductivity set-point or 3D TRASAR Scale Control.
- 3D TRASAR Starter: On/Off based on conductivity set-point.
- Range: 200 – 10,000 microsiemens.
- Non-fouling toroidal conductivity probe.

Chemical Feed – Inhibitor

- 3D TRASAR Full: On/Off based on TRASAR Tagged Polymer, 3D TRASAR Scale Control with manual, timer or slave options.
- 3D TRASAR Starter: On/Off based on TRASAR, with manual, timer or slave options.

Chemical Feed – Oxidizing Biocide

- 3D TRASAR Full: On/Off based on ORP or 3D TRASAR Bio-Control with manual, timer or slug-based feed options. Includes pre-bleed and lockout capability.
- 3D TRASAR Starter: Manual, timer or slug-based options. Includes pre-bleed and lockout capability.

Chemical Feed – Non-oxidizing Biocide

Timer or manual based feed with pre-bleed and lockout capability.

pH (3D TRASAR Full Only)

Acid or caustic on/off, based on flat surface, double junction 3-wire pH probe input, range 0-14 pH.

ORP (3D TRASAR Full Only)

Oxidizing biocide feed based on flat surface, double junction ORP probe input, range = 1000 to +1000 mv.

Multipurpose timers

Timer based feed on any available relay (no pre-bleed or lockout.)

Monitoring Functions

Corrosion Monitoring (3D TRASAR Full Only)

Continuous, on-line measurement of mild steel and copper. Other metallurgies available. Range: 0 to 99 mpy.

Additional Monitored Variables

- Cell Fouling (3D TRASAR Full Only)
- Turbidity
- Temperature
- Background Fluorescence (3D TRASAR Full Only)
- Relay Status
- Pulse counter with water meter

Additional Calculated Variables

- Holding Time Index (3D TRASAR Full Only)
- System Volume
- Blowdown Rate
- Heat Rejection (3D TRASAR Full Only)
- Makeup Water Rate
- Recirculation Rate
- Pump Duty
- Product Usage

Specifications

Plumbing Requirements

Control Panel 3/4" MNPT inlet. (2) outlets (1) 3/4" MNPT & (1) 1/2" MNPT. Total flow required 5 gpm. Outlet piping must be run separately.

Pellet Feeder 3/4" FNPT inlet, 3/4" FNPT outlet. 5 gpm required. 20 psig differential across both units.

Electrical

85 to 250 VAC @ 20 amps service

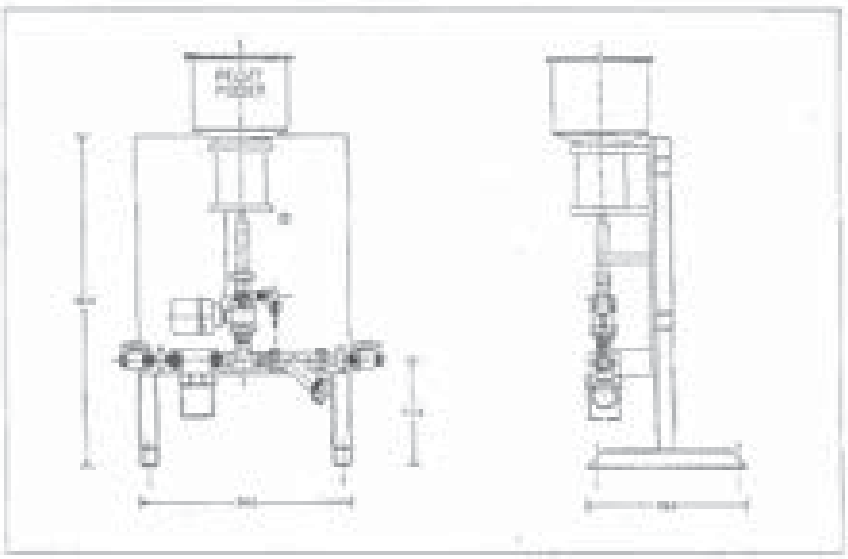
Sample requirements minimum Conductivity of 10 uS/cm required for Corrosion measurement.

Inputs

- (2) unassigned 4-20 mA unpowered non-isolated inputs (used for logging and alarm level call out.)
- (1) Flow input (contact closure)
- (1) Interlock input (contact closure)
- (2) Spare digital inputs (contact closure) used to log input states or low frequency water meter counts
- Modbus RS-232 or RS-485 (choose one) RTU SCADA port

Outputs

- (7) control relay outputs rated 2.5 amps each (larger loads require external motor starters)
- (8) 4-20 mA powered non-isolated outputs



Pellet Feeder

Alarms

- (1) Alarm output relay (rated 1.0 amp max unpowered)
- E-mail notification of alarm conditions (via modem to ISP or customer's LAN-based mail server.)

Enclosure

Nema 4X

Ambient temperature

40-120°F (4-50°C)

Process water temperature

40-120°F (4-50°C)

Relative Humidity

0-95% non-condensing

Maximum water pressure

90 psi

Display/Keypad

Numeric keypad plus specialty keys, graphical display with plotting functions

Security

Password protected (user assignable)

Data management

All variables are data logged in spreadsheet format

Communications

- Ethernet port for direct PC connection
- Built-in modem for direct remote connection or access to 3D TRASAR Web via Internet (requires ISP)
- Optional wireless gateway with monthly service package

Approvals

UL, CUL, CE

Software

- 3D TRASAR Configurator for system configuration and data transfer
- Optional Vantage® 100 PC software for comprehensive data management and analysis

Support

If you have any questions, please contact your local Nalco Sales Engineer. In North America, you can also contact the Equipment Solutions Technical Support Group at 1-800-323-8483.

Replacement Parts and Accessories

Part Number	Description
3D TRASAR (NA)	
946-TR3500.88	Wall Mount, small backboard
946-TR3501.88	Frame Mount, small backboard
946-TR3510.88	Wall Mount with Junction Box
946-TR3511.88	Frame Mount with Junction Box
946-TR3520.88	Enclosed Wall Mount with Junction Box
946-TR3521.88	Enclosed Frame Mount with Junction Box
946-TR3522.88	Enclosed Wall, Junction Box, Gateway
946-TR3523.88	Enclosed Frame, Junction Box, Gateway
946-TR3530.88	Air Purged Wall Mount with Junction Box
946-TR3531.88	Air Purged Frame Mount with Junction Box
946-TR3532.88	Air Wall, Junction Box, Gateway
946-TR3533.88	Air Frame, Junction Box, Gateway
3D TRASAR Starter (NA)	
946-TR3500.88	Wall Mount, small backboard
946-TR3501.88	Frame Mount, small backboard
946-TR3510.88	Wall Mount with Junction Box
946-TR3511.88	Frame Mount with Junction Box
946-TR3520.88	Enclosed Wall Mount with Junction Box
946-TR3521.88	Enclosed Frame Mount with Junction Box
946-TR3522.88	Enclosed Wall, Junction Box, Gateway
946-TR3523.88	Enclosed Frame, Junction Box, Gateway
946-TR3530.88	Air Purged Wall Mount with Junction Box
946-TR3531.88	Air Purged Frame Mount with Junction Box
946-TR3532.88	Air Wall, Junction Box, Gateway
946-TR3533.88	Air Frame, Junction Box, Gateway
3D TRASAR Bio-Reporter Feed Options	
946-TR3120.88	Bio-Reporter Pellet Feeder Assembly for system sizes greater than 12,000 gallons
141-PJH035.88	Bio-Reporter, Liquid Feed pump, for system sizes 3,000 to 12,000 gallons
6009565	Bio-Reporter, Liquid Feed pump, for system sizes up to 3,000 gallons
460-3DTBRC.87	Bio-reporter Quick Dose Pouch (pretreats approx. 150,000 gallons)
Probes	
960-TRG411.80	pH Probe, flat surface, 3/4" NPT
960-TR3421.88	ORP Probe, flat surface, 3/4" NPT
960-TR3441.89	Conductivity Probe, torroidal probe and ser. (for 2" Union)
400-NCMP1B.88	Corrosion Probe w/ferrule, Mild Steel
400-NCMP2B.88	Corrosion Probe w/ferrule, Copper
400-NCMP4B.80	Corrosion Probe w/ferrule, CuNi 90/10
400-NCMP5B.88	Corrosion Probe w/ferrule, CuNi 70/30
400-NCMP7B.88	Corrosion Probe w/ferrule, 443 Admiralty Brass
Spares	
991-3055431B.88	Fuse, 2.5 A, 250V, (output relay fuse)
960-TR3223.88	Desiccant Canister (Fluorometer)
960-TR3223.88	Desiccant Indicator (Fluorometer)
500-P2818.88	Pellet Feeder Cleaning Brush
960-TR3313.88	Pellet Feeder Shield (Dent Repair Kit)
400-NCMAC3.88	Corrosion Probe Swagelock Fitting, Nylon 3/4"
400-NCMAC15.88	Corrosion Probe Restraint Device
6000668	Replacement Flowswitch
TK-135	Configurator Software CD
Reagents and Calibration Supplies	
500-TR3003.88	TRASAR 3400 Series Startup Kit

Start up Kit includes: TRASAR 5000 Calibration Solution 1L (2.) pH 7.0 and 10.0 Calibration solutions 1L (1 of each.) ORP 200 mv and 600 mv Calibration Solutions 1L (1 of each.) Fluorometer Cleaning Solution 1L Replacement Mild Steel and Copper NCM probes (1 of each.) Fluorometer Probe Brush, 800 mL Plastic Beakers (3.) 60 cc Plastic Syringes (3.)

Maintenance Value Package	
946-TR3MVP.88	TRASAR 3400 Series Maintenance Value Pkg

Maintenance Value Package includes: TRASAR 5000 Calibration Solution 1L (2.) pH 7.0 and 10.0 Calibration solutions 1L (1 of each.) ORP 200 mv and 600 mv Calibration Solutions 1L (1 of each.) Fluorometer Cleaning Solution 1L Replacement Mild Steel and Copper NCM probes (2 of each.) Fluorometer Probe Brush, 800 mL Plastic Beakers (3.) 60 cc Plastic Syringes (3.) Replacement pH Probe (1.) Replacement ORP Probe (1.) Fluorometer Desiccant Canister Fluorometer Desiccant Indicator

460-50948.75	TRASAR 5000 Series Calibration Solution, 1L
460-50408.75	pH Calibration Solution, pH 10.0, 1L
460-50407.75	pH Calibration Solution, pH 7.0, 1L
460-50933A.75	ORP Calibration Solution, 200 mv, 1L
460-50933A.75	ORP Calibration Solution, 600 mv, 1L
460-50298.75	Conductivity Calibration Solution, 600 uS, 1L
460-50297.75	Conductivity Calibration Solution, 3800 uS, 1L
460-50800.75	Fluorometer Cleaning Solution, 1L
500-P2817.88	Flow Cell Brush
500-P0016.88	Beaker, 500 mL, plastic
500-P2147.88	Syringe, 60 cc, w/female luer lock, plastic
Cables	
960-TR3321.88	Fluorometer Cable, 4.1L
960-TR3311.88	Pellet Feeder Cable, 25 ft.
960-TR3413.88	pH Cable
960-TR3423.88	ORP Cable
991-01928722.88	Service Cord, 12/3 SJOW (no termination)
991-60053481.88	Pigtail, 16/3 SJOW, 18" w/ US plug
991-60047661.88	Ethernet Crossover cable, 6' orange
Optional Accessories	
960-TR3270.88	LAN Router
960-TR3280.88	Wireless Gateway
960-TR3702.88	Optional Antenna for Wireless Gateway
169VTG-190	Vantage V180
960-TR3250.88	Bio-Reporter Liquid Overflow Container
960-TR3260R.88	Wireless Service 1 yr Update

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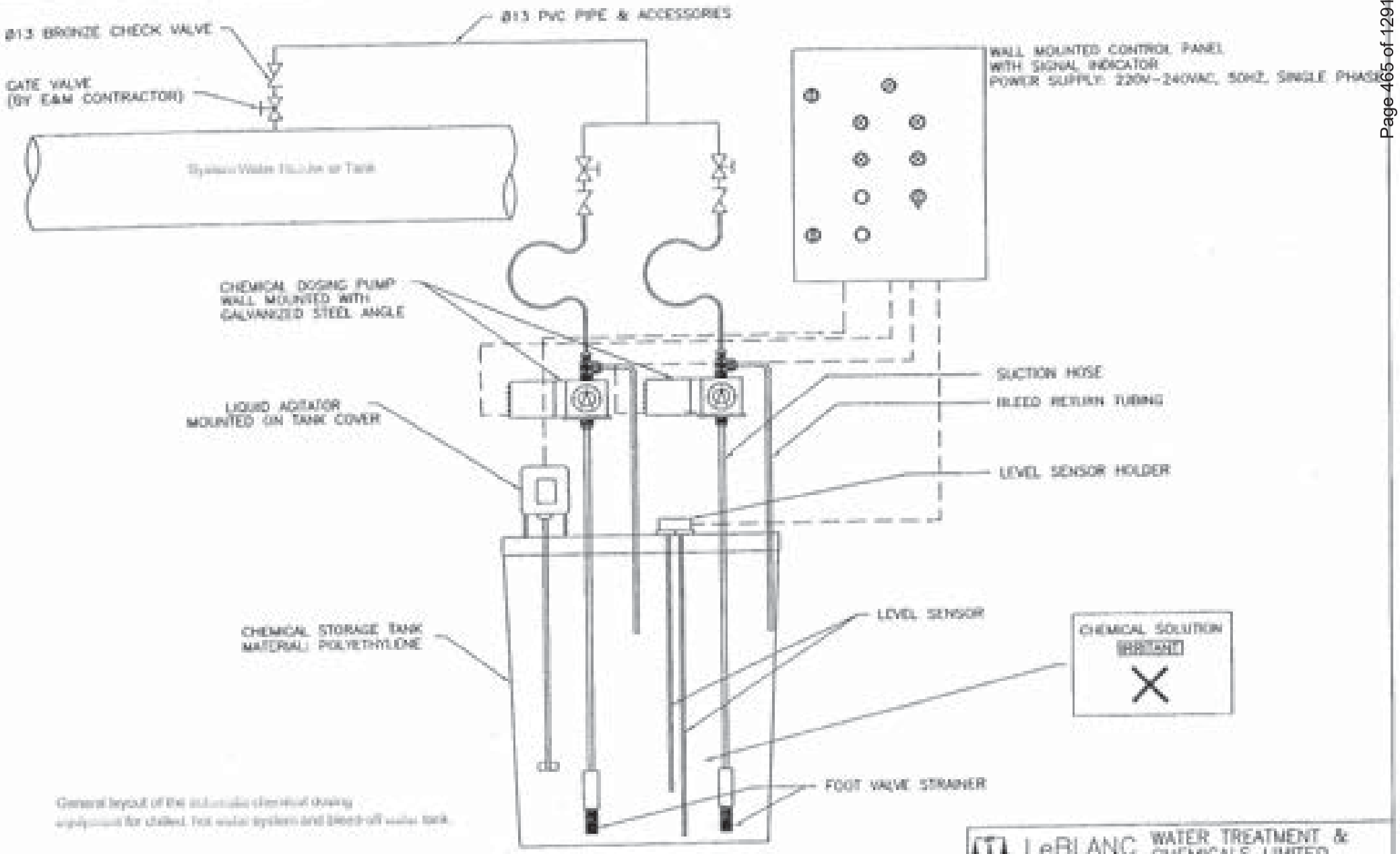


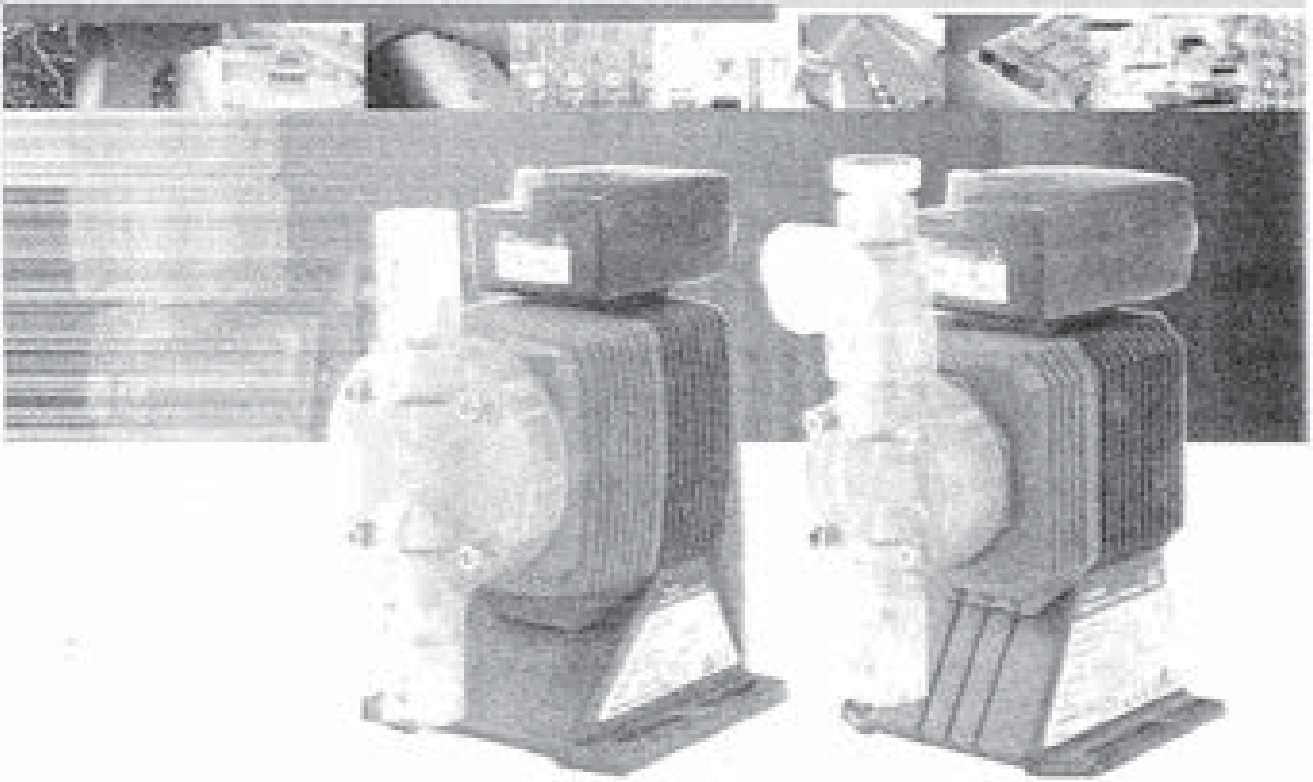
General layout of the automatic chemical dosing equipment for chilled, hot water system and bleed-off water tank

LeBLANC WATER TREATMENT & CHEMICALS LIMITED		
TITLE: Layout of Automatic Chemical Dosing Device		
PROJECT:		DATE: 08-12-01
SCALE: NIL	UNIT: NIL	MATERIAL: NIL
DWN BY:	CHD BY:	DWG NO.: 368/NL

IWAKI

Electromagnetic metering pumps

ES series



Precise chemical injection at low cost

The ES Series electromagnetic metering pump offers precise chemical injection at an economical cost. Manual or on/off control for simple addition applications. Sophisticated engineering to provide effective, reliable performance.

High speed operation
Up to 300 strokes per minute results in high resolution chemical feed, elimination of slug-feed effects.

Compact size
Ideal for OEM specifications. ES pumps are small, quiet, and lightweight.

Double ball check valves
The ball, seat and guide assembly ensures a tight seal to prevent loss of prime.

Long lasting diaphragm
PTFE laminate over EPDM is molded onto a solid core. A retainer plate is provided to minimize flow rate changes as pressure varies.

B11/B16/B21, C16/C21

B31, C31/C36

Wet-end part materials

Material symbol	VC	VH
❶ Pump head	PVC	
❷ Valve	Bumna-cryanic	Hastelloy C276
❸ Valve seat	FKM	EPDM
❹ Valve guide	PVC	
❺ Gasket	PTFE	
❻ O-ring	FKM	EPDM
❼ Diaphragm	PTFE coated EPDM	

Pump identification

ES - B 16 VC - 230N 1
❶ ❷ ❸ ❹ ❺ ❻

❶ Series name

❷ Drive unit symbol
B : 16W
C : 25W

❸ Discharge effective diameter
11 : 10mm 16 : 15mm
21 : 20mm 31 : 30mm
36 : 35mm

❹ Wet-end part material symbol
VC, VH

❺ Power supply voltage symbol

❻ Hose connection (in mm)
1 : 4 X 6 2 : 6 X 9
4 : 8 X 12 5 : 9 X 12

Specifications

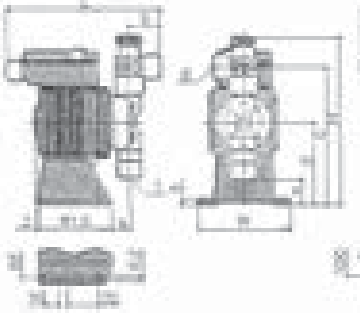
Model		B11	B16	B21	B31	C16	C21	C31	C36
Max. capacity	L/hr	0.25	0.6	0.7	12	4.8	7.8	10.2	24
	mL/min	58	65	95	200	80	130	270	400
	mL/shot	0.11	0.13	0.38	0.56	0.25	0.37	0.76	1.15
Max. discharge pressure	MPa	1.0	0.7	0.4	0.2	1.0	0.7	0.35	0.2
Stroke rate		0 - 360 spm							
Power supply		AC 220 - 240V, single phase, 50Hz / 60Hz							
Insulation type, etc.		B type insulation and built-in thermal protector, with a 2.0m power cable, without plug							

Note • The max. discharge value in the table shows represents the performance measured with clean water at max. discharge pressure, ambient temperature, and rated voltage. Actual discharge may increase if operation is conducted at a lower pressure.
• Set the discharge pressure at 0.17 MPa or higher to prevent over-feeding stable. (0.05 MPa or higher in the case of B31, C36.)
If the pressure is to be lower than these levels, make sure to use a check valve or a back pressure valve, which is supplied as an optional item.
• Range of liquid temperature : 0-40°C
• Range of the ambient temperature : 0-40°C
• Max. viscosity : Up to 50mPa·s. If the viscosity exceeds 50mPa·s, please contact us.

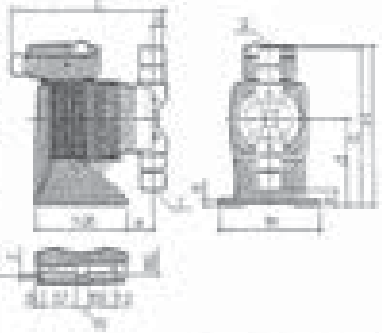
Dimensions in mm

Model	W	H	D	W1	D1	H1	W2	H2	Fig.g Fig.h
ES-B11	100	174	119	126	121	170	90	126	4.3 X 6.4 X 9
ES-B16									
ES-B21									
ES-B31		172	119	121	45	–		80	6 X 13.5 X 12
ES-C16	110	194	136	121	121	190	100	140	4.3 X 6.4 X 9
ES-C21									
ES-C31		196	137.5	126	126	192		150	6 X 13.5 X 12
ES-C36			171	126		189.5		150	

B11/B16/B21, C16/C21



B31, C31/C36



Optional accessory

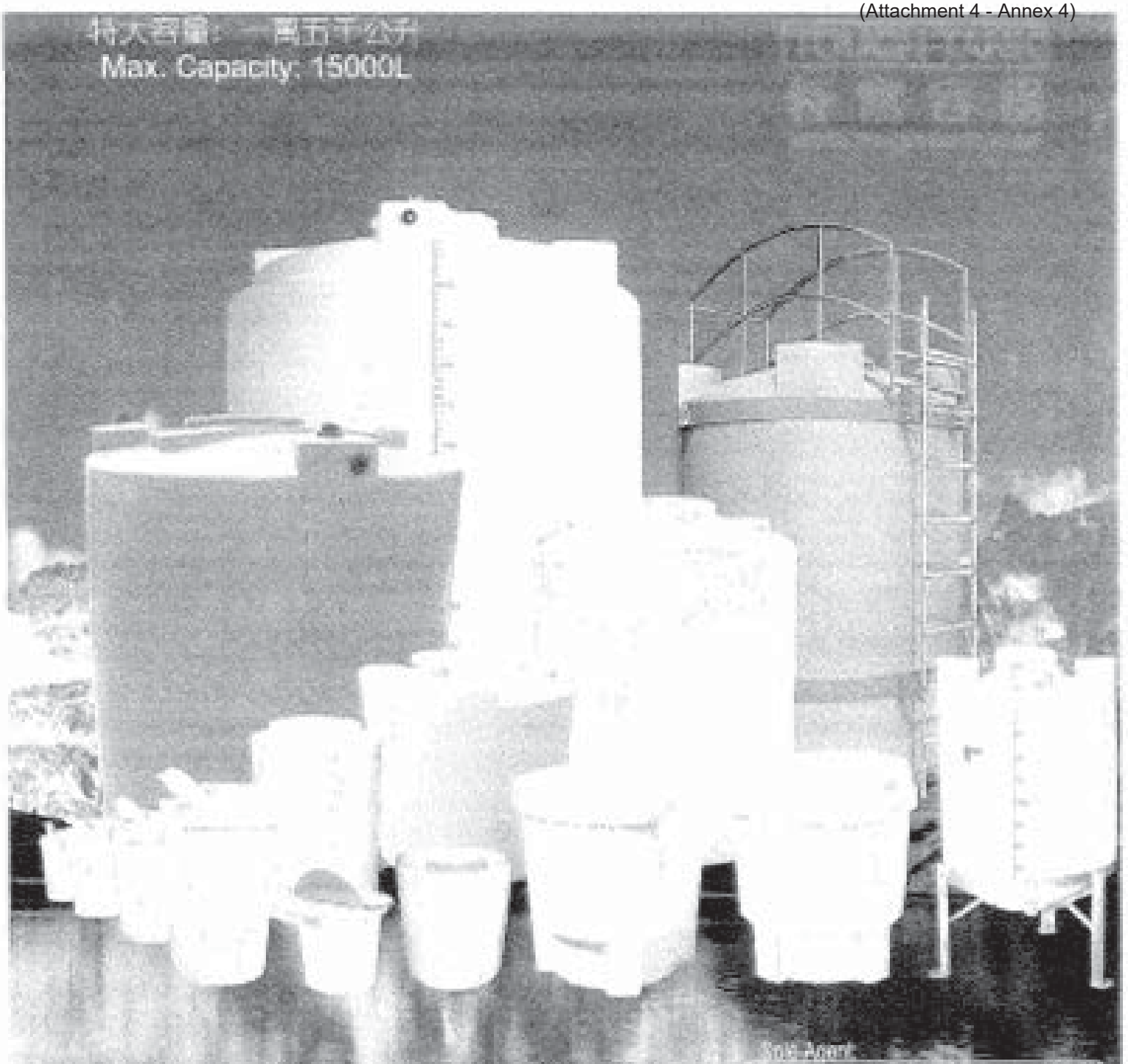
Check valve
This has the function of a non-return valve and prevents siphon and overfeed.

CA : Available in PVC.
CB : In-line type to be connected in the middle of a hose, made of PVC.

Model	Connection Inlet mm	Outlet	Set pressure MPa	Material Body	Sealing	Spring	Applicable model
CA-1VC	4x6 9x9	6x9 and 8x12	0.17 ±0.05	PVC	Hastelloy C276	FKM	B11, B16, B21 C16, C21
CA-1VE						EPDM	
CA-2VC	8x12 9x12					FKM	B31, C31
CA-2VE						EPDM	
CA-2VCL			0.05 - 1.0 0.05			FKM	B31 C31
CA-2VEL						EPDM	

Note: Please contact us for the specifications of CB.

特大容量：一萬五千公升
Max. Capacity: 15000L



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TOUGH-TANK
www.Tough-Tank.com

特厚設計 * 安全衛生 * 防結防鏽

Small-Tanks
小型缸系列

型號	容量 L	淨重 kg	直徑/Dia x H(mm)
Y02100	100	8	490 x 820
Y02300	260	12	620 x 1030
Y02500	300	16	710 x 1180
Y02700	500	22	840 x 1400

型號	容量 L	淨重 kg	直徑/Dia x H(mm)
Y02101	100	7	520 x 610
Y02301	200	11	655 x 765
Y02501	300	13	750 x 875
Y02701	500	17	890 x 1040

型號	容量 L	淨重 kg	直徑/Dia x H(mm)
Y02170	105	9	520 x 725
Y02370	210	14	655 x 910
Y02570	320	16	750 x 1040
Y02770	525	23	890 x 1225
Y02870	750	26	864 x 1425

型號	容量 L	淨重 kg	直徑/Dia x H(mm)
Y02400	220	7	500 x 900
Y02600	340	11	600 x 1250
Y02850	600	13	800 x 1340

型號	容量 L	淨重 kg	直徑/Dia x H(mm)
Y02640	418	16	770 x 1190
Y02680	500	18	770 x 1240

Y02892

型號	容量 L	淨重 kg	直徑/Dia x H(mm)
Y02890	1000	40	1200 x 1350
Y02892	1000	38	1200 x 1250

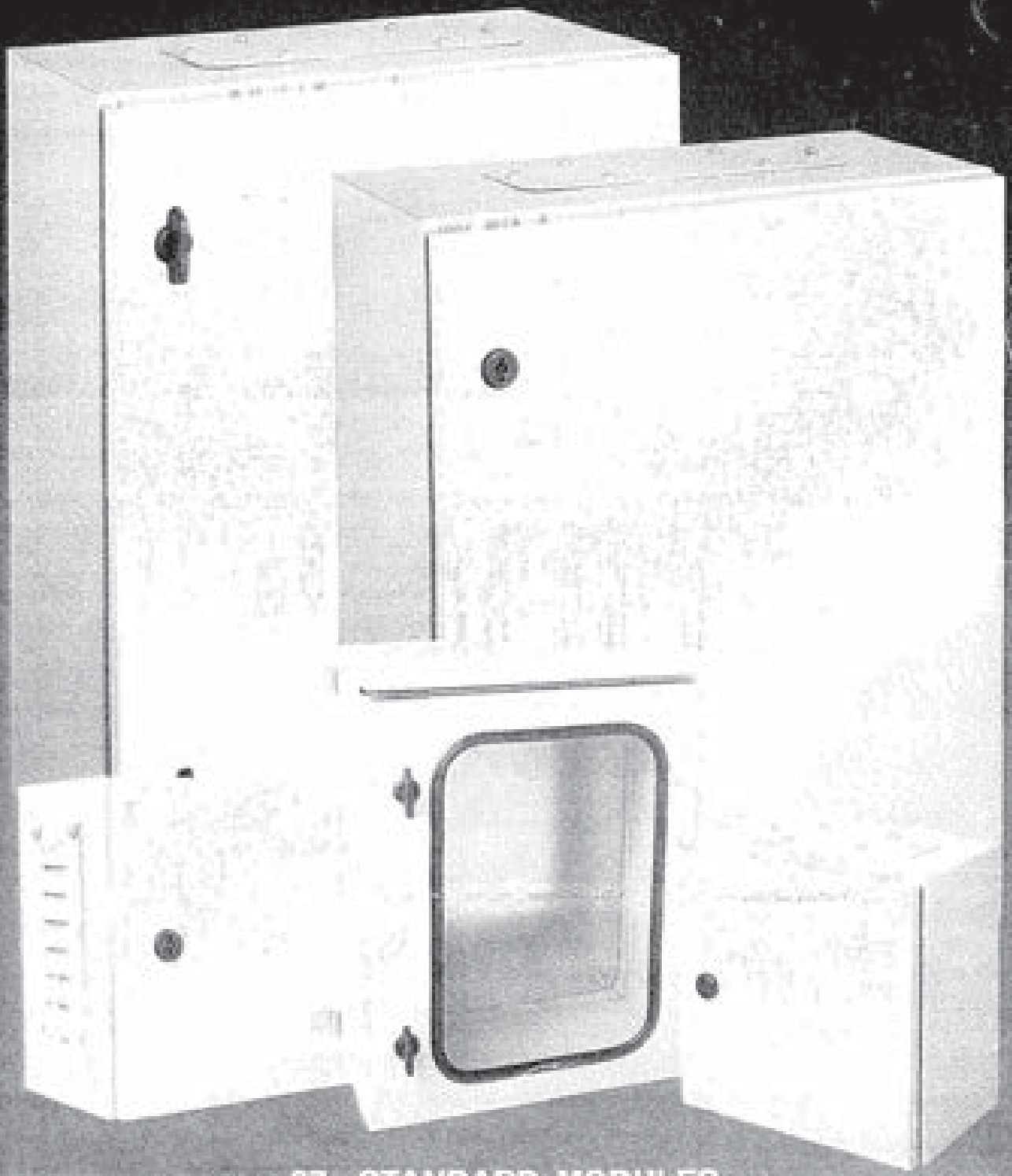
Y02890

Metrix

TYPE **ME**

Wall Mounting Metal Enclosures

IP - 54 (BS 5490, DIN 40050 and IEC 529)

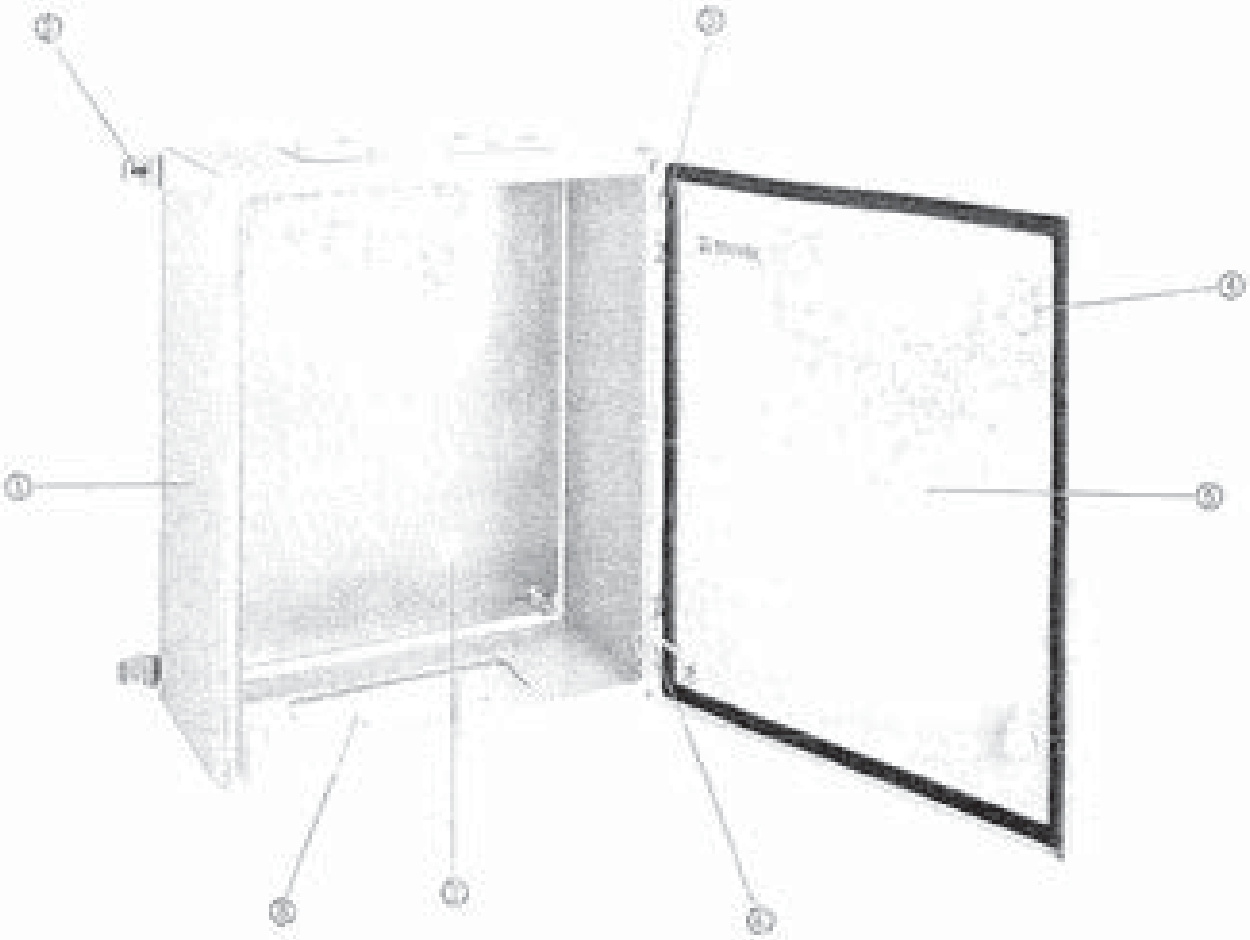


37 - STANDARD MODULES

Metrix

Type "ME" Wall Mounting Metal Enclosures are designed and tested to

IP - 54 (IS 5490, DIN 40050 and IEC 529)



① The enclosures are manufactured from heavy gauge galvanized sheet steel finished with stoved, textured light grey polyester - epoxy powder coating

② 4 external wall mounting brackets, suitable for both Horizontal or vertical mounting

③ Doors are fitted with easily detachable concealed hinges, permiting more than 110° opening

④ Standard door locks are operated by plastic T - shape handles

⑤ Hinged door sealed with neoprene rubber gaskets

⑥ 2 earthing studs M6 with nuts (Earthing leads are available as an extra)

⑦ Zinc plated sheet steel mounting plate with earth terminal and mounting holes

⑧ Flange plate with sealing rubber gasket

Options are available upon request

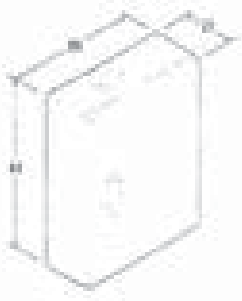
- Stainless steel enclosures
- Higher degree of protection, e.i. **IP-55** and **IP-65**
- Other modular sizes
- Other colours, electric orange or RAL 7032
- Safety cylinder locks or castell locks

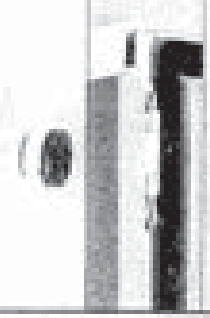
Metrix

Type "ME" Wall Mounting Metal Enclosures — IP - 54

(BS 5490, DIN 40050 and IEC 529)

Dimensions (mm) Width W	x Height H	x Depth D	Type No.	No. of Locks	No. of Hinges	No. of Wall Brackets	Approx Weight (Kg)
200	250	140	ME – 20 x 25 x 14	1	2	4	3.4
250	300	140	ME – 25 x 30 x 14	1	2	4	4.5
		200	ME – 25 x 30 x 20	1	2	4	5.2
300	300	140	ME – 30 x 30 x 14	1	2	4	5.2
		200	ME – 30 x 30 x 20	1	2	4	5.9
300	400	140	ME – 30 x 40 x 14	1	2	4	6.4
		200	ME – 30 x 40 x 20	1	2	4	7.5
400	500	140	ME – 40 x 50 x 14	2	2	4	9.6
		200	ME – 40 x 50 x 20	2	2	4	10.7
		260	ME – 40 x 50 x 26	2	2	4	11.8
400	600	140	ME – 40 x 60 x 14	2	2	4	13.9
		200	ME – 40 x 60 x 20	2	2	4	15.8
		260	ME – 40 x 60 x 26	2	2	4	16.8
500	600	140	ME – 50 x 60 x 14	2	2	4	16.7
		200	ME – 50 x 60 x 20	2	2	4	18.3
		260	ME – 50 x 60 x 26	2	2	4	19.9
		320	ME – 50 x 60 x 32	2	2	4	21.5
500	700	140	ME – 50 x 70 x 14	2	2	4	19.1
		200	ME – 50 x 70 x 20	2	2	4	20.8
		260	ME – 50 x 70 x 26	2	2	4	22.6
		320	ME – 50 x 70 x 32	2	2	4	24.4
600	800	200	ME – 60 x 80 x 20	2	3	4	27.2
		260	ME – 60 x 80 x 26	2	3	4	29.3
		320	ME – 60 x 80 x 32	2	3	4	31.3
		380	ME – 60 x 80 x 38	2	3	4	33.4
600	1000	260	ME – 60 x 100 x 26	2	3	6	35.6
		320	ME – 60 x 100 x 32	2	3	6	38.0
		380	ME – 60 x 100 x 38	2	3	6	40.3
		450	ME – 60 x 100 x 45	2	3	6	43.1
800	1000	260	ME – 80 x 100 x 26	2	3	6	45.1
		320	ME – 80 x 100 x 32	2	3	6	47.7
		380	ME – 80 x 100 x 38	2	3	6	50.4
		450	ME – 80 x 100 x 45	2	3	6	53.5
800	1200	260	ME – 80 x 120 x 26	3	3	6	52.9
		320	ME – 80 x 120 x 32	3	3	6	55.9
		380	ME – 80 x 120 x 38	3	3	6	58.8
		450	ME – 80 x 120 x 45	3	3	6	62.3

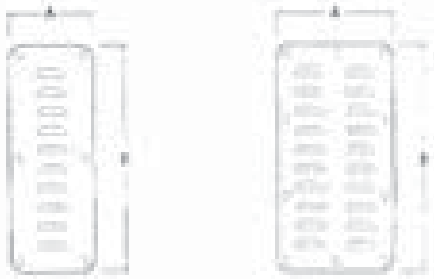




* A mounting plate is delivered with each metal enclosure.

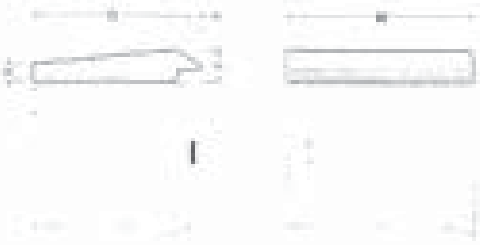
OPTIONS AND ACCESSORIES

LOUVRE PLATES

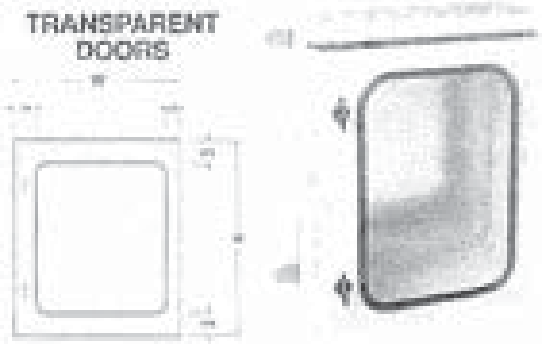


Type No.	A	B
LP - 1	65	120
LP - 2	95	150
LP - 3	190	200
LP - 4	250	300

CANOPIES



TRANSPARENT DOORS



TOUCH UP PAINT

Type No. TUP - RAL 7032
Type No. TUP - 31 grey

STANDARD DOOR LOCK

Type No. DL-T

WALL MOUNTING BRACKETS

(4 pcs. per set)

Type No. WMB-01

EARTHING LEADS

Type No.	Length (in mm)	Conductor (in mm²)
EL-160/2.5	160	2.5
EL-160/4	160	4
EL-200/6	200	6
EL-225/10	225	10

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TEST REPORT
(IP-54)

No. C9215 page 1 of 4 pages

Applicant: Metrix Engineering Co. Ltd.
Melbourne Industrial Building
2/F., Block A & B
16 Westland Road
Hong Kong

Item: "Metrix" Wall Mounting Metal Enclosure
Type No. ME-25x30x14 (as per drawing on page 3)

Investigation Requested: Protection against external influences

Date of Execution: February 29, 1992

Testing Tooling and Materials: Pneumatic nozzle (gun); water jet; dust (powder); and pressurized water.

Test Results:

The abovesaid item which is of totally enclosed type with no ventilation louvers or aperture, was tested in accordance with IP-54 as per BS5490, DIN40050, and IEC529.

First, test on protection against solid bodies was performed. Dust was purposely spread over surrounding the enclosure. It was found that the enclosure was able to protect against dust, no harmful deposit of dust was found inside the enclosure.

Secondly, test on protection against liquids was performed. Projections of water were purposely projected from all directions to the enclosure. It was found that the enclosure was able to protect against the projections of water. No water drop was found inside the enclosure.

Conclusions:

The above test results shown that the captioned enclosure is complied with the IP-54 as per BS5490, DIN40050, and IEC529.

Dr. C. C. Chan BSc MSc PhD
FIEE
Chartered Electrical Engineer
Membership No. 171604 - 94

Dr. C.C. Chan
FIEEE, FIEF, FHKIE
Chartered Electrical Engineer, U.K.
Registered Professional Engineer, H.K.

April 9, 1992.

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DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING
Pokfulam Road, Hong Kong

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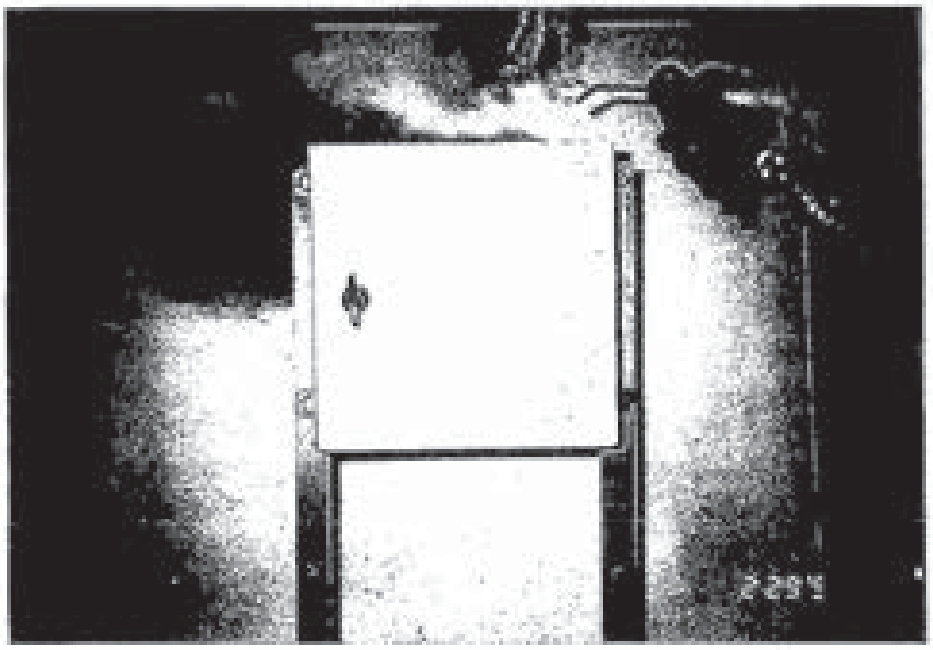
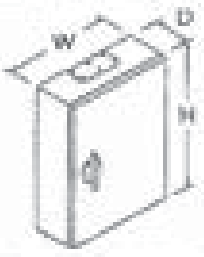


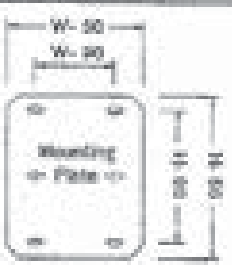
Fig. 1 Test on protection against solid bodies

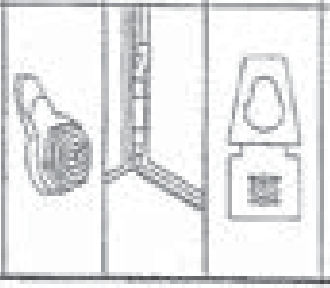
Fig. 2 Test on protection against liquids

Metrix Type "ME" Wall Mounting Metal Enclosures 美捷防水鐵箱

Dimensions (mm) 體積 Width 長 W	x Height 高 H	x Depth 厚 D	Type No. 型號	No. of Locks	No. of Hinges	No. of Wall Brackets	Approx. Weight (Kg.)
200	250	140	ME - 20 x 25 x 14	1	2	4	3.4
250	300	140	ME - 25 x 30 x 14	1	2	4	4.8
		200	ME - 25 x 30 x 20	1	2	4	5.2
300	300	140	ME - 30 x 30 x 14	1	2	4	5.2
		200	ME - 30 x 30 x 20	1	2	4	5.8
300	400	140	ME - 30 x 40 x 14	1	2	4	6.4
		200	ME - 30 x 40 x 20	1	2	4	7.3
400	500	140	ME - 40 x 50 x 14	2	2	4	9.6
		200	ME - 40 x 50 x 20	2	2	4	10.7
		260	ME - 40 x 50 x 26	2	2	4	11.6
400	600	140	ME - 40 x 60 x 14	2	2	4	10.9
		200	ME - 40 x 60 x 20	2	2	4	15.8
		260	ME - 40 x 60 x 26	2	2	4	16.6
500	600	140	ME - 50 x 60 x 14	2	2	4	16.7
		200	ME - 50 x 60 x 20	2	2	4	18.3
		260	ME - 50 x 60 x 26	2	2	4	19.9
		320	ME - 50 x 60 x 32	2	2	4	21.5
500	700	140	ME - 50 x 70 x 14	2	2	4	18.1
		200	ME - 50 x 70 x 20	2	2	4	20.6
		260	ME - 50 x 70 x 26	2	2	4	22.8
		320	ME - 50 x 70 x 32	2	2	4	24.4
600	800	200	ME - 60 x 80 x 20	2	3	4	27.2
		260	ME - 60 x 80 x 26	2	3	4	29.3
		320	ME - 60 x 80 x 32	2	3	4	31.3
		380	ME - 60 x 80 x 38	2	3	4	33.4
600	1000	260	ME - 60 x 100 x 26	2	3	6	35.8
		320	ME - 60 x 100 x 32	2	3	6	38.0
		380	ME - 60 x 100 x 38	2	3	6	40.3
		450	ME - 60 x 100 x 45	2	3	6	43.1
800	1000	260	ME - 80 x 100 x 26	2	3	6	45.1
		320	ME - 80 x 100 x 32	2	3	6	47.7
		380	ME - 80 x 100 x 38	2	3	6	50.4
		450	ME - 80 x 100 x 45	2	3	6	53.5
800	1200	260	ME - 80 x 120 x 26	3	3	6	52.9
		320	ME - 80 x 120 x 32	3	3	6	55.8
		380	ME - 80 x 120 x 38	3	3	6	58.6
		450	ME - 80 x 120 x 45	3	3	6	62.3







* A mounting plate has been included for each metal enclosure. 所有防水鐵箱已包底板

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Melbourne Industrial Building, 2/F. Block A-B,
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1-8-1993

Index of protection (IP) No. C9215 page 4 of 4 pages

IP • • = degree of protection of enclosures of electrical equipment according to standards IEC 529, DIN 40 050 and NFC 20 010

1st figure: protection against solid bodies		
IP	tests	
0		No protection
1	⌀ 50 mm	Protected against solid bodies larger than 50 mm (eg. accidental contact with the hand)
2	⌀ 12 mm	Protected against solid bodies larger than 12 mm (e.g. fingers or the hand)
3	⌀ 2.5 mm	Protected against solid bodies larger than 2.5 mm (e.g. tools, wires)
4	⌀ 1 mm	Protected against solid bodies larger than 1 mm (fine tools and small wires)
5		Protected against dust (no harmful deposit)
6		Completely protected against dust

2nd figure: protection against liquids		
IP	tests	
0		No protection
1		Protected against vertically falling drops of water (condensation)
2		Protected against drops of water falling at up to 15° from the vertical
3		Protected against drops of rain water at up to 60° from the vertical
4		Protected against splashes of water from all directions
5		Protected against jets of water from all directions
6		Protected against jets of water of similar force to heavy seas
7	1 m	Protected against the effects of immersion
8		Protected against prolonged effects of immersion under pressure

3rd figure: mechanical protection		
IP	tests	
0		No protection
1	150 g	Impact energy 0.225 joule
2	250 g	Impact energy 0.375 joule
3	500 g	Impact energy 0.500 joule
5	1 kg	Impact energy 1.00 joules
7	2.5 kg	Impact energy 2.00 joules
9	5 kg	Impact energy 20.00 joules

The 3rd figure is reserved in the French Standard NFC 20 010

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TEST REPORT
(IP-54)

No. C9216 page 1 of 4 pages

Applicant: Metrix Engineering Co. Ltd.
Melbourne Industrial Building
2/F., Block A & B
16 Westland Road
Hong Kong

Item: "Metrix" Wall Mounting Metal Enclosure
Type No. ME-30x40x20 (as per drawing on page 3)

Investigation Requested: Protection against external influences

Date of Execution: February 29, 1992

Testing Tooling and Materials: Pneumatic nozzle (gun); water jet; dust (powder); and pressurized water.

Test Results:

The abovesaid item which is of totally enclosed type with no ventilation louvres or apertures, was tested in accordance with IP-54 as per BS5490, DIN40050, and IEC529.

First, test on protection against solid bodies was performed. Dust was purposely spread over surrounding the enclosure. It was found that the enclosure was able to protect against dust, no harmful deposit of dust was found inside the enclosure.

Secondly, test on protection against liquids was performed. Projections of water were purposely projected from all directions to the enclosure. It was found that the enclosure was able to protect against the projections of water. No water drop was found inside the enclosure.

Conclusions:

The above test results shown that the captioned enclosure is complied with the IP-54 as per BS5490, DIN40050, and IEC529.

Dr. C. C. Chan BSc MSc PhD
FIEE
Chartered Electrical Engineer
Membership No: 171604 - 84

Dr. C.C. Chan
FIEEE, FIEE, FIHKIE
Chartered Electrical Engineer, U.K.
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April 9, 1992.

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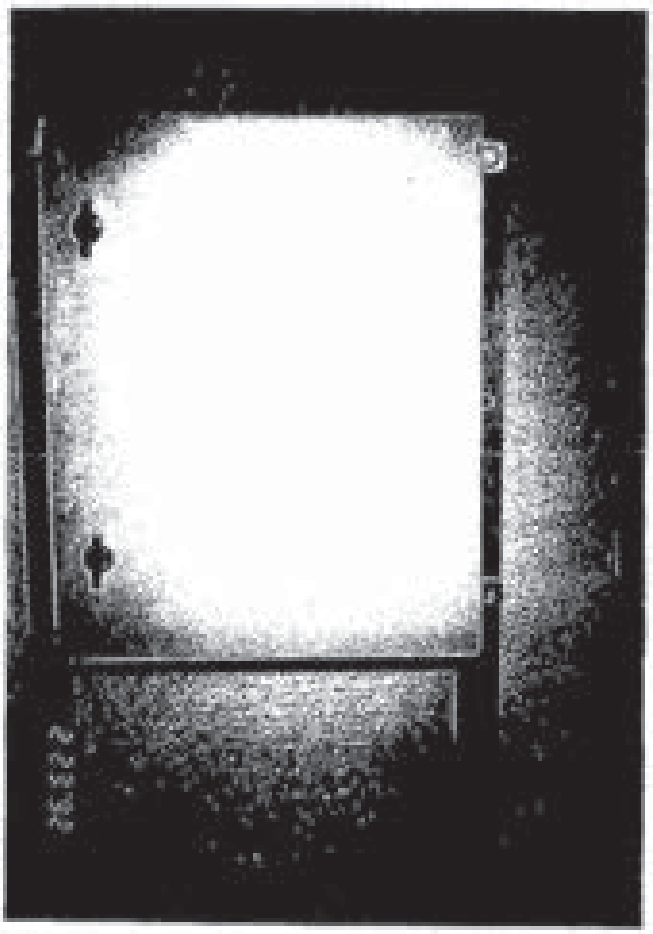
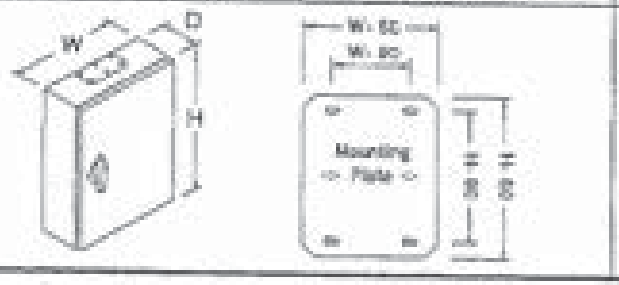


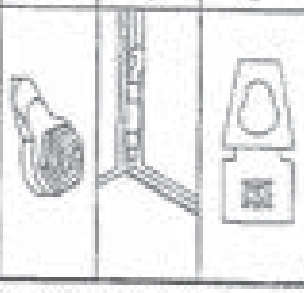
Fig. 1 Test on protection against solid bodies

Fig. 2 Test on protection against liquids

Metrix Type "ME" Wall Mounting Metal Enclosures 美捷特水鐵箱

Dimensions (mm) 體積 Width 長 W	x Height 高 H	x Depth 厚 D	Type No. 型號	No. of Locks	No. of Hinges	No. of Wall Brackets	Approx. Weight (Kg.)	
200	250	140	ME - 20 x 25 x 14	1	2	4	3.4	
250	300	140	ME - 25 x 30 x 14	1	2	4	4.5	
		200	ME - 25 x 30 x 20	1	2	4	5.2	
300	350	140	ME - 30 x 35 x 14	1	2	4	5.2	
		200	ME - 30 x 35 x 20	1	2	4	5.9	
350	400	140	ME - 35 x 40 x 14	1	2	4	6.4	
		200	ME - 35 x 40 x 20	1	2	4	7.3	
400	500	140	ME - 40 x 50 x 14	2	2	4	9.6	
		200	ME - 40 x 50 x 20	2	2	4	10.7	
		260	ME - 40 x 50 x 26	2	2	4	11.8	
400	600	140	ME - 40 x 60 x 14	2	2	4	10.9	
		200	ME - 40 x 60 x 20	2	2	4	15.8	
		260	ME - 40 x 60 x 26	2	2	4	16.8	
500	600	140	ME - 50 x 60 x 14	2	2	4	16.7	
		200	ME - 50 x 60 x 20	2	2	4	18.3	
		260	ME - 50 x 60 x 26	2	2	4	19.9	
		320	ME - 50 x 60 x 32	2	2	4	21.5	
500	700	140	ME - 50 x 70 x 14	2	2	4	19.1	
		200	ME - 50 x 70 x 20	2	2	4	20.8	
		260	ME - 50 x 70 x 26	2	2	4	22.6	
		320	ME - 50 x 70 x 32	2	2	4	24.4	
600	800	200	ME - 60 x 80 x 20	3	3	4	27.2	
		260	ME - 60 x 80 x 26	3	3	4	29.3	
		320	ME - 60 x 80 x 32	3	3	4	31.3	
		380	ME - 60 x 80 x 38	3	3	4	33.4	
600	1000	260	ME - 60 x 100 x 26	3	3	6	35.6	
		320	ME - 60 x 100 x 32	3	3	6	38.0	
		380	ME - 60 x 100 x 38	3	3	6	40.3	
		450	ME - 60 x 100 x 45	3	3	6	43.1	
800	1000	260	ME - 80 x 100 x 26	3	3	6	46.1	
		320	ME - 80 x 100 x 32	3	3	6	47.7	
		380	ME - 80 x 100 x 38	3	3	6	50.4	
		450	ME - 80 x 100 x 45	3	3	6	53.3	
800	1200	260	ME - 80 x 120 x 26	3	3	6	52.9	
		320	ME - 80 x 120 x 32	3	3	6	55.9	
		380	ME - 80 x 120 x 38	3	3	6	58.8	
		450	ME - 80 x 120 x 45	3	3	6	62.3	





* A mounting plate has been included for each metal enclosure. 所有特水鐵箱已包底板

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Index of protection (IP)

IP · · · degree of protection of enclosures of electrical equipment according to standards IEC 529, DIN 40 050 and NFC 20 010

1st figure: protection against solid bodies			2nd figure: protection against liquids			3rd figure: mechanical protection		
IP	tests		IP	tests		IP	tests	
0		No protection	0		No protection	0		No protection
1	⌀ 50 mm	Protected against solid bodies larger than 50 mm (eg. accidental contact with the hand)	1 4		Protected against vertically-falling drops of water (condensation)	1		Impact energy 0.225 joule
2	⌀ 12 mm	Protected against solid bodies larger than 12 mm (eg. finger or like)	2		Protected against drops of water falling at up to 15° from the vertical	2		Impact energy 0.375 joule
3	⌀ 2.5 mm	Protected against solid bodies larger than 2.5 mm (eg. tools, wires)	3		Protected against drops of rain falling at up to 60° from the vertical	3		Impact energy 0.500 joule
4	⌀ 1 mm	Protected against solid bodies larger than 1 mm (tools, wire) (small wires)	4		Protected against projections of water from all directions	5		Impact energy 2.00 joules
5		Protected against dust (no harmful deposits)	5		Protected against jets of water from all directions	7		Impact energy 6.00 joules
6		Complete protection against dust	6		Protected against jets of water of similar force to heavy seas	9		Impact energy 20.00 joules
			7		Protected against the effects of immersion			
			8		Protected against prolonged effects of immersion under pressure			

The 3rd figure is identic to the French Standard NFC 20 010

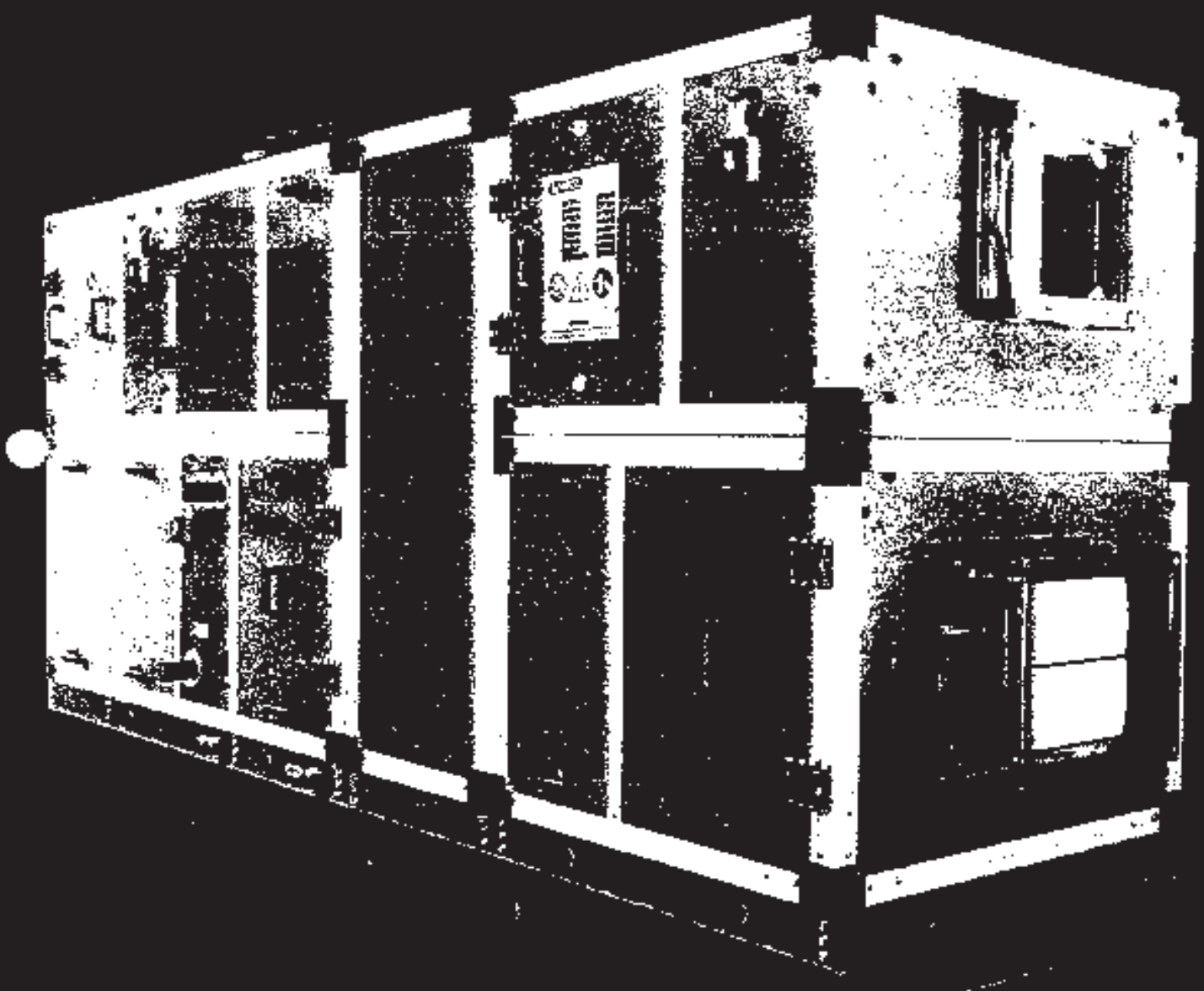
Technical Literature

8) Air Handling Unit / Primary Air Unit

SAIVER

INTEGRATED AIR HANDLING SYSTEM

A1-Series



Handling air to SAIVER, is as natural as breathing.

SAIVER has been manufacturing high quality Air Handling Units for almost half of a century. The Series A1 Air Handling System is the culmination of experience over the years together with continuing improvement through Research and Development.

The superior quality of the Series A1 have also been recognized by the world, including the certification of EUROVENT.

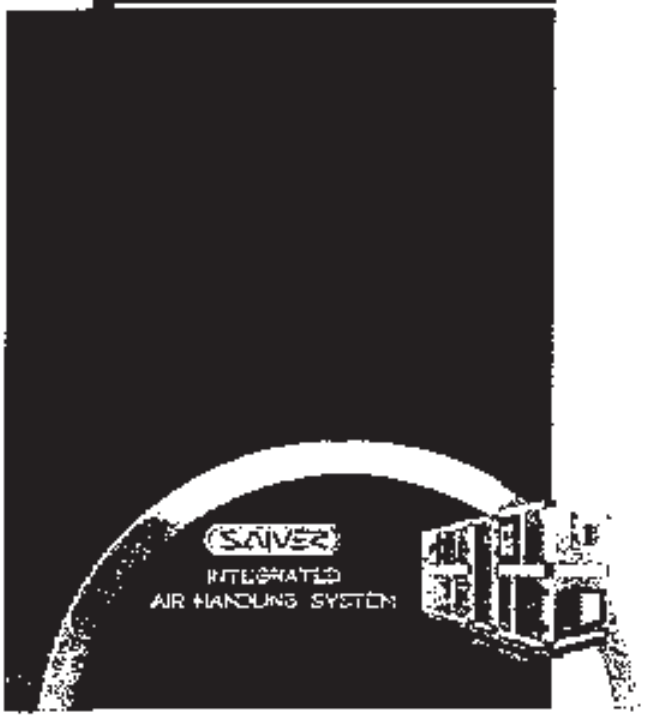
SAIVER AHU test result

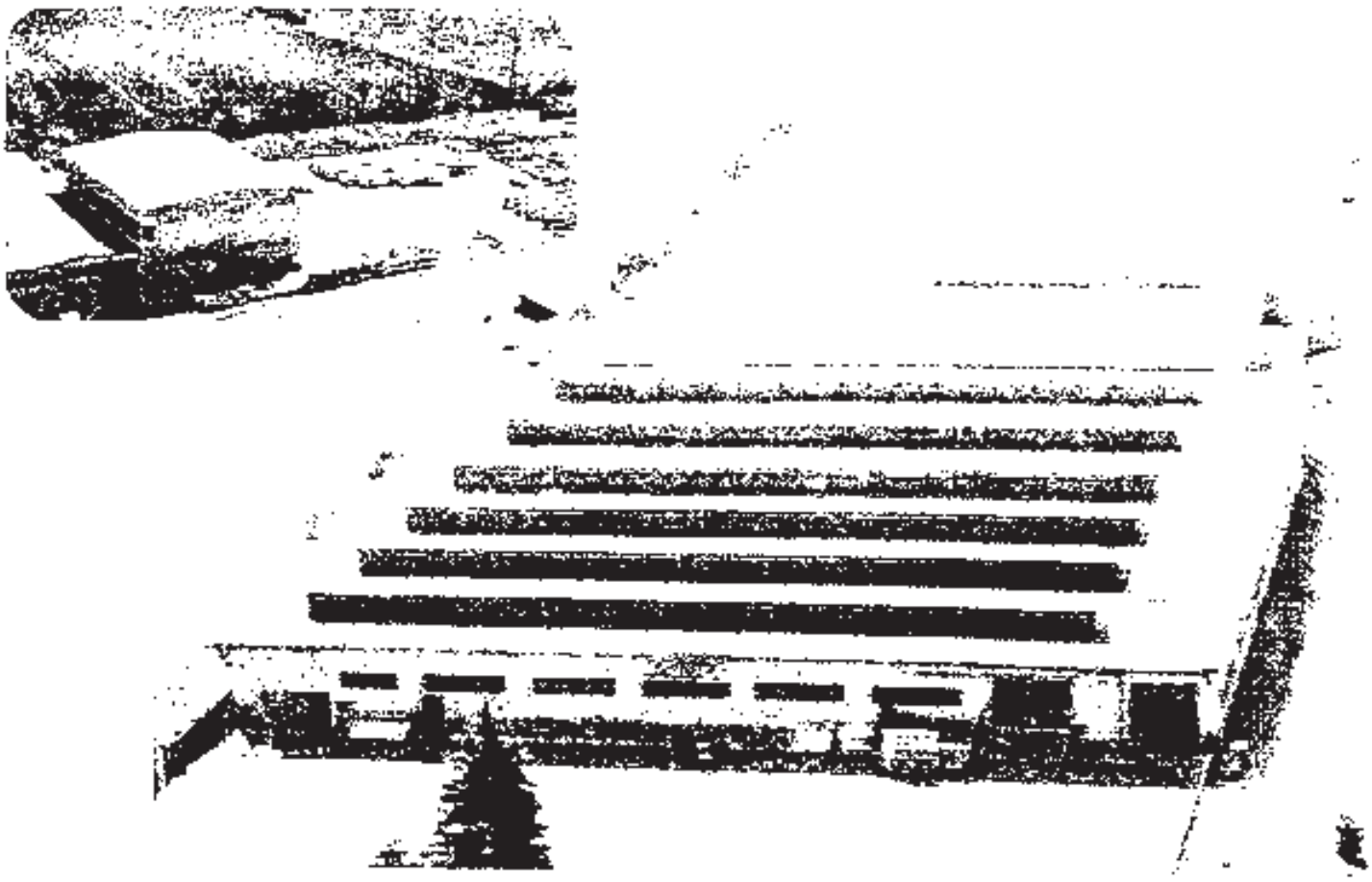
Panel Thickness	Casing Strength	Casing Air Leakage Under -400Pa	Casing Air Leakage Under +700Pa	Filter Bypass Leakage	Thermal Performance	Thermal Bridging Factor
50mm	A1	L1	L1	F9	T1	TB1
50mm	A1	L1	L1	F9	T2	TB2

COMPANY PROFILE

SAIVER Air Handling Units incorporate the finely tuned, value engineered cost effective design aided by computer coupled with human ingenuity.

SAIVER team comprises of highly experienced Engineers and Technicians totally committed to produce one of the finest Double Skinned Air Handling Units range in the World to meet the requirements of most demanding Cost and Quality conscious customer.





SAIVER has kept pace with the time and has always been ahead of its competitors. With automatic production (directly from selection program), SAIVER manufactures CUSTOM-MADE units economically, efficiently and quality assuringly.

SAIVER units incorporate the finest corrosion resistant materials such as Stainless Steel, Marine Aluminium Alloy and Copper to ensure long years of trouble free operation in the most adverse conditions.

The Frame

SAIVER unique frame design has inherent strength stability. The modular framework utilises a corrosion resistant, extruded marine aluminium alloy patented twin box section with True Thermal Break Construction. The entire module is subsequently mounted on a heavy sectional aluminium alloy or galvanized steel channel base.

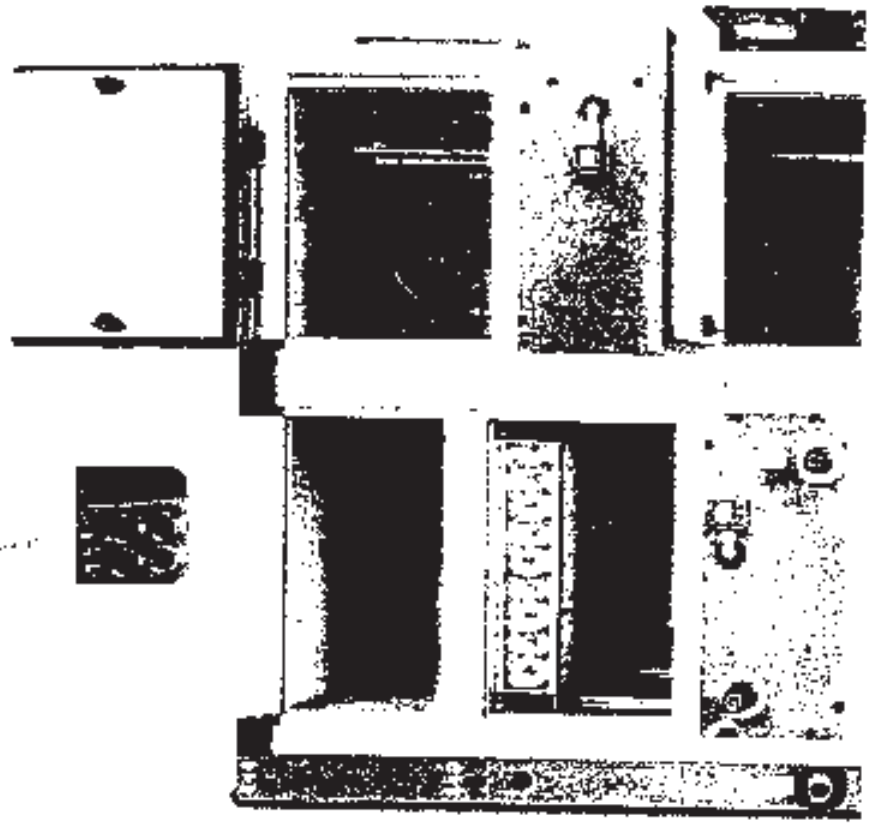
Infill Panels

Standard 30mm or 60mm thick infill panels are of double skinned construction from pressure injected polyurethane foam insulation with 'K' value of 0.02Watts/m°C and density 40kg/m³, sandwiched between galvanized steel with optional preplasticised or pre-painted finish. PERALUMAN and stainless steel sheet is also available.

Accessibility

Filter Cells, Air Washers and Fan Sections requiring regular maintenance and inspection have hinged or fully removable access panels. These are fitted to the frame with easy release, half-turn nylon handles and cam locks. Handles can be operated internally for additional safety.

Hinges are of heavy duty load-bearing design with stainless steel pivot. Other panels can be detached, if necessary for access by removing screws with simple hand tools.



Inlet Section : Mixing Box

Plenum completed with dampers are specifically designed to maximize the stratification of entering air streams for maximum efficiency. Dampers are assembled within a rigid extruded aluminium frame, flanged and pre-drilled for easy fitting to connecting ductwork. Dampers are opposed blade type and available in both flat and double skinned aerofoil sections. Blades are formed from extruded aluminium with edge interlocks. Gaskets are provided to minimize leakage of air.

Coil Section

Coils are computer selected to obtain optimum psychrometric efficiency with low air and water pressure drops. Chilled water, direct expansion, hot water and steam coils are constructed from copper tubes, mechanically bonded to aluminium fins as standard. Other fin materials are available including vinyl coated aluminium, copper tinned copper and galvanised steel. For corrosive flow media, stainless steel tubes and fins are available as an option. The coil assembly completed with carbon steel, copper or stainless steel headers is located within the coil section on aluminium support for easy withdrawal from either side.

On Site Assembly

The lightweight construction material and modular nature of the units make them particularly suitable for lifting and manouvering in difficult or confined locations.

Modules can be easily planned on site and locked together by sturdy stainless steel bolts, located in factory pre-drilled assembly holes. Continuous gaskets between each section ensure an airtight seal and thermal insulation. All fixings and gaskets are concealed within the unit.

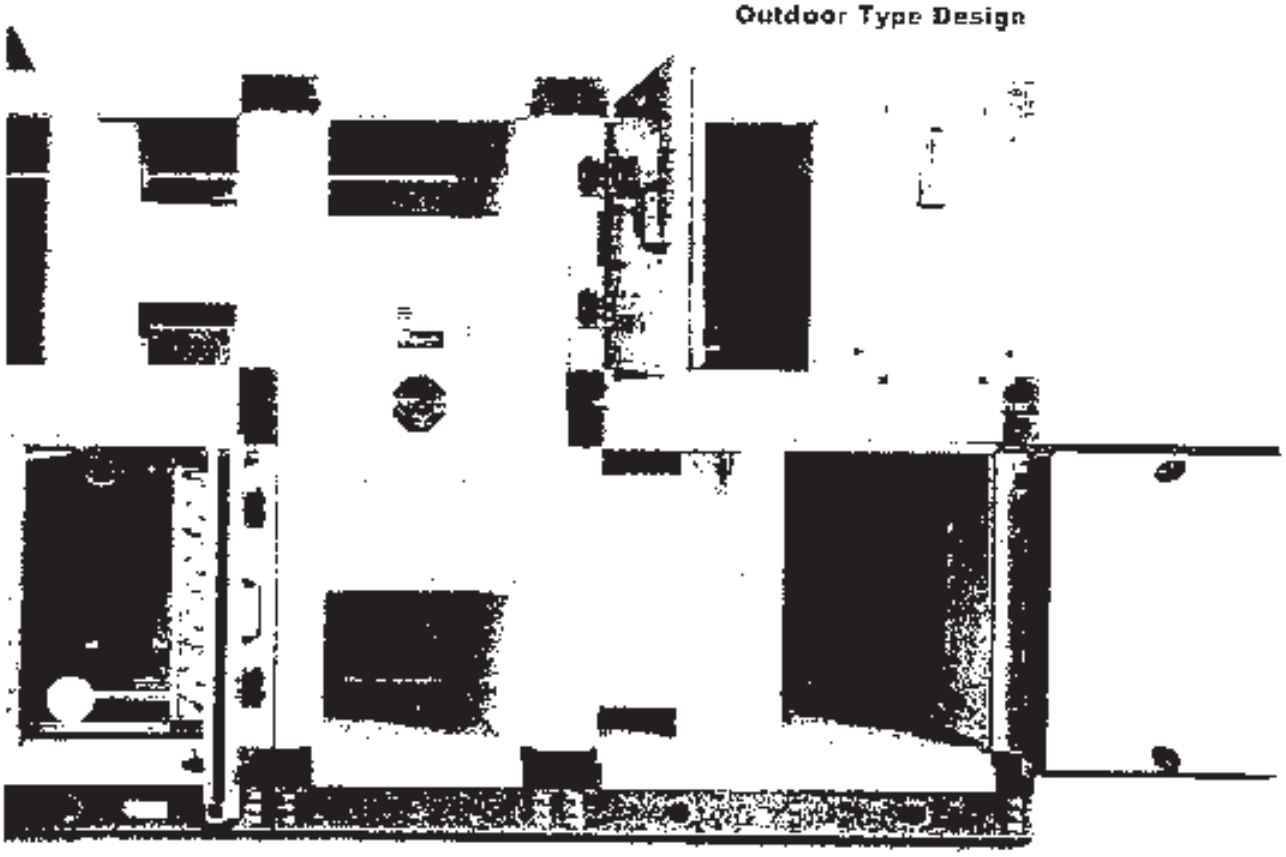
lamp switch

bulkhead lamp

inspection window

Accessories

Outdoor Type Design

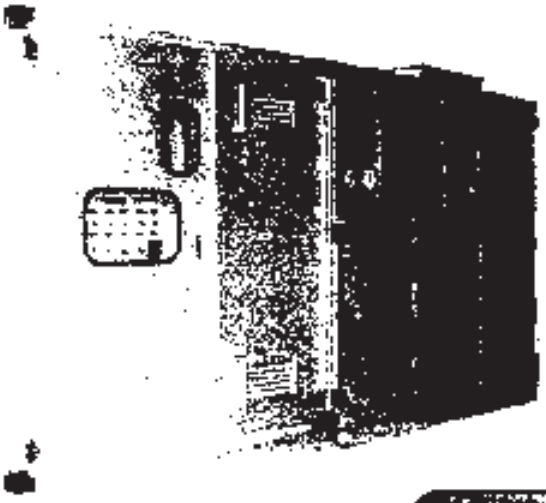


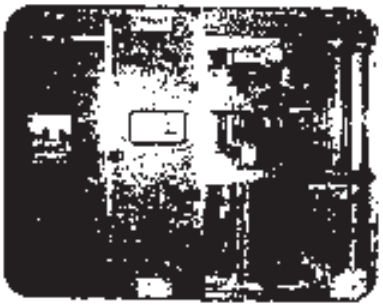
Filter Sections

Fully sealed filter sections are designed for easy withdrawal and renewal of filter cells and are constructed to house any type of primary or secondary filters of different media with vanes efficiencies. In areas of particular importance, such as hospitals and clean rooms, absolute filters can be provided to ensure safe human and machine environments.

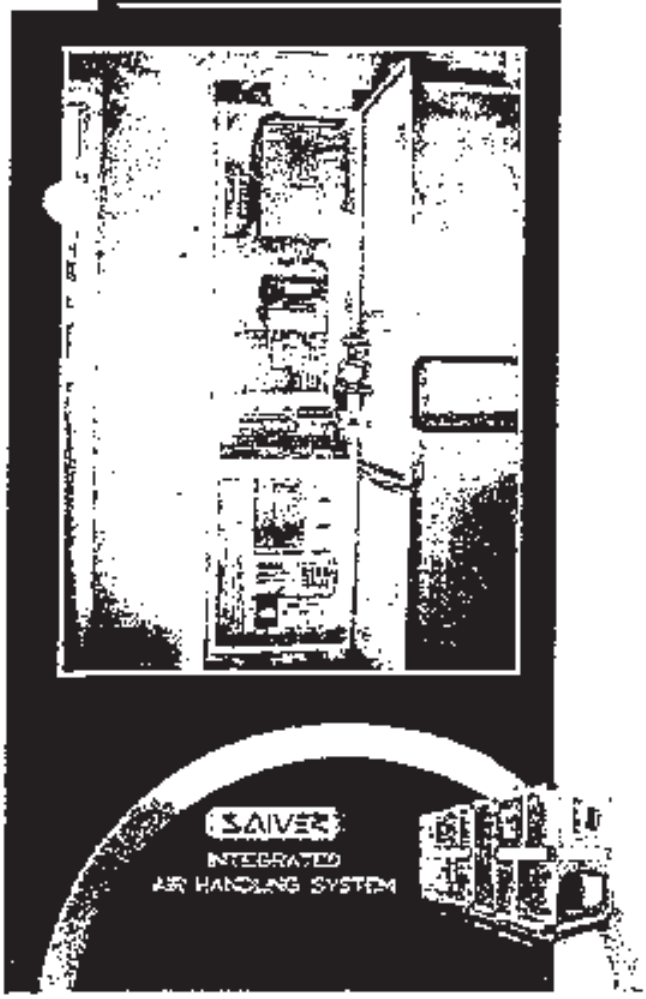
Fan and Motor Section

SAIVER manufactured fans form the heart of all systems. Forward curved or backward curved non-overloading aerofoil centrifugal fans are available with various outlet configurations. All fan wheels and pulleys are individually tested and precision balanced, statically and dynamically, and keyed to the shaft. Motors, mounted on slide rails with provision for easy belt tensioning, drive the fan with heavy duty V-belts. Combination spring and rubber vibration isolators are selected to match the power/weight ration of each fan for maximum isolation.





INTEGRATED PACKAGED



Intelligent Motor Control Center

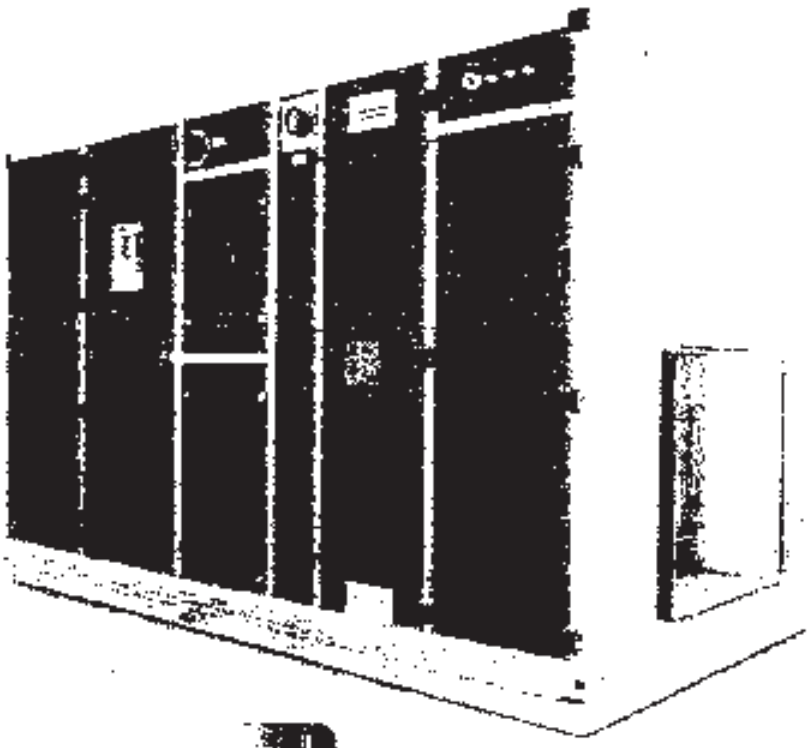
SAIVER Integrated Air Handling System equips with various operative and control devices to optimize unit running conditions.

Motor control panel (MCP module) and direct digital controller (DDC module) can be integrated into our SAIVER Integrated Air Handling System.

All-in-one modular control center results a fast and simple installation as well as a flexible and reliable operations. A unit mounted feature means space and cost saving

MCP modules

- Inverter completed with EMC Filters to comply with EN regulations
- Auto-bypass starting in case of inverter failure
- Marshalling box for other services interfacing/connection, e.g. Fire Services/BMS/M&E.



control valve

water pressure sensor

damper actuator

air pressure sensor

micro switch

emergency stop

control panel

temperature sensor

smoke detector

air flow sensor

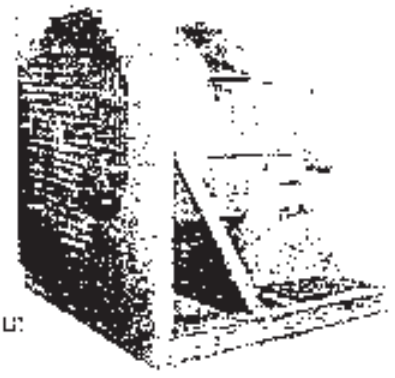
carbon dioxide sensor

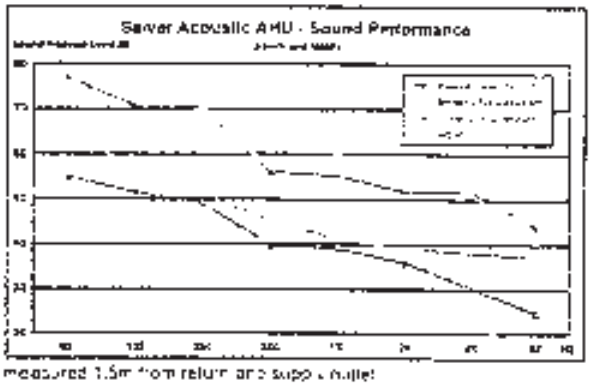
DDC modules

- DDC controller for local/ remote controlling/monitoring
- Chilled water valve completed with electronic control actuator
- Water/ Air differential pressure sensor
- Water/ Air temperature sensor
- Micro switch adjacent to access door
- Damper actuator at supply section
- Probe type smoke detector at return air section
- Carbon dioxide sensor at return air section
- Filter differential pressure sensor.

Super Quiet Operation

Through continuous Research and Development, SAIVER is capable to design and manufacture Acoustic AHU with much lower noise level. For VAV application, with the combination of plug fan and SAIVER Acoustic Panel, we are able to meet NC39 at 9.0m³/s and 1000Pa without supply silencer.

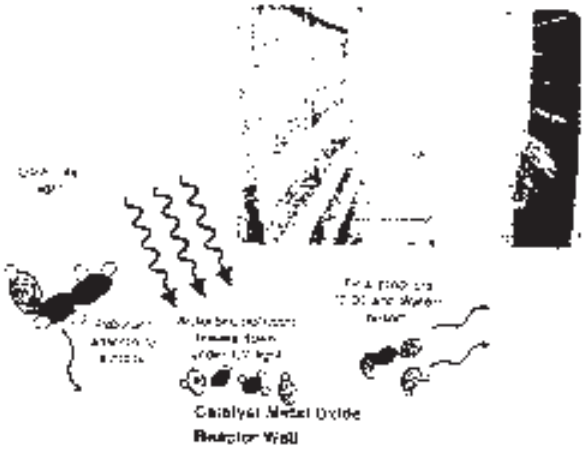




measured 1.5m from return and supply outlet

Photo Catalytic Oxidation (PCO)

The photo catalytic oxidation (PCO) technology utilizes ultraviolet light (UV-C) focused on a catalyst in the presence of water vapor can generate an energy field equals to 10,000 times of nature sunlight which destroy microbes and oxides volatile organic compounds (VOC) in the air.



IAQ PACKAGE

UV Sterilizing Light

An UV system intends to "capture and kill" airborne pathogens, improve IAQ and worker safety. The germicidal UV lamps in our SAIVER air handler disinfect the air by irradiation and provide full coverage of the target surfaces. Installation sights include coils, drain pans filters, exhaust systems, or anywhere mold, bacteria and pathogens can breed.

Ionizer

Ionizer ultimately destroys airborne and living micro organisms by electrolysis process. The generator produces both positive and negative ions as they would occur under natural condition and the microbial control is performed by electrolysis (corona discharge) inside the Bi-polar unit. Single cell organisms are shocked/killed by the polar difference as negatively charged organisms collide with a positively charged particle.

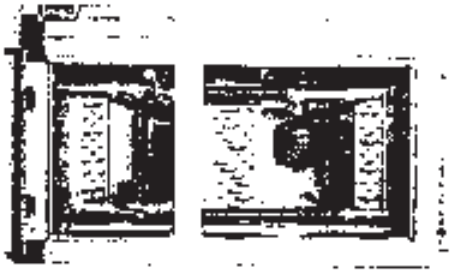
Heat Recovery Unit

To improve Indoor Air Quality (IAQ), one of the best solutions is to increase the fresh air quantity. However, fresh air is always expensive no matter in winter & summer condition.A rotary heat recovery unit allows energy exchange between supply and exhaust air streams. This high efficient heat exchanger can reduce the annual energy consumption in AHU by as much as 90%. (Latent and Sensible Heat Recovery)

Alternatively, Heat Plate is also one of the best heat recovery device which totally eliminates the potential problem of cross contamination.

Heat Pipes

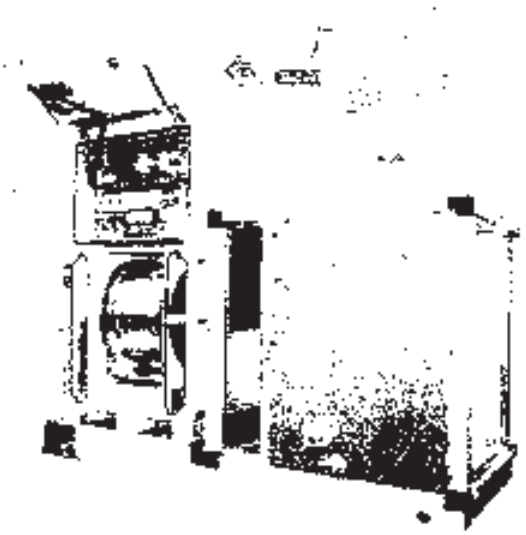
Besides the heat recovery application, heat pipes are now widely used in dehumidification. Heat pipes can increase an air handler moisture removal capability by 50% to 100%. The heat pipes not only reduced the chiller load by free pre-cooling but also provide free re-heating to lower the relative humidity of supply air. As most today's primary indoor air quality concerns are humidity related the health benefits of heat pipes are noticeable.



Run-around-coil is also an alternative solution to reduce dehumidification load on HVAC application.

Desiccant Package

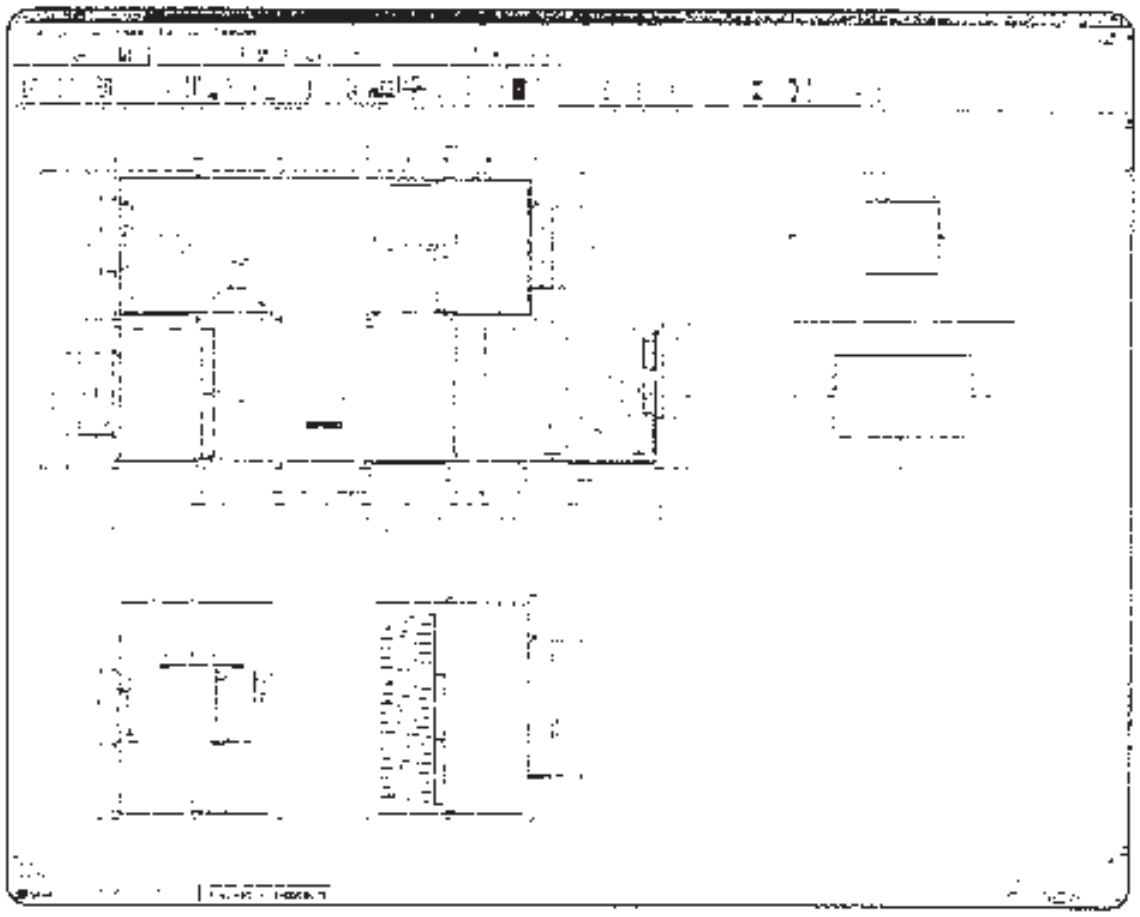
SAIVER is working closely with desiccant wheel manufacturers in order to provide All-in-one dehumidification control system (able to reach below 10% relative humidity). Desiccant dehumidification ensures a hygienic and healthy environment by preventing the formation of moulds and fungi inside airstream.



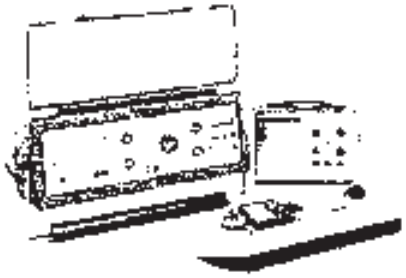
Computer Selection Program

Saiver use their own developed software program to make optimum equipment selection and submit quotation together with full technical information and drawings. Any variables such as local climatic conditions, unusual psychometric and physical parameters, are taken into account automatically. Clients are presented with computer generated, certified drawings for approval prior to equipment manufacturing.

COMPUTER SELECTION



PROGRAM



Testing and Inspection

Saiver's reputation for consistent high standard is rigorously maintained by a strict quality control program (ISO9001 Quality System Certified).

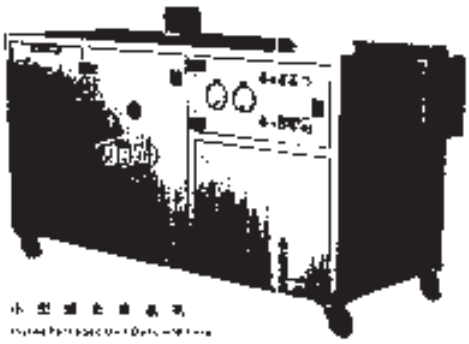
Continuous monitoring is carried out at all themanufacturing stages. Besides, on request, we can also do the variable speed dynamic fan test, sampling digital pressure test, sound performance test and coil performance test.

A full range of test instrumentation to check every aspect of performance offer further guarantees of reliability.

Dry-Air Industrial Dehumidifiers-FPU

Dry-Air 工 业 除 湿 机 -FPU

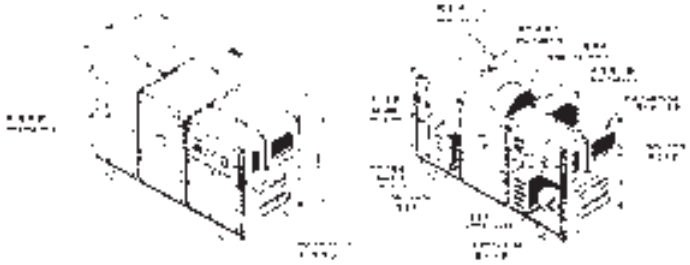
HIGH EFFICIENCY AND RELIABILITY



型 号 说 明　　FPU 系 列 - 规 格

FPU-250	250	625	220	135	450	150	220	1	380-415	175
FPU-630	630	1500	320	135	1000	150	320	1	380-415	340
FPU-1000	1000	2500	320	135	1600	150	320	2	380-415	530

FPU-250	520x381	124x154	232x235	130x98	615x305
FPU-630	520x381	124x154	232x235	130x98	615x305
FPU-1000	520x381	124x154	232x235	130x98	615x305



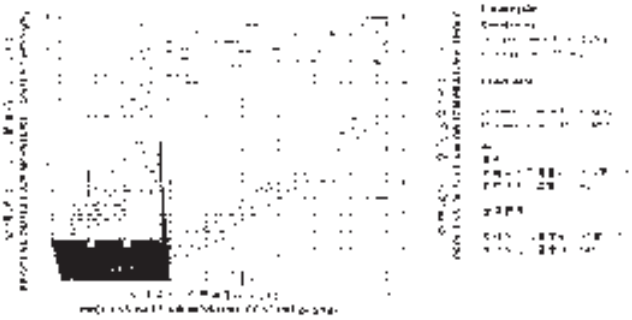
Universal Options

Dimensional Data & Duct Connection

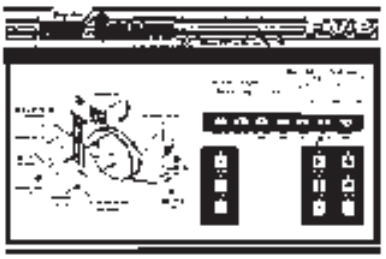
Bry-Air FLC 系 列
除 湿 机

Bry-Air FLC Series
DEHUMIDIFIERS

FLC系列产品性能图表
PERFORMANCE CHART FLC-SERIES



FVB·FLC·FLB 可选BRYSMART数字除湿控制器
OPTIONAL DEHUMIDIFIER DIGITAL CONTROLLER BRYSMART FOR FVB&FLC&FLB

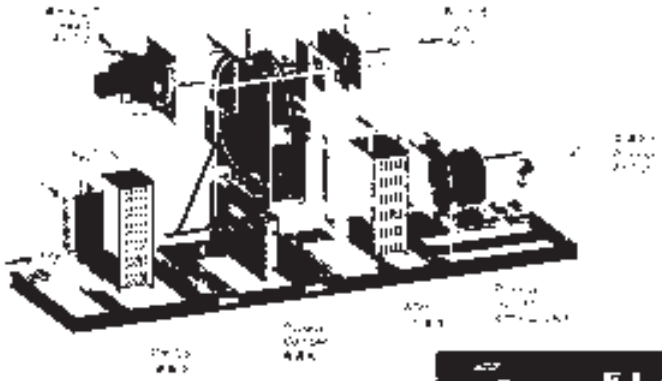


Bry-Air Industrial Dehumidifies-FLC Series

Bry-Air 工 业 除 湿 机 – FLC 系 列

Unique Design Features for more benefits

High efficiency and reliability



设计独特带来更多性能优点

高效可靠

Bry-Air FFB 系列
精巧型除湿机

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Largest Capacity [illegible]

Light Weight

[illegible]

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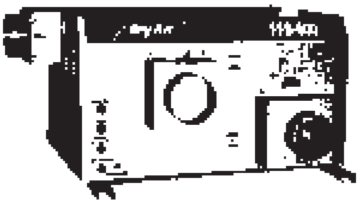
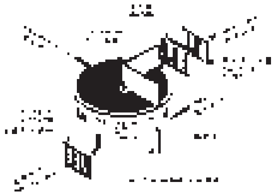
Bry-Air FFB Series
COMPACT DEHUMIDIFIERS





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Simple to Operate

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Bry-Air FVB 系列
工业除湿机

[illegible]

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Bry-Air FVB Series
INDUSTRIAL DEHUMIDIFIERS

Options

[illegible]

FVB[illegible] FVB Junior Series — **FVB[illegible] FVB Senior Series**

Model 型号	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Bry-Air

干 燥 剂 的 选 择

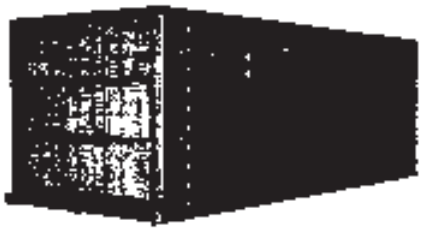
The Choice for Desiccant

Advanced Technology

Advantage with

转 轮 除 湿 机

Dehumidification



其 它 产 品

Our other Products

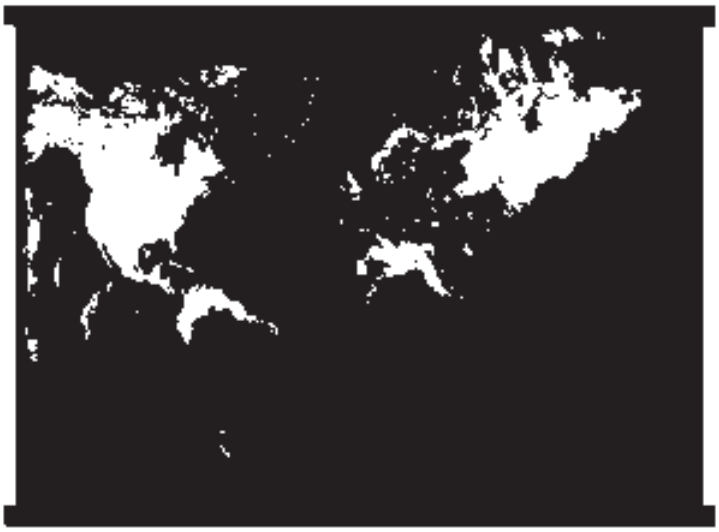
百瑞.世界干燥除湿技术的领先者

Bry-Air a World Leader in Desiccant Dehumidifier Technology

Bry-Air 空 气 干 燥 for Dry air

我 们 就 在 您 身 边

We are never too far from you!



Bry-Air

一 家 以 知 识 为 基 础 、 以 技 术 为 动 力 的 空 气 工 程 公 司

Knowledge-based,technology driven,air engineering company

Bry-Air

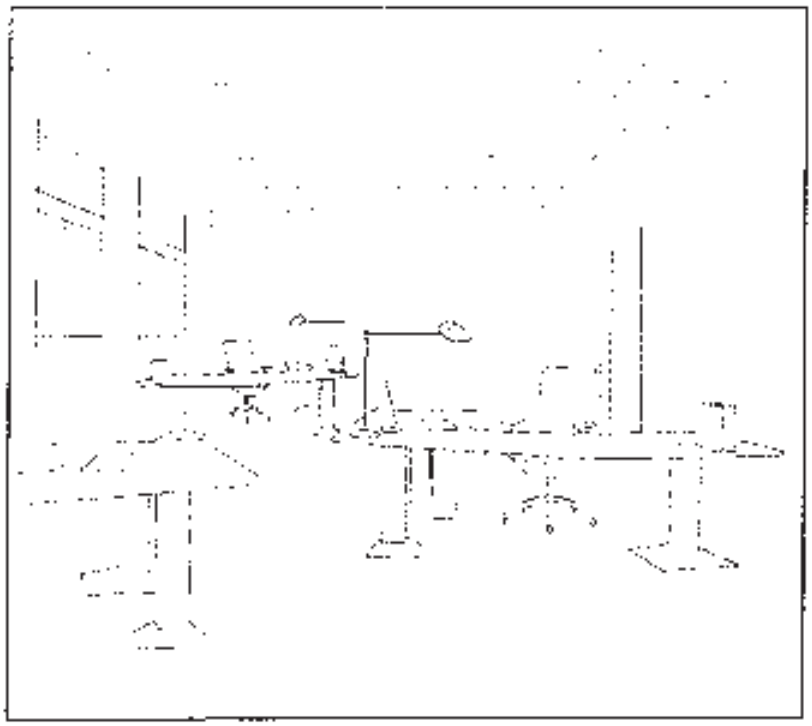
世 界 除 湿 技 术 的 领 先 者

Leaders in Dehumidification . . .
Worldwide

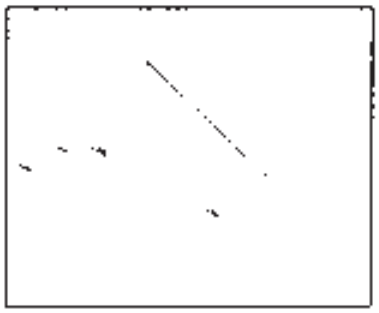
Technical Literature

9) Desiccant Dehumidification Wheel

Passive chilled beams QPSA, QPVA, QPBA, QPDA



Functions
- Controls
- Lighting

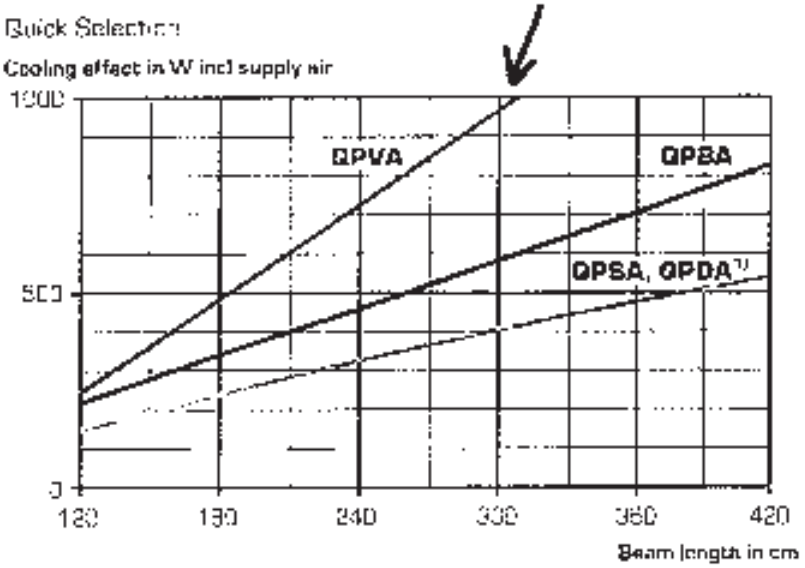


The Flexicool® QPSA, QPVA, QPBA and QPDA passive chilled beams provide for the cooling in a room. QPSA is a narrow, passive chilled beam (width 290 mm), QPVA (width 570 mm) and QPBA (width 630 mm) are broader passive chilled beams and QPDA is our new passive chilled beam with a designer casing (width 400 mm). The passive chilled beams are either ceiling installed, in which case they lie flush with the suspended ceiling, or free space installed without ceiling. QPDA can only be free space installed.
The passive chilled beams are available in lengths 1,2 - 4,2 m (not QPDA, which is only available in sizes 1,8 and 4,2 m) at 60 cm intervals. In installations with passive chilled beams the air is supplied by means of separate supply air valves.

Product Facts

- Passive chilled beams QPSA, QPBA and QPVA for ceiling installation or free space installation
- QPDA Passive chilled beam with designer casing for freely suspended installation.
- Coil and casing are easy to clean
- Adapted control and adjustment equipment and lighting (QPDA) available as accessories
- Quick and easy installation with suspension rods

Quick Selection



The diagram shows the approximate cooling effect in W with water flow qv = 0,03 l/s, difference between room air temperature and average water temperature = 8 °C and max. sound pressure level LA = 35 dB(A). 1) QPDA is available in sizes 1,8 m and 2,4 m.

Product code example

430 mm wide passive chilled beam QPBA manufactured by Flakt Woods, length 240 cm.
Chilled beam QPBA-240-1 for individual installation.

Main data, range, variants and accessories

Main data for QPBA, QPSA and QPVA

Cooling effect	ca 260 W/m (dt = 10°C)
Length	140 mm
Width	290, 420, 570 mm
Lengths	1,2 - 4,2 m at 10 cm intervals

The circulating room air flow through the chilled beam is determined by the temperature difference (actually density difference) in- and outside the beam, together with beam height.

Our range of passive chilled beams

QPBA

Width = 430 mm.

Height = 142 mm

Lengths = 1,2 - 4,2 m at 10 cm intervals.

The bottom plate is perforated with 50% free area

QPSA

Width = 290 mm

Height = 142 mm

Lengths = 1,2 - 4,2 m at 10 cm intervals.

The bottom plate is perforated with 50% free area.

QPVA

Width = 570 mm.

Height = 140 mm

Lengths = 1,2 - 4,2 m at 10 cm intervals.

The bottom plate is perforated with 50% free area.

QPDA

Width = 400 mm

Height = 150 mm

Lengths = 1,2 - 4,2 m at 60 cm intervals

QP chilled beam with a designer casing

The QP chilled beam is available with a designer casing and has the product designation QPDA. QPDA is a customized designer beam for freely suspended individual installation.

The cooling capacity and the pressure drop for QPDA are the same as for QPSA. QPDA can also be supplied with lighting, see separate lighting section in this catalogue.

Material and surface finish

The casing is made of galvanized steel sheet and it is powder painted in white NCS 0502-Y, gloss level 30 (corresponds to RAL 9010)

The casing is also available in other colours. When ordering, the desired colour should be specified in writing.

The cooling coil is made of copper pipe with connection 15 mm and aluminium fins. Maximum working pressure 1,6 MPa

Placing of coil in the casing

In the standard construction, the casing length is 10 cm longer than the effective length (coil length). The coil is placed centrally. To adapt to room dimensions, or to obtain space for control and adjustment equipment or for an overhead connection of supply air and water, the beam casing can be extended from the standard length. The coil can be placed as desired on the longitudinal axis of the casing

Variants and accessories

Top connection

The coil is available with upwards bent pipelines

Purging nipple of the coil

Required if the beam constitutes a high point in the piping system. Placed in the return pipe

Casing adapter (not QPDA)

An adapter having the same form as the beam can be used to adjust the beam length to the desired measurement or to be placed between beams in case of series connection.

Series connection is described in the chapter "System and project design"

In the normal design, the adapter has open end walls to allow the penetration of duct and water pipes. If a solid end wall is required, this must be mentioned in the order.

The bottom plate of the adapter can easily be removed in order to make e.g. duct or pipe connections.

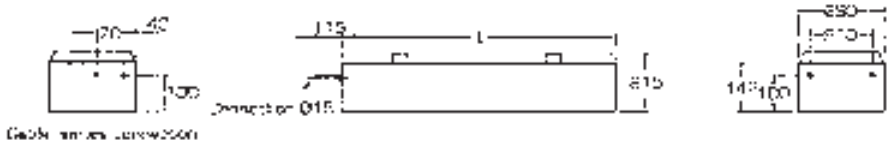
Hoses, water

Used for connection to the pipe system and in case of series connection of beams. Length = 210 mm

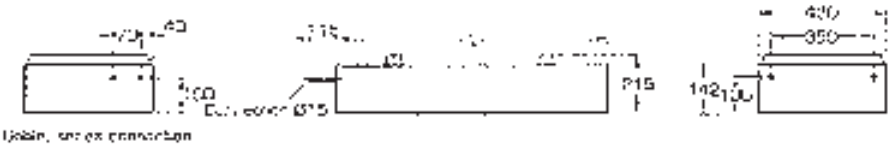
Dimensions and weights

Dimensions and weights

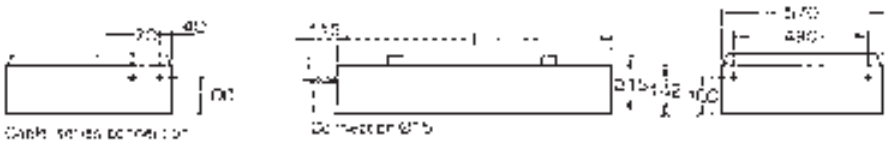
GPSA



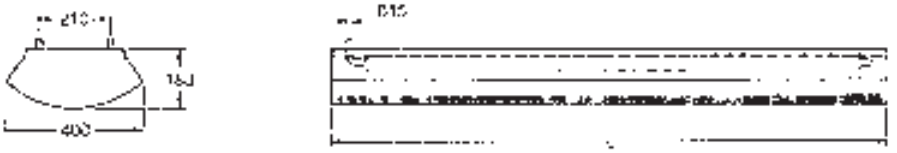
GPBA



GPVA



GPDA



L = Nominal length-5 mm
Example: L = 2400 - 5 = 2392 mm

Technical data – cooling

Definitions

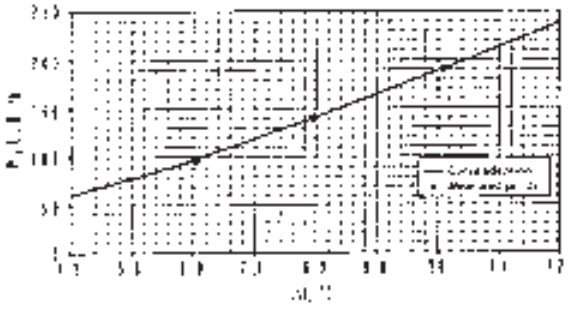
L	Casing length, m
L_{eff}	Effective length = casing length, m
b	Beam width, mm
P_K	Cooling effect, W/m (W/m^2K)
$P_{K0,05}$	Cooling effect with water flow 0.05 l/s, W/m (W/m^2K)
q_w	Water flow, l/s
t_r	Room temperature, °C
Δt_{aw}	Temperature difference between inlet and outlet water, °C
t_w	Mean temperature water, °C
Δt	Temperature difference between room air and mean cooling, °C
Δp_w	Pressure drop water, kPa
P_{WL}	Cooling effect on the water connection side (water and beam)

SP-diagram

The result from tests performed by SP (Swedish National Testing and Research Institute) according to the method Nordtest for testing cooling ceilings and chilled beams.

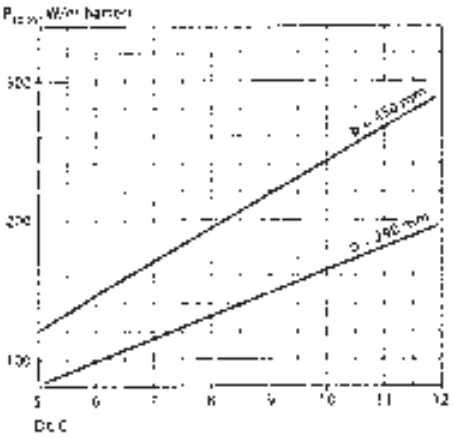
The diagram applies for Δt_{aw} = 2.0° C.

QPBA-1400-1

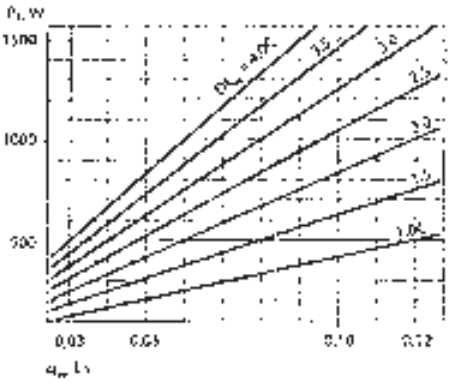


Cooling effect in W/m effective length, $P_{K0,05}$ for chilled beam QPBA (430 mm), QP(S,D)A (290mm)

Water flow = 0.05 l/s

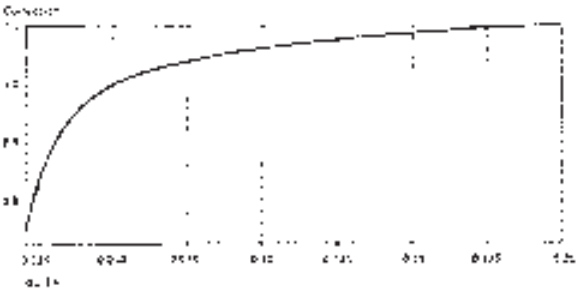


Water flow l/s

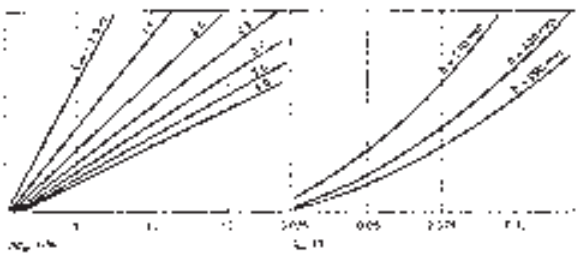


Note! The diagram is based on tests performed according to the method V (future Nordtest), which gives a very small temperature difference between the air entering the beam and the average temperature at 1.1 m above floor surface. In actual conditions with relatively concentrated heat sources, the temperature difference can be 1 -2 °C. The temperature difference between room air and water should in this case be increased by 1 - 2 °C. This is because in the actual conditions, the beam will produce a higher effect.

Correction of cooling effect for water flows other than 0.05 l/s



Pressure drop water kPa



Tecnical data - cooling, dimensioning example

Air velocity below chilled beam

The label shows the velocity below the chilled beam, at diffrent cooling capacities. The values are valid for a room without external influences, like heating sources or other air movements that affect the velocity below the chilled beam.

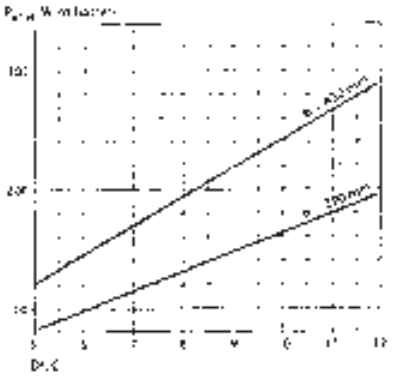
Chilled beam	Velocities below chilled beam Cooling cap./active m (W/m)	Distance below beam (m) 0,5	1,0	2,0
GPSA	100	0,05	0,17	0,09
	150	0,08	0,21	0,11
	200	0,35	0,25	0,13
	250	0,19	0,13	0,07
GPBA	300	0,05	0,18	0,09
	350	0,31	0,23	0,12
	400	0,39	0,14	0,07
GPVA	500	0,20	0,26	0,14
	600	0,50	0,22	0,14

Requirements

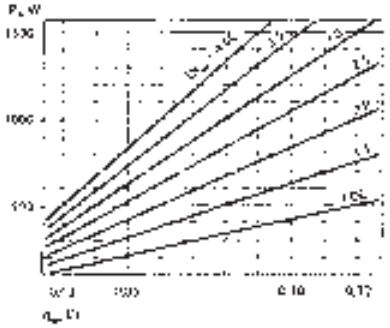
Maximum beam length	3,6 m
Cooling effect	700 W
Room temperature	24°C
Cooling medium temperature	16 - 18°C
Complies with perforated bottom plate GPA-GP	

Result, cooling

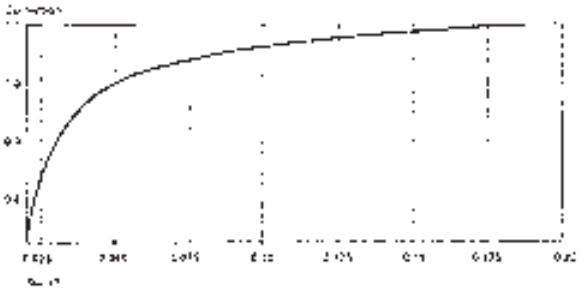
Temperature difference between air and water $\Delta t = 24 - (24 + 16)/2 = 9°C$. The diagram "Cooling effect in W/m effective length, Pk0,05, for chilled beam Q P(S, B)A" gives for wide passive beam with perforated bottom plate and water flow 0,05 l/s: Pk0,05 = 218 W/m



The diagram "Water flow, l/s" on page 59 results in water flow qw = 0,063 l/s for $\Delta tw = 7°C$ and cooling effect 700 W.



Correction for water flow, on basis of the diagram "Correction of cooling effect for water flow other than 0,05 l/s" is obtained K = Pk 0,083/Pk 0,05 = 1,05. The actual effect is therefore 5 % higher than the result given by the diagram, due to the higher water flow



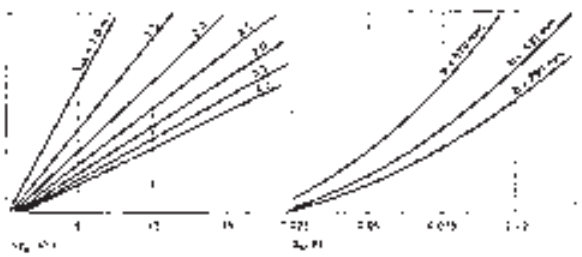
Pk = 1,05 x 218 = 229 W/m

Required effective length (coil length) Leff = 700/229 = 3,1 m.

Casing length L = 3,1 + 0,1 = 3,2 m.

It is thus not necessary to use the maximum casing length 3,6 m.

The diagram "Pressure drop water" on page 59 gives the pressure drop of water across the coil $\Delta pw = 12$ kPa



Select thn GPBA320-1

If the temperature of the air flowing into the beam is 1°C above room temperature (measured at 1,1 m above floor surface), the result is $\Delta t = 25 - (24 - 16)/2 = 13°C$ and not 9° C, as in the above example

On basis of this requirement, the necessary effective length will be 2,8 m instead of 3,1 m.

Product code, product code - accessories

Product code

Main code

Passive chilled beam, standard	QabA-eee-d

Construction: beam underside (a)
P = perforated

Beam width (b)
S = 290 mm
B = 430 mm
V = 570 mm

Length, cm (eee)
120–420, with 30 cm interval

Construction (d)
1 = for individual installation
2 = for series connection with a beam for individual installation corresponding to code 1 above

Note! In the standard construction, the casing is 10 cm longer than the effective length (eee length). The rod is placed centrally.

Main code

Passive chilled beam, design	QPDA-aaa-X

Length, cm (aaa)
280, 340

X = Description of the execution of the beam in clear text.

Plug options

Overall plastic coating for the beam	QFAZ-16

For protection prior to use

Purging nipple	BFAZ-01

Accessories

Beam attachments	QFAZ-13-a-b

Set with 2 pcs. One set per beam

For beam length (a)
1 = 290 mm (QPSA, QPDA)
2 = 430 mm (QPBA)
4 = 570 mm (QPVA)

Surface finish (b)
1 = unpainted
2 = painted, standard white

Suspension brackets	QFAZ-11-a

Two pieces per beam.

For beam width (a)
1 = 290 mm (QPSA)
2 = 430 mm (QPBA)
4 = 570 mm (QPVA)

Suspension rods M8, set	QFAZ-12

Length = 500 mm. Two sets per beam.

Casing adapter	QFBZ-13-a-bbb

The fitting piece has open end walls. The length 40 cm is used when installation beams in series.

For beam (a)
5 = QPSA
6 = QPBA
7 = QPVA

Length, cm (bbb)
040, 060, 090, 120

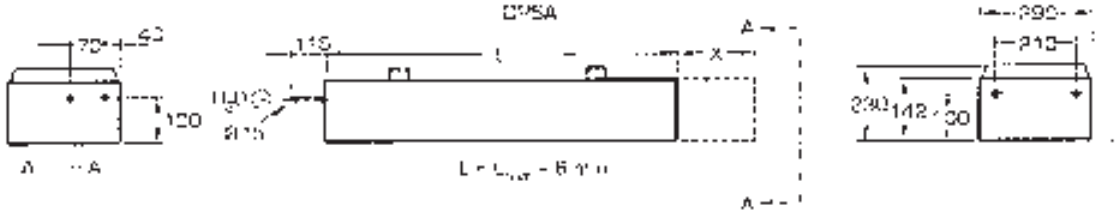
Set of hoses, water (2 pcs. hoses)	QFAZ-05

Length = 210 mm. Tightening ring coupling 15 mm

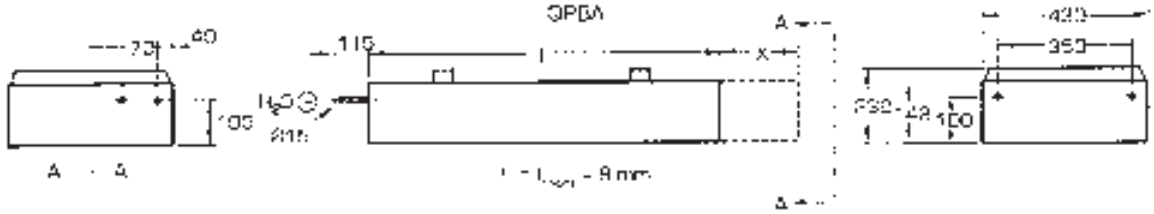
Control equipment and lighting are described in a separate section of this catalogue.

Installation

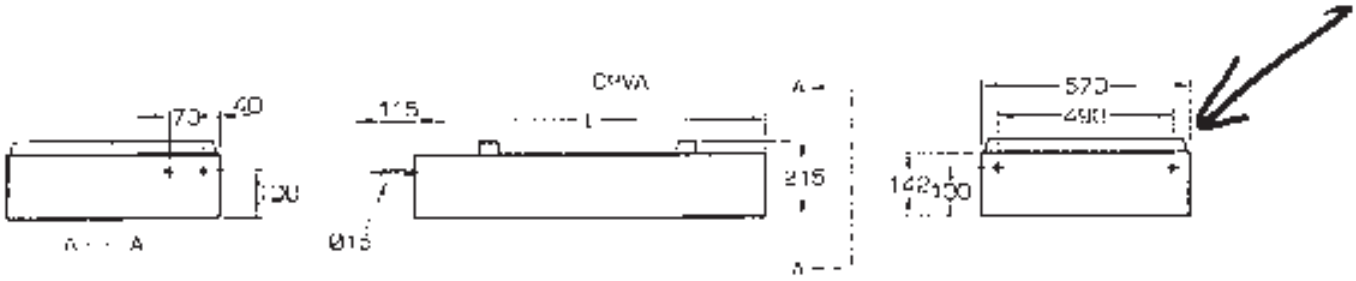
QPSA



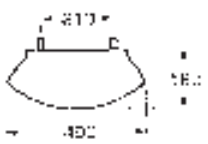
QPBA

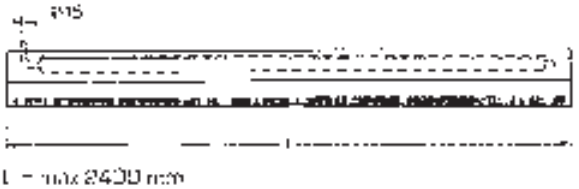


QPVA



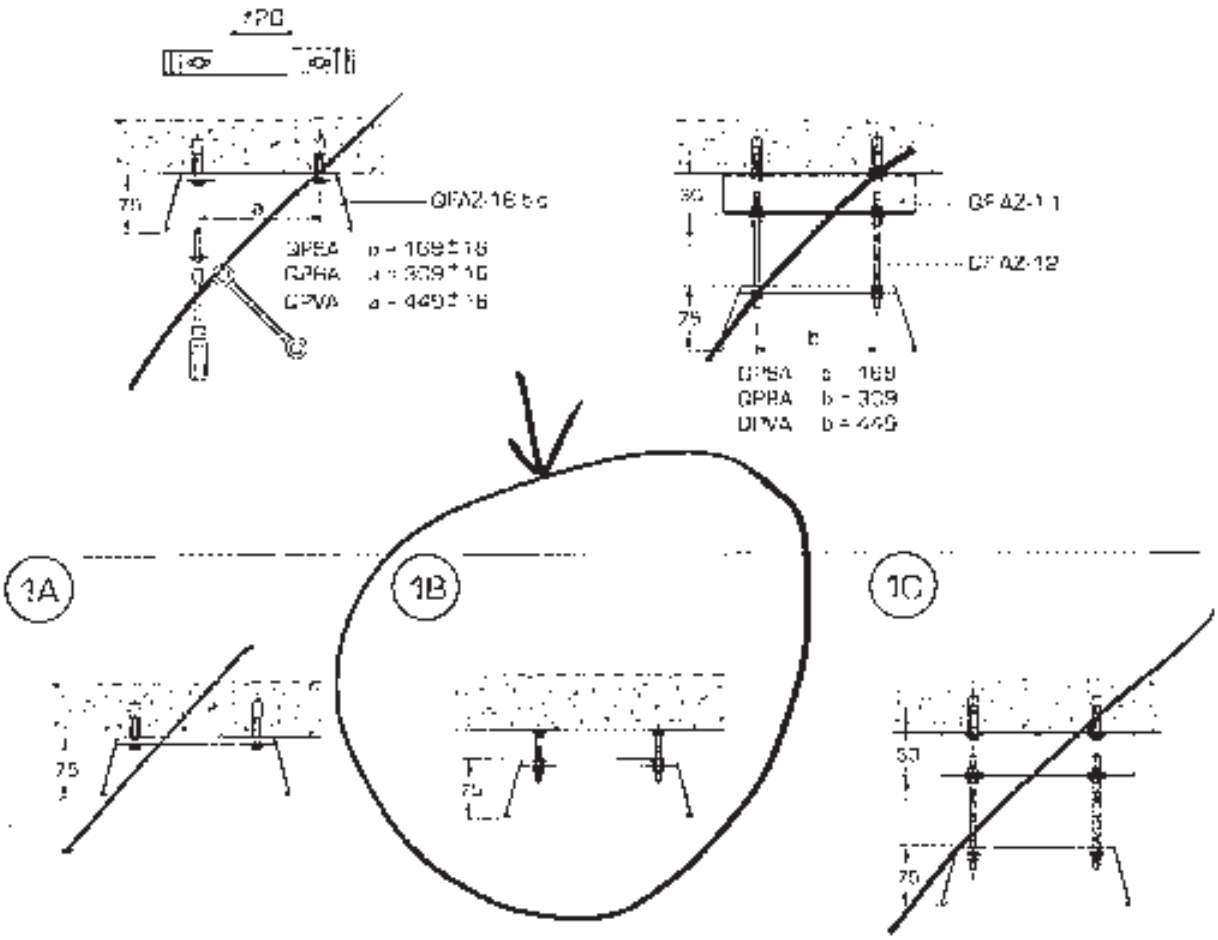
QPDa



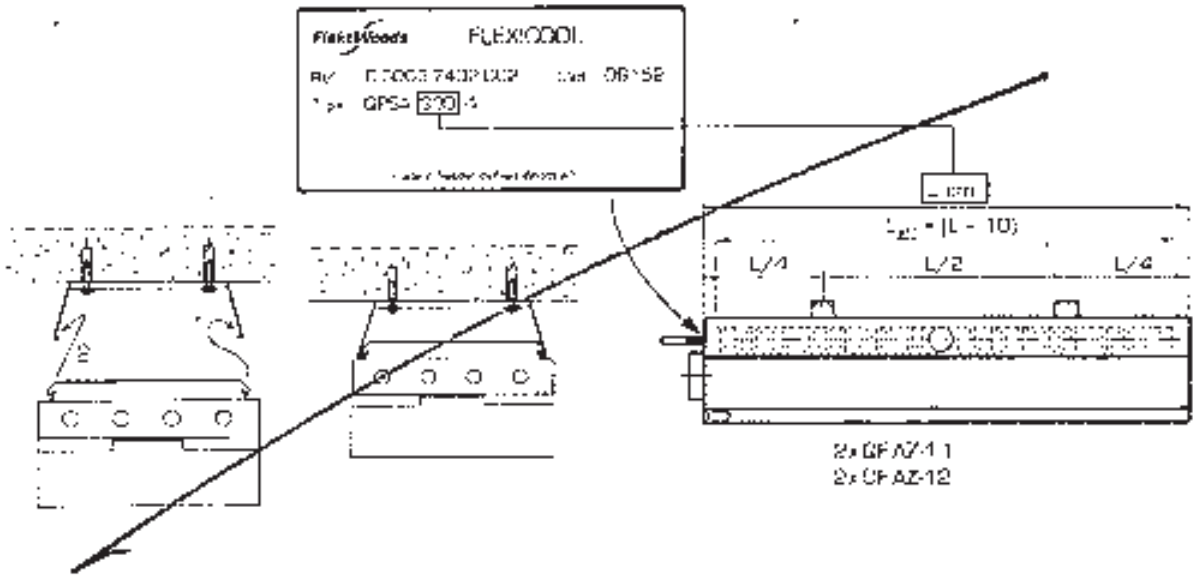


Installation

1



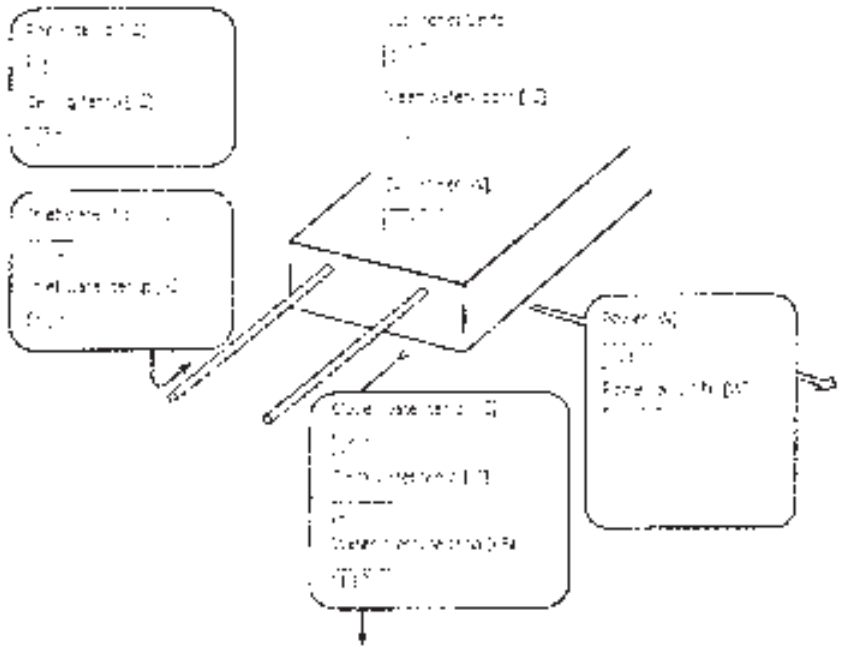
2



Calculation

Product code: GPVA-120-1

Freely suspended	No
Installation	Individual
Length [mm]	120
Height [mm]	Standard



Technical Literature

10) Chilled Beam

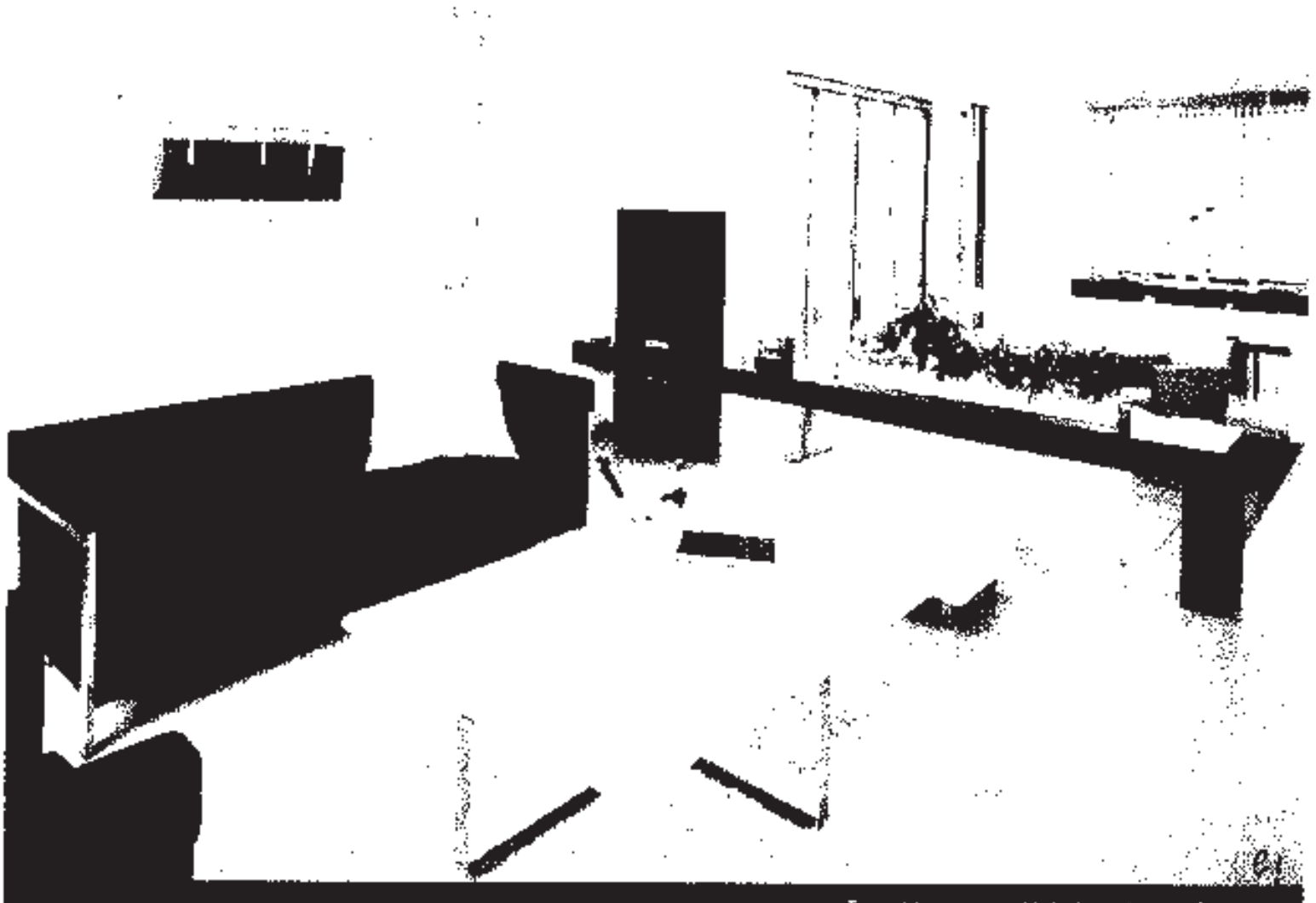
PCR0709A

DAIKIN

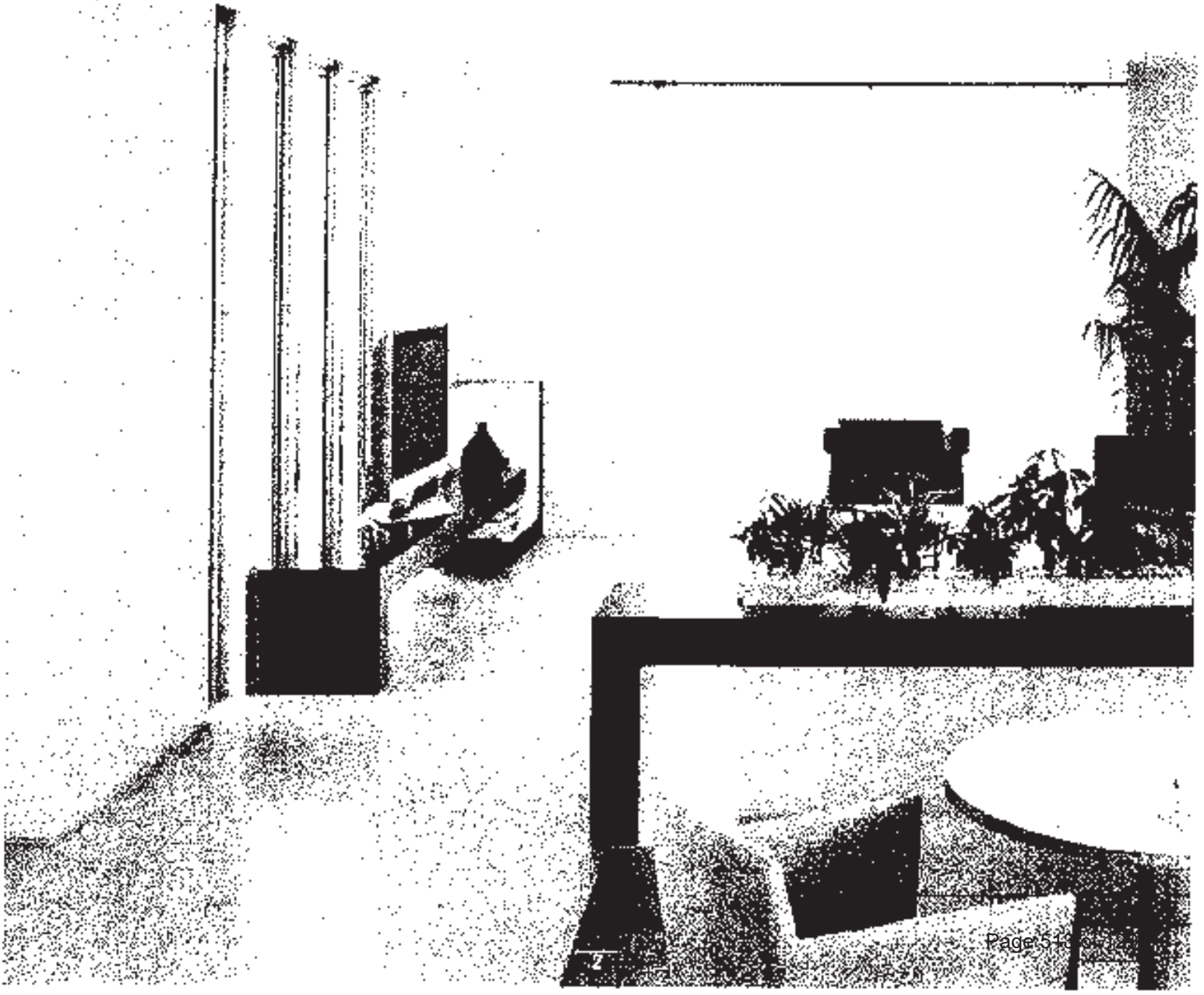
Split Type Air Conditioners

DC Inverter Power Control

Cooling Only & Heat Pump [50 Hz] R-410A



This catalogue is available for Hong Kong and South Africa.



Sophisticated Appearance with Flat Panel

The series' simple and stylish flat panel design harmonises with any interior decor

► See page 10

Higher Energy Savings

The DC Inverter series achieves high COPs thanks to its swing compressor with Reluctance DC motor and DC motor for fan. The 2.5 kW model delivers a 48% higher COP of 4.17.

► See page 9

Quiet Operation

Daikin has achieved lower sound levels for both the indoor and outdoor units. The 2.5 kW model now operates at a whisper-like 22 dB.

► See page 11

Cleanliness

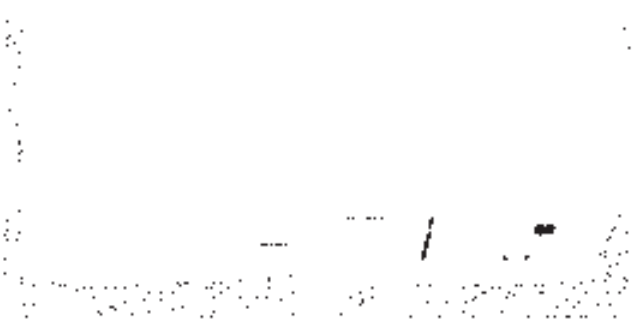
The range of clean features includes the photocatalytic air-purifying filters, Mould-Proof Operation and Wipe-Clean Flat Panel.

► See page 12

Design Concept

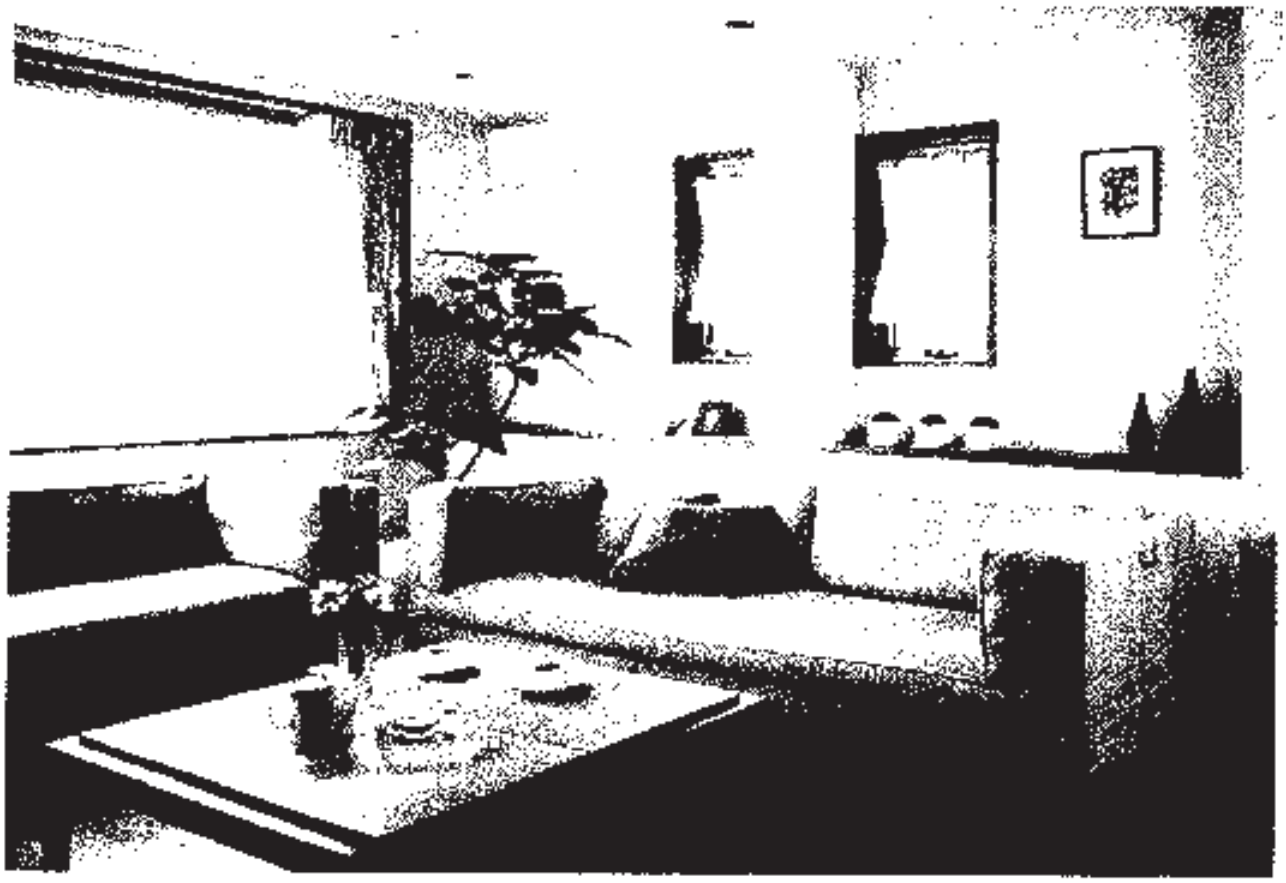
A Refreshingly Simple Design

The stylish flat panel design creates a simplicity and sophistication that enhances any interior space. The flat panel can be cleaned with a single wipe.



Product Line Up

Stylish Design Creates Harmony in Any Interio



FTKS25/35E and FTXS25/35E

RKS25/35EB and RXS25/35EB

The Good Design Award is sponsored by the Japan Industrial Design Promotion Organization to promote excellence in commercial product design.

Cooling Only Type

FTKS25EVMA / RKS25EBVMA
Cooling 2.5 (1.2-3.0) kW
8,500 (4,100-10,200) Btu/h

FTKS35EVMA / RKS35EBVMA
Cooling 3.6 (1.2-3.8) kW
11,900 (4,100-12,950) Btu/h

Heat Pump Type

FTXS25EVMA / RXS25EBVMA
Cooling 2.5 (1.2-3.0) kW
8,500 (4,100-10,200) Btu/h
Heating 3.4 (1.2-4.5) kW
11,600 (4,100-15,350) Btu/h

FTXS35EVMA / RXS35EBVMA
Cooling 3.5 (1.2-3.8) kW
11,900 (4,100-12,950) Btu/h
Heating 4.0 (1.2-5.0) kW
13,600 (4,100-17,050) Btu/h

INVERTER

C6

Space

FTKS50/60/71F and FTXS50/60/71F

RKS50/60/71F and RXS50/60F RXS71F

Cooling Only Type

FTKS50FVM / RKS50FVM
Cooling 5.0 (1.7-6.0) kW
17,100 (5,800-20,500) Btu/h

FTKS60FVM / RKS60FVM
Cooling 6.0 (1.7-6.7) kW
20,500 (5,800-22,900) Btu/h

FTKS71FVM / RKS71FVM
Cooling 7.1 (2.3-8.3) kW
24,200 (7,800-28,300) Btu/h

Heat Pump Type

FTXS50FVMA / RXS50FVMA
Cooling 5.0 (1.7-6.0) kW
17,100 (5,800-20,500) Btu/h
Heating 5.8 (1.7-7.7) kW
19,800 (5,800-26,300) Btu/h

FTXS60FVMA / RXS60FVMA
Cooling 6.0 (1.7-6.7) kW
20,500 (5,800-22,900) Btu/h
Heating 7.0 (1.7-8.0) kW
23,900 (5,800-27,300) Btu/h

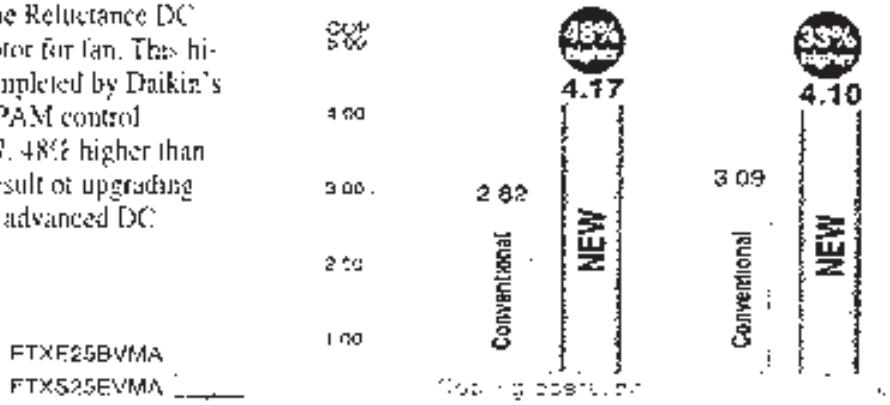
FTXS71FVMA / RXS71FVMA
Cooling 7.1 (2.3-8.5) kW
24,200 (7,800-29,000) Btu/h
Heating 8.2 (2.3-10.0) kW
28,000 (7,900-34,100) Btu/h

INVERTER

Energy Savings

DC Inverter Power Control Achieves High COPs

The DC Inverter series features the Reluctance DC motor for compressor and DC motor for fan. This hi-tech energy-saving package is completed by Daikin's advanced swing compressor and PAM control. FTXS25E achieves a COP of 4.17, 48% higher than conventional model. This is the result of upgrading from conventional AC inverter to advanced DC Inverter technology.

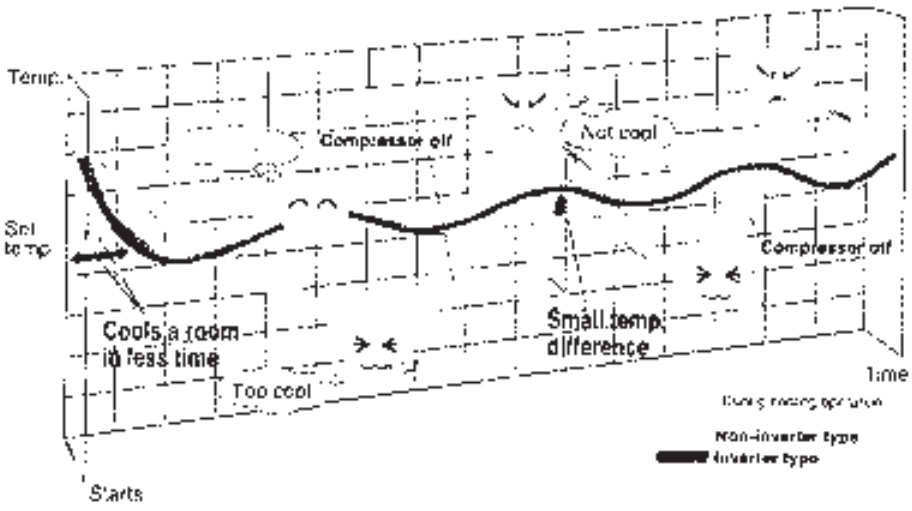


Inverter Advantages Compared to Non-Inverter

Inverters are devices that are able to vary their operating capacity by adjusting frequency. Inverter air conditioners can vary their heating/cooling capacity by adjusting the power supply frequency of their compressors. In contrast, non-inverter air conditioners have a fixed heating/cooling capacity and can only control the indoor temperature by starting or stopping their compressors.

Energy Saving

After the indoor temperature approaches the set temperature, Inverter Control adjusts to low capacity operation to maintain this temperature. This makes inverter models more energy-saving than non-inverter models, which must repeatedly start or stop their compressors to maintain the room temperature.



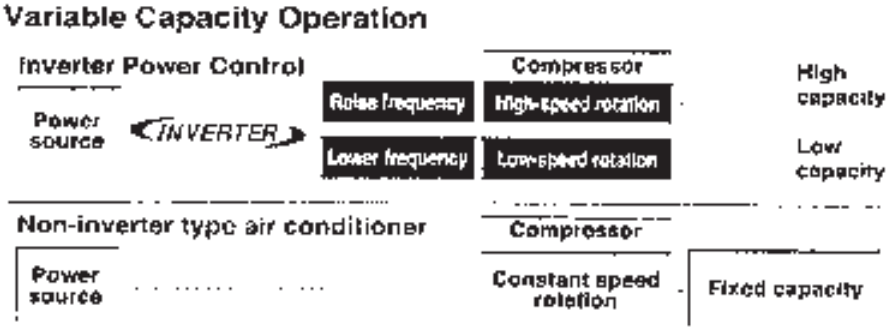
Powerful

Inverter air conditioners operate at maximum capacity as soon as they start up. As a result, the set temperature can be reached more quickly.

Comfortable

Inverter air conditioners finely adjust capacity according to changes in the air-conditioning load and the difference between the indoor temperature and set temperature is small. These give higher comfort levels than with non-inverter air conditioners.

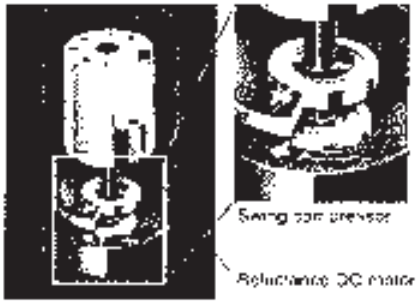
Variable Capacity Operation



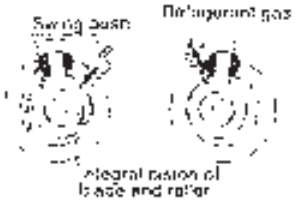
Inverter air conditioners are able to vary their operating capacity. Non-inverter air conditioners can only operate at a fixed capacity.

Energy-Saving Technological Features INVERTER

Swing Compressor



Thanks to its smooth rotation, the swing compressor decreases friction and vibration. It also prevents the leakage of refrigerant gas during compression. These advantages provide quiet and efficient operation.



The swing compressor can reduce operational vibration and sound because its piston moves smoothly as in the compressor.

This marked the development of a high-performance swing compressor that was compatible with alternative refrigerants. The project was presented in 1997.

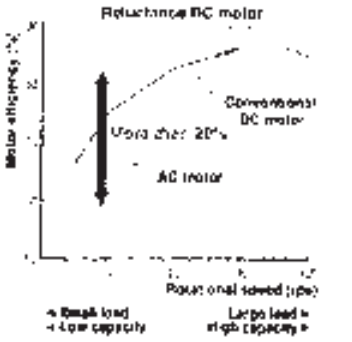
Reluctance DC Motor for Compressor

Neodymium magnets are used in the pre-coupled rotor.

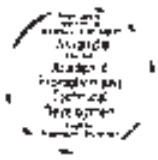
Daikin DC Inverter models are equipped with the Reluctance DC motor for compressor. The Reluctance DC motor uses 2 different types of torque, neodymium magnet*1 and reluctance torque*2. This motor can save energy because it generates more power with a smaller electric power than an AC or conventional DC motor. It is more efficient at the low frequencies most commonly used by air conditioners,*3 improving efficiency by approximately 20%.

*1. A neodymium magnet is approximately 10 times stronger than a standard ferrite magnet.
*2. The torque created by the change in power between the iron and magnet parts.
*3. The frequency range used by air conditioners during periods of stable operation. This is the range in which air conditioners operate for the longest periods.

Efficiency of Reluctance DC motor *4



*4. Data are based on studies conducted under controlled conditions at a Daikin laboratory.

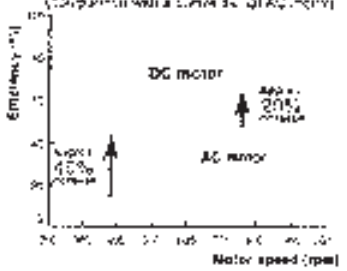


This was the first scroll compressor to be equipped with the Reluctance DC motor in commercial use air conditioners. The Institute of Electrical Engineers of Japan presented the award in 1998.

DC Motor for Fan

The DC motor allows fine rotation control, which reduces energy consumption. The motor also provides improvements in operational efficiency of up to 40%, compared to an AC motor. These improvements are particularly noticeable in the low-speed range.

Efficiency of DC motor for fan *5



*5. Data are based on studies conducted under controlled conditions at a Daikin laboratory.

PAM Control

PAM (Pulse Amplitude Modulation) control reduces energy loss by controlling how often the converter switches on and off.

What Is DC Inverter?

Daikin calls an inverter model that is equipped with a DC motor DC Inverter. A DC motor offers higher efficiency than an AC motor. A DC motor uses the power of magnets to attract and repel to generate rotation. A DC motor that is equipped with high-power neodymium magnets, which enable even greater efficiency, is called a Reluctance DC motor.

Main Functions

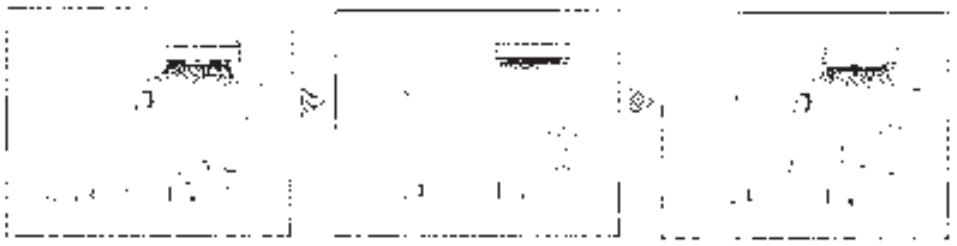
Efficient Operation with No Energy Wastage

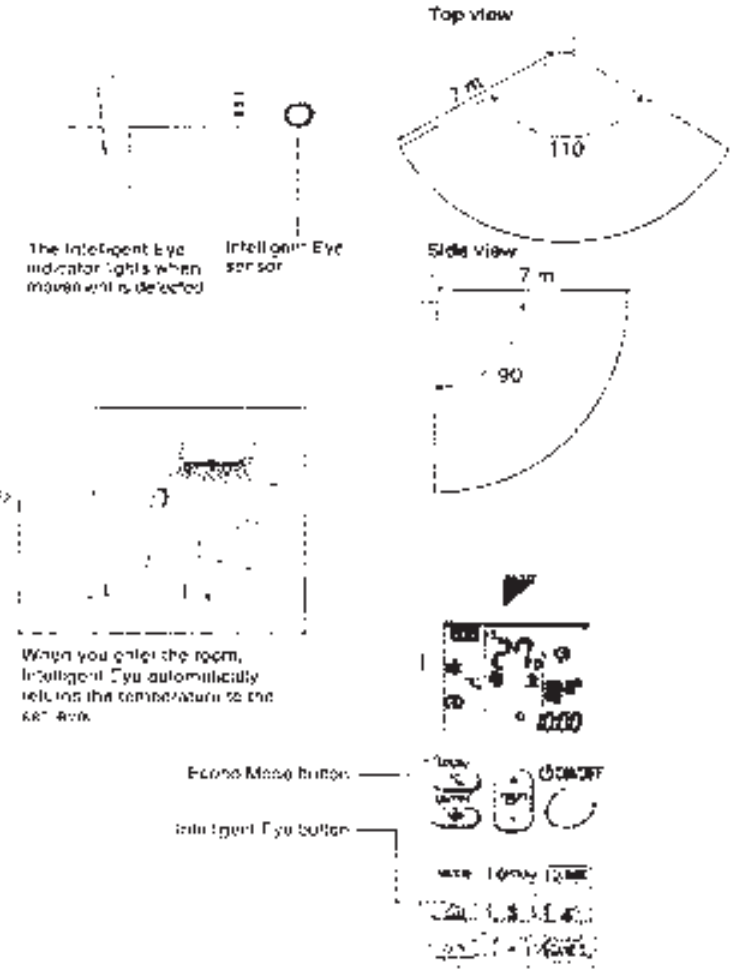
Intelligent Eye

Intelligent Eye prevents energy wastage by using its infrared sensor to detect human movement in a room. When there is no movement, Intelligent Eye increases/decreases the temperature by 2 °C to give energy savings of up to 20% for cooling operation and 30% for heating operation. This reduces energy wastage if, for example, you forget to turn off the air conditioner.

All models from 2.5 to 7.1 kW class are equipped with Intelligent Eye. This function can be conveniently activated from the remote controller.

Once Intelligent Eye is set, it continues to work to save energy. You do not need to push the SENSOR button each time you wish to use this function.

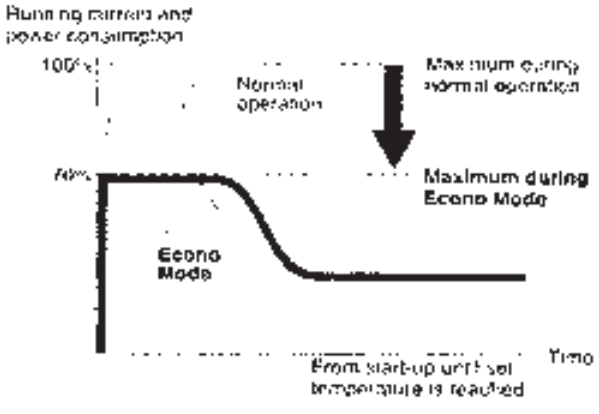




Econo Mode

This function limits both the maximum running current and maximum power consumption to 70% of those during normal operation. It is particularly effective if the cooling/heating load is high, for example, at start-up or during large gatherings and periods of direct sunshine. At the same time, it maintains maximum capacity at 80% of normal, giving improved operating efficiency, although it may take slightly longer to reach the set temperature.

Econo Mode is also useful for preventing circuit breakers from being overloaded during temporary peaks in the running current. The function is easily activated from the remote controller by pushing the ECONO button. Econo Mode is available for FTK(X)S25/35E.



- This diagram is a representation for illustrative purposes only.
- Maximum capacity decreases during Econo Mode, requiring more time to reach the set temperature.

and Quiet Operation

Indoor Unit Quiet Operation

This series gives you the choice of 5-step, Quiet or Automatic settings for the fan speed. The Quiet setting selects Indoor Unit Quiet Operation. This function decreases the operation sound level by 3 dB below the Low setting.

This wide range of settings allows you to precisely control the fan speed according to your requirements. For example, Indoor Unit Quiet Operation provides you with a good night's sleep. The sound level for FTK(X)S 25E is 22 dB.

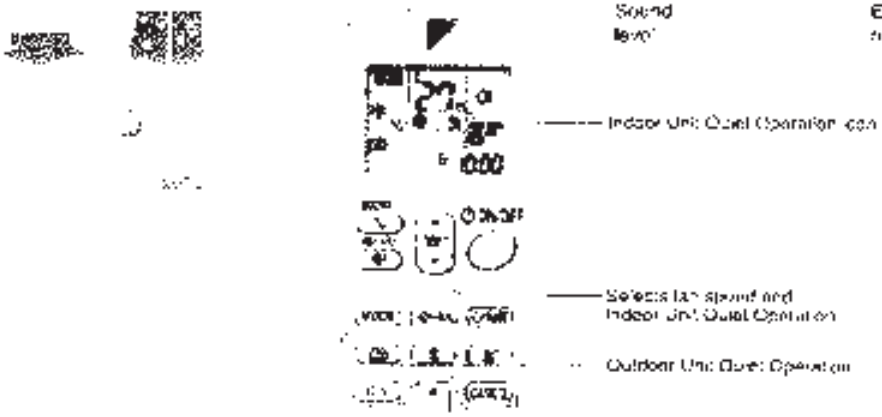
FTK(X)S25E

High (H)	
Low (L)	
Quiet (SL)	

During cooling operation

Fan speed: Low ... High

Sound level: Each decrease in airflow volume reduces the sound level by 2 or 3 dB



Outdoor Unit Quiet Operation

Outdoor Unit Quiet Operation is available for all models from 2.5 to 7.1 kW class. This function decreases the operation sound level by 3 dB below the rated operation. It provides a low sound level of 43 dB for RK(X)S25EB.

Capacity may decrease when Outdoor Unit Quiet Operation is selected

RK(X)S25EB

Rated (H)	
Quiet (L)	

During cooling operation

22 dB Is So Quiet You Can Even Hear Whispers

Indoor unit	Outdoor unit

Rustling of leaves — Library

Pendulum of a wall clock — Normal office

Based on "Examples of Sound Levels", Ministry of the Environment, Japan

Cleanliness

Advanced Photocatalytic Air Purifying

Titanium Apatite Photocatalytic Air-Purifying Filter

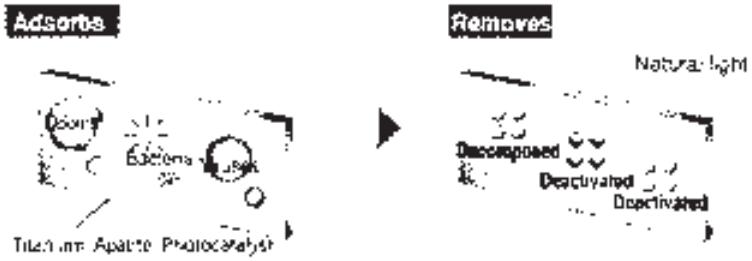
Titanium apatite is a new photocatalytic material with advanced adsorption power. While the filter's micron-level fibres trap dust, this photocatalyst effectively adsorbs and decomposes bacteria and viruses and also breaks down mould and odours. The photocatalyst is activated simply by exposure to natural light. The filter delivers consistent performance for approximately 3 years if periodic maintenance is performed

Titanium Apatite Photocatalytic Air-Purifying Filter

Bacteria removal test

Testing method	Dropping method
Testing organization	Japan Spinners Inspecting Foundation
Result certificate	No. 012553-1 and 012553-2

Effect of Titanium Apatite Photocatalyst



Apatite strongly adsorbs bacteria and viruses. At the same time, the photocatalyst powerfully oxidises odour components, breaking them down. Viruses are turned into clumps of protein and removed

Photocatalyst Mechanism

The Titanium Apatite Photocatalytic Air-Purifying Filter incorporates titanium apatite. Titanium apatite is a new photocatalyst material with advanced adsorption power. When this photocatalyst is exposed to light, a powerful oxidising action occurs

Light strikes the photocatalyst and activates the surface particles

A chemical reaction decomposes the odours into CO_2, O_2 and H_2

The odourless substances are released into the air

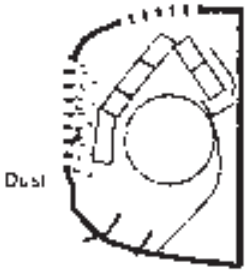
Mould-Proof Operation

When cooling or dry operation is stopped, fan-only operation runs automatically for 1 hour. This airflow dries the inside of the indoor unit to reduce the generation of mould and odours. It is available with FTK(X)S25/35E.

Wipe-Clean Flat Panel

Flat panel models can be cleaned instantly with a single wipe of a cloth across their smooth surface. If more thorough cleaning is required, the panel can also be easily removed from the unit.

Conventional Front Grille Design



Front grille design units collect dust on their air inlet grilles unless those grilles are cleaned regularly

1 Difficult to remove dust on the grille through wiping alone

2 Reduced capacity due to increased suction resistance

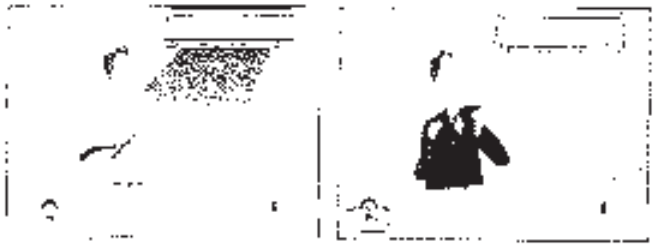
3 High sound levels due to increased suction resistance

Other Functions

Comfortable and Highly Effective Airflow

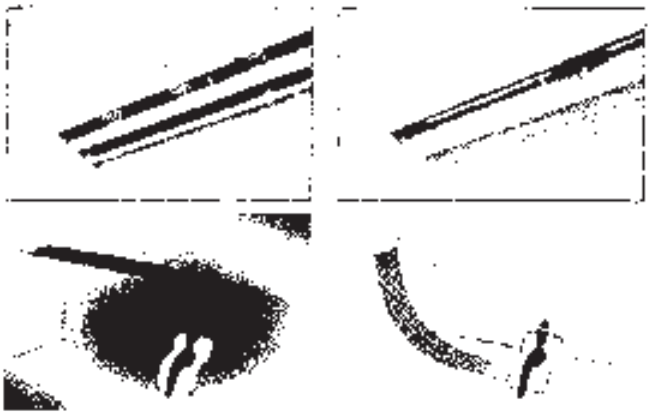
Comfortable Airflow

Inverter Powerful Operation boosts cooling/heating performance for a 20-minute period. This is convenient both when you first turn on your air conditioner and when you want to quickly change the temperature during operation.



Power-Airflow Dual Flaps and Wide-Angle Louvers work in tandem to precisely control both vertical and horizontal airflow for distribution of air.

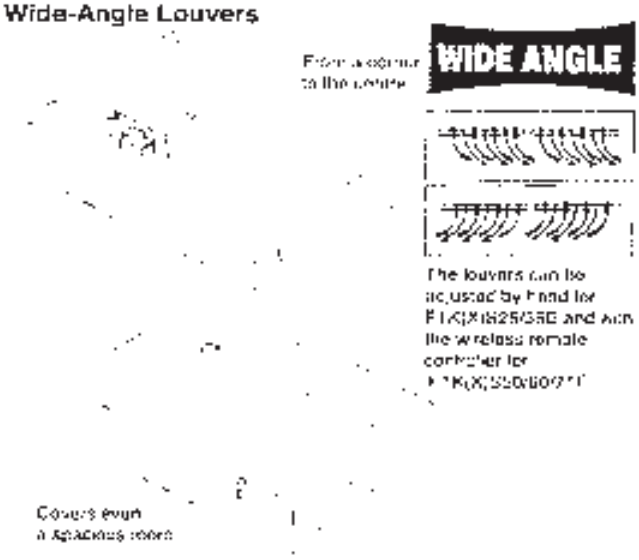
Power-Airflow Dual Flaps



Cooling: the flaps flatten out during operation so that cool air slides off to reach the corner of the room.

Heating: the flaps descend to blow warm air directly down to the floor to quickly warm the whole room.

Wide-Angle Louvers

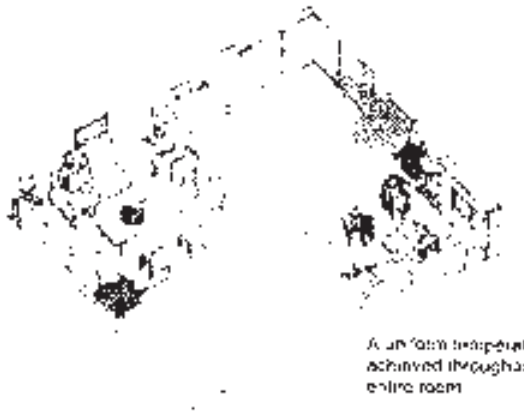


The louvers can be adjusted by hand for FTK(X)S25/35D and with the wireless remote controller for FTK(X)S50/60/71F.

Covers even a spacious room.

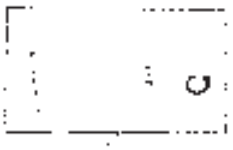
Vertical Auto-Swing automatically moves the flaps up and down and Horizontal Auto-Swing automatically moves the louvers to the left and right. 3-D Airflow combines Vertical and Horizontal Auto-Swing to circulate air to every part of a room for uniform cooling/heating of even large spaces.

Horizontal Auto-Swing and 3-D Airflow are available for FTK(X)S50/60/71F.



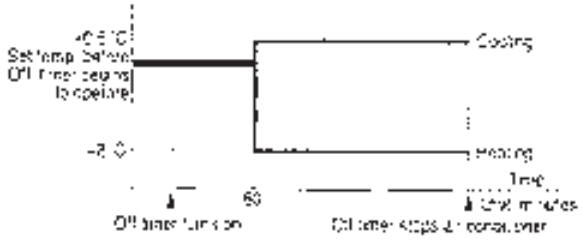
A uniform temperature is achieved throughout the entire room.

The unit can be conveniently started manually in the event the wireless remote controller is misplaced or the wireless remote controller batteries are not charged.



Indoor Unit On/Off Switch

Pressing the Off timer button automatically selects Night Set Mode. This function prevents any sudden change in room temperature by gradually raising/lowering the temperature before the air conditioner stops, so you can sleep comfortably.



Cooling operation: Room temperature is raised by 0.5 °C after 60 minutes, while minimum outdoor unit sound levels are maintained. If the outdoor temperature is below 27 °C, room temperature is raised by a further 0.5 °C after 60 minutes for FTK(X)S50/60/71F.
Heating operation: Room temperature is lowered by 2 °C after 60 minutes.

Functions

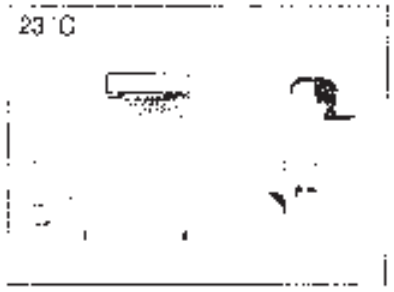
Lifestyle Convenience

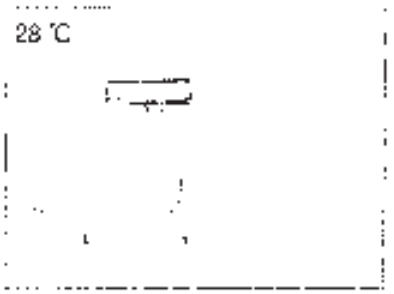
Home Leave Operation prevents large rises or falls in the indoor temperature by continuing operation* while you are sleeping or out of your home. This means that an air-conditioned welcome awaits when you wake or return. It also means that the indoor temperature can quickly return to your favourite comfort setting.

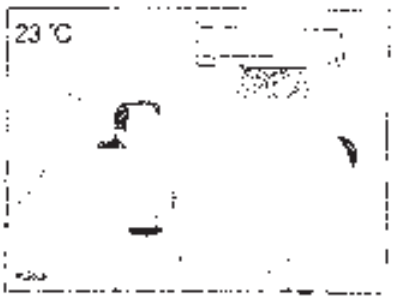
* Home Leave Operation can be set at any temperature from 18 to 32 °C for cooling operation and 10 to 30 °C for heating operation.

Home Leave Operation is available for FTX(J)S50/60/71F.

During cooling operation, 23 °C for the room temperature setting, and 28 °C for the Home Leave setting

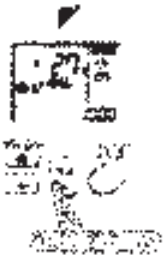






Start Home Leave Operation simply by pushing a button on the remote controller.

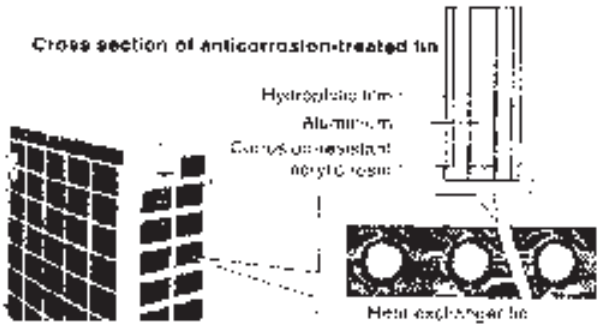
When you are out of your home, your air conditioner prevents large changes in the indoor temperature by continuing to operate using Home Leave Operation settings.



When you return, you will be greeted by an air-conditioned room. Just push the HOME LEAVE button again to return to your previous settings.

Worry Free

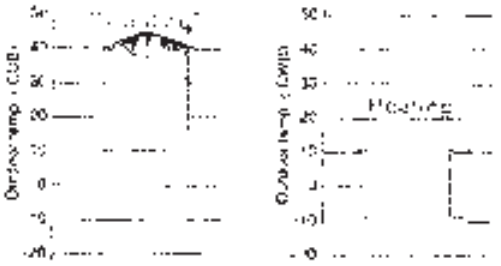
The outdoor unit's heat exchanger fins are processed using a special anticorrosion treatment. The surface is covered with a thin acrylic resin layer to enhance the fins' resistance to acid rain and salt corrosion. A hydrophilic film layer also prevents rust caused by the run off of water droplets.



Wide Operation Range

Even during cold seasons, a crowded party or sudden change in the indoor temperature can leave a room overheated. With the heat pump type FTXS50/60/71F, cooling operation is possible even during outdoor temperatures of as low as 10 °C. Heating operation can also be performed during outdoor temperatures of -15 to 18 °C. This makes these units ideal for even very cold areas.

Heat pump type FTXS50/60/71F



Installation Flexibility

A long piping length gives installation flexibility. Installation is possible even if there is no space for the outdoor unit near the indoor unit.

	Max. piping length	Max. height difference
FTK(X)S25/35E	20 m	15 m
FTK(X)S50/60/71F	30 m	20 m

Function Dictionary

Comfortable Airflow

Power-Airflow Dual Flaps
Power-Airflow Dual Flaps can flatten out during cooling operation to deliver cool air to the corners of a room. The flaps can direct warm air straight down to the floor during heating operation.
▶ See page 14

Wide-Angle Louvers
The smoothly curved Wide-Angle Louvers provide wide airflow coverage for effective operation no matter where the indoor unit is placed in a room.
▶ See page 14

Vertical Auto-Swing (up and down)
This function automatically moves the flaps up and down to distribute air across a room.
▶ See page 14

Horizontal Auto-Swing (left and right)
Horizontal Auto-Swing automatically moves the louvers to the left and right to cover a room with cool/warm air.
▶ See page 14

3-D Airflow
This function combines Vertical and Horizontal Auto-Swing to circulate a cloud of cool/warm air right to the corners of even large spaces.
▶ See page 14

Lifestyle Convenience

Econo Mode
This mode limits maximum running current and power consumption to 70% of normal operation, while maintaining maximum capacity at 80%. This improves operating efficiency and also prevents circuit breakers from being overloaded.
▶ See page 19

Inverter Powerful Operation
This function is convenient for boosting cooling/heating performance for a 20-minute period both when you first turn on your air conditioner or want to quickly change the room temperature.
▶ See page 14

Home Leave Operation
Home Leave Operation continues operation to prevent a room from becoming too hot or cold, while you are sleeping or out of your home. Select any temperature from 18 to 32 °C for cooling operation and 10 to 30 °C for heating operation.
▶ See page 15

Indoor Unit On/Off Switch
There is a second On/Off switch on the body of the indoor unit to prevent any problems if the wireless remote controller is misplaced.
▶ See page 14

Comfort Control

Indoor Unit Quiet Operation
Indoor unit operating sound levels are decreased by 2 or 3 dB from the Low setting fan speed using the wireless remote controller.
▶ See page 11

Outdoor Unit Quiet Operation
Outdoor unit operating sound levels are decreased by 3 dB from the rated operation sound using the wireless remote controller.
▶ See page 11

Intelligent Eye
Intelligent Eye with its infrared sensor automatically controls air conditioner operation according to human movement in a room. When there is no movement, it adjusts the temperature by ± 2 °C for energy savings of up to 20% for cooling operation and 20% for heating operation.
▶ See page 10

Automatic Operation
This function automatically selects cooling or heating operation mode based on the room temperature at start-up.

Programme Dry Function
This function automatically reduces the level of humidity while maintaining the preset room temperature.

Auto Fan Speed
The microprocessor automatically controls fan speed to adjust the room temperature to the set temperature.

Timers

24-Hour On/Off Timer
This timer can be preset to start and stop at any time within a 24-hour period. The air conditioner is started/stopped simply by pressing the On/Off timer button on the wireless remote controller.

Night Set Mode
Pressing the Off timer button automatically selects Night Set Mode. This function prevents any sudden change in room temperature by gently raising/lowering the temperature before the air conditioner stops, so you can sleep comfortably.
▶ See page 14

Worry Free

Auto-Restart after Power Failure
The air conditioner memorises the settings for mode, airflow, temperature, etc., and automatically returns to them when power is restored after a power failure.

Self-Diagnosis with Digital Display
Malfunction codes are shown on the digital display panel of the wireless remote controller for fast and easy maintenance.

Anticorrosion Treatment of Outdoor Heat Exchanger Fins
The outdoor unit's heat exchanger fins are processed using a special anticorrosion treatment. The surface is covered with a thin acrylic resin layer to enhance the fins' resistance to acid rain and salt corrosion.
▶ See page 15

Cleanliness

Titanium Apatite Photocatalytic Air-Purifying Filter

This filter contains the new photocatalytic material titanium apatite. While the filter's micron-level fibres trap dust, this photocatalyst adsorbs and decomposes bacteria and viruses, and breaks down mould and odours. The filter can be used for up to 3 years with proper maintenance.

▶ See page 12

Mould-Proof Operation

Mould-Proof Operation automatically runs fan only operation for 1 hour when cooling or dry operation is stopped. This airflow prevents the generation of moulds and mould odours inside the indoor unit.

▶ See page 13

Wipe-Clean Flat Panel

The flat panel models can be cleaned with only the single pass of a cloth across their smooth surface. The flat panel can also be easily removed for more thorough cleaning.

▶ See page 13

Mould-Proof Air Filter

The air filter is finished with a coating that suppresses the growth of mould on its surface.

Others

Comfort Control

Quick Warming Function

During low outdoor temperatures, this function pre-heats the compressor to shorten the time required to discharge warm air.

Automatic Defrosting

Before starting heating operation, a sensor checks for frost in the outdoor unit and performs automatic defrosting if necessary so that only warm air is discharged.

Hot-Start Function

After defrosting or when starting heating operation, air is pre-heated before discharge to prevent uncomfortable cold drafts.

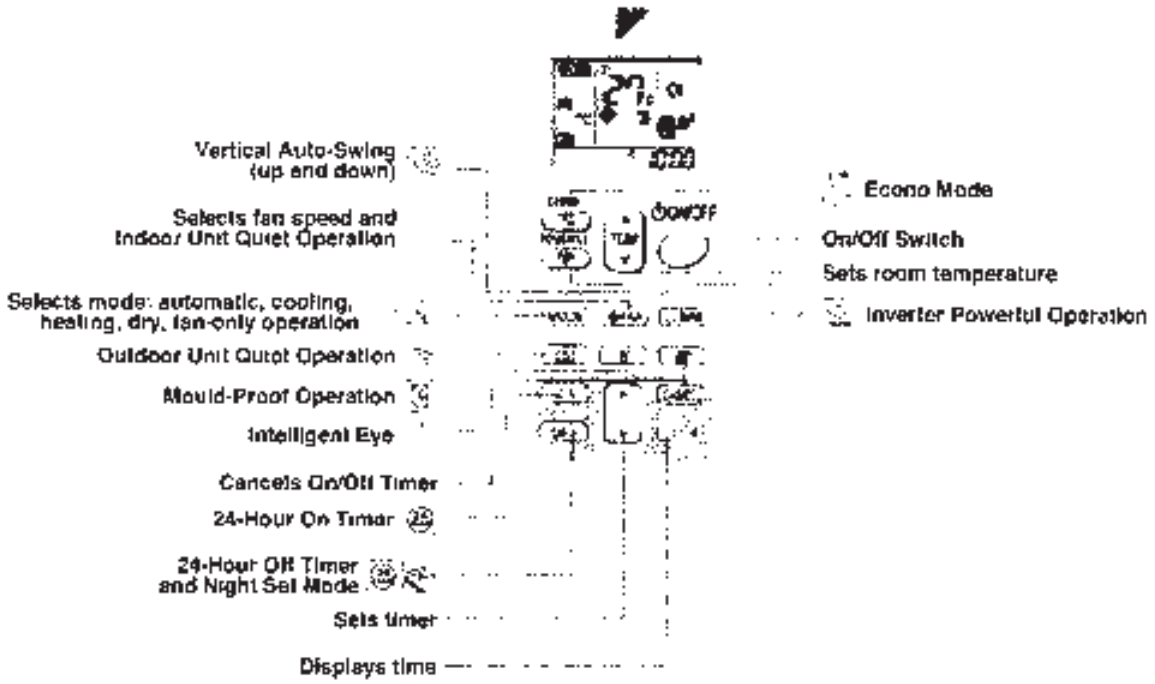
Function List

Models	Wall-mounted type	
Functions	FTK(X)S 25/35E	FTK(X)S 50/60/71F
INVERTER DC Inverter		
Comfortable Airflow: Power-Airflow Dual Flaps		
Comfortable Airflow: Wide-Angle Louvers		
Comfortable Airflow: Vertical Auto-Swing (up and down)		
Comfortable Airflow: Horizontal Auto-Swing (left and right)		
Comfortable Airflow: 3-D Airflow		
Comfort Control: Indoor Unit Quiet Operation		
Comfort Control: Outdoor Unit Quiet Operation		
Comfort Control: Intelligent Eye		
Comfort Control: Automatic Operation*		
Comfort Control: Programme Dry Function		
Comfort Control: Auto Fan Speed		
Lifestyle Convenience: Econo Mode		
Lifestyle Convenience: Inverter Powerful Operation		
Lifestyle Convenience: Home Leave Operation		
Lifestyle Convenience: Indoor Unit On/Off Switch		
Cleanliness: Titanium Apatite Photocatalytic Air-Purifying Filter		
Cleanliness: Mould-Proof Operation		
Cleanliness: Wipe-Clean Flat Panel		
Cleanliness: Mould-Proof Air Filter		
Timers: 24-Hour On/Off Timer		
Timers: Night Set Mode		
Worry Free: Auto-Restart after Power Failure		
Worry Free: Self-Diagnosis with Digital Display		
Worry Free: Anticorrosion Treatment of Outdoor Heat Exchanger Fins		

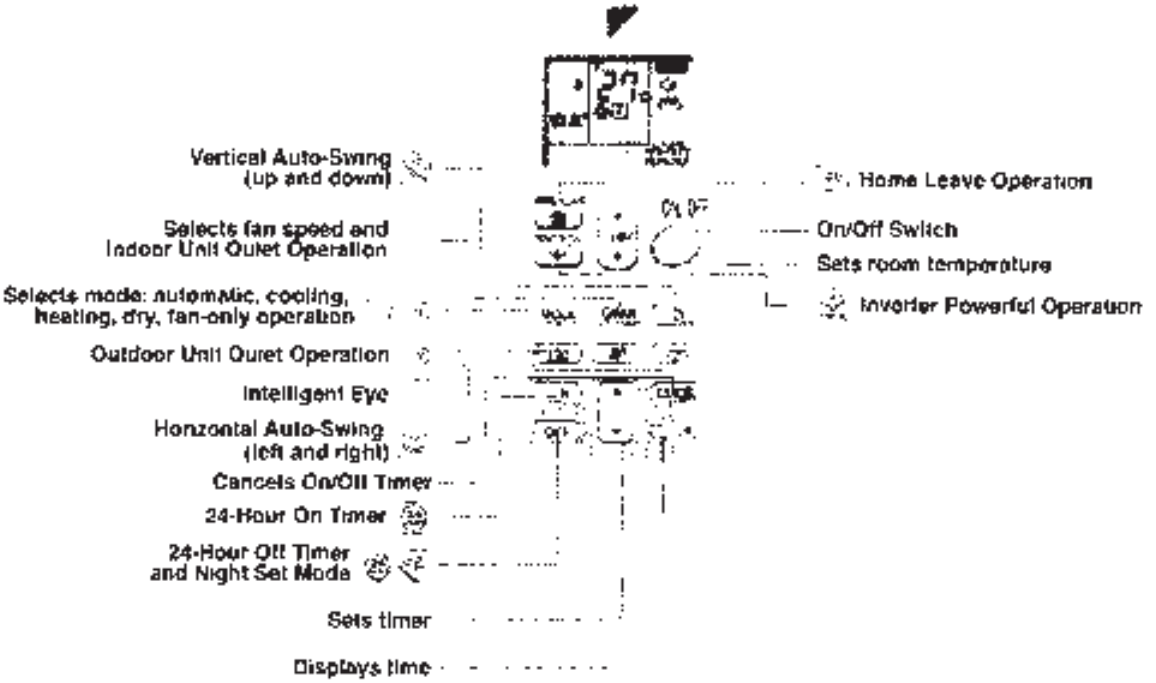
* Available in the heat pump type

Easy-to-Use Wireless Remote Controller

Wireless remote controller for FTK(X)S25/35E



Wireless remote controller for FTK(X)S50/60/71F



Specifications

FTK(X)S25/35E

Model name				Cooling only		Heat pump	
	Indoor unit			FTKS25EVMA	FTKS35EVMA	FTXS25EVMA	FTXS35EVMA
	Outdoor unit			RKS25EBVMA	RKS35EBVMA	RXS25EBVMA	RXS35EBVMA
Capacity	Cooling	Rated (Min.-Max.)	kW	2.5 (1.2-3.0)	3.5 (1.2-3.8)	2.5 (1.2-3.0)	3.5 (1.2-3.8)
			Btu/h	8,500 (4,100-10,200)	11,900 (4,100-12,950)	8,500 (4,100-10,200)	11,900 (4,100-12,950)
	Heating	Rated (Min.-Max.)	kW	–	–	3.4 (1.2-4.5)	4.0 (1.2-5.0)
			Btu/h	–	–	11,600 (4,100-15,350)	13,600 (4,100-17,050)
Power supply				1 phase, 220-240 V/220-230 V, 50/60 Hz			
Running current	Cooling / Heating	Rated	A	3.5	4.9	3.5	4.9
				–	–	4.3	5.1
Power consumption	Cooling / Heating	Rated (Min.-Max.)	W	600 (300-900)	1,020 (300-1,200)	600 (300-800)	1,020 (300-1,200)
				–	–	830 (290-1,340)	1,060 (290-1,550)
COP	Cooling / Heating	Rated	W/W	4.17	3.43	4.17	3.43
				–	–	4.10	3.70
Indoor unit				**FTKS25EVMA**	**FTKS35EVMA**	**FTXS25EVMA**	**FTXS35EVMA**
Front panel colour				White			
Airflow rate (H)	Cooling / Heating		m³/min (cfm)	9.7 (307)	9.9 (314)	9.7 (307)	9.9 (314)
				–	–	9.4 (332)	9.7 (342)
Fan speed				5 steps, quiet and automatic			
Sound levels (H/M/L)	Cooling / Heating		dB (A)	37/25/22	38/26/23	37/25/22	38/26/23
				–	–	37/28/25	38/29/26
Dimensions (H x W x D)			mm	293 x 800 x 195			
Machine weight			kg	9			
Outdoor unit				**RKS25EBVMA**	**RKS35EBVMA**	**RXS25EBVMA**	**RXS35EBVMA**
Casing colour				Ivory white			
Compressor	Type			Hermetically sealed swing type			
	Motor output		W	600			
Refrigerant charge (R-410A)			kg	1.0			
Sound levels (FBL)	Cooling / Heating		dB (A)	46/43	47/44	46/43	47/44
				–	–	47/44	48/45
Dimensions (H x W x D)			mm	550 x 765 x 285			
Machine weight			kg	34			
Operation range	Cooling		CDB	10 to 46		10 to 46	
	Heating		CWB	–		-10 to 20	
Piping connections	Liquid		mm	ø6.4			
	Gas			ø9.5			
	Drain			ø18.0			
Max. piping length			m	20			
Max. height difference				15			

Note: The above values are based on operation with a 220 V, 50 Hz power supply.

Measurement conditions
1. Cooling capacity is based on indoor temp. 27 CDB, 19 CWB, outdoor temp. 35 CDB, piping length 7.5 m
2. Heating capacity is based on indoor temp. 20 CDB, outdoor temp. 7 CDB, 6 CWB, piping length 7.5 m
3. Sound levels are based on the temperature conditions 1 and 2 above. These are unprocessed conversion values. These values are normally somewhat higher due to actual operation and a mix of ambient sounds.

Specifications

FTK(X)S50/60/71F

Model name				Cooling only			Heat pump		
Indoor unit				FTKS50FVM	FTKS60FVM	FTKS71FVM	FTXS50FVMA	FTXS60FVMA	FTXS71FVMA
Outdoor unit				RKS50FVM	RKS60FVM	RKS71FVM	RXS50FVMA	RXS60FVMA	RXS71FVMA
Capacity	Cooling	Rated	kW	5.0 (1.7-6.0)	6.0 (1.7-6.7)	7.1 (2.3-8.3)	5.0 (1.7-6.0)	6.0 (1.7-6.7)	7.1 (2.3-8.5)
		(Min.-Max.)	Btu/h	17,100 (5,800-20,500)	20,500 (5,800-22,900)	24,200 (7,800-28,300)	17,100 (5,800-20,500)	20,500 (5,800-22,900)	24,200 (7,800-29,000)
	Heating	Rated	kW				5.6 (1.7-7.1)	7.0 (1.7-8.0)	8.2 (2.3-10.0)
		(Min.-Max.)	Btu/h				19,100 (5,800-24,200)	23,900 (5,800-27,300)	28,000 (7,800-34,100)
Power supply				1 phase, 220-240 V/220-230 V, 50/60 Hz					
Running current	Cooling	Rated	A	7.2	9.2	11.5	7.9	9.2	10.8
	Heating						7.4	9.4	11.6
Power consumption	Cooling	Rated	W	1,550 (440-2,980)	1,980 (440-2,980)	2,510 (570-3,560)	1,950 (440-2,980)	1,960 (440-2,980)	2,360 (570-3,560)
	Heating	(Min.-Max.)					1,610 (430-2,530)	2,040 (430-2,810)	2,520 (520-3,730)
COP	Cooling	Rated	W/W	3.23	3.03	2.83	3.23	3.03	3.01
	Heating						3.63	3.43	3.25
Indoor unit				FTKS50FVM	FTKS60FVM	FTKS71FVM	FTXS50FVMA	FTXS60FVMA	FTXS71FVMA
Front panel colour				White					
Airflow rate (H)	Cooling		m³/min (cfm)	14.7 (519)	16.2 (572)	17.4 (614)	14.7 (519)	16.2 (572)	17.4 (614)
	Heating						16.2 (572)	17.4 (614)	21.5 (759)
Fan speed				5 steps, quiet and automatic					
Sound levels (H/L/SL)	Cooling		dB(A)	41/34/31	45/36/33	46/37/34	44/35/32	45/36/33	46/37/34
	Heating						42/33/30	44/35/32	46/37/34
Dimensions (H x W x D)			mm	290 x 1,050 x 234					
Machine weight			kg	12					
Outdoor unit				RKS50FVM	RKS60FVM	RKS71FVM	RXS50FVMA	RXS60FVMA	RXS71FVMA
Casing colour				Ivory white					
Compressor		Type		Hermetically sealed swing type					
		Motor output	W	1,100	1,920		1,100		1,920
Refrigerant charge (R-410A)			kg	1.50	1.70		1.50		2.30
Sound levels (H/L)	Cooling		dB(A)	47/44	49/46	53/49	47/44	49/46	52/49
	Heating						48/45	49/46	52/49
Dimensions (H x W x D)			mm	735 x 825 x 300					770 x 900 x 320
Machine weight			kg	47	55		48		71
Operation range	Cooling		CDB	-10 to 46					
	Heating		CWB				-15 to 18		
Piping connections	Liquid		mm	ø6.4					
	Gas			ø12.7	ø15.9		ø12.7		ø15.9
	Drain			ø18.0					
Max. piping length			m	30					
Max. height difference			m	20					

Note: The above values are based on combination with a 220 V, 50 Hz power supply.

Measurement conditions:
1. Cooling capacity is based on: indoor temp. 27 °CDB, 19 °CWB; outdoor temp. 35 °CDB; piping length 7.5 m
2. Heating capacity is based on: indoor temp. 20 °CDB; outdoor temp. 7 °CDB, 6 °CWB; piping length 7.5 m
3. Sound levels are based on the temperature conditions 1 and 2 above. These are anechoic conversion values. These values are normally somewhat higher during actual operation as a result of ambient conditions.

Options

Indoor unit

No.	Item	FTK(X)S25/35E	FTK(X)S50/60/71F
1	5-room centralised controller	KRC72	
2	Wiring adaptor for Fine coat/remote controller (Normal open pulse contact/normal open contact) *1	KRP413A1S	
3	Titanium apatite photocatalytic air-purifying filter *2, *3	KAF970A46	KAF952B42
4	Remote controller loss prevention with chain	KKF917A1	

Note: *1. A wiring adaptor (KRP413A1S) is also required for each indoor unit.
*2. The long life and other benefits should be obtained locally.
*3. The filter is a standard accessory. It should be replaced approximately every 3 years.

5-room centralised controller
KRC72

Titanium apatite photocatalytic air-purifying filter
KAF970A46

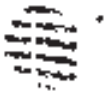
Titanium apatite photocatalytic air-purifying filter
KAF952B42

Remote controller loss prevention with chain
KKF917A4

Outdoor unit

No.	Item	RK(X)S25/35E	RKS50/60/71F, RXS50/60F	RXS71F
1	Air direction adjustment grille	KPW937A4	KPW945A4	
2	Drain plug	KKP937A4		KKP915A4

Note: *1. One set includes 5 pieces for 5 units.



Air direction adjustment grille
KPW945A4

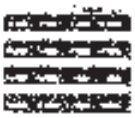
Drain plug
KKP937A4

Control system

No.	Item	FTK(X)S25/35E	FTK(X)S50/60/71F
1	Central remote controller	DCS302CA61	
2	Unified On/Off controller	DCS301BA61	
3	Schedule timer	DST301BA61	
4	Interface adaptor for DIII-NET use	KRP928B2S	

Note: *1. A wiring adaptor (KRP928B2S) is also required for each indoor unit.

Central remote controller
DCS302CA61



Unified On/Off controller
DCS301BA61

Schedule timer
DST301BA61

Warning

- Daikin Industries, Ltd.'s products are manufactured for export to numerous countries throughout the world. Daikin Industries, Ltd. does not have control over which products are exported to and used in a particular country. Prior to purchase, please therefore confirm with your local authorised importer, distributor and/or retailer whether this product conforms to the applicable standards, and is suitable for use, in the region where the product will be used. This statement does not purport to exclude, restrict or modify the application of any local legislation.
- Ask a qualified installer or contractor to install this product. Do not try to install the product yourself. Improper installation can result in water or refrigerant leakage, electrical shock, fire or explosion.
- Use only those parts and accessories supplied or specified by Daikin. Ask a qualified installer or contractor to install those parts and accessories. Use of unauthorised parts and accessories or improper installation of parts and accessories can result in water or refrigerant leakage, electrical shock, fire or explosion.
- Read the User's Manual carefully before using this product. The User's Manual provides important safety instructions and warnings. Be sure to follow these instructions and warnings.

If you have any enquiries, please contact your local importer, distributor and/or retailer.

Cautions on product corrosion

1. Air conditioners should not be installed in areas where corrosive gases, such as acid gas or alkaline gas, are produced.
2. If the outdoor unit is to be installed close to the sea shore, direct exposure to the sea breeze should be avoided. If you need to install the outdoor unit close to the sea shore, contact your local distributor.

ISO 9001
JMI-0107

ISO 9001
JQA-1452

About ISO 9001
ISO 9001 is a plant certification system refined by the International Organization for Standardization (ISO) relating to quality assurance. ISO 9001 certification covers quality assurance aspects related to the design, development, manufacture, installation, and supplementary service of products manufactured at the plant.

EC2002/44

About ISO 14001
ISO 14001 is the standard defined by the International Organization for Standardization (ISO) relating to environmental management systems. Our group has been acknowledged by an internationally accredited compliance organization as having an appropriate programme of environmental protection procedures and policies to meet the requirements of ISO 14001.

Dealer

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Printed in Japan 02/05/003 YA, P/C

Specifications, designs and other content appearing in this brochure are current as of February 2008 but subject to change without notice.

Technical Literature

11) Direct Expansion Split Type A/C Unit

TERMINAL UNITS

Model VAV

"SUN" Pressure Independent type Single Duct VAV terminal unit is factory built assembly, utilizing the latest development in volume control. These units are designed to control the air flow rate of conditioned air into an enclosed space in response to a remote signal, usually a thermostat. The silent and efficient design of these single duct terminal units results in a system component which has minimal pressure drop, reducing fan horsepower requirement and low noise generation. Its quiet operation, compact configuration makes this unit easily used in today HVAC application.

Common Applications

Cooling application apply for interior zones where full shut-off of conditioned air delivery is allowable and no overheat control.

Cooling and heating application apply for exterior zone where convective and radiated heat losses create a need for overhead heating.

Features :

- Ranges from 25 L/s to 1500 L/s
- Pressure independent operation
- Variable Air Volume control for volume application
- Electronic or Direct Digital Control
- Factory calibrated to ± 5% accuracy
- External mounted DDC controller ports
- Low pressure pneumatic or electronic flow sensor connections
- Full range of accessories for each unit available

Construction

- 0.8 or 1.0 mm G.I. construction
- 25 mm and 48 kg/m³ density fiberglass internal insulation, facing with, mylar and perforated metal sheet protection. Meets requirements for BS 476 Part 6 and HKFSD regulation.
- Blade type Damper constructed of two layers of heavy gauge galvanized steel with extruded peripheral gasket.
- Pneumatic damper shaft is mounted in self-lubricated bearings.
- UL 94 type pneumatic tubing.
- Discharge complete with 'S' flange and meet DW / 142 requirement.
- Special inlet and installation available.

Model Number Selection

VAV / CAV — Nom. Size — Special requirements

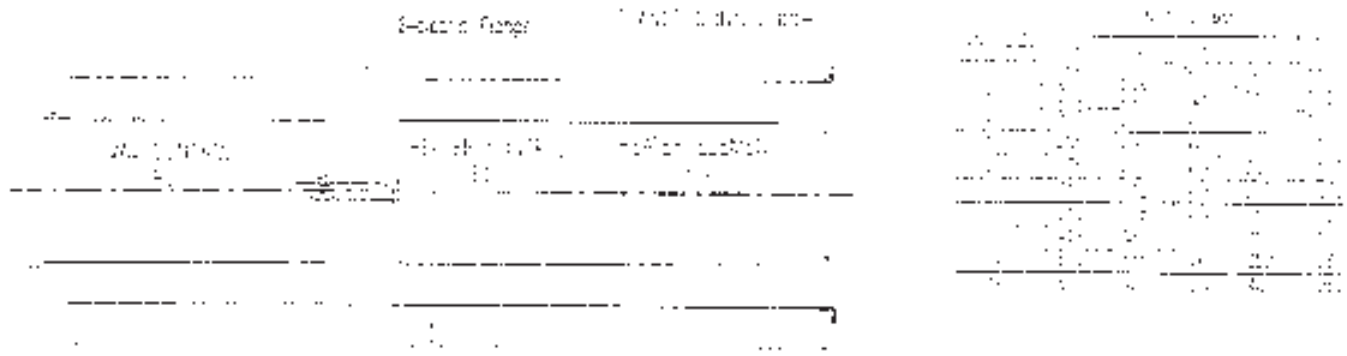
- Blank = Pneumatic Controller
- W = Hot Water Coil
- E = Electric Coil
- S = Controller supplied by SUN

TERMINAL UNITS

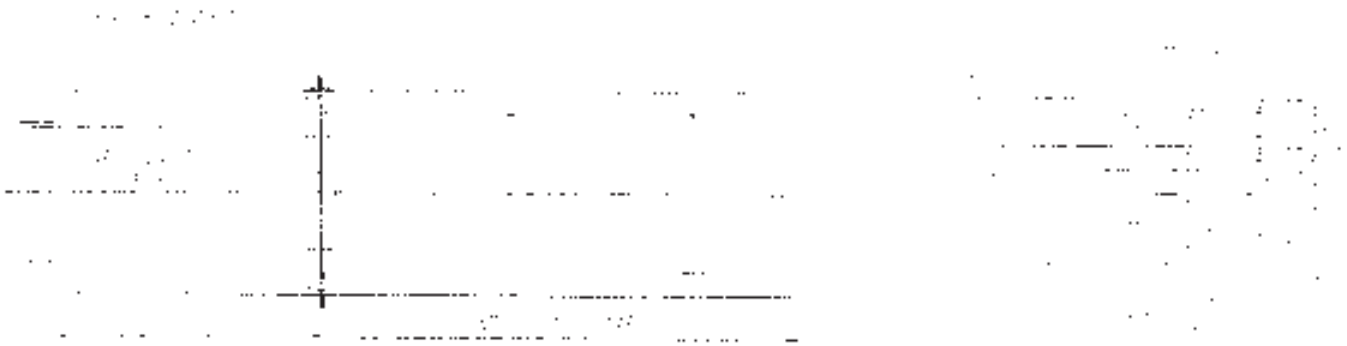
Dimensional Data

VAV Barebox Dimension:

VAV Barebox With Electric Duct Heater Section Dimension:



VAV Barebox with Multi-Outlet Plenum Section Dimension:



TERMINAL UNITS

Unit Configuration and Accessories

Single Duct VAV Size 4 to 47

Single Duct VAV Size 4 to 16 with Multi-outlet attenuator

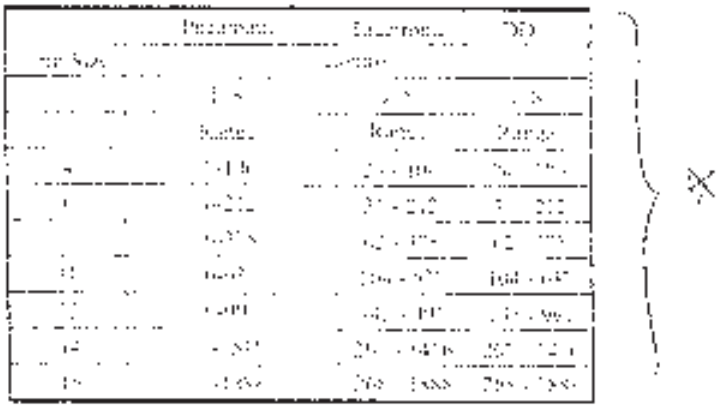
Single Duct VAV Size 4 to 16 with Electric Heater Section

Single Duct VAV Size 4 to 16 with Hot water coil and MEBA

TERMINAL UNITS

Performance Data

Recommended Air Volume Flow Range

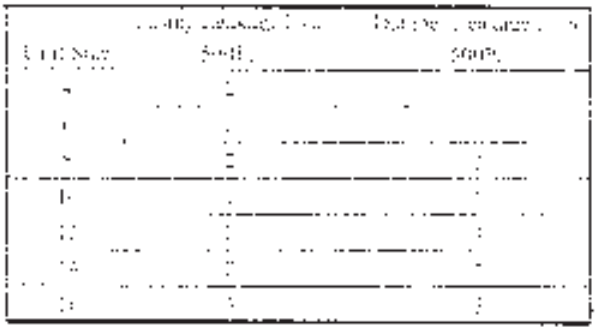


Notes

Factory calibrated control range of selected Airflow Variable Air Volume (VAV) Terminal Unit. Minimum airflow may be zero unless otherwise noted.

Selection of unit for airflow rates below listed minimum is not recommended. Stability and accuracy may not be acceptable at lower than recommended airflow limits. Terminal pressure drop will vary depending on VAV control device.

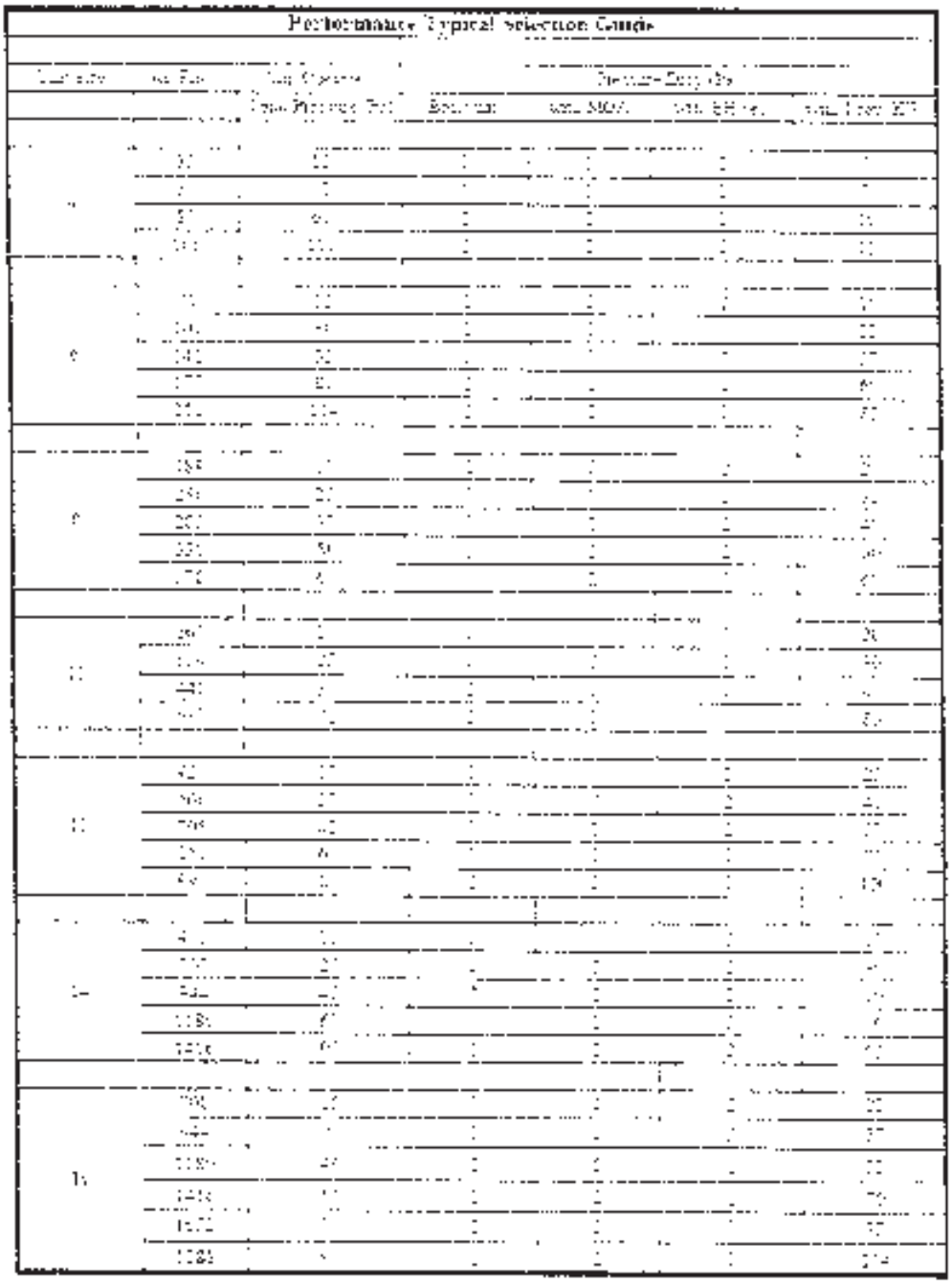
Basic Box Casing and Damper Leakage



TERMINAL UNITS

Performance Data

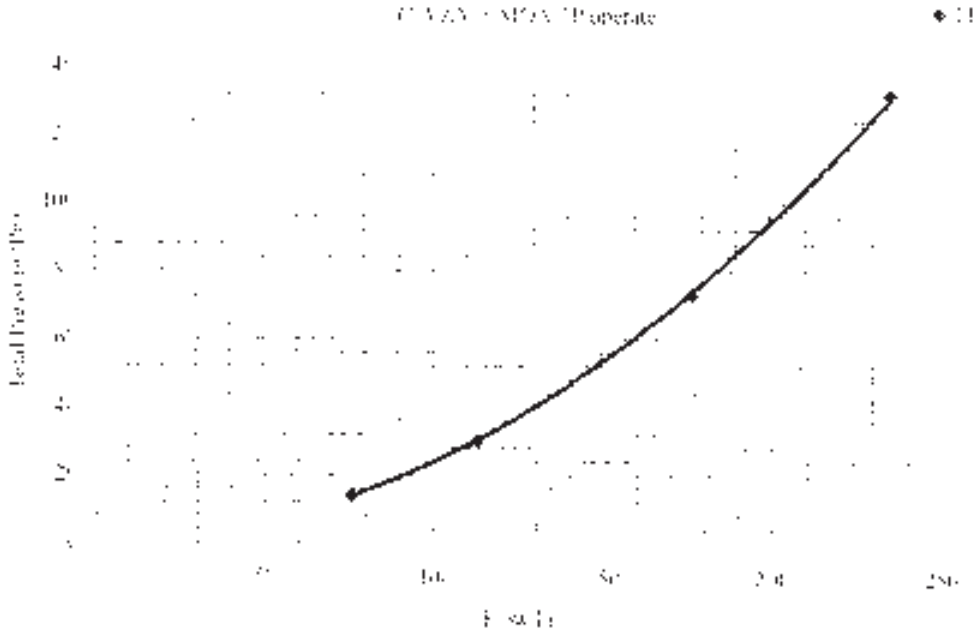
Performance Typical Selection Guide



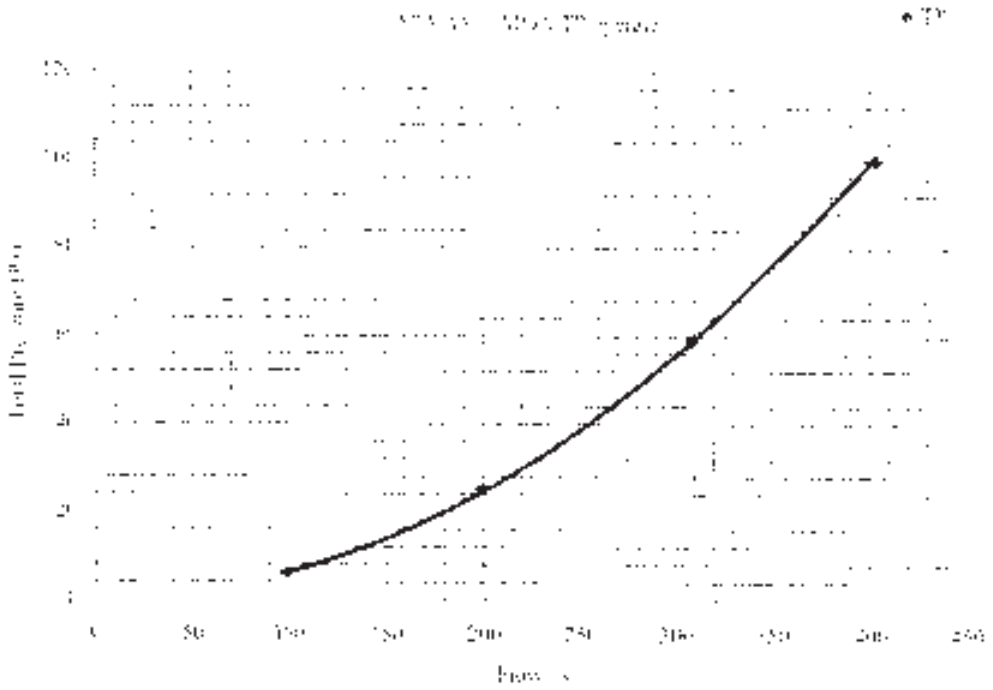
TERMINAL UNITS

Performance Data / Total Pressure Vs Flow

Size 6



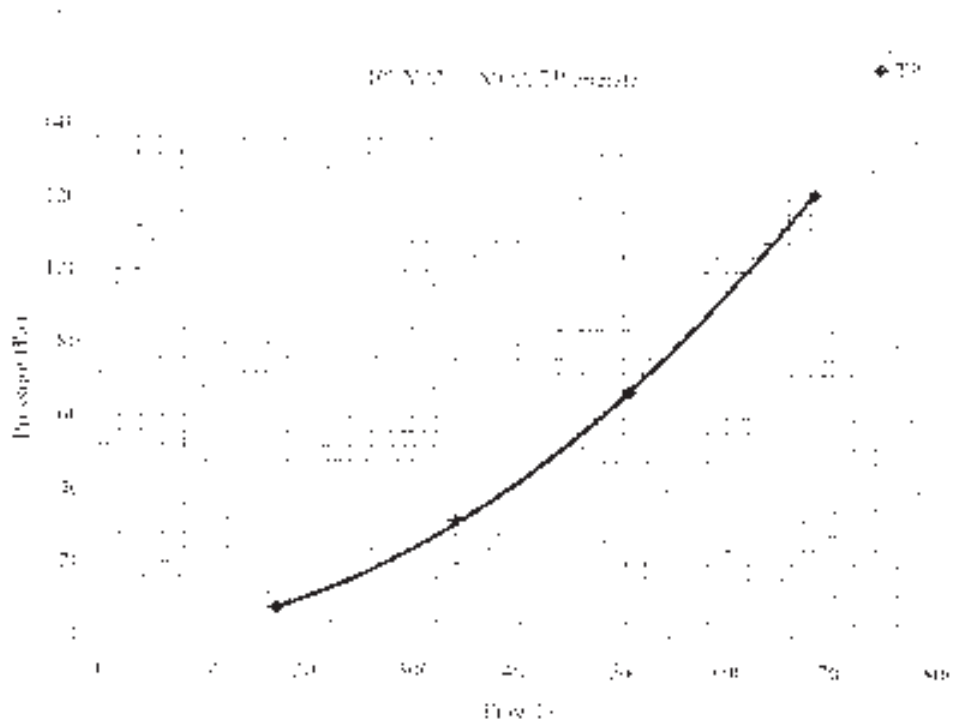
Size 8



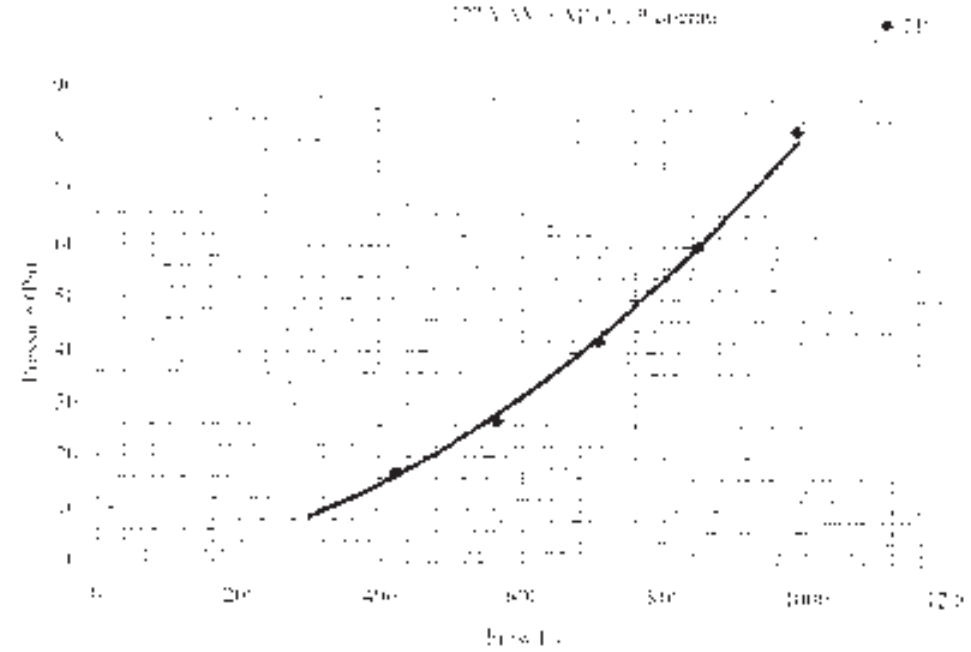
TERMINAL UNITS

Performance Data : Total Pressure Vs Flow :

Size 10



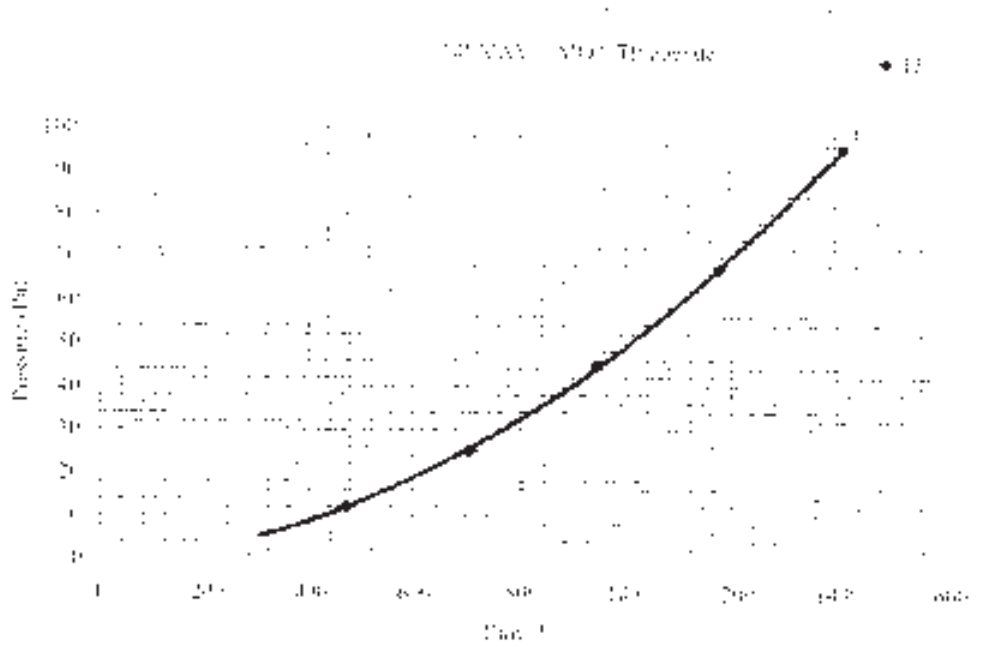
Size 12



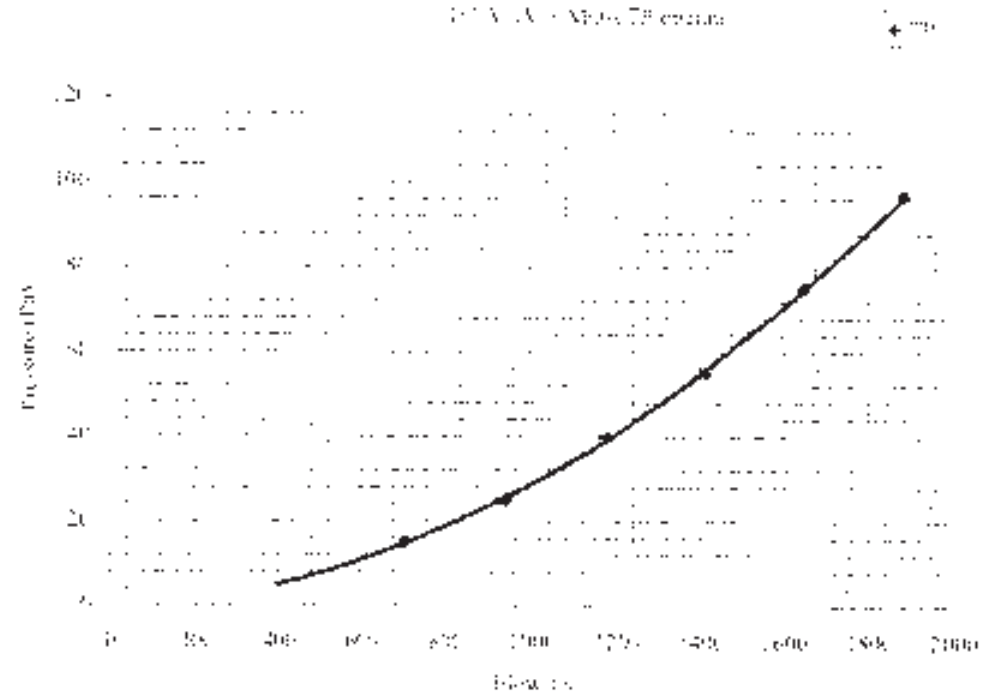
TERMINAL UNITS

Performance Data : Total Pressure Vs Flow :

Size 14



Size 16



TERMINAL UNITS

Performance Data

NC Level Quiet Selection Guide							
Basic unit							
Unit Size	Air Flow	Discharge NC			Radiated NC		
		125 Pa	375 Pa	750 Pa	125 Pa	375 Pa	750 Pa
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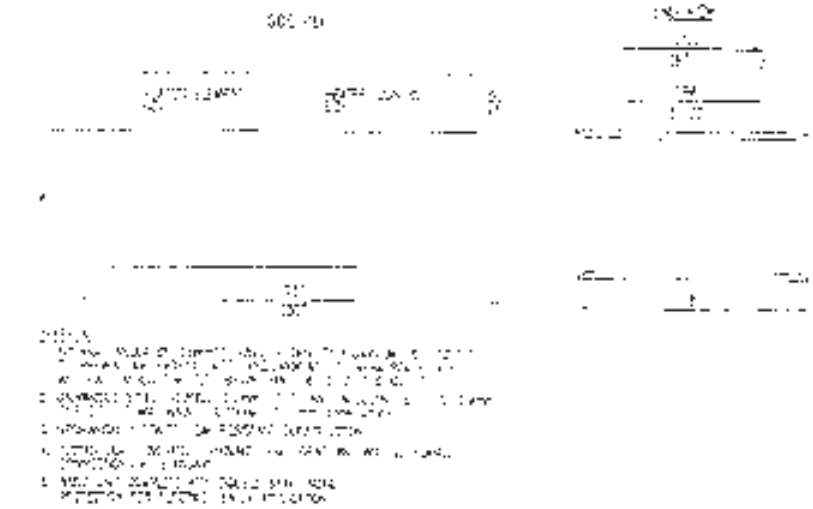
TERMINAL UNITS

Accessories - Electric heater section



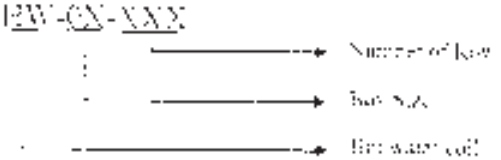
Heater Section size (mm)			
Unit	A	B	Length

Model Number Selection

Accessories - Hot Water Coil section

Hot Water Coil Section size (mm)			
Unit	A	B	Length

Model Number Selection



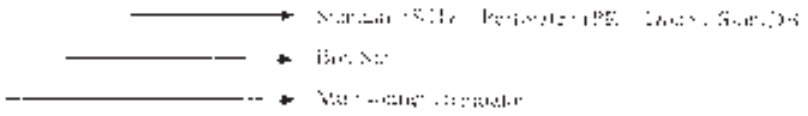
TERMINAL UNITS

Accessories - Multi-outlet attenuator

MQA Series size (mm)			
Unit	A	B	Length

Model Number Selection

MQA-<u>0X</u>-<u>XXX</u>



"SUNRISE" Variable Air Volume Box are successful to fully integrated with the following DDC controller

Technical Literature

12) Variable Air Volume Box

NICOTRA

DDM

ELETTROVENTILATORI
CON MOTORE A ROTORE ESTERNO

DIRECT DRIVEN FANS
WITH EXTERNAL ROTOR MOTOR

RADIAL-VENTILATOREN
MIT AUßENLÄUFERMOTOR

MOTOVENTILATEURS
AVEC MOTEUR À ROTOR EXTÉRIEUR

VENTILADORES
CON MOTOR A ROTOR EXTERIOR

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NICOTRA

DDM

ELETTROVENTILATORI
CON MOTORE A ROTORE ESTERNO

DIRECT DRIVEN FANS
WITH EXTERNAL ROTOR MOTOR

RADIAL-VENTILATOREN
MIT AUßENLÄUFERMOTOR

MOTOVENTILATEURS
AVEC MOTEUR À ROTOR EXTÉRIEUR

VENTILADORES
CON MOTOR A ROTOR EXTERIOR

catalogo
catalogue
Katalog
catalogue
catálogo

J-4 10/04

1.640.10 - 4000/1 - 10/04

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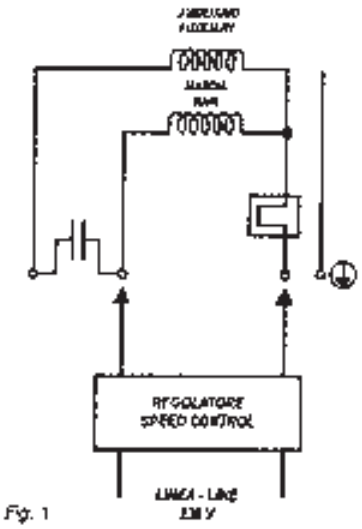

Fig. 1

Information:

Speed regulation

A) Multi-speed motors

Speed regulation is obtained by switching the main feed to the appropriate motor speed tapping terminal in accordance with the wiring diagram supplied with the fan.

These motors:

- ***"Do not allow"***:
any further regulation by means of electric Triac regulators or frequency static converters.

- ***"Allow"***:
The use of transformers or devices which do not modify the sinusoidal wave line.

Attention!!

By connecting fans in parallel there is a risk of eddy currents damaging motor windings. Our Technical Services will be pleased to advise.

Please note that not all commercially available electronic controllers are compatible with our fans. We recommend only Nicotra approved controllers.

All our DDM fans are supplied for two wires connection.

Frequency static converters:

Our standard motors are not suitable for this type of regulation
Specially built motors may allow this regulation, on condition that used converters are built in accordance with IEC 34-17. Our Technical Services will be pleased to advise.

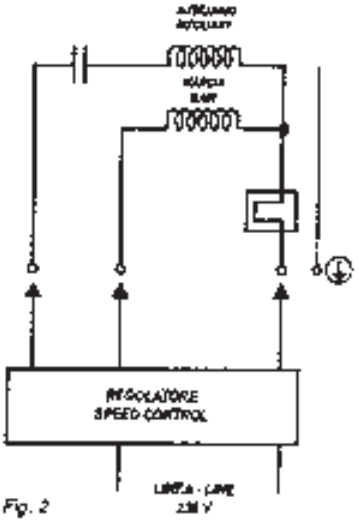

Fig. 2

B) One speed motors:

Regulation may be possible by means of:

- **Trasformer:**
All single phase and three phase motors of DDM series are generally suitable for this application because sinusoidal wave line is not altered.

- **Electronic regulators:**
The low speed curves, shown in the catalogue, produced with Nicotra regulators, are obtained with a connection on both the main and auxiliary windings for motors up to 3 Amps. max. running currents (two wire control, see pict.1). For above 3 Amps. a three wire control is used (see pict. 2) with control on the main winding only. This will comply with Community Directive 73/23 CEE, 89/336 CEE, 93/68 CEE, both for Safety and Electromagnetic Compatibility field.

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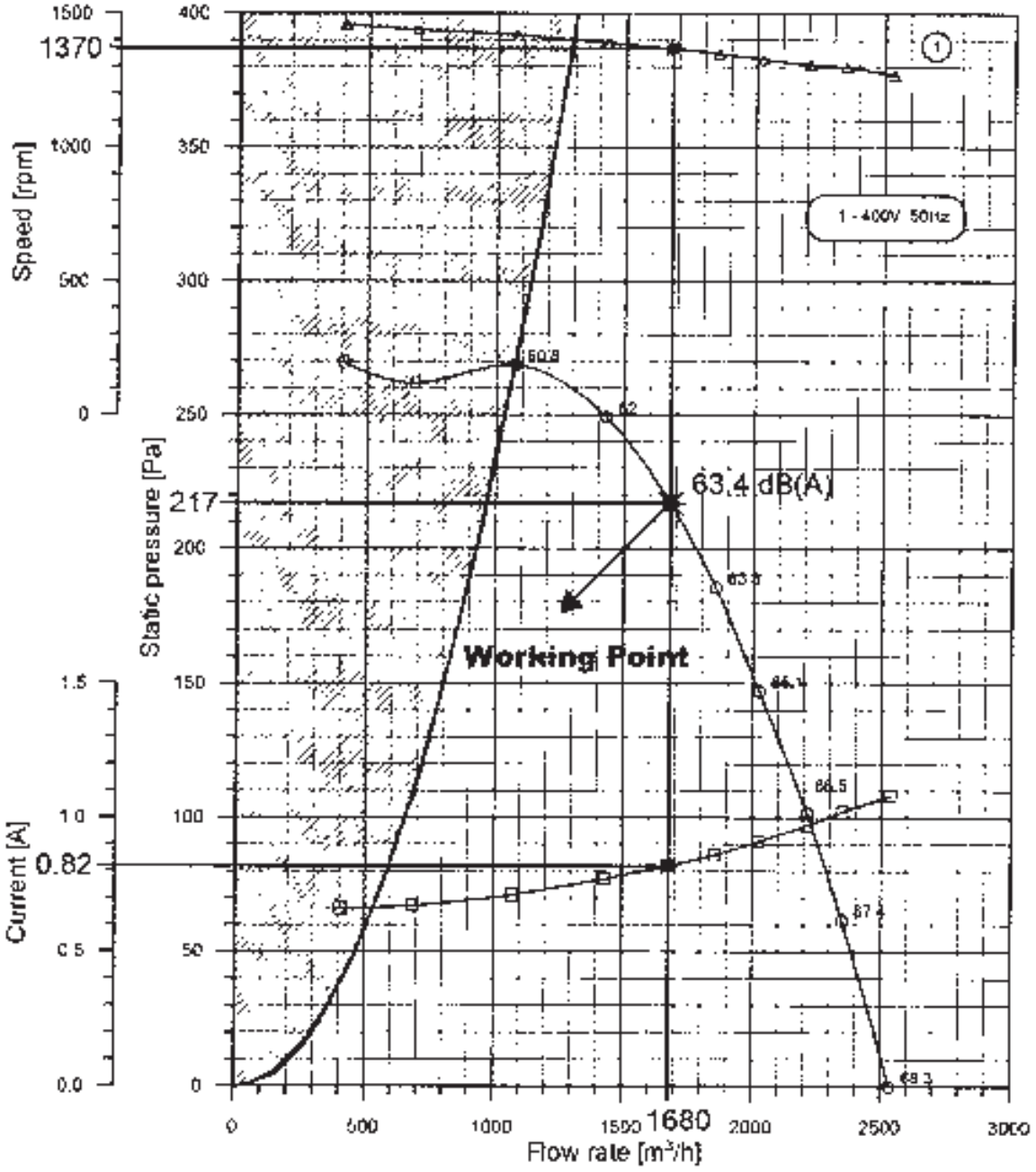
ESEMPIO DI SCELTA - EXAMPLE OF READING



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LEGENDA DATI TECNICI - TECHNICAL DATA LEGEND

	(I)	(GB)	(D)	(F)	(E)
"SP"	Speciale - senza morsettiera	Wiring coming out	Spez. ohne Klemme	Spécial - sans borne	Especial sin conex.
FL	Flangia premente	Outlet flange	Ausblasflansch	Bride refoulement	Brida de salida
FLsp	Flangia premente speciale	Special outlet flange	Spez. Ausblasflansch	Bride refoulement spéc	Brida de salida esp
SB	Supporti base	Mounting feet	Füße	Jeux de pieds	Soporte base
SCT	Scatola morsettiera	Terminal box	Klemmkasten	Boîte à borne	Caja conexiones
GRG	Griglia aspirante	Inlet guard	Ansaugitter	Grille à l'aspiration	Rejilla aspiración
GRGP	Griglia premente	Outlet guard	Ausblasgitter	Grille de refoulement	Rejilla impulsión
VERN	Esecuzione verniciata	Painted execution	Lackierte Ausführung	Exécution peinte	Ejecución pintada
1 F	Motore monofase	Single phase motor	Wechselstrom Motor	Moteur monophasé	Motor monofásico
3 F	Motore trifase	Three phase motor	Drehstrom Motor	Moteur triphasé	Motor trifásico
4 P	Motore a 4 poli	4 pole motor	4-polig Motor	Moteur à 4 pôles	Motor de 4 polos
6 P	Motore a 6 poli	6 pole motor	6-polig Motor	Moteur à 6 pôles	Motor de 6 polos
8 P	Motore a 8 poli	8 pole motor	8-polig Motor	Moteur à 8 pôles	Motor de 8 polos

LEGENDA SCHEMA DI COLLEGAMENTO - WIRING CONNECTION LEGENDA

(I)	(GB)	(F)	(D)	(E)	(NL)
NERO	BLACK	NOIR	SCHWARZ	NEGRO	ZWART
BLU	BLUE	BLEU	BLAU	AZUL	BLAUW
ROSSO	RED	ROUGE	ROT	ROJO	ROOD
GIALLO	YELLOW	JAUNE	GELB	AMARILLO	GEEL
MARRONE	BROWN	MARRON	BRAUN	MARRON	BRUN
VERDE	GREEN	VERT	GRÜN	VERDE	GROEN
BIANCO	WHITE	BLANC	WEIß	BLANCO	WIT
GIALLO / VERDE	YELLOW / GREEN	JAUNE / VERT	GELB / GRUN	AMARILLO / VERDE	GEEL / GROEN
ARANCIONE	ORANGE	ORANGE	ORANGE	ANARANJADO	ORANJE
GRIGIO	GREY	GRIS	GRAU	GRIS	GRIJS
VIOLA	VIOLET	VIOLET	VIOLETT	MORADO	PAARS
VELOCITA' 1, 2, 3, 4	SPEED 1, 2, 3, 4	VITESSE 1, 2, 3, 4	GESCHWIND. 1, 2, 3, 4	VELOCIDAD 1, 2, 3, 4	SNELHEID 1, 2, 3, 4
FASE	PHASE	PHASE	PHASE	FASE	FASE
NEUTRO	NEUTRAL	NEUTRE	NULL	NEUTRO	NULLEIDER

(P)	(FIN)	(S)	(N)	(DK)	(GR)
PRETO	MUSTA	SVART	SVART	SORT	ΜΑΥΡΟ
AZUL	SININEN	BLÅ	BLÅ	BLÅ	ΜΠΛΕ
VERMELHO	PUNAINEN	RÖD	RØD	RØD	ΚΟΚΚΙΝΟ
AMARELO	KELTAINEN	GUL	GUL	GUL	ΚΙΤΡΙΝΟ
CASTANHO	RUSKEA	BRUN	BRUN	BRUN	ΚΑΦΕ
VERDE	VIHREA	GRÖN	GRØNN	GRØN	ΠΡΑΣΙΝΟ
BRANCO	VALKOINEN	VIT	HVIT	HVID	ΑΣΠΡΟ
AMARELO / VERDE	KELTAINEN / VIHREA	GUL / GRÖN	GUL / GRØNN	GUL / GRØN	ΚΙΤΡΙΝΟ / ΠΡΑΣΙΝΟ
LARANJA	ORANSSI	ORANGE	ORANSJE	ORANGE	ΠΟΡΤΟΚΑΛΙ
CINZA	HARMAA	GRÅ	GRÅ	GRÅ	ΓΚΡΙ
ROXO	VIOLETTI	VIOLETT	FIOLETT	VIOLET	ΜΩΒ
VELOCIDADE 1, 2, 3, 4	NOPEUDET 1, 2, 3, 4	HASTIGHET 1, 2, 3, 4	HASTIGHET 1, 2, 3, 4	HASTIGHED 1, 2, 3, 4	ΤΑΧΥΤΗΤΑ 1, 2, 3, 4
FASE	VAIHE	FASER	FASE	FASER	ΦΑΣΗ
NEUTRO	NEUTRAALI	NEUTRAL	NØYTRAL	NEUTRAL	ΟΥΔΕΤΕΡΟ

NICOTRA

DDM - Dati tecnici / Technical data

FAN CODE	FAN TYPE	Phase Poles	Motor code	Power (watt)	Volts	Hz	nr. speed	Prot. IP	Thermal prot.
	DDM 120								
6102XT	DDM 120/126	1F 2P	7725F9	45	230	50/60	2	32	yes-in
	DDM 133								
6102XU	DDM 133/126 +FL	1F 2P	7725F7	60	230	50/60	4	32	yes-in
6102MZ	DDM 133/190 +FL	1F 2P	7725C6	60	230	50/60	4	32	yes-in
6102FW	DDM 133/190 +FL	1F 2P	7725C0	90	230	50/60	1	32	yes-out
	DDM 146								
6102MH	DDM 146/190 +FL	1F 4P	7725C5	20	230	50/60	1	32	yes-in
6102XW	DDM 146/190 +FL	1F 2P	7725C2	140	230	50/60	1	32	yes-out
	DDM 7/7								
6M029M	DDM 7/7 +SCT	1F 4P	E5G3301	147	230	50/60	1	55	yes-out
6M02L7	DDM 7/7 +SCT	1F 4P	E5G3402	184	230	50	1	55	yes-out
6M02Y8	DDM 7/7 +SCT	1F 4P	E6G3304	300	230	50/60	1	55	yes-out
6M02WL	DDM 7/7 +SCT	1F 4P	E6G3405	420	230	50/60	1	55	yes-out
6M02Z4	DDM 7/7 +SCT	1F 6P	E5G3302	90	230	50/60	1	55	yes-out
6M02U8	DDM 7/7 +SCT	1F 4P	E5G3401	147	230	50	3	44	yes-out
6M022U	DDM 7/7 +SCT	1F 4P	E6G3307	184	230	50	3	55	yes-out
6M022H	DDM 7/7 +SCT	3F 4P	E5G3403	147	230/400	50/60	1	55	NO
6M02WM	DDM 7/7 +SCT	3F 4P	E6G3309	300	230/400	50/60	1	55	yes-out
	DDM 7/9								
6M02L6	DDM 7/9 +SCT	1F 4P	E6G3304	300	230	50/60	1	55	yes-out
6M025X	DDM 7/9 +SCT	1F 4P	E6G3405	420	230	50/60	1	55	yes-out
6M02WN	DDM 7/9 +SCT	1F 4P	E6G3307	184	230	50	3	55	yes-out
	DDM 9/7								
6M020N	DDM 9/7 +SCT	1F 4P	E6G3304	300	230	50	1	55	yes-out
6M022A	DDM 9/7 +SCT	1F 4P	E6G3405	420	230	50	1	55	yes-out
6M020M	DDM 9/7 +SCT	1F 4P	E6G3501	550	230	50/60	1	55	yes-out
6M02U9	DDM 9/7 +SCT	1F 4P	E6G3502	350	230	50	3	55	yes-out
6M029H	DDM 9/7 +SCT	1F 6P	E6G3303	200	230	50/60	1	55	yes-out
6M02WP	DDM 9/7 +SCT	1F 6P	E6G3306	200	230	50/60	3	44	yes-out
6M02WR	DDM 9/7 +SCT	3F 4P	E6G3309	300	230/400	50/60	1	55	yes-out
6102WT	DDM 9/7 +SCT	3F 4P	E6G3603	550	230/400	50/60	1	55	yes-out
	DDM 9/7 TIGHT								
6M02WX	DDM 9/7 TIGHT+SCT	1F 4P	E6G3304	300	230	50	1	55	yes-out
6M02WY	DDM 9/7 TIGHT+SCT	1F 4P	E6G3405	420	230	50/60	1	55	yes-out
	DDM 9/9								
6M02K1	DDM 9/9 +SCT	1F 4P	E6G3304	300	230	50	1	55	yes-out
6M02XN	DDM 9/9 +SCT	1F 4P	E6G3405	420	230	50	1	55	yes-out
6M02H5	DDM 9/9 +SCT	1F 4P	E6G3501	550	230	50/60	1	55	yes-out
6M02R8	DDM 9/9	1F 4P	E6G2503	550	230	50/60	1	10	yes-out
6M02W0	DDM 9/9 +SCT	1F 4P	E6G3502	350	230	50	3	55	yes-out
6M02GE	DDM 9/9	1F 4P	E6G2701	550	230	50/60	3	10	yes-out
6M026M	DDM 9/9 +SCT	1F 6P	E6G3303	200	230	50/60	1	55	yes-out
6M02NM	DDM 9/9 +SCT	1F 6P	E6G3402	250	230	50/60	1	55	yes-out
6M02WU	DDM 9/9 +SCT	1F 6P	E6G3306	200	230	50/60	3	44	yes-out
6M02G2	DDM 9/9 +SCT	3F 6P	E6G3403	245	230/400	50/60	1	44	NO
	DDM 9/9 TIGHT								
6M02LX	DDM 9/9 TIGHT +SCT	1F 4P	E6G3304	300	230	50	1	55	yes-out
6M02L8	DDM 9/9 TIGHT +SCT	1F 4P	E6G3405	420	230	50	1	55	yes-out

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DDM - Dati tecnici / Technical data

FAN CODE	FAN TYPE	Phase Poles	Motor code	Power (watt)	Volts	Hz	nr. speed	Prot. IP	Thermal prot.
	DDM 280								
6102XE	DDM 280/204 +SCT	1F 4P	E6G3704	600	230	50	1	55	yes-out
	DDM 10/8								
6M02X4	DDM 10/8 +SCT	1F 4P	E6G3604	550	230	50	1	55	yes-out
6102Z0	DDM 10/8 +SCT	1F 4P	E6G3704	600	230	50	1	55	yes-out
6M025N	DDM 10/8	1F 4P	E6G2503	550	230	50	1	10	yes-out
61025P	DDM 10/8	1F 4P	E6G2701	550	230	50	3	10	yes-out
6M02WZ	DDM 10/8 +SCT	1F 6P	E6G3402	250	230	50	1	55	yes-out
6M02N9	DDM 10/8 +SCT	1F 6P	E6G3602	515	230	50/60	1	55	yes-out
6M024A	DDM 10/8 +SCT	1F 6P	E6G3404	280	230	50	3	44	yes-out
6M02LP	DDM 10/8	1F 6P	E6G2601	420	230	50	3	10	yes-out
6M02XA	DDM 10/8 +SCT	3F 4P	E6G3603	550	230/400	50	1	55	yes-out
6M02XC	DDM 10/8 +SCT	3F 6P	E6G3403	245	230/400	50/60	1	44	NO
	DDM 10/10								
6M02P0	DDM 10/10 +SCT	1F 4P	E6G3604	550	230	50	1	55	yes-out
6M02Z6	DDM 10/10 +SCT	1F 4P	E6G3704	600	230	50	1	55	yes-out
6M02XP	DDM 10/10	1F 4P	E6G2503	550	230	50	1	10	yes-out
6M02Z8	DDM 10/10	1F 4P	E6G2701	550	230	50	3	10	yes-out
6M02GA	DDM 10/10 +SCT	1F 6P	E6G3402	250	230	50	1	55	yes-out
6M02N1	DDM 10/10 +SCT	1F 6P	E6G3602	515	230	50/60	1	55	yes-out
6M02XM	DDM 10/10 +SCT	1F 6P	E6G3404	280	230	50	3	44	yes out
6M02FF	DDM 10/10	1F 6P	E6G2601	420	230	50	3	10	yes-out
6M02XG	DDM 10/10 +SCT	3F 4P	E6G3603	550	230/400	50	1	55	yes-out
6M021Y	DDM 10/10 +SCT	3F 4P	E6G3706	750	400/400	50	2	55	yes-out
6M02G3	DDM 10/10 +SCT	3F 6P	E6G3403	245	230/400	50/60	1	44	NO
6M025T	DDM 10/10 +SCT	3F 6P	E6G3606	350	230/400	50/60	1	55	yes-out
	DDM 12/9								
6102N3	DDM 12/9 +SCT	1F 6P	E6G3702	515	230	50	1	55	yes-out
6102CL	DDM 12/9	1F 6P	E6G2702	590	230	50	1	10	yes-out
6102XP	DDM 12/9 +SCT	1F 6P	E6G3703	500	230	50	3	55	yes-out
6102XH	DDM 12/9	1F 6P	E6G2703	200	230	50	3	10	yes-out
61021R	DDM 12/9 +SCT	3F 6P	E6G3707	550	230/400	50	1	55	yes-out
	DDM 12/12								
6102N5	DDM 12/12 +SCT	1F 6P	E6G3702	515	230	50	1	55	yes-out
6102AA	DDM 12/12	1F 6P	E6G2702	590	230	50/60	1	10	yes-out
6102XR	DDM 12/12 +SCT	1F 6P	E6G3703	500	230	50	3	55	yes-out
6102XK	DDM 12/12	1F 6P	E6G2703	200	230	50	3	10	yes-out
61020R	DDM 12/12 +SCT	3F 6P	E6G3707	550	230/400	50	1	55	yes-out

Le caratteristiche delle macchine riportate nel presente catalogo, come dimensioni, prestazioni o altro, possono essere oggetto di modifica senza preavviso.
I cataloghi Nicotra S.p.A. sono revisionati, quando necessario, con la pubblicazione di nuove edizioni. È importante che gli utenti si accertino di essere in possesso dell'ultima edizione in vigore.
Qualunque utilizzo in campo aeronautico deve essere preventivamente comunicato a Nicotra S.p.A.

The characteristics of the machines stated in this catalogue, like dimensions, performances and so on, can be modified without previous notice.
Nicotra S.p.A. catalogues are revised, when necessary, with the issue of new editions. It is important for the user to be sure of possessing the last edition in force.
Every application in aeronautics must be previously communicated to Nicotra S.p.A.

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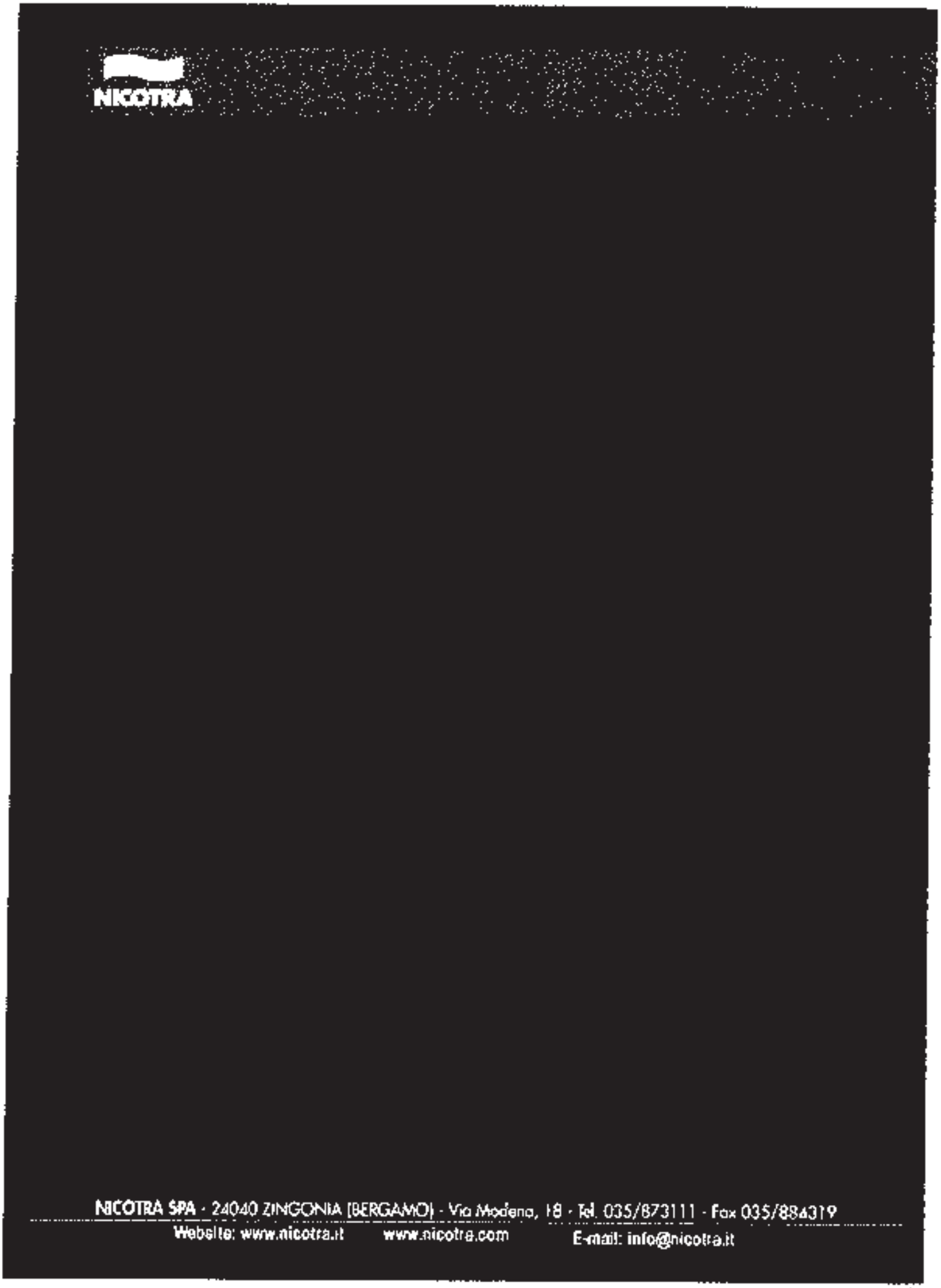
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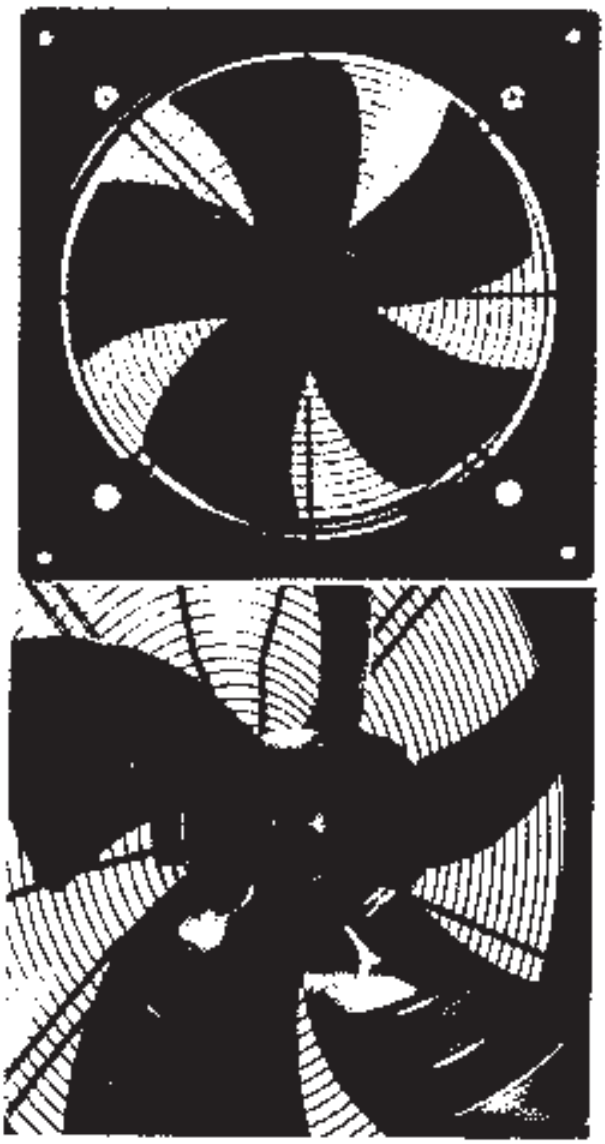
Website: www.nicotra.it
www.nicotra.com
E-mail: info@nicotra.it

Technical Literature

13) In Line Duct Fan



GELEC

GELEC "P" SERIES PROPELLER FANS

Propeller Fans

Introduction
With many years of experience in ventilation - **GELEC** remains as innovative as the day it was established.
Our products stand out from the crowd, in the design and choice of materials, in their noise and performance characteristics and product attributes - and in the functional benefits that come from our constant efforts to unite **GELEC** with our customers expectations.

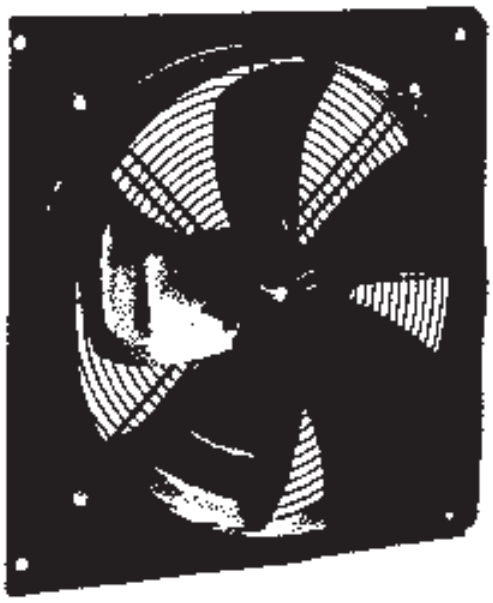
Whether your requirement is the supply of product ready for installation into a variety of air movement applications, such as building services and the agricultural sectors, or as an OEM, to integrate **GELEC** product into your own – The 'P' series of propeller fans are designed to meet your requirements.

Benefits

Durability
A tough epoxy paint finish ensures adequate protection against corrosion.

Motors
These are protected to IP54 which means they are highly resistant to dust and water ingress.
Motors have class F insulation.
Two, four and six pole motors are available.
Suitable for operating temperatures of up to +55°C and up to 95% humidity.

Cost effective
Very efficient for moving high volumes of air at relatively low pressures. Air volume flow rates of up to 4.0 m^3/sec and static pressures of up to 300Pa are attainable.
Bell mouth inlet reduces resistance to create a smoother airflow. The fans are fully speed controllable allowing levels of ventilation to be adjusted according to requirements and eliminating wasted energy expenditure.



Stability
The motor mounting brackets are constructed in the form of a welded wire framework which acts as a finger guard. The mounting brackets are electroplated prior to black epoxy powder coating to provide added protection.

Reliability
Motors have sealed for life bearings designed to operate at any angle.

Specification

General
The 'P' series of plate mounted propeller fans are available as Form A or Form B arrangements.

Plates
Each propeller fan includes a one piece bell mouth inlet and mounting plate manufactured in powder coated steel with 4 fixing points for simple installation.
For added rigidity each unit includes a steel support frame to support the motor and impeller within the mounting plate.

Guards
Each fan includes a finger protection guard to BS848-5 for mounting the fan onto the inlet ring.
Guards are electroplated prior to powder coating in RAL 9005 black finish.

Impellers
All impeller blades are pressed steel sickle type with the exception of 250mm and 315mm models which are conventional pressed steel blades, all providing excellent performance characteristics and low noise levels. Impellers are powder coated colour RAL 9005 black and impeller blades are welded to the motor rotor.

Motors
Motors are highly efficient, external rotor motors matched to the aerodynamic performance of the impeller. Motors have sealed for life, maintenance free ball bearings enabling the fan to be mounted at any angle.
Motors are protected to IP54 with Class F insulation and are suitable for ambient operating temperatures of up to +55°C and 95% maximum relative humidity and are wound for 230V/1Ph/50Hz or 400V/3Ph/50Hz supply.
All motors are pre-wired to an IP54 terminal box, incorporate built in thermal overload protection and are suitable for speed control.
Motors and impellers are balanced to Grade G6.3.

Controllers
Each Single Phase fan is fully speed controllable by using the HFC range of electronic voltage controllers or the TC range of five speed transformer voltage controllers. Each Three Phase fan is fully speed controllable by using the TC range of five speed transformer voltage controllers.
Note: P560/4-1 is not suitable for speed control.

Features

Application

'P' Series Fans are suited to a wide variety of discharge and supply applications in the building services sector such as warehousing, restaurants, sports halls, industrial units, schools and kitchen extract to agricultural markets.

- Sickle blade profile impeller.
- 9 standard sizes from 250mm to 710mm.
- Two, four, and six pole motors available.
- Air volume flow rates of up to 4.0 m³/sec.
- Static pressures of up to 300 Pa.
- Wide operating range.
- Thermal overload protection.
- Bell mouth inlet for smoother airflow.
- Suitable for operating temperatures of up to +55°C
- Sealed for life ball bearings to operate at any angle.
- Motors protected to IP54 with Class F insulation to EN 60034-5.
- Fully speed controllable.
- Operating up to 95% humidity.
- Condensation drain holes.
- All available from stock.

Adaptable

The fans are available from stock in 9 standard sizes from 250mm to 710mm.
Condensation drainage holes are built into the motors as standard which are designed to preclude the build up of condensation within the motor when operating in predominantly humid surroundings or considerable changes in temperature.

Mounting

The propeller fans are suitable for mounting in any position enabling greater flexibility for site installations.

Safety

All units have integral thermal overload protection which prevents the motor from overheating.

Ease of installation

Fans are supplied with an integral IP54 terminal box and motor side guard, which allows the fan to be positioned conveniently to incoming electrical inputs.

Tested standards

All units are tested to ISO 5801:1997 (airside performance) and to BS 848 Pt 2:1985 (sound performance).

Warranty

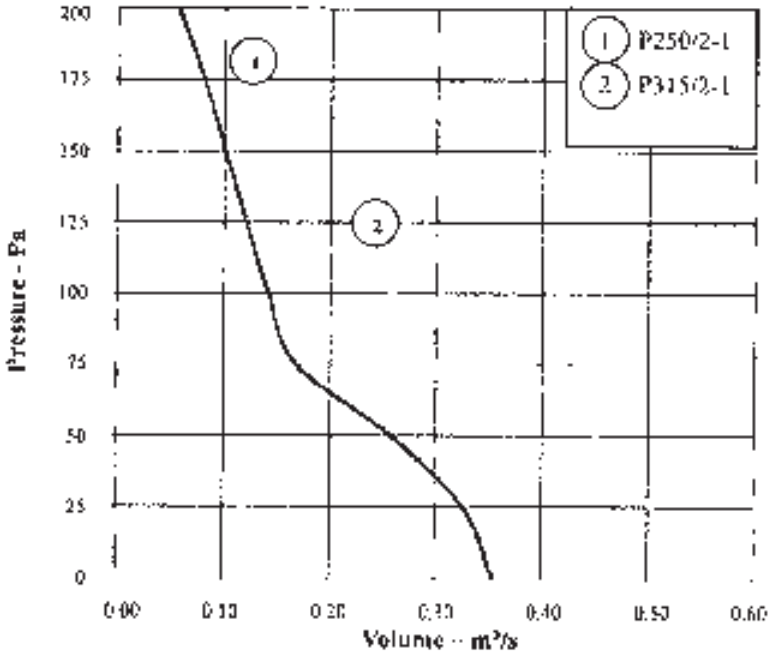
Each unit has a 12 month warranty.

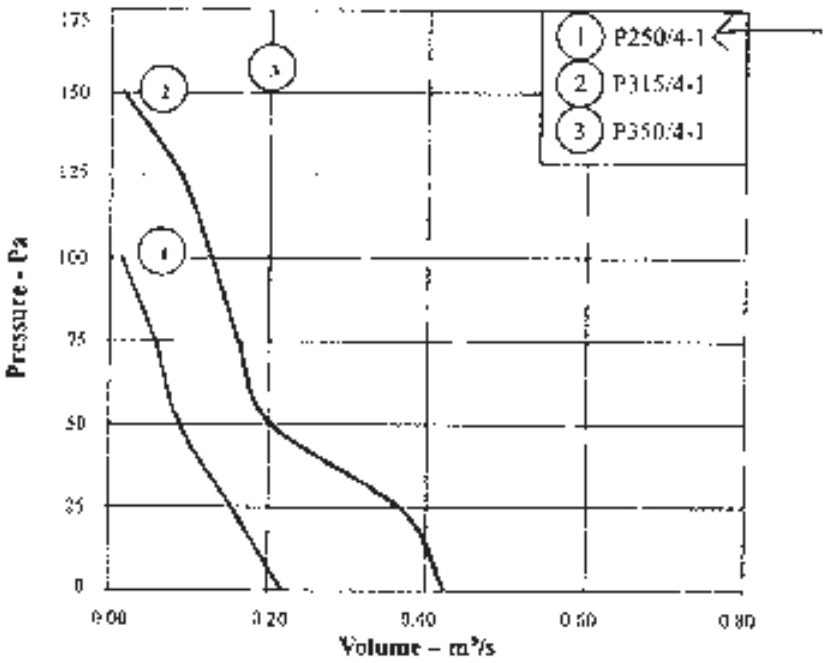
Full ancillary range

Louvre shutters, wall cowls, electronic and transformer speed controllers.

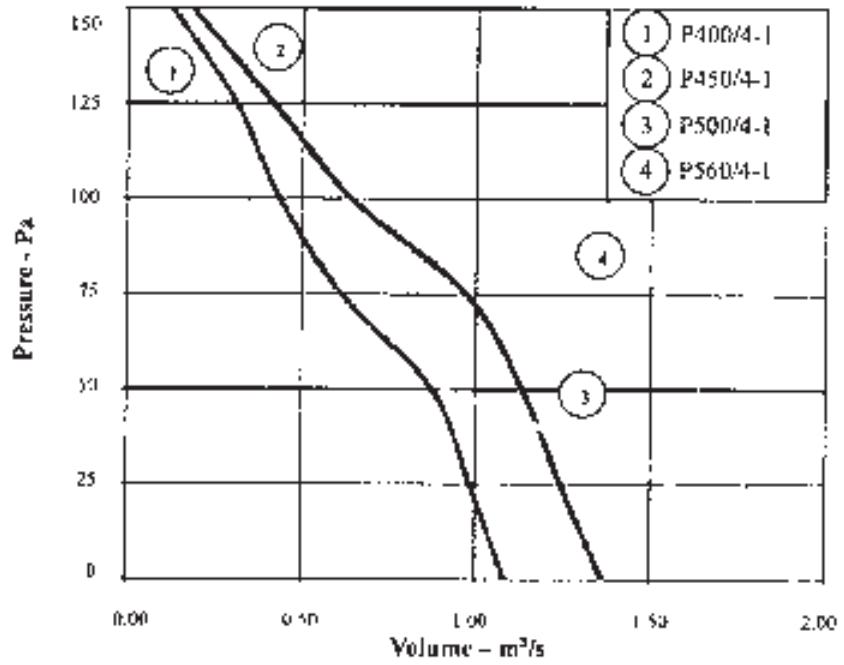
Performance Curves

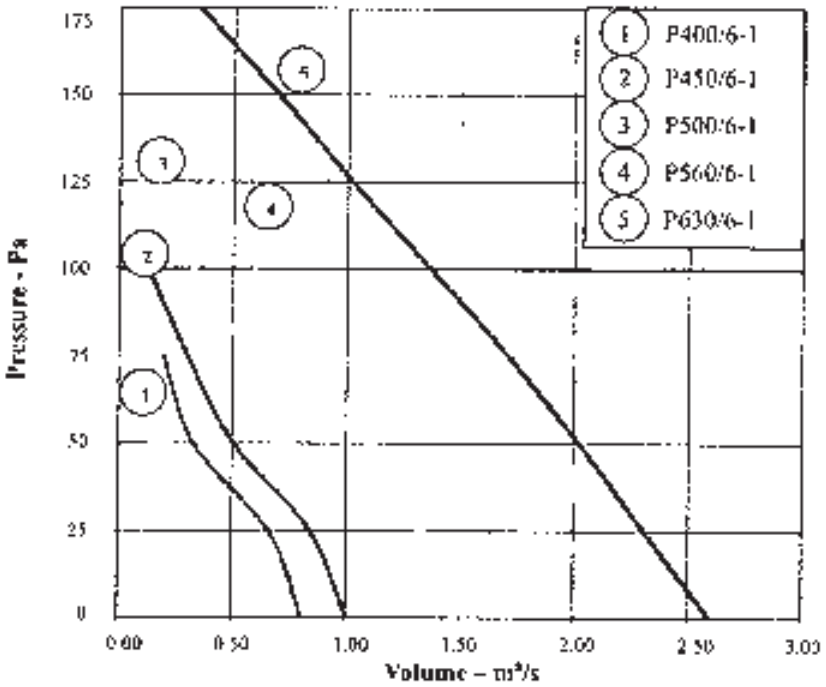
220-240V / 1Ph / 50Hz



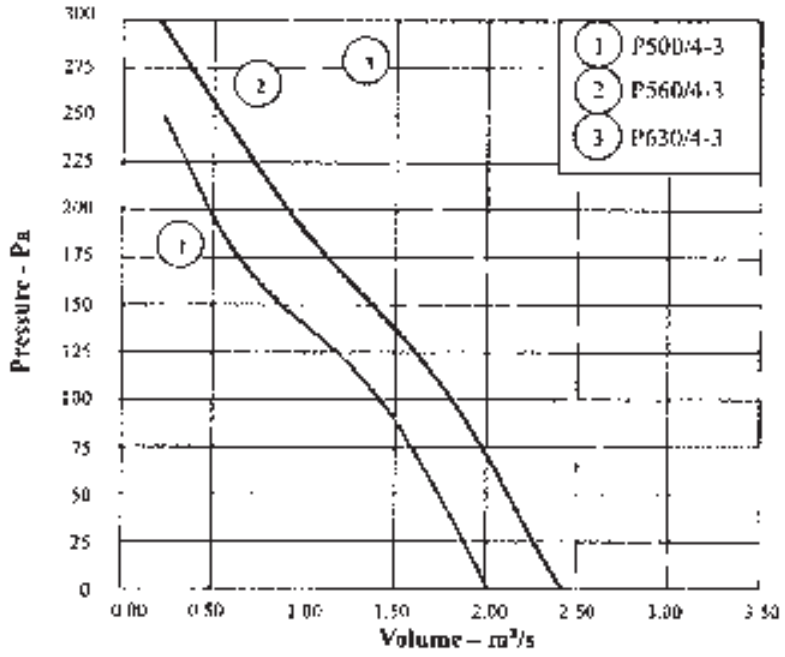


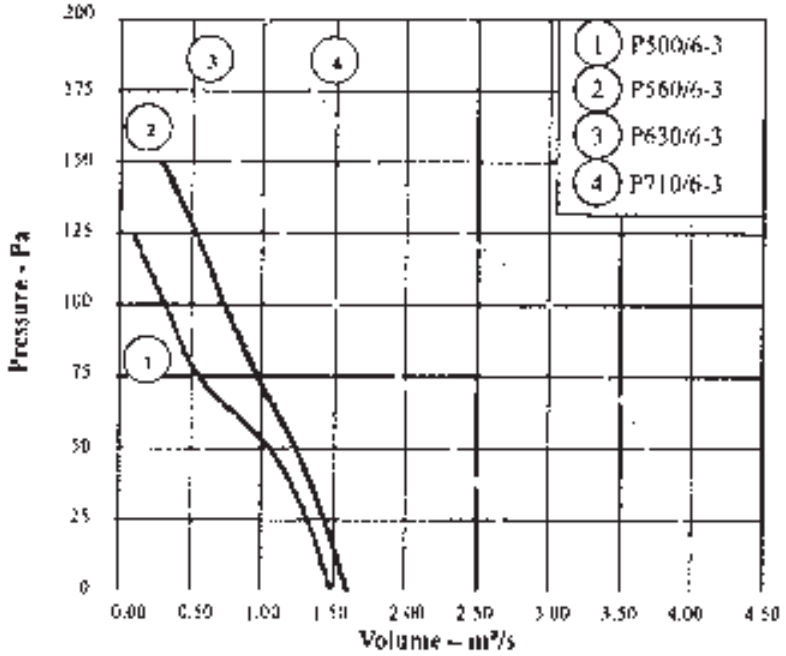
220-240V / 1Ph / 50Hz





380-420V / 3Ph / 50Hz





Sound Data

220-240V / 1Ph / 50Hz

Model		dBA@3m	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
P250/2-1	Inlet	57	74	82	76	75	72	68	64	58
	Outlet	58	74	83	76	76	74	71	66	59
P250/4-1	Inlet	48	72	76	71	64	61	57	50	44
	Outlet	46	71	75	70	64	61	56	49	42
P315/4-1	Inlet	50	76	79	73	67	64	61	55	47
	Outlet	48	73	76	71	65	62	59	54	45
P350/4-1	Inlet	54	77	79	76	72	70	64	56	49
	Outlet	52	76	78	74	70	68	63	57	48
P400/4-1	Inlet	55	77	80	76	73	70	66	60	53
	Outlet	55	77	80	77	73	70	67	61	52
P450/4-1	Inlet	60	81	88	82	77	75	71	65	57
	Outlet	60	81	86	80	77	76	71	66	57
P500/4-1	Inlet	60	86	84	82	77	76	72	66	57
	Outlet	60	84	85	82	78	76	71	65	57
P560/4-1	Inlet	62	80	86	84	80	77	75	68	60
	Outlet	62	81	87	84	79	77	74	68	60
P400/6-1	Inlet	50	74	78	77	64	62	55	48	41
	Outlet	47	77	76	69	65	62	58	51	45
P450/6-1	Inlet	47	77	76	69	65	61	56	51	44
	Outlet	47	77	76	68	65	62	58	51	44
P500/6-1	Inlet	51	80	77	72	70	67	62	55	46
	Outlet	52	79	78	72	70	67	62	55	46
P560/6-1	Inlet	54	79	83	73	71	69	65	59	52
	Outlet	53	78	81	74	71	67	64	57	48
P630/6-1	Inlet	61	86	94	81	78	73	70	65	59
	Outlet	61	85	94	81	79	73	70	66	58

380-420V / 3Ph / 50Hz

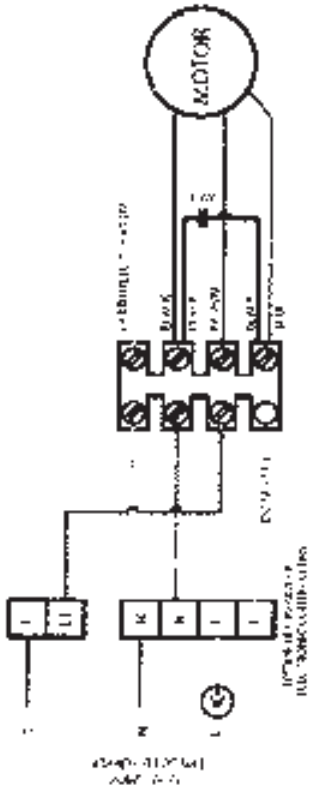
Model		dBA@3m	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
P500/4-3	Inlet	60	86	84	82	77	76	72	66	57
	Outlet	60	84	85	82	78	76	71	65	57
P560/4-3	Inlet	61	80	90	82	78	76	74	69	61
	Outlet	62	82	92	82	79	76	73	68	60
P630/4-3	Inlet	67	87	94	90	84	82	79	73	68
	Outlet	67	87	93	89	84	82	79	74	68
P500/6-3	Inlet	51	80	77	72	70	67	62	55	46
	Outlet	52	79	78	72	70	67	62	55	46
P560/6-3	Inlet	54	79	83	73	71	69	65	59	52
	Outlet	53	78	81	74	71	67	64	57	48
P630/6-3	Inlet	61	86	94	81	78	73	70	65	59
	Outlet	61	85	94	81	79	73	70	66	58

Technical Data

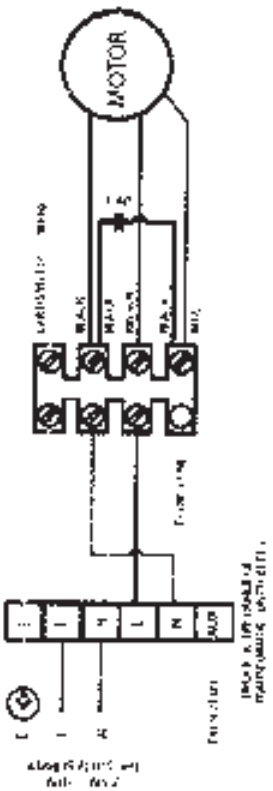
220-240V / 1Ph / 50Hz

Model	Speed r/min	FLC Amps	SC Amps	Power W	Electronic Controller	Transformer Controller
P250/2-1	2600	0.40	1.2	90	HFC1.7	TC12
P315/2-1	2400	0.75	2.3	170	HFC1.7	TC12
P250/4-1	1380	0.23	0.7	50	HFC1.7	TC12
P315/4-1	1370	0.35	1.1	80	HFC1.7	TC12
P350/4-1	1400	0.70	2.1	150	HFC1.7	TC12
P400/4-1	1380	0.82	2.5	180	HFC1.7	TC12
P450/4-1	1350	1.10	3.3	250	HFC1.7	TC12
P500/4-1	1370	1.55	4.7	350	HFC3.0	TC12
P560/4-1	1300	2.55	7.7	550	N/A	N/A
P400/6-1	920	0.50	1.5	105	HFC1.7	TC12
P450/6-1	920	0.80	2.4	160	HFC1.7	TC12
P500/6-1	920	1.17	3.5	250	HFC1.7	TC12
P560/6-1	940	1.35	4.1	280	HFC1.7	TC12
P630/6-1	940	2.00	6.0	480	HFC3.0	TC14

Single Phase Fan – No Controller



Single Phase Fan – Electronic Controller

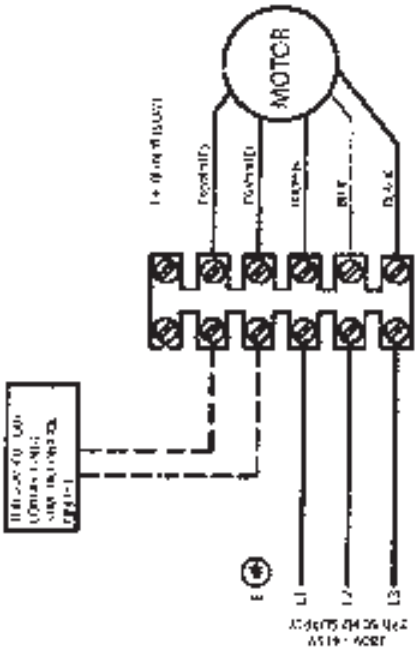


Single Phase Fan – Transformer Controller

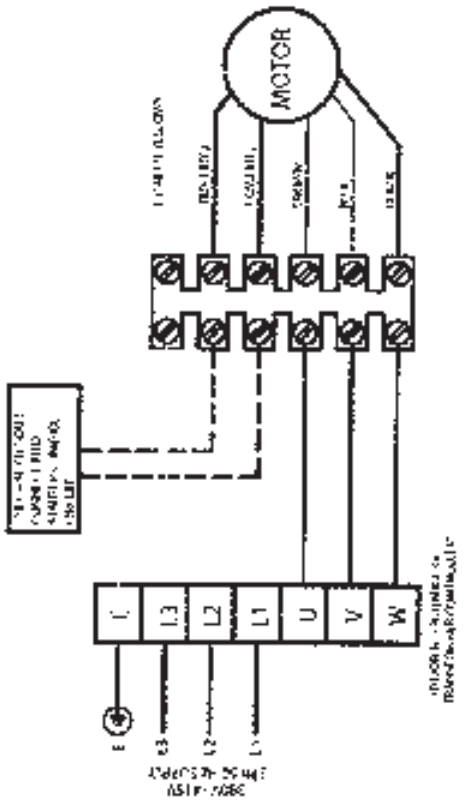
9

380-420V / 3Ph / 50Hz

Model	Speed r/min	FLC Amps	SC Amps	Power W	Transformer Controller
P500/4-3	1320	0.90	2.7	460	TC33
P560/4-3	1300	1.20	3.6	600	TC33
P630/4-3	1370	1.45	4.4	770	TC33
P500/6-3	900	0.56	1.7	230	TC33
P560/6-3	920	0.90	2.7	340	TC33
P630/6-3	900	1.56	4.7	600	TC33
P710/6-3	900	1.75	5.3	900	TC33



Three Phase Fan – No Controller

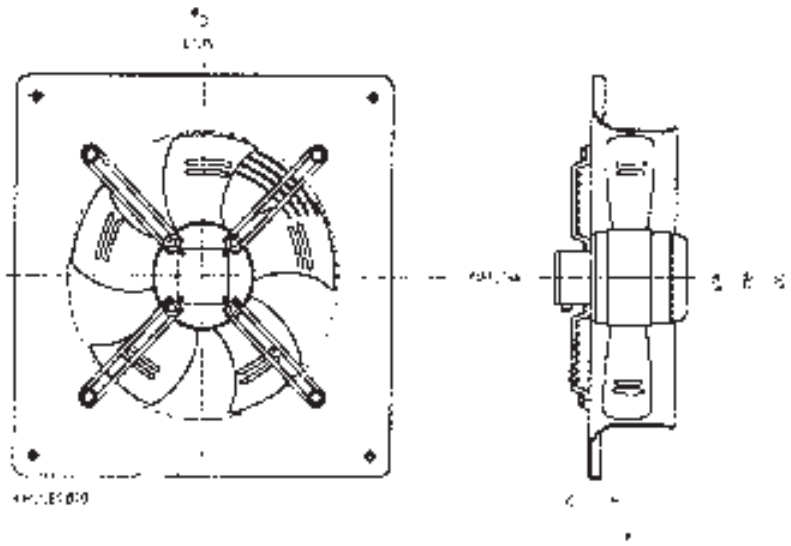


Three Phase Fan – Transformer Controller

Dimensions and Weights

Form "A"

Airflow



P250	250	260	265	370	320	90	60	15	3
P315	315	325	360	430	360	90	60	15	3.3
P350	350	360	395	485	435	90	60	15	4.9
P400	400	410	450	540	490	110	60	15	7.2
P450	450	460	500	575	535	110	60	15	7.2
P500	500	510	560	655	615	115	60	15	9.5
P560	560	575	625	725	670	115	60	15	10.5
P630	630	645	705	805	750	125	60	20	15
P710	710	722	765	850	810	130	135	27	30

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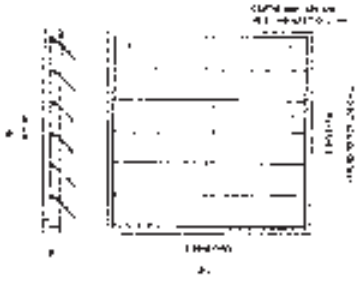
Accessories

Louvre Shutter

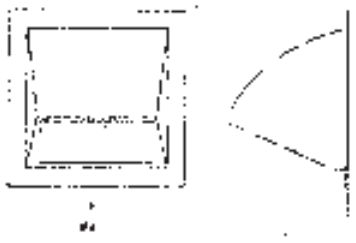
All weather louvre with vanes that open automatically when airflow commences. Fits independently of fan (ideally wall mounted downstream of fan). Supplied with screw fixings.



Product Code	Fan Size	A	B	C	D	O	E	Weight (kg)
HLVS 250	P250	299	26	235	280	-	-	0.5
HLVS 315	P315	348	26	274	310	-	-	0.5
HLVS 350	P350	348	26	298	360	-	323	1.0
HLVS 400	P400	460	26	364	423	-	-	1.0
HLVS 450	P450	502	30	404	480	-	-	1.5
HLVS 500	P500	548	30	452	510	-	-	2.0
HLVS 560	P560	610	30	530	-	569	-	2.0
HLVS 630	P630	696	30	627	-	655	-	3.0
HLVS 710	P710	745	30	668	-	732	-	3.0

Wall Cowls

Wall Cowls have been designed to protect extract fan openings from prevailing weather conditions. The shape minimizes resistance to airflow.



Product Code	Fan Size	A	B	C	Grille Area m²	Weight (kg)
HWC25/31	P250 / P315	500	410	325	0.088	2
HWC35/40	P350 / P400	610	510	390	0.140	3
HWC45/50	P450 / P500	755	645	470	0.217	7
HWC56/63	P560 / P630	935	815	555	0.345	10

Speed Control

Electronic Controllers – Single Phase 230V/50Hz

Quality electronic type speed controllers, matched to the propeller range are available for panel/wall mounting. Each unit includes a speed control knob and separate on/off switch. Order codes are shown in table provided.

When speed control is required, **GELEC** can only guarantee the fan unit when operated via a **GELEC** supplied controller and when the thermal overload is utilised.

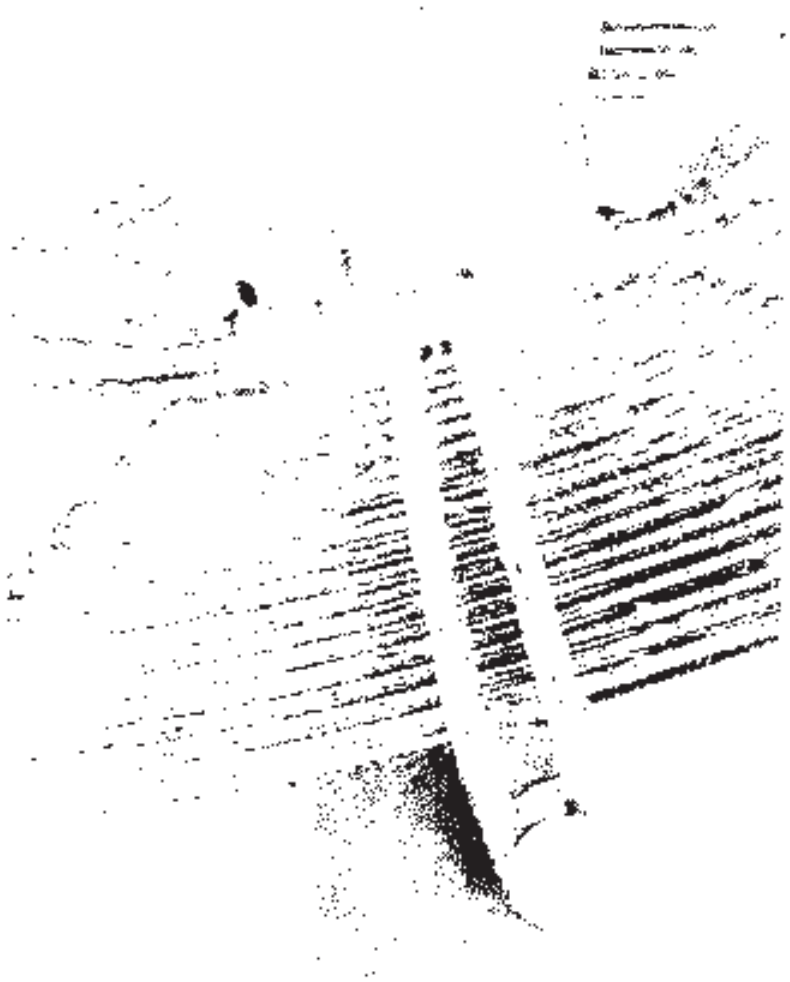
Product Code	Max Peak Current Amps	Weight (kg)	IP Rating	Height mm	Width mm	Depth mm
HFC1 7	1 7	0 3	IP51	110	110	60
HFC3 0	3 0	0 3	IP51	110	110	60
HFC6 0	6 0	0 3	IP51	110	110	60

Transformer Controllers

A range of transformer voltage controllers used to provide five speed step control of single phase or three phase motors where the peak current of the motor does not exceed the rating of the controller. Speed control is via selector switch.

Single phase units are complete with illuminated on/off switch.

Product Code	Supply	Max Peak Current Amps	Weight (kg)	IP Rating	Height mm	Width mm	Depth mm
TC12	230V/1Ph/50Hz	2	3	IP40	265	200	120
TC34	230V/1Ph/50Hz	4	4	IP40	265	200	120
TC33	400V/3Ph/50Hz	3	12	IP40	320	300	180



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Publication No: GDC 201006

Technical Literature

14) Propeller Fan

NICOTRA

ADH

VENTILATORI CENTRIFUGHI A DOPPIA ASPIRAZIONE
CON PALE CURVE IN AVANTI

DOUBLE INLET CENTRIFUGAL FANS
WITH FORWARD CURVED BLADES

DOPPELSEITIG SAUGENDE RADIAL-VENTILATOREN
MIT VORWÄRTS GEKRÜMMTEN SCHAUFELN

VENTILATEURS CENTRIFUGES A DOUBLE OUIE
AVEC AUBES A ACTION

VENTILADORES CENTRIFUGOS DE DOBLE OIDO
CON PALAS CURVADAS HACIA DELANTE

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NICOTRA

Giugno 2005
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ADH

VENTILATORI CENTRIFUGHI A DOPPIA ASPIRAZIONE
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VENTILATEURS CENTRIFUGES A DOUBLE OUIE
AVEC AUBES A ACTION

VENTILADORES CENTRIFUGOS DE DOBLE ASPIRACION
CON PALAS CURVADAS HACIA DELANTE

Nicotra S.p.A. certifica che i ventilatori serie ADH, versioni L, R, K, K1 e K2, rappresentati in questo catalogo, sono autorizzati a portare il Marchio AMCA. Le prestazioni indicate sono basate su prove e procedure in accordo con il documento AMCA 211, e soddisfano i requisiti del Programma AMCA per la Certificazione delle Prestazioni. Si veda il capitolo a pag. 32 per maggiori dettagli.

Nicotra S.p.A. certifies that ADH fans of the L, R, K, K1 and K2 versions, shown herein, are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA publication 211 and comply with the requirements of the AMCA Certified Ratings Program.
Further details can be found on page 32.

Nicotra S.p.A. bescheinigt, dass die hierin dargestellten ADH-Lüfter des Typs L, R, K, K1 und K2 von der AMCA zur Führung ihres Siegels zugelassen sind. Die dargestellten Einstufungen beruhen auf Prüfungen und Verfahren, die gemäß AMCA-Druckschrift 211 durchgeführt wurden und den Erfordernissen eines von der AMCA zugelassenen Einstufungsprogramms entsprechen.
Weitere Einzelheiten finden sich auf Seite 32.

Nicotra S.p.A. certifie que les ventilateurs de la série ADH, versions L, R , K, K1 et K2 présentés dans ce catalogue sont certifiés AMCA. Les performances indiquées sont basées sur les essais et procédures conformément au document AMCA 211 et répondent aux demandes du Programme AMCA " Certification des Performances" . Pour plus de détails, se reporter au chapitre de la page 32.

Nicotra S.p.A. certifica que los ventiladores serie ADH, versiones L, R, K, K1 y K2, representados en este catálogo, están autorizados para llevar el Sello AMCA. Las prestaciones indicadas están basadas en pruebas y procedimientos de acuerdo con el documento AMCA 211, y satisfacen los requisitos del Programa AMCA para la Certificación de las Prestaciones.
Ver el capítulo de la pág. 32.

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amca CERTIFIED RATINGS
AIR PERFORMANCE
AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

1.640.61 - 2000/1 - 06/05

NICOTRA

Gamma di produzione

Questa gamma di ventilatori impiega coclee con bocca quadra e presenta un dimensionamento omotetico, con dimensioni nominali in accordo alla serie dei numeri normali R20 secondo le norme AMCA 99 0098 76 e ISO 497-1973.
La serie ADH è composta da ventilatori centrifughi a doppia aspirazione.
Portate da 450 m^3/h a 240.000 m^3/h
Pressione fino a 2500 Pa totale.
17 grandezze da 160 a 1000 mm (diametro nominale delle ventole).

Production range

This fan range employs housings with square-shaped outlet and sizes from the R20 normal number series, in accordance to AMCA Standard 99-0098 76 and to ISO 497-1973.
The ADH range is made of double width, double inlet centrifugal fans.
Volume flow rate from 450 m^3/h to 240.000 m^3/h
Total pressure up to 2500 Pa.
17 sizes from 160 up to 1000 mm wheel diameter.

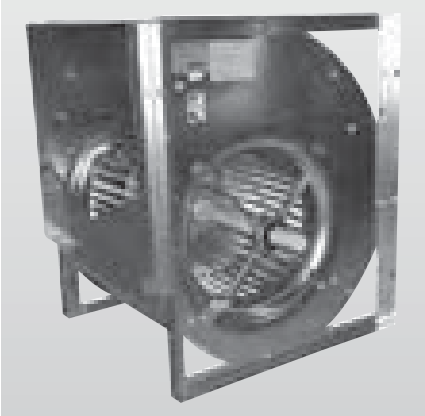
Versioni costruttive

I ventilatori della serie ADH sono disponibili nelle seguenti versioni:

Construction versions

ADH fans are available in the following versions:

	Serie ADH	
Versione/ Version	Dalla grandezza/ From size	Alla grandezza/ To size
L	160	710
R	160	710
K	200	1000
K1	315	900
K2	500	1000

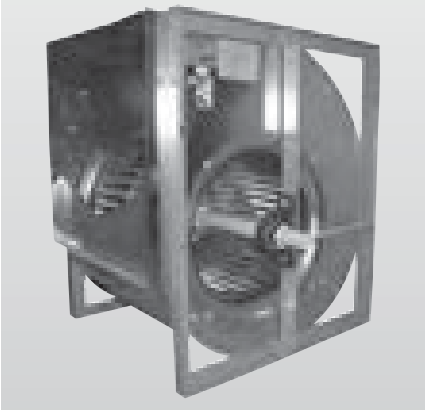


Versioni costruttive binate

Per applicazioni che richiedono un ingombro verticale contenuto, i ventilatori ADH sono disponibili anche in versione binata, ovvero con due ventole a doppia aspirazione montate sul medesimo albero, sostenuto da tre o quattro cuscinetti. Queste versioni vengono contraddistinte dal prefisso G2. I ventilatori sono disponibili nelle seguenti grandezze:

Twin fan versions

Where a limited fan height is required, ADH fans are available also in double or twin fan versions, with two double inlet impellers on a common shaft, supported by three or four bearings.
These versions are identified by the G2 prefix. Double fans are available in the following sizes:



	Serie ADH	
Versione/ Version	Dalla grandezza/ From size	Alla grandezza/ To size
G2L	160	500
G2R	160	630
G2K	250	1000
G2K2	250	1000

NICOTRA

Caratteristiche Costruttive

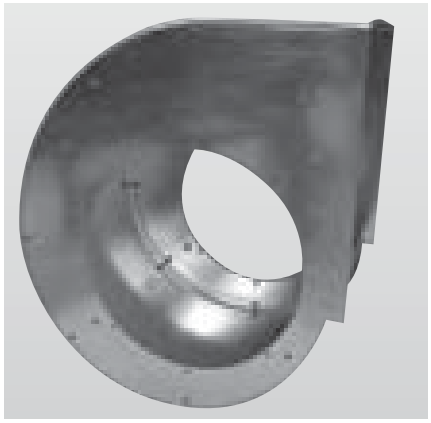
Il criterio di costruzione utilizzato per i ventilatori Nicotra ADH è ispirato alla massima robustezza e affidabilità, indipendentemente dalla versione costruttiva. Caratteristiche comuni a questi prodotti sono:

- qualità del prodotto
- prestazioni elevate
- massima economicità
- silenziosità
- rapidità di montaggio

Construction Specifications

The construction standard used for Nicotra ADH fans is inspired to the maximum strength and reliability, independently from the construction version. Common characteristics of these products are:

- product quality
- high performance
- outmost economy
- quietness
- ease of assembly

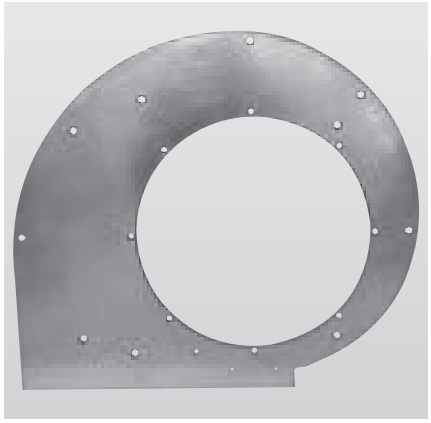


Coclee

Per tutte le grandezze, la coclea è realizzata in lamiera di acciaio zincato a caldo secondo EN 10142. Non esistono punti di saldatura perché l'unione della fiancata con il dorso viene effettuata utilizzando il sistema Pittsbourgh, eliminando così il pericolo di possibili ossidazioni.

Scrolls

All the scrolls are made with hot dip galvanised steel EN 10142.
No electrical spot welding is used as the scroll back is joined to the side plates with the Pittsbourgh lock forming system. This prevents any oxidation starting from the welding spots.



Forature di attacco sulle fiancate

Sulle fiancate sono predisposte alcune forature che permettono il fissaggio dei supporti o telai occorrenti per le varie esecuzioni.
Fino alla grandezza 400 le forature permettono un fissaggio mediante viti autofilettanti, mentre per tutte le grandezze superiori vengono applicati inserti filettati per viti M10.

Attachment points on the side plates

Standard holes in the side plates are used to attach mounting feet or side frames to create different versions.
Up to size 400, self-threading screws are used, while all the larger sizes have captive nuts for use with M10 screws.

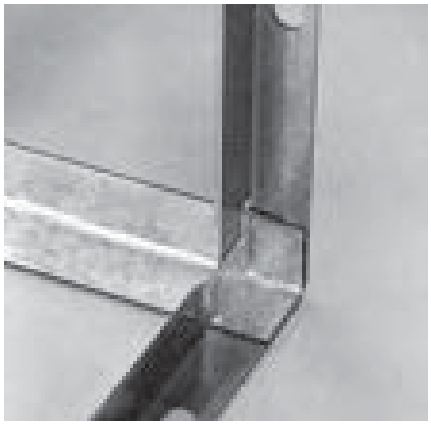
Ventole

Le ventole della serie ADH sono del tipo Tab-lock con pale curve in avanti, realizzate in acciaio zincato Sendzimir. Le ventole ADH sono equilibrate staticamente e dinamicamente secondo le norme ISO 1940 con grado G4.

Impellers

ADH impellers have specially-designed Tab-lock forward curved blades, built from cold-formed, galvanised steel "Sendzimir". ADH impellers are statically and dynamically balanced according to ISO 1940 with grade G4.

NICOTRA

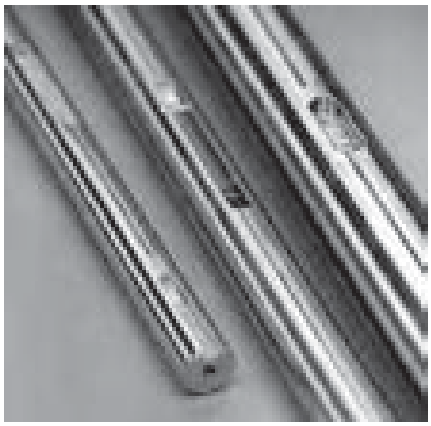


Telai

I telai laterali delle versioni R e G2R sono realizzati con angolari in acciaio zincato Sendzimir secondo EN 10142. I telai delle versioni rinforzate K, K1, K2, G2K e G2K2 sono costruiti con profilati laminati a caldo, trattati e protetti con vernice all'acqua RAL 7030 tipo alchidica melamminica. Su richiesta, questi telai possono essere finiti con zincatura a caldo.

Side frames

Light-construction side frames of the R and G2R versions are made with cold-formed, galvanised steel "Sendzimir" type EN 10142.
Heavy-duty side frames of the K, K1, K2, G2K and G2K2 versions are made with hot-rolled steel sections, welded and coated with alchidic-melamminic paint RAL 7030. As an option, they can be protected with hot dip galvanising.



Alberi

Lavorati a partire da barre rettificate di acciaio al carbonio, utilizzando un processo automatico per l'esecuzione delle cave centrali (chiuse) e d'estremità (aperte). Tutti gli alberi vengono protetti, ad assemblaggio ultimato, con verniciatura anticorrosiva di colore giallo brillante. Alberi in acciaio inox possono essere forniti su richiesta.
I diametri degli alberi sono scelti in modo da avere una velocità critica superiore alla massima velocità di funzionamento di un fattore di sicurezza ≥ 1.25

Shafts

Manufactured from precision ground, C45 carbon steel bars, using precision tools to cut keyways.
All the shafts are coated, after assembly, with a clearly distinguishable, bright yellow protective paint.
Stainless steel shafts can be provided on request.
Shaft diameters are selected to achieve a safety factor for critical speed ≥ 1.25 higher than the maximum operating speed.

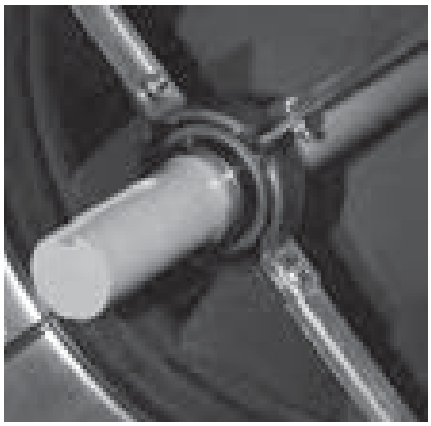


fig. 1

Cuscinetti

I ventilatori delle versioni L, R, G2L e G2R impiegano cuscinetti a singola corona di sfere, stagni, lubrificati a vita, con bloccaggio a collare eccentrico, installati entro ammortizzatori in gomma a bassa resistività elettrica, su razze imbullonate alla fiancata (fig.1).

Bearings

Fans of the L, R, G2L and G2R versions use single row, deep groove, self-aligning ball bearings. Sealed and life lubricated, they are locked on the shaft with an eccentric ring clamp and supported, inside electrically conductive rubber shock absorbers, on inlet bolted spiders (Fig. 1).

NICOTRA

fig. 2

fig. 3

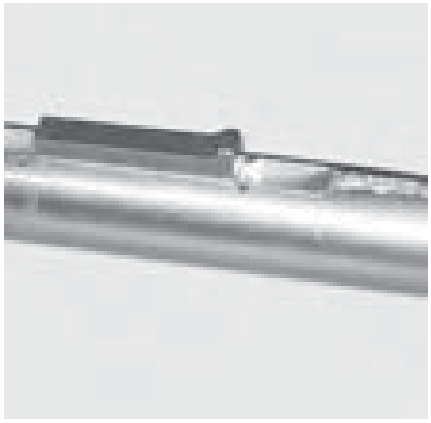


fig. 4

I ventilatori delle versioni K, G2K e parte della serie G2K2 montano cuscinetti a singola corona di sfere, stagni, con bloccaggio a collare eccentrico, montati entro supporti in ghisa autoallineanti con ingrassatore, imbullonati ai telai laterali (fig.2).
I ventilatori della serie K1 e parte della serie G2K2 impiegano cuscinetti rinforzati, a singola corona di sfere, stagni, con bloccaggio mediante bussola conica di trazione, installati entro supporti in ghisa autoallineanti con ingrassatore, imbullonati ai telai laterali (fig.3).
I ventilatori della versione K2 ed alcune grandezze della versione G2K2 montano cuscinetti stagni per impieghi pesanti, a singola corona di sfere (500), a doppia corona di sfere (560,630,710 e 800) o a doppia corona di rulli a botte (900 e 1000) installati entro supporti con ingrassatore, imbullonati ai telai laterali (fig.4).

Fans of the K and G2K versions and some sizes of the G2K2 version use sealed, single row, self-aligning ball bearings, with eccentric clamp, mounted inside cast iron pillow blocks, with grease nipples, bolted to the side-frames (Fig. 2).
Fans of the K1 version and some sizes of the G2K2 version use reinforced single row sealed ball bearings, locked on the shaft with a conical sleeve and mounted inside cast-iron pillow blocks, with grease nipples, bolted to the side-frames (Fig. 3).
All the fans of the K2 version, and some sizes of the G2K2 version, have sealed heavy-duty bearings of different types, according to the fan size: single row ball bearings with conical sleeve inside cast iron pillow blocks (500); double-row ball bearings with conical sleeve inside split block housings (560, 630, 710 and 800) or double row, self-aligning roller bearings inside single piece pillow blocks (900 and 1000). All the pillow blocks have grease nipples for lubrication and are bolted to specially reinforced side-frames (Fig. 4).

I cuscinetti impiegati sono stati scelti per raggiungere, con dimensionamenti usuali di pulegge (vedere capitolo "Scelta delle pulegge") e nelle condizioni di massimo carico, una durata L_{10} di 40.000 ore. Nelle condizioni operative nelle quali i ventilatori sono generalmente utilizzati, la durata media è molto più alta.
La vasta scelta di versioni costruttive inoltre, consente di trovare sempre una soluzione idonea a soddisfare anche requisiti molto più gravosi.

The bearings allow, with reasonable pulley diameters and at the maximum load conditions, to achieve an L_{10} operating life of 40˙000 hours (see the chapter "Pulley selection"). With more common operating conditions, the average operating life can be much higher.
Thanks to the wide choice of construction versions available, even longer design life requirements can be easily met.

Poiché la vita operativa del grasso contenuto nei cuscinetti dipende dalle condizioni di esercizio, essa può differire dalla durata L_{10} dei cuscinetti stessi.

As the operating life of the grease contained in the bearings depends on the operating conditions, it can be different from the L_{10} operating life of the bearings themselves.

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Oltre al capitolo sulle Raccomandazioni di Impiego, si consiglia di consultare il Manuale di Uso e Manutenzione per avere dettagli sulla corretta installazione, impiego e manutenzione del ventilatore, con particolare attenzione ai cuscinetti.

Apart from the chapter "Guidelines for correct use", the "Use and Maintenance Manual" contains important information covering proper installation, use and maintenance of the fan and particularly of its bearings.

Verniciature

Su richiesta, possono essere realizzate versioni interamente verniciate con vernice a polvere o all'acqua di vario spessore.

Paintings

Special powder-paint coatings of various thickness can be supplied on request.

Esecuzioni antideflagranti

Su richiesta, possono essere realizzate versioni a sicurezza aumentata, con boccagli di aspirazione in lega di alluminio, lega di rame o con bordo riportato in rame.
Si prega di contattare il produttore per la scelta ed i dettagli.

Ignition protected versions

Ignition protected versions can be built on request, with inlet cones made of aluminium, copper or with copper rubbing stripes on the edge of the inlet cones. Please, contact the manufacturer for selection and details.

Orientamento ventilatore

I ventilatori standard sono forniti con entrambe le estremità dell'albero sporgenti e predisposte per l'installazione della trasmissione. Possono essere indifferentemente impiegati sia con rotazione LG che con rotazione RD. Tutte le versioni dotate di telai laterali sono predisposte per essere semplicemente ruotate, consentendo l'installazione in uno dei quattro orientamenti 0°, 90°, 180° e 270°. I ventilatori della serie L sono invece predisposti con forature per il fissaggio dei piedi di supporto con orientamento 0°, 90° oppure 270°.
Non è quindi necessario segnalare l'orientamento del ventilatore ordinando una macchina standard.

È invece indispensabile specificare l'orientamento del ventilatore ordinando macchine dotate di accessori che, come lo scarico condensa, hanno una posizione strettamente legata all'orientamento di installazione.

Fan orientation

Standard fans are supplied with both shaft ends prepared to fit a pulley. They can be indifferently used with either RD or LG rotation. All the versions with side frames can be easily turned to install them in one of the four orientations 0°, 90°, 180° and 270°. Feet-mounted L version has holes in the side plates which allow bolting the feet with the scroll oriented to 0°, 90° or 270°.
There is no need to specify fan orientation when ordering standard fans.

Fan orientation must be specified instead when ordering fans fitted with accessories which must be located according to the scroll orientation, like drain plugs.

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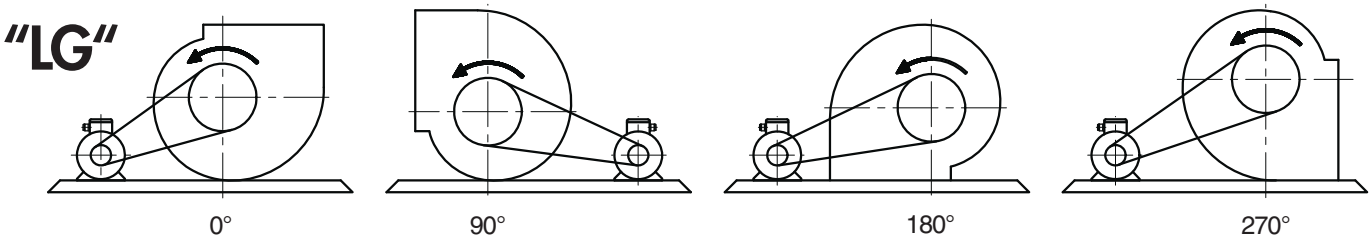
Altri accessori possono essere forniti in posizioni standard, identificate da lettere o numeri. Si veda a questo proposito la descrizione di ogni singolo accessorio.

Other accessories may be installed in coded standard positions, identified by letters or numbers. Please, check the details concerning each particular accessory.

Quando necessario, l'orientamento dei ventilatori è indicato, secondo ISO 13349 ed Eurovent 1/1, osservando il ventilatore dal lato trasmissione. La sigla RD indica rotazione destra (oraria) e la sigla LG rotazione sinistra (antioraria). Gli orientamenti possibili sono schematizzati nel disegno sottostante.

When requested, fan orientation is identified, according to ISO 13349 and Eurovent 1/1, when looking at the fan from the drive side. RD means right (clockwise) rotation, while LG means left (counter-clockwise) rotation.
The achievable orientations are shown in the drawing below.

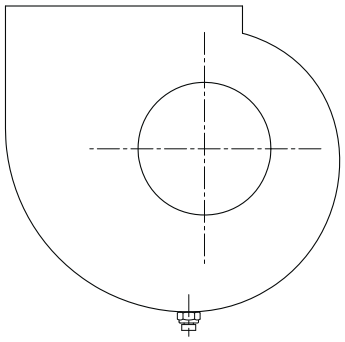


Esempio denominazione:

"VRE ADH 500 K 0° + SCARICO CONDENSA" = *ventilatore della serie ADH, grandezza 500, versione "K", con orientamento a 0° e scarico condensa nella posizione indicata in figura.*

Example:

"ADH 500 K 0° + DRAIN PLUG" = *ADH fan series, size 500, "K" version, with 0° orientation and drain plug installed as shown in the picture.*



Sonstige Zubehörteile können in codierten Standardstellungen montiert werden, die durch Buchstaben oder Zahlen gekennzeichnet sind. Bitte überprüfen Sie sämtliche Einzelheiten für jedes einzelne Zubehörteil.

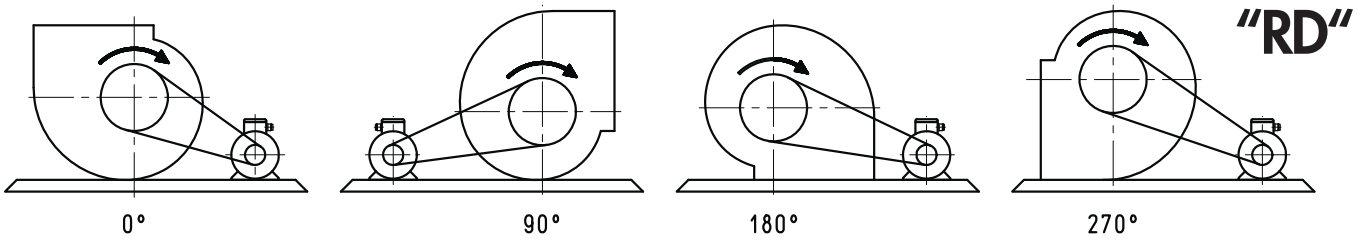
D'autres accessoires peuvent être fournis en position standard, identifiés par des lettres ou numéros. Voir à ce propos la description de chaque accessoire.

Otros accesorios pueden ser suministrados en posiciones estándar, identificadas por letras o números. Ver a este propósito la descripción de cada accesorio en particular.

Sofern eine Gebläseausrichtung vorgegeben wird, erfolgt sie gemäß ISO 13349 und Eurovent 1/1 beim Blick auf die Antriebsseite. Dabei bedeutet RD Drehung nach rechts (im Uhrzeigersinn), während LG eine Drehung nach links (entgegen dem Uhrzeigersinn).
Die verfügbaren Ausrichtungen sind der nachstehenden Zeichnung zu entnehmen.

Si nécessaire, l'orientation des ventilateurs est indiquée, selon ISO 13349 et Eurovent 1/1 en observant le ventilateur côté transmission. Le sigle RD = rotation droite (sens horaire) et le sigle LG = rotation gauche (sens anti horaire). Les orientations possibles sont schématisées dans le dessin ci-dessous.

Cuando es necesario, la orientación del ventilador está indicada según ISO 13349 y Eurovent 1/1, observando el ventilador por el lado de la transmisión. La sigla RD indica rotación derecha (horaria) y la sigla LG rotación izquierda (antihoraria). Las orientaciones posibles están esquematizadas en el diseño de abajo.



Beispiel:

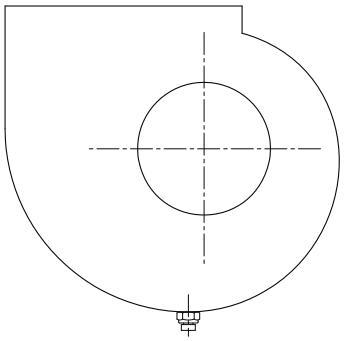
"ADH 500 K 0° + ABLASSSCHRAUBE" = *also ein Gebläse der Baureihe ADH in der Größe 500, Typ K, Ausrichtung 0° und Anordnung der einzubauenden Ablassschraube gemäß Abbildung*

Example d'appellation:

"ADH 500 K 0° + PURGE DE VOLUTE" = *ventilateur de la série ADH, taille 500, version K avec une orientation 0° et purge de volute dans la position indiquée sur la figure.*

Ejemplo de denominación:

"ADH 500 K 0° + PURGADOR CONDENSADOS" = *ventilador de la serie ADH, tamaño 500, versión K, orientación 0º y purgador de condensados en la posición indicada en la figura.*



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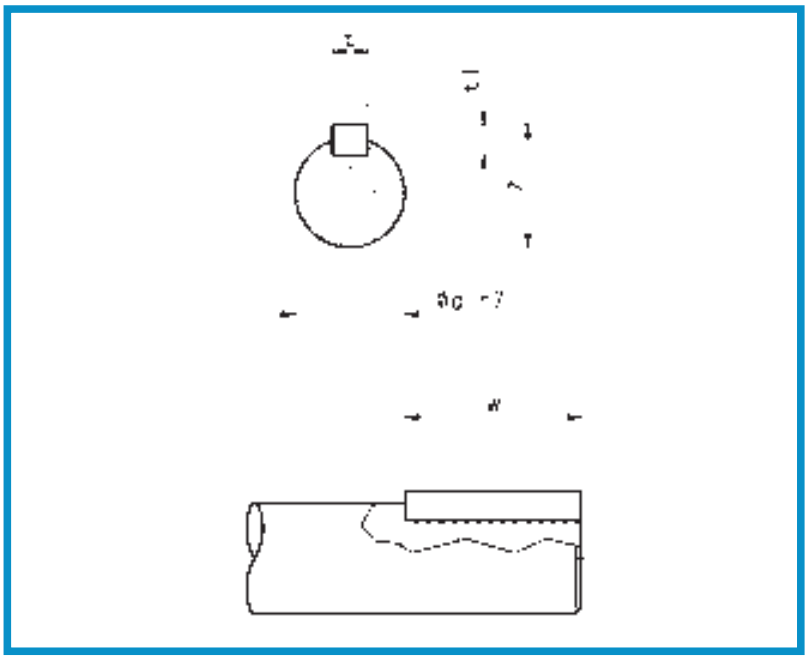
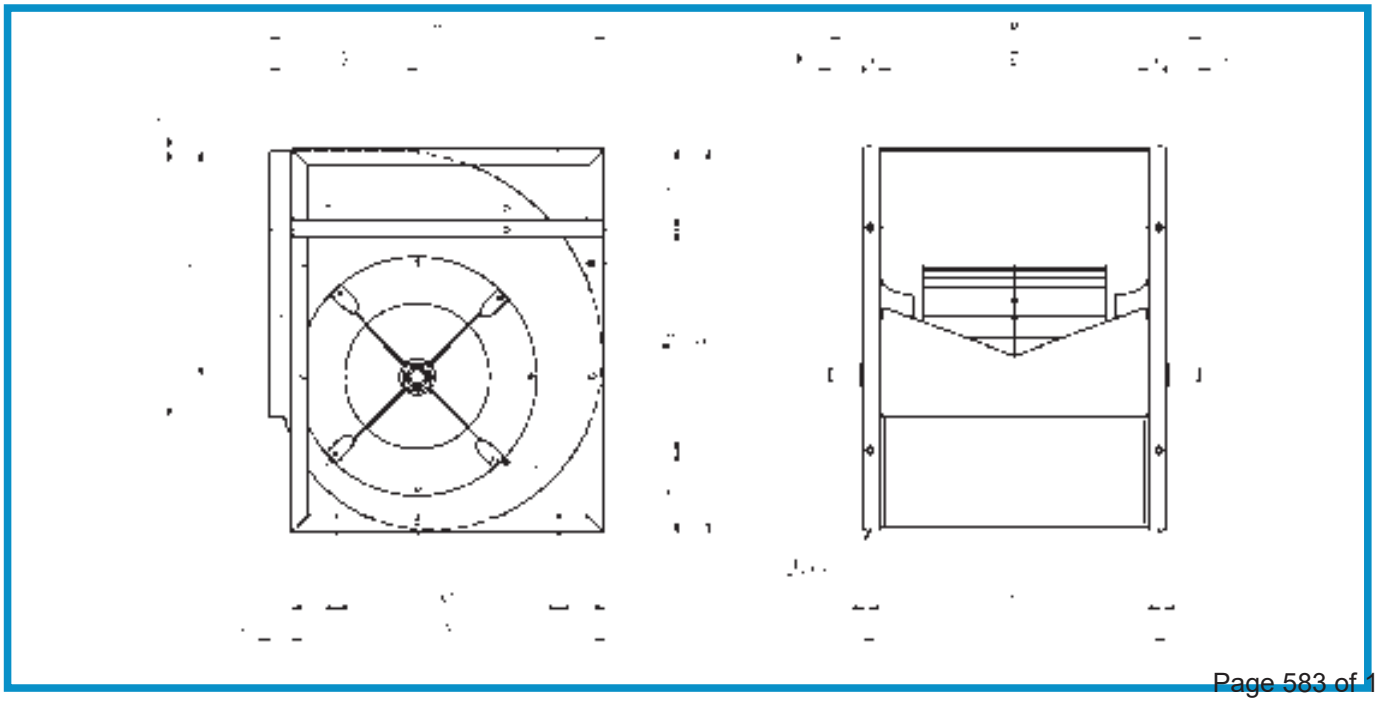
Versione R

A differenza della versione precedente, la versione "R" è dotata di telai in angolari d'acciaio zincato, avvitati alle due fiancate, che danno alla struttura del ventilatore una maggiore robustezza e stabilità, consentendo l'orientamento su quattro posizioni.
Questa versione è disponibile fino alla grandezza 710.
Per altre informazioni, si raccomanda di consultare la tabella "limiti di impiego".

R version

Unlike the L version, the R version is fitted with side frames made of cold-formed galvanized steel, bolted to the two side plates. They give better strength and rigidity to the fan structure and allow the mounting of the fan in four different positions.
This version is available up to the size 710.
For further information, please see the table "Operational Limits".





R-Typ

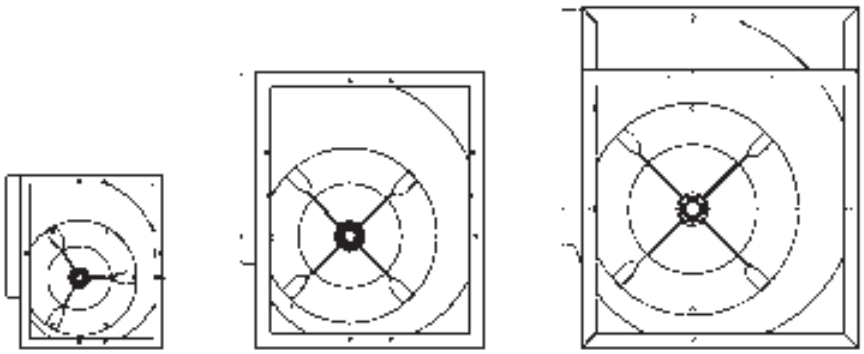
Im Unterschied zum L-Typ verfügt die Bauart R über Seitenrahmen aus kalt gewalztem verzinktem Stahl, die an die beiden Seitenplatten angeschraubt werden. Dadurch wird der Aufbau des Gebläses stärker und steifer; für die Montage stehen vier unterschiedliche Stellungen zur Verfügung.
Dieser Typ ist bis zur Größe 710 erhältlich.
Nähere Angaben finden sich unter "Grenzwerte für den Betrieb".

Version R

A la différence de la version précédente, la version "R" est équipée de cadres en acier zingué vissés aux deux flancs qui donnent à la structure du ventilateur une meilleure robustesse et stabilité avec la possibilité d'une orientation en 4 positions.
Cette version est disponible jusqu'à la taille 710.
Pour d'autres informations, consulter le tableau "limites d'utilisation".

Versión R

A diferencia de la versión precedente, la versión "R" está dotada de bastidores de ángulo de acero cincado, atornillados a los dos laterales, que dan a la estructura del ventilador una mayor robustez y estabilidad, permitiendo la orientación en cuatro posiciones.
Esta versión está disponible hasta el tamaño 710.
Para mas información se recomienda consultar la tabla "límites de empleo".



160 - 315 355 - 450 500 - 710

ADH R **QUOTE DIMENSIONALI - DIMENSIONS - ABMESSUNGEN - DIMENSIONES**

Taglia Size	CODICE CODE	mm																						
		A	B	C	E	F	G	H	L	M	P	Q	R	S	V	K	X1	X2	t	t1	w	z	Ø d	u x s
160	630020W	259	300	205	205	172	140	286	245	345	229		27	5	20	50	180	180	6	6	30	22,5	20	9 x 12
180	630021W	294	336	229	229	195	152	322	269	370	253	n.a.	28	2	20	51	180	180	6	6	30	22,5	20	9 x 12
200	630022W	306	370	256	256	215	164	343	306	420	286	n.a.	37	4	25	57	224	224	6	6	30	22,5	20	11 x 16
225	630023W	345	415	288	288	243	180	382	338	450	318	n.a.	37	4	25	56	224	224	6	6	30	22,5	20	11 x 16
250	630024W	381	461	322	322	270	195	419	372	485	352	n.a.	38	4	25	57	224	224	6	6	30	22,5	20	11 x 16
280	630025W	429	518	361	361	302	215	466	421	555	391	n.a.	37	5	30	67	280	280	8	7	40	28	25	13 x 18
315	630026W	480	578	404	404	340	236	518	464	600	434	n.a.	38	4	30	68	280	280	8	7	40	28	25	13 x 18
355	630027W	544	655	453	453	383	261	578	533	675	493	n.a.	34	6	40	71	355	355	8	7	40	33	30	13 x 18
400	630028W	609	736	507	507	432	290	649	587	725	547	n.a.	40	5	40	69	355	355	8	7	40	33	30	13 x 18
450	630029W	679	827	569	569	486	322	726	649	815	619	n.a.	46	6	40	83	530	530	10	8	50	38	35	13 x 18
500	630030W	748	918	638	638	538	352	800	718	885	688	n.a.	51	6	40	84	530	530	10	8	50	38	35	13 x 18
560	630031W	839	1030	715	715	603	390	891	815	1000	765	n.a.	50	8	50	93	530	530	12	8	70	43	40	13 x 18
630	630032W	940	1157	801	801	679	434	996	901	1085	851	n.a.	56	7	50	92	530	530	12	8	70	43	40	13 x 18
710	630033W	1050	1303	898	898	765	485	1117	998	1255	948	n.a.	67	7	50	129	630	630	14	9	90	53,5	50	17 x 22

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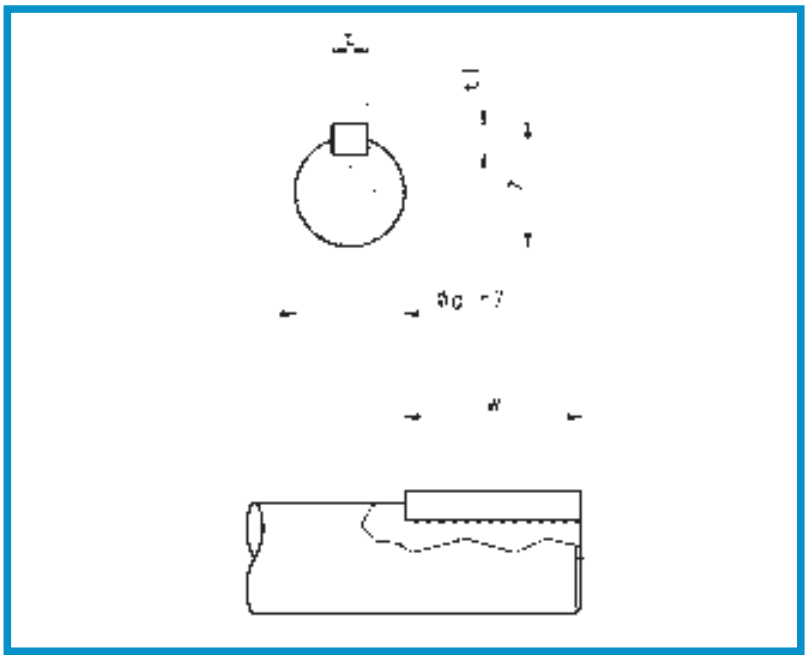
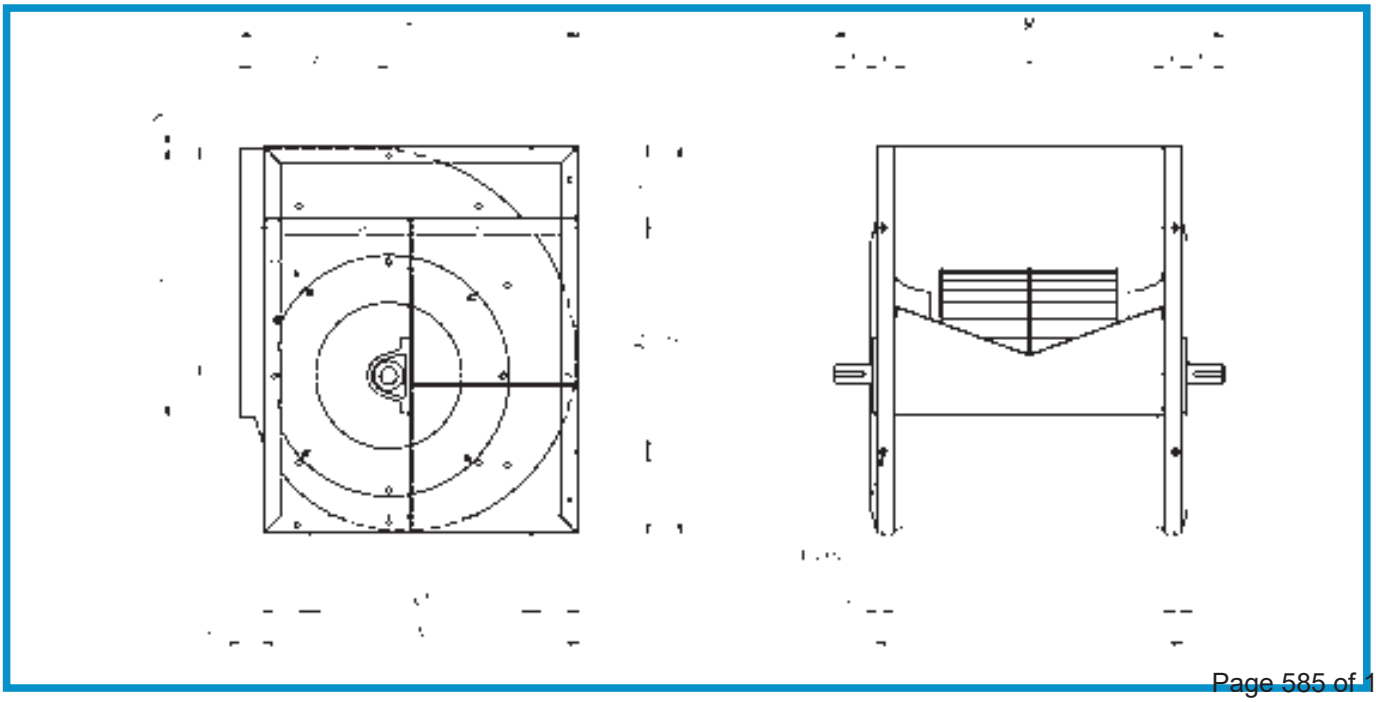
Versione K

Questa versione è irrigidita mediante l'applicazione di telai laterali rinforzati, avvitati alle fiancate, realizzati con profilati di acciaio laminato a caldo e protetti con vernice all'acqua alchidica melamminica. Su richiesta possono essere forniti telai zincati a caldo.
Disponibile nelle grandezze da 200 fino a 1000.
Tutte le dimensioni sono dotate di cuscinetti a supporto rilubrificabili.
Per ulteriori informazioni, si raccomanda di consultare la tabella "limiti di impiego".

K version

This version is stiffened through the application of reinforced side frames, bolted on the side plates and made with hot rolled steel sections, welded and coated with alchidic-melamminic paint. As an option, they can be protected with hot-dip galvanising.
This version is available in the sizes from 200 up to 1000.
All the sizes are fitted with cast iron, pillow-block bearings.
For further information, please see the table "Operational Limits".





K-Typ

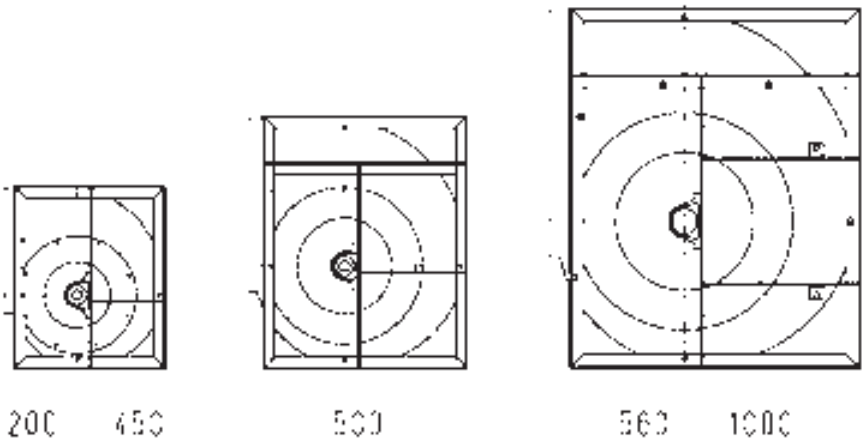
Dieser Bautyp wird durch den Einsatz verstärkter Seitenrahmen ausgesteift, die an den Seitenwänden angeschraubt sind und aus warm gewalzten Stahlprofilen bestehen, die angeschweißt und mit einem Alkyd-Melamin-Anstrich versehen wurden. Feuerverzinkte Profile stehen aus Option zur Verfügung.
Dieser Typ ist in Größen zwischen 200 und 1000 erhältlich.
Sämtliche Größen verfügen über gusseiserne Stehlager.
Nähere Angaben finden sich unter "Grenzwerte für den Betrieb".

Version K

Cette version est équipée de cadres latéraux renforcés, vissés aux flancs, réalisés en acier laminé à chaud et protégés par une peinture à l'eau alchido mélaminée. On peut fournir sur demande des cadres zingués à chaud.
Version disponible de la taille 200 à 1000.
Toutes les tailles sont équipées de paliers avec graisseur montés avec supports.
Pour d'autres informations, consulter le tableau "limites d'utilisation".

Versión K

Esta versión está reforzada mediante la aplicación de bastidores laterales reforzados, atornillados a los laterales, realizados con perfil de acero laminado en caliente y protegido con pintura al agua alquídica melamínica. Bajo pedido pueden ser suministrados bastidores cincados en caliente.
Disponible en los tamaños de 200 hasta 1000.
Todos los tamaños están dotados de rodamientos a soporte relubrificables.
Para mas información se recomienda consultar la tabla "límites de empleo".



ADH K **QUOTE DIMENSIONALI - DIMENSIONS - ABMESSUNGEN - DIMENSIONES**

Taglia Size	CODICI CODE	mm																					
		A	B	C	E	F	G	H	L	M	P	R	S	V	K	X1	X2	t	t1	w	z	Ø d	u x s
200	630042W	306	370	256	256	215	164	343	306	420	286	37	4	25	57	224	224	6	6	30	22,5	20	11 x 16
225	630043W	345	415	288	288	243	180	382	338	450	318	37	4	25	56	224	224	6	6	30	22,5	20	11 x 16
250	630044W	381	461	322	322	270	195	419	372	515	352	38	4	25	72	224	224	8	7	40	28	25	11 x 16
280	630045W	429	518	361	361	302	215	466	421	580	391	37	5	30	80	280	280	8	7	40	33	30	13 x 18
315	630046W	480	578	404	404	340	236	518	464	625	434	38	4	30	81	280	280	8	7	40	33	30	13 x 18
355	630047W	544	655	453	451	383	261	578	531	685	493	34	6	40	77	355	355	10	8	50	38	35	13 x 18
400	630048W	613	736	507	507	432	290	651	587	750	547	38	5	40	82	355	355	10	8	50	38	35	13 x 18
450	630049W	679	827	569	569	486	322	726	649	850	619	45	6	40	101	530	530	12	8	70	43	40	13 x 18
500	630050W	748	918	638	638	538	352	800	718	920	688	50	6	40	101	530	530	12	8	70	43	40	13 x 18
560	630051W	839	1030	715	715	603	390	893	815	1070	765	54	8	50	127	530	530	14	9	90	53,5	50	13 x 18
630	630052W	940	1157	801	801	679	434	999	901	1155	851	59	7	50	127	530	530	14	9	90	53,5	50	13 x 18
710	630053W	1050	1303	898	898	765	485	1121	998	1255	948	71	7	50	129	630	630	14	9	90	53,5	50	17 x 22
800	630054W	1181	1468	1007	1007	862	540	1255	1107	1360	1057	74	8	50	127	710	710	14	9	90	53,5	50	17 x 22
900	630055W	1319	1648	1130	1130	971	604	1408	1230	1520	1180	89	8	50	145	800	800	18	11	90	64	60	17 x 22
1000	630056W	1451	1810	1267	1267	1066	657	1541	1367	1660	1217	90	10	50	147	900	900	18	11	90	64	60	17 x 22

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RDH

VENTILATORI CENTRIFUGHI A DOPPIA ASPIRAZIONE
CON PALE INCLINATE ALL'INDIETRO

DOUBLE INLET CENTRIFUGAL FANS
WITH BACKWARDS INCLINED BLADES

DOPPELSEITIG SAUGENDE RADIAL-VENTILATOREN
MIT RÜCKWÄRTS GEKRÜMMTEN SCHAUFELN

VENTILATEURS CENTRIFUGES A DOUBLE OUIE
AVEC AUBES INCLINÉES VERS L'ARRIÈRE

VENTILADORES CENTRIFUGOS DE DOBLE ASPIRACION
CON PALAS INCLINADAS HACIA ATRAS

amca CERTIFIED RATINGS
AIR PERFORMANCE
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March 2005
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RDH

VENTILATORI CENTRIFUGHI A DOPPIA ASPIRAZIONE
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CON PALAS INCLINADAS HACIA ATRAS

Nicotra S.p.A. certifica che i ventilatori serie RDH, versioni L, R, K, K1 e K2, rappresentati in questo catalogo, sono autorizzati a portare il Marchio AMCA. Le prestazioni indicate sono basate su prove e procedure in accordo con il documento AMCA 211, e soddisfano i requisiti del Programma AMCA per la Certificazione delle Prestazioni. Si veda il capitolo a pag. 32 per maggiori dettagli.

Nicotra S.p.A. certifies that RDH fans of the L, R, K, K1 and K2 versions, shown herein, are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA publication 211 and comply with the requirements of the AMCA Certified Ratings Program.
Further details can be found on page 32.

Nicotra S.p.A. bescheinigt, dass die hierin dargestellten RDH-Lüfter des Typs L, R, K, K1 und K2 von der AMCA zur Führung ihres Siegels zugelassen sind. Die dargestellten Einstufungen beruhen auf Prüfungen und Verfahren, die gemäß AMCA-Druckschrift 211 durchgeführt wurden und den Erfordernissen eines von der AMCA zugelassenen Einstufungsprogramms entsprechen.
Weitere Einzelheiten finden sich auf Seite 32.

Nicotra Spa certifie que les ventilateurs de la série RDH, versions L, R , K, K1 et K2 présentés dans ce catalogue sont certifiés AMCA. Les performances indiquées sont basées sur les essais et procédures conformément au document AMCA 211 et répondent aux demandes du Programme AMCA " Certification des Performances" . Pour plus de détails, se reporter au chapitre de la page 32.

Nicotra S.p.A. certifica que los ventiladores serie RDH, versiones L, R, K, K1 y K2, representados en este catálogo, están autorizados para llevar el Sello AMCA. Las prestaciones indicadas están basadas en pruebas y procedimientos de acuerdo con el documento AMCA 211, y satisfacen los requisitos del Programa AMCA para la Certificación de las Prestaciones.
Ver el capítulo de la pág. 32.

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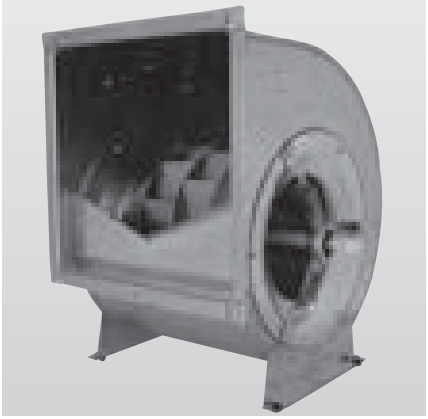
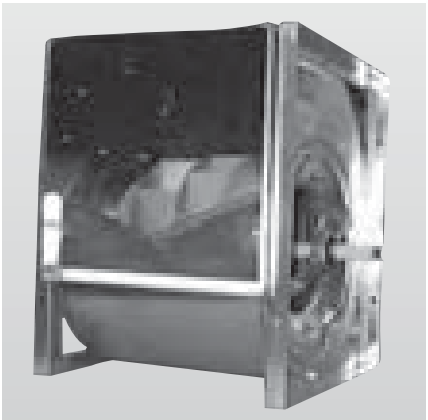
Gamma di produzione

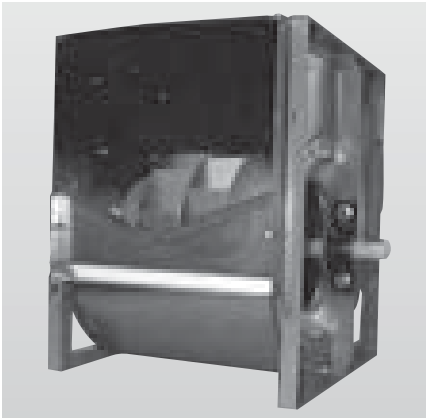
Questa gamma di ventilatori impiega coclee con bocca quadra e presenta un dimensionamento omotetico, con dimensioni nominali in accordo alla serie dei numeri normali R20 secondo le norme AMCA 99 0098 76 e DIN 323.
La serie RDH è composta da ventilatori centrifughi a doppia aspirazione ad alta efficienza con ventola a pale inclinate all'indietro.
Portate da 600 m^3/h a 150.000 m^3/h
Pressione fino a 3500 Pa totale.
16 grandezze da 180 a 1000 mm (diametro nominale delle ventole).

Production range

This fan range employs housings with square-shaped outlet and sizes from the R20 normal number series, in accordance to AMCA Standard 99-0098 76 and to DIN 323.
The RDH range is made of high efficiency, double width, double inlet centrifugal fans with backward inclined blades.
Volume flow rate from 600 m^3/h to 150.000 m^3/h
Total pressure up to 3500 Pa.
16 sizes from 180 up to 1000 mm wheel diameter.







Versioni costruttive

I ventilatori della serie RDH sono disponibili nelle seguenti versioni:

Construction versions

RDH fans are available in the following versions:

	Serie RDH	
Versione/ Version	Dalla grandezza/ From size	Alla grandezza/ To size
L	180	560
R	180	710
K	200	1000
K1	315	900
K2	500	1000

Versioni costruttive binate

Per applicazioni che richiedono un ingombro verticale contenuto, i ventilatori RDH sono disponibili anche in versione binata, ovvero con due ventole a doppia aspirazione montate sul medesimo albero, sostenuto da tre o quattro cuscinetti.
Queste versioni vengono contraddistinte dal prefisso G2.
I ventilatori sono disponibili nelle seguenti grandezze:

Twin fan versions

Where a limited fan height is required, RDH fans are available also in double or twin fan versions, with two double inlet impellers on a common shaft, supported by three or four bearings.
These versions are identified by the G2 prefix. Double fans are available in the following sizes:

	Serie RDH	
Versione/ Version	Dalla grandezza/ From size	Alla grandezza/ To size
G2K	250	1000
G2K2	250	1000

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Caratteristiche Costruttive

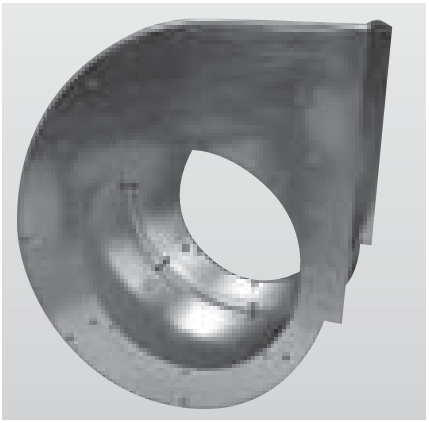
Il criterio di costruzione utilizzato per i ventilatori Nicotra RDH è ispirato alla massima robustezza e affidabilità, indipendentemente dalla versione costruttiva. Caratteristiche comuni a questi prodotti sono:

- qualità del prodotto
- prestazioni elevate
- massima economicità
- silenziosità
- rapidità di montaggio

Construction Specifications

The construction standard used for Nicotra RDH fans is inspired to the maximum strength and reliability, independently from the construction version. Common characteristics of these products are:

- product quality
- high performance
- outmost economy
- quietness
- ease of assembly

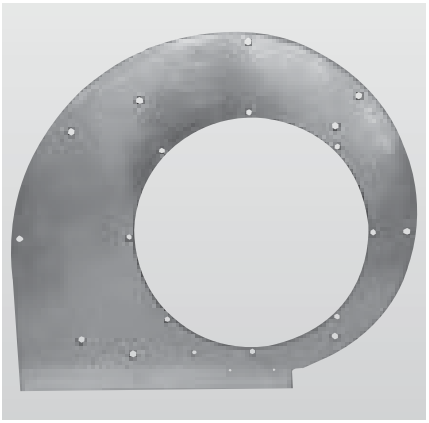


Coclee

Per tutte le grandezze, la coclea è realizzata in lamiera di acciaio zincato a caldo secondo EN 10142. Non esistono punti di saldatura perché l'unione della fiancata con il dorso viene effettuata utilizzando il sistema Pittsbourgh, eliminando così il pericolo di possibili ossidazioni.

Scrolls

All the scrolls are made with hot dip galvanised steel EN 10142.
No electrical spot welding is used as the scroll back is joined to the side plates with the Pittsbourgh lock forming system. This prevents any oxidation starting from the welding spots.



Forature di attacco sulle fiancate

Sulle fiancate sono predisposte alcune forature che permettono il fissaggio dei supporti o telai occorrenti per le varie esecuzioni.
Fino alla grandezza 400 le forature permettono un fissaggio mediante viti autofilettanti, mentre per tutte le grandezze superiori vengono applicati inserti filettati per viti M10.

Attachment points on the side plates

Standard holes in the side plates are used to attach mounting feet or side frames to create different versions.
Up to size 400, self-threading screws are used, while all the larger sizes have captive nuts for use with M10 screws.

Ventole

Le ventole della serie RDH, a partire dalla grandezza 250, sono del tipo con 11 pale inclinate all'indietro, realizzate in acciaio saldato, trattato e verniciato con vernice all'acqua RAL 7030 tipo alchidica melamminica.

Impellers

RDH impellers, starting from size 250, have 11 specially-designed, backward inclined blades. Built from mild steel, they are welded, treated and painted with alchidic-melamminic paint RAL 7030.

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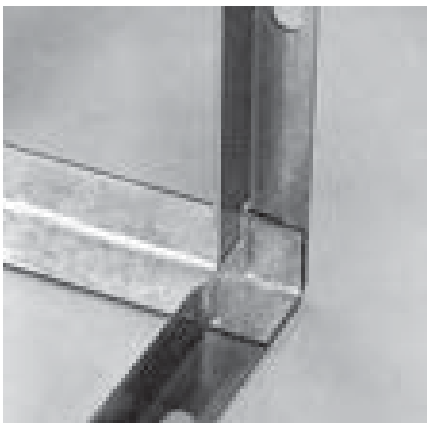
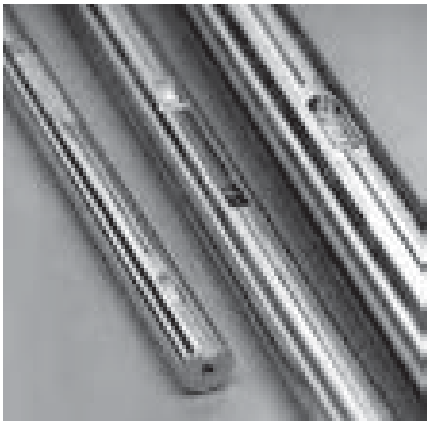
I modelli più piccoli (180/200/225) hanno ventole ad 8 pale curve all'indietro, in Poliammide rinforzata con fibra di vetro. Le ventole RDH sono equilibrate staticamente e dinamicamente secondo le norme ISO 1940 con grado G4.

The smaller fan sizes (180 - 200 – 225) have 8 bladed, backward curved impellers, made with Glassfibre Reinforced Polyamide.
RDH impellers are statically and dynamically balanced according to ISO 1940 with grade G4.



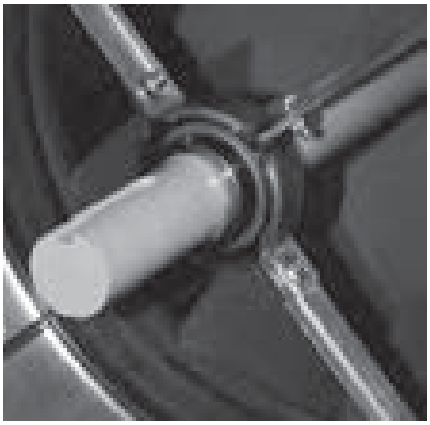
Telai
I telai laterali delle versioni R sono realizzati con angolari in acciaio zincato Sendzimir secondo EN 10142.
I telai delle versioni rinforzate K, K1, K2, G2K e G2K2 sono costruiti con profilati laminati a caldo, trattati e protetti con vernice all'acqua RAL 7030 tipo alchidica melamminica. Su richiesta questi telai possono essere finiti con zincatura a caldo.

Side frames
Light-construction side frames of the R versions are made with cold-formed, galvanised steel "Sendzimir" type EN 10142. Heavy-duty side frames of the K, K1, K2, G2K and G2K2 versions are made with hot-rolled steel sections, welded and coated with alchidic-melamminic paint RAL 7030. As an option, they can be protected with hot dip galvanising.



Alberi
Lavorati a partire da barre rettificate di acciaio al carbonio, utilizzando un processo automatico per l'esecuzione delle cave centrali (chiuse) e d'estremità (aperte). Tutti gli alberi vengono protetti, ad assemblaggio ultimato, con verniciatura anticorrosiva di colore giallo brillante. Alberi in acciaio inox possono essere forniti su richiesta, con una opportuna riduzione della velocità massima raggiungibile. I diametri degli alberi sono scelti in modo da avere una velocità critica superiore alla massima velocità di funzionamento di un fattore di sicurezza ≥ 1.25

Shafts
Manufactured from precision ground, C45 carbon steel bars, using precision tools to cut keyways.
All the shafts are coated, after assembly, with a clearly distinguishable, bright yellow protective paint.
Stainless steel shafts can be provided on request, with an appropriate reduction of the maximum operating speed.
Shaft diameters are selected to achieve a safety factor for critical speed ≥ 1.25 higher than the maximum operating speed.



Cuscinetti
I ventilatori delle versioni L, R, impiegano cuscinetti a singola corona di sfere, stagni, lubrificati a vita, con bloccaggio a collare eccentrico, installati entro ammortizzatori in gomma a bassa resistività elettrica su razze imbullonate alla fiancata (fig.1).

Bearings
Fans of the L and R versions use single row, deep groove, self-aligning ball bearings. Sealed and life lubricated, they are locked on the shaft with an eccentric ring clamp and supported, inside electrically conductive rubber shock absorbers, on inlet bolted spiders (Fig. 1).

fig. 1

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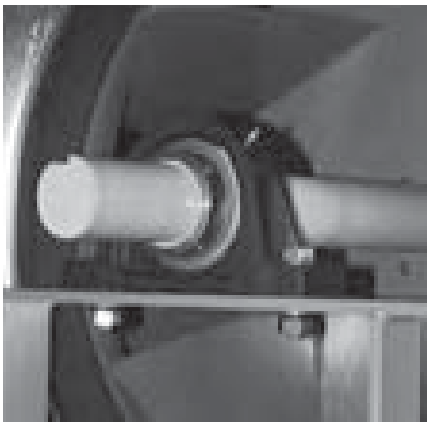

fig. 2

fig. 3

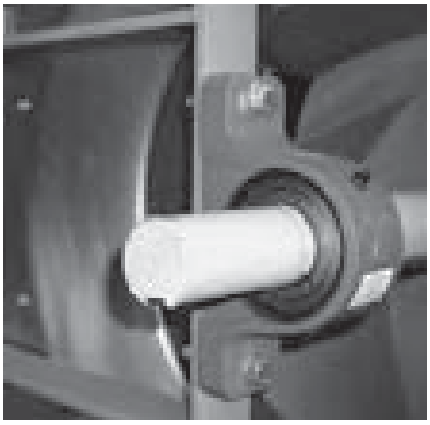

fig. 4

I ventilatori delle versioni K, G2K e G2K2 montano cuscinetti a singola corona di sfere, stagni, con bloccaggio a collare eccentrico, montati entro supporti in ghisa autoallineanti con ingrassatore, imbullonati ai telai laterali (fig.2).
I ventilatori della serie K1 impiegano cuscinetti rinforzati, a singola corona di sfere, stagni, con bloccaggio mediante bussola conica di trazione, montati entro supporti in ghisa autoallineanti con ingrassatore, imbullonati ai telai laterali (fig.3).
I ventilatori della versione K2 ed alcune grandezze della versione G2K2 montano cuscinetti stagni per impieghi pesanti, a singola corona di sfere (500), a doppia corona di sfere (560,630,710 e 800) o a doppia corona di rulli a botte (900 e 1000) montati entro supporti con ingrassatore, imbullonati ai telai laterali (fig.4).

Fans of the K, G2K and G2K2 versions use sealed, single row, self-aligning ball bearings, with eccentric clamp, mounted inside cast iron pillow blocks, with grease nipples, bolted to the side-frames (Fig. 2).
K1 version fans use reinforced single row sealed ball bearings, locked on the shaft with a conical sleeve and mounted inside cast-iron pillow blocks, with grease nipples, bolted to the side-frames (Fig. 3).
All the fans of the K2 version, and some sizes of the G2K2 version, have sealed heavy-duty bearings of different types, according to the fan size: single row ball bearings with conical sleeve inside cast iron pillow blocks (500); double-row ball bearings with conical sleeve inside split block housings (560, 630, 710 and 800) or double row, self-aligning roller bearings inside single piece pillow blocks (900 and 1000). All the pillow blocks have grease nipples for lubrication and are bolted to specially reinforced side-frames (Fig. 4).

I cuscinetti impiegati sono stati scelti per raggiungere, con dimensionamenti usuali di pulegge (vedere capitolo “Scelta delle pulegge”) e nelle condizioni di massimo carico, una durata L_{10} di 40.000 ore. Nelle condizioni di utilizzo nelle quali i ventilatori sono generalmente utilizzati, la durata media è molto più alta.
La vasta scelta di versioni costruttive inoltre, consente di trovare sempre una soluzione idonea a soddisfare anche requisiti molto più gravosi.

The bearings allow, with reasonable pulley diameters and at the maximum load conditions, to achieve an L_{10} operating life of 40000 hours (see the chapter “Pulley selection”). With more common operating conditions, the average operating life can be much higher.
Thanks to the wide choice of construction versions available, even longer design life requirements can be easily met.

Poiché la vita operativa del grasso contenuto nei cuscinetti dipende dalle condizioni di esercizio, essa può differire dalla durata L_{10} dei cuscinetti stessi.

As the operating life of the grease contained in the bearings depends on the operating conditions, it can be different from the L_{10} operating life of the bearings themselves.

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Oltre al capitolo sulle Raccomandazioni di Impiego, si consiglia di consultare il Manuale di Uso e Manutenzione per avere dettagli sulla corretta installazione, impiego e manutenzione del ventilatore, con particolare attenzione ai cuscinetti.

Apart from the chapter “Guidelines for correct use”, the “Use and Maintenance Manual” contains important information covering proper installation, use and maintenance of the fan and particularly of its bearings.

Verniciature

Su richiesta, possono essere realizzate versioni interamente verniciate con vernice a polvere o all'acqua di vario spessore.

Paintings

Special powder-paint coatings of various thickness can be supplied on request.

Esecuzioni antideflagranti

Su richiesta, possono essere realizzate versioni a sicurezza aumentata, con boccagli di aspirazione in lega di alluminio, lega di rame o con bordo riportato in rame.
Si prega di contattare il fabbricante per la scelta ed i dettagli.

Ignition protected versions

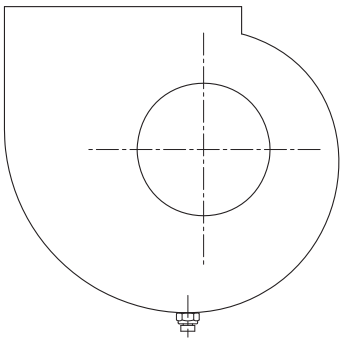
Ignition protected versions can be built on request, with inlet cones made of aluminium, copper or with copper rubbing stripes on the edge of the inlet cones.
Please, contact the manufacturer for selection and details.

Orientamento ventilatore

I ventilatori standard sono forniti con entrambe le estremità dell’albero sporgenti e predisposte per l’installazione della trasmissione. Possono essere indifferentemente impiegati sia con rotazione LG che con rotazione RD. Tutte le versioni dotate di telai laterali sono predisposte per essere semplicemente ruotate, consentendo l’installazione in uno dei quattro orientamenti 0°, 90°, 180° e 270°. I ventilatori della serie L sono invece predisposti con forature per il fissaggio dei piedi di supporto con orientamento 0°, 90° oppure 270°.
Non è quindi necessario segnalare l’orientamento del ventilatore ordinando una macchina standard.

Fan orientation

Standard fans are supplied with both shaft ends prepared to fit a pulley. They can be indifferently used with either RD or LG rotation. All the versions with side frames can be easily turned to install them in one of the four orientations 0°, 90°, 180° and 270°. Feet-mounted L version has holes in the side plates which allow bolting the feet with the scroll oriented to 0°, 90° or 270°.
There is no need to specify fan orientation when ordering standard fans.



È invece indispensabile specificare l’orientamento del ventilatore ordinando macchine dotate di accessori che, come lo scarico condensa, hanno una posizione strettamente legata all’orientamento di installazione.

Fan orientation must be specified instead when ordering fans fitted with accessories which must be located according to the scroll orientation, like drain plugs.

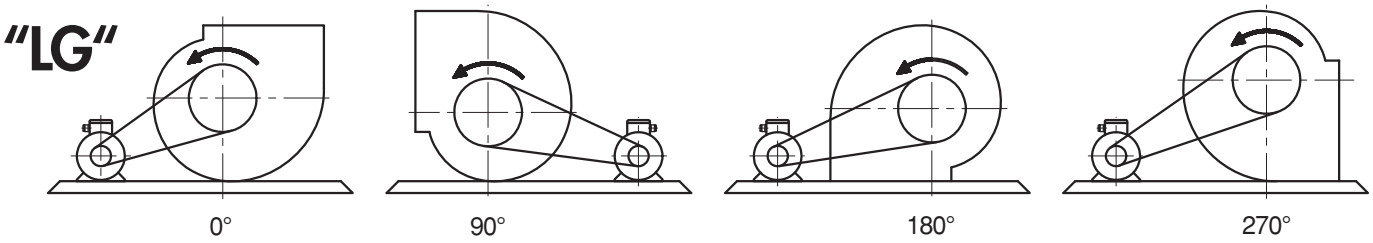
NICOTRA

Altri accessori possono essere forniti in posizioni standard, identificate da lettere o numeri. Si veda a questo proposito la descrizione di ogni singolo accessorio.

Other accessories may be installed in coded standard positions, identified by letters or numbers. Please, check the details concerning each particular accessory.

Quando necessario, l'orientamento dei ventilatori è indicato, secondo ISO 13349 ed Eurovent 1/1, osservando il ventilatore dal lato trasmissione. La sigla RD indica rotazione destra (oraria) e la sigla LG rotazione sinistra (antioraria). Gli orientamenti possibili sono schematizzati nel disegno sottostante.

When requested, fan orientation is identified, according to ISO 13349 and Eurovent 1/1, when looking at the fan from the drive side. RD means right (clockwise) rotation, while LG means left (counter-clockwise) rotation.
The achievable orientations are shown in the drawing below.



Esempio denominazione:

"VRE RDH 500 K 0° + SCARICO CONDENSA" = *ventilatore della serie RDH, grandezza 500, versione "K", con orientamento a 0° e scarico condensa nella posizione indicata in figura.*

Example:

"RDH 500 K 0° + DRAIN PLUG" = *RDH fan series, size 500, "K" version, with 0° orientation and drain plug installed as shown in the picture.*

Sonstige Zubehörteile können in codierten Standardstellungen montiert werden, die durch Buchstaben oder Zahlen gekennzeichnet sind. Bitte überprüfen Sie sämtliche Einzelheiten für jedes einzelne Zubehörteil.

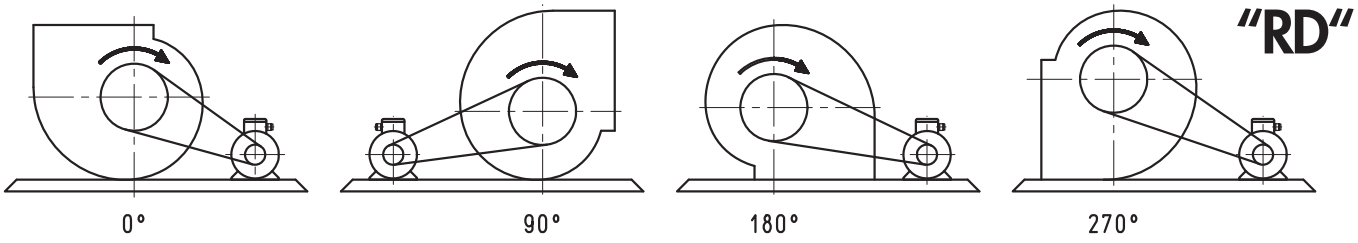
D'autres accessoires peuvent être fournis en position standard, identifiés par des lettres ou numéros.
Voir à ce propos la description de chaque accessoire.

Otros accesorios pueden ser suministrados en posiciones estándar, identificadas por letras o números. Ver a este propósito la descripción de cada accesorio en particular.

Sofern eine Gebläseausrichtung vorgegeben wird, erfolgt sie gemäß ISO 13349 und Eurovent 1/1 beim Blick auf die Antriebsseite. Dabei bedeutet RD Drehung nach rechts (im Uhrzeigersinn), während LG eine Drehung nach links (entgegen dem Uhrzeigersinn).
Die verfügbaren Ausrichtungen sind der nachstehenden Zeichnung zu entnehmen.

Si nécessaire, l'orientation des ventilateurs est indiquée, selon ISO 13349 et Eurovent 1/1 en observant le ventilateur côté transmission. Le sigle RD = rotation droite (sens horaire) et le sigle LG = rotation gauche (sens anti horaire). Les orientations possibles sont schématisées dans le dessin ci-dessous.

Cuando es necesario, la orientación del ventilador está indicada según ISO 13349 y Eurovent 1/1, observando el ventilador por el lado de la transmisión. La sigla RD indica rotación derecha (horaria) y la sigla LG rotación izquierda (antihoraria). Las orientaciones posibles están esquematizadas en el diseño de abajo.



Beispiel:

"RDH 500 K 0° + ABLASSSCHRAUBE" = *also ein Gebläse der Baureihe RDH in der Größe 500, Typ K, Ausrichtung 0° und Anordnung der einzubauenden Ablassschraube gemäß Abbildung.*

Example d'appellation:

RDH 500 K 0° + PURGE DE VOLUTE" = *ventilateur de la série RDH, taille 500, version K avec une orientation 0° et purge de volute dans la position indiquée sur la figure.*

Ejemplo de denominación:

RDH 500 K 0° + PURGADOR CONDENSADOS" = *ventilador de la serie RDH, tamaño 500, versión K, orientación 0º y purgador de condensados en la posición indicada en la figura.*

NICOTRA

Versione R

A differenza della versione precedente, la versione “R” è dotata di telai in angolari d’acciaio zincato, avvitati alle due fiancate, che danno alla struttura del ventilatore una maggiore robustezza e stabilità, consentendo l’orientamento su quattro posizioni.

Questa versione è disponibile fino alla grandezza 710.

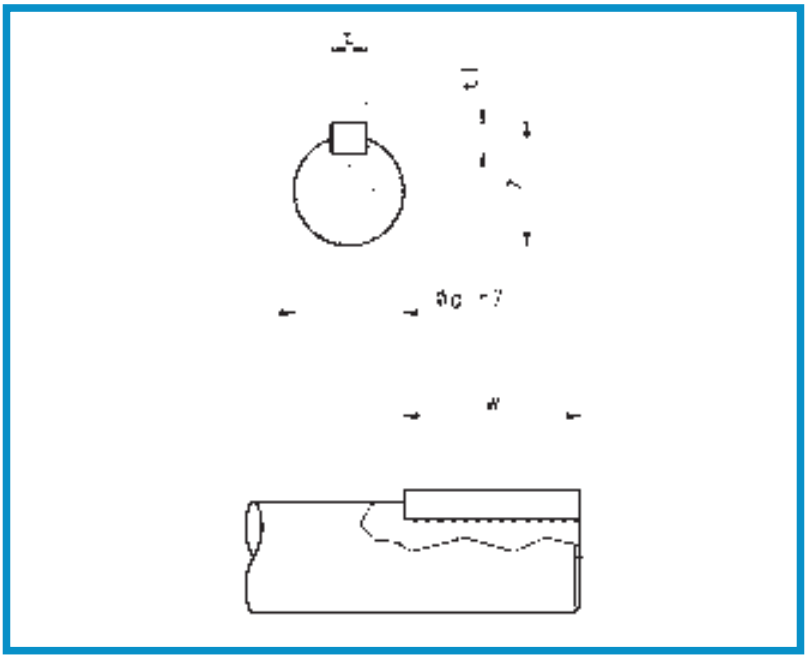
Per altre informazioni, si raccomanda di consultare la tabella “limiti di impiego”.

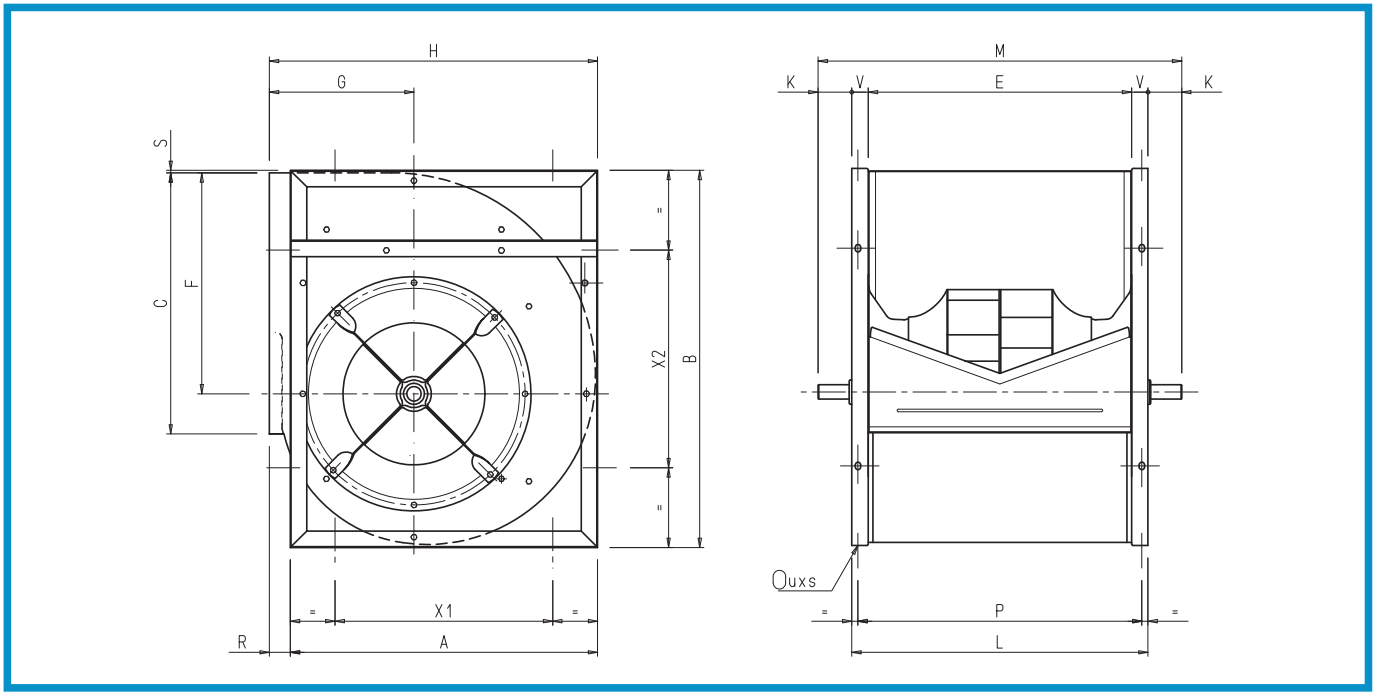
R version

Unlike the L version, the R version is fitted with side frames made of cold-formed galvanized steel, bolted to the two side plates. They give better strength and rigidity to the fan structure and allow the mounting of the fan in four different positions.

This version is available up to the size 710.

For further information, please see the table “Operational Limits”.





R-Typ

Im Unterschied zum L-Typ verfügt die Bauart R über Seitenrahmen aus kalt gewalztem verzinktem Stahl, die an die beiden Seitenplatten angeschraubt werden. Dadurch wird der Aufbau des Gebläses stärker und steifer; für die Montage stehen vier unterschiedliche Stellungen zur Verfügung.

Dieser Typ ist bis zur Größe 710 erhältlich.

Nähere Angaben finden sich unter "Grenzwerte für den Betrieb".

Version R

A la différence de la version précédente, la version "R" est équipée de cadres en acier zingué vissés aux deux flancs qui donnent à la structure du ventilateur une meilleure robustesse et stabilité avec la possibilité d'une orientation en 4 positions.

Cette version est disponible jusqu'à la taille 710.

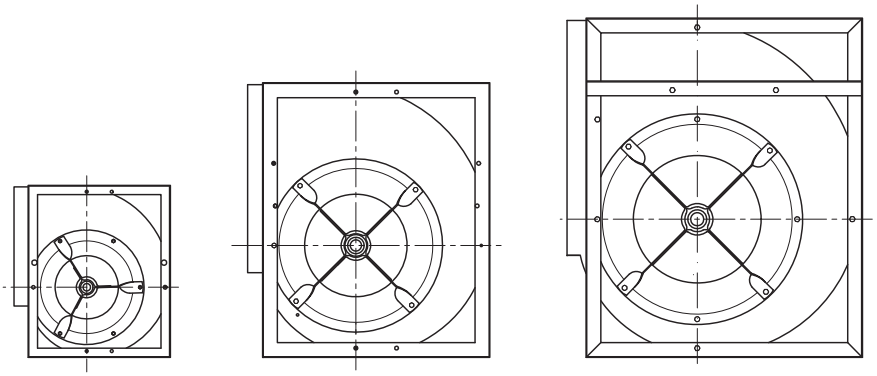
Pour d'autres informations, consulter le tableau "limites d'utilisation".

Versión R

A diferencia de la versión precedente, la versión "R" está dotada de bastidores de ángulo de acero cincado, atornillados a los dos laterales, que dan a la estructura del ventilador una mayor robustez y estabilidad, permitiendo la orientación en cuatro posiciones.

Esta versión está disponible hasta el tamaño 710.

Para mas información se recomienda consultar la tabla "límites de empleo".



180 - 315 355 - 450 500 - 710

RDH R **QUOTE DIMENSIONALI - DIMENSIONS - ABMESSUNGEN - DIMENSIONES**

Taglia Size	CODICE CODE	mm																						
		A	B	C	E	F	G	H	L	M	P	Q	R	S	V	K	X1	X2	t	t1	w	z	Ød	u x s
180	632021W	294	336	229	229	195	152	322	269	370	253	n.a.	28	2	20	51	180	180	6	6	30	22,5	20	9 x 12
200	632022W	306	370	256	256	215	164	343	306	420	286	n.a.	37	4	25	57	224	224	6	6	30	22,5	20	11 x 16
225	632023W	345	415	288	288	243	180	382	338	450	318	n.a.	37	4	25	56	224	224	6	6	30	22,5	20	11 x 16
250	632024W	381	461	322	322	270	195	419	372	485	352	n.a.	38	4	25	57	224	224	6	6	30	22,5	20	11 x 16
280	632025W	429	518	361	361	302	215	466	421	555	391	n.a.	37	5	30	67	280	280	8	7	40	28	25	13 x 18
315	632026W	480	578	404	404	340	236	518	464	600	434	n.a.	38	4	30	68	280	280	8	7	40	28	25	13 x 18
355	632027W	544	655	453	453	383	261	578	533	675	493	n.a.	34	6	40	71	355	355	8	7	40	33	30	13 x 18
400	632028W	609	736	507	507	432	290	649	587	725	547	n.a.	40	5	40	69	355	355	8	7	40	33	30	13 x 18
450	632029W	679	827	569	569	486	322	726	649	815	619	n.a.	46	6	40	83	530	530	10	8	50	38	35	13 x 18
500	632030W	748	918	638	638	538	352	800	718	885	688	n.a.	51	6	40	84	530	530	10	8	50	38	35	13 x 18
560	632031W	830	1030	715	715	603	390	891	815	1000	765	n.a.	50	8	50	93	530	530	12	8	70	43	40	13 x 18
630	632032W	940	1157	801	801	679	434	996	901	1085	851	n.a.	56	7	50	92	530	530	12	8	70	43	40	13 x 18
710	632033W	1050	1303	898	898	765	485	1117	998	1255	948	n.a.	67	7	50	129	630	630	14	9	90	53,5	50	17 x 22

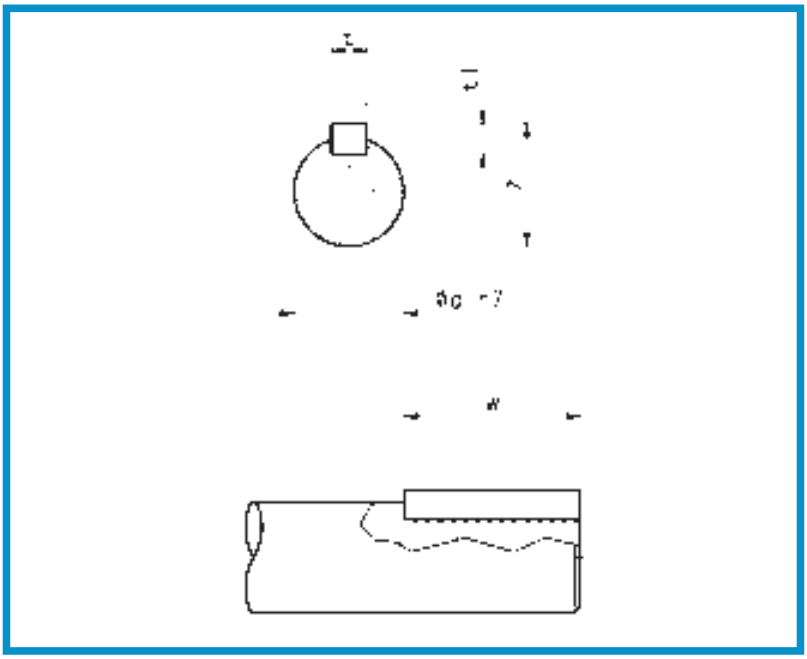
NICOTRA

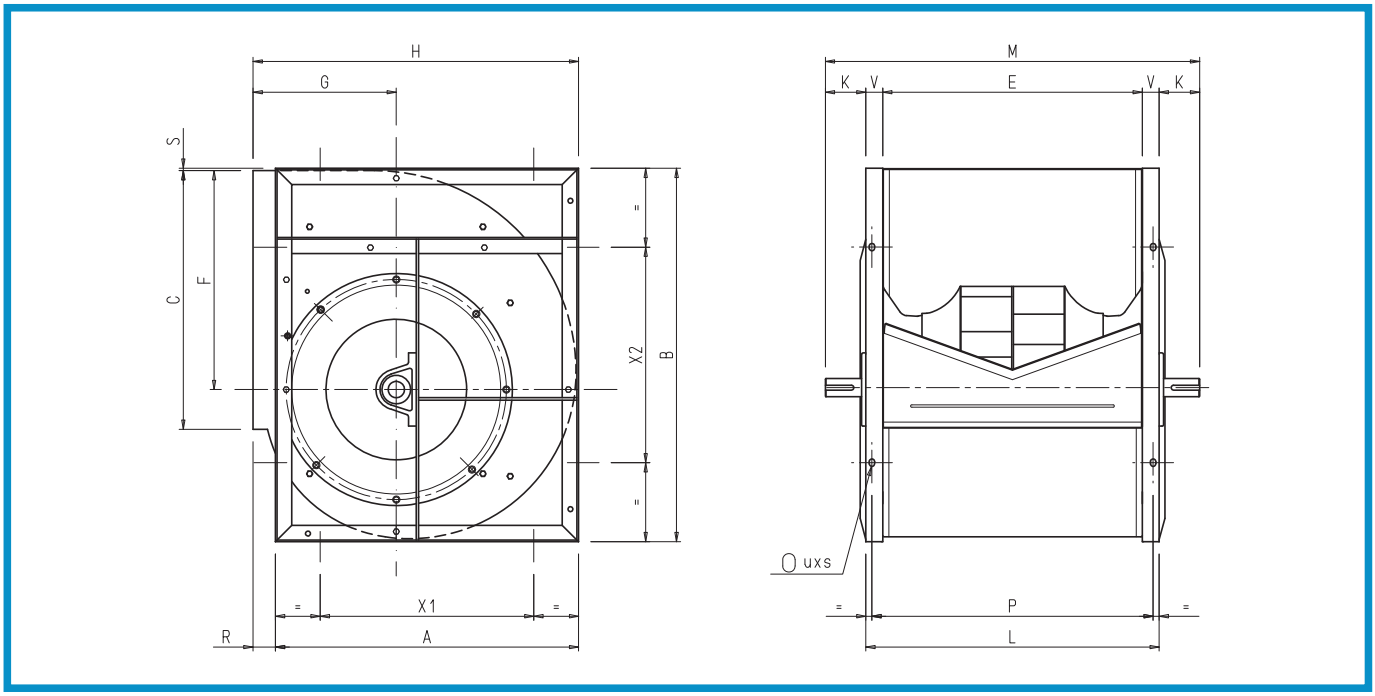
Versione K

Questa versione è irrigidita mediante l'applicazione di telai laterali rinforzati, avvitati alle fiancate, realizzati con profilati di acciaio laminato a caldo e protetti con vernice all'acqua alchidica melamminica.
Su richiesta possono essere forniti telai zincati a caldo.
Disponibile nelle grandezze da 200 fino a 1000.
Tutte le dimensioni sono dotate di cuscinetti a supporto rilubrificabile.
Per ulteriori informazioni, si raccomanda di consultare la tabella "limiti di impiego".

K version

This version is stiffened through the application of reinforced side frames, bolted on the side plates and made with hot rolled steel sections, welded and coated with alchidic-melamminic paint. As an option, they can be protected with hot-dip galvanising.
This version is available in the sizes from 200 up to 1000.
All the sizes are fitted with cast iron, pillow-block bearings.
For further information, please see the table "Operational Limits".





K-Typ

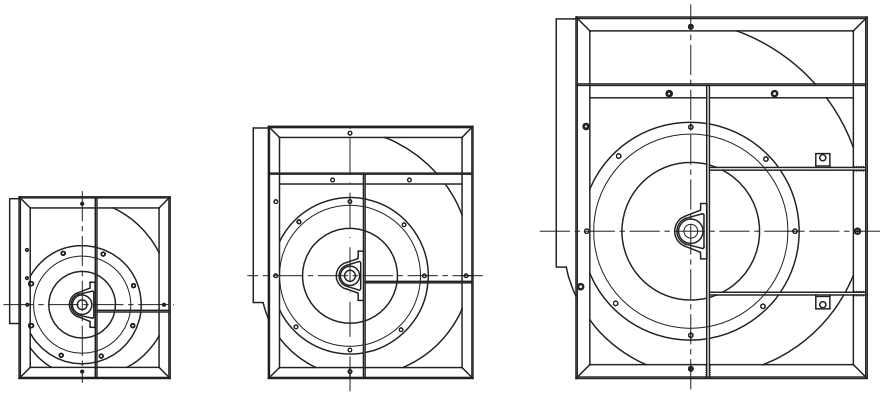
Dieser Bautyp wird durch den Einsatz verstärkter Seitenrahmen ausgesteift, die an den Seitenwänden angeschraubt sind und aus warm gewalzten Stahlprofilen bestehen, die angeschweißt und mit einem Alkyd-Melamin-Anstrich versehen wurden. Feuerverzinkte Profile stehen aus Option zur Verfügung.
Dieser Typ ist in Größen zwischen 200 und 1000 erhältlich.
Sämtliche Größen verfügen über gusseiserne Stehlager.
Nähere Angaben finden sich unter "Grenzwerte für den Betrieb".

Version K

Cette version est équipée de cadres latéraux renforcés, vissés aux flancs réalisés en acier laminé à chaud et protégés par une peinture à l'eau alchido mélaminée. On peut fournir sur demande des cadres zingués à chaud.
Version disponible de la taille 200 à 1000.
Toutes les tailles sont équipées de paliers avec graisseur montés sur supports.
Pour d'autres informations, consulter le tableau "limites d'utilisation".

Versión K

Esta versión está reforzada mediante la aplicación de bastidores laterales reforzados, atornillados a los laterales, realizados con perfil de acero laminado en caliente y protegido con pintura al agua alquídica melamínica. Bajo pedido pueden ser suministrados bastidores cincados en caliente.
Disponible en los tamaños de 200 hasta 1000.
Todos los tamaños están dotados de rodamientos a soporte relubrificables.
Para mas información se recomienda consultar la tabla "límites de empleo".



200 - 450 500 560 - 1000

RDH K **QUOTE DIMENSIONALI - DIMENSIONS - ABMESSUNGEN - DIMENSIONES**

Taglia Size	CODICE CODE	mm																					
		A	B	C	E	F	G	H	L	M	P	R	S	V	K	X1	X2	t	t1	w	z	Ød	u x s
200	632042W	306	370	256	256	215	164	343	306	420	286	37	4	25	57	224	224	6	6	30	22,5	20	11 x 16
225	632043W	345	415	288	288	243	180	382	338	450	318	37	4	25	56	224	224	6	6	30	22,5	20	11 x 16
250	632044W	381	461	322	322	270	195	419	372	515	352	38	4	25	72	224	224	8	7	40	28	25	11 x 16
280	632045W	429	518	361	361	302	215	466	421	580	391	37	5	30	80	280	280	8	7	40	33	30	13 x 18
315	632046W	480	578	404	404	340	236	518	464	625	434	38	4	30	81	280	280	8	7	40	33	30	13 x 18
355	632047W	544	655	453	451	383	261	578	531	685	493	34	6	40	77	355	355	10	8	50	38	35	13 x 18
400	632048W	613	736	507	507	432	290	651	587	750	547	38	5	40	82	355	355	10	8	50	38	35	13 x 18
450	632049W	679	827	569	569	486	322	726	649	850	619	45	6	40	101	530	530	12	8	70	43	40	13 x 18
500	632050W	748	918	638	638	538	352	800	718	920	688	50	6	40	101	530	530	12	8	70	43	40	13 x 18
560	632051W	839	1030	715	715	603	390	893	815	1070	765	54	8	50	127	530	530	14	9	90	53,5	50	13 x 18
630	632052W	940	1157	801	801	679	434	999	901	1155	851	59	7	50	127	530	530	14	9	90	53,5	50	13 x 18
710	632053W	1050	1303	898	898	765	485	1121	998	1255	948	71	7	50	129	630	630	14	9	90	53,5	50	17 x 22
800	632054W	1181	1468	1007	1007	862	540	1255	1107	1360	1057	74	8	50	127	710	710	14	9	90	53,5	50	17 x 22
900	632055W	1319	1648	1130	1130	971	604	1408	1230	1520	1180	89	8	50	145	800	800	18	11	90	64	60	17 x 22
1000	632056W	1451	1810	1267	1267	1066	657	1541	1367	1660	1217	90	10	50	147	900	900	18	11	90	64	60	17 x 22

Technical Literature

15) Centrifugal Fan

Technical Literature

16) Ceiling Fan

BIG ASS FANS®

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An ISO 9001:2008 Certified Company

WHO WE ARE

Big Ass Fans® is the preeminent designer and manufacturer of six to 24-foot diameter high volume, low-speed ceiling and vertical fans, each engineered to provide significant energy savings and improve occupant comfort year-round.

The components of each Big Ass Fan are individually designed, built, and tested to Big Ass Fans' exacting standards, right here in the USA. From our start in 1999, Big Ass Fans has remained committed to product innovation and quality. Over the years, Big Ass Fans' product line has evolved in response to customer demand, from fans that provide year-round air movement solutions for industrial and agricultural facilities to those designed to optimize thermal comfort in schools, churches, restaurants, and homes. Our growing family of fans includes Powerfoil® X, Powerfoil® X Plus, Pivot®, AirGo®, Yellow Jacket®, Element® and Isis®, all designed and engineered with comfort, reliability and sustainability in mind.

Today, over 60,000 Big Ass Fans are in operation in hundreds of different applications all over the world. Our ongoing success is due not only to our technologically advanced product line and unique marketing approach, but also in large part to the hard work and commitment of a dedicated, enthusiastic workforce who maintain an unwavering focus on our customers.

WHERE WE DO IT

Headquartered in Lexington, KY, Big Ass Fans occupies a 100,000 sq. ft. manufacturing facility and a 33,000 sq. ft. administrative office. In 2009, as further evidence of our commitment to innovation and an enduring future, Big Ass Fans built the world's first (and only) LEED®-Gold Research & Development facility dedicated to advancing large diameter fan technology. This imposing 44,000 sq. ft. edifice remains the definitive statement of our commitment to sustainability and to the art and science of fan development.

Top: *Big Ass Fans' LEED®-Gold certified R&D facility*
Bottom: *Interior of the R&D Center*

WHAT IT MEANS FOR OUR CUSTOMERS

Reducing energy consumption and maximizing thermal comfort are critical to Big Ass Fans' success. But we don't stop there. The company's unique, hands-on business approach, from design through manufacturing, as well as our commitment to buying locally sourced components, ensures that Big Ass Fans are of the highest possible quality. Big Ass Fans' performance, reliability, durability, unprecedented warranty, team of certified independent installers, proven service record and customer advocacy continue to deliver the best overall value in the industry.

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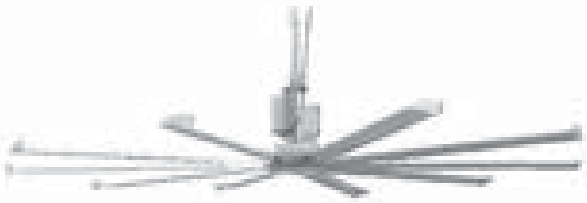


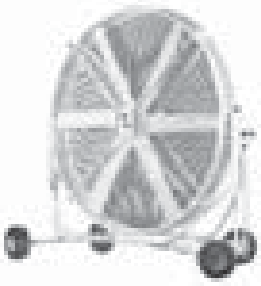
POWERFOIL X

POWERFOIL X

ELEMENT

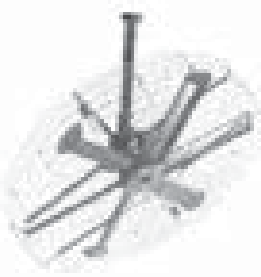
ISIS

AIRGO



AIRGO

pivot



pivot

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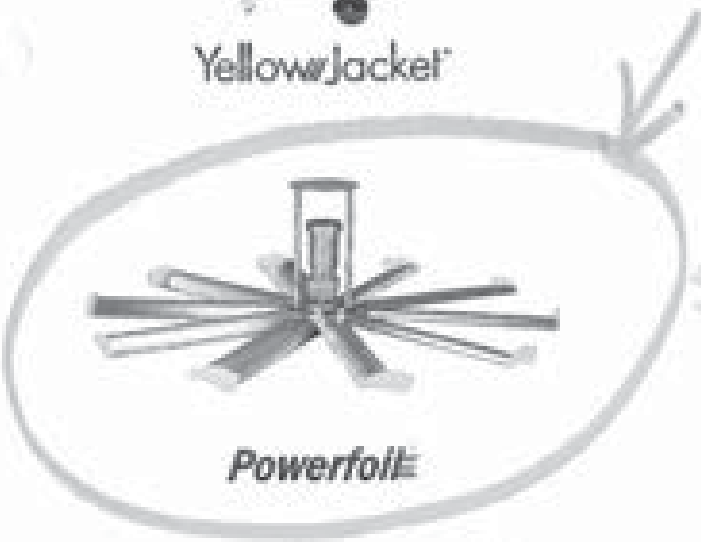
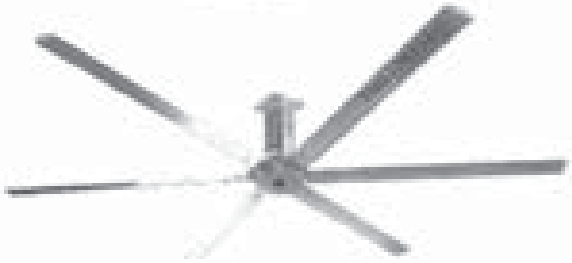
YellowJacket®

ISIS®

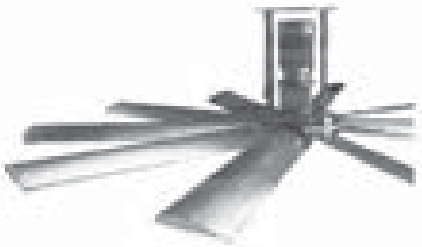


Powerfoil®

Powerfoil® Plus



ShopFan®



Wickerbill

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Warranty Information*

Powerfoil® X, Powerfoil® X Plus, Element®, Isix®:
- Hub & Airfoils - Lifetime
- Labor - 1 Year
- Motor, Gearbox, Controller Components:
  - 5 Years w/o Install
  - 10 Years w/ Standard or Turnkey Install

Pivot™, AirGo® AE, AirGo®, Powerfoil® Plus, Powerfoil®, Wickedbill:
- Hub & Airfoils - Lifetime
- Labor - 1 Year
- Motor, Gearbox, Controller Components - 3 Years

Yellow Jacket®:
- Hub & Airfoils - Limited Lifetime (Parts)
- Motor & Electrical Components - 3 Years (Parts)
- Workmanship - Limited Lifetime (free from defects in workmanship and/or materials)

*Warranty information provided here applies to new units only.

Standard Terms - Net 30 Days Upon Approval

Shipping and Handling is an estimate, Tax excluded from proposals unless requested or provided.

Restocking fee for unopened shipping boxes is 25%; opened boxes will incur a 50% restocking fee. Returns must be received within 90 days. Customer will be responsible for return freight charges.

The Buyer must insure that product specifications are consistent with actual field installation requirements. Big Ass Fans product recommendations are based on product specifications as transmitted to the company. As such, Big Ass Fans is not responsible for inaccuracies between the communicated product specifications and actual field installation requirements. The Buyer of the specified products assumes responsibility for the cost of returning or exchanging specified product where specified product does not meet field requirements.

Installation pricing is quoted in good faith for normal business hours and working conditions.
- Normal business hours are defined as Monday-Friday 8am-5pm, weekends and holidays excluded.
- Normal working conditions exclude such items but are not limited to:
  Prevailing wage, union wages, certified payroll, mandatory work stoppages, operational delays.

CLIENT	BIG ASS FANS
Signature	Signature
Print Name	Print Name
Date	Date

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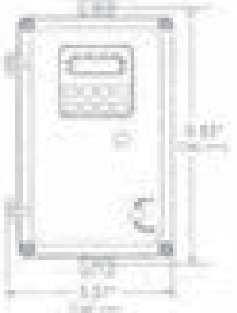
Powerfoil

8 Ft	Extension Tubes
	1 ft (0.3 m) to 10 ft (4.5 m)
	Standard 1 ft (0.3 m) shown

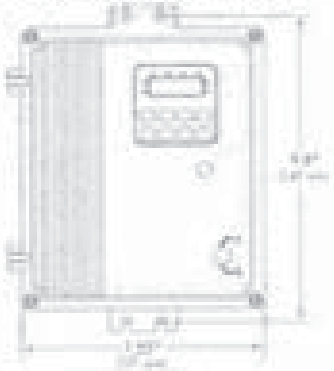
Technical Specifications	
Model number	PF08
Number and type of airfoils	10 Patented Powerfoil® airfoils
Airfoil finish	Mill finish aluminum
Winglet (standard color)	Powerfoil winglet (safety yellow)
Fan weight (as shown)	206 lbs (93 kg)
Motor	1.0 HP (0.75 kw)
Maximum speed	112 RPM
Maximum amps	3.8 A @ 200-250 V ~~1.7 A @ 400-480 V~~
Input power and required breaker	200-250 VAC, 50/60 Hz, 1 Φ, 20 A ~~200-250 VAC, 50/60 Hz, 3 Φ, 15 A~~ ~~400-480 VAC, 50/60 Hz, 3 Φ, 10 A~~
Controller	Variable speed controller, NEMA 4X
Sound level at maximum speed	< 55 dBA
Minimum airfoil clearances required	2 ft (0.6 m) on sides 3 ft (0.9 m) below ceiling deck
Certifications	ANSI/UL 507 CAN/CSA C 22.2 No. 113-08 CE

[1] Fan weight excludes standard 1 ft extension tube and mounting hardware.
[2] Sound level measured at a blade height of 20 ft and 20 ft horizontally from center of fan.

Controller
100-125 V & 200-250 V (Single Phase)



Controller
200-250 V & 400-480 V (Three Phase)



Powerfoil Features
- Powerfoil winglets and airfoils

Powerfoil Options
- Special purpose motors
- Custom color packages
- SmartSense365 for year-round automated control

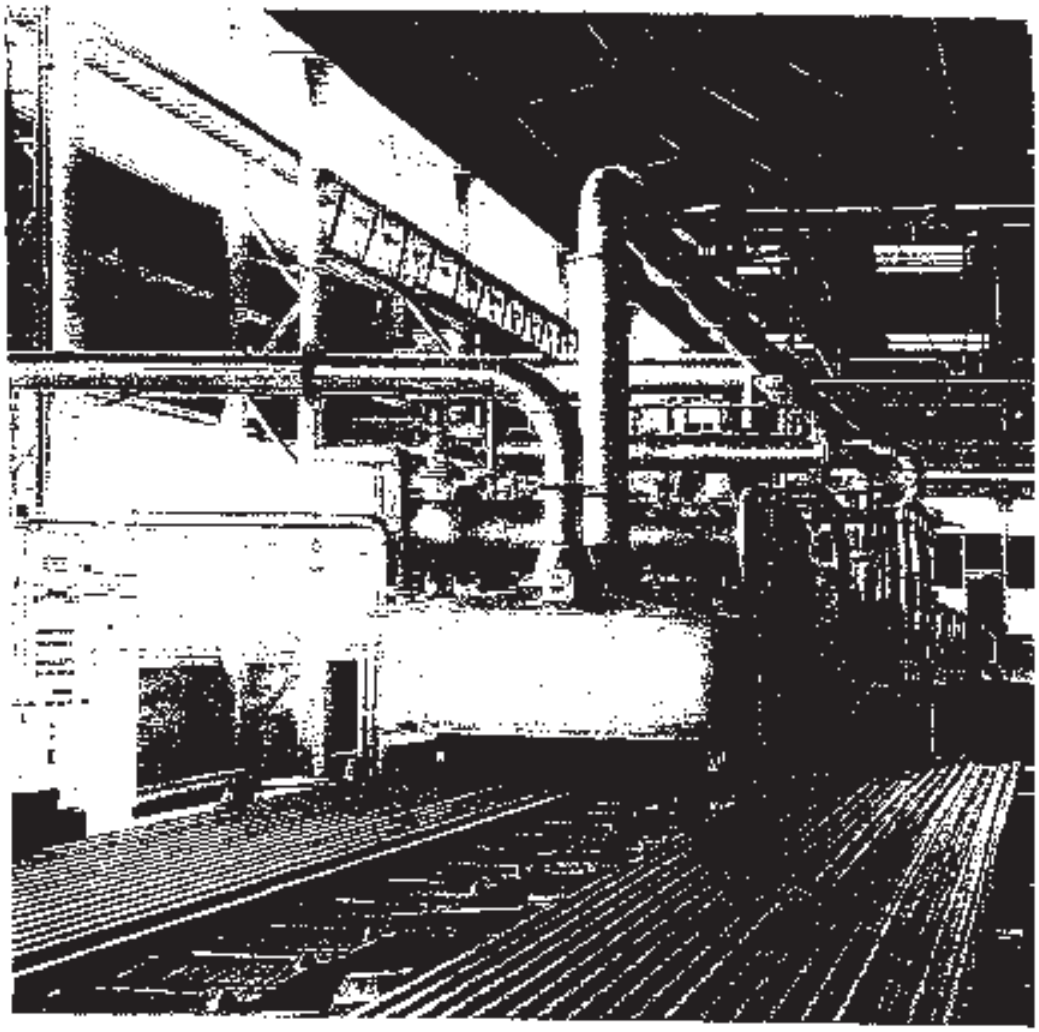
Controller Features
- Compact and versatile controller
- Dust tight, water tight and corrosion resistant
- LED display with status indicators
- Special controllers available upon request

Technical Literature

17) Black Steel Pipe

PSP STEEL PIPE & TUBE

General Purpose in Building Services



PUSAN STEEL PIPE

Tubes for Structural & Mechanical Purposes

Lightweight and durable, a widely varied range of PSP general structural tubes also boasts the advantages of economy plus a remarkable degree of versatility. Tubes for diverse mechanical purposes are manufactured and rigorously tested to specificatio

■ Structural Tubes

Characteristic lightness of steel pipe structures means they afford cost reduction in terms of transportation, convenient assembly, and easy restproofing to enable a lastingly attractive appearance.

Fabricated with homogeneous materials, PSP structural tubes are also recognized for superiority in multidirectional moment of inertia as well as radius of curvature strength.

Various specifications are available for use in bridges, electric utility poles, steel furniture, steel towers, scaffolding, motorized vehicles and bicycles.

■ Mechanical Tubes

Since tubes for mechanical purposes are applied so widely, they must differ accordingly in precision, surface treatment and physical properties.

PSP produces tubes based on specific standards of appl cation, aiming at perfection through visual examination coupled with other required inspections involving water pressure, eddy current, magnetic particles, ultrasonic waves and indestructibility.

Production is governed by meticulous quality control, ensuring stable mechanical properties. Assured as well are outstanding extension plus a substant al product range for broad applicability.

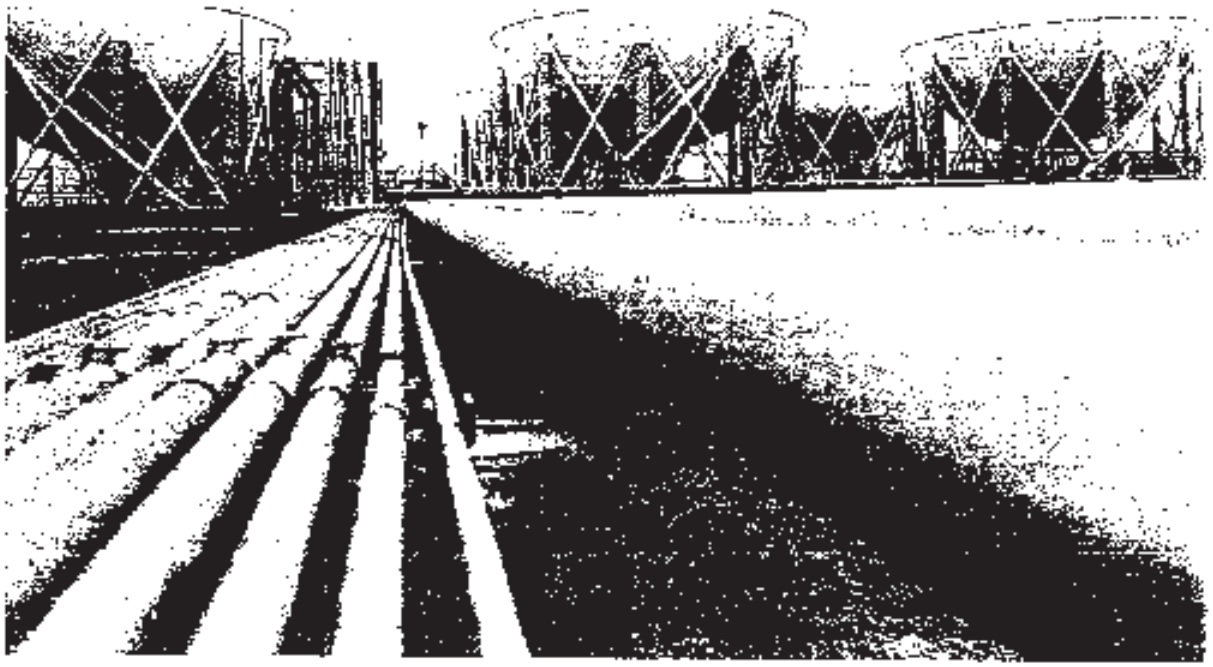
Carbon Steel Pipe & Tube for Heat Transfer

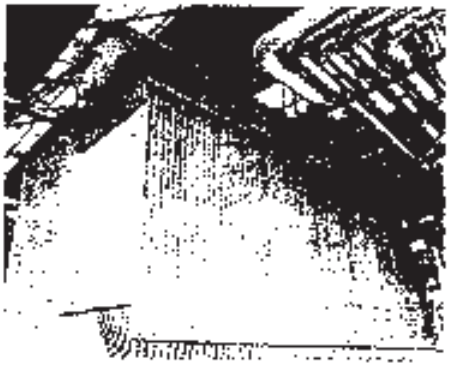
End-to-end control over all variables, from raw material to final delivery, is what guarantees users of PSP carbon steel pipe the maximum possible level of value received, regardless of the intended mode of heat transfer.

Steel tube products by PSP for heat exchangers and boilers are not in the least inferior in comparison to seamless pipe.

Heat exchangers in chemical industries employ our tubes for water, smoke, preheating and superheating applications. For petroleum industries, we also supply tubes used in heat exchangers plus condenser and catalyzer tubes.

In addition, all products undergo perfect heat treatment for finer machinability, while capping at each end prevents internal contamination.





Main Products

Carbon Steel Pipes for Ordinary Piping	○ Pipes for Water Piping ○ Pipes for General Ordinary Piping	▶ For City & Industrial Water, Irrigation & Agriculture Water, Oil & Gas Supply, Sprinkler, Fire Hydrant, Ship Piping, ect	KS D3507, D3507 JIS G3452 BS 1387, 3601 ASTM A530 EN10255 EN10217-1
Oil Country Tubular Goods	○ Line Pipe ○ High Test Line Pipe ○ Casing & Tubing API 5CT	▶ For use conveying Gas, Water, and Oil, in producing operation in both Oil and Natural Gas Industries	API 5L, 5CL
Conduit Tubes	○ Electrical Metallic Tubing ○ Thin Wall Conduit Tubes ○ Thick Wall Conduit Tubes	▶ For electric wiring	KS C8401 JIS C8305 UL 6, 797 CSA ANSI C80.1, C80.2 C80.3
Carbon Steel Tubes for Structural Purpose	○ Tubes for General Structural Purpose ○ Tubes for Mechanical Structural Purpose ○ Automobile Structural Purposes ○ Fence Tubes ○ Pipe Scaffoldings ○ Supports ○ Posts for Green House ○ Steel Pipe Pile ○ Steel Pipe Pole	▶ For Building, Bridge, Harbor, Machinery, Steel Tower, Automobile, Bicycle, Electric Light Post, Scaffold, Steel Furniture, Support, Hand Rail and Fence etc	KS D3566, D3517 JIS G3444, G3445 A5525 ASTM A252, A500 A513
Spiral Welded Pipe	○ Asphalt Coating Pipe ○ Coal-tar Enamel Coating Pipe ○ Steel Fittings for Coating Steel Pipes for Water Service ○ Bare Spiral Pipe ○ Steel Pipe Pile	▶ For Water, Gas, Oil Piping & other purposes such as Temporary Structures, Grouping, Supply & exhaust piping for Steam & Air	KS D3563 JIS G3457 ASTM A211, A139 AWWA C200
Carbon Steel Pipes for Pressure Service	○ Pipes for Pressure Service	▶ For Pressure Service at the Temperature not exceeding 350℃	KS D3562 JIS G3454
Carbon Steel Tubes for Heat Transfer	○ Boiler Tubes ○ Heat Exchanger Tubes	▶ For Heat Exchange such as Water Tube, Smoke Tube, Superheater Tube, Air Preheater Tube, Reheater Tube, Economizer Tube, Condenser Tube and Cooler Tube in the Chemical or, Petroleum Industries	KS D3532 JIS G3461 ASTM A178, A192, A210, A209, A213, A334 ASME
Carbon Steel Pipe for Boiler	○ Boiler Tubes ○ Heat Exchanger Tubes ○ Steel Heater Tubes	▶ For Boiler, Pressure Vessel, Condenser, Machinery, Pressure Piping system	KS ASME JIS G3461 DIN
Carbon Alloy Steel Pipes for Boiler	Boiler, Superheater & Steam Air Preheater, Condenser, Heat Exchanger, Economizer, Water Wall Tubes, Boiler Tubes	▶ For Boiler, Heat Exchanger, Condenser, Economizer, Superheater, Reheater, Steam Generator, Petroleum Refinery, Petrochemical Plant	ASTM A213 ASME DIN
Alloy Steel Pipes for High Temperature Service	Pipes for Pressure Service	▶ For Pressure Service at the Temperature exceeding 350℃	KS D3570 JIS G3458

▪ Stainless Steel Pipes for Ordinary Piping	○ Pipes for Water Piping ○ Pipes for General Ordinary Piping	▶ For City & Industrial Water, Irrigation & Agriculture Water, Oil & Gas Supply, Sprinkler, Fire Hydrant, Ship Piping, ect	KS D3576 JIS G3459 BS 1387, 3601 ASTM A312 EN10255 EN10217-7
▪ Stainless Steel Tubes for Heat Transfer	○ Boiler Tubes ○ Heat Exchanger Tubes	▶ For Heat Exchange such as Water Tube, Smoke Tube, Superheater Tube, Air Preheater Tube, Reheater Tube, Economizer Tube, Condenser Tube and Cooler Tube in the Chemical or, Petroleum Industries	KS D3536 JIS G3463 ASTM A213, A249, A269, A270 ASME
▪ Stainless Steel Pipes for Pressure Service	○ Pipes for Pressure Service	▶ For Pressure Service at the Temperature not exceeding 350℃	KS D3576 JIS G3459
▪ Stainless Steel Pipes for High Temperature Service	○ Pipes for Pressure Service	▶ For Pressure Service at the Temperature exceeding 350℃	KS D3577 JIS G3460
▪ Stainless Steel Tubes for Heat Transfer	○ Boiler Tubes ○ Heat Exchanger Tubes	▶ For Heat Exchange such as Water Tube, Smoke Tube, Superheater Tube, Air Preheater Tube, Reheater Tube, Economizer Tube, Condenser Tube and Cooler Tube in the Chemical or, Petroleum Industries	KS D3536 JIS G3463 ASTM A213, A249, A269, A270 ASME

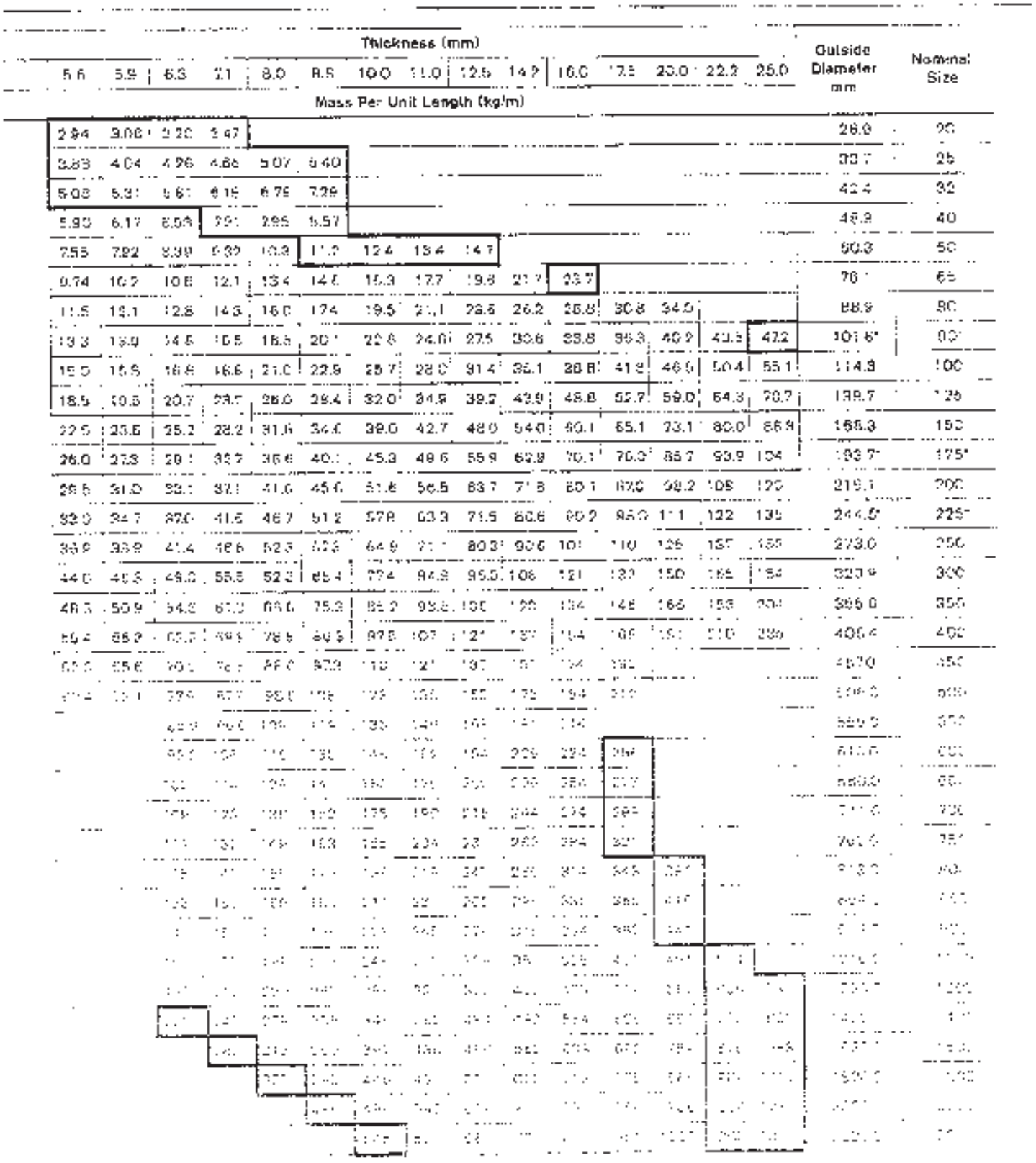
Galvanize Iron & Black Steel Pipe to EN 10255 : 2004

Series	Nominal Size		Outside Diameter		Wall Thickness	Weight	
						Plain End	Threaded and Sockeled
	(in.)	(mm)	max. (mm)	min. (mm)	(mm)	(kg/m)	(kg/m)
Type L2	1/4	13.5	13.6	13.2	1.8	0.515	0.515
	3/8	17.2	17.1	16.7	1.8	0.67	0.676
	1/2	21.3	21.4	21	2	0.947	0.956
	3/4	26.9	26.9	26.4	2.3	1.38	1.39
	1	33.7	33.8	33.2	2.6	1.98	2
	1 1/4	42.4	42.5	41.9	2.6	2.54	2.57
	1 1/2	48.3	48.4	47.8	2.9	3.23	3.27
	2	60.3	60.2	59.6	2.9	4.08	4.15
	2 1/2	76.1	76	75.2	3.2	5.71	5.83
	3	88.9	88.7	87.9	3.2	6.72	6.89
	4	114.3	113.9	113	3.6	9.75	10
Medium	1/4	13.5	14	13.2	2.2	0.641	0.648
	3/8	17.2	17.6	16.7	2.3	0.839	0.845
	1/2	21.3	21.8	21	2.6	1.21	1.22
	3/4	26.9	27.3	26.5	2.6	1.56	1.57
	1	33.7	34.2	33.3	3.2	2.41	2.43
	1 1/4	42.4	42.9	42	3.2	3.1	3.13
	1 1/2	48.3	48.8	47.9	3.2	3.56	3.6
	2	60.3	60.8	59.7	3.6	5.03	5.1
	2 1/2	76.1	76.6	75.3	3.6	6.42	6.54
	3	88.9	89.6	88	4	8.30	8.53
	4	114.3	115	113.1	4.5	12.2	12.5
	5	139.7	140.8	138.5	5	16.6	17.1
	6	165.1	166.5	163.9	5	19.8	20.4
Heavy	1/4	13.5	14	13.2	2.9	0.765	0.769
	3/8	17.2	17.6	16.7	2.9	1.02	1.03
	1/2	21.3	21.8	21	3.2	1.44	1.45
	3/4	26.9	27.3	26.5	3.2	1.87	1.89
	1	33.7	34.2	33.3	4	2.93	2.95
	1 1/4	42.4	42.9	42	4	3.79	3.82
	1 1/2	48.3	48.8	47.9	4	4.37	4.41
	2	60.3	60.8	59.7	4.5	6.19	6.26
	2 1/2	76.1	76.6	75.3	4.5	7.91	8.05
	3	88.9	89.6	88	5	10.3	10.5
	4	114.3	115	113.1	5.4	14.5	14.8
	5	139.7	140.8	138.5	5.4	17.9	18.4
	6	165.1	166.5	163.9	5.4	21.3	21.9

EN 10217-1 / BS 3601 Steel Pipes and Tubes for Pressure Purposes (Room Temperature)
BS 3602 Steel Pipes and Tubes for Pressure Purposes (Elevated Temperature)
BS 3603 Steel Pipes and Tubes for Pressure Purposes (Low Temperature)
BS 3604 Steel Pipes and Tubes for Pressure Purposes (Ferritic Alloy Steel with Specified Elevated Temperature)
BS 3605 Seamless and Welded Austenitic Stainless Steel Pipes and Tubes for Pressure Purposes
BS 4360 Weldable Structural Steels

(1) Available Size (Dimension and Weights)

Nominal Size	Outside Diameter (mm)	Thickness (mm)									
		2.0	2.3	2.6	2.9	3.2	3.6	4.0	4.5	5.0	5.4
		Mass Per Unit Length (kg/m)									
20	26.9			1.56	1.72	1.87	2.07	2.28	2.49	2.70	2.86
25	33.7					2.41	2.67	2.95	3.24	3.54	3.77
32	42.4					3.09	3.44	3.79	4.21	4.61	4.93
40	48.3						3.97	4.37	4.86	5.34	5.71
50	60.3		2.82	3.29	3.70	4.11	4.61	5.08	5.65	6.19	6.62
65	76.1		3.55	4.19	4.71	5.24	5.75	6.44	7.11	7.85	8.77
80	88.9			4.91	5.53	6.15	6.76	7.57	8.38	9.07	10.3
90	101.6			5.63	6.36	7.06	7.77	8.70	9.68	10.6	11.9
100	114.3			6.34	7.16	7.97	8.77	9.83	10.9	12.0	13.5
125	139.7					9.8	10.1	13.4	15.0	16.6	17.9
150	168.3					12.0	13.6	16.2	18.2	20.1	21.7
175	193.7							18.7	21.0	23.3	25.1
200	219.1					17.0	19.1	21.2	23.8	26.4	28.5
225	244.5							23.7	26.6	29.5	31.8
250	273.0							26.5	29.7	33.0	35.6
300	323.9								35.4	39.3	42.4
350	355.6									43.2	46.6
400	406.4									49.5	53.4
450	457.0									55.7	60.1
500	508.0									62.0	66.9
550	559.0										
600	610.0										
650	660.0										
700	711.0										
750	762.0										
800	813.0										
850	864.0										
900	914.0										
950	965.0										
1000	1016.0										
1050	1067.0										
1100	1118.0										
1150	1168.0										
1200	1219.0										



Thickness (mm)															Outside Diameter mm	Nominal Size
5.6	5.9	6.3	7.1	8.0	8.5	10.0	11.0	12.5	14.2	16.0	17.5	20.0	22.2	25.0		
Mass Per Unit Length (kg/m)																
2.84	3.00	3.30	3.47												26.9	20
3.83	4.04	4.26	4.86	5.07	5.40										33.7	25
5.03	5.31	5.61	6.15	6.75	7.29										42.4	32
5.90	6.17	6.56	7.21	7.95	8.57										48.3	40
7.55	7.92	8.39	9.32	10.3	11.0	12.4	13.4	14.7							60.3	50
9.74	10.2	10.8	12.1	13.4	14.4	16.3	17.7	19.6	21.7	23.7					76.1	65
11.5	12.1	12.8	14.3	16.0	17.4	19.5	21.1	23.6	26.2	28.8	30.8	34.0			88.9	80
13.3	13.9	14.8	16.5	18.5	20.1	22.6	24.6	27.5	30.6	33.8	36.3	40.2	43.5	47.2	101.6	90
15.0	15.8	16.8	18.6	21.0	22.9	25.7	28.0	31.4	35.1	38.8	41.8	46.6	50.4	55.1	114.3	100
18.5	19.5	20.7	23.0	26.0	28.4	32.0	34.9	39.2	43.9	48.8	52.7	59.0	64.3	70.7	139.7	125
22.5	23.6	25.2	28.2	31.8	34.8	39.3	42.7	48.0	54.0	60.1	65.1	73.1	80.0	88.9	168.3	150
26.0	27.3	29.1	32.7	36.8	40.3	45.3	49.6	55.9	62.9	70.1	76.0	85.7	93.9	104	193.7	175*
28.5	31.0	33.1	37.1	41.8	45.8	51.8	56.5	63.7	71.8	80.1	87.0	98.2	108	120	219.1	200
32.0	34.7	37.0	41.6	46.7	51.2	57.8	63.3	71.5	80.6	90.2	98.0	111	122	135	244.5*	225*
36.9	38.9	41.4	46.6	52.3	57.3	64.9	71.1	80.3	90.6	101	110	126	137	153	273.0	250
44.0	46.3	49.3	55.5	62.3	68.4	77.4	84.9	95.9	108	121	133	150	165	184	323.9	300
48.3	50.9	54.2	61.0	68.6	75.3	85.2	93.5	106	120	134	146	166	183	204	355.6	350
54.4	57.2	60.9	68.6	77.2	84.8	96.0	105	119	135	151	165	188	207	230	406.4	400
60.3	63.5	67.6	76.2	85.8	94.3	107	117	133	150	168	183	209	230	256	457.0	450
64.4	67.8	72.2	81.3	91.6	101	114	125	142	160	179	195	223	246	273	488.0	500
		75.9	85.5	96.3	106	120	131	149	168	188	205	234	258	287	512.0	550
		81.3	91.6	103	114	129	141	160	180	202	220	251	277	308	550.0	600
		86.7	97.7	110	121	138	151	171	193	216	236	269	297	330	588.0	650
		92.1	104	117	129	147	161	183	205	230	251	286	316	352	626.0	700
		97.5	110	124	136	155	170	193	217	243	266	303	335	373	664.0	750
		102	115	130	143	163	179	203	229	257	281	321	354	395	702.0	800
		108	121	137	151	172	189	214	241	271	296	338	374	417	740.0	850
		113	127	144	158	180	198	224	253	284	311	355	393	438	778.0	900
		119	134	151	166	189	208	235	265	298	326	372	412	460	816.0	950
		124	140	158	173	197	217	245	277	312	341	389	431	481	854.0	1000
		130	146	165	181	206	227	256	289	326	356	406	450	502	892.0	1050
		135	152	172	188	214	236	267	301	339	371	423	469	524	930.0	1100
		141	159	179	196	223	246	277	313	353	386	440	488	545	968.0	1150
		147	165	186	203	231	255	288	325	367	401	457	507	567	1006.0	1200
		152	171	193	211	240	264	299	337	381	416	475	526	588	1042.0	1250
		158	178	200	219	248	274	309	349	394	431	492	545	609	1080.0	1300
		163	184	207	226	257	283	320	361	408	446	509	564	630	1118.0	1350
		169	190	214	234	265	293	331	373	422	461	526	583	651	1156.0	1400
		174	196	221	241	274	302	341	385	435	476	543	602	672	1194.0	1450
		180	202	228	249	282	312	352	397	449	491	560	621	693	1232.0	1500
		185	208	235	256	291	321	363	409	463	506	577	640	714	1270.0	1550
		191	215	242	264	299	331	373	421	476	521	594	659	735	1308.0	1600
		196	221	249	271	308	340	384	433	490	536	611	678	756	1346.0	1650
		202	227	256	279	316	350	395	445	504	551	628	697	777	1384.0	1700
		207	233	263	286	325	359	405	457	517	566	645	716	798	1422.0	1750
		213	239	270	294	333	369	416	469	531	581	663	735	819	1460.0	1800
		218	245	277	301	342	378	427	481	545	596	680	754	840	1498.0	1850
		224	251	284	309	350	388	437	493	558	611	697	773	861	1536.0	1900
		229	257	291	316	359	397	448	505	572	626	714	792	882	1574.0	1950
		235	263	298	324	367	407	459	517	586	641	731	811	903	1612.0	2000
		240	269	305	331	376	416	469	529	599	656	748	830	924	1650.0	2050
		246	275	312	339	384	426	480	541	613	671	765	849	945	1688.0	2100
		251	281	319	346	393	435	491	553	627	686	782	868	966	1726.0	2150
		257	287	326	354	401	445	501	565	640	701	799	887	987	1764.0	2200
		262	293	333	361	410	454	512	577	654	716	816	906	1008	1802.0	2250
		268	299	340	369	418	464	523	589	668	731	834	925	1029	1840.0	2300
		273	305	347	376	427	473	533	601	681	746	851	944	1050	1878.0	2350
		279	311	354	384	435	483	544	613	695	761	868	963	1071	1916.0	2400
		284	317	361	391	444	492	555	625	708	776	885	982	1092	1954.0	2450
		290	323	368	399	452	502	565	637	722	791	902	1001	1113	1992.0	2500
		295	329	375	406	461	511	576	649	735	806	919	1020	1134	2030.0	2550
		301	335	382	414	469	521	587	661	749	821	936	1039	1155	2068.0	2600
		306	341	389	421	478	530	597	673	762	836	953	1058	1176	2106.0	2650
		312	347	396	429	486	540	608	685	776	851	970	1077	1197	2144.0	2700
		317	353	403	436	495	549	619	697	790	866	987	1096	1218	2182.0	2750
		323	359	410	444	503	559	629	709	803	881	1004	1115	1239	2220.0	2800
		328	365	417	451	512	568	640	721	817	896	1021	1134	1260	2258.0	2850
		334	371	424	459	520	578	651	733	831	911	1038	1153	1281	2296.0	2900
		339	377	431	466	529	587	661	745	844	926	1055	1172	1302	2334.0	2950
		345	383	438	474	537	597	672	757	858	941	1072	1191	1323	2372.0	3000

Marking

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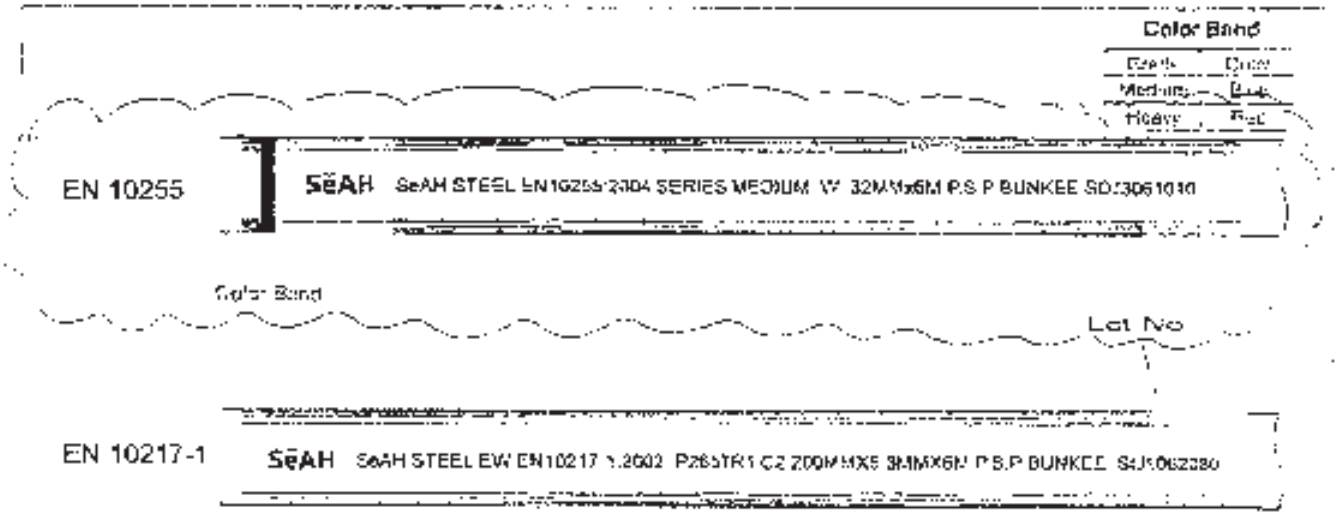
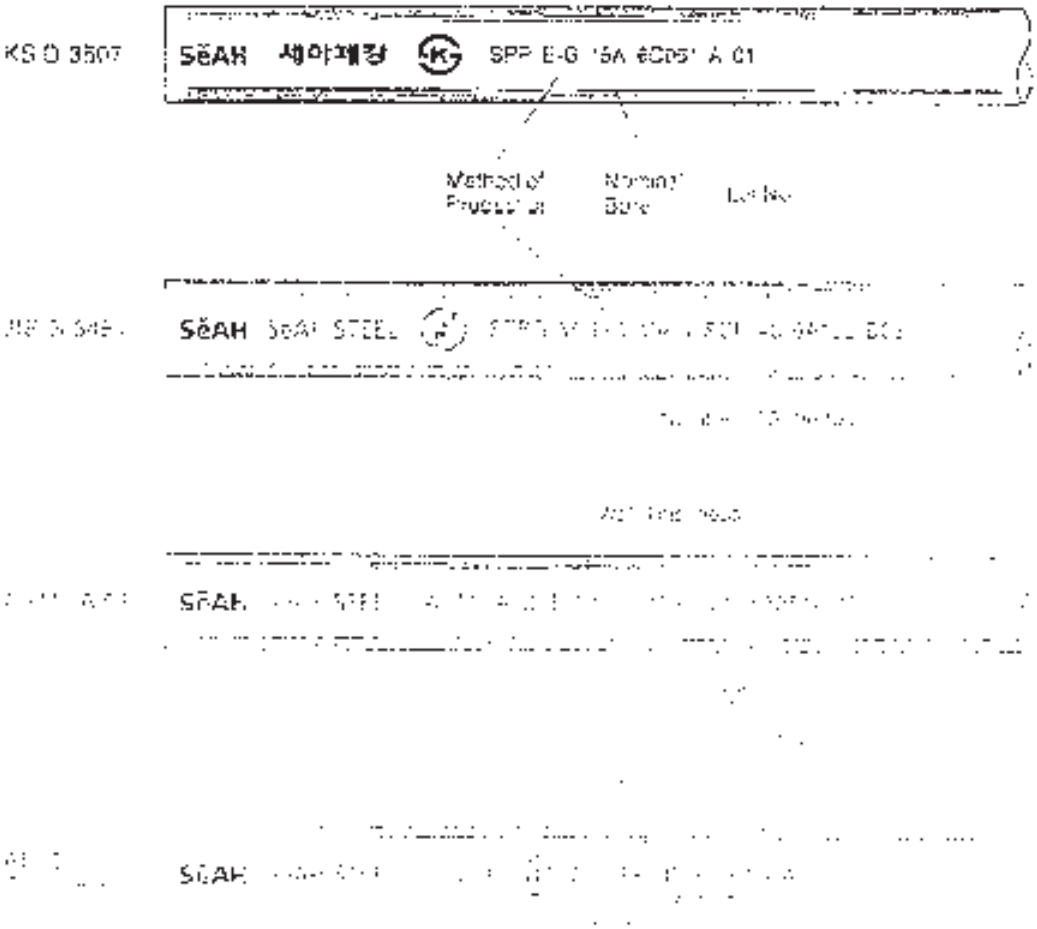




Technical Literature

18) Black Steel Pipe Fittings

STEEL WELDING PIPE FITTINGS

CARBON STEEL • STAINLESS STEEL

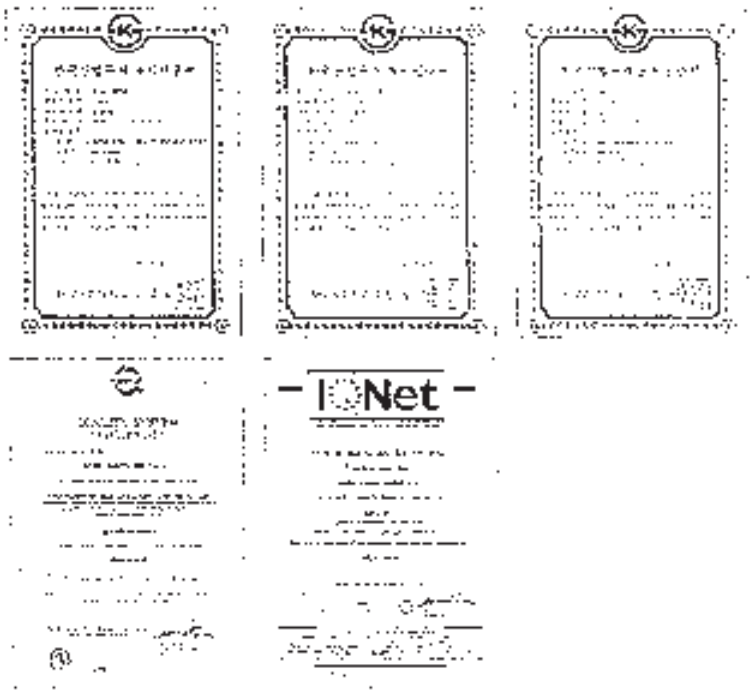
CONTENTS

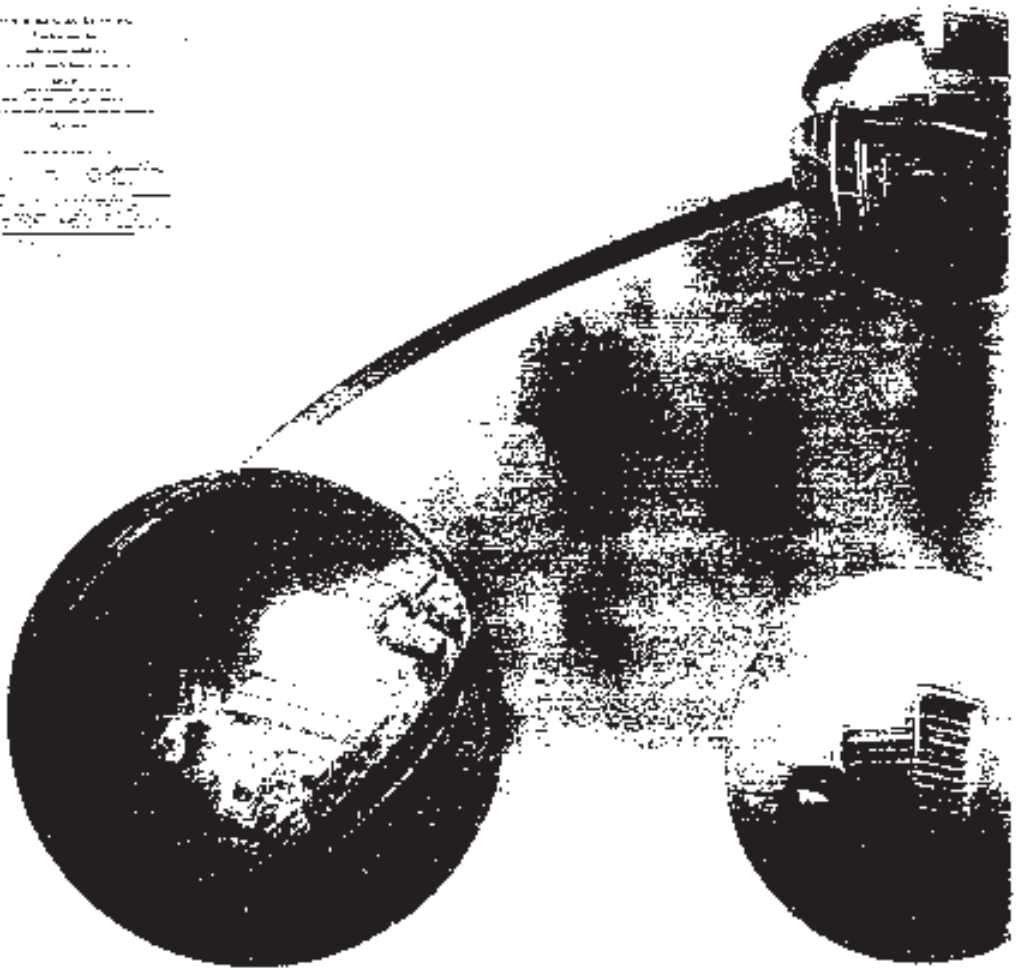
C 2.

MINERALITES

QUALITY CONTROL SYSTEM

CERTIFICATES





APPLICABLE SPECIFICATIONS

API Standard

API 5L Seamless And Welded Steel Line Pipe

API 5LX Seamless And Welded High-Test Line Pipe

ANSI STANDARDS

ANSI B16.9 Factory-Made Wrought Steel Butt-Welding Fittings

ANSI B16.28 Wrought Steel Butt Welding Short Radius Elbows and Returns

ANSI B16.5 Steel Pipe Flanges And Flanged Fittings.

ANSI B16.11 Forged Steel Fittings Socket-Welding and Threaded.

MSS STANDARDS

MSS SP-43 Wrought Stainless Steel Butt-Welding Fittings

MSS SP-75 Specification for High Test Wrought Butt-Welding Fittings.

MSS SP-79 Socket-Welding Reducer Inserts.

JIS STANDARDS

JIS B2311 Steel Butt-Welding Pipe Fittings for Ordinary Use.

JIS B2312 Steel Plate Butt-Welding Pipe Fittings

JIS B2313 Steel Pipe-Welding Pipe Fittings

JIS B2316 Steel Socket-Welding Pipe Fittings

BS STANDARDS

BS 1640 Steel Butt-Welding Pipe Fittings For The Petroleum Industry

Part 1 Wrought Carbon And Ferritic Alloy Steel Fittings

BS 1965 Butt Welding Pipe Fittings For Pressure Purposes Part 1

Carbon Steel & Ferritic Austenitic Steel Fittings

ASTM STANDARD

ASTM A234 Piping Fittings Of Wrought Carbon Steel And Alloy Steel

Materials For Low-Temperature Service

ASTM A403 Wrought Austenitic Stainless Steel Piping Fittings

ASTM A420 Piping Fittings Of Wrought Carbon Steel And Alloy Steel

For Low-Temperature Service

ASTM A815 Wrought Ferritic, Ferritic/Austenitic, And Martensitic

Stainless Steel Piping Fittings

ASTM A182 Forged Or Rolled Alloy-Steel Pipe Flanges, Forged Fittings,

And Valves And Parts For High-Temperature Service

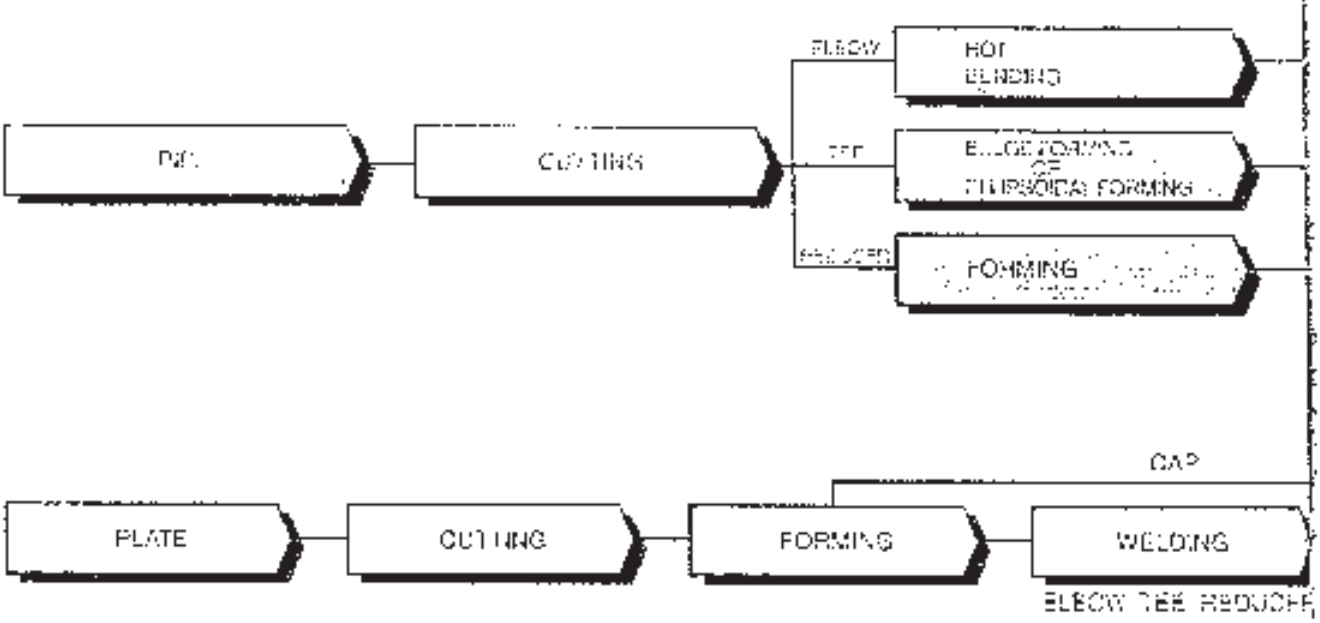
ASTM A105 Specification for Carbon Steel Forgings for Piping

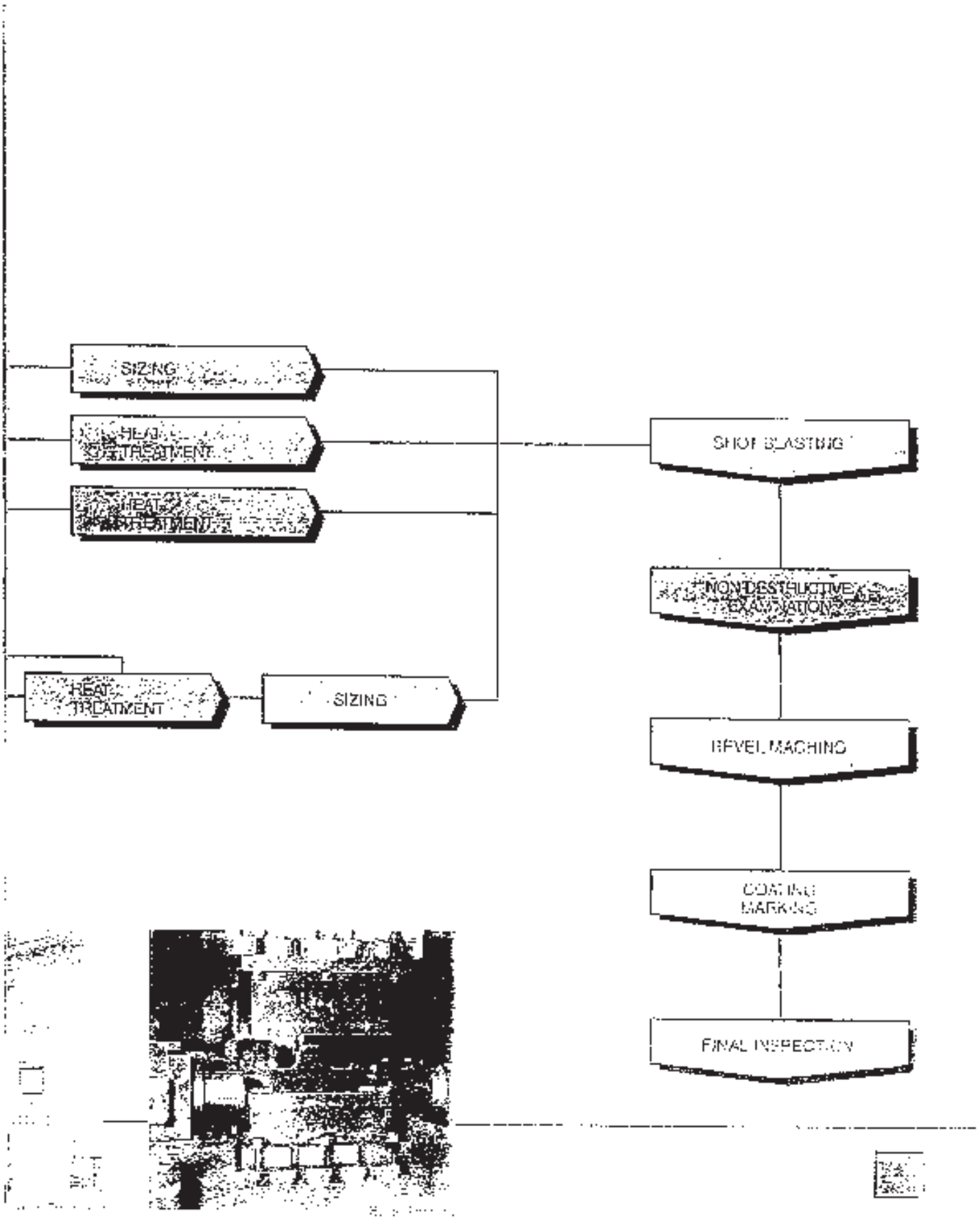
Components

ASTM A350 Specification for Carbon and Low-Alloy Steel Forgings,

Requiring Notch Toughness Testing for Piping Components

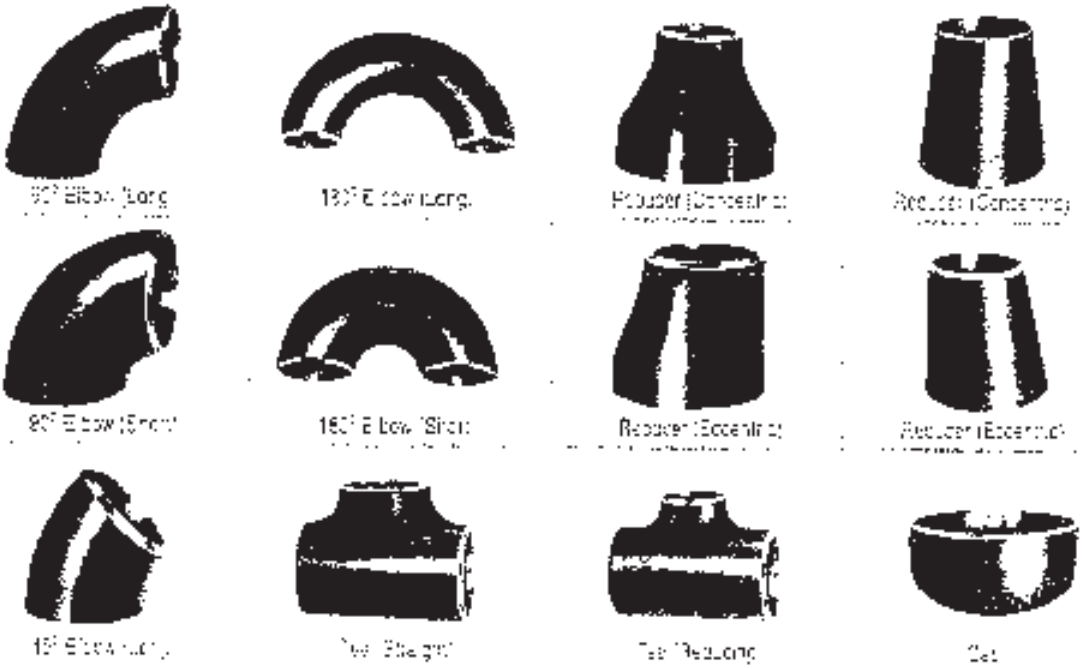
MANUFACTURING PROCESS



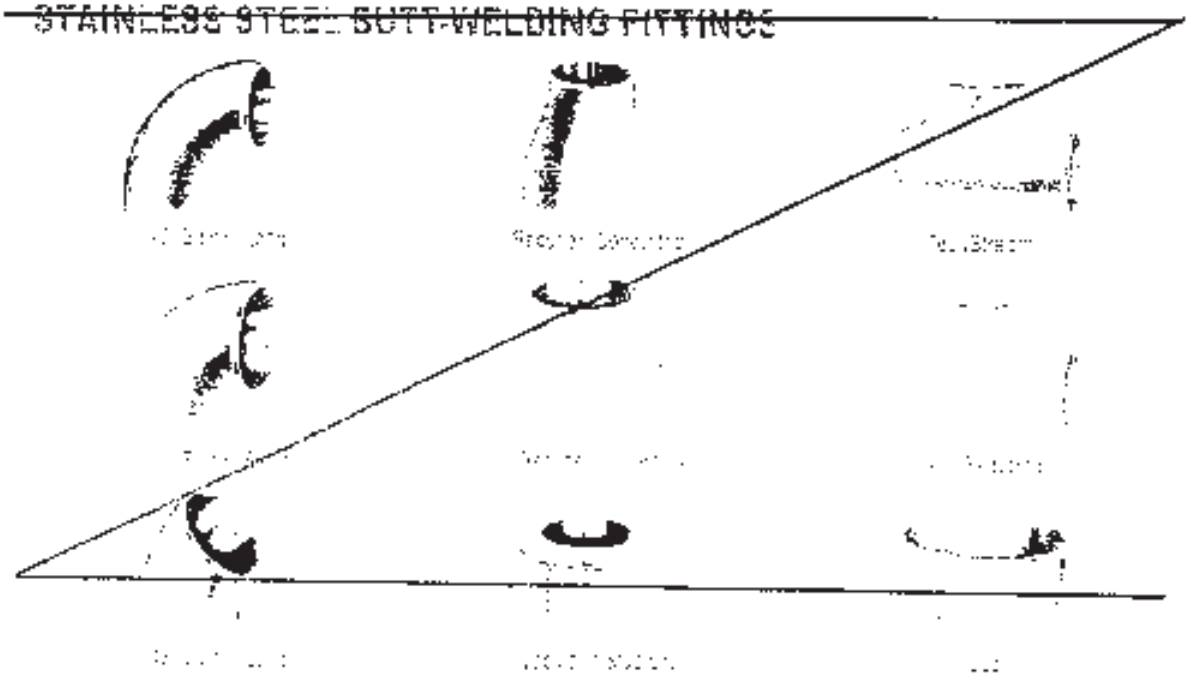

SIZING
HEAT TREATMENT
HEAT TREATMENT
HEAT TREATMENT
SIZING
SHOT BLASTING
NON DESTRUCTIVE EXAMINATION
BEVEL MACHING
COATING MARKING
FINAL INSPECTION

GENERAL ILLUSTRATION

WROUGHT STEEL BUTT-WELDING FITTINGS(Carbon & Alloy Steel)



STAINLESS STEEL BUTT-WELDING FITTINGS



MARKING SYSTEM

• BS/KS/JIS Products

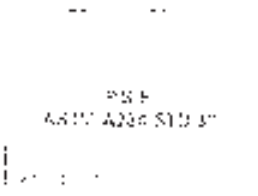
Steel Butt-Welding Fittings

1. Manufacturer identification mark
2. BS·KS or JIS material designation-the symbol identifying the type of material from which the products
3. Thickness designation or schedule number
4. Nominal size
5. Heat number(if necessary)

• ASTM A234/ANSI Products

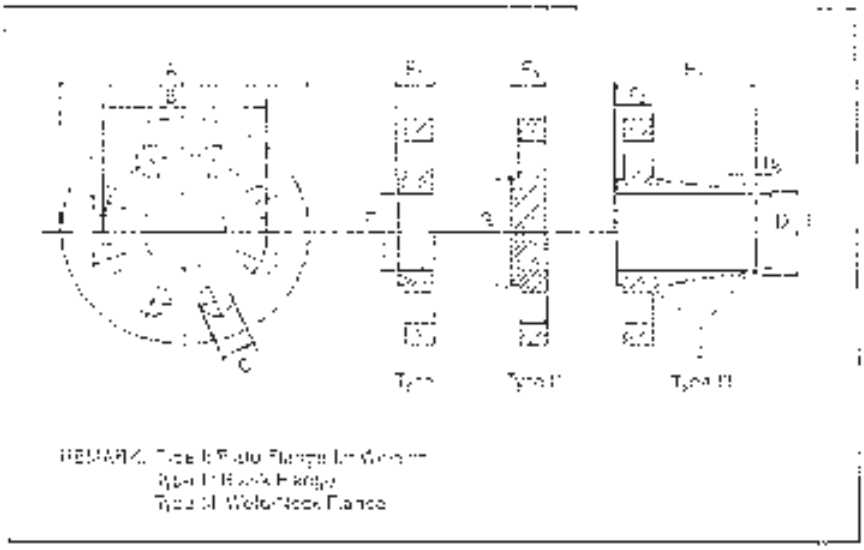
Steel Butt-Welding Fittings

1. Manufacturer identification mark
2. ASTM material designation-the symbol identifying the type of material from which the products
3. Seamless, welded or combined wall thickness designation
4. Nominal size
5. Heat number(if necessary)



PS

Circular flanges for pipes, valves and fittings to BS4504 PN16 (For Steel)

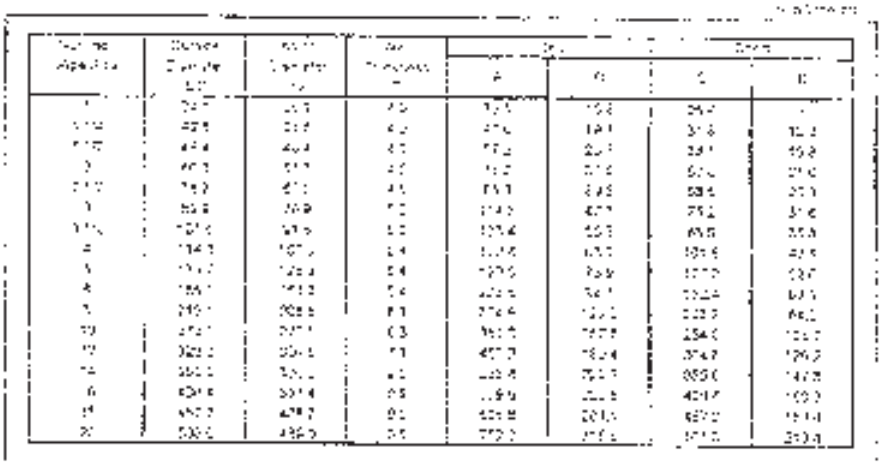


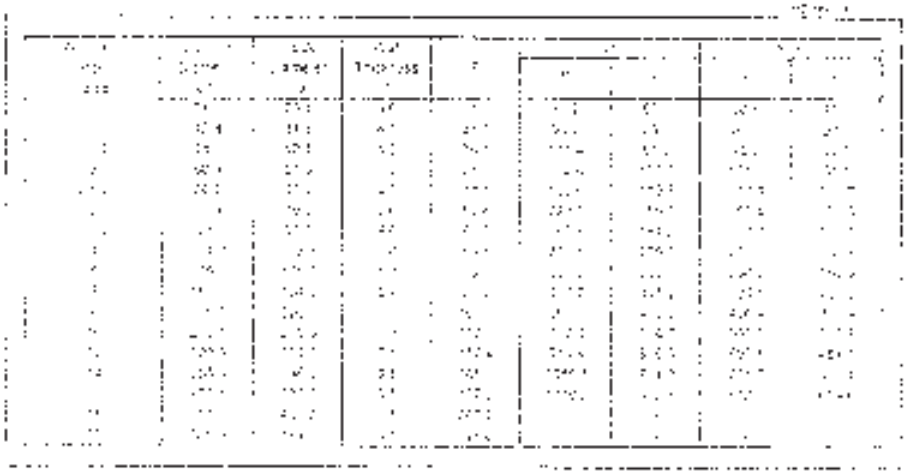
Nominal Size DN	Outside Diameter A	Diameter of Bolt Circle B	Diameter of Bolt Hole C	Bolting Number	Bolting Size	Outside Diameter of Neck D (Type II)	Bore Diameter E (Type I)
10	90	60	14	4	M12	17.2	18.0
15	95	65	14	4	M12	21.9	22.0
20	105	75	14	4	M12	27.6	27.4
25	115	85	14	4	M12	33.7	34.5
32	140	100	18	4	M16	42.4	43.2
40	150	110	18	4	M16	48.3	49.1
50	165	125	18	4	M16	60.3	61.2
65	185	145	18	8	M16	76.1	77.9
80	200	160	18	8	M16	88.9	90.5
100	220	180	18	8	M16	114.3	115.0
125	250	210	18	8	M16	139.7	141.3
150	285	240	22	8	M20	168.3	170.6
200	340	295	22	12	M20	219.1	221.8
250	405	355	26	12	M24	273.0	276.9
300	460	410	26	12	M24	323.9	327.6
350	520	470	26	16	M24	355.6	359.0
400	580	525	30	16	M27	406.4	410.0
450	640	585	30	20	M27	457.2	461.0
500	715	650	33	20	M30	508.0	513.0
600	840	770	36	20	M33	610.0	616.0
700	910	840	36	24	M33	711.0	716.0
750	970	900	36	24	M33	762.0	767.0
800	1025	950	36	24	M33	813.0	818.0
900	1125	1050	36	28	M33	914.0	919.0
1000	1255	1170	39	28	M36	1016.0	1021.0
1200	1485	1390	42	32	M39	1219.0	1224.0

Flange Thickness			Diameter of Shoulder	Lengths of Neck		Neck Diameter	
F_1 (Type I)	F_2 (Type II)	F_3 (Type II)	G (Type II)	H_1 (Type III)	H_2 (Type III)	I (Type III)	J (Type III)
14	14	14	-	35	6	28	3
14	14	14	-	35	6	33	3
16	16	16	-	45	6	37	4
16	16	16	-	54	6	42	4
18	18	18	-	45	6	33	4
18	18	18	-	54	7	44	4
20	18	18	-	45	6	44	5
20	18	18	33	45	10	66	5
20	20	20	35	45	10	110	5
22	22	22	40	45	10	110	5
22	22	22	45	45	10	132	5
24	22	22	50	45	10	154	6
24	24	24	55	45	10	154	6
26	24	24	60	45	10	176	6
26	26	26	65	45	10	198	7
28	26	26	70	45	10	198	7
28	28	28	75	45	10	220	7
30	28	28	80	45	10	220	7
30	30	30	85	45	10	242	8
32	30	30	90	45	10	242	8
32	32	32	95	45	10	264	8
34	32	32	100	45	10	264	8
34	34	34	105	45	10	286	9
36	34	34	110	45	10	286	9
36	36	36	115	45	10	308	9
38	36	36	120	45	10	308	9
38	38	38	125	45	10	330	10
40	38	38	130	45	10	330	10
40	40	40	135	45	10	352	10
42	40	40	140	45	10	352	10
42	42	42	145	45	10	374	11
44	42	42	150	45	10	374	11
44	44	44	155	45	10	396	11
46	44	44	160	45	10	396	11
46	46	46	165	45	10	418	12
48	46	46	170	45	10	418	12
48	48	48	175	45	10	440	12
50	48	48	180	45	10	440	12
50	50	50	185	45	10	462	13
52	50	50	190	45	10	462	13
52	52	52	195	45	10	484	13
54	52	52	200	45	10	484	13

Steel Butt-Welding Pipe Fittings
To BS 1965

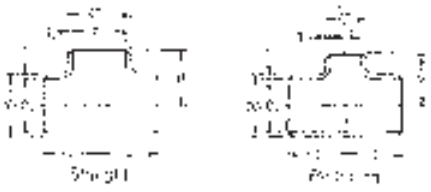
90° Elbows (Long, Short)
45° Elbows (Long, Short)





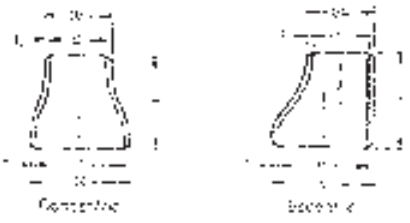
Steel Butt-Welding Pipe Fittings
To BS 1965

Tees



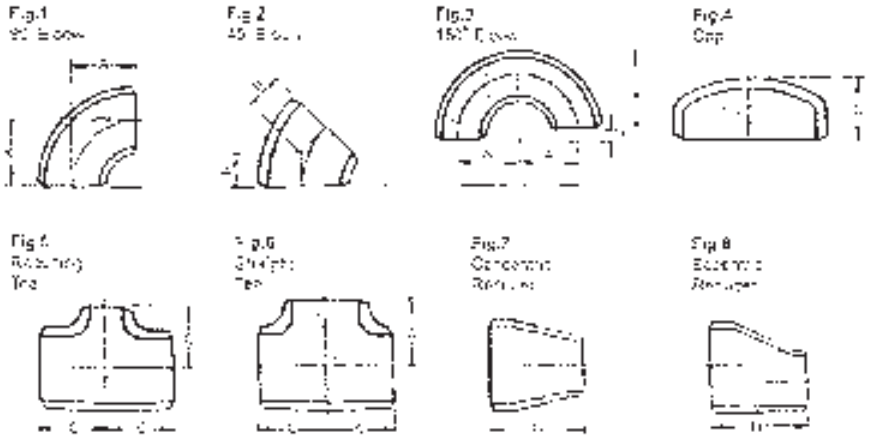
Steel Butt-Welding Pipe Fittings
To BS 1965

Reducers



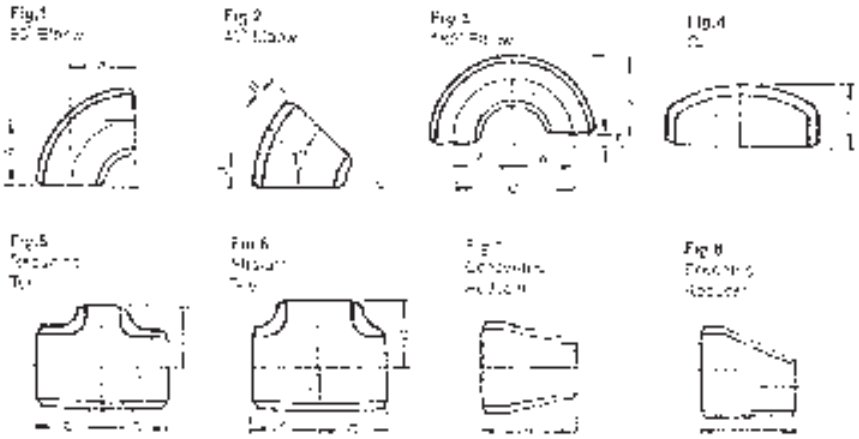
Nominal Size	Large End			Small End			H
	Outside Diameter	Inside Diameter	Wall Thickness	Outside Diameter	Inside Diameter	Wall Thickness	
	D		T	d		t	
	42.8	36.8	3.0	34.1	29.1	2.5	57.0
	48.4	42.4	3.0	42.4	36.9	2.5	73.0
	48.3	41.4	3.5	34.1	29	2.5	63.5
	60.3	53.9	3.5	48.4	42.4	3.0	76.2
	60.3	51.5	4.5	42.4	34.6	3.9	76.2
	60.3	53.9	3.5	34.1	28.7	2.5	76.2
	76.2	69.2	3.5	60.3	54.9	2.7	63.5
	76.2	69.2	3.5	48.4	42.4	3.0	88.9
	76.2	67.2	4.5	42.4	34.6	3.9	88.9
	76.2	69.2	3.5	34.1	28.1	3.0	88.9
	88.9	79.9	4.5	76.2	69.2	3.5	88.9
	88.9	79.9	4.5	60.3	54.9	3.0	88.9
	88.9	77.9	5.5	48.4	40.1	3.9	88.9
	88.9	79.9	4.5	42.4	34.2	3.9	88.9
	114.3	102.3	5.5	88.9	79.9	4.5	101.6
	114.3	102.3	5.5	76.2	67.4	4.5	101.6
	114.3	102.3	5.5	60.3	51.3	4.5	101.6
	114.3	102.3	5.5	48.4	40.1	4.0	101.6
	139.7	128.5	5.5	114.3	102.3	5.5	127.0
	139.7	128.5	5.5	88.9	79.9	4.5	127.0
	139.7	128.5	5.5	76.2	67.4	4.5	127.0
	139.7	128.5	5.5	60.3	51.3	4.5	127.0
	168.3	154.1	7.1	139.7	128.5	5.5	152.4
	168.3	154.1	7.1	114.3	102.3	5.5	152.4
	168.3	154.1	7.1	88.9	79.9	4.5	152.4
	168.3	154.1	7.1	76.2	67.4	4.5	152.4
	219.1	202.7	8.2	168.3	154.1	7.1	203.2
	219.1	202.7	8.2	139.7	128.5	5.5	203.2
	219.1	202.7	8.2	114.3	102.3	5.5	203.2
	219.1	202.7	8.2	88.9	79.9	4.5	203.2
	273.0	254.5	9.3	219.1	202.7	8.2	254.0
	273.0	254.5	9.3	168.3	154.1	7.1	254.0
	273.0	254.5	9.3	139.7	128.5	5.5	254.0
	273.0	254.5	9.3	114.3	102.3	5.5	254.0
	323.9	304.7	9.5	273.0	254.5	9.3	304.8
	323.9	304.7	9.5	219.1	202.7	8.2	304.8
	323.9	304.7	9.5	168.3	154.1	7.1	304.8
	323.9	304.7	9.5	139.7	128.5	5.5	304.8
	355.6	336.4	9.5	323.9	304.7	9.5	355.6
	355.6	336.4	9.5	273.0	254.5	9.3	355.6
	355.6	336.4	9.5	219.1	202.7	8.2	355.6
	355.6	336.4	9.5	168.3	154.1	7.1	355.6
	406.4	387.2	9.5	355.6	336.4	9.5	406.4
	406.4	387.2	9.5	323.9	304.7	9.5	406.4
	406.4	387.2	9.5	273.0	254.5	9.3	406.4
	406.4	387.2	9.5	219.1	202.7	8.2	406.4
	457.2	436.0	9.5	406.4	387.2	9.5	457.2
	457.2	436.0	9.5	355.6	336.4	9.5	457.2
	457.2	436.0	9.5	323.9	304.7	9.5	457.2
	457.2	436.0	9.5	273.0	254.5	9.3	457.2
	508.0	487.8	9.5	457.2	436.0	9.5	508.0
	508.0	487.8	9.5	406.4	387.2	9.5	508.0
	508.0	487.8	9.5	355.6	336.4	9.5	508.0
	508.0	487.8	9.5	323.9	304.7	9.5	508.0
	559.0	539.6	9.7	508.0	487.8	9.5	559.0
	559.0	539.6	9.7	457.2	436.0	9.5	559.0
	559.0	539.6	9.7	406.4	387.2	9.5	559.0	
	559.0	539.6	9.7	355.6	336.4	9.5	559.0
	610.0	589.8	10.1	559.0	539.6	9.7	610.0
	610.0	589.8	10.1	508.0	487.8	9.5	610.0
	610.0	589.8	10.1	457.2	436.0	9.5	610.0
	610.0	589.8	10.1	406.4	387.2	9.5	610.0
	660.4	639.0	10.7	610.0	589.8	10.1	660.4
	660.4	639.0	10.7	559.0	539.6	9.7	660.4
	660.4	639.0	10.7	508.0	487.8	9.5	660.4
	660.4	639.0	10.7	457.2	436.0	9.5	660.4
	711.2	689.0	11.1	660.4	639.0	10.7	711.2
	711.2	689.0	11.1	610.0	589.8	10.1	711.2
	711.2	689.0	11.1	559.0	539.6	9.7	711.2
	711.2	689.0	11.1	508.0	487.8	9.5	711.2
	762.0	739.6	11.9	711.2	689.0	11.1	762.0
	762.0	739.6	11.9	660.4	639.0	10.7	762.0
	762.0	739.6	11.9	610.0	589.8	10.1	762.0
	762.0	739.6	11.9	559.0	539.6	9.7	762.0
	813.0	790.6	12.7	762.0	739.6	11.9	813.0
	813.0	790.6	12.7	711.2	689.0	11.1	813.0
	813.0	790.6	12.7	660.4	639.0	10.7	813.0
	813.0	790.6	12.7	610.0	589.8	10.1	813.0
	864.0	840.6	13.5	813.0	790.6	12.7	864.0
	864.0	840.6	13.5	762.0	739.6	11.9	864.0
	864.0	840.6	13.5	711.2	689.0	11.1	864.0
	864.0	840.6	13.5	660.4	639.0	10.7	864.0
	914.4	889.0	14.3	864.0	840.6	13.5	914.4
	914.4	889.0	14.3	813.0	790.6	12.7	914.4
	914.4	889.0	14.3	762.0	739.6	11.9	914.4
	914.4	889.0	14.3	711.2	689.0	11.1	914.4
	965.2	939.8	15.1	914.4	889.0	14.3	965.2
	965.2	939.8	15.1	864.0	840.6	13.5	965.2
	965.2	939.8	15.1	813.0	790.6	12.7	965.2
	965.2	939.8	15.1	762.0	739.6	11.9	965.2
	1016.0	990.6	15.9	965.2	939.8	15.1	1016.0
	1016.0	990.6	15.9	914.4	889.0	14.3	1016.0
	1016.0	990.6	15.9	864.0	840.6	13.5	1016.0
	1016.0	990.6	15.9	813.0	790.6	12.7	1016.0
	1066.8	1041.4	16.7	1016.0	990.6	15.9	1066.8
	1066.8	1041.4	16.7	965.2	939.8	15.1	1066.8
	1066.8	1041.4	16.7	914.4	889.0	14.3	1066.8
	1066.8	1041.4	16.7	864.0	840.6	13.5	1066.8
	1117.6	1092.2	17.5	1066.8	1041.4	16.7	1117.6
	1117.6	1092.2	17.5	1016.0	990.6	15.9	1117.6
	1117.6	1092.2	17.5	965.2	939.8	15.1	1117.6
	1117.6	1092.2	17.5	914.4	889.0	14.3	1117.6
	1168.4	1143.0	18.3	1117.6	1092.2	17.5	1168.4
	1168.4	1143.0	18.3	1066.8	1041.4	16.7	1168.4
	1168.4	1143.0	18.3	1016.0	990.6	15.9	1168.4
	1168.4	1143.0	18.3	965.2	939.8	15.1	1168.4
	1219.2	1193.8	19.1	1168.4	1143.0	18.3	1219.2
	1219.2	1193.8	19.1	1117.6	1092.2	17.5	1219.2
	1219.2	1193.8	19.1	1066.8	1041.4	16.7	1219.2
	1219.2	1193.8	19.1	1016.0	990.6	15.9	1219.2

BS Dimensional Tolerances Of Fittings



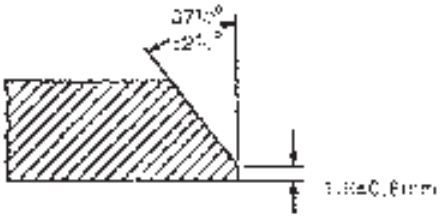
Fitting	Dimensions	Nominal size (in)	Tolerances (mm)
90° Elbows 45° Elbows	Centre to end A or B (see Figs. 1 and 2)	Up to and including 1½	± 2.4
		2½ to 4	± 3.2
		5 to 8	± 4.0
		10 and over	± 4.8
	Centre to centre C (see Fig. 3)	Up to and including 1½	± 4.8
		2½ to 4	± 6.3
		5 to 8	± 7.9
Return Bends (180°)		10 and 12	± 9.5
	Back to face K (see Fig. 3)	All sizes	± 6.3
	Alignment of faces F (see Fig. 3)	Up to and including 2	± 0.8
		10 and 12	± 1.6
Reducers	[illegible] (see Fig. 7 and 8)	Up to and including 6	± 1.6
		10 and over	± 2.4
Tees	Centre to face C (see Figs. 5 and 6)	Up to and including 8	± 1.6
		10 and over	± 2.4
[illegible]	[illegible] (see Fig. 4)	Up to and including 4	3.2
		5 and over	4.8

BS Dimensional Tolerances Of Fittings



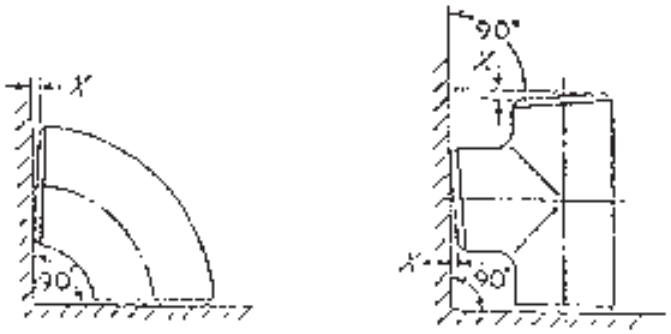
Fitting	Dimensions	Nominal size (in)	Tolerances (mm)
90° bends 45° bows	Centre to end A or B (see Figs 1 and 2)	Up to and including ¼	± 2.4
		⅜ to 4	± 3.2
		5 to 8	± 4.0
		10 and over	± 4.8
	Centre to centre D (see Fig 3)	Up to and including 1½	± 4.6
		2 to 4	± 6.3
		5 to 8	± 7.9
		10 and 12	± 9.7
Return Bends (180°)	Back to face K (see Fig 3)	All sizes	± 6.3
	Alignment of faces J (see Fig.3)	Up to and including 6	± 0.8
		10 and 12	± 1.6
Reducers	End to end H (see Fig.7 and 8)	Up to and including 6	± 1.6
		10 and over	± 2.4
Tees	Centre to face F (see Fig.5 and 6)	Up to and including 4	± 1.6
		10 and over	± 2.4
Caps	End to face E (see Fig.4)	Up to and including 4	± 3.2
		5 and over	± 4.0

Steel Butt-Welding Pipe Fitting For Ordinary Use



off-square Tolerances

Off-square tolerances shall be as given in Table



Typical examples of off-square tolerance "X" on pipe end

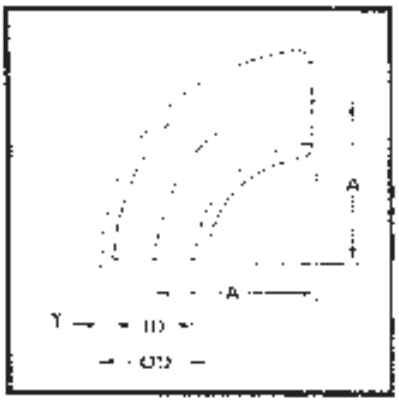
(Table of reference)

(SQUARE TOLERANCE)

Nominal size of pipe	Off-square tolerance "X"

Approx Weight Estimate Equation

90° Elbow



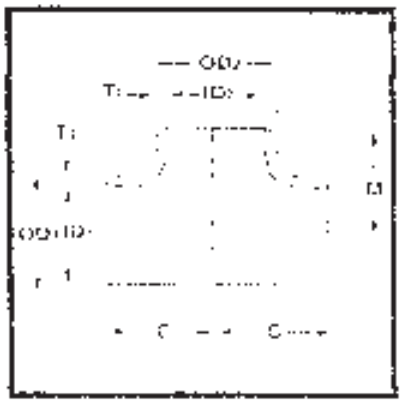
AW = 0.0699 X A X T X (OD - T) X T

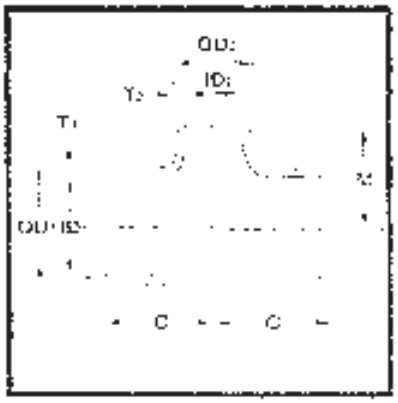
AW : Approx. Weight (Decimal)
T : Wall Thickness (inch)
OD : Outside Diameter (inch)
A : Radius (inch)

45° Elbow

AW = 0.0350 X A X T X (OD - T) X T

AW : Approx. Weight (Decimal)
T : Wall Thickness (inch)
OD : Outside Diameter (inch)
A : Radius (inch)

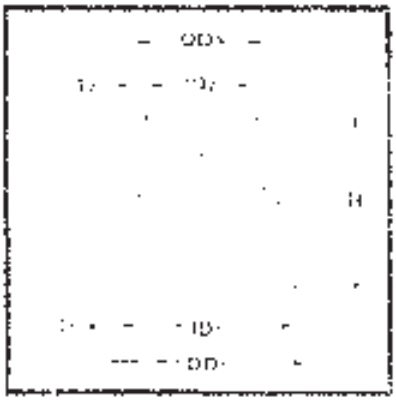


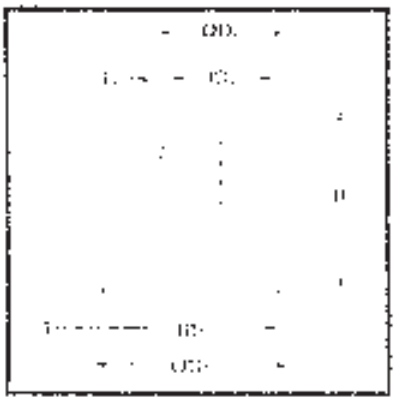


Tee

AW = 0.0699 [2T - (OD - T)] x T x

AW : Approx. Weight (Decimal : Kg)
T : Wall Thickness (inch)
OD : Outside Diameter (inch)
C : Center to End Dimension (inch)



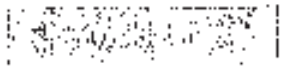


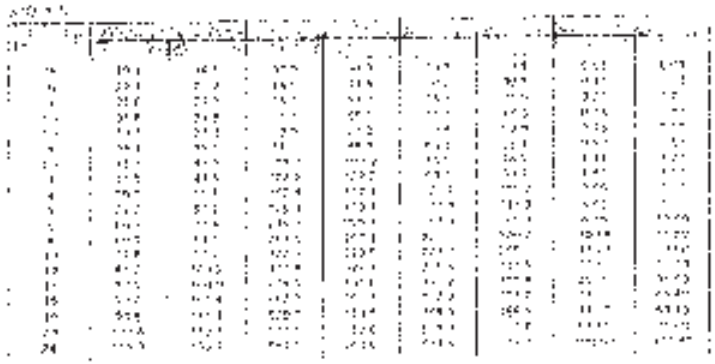
Reducer

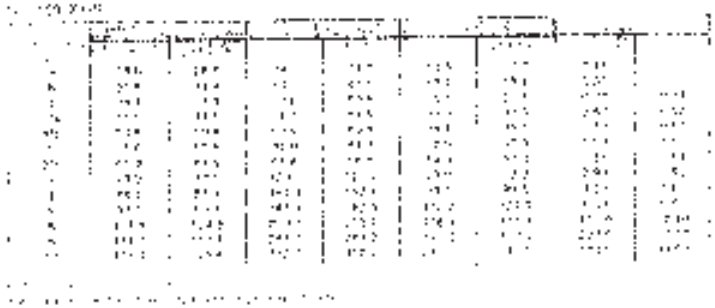
AW = 0.0699 x T x [2T - (OD + OD)] x H x

AW : Approx. Weight (Decimal : Kg)
T : Wall Thickness (inch)
OD : Outside Diameter (inch)
OD : Outside Diameter (inch)
H : Height (inch)

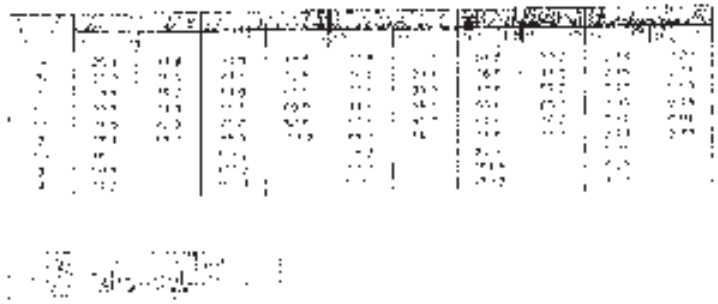
FORGED OUTLET FITTINGS
To ASTM A234/ANSI B16.9

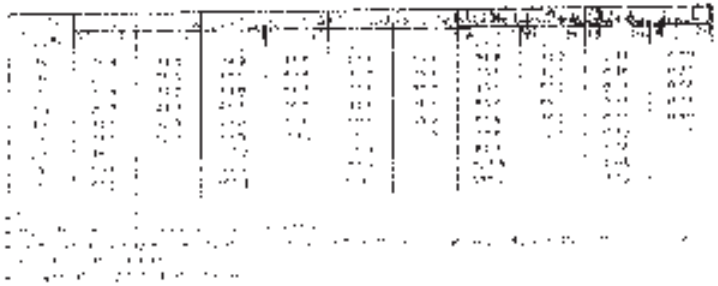






FORGED OUTLET FITTINGS
To ASTM A234/ANSI B16.9





Butt Welding Fittings Approx Weight List

90° Elbow

LONG

SHORT

	SCH	STD	40	XS	80	100	120	SCH	STD	40	XS	80	100	120	
½	0.08	0.08	0.08	0.10	0.10	-	-	-	-	-	-	-	-	-	½
¾	0.10	0.11	0.11	0.14	0.14	-	-	-	-	-	-	-	-	-	¾
1	0.15	0.16	0.16	0.20	0.20	0.30	0.25	0.10	0.11	0.11	0.14	0.14	-	-	1
1¼	0.26	0.26	0.26	0.36	0.36	0.44	0.42	0.17	0.18	0.18	0.23	0.23	-	-	1¼
1½	0.35	0.37	0.37	0.50	0.50	0.62	0.55	0.24	0.25	0.25	0.33	0.35	-	-	1½
2	0.54	0.66	0.66	0.89	0.89	1.08	1.02	0.42	0.44	0.44	0.60	0.80	1.13	0.89	2
2½	1.02	1.37	1.37	1.79	1.79	2.15	2.30	0.75	0.91	0.91	1.15	1.19	2.19	1.49	2½
3	1.58	2.04	2.04	2.74	2.74	3.85	3.80	1.05	1.35	1.35	1.83	1.83	3.40	2.56	3
4	2.91	3.64	3.64	5.36	5.33	10.2	8.02	1.91	2.56	2.56	3.56	3.56	6.70	3.85	4
5	4.19	6.48	6.48	9.13	9.13	17.0	14.7	3.50	4.32	4.32	6.09	6.09	11.9	5.72	5
6	7.09	9.94	9.94	15.0	15.0	29.1	21.2	4.75	6.55	6.55	10.0	10.0	19.5	16.2	6
8	14.4	20.1	20.1	30.5	30.5	51.4	52.2	9.61	13.4	13.4	20.5	20.5	34.2	35.5	8
10	25.4	35.4	35.4	47.7	57.0	82.0	105	16.9	23.6	23.6	31.8	35.0	61.0	68.6	10
12	38.1	52.0	57.0	66.7	94.0	130	171	25.4	34.0	38.0	45.2	63.0	87.0	114	12
14	56.7	67.9	79.1	59.0	193	-	236	37.9	45.3	53.0	80.0	89.0	-	156	14
16	74.3	89.0	118	118	195	-	250	49.5	59.1	79.0	78.2	130	-	254	16
18	94.2	113	169	150	275	-	485	62.8	75.3	113	95.0	183	-	305	18
20	116	140	220	186	373	-	676	77.7	93.1	147	124	249	-	451	20
22	141	165	-	225	495	-	865	94.1	110	-	150	329	-	591	22
24	169	202	306	269	636	-	1160	112	135	244	179	426	-	773	24
26	199	237	-	315	-	-	-	132	158	-	210	-	-	-	26
28	230	276	-	367	-	-	-	154	184	-	245	-	-	-	28
30	264	316	-	421	-	-	-	176	211	-	281	-	-	-	30
32	301	361	604	480	-	-	-	201	241	430	320	-	-	-	32
34	340	406	739	543	-	-	-	227	272	493	362	-	-	-	34
36	380	457	904	608	-	-		253	304	603	405	-	-	-	36
38	425	510	-	679	-	-	-	283	340	-	453	-	-	-	38
40	471	565	-	752	-	-	-	314	377	-	502	-	-	-	40
42	518	622	-	826	-	-	-	346	416	-	554	-	-	-	42
44	570	684	-	912	-	-	-	380	456	-	608	-	-	-	44
46	625	748	-	997	-	-	-	415	499		665	-	-	-	46
48	677	813	-	[illegible]	-	-	-	452	543		724	-	-	-	48

180° Elbow

LONG

SHORT

½	0.160	0.16	0.16	0.20	0.20	-	-	-	-	-	-	-	-	-	½
¾	0.21	0.22	0.22	0.28	0.28										¾
1	0.30	0.32	0.32	0.40	0.40	0.52	0.50	0.20	0.22	0.22	0.29	0.28	-	-	1
1¼		0.42	0.42	0.54	0.54	0.68	0.64	0.25	0.28	0.28	0.36	0.36			1¼
1½	0.51	0.54	0.54	0.71	0.71	0.91	0.81	0.33	0.36	0.36	0.47	0.47			1½
2	0.84	0.92	0.92	1.22	1.22	1.56	1.46	0.55	0.61	0.61	0.80	0.80	1.46	1.08	2
2½	1.38	1.56	1.56	2.07	2.07	2.68	2.68	0.91	1.03	1.03	1.37	1.37	2.68	2.09	2½
3	2.16	2.32	2.32	3.18	3.18	4.32	4.32	1.42	1.53	1.53	2.09	2.09	4.32	3.18	3
4	3.97	4.14	4.14	6.36	6.36	8.64	8.64	2.61	2.72	2.72	4.18	4.18	8.64	6.36	4
5	6.35	7.38	7.38	10.2	10.2	13.6	13.6	4.18	4.86	4.86	6.70	6.70	13.6	10.2	5
6	9.67	11.3	11.3	15.9	15.9	20.4	20.4	6.37	7.44	7.44	10.5	10.5	20.4	15.9	6
8	19.6	22.9	22.9	31.8	31.8	40.8	40.8	12.9	15.1	15.1	21.0	21.0	40.8	31.8	8
10	34.6	40.3	40.3	54.4	54.4	72.6	72.6	22.8	26.5	26.5	35.8	35.8	72.6	54.4	10
12	51.9	59.2	59.2	77.2	77.2	104	104	34.2	39.0	39.0	50.9	50.9	104	77.2	12
14	77.3	77.3	77.3	104	104	136	136	51.0	51.0	51.0	68.6	68.6	136	104	14
16	101	101	101	136	136	177	177	66.6	66.6	66.6	89.6	89.6	177	136	16
18	128	128	128	172	172	224	224	84.4	84.4	84.4	113	113	224	172	18
20	158	158	158	213	213	277	277	104	104	104	140	140	277	213	20
22	192	192	192	258	258	336	336	127	127	127	170	170	336	258	22
24	230	230	230	309	309	402	402	152	152	152	204	204	402	309	24
26	271	271	271	364	364	473	473	179	179	179	240	240	473	364	26
28	315	315	315	423	423	550	550	208	208	208	279	279	550	423	28
30	362	362	362	486	486	632	632	239	239	239	321	321	632	486	30
32	412	412	412	553	553	719	719	272	272	272	365	365	719	553	32
34	465	465	465	624	624	812	812	307	307	307	412	412	812	624	34
36	521	521	521	699	699	909	909	344	344	344	461	461	909	699	36
38	580	580	580	778	778	1012	1012	383	383	383	513	513	1012	778	38
40	643	643	643	863	863	1122	1122	424	424	424	569	569	1122	863	40
42	708	708	708	950	950	1235	1235	467	467	467	627	627	1235	950	42
44	777	777	777	1043	1043	1356	1356	513	513	513	688	688	1356	1043	44
46	850	850	850	1141	1141	1483	1483	561	561	561	753	753	1483	1141	46
48	926	926	926	1242	1242	1615	1615	611	611	611	820	820	1615	1242	48

45° Elbow

LONG

SHORT

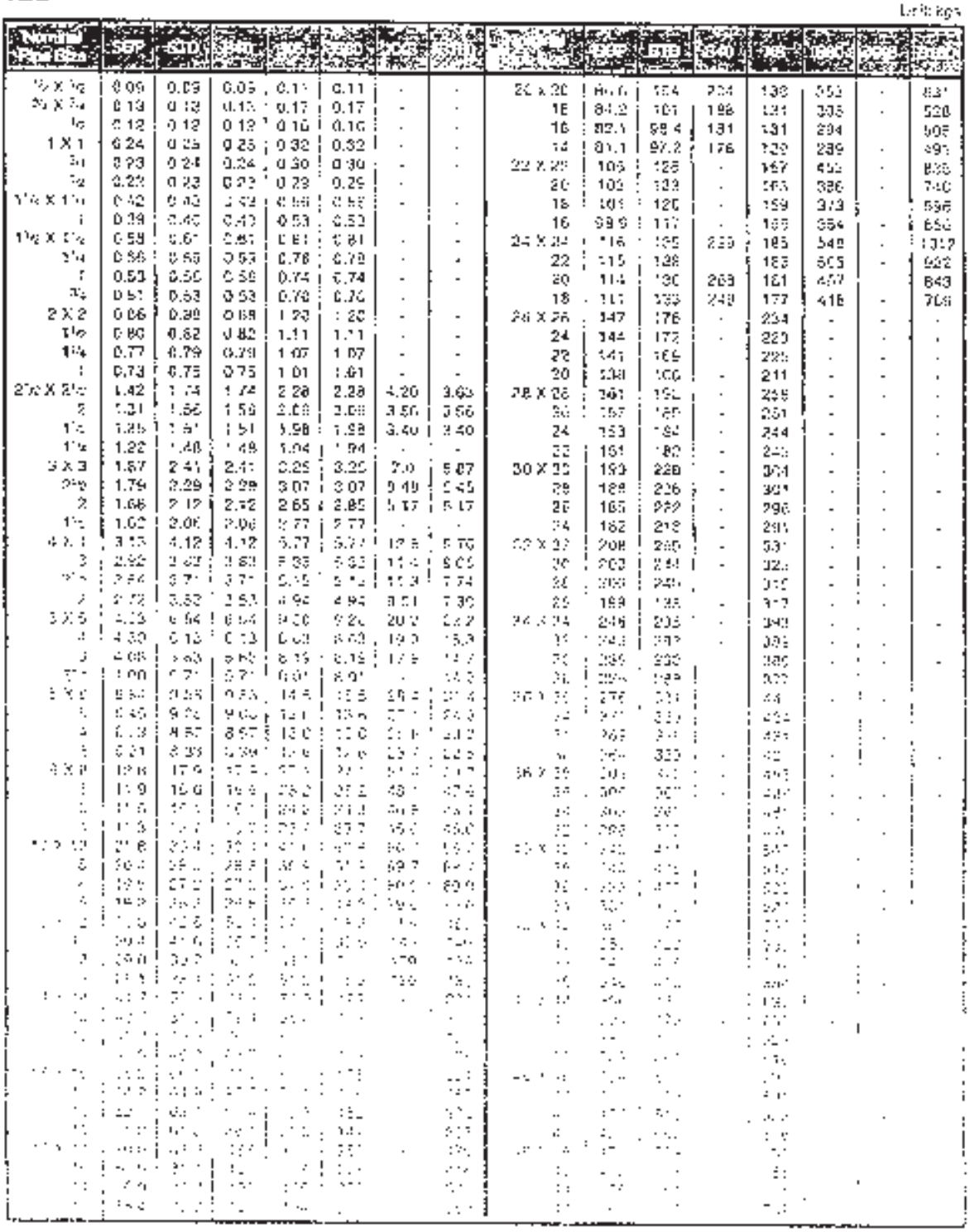
Unit kg

Nominal Pipe Size	BGP	STD	40	XS	80	XXS	160	BGP	STD	40	XS	80	XXS	160	Nominal Pipe Size
½	0.04	0.04	0.04	0.05	0.05	-	-	-	-	-	-	-	-	-	½
¾	0.05	0.05	0.06	0.07	0.07	-	-	-	-	-	-	-	-	-	¾
1	0.09	0.09	0.09	0.10	0.10	0.18	0.18	0.08	0.08	0.08	0.07	0.07	-	-	1
1½	1.12	0.13	0.13	0.16	0.18	0.32	0.21	0.09	0.09	0.09	0.12	0.12	-	-	1¼
1½	0.15	0.15	0.19	0.25	0.25	0.47	0.32	0.12	0.13	0.13	0.17	0.17	-	-	1½
2	0.29	0.33	0.33	0.45	0.45	0.82	0.67	0.23	0.23	0.23	0.30	0.30	0.57	0.85	2
2½	0.51	0.69	0.69	0.90	0.90	1.72	1.17	0.38	0.40	0.40	0.49	0.63	1.10	0.75	2½
3	0.79	1.02	1.02	1.37	1.37	2.63	1.82	0.53	0.66	0.66	0.82	0.97	1.76	1.28	3
4	1.46	1.92	1.92	2.66	2.66	5.09	4.01	0.97	1.26	1.26	1.79	1.79	3.40	2.60	4
5	2.75	3.24	3.24	4.57	4.57	8.80	7.55	1.50	2.16	2.16	3.04	3.05	6.58	4.00	5
6	5.52	4.97	4.97	7.50	7.50	14.5	12.1	2.35	3.32	3.32	5.03	5.03	9.75	8.10	6
8	7.32	10.1	10.1	15.3	15.3	28.7	25.6	4.80	6.71	6.71	10.2	10.2	17.2	17.8	8
10	12.7	17.7	17.7	23.9	28.5	41.0	51.5	8.46	11.8	11.8	15.9	18.0	30.6	34.2	10
12	19.0	26.0	28.5	34.4	47.0	65.0	85.5	12.7	17.5	19.0	22.9	31.5	48.4	57.0	12
14	28.4	34.0	40.1	48.0	66.5	-	118	18.0	23.0	26.5	30.0	44.5	-	79.0	14
16	37.2	44.5	59.0	59.0	97.5	-	175	24.0	29.5	39.2	39.2	65.0	-	117	16
18	47.1	56.5	84.5	75.0	138	-	247	31.0	37.6	56.5	50.0	91.5	-	165	18
20	58.3	70.0	110	93.0	187	-	335	38.0	46.0	73.5	62.0	124	-	225	20
22	70.1	84.5	-	113	257	-	445	47.0	56.5	-	75.0	164	-	295	22
24	84.1	101	169	134	340	-	580	56.0	67.3	122	89.5	212	-	386	24
26	99.5	119	-	156	-	-	-	66.0	79.1	-	105	-	-	-	26
28	115	138	-	184	-	-	-	77.0	92.0	-	122	-	-	-	28
30	135	156	-	211	-	-	-	87.0	103	-	140	-	-	-	30
32	151	180	337	240	-	-	-	101	120	216	160	-	-	-	32
34	170	204	369	272	-	-	-	114	131	246	181	-	-	-	34
36	185	226	462	304	-	-	-	127	152	331	202	-	-	-	36
38	212	255	-	338	-	-	-	142	170		228	-	-	-	38
40	235	282		376	-	-	-	157	188		251	-	-	-	40
42	258	311	-	414			-	173	216		277		-	-	42
44	284	342	-	455	-	-	-	190	228	-	304	-	-	-	44
46	312	376		496			-	208	250		333		-	-	46
48	339	407	-	543	-	-	-	226	271	-	362		-	-	48

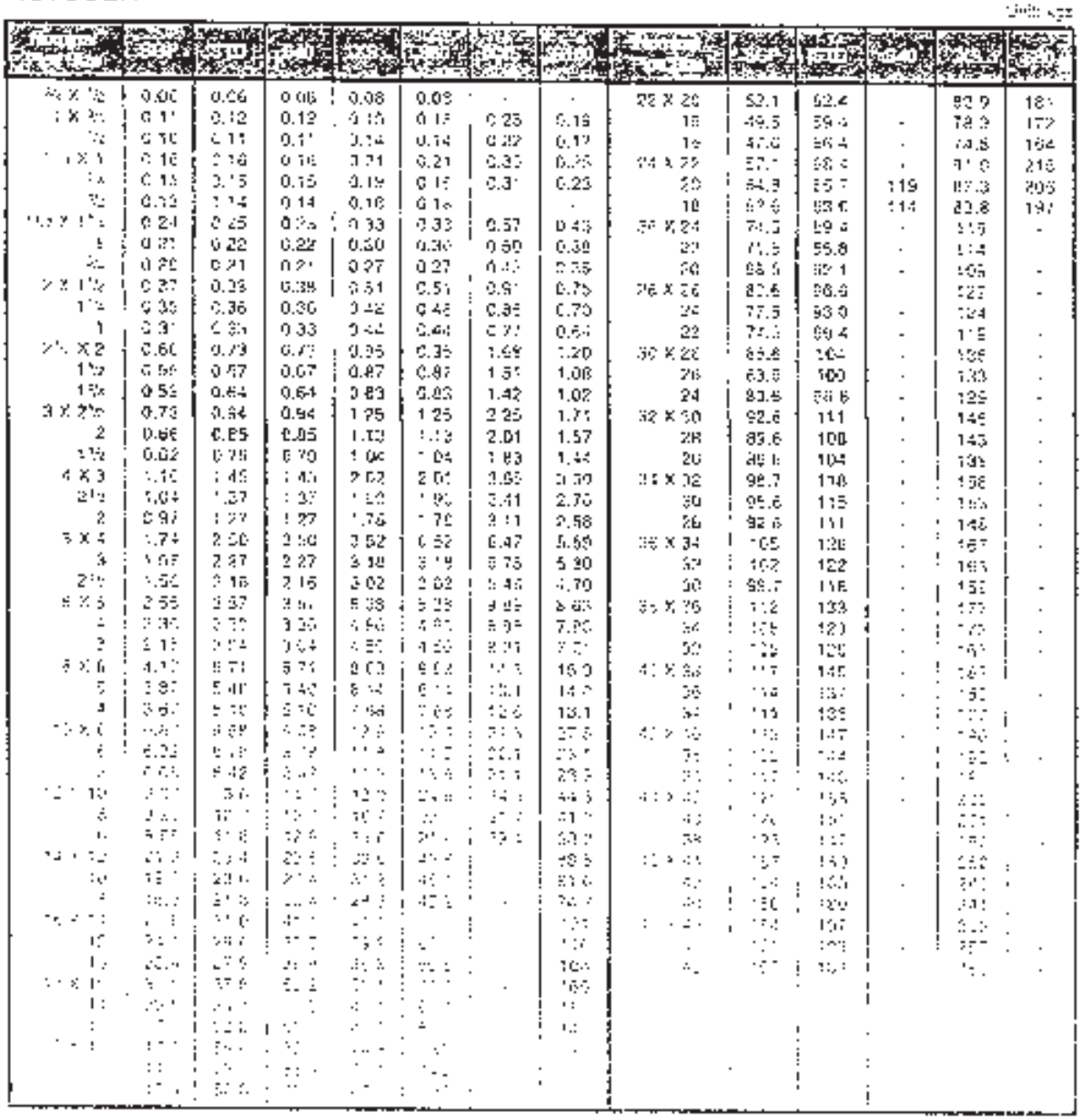
CAP

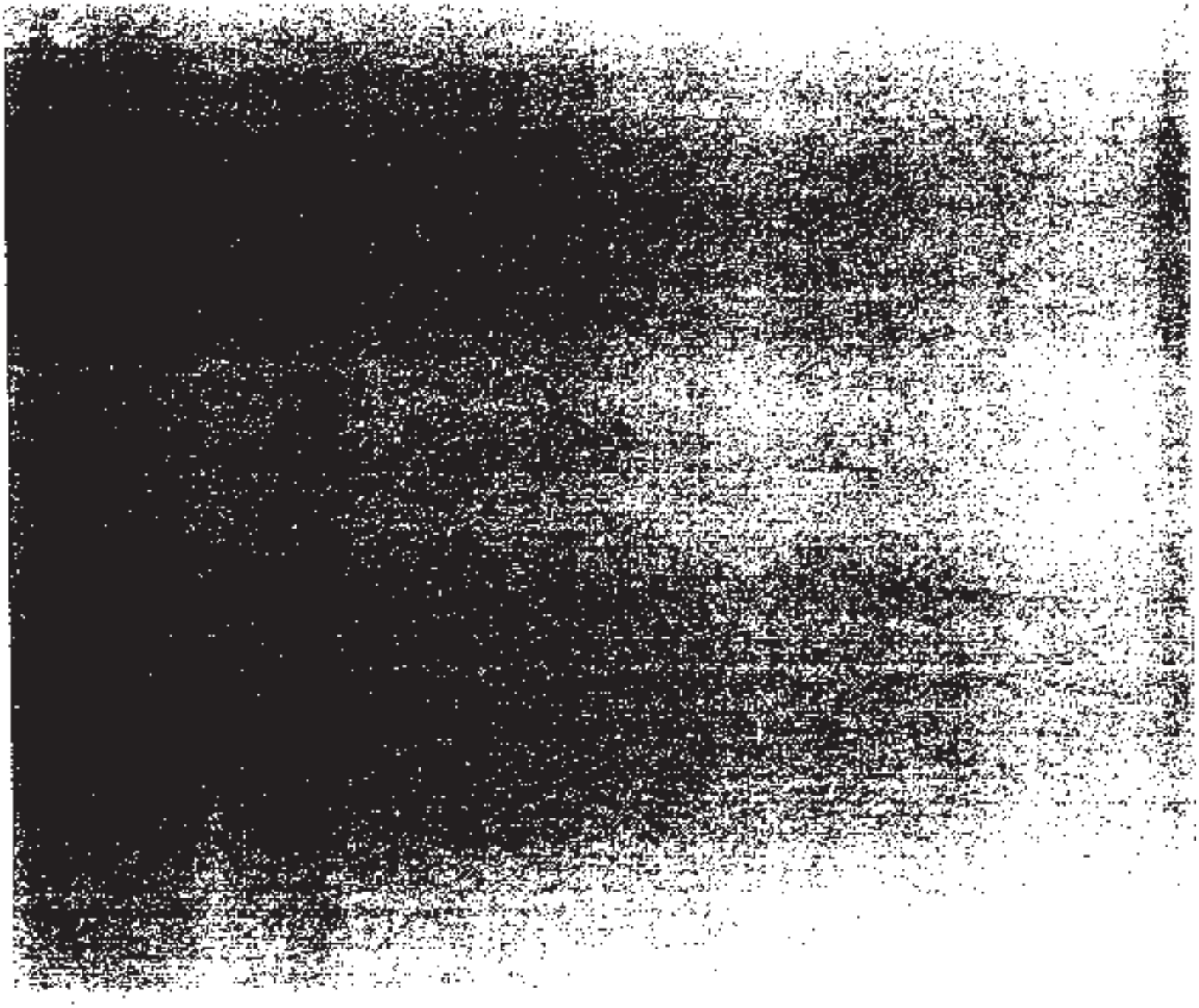
Butt Welding Fittings Approx Weight List

TEE



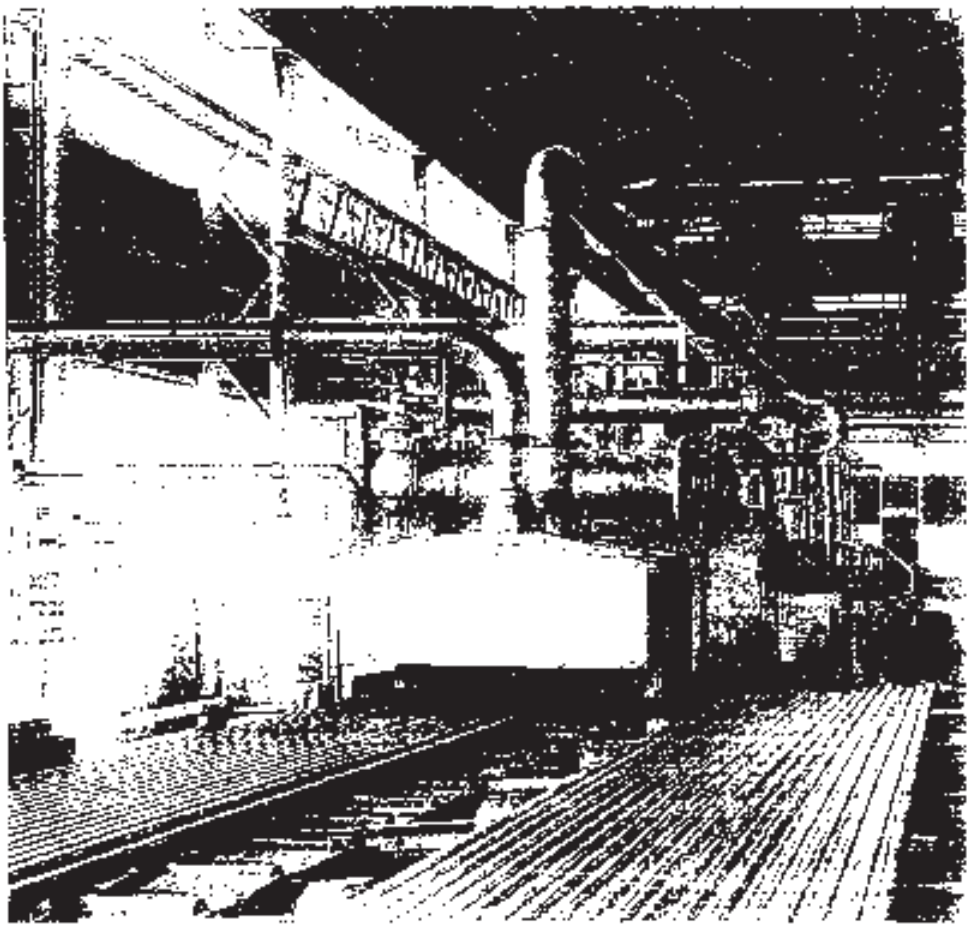
REDUCER





PSP STEEL PIPE & TUBE

General Purpose in Building Services



Tubes for Structural & Mechanical Purposes

Lightweight and durable, a widely varied range of PSP general structural tubes also boasts the advantages of economy plus a remarkable degree of versatility. Tubes for diverse mechanical purposes are manufactured and rigorously tested to specificatio

■ Structural Tubes

Characteristic lightness of steel pipe structures means they afford cost reduction in terms of transportation, convenient assembly, and easy rustproofing to enable a lastingly attractive appearance.

Fabricated with homogeneous materials, PSP structural tubes are also recognized for superiority in multidirectional moment of inertia as well as radius of curvature strength.

Various specifications are available for use in bridges, electric utility poles, steel furniture, steel towers, scaffolding, motorized vehicles and bicycles.

■ Mechanical Tubes

Since tubes for mechanical purposes are applied so widely, they must differ accordingly in precision, surface treatment and physical properties

PSP produces tubes based on specific standards of application, aiming at perfection through visual examination coupled with other required inspections involving water pressure, eddy current, magnetic particles, ultrasonic waves and indestructibility.

Production is governed by meticulous quality control, ensuring stable mechanical properties. Assured as well are outstanding precision plus a substantial product range for broad applicability

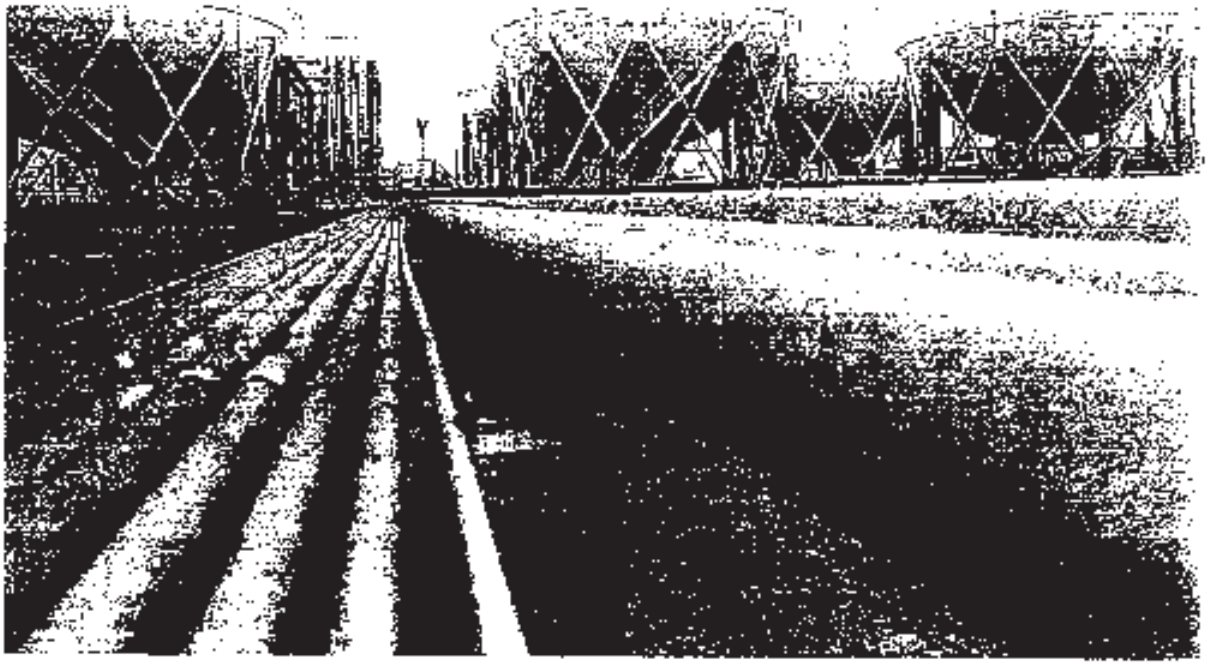
Carbon Steel Pipe & Tube for Heat Transfer

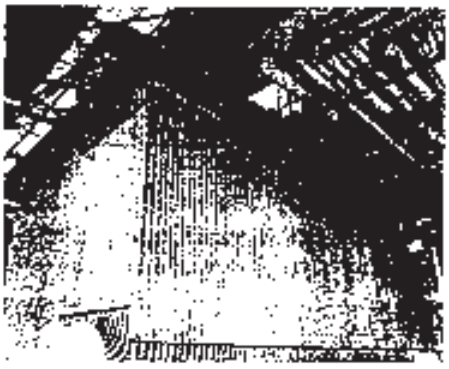
End-to-end control over all variables, from raw material to final delivery, is what guarantees users of PSP carbon steel pipe the maximum possible level of value received, regardless of the intended mode of heat transfer.

Steel tube products by PSP for heat exchangers and boilers are not in the least inferior in comparison to seamless pipe.

Heat exchangers in chemical industries employ our tubes for water, smoke, preheating and superheating applications. For petroleum industries, we also supply tubes used in heat exchangers plus condenser and catalyzer tubes.

In addition, all products undergo perfect heat treatment for inner machinability, while capping at each end prevents internal contamination.





Main Products

Carbon Steel Pipes for Ordinary Piping	○ Pipes for Water Piping ○ Pipes for General Ordinary Piping	▶ For City & Industrial Water, Irrigation & Agriculture Water, Oil & Gas Supply, Sprinkler, Fire Hydrant, Ship Piping, etc.	KS D3507, D3507 JIS G3452 BS 1387, 3601 ASTM A530 EN10255 EN10217-1
Oil Country Tubular Goods	○ Line Pipe ○ High Test Line Pipe ○ Casing & Tubing API 5CT	▶ For use conveying Gas, Water, and Oil in producing operation in both Oil and Natural Gas Industries	API 5L 5CT
Conduit Tubes	○ Electrical Metallic Tubing ○ Thin Wall Conduit Tubes ○ Thick Wall Conduit Tubes	▶ For electric wiring	KS C8401 JIS C8305 UL & 797 CSA ANSI C80.1, C80.3, C80.6
Carbon Steel Tubes for Structural Purpose	○ Tubes for General Structural Purpose ○ Tubes for Mechanical Structural Purpose ○ Automobile Structural Purposes ○ Fence Tubes ○ Pipe Scaffoldings ○ Supports ○ Posts for Green House ○ Steel Pipe Pile ○ Steel Pipe Pole	▶ For Building, Bridge, Harbor, Machinery, Steel Tower, Automobile, Bicycle, Electric Light Post, Scaffold, Steel Furniture, Support, Hand Rail and Fence etc.	KS D3566, D3517 JIS G3444, G3445, A5525 ASTM A252, A500, A513
Spiral Welded Pipe	○ Asphalt Coating Pipe ○ Coal-tar Enamel Coating Pipe ○ Steel Fittings for Coating Steel Pipes for Water Service ○ Bare Spiral Pipe ○ Steel Pipe Pile	▶ For Water, Gas, Oil, Piling & other purposes such as Temporary Structures, dredging, supply & exhaust pipe for Steam & Air.	KS D3583 JIS G3457 ASTM A211, A139 AWWA C200
Carbon Steel Pipes for Pressure Service	○ Pipes for Pressure Service	▶ For Pressure Service at low Temperature not exceeding 350°C	KS D3562 JIS G3454
Carbon Steel Tubes for Heat Transfer	○ Boiler Tubes ○ Heat Exchanger Tubes	▶ For Heat Exchanger, such as Water Tube, Smoke Tubes, Superheater Tubes and Air Preheater Tubes of Boilers and Heat Exchanger Tubes, Condenser Tubes and Refrigerator Tubes in the Chemical and Petroleum Industries	KS D3563 JIS G3461 ASTM A178, A214, A226, A250, A423 ASME
Carbon Steel Pipes for Ship	○ Boiler Tubes ○ Heat Exchanger Tubes ○ Superheater Tubes ○ Pipes for Pressure Piping	▶ For Boiler, Pressure Vessels, Fire and Machinery Pressure Piping Systems	KR ABS LR/NK03 DNV
Carbon Steel Pipes for Water Gas	○ Pump Delivery & Shaft ○ Water Well Casing, Deep Well Borehole & Oil Field Drive Pipe	▶ For Water Well	ASTM A589
[illegible]	[illegible]	▶ Piping for Central Heating System Central Heating System (Hot Water) Conveying Chemical Materials Low Temperature Service Solar Energy System	KR ANSI/ASME ASME/ANSI

• Korean Industrial Standard	KS	• American Society for Testing & Materials	ASTM
• Japanese Industrial Standard	JIS	• American National Standards Institute	ANSI
• British Standard	BS	• American Bureau of Shipping	ABS
• Deutsches Institut für Normung	DIN	• Lloyd's Register of Shipping	LLOYD'S
• Association Française de Normalisation	AFNOR	• Det Norske Veritas	DNV
• Canadian Standards Association	CSA	• Germanischer Lloyd	GL
• American Petroleum Institute	API	• Nippon Kaiji Kyokai	NK

Galvanize Iron & Black Steel Pipe to EN 10255 : 2004

Series	Norminal Size		Outside Diameter		Wall Thickness	Weight	
						Plain End	Threaded and Socketed
	(in.)	(mm)	max. (mm)	min. (mm)	(mm)	(kg/m)	(kg/m)
Type L2	1/4	13.5	13.8	13.2	1.8	0.575	0.579
	3/8	17.2	17.1	16.7	1.8	0.67	0.676
	1/2	21.3	21.4	21	2	0.947	0.956
	3/4	26.9	26.9	26.4	2.3	1.38	1.39
	1	33.7	33.8	33.2	2.6	1.98	2
	1 1/4	42.4	42.5	41.9	2.6	2.54	2.57
	1 1/2	48.3	48.4	47.8	2.9	3.23	3.27
	2	60.3	60.2	59.6	2.9	4.08	4.15
	2 1/2	76.1	76	75.2	3.2	5.71	5.83
	3	88.9	88.7	87.9	3.2	6.72	6.89
	4	114.3	114.5	113	3.6	9.75	10
Medium	1/4	13.5	14	13.2	2.3	0.641	0.645
	3/8	17.2	17.6	16.7	2.3	0.839	0.845
	1/2	21.3	21.8	21	2.6	1.21	1.22
	3/4	26.9	27.3	26.5	2.6	1.56	1.57
	1	33.7	34.2	33.3	3.2	2.41	2.43
	1 1/4	42.4	42.9	42	3.2	3.1	3.13
	1 1/2	48.3	48.8	47.9	3.2	3.56	3.6
	2	60.3	60.8	59.7	3.6	5.03	5.1
	2 1/2	76.1	76.6	75.3	3.6	6.42	6.54
	3	88.9	89.5	88	4	8.36	8.53
	4	114.3	115	113.1	4.5	12.2	12.5
	5	139.7	140.8	138.5	5	16.6	17.1
	6	165.1	166.5	163.9	5	19.9	20.4
Heavy	1/4	13.5	14	13.2	2.9	0.765	0.769
	3/8	17.2	17.6	16.7	2.9	1.02	1.03
	1/2	21.3	21.8	21	3.2	1.44	1.45
	3/4	26.9	27.3	26.5	3.2	1.87	1.88
	1	33.7	34.2	33.3	4	2.93	2.96
	1 1/4	42.4	42.9	42	4	3.79	3.82
	1 1/2	48.3	48.8	47.9	4	4.37	4.41
	2	60.3	60.8	59.7	4.5	6.19	6.26
	2 1/2	76.1	76.6	75.3	4.5	7.93	8.05
	3	88.9	89.5	88	5	10.3	10.5
	4	114.3	115	113.1	5.4	14.5	14.8
	5	139.7	140.8	138.5	5.4	17.9	18.4
	6	165.1	166.5	163.9	5.4	21.3	21.9

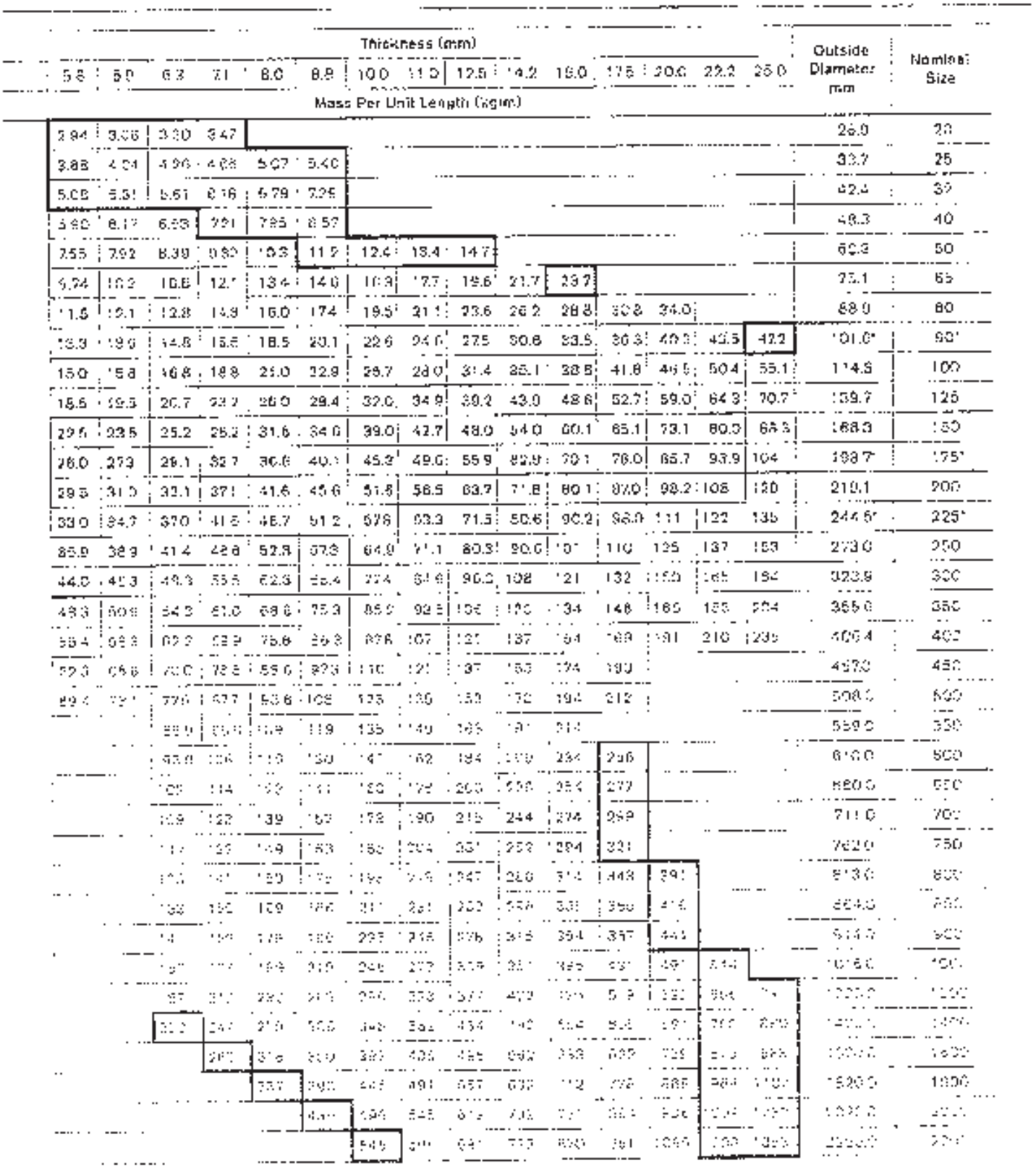
EN 10217-1 / BS 3601 Steel Pipes and Tubes for Pressure Purposes (Room Temperature)
BS 3602 Steel Pipes and Tubes for Pressure Purposes (Elevated Temperature)
BS 3603 Steel Pipes and Tubes for Pressure Purposes (Low Temperature)
BS 3604 Steel Pipes and Tubes for Pressure Purposes (Ferritic Alloy Steel with Specified Elevated Temperature)
BS 3605 Seamless and Welded Austenitic Stainless Steel Pipes and Tubes for Pressure Purposes
BS 4360 Weldable Structural Steels

(1) Available Size (Dimension and Weights)

Nominal Size	Outside Diameter mm	Thickness (mm)										
		2.0	2.3	2.6	2.9	3.2	3.6	4.0	4.5	5.0	5.4	
		Mass Per Unit Length (kg/m)										
20	26.9			1.56	1.77	1.97	2.07	2.36	2.46	2.79	2.60	
25	33.7					2.41	2.67	2.93	3.04	3.54	3.77	
32	42.4					3.09	3.44	3.79	4.21	4.81	4.93	
40	48.3						3.97	4.37	4.85	5.34	5.71	
50	60.3			2.82	3.20	3.20	4.11	4.60	5.03	5.55	6.19	6.63
65	76.1			3.55	4.19	4.71	5.24	5.75	6.44	7.11	7.95	8.77
80	88.9				4.91	5.53	6.15	6.76	7.57	8.38	9.37	10.3
90*	101.6*				5.63	6.35	7.06	7.77	8.70	9.63	10.8	11.9
100	114.3				6.36	7.16	7.97	8.77	9.83	10.9	12.2	13.5
125	139.7						10.8	12.1	13.4	14.9	16.6	17.9
150	168.3						13.0	14.6	16.2	18.2	20.1	21.7
175*	193.7*								18.7	21.0	23.3	25.1
200	219.1						17.0	19.1	21.2	23.8	26.4	28.5
225*	244.5*								23.7	26.6	29.5	31.8
250	273.0								26.5	29.6	33.0	35.6
300	323.9									35.4	39.3	42.4
350	355.6										43.3	46.6
400	406.4										49.8	53.4
450	457.0										56.7	60.1
500	508.0										63.0	66.9
550*	559.0											
600	610.0											
650	660.0											
700	711.0											
750	762.0											
800	813.0											
850	864.0											
900*	914.0											
1000	1016.0											
1050*	1067.0											
1200*	1219.0											
1400	1422.0											
1600	1626.0											
2000*	2032.0											
2400*	2438.0											

* The use of these sizes should be avoided if possible.

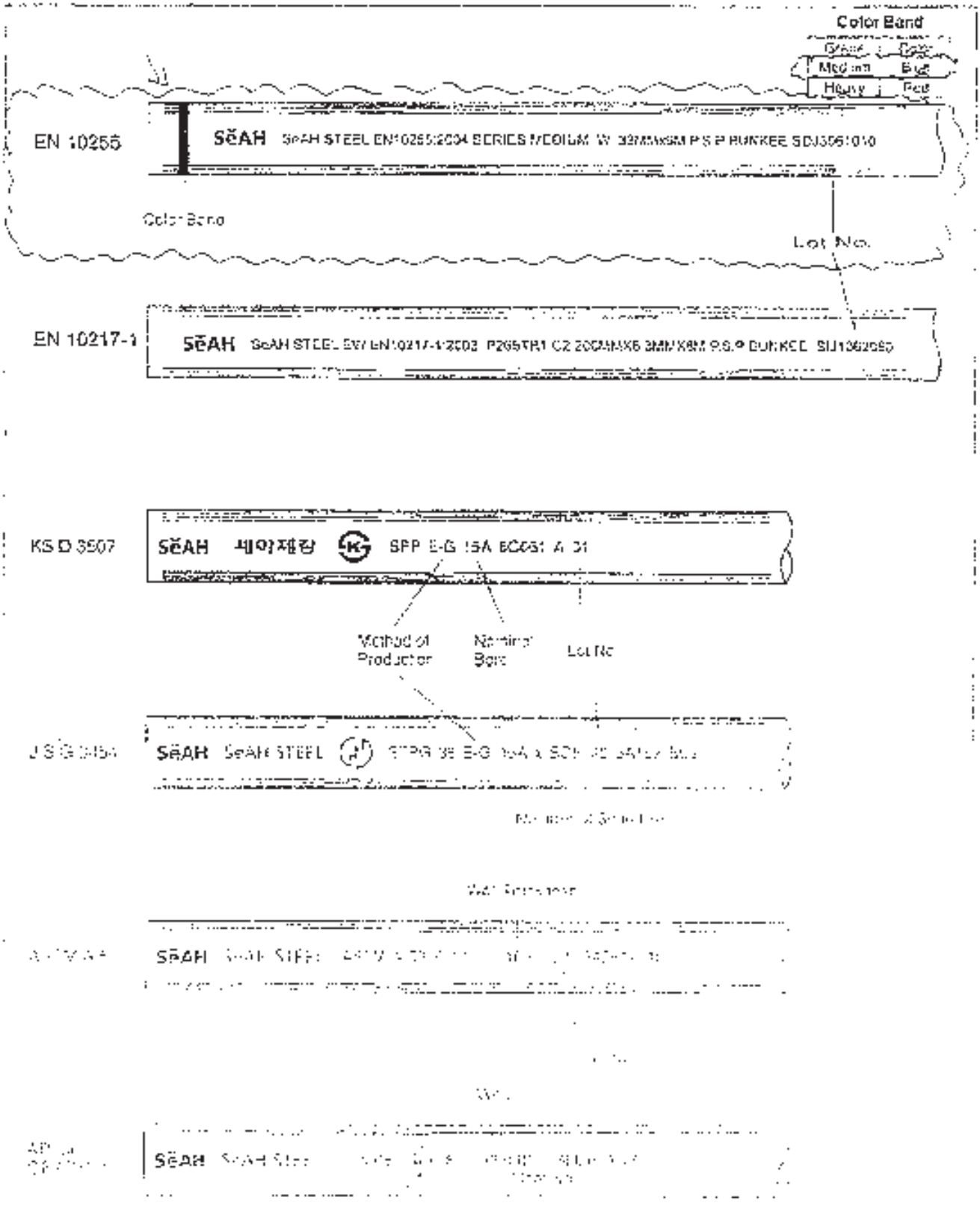
Note: ☐ Hot finished ... Cold finished ... Either hot or cold finished ...



Thickness (mm)															Outside Diameter mm	Nominal Size
5.6	5.0	6.3	7.1	8.0	8.8	10.0	11.0	12.5	14.2	16.0	17.5	20.0	22.2	25.0		
Mass Per Unit Length (kg/m)																
2.84	3.06	3.30	3.47												26.9	20
3.88	4.04	4.36	4.68	5.07	5.40										33.7	25
5.08	5.31	5.61	6.16	6.79	7.26										42.4	32
5.80	6.17	6.68	7.31	7.95	8.57										48.3	40
7.55	7.92	8.39	9.80	10.3	11.2	12.4	13.4	14.7							60.3	50
9.24	10.2	10.8	12.7	13.4	14.0	16.3	17.7	19.6	21.7	23.7					76.1	65
11.5	12.1	12.8	14.9	16.0	17.4	19.5	21.1	23.6	26.2	28.8	30.8	34.0			88.9	80
13.3	13.9	14.8	15.8	18.5	20.1	22.6	24.0	27.5	30.8	33.5	36.3	40.3	43.5	47.2	101.6	90
15.0	15.8	16.8	18.9	21.0	22.9	25.7	28.0	31.4	35.1	38.5	41.8	46.5	50.4	55.1	114.3	100
18.6	19.5	20.7	23.2	26.0	28.4	32.0	34.9	39.2	43.9	48.6	52.7	59.0	64.3	70.7	139.7	125
22.6	23.5	25.2	28.2	31.6	34.6	39.0	42.7	48.0	54.0	60.1	65.1	73.1	80.0	88.3	168.3	150
26.0	27.3	29.1	32.7	36.6	40.1	45.2	49.6	55.9	62.9	70.1	76.0	85.7	93.9	104	193.7	175
29.5	31.0	33.1	37.1	41.6	45.6	51.5	56.5	63.7	71.8	80.1	87.0	98.2	108	120	219.1	200
33.0	34.7	37.0	41.6	46.7	51.2	57.8	63.3	71.5	80.6	90.2	98.0	111	122	135	244.5	225
36.9	38.9	41.4	46.6	52.3	57.3	64.9	71.1	80.3	90.6	101	110	125	137	153	273.0	250
44.0	45.3	48.3	55.5	62.3	68.4	77.4	84.9	96.0	108	121	132	150	165	184	323.9	300
48.3	50.6	54.3	61.0	68.6	75.3	85.0	93.5	106	120	134	146	166	183	204	355.6	350
53.4	56.3	60.2	67.9	76.6	84.3	95.6	107	121	137	154	169	191	210	235	406.4	400
59.3	62.6	67.0	75.6	85.0	93.6	106	119	135	153	174	190				457.0	450
69.4	73.1	77.6	87.7	98.6	108	123	138	158	178	201	219				508.0	500
		88.0	99.4	112	123	139	156	179	201	227					559.0	550
		98.8	112	126	138	157	176	201	226	254	276				610.0	600
		109	124	140	153	174	195	223	250	281	305				660.0	650
		120	136	153	168	191	214	245	275	309	336				711.0	700
		131	148	167	183	208	233	267	299	336	365				762.0	750
		142	160	181	198	225	252	289	324	364	395	441			813.0	800
		153	172	194	213	242	271	311	348	391	425	474			864.0	850
		164	184	208	228	259	290	333	373	419	455	508			914.0	900
		175	196	221	243	276	309	355	397	446	485	541	597		1016.0	1000
		197	220	249	273	311	348	400	447	502	546	609	672		1143.0	1125
		219	245	276	303	345	386	444	497	558	606	676	746		1270.0	1250
		241	269	304	333	380	425	489	547	614	667	744	821		1397.0	1400
		263	294	331	364	414	463	533	597	670	728	812	896		1524.0	1500
		285	318	359	394	448	502	578	646	726	788	879	970		1651.0	1600
		307	343	386	424	483	540	622	696	781	849	947	1045		1778.0	1750
		329	367	414	454	517	579	667	746	837	910	1015	1120		1905.0	1900
		351	392	441	485	552	617	711	796	893	970	1083	1195		2032.0	2000
		373	416	469	515	586	656	756	845	949	1031	1151	1270		2159.0	2150
		395	441	496	545	621	694	800	895	1004	1091	1219	1345		2286.0	2250
		417	465	524	576	655	733	845	944	1060	1152	1287	1419		2413.0	2400
		439	490	551	606	690	771	889	994	1115	1212	1355	1494		2540.0	2500

Marking

SĕAH



Technical Literature

19) Galvanised Steel Pipe

THAI MALLEABLE
IRON & STEEL CO., LTD

TM
ISO 9002

HIGH GRADE MALLEABLE IRON
PIPE FITTINGS

FIG. 102
Elbows, Banded
Equal
1/8"-8"

FIG. 112
Elbows, Banded
Reducing
1/4"-6"

FIG. 122
Elbows, 45°,
Banded
1/8"-6"

FIG. 162
Street Elbows,
Banded, Equal
1/8"-6"

FIG. 172
Street Elbows,
Banded, Reducing
1/2"-2"

FIG. 182
Street Elbows,
45°, Banded
1/8"-4"

FIG. 201
Side Outlet Elbows
1/4"-2"

FIG. 202
Tees, Banded,
Equal
1/8"-8"

FIG. 212-a
Tees, Banded
Reducing on branch
1/4"-6"

FIG. 212-b
Tees, Banded, Red
outlet, equal on
branch 3/8"-4"

FIG. 212-c
Tees, Banded,
Increasing on
branch 1/4"-4"

FIG. 212-d
Tees, Banded
Reducing on run
and branch 3/8"-3"

FIG. 221
Side Outlet Tee
1/4"-2"

FIG. 231
Side Outlet Tee
1/4"-2"

FIG. 242
45° Y Branch
Banded, Equal
3/8"-2"

FIG. 302
Cross, Banded,
Equal
1/8"-6"

FIG. 312
Cross, Banded,
Reducing
1/4"-4"

FIG. 402
Reducing Banded
Coupling
1/8"-6"

FIG. 412
Union, Banded,
Reducing
1/2"-2"

FIG. 421
Union, Banded,
Equal
1/8"-4"

FIG. 432
Union, Banded,
Reducing
1/4"-4"

FIG. 442
Union, Banded,
Equal
1/8"-4"

FIG. 452
Union, Banded,
Reducing
1/2"-2"

FIG. 502
Cap, Banded
1/8"-4"

FIG. 511
Plug, Banded
1/8"-4"

FIG. 512
Plug, Banded,
Reducing
1/4"-4"

FIG. 521
Plug, Banded,
Square Head
1/8"-4"

FIG. 532
Plug, Banded,
Hex Head
1/8"-4"

FIG. 542
Bushing, Banded,
Hex
1/4"-2"

FIG. 563
Union Elbows
Flat Seat M&F
1/2"-2"

FIG. 673
Union Elbows
Taper Seat
3/8"-2"

FIG. 683
Union Elbows
Taper Seat M&F
3/8"-2"

FIG. 700
Short Bends
Banded
1/2"-4"

FIG. 713
Short Bends
M&F, Banded
1/2"-4"

FIG. 722
Long Sweep Bends
Banded, 90
1/2"-4"

FIG. 732
Long Sweep Bends
Banded, 45°
1/2"-2"

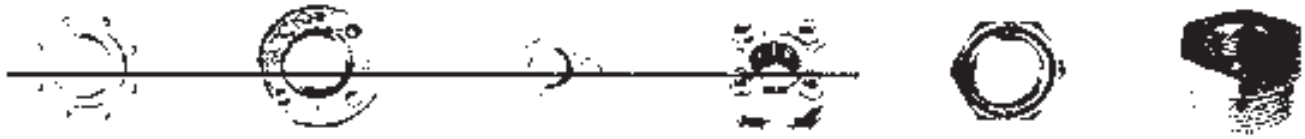
FIG. 742
Long Sweep Bends
Banded, 90° M&F
1/2"-6"

FIG. 752
Long Sweep Bends
Banded, 45°, M&F
1,2"-4"

FIG. 760
Long Sweep Bends
Male
1/2"-2"

FIG. 900
Round Flanges
without Bolt Hole
3/8"-6"

FIGs. 901 & 902
Round Flanges
(see footnote*)
3/8"-6"



FIGs. 903, 904 & 905
[illegible]

FIG. 906
[illegible]

FIG. 907
[illegible]

FIG. 908
[illegible]

FIG. 910
[illegible]

FIG. 920
[illegible]

FIG. 921
[illegible]

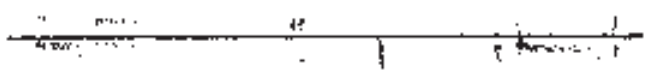
FIG. 930
[illegible]

FIG. 931
[illegible]

FIG. 933
[illegible]

FIG. 940
[illegible]

FIG. 941
[illegible]



NOTES:

[illegible]

FIG. [illegible]

FIG. [illegible]

[illegible]

FIG. [illegible]

FIG. [illegible]

FIG. [illegible]

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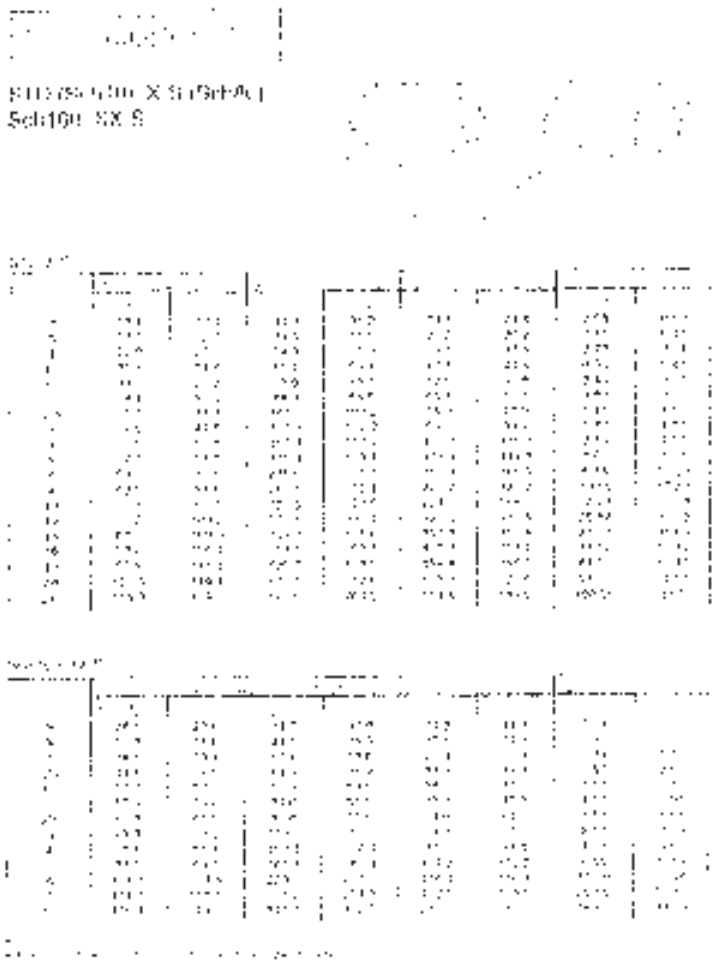
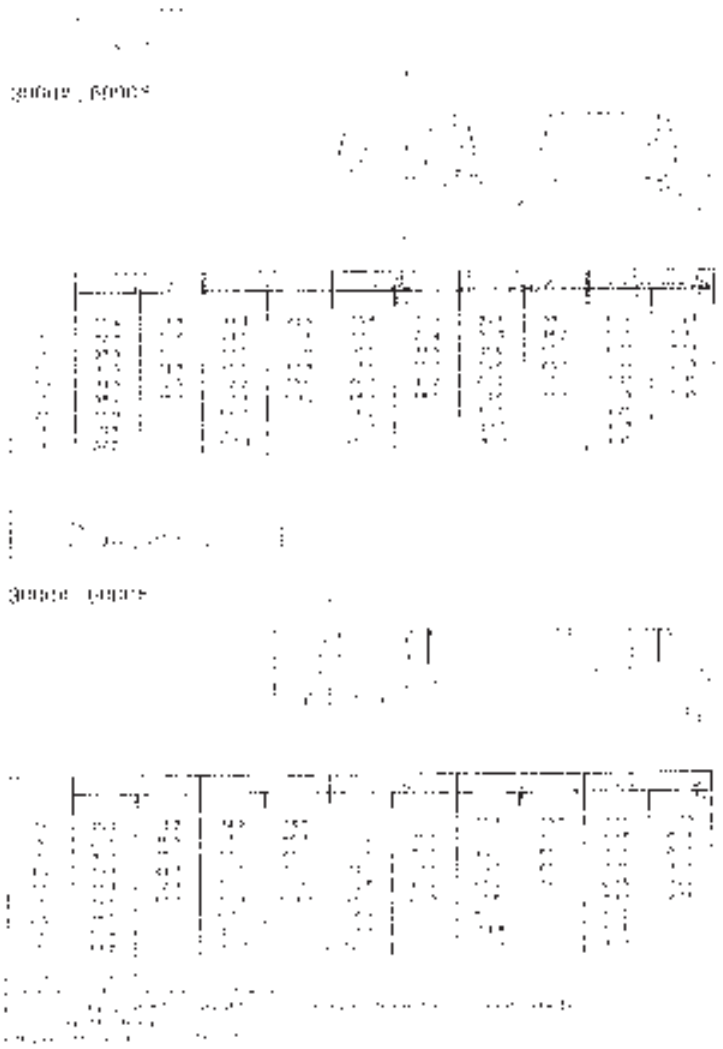
[illegible]

[illegible]

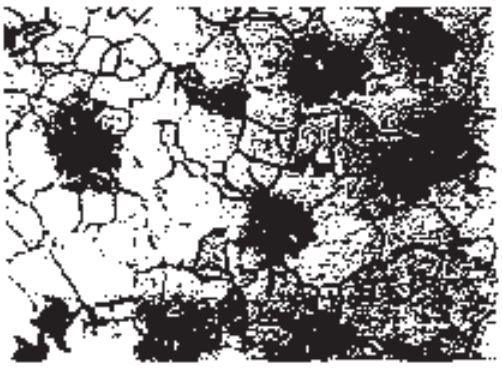
FORGED OUTLET FITTINGS
To ASTM A234/ANSI B16.9



FORGED OUTLET FITTINGS
To ASTM A234/ANSI B16.9



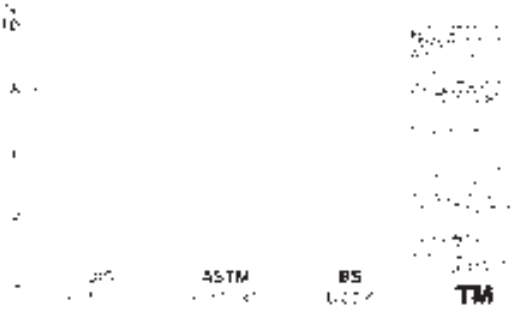
- TM fittings are made to ISO 49, BS 143 and 1256 or EN 10242 standards.
- Threads of TM fittings conform to either British (BS 21-1985)/ISO (7/1 W-1978) or Europe (EN 10226-1) depending upon customers' specifications.
- TM fittings are manufactured of black heart malleable iron which is melted and refined in electric induction furnaces, and annealed with extreme care.
- TM malleable iron has mechanical properties more superior than those specified by various international standards for pipe fittings (see the figures below).
- TM fittings are available either galvanized or black. Galvanized fittings have average coating thickness of 86 micrometer or average coating weight of 610 g/m² or higher.
- TM fittings are suitable either to be used for steam, air, water, gas and oil pipes and for many other fluids.



Microstructure of TM Black Heart Malleable Cast Iron (x100)

Constituents of Internal Fluid	Maximum Working Pressure (kg/cm^2)
Steam, Air, Gas, and Oil at 300°C	10
Steam, Air, Gas, Oil and Water at 200°C	14
Water Non-Shock at 120°C	20

TENSILE STENGTH



ELONGATION

AMERICAN STANDARD THREADS Note: Table extracted from USAS B2.1-1968

Table 1.

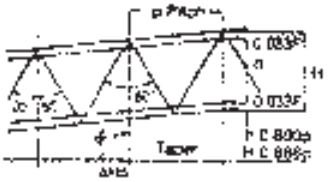


Fig. 5 (Taper)
H = 0.8660 × p
h = 0.6500 × p

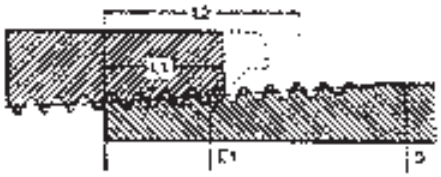


Fig. 5 (Taper)
L2 = (0.5D − 0.8)

*Straight Pipe Thread: the pitch, angle, and depth of thread are the same as the corresponding dimension of the taper pipe threads.

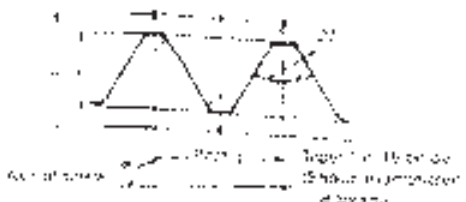
Table 1. Basic Dimensions

Dimensions, in inch

Nominal Size of Pipe	Outside Diameter of Pipe	Threads Per Inch	Pitch of Thread	Hand-Tight Engagement		Effective Thread Length External	Depth of Thread
	D	n	P	L1	E1	L2	h
1/8"	0.405	27	0.03704	0.180	0.37477	0.2611	0.02963
1/4"	0.540	18	0.05556	0.200	0.49163	0.4018	0.04444
3/8"	0.675	18	0.05556	0.240	0.62701	0.4078	0.04444
1/2"	0.840	14	0.07143	0.320	0.77843	0.5337	0.05714
3/4"	1.050	14	0.07143	0.339	0.98887	0.5457	0.05714
1"	1.315	11½	0.08696	0.400	1.23609	0.6828	0.06957
1 1/4"	1.660	11½	0.08696	0.420	1.58338	0.7068	0.06957
1 1/2"	1.900	11½	0.08696	0.420	1.82234	0.7229	0.06957
2"	2.375	11½	0.08696	0.436	2.29627	0.7565	0.06957
2 1/2"	2.875	8	0.12500	0.682	2.76214	1.1875	0.10000
3"	3.500	8	0.12500	0.766	3.38350	1.2000	0.10000
3 1/2"	4.000	8	0.12500	0.821	3.88881	1.2500	0.10000
4"	4.500	8	0.12500	0.844	4.38712	1.5000	0.10000
5"	5.563	8	0.12500	0.937	5.44624	1.4063	0.10000
6"	6.625	8	0.12500	0.958	6.50507	1.5125	0.10000

BRITISH STANDARD THREADS Note: Table extracted from B2.1-1968

Table 2.



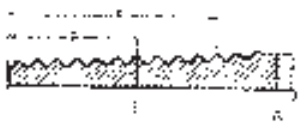
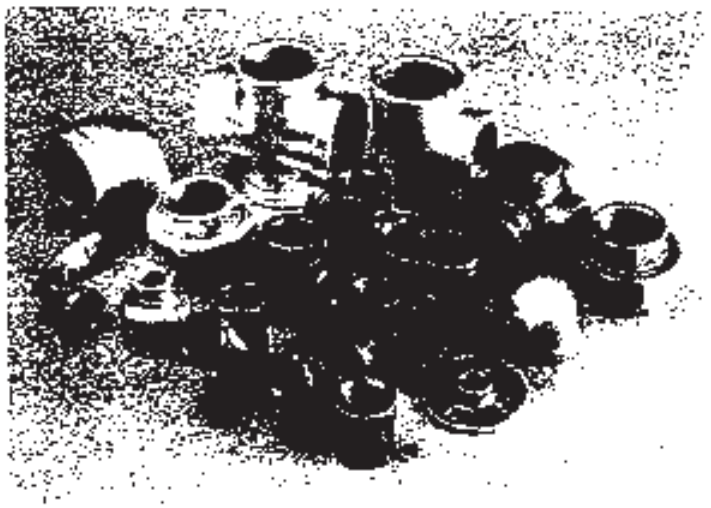


Table 2. Basic Sizes

Dimensions, in inch

The TM brand malleable iron pipe fittings are always ready for delivery to our customers. Please provide us the following information, when you order TM brand pipe fittings:

- Figure number, name and nominal size;
- Type of thread;
- Black or galvanized; and
- Quantity.



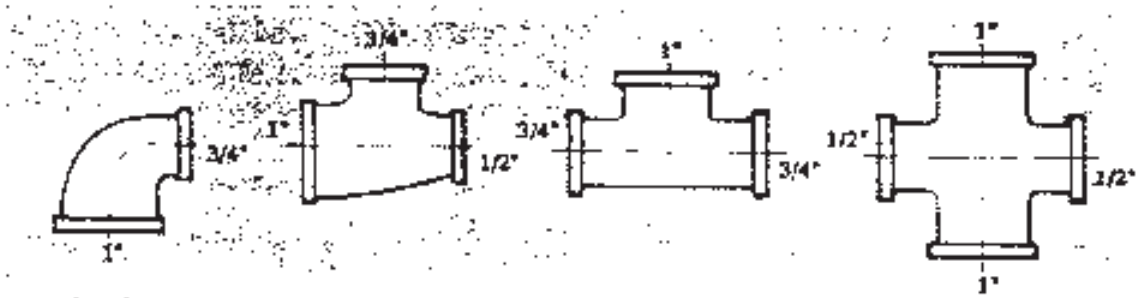
TM Malleable Iron Pipe Fittings

To avoid any confusion, the nominal size of different types of pipe fittings are designated as the following:

- Irrespective of the number of outlets, equal fittings (all outlets are of the same size) are referred to by that one size.

- For unequal fittings with two, three or four outlets:
  - 2 outlets: the larger diameter comes first and the smaller second.
  - 3 outlets: the larger diameter of the two on the same line comes first, the smaller second and the remaining third.
  - 4 outlets: the largest diameter comes first followed by the one on the same line, then the larger one of the remaining two and the last one fourth.

Please refer to the following figures as examples.

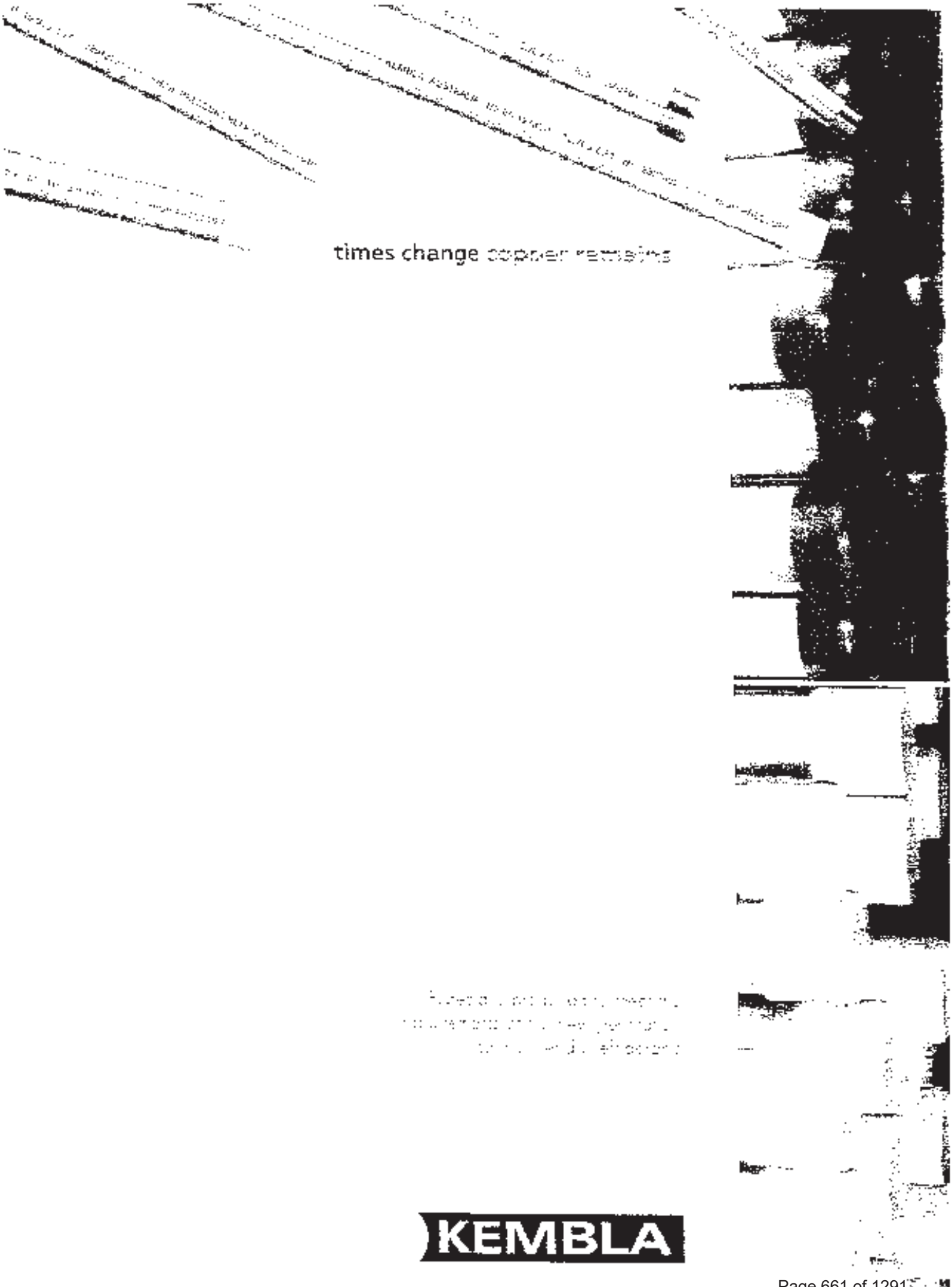


1 x 3/4 | 1 x 1/2 x 3/4 | 3/4 x 3/4 x 1 or 3/4 x 1 | 1 x 1 x 1/2 x 1/2 or 1 x 1/2

THAI MALLEABLE IRON AND STEEL CO., LTD.

Technical Literature

20) Galvanised Steel Pipe Fittings



KEMBLA

KEMBLA® AIR CONDITIONING & REFRIGERATION TUBE TO EUROPEAN STANDARD EN 12735-1

MM Kembla is a world-class producer and Australia's leading supplier of copper tube manufactured under the famous KEMBLA® brand name. MM Kembla manufactures a comprehensive range of copper tube products to comply with a variety of applications and International Standards.

Included in the KEMBLA® range is tube manufactured to fully conform to the European Standard for Air Conditioning & Refrigeration EN 12735-1. Tubes are available from 6.35mm (¼") to 104.78mm (4⅛") diameter in various wall thicknesses and can also be manufactured to larger sizes upon request. Copper tube manufactured to EN 12735-1 is now being supplied in place of the previously specified BS 2871-3, which is now a redundant Standard.

Now included in this range are products suitable for high-pressure refrigerants such as R410A, which has been selected as a replacement for R22 refrigerant that has been commonly used in light commercial and residential air-conditioning. These tubes are protected with pink caps to designate they are high-pressure tubes and the opposite table shows the sizes available. R410A has a 60% higher operating pressure than R22 thus requiring a thicker wall copper tube and significantly stronger copper fittings. 15% silver solder is recommended when brazing tube for use with R410A or other high-pressure refrigerants.

The internal cleanliness of air conditioning and refrigeration tube is critical in order to prevent contamination to the components in the piping system. MM Kembla has a unique manufacturing process and certified laboratory to confirm that the total residue does not exceed 0.03$gm/L as specified in EN 12735-1, AS/NZS 1571 and ASTM B280. After cleaning, all tubes are individually end capped to maintain their internal cleanliness. All straight tubes are manufactured in 5.8m lengths for ease of containerisation and are bundled and wrapped in plastic for maximum protection. Individual coils are also wrapped in plastic, packed into cardboard cartons and stacked on pallets ready for delivery.

Test Certificates are available for all products upon request.

EN12735-1 TUBE IDENTIFICATION

All straight lengths and coiled tube will be marked according to the EN 12735-1 Standard as follows:

[illegible] KEMBLA AUSTRALIA EN12735-1 15.88x1.2Y ACR 140326 [illegible]

[illegible] KEMBLA AUSTRALIA EN12735-1 15.88x1.2Y ACR 140326 [illegible] MEDICAL GRADE REFRIGERATION TUBE [illegible]

KEMBLA® REFRIGERATION FITTINGS TO STANDARD ASME B16.22

MM KEMBLA NEW ZEALAND is a leading manufacturer of a comprehensive range of copper fittings conforming to a variety of applications and International Standards. KEMBLA® fittings are marketed under the famous KEMBLA® and K Tick brand marks. A full range of fittings is available to suit KEMBLA® EN 12735 Air Conditioning & Refrigeration tube from 6.35mm (1/4") to 104.78mm (4⅛").

KEMBLA® refrigeration fittings are manufactured in accordance with Standard ASME B16.22 from copper tube manufactured to Kembla's unique specification. Each fitting is permanently marked to provide product tracing information for the life of the installation. All Kembla fittings are individually cleaned, bagged and labelled to fully comply with the cleanliness requirements of EN12735-1.

Refer to the KEMBLA Refrigeration Fittings Range brochure or available from our web site for product information and ordering details.

	Actual Tube Size Outside Dia. Diameter x Thickness		Weight	Safe Working Pressure (MPa)		Product Code				
	metric mm	imperial inches	kg/m	up to 50°C	over 50° up to 75°	Straight Length (6.0m)	Lengths per Bundle	Approved Coil (15m)	Coils per Carton	Coils per Pallet
	6.35 x 0.56	1/4" x 24swg	0.091	7.066	5.502			T22457	10	200
	6.35 x 0.81	1/4" x 22swg	0.098	7.766	6.435			T22358	10	200
	6.35 x 0.71	1/4" x 23swg	0.113	9.175	7.609	T5986*	25*	T23435	10	200
→	6.35 x 0.81	1/4" x 21swg	0.126	10.635	8.819	T51425	10*	T24836	10	200
	6.50 x 0.56	3/8" x 24swg	0.147	4.884	3.867			T33139	5	150
	9.52 x 0.81	3/8" x 22swg	0.153	5.018	4.167			T66140	5	150
	9.52 x 0.71	3/8" x 23swg	0.177	5.905	4.893	T32151	10*	T31771	5	150
→	9.52 x 0.81	3/8" x 21swg	0.198	6.601	5.475	T77113	10*	T58746	5	150
	12.70 x 0.71	1/2" x 24swg	0.191	3.786	3.871			T13617	5	125
	12.70 x 1.63	1/2" x 13swg	0.337	3.702	3.070			T67413	5	125
	12.70 x 0.9	1/2" x 22swg	0.236	4.344	3.604	T16352	10*	T13511	5	125
→	12.70 x 0.81	1/2" x 21swg	0.251	4.984	4.147	T16285*	10*	T34140	5	125
	15.88 x 0.56	5/8" x 24swg	0.241	3.068	2.535			T13254	5	100
	15.88 x 0.81	5/8" x 22swg	0.304	3.936	3.495			T91730	5	100
	15.88 x 0.71	5/8" x 23swg	0.303	3.438	2.911			T13140	5	100
→	15.88 x 0.91	5/8" x 20swg	0.381	4.956	3.998	T45397*	10*			
→	15.88 x 1.22	5/8" x 18swg	0.426	5.531	4.177	T16675*	10*	T15855	5	100
	19.05 x 0.71	3/4" x 23swg	0.370	2.646	1.966			T73974	5	80
	19.05 x 0.91	3/4" x 20swg	0.484	3.494	3.013	T8803*	10*			
	19.05 x 1.14	3/4" x 0.045"	0.574	4.089	3.671	T16754	10*	T16852	4	80
	22.22 x 0.91	7/8" x 20swg	0.561	3.138	2.602	T13605	10*			
	22.22 x 1.14	7/8" x 0.045"	0.675	3.970	3.292	T21051	10*			
	22.22 x 1.40	7/8" x 0.055"	0.814	4.825	4.036	T16883	10*			
	25.40 x 0.91	1" x 20swg	0.638	2.731	2.266	T20587	10*			
	25.40 x 1.22	1" x 18swg	0.829	3.735	3.077	T51954	10*			
	25.40 x 1.63	1" x 16swg	1.059	5.026	4.168	T7955	10*			
	28.58 x 0.91	1 1/8" x 20swg	0.706	2.479	2.006	T73974	10*			
	28.58 x 1.83	1 1/8" x 14swg	1.576	5.814	4.758	T24572	10*			
	34.93 x 0.91	1 3/8" x 20swg	0.87	1.964	1.615	T13743	5*			
	34.93 x 1.63	1 3/8" x 0.062"	1.317	3.021	1.926	T61526	5*			
	34.93 x 1.22	1 3/8" x 18swg	1.156	2.662	1.268	T51597	5*			
	34.93 x 1.40	1 3/8" x 0.056"	1.319	3.037	1.943	T21677	5*			
	34.93 x 2.03	1 3/8" x 14swg	1.871	4.507	3.754	T13982	5*			
	41.28 x 1.22	1 5/8" x 18swg	1.373	2.347	1.558	T51794	5*			
	41.28 x 1.83	1 5/8" x 14swg	2.029	3.458	2.830	T37212	5*			
	41.28 x 2.41	1 5/8" x 12swg	2.652	4.548	3.771	T16867	5*			
	53.98 x 1.22	2 1/8" x 18swg	1.809	1.902	1.412	T94583	3*			
	66.68 x 1.63	2 5/8" x 16swg	2.744	1.975	1.638	T19625	3*			
	66.68 x 2.03	2 5/8" x 14swg	3.407	2.845	1.930	T37564	3*			
	79.38 x 2.29	3 1/8" x 0.090"	4.661	2.156	1.613	T20812	1*			

Suitable for R410A and other high pressure refrigerants

* Manufactured to metric tender. All other straight lengths are hard drawn

Other sizes available on request

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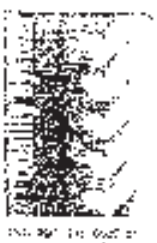
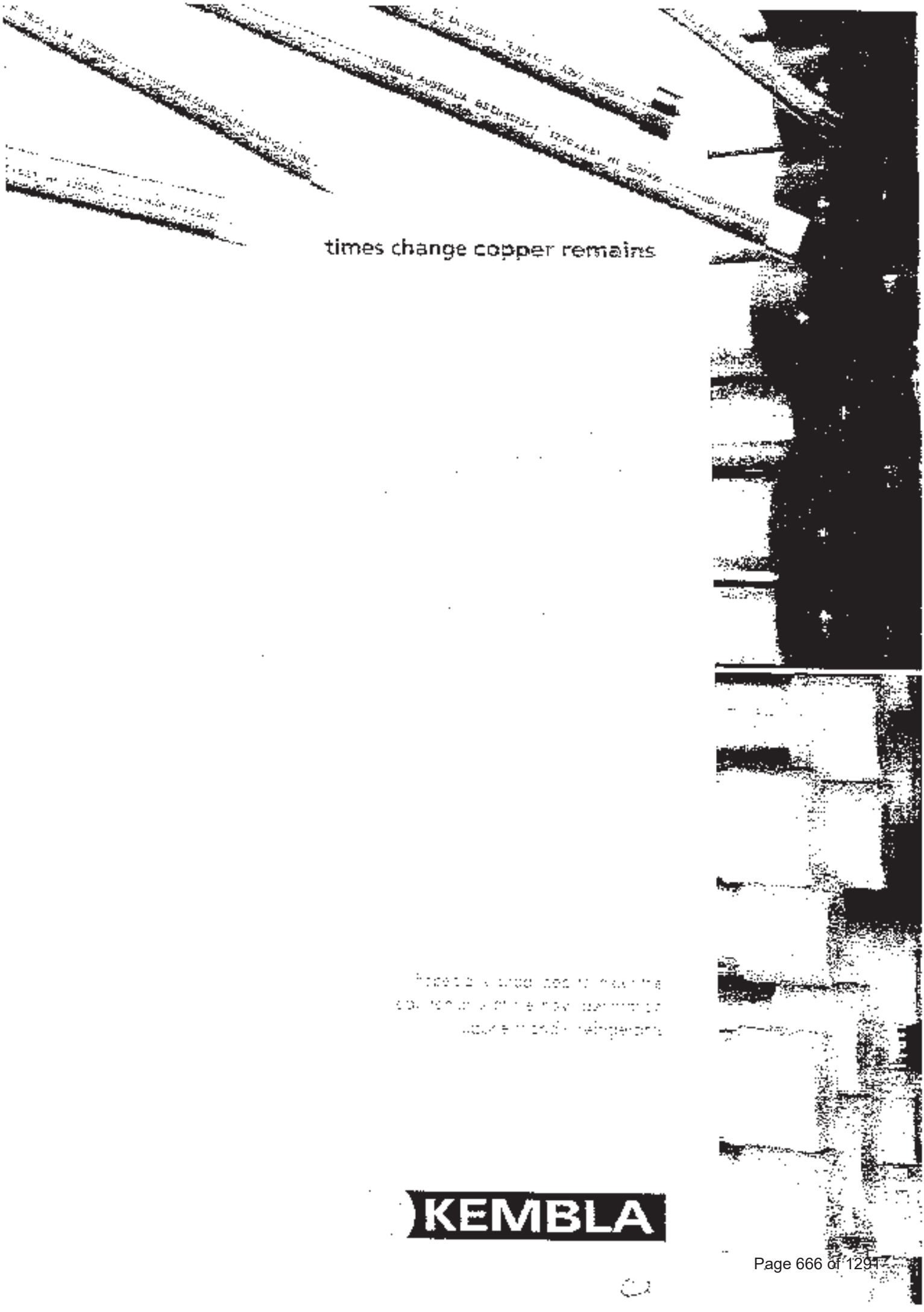


Technical Literature

21) Copper Pipe



KEMBLA

KEMBLA® AIR CONDITIONING & REFRIGERATION TUBE TO EUROPEAN STANDARD EN 12735-1

MM Kembla is a world-class producer and Australia's leading supplier of copper tube manufactured under the famous **KEMBLA®** brand name. MM Kembla manufactures a comprehensive range of copper tube products to comply with a variety of applications and international Standards.

Included in the **KEMBLA®** range is tube manufactured to fully conform to the European Standard for Air Conditioning & Refrigeration EN 12735-1. Tubes are available from 6.35mm (1/4") to 104.78mm (4 1/8") diameter in various wall thicknesses and can also be manufactured to larger sizes upon request. Copper tube manufactured to EN 12735-1 is now being supplied in place of the previously specified BS 2871-2, which is now a redundant Standard.

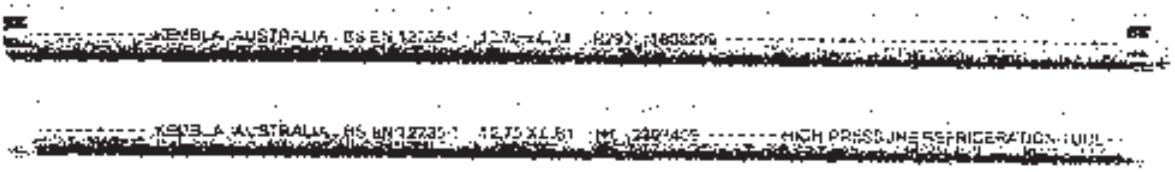
Now included in this range are products suitable for high-pressure refrigerants such as R410A, which has been selected as a replacement for R22 refrigerant that has been commonly used in light commercial and residential air-conditioning. These tubes are protected with pink caps to designate they are high-pressure tubes and the opposite table shows the sizes available. R410A has a 60% higher operating pressure than R22 thus requiring a thicker wall copper tube and significantly stronger copper fittings. 15% silver solder is recommended when brazing tube for use with R410A or other high-pressure refrigerants.

The internal cleanliness of air conditioning and refrigeration tube is critical in order to prevent contamination to the components in the piping system. MM Kembla has a unique manufacturing process and certified laboratory to confirm that the total residue does not exceed 0.038g/m2 as specified in EN12735-1, AS/NZS1571 and ASTM B280. After cleaning, all tubes are individually end-capped to maintain their internal cleanliness. All straight tubes are manufactured in 5.8m lengths for ease of containerisation and are bundled and wrapped in plastic for maximum protection. Individual coils are also wrapped in plastic, packed into cardboard cartons and stacked on pallets ready for delivery.

Test Certificates are available for all products upon request.

EN12735-1 TUBE IDENTIFICATION

All straight lengths and coil on tube will be marked according to the EN 12735-1 Standard as follows:



KEMBLA® REFRIGERATION FITTINGS TO STANDARD ASME B16.22

MM KEMBLA NEW ZEALAND is a leading manufacturer of a comprehensive range of copper fittings conforming to a variety of applications and international Standards. KEMBLA® fittings are marketed under the famous **KEMBLA®** and K Tick brand marks. A full range of fittings is available to suit **KEMBLA®** EN 12735 Air Conditioning & Refrigeration tube from 6.35mm (1/4") to 104.78mm (4 1/8").

KEMBLA® refrigeration fittings are manufactured in accordance with Standard ASME B16.22 from copper tube manufactured to Kembla's unique specification. Each fitting is permanently marked to provide product-tracing information for the life of the installation. All Kembla fittings are individually cleaned, bagged and labelled to fully comply with the cleanliness requirements of EN12735-1.

Refer to the KEMBLA 'Refrigeration Fittings Range' brochure as available from our web site for product information and ordering details.

C2

Actual Tube Size Outside Diameter x Thickness metric (mm)	imperial (inches)	Weight (kg/m)	Safe Working Pressure (kPa) up to 50° C	over 50° C up to 75°	Product Code Straight lengths (5.8m)	Lengths per bundle (..)	Annealed Coils (15m)	Coils per Carton	Coils per Pallet
6.35 x 0.56	1/4" x 24swg	0.091	7,065	5,802			T32457	10	200
6.35 x 0.61	1/4" x 23swg	0.098	7,760	6,435			T33336	10	200
6.35 x 0.71	1/4" x 22swg	0.112	9,175	7,605	T33967	200	T32430	10	200
6.35 x 0.81	1/4" x 21swg	0.126	10,635	8,819	T31425	100	T34030	10	200
9.53 x 0.56	3/8" x 24swg	0.141	4,594	3,807			T33285	6	160
9.53 x 0.61	3/8" x 23swg	0.155	5,018	4,161			T36746	6	160
9.53 x 0.71	3/8" x 22swg	0.176	5,900	4,893	T32193	100	T32771	6	160
9.52 x 0.81	3/8" x 21swg	0.198	6,800	5,635	T27119	100	T35745	6	160
12.70 x 0.56	1/2" x 24swg	0.191	3,339	2,819			T34027	6	120
12.70 x 0.61	1/2" x 23swg	0.207	3,705	3,072			T37416	6	120
12.70 x 0.71	1/2" x 22swg	0.239	4,344	3,603	T16062	100	T33011	6	120
12.70 x 0.81	1/2" x 21swg	0.271	4,994	4,141	T10285*	100	T34140	6	120
15.88 x 0.56	5/8" x 24swg	0.241	2,688	2,229			T33254	5	100
15.88 x 0.61	5/8" x 23swg	0.262	2,930	2,435			T31230	5	100
15.88 x 0.71	5/8" x 22swg	0.303	3,435	2,851			T33146	5	100
15.88 x 0.91	5/8" x 20swg	0.383	4,454	3,698	T24939*	100			
15.88 x 1.02	5/8" x 19swg	0.426	5,031	4,173	T16875*	100	T16853	5	100
19.05 x 0.71	3/4" x 22swg	0.366	2,846	2,364			T33516	4	80
19.05 x 0.91	3/4" x 20swg	0.464	3,684	3,059	T38074*	100			
19.05 x 1.14	3/4" x 0.045"	0.574	4,668	3,871	T16854	100	T16860	4	80
22.22 x 0.91	7/8" x 20swg	0.545	3,138	2,602	T13805	100			
22.22 x 1.14	7/8" x 0.045"	0.675	3,970	3,293	T21052	100			
22.22 x 1.40	7/8" x 0.055"	0.819	4,929	4,088	T16855	100			
25.40 x 0.91	1" x 20swg	0.626	2,750	2,268	T6066*	100			
25.40 x 1.22	1" x 18swg	0.829	3,705	3,070	T21553	100			
25.40 x 1.63	1" x 16swg	1.089	5,026	4,166	T79851	100			
28.58 x 0.91	1 1/8" x 20swg	0.708	2,419	2,005	T12574	100			
28.58 x 1.63	1 1/8" x 16swg	1.376	5,014	4,158	T14572	100			
34.92 x 0.91	1 3/8" x 20swg	0.87	1,966	1633	T15245	50			
34.92 x 1.07	1 3/8" x 0.042"	1.053	2,525	1,979	T21525	50			
34.92 x 1.22	1 3/8" x 18swg	1.155	2,662	2,208	T21990	50			
34.92 x 1.40	1 3/8" x 0.055"	1.319	3,041	2,543	T21877	50			
34.92 x 2.03	1 3/8" x 14swg	1.870	4,507	3,764	T25983	50			
41.28 x 1.22	1 5/8" x 16swg	1.573	3,047	1,859	T21794	50			
41.28 x 1.63	1 5/8" x 15swg	2.029	3,408	3,633	T21213	50			
41.28 x 2.41	1 5/8" x 12swg	2.932	4,548	3,771	T16857	50			
53.98 x 1.22	2 1/8" x 18swg	1.809	1,703	1,412	T24582	25			
53.98 x 1.63	2 1/8" x 16swg	2.344	1,373	1,138	T19528	25			
66.68 x 1.63	2 5/8" x 16swg	2.951	1,845	1,530	T23569	25			
79.38 x 2.29	3 1/8" x 0.090"	4.961	2,186	1,813	T20812	10			

Suitable for R410A and other high pressure refrigerants

* Manufactured in half hard temper, all other straight lengths are soft drawn

Other sizes available on request

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REFRIGERATION FITTINGS
Elbows - Female/Female

Elbows - Female/Female

90° Elbows - Long Radius

1/4	R410A	J00236	10
3/8	R410A	J00238	10
1/2	R410A	J00240	10
5/8	R410A	J00242	10
3/4	Std	J00244	10
3/4	R410A	J00245	10
7/8	Std	J00247	10
7/8	R410A	J00248	10
1	Std	J00249	10
1	R410A	J00250	10
1 1/8	Std	J00251	10
1 1/8	R410A	J00252	10
1 1/4	Std	J00253	10
1 3/8	Std	J00254	10
1 3/8	R410A	J00255	10
1 1/2	Std	J00256	10
1 5/8	Std	J00257	10
1 5/8	R410A	J00258	10
2	Std	J00259	4
2 1/8	Std	J00260	4
2 1/2	Std	J00261	2
2 5/8	Std	J00262	2
3	Std	J00263	1

90° Elbows - Short Radius

1/2	Std	J00264	10
1/2	R410A	J00265	10
5/8	R410A	J00266	10
3/4	Std	J00267	10
7/8	Std	J00268	10
1	Std	J00269	10
1 1/8	Std	J00270	10
1 1/4	Std	J00271	10
1 3/8	Std	J00272	10
1 1/2	Std	J00273	10
1 5/8	Std	J00274	10
2 1/8	Std	J00275	4
2 5/8	Std	J00276	2
3	Std	J00277	1

Designed and manufactured by MM Kembla to fully comply with the requirements of American standard ASME B16.22 for use with ASTM B280 and AS/NZS 1571 Refrigeration Tube

KEMBLA

REFRIGERATION FITTINGS
Elbows - Female/Female Cont...

Elbows - Female/Female

45° Elbows - Long Radius

3/8	Std	J00135	12
3/8	R410A	J00137	12
1/2	Std	J00122	12
1/2	R410A	J00123	12
5/8	Std	J00124	12
5/8	R410A	J00125	12
3/4	Std	J00126	12
3/4	R410A	J00127	12
7/8	Std	J00128	12
7/8	R410A	J00129	12
1 1/8	Std	J00141	12
1 1/8	Std	J00147	12
1 1/8	R410A	J00148	12
1 3/8	Std	J00150	12
1 3/8	Std	J00156	12
1 3/8	R410A	J00157	12
1 5/8	Std	J00151	12
1 5/8	Std	J00155	12
1 5/8	R410A	J00158	12
2 1/8	Std	J00172	6
2 5/8	Std	J00177	6

Designed and manufactured by MM Kembla to fully comply with the requirements of American standard ASME B16.22 for use with ASTM B280 and AS/NZS 1571 Refrigeration Tube

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REFRIGERATION FITTINGS
Elbows/Bends

Elbows/Bends

180° Elbows - Female/Female

3/8	1 1/4	R410A	J28148	10
3/8	1 1/2	R410A	J28067	10
5/8	3	R410A	J28034	10
3/4	3 1/4	Std	J28037	10
7/8	4 1/2	Std	J00452	10
1	5	Std	J28011	10
1 1/8	6	Std	J00457	10
1 3/8	8	Std	J28030	5
1 5/8	9 1/2	Std	J28035	4
2 1/8	12 1/2	Std	J28051	2

90° Bends - Male/ Female

3/8	R410A	J28038	10
1/2	R410A	J28041	10
5/8	R410A	J00916	10
3/4	Std	J28031	10
3/4	R410A	J00329	10
7/8	Std	J00921	10
7/8	R410A	J28027	10
1	Std	J28007	10
1	R410A	J00325	10
1 1/8	Std	J00535	10
1 1/8	R410A	J00532	10
1 1/4	Std	J28008	10
1 3/8	Std	J00536	10
1 3/8	R410A	J28037	10
1 1/2	Std	J28047	10
1 5/8	Std	J28042	10
1 5/8	R410A	J00542	10
2 1/8	Std	J00547	4
2 5/8	Std	J28015	2

Designed and manufactured by MM Kembla to fully comply with the requirements of American standard ASME B16.22, for use with ASTM B280 and AS/NZS 1571 Refrigeration Tube

KEMBLA

REFRIGERATION FITTINGS
Connectors

Connectors

Y' Piece - 3 Way Connectors

1/2 x 3/8 x 3/8	R410A	J01166	10
5/8 x 1/2 x 1/2	R410A	J01167	10
5/8 x 5/8 x 5/8	R410A	J01168	10
3/4 x 5/8 x 5/8	R410A	J01169	10
7/8 x 5/8 x 5/8	R410A	J01170	10
7/8 x 7/8 x 7/8	R410A	J01171	10
1 x 5/8 x 5/8	R32	J01172	10
1 x 3/4 x 3/4	R32	J01173	10
1 1/8 x 5/8 x 5/8	R32	J01174	10
1 1/8 x 3/4 x 3/4	R32	J01175	10
1 1/8 x 7/8 x 7/8	R32	J01176	10

In Line Connectors

1/4	R32	J00571	10
1/4	R410A	J00572	10
3/8	R32	J00590	10
3/8	R410A	J00592	10
1/2	R32	J00720	10
1/2	R410A	J00722	10
5/8	R410A	J00710	10
3/4	R410A	J00730	10
7/8	R410A	J00750	10
1	R32	J00751	10
1 1/8	R410A	J00811	10
1 1/4	R32	J00830	10
1 3/8	R32	J00851	10
1 3/8	R32	J01060	10
1 5/8	R32	J00970	10
2	R32	J00990	10
2 1/8	R32	J00995	10
2 5/8	R32	J00320	10

Designed and manufactured by MM Kembla to fully comply with the requirements of American standard ASME B16.22 for use with ASTM B280 and AS/NZS 1571 Refrigeration Tube

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REFRIGERATION FITTINGS
Reducers - Female/Female

Reducers - Female/Female

→ Reducers

5/8 x 1/2	R410A	J00696	10
1/2 x 1/4	R410A	J00695	10
1/2 x 3/4	R410A	J00697	10
5/8 x 3/4	R410A	J00703	10
5/8 x 7/8	R410A	J00704	10
3/4 x 5/8	Std	J00731	10
3/4 x 1	Std	J00732	10
3/4 x 5/8	R410A	J00734	10
7/8 x 1 1/8	Std	J00740	10
7/8 x 5/8	R410A	J00746	10
7/8 x 3/4	Std	J00751	10
1 x 3/4	R410A	J00775	10
1 1/8 x 7/8	Std	J00780	10
1 1/8 x 5/8	Std	J00791	10
1 1/8 x 3/4	Std	J00795	10
1 1/8 x 7/8	Std	J00801	10
1 1/8 x 1	Std	J00805	10
1 3/8 x 1 1/8	Std	J00838	10
1 3/8 x 7/8	Std	J00841	10
1 3/8 x 1 1/8	Std	J00847	10
1 5/8 x 7/8	Std	J00867	10
1 5/8 x 1 1/8	Std	J00868	10
1 5/8 x 1 3/8	Std	J00871	10
2 1/8 x 7/8	Std	J00885	10
2 1/8 x 1 1/8	Std	J00891	10
2 1/8 x 1 3/8	Std	J00896	10
2 1/8 x 1 5/8	Std	J00901	10
2 5/8 x 1 3/8	Std	J00911	5
2 5/8 x 1 5/8	Std	J00917	5
2 5/8 x 2 1/8	Std	J00931	5
3 1/8 x 2 1/8	Std	J00937	5
3 1/8 x 2 5/8	Std	J00954	5

Designed and manufactured by MM Kembla to fully comply with the requirements of American standard ASME B16.22 for use with ASTM B280 and AS/NZS 1571 Refrigeration Tube

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REFRIGERATION FITTINGS
Bushings - Male/Female

Bushings - Male/Female

→ Bushings

3/8 x 1/4	R410A	J02032	10
1/2 x 1/4	R410A	J27002	10
1/2 x 3/8	R410A	J02036	10
5/8 x 3/8	R410A	J02946	10
5/8 x 1/2	R410A	J02946	10
3/4 x 1/2	Std	J27003	10
3/4 x 5/8	R410A	J02944	10
7/8 x 1/2	Std	J27005	10
7/8 x 5/8	Std	J02951	10
7/8 x 3/4	Std	J02952	10
1 1/8 x 1/2	Std	J02961	10
1 1/8 x 5/8	Std	J02977	10
1 1/8 x 3/4	Std	J02951	10
1 1/8 x 7/8	Std	J02980	10
1 3/8 x 5/8	Std	J27016	10
1 3/8 x 7/8	Std	J02996	10
1 3/8 x 1 1/8	Std	J01002	10
1 5/8 x 7/8	Std	J01021	10
1 5/8 x 1 1/8	Std	J27025	10
1 5/8 x 1 3/8	Std	J01031	10
2 1/8 x 1 1/8	Std	J01042	10
2 1/8 x 1 3/8	Std	J01046	10
2 1/8 x 1 5/8	Std	J01051	10
2 5/8 x 1 3/8	Std	J01062	5
2 5/8 x 1 5/8	Std	J01065	5
2 5/8 x 2 1/8	Std	J01067	5

Designed and manufactured by IMI Kembla to fully comply with the requirements of American standard ASME B16.22, for use with ASTM B280 and AS/NZS 1571 Refrigeration Tube

KEMBLA

REFRIGERATION FITTINGS
Tees

Tees

Tees - Equal

1/4	Std	J00477	10
1/4	R410A	J00478	10
5/16	R410A	J00481	10
3/8	Std	J00492	10
3/8	R410A	J00497	10
1/2	R410A	J00515	10
5/8	R410A	J00535	10
3/4	Std	J00555	10
3/4	R410A	J00557	10
7/8	Std	J00581	10
1	Std	J00602	10
1	R410A	J00611	10
1 1/8	R410A	J00617	10
1 1/4	Std	J00622	10
1 3/8	Std	J00628	10
1 1/2	Std	J00631	10
1 5/8	Std	J00655	5
2	Std	J00641	4
2 1/8	Std	J00642	3
2 5/8	Std	J00653	2
3	Std	J00654	2
3 1/8	Std	J00655	Pair

Tees - Branch Reduction

1/2 x 3/8 x 1/4	R410A	J00482	10
5/8 x 3/8 x 1/4	R410A	J00487	10
1/2 x 1/2 x 1/4	R410A	J00490	10
1/2 x 1/2 x 3/8	R410A	J00515	10
5/8 x 5/8 x 3/8	R410A	J00530	10
5/8 x 5/8 x 1/2	R410A	J00535	10
3/4 x 3/4 x 1/2	R410A	J00554	10
3/4 x 3/4 x 5/8	R410A	J00555	10
7/8 x 7/8 x 1/2	R410A	J00574	10
1 x 1 x 1/2	R410A	J00580	10
1 x 1 x 3/4	Std	J00585	10
1 5/8 x 1 5/8 x 1 1/2	Std	J00611	5

Designed and manufactured by MM Kembla to fully comply with the requirements of American standard ASME B16.22, for use with ASTM B280 and AS/NZS 1571 Refrigeration Tube

KEMBLA

REFRIGERATION FITTINGS
'P' Traps

Copper 'P' Traps

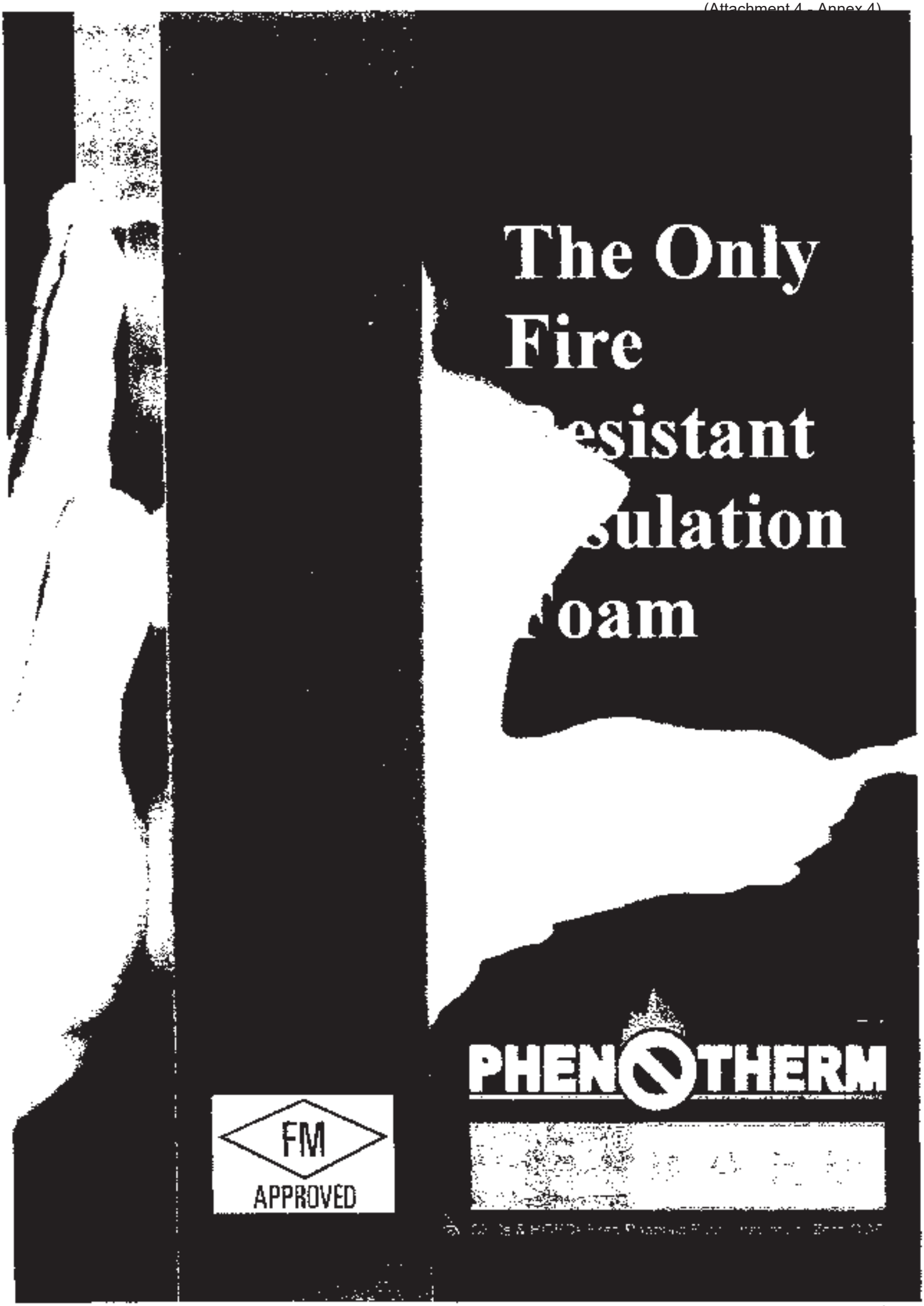
'P' Traps

5/8	R410A	302321	2
3/4	R410A	302322	3
7/8	R410A	302323	1
1 1/8	R410A	302324	4
1 3/8	R410A	302325	2
1 5/8	R410A	302326	n/a
2 1/8	R410A	302327	n/a

Designed and manufactured by MM Kembla to fully comply with the requirements of American standard ASME B16.22 for use with ASTM B280 and AS/NZS 1571 Refrigeration Tube

Technical Literature

22) Copper Pipe Fittings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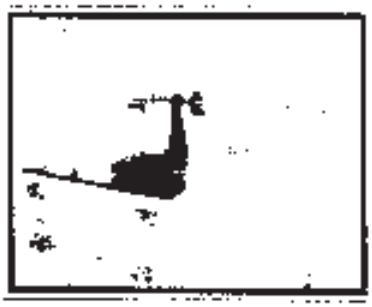
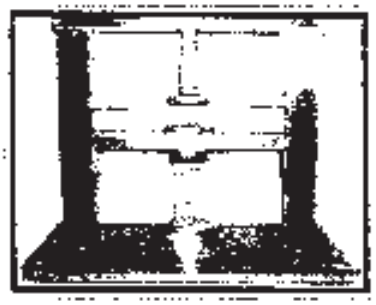
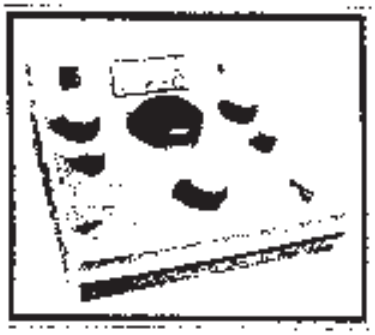
Contents

Description

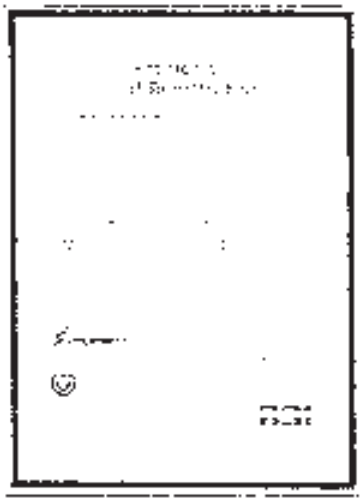
Test Instruments

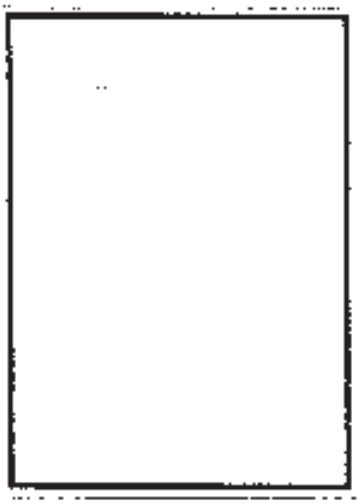


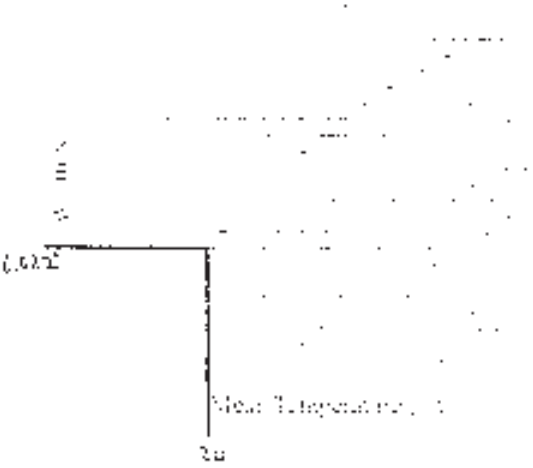




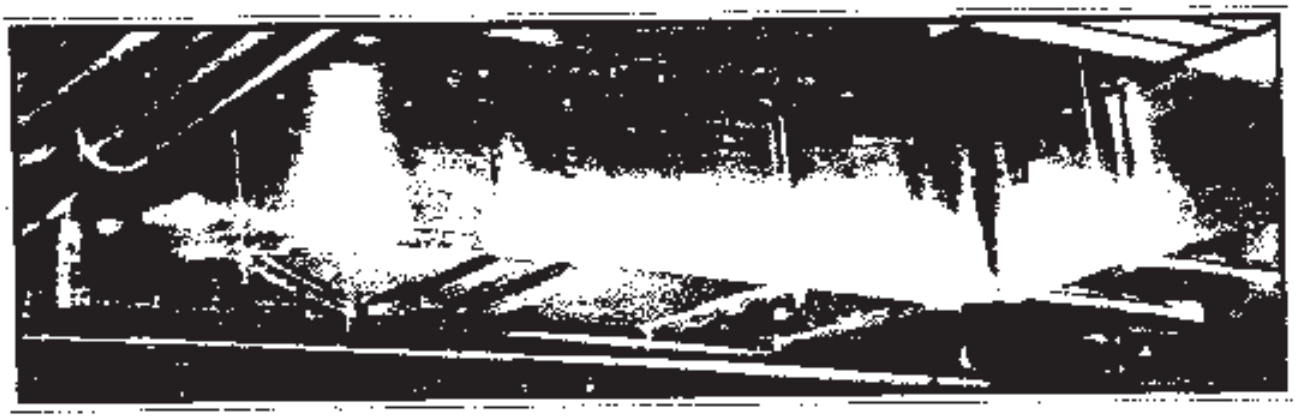
Thermal Conductivity (ISO 8302)
Nominal Density







Use and Application



Distinctive Features

Environmentally Friendly

Superior Thermal Characteristics

Low Water Absorption

Fire Performance

Toxicity

Wide Service Temperature

Longer Lifetime

Z-Shape and Tongue-Shiplap Joints

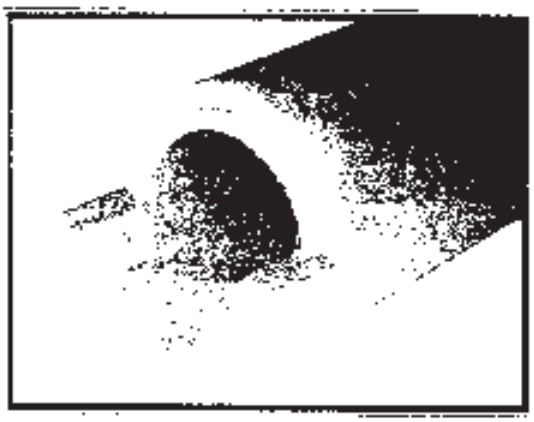
Ease to Design

Storage

Maintenance

High Tensile Strength (UTS)

Product Matching



Standard Supply Ranges

Pipes of these [illegible] are available :

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

	Rigid Pipes
Nominal Densities Ratings	40 kg/m³, 50 kg/m³ & 120 kg/m³
DSI :	Double Sided Reinforced Aluminium Foil
DSI-White :	All Service White Antiglare Coated Double Sided Reinforced Aluminium Foil
WGC :	White Glass Tissue
Thickness :	15 mm to 100 mm
Standard Lengths :	1.2 M x 1.2 M for 40 kg/m³ & 50 kg/m³ 1.2 M x 1.2 M for 80 kg/m³, 120 kg/m³

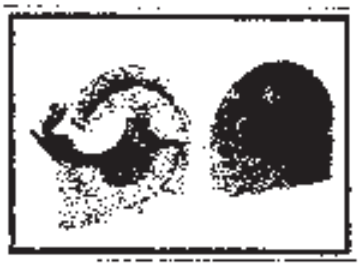
Preformed Rigid Pipe Section - High Density Pipe Supports - Fittings

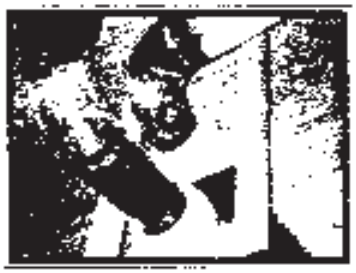
Nominal Densities Ratings	80 kg/m³ & 120 kg/m³
DSI :	Double Sided Reinforced Aluminium Foil
DSI-White :	All Service White Antiglare Coated Double Sided Reinforced Aluminium Foil
Nominal Bore :	15 mm to 65 mm
Thickness :	25 mm to 100 mm
Standard Length :	
Rigid Pipe Section :	1200 mm
Pipe Supports :	250 mm to 300 mm

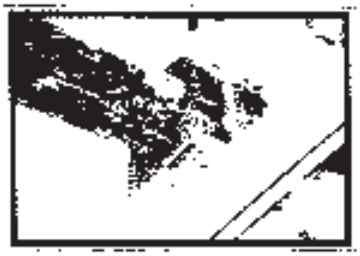
High Density Duct Supports

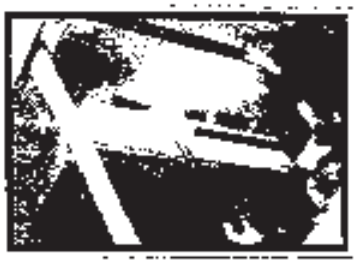
Nominal Density Ratings	64 kg/m³
DSI :	Double Sided Reinforced Aluminium Foil
DSI-White :	All Service White Antiglare Coated Double Sided Reinforced Aluminium Foil
WGC :	White Glass Tissue
Standard Width :	75 mm to 150 mm

High Density Supports









Technical Properties

Properties	Test Method	Technical Data
Nominal Density		
Thermal Properties		
Thermal Conductivity		
Mean Temperature at 10 °C		W/(m·K)
Mean Temperature at 25 °C		W/(m·K)
Service Temperature Min.		°C
Max.		°C
Mechanical Properties		
Compressive Strength		
Perpendicular to Rise		
Moisture Properties		
Closed Cell Content		%
Water Absorption by Volume		
Water Vapour Permeability		
Fire Performance		
Ignitability		Class E
Flame Penetration		
Surface Spread of Flame		Class 1
Fire Safety – UK Building Regulations (Note: Appendix A Cl. 1.4)		Conforms to Class 0
Oxygen Index		%
Smoke Obscuration		
Reaction to Fire Classification		Euro Class
Surface Burning Characteristics		Flame Spread Index
		Smoke Density Index

Major Job References

Successful Application in Chilled Water Pipework, Steam Main, Gas Pipework and Heating Systems

HONG KONG

- Princess Margaret Hospital Extension, Lai Chi Kok, Kowloon
  Wan Chai Kowloon Reclamation Phase 1, Eastern Harbour Crossing
  Tsing Yi Island - Cheung Sha Wan Island Reclamation, Phase 1
  Queen Elizabeth Hospital - Phase 1, Jordan, Kowloon
  Hong Kong Temple - Mr. Lee Shau Kee, Sheung Wan
- Pokfulam Development - Phase 1, Hong Kong
- Hong Kong Japanese International School, Aberdeen
- Caltex Refinery at Tsing Yi
- International Finance Centre - Phase 1
  Yau Ma Tei Reclamation - Multi-Storey Carparks at Public Cargo Working Area
  HKUST - Redevelopment of South East Kowloon - Phase 1A
  Wan Chai Reclamation, Phase 1
  Western Harbour Crossing, Tsing Yi Approach Viaduct, Tsing Yi Island
- Island East Development at Hong Kong - Phase 1
- Hong Kong Science & Technology Park, Shatin, New Territories
  Olympian City, Yau Ma Tei - Development - Phase 1
- Kowloon Station Over Site Development
- MTR/KCR - Installation at Sha Tin Wai Road, CWB & ERP
- The University of Hong Kong - Lee Shau Kee Medical Complex
- MTR/KCR - Tsuen Wan Line - Extension to Tsuen Wan West, Hung Hom to Tsim Sha Tsui East & Tsim Sha Tsui to Austin Station
  Proposed Extension to Tsuen Wan Line, MTR No. 421 Tender, Hung Hom - Kwai Chung
- Cyberport Development at Telegraph Bay, Hong Kong, Building Complex (2 Towers)
- KCRC - Ngau Tau Kok Extension to Kwun Tong & Tai Wai to Ho Man Tin, Hung Hom to Admiralty and Racecourse
- No. 1 Peking Road, Tsim Sha Tsui
  Contract No. 3/96 - Site Formation & Services for Tung A, Area 56, Tai Kok Tsui, Phase IV
- Contract No. 3/SSDS/97 - Site Formation & Services for Area 56, Tai Kok Tsui, Phase V
- ICBC (Asia) Building, Garden Road, Central
- KCRC - Contract No. 3/97 - Tai Wai to Ma On Shan Extension
  Sheppard Building at Hong Kong International Airport
  New Power Station at Castle Peak
  Four Seasons Hotel at Central
- New Territories Sports Ground at Penny's Bay, Lantau Island & Associated Works
- 2/4 Magazine Launch at Victoria

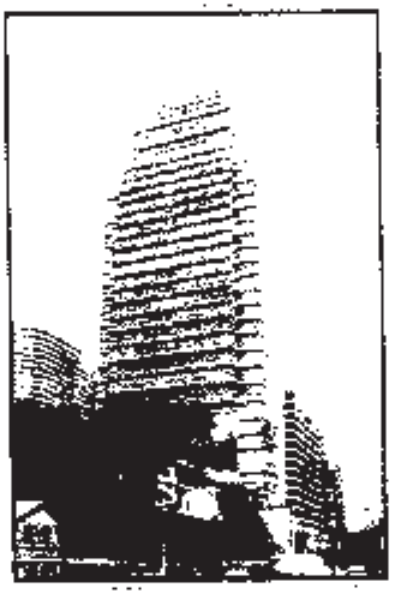
CHINA

- Guangzhou - Shenzhen Railway
- Shanghai Commercial Bank Building, Pudong
- Guangzhou Waterworks Extension, Phase 1
- Guangzhou - Asian Manufacturing Facilities Extension
  Construction of Gas Pipes
  Steam to Premises Lines
- Liberal Democrat Victoria New Plant - Phase 1
  Shanghai - Hong Kong New World Tower

MACAU

- Sai Van Bridge Viaduct
- Administration Building at Pac On
- Macau - Taipa - Coloane Reclamation at Cotai
- Macau Light Rail Transit
- Macau Stadium
- Macau Jockey Club
- Wynn Resort - Phase 1 & 2
- Venetian Hotel, Cotai
- MGM Grand, Cotai
- Galaxy Hotel, Cotai
- New Macau International Airport
- Parkview Hotel - Macau
- Pousada

CFCs & HCFCs Free Phenolic Foam Insulation Zero ODP



Technical Literature

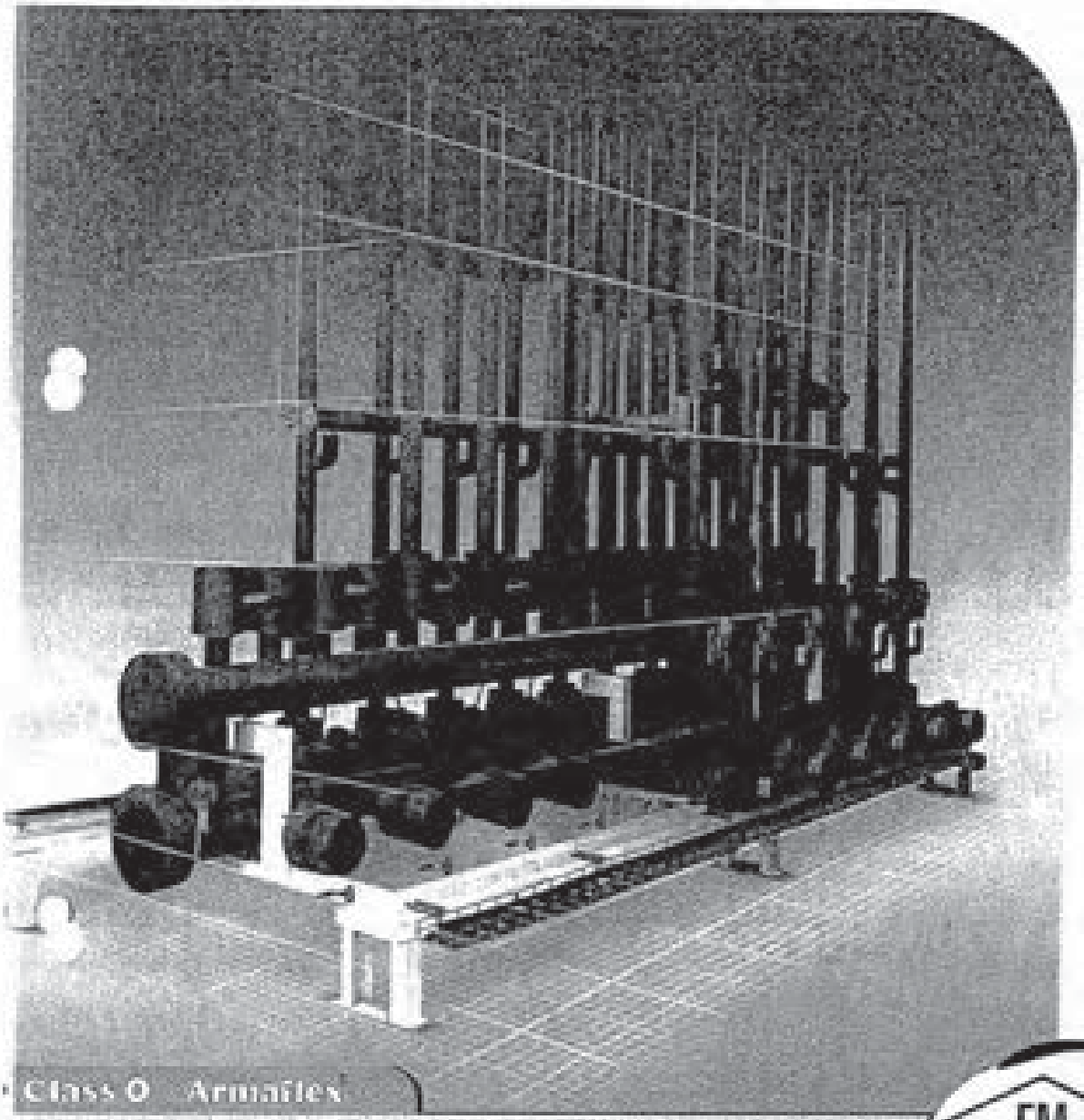
23) Pipework Phenolic Foam Insulation

Technical Literature

24) Refrigerant Pipework Flexible Closed Cell Elastomeric Insulation

armacell
engineered foams

THE MAKERS OF Armaflex®



Class 0 Armaflex®

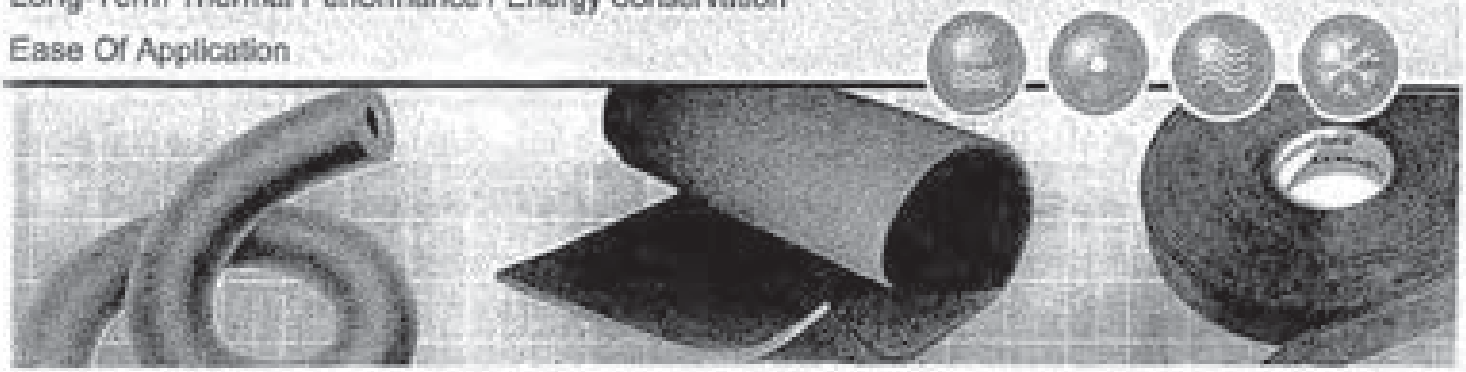
FM APPROVED

he Professional Insulation with Double Performance:
eliable Condensation Control and Effective Energy Saving

Built-In Vapour Barrier Prevents Condensation

Long-Term Thermal Performance / Energy Conservation

Ease Of Application



The Armaflex Assurance System - your peace-of-mind assurance that Armaflex is made to the strictest quality, technical performance and environmentally friendly standards.

Prevents Moisture Permeation
Multi-layered closed wall cells provide a built-in vapour barrier which can't be compromised by surface punctures or rips - this ensures the vapour barrier stays working for the lifetime of the insulation system.

Provides Long-Term Thermal Performance
Non-wicking - No transmission of water vapour is possible through the insulation due to the closed cell nature of Armaflex. Moisture will not migrate through professionally installed Armaflex.

Long-Term Durability
No fragile water vapour barrier - The built-in vapour barrier can't be "damaged" during installation or over the lifetime of the insulation.

Avoids Thermal Bridging
Armaflex is a seamless insulation system - these same technical properties provide a secure system.

Long-Term Energy Efficiency
By minimising the ingress of water vapour into the insulation the multi-layered cells in Armaflex prevent the thermal conductivity from rising. Increased thermal conductivity can in the long term lead to increased energy costs and surface condensation.

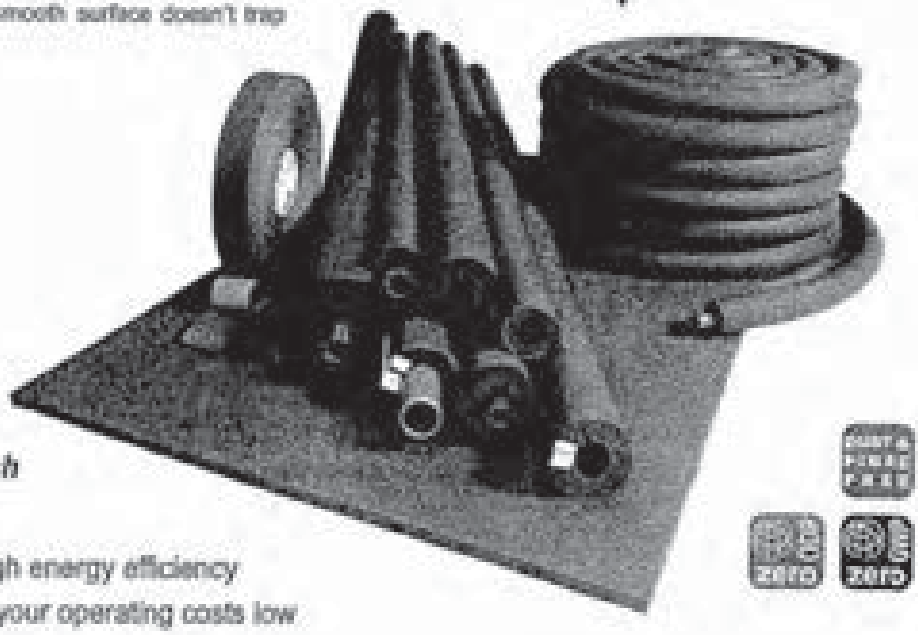
Inhibits Growth of Mould
- Minimises moisture permeation, the first requirement for mould growth
- Minimises the second requirement: No cellulosic vapour jacket, and the smooth surface doesn't trap dust

Formaldehyde-Free
Ensures that Armaflex is a low-emitting product. It is also low VOC.

Support Requirements of Health & IAQ (Indoor Air Quality)
- Dust and Fibre-Free
- Will not emit any particles or fibres - even when cut into shapes and fittings
- No outgassing - CFC & HCFC free manufacturing process

Supervised Manufacturing & Technical Values
Factory Mutual Approval Guide - guarantee consistent performance to published values by monitoring
- Fire Performance (the slow sharoa test, Flammability test)
- Water Vapour Transmission
- Thermal Conductivity

Supervised Quality Standards
ISO Registration ensures that all Armacell manufacturing facilities consistently meet customer requirements . . . by managing all processes with ongoing quality assessments.



Armaflex®
The Insulation System which
- ✓ Protects yo
- ✓ Provides high energy efficiency
- ✓ Keeps your operating costs low

ODP ZERO
GWP ZERO

(2)

Class O Armaflex is the flexible, closed cell, elastomeric, nitrile rubber insulation that offers reliable protection against condensation and effectively prevents energy loss.

A highly efficient method of insulating hot and cold water services, chilled water lines, heating systems, air conditioning duct work and refrigerated pipe work for frost protection, energy conservation and condensation control. Armaflex is dust free, fibre free and CFC free with an ODP of zero which means an environmentally friendly product.

- Built in vapour barrier prevents condensation
- Long-term thermal performance / energy conservation
- Lightweight and flexible, quick and easy installation with low maintenance requirements, resulting in time and cost savings
- Excellent resistance to the effects of ozone, oil and chemicals (consult product test list)

ARMAFLEX Adhesive 520

Armaflex 520 adhesive is based on modified chloroprene rubber in a blend of flammable solvents. The material has low viscosity for ease of application and quick drying characteristics. In the dry state, Armaflex 520 Adhesive is not flammable. The adhesive is particularly suitable for joining Armaflex flexible elastomeric insulation and for bonding the material to clean prepared surfaces. When properly cured the adhesive maintains the resistance to water vapour expected of Armaflex.

ARMAFLEX Gluemaster

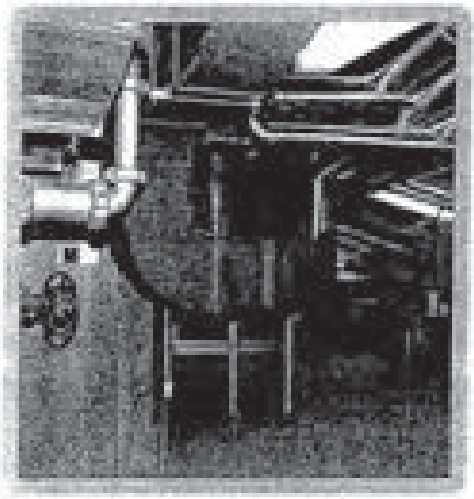
Glue pump enhanced to use with Armaflex adhesives. Metal can and brush in one with dose pump. Gluing is made faster and more efficient than manual application, requiring no manual "dunking" of an application brush. By adequately spreading the glue onto the surface Gluemaster provides savings by reducing waste to an absolute minimum.

ARMAFLEX Pipe Support Section

Armafix Insulation Pipe Hangers (IPH) is quick, innovative alternative to traditional block and dowel pipe supports. The engineered, foam-to-foam solutions provide optimum load bearing while protecting against thinkness compression and condensation gaps that can compromise system integrity

ARMAFINISH 99 Paint

Armafinish 99 is a water-based coating using an advanced terpolymer resin system. When properly applied the coat-ing is suitable for the protection of Armaflex flexible thermal insulation materials against sunlight, UV radiation and chemical attack.The coating, when fully cured, maintains the flexibility, resistance to water vapour and fire performance of the Armaflex material. Where resistance to damage is a particular requirement the coating may be further strength-ened using a random mesh glass fibre scrim.



ARMAFLEX Tape Self-Adhesive

Self-Adhesive tape (available in Class O Armaflex, NH/Armaflex or HT/Armaflex) which may be used for insulating difficult shapes or areas not easily accessible

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Class O Armaflex®

Technical Data and product range

Class O Armaflex Technical Data

Temperature range	Minimum line temperature -40°C* Maximum line temperature +105°C Flat surfaces and tape +85°C				
Thermal Conductivity (mean temperature) BS874 Part 2 1986	0 0.035	+20 0.037	+40 0.039	°C W/(m·K)	
Water vapour permeability Moisture Resistance factor BS EN ISO 9346:1996 BS4370 Part 2 1973				μ > 5,000 3.6 x 10⁻¹² kg/(m·s·Pa) 0.13ng/(N·s)	
Water absorption, by volume after 28 days				0.9% average, 1.5% maximum	
• **Fire performance**, surface spread of flame, BS476 Part 7 1997				Class 1	
• **Fire propagation**, BS476 part 6 1989 Total Index of Performance(I) Sub Index(i)				Less than 12 Less than 6	
Reaction to fire				Self-extinguishing, does not drip	
Noise reduction				Acoustic level to 30 dB(A)	
Resistance to building materials				Very good	
Resistance to chemicals				Consult product test list	
Health Aspects				Dust & Fibre Free	
Dimensions				Standard tube 2m lengths	

Outdoor applications should be painted with Armafinish CO paint in the recommended thickness. Two or more coats may be required.

Armaflex is ideal for all thermal and acoustic insulation required on:

- Chilled water lines
- Hot and cold water services
- Heating systems
- Air conditioning ductwork
- Refrigeration pipework and ancillary equipment
- Drainage pipe / rain water pipe

* If lower temperatures, down to -200°C, are involved please consult our sales.
* This meets the 1991 Building Regulations (England and Wales) and the Building Standards (Scotland) Regulations 1990 for the Class O fire category.

All statements and technical information are based on results obtained under typical conditions. It is the responsibility of the recipient to verify with us that the information is appropriate for the specific use intended by the recipient.

Tube Size Range

Copper Tube			Iron & Steel Pipe		Minimum ID Armaflex	D Nominal Thickness 6mm	F Nominal Thickness 9mm	H Nominal Thickness 13mm	M Nominal Thickness 19mm	R Nominal Thickness 25mm	T Nominal Thickness 32mm	U Nominal Thickness 40mm	V Nominal Thickness 50mm
NB in	Nom OD in	Nom OD mm	NB in	Nom OD mm	Min ID mm	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	¼	6			6.5	CO-D-006	CO-F-006	CO-H-006	CO-M-006	CO-R-006	–	–	–
	⅜	10			10.5	CO-D-010	CO-F-010	CO-H-010	CO-M-010	CO-R-010	CO-T-010	CO-U-010	–
⅜	½	12			12.5	CO-D-012	CO-F-012	CO-H-012	CO-M-012	CO-R-012	CO-T-012	CO-U-012	CO-V-012
½	⅝	15			16.0	CO-D-015	CO-F-015	CO-H-015	CO-M-015	CO-R-015	CO-T-015	CO-U-015	CO-V-015
⅝	¾				20.0	CO-D-020	CO-F-020	CO-H-020	CO-M-020	CO-R-020	CO-T-020*	CO-U-020*	CO-V-020*
¾	⅞	22	½	21.3	22.5	CO-D-022	CO-F-022	CO-H-022	CO-M-022	CO-R-022	CO-T-022	CO-U-022	CO-V-022
1	1⅛	28	¾	26.9	29.0	CO-D-028	CO-F-028	CO-H-028	CO-M-028	CO-R-028	CO-T-028	CO-U-028*	CO-V-028*
1¼	1⅜	35	1	33.7	35.5		CO-F-035	CO-H-035	CO-M-035	CO-R-035	CO-T-035*	CO-U-035*	CO-V-035*
1½	1⅝	42	1¼	42.4	43.5		CO-F-042	CO-H-042	CO-M-042	CO-R-042	CO-T-042*	CO-U-042*	CO-V-042*
			1½	48.3	49.0		CO-F-048	CO-H-048	CO-M-048	CO-R-048	CO-T-048*	CO-U-048*	CO-V-048*
2	2⅛	54			55.0		CO-F-054	CO-H-054	CO-M-054	CO-R-054	CO-T-054*	CO-U-054*	CO-V-054*
			2	60.3	61.0		CO-F-060	CO-H-060	CO-M-060	CO-R-060	CO-T-060*	CO-U-060*	CO-V-060*
2½	2⅝	67			68.0			CO-H-067*	CO-M-067	CO-R-067	CO-T-067*	CO-U-067*	CO-V-067*
2 13/16	3	76.1	2½	76.1	77.0			CO-H-076	CO-M-076	CO-R-076	CO-T-076*	CO-U-076*	CO-V-076*
			3	88.9	90.0			CO-H-089*	CO-M-089	CO-R-089*	CO-T-089*	CO-U-089*	CO-V-089*
4	4⅛	108			109.0				CO-M-108*	CO-R-108*	CO-T-108*	CO-U-108*	CO-V-108*
			4	114.3	115.5				CO-M-114*	CO-R-114*	CO-T-114*	CO-U-114*	CO-V-114*
			5	139.7	142.0				CO-M-140*	CO-R-140*	CO-T-140*	CO-U-140*	CO-V-140*
			6	165.2	168.0					CO-R-168*	CO-T-168*	CO-U-168*	CO-V-168*

*Delivery quoted on request.

Continuous Sheet		
Nominal Thickness mm	Sheet Size Width mm	Length mm
6	1,220	x 15,000
9	1,220	x 10,000
13	1,220	x 8,000
19	1,220	x 6,000
25	1,220	x 4,000
32	1,220	x 3,000
40	1,220	x 3,000
50	1,220	x 2,600

Armaflex Tape self-adhesive
Width:50mm
Thickness:3mm
Length:9.14m

If any other size request, please contact sales

armacell
engineered foams

Armacell Asia Ltd.
Room 1205, Tai Tung Building
8 Fleming Road,
Wanchai,
Hong Kong
Tel:852-2574 6420 Fax:852-2574 6094
www.armacell.com

Armacell Asia Ltd - Singapore Branch
583 Orchard Road Forum Building
#16-01/17-01
Singapore 238884
Tel:65-6737 2788 Fax:65-6737 2288
www.armacell.com

BF-HWC5 SERIES

WAFER TYPE CONCENTRIC DISC BUTTERFLY VALVES WITH HAND LEVER OR GEAR OPERATED HANDWHEEL

PRODUCT SPECIFICATION SHEET

Valve Designed according to EN593 and EN12266
Valve seat are In-Cold replaceable

FEATURES

- Cast Iron Body
- 90° closing / opening operation (10 position)
- Lock-lever handle, (steel material)
- Elastomer Liner
- Memory lock mechanism
- Ductile disc with nickel plated

SPECIFICATIONS

Valve sizes: DN50 to DN1000

Nominal pressure: 16 bar

Temperature range: -10 °C to 120 °C

Test Pressure (Bubble Tight Shut Off)

Shell (Water) 24 bar

Seat (Water) 17.6 bar

No.	Description	Material	Material Symbol
1	Body	Cast Iron	GG-25 EN1561
		Ductile Cast Iron	GGG-40 EN1563
2	Shaft	Stainless Steel	420 S37 EN10088-3
3	Disc	Ductile Iron	GGG-40 with nickel plated
		Stainless Steel	304/S31 EN10088-3
		Aluminium Bronze	C95400 ASTM
4	Bushing	PTFE	
5	Liner	Rubber	EPDM
6	O-rings	Rubber	EPDM

Option
Shaft material: SS316
Disc material: SS316

DIMENSIONS in (mm)

PN10

PN16

DIMENSION & WEIGHT OF HAND LEVERS (REFERENCE)

SIZE	A	B	R	WEIGHT(KG)
DN50-150	266.7	35	82	0.9
DN200-300	368	90	76.2	2.2

DIMENSION & WEIGHT OF GEAR OPERATORS

Size	A	B	C	E	F	G	Weight (kg)
DN40-150	65	90	74	52	147	72	144	8.8
DN200-250	75	65	100	75	278	88	287	15
DN300-350	72	63	114	81	221	85	287	15

DIMENSION &WEIGHT OF 2nd-STAGE GEAR OPERATORS

Size		A	B	C	D	E	F	H	L	I	Weight(KG)
PN10	PN16										
DN400-500	DN400-500	56.5	176.5	121	115	124	174	195.5	66	300	66.9
DN600	DN600	56.5	197.5	142	144	130	174	145.5	66	300	72.97
DN700-800	DN700	67	244	193	199	167	165	197	98	400	124
DN900-1000	DN800-900	76	270	215	220	196	215	235	126	300	156
DN1200	DN1000	74	418	265	185	240	215	315	126	435	370

CV VALUE - FLOW RATE COEFFICIENT

Size	10	20	30	40	50	60	70	80	90
DN50	0.1	5	12	24	45	64	90	125	155
DN65	0.2	8	20	37	65	88	144	204	250
DN80	0.3	12	22	35	70	116	160	275	302
DN100	0.5	17	36	78	139	230	364	546	660
DN125	0.8	29	81	133	237	392	620	930	1022
DN150	2	45	93	206	369	610	956	1437	1575
DN200	3	89	186	409	727	1202	1900	2854	3136
DN250	4	151	330	694	1237	2047	3240	4859	5340
DN300	5	234	495	1042	1871	3102	5005	7507	8250
DN350	6	336	715	1449	2761	4563	7295	10943	11917
DN400	8	464	983	2135	3797	6262	9942	14913	16368
DN450	11	615	1307	2822	5022	8320	13168	19752	21705
DN500	14	791	1674	3628	6465	10698	16934	25396	27906
DN600	22	1222	2587	5607	9953	16520	26157	39230	43116
DN700	36	1613	3639	5634	6000	16949	27089	34896	49680
DN800	45	2597	5791	8736	3798	20813	31295	46117	0B2981
DN900	60	3021	6063	11035	17449	26096	39731	0B983	8B345
DN1000	84	4153	8395	15302	24159	36184	0B084	84426	119750

SELECTION CHART

BF – HWC5 – PN16 – 0100 – X

- Butterfly Valve
- Control Type
  - H - Hand Lever (≤ DN300)
  - M - Gear Operated
- Connection Type
  - F – Flange
  - W – Wafer
  - L – Lug
- Structure Type
  - C – Concentric Disc
  - S – Single Eccentric
  - D – Double Eccentric
  - T – Triple Offset
- Body Material
  - 2 – Brass
  - 3 – Bronze
  - 4 – Cast Iron (≥ DN150)
  - 6 – Ductile Iron
  - 7 – SS304
- Pressure Rating
  - PN10 – PN16
  - A150 – ANSI CL 150
  - A300 – ANSI CL 300
- Valve Size
  - 0040 – DN40
  - 0065 – DN65
  - ...
- Disc Material
  - Blank - Ductile Iron with nickel plated
  - 2 - Stainless Steel
  - 5 - Aluminum Bronze

Technical Literature

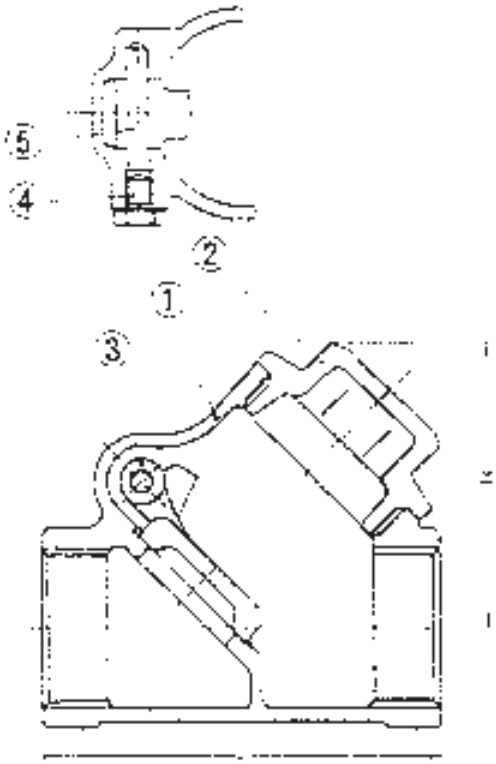
25) Butterfly Valve

FIG. NO. 236

125-POUND BRONZE CHECK VALVES

Swing type, Y-pattern, screwed cap, integral disc, screwed ends

MSS Specification Valves



Working Pressure

Working Pressure Non-Shock		Test Pressure	
Saturated Steam	Cold Water Or Gas	Shell (Water)	Seat (Water)
8.6 Bar	16 Bar	24 Bar	16 Bar

Materials

No.	Name of Parts	Materials	B.S
1	Body	Cast Bronze	BS1400 LG2
2	Cap	Cast Bronze	BS1400 LG2
3	Disc	Cast Bronze	BS1400 LG2
4	Stem	Brass rod	BS2874 CZ121
5	Hexagon nut	Copper alloy rod*	BS2874

*Dezincification resistant brass is a Resist-Dezincification material whose mechanical strength is equivalent to BS2874 CZ132

Note

1. End threads conform to the American or British standard pipe threads.
2. These valves conform to the requirements of MSS SP-80.

Dimensions

Mark \ Size		3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
A	mm	2.20	2.76	3.15	3.78	4.33	5.04	6.14	7.24	8.13	
	mm	55	70	80	96	110	128	156	184	207	
B	in.	1.35	1.57	2.28	2.72	3.19	3.86	4.09	5.47	5.63	
	mm	42	50	58	69	81	98	119	139	172	
Wt.	lb	0.37	0.95	1.34	2.11	3.08	4.99	8.71	12.50	24.16	
	kg	0.26	0.43	0.61	0.96	1.40	2.27	3.96	5.68	10.90	

Toyo Valve Co., Ltd.

C1

FIG. 443B

Cast Iron Dual Plate Check Valves

Working pressure

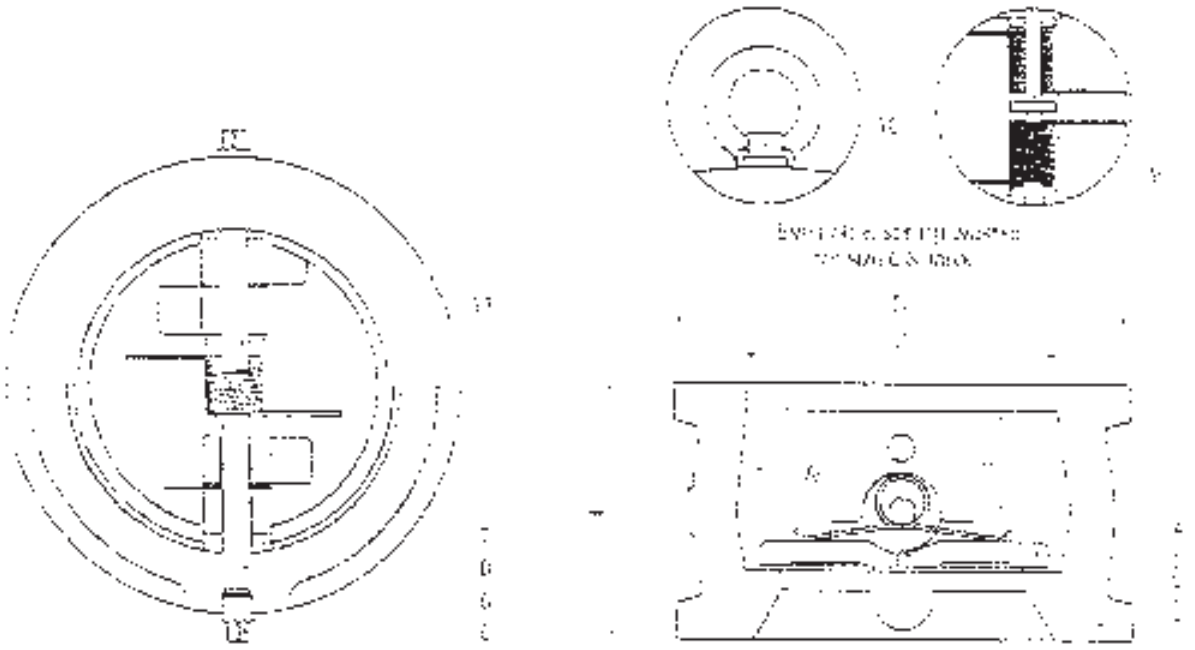
Materials

No.			

Body seat materials

No.		

FIG. 443B



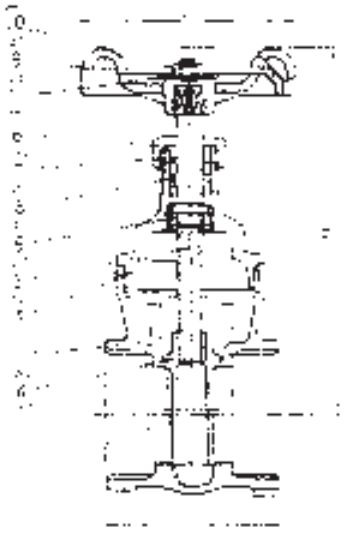
Technical Literature

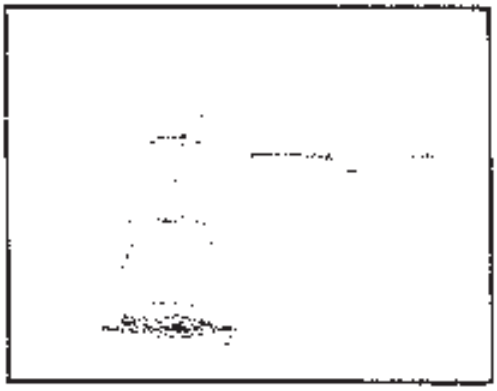
26) Check Valve

FIG. NO. 272

125-POUND BRONZE GATE VALVES

Non-rising stem, screw-over bonnet, solid wedge disc, screwed ends.





With Lockable Device
(Operate With T-key)

Materials

No.	Name of Parts		Materials	B.S.
1	Body		Cast Bronze	BS1400 LG2
2	Bonnet		Cast Bronze	BS1400 LG2
3	Stem		Gunmetal stem rod*	BS2874
4	Disc		Cast Bronze	BS1400 LG2
5	Lock nut		Gunmetal stem rod*	BS2874
6	Packing	1/2-3	Forged brass	BS2874 CZ132
	Nut	4	Cast bronze	BS1400 LG2
7	Gland		Forged brass	BS2874 CZ132
8	Gland packing		Non-asbestos	
9	Handwheel	1/2-1	Zinc alloy	BS1004
		1 1/2-3	Aluminium alloy	BS1490 LM6
10	Wheel nut		Carbon steel	BS4360 40B
11	Name Plate		Aluminium Plate	EN485-2

*Non-copper alloy items to Resistance to dezincification material, with minimum strength to accordance to BS2874 CZ132

Working Pressure

Working Pressure Non-Shock		Test Pressure	
Saturated Steam	Cold Water Oil, Gas	Shell (Water)	Seat (Water)
2.6 Bar	16 Bar	24 Bar	16 Bar

Dimensions

Mark \ Size		1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
L	in	1.65	1.85	1.97	2.36	2.48	2.83	3.13	3.62
	mm	42	47	50	60	63	72	80	92
H	in	3.03	3.43	3.94	4.61	5.04	5.98	7.01	7.91
	mm	77	87	100	117	128	152	177	201
D	in	1.89	2.17	2.48	2.76	2.76	3.15	3.94	4.61
	mm	48	55	63	70	70	80	100	117
Wt	lb	1.65	2.22	3.04	4.61	5.12	8.38	9.13	13.23
	kg	0.75	1.00	1.47	2.09	2.33	3.80	4.14	6.00

Note
End threads conform to British Standard pipe threads

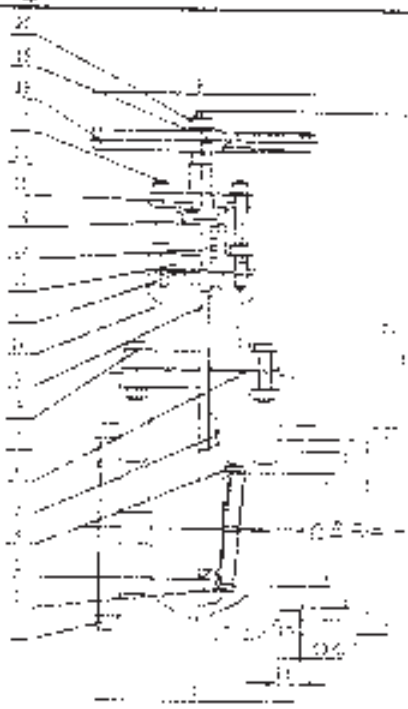
Toyo Valve Co., Ltd.

FIG. NO. 415E

RED-WHITE
TOYO

PN16 CAST IRON GATE VALVES

To BS5150 Non-rising stem, bolted bonnet, solid wedge disc, flanged ends.



- Design and Manufacture Conform to BS5150
- Flange dimensions Conform to BS4504 PN16
- Face to face dimensions Conform to BS5150 (PN16)
- Testing Conform to BS6755

* Size ≥ 65 mm

MATERIALS

NO.	PART NAME	MATERIAL (JIS)	MATERIAL (BS)
1	BODY	ASTM A126 B	ASTM A126
2	SEAT RING	ASTM B62 or 283	ASTM B62 or 283
3	WEDGE	ASTM A126 B	ASTM A126
4	WEDGE RING	ASTM B62 or 283	ASTM B62 or 283
5	WEDGE NUT	Ni-BRASS	Ni-BRASS
6	BONNET GASKET	GRAPHITE-STEEL	GRAPHITE-STEEL
7	BONNET BOLT	ASTM A307	ASTM A307
8	BONNET NUT	CARBON STEEL	CARBON STEEL
9	STEM	ASTM B16 or 105	ASTM B16 or 105
10	BONNET	ASTM A126 B	ASTM A126
11	STUFFING BOX BUSH	GRAPHITE-STEEL	GRAPHITE-STEEL
12	STUFFING BOX	ASTM A126 B	ASTM A126
13	PACKING	GRAPHITE	GRAPHITE
14	PACKING GLAND	ASTM B62 or 283	ASTM B62 or 283
15	GLAND FOLLOWER	ASTM A126	ASTM A126
16	HANDLE NUT	CARBON STEEL	CARBON STEEL
17	HANDLE BASE	CARBON STEEL	CARBON STEEL
18	HANDWHEEL	ASTM A126 B	ASTM A126 B
19	HANDLE	CARBON STEEL	CARBON STEEL
20	NUT	CARBON STEEL	CARBON STEEL

* (1) can be supplied with steel arc floor position indicator.

DIMENSIONS (mm)

DN	L	D	K	d	n	f	S	H	W	Approx. kg
50	230	165	125	18	4	2	224	181	20	20
65	290	185	145	18	4	2	170	200	20	30
80	310	200	160	18	8	2	430	230	40	40
100	350	220	180	18	8	2	430	246	50	50
125	400	250	210	18	8	2	470	346	50	70
150	480	285	240	22	8	2	470	346	50	90
200	600	340	295	22	8	2	570	446	60	140
250	730	405	355	26	12	2	570	446	60	210
300	850	460	410	26	12	3	570	446	60	280
350	980	520	470	26	16	3	570	446	60	350
400	1100	580	525	30	16	3	570	446	60	430
450	1200	640	585	30	20	3	570	446	60	510
500	1250	715	650	33	20	3	570	446	60	600
600	1450	840	770	36	20	3	570	446	60	800

Toyo Valve Co., Ltd.

C2

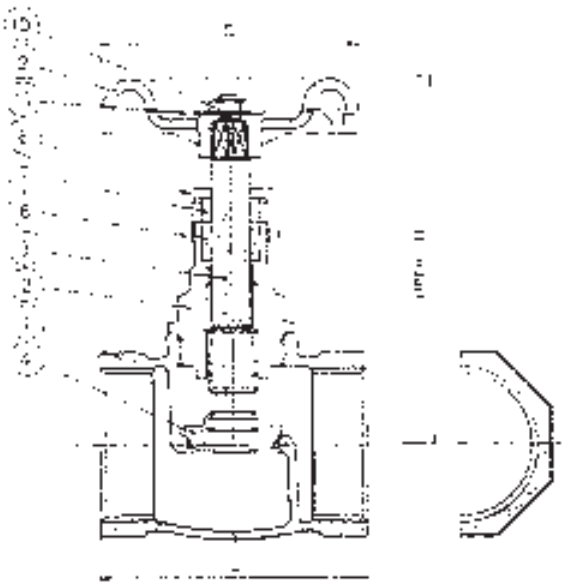
Technical Literature

27) Gate Valve

FIG. NO. 210

125-POUND BRONZE GLOBE VALVES

Screwed bonnet, swivel type metal disc, screwed ends



Stuffing box construction for sizes 1" to 3"

Screwed ends for sizes ½" to 2"

Screwed ends for sizes ½" to 3"

Materials

No	Name of Parts		Materials	B.S
1	Body		Cast Bronze	BS1400 LG2
2	Bonnet		Cast Bronze	BS1400 LG2
3	Stem		Copper alloy rod*	BS2874*
4	Disc		Cast Bronze	BS1400 LG2
5	Lock nut		Copper alloy rod*	BS2874*
6	Packing		Forged brass	BS2874 CZ122
7	Gland		Forged brass	BS2874 CZ122
8	Gland packing		Non-asbestos	TF2596NA
9	Handwheel	½-¾	Zinc alloy	BS1004-A
		1-3	Aluminium alloy	BS1490-LM2
10	Wheel nut		Zinc plated steel	BS4360-40B
11	Name Plate		Aluminium Plate	EN485-7

*Toyo copper alloy rod is a Resist Dezincification material, which mechanical strength is equivalent to BS2874 CZ132

Working Pressure

Working Pressure Non-Shock		Test Pressure	
Saturated Steam	Cold Water Or Gas	Shell (Water)	Seat (Water)
8.6 Bar	16 Bar	24 Bar	18 Bar

Dimensions

Mark	Size	½	¾	1	1¼	1½	2	2½	3
L	in	1.89	2.09	2.48	2.87	3.23	3.86	4.60	5.35
	mm	48	53	63	73	82	98	118	136
H	in	2.91	3.09	3.50	4.33	5.16	5.67	7.20	8.27
	mm	74	77	89	110	131	144	183	210
D	in	2.17	2.17	2.48	2.76	3.15	3.54	4.33	4.92
	mm	55	55	63	70	80	90	110	125
Wt	lb	0.53	0.71	0.99	1.61	2.34	3.55	6.58	9.42
	kg	0.24	0.32	0.45	0.73	1.06	1.61	2.99	4.28

Note

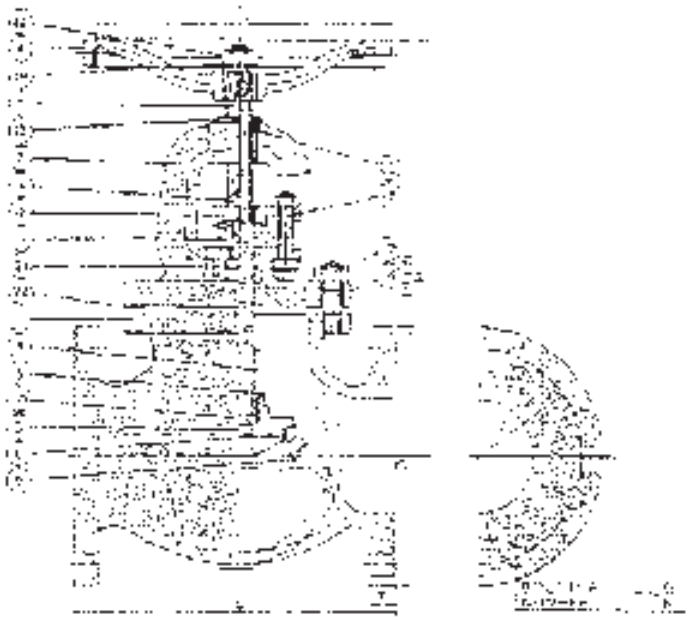
End connections conform to British Standard pipe threads

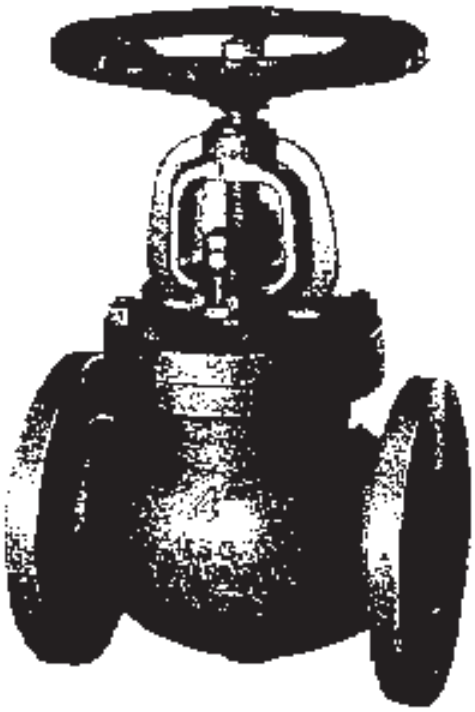
Toyo Valve Co., Ltd.

FIG. NO. 400A

PN16 CAST IRON GLOBE VALVES

To BS5152. Rising stem, bolted bonnet, bronze trimed, flanged ends.





Material (Standard)

No	Name of Parts	Material	ASTM	B.S
1	Body	Cast iron	A126 Class B	1452 Gr 220
2	Bonnet	Cast iron	A126 Class B	1452 Gr 220
3	Disc	Cast iron	A126 Class B	1452 Gr 220
4	Handwheel	Ductile iron	A536	EN1563
5	Body Seat Ring	Cast Bronze	B62-C83600	1400 LG2
		304 Stainless steel	A182 Gr. F304	970 304S15
		316 Stainless steel	A182 Gr. F316	970 316S17
6	Disc Seat Ring	Cast Bronze	B62-C83600	1400 LG2
		304 Stainless steel	A182 Gr. F304	970 304S15
		316 Stainless steel	A182 Gr. F316	970 316S17
7	Stem	Forged brass	B124-C37700	2874-CZ122
		304 Stainless steel	A182 Gr. F304	970-304S15
		316 Stainless steel	A182 Gr. F316	970 316S17
9	Lock nut	Cast Bronze	B62-C83600	1400 LG2
9	Lock washer	Cast Bronze	B62-C83600	1400 LG2
10	Stem ring	Cast Bronze	B62-C83600	1400 LG2
11	Gland	Ductile iron	A536	EN1563
12	Gland flange	Ductile iron	A536	
13	Yoke bush	Steel, Zinc Plated	A307 Gr B	4190-40B
14	Bonnet stud bolt	Steel, Zinc Plated	A307 Gr B	4190-40B
15	Gland bolt	Steel, Zinc Plated	A307 Gr B	4190-40B
16	Wheel nut	Steel, Zinc Plated	A307 Gr B	4190-40B
17	Bonnet stud nut	Steel, Zinc Plated	A307 Gr B	4190-40B
18	Gland bolt nut	Steel, Zinc Plated	A307 Gr B	4190-40B
19	Washer	Steel, Zinc Plated	A307 Gr B	4190-40B
20	Knock pin	Steel, Zinc Plated	A307 Gr B	4190-40B
21	Gland Packing	Non-asbestos packing		
22	Gasket	Non-asbestos packing		

Working Pressure / Temperature

Working Pressure Non-Shock		Test Pressure		Working Temp.
Saturated Steam	Water Or Gas	Body (Water)	Seat (Water)	
5.6 Bar	16 Bar	24 Bar	18 Bar	

Dimensions

Size (mm)	L	H	D	Wt. kg
50 mm	203	320	250	23
65 mm	216	345	230	30
80 mm	241	367	254	36
100 mm	292	440	300	61
125 mm	330	570	350	97
150 mm	356	680	400	165
200 mm	495	805	450	182
250 mm	622	1210	535	302
300 mm	698	1230	615	412

Dimension 'L', 'H' & 'W' refer to the flange face of BS4504, PN16

Toyo Valve Co., Ltd.

Technical Literature

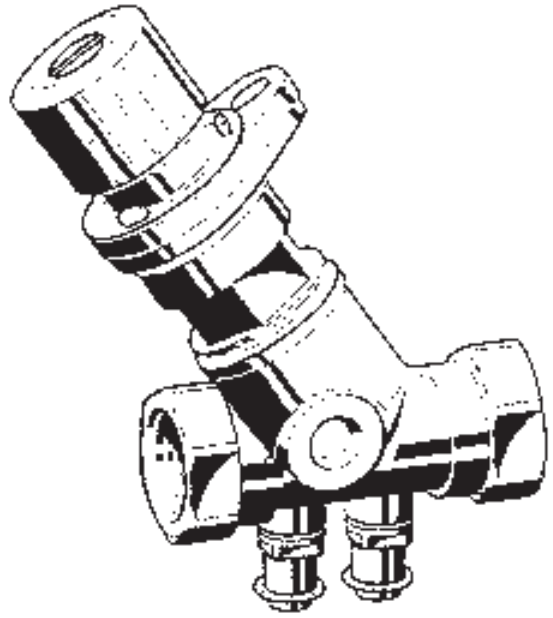
28) Globe Valve

Honeywell

V5032 Kombi-2-plus

BALANCING AND SHUT-OFF VALVE

PRODUCT DATA



CONTENTS

Design

The Kombi-2-plus valve consists of

- Valve body with pressure test nipples and internal threads DN 10 - DN 25 to ISO 7 - DIN 2999 for threaded pipe or copper and pressure steel tube 12–28 mm (set Accessories) or
- Valve body DN 32 to DN 80 with pressure test nipples and internal threads to ISO 7 - DIN 2999 for threaded pipe
- Valve insert
- Blue handwheel with pre-setting dial and display

Materials

- Valve housing made of red bronze Rg5 according to DIN 17662 - CuSn5Zn5Pb
- Valve insert and pressure test nipple made of brass (CuZn39Pb3)
- O-rings and soft seals made of EPDM
- Handwheel, pre-setting dial and display made of plastic

Application

The Kombi-2-plus is installed in the return flow of pump driven warm water heating systems and cold water cooling systems to regulate the hydronic balance and as shut-off valve. The Kombi-2-plus has an O-ring spindle seal and is maintenance free. The valve body can be installed easily and is equipped with pressure test nipples for differential pressure or flow measurement.

Further functions can be retrofitted without interrupting operation of the system: 3/4 ring, Ring and automatic regulation in combination with a Kombi-2-plus BASIC valve in the supply and a Kombi-Diaphragm Unit.

Features

- **Maintenance free spindle with double O-ring sealings**
- **PTFE seat sealing**
- **High accuracy of the pre-setting because of individual adjustment**
- **Valve body PN 16**
- **Dimensions DN 15 to DN 40 can be retrofitted with a Kombi-Diaphragm Unit**
- **Robust valve body made of corrosion resistant red bronze**
- **Available in sizes up to DN 80**
- **Visible pre-setting dial with concealed pre-setting wheel**

EN0H-0346GE25 R0720

Specifications

Medium	Water, water-glycole mixture
Operating temperature	2 to 130 °C, 36 to 265 °F
Operating pressure	max. 16 bar (232 p.s.i.)
Differential pressure	max. 2.0 bar (29 p.s.i.) see NOTE below
kvs-values	see table on page 2

NOTE Differential pressure: Closing pressure for Komb-2-plus with installed Komb-Diaphragm Unit. Regarding noise generation the conditions, requirements and installation design have to be taken into account.

Function

The hydronic balance is a significant requirement for the efficient operation of a modern heating or cooling installation. In an unbalanced system, under or over provision of hot water to individual radiators or circuits can occur. Apart from the correct selection of radiator valves, regulation of individual circuits is also necessary and, in some cases, such as in DIN 18 380, VOB part C, is required by national standards.

This requirement is met with the shut-off and balancing valve Komb-2-plus. The Komb-2-plus for the return has the functions shut-off, pre-setting, regulation (with diaphragm unit accessory), draining and (with any strainer) isolation.

Dimensions, kvs-values and ordering information

Type	R (=D)	DN	kvs-value	H	Dimensions L1	L2	SW	OS-No.
internal threads	1/2"	15	2.7	85	65	41	27	V6032Y0019
internal threads	3/4"	20	6.4	100	75	42	32	V6032Y0020
internal threads	1"	25	8.5	100	90	45	41	V6032Y0021
internal threads	1 1/4"	32	21.0	130	110	48	50	V6032Y0022
internal threads	1 1/2"	40	22.0	150	125	49	55	V6032Y0243
internal threads	2"	50	38.0	152	150	55	70	V6032Y0244
~~internal threads~~	~~2 1/2"~~	~~65~~	~~47.0~~	~~190~~	~~180~~	~~80~~	~~85~~	~~V6032Y0245~~
~~internal threads~~	~~3"~~	~~80~~	~~74.0~~	~~210~~	~~200~~	~~90~~	~~100~~	~~V6032Y0246~~

NOTE All values in mm if not stated otherwise.
Dimension H refers to fully open valve.

Accessories

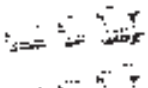
Connections

Set of compression ring and nut

1/2" x 15 mm	1 01 01 15 015 000
1/2" x 18 mm	1 01 01 18 015 000
1/2" x 14 mm	1 01 01 14 015 000
1/2" x 15 mm	1 01 01 24 015 000
1/2" x 16 mm	1 01 01 25 015 000
3/4" x 18 mm	1 01 01 35 020 000
3/4" x 22 mm	1 01 01 24 020 000

NOTE For soft copper and steel pipe support sleeves have to be used

Set of compression ring, nut and support insert (2 pcs each)



1/2" x 12 mm	1 01 01 35 120 000
1/2" x 15 mm	1 01 01 35 150 000
1/2" x 16 mm	1 01 01 35 160 000
3/4" x 18 mm	1 01 01 35 180 000

Accessories

Kombi-Diaphragm Unit

Setting range 0.1 to 0.6 bar differential pressure for valves DN 15–DN 40	1 01 10 00 001 000
Setting range 0.3 to 0.6 bar differential pressure, for valve DN 15–DN 40	1 01 10 00 002 000

NOTE For product technical data and diagrams see product data sheet "Kombi-Diaphragm Unit".
The Kombi-2-plus BLUE valve must be pre-set to "5" for DN 10–25 or "3" for DN 32–40 when used with the Kombi-Diaphragm Unit.

Kombi-2-plus BLACK as shut-off valve and Kombi-Diaphragm Unit connection point in the supply

DN 15	V5100Y0015
DN 20	V5100Y0020
DN 25	V5100Y0025
DN 32	V5100Y0032
DN 40	V5100Y0040

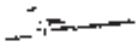
Draining adapter

for all sizes	1 03 99 05 030 000

Tamper-proof cap

for valves DN 15–DN 25	1 01 01 64 010 000
for valves DN 32–DN 50	1 01 01 64 032 000

Adapter for actuators with M 30 x 1.5 connection



for valves DN 10–DN 40	1 01 01 70 050 000

Kvs-values for Kombi-2-plus with installed adapter

DN	15	20	25	32	40
Kvs-value	1.6	2.5	4.0	6.3	9.0

NOTE The Kombi-2-plus valve must be pre-set to "5" for DN 10–25 or "3" for DN 32–40 when used with actuator.
Actuator adapter can only be used with DN 10–50 valve housings with 3/4" mounting valve housing code 10 1999.

Measuring equipment

Extension piece for pressure test cocks, length 45 mm – for use with insulated Kombi-2-plus

for all sizes	1 01 10 05 045 000

Measuring adapters (2 pcs)

for all sizes	1 01 01 30 035 000

Flow meter

for all sizes	1 86 00 11 000 000

FlowPlus measuring computer 230 V

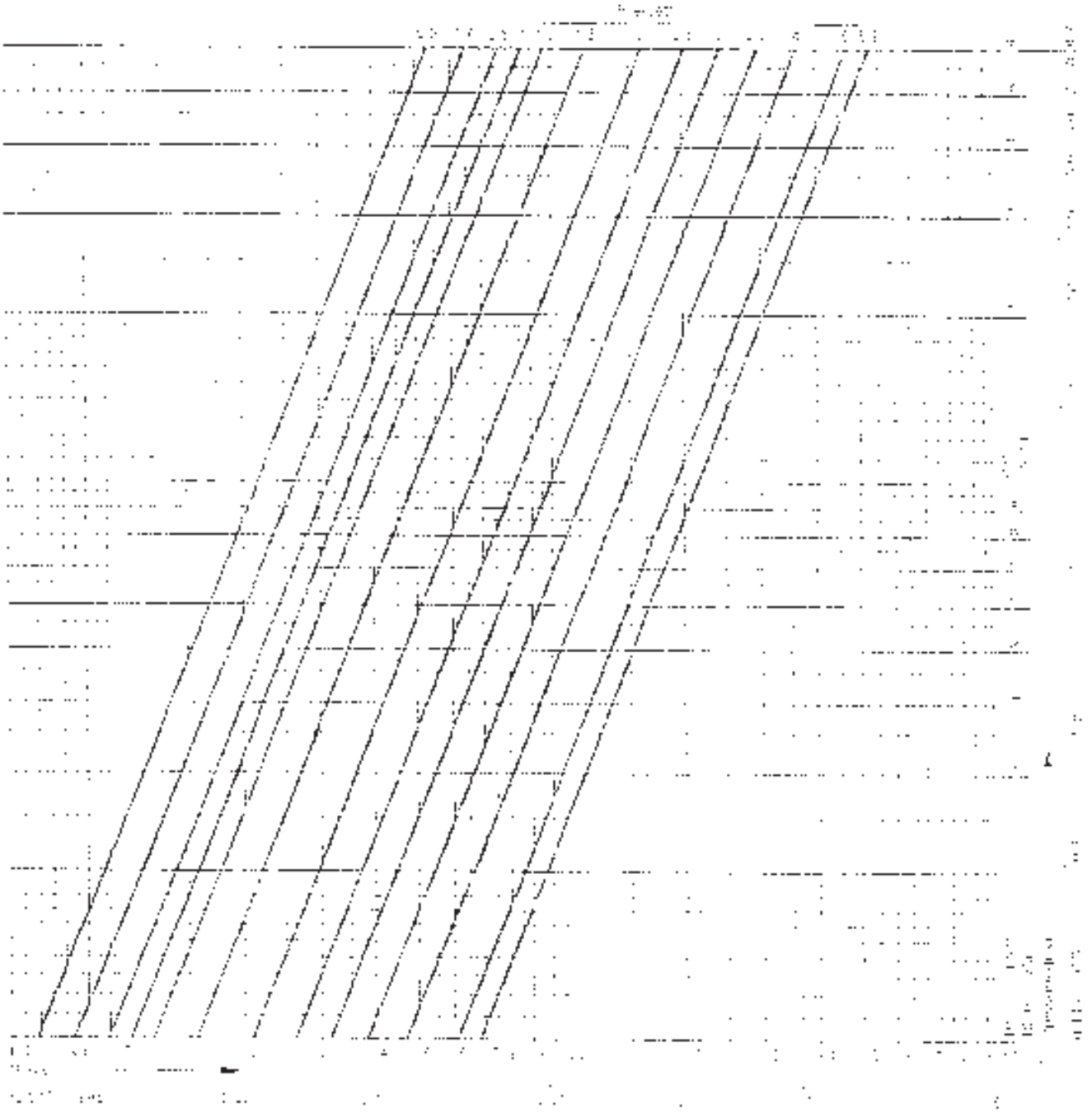
for all sizes with pressure sensors 0–10 bar	1 86 10 05 100 000
for all sizes with pressure sensors 0–25 bar	1 86 10 05 700 000

Spare parts

Pressure test cocks (2 pcs)

for all sizes	1 01 01 10 005 000

Flow diagram DN 25

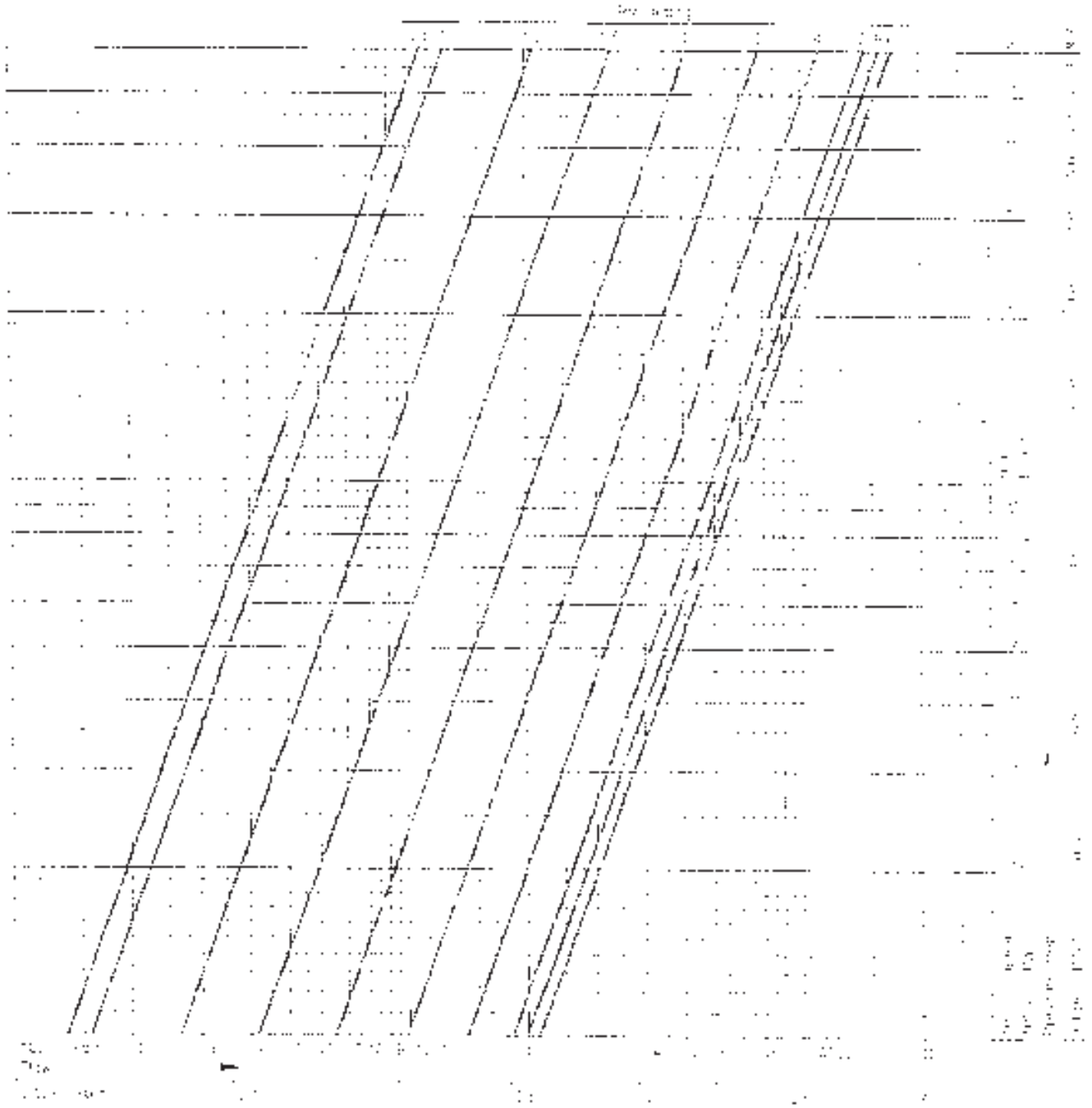


Pre-setting	0.1	0.4	0.8	1.2	1.6	2	2.4	2.8	3.2	3.6	4	4.4	4.8	5.2	5.6	6	6.4	6.8
kv-value	0.58	0.72	0.84	0.97	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.60	2.70	2.93	3.05	3.40	3.70	4.05

Pre-setting	7.2	7.6	8	8.4	8.8	9.2	9.6	10	10.4	10.8	11.2	11.6	12	open
kv-value	4.34	4.64	4.94	5.24	5.52	5.80	6.06	6.30	6.50	6.65	6.75	6.80	6.80	kv = 6.80

NOTE Flow diagram is ONLY valid for valve WITHOUT installed actuator adaption or Komb-Quadregelunit

Flow diagram DN 32

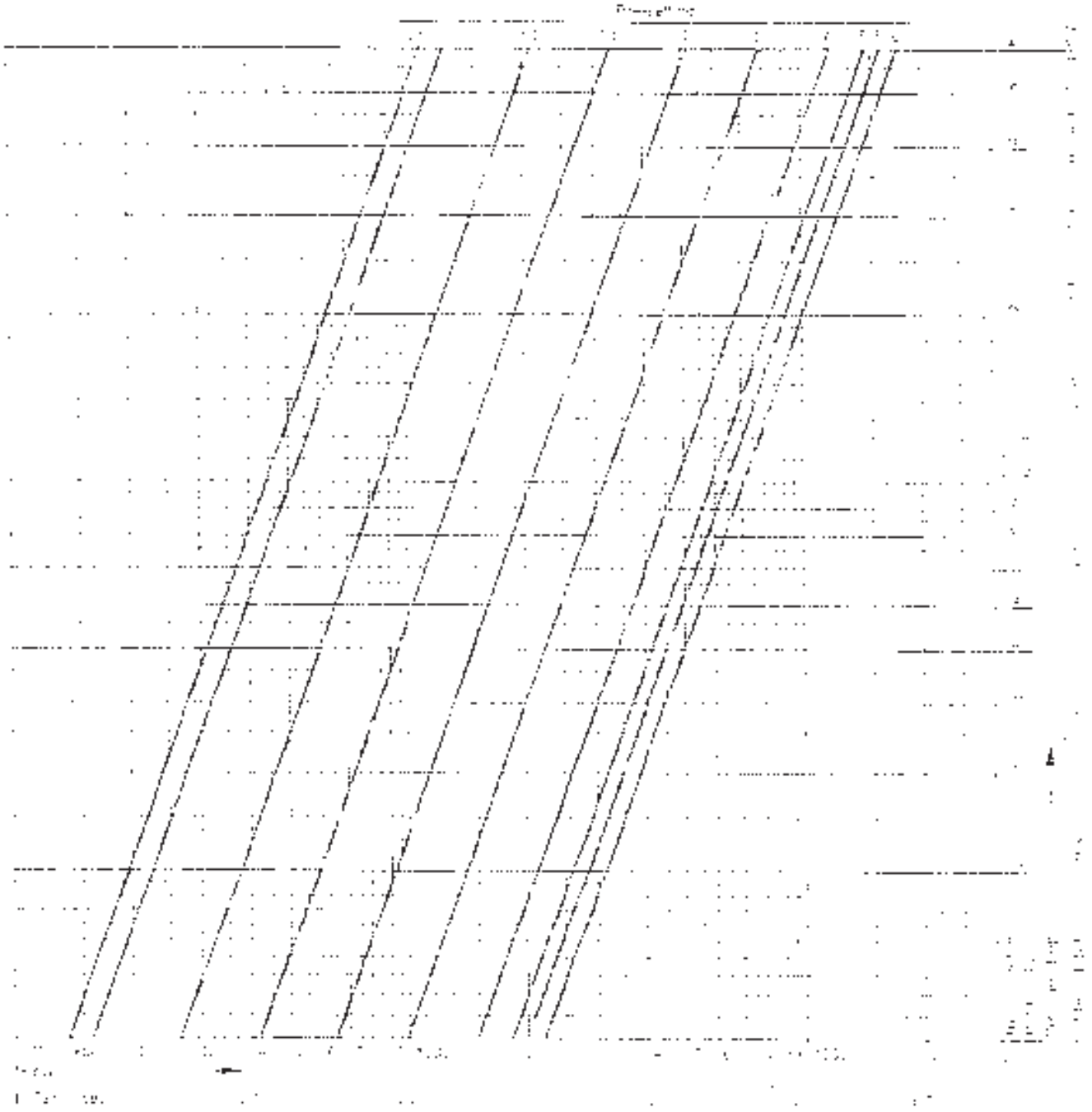


Pre-setting	0.5	0.7	0.9	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8
kv-value	1.45	1.45	1.85	1.90	2.60	3.70	4.60	5.50	6.30	6.90	7.50	8.30	9.20	10.2	11.2	12.0	13.2	14.1

Pre-setting	4.0	4.2	4.4	4.6	4.8	5.0	5.1	5.4	5.6	5.8	6.0	6.2	6.4	6.8 = open
kv-value	15.0	15.5	16.5	17.1	17.7	18.3	18.6	19.0	19.4	19.7	20.0	20.4	20.6	kv = 21.0

NOTE Flow diagram is ONLY valid for valve WITHOUT installed actuator, adapter or Kombi-Diaphragm Unit

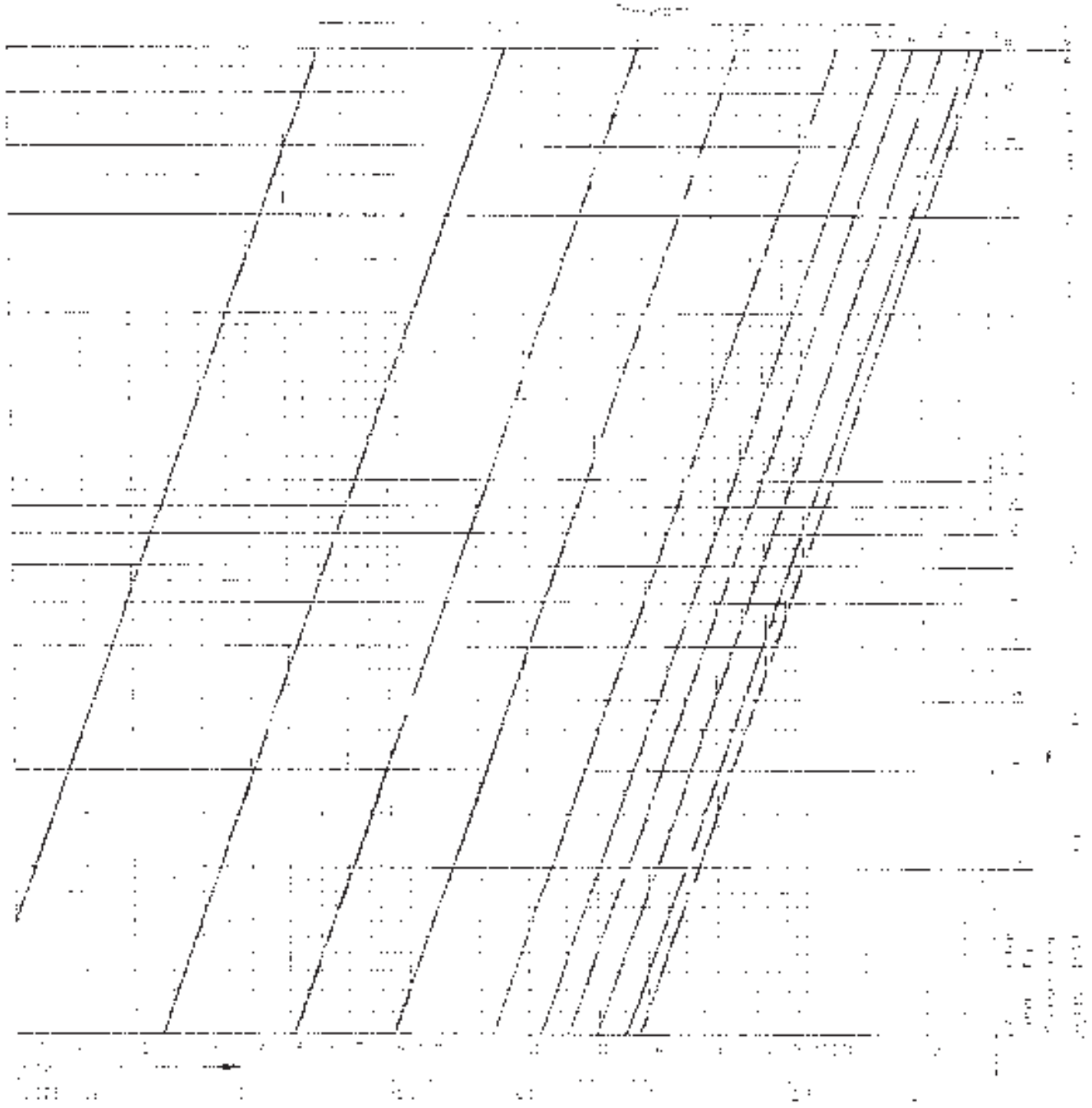
Flow diagram DN 40



Pre-setting	0.5	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.4	3.6	3.8	
kv-value	1.40	1.45	1.55	1.60	2.50	3.75	4.80	5.90	6.60	8.90	7.80	8.30	9.20	10.1	11.2	12.0	12.8	13.1
Pre-setting	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.2	6.4	6.6 = open				
kv-value	15.2	15.8	16.5	17.1	17.7	18.2	18.8	19.2	19.4	19.7	20.0	20.6	21.0	kv = 22.0				

NOTE: Flow diagram is ONLY valid for valve WITHOUT installed actuator, adapter or Kombi-Baugruppe (unit)

Flow diagram DN 50



Pre-setting																				
kv-value																				
Pre-setting																				= open
kv-value																				= open

Influence of coolants on flow values

The flow through a valve is defined by the K_V value. The K_V value gives the flow $\dot{m}$ through a valve in (m^3/h) at a differential pressure of 1 bar (14.5 P.S.I.) and is only valid for fluids with a density of $\rho_0 = 1000$ kg/m³. This condition is met by water at a temperature of 20°C (68°F). For fluids with another density the following formula can be applied:

$$K_{V\,\rho} = \frac{\dot{m}}{\sqrt{\Delta p}} \cdot \sqrt{\frac{\rho}{\rho_0}}$$

Correction factor f

When the density ρ is expressed in [kg/m³] instead of [kg/m³] the correction factor f is the result. The correction factor f can be used to recalculate the K_V value, pressure drop and flow.

$$K_{V\,\rho} = K_V \cdot \frac{1}{\sqrt{f}} \qquad \Delta p_{V\,\rho} = \Delta p \cdot f \qquad \dot{m}_{V\,\rho} = \dot{m}_V \cdot \frac{1}{\sqrt{f}}$$

Table 1: Values for correction factor f

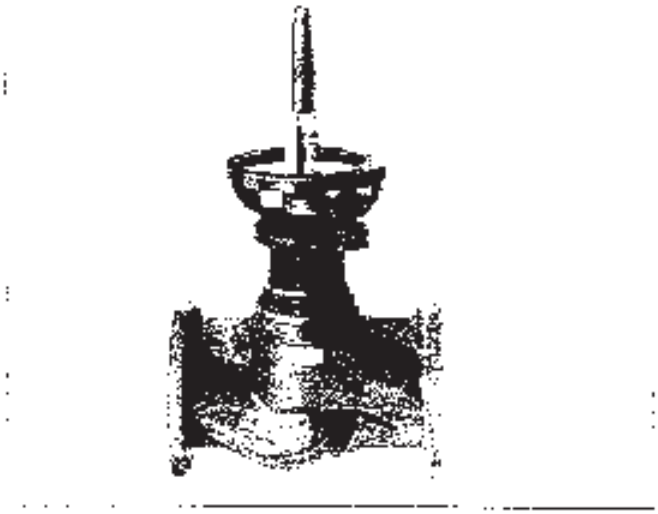
Medium	water part	Correction factor f					
		5°C	20°C	35°C	50°C	65°C	80°C
Normal water	100%	1.001	0.998	0.994	0.988	0.981	0.972
Ethylen glycol	70%	1.052	1.047	1.041	1.033	1.024	1.013
Antifrogen N	50%	1.050	1.045	1.039	1.03	1.022	1.012
Propylen glycol	70%	1.036	1.031	1.025	1.017	1.008	0.997
Antifrogen L	60%	1.050	1.044	1.038	1.029	1.019	1.008

Honeywell

Kombi-F V4SV Series

Flanged Static Balancing Valve

Product Specifications



Application

Honeywell V4SV series flanged static balancing valve is a key hydraulic balance product used for precise flow regulating of water pipelines system in HVAC application to ensure static hydraulic balance across whole water system.

Honeywell V4SV series can ensure the actual flow of each terminal equipment and pipeline in line with the design flow in the phase of system initial commissioning by site commissioning with flow measuring computer.

Honeywell V4SV series are widely used in main pipes, branch pipes and terminal equipment pipelines in HVAC water system. It also can be used in other application with the same function requirement.

Honeywell V4SV series flanged static balancing valve is a two-way manual high accuracy flow regulating valve with the dimensions of DN65~DN350 which is composed of valve housing, valve seat, test cocks, handwheel and stroke indicator, etc.

Features

- Simplified pipe design and calculation
- Quick and easy installation
- Easy to measure and regulate water flowrate in site by the measuring computer
- Easy to measure differential pressure in site
- Balancing through stroke limitation with digital presetting and visible presetting display
- Equipped with both pressure test cocks for differential pressure measurement
- Non-rising hand wheel for convenience operation
- Stroke limitation-screw protected by protection cap
- Valve stem made of stainless steel SS416
- Cast iron body with corrosion resistant painting of epoxy powder

Specifications

- **Size Range:** DN65 ~ DN350
- **Flow precision:** 5%
- **Pressure Rating:** PN16 /16 bar
- **End Connections:** Flange ISO7005-2
- **Medium:** Water, water-glycol mixture
- **Media Temperature:** -10 ~ 120°C
- **Material:** body of cast iron GG25 epoxy coated
  stem of stainless steel SS416
  disc of stainless steel SS410/SS304
  test cocks of brass
  seat sealing of EPDM
  handwheel of ductile cast iron GGG40
  stroke display of ABS plastic
- **Ambient Temperature:** 0 ~ 65°C
- **Shipping&Storage Temperature:** -40 ~ 65°C
- **Atmosphere** non-corrosive, non-explosive

Dimensions and Ordering information

DN	Kvs Value	L	H	D	K	n × d	Weight kg	OS-No.
65	74.4	290	385	185	145	4 × 19	19.5	V4SV065
80	111	310	395	200	160	8 × 19	24.3	V4SV080
100	185	350	430	220	180	8 × 19	34.8	V4SV100
125	242	400	495	250	210	8 × 19	64.3	V4SV125
150	372	480	530	285	240	8 × 23	76.7	V4SV150
200	704	600	555	340	295	12 × 23	145	V4SV200
250	812	730	800	405	355	12 × 28	265	V4SV250
300	1360	850	685	460	410	12 × 28	350	V4SV300
350	1651	980	775	520	470	16 × 28	535	V4SV350

Note: All dimensions in mm unless stated otherwise

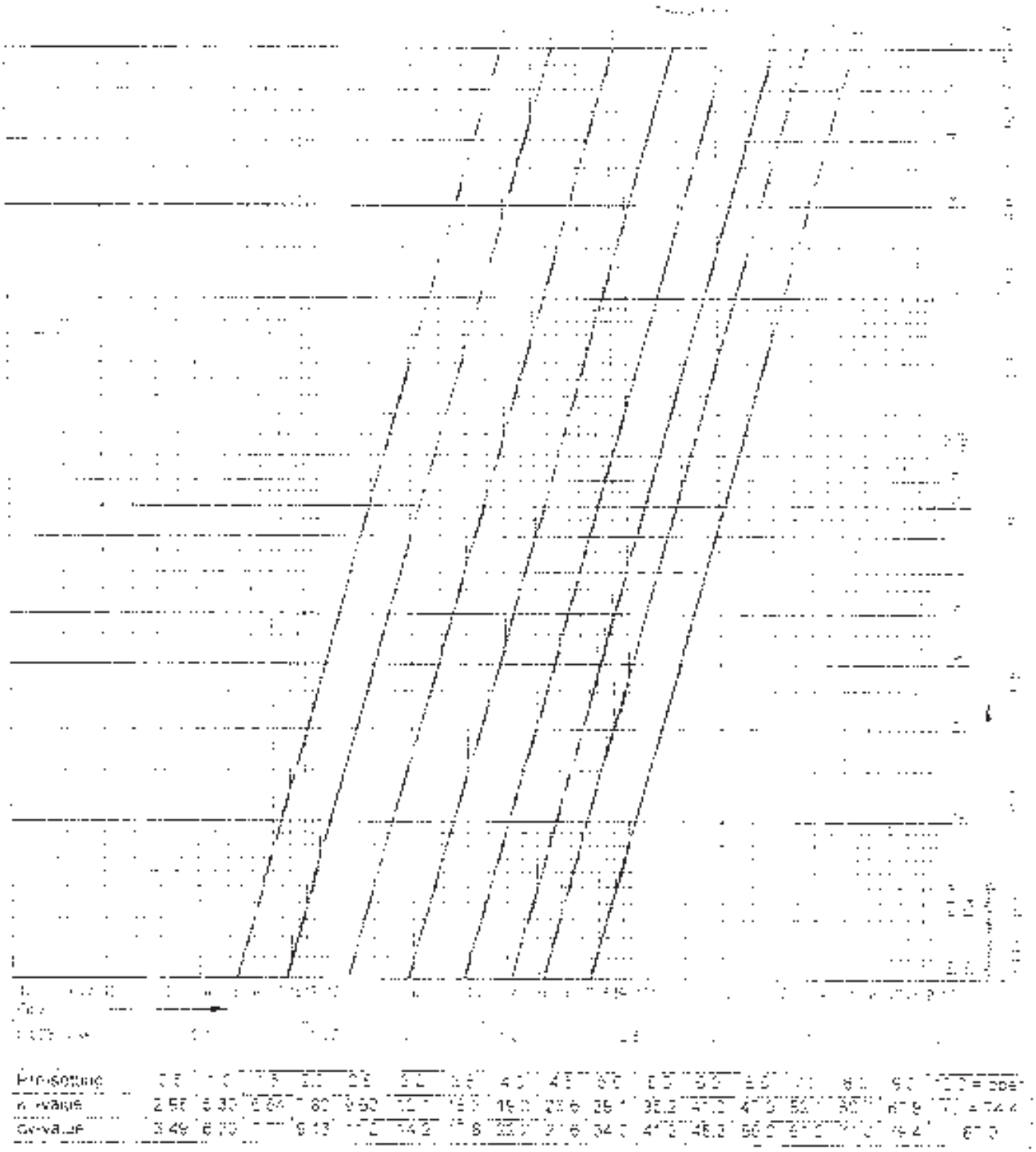
Fig.1 V4SV DN65-DN80

Fig.2 V4SV DN100-DN200

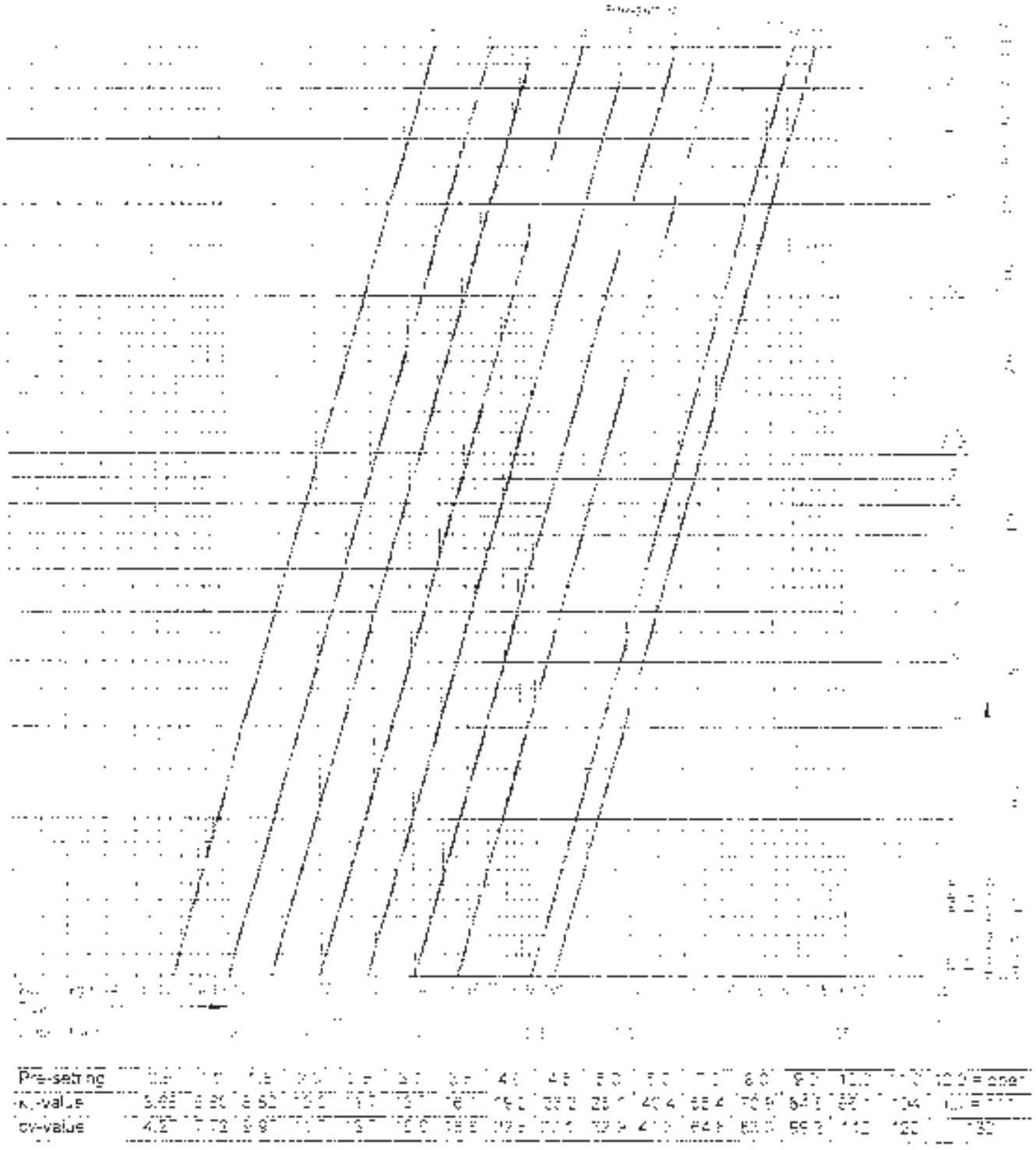
Fig.3 V4SV DN250-DN350

Honeywell

Flow Data V4SV Kombi-F, DN65

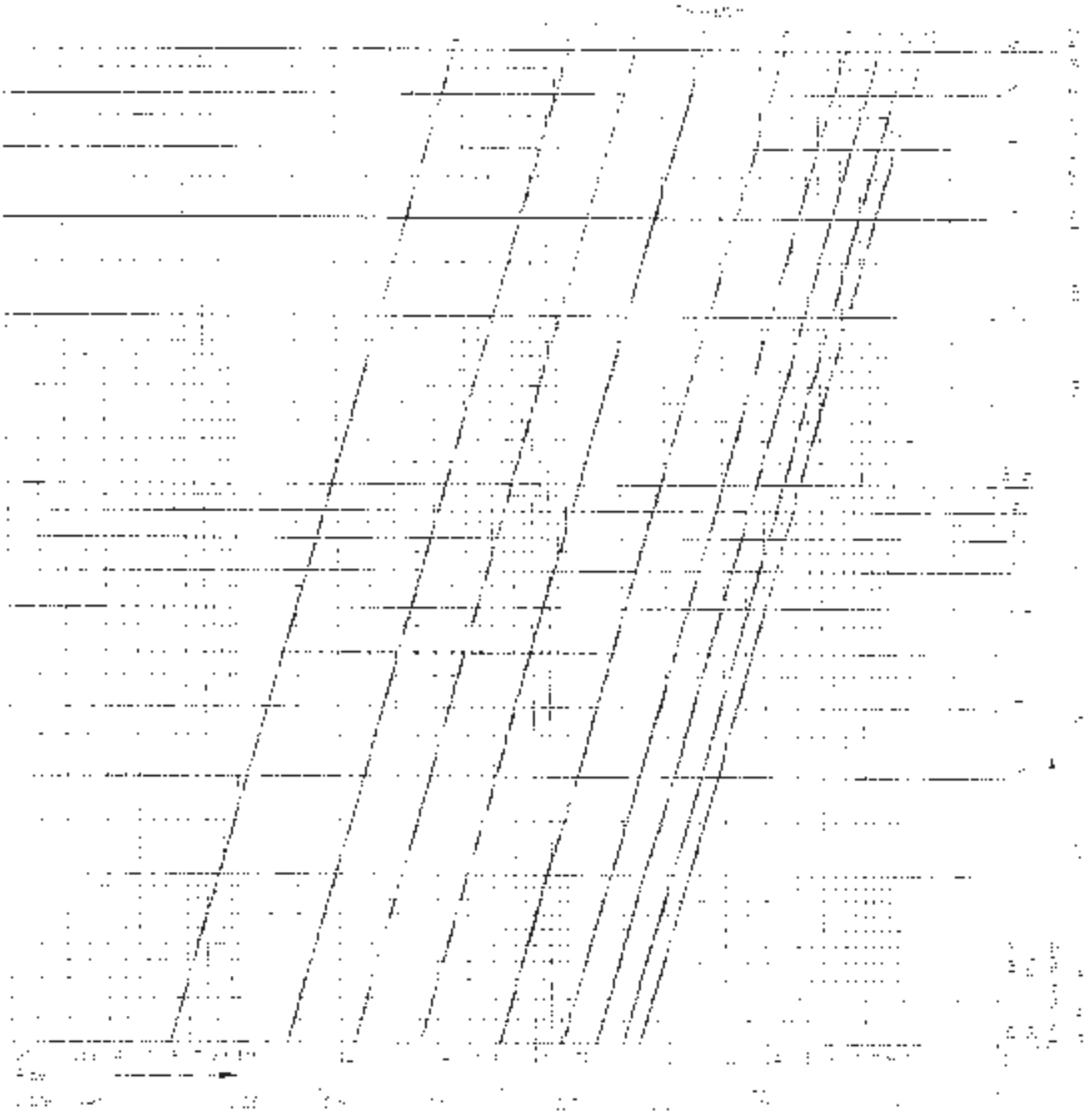


Flow Data V4SV Kombi-F, DN80



Honeywell

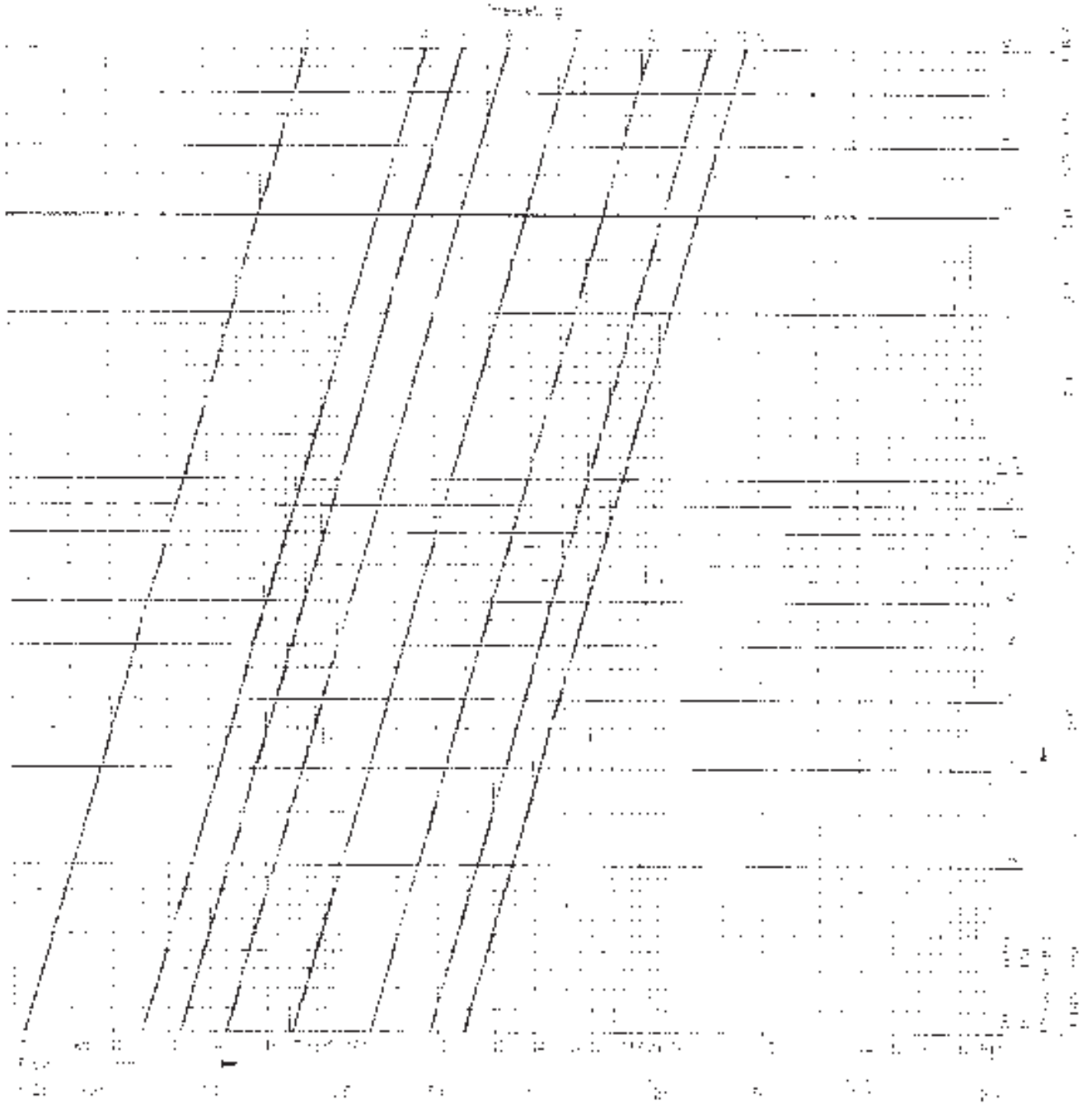
Flow Data V4SV Kombi-F, DN100



Pre-setting															
kv-value	3.80	6.20	9.50	13.4	17.3	21.4	27.6	35.1	47.2	62.4	78.1	96.5	119	137	151
cv-value	4.40	7.20	11.0	15.5	20.0	24.8	32.0	40.7	54.7	72.3	90.5	112	138	159	175

Pre-setting				
kv-value	149	152	160	165
cv-value	173	184	193	

Flow Data V4SV Kombi-F, DN125

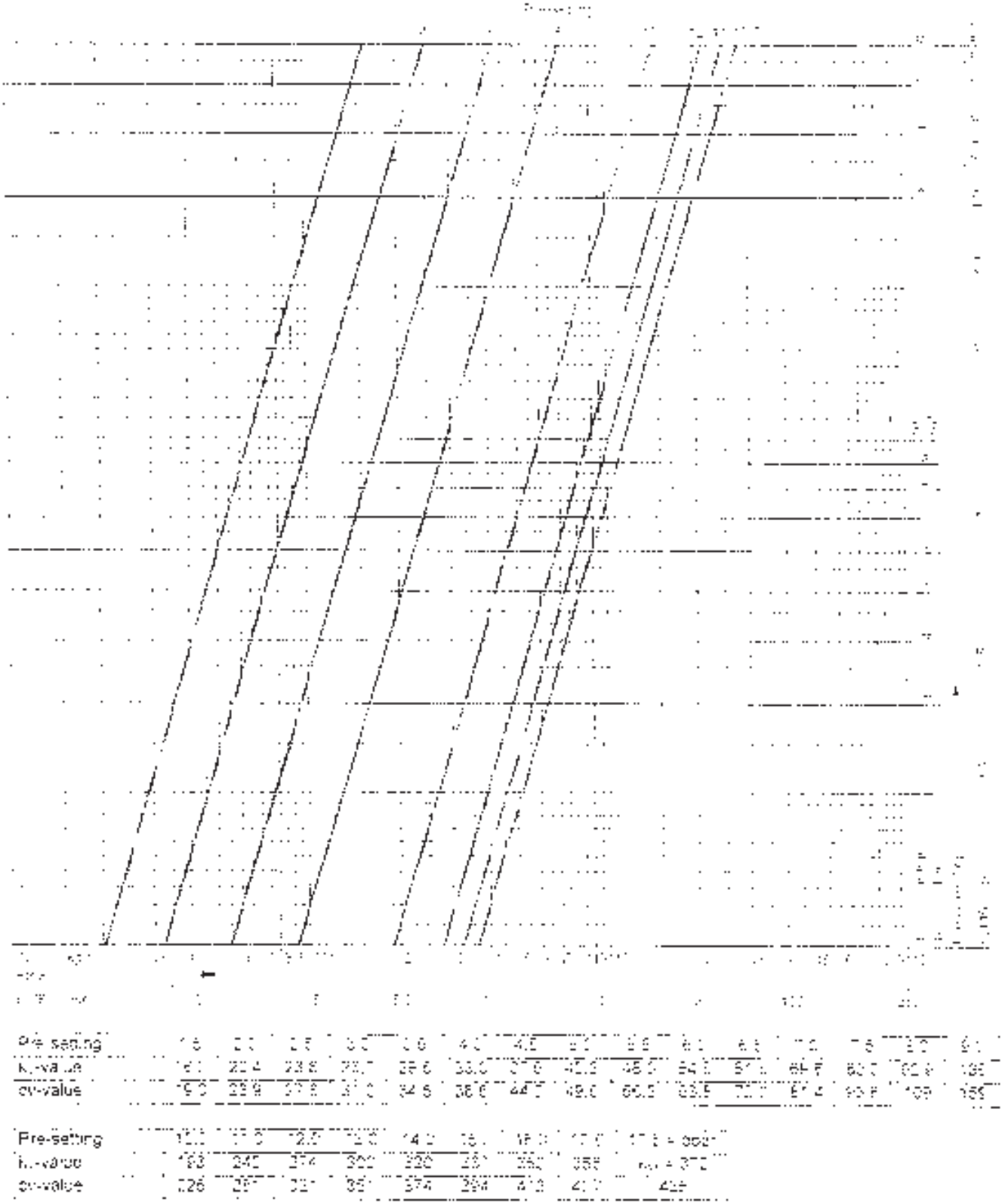


Pre-setting															
Kv-value															
Dp-value															

Pre-setting					
Kv-value					
Dp-value					

Honeywell

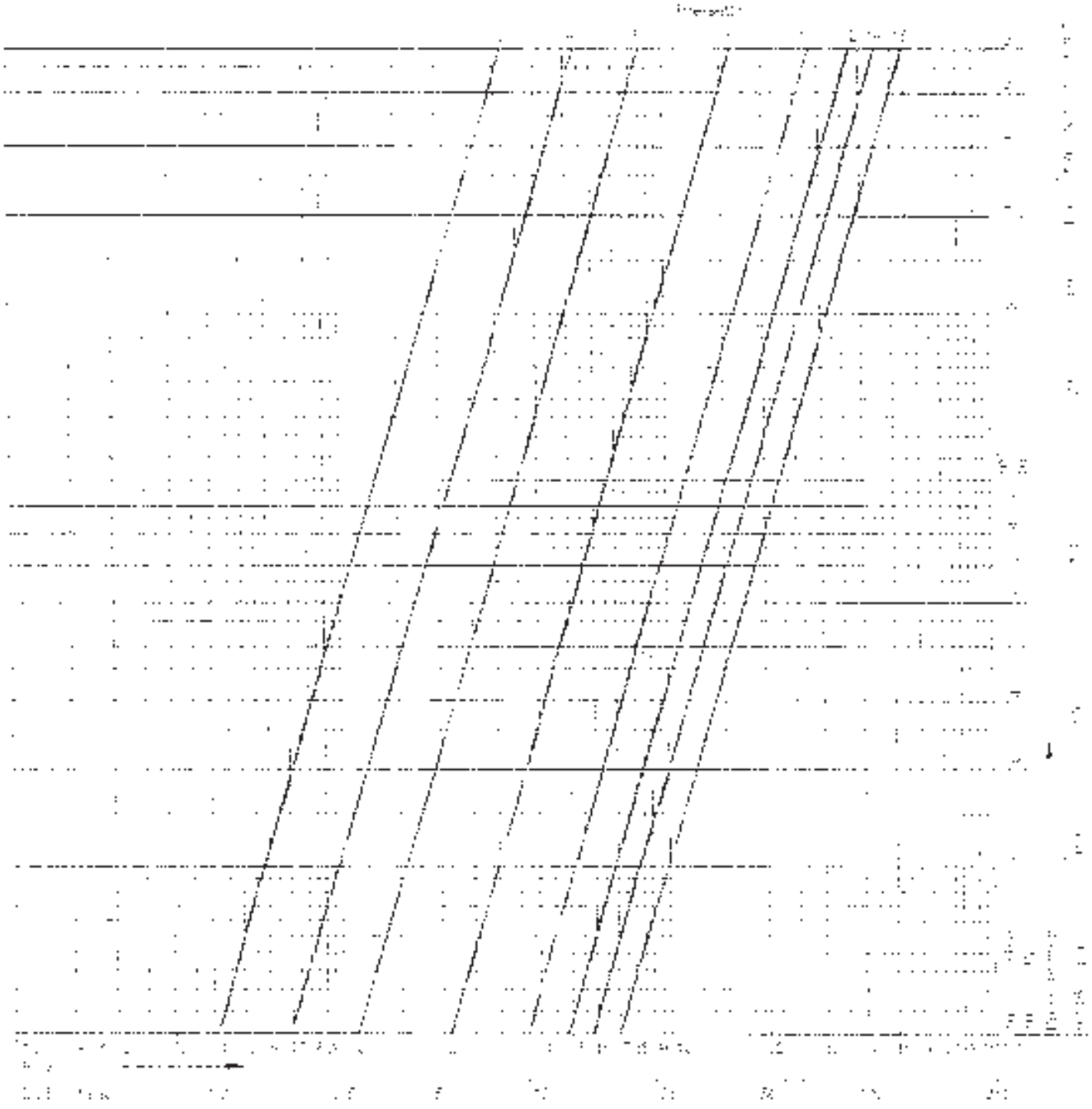
Flow Data V4SV Kombi-F, DN150



Pre-setting																
kv-value																
cv-value																

Pre-setting										
kv-value										
cv-value										

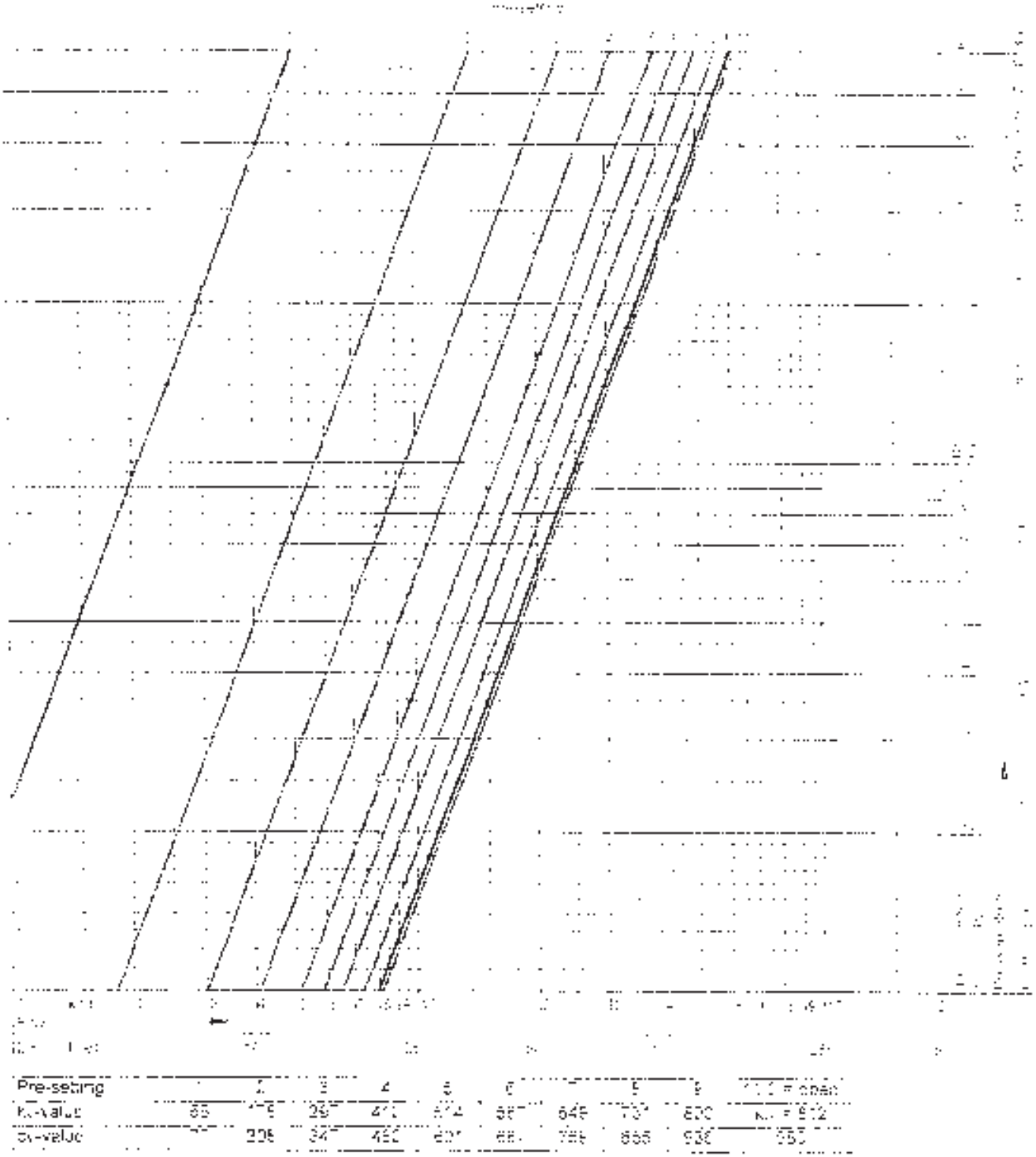
Flow Data V4SV Kombi-F, DN200



Pre-setting	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	Open
k_{vs}-value	354	435	489	537	579	615	646	674	724
Cv-value	409	503	572	623	671	713	750	782	839

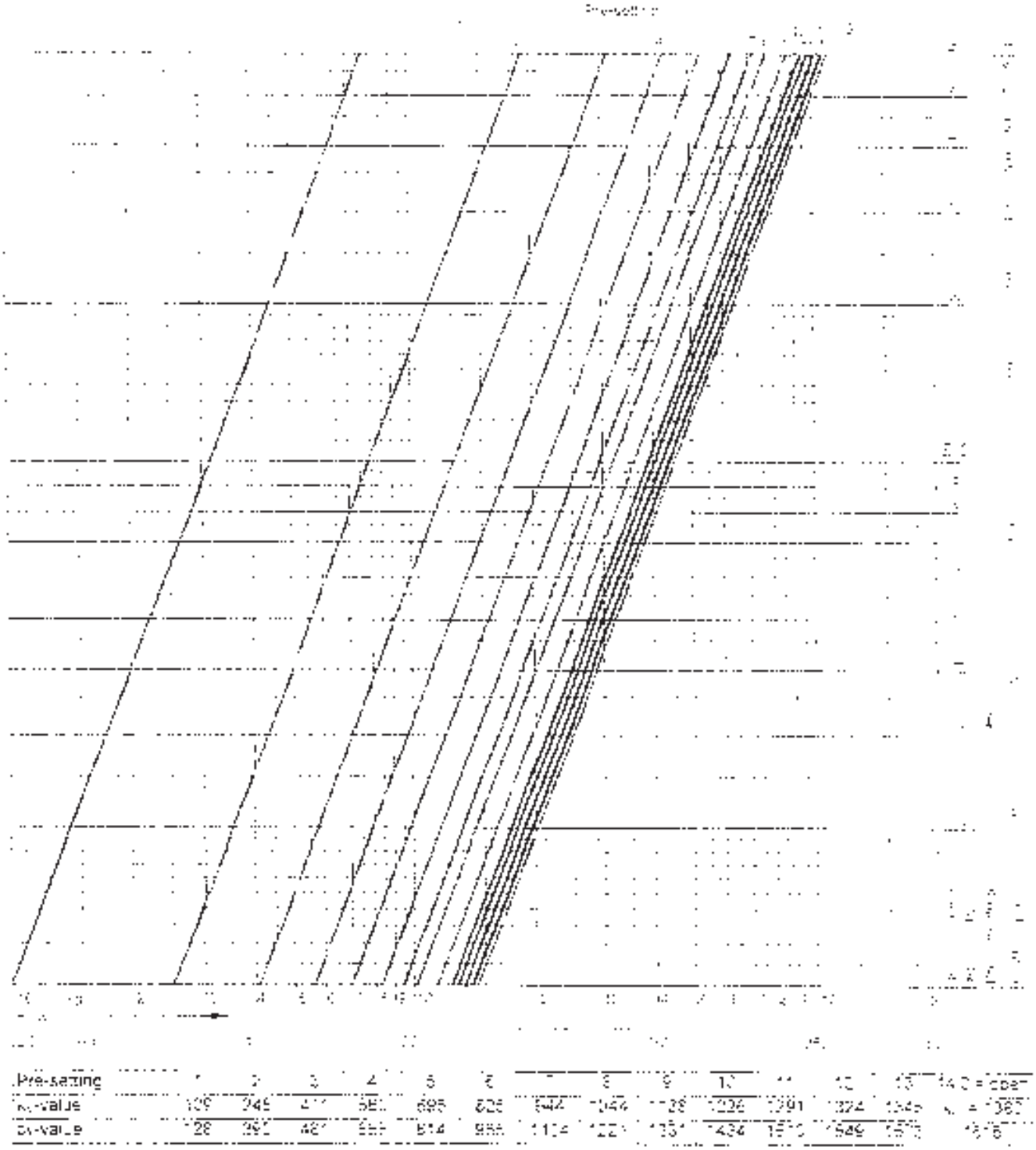
Honeywell

Flow Data V4SV Kombi-F, DN250



Pre-setting	1	2	3	4	5	6	7	8	9	10	Full open
Kv-value	85	195	295	471	674	851	945	1131	1330	1512	
Cv-value		225	341	452	621	881	1091	1305	1536	1747	

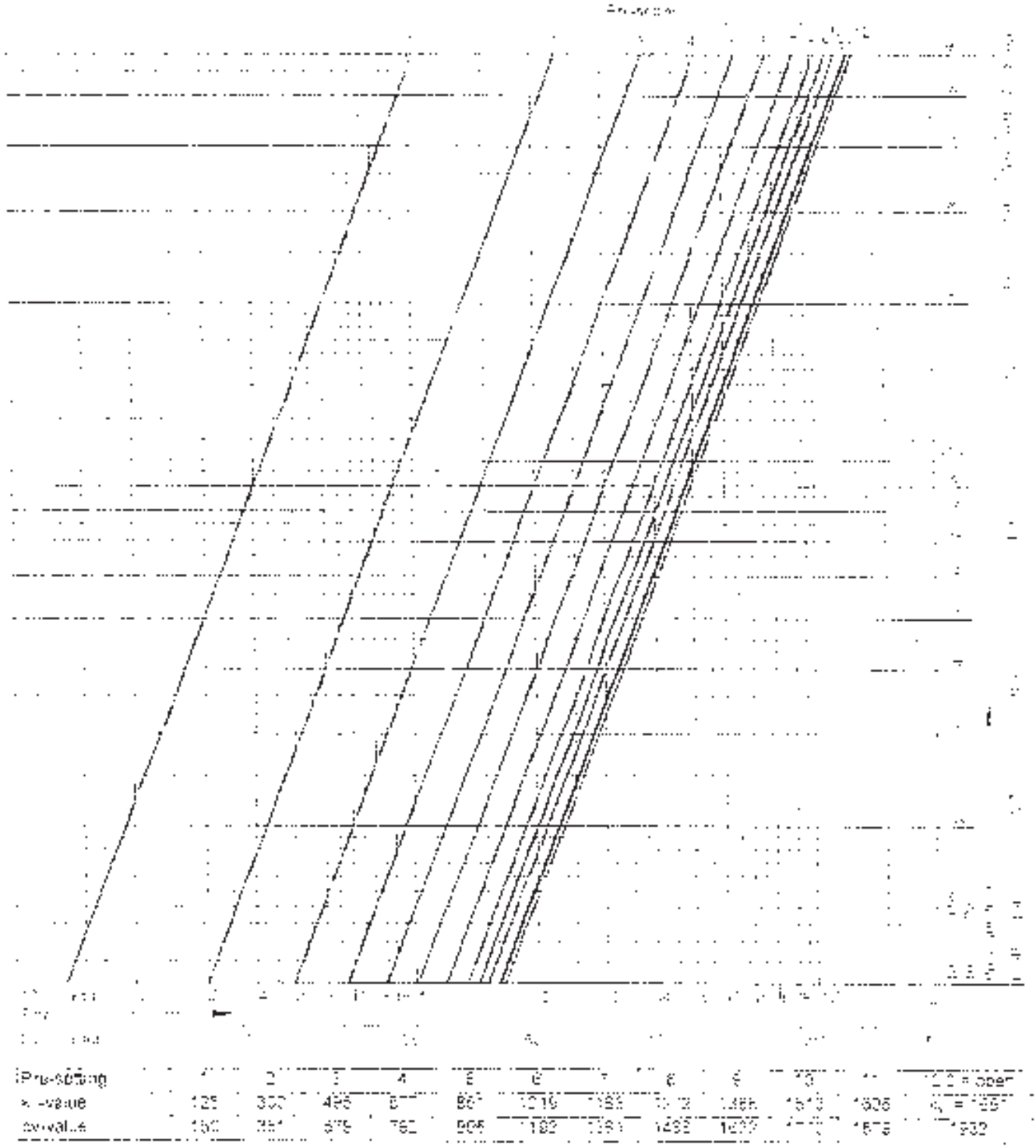
Flow Data V4SV Kombi-F, DN300



Pre-setting	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Open
Kv-value	109	245	411	581	695	825	942	1046	1128	1236	1391	1524	1645	1757	1967
Δp-value	28	362	487	669	814	988	1104	1221	1351	1494	1670	1849	1979	2116	2116

Honeywell

Flow Data V4SV Kombi-F, DN350



Installation

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service person.
4. Always conduct a thorough checkout when installation is completed.

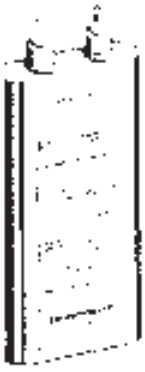
IMPORTANT:

5. For trouble-free operation of the product, good installation practice must include: initial system flushing, chemical water treatment and the use of a 50 micron or finer system side stream filter(s). Remove all filters before flushing.
6. Suggest using a tentative pipe to do the initial system flushing. Then plumb the valve in the piping.
7. Do not use boiler additives, solder flux and wetted materials which are petroleum based or contain mineral oil, hydrocarbons, or ethylene glycol acetate. Compounds which can be used with minimum 50% water dilution are diethylene glycol, ethylene glycol, and propylene glycol antifreeze solutions.
8. The valve may be installed with flow direction same as the arrow on the valve body. Wrong installation will lead to hydronic system paralysis.
9. A pair of test cocks attached in the packing case. Make sure it should be installed before initial commissioning and flushing. Make sure it isn't damaged after installation.

Accessories

Measuring Equipment

'BasicMES' handheld measuring Computer



230V, 0-10bar

VM241A1002

Computer is supplied with case and accessories

Set of 2 measuring adapters

for all dimensions VA3600A008

Spare Parts

Spare set of 2 pressure test cocks G1/4"

for all dimensions VA2600A008

Installation Example

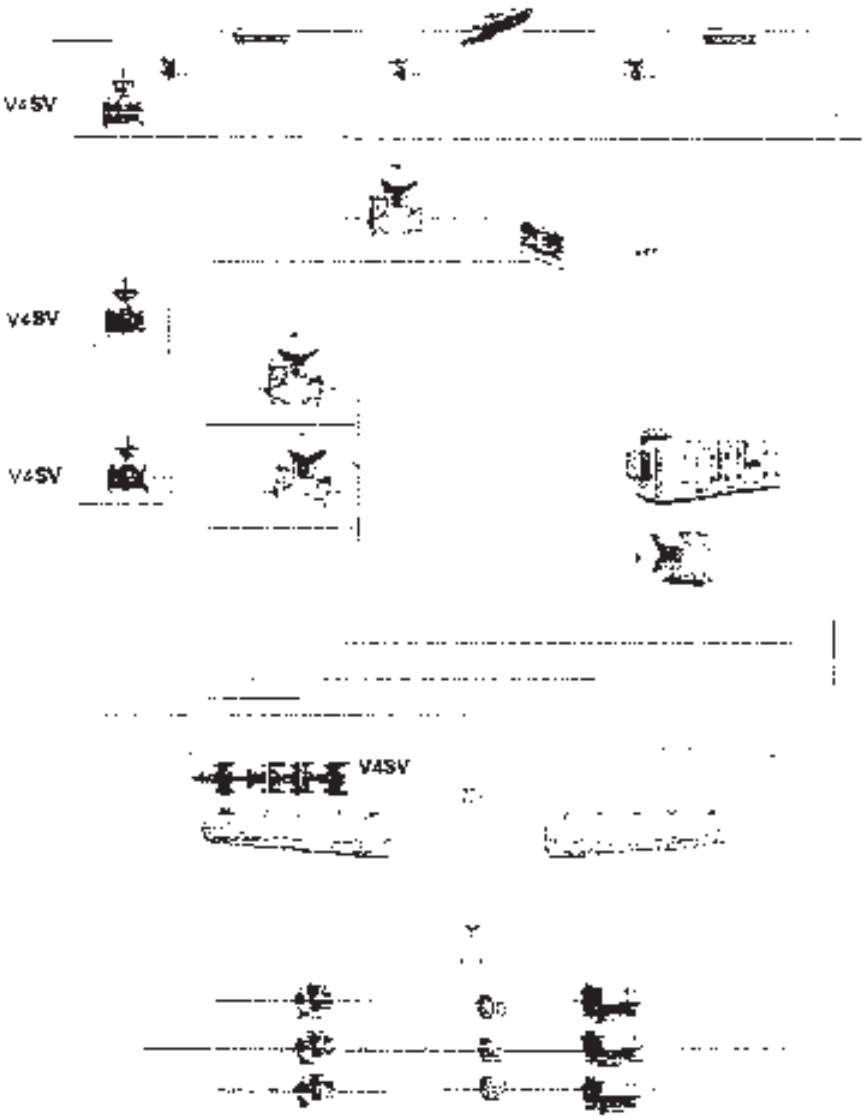


Fig. 4 V4SV in a HVAC cooling system

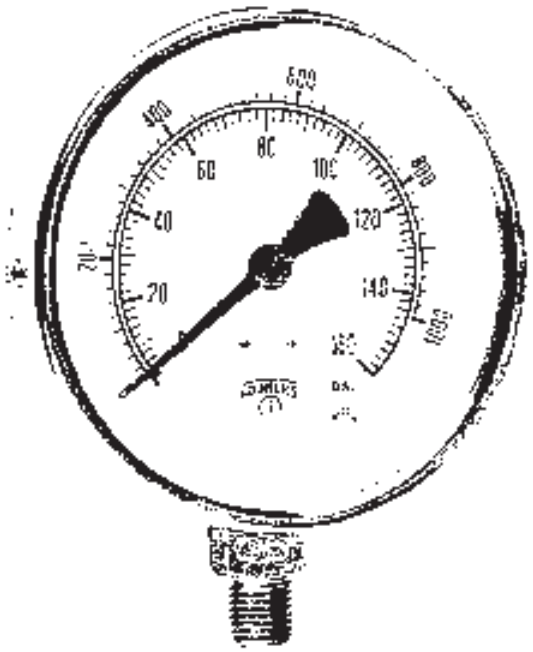
Automation and Control Solutions
Honeywell Environmental & Combustion Controls (Thailand) Co., Ltd.
No. 161 Rama 9 Road
Suanluang Subdistrict, Suanluang District, Bangkok
Thailand 10250
Phone: +66-2-[illegible]
Fax: +66-2-[illegible]

Technical Literature

29) Double Regulating Valve

100 Series

CRN



Optional Back Flange

4" Dial, Centre Back

Description

The Winters' 100 Series Gauges are designed for applications that require reliable measurement of steam, water, oil or any media that have no corrosive effect on brass. These quality all-purpose gauges are available in a steel case or aluminum case and meet all standards of ASME B40.1-1991. The instrument is also, CRN registered.

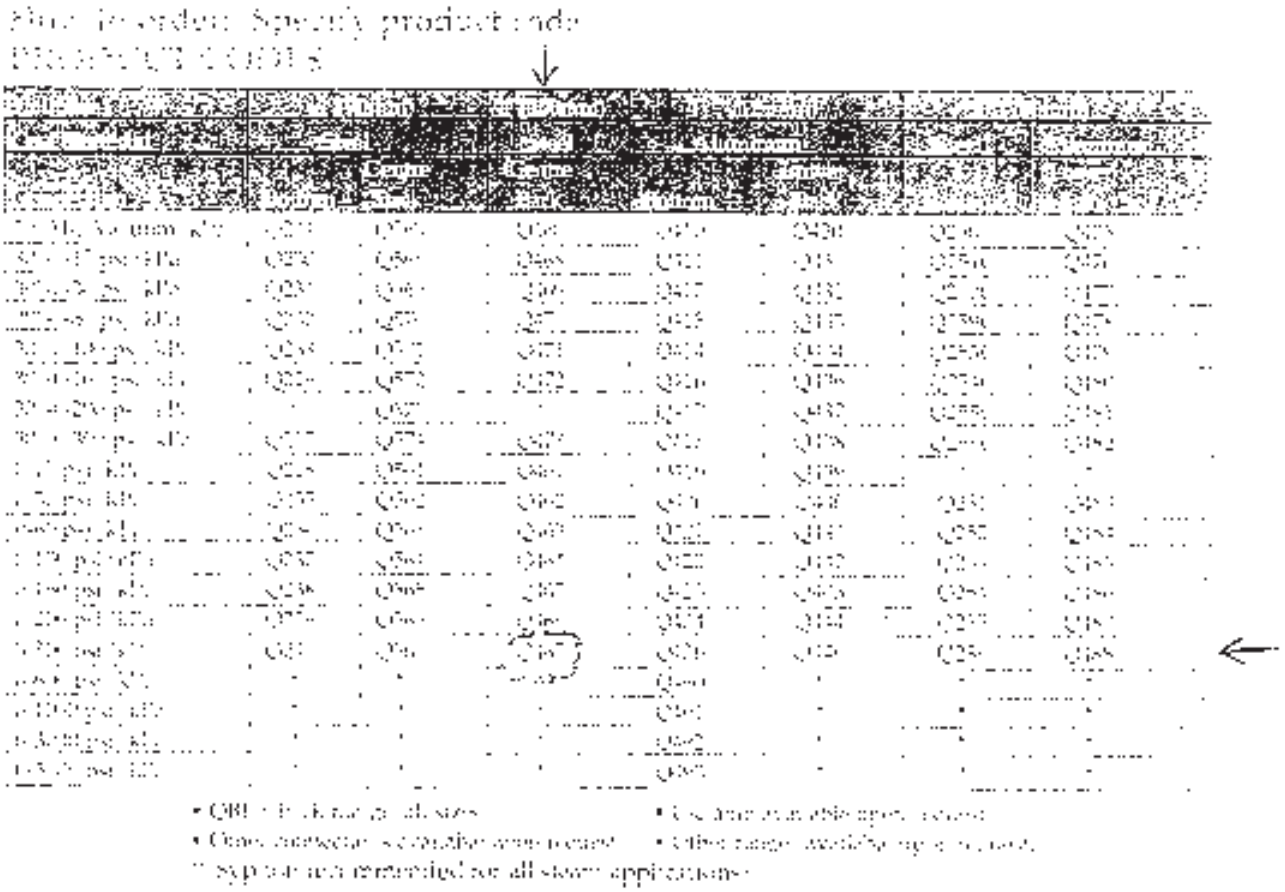
This versatile instrument with an accuracy of 1.0% full scale is available in various dial sizes.

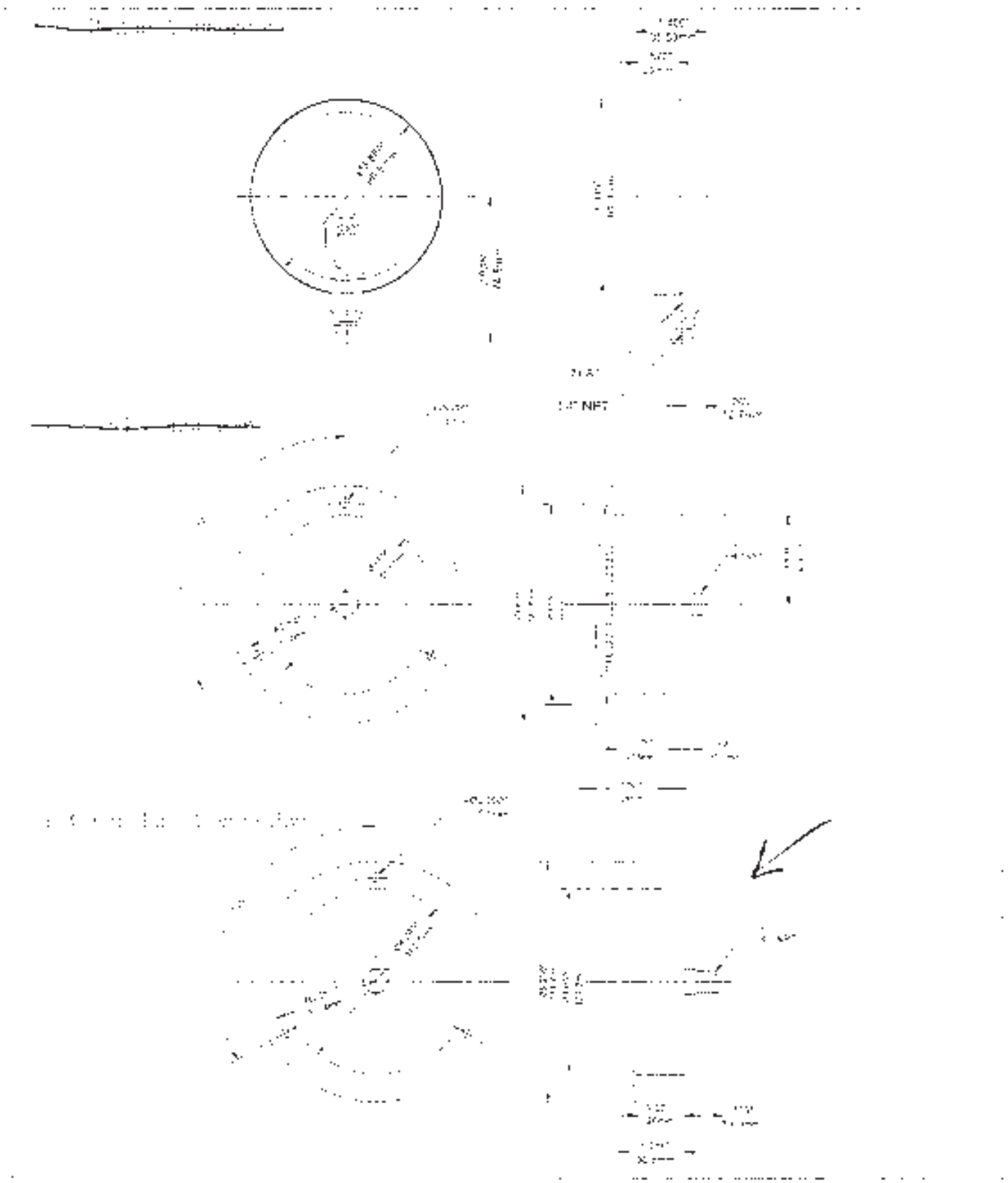
Dial	[illegible]
Case	[illegible]
Bezel	[illegible]
Ring	[illegible]
Pointer	Aluminum [illegible]
Socket	Brass
Connection	[illegible]
Bourdon Tube	[illegible]
Welding	[illegible]
Overpressure Stops	[illegible]
Operating Mechanism	[illegible]
Ambient Temperature	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

WINTERS Corporate Office: 121 Ballside Road • Ivoryton • CN • MCA 1302 • (413) 449-2248 • Fax (413) 449-2571
USA Office: 600 Brewster Road • Pittsfield • NY • 14534 • (716) 574-8700 • Fax (716) 574-8880
www.winters.com • Sales@WINTERS (946-9377)

Page C1

100 Series





Corporate Office: 32 Riviera Road • Toronto, ON M3K 1B2 • Tel: 416 633 2361 • Fax: 416 444 9776
U.S.A. Office: 50 Ehrlanger Road • Dundee, NY 14837 • Tel: 716 971 9200 • Fax: 716 971 9201
www.cwinters.com • 1-800-665-0175 (866-463-7737)

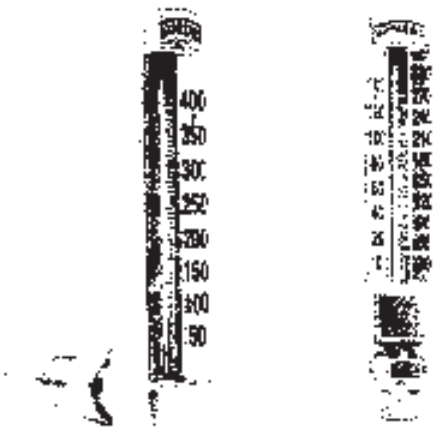
Technical Literature

30) Pressure Gauge

HVAC (GC Series) Thermometer

Applications

Bi-metal in heating, plumbing, air conditioning and ventilation (HVAC) applications. Winters gold-coloured aluminium case thermometers are available in 4 1/2" (110mm) or 6" (150mm) scales. Offers ruggedness and durability in harsh industrial environments. A brass socket 1/2" NPT is standard (stainless steel optional) and the thermometer is available in either a straight model (bottom connection) or 90 angle model (back connection).



Specifications

Body
~~4.5"/110mm~~ or 6"/150mm aluminium, anodized gold

Scale
Black markings

Tube
Glass cushioned

Liquid Filling
Blue organic liquid filled triangle glass tube

Stem
Brass standard. Stainless Steel optional

Connection
1/2" NPT, (1/2" BSP optional)

Swivel Nut
Brass standard, or stainless steel optional (swivel & stem one unit)

Operating Pressure
Maximum 710 psi (50bar)

Ambient Temperature
-40°F-400°F (-40°C-200°C)

Accuracy
±2.0%

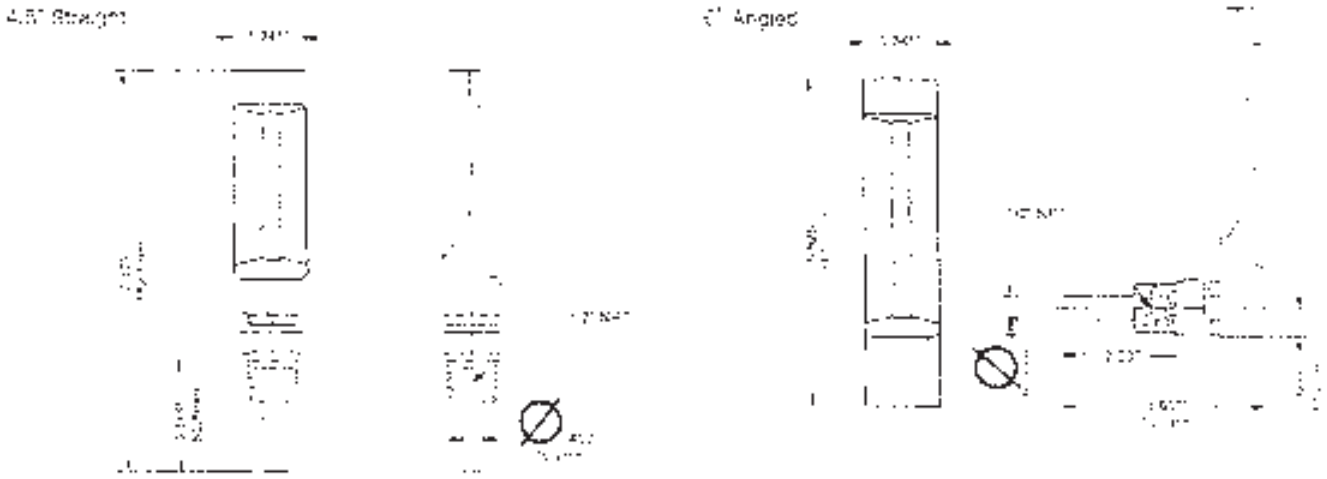
Operating Temperature
Maximum 80% of full scale value recommended

Protection
IP 65

Option
304 stainless steel thermowell

TAG - HVAC (GC Series) Thermometer

Dimensions



How to Order

TAG – G – R – 0 2 0 – 2 – – – B 3 1

Scale Size

4"	4
→ 6.0" (150mm)	6

Configuration

Angle	A
Bottom	B

Stem Length

2"	0 2 0
3"	0 3 0
4"	0 4 0
Dimension (inches X10)	x x x

Stem Material

Brass	B
304 SS	2

Thread Size

1/2"	2
3/4"	4
Special	Z

Thread Type

NPT	N
BSP	B
BSPT	T
M20 x 1.5	M

Range

-40 to 120°C (-40/+40°C)	B 4 1
20 to 180°F (-5/80°C)	B 2 1
→ 30 to 230°F (-1 to 110°C)	B 3 1
30 to 240°F (-1 to 115°C)	B 3 2
50 to 300°F (+10 to 150°C)	B 3 3
50 to 400°F (+10 to 200°C)	B 5 4
0 to 50°C (32 to 122°F)	B B 1
0 to 100°C (32 to 212°F)	B B 2

Technical Literature

31) Temperature Gauge

* SIZE BELOW < DN 50

...engineered rubber connectors

The PROCO Series 315 Rubber Connector is designed for supply distribution pipeline service to connect piping to split fan equipment applications such as: Pumps, Chillers, Cooling Towers, Compressors, Blowers, Fans, Absorption Machines, etc. Installed next to mechanical equipment or between the anchor points of a piping system, specify the PROCO Series 315 to: (1) Absorb Pipe Movement Stress, (2) Reduce System Noise, (3) Isolate Mechanical Vibration, (4) Compensate Alignment Offset, (5) Eliminate Electrolysis, (6) Protect Against Start-Up Surge Forces. The PROCO Series 315 is engineered for tough, demanding industrial and commercial applications, as found in: Air Conditioning-Heating and Ventilating Systems, Chemical-Petrochemical and Industrial Process Piping Systems, Power Generating Plants, Steel Mills, Marine Services, Pulp/Paper Systems, Water-Wastewater-Sewage and Pollution Control Systems where spherical expansion joints or flexible metal hose may have been previously used or specified. Our history in the manufacture of expansion joint products dates back to 1930. PROCO Products is a member of the Rubber Expansion Joint Division, Fluid Sealing Association. When you need an engineered rubber solution to a piping system problem, call PROCO.

Engineered for your Application. The PROCO Series 315 Connector is a [illegible] ...

Style 315. [illegible] ...

Style 315-A. [illegible] ...

Style 315-RP. [illegible] ...

Choice of Installation Hardware. [illegible] ...

Chemical Or Abrasive Service Capability At Minimal Cost. [illegible] ...

Absorbs Pipe-Wall and Fluid-Borne Noise. [illegible] ...

Isolates Vibrations And Motion. [illegible] ...

Prevents Electrolysis and Electrolytic Action. [illegible] ...

Reduces System Stress And Strain-Compensate for Misalignment. [illegible] ...

Full Flow With Less Turbulence Or Material Entrapment. [illegible] ...

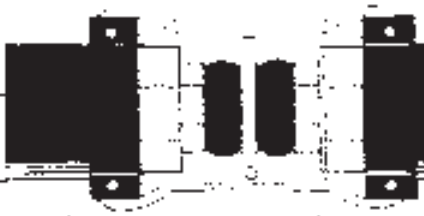
Wide Size Range-Complete Engineering Data. [illegible] ...

Table 1: Available Styles • Materials • Stock

For Specific Elastomer Availability/Materials, See: **PROCO™ "Chemical To Elastomer Guide"**

Style #			PROCO™ Material Code	Cover Elastomer	Tube Elastomer	Maximum Operating Temp. F	Lead Time	U.S.A. Made in USA
315	315-A	315-RP						
[illegible]								

Visit Our Website: http://www.procoproducts.com
email: sales@procoproducts.com



Protecting Piping And Equipment Systems From Stress/Motion

Water Environment Federation

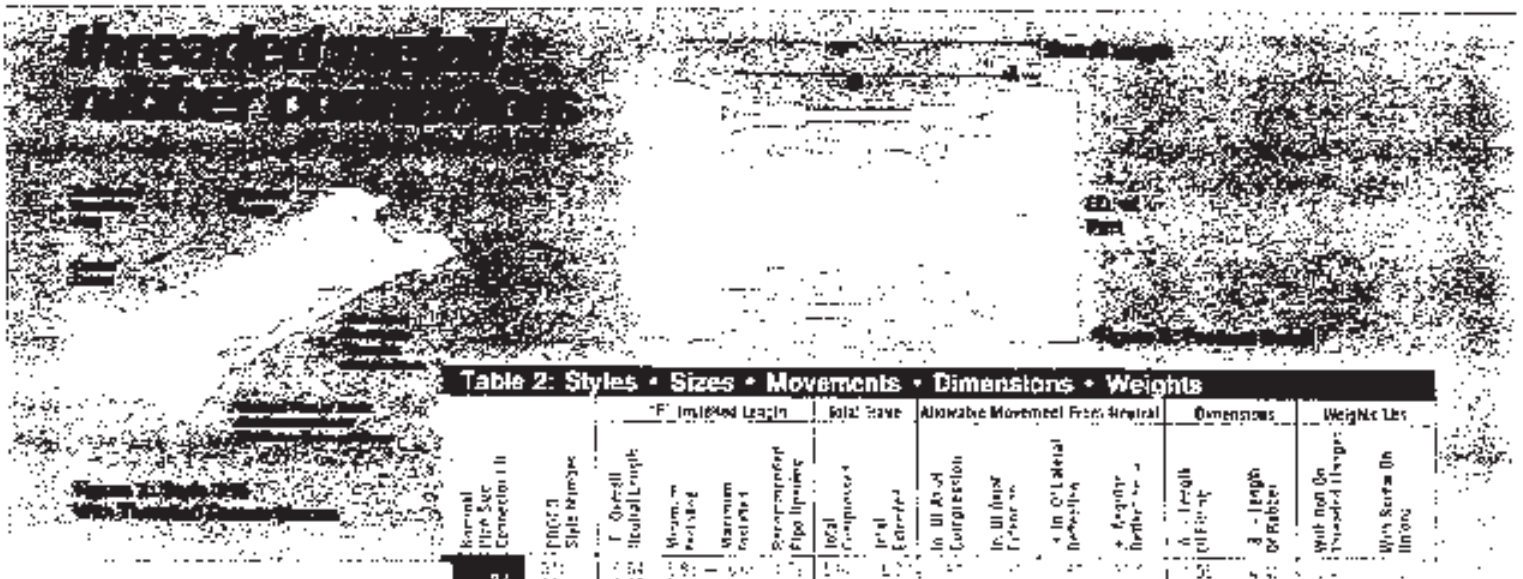


Table 2: Styles • Sizes • Movements • Dimensions • Weights

Nominal Pipe Size Connection I.D.	PROCO Style Number	"F" Installed Length: Overall Installed Length	"F" Installed Length: Maximum Recessed	"F" Installed Length: Maximum Extended	"F" Installed Length: Recommended Pipe Spacers	Total Travel: Total Compression	Total Travel: Total Extension	Allowable Movement From Neutral: In. Of Axial Compression	Allowable Movement From Neutral: In. Of Axial Extension	Allowable Movement From Neutral: + In. Of Lateral Deflection	Allowable Movement From Neutral: ± Angular Deflection	Dimensions: A – Length (Effective)	Dimensions: B – Length Of Rubber	Weights Lbs: With Nuts On Threaded End Flanges	Weights Lbs: With Nuts On Flanges
¾															
1															
1¼															
1½															
2															
2½															
3															

OTHER HVAC PRODUCTS AVAILABLE FROM PROCO...

Style 350 & 352

Style [illegible]

Style [illegible]

Style [illegible]

Table 3: Temperature/Pressure Relationship

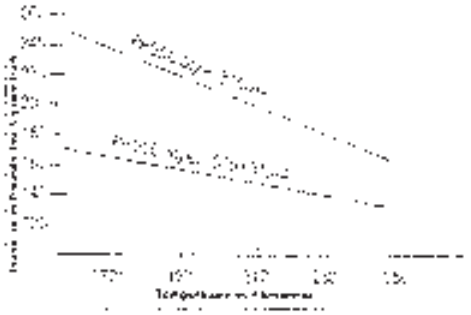


Table 4: Pressures

PROCO Style	Maximum Operating: Test Line PSIG	Maximum Operating: Vacuum Inches of Hg	Maximum: Test PSIG	Maximum: Burst PSIG
315				
315-A				
315-HP				

Table 5: Available Metal Materials

Order Codes Prefix to Style Number: Screw On Female Unions	Order Codes Prefix to Style Number: Bolt-On Floating Flanges	Materials Selection: Unions - Flanges
304		
316		
B		

Wide Service Range With Low Cost. [illegible]

Large Inventories Mean Same-Day Shipment. [illegible] If PROCO doesn't have your requirement, nobody does!

Information-Ordering-Pricing Delivery. [illegible] 800 Ji 344-3246. [illegible]

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PROCO
PROCO PRODUCTS, INC.
[illegible]
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(508) 943-4000
email: sales@procoproducts.com
website: http://www.procoproducts.com

* size > 8" mm

PROCO
SERIES 240/242
molded expansion joints

PROCO Series 240 and Series 242 Hot Metallic Expansion Joints are designed for tough demanding industrial applications as found in: Air Conditioning-Heating and Ventilating Systems; Chemical-Petrochemical and Industrial Process Piping Systems; Power Generating Systems; Marine Services; Pulp & Paper Systems; Water-Wastewater-Sewage and Pollution Control Systems. Installed next to mechanical equipment or between the anchor points of a piping system, specify the PROCO Series 240 or 242 to: (1) Absorb Pipe/Equipment Stress; (2) Reduce System Noise; (3) Isolate Vibration; (4) Compensate Alignment Offset; (5) Eliminate Electrolysis; (6) Protect Against Shut-Up/Surge Forces. Our history in the manufacturing of expansion joint products dates back to 1930. When you need an engineered rubber solution to a piping system problem, call PROCO.

Spherical Shapes-Stronger-More Efficient [illegible]

Greater Movements Are Available [illegible]

Easy Installation With Available Metallic Flanges [illegible]

Less System Strain With Thin Wall Design [illegible]

Specifications Met [illegible]

Absorbs Vibration-Noise-Shock [illegible]

Flange Materials, Drilling [illegible]

Chemical Service Capability At Minimal Cost [illegible]

Wide Service Range With Low Cost [illegible]

Large Inventory Means Same-Day Shipment [illegible] **If PROCO doesn't have your requirement, nobody does**

Information • Ordering • Pricing • Delivery [illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

Table 1: Available Styles • Materials

[illegible]	[illegible]	[illegible]	[illegible]	PROCO's Material Code	Cover Elastomer	Liner Elastomer	Maximum Operating Temp. °F	Low Temp. Capability Good Leak
[illegible]								
[illegible]								
[illegible]								
[illegible]								
[illegible]								
[illegible]								
[illegible]								
[illegible]								
[illegible]								
[illegible]								

[illegible]

Protecting Piping And Equipment Systems From Stress/Motion

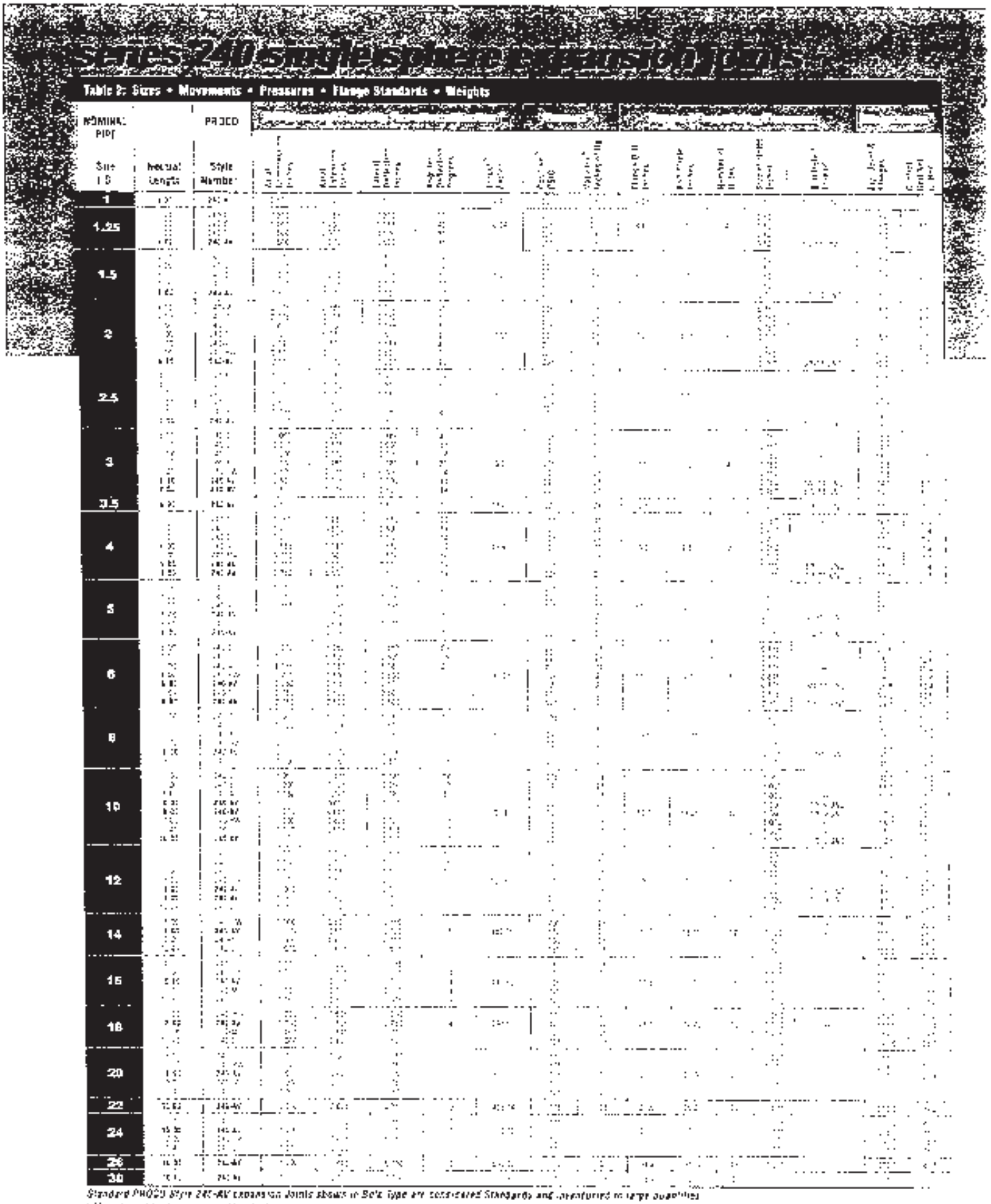


Table 2: Sizes • Movements • Pressures • Flange Standards • Weights

NOMINAL PIPE Size I.D.	Nominal Length	PROCO Style Number																
1																		
1.25																		
1.5																		
2																		
2.5																		
3																		
3.5																		
4																		
5																		
6																		
8																		
10																		
12																		
14																		
16																		
18																		
20																		
22																		
24																		
26																		
30																		

Standard PROCO Style 240-AV expansion joints shown in Bolt type are constructed Standards and advertised in large quantities

Series 241 Dual-Sphere expansion joints

Table 3: Sizes • Movements • Pressures • Flange Standards • Weights

NOMINAL PIPE Size C	Nominal Length	PROCO Style Number																
1																		
1.25																		
1.5																		
2																		
2.5																		
3																		
3.5																		
4																		
5																		
6																		
8																		
10																		
12																		
14																		
16																		
18																		
20																		
22																		
24																		
26																		
30																		

Standard PROCO Style 241-A expansion joints shown in Bold Type are considered Standards and maintained in large quantities.

Installation Note

Care must be taken when pulling the joint into the breech between the mating flanges so as not to roll the sealing tape or the rubber out of its flange groove.

Pressurization Note

Water Environment Federation

Fluid Sealing Association FSA

ISD

NAHAD

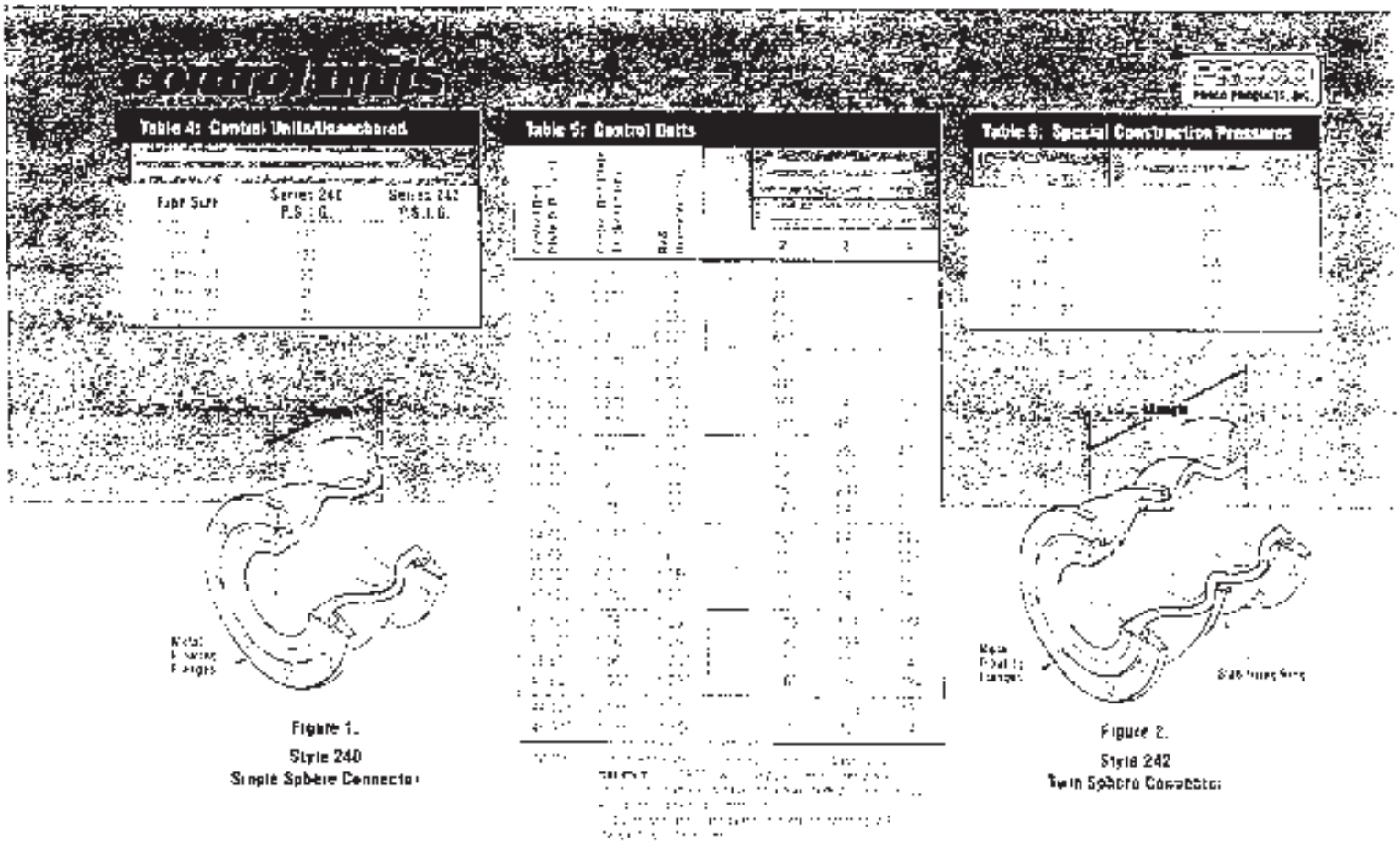
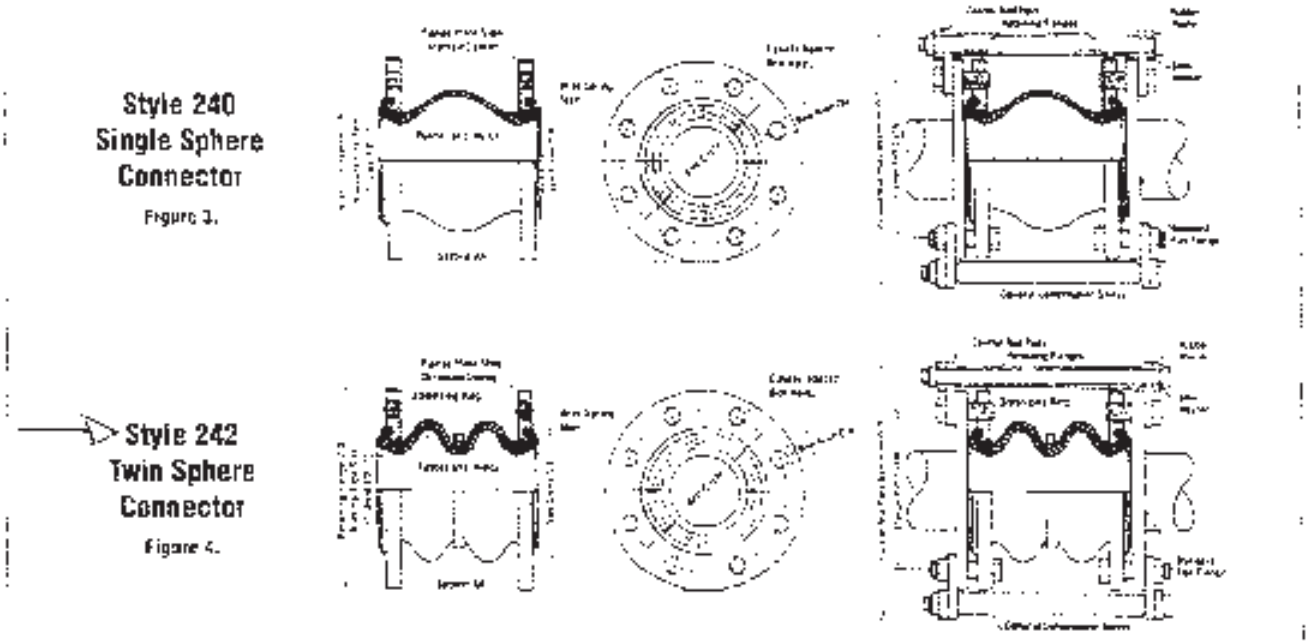


Figure 1.
Style 240
Single Sphere Connector

Figure 2.
Style 242
Twin Sphere Connector



Style 240
Single Sphere
Connector

Figure 3.

Style 242
Twin Sphere
Connector

Figure 4.

Control Rod/Unit Applications Control rod/unit applications are determined by the type of piping system in which the expansion joint is installed. Refer to the following descriptions and to Tables 4 & 5 for the proper control rod/unit for each type of piping system.

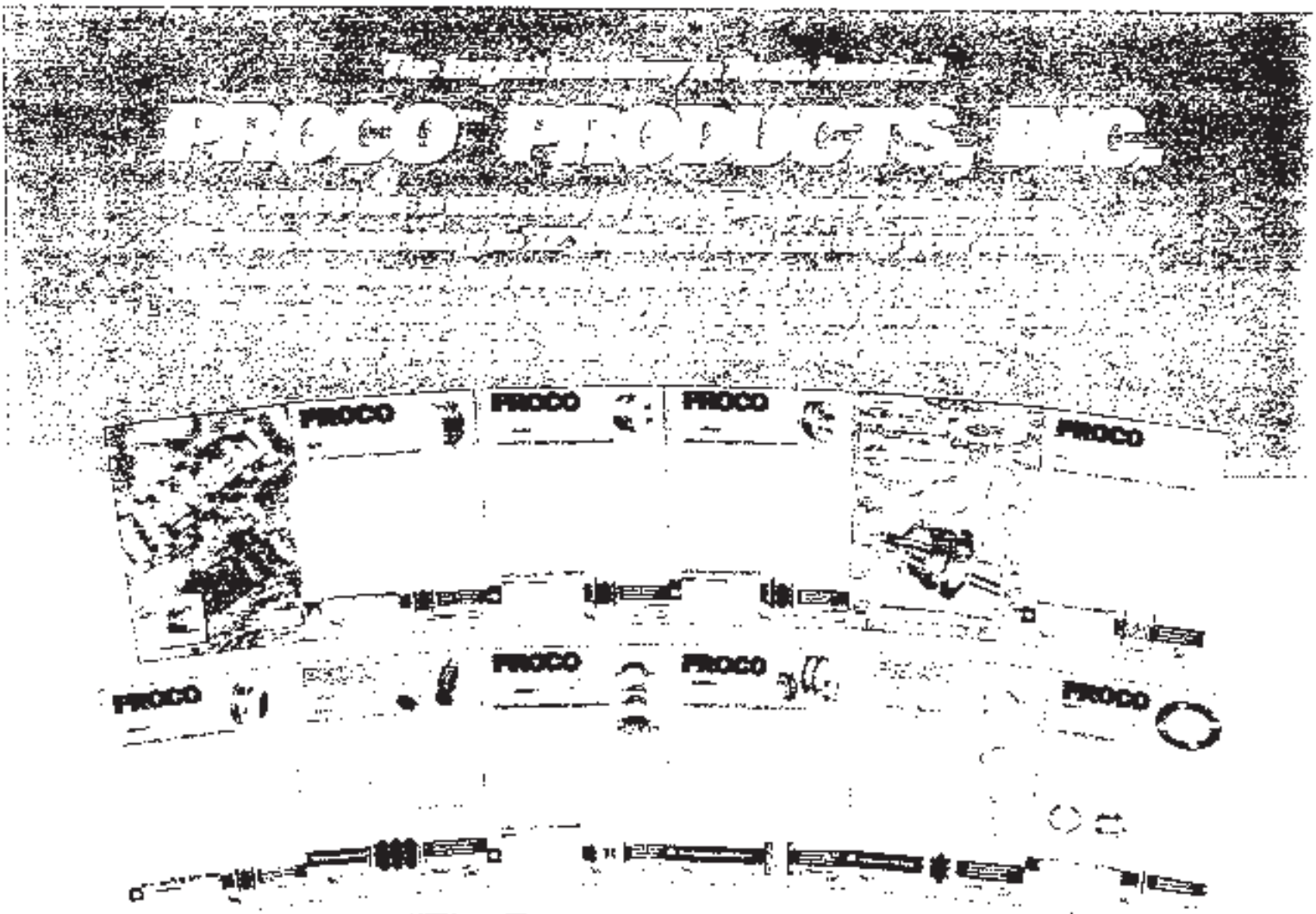
1. **Anchored Systems.** Control units are not required for anchored systems where the anchors are adequate to withstand the maximum pressure thrust. Control rods are not required for anchored systems. Refer to Tables 4 & 5.
2. **Unanchored Systems** Control units are required for unanchored systems. Select the control unit that will withstand the maximum pressure thrust. The control rod is required for unanchored systems. Refer to Tables 4 & 5 for the proper control rod/unit for each type of piping system.
3. **Spring-Mounted Equipment** Control units are required for spring-mounted equipment where the maximum pressure thrust exceeds the rated capacity of the spring mounting system. Refer to Tables 4 & 5.

Special Applications Style 240 single sphere and 242 twin sphere expansion joints are not recommended for applications involving pulsating flow, such as reciprocating pumps, unless a detailed analysis of the piping system indicates that the pulsating flow will not cause resonance in the piping system. Refer to Table 6. The design of piping systems for pulsating flow is the responsibility of the engineer. Proper design of piping systems to avoid resonance is the responsibility of the engineer.

drilling for series 240 and series 242 expansion joints

Table 1: Flange Drilling

PROCO™ Series 240 and 242 are Designed to Absorb Different Movements Concurrently



"The Expansion Joint People"

- Same-day shipping
- Knowledgeable sales staff that has an average of 20 years experience with expansion joints
- Daily UPS[1] pick-up
- Preselected freight carriers to minimize "interline transfer"
- Emergency service for nights, weekends, and even holidays
- Complete expansion joint product line
- Largest inventory in North America with warehouses in
  Stockton, CA
  Houston, TX
  Atlanta, GA

PROCO PRODUCTS, INC.

DISTRIBUTED BY:

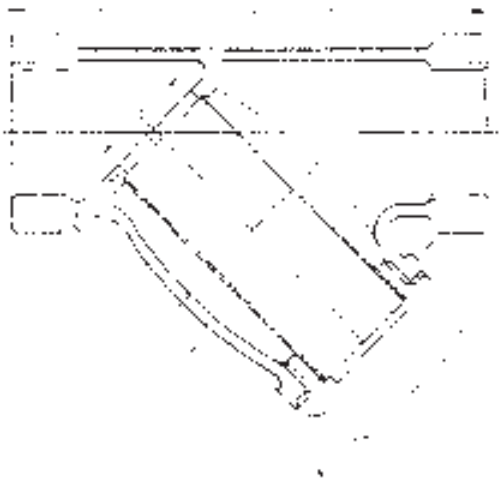
Technical Literature

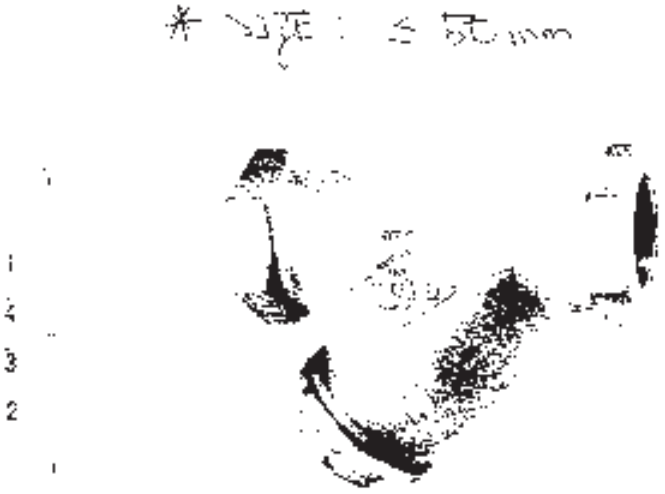
32) Flexible Connector (Water Side)

FIG. NO. 380

150-POUND BRONZE STRAINERS

Screwed cap, Y-pattern, screwed ends.





Cap construction
for sizes 2½ & larger

Working Pressure

Working Pressure Non-Shock	Test Pressure
Water, Oil	Body (Water)
20 Bar	30 Bar

Note

Cast Bronze complies to the American or British Standard pressure

P Pitch 0.098 inch (2 mm)
A Diameter 0.059 inch (1.5 mm)
N Number of holes
O Open Area %
S Total Screen area

Materials

No.	Name of Parts	Materials	B.S.
1	Body	Bronze	BS1400 LG2
2	Cap	Bronze	BS1400 LG2
3	Screen	Stainless Steel	BS970 Gr 304*
4	Gasket	Non-asbestos	
5	O-ring	Buna-N	

*316 stainless steel is optional

Dimensions

Mark \ Size		½	¾	1	1½	1½	2	2½	3
L	in	3.15	3.94	4.53	5.31	6.30	7.68	8.66	9.45
	mm	80	100	115	135	160	195	220	240
H	in	2.36	2.87	3.39	3.90	4.41	5.71	7.05	7.72
	mm	60	73	86	99	112	145	179	196
h	in	2.01	2.44	2.91	3.23	3.70	4.76	5.79	6.50
	mm	51	62	74	82	94	121	147	165
c	in	0.59	0.79	0.98	1.25	1.57	1.97	2.48	2.99
	mm	15	20	25	32	40	50	61	76
W	lb	0.64	1.04	1.65	2.71	3.75	6.19	9.61	13.89
	kg	0.29	0.47	0.75	1.23	1.72	2.81	4.35	6.27

Data of screen

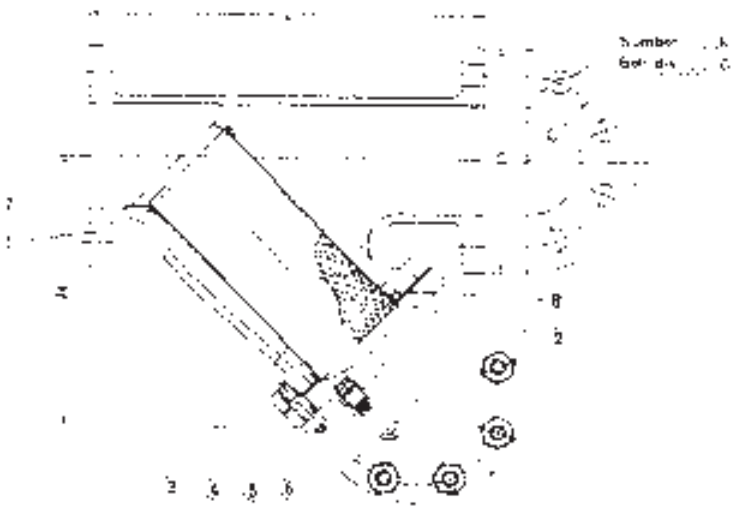
Mark \ Size		½	¾	1	1½	1½	2	2½	3
N	pc	119.4	119.4	119.4	119.4	119.4	119.4	119.4	119.4
P	cm	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
O	%	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7
S	in²	3.14	5.12	7.71	11.27	16.32	27.63	42.56	59.39
	cm²	20.23	33.03	49.75	72.73	105.3	178.3	274.6	376.2

*Design and materials are subject to change without notice

FIG. NO. 381

125-POUND CAST IRON STRAINERS

Y-pattern, bolted cover, flanged ends.



Working Pressure

Working Pressure Non-Shock	Test Pressure
Water @	Body Water
16 Bar	24 Bar

Materials

No.	Name of Parts	Materials	B.S
1	Body	Cast iron	BS1452 Gr.220
2	Cover	Cast iron	BS1452 Gr.220
3	Screen	Stainless Steel	BS970 Gr.304S*
4	Cover Bolt	Steel (Zinc plated)	BS4360
5	Cover Nut	Steel (Zinc plated)	BS4360
6	Drain Plug	Malleable iron	BS310-32
7	Supporting		BS970 Gr.420
8	Gasket	Non-asbestos	

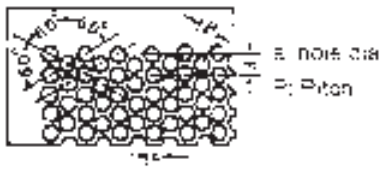
*316 stainless steel is optional

Dimensions

Size / Mark		50	65	80	100	125	150	200	250	300
A	mm	225	273	292	352	391	470	642	660	701
B	mm	144	176	195	248	300	327	395	483	551
D	mm	165	185	205	225	350	265	340	405	460
C	mm	125	145	160	190	210	240	295	355	410
W	kg	11	16	20	34	51	68	111	182	269

Note:
Dimension of "G" & "N" refer to the flange table of BS4504 PN16

Detail of screen



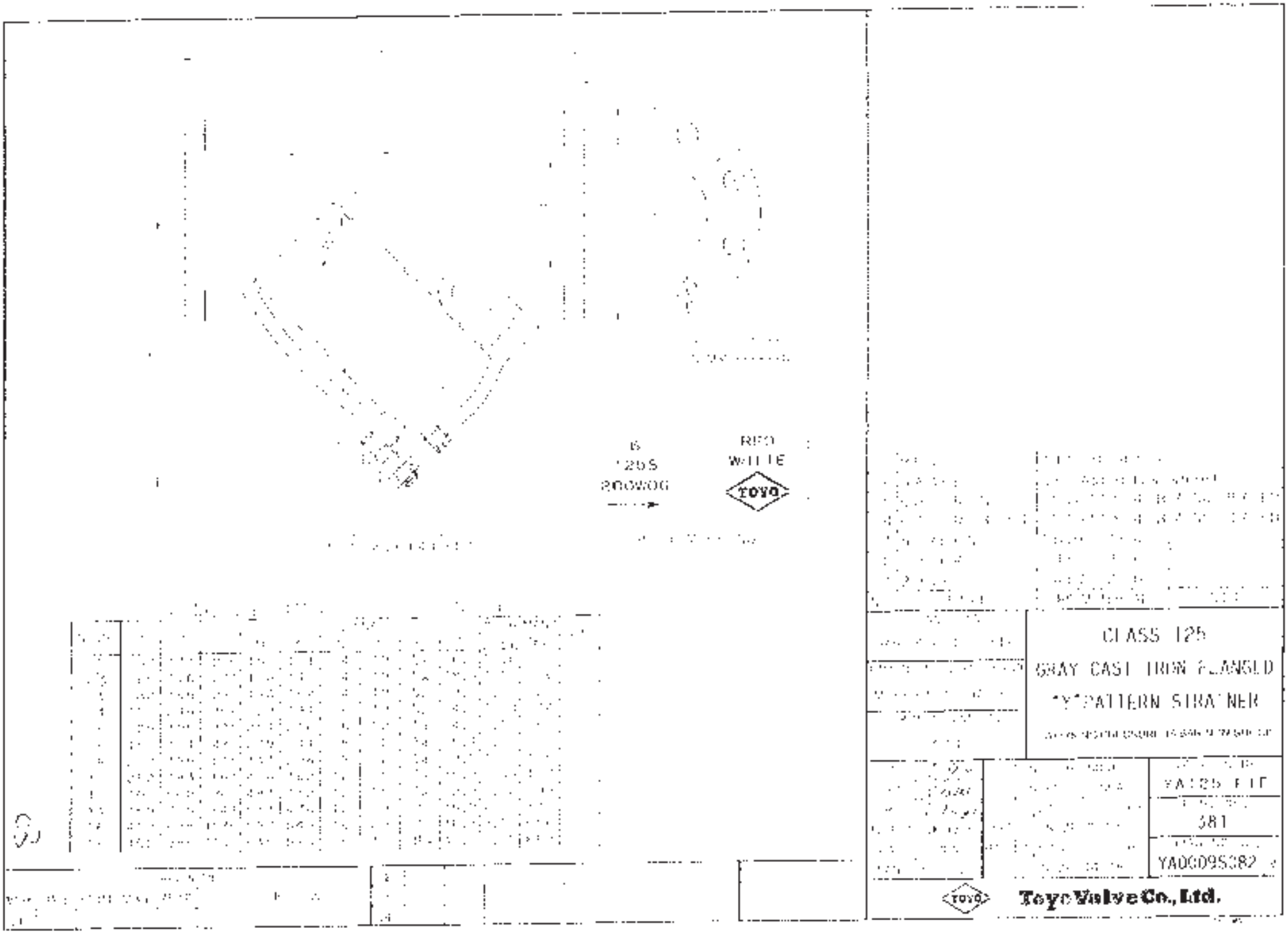
Data of screen

Size / Mark		50	65	80	100	125	150	200	250	300
B*	mm	1.5	1.5	1.5	1.5	1.5	2	2	2	2
P	mm	2.5	2.5	2.5	2.5	2.5	3	3	3	3

*Other hole dia. are also available

*Design and materials are subject to change without notice.

Toyo Valve Co., Ltd.


B
125S
200W0G
RED
WHITE
toyo
CLASS 125
GRAY CAST IRON FLANGED
"Y" PATTERN STRAINER
381
YA0G09S382
toyo
Toyo Valve Co., Ltd.

Technical Literature

33) Y Strainer

MINICAL – VALCAL
Automatic air vent valves

series 5020 · 5021 · 5022

CALEFFI

Function

Product range

Technical specification

Materials:

Performance

Dimensions

Operation

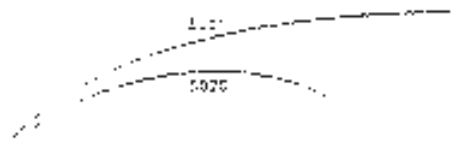
Construction details

Hygroscopic cap

Models with shut-off

Flow curves

Air flow when the system is being filled



Installation

... replace the valve cap with a Caleffi Series 562L safety hygroscopic cap in all those locations where cannot be inspected.

Accessories

SPECIFICATION SUMMARIES

Series 5020

Series 5020

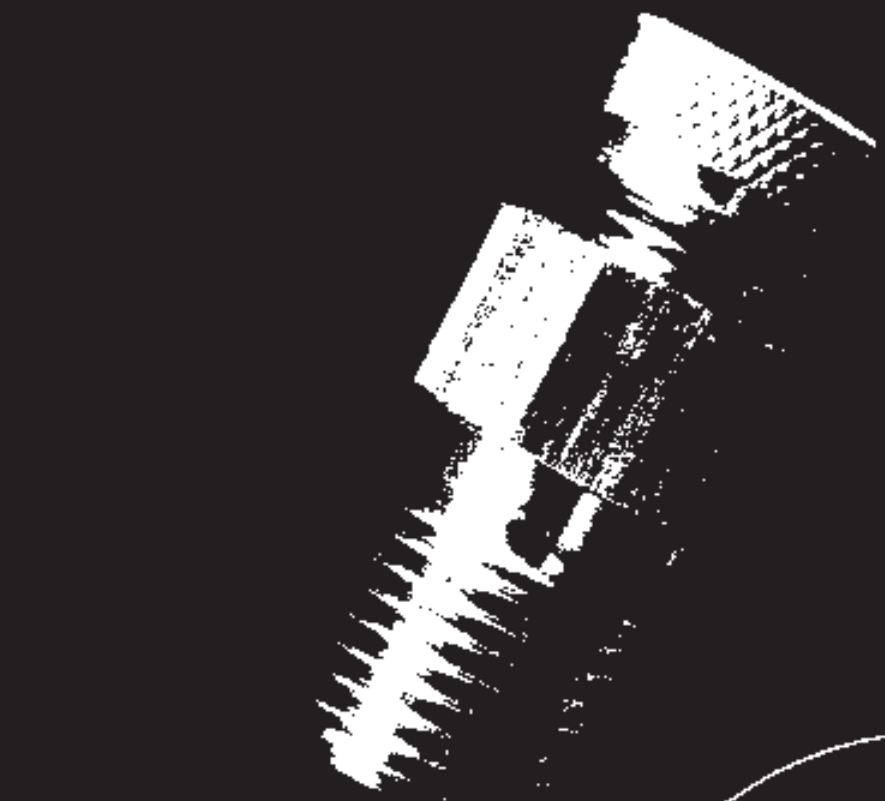
Series 5021

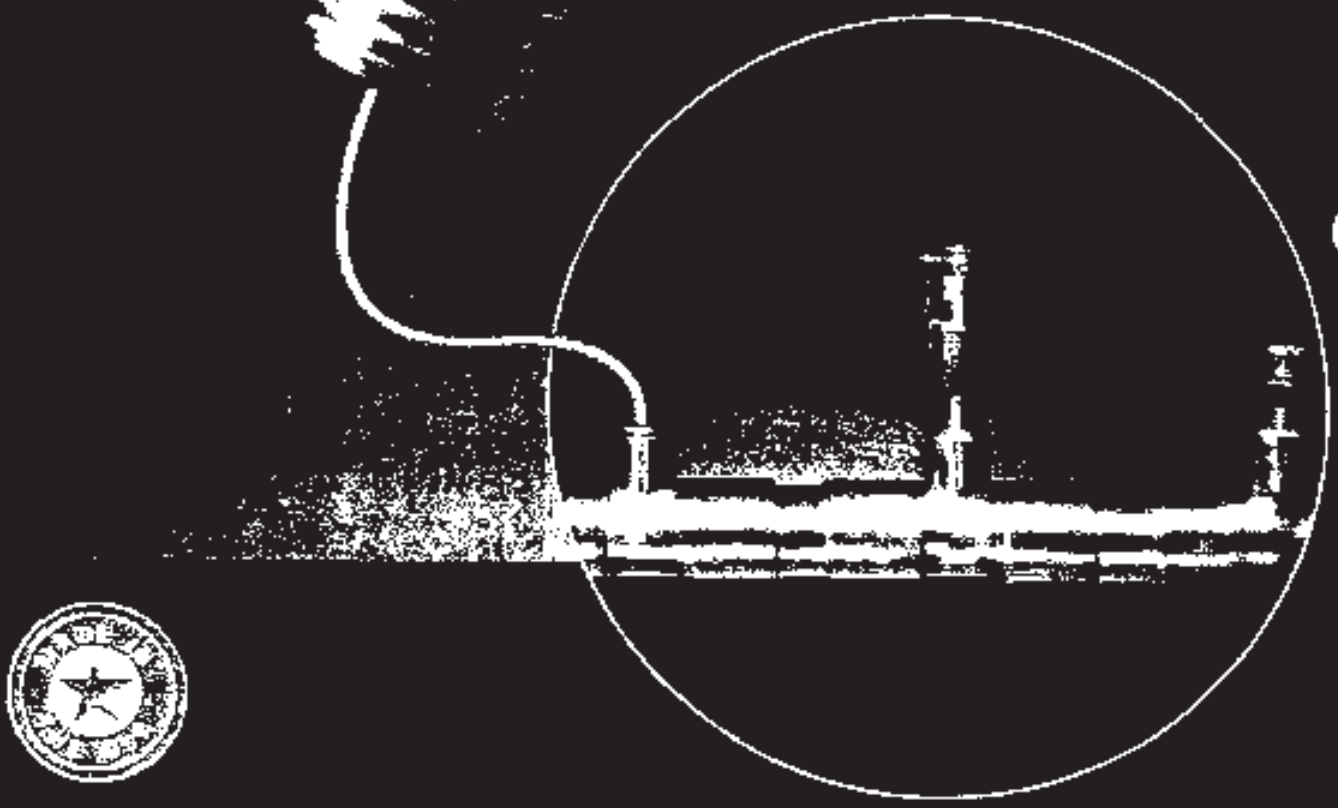
Series 5022

Technical Literature

34) Automatic Air Vent

Test Plugs For Pressure or Temperature





WHY A SISCO PLUG?

ZERO LEAKAGE TO ATMOSPHERE

OUR DUAL CORE SEAL DESIGN WITH THE MEMBRANE COUPLER SERVES A DUAL PURPOSE...

- DUAL CORE DESIGN ALLOWS THE BOTTOM SEAL TO CLOSE, SEALING YOUR SYSTEM BEFORE THE PROBE IS FULLY REMOVED THROUGH THE TOP CORE.
- THE MEMBRANE CONNECTING THE TWO SEPARATE CORES MAINTAINS TRUE ALIGNMENT FOR INCREASED EASE WHEN INSERTING PROBES.

SISCO'S 1/8" MINI PLUG

THIS SISCO PLUG WAS CREATED AT THE REQUEST OF OUR CUSTOMERS FOR USE WHERE SPACE IS CONSTRAINED. USE ANYWHERE YOU CAN USE A 1/8" NPT SCHRADER VALVE.

[illegible] GAUGE ADAPTER FOR INDICATOR TO TAKE [illegible] PRESSURE AND TEMPERATURE READ[illegible]

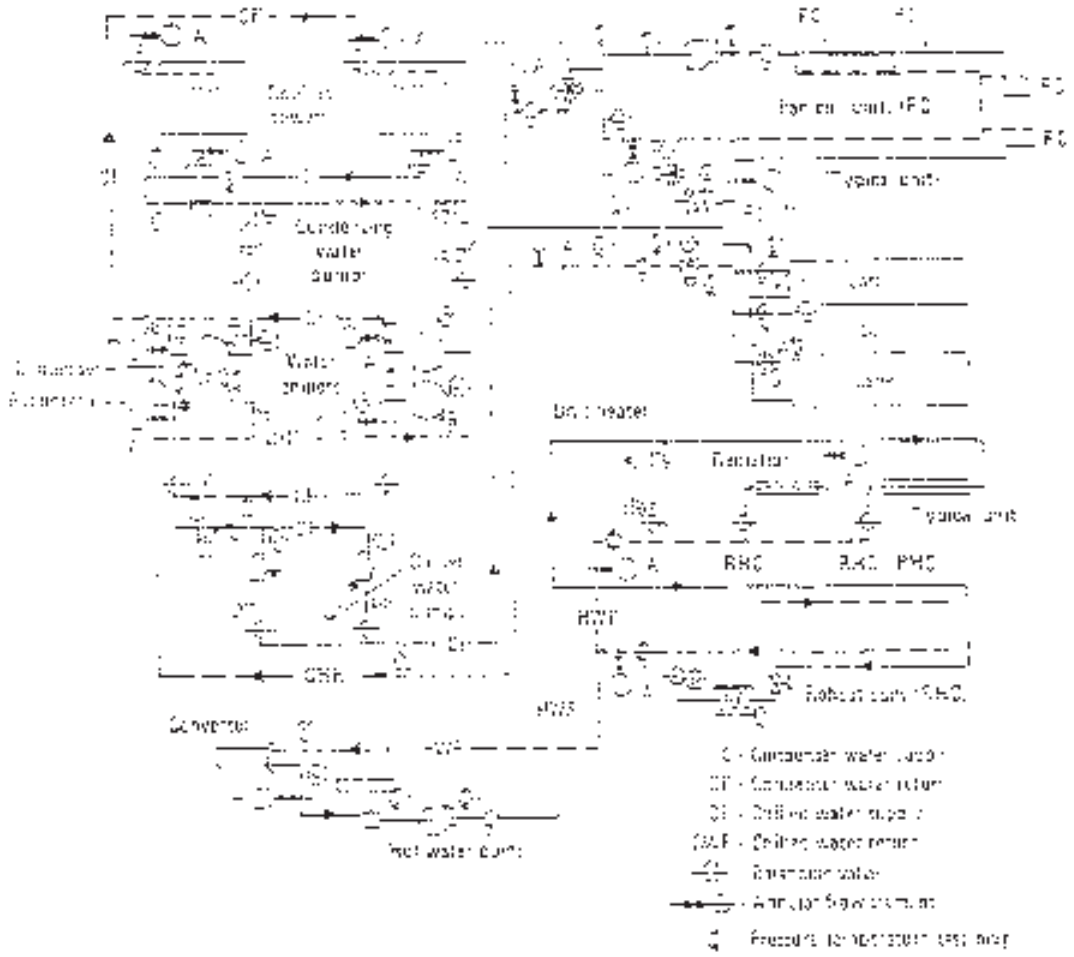
SISCO PLUGS ARE UNIQUE

UNIQUE IDEAS FOR USING A SISCO PLUG...

- INJECT OR EXTRACT SUBSTANCES FROM LINES WHILE IN OPERATION
- BLEED AIR OR GASES
- SEPARATE EXTENSION: YOU CAN USE THE SAME TEST EQUIPMENT ON PLUGS WITH EXTENSIONS... "OUR CORE IS ALWAYS AT THE TOP."
- MEASURE FLOW RATES.

[illegible]

RECOMMENDED LOCATIONS FOR P/T TEST PLUGS FOR BALANCED HEATING AND COOLING SYSTEMS

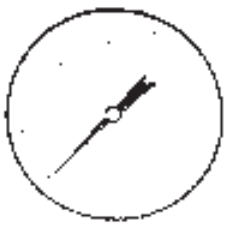


SISCO PLUGS PASS THE TEST, SAVE TIME & MONEY

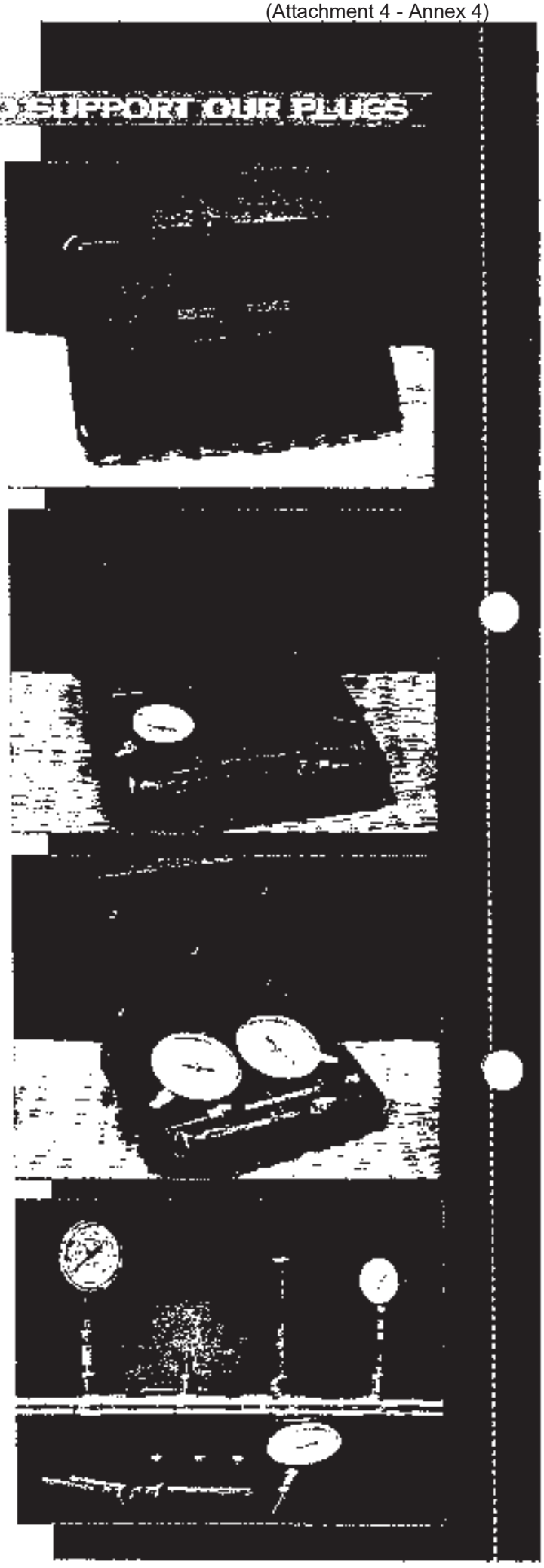
- MEASURING:
  PRESSURE/TEMPERATURE/FLOW RATE
- SAMPLING:
  RETRIEVE SAMPLES WITHOUT DISRUPTING SYSTEM
- BLEEDING:
  BLEED AIR FROM A/C LINES TO INCREASE EFFICIENCY
- SINGLE SET OF GAUGES TO TEST OR SAMPLE ALL POINTS.
- QUICKLY MOVE FROM POINT TO POINT
  FINGERTIP CAPS PROVIDE QUICK AND EASY ACCESS
- SECURITY
  TESTING EQUIPMENT IS NOT DUPLICATED NOR PRONE TO VANDALISM, CLIMATE EXTREMES AND CORROSIVE CONTAMINANTS.
- FLEXIBILITY AND DURABILITY

DESCRIPTIONS OF SISCO PLUGS AND ACCESSORIES

ENGINEERING SPECIFICATIONS FOR HYDRONIC APPLICATIONS



SUPPORT OUR PLUGS



1. PIPE SHOULD BE PREPARED TO ACCEPT TEST PLUG BY HAVING THE PROPER SIZE "T" OR SOCKET INSTALLED ON THE PIPE.
2. CAUTION: BE SURE THE TEST PLUG IS INSTALLED ON THE TOP HALF OF THE PIPE. NEVER INSTALL TEST PLUGS ON THE BOTTOM SIDE OF A PIPE!
3. PREPARE TEST PLUG FOR INSTALLATION BY LIGHTLY COATING NPT OR BSP THREADS WITH TEFLON TAPE.
4. WARNING: OPERATOR SHOULD ALWAYS WEAR PROTECTIVE CLOTHING AND SAFETY GOGGLES WHEN USING TEST PLUG.
5. SCREW TEST PLUG INTO SOCKET UNTIL IT IS FIRMLY SEATED INTO THE SOCKET.
6. PLACE SYSTEM UNDER OPERATING CONDITIONS.

1. SCREW GAUGE ADAPTER OR PRESSURE GAUGE / TESTING THERMOMETER BE SURE TO ENGAGE SWIVEL NUT ON GAUGE ADAPTER FOR EASY TIGHTENING.
2. PREPARE GAUGE ADAPTER OR THERMOMETER PROBE FOR INSERTION INTO TEST PLUG BY CLEANING IT, LEAVING IT FOR BURPS AND APPLYING A SMALL AMOUNT OF SILICONE LUBRICANT.
3. CARE SHOULD BE TAKEN TO SELECT THE PROPER GAUGE RANGE. IF YOU GUESS WRONG THE PRESSURE GAUGE COULD EXPLODE IN YOUR HAND.
4. SLOWLY REMOVE PROTECTIVE CAP. IF YOU BEGIN TO SEE OR HEAR ANY LIQUID OR GASES ESCAPING, RETIGHTEN CAP IMMEDIATELY AND ATTEMPT NO PROBING. REPLACE TEST PLUG IF NECESSARY.
5. IT IS RECOMMENDED TO CARRY SPARE CAPS OR PURCHASE THE OPTIONAL CAP RETAINER.
6. INSERT THE PRESSURE GAUGE WITH GAUGE ADAPTER OR THERMOMETER INTO THE TOP OF THE PLUG.
7. DO NOT LEAVE PROBE IN THE PLUG ANY LONGER THAN REQUIRED.
8. REMOVE MEASURING DEVICE AND REPLACE CAP QUICKLY. NOTE: IN TEMPERATURES BELOW 45° F. PLUG MAY CLOSE SLOWLY.
9. CAPS SHOULD ALWAYS BE INSTALLED WHEN TEST PLUG IS NOT IN USE.

Technical Literature

35) Test Plug (Water Side)

AVESAN

GRP组合式玻璃钢水箱
GRP SECTIONAL STORAGE WATER TANKS

Company Profile 公司简介

GRP Sectional Water Tank -
Proven Excellence in Customer Satisfaction and Environmental Quality Management

SUNG IL Co. Ltd specializes in the development and production of GRP sectional water tanks in Korea since 1998. SUNG IL has appointed Mesan Cooling Tower Ltd as their exclusive distributor and the water tanks are fully satisfied all conditions related to sanitation, durability, water tightness and heat insulation. SUNG IL has obtained ISO9001, ISO14001 certification and accredited a number of global assured certificates - AS/NZ 4200:2005, PSB certificate and WRAS certificate.

GRP 水箱——用户满意的优质环保水箱

韩国成H株式会社创建于1998年，是专业制造GRP产品的高档塑料制品制造商。

企业通过了ISO9001和ISO14001认证，成H水箱荣获多项世界认可 包括：AS/NZ4200:2005、PSB、WRAS及多项产品专利，满足用户对水箱耐久性、卫生性、水密性和保温性的高性能需求。

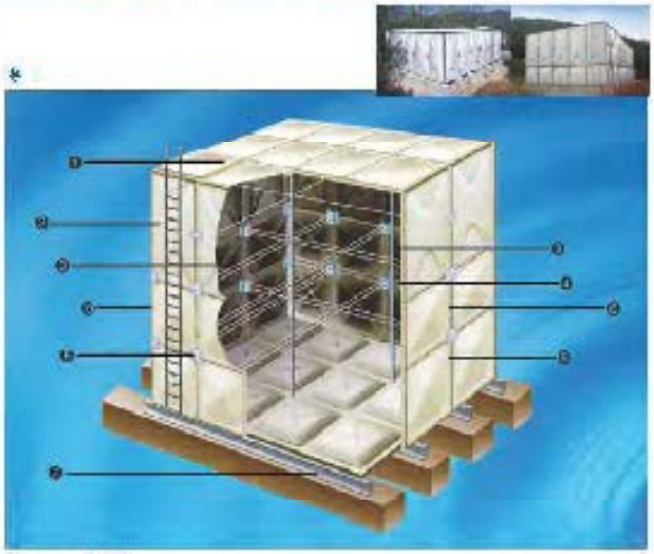
GRP Sheet Factory
GRP 生产车间

Compressing Moulding Factory
片模车间

Patents Status in Korea 韩国国家专利

Heat Insulation Panel 保温板	: No. 0495287
Water Inspection Panel 检修板	: No. 2004-0008395
Elvan Water Tank Panel 抗菌水箱板	: No. 2004-00011977
Water Tank Panel 水箱板	: No. 2005-0001929
	: No. 2005-0001930

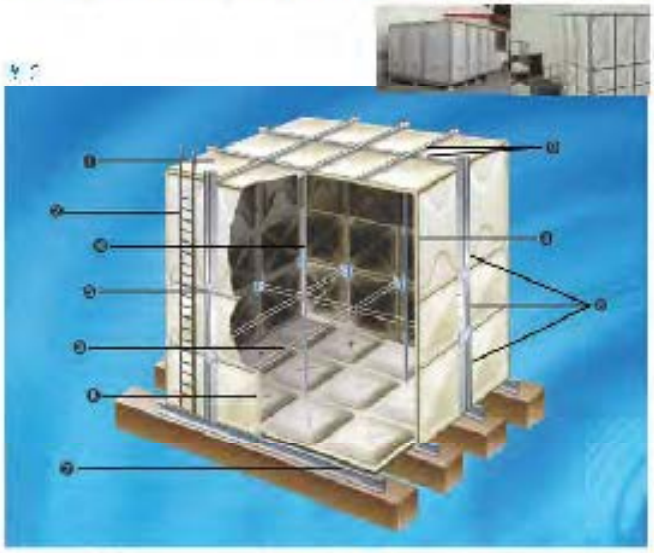
Internally Reinforced System 内部加强系统



No.	Name 名称	Material 材料
1.	Manhole Tank 检修口	SUS
2.	External water 外板	SGH (Galvanized Steel) 镀锌
3.	Internal Reinforced Stay 内部加强支撑	Stainless steel L/A SUS (available to accept size made by stainless steel for small tank 小型水箱可选择不锈钢加工 6
4.	Sealing Tape 密封材料	PVC Foam (Maintain water proof-ness for a long time) PVC泡沫(防漏水)
5.	Cross Support Plate 加固板	SGH (Galvanized Steel, Fixing cross bolt) 镀锌
6.	Bolts and Nuts 螺丝	Type: SUS304 / SUS316, Deco = PVC Cap 类型：SUS304 / SUS316, 装饰 = PVC盖 Outside: Galvanized Steel 外侧：镀锌钢 Connection: Rubber Gasket + Washer 连接：橡胶垫片 + 垫圈 Size: M8, 10, 12 尺寸：M8, 10, 12
7.	Base Frame 底座架	SS41 (Galvanized Steel) 镀锌
8.	Flange Support Bar 法兰支撑	SUS304 PVC 覆盖
9.	Foot Support Plate 脚板支撑板	SS41 (Galvanized Steel) 镀锌
10.	Corner Frame 边框架	SS41 (Galvanized Steel) 镀锌

Optional 可选件
Internal reinforcing stay: grade 304 stainless steel pipe bracing function to form
Illumination external galvanized steel vertical duct.
内部加强支撑：采用不锈钢304钢管支撑结构
外部镀锌钢垂直管道照明

Externally Reinforced System 外部加强系统



No.	Name 名称	Material 材料
1.	Manhole Tank 检修口	SUS
2.	External water 外板	SGH (Galvanized Steel) 镀锌
3.	Internal Reinforced Stay 内部加强支撑	Stainless steel L/A SUS (available to accept size made by stainless steel for small tank 小型水箱可选择不锈钢加工 6
4.	Sealing Tape 密封材料	PVC Foam (Maintain water proof-ness for a long time) PVC泡沫(防漏水)
5.	Cross Support Plate 加固板	SGH (Galvanized Steel, Fixing cross bolt) 镀锌
6.	Bolts and Nuts 螺丝	Type: SUS304 / SUS316, Deco = PVC Cap 类型：SUS304 / SUS316, 装饰 = PVC盖 Outside: Galvanized Steel 外侧：镀锌钢 Connection: Rubber Gasket + Washer 连接：橡胶垫片 + 垫圈 Size: M8, 10, 12 尺寸：M8, 10, 12
7.	Base Frame 底座架	SS41 (Galvanized Steel) 镀锌
8.	External Support Bar 外部加强支撑(选择)	SGH (Galvanized Steel) 镀锌
9.	External Support Plate 外部支撑板(选择)	SS41 (Galvanized Steel) 镀锌
10.	Foot Support Plate 脚板支撑板(选择)	SUS304 PVC 覆盖

Optional 可选件
Internal reinforcing stay: grade 304 stainless steel pipe bracing function to form
Illumination external galvanized steel vertical duct.
内部加强支撑：采用不锈钢304钢管支撑结构
外部镀锌钢垂直管道照明

可根据客户要求可同时使用内外部加强系统

Partition Type Water Tank 分隔式水箱

It is possible to eliminate unusable space, and utilize the maximum space, by installing a partition type tank. Economical and effective for maintenance.
通过隔板将水箱内空间有效分隔，可分区间使用，减少占地空间和维护成本。

- Utilizing Maximum Capacity 容量最大化
- Various Uses 用途多样化
- Easy Maintenance 检修简易化
- Cost Effectiveness 成本最少化

Characteristics 特性

Excellent in Clean & Hygienic
水质保证

Tank material can block the sun light to penetrate the tank and thus bacteria growth is prohibited.
GRP水箱采用食品级树脂机械模压成型, 表面光滑性能稳定, 良好的密封性能防止了细菌在水箱壁的滋生, 因此水质好, 清洁无污染。该水箱已通过英国WRAS水质认证, 为食用型高档水箱；

Intensity, Durability
强韧耐用

GRP Panel is moulded under condition of high temperature and pressure to maintain the best endurance. Best performance by using stainless steel for inside structure and plated steel for outside.
GRP面板采用高温高压模压而成, 强韧耐用。
附加上内置不锈钢及外置热镀锌钢加强结构,
将提供最高防护效能；

Water Tightness
水密性强

The joint sealed with special sealing tape especially developed for water tank
采用水箱专用密封材料,
安全不渗漏；

Heat Insulation & Dewdrops Prevention
保温防露

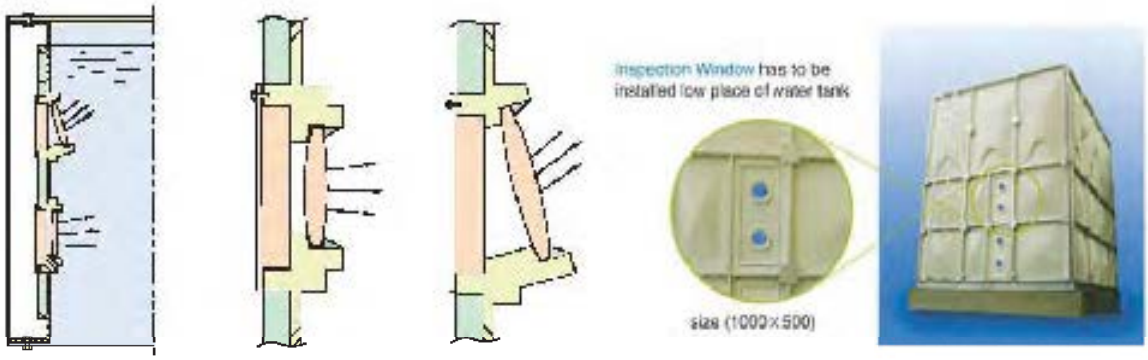
The heat insulation panel with 3 layer structured improves heat insulation effect. Protects water from dewdrops and minimized temperature variation of the stored water.
附加件保温板材, 采用3层结构, 令绝热效果更优秀。
高温不变形, 并可防止水箱外部结露, 同时将水箱内温度变化减到最小。

Design Standards 设计标准

Item 项目	Guaranteed Load Condition 负重保证
Hydrostatic Pressure 静水压力	Water Level (Height in Meters) X 0.1kgf/cm² (0.01MPa) 水量(高)
Horizontal Seismic Load 水平地震荷载	Kh=2/3(Load on SUNG IL GRP Tank itself)
Vertical Seismic Load 垂直地震荷载	Kh=1/3(Load on SUNG IL GRP Tank itself)
Wind Force 风力	[illegible]
Wind Load 风负荷	[illegible]
Snow Load 雪负荷	[illegible]
Component Materials 材料	[illegible]

Water Inspection Window (Available by request)
检修窗(可供选择)

Developed for easy water condition check from outside of Sectional GRP Water Tank by not using ladder.
加装于水箱外部，专为方便检测水状态而设计。



Best Watertight - Sealing Tape / Bottom Drain System
加强水密性-密封材料 / 底部排水系统

- Especially developed sealing tape maintains perfect non-leakage of the water tank.
  特别设计专用密封材料，达到最佳防漏性能。
- The dome shaped bottom panel with a concave drain panel facilitates complete and quick drainage.
  圆拱形底板及凹陷的排水板可加速排干。

1: Collecting Basin 收集盆
2: Drainage 排水
3: Drain pipe 排水管

Sealing tape 密封带

Sealing tape maintains optimized and adhesives even at low temperatures
密封带在低温条件下保持最佳粘合性

Photo of test report
PSE测试报告照片

System design (FEM) FEM 系统设计

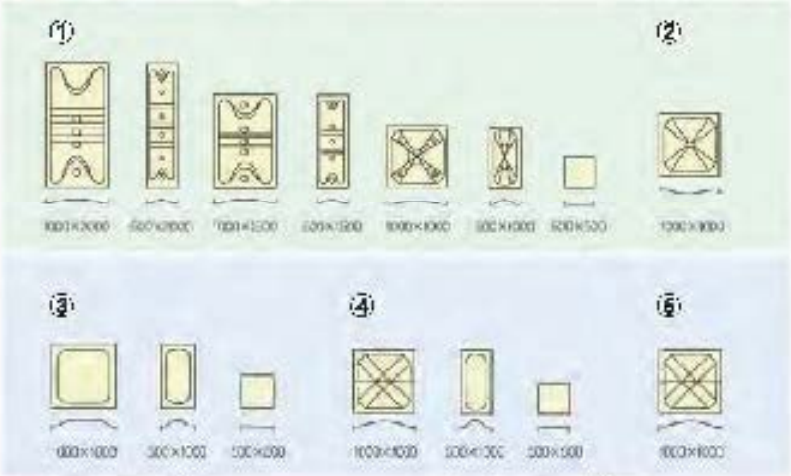
Safe and robust panel construction is designed considering the stress concentration on the panel when load is applied by FEM. And we always satisfy all safety requirements such as strength, durability and stability with rigid design regulation and quality control.

水箱面板结构根据有限单元法(FEM)在单位面积上集中施以压力而设计，安全坚固。严格的设计规范和质量控制使我们的水箱达到最佳抗压性、耐久性和稳定性，并符合安全要求。

Efficent Space Using with Various Panels 标准化面板设计

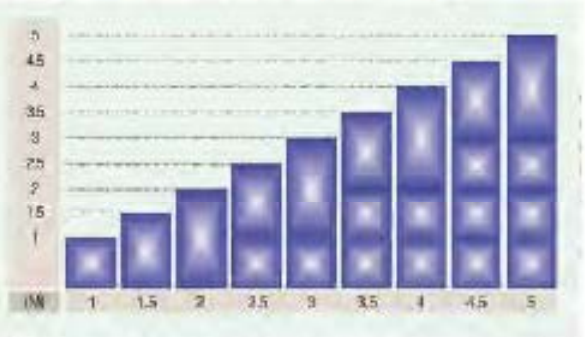
SUNG IL Sectional GRP Water Tank use limited space efficiently with several type and size panels.
Sectional GRP Water Tank can be easily installed even in a confined space because the standardized panels and accessories are merely bolted together.
SUNG IL 组合式GRP水箱由多种型号的标准化面板有效拼装而成，因此可以按照用户需求被方便地安装于各种有限空间之中。

GRP Panel Type and Size
GRP面板型号和尺寸



1. Wall Panel 侧板
2. Drain Panel 排水板
3. Bottom Panel 底板
4. Roof Panel 顶板
5. Manhole Panel 检修板

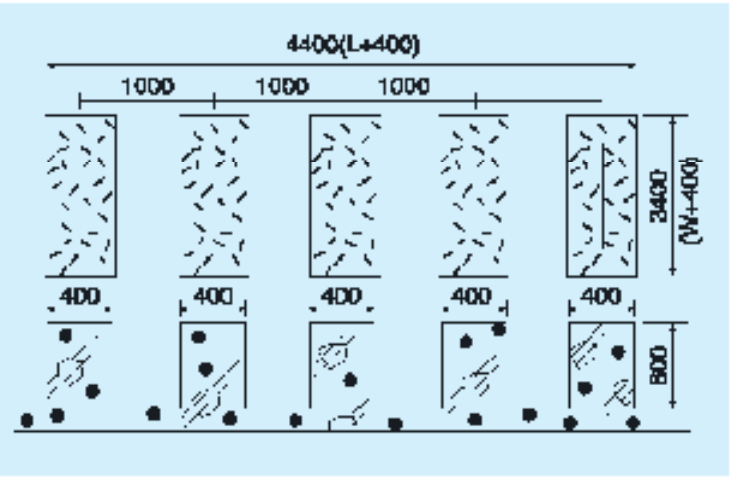
GRP Panel Composition by Height
GRP面板种类（按高度排列）



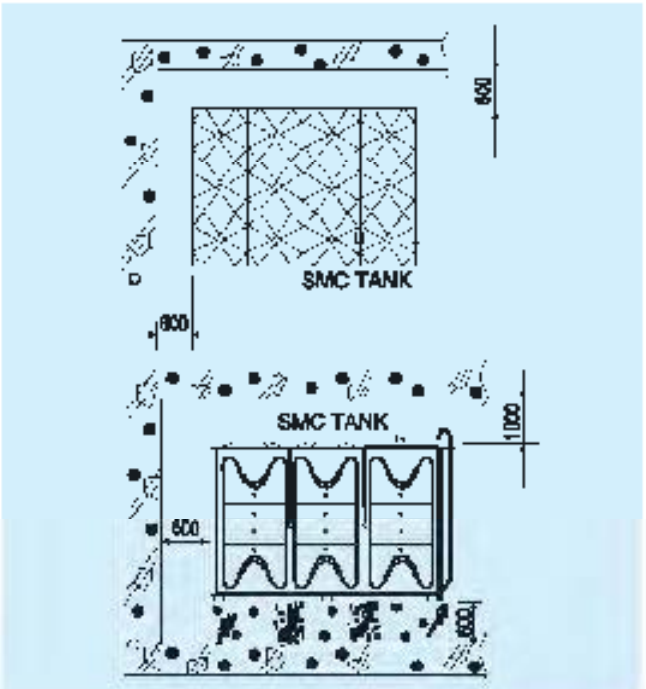
SUNG IL Sectional GRP Water Tank use limited space efficiently with several type and size panels.
Sectional GRP Water Tank can be easily installed even in a confined space.
标准化的面板设计和组合，可满足用户根据空间订制各种尺寸水箱需求。

Standard of Base Concrete PAD Installation and Space 水泥基础要求

For maintenance of GRP tank, it needs extra space at least 600mm from wall and 1, 000mm from ceiling.
需要预留安装维护空间，侧面距离墙壁至少600mm，顶部距离墙壁至少1000mm。



Width 宽	over 4[illegible]mm [illegible]mm 以上
Height 高	Over [illegible]mm (Based on Panel Assembly) [illegible]mm 以上(按拼装高度计)
Space 空间	[illegible] mm Min. (W) 最少 [illegible]m
Outer Dimension 外箱尺寸	W: [illegible]mm 长度分别加[illegible]mm
Horizontal Degree 水平倾斜度	[illegible] mm/m (1/[illegible]) 少于 [illegible]



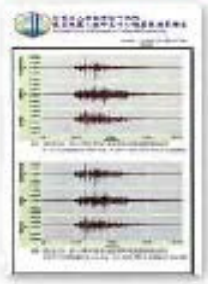
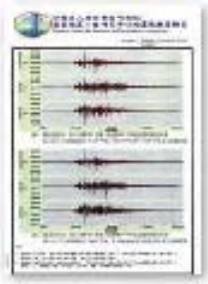
Patent & Certificates 专利及证书







EARTHQUAKE TESTING REPORT 地震测试报告

Job Reference Photo 工程项目



Sole Distributor

MESAN COOLING TOWER LTD.

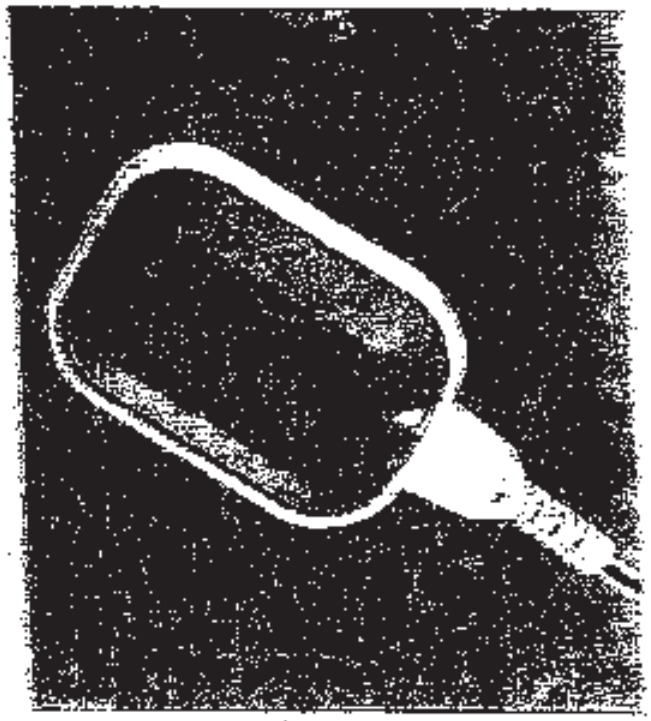
http://www.mesanct.com
E-mail : sales@mesanct.com

Technical Literature

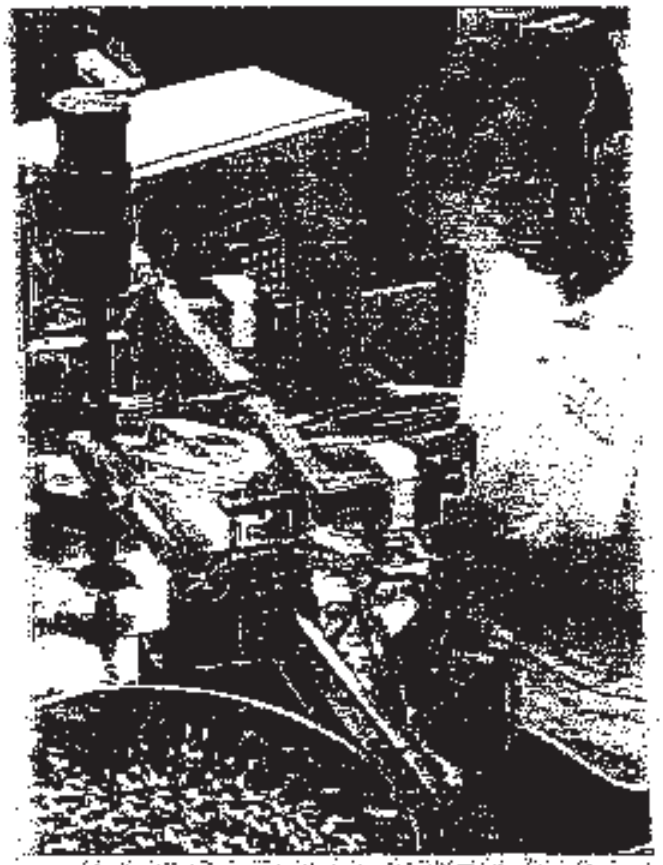
36) Fiberglass Water Tank

Key

Regolatore di livello ad azionamento elettromeccanico
Electromechanical level regulator



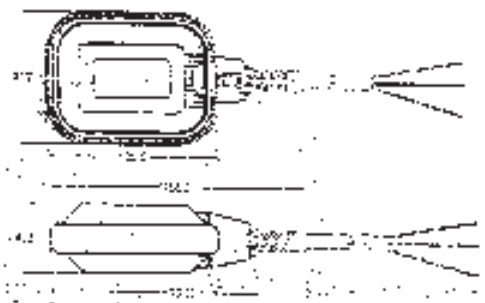
Il regolatore di livello KEY è un interruttore a galleggiante che permette l'automazione di apparecchiature elettriche normalmente pompe, mediante l'azionamento di una valvola motorizzata ecc... al raggiungimento di un livello prefissato.
Può anche azionare altre grandezze di sistemi di impianti multipli su particolare. Il interruttore a galleggiante può anche essere di impiego per l'azionamento di pompe, avviatori, contattori ecc... in tutte le più svariate industrie.
I cavi con cavi 3X1 doppio e/o cavi 4G1 possono essere usati per funzionamento e per spegnimento a seconda del tipo di connessione. I cavi con cavi 3G1 normali non hanno la cavo 2 sono progettati per una sola funzione di funzionamento e spegnimento.



The KEY level regulator is a float switch which allows electrical equipment to start and stop automatically, such as pumps, motorized valves, alarms, etc., when a preset level has been reached. ... regulator is suitable for multiple applications, on the furnace.
It is the most commonly used float switch in the sump for the automation of pumps and is used directly by pump producers. The models with cable 3X1 or cable 4G1 can be used for both pump or emptying functions according to the cable connection used connection.
The models with 3G1 cable have ground and can be used for one function only and that is for pump or emptying.

Caratteristiche			
Caratteristiche elettriche	208/[illegible] - 380/[illegible] - 460/[illegible]		
Omologazioni	EAC 208/[illegible] - 380/[illegible] - 460/[illegible]	CSA 230/[illegible] - [illegible] 460/[illegible] - [illegible]	CSA 230/[illegible] - [illegible] 460/[illegible] - [illegible]
Temp. di funzionamento	[illegible]		
Temp. di immagazzinamento	[illegible]		
Grado di protezione	IP55		
Angolo di montaggio	[illegible]		
Dimensioni	[illegible]		
Peso	[illegible]		
Altezza	[illegible]		
Pressione di progetto	[illegible]		
Connessioni	[illegible]	[illegible]	[illegible]
Materiali	[illegible]		
Classe di isolamento	[illegible]		
Cavi standard	[illegible] [illegible] [illegible] [illegible] [illegible]	[illegible]	[illegible]
Note	[illegible]		

Caratteristiche			
Alimentazione elettrica	208/[illegible] - 380/[illegible] - 460/[illegible]		
Approvazioni	EAC 208/[illegible] - 380/[illegible] - 460/[illegible]	CSA [illegible] - [illegible] [illegible] - [illegible]	CSA [illegible] - [illegible] [illegible] - [illegible]
Temperatura ambiente	[illegible]		
Temperatura di stoccaggio	[illegible]		
Grado IP	IP55		
Peso	[illegible]		
Dimensioni	[illegible]		
Cavo	[illegible]		
Altezza	[illegible]		
Pressione di progetto	[illegible]		
Materiali	[illegible]	[illegible]	[illegible]
Scarico	[illegible]	[illegible]	[illegible]
Classe di isolamento	[illegible]		
Cavi standard	[illegible] [illegible] [illegible] [illegible] [illegible]	[illegible]	[illegible]
Note	[illegible]		

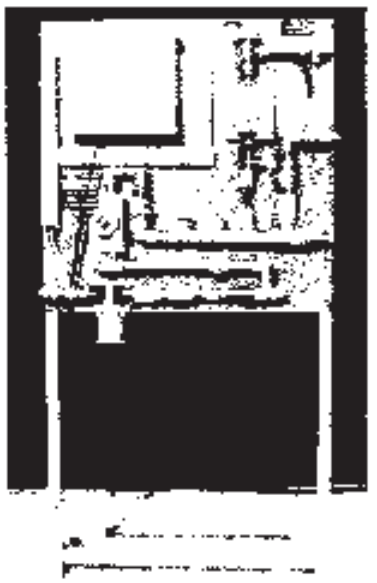


Technical Literature

37) Water Level Switch

3D TRASAR® Systems

Delivering Sustainable Development



3D TRASAR unit

Nalco introduces 3D TRASAR technology for cooling water systems to help sustainable improvement of your operations, improved finished product performance and optimized operating efficiency.

Nalco was the winner of the 2002 Presidential Green Chemistry Challenge Award for its 3D TRASAR technology for cooling water. 3D TRASAR program management and water treatment monitoring and troubleshooting automated control leading-edge technologies put Nalco continuously on the cutting edge to deliver sustainable cost benefits.

The 3D TRASAR system is a water program monitoring and control system available in two configurations:

- 3D TRASAR Full
- 3D TRASAR Starter

3D TRASAR technology continuously monitors key system variables and detects upsets, takes appropriate corrective action and communicates with system users. 3D TRASAR programs are based on fundamental principles of control (PID) and prevent operating problems.

3D TRASAR starter makes the cost 3D TRASAR technology more accessible. Customizable to meet specific user needs, 3D TRASAR Starter delivers TRASAR technology conveniently and cost effectively and is an easy to install, easy to operate 3D TRASAR system that can be easily upgraded to full 3D TRASAR system by adding modules as required.

3D TRASAR Scale Control

Scale deposition from cooling water systems can reduce your cooling water system efficiency, increase maintenance costs and cause unscheduled downtime. Nalco's 3D TRASAR Scale Control program helps prevent scale deposition.

Table [illegible]

	3D TRASAR Starter	3D TRASAR Full
[illegible]	X	X
[illegible]	X	X
[illegible]	X	X
[illegible]	X	X
[illegible]		X
[illegible]		X
[illegible]	X	X
[illegible]		X
[illegible]		X
[illegible]		X

[illegible] 3-601

3DTRASAR Corrosion Monitoring continuously monitors corrosion and deposition, with help from your Nalco Water Engineer to flag abnormal corrosion conditions.

3DTRASAR Bio-Control applies the combination of microbiocide pre-actives in water treating systems. 3DTRASAR Bio-Control reports out and controls biofilm control to achieve pre-activity established in relation to 3DTRASAR technology.

Treatment Control Variables

Cycles of Concentration

- 3DTRASAR Full On/Off based on conductivity set-point or 3DTRASAR Scale Control
- 3DTRASAR Basic On/Off based on conductivity set-point
- Range: 20% – 10,000 microsiemens
- Non-fouling, corrosion resistant conductivity probe

Chemical Feed – Inhibitor

- 3DTRASAR Full On/Off based on TRASAR Tagged Polymer, 3DTRASAR Scale Control with manual, timer or valve passive
- 3DTRASAR Basic On/Off based on TRASAR with manual, timer or valve passive

Chemical Feed – Oxidizing Biocide

- 3DTRASAR Full On/Off based on ORP or 3DTRASAR Bio-Control with manual, timer or valve-based feed control. Includes pre-biocide and lockout capability
- 3DTRASAR Basic: Manual timer or stage-based control, includes pre-biocide and lockout capability

Chemical Feed – Non-oxidizing Biocide

Timer or manual stage feed with pre-biocide and lockout capable

pH (3DTRASAR Full Only)

Acid or caustic on/off based on flat surface, durable, amine-based pH probe, measuring range 0–14 pH

ORP (3DTRASAR Full Only)

On/off control based on flat surface, durable, amine-based ORP probe, measuring range -1000 mV to +1000 mV

Multipurpose timers

Timer-based feed on any available relay, may be time-based or proactive

Monitoring Functions

Corrosion Monitoring (3DTRASAR Full Only)

Corrosion, on-line monitoring of carbon steel corrosion rate. Other metallurgies available. Range: 0 to 99 mpy

Additional Monitored Variables

- Cycles of Concentration
- Turbidity
- Temperature
- Background fluorescence
- Relay status
- Pulse counter with water meter

Additional Calculated Variables

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- Makeup Water Rate
- Recirculation Rate
- [illegible]
- [illegible]

[illegible]

Plumbing Requirements

Control Panel [illegible] NPT inlet
[illegible] NPT & [illegible]
NPT. Total flow required 5 gpm
Outlet plug must be removed

Pellet Feeder [illegible] NPT inlet
[illegible] NPT outlet, 5 gpm minimum
[illegible] psig Permanent connection required

Electrical

85 to 250 VAC @ 20 amps service

Sample requirements minimum
Conductivity of 10 uS/cm required for
Corrosion measurement

Inputs

- [illegible] 4-20 mA transmitters
[illegible] pressure, temperature, pH, ORP,
[illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- Modbus RS-232 or RS-485
[illegible] RTU, SCADA port

Outputs

- [illegible] control relay outputs rated
2.5 amps each (larger loads require
external motor starters)
- [illegible] 4-20 mA powered non-isolated
outputs

Side View

Alarms

- [illegible] Alarm output for external
[illegible] (optional)
- [illegible] notification via SMTP to
customer's LAN based mail server

Enclosure

Type 4X

Ambient temperature

40-120°F (4-50° C)

Process water temperature

40-120°F (4-50° C)

Relative Humidity

0-95% non-condensing

Maximum water pressure

[illegible] psi

Display/Keypad

[illegible] keypad to control by [illegible]
[illegible] display with [illegible] functions

Security

Password protection [illegible] assignable)

Data management

[illegible] data logging to spreadsheet
format

Communications

- [illegible] for direct PC
connection
- Built-in modem for alarm
remote connection or access
to 3D TRASAR Web via Internet
(required ISP)
- Optional wireless gateway for
normally remote locations

Approvals

UL, C-UL, CE

Software

- 3D TRASAR Configuration
[illegible] parameter and data
[illegible]
- Optional Vantage [illegible] software
for computer data management
and [illegible]

Technical

If you have any questions, please
contact your local Nalco Water Engineer
or Nalco Water Customer Service
Equipment Solutions Technical
Support Group at [illegible]

[illegible] Products and Accessories

Part Number	Description
	3D TRASAR (NA)
[illegible]	[illegible]
0[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
	3D TRASAR Starter (NA)
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
	3D TRASAR Bio-Reporter Feed Options
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
	Probes
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
	Spares
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
	Reagents and Calibration Supplies
[illegible]	[illegible]

Start-up (kit includes: [illegible]

	Maintenance Value Package
[illegible]	[illegible]

Maintenance Value Package (includes [illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
	Cables
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
	Optional Accessories
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

NALCO COMPANY OPERATIONS

[illegible]

3D TRASAR Technology for Cooling Water Series Bulletin

Nalco's innovative 3D TRASAR Technology for Cooling Water contributes to the sustainable development of operations, improves the bottom-line performance, and optimizes operational efficiency. It is also a 2008 winner of the Presidential Green Chemistry Challenge Award.

3D TRASAR programs integrate the world's most advanced monitoring, automated control, knowledge systems and field service expertise to deliver sustainable development. 3D TRASAR technology continuously monitors key system parameters, detects upsets, takes appropriate corrective action and communicates with system users. 3D TRASAR programs minimize total cost of operation (TCO) and prevent operational problems.

3D TRASAR Scale Control intelligently optimizes the cooling potential of cooling water systems by maximizing cycles of concentration and its control strategy prevents system degradation. This saves both water and chemicals.

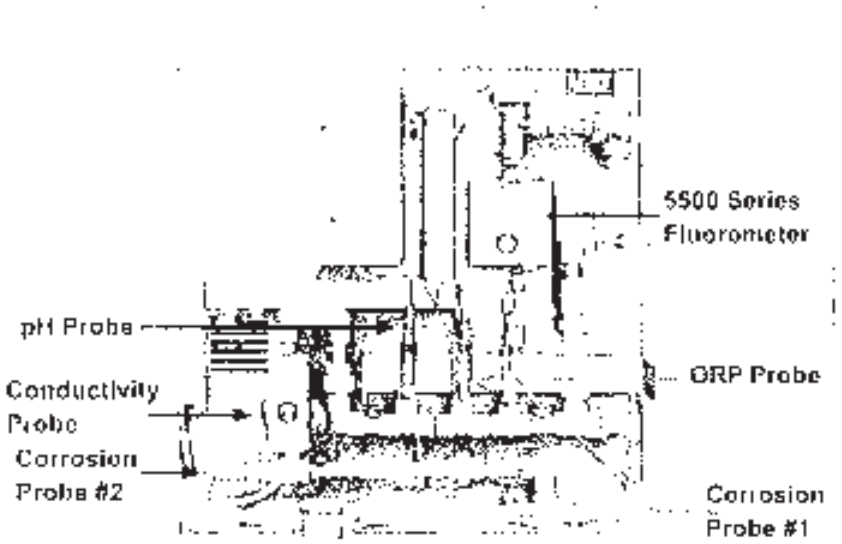
3D TRASAR Corrosion Control continuously monitors corrosion trends, alerts customers and Nalco Sales Engineers, reacts quickly to correct corrosive conditions.

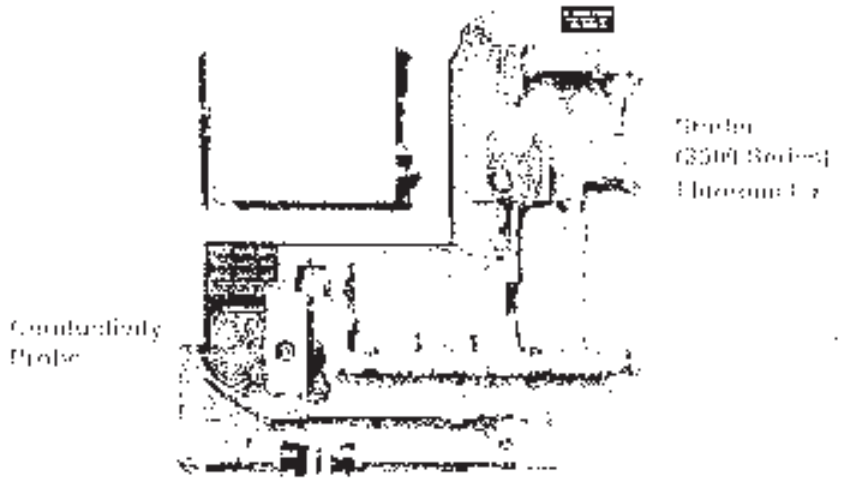
3D TRASAR Bio-Control applies biocides based on the measured activity in the cooling system. 3D TRASAR bio-control measures and controls both sessile and planktonic activity, a capability unique to 3D TRASAR technology.

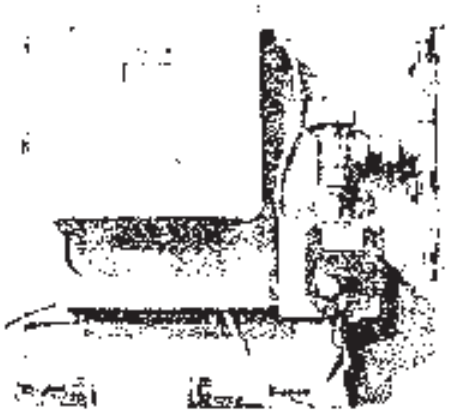
The 3D TRASAR system is an example of water treatment control and monitoring system available in 3 configurations:

- 3D TRASAR (3500 Series)
- 3D TRASAR Plus (3510 Series)
- 3D TRASAR [illegible] (2500 Series) [illegible]

CS


5500 Series
Fluorometer
pH Probe
ORP Probe
Conductivity
Probe
Corrosion
Probe #2
Corrosion
Probe #1


Conductivity
Probe



Technical Literature

38) Bleed-off Controller

Technical Literature

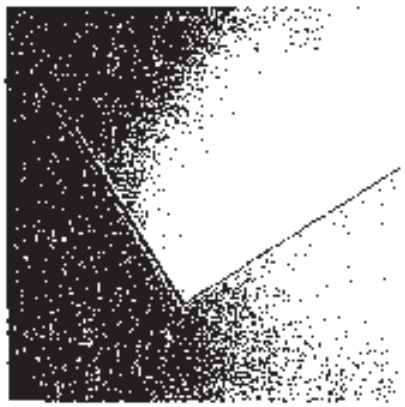
39) Galvanised Steel Ductwork

NCOM STAR
ZINC-COATED
STEEL

Galvanized Steel
Galvannealed Steel

NISSHIN STEEL

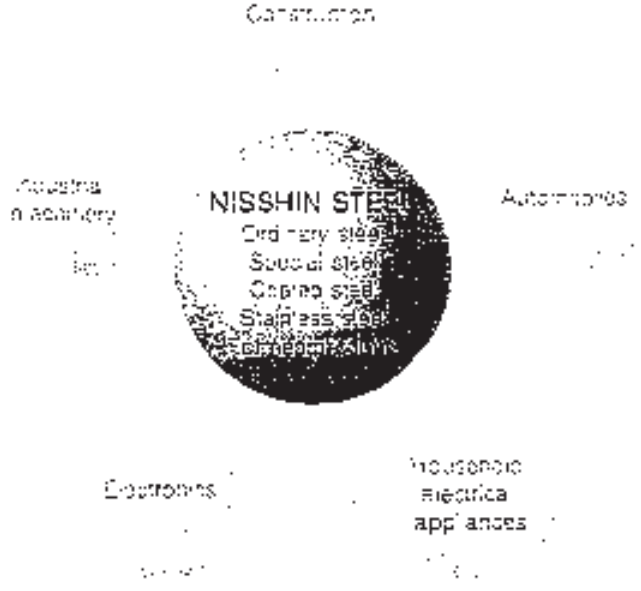
Contents



Nisshin Steel is an integrated steel manufacturer in Japan specializing in steel sheet. The company has a long history having begun as two companies in the zinc coating business in the early 1900s. With its origins in the zinc coating business, the company has gained a high reputation worldwide for quality and the most advanced manufacturing technology.

Today, Nisshin Steel offers a broad range of innovative steel products, including coated steel such as galvanized, galvannealed, aluminized and copper plated steel sheet and strip; stainless steel sheet and strip; ordinary steel; and special steel. The principal users of our products encompass a wide range of industries, including construction, household electrical appliances, automobiles, electronics and industrial machinery.

PRODUCT CATEGORIES

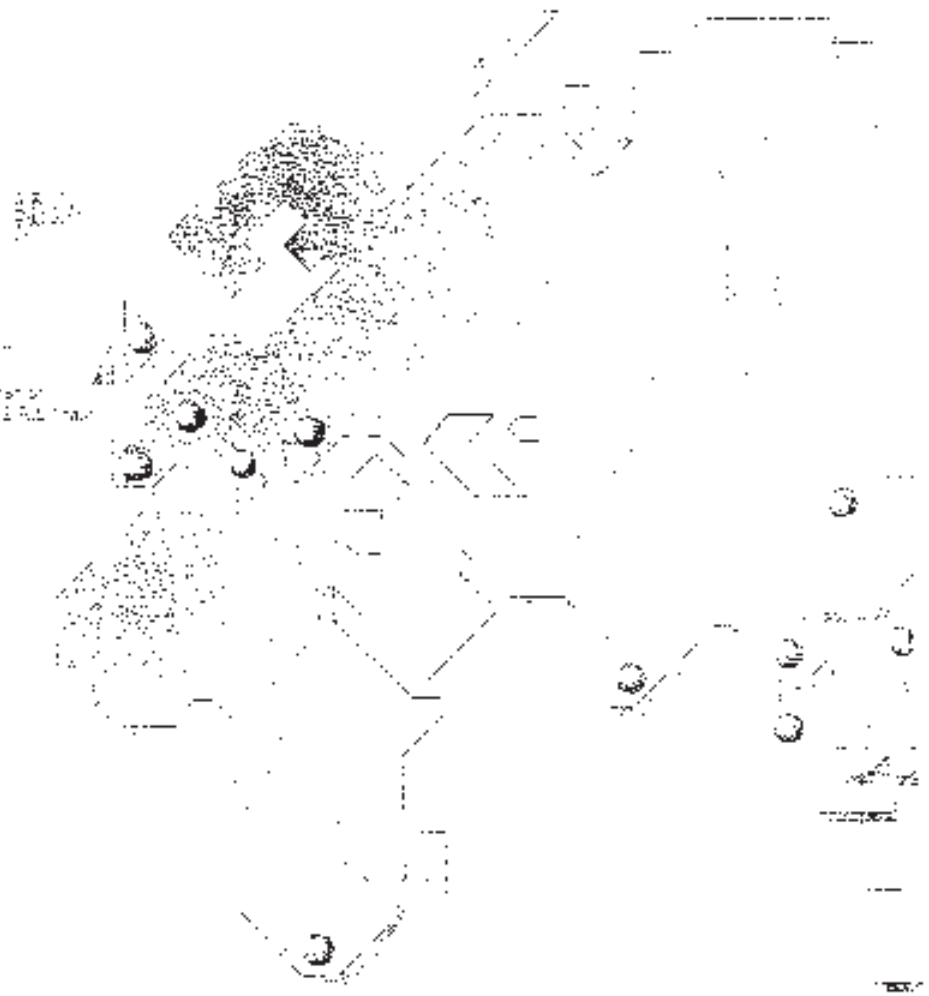


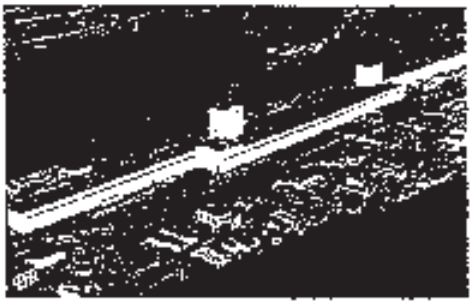
Overseas Business Operations

Nisshin Steel is moving forward with overseas operations through the establishment of joint venture companies and capital participation abroad, as well as foreign technical cooperation in providing technical know-how, mainly for coated steel and stainless steel.

In the field of coated steel in particular, the joint venture company Wheeling-Nisshin Inc. was established in partnership with Wheeling-Pittsburgh Steel Corporation in the United States in June 1984 to manufacture galvanized and aluminized steel sheet. Its first production line went into operation in 1985 and operations are proceeding smoothly. To meet the growing demand for coated steel sheet in the American market, in 1991 the company began construction of a second production line which came on line in 1993. At present, the company maintains a combined annual production of 50,000 tons.

Using Nisshin Steel's stainless steel sheet, SOLFRICX has been fabricated into solar cell modules for use in many countries around the world.

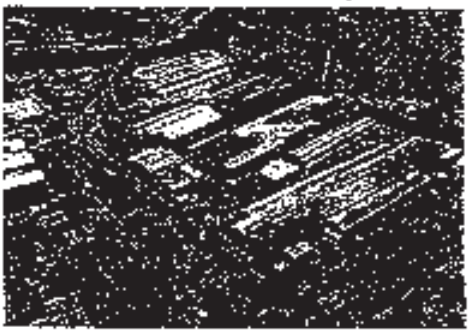




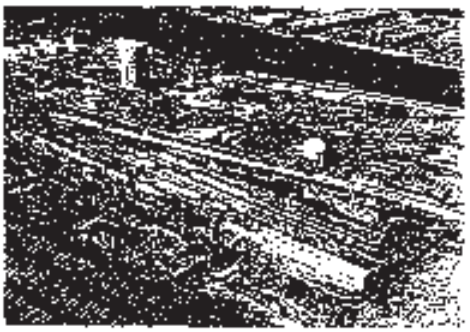
The Plants behind Our Products

KURE WORKS

AMAGASAKI WORKS

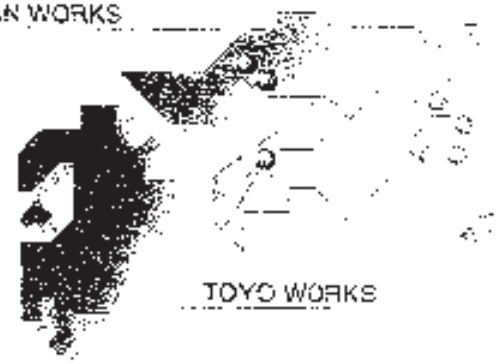


OSAKA WORKS



KURE WORKS

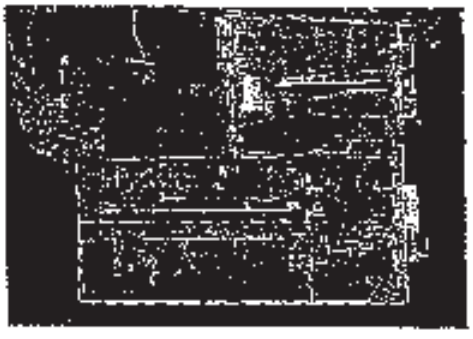
SHUNAN WORKS



TOYO WORKS

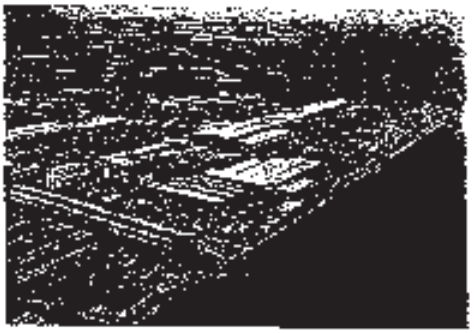
SHUNAN WORKS

TOYO WORKS



MOON STAR
ZINC-COATED
STEEL

ICHIKAWA WORKS



Continuous galvanizing line

AMAGASAKI WORKS

HEAD OFFICE (TOKYO)

ICHIKAWA WORKS

OSAKA WORKS

SAKAI WORKS

SAKAI WORKS

Zinc coating line

Continuous galvanizing and aluminizing line

Tandem cold rolling mill

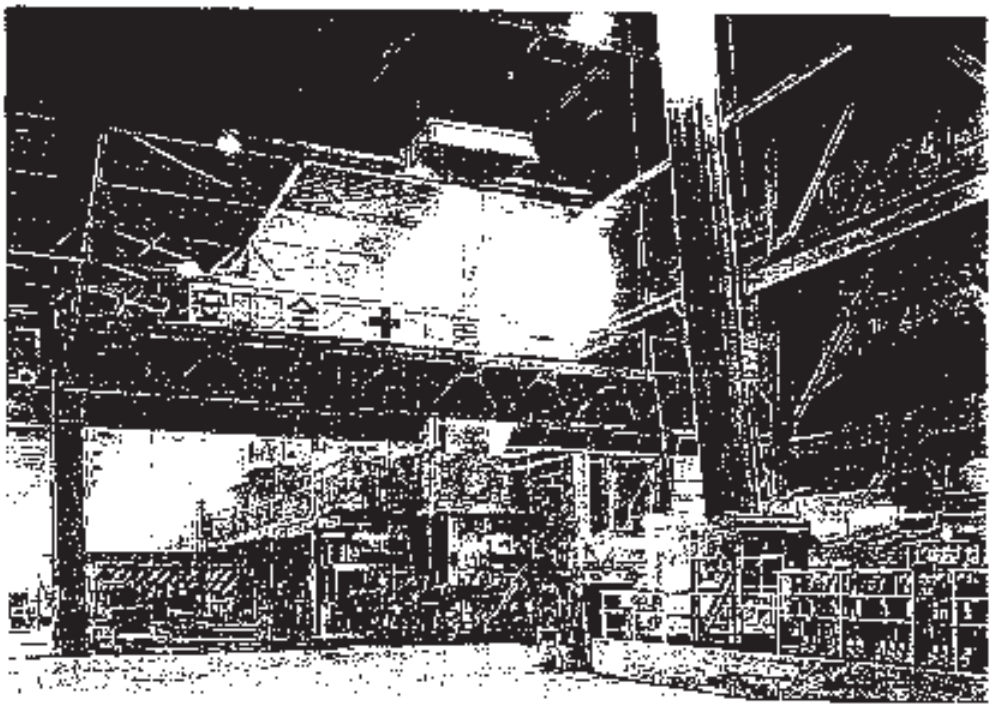
Zinc-Coated Products at a Glance

Zinc-Coated Products Manufactured through Nissin Steel's Unique Gas Wiping Process

The superiority of Nissin Steel in galvanizing extends back a century. We are one of the pioneers in coating steel products.

Over the years, our objective has been to develop innovative products and technologies. In the coated steel segment, the opportunities have been highly diverse as demand has grown and applications broadened. The result has been an increasing variety of Nissin products.

To manufacture these products we have developed innovative processing technologies. The gas wiping technique, which we developed, has achieved superior coating uniformity for zinc-coated sheet. Additional advancements have enhanced other properties such as corrosion resistance, paint adhesion, and formability.



GALVANIZED STEEL SHEET

Cross-sectional structure of galvanized steel sheet

Zinc coating

Steel sheet

Uniform coating thickness

Nisshin Steel's unique galvanizing process ensures the formation of a uniform zinc coating over the steel surface. Many problems of the conventional process have been completely overcome, greatly improving the quality of the finished product.

High corrosion resistance

Zinc coating prevents corrosion by coating on the steel surface from corrosive environments. If the coating is accidentally scratched, the surrounding zinc layer acts as a sacrificial anode and helps to prevent rust. This is called "sacrificial protection."

Superior workability

Nisshin Steel's galvanized steel sheets have a minimum hexavalent chromium layer. This ensures that the coating will not peel under normal forming practices.

Uniform Appearance

Uniform and Spangles

Excellent appearance

This sheet has a beautiful, smooth surface due to the complete suppression of spangle by a special treatment right after galvanizing. It can be used as it is or can be painted without any pretreatment.

GALVANNEALED STEEL SHEET

Various coating thicknesses available

Galvannealed sheet is formed by subjecting the galvanized steel sheet to a heat treatment. Several different coating thicknesses are available to suit many applications.

High corrosion resistance

Galvannealed sheet is made by our unique galvanizing process. After forming a uniform zinc coating, the galvanized steel sheet is heated in the galvannealing furnace. The zinc coating and the steel substrate react with each other to form a zinc-iron alloy coating.

Strong paint adhesion

This sheet's coarse surface reduces paint adhesion far better than other coated steel sheets.

Economical

There is no need for chromate treatment when applying paint. This means cost savings in labor, materials, and time.

A broad range of applications

Galvannealed sheet is ideal for a broad range of applications from construction materials to electrical appliances.

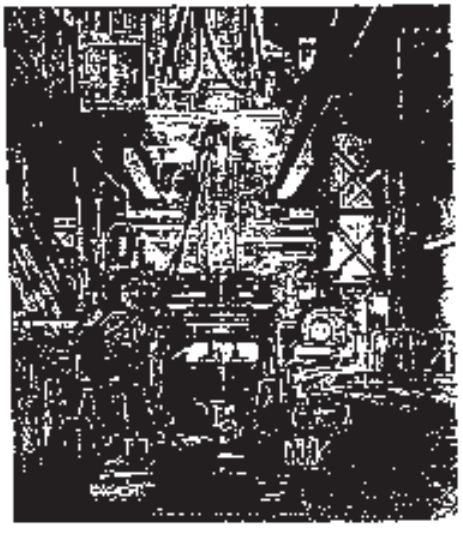
Cross-sectional structure of galvannealed steel sheet

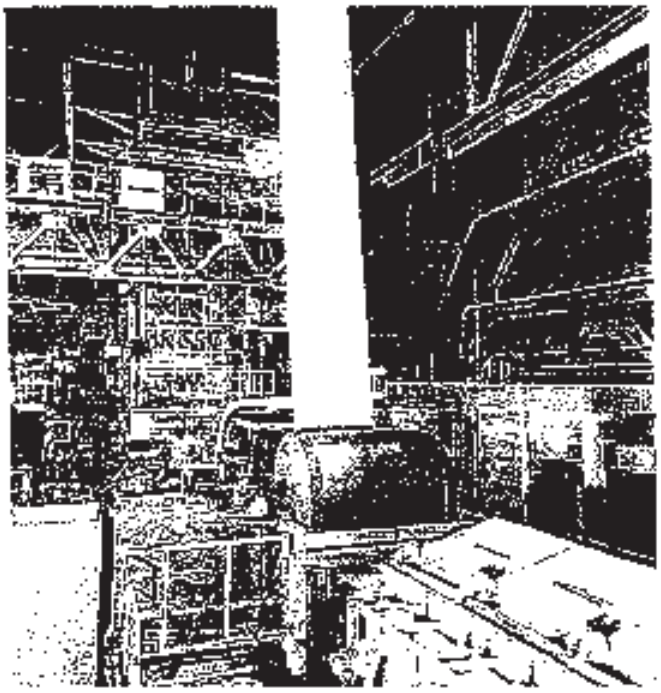
Zinc-Iron alloy coating

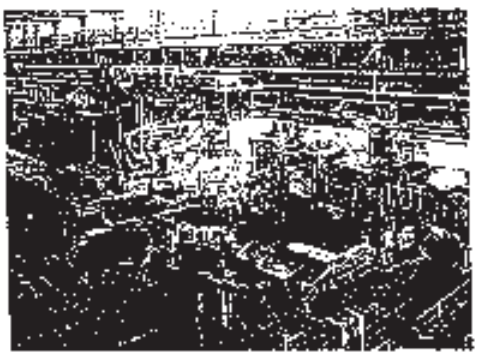
Steel sheet

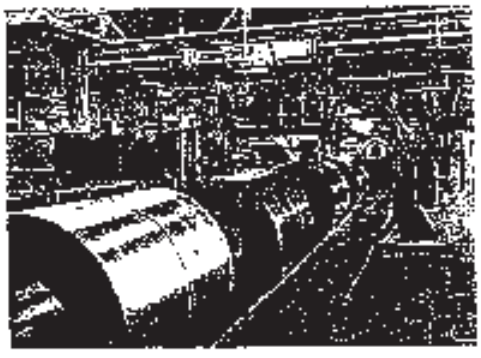
Manufacturing Processes

Continuous Galvanizing Line

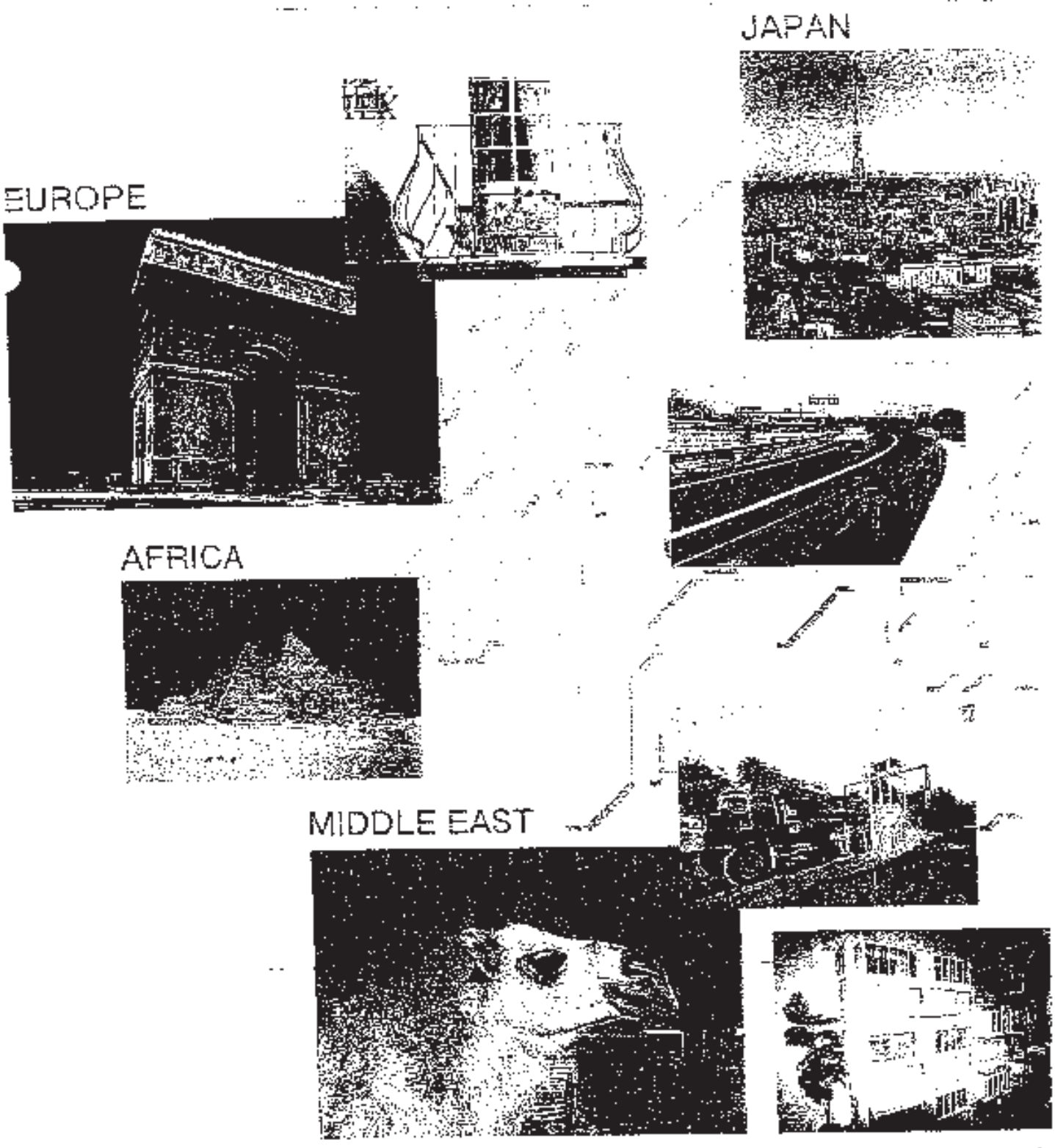








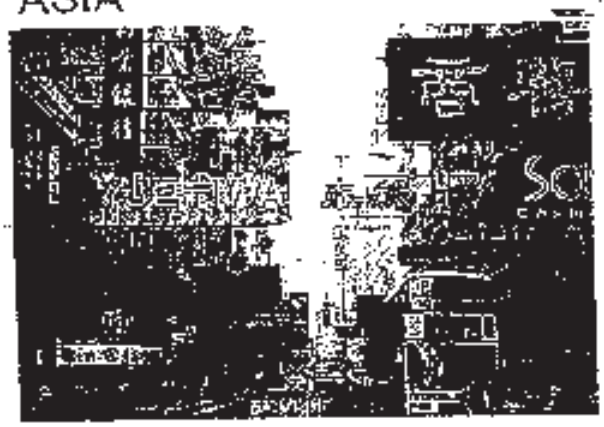
Examples of Application

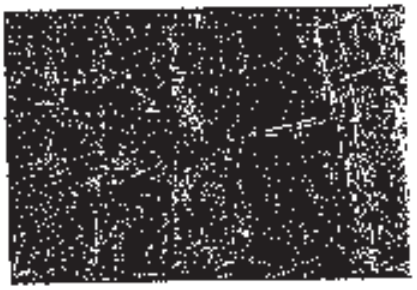


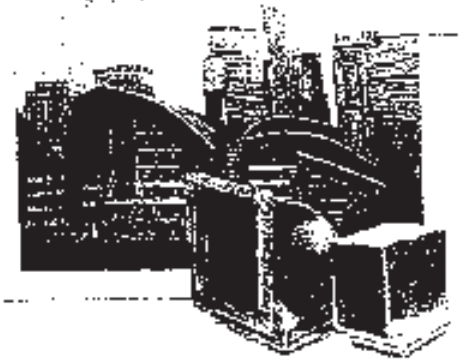
MOON STAR ZINC-COATED STEEL

AMERICA

ASIA







JIS (JAPANESE INDUSTRIAL STANDARDS) Tolerances

G 3302 (1994) HOT-DIP ZINC-COATED STEEL SHEETS AND COILS

1. SIZE TOLERANCES

The nominal thickness is the thickness of the base metal.

1) Thickness Tolerances

The tolerance applies to the minimum value obtained by adding the coating thickness given in the table below to the nominal thickness. The thickness is measured at any point not less than 25 mm inward from the edge.

Unit: mm

Nominal Thickness	Width	Thickness Tolerance for Specified Width		
		≤ 600	> 600 and ≤ 1 000	> 1 000
≥ 0.25 and < 0.40	≤ 1 250	± 0.07	± 0.08	± 0.10
	> 1 250 and ≤ 1 600	± 0.08	± 0.09	± 0.11
≥ 0.40 and < 0.60	≤ 1 250	± 0.08	± 0.09	± 0.11
	> 1 250 and ≤ 1 600	± 0.09	± 0.10	± 0.12
≥ 0.60 and < 0.80	≤ 1 250	± 0.09	± 0.10	± 0.12
	> 1 250 and ≤ 1 600	± 0.10	± 0.11	± 0.13
≥ 0.80 and < 1.00	≤ 1 250	± 0.10	± 0.11	± 0.13
	> 1 250 and ≤ 1 600	± 0.11	± 0.12	± 0.14
≥ 1.00 and < 1.25	≤ 1 250	± 0.11	± 0.12	± 0.14
	> 1 250 and ≤ 1 600	± 0.12	± 0.13	± 0.15
≥ 1.25 and < 1.60	≤ 1 250	± 0.12	± 0.13	± 0.15
	> 1 250 and ≤ 1 600	± 0.13	± 0.14	± 0.16
≥ 1.60 and < 2.00	≤ 1 250	± 0.13	± 0.14	± 0.16
	> 1 250 and ≤ 1 600	± 0.14	± 0.15	± 0.17
≥ 2.00 and ≤ 2.30	≤ 1 250	± 0.14	± 0.15	± 0.17
	> 1 250 and ≤ 1 600	± 0.15	± 0.16	± 0.18

Unit: mm

Nominal Thickness	Thickness Tolerance for Specified Width	
	≤ 1 250	> 1 250
≥ 2.30 and < 2.50	± 0.16	± 0.18
≥ 2.50 and < 3.15	± 0.18	± 0.20
≥ 3.15 and < 4.00	± 0.20	± 0.22
≥ 4.00 and < 5.00	± 0.22	± 0.24
≥ 5.00 and < 6.00	± 0.24	± 0.26
≥ 6.00	± 0.26	± 0.28

Equivalent Coating Thickness

Coating Type (g/m² both sides)	200	220	250	275	300	350	400	450	500	550	600
Equivalent Coating Thickness (μm)	14	16	18	20	21	25	28	32	35	39	42
Coating Type (g/m² one side)	75	90	105	120	130	150	170	190	210	230	250
Equivalent Coating Thickness (μm)	11	13	15	17	18	21	24	27	30	33	36

2) Width Tolerances

Unit: mm

Nominal Width	Width Tolerance for Coil	Width Tolerance for Cut Sheet
≥ 600 and < 1 000	+ 25, 0	+ 5, 0
≥ 1 000 and < 1 250	+ 30, 0	+ 5, 0
≥ 1 250 and ≤ 1 600	+ 40, 0	+ 5, 0

3) Length Tolerances

Unit: mm

Nominal Length	Length Tolerance for Cut Sheet
≥ 1 000 and < 2 000	+ 10, 0
≥ 2 000 and < 4 000	+ 20, 0
≥ 4 000	+ 40, 0

2. SHAPE TOLERANCES

1) Camber Tolerances

Unit: mm

Width	Camber Tolerance for Cut Sheet			Camber Tolerance for Coil
	Length of Cut Sheet			
	≥ 1 000 and < 2 000	≥ 2 000 and < 4 000	≥ 4 000	
≥ 600 and < 1 000	4	8	12	20
≥ 1 000 and < 1 250	4	8	12	25
≥ 1 250 and ≤ 1 600	5	10	15	30

Unit: mm

Width	Camber Tolerance for Coil			
	Length of Coil			
	≥ 1 000 and < 2 000	≥ 2 000 and < 4 000	≥ 4 000 and < 6 000	≥ 6 000
≥ 600 and < 1 000	4	8	12	20
≥ 1 000 and < 1 250	5	10	15	25
≥ 1 250 and ≤ 1 600	6	12	18	30

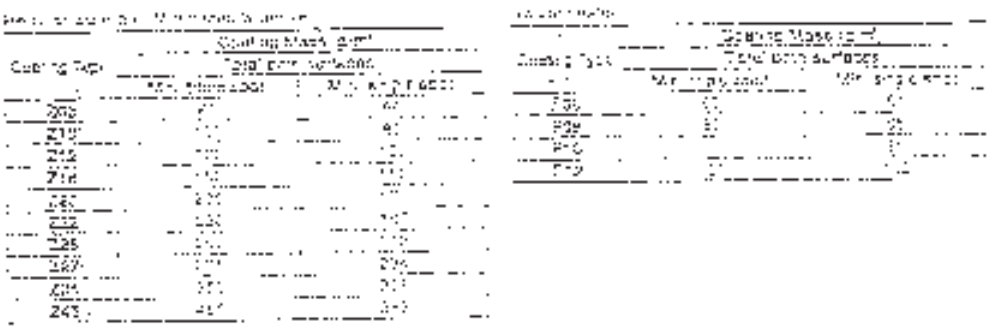
2) Out-of-Square

The out-of-square tolerances for flat sheets shall be expressed by A/W × 100 (%) in the right figure.

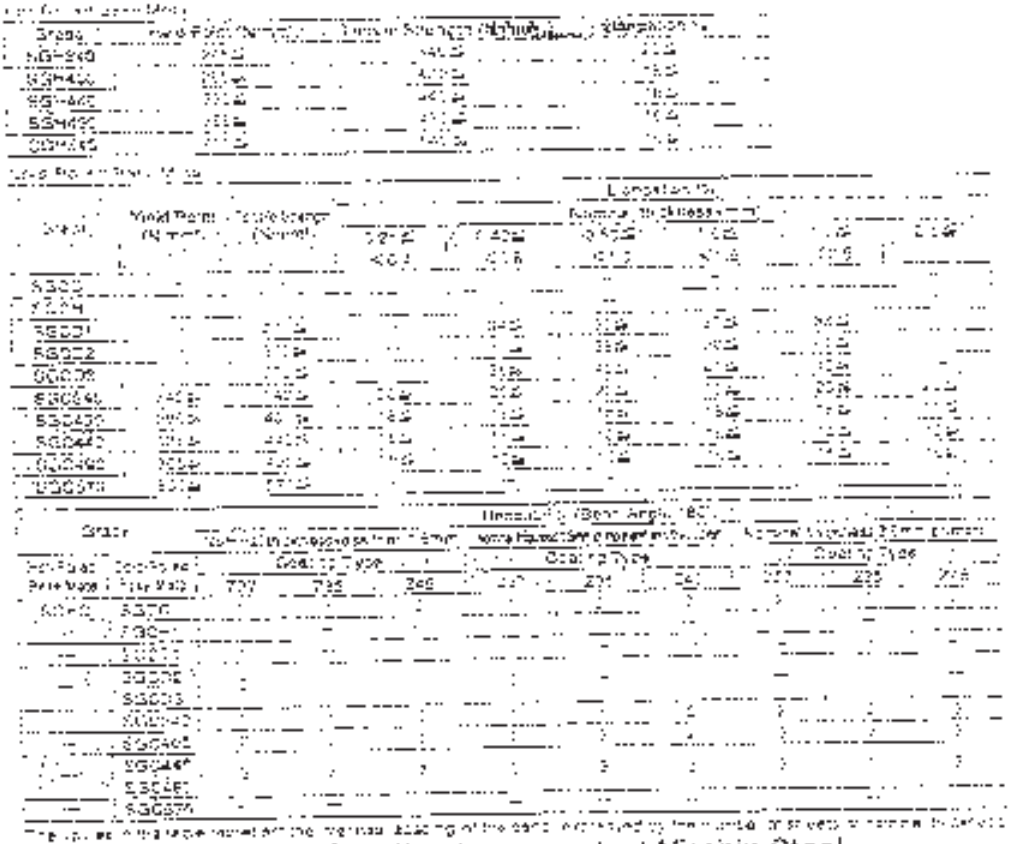
MOON STAR ZINC-COATED STEEL

3. Fasteners

3. COATING TOLERANCES



4. MECHANICAL PROPERTIES (Test piece : No.5 JIS Z 2241 rolling direction)



For specification other than above or for cut length, please contact Nisshin Steel.

ASTM International—Standards Tole...

ASTM A653/653M-94 ASTM A924/924M-96

1. SIZE TOLERANCES

1. Thickness Tolerances

The coated sheet thickness tolerance is based on the base metal and coating and is measured at any point across the width of the coated sheet not less than 3/8 in. [10 mm] from a slit edge.

Specified Thickness	Thickness Tolerances Over and Under Specified Thickness					
	Specified Width					
	≤ 24 in. [600 mm]		> 24 in. [600 mm]		Specified Thickness	

2. Width Tolerances

The width tolerances as ... highly recommended rather than ASTM tolerances. For specification application ... follow closely contact Nucor in Steel.

Width	Edge Trim	Cut Edge	Specified Specified

3. Length Tolerances

Specified Length	Length Tolerances (applicable to all thicknesses)		Specified Specified

2. SHAPE TOLERANCES

1. Camber Tolerances

Camber is the greatest deviation of a side edge from a straight line, the measurement being taken on the concave side with a straightedge.

Camber Tolerances				
Specified Width		Specified Length		

2. Flatness Tolerances

Flatness Tolerances						
Specified Width	Specified Thickness			Specified Width	Specified Thickness	

Flatness Tolerance ... [illegible]

2. CHEMICAL COMPOSITION

4. MECHANICAL PROPERTIES

5. COATING PROPERTIES

1) Coating Weight (Mass)

2) Coating Bend Test

For specification other than above or for cut length, please contact Nisshin Steel.

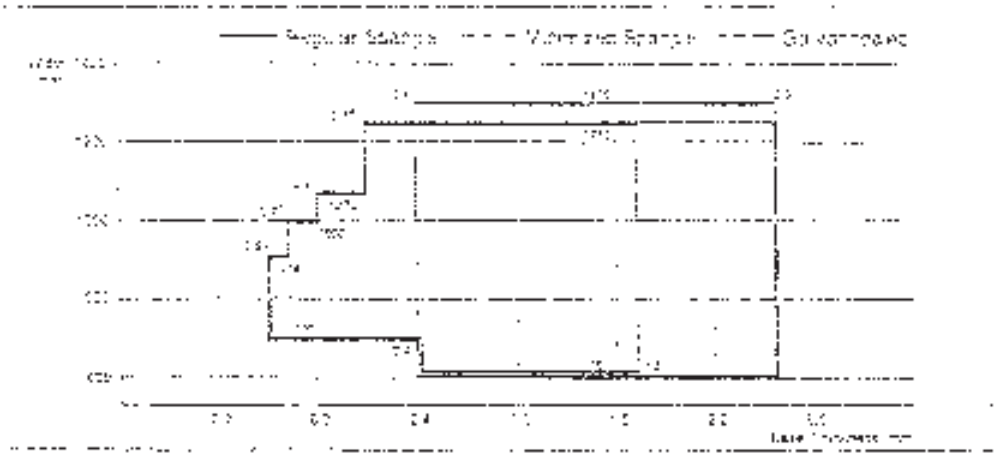
Product Availability

Dear customers, request, Nippon Steel may apply production out of the products available below. Please contact Nippon Steel for specific product availability.

Note: The nominal base thickness in the figures below is the thickest of base metal before coating. For coating grades on ASTM metric thickness applies to the number can be obtained by subtracting equivalent coating thickness given in the table below from the coated sheet thickness.

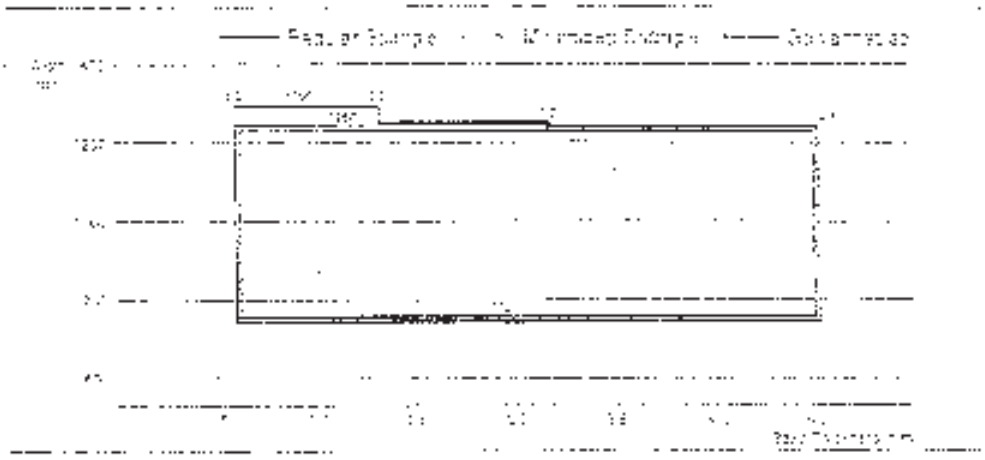
Coating Type	G40	G60	G90
Minimum Coating Mass (g/m²)	0.40	0.60	0.90
Equivalent Coating Thickness (mm)	0.028	0.042	0.064

Commercial Qualities (Cold-Rolled Base Metal)

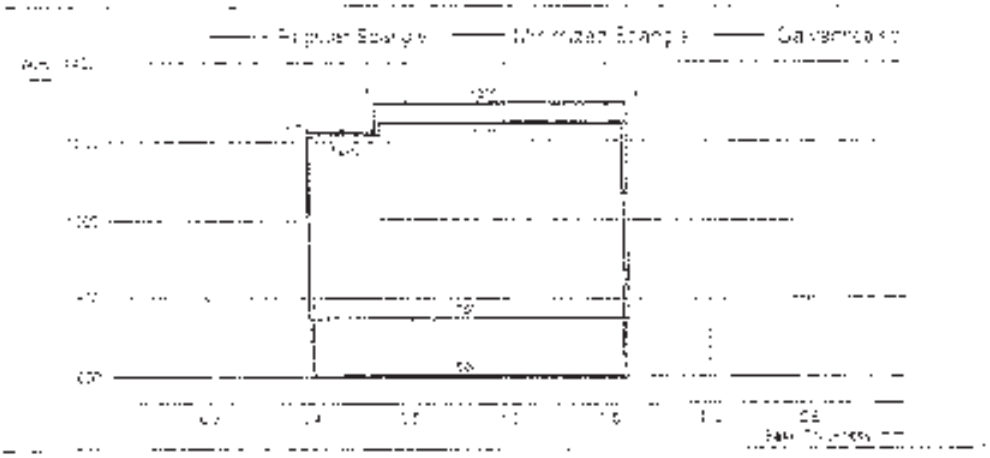


MOON STAR ZINC-COATED STEEL

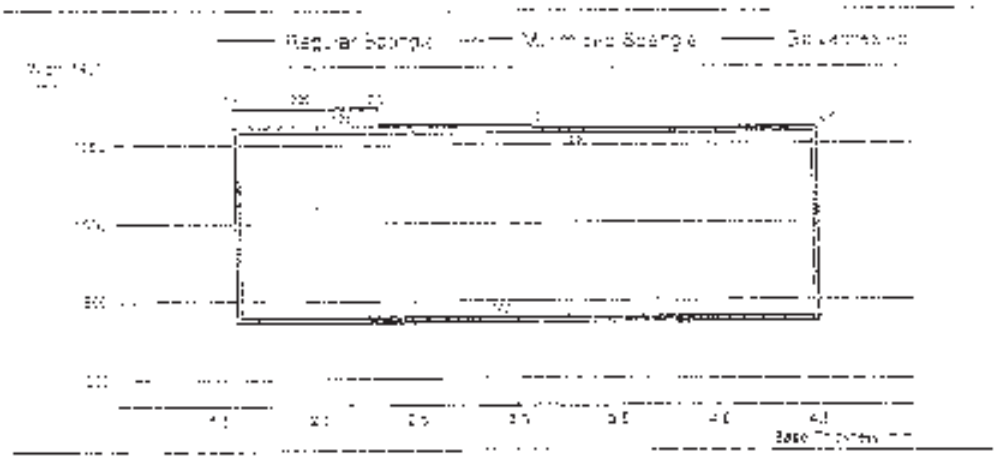
Commercial Qualities (Hot-Rolled Base Metal)



Structural Qualities (Cold-Rolled Base Metal 400N Grade, SQ37, SQ40)

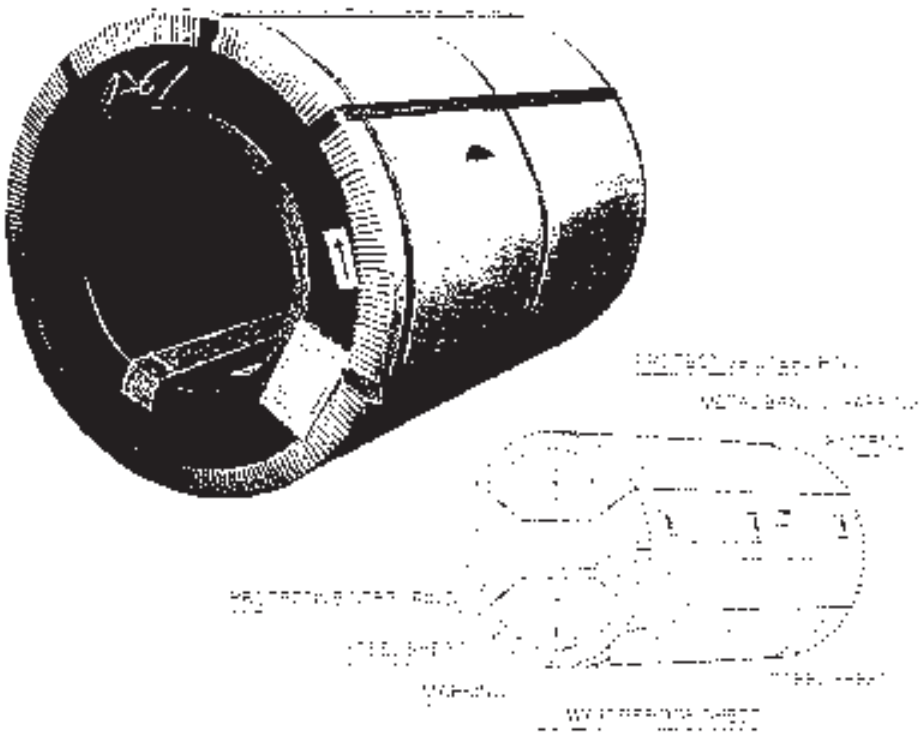


Structural Qualities (Hot-Rolled Base Metal 400N Grade, SQ37, SQ40)

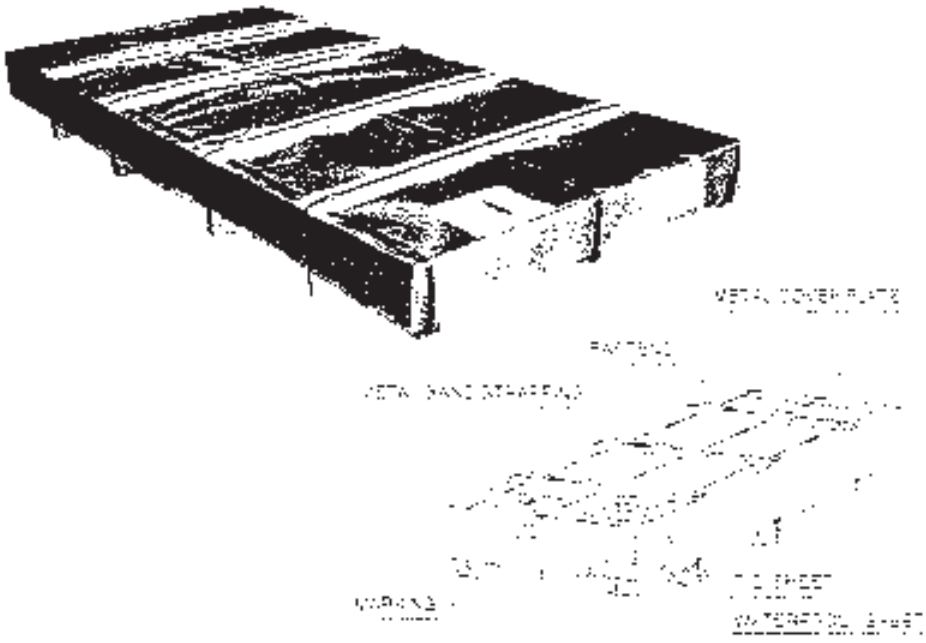


Packing and Marking

Example Coil



Sheet



Shipping Mark

Sample of case for non-dip galvanized product

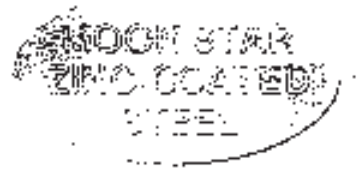
ABC COMPANY
TEL : (123) 4567 8901
52122
HONG KONG
JISG3302 - 94 SGCC-RCX Z22
D. 80X12 9XC
NET MASS 8.930 KGS
GROSS MASS 9.015 KGS
COIL NO. 95

NISSHIN STEEL CO., LTD.
MADE IN JAPAN

MILL

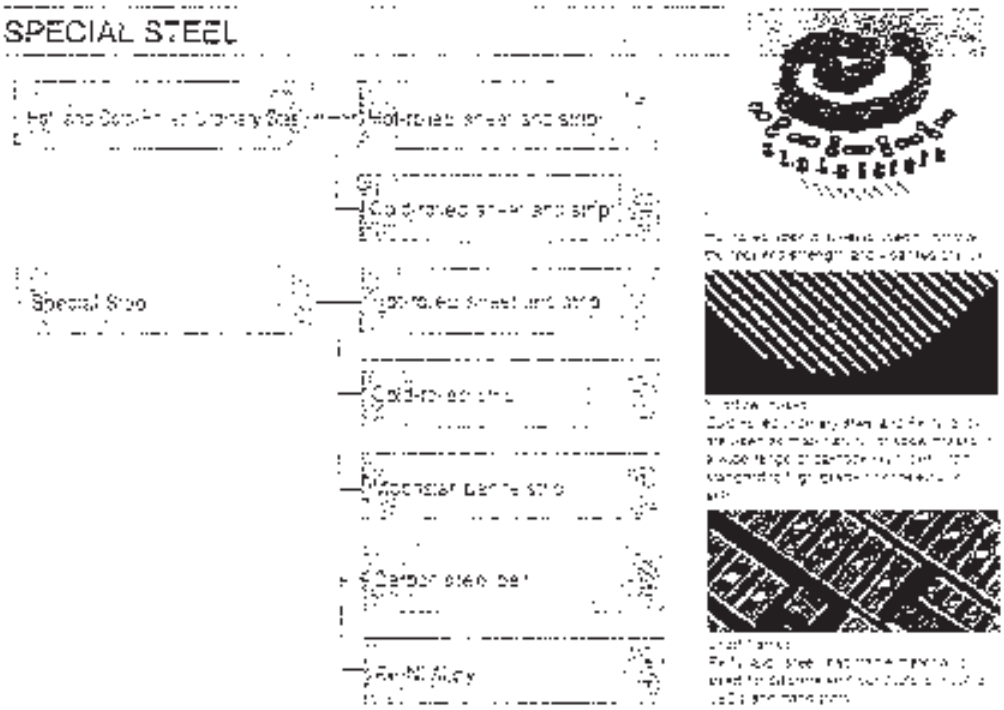
Main Product Lines

COATED STEEL

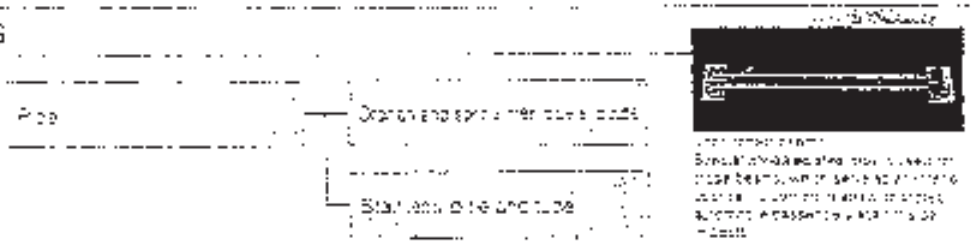


STAINLESS STEEL

ORDINARY STEEL & SPECIAL STEEL



FORMED PRODUCTS



Guide to Ordering

Specification

Select the most suitable grade from this brochure according to the desired degree of forming to be employed and the intended final use.

Surface Treatment

Select the most appropriate surface treatment from this brochure according to the desired method of treatment after forming and the conditions under which the final products will be used.

Coating Mass

Specify the proper coating mass according to the desired corrosion resistance, the conditions of use of the final products, the forming method to be employed and other relevant factors.

Oiling

The application of rust-preventive oil may be specified regardless of the surface treatment. It is recommended to apply oiling in order to protect against rusting in intermediate processes and against fingerprints, scratching or damage during handling as well as for lubrication during the forming process. Oiling is necessary for zinc-coated steel sheets without surface treatment.

Coils

Speedy delivery in coils or cut-lengths according to the conditions of cutting or forming. Coils offer a higher material yield and less stoppages in the automatic forming operations. However, some defective portions in part (certain defects may be removed through inspection).

Edge Finishing

Select either mill edge or slit edge according to the conditions of use.

Precautions in Use

Unloading and Storage

1. Zinc-coated steel sheets become wet during unloading or storage, white rust may occur. Keep zinc-coated steel sheets fully protected from rain, dew and seawater. Storage where humidity is high or in a sulfur gas atmosphere should be avoided. Store in a clean, dry place.
2. Any damage to packing paper should be repaired.

Abrasion-specific flaking should

■ Any coating may flake off if it is subjected to abrasion caused by movement of the surface of one coated steel sheet against another. Such flaking can be avoided when packaging, storing, or any other process. Take care not to damage coated steel sheets during packaging, transportation, storage, or processing. Protect coated steel sheets from rubbing against each other or against abrasives.

■ How do stains occur? Zinc-coating and chromate films are subjected to hydration during exposure to water. Under some conditions, a white powder (basic zinc carbonate) may develop on the surface. Exposure to carbon dioxide in the air promotes the formation of basic carbonates. Therefore, it is recommended to avoid contact between coated steel sheets and alkaline substances.

Forming

1. Use lubricating oil for forming sticks to the surface of the roll in roll forming or to the die in press forming.
2. Some lubricating oils containing an extreme-pressure additive are corrosive to zinc. Before using a lubricating oil, confirm that it is not corrosive. If the use of corrosive oil is unavoidable, perform degreasing or other post-treatment immediately after forming.

Welding

When resistance welding is employed, zinc will stick to the electrodes, requiring them to be cleaned or replaced as appropriate.

Painting

In order to obtain good paint-coated adhesion, the surface of zinc-coated steel sheets should be subjected to chemical or similar treatments prior to painting.

Fabricating

Chips such as metal dust will be produced in fabricating and the appearance of the products. Remove chips from the products carefully.

ISO Certification

All the Company's Works Achieve ISO 9002 Certification

ISO 9002 certification was obtained by all Nisshin Steel's works by March 1995. In acquiring this certification, the company's quality management systems have acquired a global assurance 'passport' for all of its products and production technologies.

All Zinc-coated Steel Sheet Products under ISO 14001 Certification

To further promote the principle of continuously improving the company's environmental management system, Nisshin Steel has been actively seeking ISO 14001 certification. By March 1998 five of Nisshin Steel's works attained certification for this international environmental management standard. The certified works include the Kure works which serves as our mainline center and the Sakai and Ichikawa works which produce coated steel. Thus, all Nisshin Steel's zinc coated steel sheets are manufactured in the works with ISO 14001 certification.

The Sakai Works, our first works obtaining the certification, uses a variety of manufacturing processes to create a range of products - principally different types of surface-treated steel sheets. Moreover, the works' proximity to populous urban areas as well as the Seto Inland Sea National Park requires it to have all the more stringent controls in place. Keenly aware of the importance of promoting environmental protection, the works established an environmental management system, which directly led to the achievement of ISO 14001 certification.

ISO 14001 Certificate of Registration awarded to the company's Sakai Works

MOON STAR ZINC-COATED STEEL

Offices

DOMESTIC

Registered Head Office

Shinkokusai Building, 4-1, Marunouchi 3-chome
Chiyoda-ku, Tokyo 100-6268, Japan
Telephone: 81-3-3216-5691
Facsimile: 81-3-3214-1225

OVERSEAS

Singapore Representative Office

16 Raffles Quay #20-01, Hong Leong Bldg.
Singapore 048581
Telephone: 65-224-1277-6
Facsimile: 65-224-0357

Düsseldorf Office

Immermannstrasse 45, 40210 Düsseldorf, Germany
Telephone: 49-211-353331
Facsimile: 49-211-356451

Shanghai Office

Orient International Plaza, Unit 5
No. 85 Lou Shang Guan Road,
Shanghai, People's Republic of China
Telephone: 86-21-6278-7570
Facsimile: 86-21-6278-7590

Hong Kong Office

3403A, Tower One, Lippo Centre, 89 Queensway,
Hong Kong
Telephone: 852-2521-8678-8634
Facsimile: 852-2521-8358

Beijing Office

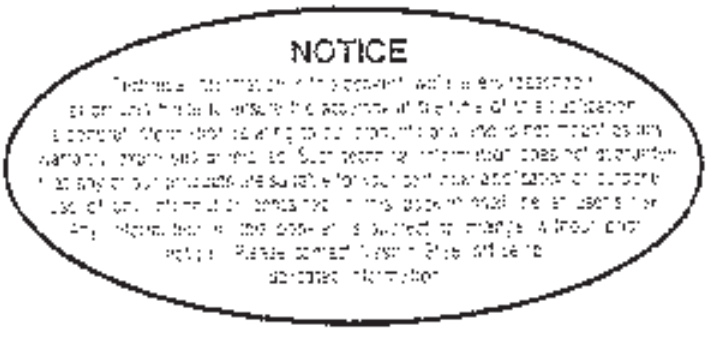
Chang Fu Gong Center Office Bldg. 4th Fl.,
#26 Jian Guo Men Wai Da Jie, Chao Yang Qu,
Beijing, People's Republic of China
Telephone: 86-10-6513-8008
Facsimile: 86-10-6513-8010

Subsidiary

Nisshin Holding, Inc.
Nisshin Steel USA, Inc.

375 Park Avenue, New York, NY 10152, U.S.A.
Telephone: 1-212-317-3500
Facsimile: 1-212-421-0496

NISSHIN STEEL CO., LTD.



Ductflex
Flexible Duct Connector

Eliminates Duct System Noises and Vibrations

All air duct installations for heating, cooling or ventilation are attached to mechanical equipment containing a fan or blower. Vibrations, noises and rattles resulting from operation of the fan or blower are transmitted into the metal ducts which carry the noises throughout the system.

Ductflex Flexible Duct connector isolates the vibration and noises to the source or straight duct joint consisting of a fabric which is secured to sheet metal or duct collars must be inserted between the equipment and the ductwork. It meets every type of installation requirements, whether it be for factory, institution, office or home.

Brand (Model)	: **Ductflex 70A**
Usage	: Ventilation system at normal Duct work System and External ventilation System
Color	: Black
Content	: Fiberglass Rubber
Thickness	: 0.5 ~ 1.0mm
Length	: 3cm
Temperature Range	: -30°C ~ +70°C
Pressure	: -2 ~ 5 Kpa
Advantage	: - Excellent water resistance - Excellent tear strength - Unaffected by mildew - Economical & Durable - Easy & Quick to install

Model	**Ductflex 70A**
Width	: 100mm, 150mm, 200mm, 250mm, & 300mm

Model	**Ductflex 70A-GS**
Width	: Galvanized Steel + Ductflex 70A + Galvanized Steel

Ductflex
Flexible Duct Connector

Brand (Model)	: Ductflex 300
Usage	: Ventilation System, Boiler, Service, Extraction System, all normal Extraction System and which requires, High Temperature and Chemical Ventilation System
Color	: Orange Brown
Content	: Fire Resistant Woven Fiberglass, Silicon Rubber, Stainless Steel Wire
Thickness	: [illegible]
Length	: [illegible]
Temperature Range	: [illegible]
Pressure	: [illegible]

Advantage:

- Excellent water resistance
- Excellent tear strength
- Excellent high & low temperature resistance
- Excellent abrasion resistance
- Extremely low smoke emission
- Excellent ozone resistance
- Excellent resistance to weathering
- Unaffected by mildew
- Economical & Durable
- Easy & Quick to install

Model	: Ductflex 300
Width:	100mm, 150mm, 200mm, 250mm & 300mm

Model	: Ductflex 300-GS
Width	: Galvanized Steel + Ductflex 300 + Galvanized Steel

Fire Specifications

BS476 – Part 6 Fire Propagation	: Class [illegible]
BS476 – Part 7 Surface Spread of Flame	: Class [illegible]

Ductflex
Flexible Duct Connector

Method for Flexible Connector at Corner of Connector:

Picture 1: Cut the [illegible] Corner of Connector as marked. Cut [illegible] deep to [illegible] Fabric Lap.

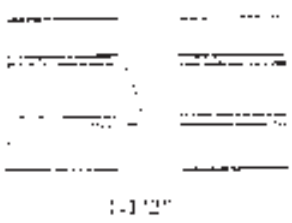
Picture 2: From Front of connector, pull away metal as indicated. Metal falls away exposing fabric ready for sealing.

Picture 3: [illegible] finished [illegible] duct connector.

Picture 4: [illegible] finished [illegible]

Picture 5: Flexible duct connector [illegible] with [illegible]

Picture 1



Picture 2:

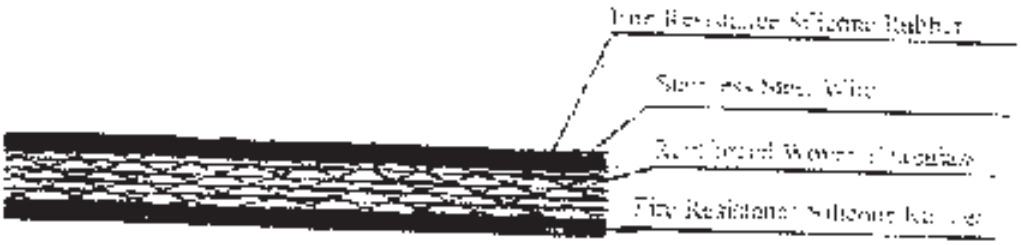
Picture 3:

Picture [illegible]

Picture [illegible]

Sunwatch Installation Materials Supplies Ltd
Ground Floor, 88-96 Lunch Street,
Tai Kok Tsui, Kowloon, Hong Kong.
Tel: (852) 2395 0288 Fax: (852) 2348 3077
www.sunwatch.com

Cut Composition of Class "A" Ductflex Flexible Duct Connector



Ductflex "A" (Orange Brown Color)

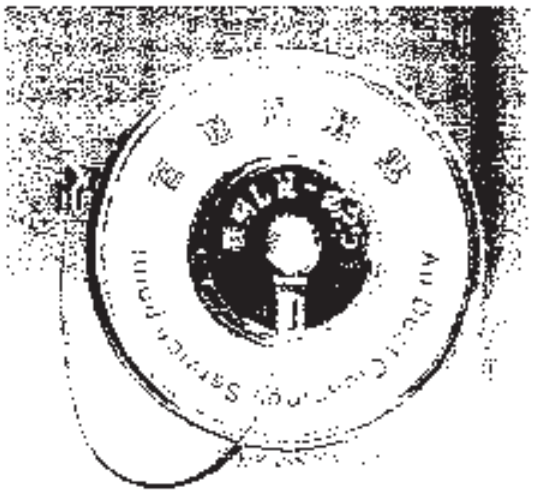
Ductflex "A" (Black Color)

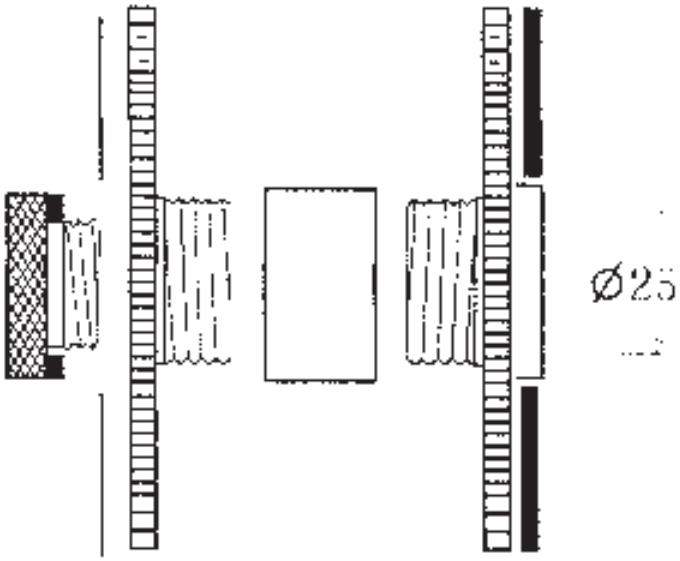
Schwegmann Insulation Materials Supplies Ltd.
Ground Floor, Shun Cheung Street,
Tai Kok Tsui, Kowloon, Hong Kong.
Tel: (852) 2398 0288 Fax: (852) 2398 3927
http://www.schwegmann.com

Technical Literature

40) Duct Flexible Connector

Ø25 AIR DUCT CLEANING/SERVICE POINT





联明LM Ø25mm Air Duct Cleaning / Service Point has been engineered to fulfil the need for a quality fitting which can be used with full confidence. It's 'CLASS O' Closed-Cell rubber gasket provides effective air-tight/water-tight finish on plus condensation control.

MAIN FEATURE

- Heavy duty aluminium alloy die construction with anti-corrosive chromed plate finished
- Convenient instant release screw plug
- Air-tight complied to high pressure class
- Accommodates 25mm insulation either with internal, external or without insulation
- Handles any instrument measuring up to Ø25mm
- 'Class O' Closed-cell Rubber mounting gasket are complied with Bs476 Part 6&7

ONE SET CONSISTS OF

1. SCREW PLUG
2. 'CLASS O' GASKET
3. SELF-ADHESIVEIDENTIFICATION RING
4. THREAD PORT
5. EXTENSION TUBE
6. SCREW BASE
7. ' CLASS O' GASKET

INSTALLATION

WITH EXTERNAL INSULATION

1. Using 2"-1/4"(52mm) hole saw to make hole on the metal duct
2. Put the SCREW BASE externally on position with "Class 0" Gasket or Duct Sealant as 3M 750C or equivalent & fix with 3 screws
3. Wrap Insulation on top the SCREW BASE & trim the insulation to leave the hole of SCREW Base in Position
4. Screw the THREAD PORT on top the SCREW BASE
5. Fix the SCREW PLUG on THREAD PORT

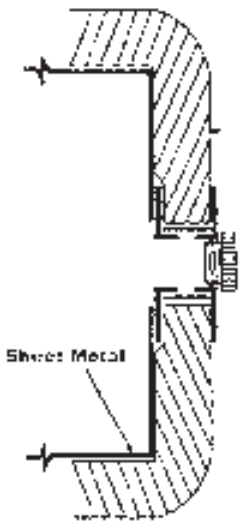
WITH INTERNAL INSULATION

1. Using 2"-1/4"(52mm) hole-saw to make hole on the metal duct
2. Put "Class 0" Gasket or Duct Sealant such as 3M 750C or equivalent on the contact surface between the THREAD PORT & metal duct
3. Put the THREAD PORT externally on position and fix with 3 screw
4. Put Duct liner Insulation inside metal duct on top the hole of THREAD PORT, trim the insulation to leave An Exact hole in position
5. Screw on the SCREW BASE and SCREW PLUG

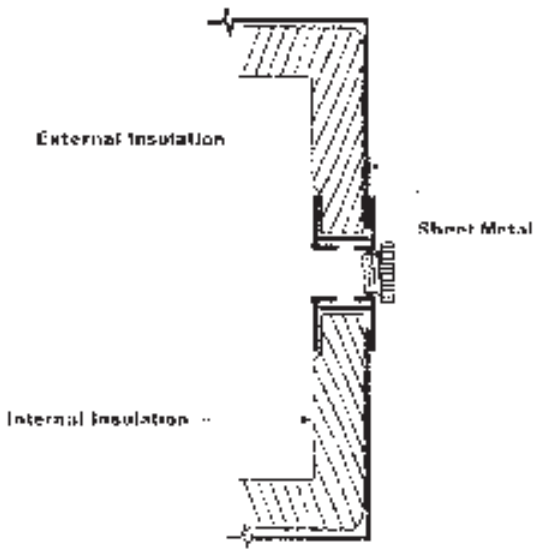
WITHOUT INSULATION

1. Using 2"-1/4"(52mm) hole-saw to make hole on the metal duct
2. Put "Class 0" Gasket or Duct Sealant such as 3M 750C or equivalent on the contact surface between the THREAD PORT & metal duct
3. Put the THREAD PORT externally on position and fix with 3 screw

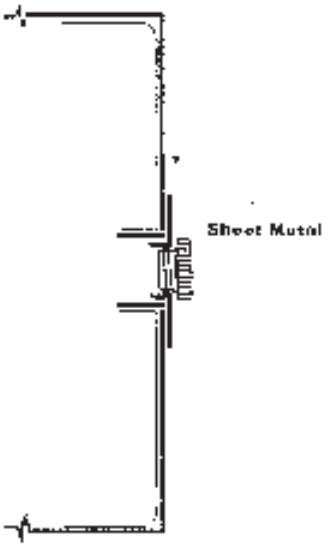
WITH EXTERNAL INSULATION



WITH INTERNAL INSULATION



WITHOUT INSULATION



N.O.6 Yongchun Road, Pingshan Village, Pingshan Town, Pingshan District, Shenzhen City, Guangdong Province, P.R. China
TEL: (86-755) 8483 7xxx (8 lines)
FAX: (86-755) 8483 2xxx (86-755) 8483 2xxx
E-mail: xxx@xxx.com.cn
Website: www.xxx.com.cn

Unit 2xx, xx/F., xxx Centre, 3x Sha Tsui Road, Tsuen Wan, New Territories, Hong Kong
TEL: 852 2xxx 2xxx
FAX: 852 2xxx 1xxx
E-mail: xxx@xxx.com.hk
Website: www.xxx.com.hk

Technical Literature

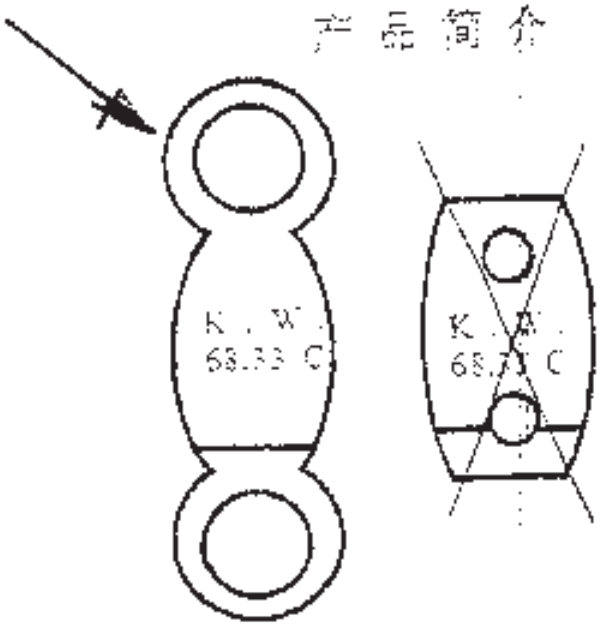
41) Test Point (Air Side)

Fusible Link

广胜五金表壳制品公司

KWIN METAL WORKS MFY.CO.

产品简介



规格	产品装置标注	本体温度
2×5mm	K.W.68.33°C	68.33°C
3×8mm	K.W.96.85°C	96.85°C

一、 本产品采用之原料为本厂自设置之标准产品配合制作完成及经过严格检
查.

二、 本产品将"THE HONG KONG STANDARDS AND TESTING CENTRE LTD."
之测试报告有效证明

三、 本产品参考编号为此表A.B.之 OUR REF:(100) IN EP10616 之有效证书文
件

四、 本产品生产及测试工序,均是在本厂高素质的香港技术人员监督及管理

五、 本产品"K.W.68.33°C"为公司唯一一系列此产品商标注册号码之证明标
识.

产地:深圳市龙岗区平湖镇

通讯人:陈 深圳 13828833232 香港 91692953

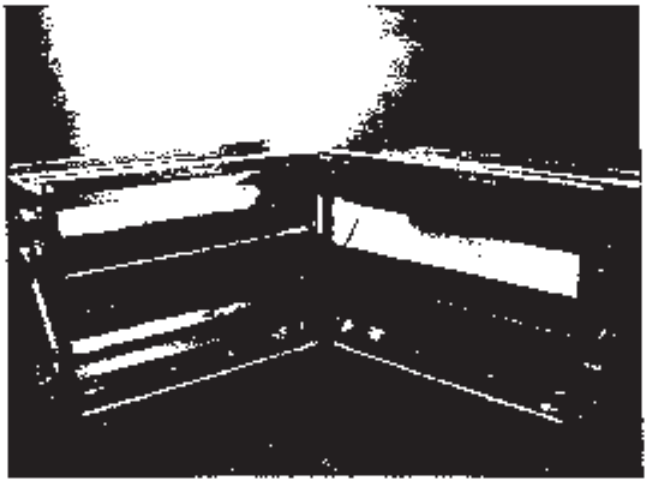
常备产品及有效各项文件欢迎垂询!

C1

Technical Literature

42) Fusible Link

AEROTECH Volume Control Damper

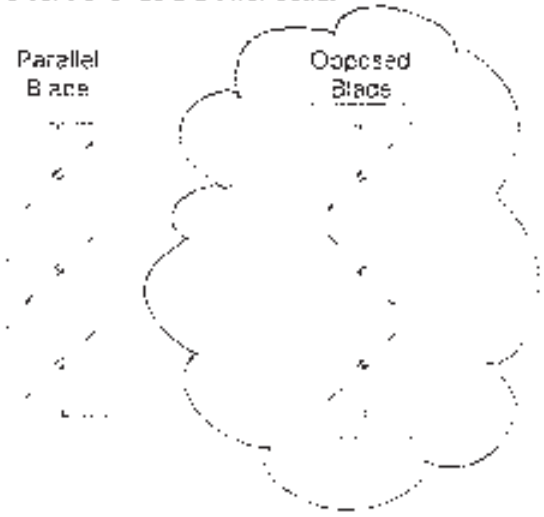


Aerotech double skin blade volume control dampers are designed for a steady range of pressure and velocities.

The performance of the parallel or opposed blade design for clean air systems allows superior performance in both constant and varying pressure drop applications.

The parallel blade unit is recommended for constant pressure drop applications such as mixing air, multi-zone, face and bypass as well as normal open/close applications.

The opposed blade unit is recommended for varying pressure drop conditions such as volume control or as a blower outlet.



Options

Axles and linkage construction 304 or 316 stainless steel
Blade Seals: Insulation tape
Side Seals: Stainless steel plate
Special flange width: 100mm max
304 or 316 stainless steel construction
Manual or electric actuation options

→ Model: VCD-M c/w hand quadrant for manual control
Model: VCD-S c/w extend spindle for electric control

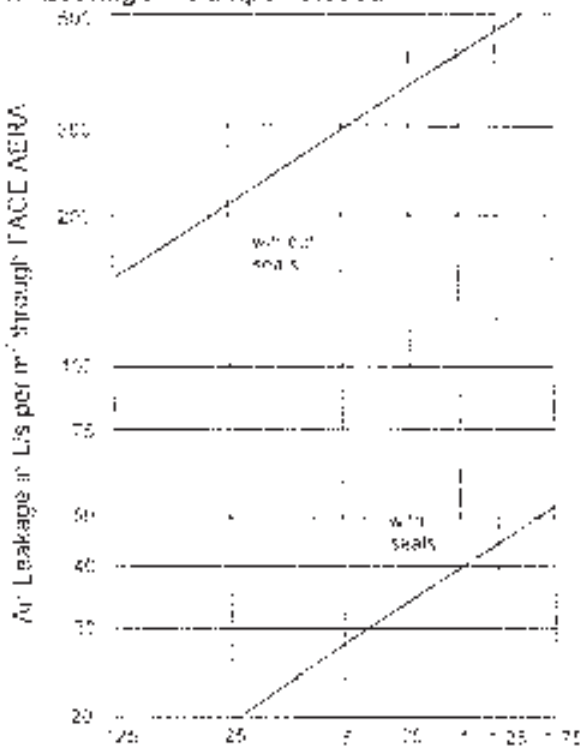
STANDARD SPECIFICATIONS

Max. Face Velocity:	15m/s
Max. Diff. Pressure:	1000Pa
Max Temp.:	120°C
Min. Panel Size:	100mm x 100mm
Max. Panel Size:	1200mm x 1200mm
→ Frame:	150mm x 37mm x 1.2mm galvanised steel
→ Blade	150mm x 0.8mm galvanised steel double skin aerofoil blade
Axles:	13mm plated steel
Bearing:	Oilless bronze bearing
Linkage	Heavy duty plated steel
Stop	Galvanised steel angle
Finish:	Mill
Actuator	An external shaft 4" beyond frame on right is standard

AEROTECH Volume Control Damper

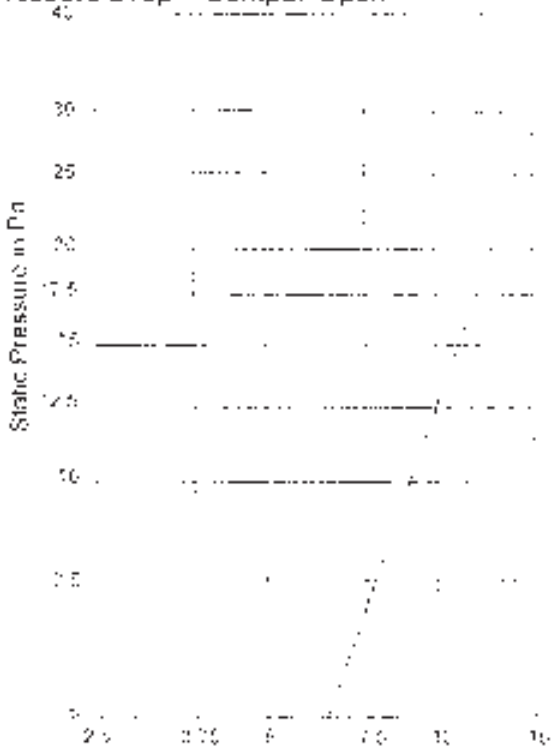
PERFORMANCE DATA

Air Leakage – Damper Closed



Static Pressure in kPa. Tested per AMCA Std. 500-D-98 Laboratory Methods for Testing Dampers for Rating

Pressure Drop – Damper Open



Air Velocity in m/s through FACE AERA Tested per AMCA Std 500-D-98. Laboratory Methods for Testing Dampers for Rating

SUNWACORK INSULATION MATERIALS SUPPLIES LTD.
Sales Dept : Off., 58-60 Larch Street, Tai Kok Tsui, Kowloon, Hong Kong.
TEL : 2398 0288 (4 LINES); 2395 1338
FAX : (852) 2388 3827 / 3188 8758
WEBSITE : http://www.sunwacork.com

新華水松恒源材料有限公司
地 址 : 九龍大角嘴利榮街58-60號地下
電 話 : 2398 0288 (四線); 2395 1338
傳 真 : (852) 2388 3827 / 3188 8758
網 址 : http://www.sunwacork.com

專營：各類水松、泡沫膠 (Phenolic Foam)、玻璃纖、岩棉、高溫白棉、硅酸鈣板、隔熱膠、
消防板機、防腐劑、膠料、鋁紙、發泡膠、膠帶、各類膠水、氣溫及其他設備用品。

Ref.No.: 005LET10.TW(IF)

Date: 20th January, 2010

FOR BANK SEAL

To Whom It May Concern

Please be informed that Insulflex CPC free closed cell insulation is made of synthetic has rated as Class "0" product according to BS476 Part 6 & Part 7.

To carry out the tests for physical properties and performance by recognized laboratory, we are advised to submit thickness 25mm for testing. All thickness is made of the same materials, thus, there is no doubt to consider as same materials even their thickness is different.

We hereby to clarify that Insulflex tape is also made of the same materials.
The tape sizes are 3mm(thick) x 50mm(width) x 10mm(length) &
6mm(thick) x 20mm(width) x 10m(length).
Other sizes is available on request.

For further information required, please feel free to contact us.

Yours faithfully,

For and on behalf of
新華水松恒源材料有限公司
SUNWACORK INSULATION MATERIALS SUPPLIES LTD.

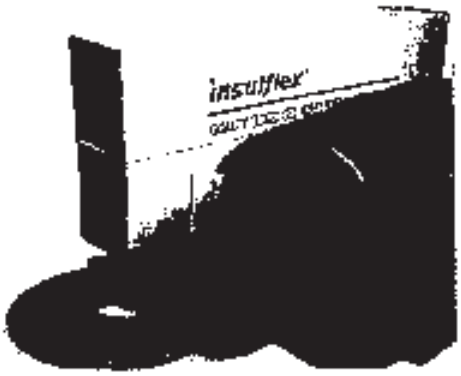
Authorized Signature(s)

Sandy Lau,
Executive Manager

THE PRODUCT

insulflex

High Quality Closed Cell Tubing And Sheet Insulation For Air Conditioning, Heating, Refrigeration and Dual Temperature Lines



Description:

insulflex is a flexible and light weight elastomeric nitrile rubber material designed for thermal insulation. Insulflex insulation is black in colour available in tubing and sheet form. The extruded flexible tubings are specially designed to fit the standard diameters of steel and copper pipings. Sheets are available in standard precut sizes or in rolls.

Uses:

Insulflex expanded closed cell structure provides the ideal and most efficient vapour barrier for the prevention of condensation or frost formation on cooling systems, chilled water and refrigerant lines.

Insulflex also retards heat loss for hot water plumbing and heating, dual temperature piping and solar systems. It protects pipes by acting as a vibration damper and giving protection against corrosion by atmospheric and industrial environment.

Insulflex inherent flexibility makes it ideally suited for the insulation of large surface area such as tanks, irregular shaped vessels, air-ducts and large diameter pipes.

Characteristics and Advantages:

Insulflex insulation material has been specially designed to provide the following features:

- Its low thermal conductivity (k value) which makes it highly efficient and effective in the insulation of cooling or heating systems.
- The hermetic tiny closed cell structure forms an impermeable layer which is in itself a good vapour barrier.
- It is suitable for application within the temperature range of -40 deg to + 105 deg C.
- The material has been specially compounded to be self-extinguishing in nature.
- Insulflex has excellent ozone and ultraviolet ray resistance.
- It is CFC, chlorine and fibre free and does not cause skin allergy.
- It is also inert to majority of chemical agents and neutral to pipe metals.
- The extreme flexibility of the material makes installation fast, easy and economical.
- It is able to withstand tearing, rough handling and severe site conditions.
- Much lesser space is needed for Insulflex as a thinner wall is required due to its low k value as compared to other types of insulation.
- The smooth surface of Insulflex material gives the finished insulation a neat aesthetic appearance. No cooling is needed on most indoor installations.

1

TECHNICAL SPECIFICATIONS

insulflex® Closed Cell Tubing, Sheet And Roll Insulation

AVERAGE PHYSICAL PROPERTIES	RATING	TEST METHOD
Density	50 kg/m³ to 120 kg/m³ (5 - 9 lbs/ft³)	ASTM D 1667
Thermal Conductivity @ 20°C mean temp	0.034 W/mK (0.236 BTU in/hr ft² °F)	ASTM C 177
Temperature Limits °C	-40°C to +105°C	
Water Absorption (% by weight)	3	ASTM D 1056
Water Vapour Permeability Perm - in. Max	0.05	ASTM E 96
Ozone Resistance	Excellent	
Thermal Stability (% shrinkage) 7 Days 200°F	4.5	ASTM C 534
7 Days 220°F	6.5	
Average Ignitability of Material	Class P	BS 476 PART 5
Average Fire Propagator	Class 3	BS 476 PART 6
Average Surface Spread of Flame	Class 1	BS 476 PART 7
Average Time of Burning	Less than 2 seconds	ASTM D 635 - 91
Average Extent of Burning	15 mm	
Flexibility	Excellent	
Weather and Ultraviolet Rays Resistance	Good	
Chemical Resistance	Good	
Odour	Negligible	
Mildew Resistancy	No Fungal Growth	

- The above average physical properties are values obtained in accordance with accepted test methods.
- At -40°C Insulflex Closed Cell insulation becomes hard and as temperature drops below -40°C will be increasingly brittle; however this hardening characteristic does not affect thermal or water vapour permeability.
- The Fire Rating standard method of tests conducted under controlled laboratory conditions is a measure of a material to spread flame when compared to a known standard and is not intended to reflect hazards presented by this or any other material under actual fire conditions.

APPLICATION RECOMMENDATION

insulflex Closed Cell Tubing And Sheet Insulation

Thickness Recommendations To Control Condensation In Pipe Insulation Of Cooling Lines

DESIGN CONDITIONS	PIPE SIZE	PIPELINE TEMPERATURE 14.4°C (58°F)	7°C (44.6°F)	2.5°C (36.5°F)	-18°C (0°F)
MILD CONDITION 26.7°C (80°F 50% RH	10mm ID to 76mm IPS	9mm	9mm	9mm	19mm
	Above 76mm IPS to 127mm IPS	9mm	13mm	13mm	25mm
	Above 127mm IPS to 254mm IPS	13mm	13mm	19mm	25mm
NORMAL CONDITION 29.4°C (85°F) 70% RH	10mm ID to 76mm IPS	9mm	13mm	13mm	25mm
	Above 76mm IPS to 127mm IPS	13mm	13mm	13mm	31mm
	Above 127mm IPS to 254mm IPS	13mm	13mm	13mm	31mm
SEVERE CONDITION 32.2°C (90°F) 80% RH	10mm ID to 76mm IPS	13mm	19mm	19mm	38mm
	Above 76mm IPS to 127mm IPS	13mm	25mm	25mm	38mm
	Above 127mm IPS to 254mm IPS	13mm	25mm	31mm	50mm
EXTREMELY SEVERE CONDITION 35.2°C (95°F) 85% RH	10mm ID 76mm IPS	13mm	25mm	31mm	38mm
	Above 76mm IPS to 127mm IPS	19mm	31mm	31mm	50mm
	Above 127mm IPS to 254mm IPS	25mm	31mm	38mm	50mm

- Insulation for tube of 10mm ID to 76mm IPS are available in tubing form with wall thickness of up to 25mm.
- Insulation above 76mm IPS are in precut sheets and available up to 25mm thickness.
- Insulflex thickness recommended within the specified temperature ranges will provide condensation on indoor piping under design conditions defined as follows:

MILD	- Air-Conditioned and dry areas
NORMAL	- Maximum severity of most indoor conditions seldom exceeds 29.4°C and 70% RH.
SEVERE & EXTREMELY SEVERE	- Conditions of high humidity or poorly ventilated areas where temperature may be depressed below the ambient. Under conditions of high humidity additional thickness of insulation may be required.

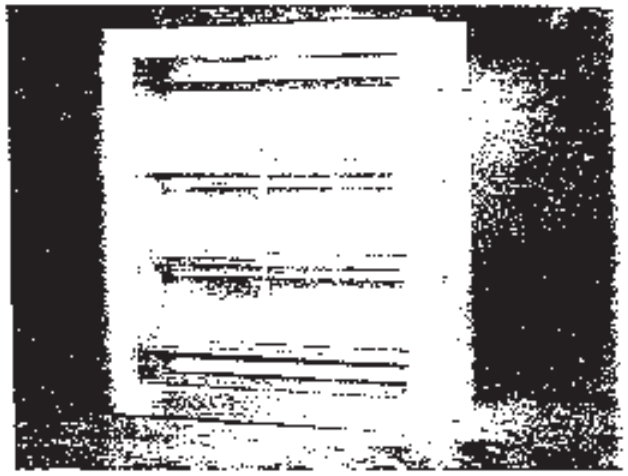
Thickness Recommendations For Insulation Of Ductings, Tanks And Equipment Of Cooling Systems

DESIGN CONDITIONS	METAL SURFACE TEMPERATURE 15°C (59°F)	12°C (53.6°F)	7°C (44.6°F)	2.5°C (36.5°F)	-18°C (0°F)
26.7°C (80°F 50% RH	9mm	9mm	13mm	19mm	25mm
29.4°C (85°F) 70% RH	13mm	13mm	19mm	25mm	31mm
32.2°C (90°F) 80% RH	13mm	19mm	25mm	31mm	50mm
35.2°C (95°F) 85% RH	25mm	25mm	31mm	38mm	50mm

Technical Literature

43) Volume Control Damper

AEROTECH Backdraft Damper



Backdraft damper may be using as basic non-return damper. Units are suitable for duct mounting for project requiring coarse control of differential pressure. The damper blades modulate automatically with increasing and produce a flat pressure response which is useful for regulation purposes.

Features

- Frame constructed from galvanised steel and stainless steel as a special option
- Blade constructed from aluminium
- Counterbalance units as an extra option
- Low leakage on fully close position
- Economically priced
- Blade Seals Insulation Tape

MODEL NRD

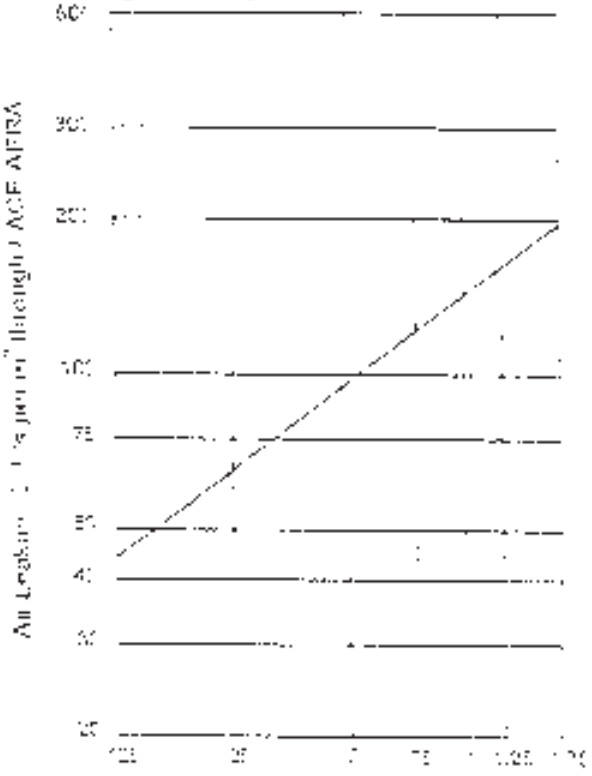
STANDARD SPECIFICATIONS

Max. Face Velocity	10m/s
Max. Dif. Pressure	1000Pa
Max Temp.	120°C
Min. Panel Size	150mm x 100mm
Max. Panel Size.	1000mm x 1000mm
Frame	150mm x 32mm x 1.0m galvanised steel
Blade	0.6mm thick aluminium 150mm max and 100mm min. blade width
Axles	12mm diameter plated steel
Bearing	Oilless bronze bearing
Linkage	1.5mm x 13mm aluminium
Stop	Galvanised steel angle
Finish	Mill

AERO TECH Backdraft Damper

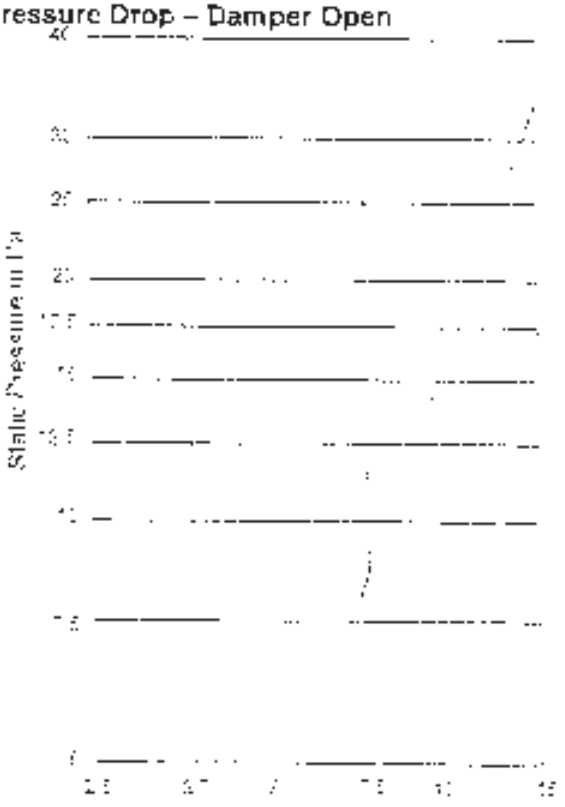
PERFORMANCE DATA

Air Leakage – Damper Closed



Static Pressure in kPa Tested per AMCA Std 500-D 98 "Laboratory Methods for Testing Dampers for Rating

Pressure Drop – Damper Open



Air Velocity in m/s through FACE AERA Tested per AMCA Std 500-D 98 "Laboratory Methods for Testing Dampers for Rating

SUNWACORK INSULATION MATERIALS SUPPLIES LTD.
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FAX: (852) 2398 3927 3188 8758
WEBSITE: http://www.sunwacork.com
新基木板保溫材料有限公司
電話：2398 0288 (四線)
傳真：(852) 2398 3927 / 3188 8758
網址：http://www.sunwacork.com

Ref.No.: 005LET10.TWCP

Date: 20th January, 2010

To Whom It May Concern

Please be informed that Insulflex CFC free closed cell insulation is made of synthetic rubber and rated as Class "0" product according to BS476 Part 6 & Part 7.

To carry out the tests for physical properties and performances by recognized laboratory, we are advised to submit thickness 25mm for testing. All thickness is made of the same materials, thus, there is no double to consider as same materials even their thickness is different.

We hereby to clarify that Insulflex tape is also made of the same materials.
The tape sizes are 3mm(thick) x 50mm(width) x 15mm(length) &
6mm(thick) x 20mm(width) x 10m(length).
Other sizes is available on request.

For further information required, please feel free to contact us.

Yours faithfully,

Sandy Lau
Executive Manager

THE PRODUCT

insulflex

High Quality Closed Cell Tubing And Sheet Insulation For Air Conditioning, Heating, Refrigeration and Dual Temperature Lines

Description:

insulflex is a flexible and light weight elastomeric foam rubber material designed for thermal insulation. Insulflex insulation is also in colour available in tubing and sheet form. The extruded flexible tubings are ideally designed to fit the standard diameters of iron and copper pipes. Sheets are available in standard thicknesses of 6 mm.

Uses:

Insulflex expanded closed cell structure provides the cost efficient vapour barrier for the prevention of condensation or heat formation on cooling systems on the water and refrigerant lines.

Insulflex also enhances heat loss for hot water plumbing and heating, cold temperature piping and solar systems. It protects steel by acting as a vapour barrier and giving protection against corrosion by atmospheric and industrial environment.

Insulflex inherent flexibility makes it ideally suited for the insulation of large surface areas such as tanks, irregular shaped vessels, air-ducts and large diameter pipes.

Characteristics and Advantages:

Insulflex insulation material has been specially designed to provide the following features.

- Its low thermal conductivity (k value) which makes it highly efficient and effective in the insulation of cooling or heating systems.
- The hermetic tiedon closed cell structure forms an impermeable layer which is in itself a good vapour barrier.
- It is suitable for application within the temperature range of -40 deg. to +105 deg C.
- The material has been specially compounded to be self extinguishing in nature.
- Insulflex has excellent ozone and ultraviolet ray resistance.
- It is CFC, chlorides and fibre free and does not cause skin allergy.
- It is also inert to majority of chemical agents and neutral to pure metals.
- The extreme flexibility of the material makes installation fast, easy and economical.
- It is able to withstand tearing, rough handling and severe site conditions.
- Much lesser space is required for Insulflex as a thinner wall is required due to its low k value as compared to other types of insulation.
- The smooth surface of Insulflex material gives the finished installation a neat aesthetic appearance. No coating is needed on most indoor installations.

TECHNICAL SPECIFICATIONS

insulflex Closed Cell Tubing, Sheet And Roll Insulation

AVERAGE PHYSICAL PROPERTIES	RATING	TEST METHOD
Density	45 kg/m³ to 120 kg/m³ (2.8 lb/ft³ to 7.5 lb/ft³)	ASTM D 1667
Thermal Conductivity at 25°C mean temp	0.038 W/m°K (0.265 BTU in/hr ft² °F)	ASTM C 177
Temperature Limits °C	-40°C to +105°C	
Water Absorption % by weight	2	ASTM D 1056
Water Vapour Permeability Perm - in Max	0.05	ASTM E 96
Ozone Resistance	Excellent	
Thermal Stability 7 Days 70°C 158°F % dimensional change 200 °F 7 Days 100°C 212°F	4.0 5.0	ASTM D 794
Average Ignitability of Material	Class 1	25 mm (ASTM E 84)
Average Flame Propagation	Class 1	25 mm (ASTM E 84)
Average Surface Spread of Flame	Class 1	25 mm (ASTM E 84)
Average Time of Burning	Less than 1 second	ASTM D 635
Average Extent of Burning	15 mm	
Flexibility	Excellent	
Weather and Ultraviolet Resistance	Good	
Chemical Resistance	Good	
Odour	Negligible	
Mildew Resistance	No Fungal Growth	

- The above average physical properties are values obtained in accordance with accepted test methods.
- At -40°C Insulflex Closed Cell Insulation becomes hard and at temperatures below -40°C will be increasingly brittle, however this hardening or brittleness does not affect thermal or water vapour permeability.
- The Fire Rating standard methods of tests conducted under controlled laboratory conditions is a measure of a material to spread flame when compared to a known standard and is not intended to forecast hazards presented by this or any other material under actual fire conditions.

APPLICATION RECOMMENDATION

insulflex Closed Cell Tubing And Sheet Insulation

Thickness Recommendations To Control Condensation In Pipe Insulation Of Cooling Lines

DESIGN CONDITIONS	PIPE SIZE	PIPELINE TEMPERATURE			
		10°C (50°F)	7°C (44.6°F)	4.4°C (40°F)	0°C (32°F)
MILD CONDITION	10mm (3/8") to 25mm (1")	9mm	9mm	9mm	13mm
30.5°C (86°F)	Above 25mm (1") to 114mm (4")	9mm	13mm	13mm	19mm
70% RH	Above 114mm (4") to 254mm (10")	13mm	13mm	13mm	25mm
NORMAL CONDITION	10mm (3/8") to 25mm (1")	9mm	13mm	13mm	25mm
32.8°C (91°F)	Above 25mm (1") to 114mm (4")	13mm	13mm	13mm	32mm
75% RH	Above 114mm (4") to 254mm (10")	13mm	19mm	19mm	38mm
SEVERE CONDITION	10mm (3/8") to 25mm (1")	13mm	19mm	19mm	38mm
35.0°C (95°F)	Above 25mm (1") to 114mm (4")	19mm	25mm	25mm	38mm
80% RH	Above 114mm (4") to 254mm (10")	19mm	25mm	31mm	50mm
EXTREMELY SEVERE CONDITION	10mm (3/8") to 25mm (1")	19mm	25mm	25mm	38mm
37.8°C (100°F)	Above 25mm (1") to 114mm (4")	25mm	31mm	31mm	50mm
85% RH	Above 114mm (4") to 254mm (10")	25mm	31mm	38mm	57mm

- Insulation for pipes of 10mm (3/8") to 76mm (3") are available in tubing form with wall thickness of up to 32mm.
- Insulation above 76mm (3") are in sheet forms and available up to 38mm in thickness.
- Insulation thicknesses recommended within the above temperature ranges will control condensation on insulation surface under design conditions defined as follows:

MILD	Air conditioned and dry areas.
NORMAL	- Maximum severity in most indoor conditions (below 75% RH and 32°C).
SEVERE & EXTREMELY SEVERE	- Conditions of high humidity or poorly ventilated areas where temperature may be depressed below the ambient. Under conditions of high humidity, additional thicknesses of insulation may be required.

Thickness Recommendations For Insulation Of Ductings, Tanks And Equipment Of Cooling Systems

DESIGN CONDITIONS	METAL SURFACE TEMPERATURE				
	10°C (50°F)	7°C (44.6°F)	4.4°C (40°F)	0°C (32°F)	-17.8°C (0°F)
25°C (77°F) 75% RH	9mm	9mm	13mm	19mm	25mm
30.4°C (86°F) 70% RH	13mm	13mm	19mm	25mm	31mm
32.8°C (91°F) 80% RH	19mm	19mm	25mm	31mm	50mm
35.0°C (95°F) 90% RH	25mm	25mm	31mm	38mm	57mm

Technical Literature

44) Non-Return Damper

AEROTECH Volume Control Damper

Aerotech double skin blade volume control dampers are designed for a steady range of pressure and velocities

The performance of the parallel or opposed blade design for clean air systems allows superior performance in both constant and varying pressure drop applications

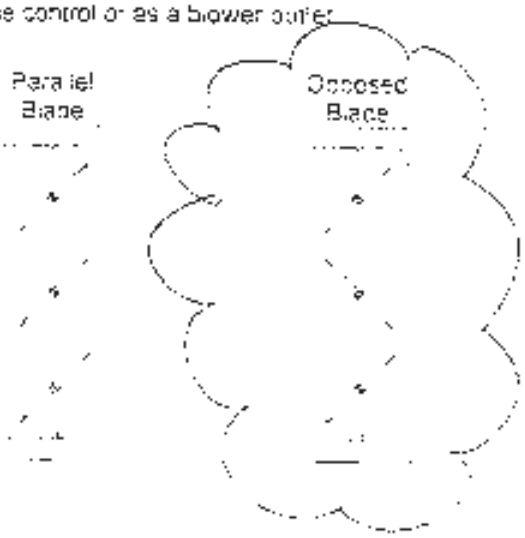
The parallel blade unit is recommended for constant pressure drop applications such as mixing air, multi-zone, face and bypass as well as normal open/close applications

The opposed blade unit is recommended for varying pressure drop conditions such as volume control or as a blower outlet

Options

Axles and linkage construction 304 or 316 stainless steel
Blade Seals, Insulation tape
Side Seals Stainless steel plate
Special flange width 100mm max
304 or 316 stainless steel construction
Manual or electric control options

Model VCD-M c/w hand quadrant for manual control
Model VCD-S c/w extend spindle for electric control



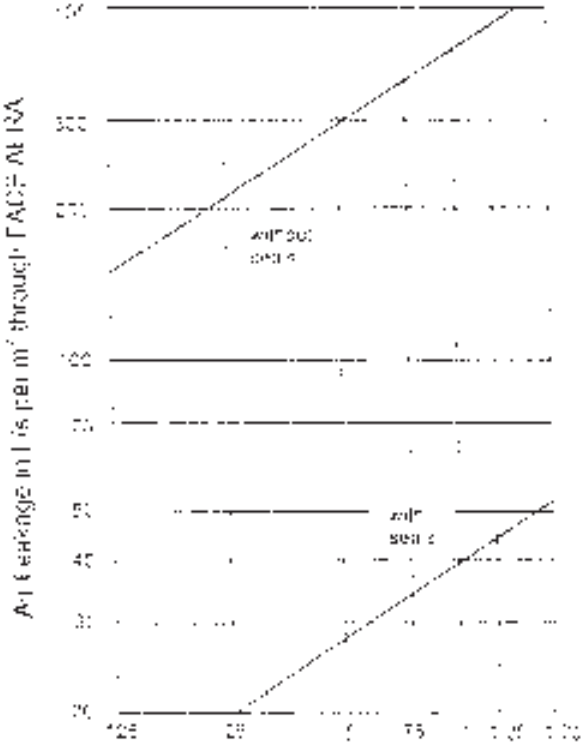
STANDARD SPECIFICATIONS

Max. Face Velocity	15m/s
Max. Diff. Pressure	1000Pa
Max Temp.:	120°C
Min. Panel Size.	100mm x 100mm
Max. Panel Size.	1200mm x 1200mm
Frame:	150mm x 52mm x 1.2mm galvanised steel
Blade:	150mm x 0.8mm galvanised steel double skin aerofoil blade
Axles:	13mm plated steel
Bearing	Oilless bronze bearing
Linkage:	Heavy duty plated steel.
Stop	Galvanised steel angle
Finish:	Mill.
Actuator	An external shaft 4" beyond frame on right is standard.

AEROTECH Volume Control Damper

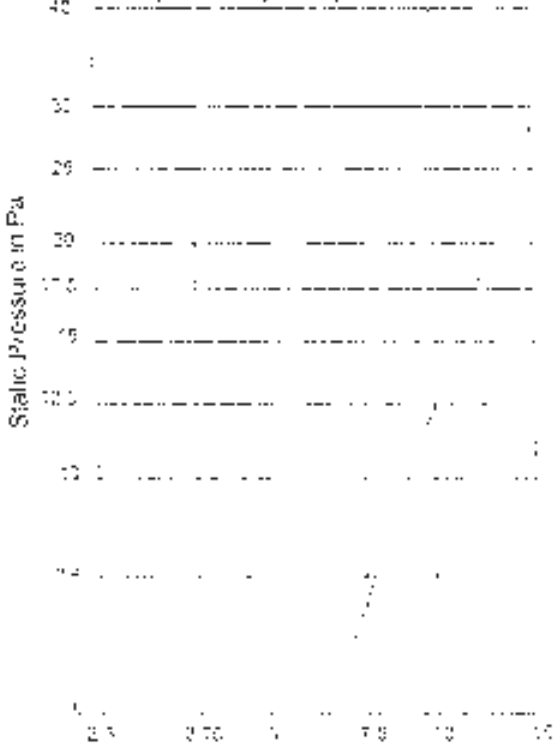
PERFORMANCE DATA

Air Leakage – Damper Closed



Static Pressure in kPa Tested per AMCA Std 500-D-98, Laboratory Methods for Testing Dampers for Rating

Pressure Drop – Damper Open



Air Velocity in m/s through FACE AERA Tested per AMCA Std 500-D-98 Laboratory Methods for Testing Dampers for Rating

C2

SUNWACORK INSULATION MATERIALS SUPPLIES LTD.
Sales Dept: G/F, 58-60 Larch Street, Tai Kok Tsui, Kowloon, Hong Kong.
電 : 2395 0295 (4 LINES) 2395 1236
FAX : (852) 2396 3827 / 3188 8756
WEBSITE : http://www.sunwacork.com

新華水松保溫材料有限公司
地 址 : 九龍大角咀海輝街58-60號地下
電 話 : 2395 0295 (四線) 2395 1236
傳真號碼 : (852) 2396 3827 / 3188 8756
網 頁 : http://www.sunwacork.com

專營：發泡水松、酚醛膠 (Phenolic Foam)、玻璃棉、岩棉、氣凝毛氈、橡塑海綿、膨脹膠、
自黏玻纖、自黏鋁箔、膠紙、鋁箔、鋁箔膠帶、膠水、金屬膠水、氣凝及其他金屬保溫工程。

Ref.No.: 005_ET)0.TW(CF.

Date: 30th January, 2013

To Whom It May Concern

Please be informed that Insulflex CFC free closed cell insulation is made of synthetic ins rated as Class "0" product according to BS476 Part 6 & Part 7.

To carry out the tests for physical properties and performance by recognized laboratory, we are advised to submit thickness 25mm for testing. All thickness is made of the same materials, thus, there is no double to consider as same materials even their thickness is different.

We hereby to clarify that Insulflex tape is also made of the same materials.
The tape sizes are 3mm(thick) x 50mm(width) x 10mm(length) &
6mm(thick) x 20mm(width) x 10m(length).
Other sizes is available on request.

For further information required, please feel free to contact us.

Yours faithfully,

For and on behalf of
新華水松保溫材料有限公司
SUNWACORK INSULATION MATERIALS SUPPLIES LTD.

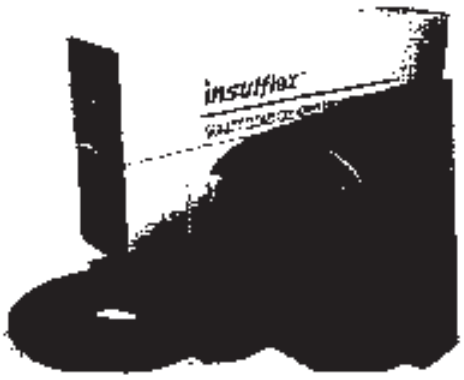
Authorized Signature(s)

Sandy Lau,
Executive Manager

THE PRODUCT

insulflex

High Quality Closed Cell Tubing And Sheet Insulation For Air Conditioning, Heating, Refrigeration and Dual Temperature Lines



Description:

insulflex is a flexible and light weight elastomeric nitrile rubber material designed for thermal insulation. Insulflex insulation is presently available in tubing and sheet form. The extruded flexible tubings are specially designed to fit to standard diameters of steel and copper pipes. Sheets are available in standard gauges of 6 mm.

Uses:

Insulflex expanded closed cell structure provides the most efficient vapour barrier for the prevention of condensation or frost formation on cooling systems such as water and refrigerant lines.

Insulflex also retards heat loss for hot water plumbing and heating. Sub temperature plumbing and cold systems it protects pipes by acting as a vibration damper and giving protection against corrosion by atmospheric and industrial environment.

Insulflex, being lightly moulded is ideally suited for the insulation of large surface area such as tanks, irregular shaped vessels, air-ducts and large diameter pipes.

Characteristics and Advantages:

Insulflex insulation material has been specially designed to provide the following features:

- Its low thermal conductivity (k value) which makes it highly efficient and effective in the insulation of cooling or heating systems.
- The cuchronic blister closed cell structure forms an impermeable layer which is in itself a good vapour barrier.
- It is suitable for application within the temperature range of -40 deg to + 105 deg C.
- The material has been specially compounded to be self extinguishing in nature.
- Insulflex has excellent ozone and ultraviolet ray resistance.
- It is CFC, chlorine and fibre free and does not cause skin allergy.
- It is also inert to majority of chemical agents and neutral to pipe metals.
- The extreme flexibility of the material makes installation fast, easy and economical.
- It is able to withstand tearing, rough handling and severe site conditions.
- Much lesser space is needed for Insulflex as a thinner wall is required due to its low k value as compared to other types of insulation.
- The smooth surface of Insulflex material gives the finished insulation a neat aesthetic appearance. No cooling is needed on most indoor installations.

TECHNICAL SPECIFICATIONS

insulflex Closed Cell Tubing, Sheet And Roll Insulation

AVERAGE PHYSICAL PROPERTIES	RATING	TEST METHOD
Density	32 kg/m³ to 128 kg/m³ (2 - 8 lb/ft³)	ASTM D 1667
Thermal Conductivity at 23°C (73°F) mean temp	0.0274 W/m°K (0.036 BTU in/ft² °F)	ASTM C 177
Temperature Limits °C	-40°C to +105°C	
Water Absorption % by weight	3	ASTM D 1056
Water Vapour Permeability Perm - in (Wet)	0.05	ASTM E 96
Ozone Resistance	excellent	
Thermal Stability % Dimensional Change 158°F (70°C)	4.8	ASTM D 2126
212°F (100°C)	5.0	
250°F (121°C)		
Average Combustibility Material	Class F	BS 476 PART 5
Average Fire Propagation	Class 1	BS 476 PART 6
Average Surface Spread of Flame	Class 1	BS 476 PART 7
Average Time to Extinction	less than 5 seconds	ASTM D 635 - 91
Average Extent of Burning	15 mm	
Flexibility	Excellent	
Weather and Ultraviolet Ray Resistance	Good	
Chemical Resistance	Good	
Odour	Negligible	
Mildew Resistance	No Fungal Growth	

- The above average physical properties are values obtained in accordance with accepted test methods.
- At -40°C, Insulflex Closed Cell insulation becomes hard and as temperature goes below -40°C will be increasingly brittle, however this hardening characteristic does not affect thermal or water vapour permeability.
- The Fire Rating standard method of tests conducted under controlled laboratory conditions is a measure of a material to spread flame when compared to a known standard and is not intended to reflect hazards presented by this or any other material under actual fire conditions.

insulflex Closed Cell Tubing And Sheet Insulation

Thickness Recommendations To Control Condensation In Pipe Insulation Of Cooling Lines

DESIGN CONDITIONS	PIPE SIZE	PIPELINE TEMPERATURE			
		14.4°C (58°F	7°C (44.6°F	2.6°C (36°F	-18°C (0°F
MILD CONDITION	10mm ID to 76mm PS	9mm	9mm	9mm	19mm
26.7°C 80°F	Above 76mm PS to 121mm PS	9mm	13mm	13mm	25mm
60% RH	Above 121mm PS to 254mm PS	13mm	19mm	19mm	38mm
NORMAL CONDITION	10mm ID to 76mm PS	9mm	19mm	19mm	32mm
32.2°C 90°F	Above 76mm PS to 121mm PS	13mm	19mm	19mm	38mm
75% RH	Above 121mm PS to 254mm PS	19mm	25mm	25mm	51mm
SEVERE CONDITION	10mm ID to 76mm PS	13mm	19mm	19mm	38mm
35.0°C 95°F	Above 76mm PS to 121mm PS	19mm	25mm	31mm	51mm
85% RH	Above 121mm PS to 254mm PS	19mm	38mm	31mm	63mm
EXTREMELY SEVERE CONDITION	10mm ID to 76mm PS	19mm	25mm	25mm	38mm
35.0°C 95°F	Above 76mm PS to 121mm PS	19mm	31mm	31mm	51mm
85% RH	Above 121mm PS to 254mm PS	25mm	38mm	38mm	63mm

- Insulation for pipes of 10mm ID to 76mm PS and equivalent rectangular tubing sizes with wall thickness of up to 25mm.
- Insulation above 76mm PS and for measurements not given above up to 38mm thickness.
- Insulation thicknesses recommended with the specific temperature ranges will control condensation on pipework under design conditions defined as follows:

MILD - Air-Conditioned and arid areas.

NORMAL - Maximum severity of most indoor conditions seldom exceed 29.4°C and 70% RH.

SEVERE & EXTREMELY SEVERE - Conditions of high humidity or tropical wet and arid areas where temperatures may be depressed below the ambient. Under conditions of high humidity, condensation leakages of insulation may be reduced

Thickness Recommendations For Insulation Of Ductings, Tanks And Equipment Of Cooling Systems

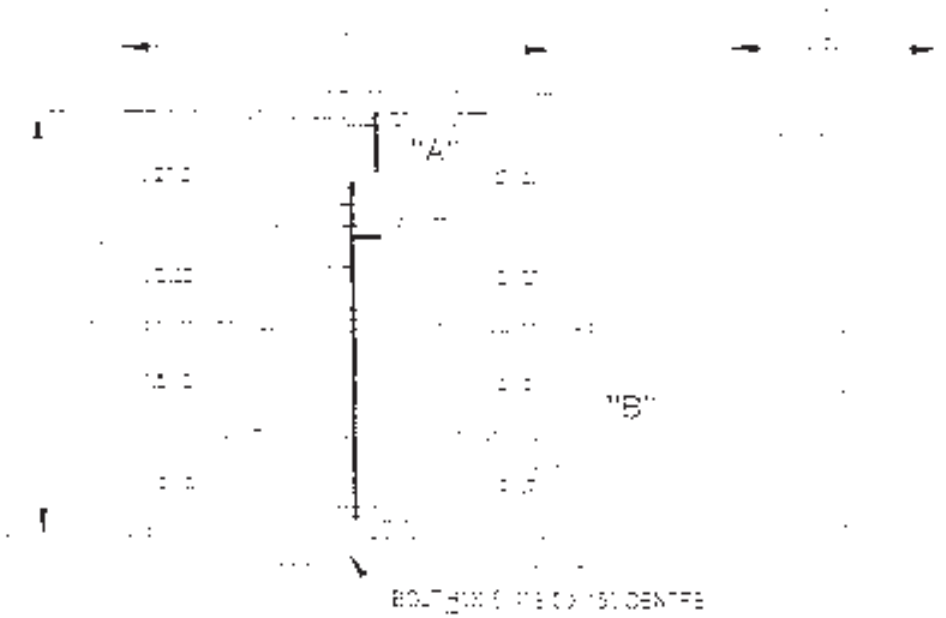
DESIGN CONDITIONS	METAL SURFACE TEMPERATURE				
	15°C (59°F)	12°C (53.6°F)	7°C (44.6°F)	2.5°C (36.5°F	-18°C(0°F
26.7°C 80°F 60% RH	9mm	9mm	13mm	19mm	25mm
32.2°C 90°F 75% RH	13mm	13mm	19mm	25mm	31mm
35.0°C 95°F 80% RH	19mm	19mm	25mm	31mm	38mm
35.0°C 95°F 85% RH	25mm	25mm	31mm	38mm	50mm

Technical Literature

45) Motorized Volume Control Damper

联明坪山冷气制品厂有限公司

FIRE DAMPER

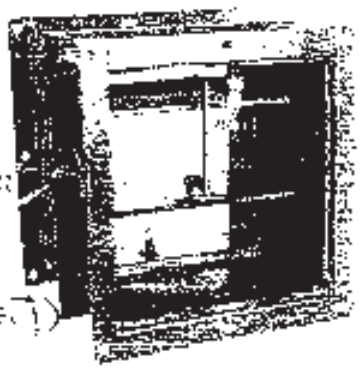


DETAIL "A"

DETAIL "B"

APPLICATION

Fire Damper is generally used for central air conditioning system in event of fire, Fire Damper will shut automatically, disconnecting air flow into the room, thus prevent spreading of fire.

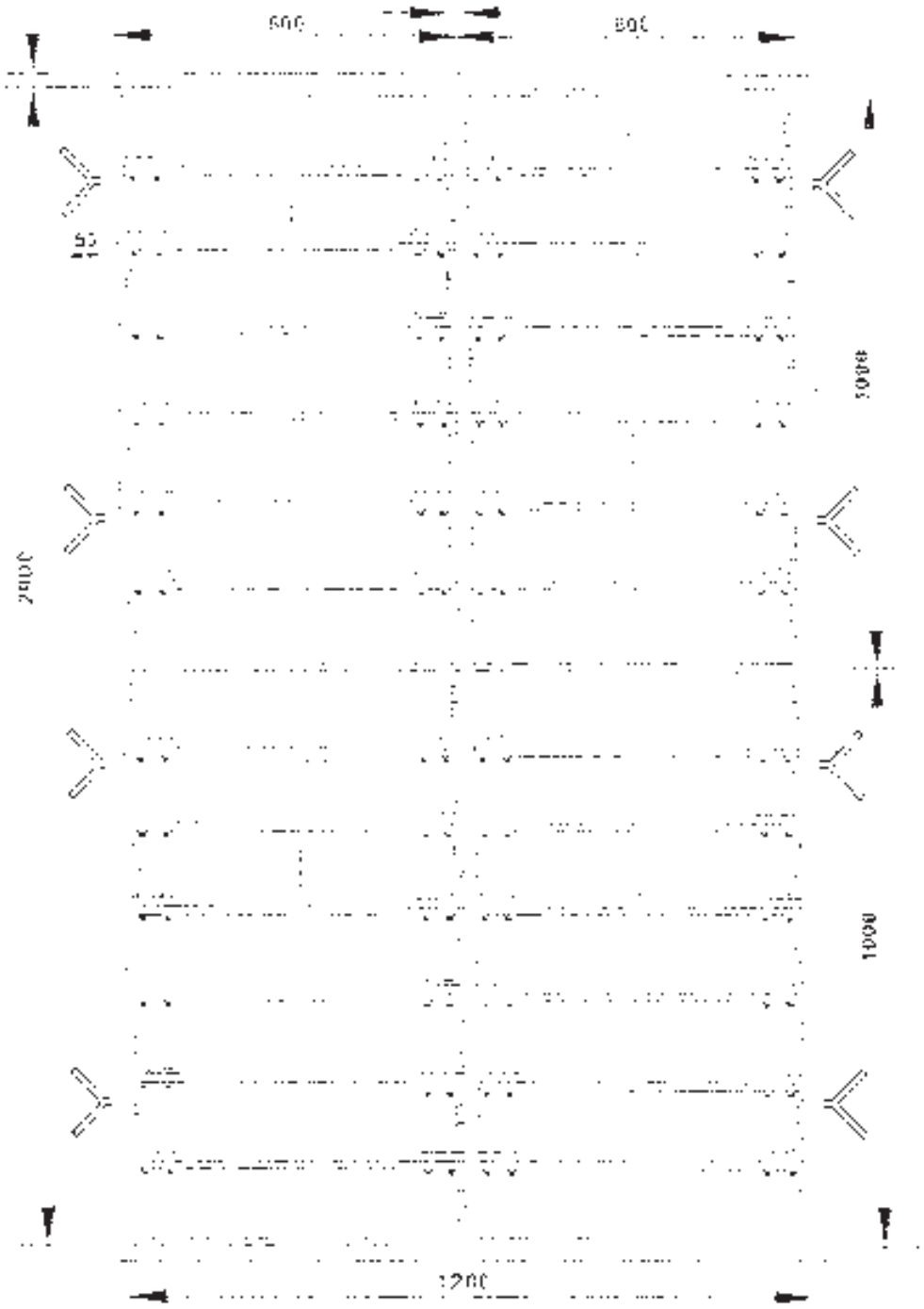


CONSTRUCTION

- Casing: 0.8mm thk galvanized steel sheet
- Blade Shafts: mild steel rod square tube
- Fire Rating: 4 hours
- Finish: Red lead Primer
- Fusible Link: 68°C Solder

STANDARD SIZES

Damper Size: 150<W<500 mm, 150<H<1000 mm
Depth: D=200 mm


600
600
1000
2000
1000
1200

Technical Literature

46) Fire Damper

RUSKIN®

3900 Dr. Greaves Rd. • Kansas City, MO 64030 • (816) 761-7476 • FAX (816) 765-8955

~~DIBD2~~ and DIBD23 CURTAIN TYPE DYNAMIC FIRE DAMPERS

1½ AND 3 HOUR UL555 RATED FOR USE IN DYNAMIC AND STATIC SYSTEMS

APPLICATION

~~DIBD2 fire dampers can be installed vertically in walls or horizontally in floors with fire resistance ratings of less than 3 hours. The DIBD2 carries a 1½ hour UL fire damper label and is classified as a dynamic damper for use in HVAC systems that remain in operation during a fire.~~

DIBD23 fire dampers can be installed vertically in walls or horizontally in floors with fire resistance ratings of 3 hours or more. The DIBD23 carries a 3 hour UL fire damper label and are classified as a dynamic damper for use in HVAC systems that remain in operation during a fire.

DYNAMIC CLOSURE RATINGS

MAXIMUM VELOCITY – 2,000 fpm (10.16 m/s) on all sizes.

MAXIMUM PRESSURE – 4 in. w.g. (1kPa)

STANDARD CONSTRUCTION

FRAME

20 gage (1.0) galvanized steel channel.

BLADES

24 gage (.7) galvanized curtain type in airstream.

CLOSURE SPRINGS

301 stainless steel constant force or spring clip type.

FUSIBLE LINK

165°F (74°C) is standard. 212°F (100°C) and 286°F (141°C) are available.

DAMPER SIZES

The sizes listed below are for A Style dampers. Refer to pages 2 and 3 for sizes of other style dampers.

MINIMUM SIZE

Vertical Installation – 4"w x 4"h (102 x 102)

Horizontal Installation – 6"w x 6"h (152 x 152) for dampers no larger than 24"w or 24"h (610 or 610). Dampers larger than 24"w or 24"h (610 or 610) have a minimum size of 10"w or 10"h (254 or 254).

MAXIMUM SIZE

Single Section

Vertical Installation – 33"w x 36"h (838 x 914)

Horizontal Installation – 24"w x 24"h (610 x 610)

Multiple Section

Vertical Installation – 72"w x 48"h (1829 x 1219), 48"w x 72"h (1219 x 1829) or 120"w x 24"h (3048 x 610)**

**90"w x 24"h (2286 x 610) for DIBD23

Horizontal Installation – 36"w x 48"h (914 x 1219)

OPTIONS

- **FM Approvals** as Specification Tested Product
- **Switch Package** to remotely indicate damper blade position
- **FAST Angle** for one side angle installations
- **G Style** for grille applications.
- **GA, Grille Access Type** for out of the wall/floor and no angle grille applications
- **OW, Out of Wall Type** for out of wall/floor installations.
- **Sleeve** of various lengths and gages to insure field compliance with UL installation requirements.
- **Access Door** factory mounted in common sleeve to ensure compliance with UL installation requirements.

NOTE: Dimensions shown in parenthesis ( ) indicate millimeters.

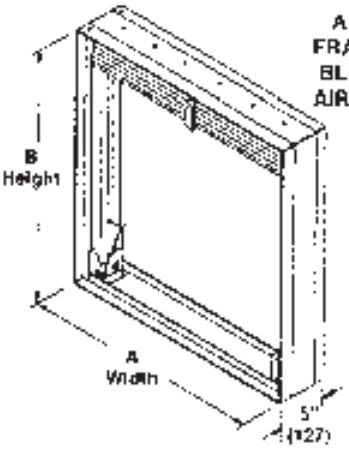
Models DIBD2 and DIBD23 meet the requirements for fire dampers established by:

- **National Fire Protection Association** NFPA Standards 80, 90A and 101
- **BOCA National Building Codes**
- **ICBO Uniform Building Codes**
- **SBCCI Standard Building Codes**
- **ICC International Building Codes**
- **CSFM California State Fire Marshal** Fire Damper Listing (#3225-245:005 and #3225-245:004)
- **New York City** (BSA Listing #297-71-SA and #298-85-SA)

UL CLASSIFIED
UL555 Listing R5531

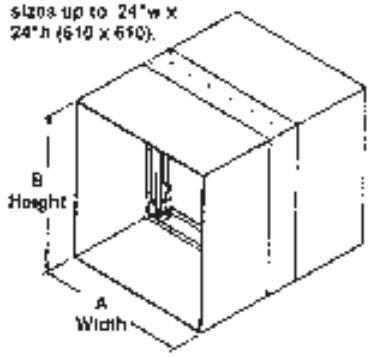
SEE COMPLETE MARKING ON PRODUCT

FM Approvals
Specification Tested Product
(Optional)

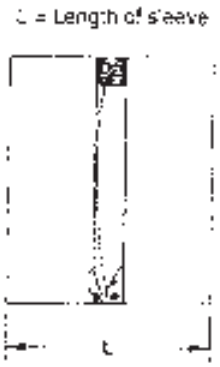


A STYLE FRAME AND BLADES IN AIRSTREAM

Taped and sealed on vertical sizes up to 33"w x 36"h (838 x 914) and horizontal sizes up to 24"w x 24"h (610 x 610).



DIBD2 OR 23 STYLE A IN 20 GAGE FACTORY SLEEVE



ASSEMBLY AND DIMENSIONAL INFORMATION

Dampers normally fabricated approximately ¼" (6) less than given nominal dimensions. A (width) and B (height) dimensions shown describe maximum UL Classified sizes. Ruskin recommends the submitting sheet metal, the engineer and the contractor agree on the installation design or fabrication.
DIBD2 and DIBD23 multiple section dampers ordered without sleeves are shipped in individual sections, for field assembly.
DIBD2 and DIBD23 multiple section dampers ordered with factory furnished sleeves are normally shipped in complete assemblies.
If TDF or other flanged breakaway connections are to be used, order dampers with factory furnished sleeves actual size.

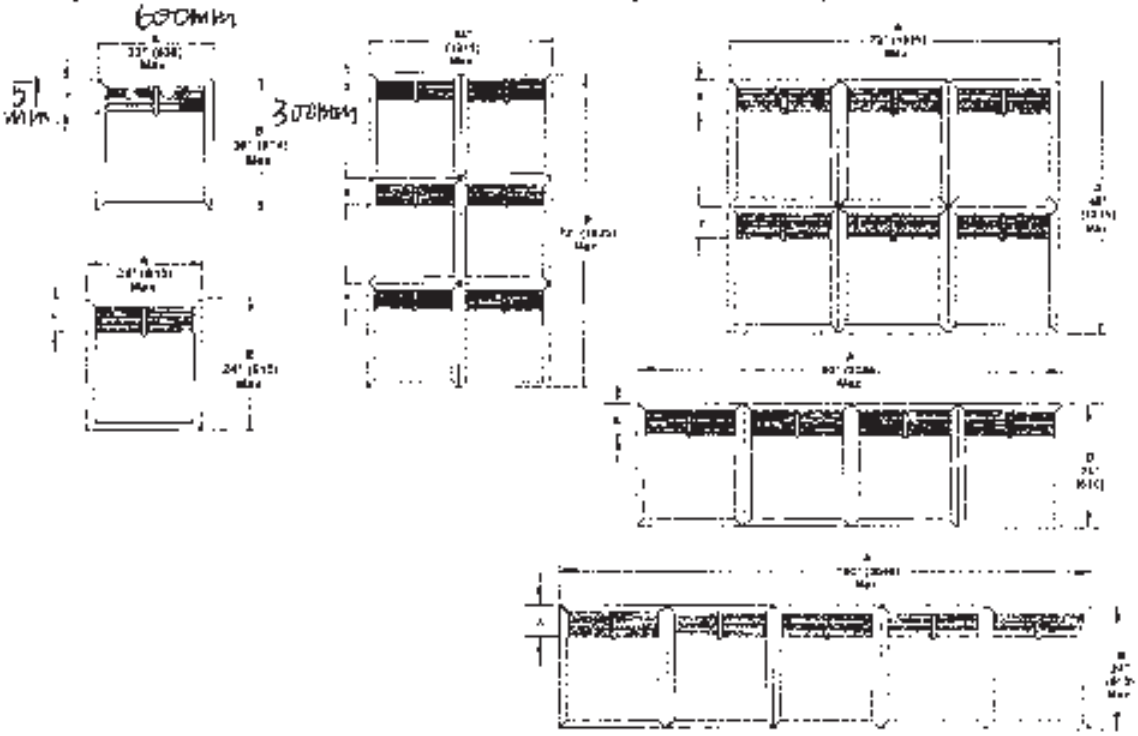
A STYLE DAMPERS

VERTICAL INSTALLATION

Important Note: Dampers larger than 33" x 36" (838 x 914) are multiple section dampers consisting of equal sections no larger than 24" x 24" (610 x 610).

Single Section Dampers

Multiple Section Dampers



	Blade Dimensions	
	B	X
6	(152)	1⅛ (29)
7	(178)	1⅛ (29)
8	(203)	1⅛ (29)
9	(229)	1⅛ (29)
10	(254)	1⅛ (29)
11	(279)	2 (51)
12	(305)	2 (51)
13	(330)	2 (51)
14	(356)	2 (51)
15	(381)	2 (51)
16	(406)	2 (51)
17	(432)	2 (51)
18	(457)	2 (51)
19	(483)	2 (51)
20	(508)	3 (76)
21	(533)	3 (76)
22	(559)	3 (76)
23	(584)	3 (76)
24	(610)	3 (76)
25	(635)	3 (76)
26	(660)	3 (76)
27	(686)	3 (76)
28	(711)	3 (76)
29	(737)	3 (76)
30	(762)	3 (76)
31	(787)	3 (76)
32	(813)	3 (76)
33	(838)	3 (76)
34	(864)	3 (76)
35	(889)	3 (76)
36	(914)	3 (76)

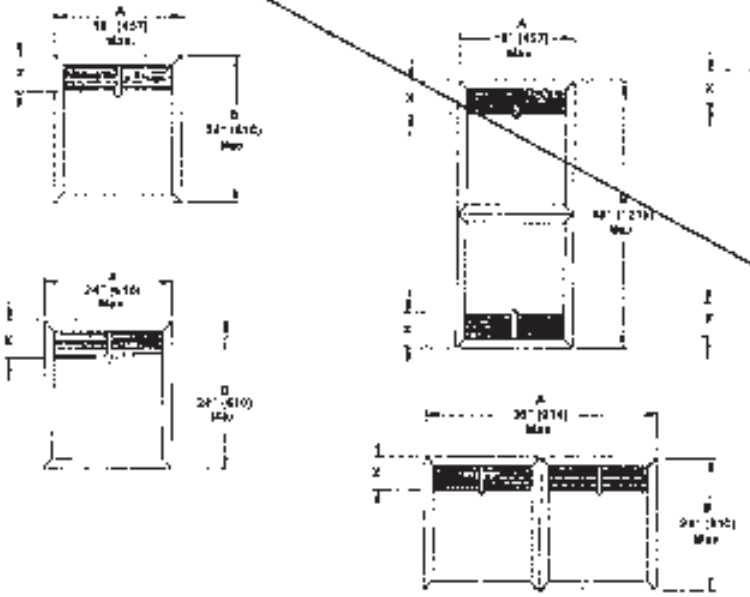
Dimensions shown in parentheses are in millimeters.

HORIZONTAL INSTALLATION

Important Note: Dampers larger than 33" x 36" (838 x 914) are multiple section dampers consisting of equal sections no larger than 24" x 24" (610 x 610).

Single Section Dampers

Multiple Section Dampers



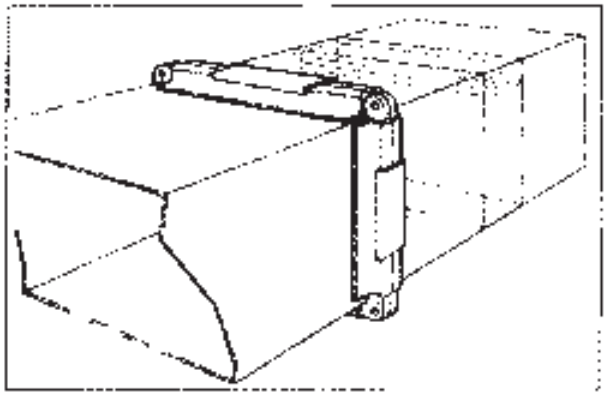
	Blade Dimensions	
	B	X
6	(152)	1⅛ (29)
7	(178)	1⅛ (29)
8	(203)	1⅛ (29)
9	(229)	1⅛ (29)
10	(254)	1⅛ (29)
11	(279)	2 (51)
12	(305)	2 (51)
13	(330)	2 (51)
14	(356)	2 (51)
15	(381)	2½ (63)
16	(406)	2½ (63)
17	(432)	2½ (63)
18	(457)	2½ (63)
19	(483)	2½ (63)
20	(508)	2½ (63)
21	(533)	2½ (63)
22	(559)	3 (76)
23	(584)	3 (76)
24	(610)	3 (76)

Dimensions shown in parentheses are in millimeters.

Important Notes:

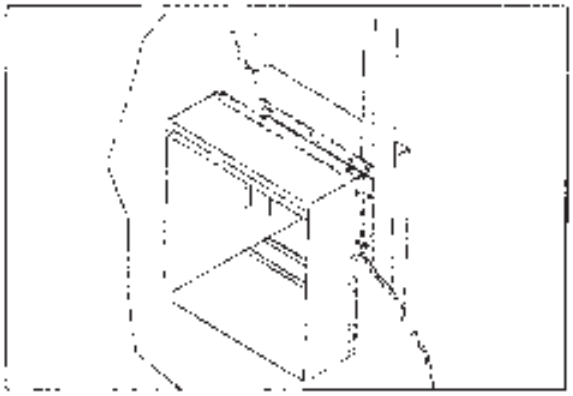
1. Dampers larger than 24" x 24" (610 x 610) are multiple section dampers consisting of equal sections no larger than 16" x 24" (457 x 610).
2. Dampers larger than 24"w or 24"h (610 x 610) have a minimum size of 10"w or 10"h (254 x 254).

LABOR SAVER OPTIONS



TDF OR DUCTMATE BREAKAWAY CONNECTIONS

Meet UL breakaway connection requirements without changing connectors. Ruskin fire dampers can be installed using non-matched flange connections for the breakaway requirement. Any flange connection can mate to a different type or model on Ruskin fire dampers.



FAST MOUNTING ANGLE

FAST mounting angles are used in lieu of conventional, eight piece mounting angles and are installed on only one side of the wall when used with Ruskin DIBD2 fire dampers. The FAST angle can be fastened directly to the metal stud underneath the fire rated gypsum wallboard.

SUGGESTED SPECIFICATION FOR DIBD2

Furnish and install, at locations shown on the plans, dynamic fire dampers tested, constructed and labeled in accordance with the latest edition of UL Standard 555. Dampers shall have a fire rating of 1½ hours and shall meet the requirements of the latest edition of NFPA90A.

Each damper shall include a 165°F (74°C) or 212°F (100°C) fusible link (***specifier select***) and shall be labeled for use in dynamic systems. Dampers labeled for use in static systems only are not permitted. The damper shall be rated for dynamic closure at 2000 fpm (10.16 m/s) and 4 inches w.g. (1 kPa) static pressure and shall be rated to close with airflow in either direction.

Each dynamic fire damper shall include a steel sleeve and mounting angles furnished by the damper manufacturer to ensure appropriate installation. Submittal information shall include the fire protection rating, maximum velocity/pressure ratings and the manufacturer's UL installation instructions. The dampers shall be installed in accordance with the manufacturer's UL installation instructions. Dynamic fire dampers shall be curtain type Ruskin model DIBD2.

SUGGESTED SPECIFICATION FOR DIBD23

Furnish and install, at locations shown on the plans, dynamic fire dampers tested, constructed and labeled in accordance with the latest edition of UL Standard 555. Dampers shall have a fire rating of 3 hours and shall meet the requirements of the latest edition of NFPA90A.

Each damper shall include a 165°F (74°C) or 212°F (100°C) fusible link (***specifier select***) and shall be labeled for use in dynamic systems. Dampers labeled for use in static systems only are not permitted. The damper shall be rated for dynamic closure to a minimum 2000 fpm (10.16 m/s) and 4 inches w.g. (1 kPa) static pressure and shall be rated to close with airflow in either direction.

Each dynamic fire damper shall include a steel sleeve and mounting angles furnished by the damper manufacturer to ensure appropriate installation. Submittal information shall include the fire protection rating, maximum velocity/pressure ratings and the manufacturer's UL installation instructions. The dampers shall be installed in accordance with the manufacturer's UL installation instructions. Dynamic fire dampers shall be curtain type Ruskin model DIBD23.

RUSKIN®

3900 Dr. Greaves Rd.
Kansas City, MO 64030
(816) 761-7476
FAX (816) 765-8955
www.ruskin.com

Technical Literature

47) Fire Damper (Curtain Type)

RUSKIN®

AMCA LICENSED
See Page 2

3900 Dr. Greaves Rd. • Kansas City, MO 64030 • (816) 761-7476 • FAX (816) 765-8955

FSD60 COMBINATION FIRE AND SMOKE DAMPER

1½ HOUR UL555 RATED, UL555S LEAKAGE CLASS 1

APPLICATION

Ruskin FSD60 ultra low leakage combination fire and smoke damper provides point-of-origin fire and smoke containment. The high strength one-piece true airfoil blades insure lowest resistance to airflow with velocities up to 4000 fpm (20.3 m/s) and 8 in. wg (2 kPa). The FSD60 may be installed vertically in walls or horizontally in floors and is rated for airflow and leakage in either direction.

OPERATIONAL RATINGS

UL555S LEAKAGE RATING
Leakage Class 1

UL555 RATED
Hourly Rating 1½

OPERATIONAL RATING

Velocity:	up to 4000 fpm (20.3 m/s)
Pressure:	up to 8 in. wg (2 kPa)
Temperature:	250°F (121°C) or 350°F (177°C)

STANDARD CONSTRUCTION

FRAME
5" x 16 gage (127 x 1.6) galvanized, single piece hat-shaped channel, structurally superior to 13 (2.3) gage channel frame.

BLADES
One-piece airfoil, 6" (152) wide and 16 (1.6) gage galvanized steel equivalent Parkweld. Blades are approximately 6" (152) on center.

BEARINGS
Stainless steel sleeve type pressed into frame.

JAMB SEALS
Stainless steel, flexible metal compression type.

BLADE SEALS
Silicone edge type for smoke seal to 450°F (232°C) and galvanized steel for flame seal to 1900°F (1038°C) mechanically fastened to the blade edge.

LINKAGE
Concealed in frame.

CONTROLLED CLOSURE DEVICE (HEAT-ACTUATED)
EFL (Electric Fuse Link) - 165°F (74°C) standard. 212°F (100°C), 250°F (121°C), 350°F (177°C) available.

PFL (Pneumatic Fuse Link) - 165°F (74°C) standard. 212°F (100°C), 286°F (141°C) available.

DAMPER SIZES

Sizes indicated below are 2000 FPM (10.2 m/s) and 4 in. w.g. (1 kPa)
See Extended Operational Ratings (page 5)

MINIMUM SIZE
8"w x 6"h (203 x 152).

MAXIMUM SIZE
Single Section Vertical – 32"w x 48"h (813 x 1219)
Single Section Horizontal – 30"w x 48"h (762 x 1219)
Multiple Section Vertical – 120"w x 96"h (3048 x 2438)
Multiple Section Horizontal
Electric Actuator – 120"w x 96"h (3048 x 2438)
Pneumatic Actuators – 144"w x 96"h (3658 x 2438)

NOTES

1. Damper are furnished approximately ¼" (6) smaller than given opening dimensions.
2. Dimensions shown in parenthesis ( ) indicate millimeters.

Model FSD60 meets the requirements for fire, smoke and combination fire and smoke dampers established by:

- **National Fire Protection Association** NFPA Standards 80, 90A, 92A, 92B and 101
- **ICC International Building Codes**
- **CSFM California State Fire Marshal** Fire Damper Listing (#3225-245:102) and Smoke Damper Listing (#3230-245:110)
- **New York City** (BSA Listing #176-82-SM)

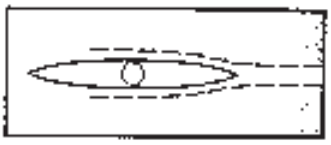
UL CLASSIFIED
UL555 Listing R5531, UL555S Listing R5531

SEE COMPLETE MARKING ON PRODUCT

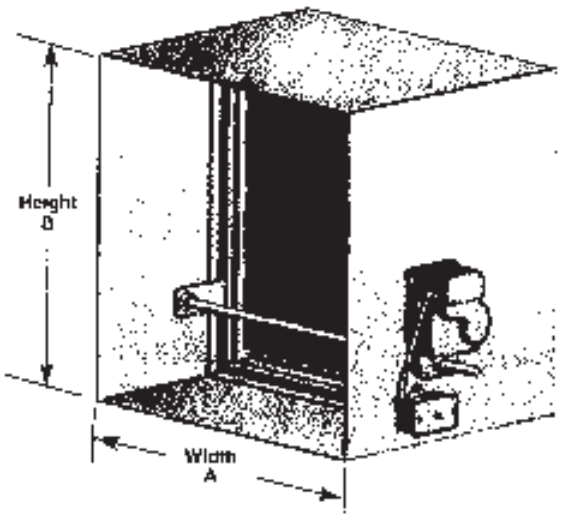
FM Approvals
Specification Tested Product (Option)

OPTIONS

- **FM Approvals** as Specification Tested Product.
- **DTS (Damper Test Switch)** test switch for cycle testing.
- **TS150 FireStat** for reopenable operation in dynamic smoke management systems
- **DSDF/DSDN Duct Smoke Detector** (Flow rated or No-Flow)
- **SP100 Switch Package** to allow remote indication of damper or damper blade position.
- **FAST Angle** factory supplied for labor saving angle one-side installations
- **MCP** control panels for test purposes or smoke management systems
- **Factory Sleeves** of various lengths and gages to insure field compliance with UL installation requirements.
- **FAST Angle** factory supplied for labor saving angle one-side installation. Other angles of various sizes and gages also available for one-side or two-side installation.



Ruskin Airfoil Blade



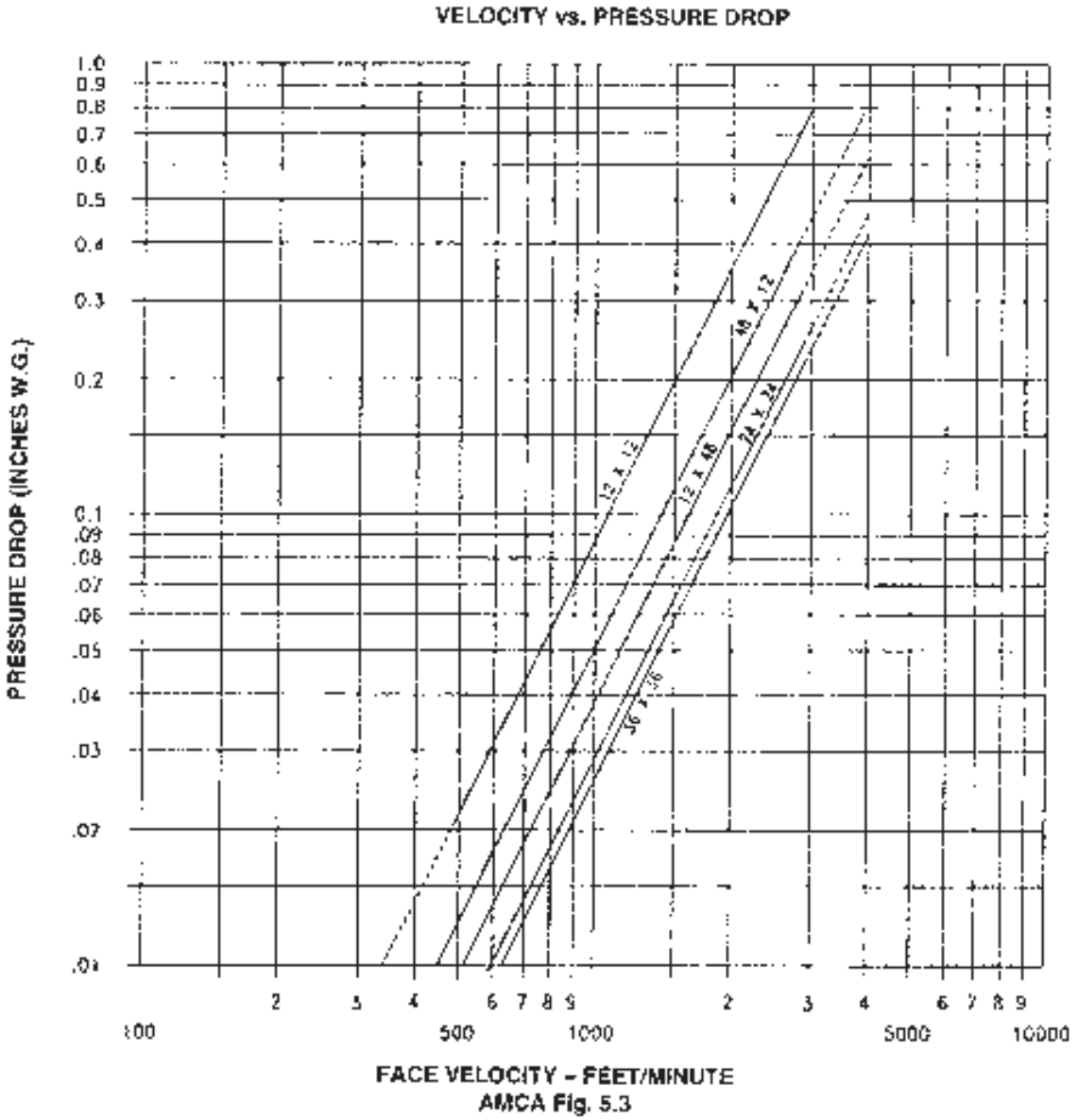
FSD60 AMCA LICENSED AIR PERFORMANCE DATA

Ruskin Company certifies that the FSD60 shown hereon is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance for the FSD60.

To determine the AMCA Licensed air performance:

Locate the applicable feet per minute face velocity on the bottom of the velocity vs. pressure drop chart below. Move up the chart to the most appropriate size damper line. From the intersection point, move left to determine the pressure drop on the left side of the chart.

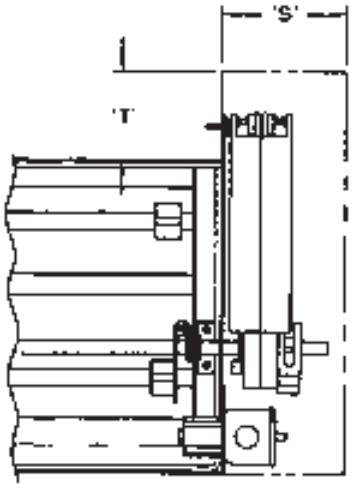
For other damper sizes refer to Air Performance Data For Alt Fire and Smoke Dampers spec sheet.



ACTUATOR and ACCESSORIES SPACE ENVELOPE

Ruskin's standard combination fire/smoke damper is external mount actuators and accessories. Ruskin's standard for combination fire/smoke dampers is external mount actuators and accessories. Also available is internal mount or a combination of external and internal mounted actuator and accessories.

Externally mounted actuators require space outside the damper sleeve. The "S" dimension is the "side" clearance, the "T" dimension is the "top" clearance required for the various actuators approved for use with Ruskin fire/smoke dampers. Actuators and accessories are factory mounted. Ruskin's standard mount is on the right side of the damper as viewed from the jackshaft face of the damper. (NOTE: damper assemblies larger than single section may require actuators to be mounted on both the right hand and left hand sides). Ruskin fire/smoke dampers can be rotated 180° or turned over to accommodate the application as long as the blades are in the horizontal position.



ACTUATORS	S	T
ML, FSLF, H2000 MS4209	4" (102)	0" (0)
FSNF, FSAF, MS4120	5" (127)	5" (127)
331-4827	5" (127)	5" (127)
331-2961	8" (203)	8" (203)
331-3060	9" (229)	11" (279)

NOTES:

1. The dimensions shown in the chart above are for dampers 14" (356) tall.
2. Dampers shorter than 14" (356) tall, increase the "T" dimension by 1" (25) for every 1" (25) the damper is less than 14" (356).
3. Dampers taller than 14" (356) high reduce the "T" dimension by 1" (25) for every 1" (25) the damper height is greater than 14" (356).

Example:

a) 12" (305) tall damper with a FSLF actuator, "T" = 2" (52) and "S" = 4" (102).

b) 18" (457) tall damper with a FSNF actuator, "T" = 1" (25) and "S" = 5" (127).

DAMPER SLEEVE DIMENSIONAL DATA

The drawing and corresponding table show the position of the damper when mounted in a factory sleeve. The standard mounting locations provide enough space for the mounting of actuators, controls and allow space for installation of retaining angles and duct connections. The minimum factory sleeve length is 17" (432). Consult Ruskin for shorter sleeve lengths.

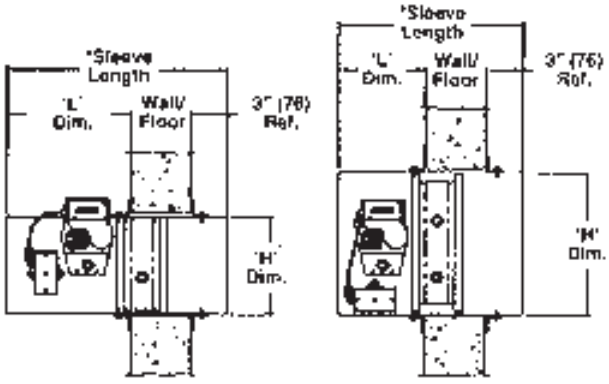
The standard location of a damper mounted in a factory sleeve ("L" dimension) is shown at right.

*Minimum Sleeve Length Formula:

Sleeve Length = "L" dimension + wall/floor thickness + 3" sleeve non-motor side

NOTE:

1. The entire damper frame is not required to be installed within the wall. The damper blades, when closed should be contained within the wall.
2. See basic UL installation instructions for complete installation requirements.



Actuator Side	All dampers with EFL or PFL		All dampers with TS150, SP100 or DTS							
			Electric Actuators		Pneumatic Actuators					
					331-4827(P)		331-2961(P)		331-3060(P)	
	'H' Over 10" (254) High	'H' 10" (254) High and Under	'H' Over 21" (533) High (see note)	'H' 21" (533) High and Under (see note)	'H' Over 28" (711) High	'H' 28" (711) High & Under	'H' Over 32" (813) High	'H' 32" (813) High & Under	'H' Over 40" (1016) High	'H' 40" (1016) High & Under
"L"	7⅛" (181)	10⅝" (270)	7⅛" (181)	10⅝" (270)	7⅛" (181)	10⅝" (270)	7⅛" (181)	10⅝" (270)	7⅛" (181)	10⅝" (270)

Note: The 21" (533) dimension becomes 32" (813) when the MS4120, MS8120, GGD221 or FSNF and FSAF Series are utilized.

EXTENDED OPERATIONAL RATINGS

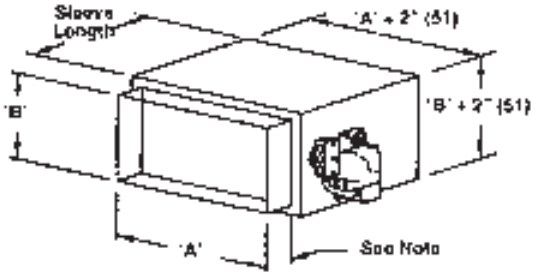
The UL555 and UL555S Test Standards require all fire, smoke and combination fire smoke dampers to prove closure or operation against heated air flow velocities of at least 2,000 feet per minute and 4 inches of water. All Ruskin fire, smoke and combination fire smoke dampers, in all sizes, meet those requirements. Some Ruskin fire, smoke and combination fire smoke dampers exceed those minimum requirements. The dampers which exceed the minimum requirements, ratings and sizes are listed below. **Consult Ruskin for the appropriate actuator model and quantities.**

MODEL	MAXIMUM SIZE	STATIC PRESSURE	TEMPERATURE	INSTALLATION
3,000 FPM				
FSD60	120" x 36" or 84" x 72"	4"	250°	Vertical
	120" x 36" or 60" x 72"			Horizontal
FSD60	120" x 32" or 84" x 84"	4"	350°	Vertical
	120" x 32" or 60" x 84"			Horizontal
FSD60	96" x 24" or 48" x 48"	6" or 8"	250°	Vert. or Horiz.
4,000 FPM				
FSD60	96" x 24" or 48" x 48"	4", 6", or 8"	250	Vert. or Horiz.

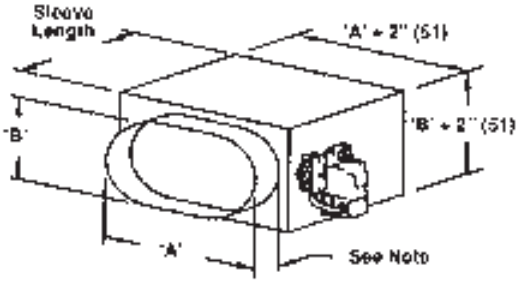
CTUATOR REQUIREMENTS

- UL555S requires that all smoke dampers have factory mounted actuators in order to bear the UL label.
- Smoke dampers larger than single section may require multiple actuators. See "Smoke Damper Multiple Section Detail" spec sheet for details.
- Ruskin's smoke dampers are UL555S labeled with either electric or pneumatic actuators mount internal (in air stream) or external (out of air stream).
- Smoke dampers utilizing multiple actuators must have all actuators field wired to a common point for simultaneous closure. All field wiring shall be in accordance with applicable codes, ordinances and regulations.

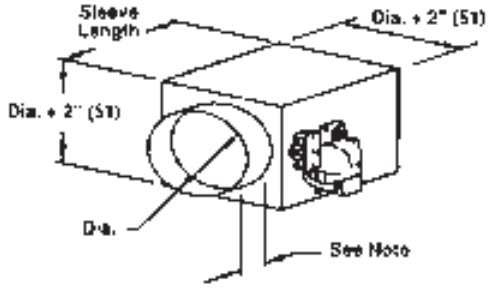
DIMENSIONAL INFORMATION



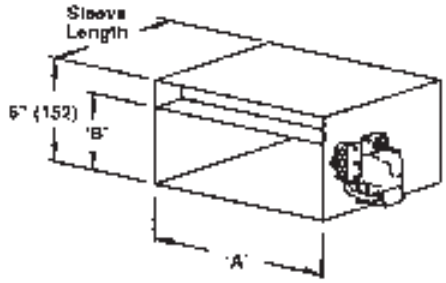
Style C and WC



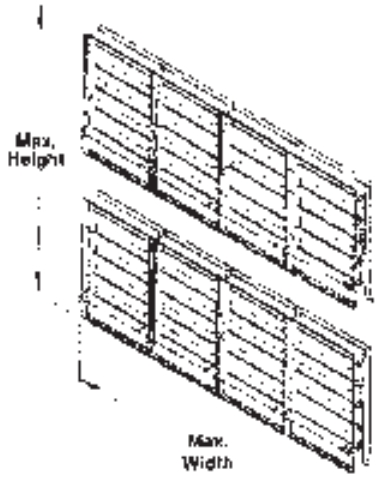
Style LO, CO and WO



Style R, CR and WR



Style B



DUCT TRANSITION CONNECTIONS

FSD36SS dampers may be supplied with Round, Oval and Rectangular duct connections

Style	Description
B	Units Under 6" Tall
R	Round Non-Sealed (Low Pressure)
CR	Round Sealed (Medium Pressure)
WR	Round Welded (High Pressure)
C	Rectangular Sealed (Low and Medium Pressure)
WC	Rectangular Welded (High Pressure)
LO	Oval Non-Sealed (Low Pressure
CO	Oval Sealed (Medium Pressure)
WO	Oval Welded (High Pressure)

The square damper size will be 2" (51) larger in width and height than the round, oval or rectangular duct size ordered.

MINIMUM and MAXIMUM SIZES

Round Transitions
Minimum 6" (152) diameter
Maximum 94" (2388) diameter

Rectangular and Oval Transitions
Minimum 6"w x 4"h (152 x 102)
Maximum 118"w x 94h" (2997 x 2388) in diameter

'B' Style Transitions
Minimum height 4" (102) 'B' style transitions are utilized on units where the damper height is less than 6" (152)

Consult Ruskin for other available styles and sizes.

Note: For medium pressure units (Styles CR, C and CO) the collar extends 1½" (38) beyond the sleeve length and for low pressure and high pressure units (Styles R, WR, WC and LO) the collar extends 2½" (64) beyond the sleeve length.

LEED 2009 Information

VOC Content (g/l) - 0

Manufacturing Locations (MR Credit 5.1)
Mira Loma, CA 91752
Parsons, KS 67357
Lexington, KY 40509
Fairmont, WV 26554

Recycled Content (MR Credit 4.1 & 4.2)
7.5% Post Consumer
7.5% Pre-Consumer Post Industrial

Approximate Damper Assembly Weight
17 lbs per sq ft

SPECIFICATION

Combination fire smoke dampers meeting or exceeding the following specifications shall be furnished and installed at locations shown on plans or as described in schedules. Dampers shall meet the requirements of NFPA90A, 92A and 92B. Dampers shall have a fire rating of 1½ hours in accordance with the latest edition of UL555 and shall be classified as Leakage Class I Smoke Dampers in accordance with the latest version of UL555S. Dampers shall be warranted to be free from defects in material and workmanship for a period of 5 years after date of shipment.

Each fire smoke damper shall be AMCA licensed and shall bear the AMCA Certified Ratings Seal for Air Performance. AMCA certified testing shall verify pressure drop does not exceed .03" w.g. at a face velocity of 1,000 fpm on a 24" x 24" damper.

In addition the dampers and their actuators shall have a UL555S elevated temperature rating of 250°F (121°C) or 350°F (177°C) depending upon the actuator. Appropriate electric or pneumatic actuators shall be installed by the damper manufacturer at time of damper fabrication. Electric actuators shall have been energized held open tested for a period of at least 1 year with no spring return failures.

Each fire smoke damper shall be equipped with a "controlled closure" quick detect heat actuated release device to prevent dust and HVAC component damage. Instantaneous damper closure through the use of fusible links is unacceptable.

Damper frame (when size permits) shall be constructed using the UniFrame Design Concept (UDC) and shall be a roll-formed structural hat channel, reinforced at the corners, formed from a single piece of minimum 16 gage (1.6) galvanized steel. Damper blades shall be airfoil shaped with 13 gage (2.3) equivalent thickness formed from a single piece of galvanized steel. Bearings shall be stainless steel turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be supplied with a factory mounted sleeve of 17" (432) minimum length. Dampers shall be Ruskin model FSD60.

(Consult Ruskin for detailed CSI *MasterFormat* Specification).

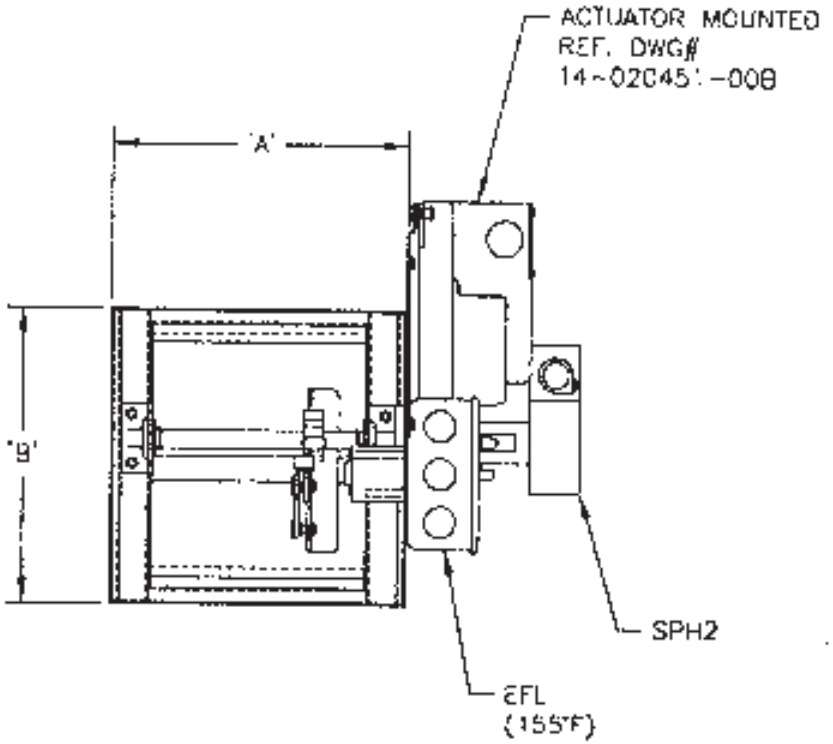
RUSKIN®
3900 Dr. Greaves Rd.
Kansas City, MO 64030
(816) 761-7476
FAX (816) 765-8955
www.ruskin.com

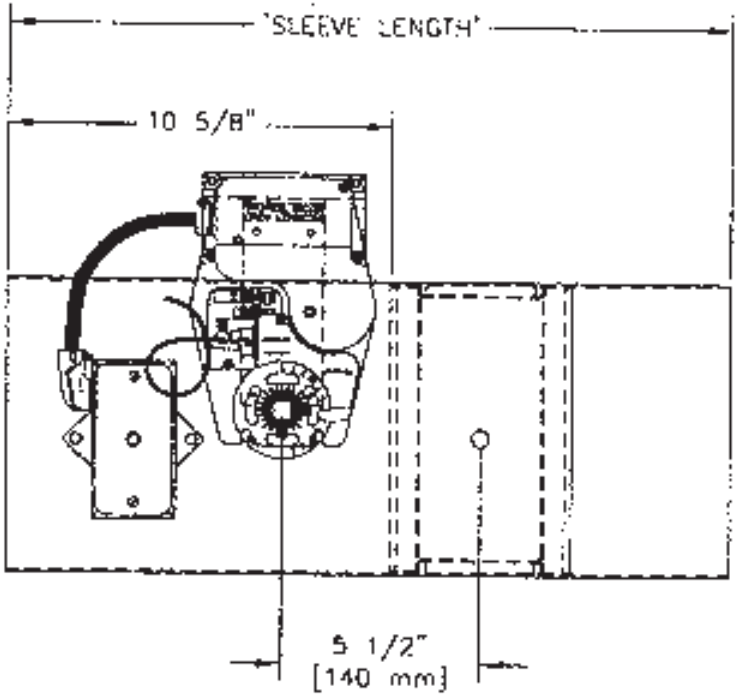
COMMERCIAL DAMPER SDA

MODEL NO.: FSD8C | STYLE: A | DEDUCT ☐ | ACTUAL SIZE ☒

QTY.	A OR DIA.	B	ACTUATOR MODEL	ACTUATOR QTY.	ACTUATOR FAIL	SLEEVE LENGTH	SLEEVE GA.	SHIP SECT.	TAG	LINE ITEM
4	8.031	8.031	H2230/3-S	1	CL	20	16	1		1
	204 mm	204 mm				508 mm				

NOTES:
1. NO UL LABEL IS REQUIRED.
2. BLADE ACTION IS OPPOSED.





REF. APPLIED TECHNOLOGY INTEGRATION LTD
P.O. NO. 12/007
CONTROL NO. 19:0317

DRAWN BY AGH DATE 02/16/12
APPV'D BY ____ DATE ____
SHEET 1 OF 4

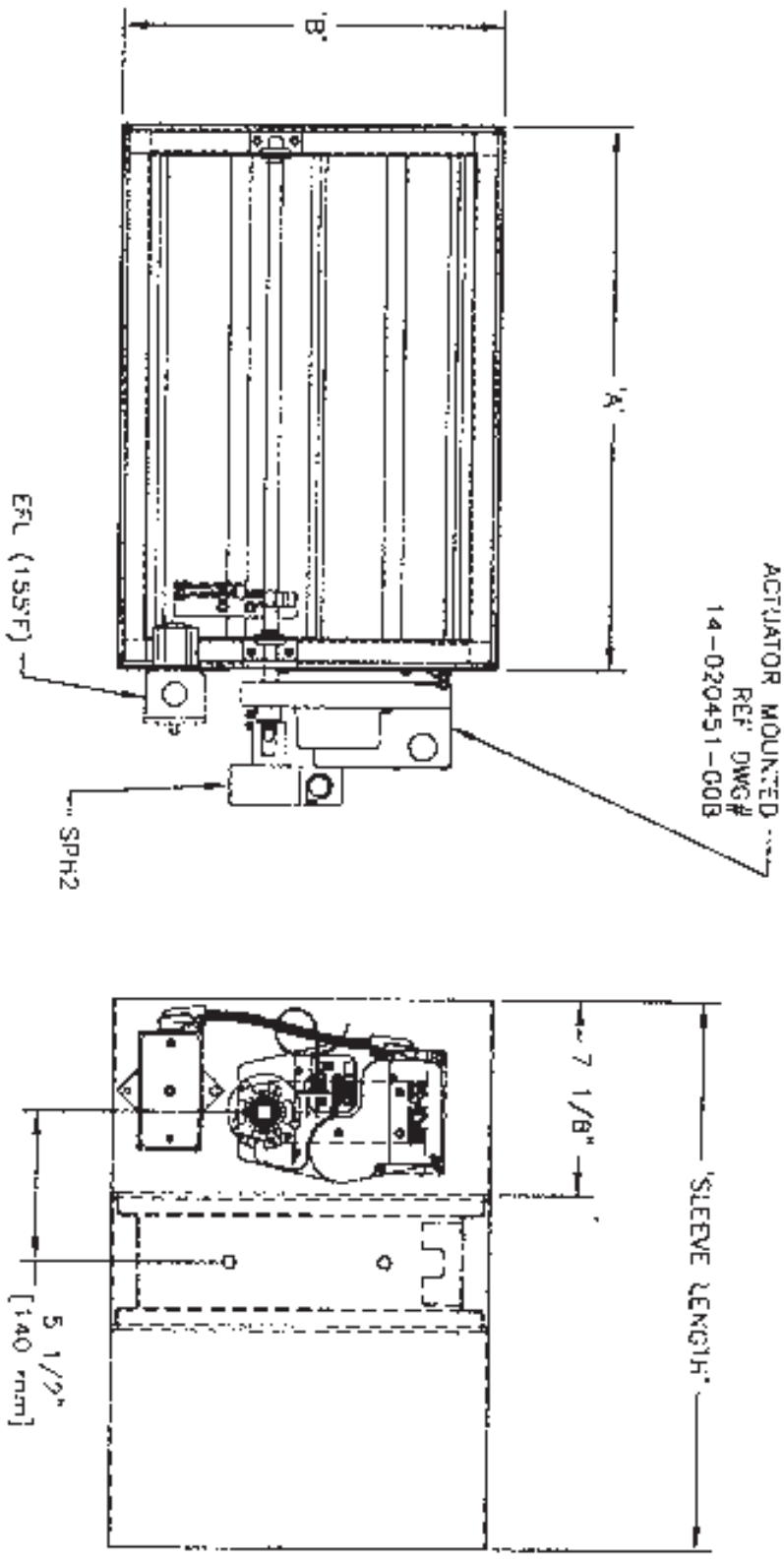
RUSKIN

NOTE: A x B DIMENSIONS ARE TO THE O.D. OF DAMPER FRAME OR O.D. OF DAMPER SLEEVE WHEN A SLEEVE IS ORDERED UNLESS SPECIFIED OTHERWISE.

MODEL NO.: FSD60 STYLE: A DEDUCT ☐ ACTUAL SIZE [X]

QTY.	A OR DIA.	B	ACTUATOR MODEL	ACTUATOR QTY.	FAIL	SLEEVE LENGTH	SLEEVE GA.	SHIP SECT.	TAG	LINE ITEM
2	19.688	13.781	M2230/3-S	1	CL	20	16	1		2
	500 mm	350 mm				508 mm				

NOTES:
1. NO UL LABEL IS REQUIRED.
2. BLADE ACTION IS OPPOSED.



NOTE: A x B DIMENSIONS ARE TO THE O.D. OF DAMPER FRAME OR O.D. OF DAMPER SLEEVE WHEN A SLEEVE IS ORDERED UNLESS SPECIFIED OTHERWISE.

COMMERCIAL DAMPER SD4

RUSKIN / EWARTWOLD

REP. APPLIED TECHNOLOGY INTEGRATION LTD
P.O. NO 12/007
CONTROL NO. 1910317

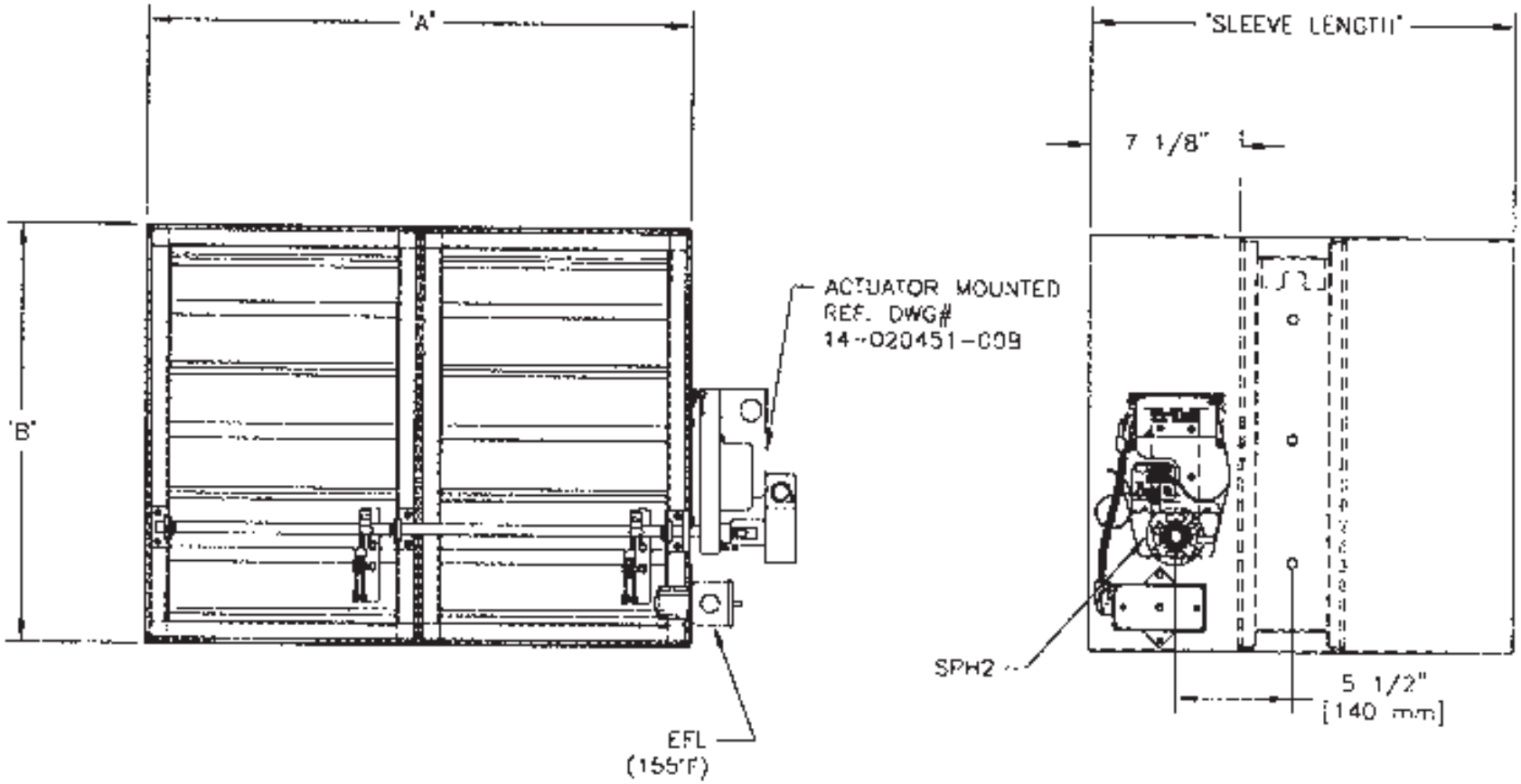
DRAWN BY ABH DATE 01/18/12
APP'D BY _____ DATE _____
SHEET 2 OF 4

COMMERCIAL DAMPER SDA

MODEL NO.: FSD60 | STYLE: A | DEDUCT ☐ | ACTUAL SIZE ☒

QTY.	A OR DIA.	B	ACTUATOR MODEL	ACTUATOR QTY.	ACTUATOR FAIL	SLEEVE LENGTH	SLEEVE GA.	SHIP SECT.	TAG	LINE ITEM
1	25.594	19.688								
	650 mm	500 mm	H2230/6-S	1	CL	20	16	1		3
						508 mm				

NOTES:
1. NO UL LABEL IS REQUIRED.
2. BLADE ACTION IS OPPOSED.



NOTE: A x B DIMENSIONS ARE TO THE O.D. OF DAMPER FRAME OR O.D. OF DAMPER SLEEVE WHEN A SLEEVE IS ORDERED UNLESS SPECIFIED OTHERWISE.

REP. APPLIED TECHNOLOGY INTEGRATION LTD
P.O. NO. 12/007
CONTROL NO. 19103-1

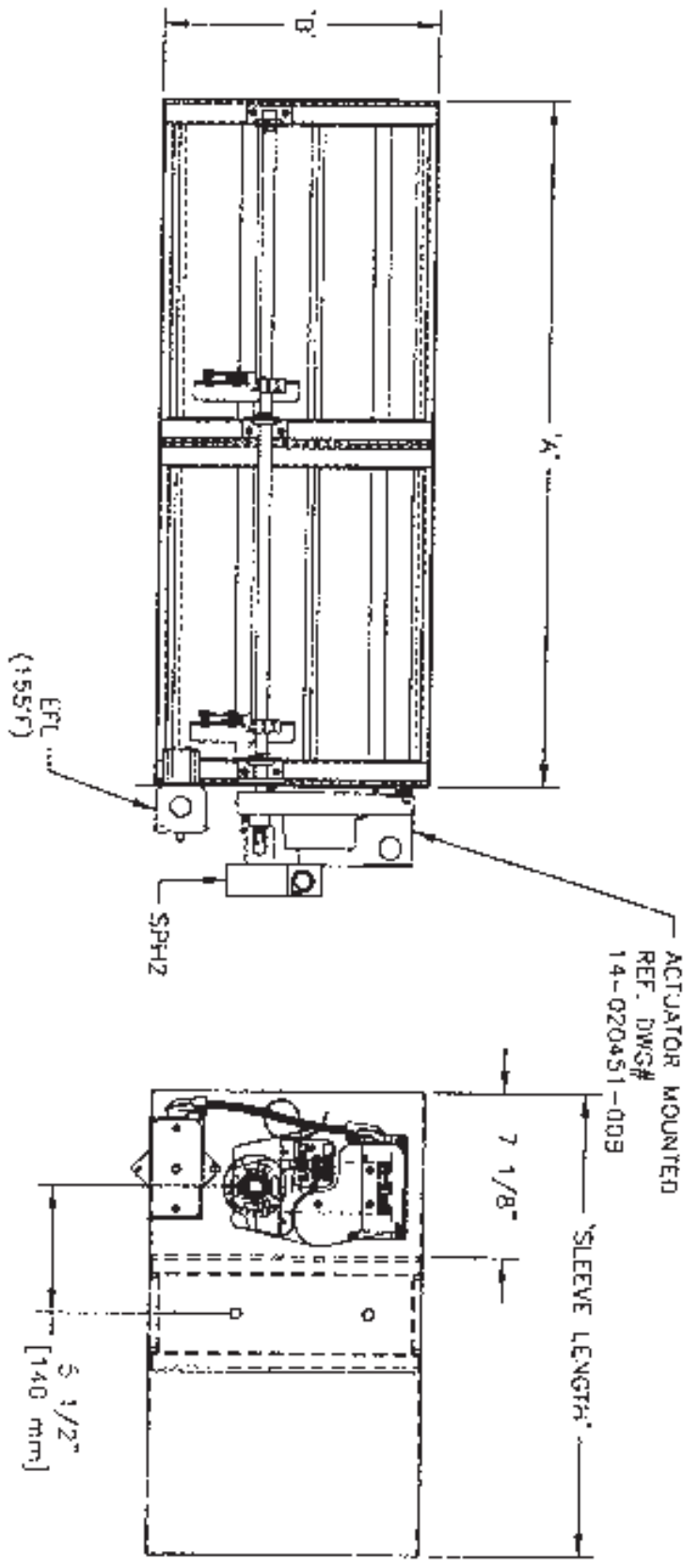
DRAWN BY: NBH DATE 01/18/12
APP'D BY: ____ DATE ____
SHEET 3 OF 4

RUSKIN COMPANY

MODEL NO.: FSD60 STYLE: A DEDUCT ACTUAL SIZE X

QTY.	A OR DIA.	B	ACTUATOR MODEL	ACTUATOR QTY.	ACTUATOR FAIL	SLEEVE LENGTH	SLEEVE GA.	SHIP SECT.	TAG	LINE ITEM
6	29.531	11.813	22.50/3-S	1	CL	20	16	1		
	750 mm	300 mm				508 mm				4

NOTES:
1. NO UL LABEL IS REQUIRED.
2. BLADE ACTION IS OPPOSED.



NOTE: A x B DIMENSIONS ARE TO THE O.D. OF DAMPER FRAME OR O.D. OF DAMPER SLEEVE WHEN A SLEEVE IS ORDERED UNLESS SPECIFIED OTHERWISE.

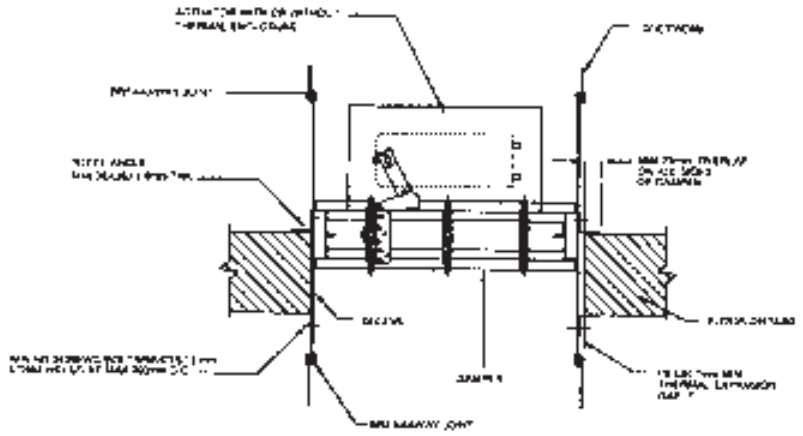
RUSKIN SWABEY WOLFE

REP. APPLIED TECHNOLOGY INTEGRATION LTD
P.O. NO. 12/007
CONTROL NO. 1910337

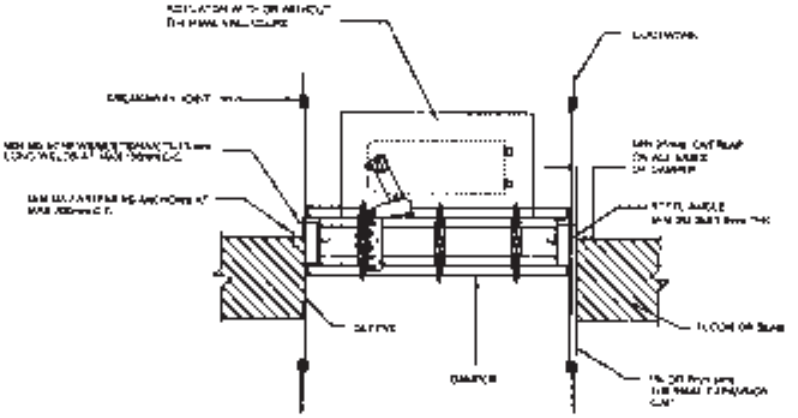
DRAWN BY ABF DATE 01/18/12
APP'D BY _____ DATE _____
SHEET 4 OF 4

COMMERCIAL DAMPER SDA

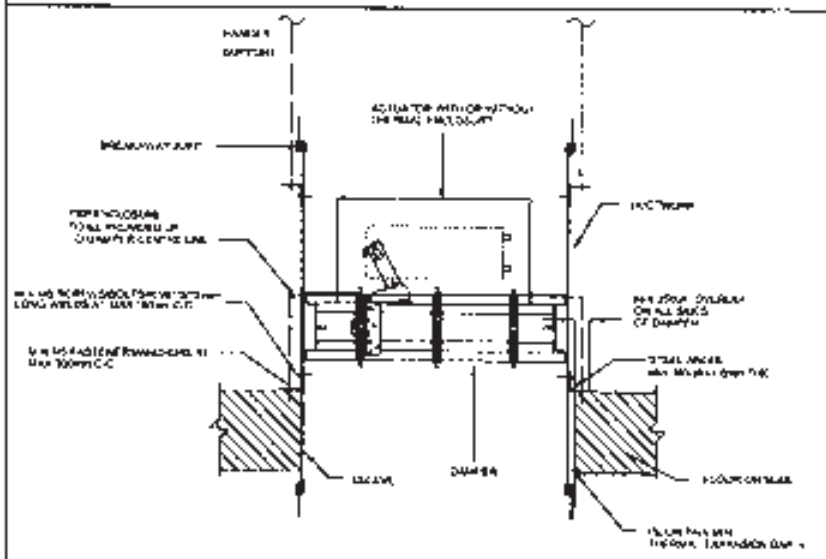
Installation Details.



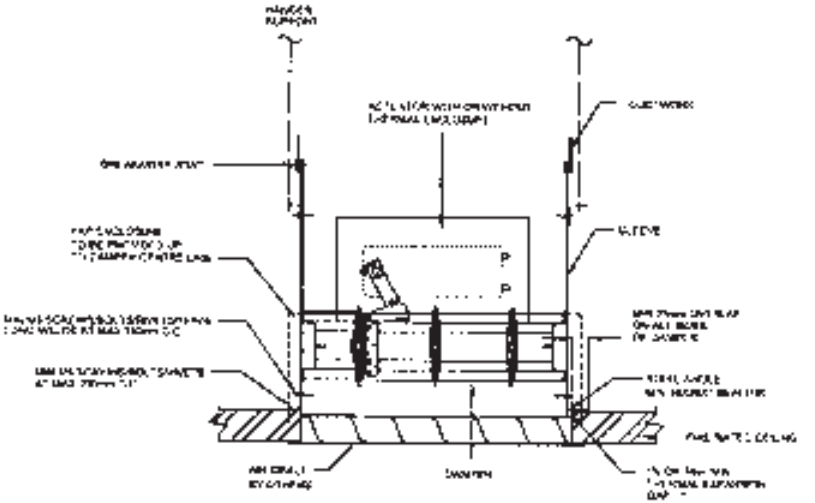
001 TYPICAL TWO ANGLES INSTALLATION



002 TYPICAL ONE ANGLE INSTALLATION[2]



003 TYPICAL OUT OF SLAB INSTALLATION[3]



004 TYPICAL FIRE RATED CEILING INSTALLATION[4]

NOTES:

1. [illegible] OF CLEARANCE INDICATED ON DRAWING TO THE SLEEVE TO ENSURE ON-TWO [illegible] FOR [illegible] INSTALLATION.
2. [illegible] INSTALLATION ONLY APPLIED ON DAMPER [illegible] ELECTRICAL.
3. [illegible] FASTENERS FOR FACADE FORMED [illegible] AND WALL OR CEILING SHOULD BE PROVIDED.
4. [illegible] INSTALLATION IS REQUIRED TO BE CONTRACTOR TO PROVIDE [illegible] MORE DETAIL TO ENSURE SLEEVE IS IN COMPLIANCE WITH [illegible] SPECIFICATION.
5. THIS [illegible] SUITABLE IN APPLICABLE FOR [illegible] FOR SLEEVE [illegible] AND WALL [illegible].
6. [illegible] SUPPORT AND/OR PROVISION [illegible] STRUCTURE TO AVOID CLASHING OR [illegible].

TITLE	TYPICAL HORIZONTAL INSTALLATION FOR MITRED CONFIGURATION (SHEET 1 OF 1)
DRAWING NO.	[illegible]
DATE	[illegible]
SIZE	[illegible]
DRAWN	[illegible]
CHECKED BY	[illegible]
REVISED BY	[illegible]
APPROVED BY	[illegible]

applied technology integration

RUSKIN®

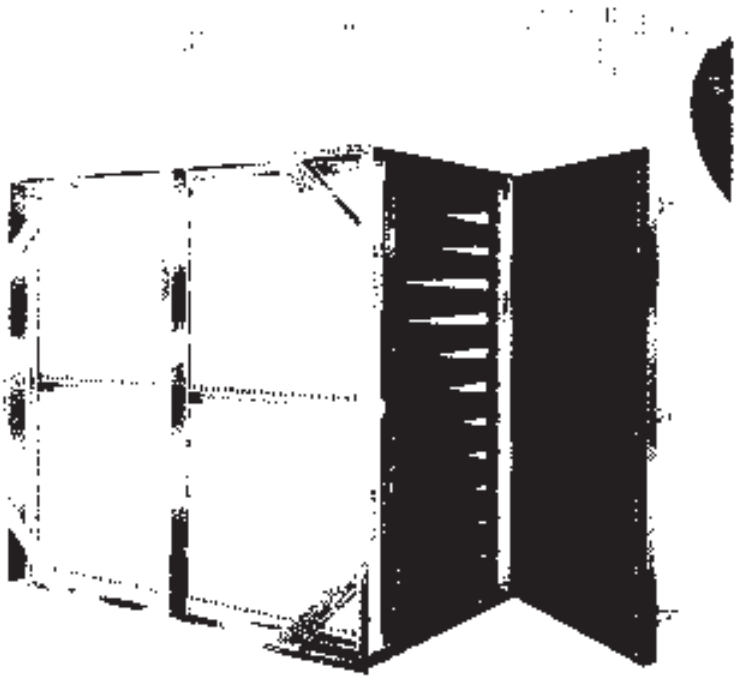
Technical Literature

48) Fire and Smoke Damper

AAF® *Better Air is Our Business®*

AmericanAirFilter® Side Access "Carbon"

Part of a Total Systems Approach to Improved Indoor Air Quality (IAQ)



The Carbon Concept

The Side Access Carbon filter housing is designed for use with air handling units or other side access equipment. It offers the convenience of servicing the filter from outside the air duct and is especially suited for installations involving limited headroom.

The Side Access Carbon housing is a gas phase filtration system. It removes gaseous contaminants (note: gaseous contaminants are not captured by particulate filters) from the airstream through adsorption and in some cases chemical neutralization. During the adsorption process, gaseous molecules are physically attracted to the surface of the adsorbent medium where they are captured and retained.

High Quality Media for Maximum Adsorption

The Side Access Carbon housing is available with a high quality activated charcoal (coconut shell based carbon), which is effective on a large range of common gaseous contaminants. The carbon conforms to a 4 x 8 mesh and has a minimum activity of 60% on carbon tetrachloride.

Since activated charcoal is not recommended on all gases, AAF International also offers alternative media such as activated alumina impregnated with Potassium Permanganate. The impregnant neutralizes the contaminant after it has been adsorbed. Such speciality media are effective on Formaldehyde, SO_2, and H_2S.

Prefilters Protect Adsorbtion Media

Prefilters are recommended to protect the adsorbent media. AAF recommends using 30% average efficiency rated filters (per ASHRAE 52.1-1992) ahead of the adsorber filters.

When an impregnated speciality media is used, after-filters should be installed (see AAF's Flatbank and Vee-Bank housing.) The after-filter will capture any dusting that may result from chemical reactions between the contaminant and the impregnant. The housing can also be installed in a reverse flow direction with the prefilter on the downstream side.

Trays are Easy to Use and Reuse

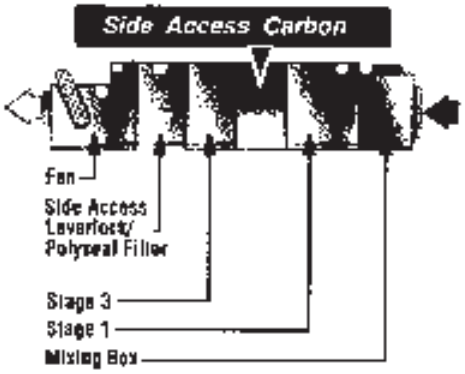
Each Side Access Carbon tray is furnished with 45 pounds of activated charcoal per 1,000 CFM of rated capacity. The retention time of the gas stream at the rated flow of 500 FPM is 0.09 seconds. Retention time can be increased by installing multiple housings in series or in parallel, or reducing the flow rate. The trays have a removable end cap which allows them to be refilled with fresh adsorbent on site. If desired, the emptied trays can be returned for refill.

Side Access Carbon, side view, showing "V" bank trays.

Side Access Filter Housing for IAQ Applications

The Side Access housing was specifically designed to meet IAQ air cleaning requirements when used with AAF high-efficiency prefilters treated with antimicrobial.

The Side Access housing is ideal for removing the gaseous contaminants, including VOCs (Volatile Organic Compounds), that cause allergic reactions, discomfort, and health risks. Buildings with a cleaner air supply have reduced maintenance costs and healthier, more productive employees and tenants.



Use the Side Access Carbon in combination with other AAF International IAQ-engineered filter products to enhance your system performance.

AmericanAirFilter
Side Access "Carbon"

Housing Features

Rugged Construction
The Side Access Carbon housing is manufactured with exceptional structural strength. It utilizes 1¾" wide flanges, welded construction, and vertical supports and angle braces. The Carbon housing is designed to operate at up to 6 in. w.g. negative or positive pressure.

Access Doors
Access doors are hinged and have over-center draw type plated latches. The doors seal against the housing using closed cell neoprene gasket. The standard housing is furnished with two doors.

Sizes
The Side Access Carbon housing is offered in 96 sizes spanning heights from nominal 1' through 8', and widths from nominal 1' through . Capacities range from 1,000 CFM to 48,000 CFM at 500 FPM.

Larger sizes are available. The Side Access Carbon housing is designed to expand using standard sizes as building blocks. For example, a nominal 16' wide unit can be built using two 8' wide modules or an 8' high unit using two 4' modules. Modules are factory pre-engineered for field installation.

Housing Depths
The standard housing is 36" deep, which includes a 2" or 4" prefilter track.

2" or 4" Prefilter
Available with a 2" or 4" prefilter track to accommodate standard 2" or 4" prefilters. The prefilters slide on raised rounded nibs for easy installation and removal.

Steel Skin Insulation
All Side Access Carbon housings can be furnished with optional 1" fiberglass insulation. Enclosed in a double metal skin, the insulation is external to the airstream. This optional insulation covers both doors, and top and bottom pans.

Standard

- 96 Sizes
- 2 Depths (36" & 38")
- 60% Activity 4x8 Mesh Coconut Shell Based Activated Carbon Charcoal
- Refillable Enamel Coated Steel Trays
- Structurally Rated up to 6" Positive Pressure
- 16-Gauge Galvanized Steel
- Welded Construction
- 1½" Turned Out Flanges
- Integral Prefilters, 2" or 4"
- Internal Bracing
- Factory Assembled

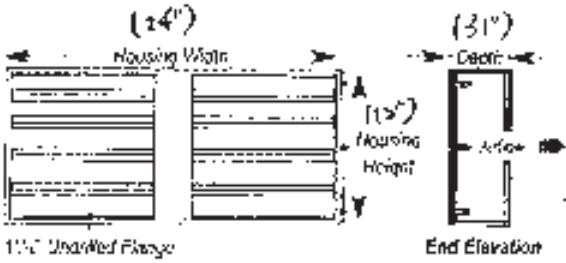
Options

- Double Skin Insulation
- AHU Mating Flanges
- Weatherproof Construction
- High Pressure Construction
- Installed Pressure Gauges
- Static Pressure Taps
- Specialty Media

Capacities (CFM) and Dimensions

Height ↓ Designation		Width → 1	2	3	4	5	6
	Housing	26¼"	49¾"	73¼"	96¾"	119¼"	143¾"
1	26¼"	2,000	4,000	6,000	8,000	10,000	12,000
2	51"	4,000	8,000	12,000	16,000	20,000	24,000
3	75¾"	6,000	12,000	18,000	24,000	30,000	36,000
4	99¾"	8,000	16,000	24,000	32,000	40,000	48,000

Note: Capacities are based on an airflow velocity of 500 FPM. Half size filter housings are available.



Prefilter Depth	Housing Depth
2"	36"
4"	36"

Total Operating Pressure Drop
Pre filter 50 Pa
Carbon filter 77 Pa
Total 127 Pa

Operating pressure drop at 500 FPM is 0.35 in. w.g.

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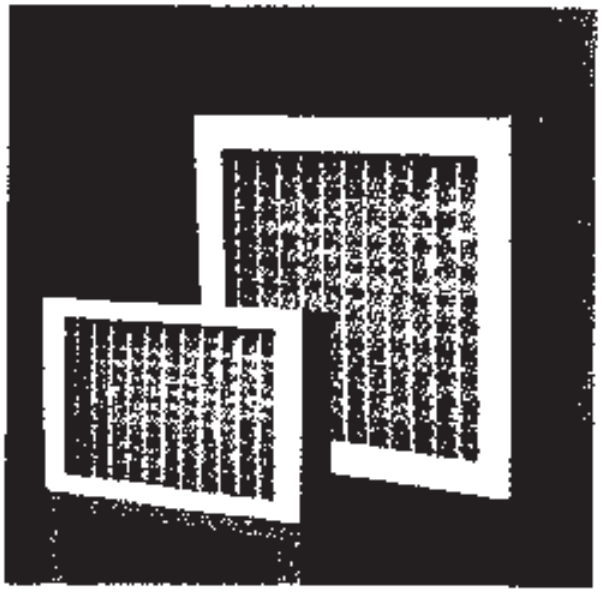
APC-1-1220 SEP 09

AmMet

Aluminum Washable Filter



- **Aluminum construction, save the cost of maintenance**
- **Low initial air resistance,high dust content,long useing**
- **Special graduated density wire mesh,easy to set and clean**

AmMet is used in heating, aeration and air-condition in industry and commerce. It's high dust content and water-fast because of the special graduated density aluminum mesh,and it will save the cost of replace and maintenance:

1.) reduce the frequency of cleaning and maintenance

2.) reduce the danger of causing fire

3.) extend the life of motor

Special construction

Special graduated density wire mesh can make the prefect filter affect, the polluted air dust will be adsorb by the filter, and the ripple aluminium layer have the enough dust space to accept it.AmMet can be used in the temperature of 300℃.

Fit and maintain

AmMet have the Strong construction, it can prevent the moving between the drape aluminum , and it can be used in the hard circumstance. It's very light and agility (the thickness is only 46mm) , it reduce the cost of travel ,move and fit is become more easier. If it need, we will have have any size of stainless steel and galvanization construction to be choosed for you.

AmMet can clean by compress air blowing, and it can be repeated use. It can be cleaned by cleanser in the limited times for repeated using.

Data

Nominal size (inches)	Trim size (mm)	Rated flow m³/h at 2.5 m³/s
12×24×1	289×594×21	1700
20×20×1	492×492×21	2178
24×24×1	594×594×21	3400
20×20×2	492×492×46	2179
20×25×2	492×619×46	2741
24×24×2	591×594×46	3176

material	standard
frame	Aluminium crushed material
Filter material	Excessive ripple aluminium material

(Different size: 24" (in) . x 12" (ft) x 2")

AAF (Shenzhen) Co., Ltd.
Factory address: fenglong road fuming industrial park qinghu town in Shenzhen ,china post number: 518111
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The tenet of AAF is to change the pre-design and not to inform before.

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AmericanAirfilter
SAAFCarbon Tray

SAAFCarbon Tray 化学过滤器由静电喷塑的冷轧孔板盒体组成，用于装填 AAF 的专利化学滤料，主要应用于商业和工业中央空调的风管中，以及 AAF 专利的化学气体净化系统中。

滤料填充口

滤料填充口采用专利的免接密封技术，确保无泄漏，填充盖结构稳定，无脱落，滤料填充方便快速。

型号说明

CT---C---2---2---2

- 2" 厚
- 24" 宽
- 24" 长
- 预填化学滤料
  - C：Carbon
  - B：Blend GP
  - O：Oxidant
- 孔板式化学过滤器

结构特点

采用数字冲孔设备加工成型，孔径精确度高，落料、板材之间焊接精细，无焊渣，无泄漏，整体外观采用静电喷塑处理，美观大方。

数据表

型号	名义尺寸 (H×W×D) (in.)	压降 (Pa@2.5m/s)
CT---C---1---1---1	12" ×12" ×1"	77
→ CT---C---1---2---1	12" ×24" ×1"	77
CT---C---2---2---1	24" ×24" ×1"	77
CT---C---1---1---2	12" ×12" ×2"	146
CT---C---1---2---2	12" ×24" ×2"	146
CT---C---2---2---2	24" ×24" ×2"	146

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ISO 9001:2000 认证

AAF INTERNATIONAL *Better Air is Our Business®*

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AmericanAirFilter®

SAAFBlend™ GP

General Purpose Engineered Gas Removal Chemical Media

- ***Non-toxic and non-hazardous***
- ***Accurate service life testing***
- ***Will not support bacterial and fungal growth***
- ***Does not support desorption***
- ***Easy disposal***

Engineered Media

SAAFBlend™ GP engineered gas removal chemical media is designed to efficiently remove 99.5% of specific gaseous contaminants from airstreams. Target contaminants include:

- Sulfur dioxide
- Hydrogen sulfide
- Nitric oxide
- Formaldehyde
- Hydrocarbons (VOC's)
- Lower molecular weight aldehydes and organic acids

Manufactured from an equal volumetric mix of SAAFOxidant™ and SAAFCarb™. Manufactured of spherical and porous pellets, SAAFOxidant engineered media is composed of a combination of activated alumina and other binders. Potassium permanganate is impregnated to this media combination in order to provide optimum adsorption, absorption, and oxidation of various gaseous contaminants. Potassium permanganate is applied uniformly during pellet formation and is distributed throughout the pellet volume. This process provides the maximum amount of impregnate for chemical reaction and optimal performance. SAAFCarb is manufactured of pelletized activated carbon media, composed of high quality virgin substrates in order to provide optimum adsorption for various gaseous contaminants.

Adsorptive Process

The unimpregnated SAAFCarb media removes toxic and impure gases by physical adsorption. In this process, the gases remain on the surface of the pellet. The process is reversible.

Chemisorptive Process

The SAAFOxidant chemisorptive process removes the contaminant gases by adsorption, absorption, and chemical reaction. In this process the gas is trapped within the pellet where oxidation changes the gases into harmless solids, thereby eliminating the possibility of desorption. SAAFOxidant's engineering allows this to be instantaneous, irreversible, and safe chemical reaction.

Quality Control

SAAFBlend GP media undergoes the following quality control tests before being shipped:

- Moisture content
- Hardness
- Bulk density
- Ash content
- Carbon tetrachloride adsorption

Service

AAF International will be pleased to offer you a maintenance contract for your chemical filter system. This includes sampling, removal of the used elements, cleaning of the installation and installation of new elements. Disposal in accordance with regulations and/or refilling is part of our scope.

AmericanAirFilter
SAAFBlend™ GP

Specifications

Physical Properties SAAFOxidant™ Fraction

Moisture content:	35% maximum acc. ASTM D2867
Crush strength:	35 - 70%
Abrasion	4.5% maximum acc. ASTM D3802
Apparent bulk density:	800 kg/m³ acc. ASTM D2854
Nominal pellet diameter:	3.175 mm
Potassium permanganate content	8% minimum

Physical Properties SAAFCarb™ Fraction

Moisture content:	< 3[wt %] acc. ASTM D2867
BET rating, active area:	> 1000 [m²/g] acc. DIN 66132
Abrasion resistance:	> 95 [%] acc. ASTM D3802
Ash content:	< 12 [wt %] acc. ASTM D2472
Ignition temperature	> 400 [°C] acc. ASTM D3466
Pore volume:	> 1 [cm³/g] acc. DIN 66132
Apparent bulk density	480 [kg/m³] acc. ASTM D2854
Nominal pellet diameter	4 mm
CTC rating:	> 60 [wt%] acc. ASTM 3467

Application Guidelines

Packaging Options

Containers:	25 liter (1 ft³)
Big bags	560 liter (20 ft³)
Ready factory filled into:	SAAF Canisters, Cassettes and Trays

Performance

Temperature:	-20°C to 50°C
Humidity:	10-95% r.H.

Applications

Airflow:	From 40 m³/h to over 170,000 m³/h
Velocity:	From 0.30 to 2.5 m/s

Refer to appropriate AAF documentation for additional information on delivery systems.

Precautions

Installation:	Use dust masks, safety goggles, and rubber gloves
MSDS	Included in each shipment
Disposal:	Must be disposed of according to local, state, and federal regulations

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Customer Service 888 AAF 7000
Fax 888.223.8500

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AmericanAirFilter®
SAAFCarb™ Media

- ***Non-toxic***
- ***System design ensures standard removal capacity***
- ***Quick and easy media changeovers***
- ***Resists a wide range of impure gases***
- ***Low pressure drop and high adsorptive capacity***
- ***Capable of being destroyed for use as fuel***

The SAAFCarb media is pelletized activated carbon that removes toxic and impure gases from the environment. The activated carbon is composed of bituminous coal substrate.

Application Note

The SAAFCarb media efficiently removes 99.5 percent of the contaminant from the SAAFCarb systems.

Target Impurities

- *Nitrogen dioxide*
- *Hydrocarbon*
- *Chlorine*
- *Volatile organic compounds*

Adsorptive Process

The SAAFCarb media removes toxic and impure gases by adsorption. In this process, the gases remain on the surface of the pellet.

Removal Capacity

SAAFCarb media meets the following contaminant removal capacities by weight:

- *Nitrogen dioxide: 6.6% minimum*
- *Toluene: 20.0 % minimum*
- *Chlorine: 10.0 % minimum*
- *Trichloroethane: 20.0%*

For instance, 100 pounds (45.36 kg) of SAAFCarb media will remove a minimum of 10 pounds (4.53 kg) of chlorine gas.

Quality Control

SAAFCarb media undergoes the following quality control tests before being shipped:

- *Moisture content*
- *Hardness*
- *Bulk density*
- *Ash*
- *Carbon tetrachloride adsorption*

AmericanAirFilter
SAAFCarb™ Media

Product Specifications

- *Moisture content: 3% maximum*
- *Hardness: 95% maximum*
- *Bulk density: 30 lbs/ft³ (0.49 gms./cc)*
- *Pellet diameter: 4.0 mm*
- *Substrate CTC: 70%*
- *Pressure drop @ 50 FPM 1.7 inch of water/ft of bed (900 Pa/m)*
- *Ash: 12% minimum*
- *Carbon tetrachloride adsorption: 60%*

ckaging Options and Application Guidelines

Packaging Options
SAAFCarb med a rs packaged in 1 cubic foot boxes and bulk containers (super sacks)

Application Guidelines
SAAFCarb med a performs under the following application guidelines:

- *Temperature: -4°F to 125°F (-20°C to 51°C)*
- *Humidity: 10% – 95% RH*
- *Airflow is effective in commercial and industrial systems, and ranges from less than 25 CFM (42.5 m³/h) to over 100,000 CFM (169,920 m³/h) and with velocities from 60 to 500 FPM (1,080 to 9,000 m/h).*

Installation and Disposal Requirements

Installation
The instal ers must use dust masks, safety goggles, and rubber gloves.

Disposal
The spent SAAFCarb media must be d sposed of according to local, state, and federal guidelines

NOTE: Refer to the appropriate AAF documentation for additional details.

Safety

Wet activated carbon adsorbs atmospheric oxygen, causing low oxygen supply in enclosed areas or packed containers. This can be potentially hazardous for workers who enter these oxygen-depleted areas. Make sure that the workers adhere to the provincial and state safety guidelines.

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AmericanAirFilter®

SAAFCarb™ MB Media

- ***Specifically impregnated media provides effective removal of ammonia gas***
- ***System design ensures standard removal capacity***

SAAFCarb MB contains an acid impregnant to enhance the capacity for removal of ammonia.

Application Note

SAAFCarb MB media efficiently removes 99.5 percent of the contaminant from SAAFCarb MB systems.

Target Impurity

- *Ammonia*

Product Specifications

- *Moisture content: 2.0% maximum*
- *Bulk density: 34 lbs/ft³ (641 kgs/m³)*
- *Carbon tetrachloride adsorption: 55.0% minimum*

Application Guidelines

SAAFCarb MB media performs under the following application guidelines:

- *Temperature: -4°F to 125°F (-20°C to 51°C)*
- *Humidity: 10% – 95% RH*
- *Airflow is effective in commercial and industrial systems, and ranges from less than 25 CFM (42.5 m³/h) to over 100,000 CFM 169,920 m³/h) and with velocities from 60 FPM to 500 FPM (0.30 to 2.54 m/s).*

Installation and Disposal Requirements

Installation
The installers must use dust masks, safety goggles, and rubber gloves.

Disposal
The spent SAAFCarb MB media must be disposed of according to local, state, and federal guidelines.

NOTE: Refer to the appropriate AAF documentation for additional details.

Removal Capacity

SAAFCarb MB media meets the following contaminant removal capacities by weight:

- *Ammonia: 7.0% minimum*

Quality Control

SAAFCarb MB media undergoes the following quality control tests before being shipped:

- *Moisture content*
- *Bulk density*
- *Carbon tetrachloride adsorption*

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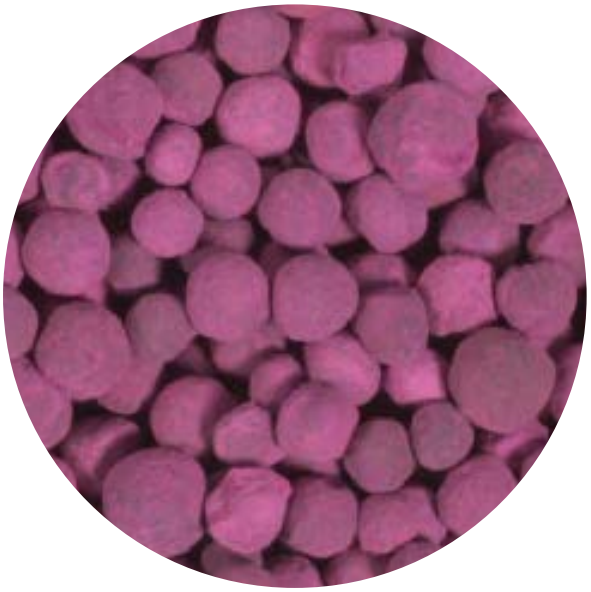
SAAFoxidant™

Engineered Gas Removal Chemical Media

- ***Non-flammable (UL Class 1), non-toxic, and non-hazardous***
- ***Accurate service life testing***
- ***Inhibits bacterial and fungal growth***
- ***Does not support desorption***
- ***Easy disposal***



SAAFoxidant™ Engineered Gas Removal Chemical Media is designed to efficiently remove 99.5% of specific gaseous contaminants from airstreams. Target contaminants include:

- ***Sulfur oxide***
- ***Hydrogen sulfide***
- ***Nitric oxide***
- ***Formaldehyde***
- ***Lower molecular weight aldehydes and organic acids***

Manufactured of spherical and porous pellets, SAAFoxidant engineered media is composed of a combination of activated alumina and other binders. Potassium permanganate is impregnated to this media combination in order to provide optimum adsorption, absorption, and oxidation of various gaseous contaminants.

Potassium permanganate is applied uniformly during pellet formation and is distributed throughout the pellet volume. This process provides the maximum amount of impregnate for chemical reaction and optimal performance.

Chemisorptive Process

The SAAFoxidant chemisorptive process removes the contaminant gases by adsorption, absorption, and chemical reaction. In this process the gas is trapped within the pellet where oxidation changes the gases into harmless solids, thereby eliminating the possibility of desorption. SAAFoxidant's engineering allows this to be instantaneous, irreversible, and safe chemical reaction.

Removal Capacity

SAAFoxidant media meets the following contaminant removal capacities by weight:

- ***Hydrogen sulfide: 14.0% minimum***
- ***Sulfur dioxide: 7.0% minimum***
- ***Nitric oxide: 4.9% minimum***
- ***Formaldehyde: 2.5% minimum***

For instance, 100 pounds (45.36 kg) of SAAFoxidant media will remove a minimum of 14 pounds (6.35 kg) of hydrogen sulfide.

AmericanAirFilter
SAAFoxidant™

Specifications

Physical Properties:

- *Moisture content: 35% maximum*
- *Crush strength: 35 – 70%*
- *Abrasion: 4.5% maximum*
- *Bulk density: 50 lbs/ft³ (800 kgs/m³)*
- *Nominal pellet diameter: 1/8" (3.175 mm)*
- *Potassium permanganate content: 8% minimum*

Packaging Options:
SAAFoxidant media shall be packaged in 1 cubic feet container, and available in 20 cubic feet super sacks

SAAFoxidant media shall be ready packaged in SAAF cartridges, cassettes, and trays

Application Guidelines:
SAAFoxidant media performs under the following application guidelines:

- *Temperature: -4° to 125° F (-20°C to 51°C)*
- *Humidity: 10 – 95% RH*
- *Airflow: Effective in commercial and industrial systems; ranges from less than 25 CFM (42.5 m3/hr) to over 100,000 CFM (169,920 m3/hr) with velocities from 60 to 500 FPM (0.30 to 2.54 m/s).*

NOTE: Refer to appropriate AAF documentation for additional information on contaminant gases

Installation
It is recommended that installers must use dust masks, safety goggles, and rubber gloves

Disposal
The spent SAAFoxidant media must be disposed of according to local, state, and federal guidelines.

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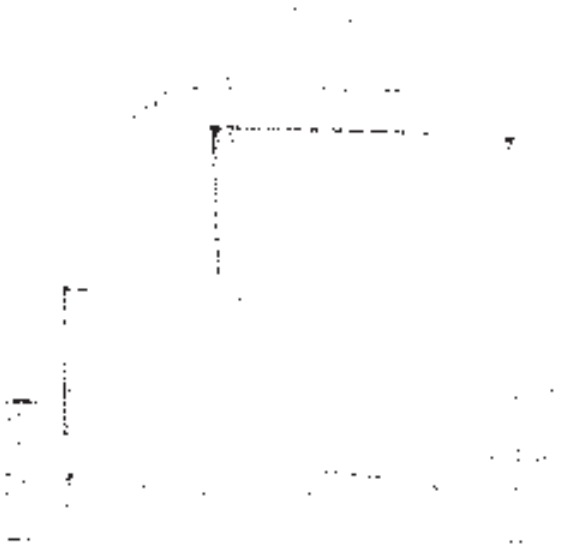
bil

Technical Literature

49) Activated Carbon Filter

AmMet

Aluminum Washable Filter



- Aluminum construction，save the cost of maintenance
- Low initial air resistance,high dust content,long useing
- Special graduated density wire mesh,easy to set and clean

AmMet is used in heating, air-dust and air-conditioning industry and construction. It's high dust content and water-fast because of the special graduated density aluminum mesh, and it will save the cost of replace and maintenance.

1. reduce the frequency of cleaning and maintenancing
2. reduce the danger of causing fire
3. extend the life of motor

Special construction

Special graduated density wire mesh can make the prefect filter effect. The polluted air-dust will be adsorb by the filter, and the ripple aluminum wave have the enough dust space to accept it. AmMet can be used in the temperature of 300℃.

Fit and maintain

AmMet have the strong rebound force, it can prevent the moving between the shape aluminum frame and it can be used in the hard circumstance. It's very light and handy, the thickness is only 1mm, it reduce the cost of transportation and it is necessary more easier. If need, we will have have any size of stainless steel and galvanized frame for you to be choosed for you.

AmMet can clean by compress air blowing, and it can be repeated use. It can be cleaned by clean-set in the limited time for repeated using.

Data

Nominal size (inches)	Trim size (mm)	Rated flow m³/h at 2.5 m/s
12×24×1	298×599×21	1700
20×20×1	502×502×21	2125
24×24×1	599×599×21	2550
25×25×1	632×632×16	2125
20×30×1	502×632×16	2125
24×24×2	599×599×46	3400
25×25×2	632×632×46	3825

material	standard
frame	aluminum alloy coated material
Filter material	1 layer or 2 layer aluminum material

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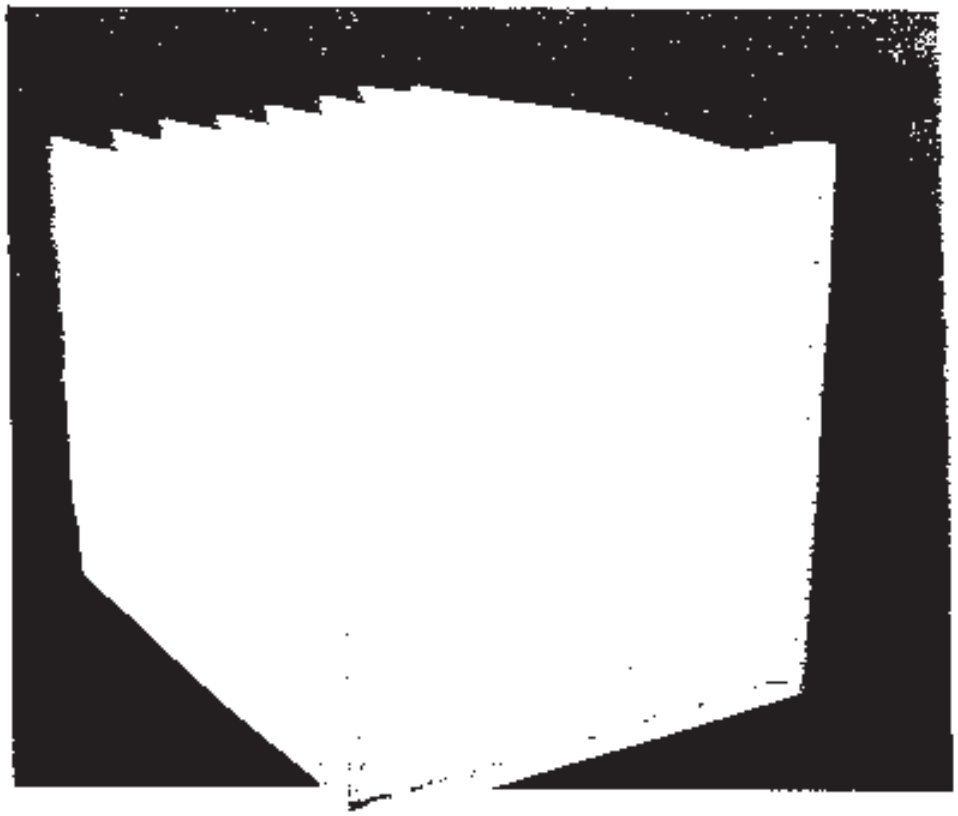
Tel: +86-755-29457069 Fax: +86-755-29457645

CHWA55OB-CN/0702

Technical Literature

50) Washable Filter

DriPak 2000

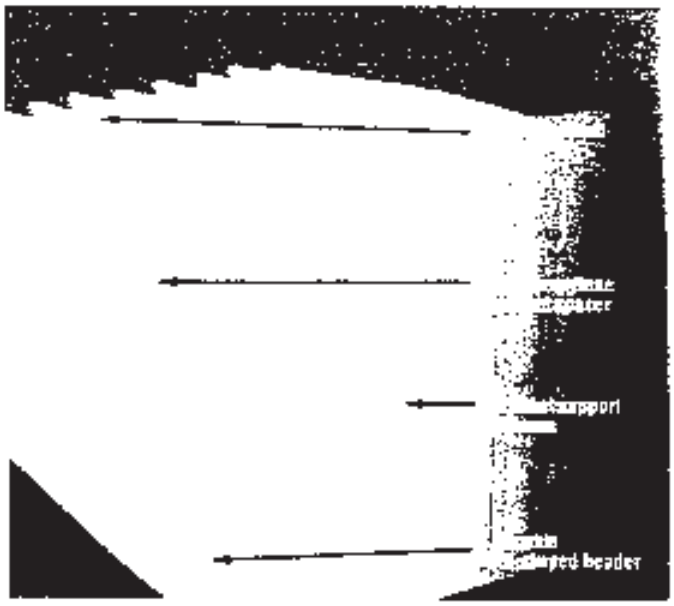


BETTER AIR IS OUR BUSINESS

* BAG FILTER FOR AHU & PAU

DriPak 2000

Extended Surface Pocket Filters With Layered, Meltblown Synthetic Media



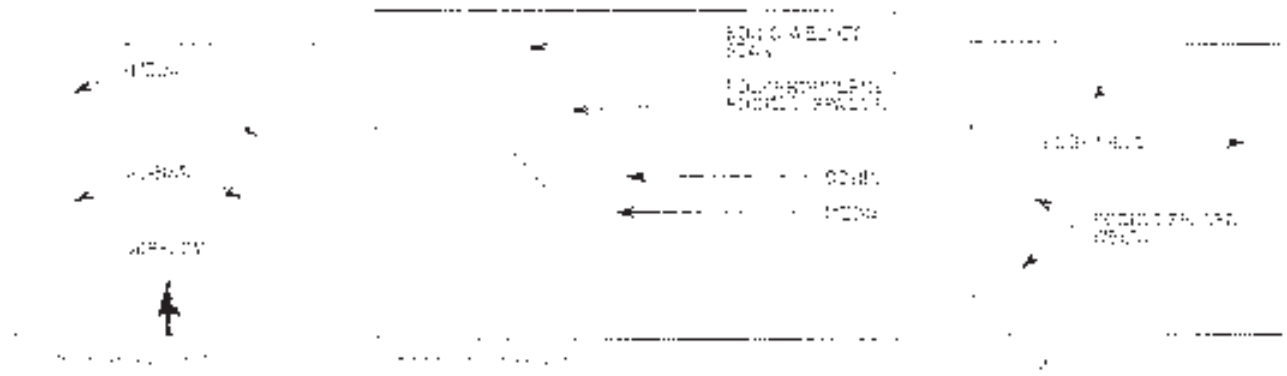
- *High-info. layered, meltblown synthetic media improves performance*
- *Ultrasonically sealed pocket spacers and edges*
- *Available in four efficiencies: MERV 15 (95-95%*), MERV 14 (80-85%*), MERV 12 (60-65%*), and MERV 8 (40-45%*)*
- *Available with integral automation*

DRIPAK 2000

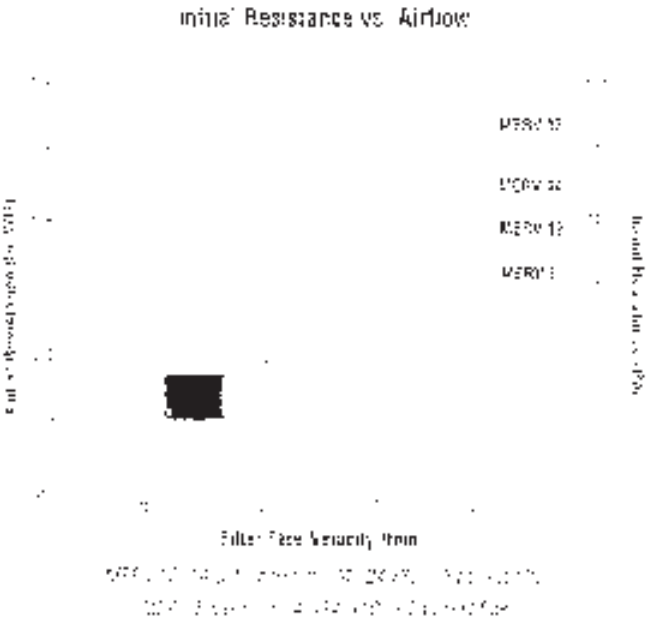
IAQ ENGINEERED

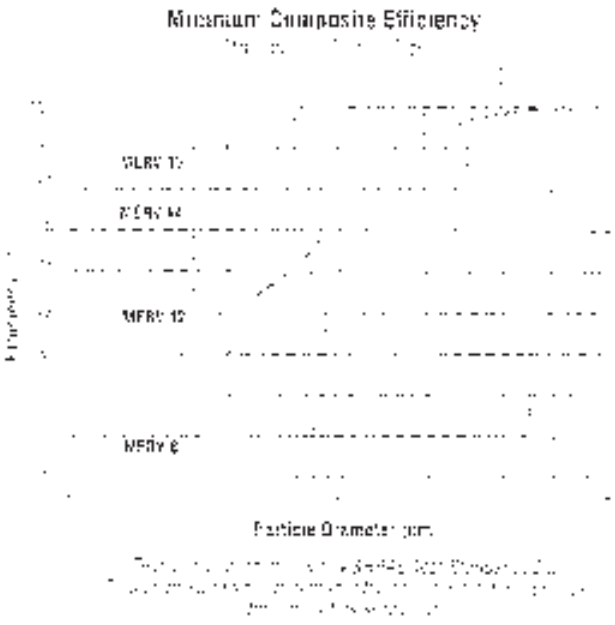
DESIGNED FOR PERFORMANCE

SONIC WELDED POCKET CONSTRUCTION

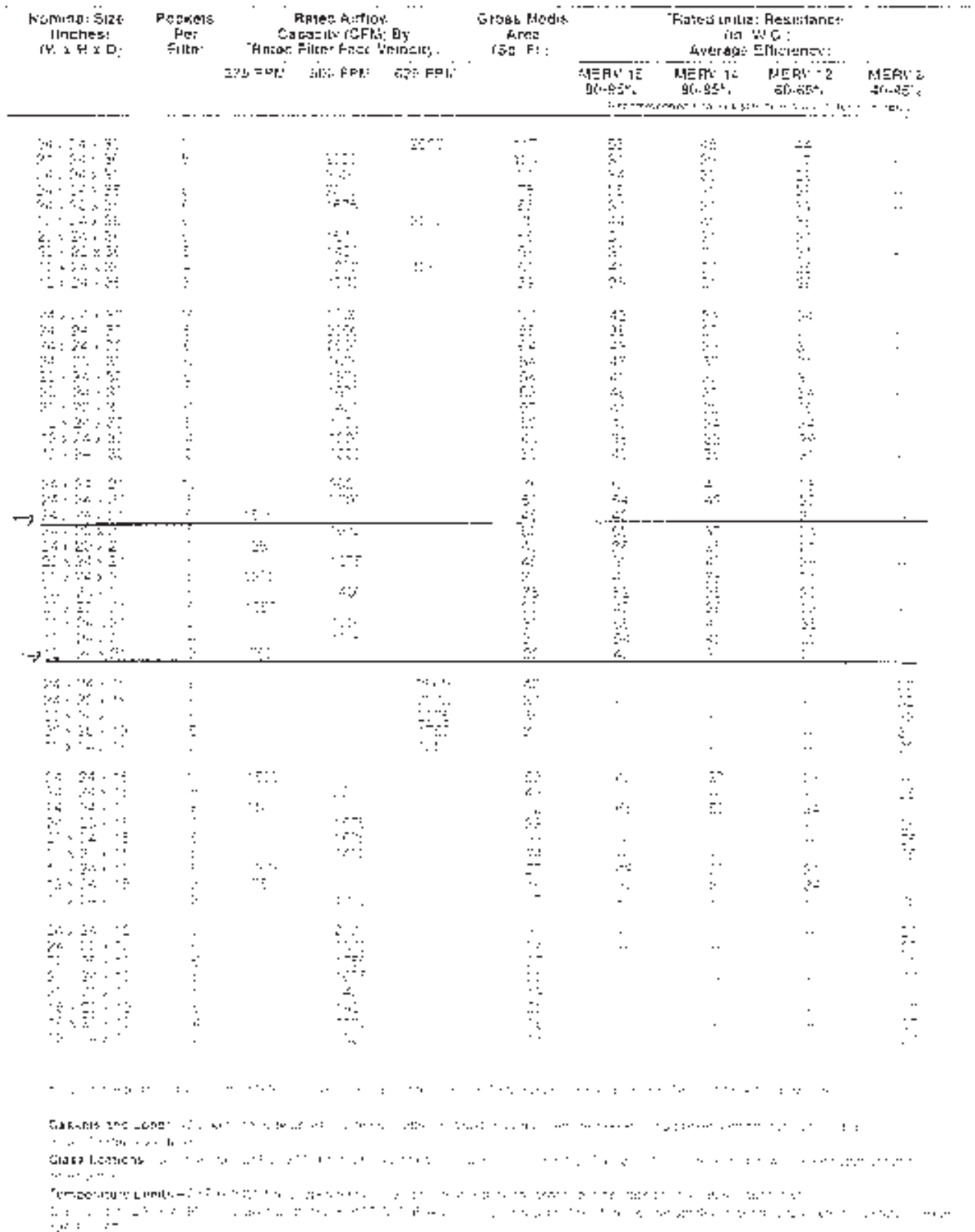


OPERATING DATA





GRIPAK 2000 PRODUCT INFORMATION



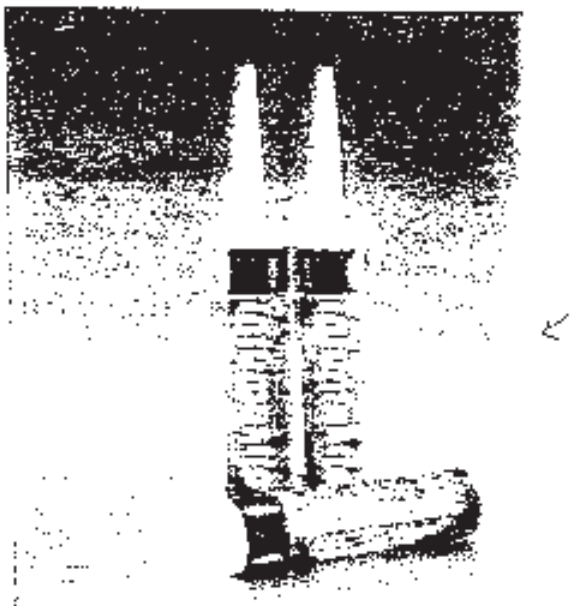
GSE AAF 2003
FAX 502.637.0321

Technical Literature

51) Bag Filter

Firetherm

FIRESTOP



Test Performance

Application

Description

Specification Writing

Technical Literature

52) Fire Resistance Sealant

Foster

SELECTED MODEL → 32-19

Product Data Sheet

PROPERTIES

COLOR: Tan

APPLICATION CONSISTENCY
Paste. Thixotropic. Smooth. Self-leveling. Soft. Creamy. Non-Sagging.

WEIGHT PER U.S. GALLON (ASTM D 1475):
[illegible]

AVERAGE NON-VOLATILE (ASTM D 2369):
[illegible]

COVERAGE RANGE (FSTM 72):
Brush: [illegible]
Caulking Gun:
[illegible]

DRYING TIME TO F (25 C- 50%RH
(ASTM D 1640):
[illegible]

SERVICE TEMPERATURE LIMITS (FSTM 165):
[illegible]

FUNGAL GROWTH RESISTANCE (ASTM G 21):
[illegible]

WET FLAMMABILITY (ASTM D 3828):
[illegible]

SURFACE BURNING CHARACTERISTICS
(ASTM E 84):
[illegible]

BS 476 Parts 6—7: Class 1

Duct-Fas Duct Sealant meet NFPA 90A and 90B requirements. It is approved for use in the city of Los Angeles, application number: RR-960057

FOSTER DUCT-FAS™ DUCT SEALANT

FOSTER DUCT-FAS DUCT Sealant [illegible]

DUCT-FAS DUCT Sealant [illegible]

DUCT-FAS DUCT Sealant [illegible]

DUCT-FAS DUCT Sealant [illegible]

DUCT-FAS DUCT Sealant [illegible]

DUCT-FAS DUCT Sealant Sealant contains no asbestos, lead, mercury or mercury compounds.

LIMITATIONS

- [illegible]
- [illegible]
- [illegible]
- [illegible]

THERMTECH BUILDING PRODUCTS LTD.
[illegible]

泛達建築材料有限公司
THERMTECH BUILDING PRODUCTS LTD.
Room [illegible], 10/F, Block [illegible], No. 33 Shing Yan Road, Kowloon Bay, Kowloon, Hong Kong
Tel: [illegible] Fax: [illegible] E-mail: [illegible] Website: www.thermtech.com.hk

Date 12 August 2011

To Whom It May Concern

Re: New Int'l Mail Centre

Dear Sir,

In response to engineer's comment, we confirm the follow:-

~~1) Firetherm intumescent Sealant - fire resistant sealant, the manufacturer will review WWRP test report on 1st Jan 2011.~~

2) Foster 32-19 - Duct Sealant, no review is necessary because it is not a fire resistant material.

If you've further query, please contact the undersigned.

Yours faithfully,
Thermtech Building Products Limited

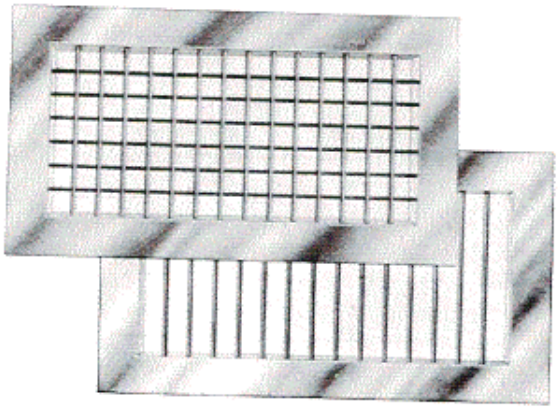
Ellen Ma
Marketing Manager

EM/jk

Technical Literature

53) Duct Sealant

Model SG Registers and Grilles
Double and Single Deflection



Model SG registers and grilles are designed for installation in sidewall or sill and can be used for supply or return air in heating, cooling or ventilating applications. The adjustable blades can be set individually at any position to provide maximum air pattern flexibility.

Features

- Choice of extruded aluminium or sheet steel construction.
- Blades with aerofoil cross section for minimum turbulance and low noise level.
- Blades set on 19mm spacing as standard, 16mm or 13mm spacing are also available.
- Polyurenthane foam gaskets.

Finish

- Steel construction
  Standard finish is white baked enamel.
  Special colour finishes are available to match architectural requirement.
- Extruded aluminium construction
  Standard finish is natural anodize.
  Baked enamel or special anodize finishes are available.

Accessories

- Opposite blade damper (OBD)
  Damper blades move simultaneously in opposite direction. Allow for smooth volume control from fully open to fully close. Smooth operation by turning a single adjustment screw. Dampers manufactured from sheet steel. Standard finish is black baked enamel.

Order Code

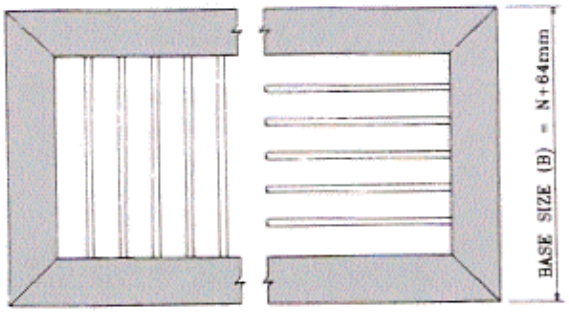
SG – S/A – D/S – V/H – [ ] × [ ] W/OBD

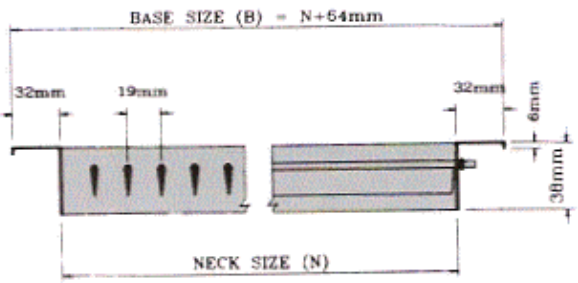
- W/OBD: Completed with opposite blades damper
  None: Without volume control damper
- Listed height
- Listed length
- V: Vertical front blades
  H: Horizontal front blades
- D: Double deflection
  S: Single deflection
- S: Steel construction
  A: Extruded aluminium construction

Note: for special finish and requirement, please specify when ordering.

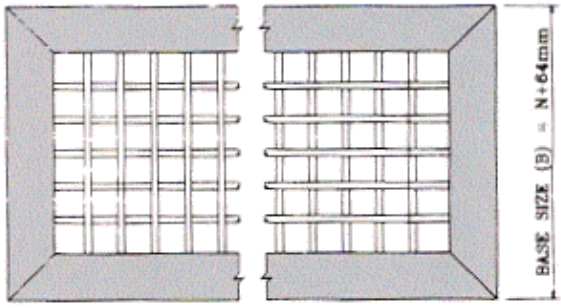
Dimension

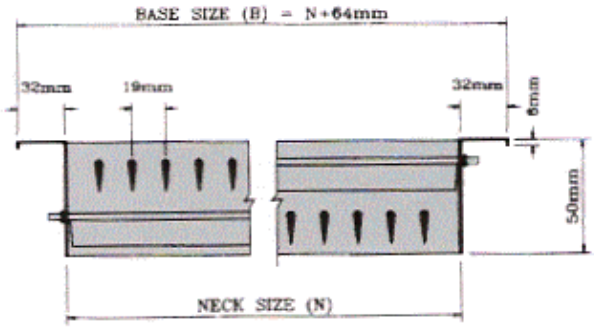
SG-S-S-V/H
Single Deflection (Steel)



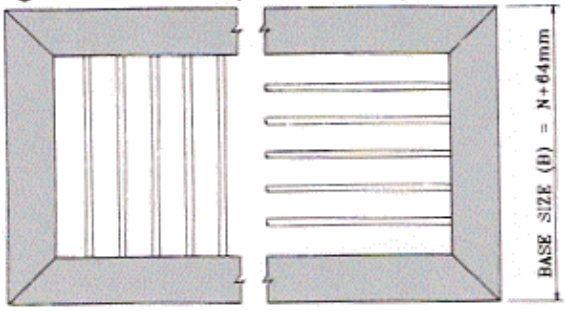


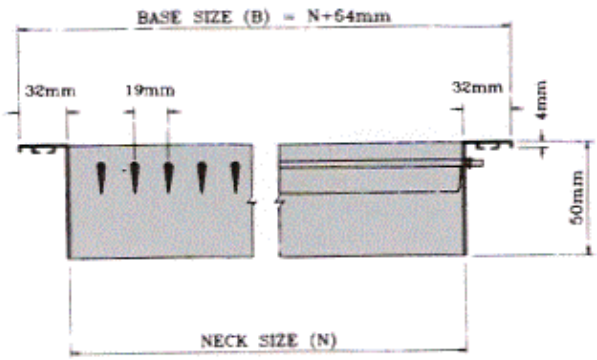
SG-S-D-V/H
Double Deflection (Steel)



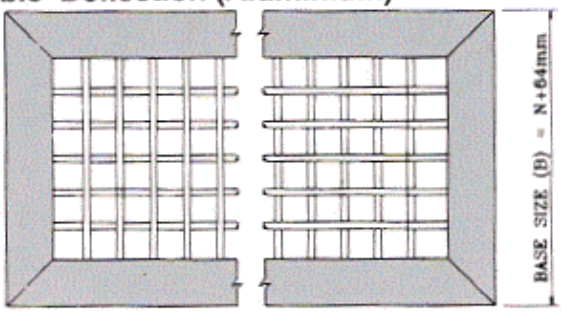


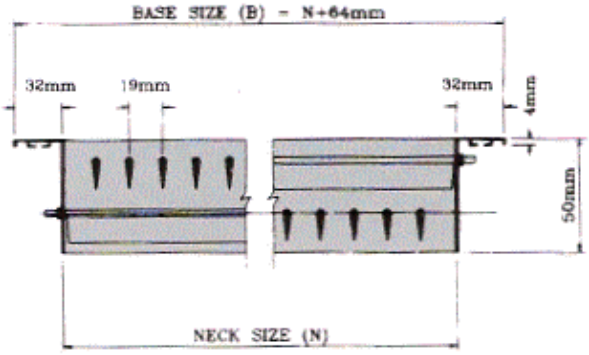
SG-A-S-V/H
Single Deflection (Aluminium)





SG-A-D-V/H
Double Deflection (Aluminium)





Model SG Performance Table

m³/s	Size	200x100			150x150 200x125 250x100			200x150 250x125 300x100			250x150 300x125 400x100			300x150 350x125 450x100			250x200 350x150 400x125 500x100		
	Deflection	0	22	45	0	22	45	0	22	45	0	22	45	0	22	45	0	22	45
0.023	Velocity	1.8	1.9	2.1	1.4	1.5	1.6												
	Total Press.	4	4	5	2	2	3												
	Throw	3	2.7	1.8	3	2.4	1.8												
	Drop	1.2	0.9	0.4	1	0.9	0.4												
0.035	Velocity	2.7	2.8	3	2.1	2.2	2.4	1.8	1.8	2	1.4	1.5	1.6						
	Total Press.	6	9	12	5	5	7	3	4	4	2	2	3						
	Throw	4.3	4	2.7	3.6	3.3	2.1	3.3	2.7	2.1	2.7	2.4	1.8						
	Drop	1.3	1.2	0.7	1.3	1.2	0.7	1.3	1.2	0.7	1.3	1.2	0.7						
0.047	Velocity	3.6	3.7	4	2.8	2.9	3.2	2.4	2.5	2.7	1.9	2	2.1	1.6	1.7	1.8			
	Total Press.	15	17	22	9	10	13	6	6	8	3	4	5	2	2	3			
	Throw	5.7	4.8	3.6	4.5	4.2	2.7	4.5	3.9	2.7	3.9	3.3	2.4	3.3	3	2.1			
	Drop	1.5	1.2	0.9	1.5	1.3	0.9	1.6	1.3	0.9	1.6	1.3	0.7	1.6	1.3	0.9			
0.059	Velocity	4.4	4.6	5.1	3.6	3.7	4	3	3.1	3.4	2.4	2.5	2.7	2	2.1	2.2	1.8	1.9	2
	Total Press.	23	26	34	14	15	20	9	10	13	5	6	7	3	4	5	3	3	4
	Throw	6.7	6	4.2	6	5.1	3.3	5.4	4.8	3.3	4.8	4.2	3	4.2	3.6	2.7	3.6	3	2.4
	Drop	1.6	1.3	1	1.6	1.5	0.9	1.8	1.5	0.9	1.8	1.5	0.9	1.8	1.5	1	1.9	1.5	0.9
0.070	Velocity	5.4	5.5	6.1	4.3	4.4	4.9	3.6	3.7	4	2.8	2.9	3.2	2.4	2.5	2.7	2.1	2.2	2.4
	Total Press.	34	37	50	20	29	21	13	14	19	8	11	12	5	6	7	4	4	6
	Throw	7.9	7	4.8	7.3	6	4.5	6	5.4	3.9	5.7	5.1	3.3	5.1	4.5	3.3	4.5	3.9	3
	Drop	1.8	1.5	1.2	1.8	1.5	1	1.9	1.5	1	1.9	1.6	1	1.9	1.5	1	2.1	1.6	1
0.082	Velocity	6.2	7	7.5	5	5.2	5.7	4.2	4.3	4.7	3.3	3.4	3.7	2.8	2.9	3.1	2.5	2.6	2.8
	Total Press.	46	51	67	29	40	45	17	19	26	10	11	15	7	8	10	6	6	8
	Throw	9.1	8.5	5.4	7.9	7	4.8	7.3	6.4	4.5	6.7	5.4	3.9	6	5.1	3.6	5.4	4.8	3.3
	Drop	1.9	1.6	1.3	1.8	1.6	1	2.1	1.6	1.2	2.1	1.6	1.2	2.1	1.8	1.2	2.1	1.8	1.2
0.094	Velocity	7.2	7.4	8.1	5.7	5.9	6.5	4.8	4.9	5.4	3.8	3.9	4.3	3.2	3.3	3.6	2.8	2.9	3.2
	Total Press.	60	67	87	35	37	51	23	24	34	13	15	19	9	10	13	7	8	11
	Throw	10.1	9.7	6.4	9.4	8.2	5.7	8.5	7.3	5.1	7.6	6.7	4.5	6.7	5.7	4.2	6	5.1	3.9
	Drop	2.2	1.8	1.3	1.9	1.8	1.2	2.2	1.8	1.3	2.1	1.8	1.2	2.1	1.9	1.2	2.1	1.9	1.3
0.106	Velocity	7.9	8.3	9.2	6.5	6.7	7.3	5.4	5.5	6.1	4.3	4.4	4.8	3.6	3.7	4	3.2	3.3	3.6
	Total Press.	75	85	11	45	48	65	29	31	42	17	19	24	12	13	17	9	10	13
	Throw	12.1	10.9	7.3	10.3	9.1	6.4	9.7	8.2	5.7	8.5	7.3	5.1	7.3	6.4	4.5	6.7	5.7	4.2
	Drop	2.4	1.8	1.5	2.1	1.9	1.2	2.4	1.9	1.3	2.2	1.8	1.3	2.2	1.9	1.3	2.4	2.1	1.3
0.118	Velocity	9	9.2	10.2	7.2	7.4	10.2	7.2	7.4	8.1	6	6.1	6.8	4.8	4.9	5.4	4	4.1	4.5
	Total Press.	95	105	137	55	60	80	35	37	52	21	23	30	14	16	21	11	12	16
	Throw	13.4	11.5	7.6	11.5	9.7	7	10.3	8.8	6.4	9.1	7.9	5.7	8.2	7.3	5.1	7.9	6.7	4.8
	Drop	2.4	1.9	1.5	2.2	1.9	1.5	2.5	2.1	1.5	2.4	1.9	1.5	2.5	1.9	1.5	2.5	2.1	1.5
0.129	Velocity	9.9	10.2	11.2	7.9	8.1	9	6.6	6.8	7.5	5.3	5.4	5.9	4.4	4.5	4.9	3.9	4	4.4
	Total Press.	112	127	167	70	70	100	44	71	65	28	30	36	17	19	25	14	15	20
	Throw	14.3	12.1	8.5	12.5	10.9	7.6	10.9	9.4	7	9.7	8.8	6	8.8	7.9	5.7	8.2	7.3	5.4
	Drop	2.7	2.2	1.6	2.4	2.1	1.6	2.5	2.1	1.5	2.5	2.1	1.5	2.5	2.1	1.6	2.5	2.2	1.5
0.141	Velocity				8.7	8.9	9.8	7.2	7.4	8.2	5.8	5.9	6.5	4.8	4.9	5.4	4.3	4.4	4.9
	Total Press.				80	85	120	51	55	77	30	33	42	21	22	30	17	18	23
	Throw				13.4	11.8	8.5	11.8	10.3	7.6	10.9	9.4	6.7	9.4	8.5	6	8.8	7.9	5.7
	Drop				2.5	2.2	1.8	2.5	2.2	1.6	2.5	2.2	1.6	2.5	2.2	1.6	2.7	2.4	1.6
0.153	Velocity				9.4	9.6	10.6	7.8	8	8.8	6.2	6.4	7	5.2	5.3	5.8	4.7	4.8	5.3
	Total Press.				92	98	137	60	65	90	36	39	57	25	27	35	20	21	27
	Throw				14.3	12.5	9.1	13.8	11.2	8.2	11.8	10	7.3	1	8.8	6.4	9.4	8.5	6.4
	Drop				2.7	2.4	1.6	2.7	2.4	1.6	2.7	2.4	1.6	2.7	2.4	1.6	2.7	2.4	1.6
0.165	Velocity							8.4	8.6	9.5	6.7	6.9	7.5	5.6	5.7	6.3	5.1	5.2	5.7
	Total Press.							70	75	105	41	45	60	28	31	41	23	24	32
	Throw							14	12.5	8.8	12.8	10.9	7.9	10.6	9.4	7	10	8.8	7
	Drop							2.7	2.4	1.8	2.7	2.4	1.8	2.7	2.4	1.6	2.8	2.4	1.6
0.177	Velocity							9	9.2	10.2	7.2	7.4	8.1	6	6.2	6.4	5.4	5.5	6.1
	Total Press.							82	85	120	47	52	67	32	36	32	26	28	36
	Throw							15.2	13.1	9.4	13.4	11.8	8.5	11.8	10.3	7.6	10.9	9.7	7.6
	Drop							2.8	2.5	1.9	2.8	2.4	1.8	2.8	2.5	1.8	2.8	2.5	1.8
0.188	Velocity							9.6	9.9	10.9	7.7	7.9	8.6	6.4	6.6	7.2	5.8	5.9	6.5
	Total Press.							92	95	135	55	60	77	37	40	55	30	32	42
	Throw							16.1	1.31	10	14	12	9.1	12.5	10.9	8.2	11.8	10.3	8.2
	Drop							3	2.7	2.1	3	2.5	1.9	3	2.5	1.9	3	2.5	1.9
0.200	Velocity										8.2	8.4	9.1	6.8	7	7.6	6.1	6.3	6.9
	Total Press.										61	67	85	41	46	62	34	36	47
	Throw										14.9	12.8	10	13.4	11.5	8.8	12.5	10.9	8.8
	Drop										3.3	2.7	2.2	2.3	2.7	2.1	3.2	2.7	2.1
0.212	Velocity										8.6	8.9	9.7	7.2	7.4	8.1	6.5	6.7	7.3
	Total Press.										69	75	95	47	52	70	37	40	52
	Throw										15.2	13.1	10.6	13.7	12.1	9.4	12.8	11.5	9.1
	Drop										3.5	2.8	2.2	3.5	2.8	2.1	3.5	2.8	2.1
0.224	Velocity													7.6	7.8	8.6	69	7	7.7
	Total Press.													53	57	77	41	45	60
	Throw													14.3	12.8	9.7	13.4	11.8	9.5
	Drop													3.5	2.8	2.2	3.5	11.8	2.1
0.236	Velocity													8	8.2	9	7.2	7.4	8.1
	Total Press.													58	65	85	46	50	65
	Throw													14.9	13.4	10	14	12.5	9.7
	Drop													3.6	3	2.2	3.6	3	2.2
0.259	Velocity													8.8	9	9.9	8	8.1	8.9
	Total Press.													70	77	102	56	60	80
	Throw													16.1	14.3	10.3	15.2	13.1	10
	Drop													3.6	3	2.2	3.6	3	2.2

Velocity (m/s)
Total Press.(Pa)
Throw (m)
Drop (m)

NC Sound Data Color Code
NC LEVEL LESS THAN 20
NC LEVEL LESS THAN 30
NC LEVEL LESS THAN 35
NC LEVEL LESS THAN 40
NC LEVEL LESS THAN 50
NC LEVEL MORE THAN 50
DATA BASED ON 8 db ROOM ATENUATION

Model SG Performance Table

AEROTECH

m³/s	Size	250x250 300x200 400x150 500x125 650x100			300x250 500x150 600x125 750x100			300x300 350x250 450x200 600x150			350x300 400x250 500x200 700x150			350x350 400x300 500x250 600x200 850x150			400x400 450x350 550x300 650x250 800x200		
	Deflection	**0**	**22**	**45**	**0**	**22**	**45**	**0**	**22**	**45**	**0**	**22**	**45**	**0**	**22**	**45**	**0**	**22**	**45**
0.023	Velocity Total Press. Throw Drop																		
0.035	Velocity Total Press. Throw Drop																		
0.047	Velocity Total Press. Throw Drop																		
0.059	Velocity Total Press. Throw Drop	1.4 2 3.4 2.1	1.5 2 2.7 1.7	1.6 3 1.5 1.1															
0.070	Velocity Total Press. Throw Drop	1.8 2 4 2.1	1.8 3 3.4 1.7	2.0 4 2.1 1.1	1.4 2 3.4 2.1	1.5 2 2.7 1.7	1.6 2 2.1 1.1	1.2 1 2.7 2.3	1.2 1 2.1 1.8	1.3 2 1.5 1.2									
0.082	Velocity Total Press. Throw Drop	2.0 3 4.6 2.3	2.1 4 4 1.8	2.3 5 2.7 1.2	1.7 2 4 2.3	1.7 2 3.4 2	1.9 3 2.4 1.2	1.4 2 3.4 2.3	1.4 2 2.7 2	1.6 2 1.8 1.4									
0.094	Velocity Total Press. Throw Drop	2.3 4 5.2 2.3	2.4 5 4.6 2.0	2.6 6 3.4 1.4	1.9 3 4.6 2.4	2.0 3 4 2.1	2.2 4 3 1.2	1.6 2 4.3 2.6	1.7 3 3.7 2.3	1.8 3 2.4 1.5	1.4 1 3.4 2.6	1.4 2 3 2.4	1.6 2 2.1 1.7						
0.106	Velocity Total Press. Throw Drop	2.6 6 6.1 2.4	2.7 6 5.2 2.1	2.9 8 4.0 1.4	2.2 4 5.2 2.4	2.2 4 4.3 2.1	2.5 5 3.4 1.4	1.8 2 4.6 2.7	1.9 3 4 2.4	2.0 4 2.7 1.5	1.5 2 4.0 2.9	1.6 2 3.4 2.4	1.8 2 2.4 1.7						
0.118	Velocity Total Press. Throw Drop	2.9 7 6.7 2.6	3.0 8 5.8 2.1	3.2 10 4.3 1.5	2.4 4 5.8 2.6	2.5 5 4.9 2.3	2.7 7 4 1.4	2.0 3 5.2 2.9	2.0 4 4.6 2.6	2.3 4 3.4 1.7	1.7 2 4.5 2.9	1.8 2 3.7 2.4	1.9 3 2.7 1.7						
0.129	Velocity Total Press. Throw Drop	3.2 9 7.3 2.6	3.3 10 6.4 2.3	3.6 13 4.9 1.5	2.6 6 6.7 2.6	2.7 6 5.5 2.4	3.0 8 4.3 1.5	2.2 4 5.8 2.9	2.3 4 5.2 2.6	2.5 5 4 1.8	1.9 3 4.9 2.9	1.9 3 4.3 2.4	2.1 4 3.0 1.7	1.6 2 4.3 2.9	1.7 2 3.4 2.4	1.8 2 2.4 1.7			
0.141	Velocity Total Press. Throw Drop	3.5 10 7.9 2.7	3.6 11 7.0 2.3	4.0 15 5.2 1.7	2.9 7 7 2.7	3.0 7 6.1 2.4	3.3 10 4.6 1.5	2.4 4 6.4 3.0	2.5 5 5.5 2.6	2.7 6 4.3 1.8	2.1 3 5.5 3.0	2.1 4 4.9 2.4	2.3 5 3.7 1.8	1.8 2 4.9 3.0	1.8 3 4.3 2.6	2.0 3 3.0 1.8	1.3 1 3.4 3.0	1.4 1 3.0 2.6	1.5 2 2.1 1.8
0.153	Velocity Total Press. Throw Drop	3.8 12 8.8 2.7	3.9 14 7.6 2.4	4.2 18 5.5 1.7	3.1 8 7.6 2.7	3.2 9 6.7 2.4	3.6 11 5.2 1.7	2.6 5 7.0 3.0	2.7 6 6.1 2.7	2.9 7 4.6 1.8	2.2 4 6.1 3.0	2.3 4 5.5 2.6	2.5 5 4.3 1.8	1.9 3 5.5 3.0	2.0 3 4.9 2.7	2.2 4 3.7 1.8	1.5 1 4.6 3.0	1.5 2 3.7 2.7	1.7 2 2.4 1.8
0.165	Velocity Total Press. Throw Drop	4.1 14 9.5 2.9	4.2 16 8.2 2.4	4.6 20 6.1 1.7	3.4 9 8.2 2.9	3.5 10 7.3 2.4	3.8 13 5.5 1.7	2.8 6 7.3 3.2	2.9 7 6.4 2.7	3.2 9 4.8 2.0	2.4 4 6.4 3.2	2.5 5 5.8 2.6	2.7 6 4.6 1.8	2.1 3 5.8 3.2	2.1 4 5.5 2.7	2.3 4 4.3 1.8	1.6 2 4.9 3.2	1.6 2 4.0 2.7	1.8 2 2.7 1.8
0.177	Velocity Total Press. Throw Drop	4.4 16 10 2.9	4.4 18 8.8 2.6	4.9 23 6.4 1.6	3.6 10 8.8 2.9	3.7 11 7.6 2.6	4.1 15 6.1 1.8	3.0 7 7.6 3.2	3.1 8 6.7 2.9	3.4 10 5.2 2.0	2.6 5 7.0 3.2	2.6 6 6.1 2.7	2.9 7 4.9 2.0	2.2 4 6.1 3.2	2.3 4 5.8 2.9	2.4 1 4.6 2.0	1.7 2 5.2 3.4	1.8 2 4.3 2.9	1.9 3 3.0 2.0
0.188	Velocity Total Press. Throw Drop	4.7 18 10.7 3.0	4.8 20 9.5 2.6	5.2 26 7.0 2.0	3.9 12 9.1 3	4.0 13 8.2 2.6	4.4 17 6.4 1.8	3.2 8 8.2 3.4	3.3 9 7.3 3.0	3.6 11 5.5 2.0	2.8 6 7.3 3.4	2.9 6 6.7 3.0	3.1 8 5.2 2.0	2.4 4 6.7 3.4	2.4 5 6.1 3.0	2.8 6 5.2 2.1	1.8 2 5.8 3.7	1.9 3 4.9 3.0	2.0 3 3.4 2.3
0.200	Velocity Total Press. Throw Drop	5.0 21 11.3 3.2	5.1 23 10.1 2.7	5.6 28 7.6 2.1	4.1 13 9.5 3.2	4.2 15 8.5 2.7	4.6 19 6.7 2.1	3.4 9 8.8 3.4	3.5 10 7.6 3.0	3.8 13 5.8 2.1	2.9 7 7.6 3.4	3.0 7 7.0 3.0	3.3 9 5.5 2.1	2.5 5 7.0 3.4	2.6 5 6.4 3.0	2.8 6 5.8 2.1	1.9 2 6.4 3.7	2.0 3 5.5 3.2	2.2 4 4.0 2.4
0.212	Velocity Total Press. Throw Drop	5.2 24 11.9 3.4	5.4 26 10.4 2.9	5.9 34 8.2 2.1	4.3 13 10 3.4	4.4 16 8.8 2.9	4.9 22 7 2.1	3.6 10 9.1 3.5	3.7 11 7.9 3	4.1 14 6.1 2.1	3.1 7 7.9 3.5	3.2 8 7.3 3.0	3.6 10 5.8 2.1	2.7 5 7.6 3.5	2.7 6 6.7 3.0	3.0 7 6.1 2.1	2.0 3 7 3.7	2.1 3 6.1 3.2	2.2 4 4.6 2.4
0.224	Velocity Total Press. Throw Drop	5.5 26 12.2 3.5	5.6 28 11 2.9	6.2 38 8.5 2.1	4.6 17 10.7 3.5	4.7 18 9.5 2.9	5.2 24 7.3 2.3	3.8 11 9.8 3.7	3.9 12 8.2 3.2	4.3 16 6.4 2.3	3.3 8 8.5 3.7	3.4 9 7.9 3.2	3.7 12 6.1 2.3	2.8 6 7.9 3.7	2.9 6 7.0 3.2	3.1 8 6.4 2.3	2.2 3 7.6 4.0	2.2 4 6.4 3.4	2.4 5 5.2 2.4
0.236	Velocity Total Press. Throw Drop	5.8 29 12.8 3.7	5.9 32 11.3 3	6.6 41 9.1 2.3	4.9 19 11.3 3.7	5.0 20 9.8 3	5.5 27 7.6 2.3	4.0 12 10.1 3.7	4.1 14 8.8 3.2	4.5 18 7.0 2.3	3.5 9 8.8 3.8	3.5 10 8.5 3.2	3.9 13 6.4 2.3	3.0 6 8.2 3.7	3.0 7 7.3 3.2	3.3 9 6.7 2.4	2.3 4 7.9 4.0	2.3 4 7.0 3.4	2.5 5 5.8 2.6
0.259	Velocity Total Press. Throw Drop	6.4 32 13.4 3.7	6.5 38 11.9 3	7.2 50 9.5 2.3	5.3 23 12.2 3.7	5.4 25 10.4 3	6.0 32 7.9 2.3	4.4 15 10.7 3.7	4.5 17 9.5 3.2	5.0 22 7.6 2.3	2.8 11 9.5 3.7	3.9 12 8.8 3.2	4.3 17 7.0 2.3	3.3 8 8.8 3.8	3.4 9 7.9 3.2	3.7 11 7.0 2.4	2.5 4 8.5 4.1	2.5 5 7.6 3.5	2.8 6 6.4 2.7

NC Sound Data Color Code
NC LEVEL LESS THAN 20
NC LEVEL LESS THAN 30
NC LEVEL LESS THAN 35
NC LEVEL LESS THAN 40
NC LEVEL LESS THAN 50
NC LEVEL MORE THAN 50
DATA BASED ON 8 db ROOM ATENUATION

Velocity (m/s)
Total Press.(Pa)
Throw (m)
Drop (m)

Model SG Performance Table

AEROTECH

m³/s	Size	250x200 350x150 400x125 500x100			250x250 300x200 400x150 500x125 650x100			300x250 500x150 600x125 750x100			300x300 350x250 450x200 600x150			350x300 400x250 500x200 700x150			350x350 400x300 500x250 600x200 850x150		
	Deflection	0	22	45	0	22	45	0	22	45	0	22	45	0	22	45	0	22	45
0.283	Velocity	8.2	9	9.8	7	7.1	8	5.8	5.9	6.6	4.9	5	5.5	4.4	4.4	4.9	3.6	3.7	4
	Total Press.	67	69	95	42	48	61	27	29	39	18	20	26	13	14	19	9	10	13
	Throw	16.4	13.7	10.6	14	13.1	10	13.1	11.2	8.5	11.5	10	7.9	10	9.1	7.3	9.4	8.5	7.3
	Drop	3.9	3.2	2.2	3.8	3.2	2.2	3.8	3.2	2.2	3.8	3.2	2.2	3.8	3.2	2.4	4.1	3.3	2.4
0.306	Velocity	8.8	9.7	10.6	7.6	7.7	8.5	6.3	6.4	7.1	5.3	5.4	5.9	4.7	4.8	5.3	3.9	4	4.3
	Total Press.	77	82	110	49	54	70	31	34	45	21	23	31	15	17	22	11	12	15
	Throw	17.9	15.2	11.2	15.2	14	10.6	14	12.1	9.1	12.5	10.9	8.5	10.6	9.7	7.6	10	9.1	7.9
	Drop	4.2	3.3	2.4	4.1	3.3	2.4	4.1	3.3	2.4	4.1	3.3	2.5	4.4	3.8	2.7	4.5	3.8	2.7
0.330	Velocity	9.5	10.4	11.4	8.2	8.3	9.1	6.8	6.9	7.1	5.6	5.8	6.4	5.1	5.2	5.7	4.2	4.3	4.6
	Total Press.	90	82	127	57	61	82	36	40	52	24	27	35	18	20	25	12	16	21
	Throw	19.5	16.7	11.2	16.4	14.9	11.2	14.9	13.1	10	13.4	11.8	9.1	11.5	10.6	8.2	10.9	9.7	8.2
	Drop	4.5	3.6	2.7	4.4	3.5	2.7	4.4	3.5	2.5	4.4	3.5	2.5	4.4	3.8	2.7	4.5	3.8	2.7
0.353	Velocity				8.7	8.9	9.8	7.2	7.4	8.2	6	6.2	6.8	5.4	5.6	6.1	4.4	4.6	5
	Total Press.				66	70	95	42	45	61	28	31	41	20	22	29	13	16	18
	Throw				17.6	15.5	11.8	15.8	14	10.9	14.3	12.8	9.7	12.5	11.5	8.8	11.8	10.6	8.8
	Drop				4.7	3.8	3	4.7	3.6	2.7	4.7	3.6	2.7	4.7	3.9	2.6	5	3.9	2.8
0.371	Velocity				9.3	9.5	10.4	7.7	7.9	8.7	6.5	6.6	7.3	5.8	5.9	6.6	4.7	4.9	5.3
	Total Press.				75	80	107	47	51	67	31	35	46	23	25	33	16	18	23
	Throw				18.7	16.7	12.5	17	14.9	11.8	15.5	13.7	10	13.4	12.5	9.7	12.5	11.5	9.1
	Drop				5	4.1	3.2	4.8	3.8	2.8	5	3.8	2.8	5	4.1	3	5.3	4.1	3
0.424	Velocity							8.7	8.9	9.8	7.3	7.4	8.2	6.5	6.7	7.4	5.4	5.5	6
	Total Press.							61	65	87	40	44	59	28	33	42	21	23	30
	Throw							18.5	16.1	13.1	16.4	14.9	10.6	14.3	13.4	10.6	13.4	11.5	10.3
	Drop							5.1	4.1	3.2	5.1	4.1	3.2	5.3	4.2	3.2	5.4	4.2	3.2
0.471	Velocity										8.1	8.3	9.1	7.3	7.4	8.2	5.9	6.1	6.7
	Total Press.										48	54	72	36	40	52	25	28	37
	Throw										17	15.5	11.5	15.8	14.3	11.2	14.6	12.8	10.9
	Drop										5.4	4.4	3.5	5.4	4.5	3.5	5.6	4.5	3.5
0.519	Velocity										8.9	9.1	10	8	8.2	9	6.5	6.7	7.3
	Total Press.										58	65	87	44	47	62	30	34	44
	Throw										18.9	16.4	12.5	17.3	15.2	11.8	15.8	13.7	11.5
	Drop										5.7	4.7	3.8	5.7	4.8	3.8	5.9	4.8	3.8
0.566	Velocity													8.7	8.9	9.8	7.1	7.3	8
	Total Press.													52	56	75	36	40	53
	Throw													18.5	16.4	12.1	17	14.9	12.5
	Drop													6	5	3.9	6.2	5	3.9
0.613	Velocity																7.7	7.9	8.7
	Total Press.																43	47	62
	Throw																18.2	16.4	13
	Drop																6.4	5.3	4.1
0.661	Velocity																		
	Total Press.																		
	Throw																		
	Drop																		
0.707	Velocity																		
	Total Press.																		
	Throw																		
	Drop																		
0.755	Velocity																		
	Total Press.																		
	Throw																		
	Drop																		
0.802	Velocity																		
	Total Press.																		
	Throw																		
	Drop																		
0.849	Velocity																		
	Total Press.																		
	Throw																		
	Drop																		
0.896	Velocity																		
	Total Press.																		
	Throw																		
	Drop																		
0.943	Velocity																		
	Total Press.																		
	Throw																		
	Drop																		
1.132	Velocity																		
	Total Press.																		
	Throw																		
	Drop																		
1.321	Velocity																		
	Total Press.																		
	Throw																		
	Drop																		
1.51	Velocity																		
	Total Press.																		
	Throw																		
	Drop																		

Velocity (m/s)
Total Press.(Pa)
Throw (m)
Drop (m)

NC Sound Data Color Code
NC LEVEL LESS THAN 20
NC LEVEL LESS THAN 30
NC LEVEL LESS THAN 35
NC LEVEL LESS THAN 40
NC LEVEL LESS THAN 50
NC LEVEL MORE THAN 50
DATA BASED ON 8 db ROOM ATENUATION

Model SG Performance Table

AEROTECH

m³/s	Size	400x400 450x350 550x300 650x250 800x200			500x350 600x300 700x250 900x200 1200x150			450x450 500x400 800x250 1000x200			500x500 550x450 700x350 850x300 1000x250			700x450 800x400 900x350 1050x300 1250x250			900x400 600x350 1200x300 1450x250 1800x200		
	Deflection	0	22	45	0	22	45	0	22	45	0	22	45	0	22	45	0	22	45
0.283	Velocity	2.7	2.8	3.0	2.5	2.6	2.8	2.2	2.2	2.4	1.7	1.8	1.9						
	Total Press.	5	6	8	5	5	7	3	4	7	2	3	3						
	Throw	9.1	8.2	6.7	8.5	7.8	6.1	7.3	6.1	4.9	6.1	4.6	3.4						
	Drop	4.3	3.5	2.7	4.3	3.7	2.9	4.4	3.7	2.9	4.4	3.7	2.9						
0.306	Velocity	2.9	3.0	3.3	2.7	2.8	3.0	2.3	2.4	2.6	1.8	1.9	2.1						
	Total Press.	6	7	9	5	6	8	4	4	6	3	3	4						
	Throw	9.8	8.5	7.0	9.1	8.2	6.4	7.9	6.7	5.2	6.7	5.8	4.0						
	Drop	4.4	3.5	2.7	4.4	3.7	2.9	4.6	3.8	2.9	4.6	3.8	2.9						
0.330	Velocity	3.2	3.3	3.6	2.9	3.0	3.3	2.5	2.6	2.8	2.0	2.1	2.3	1.6	1.7	1.8			
	Total Press.	7	8	11	6	7	9	5	5	6	3	3	4	2	2	3			
	Throw	10.4	9.1	7.6	10.1	8.8	6.7	8.8	7.3	5.5	7.6	6.4	4.3	5.8	4.9	3.4			
	Drop	4.4	3.8	2.9	4.4	4.0	3.0	4.6	4.0	3.0	4.6	4.1	3.0	4.6	4.3	3.0			
0.353	Velocity	3.4	3.5	3.8	3.1	3.2	3.5	2.7	2.8	3.0	2.1	2.2	2.4	1.7	1.8	2.0			
	Total Press.	9	10	13	7	8	11	6	6	7	3	4	5	3	3	4			
	Throw	11.0	9.8	7.9	10.4	9.1	7.0	9.8	8.2	6.1	8.8	7.0	5.2	6.4	5.5	4.0			
	Drop	4.9	4.0	2.9	5.0	4.1	3.2	5.2	4.4	3.4	5.0	4.4	3.4	5.0	4.4	3.4			
0.371	Velocity	3.6	3.7	4.1	3.4	3.4	3.7	2.9	2.9	3.2	2.3	2.4	2.6	1.9	1.9	2.1	1.5	1.7	1.8
	Total Press.	9	11	14	8	9	12	6	7	9	4	4	6	3	3	3	2	2	3
	Throw	11.6	10.4	8.5	10.7	9.8	7.3	10.1	8.8	6.4	9.5	7.9	5.8	7.0	6.1	4.9	5.8	4.9	4.0
	Drop	5.2	4.1	3.0	5.3	4.3	3.2	5.5	4.4	3.4	5.6	4.6	3.5	5.6	4.6	3.5	5.6	4.6	3.5
0.424	Velocity	4.1	4.2	4.5	3.8	3.8	4.2	3.2	3.3	3.6	2.6	2.7	2.9	2.1	2.1	2.3	1.7	1.9	2.0
	Total Press.	12	14	18	10	12	15	7	8	11	5	5	7	3	4	5	2	3	3
	Throw	12.8	11.6	9.1	11.9	11.0	8.2	11.3	9.5	7.0	10.1	8.5	6.4	7.6	6.7	5.8	6.4	5.2	4.6
	Drop	5.3	4.3	3.2	5.5	4.4	3.4	5.6	4.4	3.5	5.8	4.6	3.5	6.1	4.7	3.7	6.1	4.7	3.7
0.471	Velocity	4.5	4.6	5.1	4.2	4.3	4.6	3.6	3.7	4.0	2.9	3.0	3.3	2.3	2.4	2.6	1.8	2.1	2.3
	Total Press.	15	17	22	13	14	19	9	10	13	6	7	9	4	4	5	3	3	4
	Throw	13.7	12.5	9.8	12.5	11.9	8.8	11.9	10.4	7.6	11.0	9.1	7.0	8.5	7.6	6.4	7.3	6.1	5.2
	Drop	5.5	4.3	3.5	5.8	4.4	3.5	5.9	4.6	3.7	6.1	4.9	3.7	6.3	4.9	3.8	6.2	5.0	4.0
0.519	Velocity	5.0	5.1	5.6	4.6	4.7	5.1	3.9	4.0	4.4	3.2	3.3	3.6	2.5	2.6	2.8	2.0	2.3	2.5
	Total Press.	18	20	27	15	17	23	11	12	16	7	8	10	5	5	6	3	4	5
	Throw	14.3	13.4	10.1	13.7	12.8	9.5	13.1	11.0	7.9	12.2	9.8	7.6	9.5	8.5	7.0	8.2	7.3	6.4
	Drop	5.9	4.9	3.7	6.1	4.9	3.7	6.1	5.0	3.8	6.3	5.0	3.8	6.4	5.3	4.0	6.7	5.3	4.0
0.566	Velocity	5.4	5.6	6.1	5.0	5.1	5.6	4.3	4.4	4.8	3.5	3.6	3.9	2.8	2.8	3.1	2.4	2.5	2.7
	Total Press.	22	24	32	18	20	27	13	15	19	8	9	12	5	6	8	4	5	6
	Throw	15.5	14.0	10.7	14.6	13.4	10.1	14.0	11.9	8.5	13.1	10.7	8.2	10.4	9.1	7.6	8.8	7.9	6.7
	Drop	6.3	5.0	3.8	6.3	5.2	3.8	6.3	5.2	3.8	6.4	5.2	3.8	6.6	5.3	4.0	6.7	5.3	4.0
0.613	Velocity	5.9	6.0	6.6	5.4	5.5	6.0	4.6	4.8	5.2	3.8	3.9	4.2	3.0	3.1	3.4	2.6	2.7	2.9
	Total Press.	26	28	38	21	24	32	16	17	22	10	11	14	6	7	9	5	6	7
	Throw	16.2	14.9	11.6	15.9	14.3	10.7	15.2	12.8	9.1	14.0	11.6	8.5	11.6	9.8	7.9	9.8	8.8	7.3
	Drop	6.4	5.3	4.1	6.4	5.3	4.1	6.4	5.3	4.1	6.7	5.3	4.1	6.7	5.5	4.1	6.9	5.5	4.1
0.661	Velocity	6.4	6.5	7.1	5.8	6.0	6.5	5.0	5.2	5.6	4.1	4.2	4.5	3.2	3.3	3.6	2.8	2.9	3.2
	Total Press.	30	33	44	25	28	38	18	20	26	11	13	17	7	8	10	5	6	8
	Throw	17.1	16.2	11.9	16.8	14.9	11.0	16.2	13.7	9.5	14.9	12.5	9.1	12.8	10.7	8.5	10.7	9.5	7.9
	Drop	6.7	5.5	4.3	6.9	5.5	4.3	6.9	5.5	4.4	6.9	5.5	4.4	7.0	5.6	4.4	7.0	5.6	4.4
0.707	Velocity				6.2	6.4	7.0	5.4	5.5	6.0	4.3	4.4	4.9	3.5	3.5	3.9	3.0	3.1	3.4
	Total Press.				28	31	43	21	23	30	13	15	19	8	9	12	6	7	9
	Throw				17.7	15.9	11.6	17.1	14.6	10.1	16.2	13.4	9.5	14.0	11.6	8.8	11.6	10.1	8.2
	Drop				6.9	5.9	4.4	6.9	5.6	4.4	6.9	5.8	4.4	7.0	5.8	4.4	7.0	5.9	4.4
0.755	Velocity				6.7	6.8	7.4	5.7	5.9	6.5	4.6	4.7	5.2	3.7	3.8	4.1	3.2	3.3	3.6
	Total Press.				33	36	49	24	25	34	15	17	22	10	11	13	7	8	10
	Throw				18.6	16.8	12.5	18.0	15.5	10.7	17.1	14.3	10.1	14.6	12.5	9.5	12.2	10.7	8.5
	Drop				7.0	5.8	4.6	7.0	5.8	4.6	7.0	5.8	4.6	7.2	5.9	4.6	7.3	6.1	4.6
0.802	Velocity				7.1	7.3	7.9	6.1	6.2	6.9	4.9	5.1	5.5	3.9	4.0	4.4	3.4	3.5	3.9
	Total Press.				37	40	56	27	29	38	17	19	24	11	12	15	8	9	12
	Throw				19.5	18.0	13.1	18.9	16.5	11.3	18.0	15.2	10.7	16.5	13.7	9.8	12.8	11.6	8.8
	Drop				7.2	5.9	4.7	7.2	6.1	4.7	7.2	6.1	4.7	7.3	6.3	4.7	7.5	6.3	4.7
0.849	Velocity							6.4	6.6	7.3	5.2	5.4	5.9	4.2	4.2	4.7	3.6	3.7	4.1
	Total Press.							31	33	43	19	21	28	12	13	17	9	11	13
	Throw							19.5	17.4	12.2	18.6	16.2	11.3	15.2	14.0	10.4	13.7	12.2	9.5
	Drop							7.2	5.9	4.7	7.2	6.1	4.7	7.3	6.3	4.7	7.5	6.3	4.7
0.896	Velocity										5.5	5.7	6.2	4.4	4.5	4.9	3.8	3.9	4.3
	Total Press.										21	23	30	13	15	19	10	12	14
	Throw										19.5	17.4	11.6	18.0	14.9	11.0	14.3	12.8	9.8
	Drop										7.3	6.3	4.9	7.6	6.6	4.9	7.6	6.6	4.9
0.943	Velocity													4.6	4.7	5.2	4.0	4.1	4.5
	Total Press.													17	18	21	11	13	16
	Throw													18.6	15.5	11.6	14.9	13.4	10.4
	Drop													7.8	6.6	5.0	7.8	6.6	5.0
1.132	Velocity													5.5	5.7	6.2	4.8	5.0	5.4
	Total Press.													23	24	30	16	18	23
	Throw													19.2	17.7	12.8	17.4	15.5	11.9
	Drop													7.9	6.7	5.2	8.1	6.7	5.2
1.321	Velocity																5.6	5.8	6.4
	Total Press.																22	25	31
	Throw																19.8	17.4	13.4
	Drop																8.4	6.9	5.3
1.511	Velocity																6.5	6.6	7.2
	Total Press.																28	32	41
	Throw																22.0	19.8	16.8
	Drop																8.7	7.0	2.4

Velocity (m/s)
Total Press.(Pa)
Throw (m)
Drop (m)

NC Sound Data Color Code
NC LEVEL LESS THAN 20
NC LEVEL LESS THAN 30
NC LEVEL LESS THAN 35
NC LEVEL LESS THAN 40
NC LEVEL LESS THAN 50
NC LEVEL MORE THAN 50
DATA BASED ON A db ROOM ATENUATION

Notes On Performance Data:

The performance tables were developed to aid you in predicating performance in order to properly select registers and grilles. The performance data is applicable to either single or double deflection blade core designs with or without opposite blade damper. Tests show an increase in effective area of approximately 5% for a single deflection unit as compared to a double deflection unit. Using the outlet without an OBD can also cause an increase of up to 5% in effective area. These increases in effective area are of relatively small magnitude and do not materially affect the throw and drop characteristics of the outlets.

Vane Deflection

The vane deflection, upon which the data is based, is shown in Figure One. Effective area is changed by changing the blade setting. The throw, drop, total pressure and noise are altered by changing vane deflection.

Listed Sizes

Sizes are shown horizontally across the top of the Performance Data Tables. (Listed sizes = Neck sizes)

Throw & Drop

Throw and drop are based on a 0.25 m/s terminal velocity and a 20 ℃ temperature difference between supply air and average room temperature on the cooling cycle.

Velocity

The velocity shown in the chart is Jet velocity (m/s). This velocity is measured with an Alnor Velometer with tip No. 2220A. The velometer tip should be held flush on face of grille. At least four reading should be taken at random over the grille face and averaged.

Total Pressure

Total pressure is measured in Pa. If static pressure drop is required, calculate the CORE AREA = (Listed length) × (Listed width) and divide the m^3/s by this area to determine the CORE VELOCITY. Using this velocity, enter Table 1 to find the velocity pressure. Subtracting velocity pressure from total pressure gives static pressure drop across the grille.

Sound

The NC Sound data is based on a room attenuation of 8 decibels (db) and a sound power level (re: 10^{-12} watts). Shown in Fig. 2 is the NC Sound Data Color code for use with performance data chart.

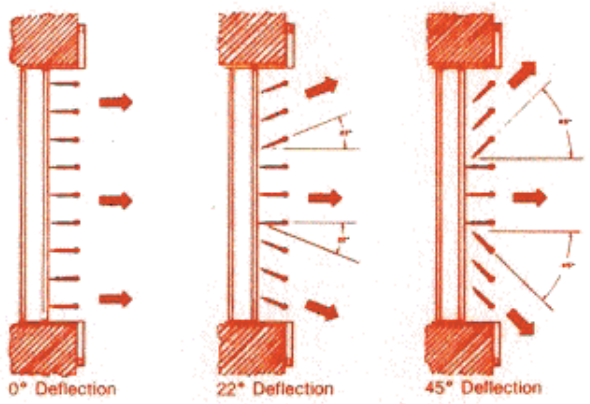
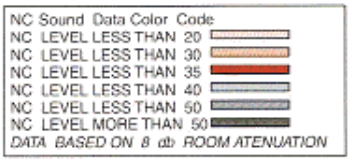


Fig.1
Blade Deflection Settings

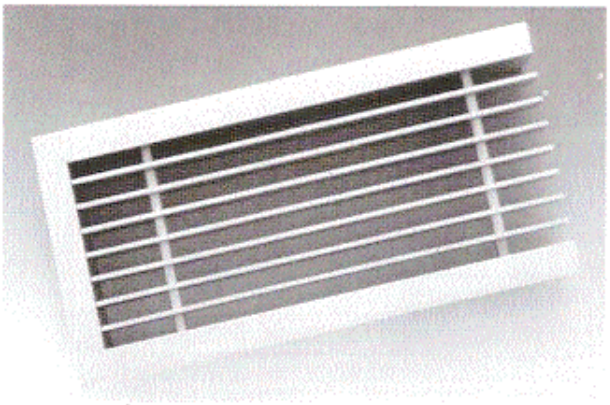
Core Velocity (m/s)	Velocity Pressure (Pa.)
1.25	1
1.5	1.5
1.75	2
2	2.5
2.25	3.3
2.5	4
2.75	4.7
3	5.5
3.25	6.5
3.5	7.7
3.75	8.7
4	10

Table 1 — Velocity Pressure Conversion Chart

Fig. 2



Model LBD/LBD2 Linear Bar Diffuser
One Way and Two Way



Model LBD/LBD2 linear bar diffusers are specially designed to match with the modern interior design with outstanding performance. With fixed bars parallel to the long dimension, linear bar diffusers are a popular choice for continuous line use on a variety of application.
Linear bar diffusers are designed for installation in side wall, ceiling, sill or floor and can be used for supply or return air in heating, cooling or ventilating application.
A variety of line styles and border widths are available to allow a selection to suit almost any application.

Features

- Extruded aluminium construction
- Maximum 3m length in one section
- Sections butt together to provide architecturally clean lines
- Choice of 4 core styles (LBD)
  Bar Deflection: 0° or 30°
  Bar spacing: 13mm or 10mm
- Choice of 3 border widths 13mm,19mm or 32mm
- Hinged / Removable cores are available as option

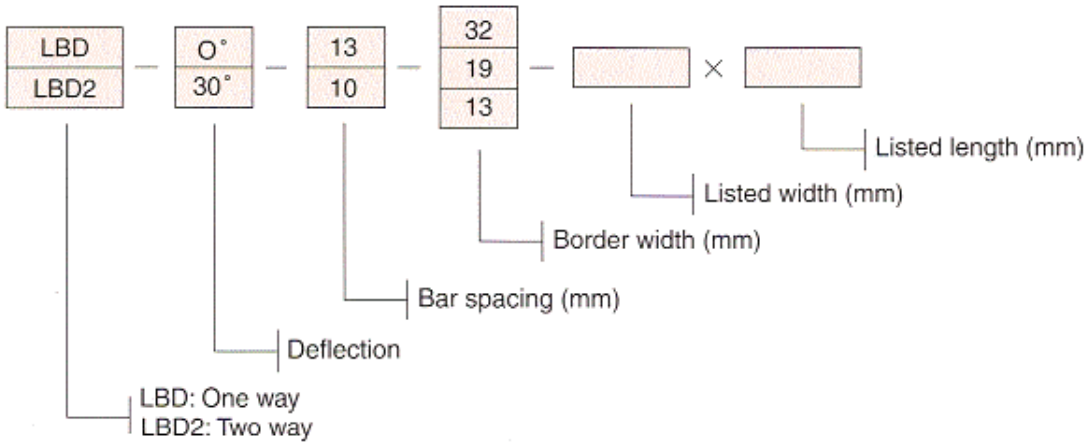
Finish

- Standard finish is nautral anodize. Baked enamel, powder coating or special anodize finishes are available

Accessories

- Opposite blade damper (OBD)
- Blade type damper (BTD)
- Blank-off strips
- Mitered corners
  Side wall, inside
  Side wall, outside
  Floor, ceiling or sill

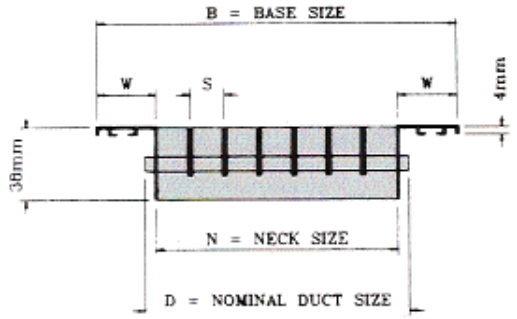
ORDER CODE



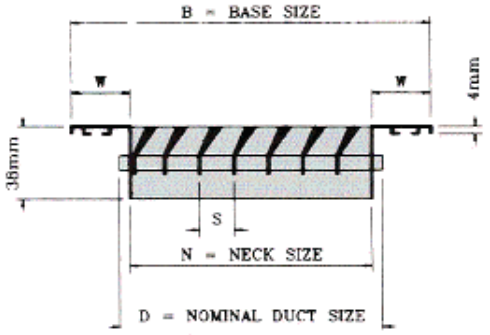
Note: For special finishes, optional construction and accessories, please specify when ordering.

Dimension And Accessories

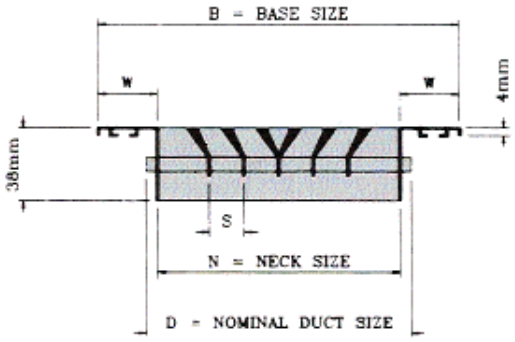
LBD O° Deflection



LBD 30° Deflection

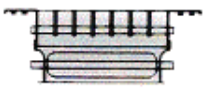
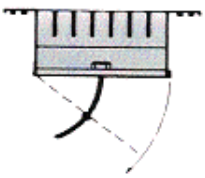


LBD2 30° Deflection



Neck Size N =D —12mm
Base Size B = N+2×W
Border Width W =13, 19 or 32mm
Bar Spacing S = 10 or 13mm

Accessories

	**Opposite blade dampers (OBD)** Damper blades move simultaneously in opposite directions. Allows for smooth volume control from fully open to fully close. Dampers manufactured from sheet steel. Standard finish is black baked enamel.
	**Blade type damper (BTD)** Damper is hinged at the rear of the grille frame. When opened, the blades swing back into the duct. The damper is screw driver operated from the face of diffuser. Dampers manufactured from sheet steel. Standard finish is black baked enamel
	**Blank-off strip** Used for deactivating a single section or alternate sections of diffuser. Made of sheet steel painted matt black.

Performance Data

LBD-30°-13 (30° Deflection, 13 mm Bar Spacing)

Size mm	Total press.Pa		3	7	12	18	27	37	48	60
63	Flow m³/s per m		.042	.063	.084	.105	.126	.147	.168	.189
Ak .021	Throw	Sill or Floor	—	1-1-1	2-2-2	3-3-4	3.5-4-4.5	3.5-4-4.5	4-4.5-5	4.5-5-5
	m	Side wall	1-1.5-2.5	1.5-2.5-3.5	2.5-3.5-5	3-4.5-6	3.5-5-7	4-5.5-7.5	4.5-6.5-8.5	5.8-7.5-9.5
75	Flow m³/s per m		.062	.093	.124	.155	.186	.217	.248	.279
Ak .031	Throw	Sill or Floor	.5-.5-.5	2-2-2	3-3-3	3.5-3.5-4.5	4-4.5-5	4.5-5-5.5	5-5.5-6	6-6.5-7
	m	Side wall	1.5-2-3	2-3-4	2-4-5.5	3.5-5-6.5	4-5.5-7.5	4.5-6.5-8.5	5-7.5-9.5	6-8.5-10.5
100	Flow m³/s per m		.092	.138	.184	.230	.276	.322	.368	.414
Ak .046	Throw	Sill or Floor	.5-.5-.5	2-2-2	3-3-3	3.5-3.5-5.5	4.5-4.5-5	5.5-6-6.5	6-6.5-7	7.5-7.5-8
	m	Side wall	1.5-2-3	2-3-4	3-4-5.5	4-5.5-7	5-6.5-8.5	5.5-7-9	6.5-8-10	8-9-11
125	Flow m³/s per m		.116	.174	.232	.290	.348	.406	.464	.522
Ak .058	Throw	Sill or Floor	1-1-1	2.5-2.5-2.5	3.5-3.5-3.5	4.5-4.5-5	5.5-5.5-6	5.5-6-6	6-6-6.5	7-7-8
	m	Sill or Floor	1-1.5-2.5	1.5-2.5-3.5	2.5-3.5-5	4-4-4.5	5-5-5.5	5-6.5-8.5	6.5-8-9	8-9-10
150	Flow m³/s per m		.144	.216	.288	.360	.432	.504	.576	.648
Ak .072	Throw	Sill or Floor	1.5-1.5-1.5	3-3-3	4-4-4	4.5-4.5-4.5	6-6-6	7-7-7.5	8-8-8	9-9-9
	m	Side wall	2-2.5-3.5	3-4-5	4-5-6.5	5-6.5-8	6.5-7.5-9	7.5-8.5-10	8-9.5-11	9-11-13
200	Flow m³/s per m		.200	.300	.400	.500	.600	.700	.800	.900
Ak .110	Throw	Side wall	2-2-2	3.5-3.5-3.5	4.5-4.5-4.5	5.5-5.5-5.5	7-7-7.5	7.5-7.5-8	9-9-9	10-10-10
	m	Side wall	3-3-4	4-5-6	5-6-8	6-7.5-8.5	7-8.5-9.5	9-9-11	9-11-12	10-12-14
250	Flow m³/s per m		.260	.390	.520	.650	.780	.910	1.04	1.17
Ak .130	Throw	Sill or Floor	2.5-2.5-2.5	4-4-4	5-5-5	6-6-6	7.5-8-8	8-8-9	10-10-10	11-11-11
	m	Side wall	4-4-5	5-6-7	6-7-9	7-8-9	8-9-10	10-11-13	10-11-12	11-14-15
Sound Level			≤ NC20	NC25	NC30	NC35	NC40	NC45	NC50	

LBD2-30°-13 (Two Way, 30° Deflection, 13mm Bar Spacing)

Size mm	Total press.Pa		3	7	12	18	27	37	48	60
100	Flow m³/s per m		.086	.129	.172	.215	.258	.301	.344	.387
Ak .043	Throw m	Ceiling	.5-1-1.5	1.5-2-3	2-2.5-4	2.5-3.5-5.5	3-4.5-7	3.5-5.5.8.5	4-6-9.5	5-7.5-11
125	Flow m³/s per m		.110	.165	.220	.275	.330	.385	.440	.495
Ak .055	Throw m	Ceiling	.5-1-1.5	1.5-2-3	2.5-2.5-4.5	2.5-4-6	3-5-7.5	3.5-6-9	4.5-6.5-10	5-8-12
150	Flow m³/s per m		.138	.207	.276	345	.414	.483	.552	.621
Ak .069	Throw m	Ceiling	.5-1-1.5	1.5-2-3	2.5-3-5	3-4-7	3.5-5.5-8.5	4-6.5-9.5	5-7-11	5.5-8.5-13
200	Flow m³/s per m		.194	.291	.388	.485	.582	.679	.776	.873
Ak .097	Throw m	Ceiling	1-1-2	2-2.5-4	2.5-3.5-5.5	3-5-8	4-6-9.5	4.5-7-11	5.5-8-12.5	6-9-14
250	Flow m³/s per m		.254	.381	.508	.635	.762	.889	1.016	1.143
Ak .127	Throw	Ceiling	1-1.5-2	2-2.5-4.5	2.5-4-6	3.5-5-8.5	4.5-6.5-10	5-7.5-12	6-9-13	6.5-10-15
300	Flow m³/s per m		.280	.420	.560	.700	.840	.980	1.120	1.260
Ak .140	Throw m	Ceiling	1-1.5-2	2-2.5-4.5	2.5-4-6.5	3.5-5-8.5	4.5-6.5-10.5	6-8.5-13.5	6-9-14	7-10.5-16
Sound Level			≤ NC20	NC25	NC30	NC35	NC40	NC45	NC50	

Recommened Air Balancing Procedure

1. Use an Alnor Velometer with Tip No. 2220A
2. Average the measuring data.
3. Determine air flow rate by the following equation
   m³/s = Ak (as shown on Performance Table) x Average Velocity (m/s) x Active Length (m)

Performance Data

LBD-0°-13 (0°Deflection, 13 mm Bar Spacing)

Size mm	Total press.Pa		2.5	6	10	16	23	31	40	50
63	Flow m³/s per m		.048	.072	0.96	.120	.144	.163	.192	.216
Ak .024	Throw	Sill or Floor	—	1-1-1	2-2-2	3-3-4	3.5-4-4.5	3-4.5-5	4-5-5.5	4.5-5.6
	m	Side wall	1-1.5-2.5	1.5-2.5-3.5	2.5-3.5-5	3-4.5-6	3.5-5-7	4.5-6-8	5-7-9	6-8-10
75	Flow m³/s per m		.072	.108	.144	.180	.216	.252	.288	.324
Ak .036	Throw	Sill or Floor	.5-.5-.5	2-2-2	3-3-3	3.5-3.5-4.5	4-4.5-5	5-5.5-6	5.5-6-6.5	6.5-7-7.5
	m	Side wall	1.5-2-3	2-3-4	2-4-5.5	3.5-5-6.5	4-5.5-7.5	5-7-9	5.8-8-10	6.5-9-11
100	Flow m³/s per m		.104	.156	.208	.260	.312	.364	.416	.468
Ak .052	Throw	Sill or Floor	.5-.5-.5	2.5-2.5-2.5	3.5-3.5-3.5	4-4-5	5-5-5.5	6-6.5-7	6.5-7-7.5	8-8-8
	m	Side wall	1.5-2-3	2.5-3.5-4.5	3.5-4.5-6	4.5-6-7.5	5.5-7-9	6-8-10	7-9-11	8-10-12
125	Flow m³/s per m		.134	.201	.268	.335	.402	.469	.536	.603
Ak .067	Throw	Sill or Floor	1-1-1	3-3-3	4-4-4	5-5-5	6-6-6.5	7-7-7	7.5-7.5-8	8.5-8.5-9
	m	Side wall	2-2.5-3.5	3-4-5	4-5-6.5	5-6.5-8	6-8-9.5	7-8.5-11	8-10-12	9-11-13
150	Flow m³/s per m		.166	.249	.332	.415	.498	.581	.664	.747
Ak .083	Throw	Sill or Floor	1.5-1.5-1.5	3-3-3	4-4-4	5-5-5	6.5-6.5-6.5	7-7-7.5	8-8-8	9-9-9
	m	Side wall	2.5-3-4	3.5-4.5-5.5	4.5-5.5-7	5.5-7-8.5	7-8-9	8-9-11	8.5-10-12	9.5-12-14
200	Flow m³/s per m		.230	.345	.460	.575	.690	.805	.920	1.035
Ak .115	Throw	Sill or Floor	2-2-2	3.5-3.5-3.5	4.5-4.5-4.5	5.5.-5.5-5.5	7-7-7.5	7.5-7.5-8	9-9-9	10-10-10
	m	Side wall	3-3.5-4.5	4-5-6	5-6-8	6-7.5-9	7.5-9-9.5	9-10-12	9-11-12	10-13-15
250	Flow m³/s per m		.296	.444	.592	.74	.888	1.036	1.184	1.332
Ak .148	Throw	Sill or Floor	2.5-2.5-2.5	4-4-4	5-5-5	6-6-6	7.5-8-8	8-8-9	10-10-10	11-11-11
	m	Side wall	4-4.5-4.5	5-6-7	6-7-9	7-8-9.5	8-9.5-10	10-11-13	10-12-13	11-14-16
Sound Level			≤NC20		NC25	NC30	NC35	NC40	NC45	

Notes On Performance Data

Throw

Maximum throws are to a terminal velocity of 0.25 m/s.
Middle throws are to a terminal velocity of 0.5 m/s.
Minimum throws are to a terminal velocity of 0.75 m/s.
These throw values are based on a 1m active section of grille with a cooling temperature differential of 11℃. The multiplier factors listed in the table below are applicable for other lengths.

Throw Correction for Length (Multiply)

	Terminal Velocity		
Active Length	.75 m/s	.5 m/s	.25 m/s
0.3m	0.5	0.6	0.7
3m or Continuous	1.6	1.4	1.2

Sound

The NC values are based on a room absorption of 10 db re10^{-12} watts and a 3m active section.

Return Air Applications

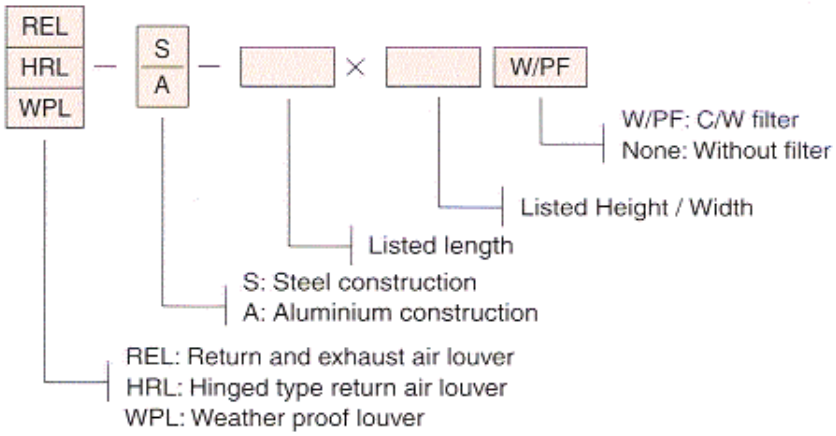
When used as a return air intake, the NC value given in the performance table will be increased by 5.
For a return air application, the negative static pressure will be 0.8 times the total pressure value as shown in the performance table.

Model REL/HRL/WPL

REL Return and exhaust Air Louvers
HRL Hinged Type Return Air Louvers
WPL Weather Proof Louvers

A complete range of air louver with similar appearance to suit several applications in HVAC system. These louvers offer a large free area with a semi-sight proof design. REL & HRL louvers are designed for installation in sidewall and ceiling. WPL louvers are designed for installation in exterior wall providing an effective weather proof protection.

Order Code



Features

General

- Choice of extruded aluminium or sheet steel construction
- Fixed horizontal louvers blades setting at 45° overlaping each other.

HRL Louvers

- Core is hinged to outer frame, release two metal locking device to swing out core and expose filter.

WPL Louvers

- Suitable for both intake and exhaust applications
- Louver blades with a weather stop at its upper edge (see drawing) providing an effective weather proof protection

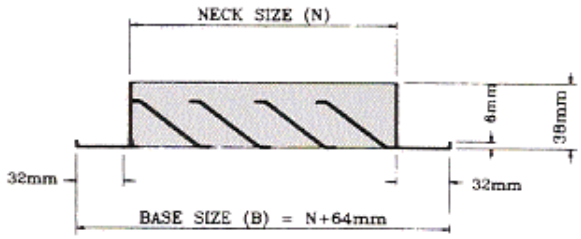
Accessories

- Panel filters
  Filter holding brackets fitted onto inner face of core to allow filter slide in/out. Filter with frames fabricated from aluminium sheet and aluminium foil filter media. Standard filter thickness is 25mm.

Finish

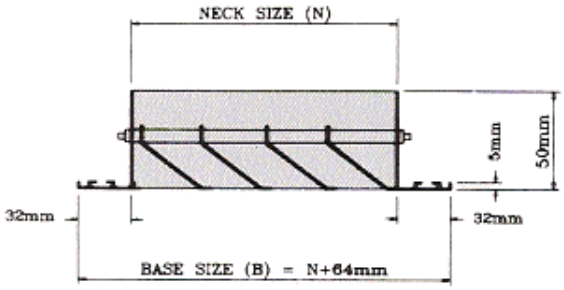
- Steel construction
  Standard finish is white baked enamel. Special colour finishes available to match architectural requirements
- Extruded aluminium construction
  Standard finish natural anodize. Baked enamel or special anodize finishes available to match architectural requirements.

Dimension



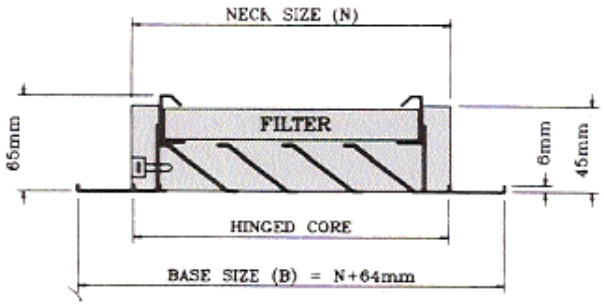
REL-S

RETURN AND EXHAUST AIR LOUVER (STEEL)



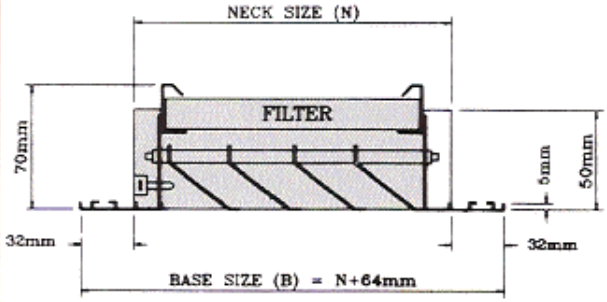
REL-A

RETURN AND EXHAUST AIR LOUVER (ALUMINIUM)



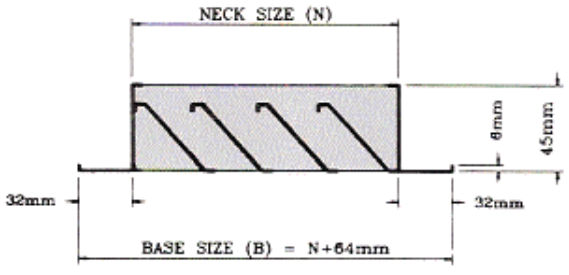
HRL-S

HINGED TYPE RETURN AIR LOUVER (STEEL)



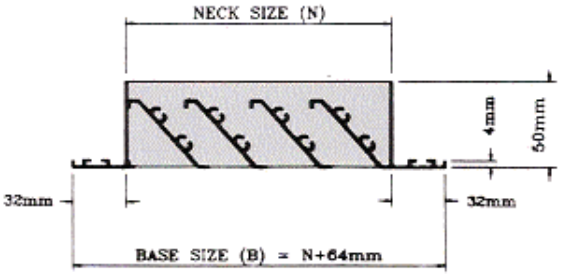
HRL-A

HINGED TYPE RETURN AIR LOUVER (ALUMINIUM)



WPL-S

WEATHER PROOF LOUVER (STEEL)



WPL-A

WEATHER PROOF LOUVER (ALUMINIUM)

Performance Data

REL Return And Exhaust Air Louvers

Static Pressure Drop

Velocity (m/s)	2	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8	9
Intake (Pa)	4	6	8	11	14	18	22	27	32	37	43	50	56	71

Effective Pressure Area (sq.m)

Neck Height (mm) \ Neck Width (mm)	150	200	250	300	350	400	450	500	600	750	900	1050	1200
150	0.009	0.012	0.015	0.018	0.021	0.024	0.027	0.030	0.035	0.044	0.053	0.062	0.081
200	0.013	0.017	0.021	0.025	0.029	0.034	0.038	0.042	0.050	0.063	0.076	0.088	0.101
250	0.016	0.022	0.027	0.033	0.038	0.044	0.049	0.055	0.065	0.082	0.098	0.114	0.131
300	0.020	0.027	0.034	0.040	0.047	0.054	0.060	0.067	0.080	0.100	0.120	0.141	0.161
350	0.024	0.032	0.040	0.048	0.056	0.064	0.072	0.080	0.095	0.119	0.143	0.167	0.191
400	0.028	0.037	0.046	0.055	0.064	0.074	0.083	0.092	0.110	0.138	0.166	0.193	0.221
450	0.031	0.042	0.052	0.063	0.073	0.084	0.094	0.105	0.125	0.159	0.188	0.219	0.251
500	0.035	0.047	0.059	0.070	0.082	0.094	0.105	0.117	0.140	0.176	0.210	0.246	0.281
600	0.043	0.057	0.071	0.085	0.099	0.054	0.128	0.142	0.170	0.213	0.256	0.298	0.341
750	0.054	0.072	0.090	0.108	0.126	0.144	0.162	0.180	0.215	0.269	0.323	0.377	0.431
900	0.065	0.087	0.109	0.130	0.152	0.174	0.195	0.217	0.260	0.326	0.390	0.456	0.521
1050	0.076	0.102	0.127	0.153	0.178	0.204	0.229	0.255	0.305	0.382	0.458	0.534	0.611
1200	0.088	0.117	0.146	0.175	0.204	0.234	0.263	0.292	0.350	0.438	0.526	0.613	0.701

HRL Hinged Type Return Air Louvers

Static Pressure Drop

Velocity (m/s)	2	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8	9
Intake (Pa)	4	6	8	11	14	18	22	27	32	37	43	50	56	71

Effective Pressure Area (sq.m)

Neck Height (mm) \ Neck Width (mm)	150	200	250	300	350	400	450	500	600	750	900	1050	1200
150	–	0.006	0.008	0.010	0.012	0.014	0.016	0.018	0.022	0.040	0.034	0.040	0.046
200	–	0.010	0.013	0.063	0.020	0.023	0.026	0.029	0.036	0.046	0.055	0.065	0.075
250	–	–	0.018	0.023	0.027	0.032	0.036	0.041	0.050	0.063	0.077	0.090	0.104
300	–	–	–	0.029	0.035	0.040	0.046	0.052	0.063	0.081	0.098	0.115	0.132
350	–	–	–	–	0.042	0.049	0.056	0.063	0.077	0.098	0.119	0.140	0.161
400	–	–	–	–	–	0.058	0.066	0.074	0.091	0.116	0.140	0.165	0.189
450	–	–	–	–	–	–	0.076	0.086	0.105	0.133	0.162	0.190	0.219
500	–	–	–	–	–	–	–	0.097	0.118	0.151	0.183	0.215	0.247
600	–	–	–	–	–	–	–	–	0.146	0.186	0.225	0.265	0.305
750	–	–	–	–	–	–	–	–	–	0.238	0.284	0.340	0.391
900	–	–	–	–	–	–	–	–	–	–	0.353	0.415	0.477
1050	–	–	–	–	–	–	–	–	–	–	–	0.490	0.564
1200	–	–	–	–	–	–	–	–	–	–	–	–	0.650

Performance Data

WPL Weather Proof Louvers

Static Pressure Drop

Velocity (m/s)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
Intake (Pa)	2	4	6	10	14	20	26	32	40	48	58	68	78	90
Exhaust (Pa)	1	2	4	7	10	13	17	22	27	32	38	45	52	60

Effective Pressure Area (sq.m)

Neck Height (mm) \ Neck Width (mm)	300	350	400	450	500	600	750	900	1050	1200	1350	1500	1800
300	0.035	0.040	0.046	0.052	0.057	0.069	0.086	0.103	0.120	0.138	0.155	0.172	0.207
350	0.041	0.048	0.055	0.062	0.069	0.082	0.103	0.124	0.144	0.165	0.185	0.206	0.247
400	0.048	0.056	0.064	0.072	0.080	0.096	0.120	0.144	0.168	0.192	0.216	0.240	0.288
450	0.055	0.064	0.073	0.082	0.091	0.109	0.137	0.164	0.191	0.219	0.246	0.273	0.328
500	0.061	0.071	0.082	0.092	0.102	0.123	0.154	0.184	0.215	0.246	0.276	0.307	0.369
600	0.075	0.087	0.100	0.112	0.125	0.150	0.187	0.225	0.262	0.300	0.337	0.375	0.450
750	0.095	0.111	0.127	0.143	0.159	0.190	0.238	0.286	0.333	0.381	0.428	0.476	0.571
900	0.115	0.135	0.154	0.173	0.192	0.230	0.289	0.346	0.404	0.462	0.519	0.577	0.693
1050	0.136	0.158	0.181	0.204	0.226	0.271	0.339	0.407	0.475	0.543	0.610	0.678	0.814
1200	0.156	0.182	0.206	0.234	0.260	0.312	0.390	0.468	0.546	0.624	0.702	0.780	0.936
1350	0.176	0.206	0.235	0.264	0.294	0.352	0.457	0.529	0.617	0.705	0.793	0.881	1.057
1500	0.196	0.228	0.262	0.295	0.327	0.393	0.491	0.589	0.687	0.786	0.884	0.982	1.179
1800	0.237	0.276	0.316	0.355	0.395	0.474	0.592	0.710	0.829	0.948	1.066	1.185	1.422

Notes on performance data

- Velocity corresponding to effective pressure area.
- Air flow (m^3/s) = Velocity (m/s) x Effective Pressure Area (m^2).

Selection Examples

Example No. 1

900 x 600 mm weather proof louver is selected for air intake. The airflow rate is 0.9 m^3/s, determine the static pressure required.

1. Using the performance table, the effective pressure area of the concerned louver is 0.23 m^2.

2. Calculate the velocity corresponding to the effective pressure area.

$$\frac{\text{Air Flow Rate } (m^3/s)}{\text{Effective Pressure Area } (m^2)} = \text{Velocity (m/s)}$$

$$\frac{0.9\ m^3/s}{0.23\ m^2} = 4\ m/s$$

3. Using the performance table, the static pressure required is 26 Pa.

Example No. 2

The air flow rate of a return air louver is 0.58 m^3/s and the maximum static pressure drop is 15 Pa. Select the size of hinged type return air louver.

1. Determine the maximum velocity using the performance table. The velocity is 4 m/s against a pressure drop of 14 Pa.

2. Calculate the effective pressure area required

$$\frac{\text{Air Flow Rate } (m^3/s)}{\text{Velocity (m/s)}} = \text{Effective Pressure Area } (m^2)$$

$$\frac{0.58\ m^3/s}{4\ m/s} = 0.145 m^2$$

3. As shown on the performance table, the effective pressure area of 600 x 600 mm louver is 0.146 m^2. Therefore, 600 x 600 mm louver or larger size can be selected.

Technical Literature

54) Air Grille and Air Louvre

The Only Fire
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PHENOTHERM

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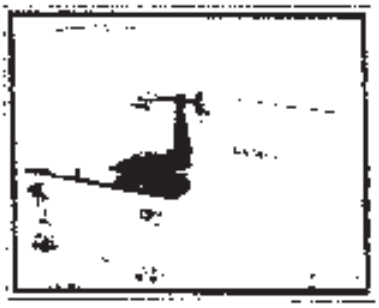
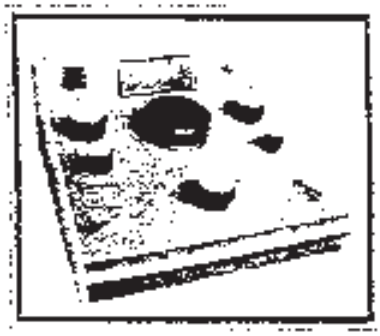
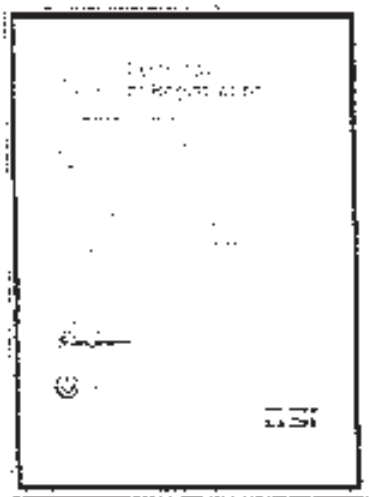
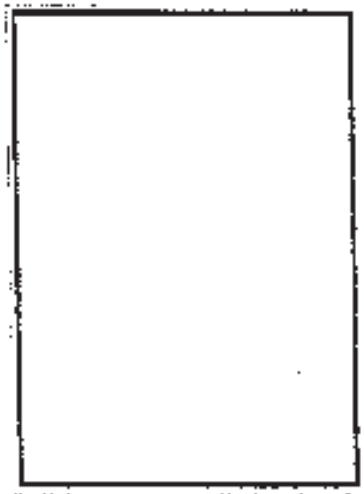
Contents

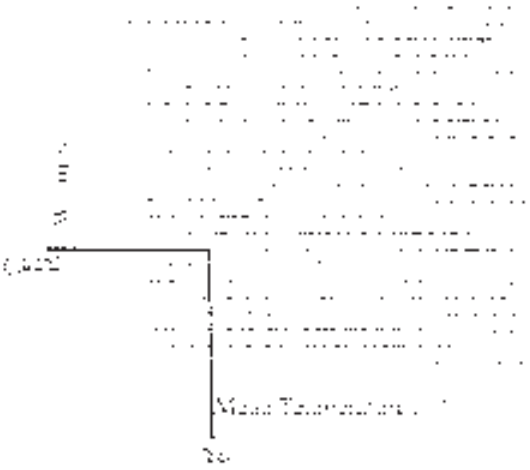
Description



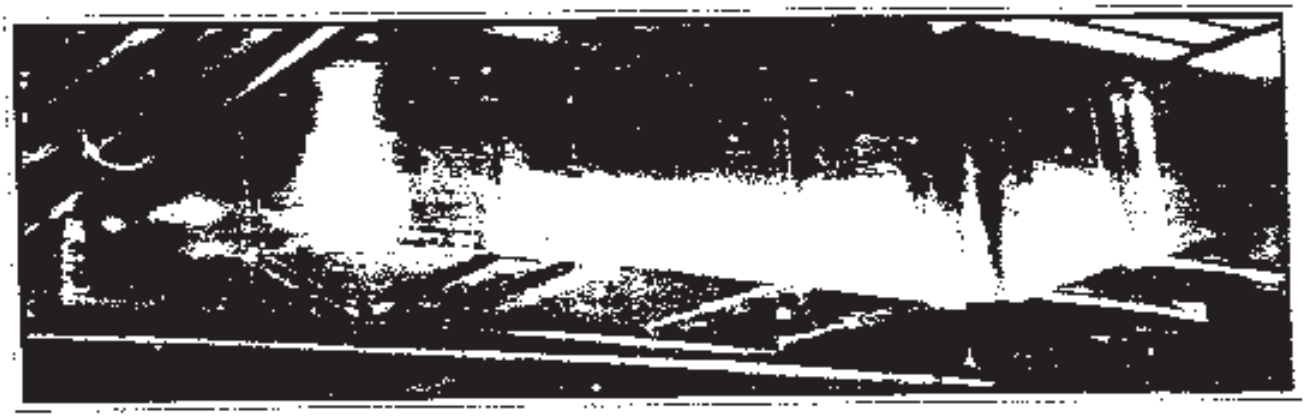


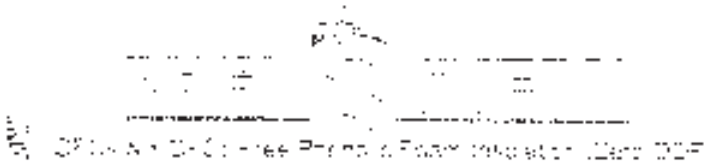


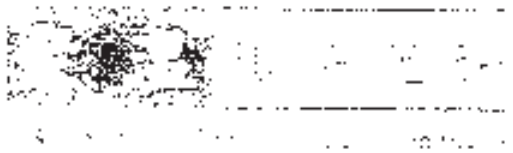




Use and Application







Distinctive Features

Environmentally Friendly

Superior Thermal Conductivity

Low Water Absorption

Fire Performance

Texture

Wide Service Temperature

Longer Lifetime

Versatile and Easy Shrinkage Joints

Impact Resistance

Storage

Maintenance

High Pressure Compressive Strength

Product Marketing

Standard Supply Ranges

Pinnacle products are available in:

- Board Form
- Pre-formed Rigid Pipe Sections
- High Density Pipe Supports (Fittings)
- Fittings for Pre-formed Rigid Pipes and Valves (Insulation Kits)
- Duct Defence Duct Supports (Sheet Metal Angles)
- Pre-insulated Duct System - PID System

Board Form:

Nominal Densities: 40 kg/m³, 60 kg/m³, 80 kg/m³ & 120 kg/m³

Facings:

DSF: Double Sided Reinforced Aluminium Foil

DSF-White: All Service White Antiglare Coated Double Sided Reinforced Aluminium Foil

WGT: White Glass Tissue

Thickness: 25 mm - 100 mm

Standard Size: 1.2 M x 2.4 M for 40 kg/m³, 60 kg/m³

1.2 M x 1.2 M for 80 kg/m³, 120 kg/m³

(Other sizes available)

Preformed Rigid Pipe Sections - High Density Pipe Supports - Fittings:

Nominal Densities: 40 kg/m³, 60 kg/m³, 80 kg/m³ & 120 kg/m³

Facings:

DSF: Double Sided Reinforced Aluminium Foil

DSF-White: All Service White Antiglare Coated Double Sided Reinforced Aluminium Foil

Nominal Bore: 15 mm - 600 mm

Thickness: 15 mm - 100 mm

Standard Length:

Rigid Pipe Sections: 200 mm

Pipe Supports: 300 mm - 900 mm

(Other sizes available)

High Density Duct Supports:

Nominal Density: 80 kg/m³

Facings:

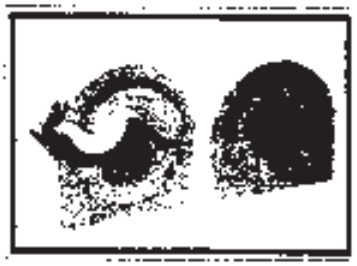
DSF: Double Sided Reinforced Aluminium Foil

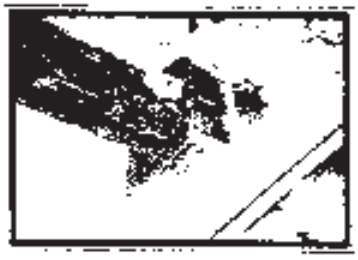
DSF-White: All Service White Antiglare Coated Double Sided Reinforced Aluminium Foil

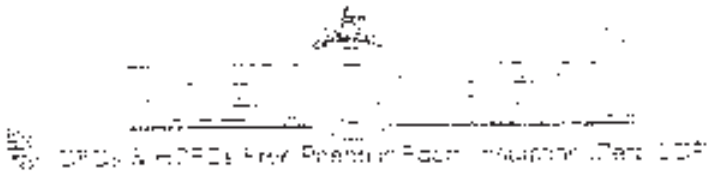
WGT: White Glass Tissue

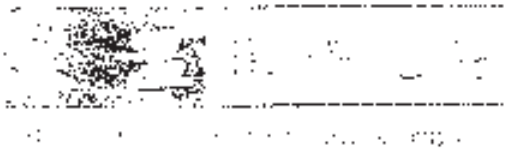
Standard Width: 75 mm - 100 mm

High Density Supports



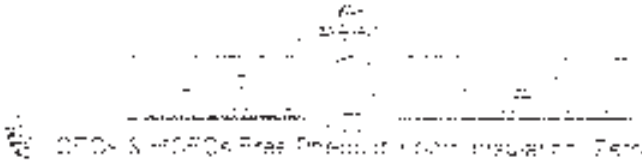


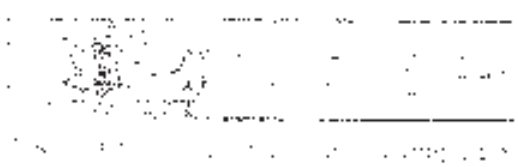




Technical Properties

Properties	Test Method	Technical Data
Nominal Density		
Thermal Properties		
Thermal Conductivity		
Mean Temperature		
Mean Temperature		
Service Temperature		
Min		
Mechanical Properties		
Compressive Strength		
Perpendicular to Rise		
Moisture Properties		
Water Absorption		
Water Absorption		
Water Vapour		
Fire Performance		
Flammability		
Flame Propagation		
Surface Spread of Flame		
Fire Safety in Building Regulations		
Dust Explosibility		
Oxygen Index		
Smoke Generation		
Reaction to Fire Classification		





Major Job References

Successful Application for Public Water Procurement Study Tour for Improvement of [illegible] System

[illegible]
- Project of Water Supply System [illegible] Square
  The Study Team for Water [illegible] Project
  Sub-Committee of Study Team [illegible]
  Water Supply Bureau, [illegible]
  Water Supply Office of [illegible]
  Professor, [illegible]
  Study Team, Japanese Government, Republic of [illegible]
  Director, Bureau of Water Supply
- Installation of Pumping Station, Phase I
  Yan'an Municipal Water Supply Office, Shaanxi Province
- JICA's Redevelopment Study for Water Supply System
  Study Team Member
  Provincial Highway Maintenance Project in Sichuan Province
  Japan Road Association, Study Team Member
  Study Team for Water Supply Development Master Plan in Chengdu City
- Construction of Water Supply Pipeline
- Installation of Water Supply System
- MDGs Achievement Project for Water Supply (WSP), Vietnam
- Water Supply Project, Kunming Water Supply Company
- Water Supply Improvement Project in Kunming City, Yunnan Province, China
- Project for Improvement of Water Supply System in Kunming City
  Kunming Water Supply Company, Kunming City, Yunnan Province, China
  Vice President, Kunming Water Supply Company
- Construction of Water Supply System in Kunming City
- Construction of Water Supply System in Kunming City, Phase II
- KOICA-Master Plan Study for Water Supply System in Kunming City, Yunnan Province, China
- KOICA Consultant for Water Supply Master Plan
  Supervisor for Kunming Water Supply Master Plan Study Team
  Vice Director of Water Bureau
- Water Supply Improvement Project
  Vice Director of Water Bureau, Kunming City, Yunnan Province, China
- 2008 Olympic Equestrian Venue

CHINA
- Construction of Water Supply System
  Director of Water Bureau, Kunming City, Yunnan Province, China
  Consultant, Water Supply Study
- Construction of Water Supply System
  Director, Water Bureau, Kunming City, Yunnan Province, China
- Construction of Water Supply System
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MACAO
- Water Supply Improvement
  Director of Water Bureau, Kunming City, Yunnan Province, China
  Vice Director of Water Bureau, Kunming City, Yunnan Province, China
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- [illegible]
- [illegible]
  Vice Director, Water Bureau, Kunming City, Yunnan Province, China
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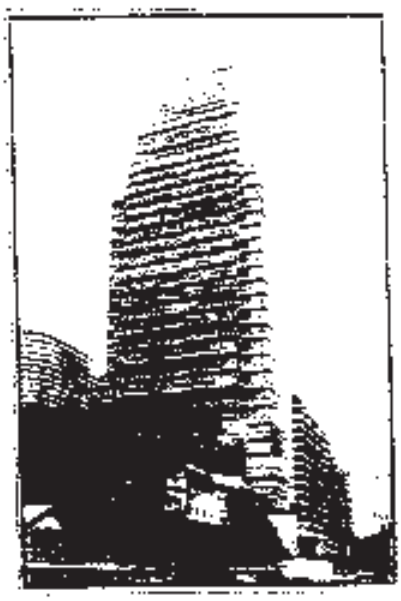
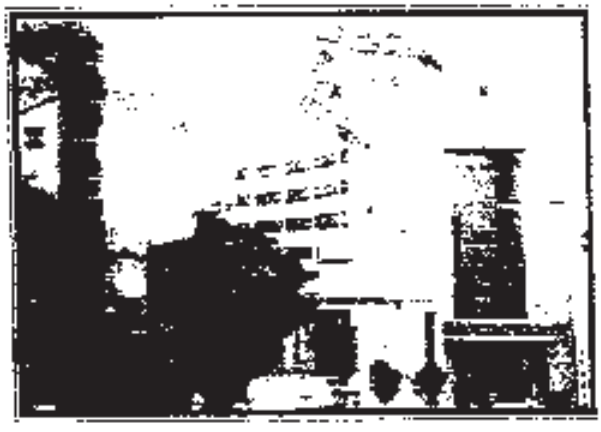
- Director

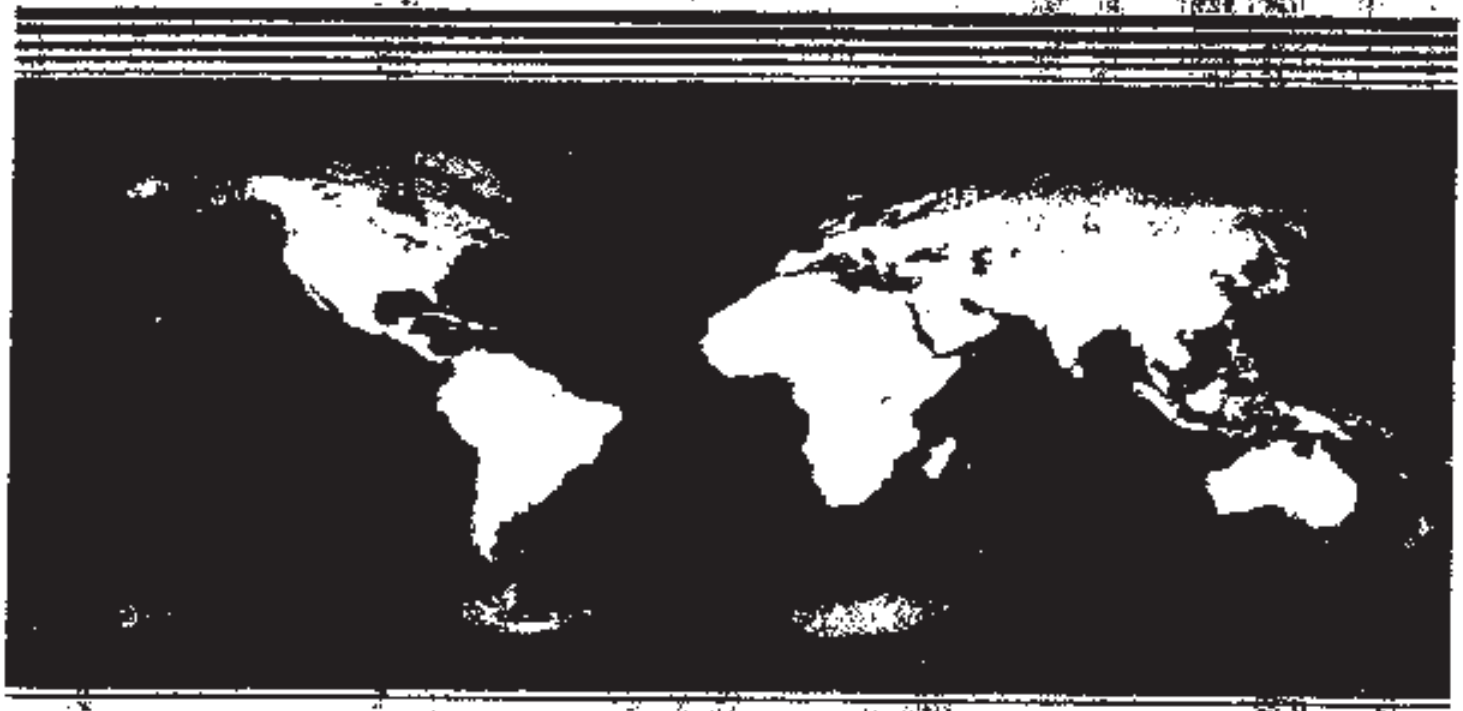




Technical Literature

55) Ductwork Phenolic Foam Insulation

Vibro-Acoustics®



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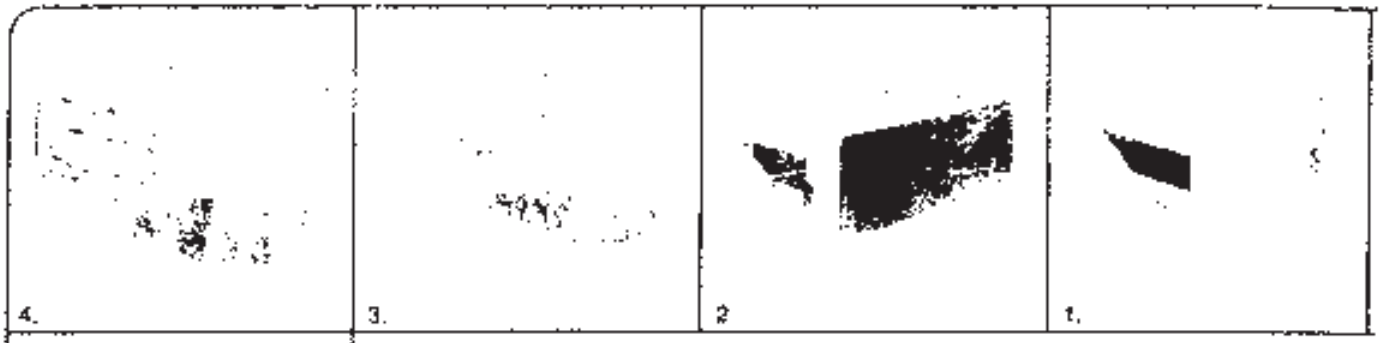
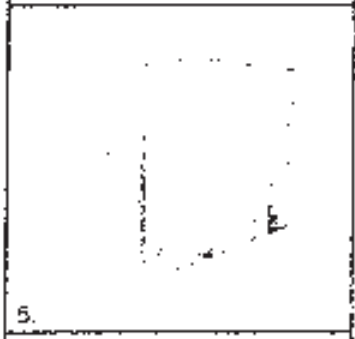
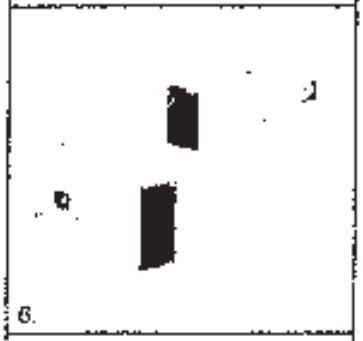
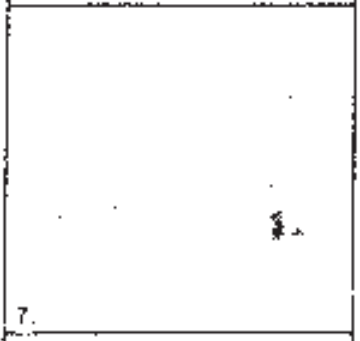
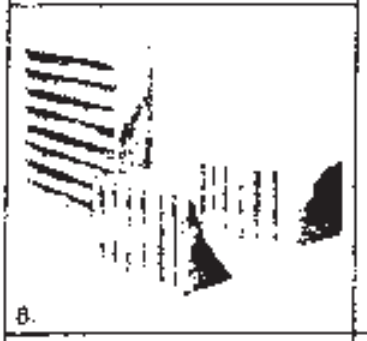










1. **2RST:** Rectangular Straight Through Silencers with thick acoustic media on two walls. Suitable for thin ducts resulting in low pressure drop.

2. **4RST:** Rectangular Straight Through Silencers with thick acoustic media on four walls Airflow passage same size as connecting duct
Alternative: Outside body dimension same size as connecting duct to conserve space.

3. **ELB-RST:** Elbow Rectangular Straight Through Silencers available with various turning radii

4. **ELB-RSS:** Elbow Rectangular Silencers with streamlined acoustic splitters for increased noise attenuation.

5. **RSS:** Rectangular Splitter Silencers Variable range of aerodynamic acoustic splitter thicknesses and air passages to optimize acoustic performance and energy conservation.

6. **PLENUM:** Acoustic intake or discharge plenums to fans are effective silencers while serving other utilitarian functions

7. **XTS:** Cross-Talk or Transfer Silencers are available in various configurations to block line of sight or transfer air to or from plenums.

8. **LVS:** Low Velocity Silencer is rectangular splitter type for installation in plenums, shafts and oversized ducts. This is the one model supplied without perforated metal as standard. Streamline inlets are optional.

AL: Acoustic Louvre is a short design for wall openings. The louvre vane is filled with acoustic media and protected from the weather by position and perforated metal

9. **RSB:** Rectangular Side Box Silencer is an inlet box combination for applications where an inlet box is required.

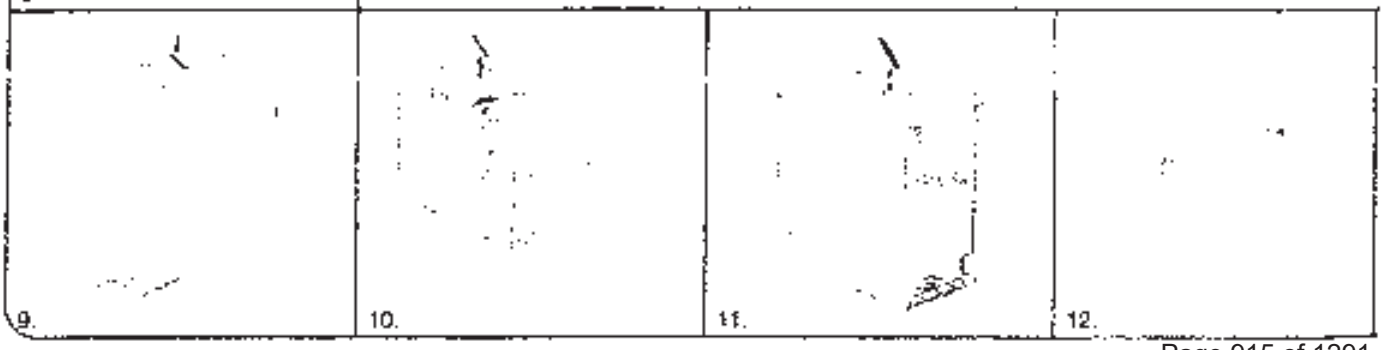
DESIGNED TO MATCH FAN CONNECTION SIZES OR DUCT SIZES

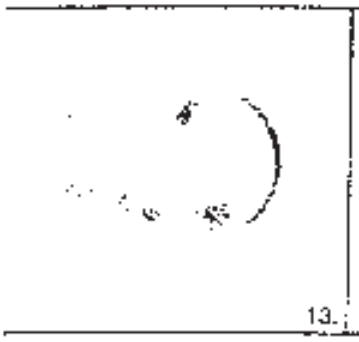
For economy of design time, cost, energy consumption and space.

10. **RHB:** Rectangular Horizontal Box Silencer is designed to bolt directly to the fan inlet flange. Type PJB inlet Box Silencer connects directly to the fan inlet box

11. **RDS:** Rectangular Discharge Silencer bolts directly to the fan discharge flange. The transitioning, included within the silencer for pressure recovery, eliminates the need for a separate transition piece.

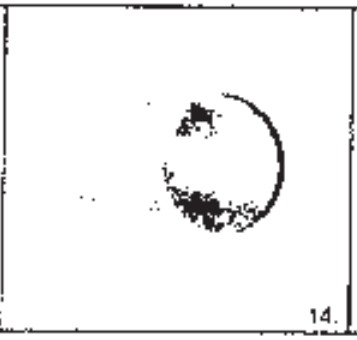
12. **RSP:** Rectangular Special Silencers include transitions, where connecting rectangular ducts are of different sizes, and high transmission loss walls of heavy plate or mass filled. Shown is a rectangular-to-round transitional silencer.




13.

13. **CST:** Circular Straight Through Silencers with thick acoustic media over the entire circumference. The air flow passage is the same size as the connecting duct.

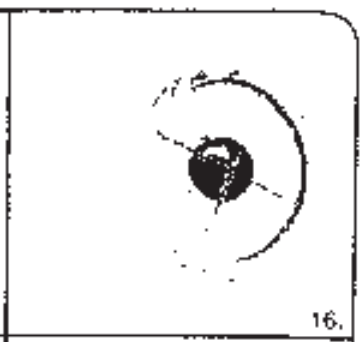
Alternatives: Outside rectangular body, spiral outer casing, outside body size same size connecting duct to conserve space, etc.


14.

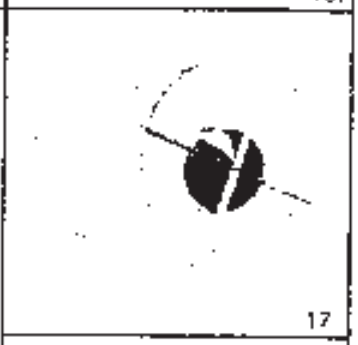
14. **SRIP:** Spiral round, internally lined, protected by perforated metal. Usually thinner media than in a CST, but supplied in longer lengths where there is added thermal advantage.


15.

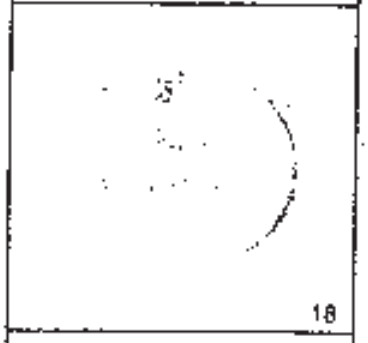
15. **SOIP:** Spiral oval, internally lined, protected by perforated metal. Oval is midway between round and rectangular in terms of space conservation, rigidity and cost.


16.

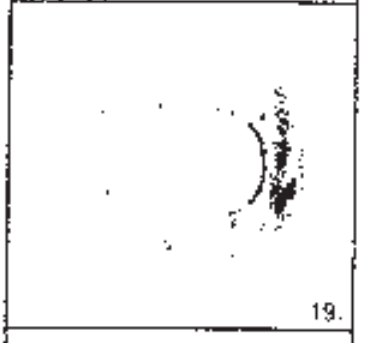
16. **CCB:** Circular Centrebody Silencers. An aerodynamic acoustic centrebody has been added to the CST silencer for greater acoustic performance, particularly in the higher frequency range. Type CLCB has a large centrebody which blocks line of sight and a much larger outside body for greater attenuation.


17

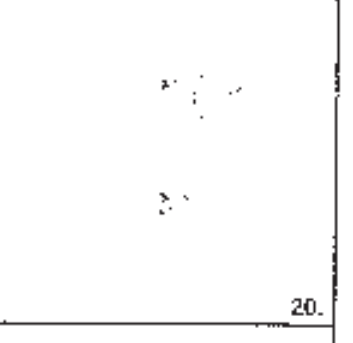
17. **ECB:** Economy Centrebody Silencers have solid steel outer shells. Selected for low air velocity applications.


18

18. **CCS:** Centre Splitters inserted in type CST. Usually used for large diameters where type CCB passes too much noise in the high and medium frequency range.


19.

19. **CTS:** Circular Tuned Silencer for specific applications where pure tones require attenuation.


20.

20. **CPV:** Circular Pressure Vessel type silencers for high pressure blowers. Various constructions include flat or dished heads.

21. **CR:** Circular Reactive type silencers have much greater outside body dimensions than duct or pipe connection for low frequency attenuation.

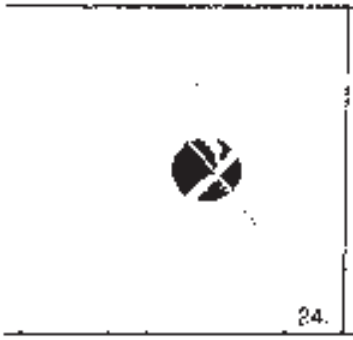
Construction compatible with fan for direct connection or for installation in associated system ductwork.

OPTIONS: Media protected with cloth, plastic film, wire screen, special media, no media (reactive design), high T.L. walls, single or multiple piece construction, special steels, aluminum, weatherhoods, birdscreens, flanges.

24. **CSP:** Circular Special Silencers include transitional where connecting ducts are of different diameter, and high transmission loss well silencers of heavy plate. Type CCBSP, Circular Centre Body Special shown, is designed to avoid a low slung beam or other obstruction.

22. **ELB-CST:** Elbow Circular Straight Through Silencers have circular inner perforated air passages and outer solid casings constructed of segments (lobster back).

23. **ELB-CSTS:** Elbow Circular Straight Through Silencers with square outside casing.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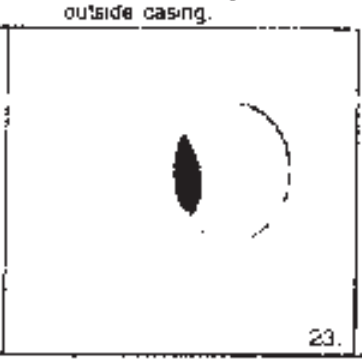
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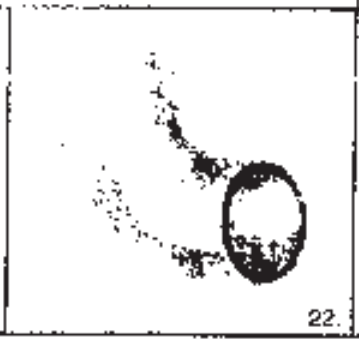
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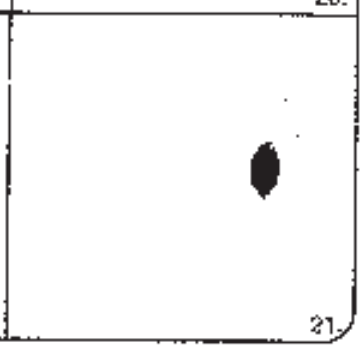

21.

THE VIBRO-ACOUSTIC NOISE CONTROL PACKAGE

Silencers • Enclosures • Vibration Isolation

- One source supply - undivided responsibility -

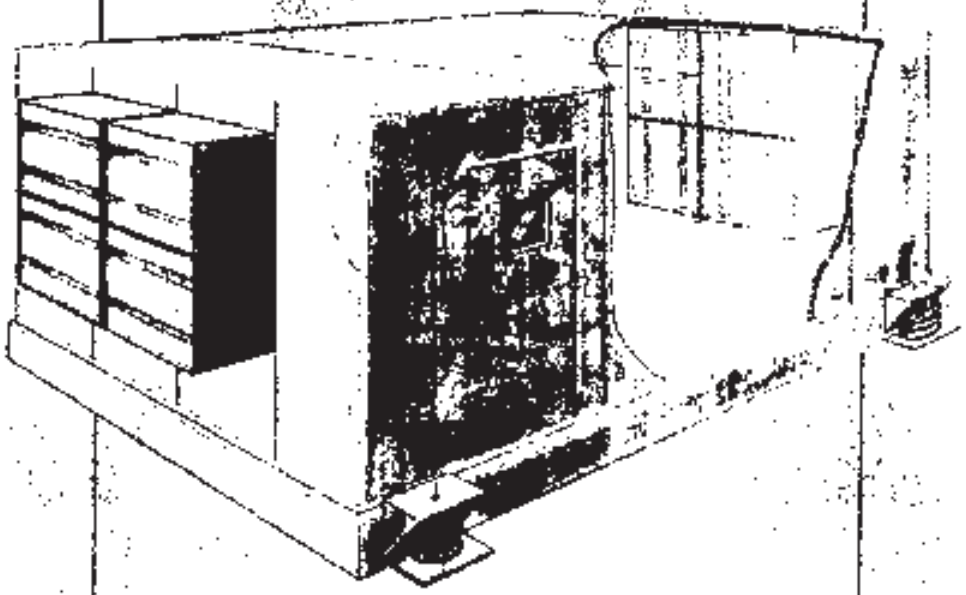
Most engineering manuals and texts, including the ASHRAE Guide, combine noise and vibration as one discipline.

Silencers: All types, as described in this catalogue, can be selected to attenuate fan inlet and/or outlet noise. However, excessive noise and vibration may also be radiated from fan casings and bases. Enclosures and vibration isolation must then be carefully selected for a balanced design and lowest space and cost requirements.

Enclosures: Include modular panels or one piece construction, thermal as well as acoustic, engineering designs for structural integrity, and specialties such as doors, windows, flexible connections, high transmission loss wrappings for fan casings.

Vibration Isolation: Includes integral steel fan and motor bases or concrete inertia base forms, spring mounts or hangers and flexible connections.

Applications: Fan companies and other original equipment manufacturers (OEM'S) including all types of air handling equipment, cooling towers, dust collectors, etc.
- Ultra quiet installations such as TV studios, auditoria and conference rooms.
- Industrial, commercial and institutional buildings.
- Engineering projects such as tunnel ventilation, power plants and manufacturing processes.



Selection Aids: Product catalogues, quick selection charts, energy conservation selections, technical data sheets, specification data sheets and special lab testing, are available upon request.

Vibro-Acoustics®

RLC
RECTANGULAR SILENCERS

INTRODUCTION

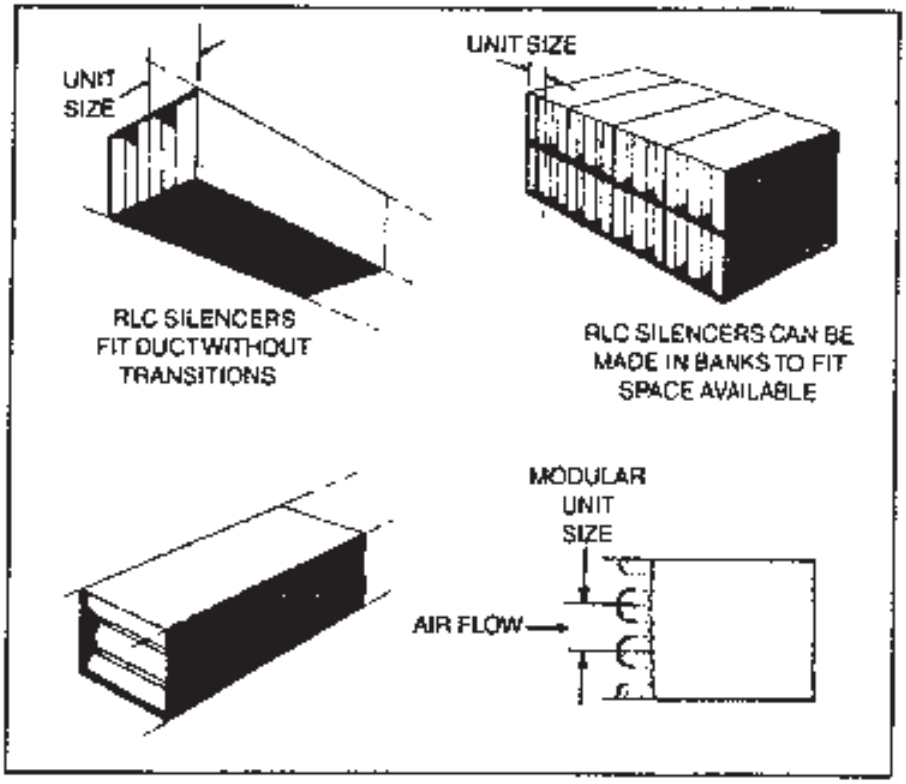
Often, one or two critical octave bands decide silencer selections, usually one of those centres on 250 Hz.

Probably very little high frequency insertion loss is needed to balance the receiving sound spectrum.

Almost always, low pressure drop is required to reduce long term energy costs.

And likely, selections must be done quickly.

RLC silencers are designed and presented to satisfy these requirements.



DESIGN PRINCIPLES

- modular unit sizes to fit ducts without transitions, and banks without major blank-offs
- standard low, medium-low, medium, and high velocity models
- standard in 3, 5, 7 or 9 foot, or alternately 900, 1500, 2100 or 2700 mm lengths
- low energy loss
- casings stiffened to application requirements
- custom models, lengths and option add-ons for more application flexibility

APPLICATION PRINCIPLES

- quick selections are possible when seeking NC-35 or greater and duct velocities are low enough that generated noise is an unlikely problem
- for NC-30 or less, more detailed performance and computer selection assistance is available from our licensees or their agents

TYPES OF APPLICATIONS

- wherever sheet metal silencers can be applied
- low or medium velocity ducts
- commercial offices, apartment buildings, concert halls, studios, etc.
- light industrial applications

APPLICATION CONCERNS

NC-30 to NC-40 Systems

- locate silencer at mechanical room or barrier walls to minimize noise breakout
- ensure uniform airflow to the silencer
- select for modest pressure drop (less than 75 Pa or 0.30 in. of water)
- keep silencers away from elbows, tees, grilles and diffusers
- self generated noise should not then be critical in most applications
- isolate silencer from wall with media and seal with mastic

NC-20 to NC-30 Systems

- all of the above
- check whether high transmission loss silencer walls are needed to stop duct breakin or breakout noise
- check generated noise of duct components, particularly grilles and diffusers
- our licensees or their agents can help you

NC-15 to NC-20 Systems

- all of the foregoing
- very accurate silencer selections are required with careful attention to silencer location, duct noise breakin or breakout, and self generated noise
- our licensees and their agents can provide detailed performance and computer assistance to help achieve a good result based on our years of ultra-quiet experience

RELIABILITY OF DATA

- data has been derived from testing using ASTM E477 and BS 4718 methods
- it has been verified by independent testing
- data has been scrutinized and certified by a registered professional engineer
- average deviation of quick selection chart from test data is 1-2dB at 250 Hz

RLC

RECTANGULAR SILENCERS

SELECTION

1. A wide range of modular unit sizes and gap models are available to fit most duct or bank sizes economically.

2. Modular Unit Size = Duct Dimension / No. of Modular Units Chosen

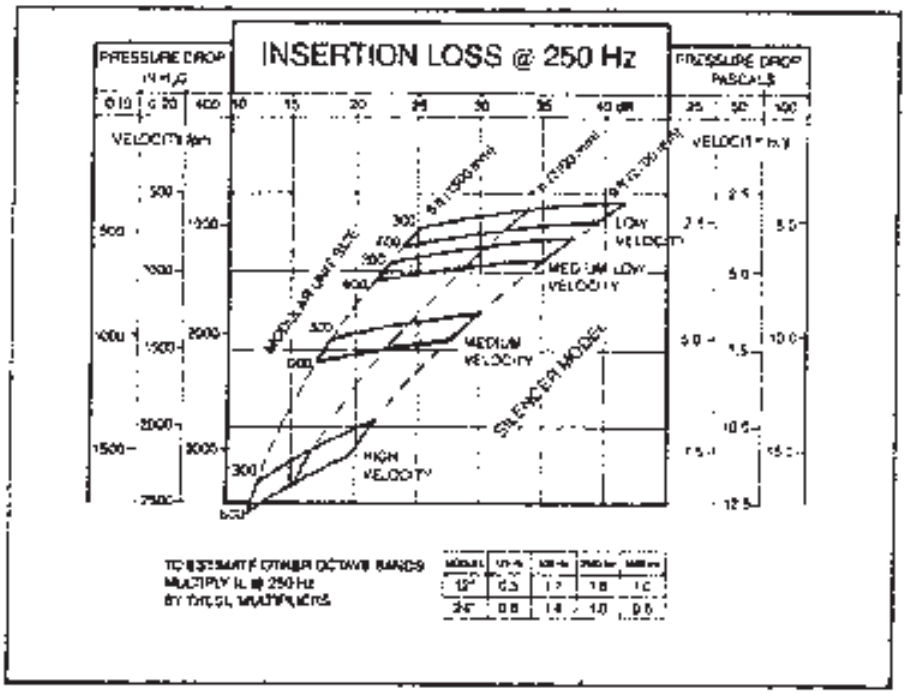
   Note: larger modular unit sizes cost less, but have less IL at high frequencies. This may not be a problem, but if it is, increase no. of modular units chosen.

3. a) QUICK SELECTIONS
   - applications noisier than NC-30
   - when 125, 250 or 500 Hz octave band is most critical
   - when silencing in other octaves is not critical
   - when low silencer first cost is essential
   - for silencer banks
   - when there is "no time"

   Using the chart at the right,
   - locate desired pressure drop and flow velocity in the duct at the silencer face
   - continue across to IL required at 250 Hz
   - make your selection at the modular unit size that you need
   - specify the RLC silencer by modular unit size, model, length and performance
   - in most applications the silencer will provide enough IL to accommodate the remaining octave bands
   - self GN is likely suitable for applications above NC-30

   b) ACCURATE SELECTIONS
   - applications quieter than NC-35 may require full octave band analysis, etc.

   Call our Vibro-Acoustics licensees or their agents who have detailed performance and information to help.



But they need system information:
- duct or bank size
- flow quantities and velocities
- fan power levels
- system design
- proposed location of silencer in the duct system

CONSTRUCTION

- constructed of galvanized sheet metal, similar to most other standard silencers
- aerodynamic design
- quality acoustic media
- media protected by galvanized perforated metal

SPECIFICATION

Our Vibro-Acoustics licensees or their agents can help you to specify and schedule economical RLC silencers.

Refer also to "construction" for guidance.

As much as possible, like all silencers, type RLC silencers should be located away from fans, duct elbows, tee fittings, etc., to allow maximum regain. Otherwise, system effect may reduce fan and/or silencer flow performance, and generate troublesome and unwanted low frequency noise.

Large volume silencers can be supplied in smaller pieces if necessary.

ADD-ONS TO RLC SILENCERS

Our licensees or their agents can help you to use the following "add-ons" correctly:
- media erosion protection at high gap velocities
- protective films to cover acoustic media for special applications
- HTL high transmission loss walls to prevent noise breakout through the silencer casing
- extra stiffening or heavier gauges
- flanges
- sealing silencer for duct leakage requirements
- special materials such as stainless steel, aluminum, etc.

Licensee/Representative

Vibro-Acoustics®

CERTIFIED PERFORMANCE DATA

RECTANGULAR
300 RLC-N

IL VARIES WITH VELOCITY

\+ "supply duct" where noise & airflow move in same direction

\- "return duct" where noise and airflow move in opposite directions

[ ] PD & GN too high for most practical applications.

LENGTH	FACE VELOCITY m/s	OCTAVE BAND - Hz							
		63	125	250	500	1000	2000	4000	8000
600 mm	-10.0	3	4	10	23	31	23	15	7
	-5.0	2	5	10	23	28	28	17	11
	+5.0	2	3	8	21	27	23	19	13
	+10.0	1	2	7	20	27	26	20	15
900 mm	-10.0	5	9	15	30	39	36	24	17
	-5.0	4	9	14	29	35	35	25	16
	+5.0	4	7	12	27	34	35	27	18
	+10.0	3	7	11	26	33	35	26	20
1200 mm	+15.0	7	14	20	37	45	45	31	17
	-5.0	6	13	18	35	44	42	33	21
	+5.0	6	11	16	33	41	42	35	23
	+10.0	5	10	15	32	39	42	36	26
1500 mm	-10.0	8	17	24	41	52	50	40	22
	-5.0	8	16	23	42	50	50	42	26
	+5.0	7	14	20	40	45	50	44	28
	+10.0	6	13	19	38	46	50	45	30
1800 mm	-10.0	12	21	28	39	59	50	48	27
	-5.0	9	59	27	48	51	50	45	31
	+5.0	7	17	23	44	47	50	47	33
	+10.0	7	16	22	43	46	50	46	35
2100 mm	-10.0	12	28	33	50	54	50	47	30
	-5.0	11	22	31	52	52	50	49	35
	+5.0	9	19	27	48	48	50	51	37
	+10.0	9	17	25	47	47	50	52	39
2400 mm	-10.0	14	27	37	54	54	50	47	35
	-5.0	13	25	34	52	52	50	49	39
	+5.0	11	21	30	48	48	50	51	41
	+10.0	10	20	28	47	47	50	52	43
2700 mm	-10.0	15	30	40	54	54	50	48	38
	-5.0	14	28	38	52	52	50	49	42
	+5.0	12	24	33	48	48	50	51	44
	+10.0	11	23	30	47	47	50	52	46
3000 mm	-10.0	16	33	44	54	54	50	47	41
	-5.0	15	31	41	52	52	50	49	45
	+5.0	13	27	36	48	48	50	51	47
	+10.0	12	25	33	47	47	50	52	49

PRESSURE DROP VARIES WITH VELOCITY

[ ] Impractical for most applications

FACE VELOCITY m/s		2.50	3.75	5.00	6.25	7.50	8.75
P.D.	600 mm	10	21	38	59	86	116
	900 mm	11	25	45	70	101	138
	1200 mm	13	29	52	81	117	159
	1500 mm	15	33	59	92	133	
	1800 mm	17	37	66	103	149	
	2100 mm	19	42	74	116		
	2400 mm	20	46	81	127		
	2700 mm	22	50	88	138		
Pa	3000 mm	24	53	95	148		

SELF GENERATED NOISE Re. 10^{-12} Watt

[ ] Impractical for most applications

@0.4m² face area

LENGTH	VELOCITY m/s	63	125	250	500	1000	2000	4000	8000
ALL	-10.0	71	67	63	58	61	67	75	72
	-5.0	49	45	40	43	48	53	54	45
	+5.0	50	44	38	32	35	38	36	32
	+10.0	74	68	62	56	50	51	46	34

FOR GUIDANCE AND HELP CALL OUR LICENSEE OR AGENT, ESPECIALLY IF HIGH VELOCITIES CANNOT BE AVOIDED.

Vibro-Acoustics®

CERTIFIED PERFORMANCE DATA

RECTANGULAR
300 RLC-O

IL VARIES WITH VELOCITY

→ "supply duct" where noise & airflow move in same direction

• "return duct" where noise and airflow move in opposite directions

PD & GN too high for most practical applications.

LENGTH	FACE VELOCITY m/s	OCTAVE BAND - Hz							
		63	125	250	500	1000	2000	4000	8000
600 mm	-10.0	4	5	10	22	28	25	15	7
	-5.0	3	3	9	21	29	25	16	11
	+5.0	3	5	7	19	27	25	19	13
	+10.0	4	5	8	18	26	25	18	16
900 mm	-10.0	5	6	14	28	38	32	22	11
	-5.0	4	7	13	27	35	32	23	15
	+5.0	4	7	11	25	33	32	25	17
	+10.0	4	8	11	26	32	32	25	19
1200 mm	-10.0	6	11	18	34	43	38	29	15
	-5.0	5	11	17	33	41	38	30	19
	+5.0	5	9	15	31	39	39	32	27
	+10.0	4	9	14	30	38	39	32	29
1500 mm	-10.0	7	15	22	40	49	46	36	19
	-5.0	6	14	20	39	48	48	37	23
	+5.0	6	12	18	37	45	46	35	25
	+10.0	5	11	17	36	43	46	35	27
1800 mm	-10.0	8	18	28	45	51	46	40	23
	-5.0	7	17	23	43	50	48	41	27
	+5.0	7	15	21	41	48	48	43	29
	+10.0	6	14	19	39	46	48	43	31
2100 mm	-10.0	9	20	29	46	53	50	45	27
	-5.0	8	19	26	44	52	50	46	31
	+5.0	8	17	24	43	48	50	48	33
	+10.0	7	16	23	42	47	50	48	35
2400 mm	-10.0	11	23	35	50	56	50	48	30
	-5.0	11	21	31	50	52	50	47	34
	+5.0	9	19	27	46	48	50	49	38
	+10.0	9	18	25	45	47	50	49	39
2700 mm	-10.0	12	26	36	52	58	50	48	33
	-5.0	12	23	34	52	52	50	49	37
	+5.0	10	21	30	48	48	50	51	39
	+10.0	10	19	28	46	47	50	51	41
3000 mm	-10.0	14	27	40	54	59	50	50	36
	-5.0	13	28	31	54	52	50	51	40
	+5.0	11	23	33	50	48	50	53	42
	+10.0	11	21	31	49	46	50	53	44

PRESSURE DROP VARIES WITH VELOCITY

Impractical for most applications

FACE VELOCITY m/s		2.50	3.75	5.00	6.25	7.50	8.75
P.D.	600 mm	7	15	27	42	61	83
	900 mm	8	18	32	50	72	98
	1200 mm	9	21	37	58	83	113
	1500 mm	11	24	42	66	95	129
	1800 mm	12	26	47	73	105	144
	2100 mm	13	29	52	81	117	
	2400 mm	14	32	58	88	126	
	2700 mm	15	34	61	95	137	
Pa	3000 mm	17	37	66	103	149	

SELF GENERATED NOISE Re. 10-12 Watt

Impractical for most applications

@0.4m² face area

LENGTH	VELOCITY m/s	63	125	250	500	1000	2000	4000	8000
ALL	-10.0	89	85	81	68	56	63	59	61
	-5.0	47	43	38	40	45	51	43	33
	+5.0	46	42	36	30	39	33	30	27
	+10.0	72	66	60	54	48	56	51	48

FOR GUIDANCE AND HELP CALL OUR LICENSEE OR AGENT, ESPECIALLY IF HIGH VELOCITIES CANNOT BE AVOIDED.

Vibro-Acoustics®

CERTIFIED PERFORMANCE DATA

RECTANGULAR
300 RLC-Q

IL VARIES WITH VELOCITY

\+ "supply duct" where noise & airflow move in same direction

\- "return duct" where noise and airflow move in opposite directions

[ ] PD & GN too high for most practical applications

LENGTH	FACE VELOCITY m/s	OCTAVE BAND - Hz							
		63	125	250	500	1000	2000	4000	8000
600 mm	-10.0	2	5	8	16	28	22	13	6
	-5.0	2	4	6	19	27	22	15	11
	+5.0	2	4	7	17	25	22	16	13
	+10.0	2	3	[illegible]	[illegible]	24	22	16	14
900 mm	-10.0	3	7	[illegible]	[illegible]	34	28	19	11
	-5.0	3	6	12	24	33	28	21	14
	+5.0	3	6	10	22	31	25	22	16
	+10.0	3	5	[illegible]	[illegible]	30	28	22	17
1200 mm	-10.0	4	9	[illegible]	[illegible]	40	34	26	16
	-5.0	4	8	15	29	38	34	27	17
	+5.0	4	8	13	27	37	34	28	19
	+10.0	4	7	[illegible]	[illegible]	36	34	28	20
1500 mm	-10.0	6	12	[illegible]	[illegible]	47	41	31	16
	-5.0	5	12	18	35	45	41	33	21
	+5.0	5	10	16	33	43	41	34	23
	+10.0	4	10	[illegible]	[illegible]	42	41	34	24
1800 mm	-10.0	7	15	[illegible]	[illegible]	56	48	36	20
	-5.0	6	14	21	39	48	46	38	23
	+5.0	6	12	19	37	46	45	38	25
	+10.0	5	12	[illegible]	[illegible]	44	46	39	26
2100 mm	-10.0	8	17	[illegible]	[illegible]	59	50	42	23
	-5.0	7	16	23	44	51	50	44	26
	+5.0	7	14	21	42	49	50	45	28
	+10.0	6	13	[illegible]	[illegible]	47	50	45	29
2400 mm	-10.0	9	19	[illegible]	[illegible]	58	50	45	26
	-5.0	8	18	25	47	51	50	47	29
	+5.0	8	16	24	45	49	50	48	31
	+10.0	7	[illegible]	[illegible]	[illegible]	47	50	48	32
2700 mm	-10.0	10	[illegible]	[illegible]	[illegible]	53	50	48	28
	-5.0	10	20	[illegible]	51	51	50	50	31
	+5.0	8	18	26	49	48	50	51	33
	+10.0	8	17	[illegible]	[illegible]	47	50	51	34
3000 mm	-10.0	11	24	[illegible]	[illegible]	53	50	51	30
	-5.0	11	22	33	56	51	50	53	33
	+5.0	9	20	29	52	49	50	54	35
	+10.0	9	19	[illegible]	[illegible]	47	50	54	36

PRESSURE DROP VARIES WITH VELOCITY

[ ] Impractical for most applications

FACE VELOCITY m/s		2.50	3.75	5.00	6.25	7.50	8.75
PD	600 mm	4	8	16	25	36	49
	900 mm	5	11	19	30	43	58
	1200 mm	6	12	22	34	50	67
	1500 mm	8	14	24	38	54	74
	1800 mm	7	15	27	42	61	83
	2100 mm	8	17	30	47	68	92
	2400 mm	8	18	32	50	72	98
	2700 mm	9	20	35	55	79	107
Pa	3000 mm	10	21	38	59	86	116

SELF GENERATED NOISE Re. 10-12 Watt

[ ] Impractical for most applications

@0.4m² face area

LENGTH	VELOCITY m/s	63	125	250	500	1000	2000	4000	8000
ALL	-10.0	68	64	59	55	56	61	59	55
	-5.0	46	41	37	33	43	45	37	28
	+5.0	47	41	35	29	30	30	27	23
	+10.0	71	69	59	53	47	48	48	45

FOR GUIDANCE AND HELP CALL OUR LICENSEE OR AGENT, ESPECIALLY IF HIGH VELOCITIES CANNOT BE AVOIDED.

Vibro-Acoustics®

CERTIFIED PERFORMANCE DATA

RECTANGULAR
350 RLC-N

IL VARIES WITH VELOCITY

\+ "supply duct" where noise & airflow move in same direction

\- "return duct" where noise and airflow move in opposite directions

PD & GN too high for most practical applications.

LENGTH	FACE VELOCITY m/s	OCTAVE BAND - Hz							
		63	125	250	500	1000	2000	4000	8000
600 mm	-10.0	3	8	10	23	27	24	14	7
	-5.0	2	7	10	22	27	21	16	10
	+5.0	2	5	8	20	25	24	17	12
	+10.0	1	5	8	19	25	24	17	14
900 mm	-10.0	5	10	15	29	34	30	21	13
	-5.0	4	10	14	28	33	30	23	14
	+5.0	4	8	12	26	31	30	24	16
	+10.0	3	8	12	25	30	30	24	18
1200 mm	-10.0	7	14	20	35	41	38	28	15
	-5.0	6	13	18	34	39	36	30	18
	+5.0	6	11	16	32	37	36	31	20
	+10.0	6	10	15	31	36	36	31	22
1500 mm	-10.0	9	18	24	42	48	46	34	18
	-5.0	8	16	23	40	47	43	36	22
	+5.0	7	14	20	38	43	41	37	24
	+10.0	8	13	18	36	42	43	37	26
1800 mm	-10.0	9	21	28	47	52	48	40	22
	-5.0	9	19	27	46	50	46	42	25
	+5.0	7	17	23	42	48	48	43	27
	+10.0	7	16	22	41	45	46	43	29
2100 mm	-10.0	12	23	33	54	58	50	46	28
	-5.0	11	22	31	52	52	55	48	28
	+5.0	9	19	27	48	49	52	49	31
	+10.0	9	17	25	47	48	50	48	33
2400 mm	-10.0	14	25	37	54	58	58	47	28
	-5.0	13	24	34	52	52	50	49	32
	+5.0	11	20	30	48	48	50	50	34
	+10.0	10	19	28	47	47	50	50	36
2700 mm	-10.0	16	28	40	54	54	50	48	32
	-5.0	14	27	38	52	52	50	50	35
	+5.0	12	23	33	48	49	50	51	37
	+10.0	11	22	30	47	47	50	51	39
3000 mm	-10.0	16	32	44	54	54	58	48	36
	-5.0	15	30	41	52	52	50	51	38
	+5.0	13	26	35	48	48	50	52	40
	+10.0	12	24	33	47	47	50	52	42

PRESSURE DROP VARIES WITH VELOCITY

Impractical for most applications

FACE VELOCITY m/s		2.50	3.75	5.00	6.25	7.50	8.75
P.D.	600 mm	10	22	39	61	88	119
	900 mm	11	25	45	70	101	136
	1200 mm	13	29	51	80	115	
	1500 mm	15	33	58	91	131	
	1800 mm	18	36	64	102	144	
	2100 mm	18	40	71	111		
	2400 mm	19	43	77	120		
	2700 mm	21	47	84	131		
Pa	3000 mm	23	51	90	141		

SELF GENERATED NOISE Re. 10-12 Watt

Impractical for most applications

@0.4m² face area

LENGTH	VELOCITY m/s	63	125	250	500	1000	2000	4000	8000
ALL	-10.0	72	67	62	58	58	58	74	71
	-5.0	49	44	43	44	53	56	53	45
	+5.0	50	44	38	32	33	39	36	33
	+10.0	74	68	62	56	59	53	56	54

FOR GUIDANCE AND HELP CALL OUR LICENSEE OR AGENT, ESPECIALLY IF HIGH VELOCITIES CANNOT BE AVOIDED.

Vibro-Acoustics®

CERTIFIED PERFORMANCE DATA

RECTANGULAR
350 RLC-O

IL VARIES WITH VELOCITY

→ "supply duct" where noise & airflow move in same direction

← "return duct" where noise and airflow move in opposite directions

PD & GN too high for most practical applications.

LENGTH	FACE VELOCITY m/s	OCTAVE BAND - Hz 63	125	250	500	1000	2000	4000	8000
600 mm	-10.0	4	7	10	22	25	21	12	8
	-5.0	3	7	9	21	25	21	14	9
	+5.0	3	7	7	18	23	21	15	11
	+10.0	4	5	8	18	22	21	16	12
900 mm	-10.0	5	9	14	27	32	27	19	10
	-5.0	4	8	13	26	31	27	20	13
	+5.0	4	8	11	24	29	27	21	15
	+10.0	4	7	11	23	28	27	21	16
1200 mm	-10.0	6	11	16	32	36	33	24	14
	-5.0	5	11	17	31	37	33	25	17
	+5.0	5	9	15	28	35	33	27	18
	+10.0	4	9	14	28	34	33	27	20
1500 mm	-10.0	7	15	22	38	40	39	30	17
	-5.0	6	14	20	37	43	39	32	20
	+5.0	6	12	18	35	41	39	33	22
	+10.0	5	11	17	34	40	39	33	23
1800 mm	-10.0	8	18	25	44	47	45	35	20
	-5.0	7	17	23	42	48	43	37	23
	+5.0	7	15	21	40	45	43	38	25
	+10.0	26	14	19	38	44	43	38	26
2100 mm	-10.0	10	20	30	49	53	51	40	22
	-5.0	8	19	28	48	52	47	42	25
	+5.0	8	17	24	45	48	47	43	27
	+10.0	27	16	23	43	47	46	43	28
2400 mm	-10.0	31	28	30	51	53	48	45	28
	-5.0	11	21	31	50	52	48	45	28
	+5.0	9	18	27	45	48	48	44	30
	+10.0	9	18	26	45	47	48	46	31
2700 mm	-10.0	15	25	36	56	58	50	46	28
	-5.0	12	23	34	52	52	50	48	31
	+5.0	10	21	30	48	48	50	48	33
	+10.0	10	19	26	47	47	50	48	34
3000 mm	-10.0	14	27	40	55	53	52	48	31
	-5.0	13	26	37	54	52	52	51	34
	-5.0	12	23	33	50	48	52	52	36
	+10.0	11	21	31	49	47	50	52	37

PRESSURE DROP VARIES WITH VELOCITY

Impractical for most applications

FACE VELOCITY m/s		2.50	3.75	5.00	6.25	7.50	8.75
P.D.	600 mm	7	16	28	44	63	86
	900 mm	9	18	32	50	72	98
	1200 mm	9	20	36	56	81	110
	1500 mm	10	23	41	64	92	126
	1800 mm	11	25	45	70	101	138
	2100 mm	12	28	49	77	110	
	2400 mm	13	30	53	83	119	
	2700 mm	15	33	58	91	131	
Pa	3000 mm	15	35	62	97	140	

SELF GENERATED NOISE Re. 10-12 Watt

Impractical for most applications

@0.4m² face area

LENGTH	VELOCITY m/s	63	125	250	500	1000	2000	4000	8000
ALL	-10.0	70	65	60	56	53	58	59	53
	-5.0	47	42	38	46	43	51	45	34
	+5.0	48	42	36	36	32	33	30	26
	+10.0	72	66	60	54	48	50	51	48

FOR GUIDANCE AND HELP CALL OUR LICENSEE OR AGENT, ESPECIALLY IF HIGH VELOCITIES CANNOT BE AVOIDED.

Vibro-Acoustics®

CERTIFIED PERFORMANCE DATA

RECTANGULAR
350 RLC-Q

IL VARIES WITH VELOCITY

\+ "supply duct" where noise & airflow move in same direction

\- "return duct" where noise and airflow move in opposite directions

▭ PD & GN too high for most practical applications.

LENGTH	FACE VELOCITY m/s	OCTAVE BAND - Hz							
		63	125	250	500	1000	2000	4000	8000
600 mm	-10.0	2	5	8	18	24	15	11	8
	-5.0	2	4	9	19	23	18	13	9
	+5.0	2	4	7	17	21	16	13	11
	+10.0	5	5	8	16	20	16	14	12
900 mm	-10.0	3	7	12	24	30	24	16	9
	-5.0	3	8	12	24	29	24	18	12
	+5.0	3	6	10	22	27	24	18	14
	+10.0	3	5	10	22	26	24	19	15
1200 mm	-10.0	4	9	15	30	36	30	24	12
	-5.0	4	8	15	29	35	30	23	15
	+5.0	5	6	13	27	33	30	23	17
	+10.0	4	7	12	26	32	30	24	18
1500 mm	-10.0	6	12	19	35	42	35	28	15
	-5.0	5	12	18	34	41	35	28	18
	+5.0	5	10	16	32	39	35	28	20
	+10.0	4	10	15	32	39	35	28	21
1800 mm	-10.0	7	15	22	40	48	40	32	17
	-5.0	6	14	21	39	46	40	32	20
	+5.0	6	12	19	37	44	40	32	22
	+10.0	6	12	18	36	42	40	32	23
2100 mm	-10.0	8	17	25	44	53	45	37	19
	-5.0	7	16	23	43	51	44	37	22
	+5.0	7	14	21	41	49	44	37	24
	+10.0	6	13	20	40	48	44	36	25
2400 mm	-10.0	9	19	28	48	58	49	41	22
	-5.0	8	18	26	47	53	47	41	25
	+5.0	8	18	24	45	49	47	41	27
	+10.0	7	17	23	43	48	47	40	28
2700 mm	-10.0	10	21	30	50	60	50	43	24
	-5.0	10	20	30	51	51	50	45	27
	+5.0	8	18	26	49	49	50	45	29
	+10.0	8	17	25	47	48	50	46	30
3000 mm	-10.0	11	24	33	57	67	53	47	28
	-5.0	11	22	33	56	51	53	49	27
	+5.0	9	20	29	52	49	53	49	31
	+10.0	8	19	28	51	49	53	50	32

PRESSURE DROP VARIES WITH VELOCITY ▭ Impractical for most applications

FACE VELOCITY m/s		2.50	3.75	5.00	6.25	7.50	8.75
P.D.	600 mm	5	10	18	28	41	56
	900 mm	5	11	20	31	45	61
	1200 mm	6	12	22	34	50	67
	1500 mm	6	14	24	38	54	74
	1800 mm	7	15	26	41	56	80
	2100 mm	7	15	27	42	61	83
	2400 mm	7	16	28	45	65	89
	2700 mm	8	17	31	48	70	95
Pa	3000 mm	8	19	33	52	74	101

SELF GENERATED NOISE Re. 10-12 Watt ▭ Impractical for most applications

@0.4m² face area

LENGTH	VELOCITY m/s	63	125	250	500	1000	2000	4000	8000
ALL	-10.0	67	63	59	55	55	61	58	54
	-5.0	45	41	37	38	43	45	36	28
	+5.0	67	41	35	29	31	30	26	22
	+10.0	70	65	59	53	47	46	40	44

FOR GUIDANCE ANDHELP CALL OUR LICENSEE OR AGENT, ESPECIALLY IF HIGH VELOCITIES CANNOT BE AVOIDED.

Vibro-Acoustics®

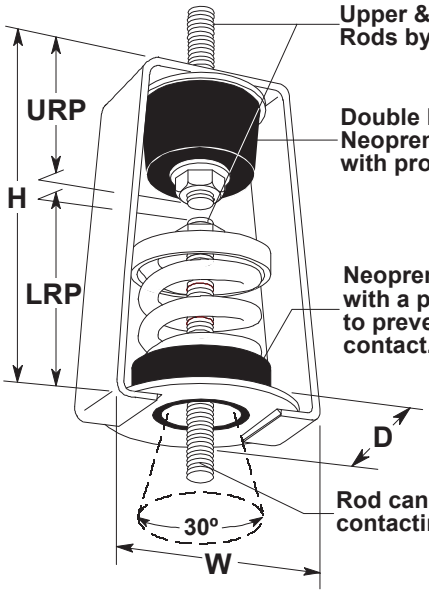
Technical Literature

56) Duct Silencer

MASON INDUSTRIES, Inc.
Manufacturers of Vibration Control Products
NY Mailing Address: PO Box 410, Smithtown, NY 11787
350 Rabro Drive, Hauppauge, NY 11788
631/348-0282
FAX 631/348-0279
Info@Mason-Ind.com
2101 W. Crescent Ave., Suite D, Anaheim, CA 92801
714/535-2727
FAX 714/535-5738
Info@MasonAnaheim.com

CERTIFIED FOR
JOB NAME :
CUSTOMER :
CUSTOMER P.O. :
MASON M.I. :
DWG. NO. :

TYPE
30N
1" Deflection
X, A, B, C, D & F
Series Hangers



TYPE 30N RATINGS

Size	Rated Capacity [lbs]	Rated Defl.† [in]	Spring Constant†† [lbs/in]	Avg Defl. Neoprene [in]	Spring Color
30N-X-23	23	1.50	18	0.20	Brown
30N-X-33	33	1.30	30		Red
30N-X-54	54	1.40	45		White
30N-X-76	76	1.22	73		Black
30N-X-113	113	1.20	113		Yellow
30N-X-130	130	1.20	130		Purple
30N-X-175	175	1.20	175		Silver
30N-X-210	210	1.20	210		Blue
30N-A-12	12	1.35	12	0.35	Red
30N-A-18	18	1.35	18		Gray
30N-A-25	25	1.35	25		Orange
30N-A-41	41	1.53	35		Pink
30N-A-56	56	1.49	49		Black
30N-A-73	73	1.41	69		Tan
30N-A-95	95	1.36	94		Green
30N-B-138	138	1.67	105	0.35	White
30N-B-222	222	1.51	191		Blue
30N-B-278	278	1.44	255		Purple
30N-B-336	336	1.35	336		Silver
30N-B-410	410	1.42	385		Black
30N-B-540	540	1.35	540		Yellow
30N-C-630	630	1.53	558	0.40	Gray
30N-C-800	800	1.40	800		Orange
30N-C-1010	1010	1.50	920		Green
30N-C-1265	1265	1.40	1265		Red
30N-D-1575	1575	1.63	1280	0.40	Pink
30N-D-2150	2150	1.43	2095		Purple
30N-F-2760	2760	1.40	2760	0.40	Silver

† includes double deflection neoprene element.
†† applies to spring only.

All springs have additional travel to solid equal to 50% of Rated Deflection.
Hanger elements have straight line deflection curves.

TYPE 30N DIMENSIONS (inches)

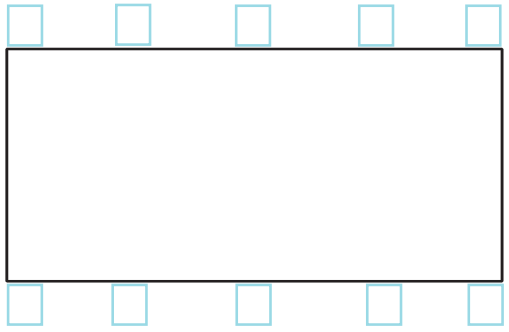
Size Range	D	H	W	LRP	URP	MRD
30N-X-23-210	2 1/2	5 1/2	2 7/8	3 1/4	1 3/4	3/8
30N-A-12-25	2 3/4	6 3/4	3 1/4	3 1/4	2 1/4	5/8
30N-A-41-95	2 3/4	6 3/4	3 1/4	3 5/8	2 1/4	5/8
30N-B-138-540	4	6 3/4	4 3/4	3 3/4	2 3/4	5/8
30N-C-630-1265	4 3/4	9	5 1/4	5	3	3/4
30N-D-1575-2150	4 3/4	12 1/2	5 3/4	7	4 1/4	7/8
30N-F-2760	6	14 1/2	6 1/4	7	5	7/8

LRP - Lower Rod Penetration
URP - Upper Rod Penetration
MRD - Maximum Rod Diameter

CERTIFICATION DATA

_____ **inch SPECIFIED DEFLECTION**

TAG : _____
UNIT : _____
PLAN VIEW OF HANGER LOCATION:



1 :	6 :
2 :	7 :
3 :	8 :
4 :	9 :
5 :	10 :
Material for One Set :	Sets Required

DWN :	CHKD:	DATE :

DWG NO. :

MASON INDUSTRIES, Inc.
Manufacturers of Vibration Control Products
NY Mailing Address: PO Box 410, Smithtown, NY 11787
350 Rabro Drive, Hauppauge, NY 11788
631/348-0282
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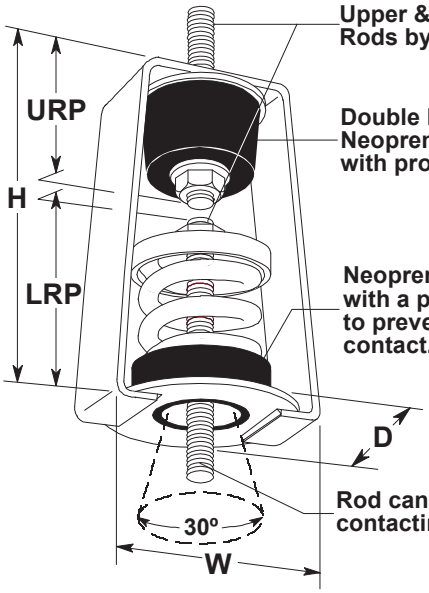
714/535-2727
FAX 714/535-5738
Info@MasonAnaheim.com

CERTIFIED FOR
JOB NAME :
CUSTOMER :
CUSTOMER P.O. :
MASON M.I. :
DWG. NO. :

TYPE
30N
25mm Deflection
X, A, B, C, D & F
Series Hangers



TYPE 30N RATINGS

Size	Rated Capacity [kg]	Rated Defl.† [mm]	Spring Constant†† [kg/mm]	Avg Defl. Neoprene [mm]	Spring Color
30N-X-23	10	38	0.3	5	Brown
30N-X-33	15	33	0.5		Red
30N-X-54	25	36	0.8		White
30N-X-76	35	31	1.3		Black
30N-X-113	51	31	2.0		Yellow
30N-X-130	59	31	2.3		Purple
30N-X-175	79	31	3.1		Silver
30N-X-210	95	31	3.8		Blue
30N-A-12	5	34	0.2	9	Red
30N-A-18	8	34	0.3		Gray
30N-A-25	11	34	0.4		Orange
30N-A-41	19	39	0.6		Pink
30N-A-56	25	38	0.9		Black
30N-A-73	33	36	1.2		Tan
30N-A-95	43	35	1.7		Green
30N-B-138	63	42	1.9	9	White
30N-B-222	101	38	3.4		Blue
30N-B-278	126	37	4.6		Purple
30N-B-336	152	34	6.0		Silver
30N-B-410	186	36	6.9		Black
30N-B-540	245	34	9.6		Yellow
30N-C-630	286	39	10.0	10	Gray
30N-C-800	363	36	14.3		Orange
30N-C-1010	458	38	16.4		Green
30N-C-1265	574	36	22.6		Red
30N-D-1575	714	41	22.9	10	Pink
30N-D-2150	975	36	37.4		Purple
30N-F-2760	1252	36	49.3	10	Silver

† includes double deflection neoprene element.
†† applies to spring only.

All springs have additional travel to solid equal to 50% of Rated Deflection.
Hanger elements have straight line deflection curves.

TYPE 30N DIMENSIONS (mm)

Size Range	D	H	W	LRP	URP	MRD
30N-X-23-210	64	140	73	83	44	10
30N-A-12-25	70	171	83	83	57	16
30N-A-41-95	70	171	83	92	57	16
30N-B-138-540	102	171	121	95	70	16
30N-C-630-1265	121	229	133	127	76	19
30N-D-1575-2150	121	318	146	178	108	22
30N-F-2760	152	368	159	178	127	22

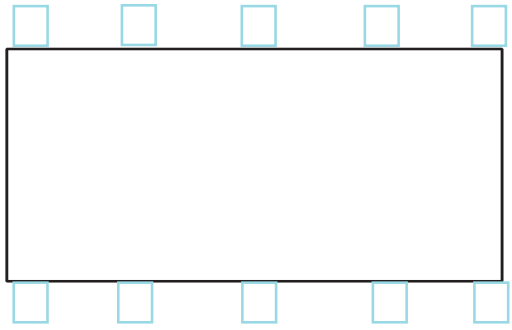
LRP - Lower Rod Penetration
URP - Upper Rod Penetration
MRD - Maximum Rod Diameter

CERTIFICATION DATA

_____ mm SPECIFIED DEFLECTION

TAG : _____
UNIT : _____

PLAN VIEW OF HANGER LOCATION:



1 :	6 :
2 :	7 :
3 :	8 :
4 :	9 :
5 :	10 :
Material for One Set :	Sets Required

DWN :	CHKD:	DATE :

DWG NO. :

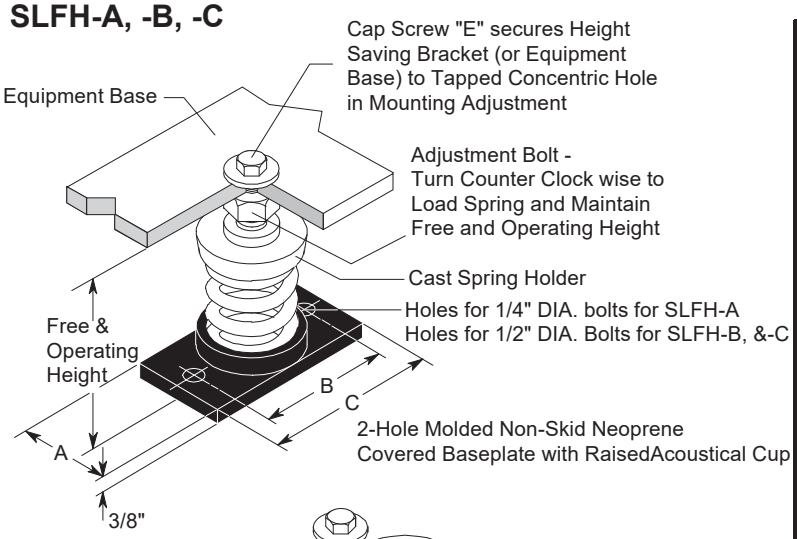
FORM S-607-9b Metric
02/98

MASON INDUSTRIES, Inc.
Manufacturers of Vibration Control Products
NY Mailing Address: PO Box 410, Smithtown, NY 11787
350 Rabro Drive, Hauppauge, NY 11788, 631/348-0282, FAX 631/348-0279, Info@Mason-Ind.com
2101 W. Crescent Ave., Suite D, Anaheim, CA 92801, 714/535-2727, FAX 714/535-5738, Info@MasonAnaheim.com

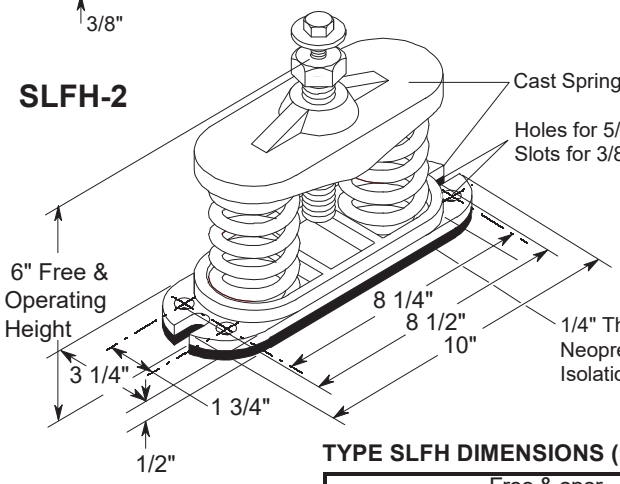
CERTIFIED FOR
JOB NAME :
CUSTOMER :
CUSTOMER P.O. :
MASON M.I. :
DWG. NO. :

TYPE
SLFH
1" Deflection
A, B, C & 2
Series Mountings

SLFH-A, -B, -C



SLFH-2



Multiple spring Mounts have C-size springs.
SLFH-2 indicates 2 springs.

TYPE SLFH RATINGS

Size	Rated Capacity [lbs]	Rated Defl. [in]	Mount Constant [lbs/in]	Spring Color/Stripe
SLFH-A-45	45	1.60	28	Blue
SLFH-A-75	75	1.50	50	Orange
SLFH-A-125	125	1.33	94	Brown
SLFH-A-200	200	1.15	174	Black
SLFH-A-310	310	1.00	310	Yellow
SLFH-A-400	400	1.00	400	Green
SLFH-A-510	510	1.00	510	Red
SLFH-A-625	625	1.00	625	White
SLFH-B-65	65	2.10	31	Brown
SLFH-B-85	85	2.10	40	White/Black
SLFH-B-115	115	2.00	57	Silver
SLFH-B-150	150	2.00	75	Orange
SLFH-B-280	280	1.60	174	Green
SLFH-B-450	450	1.31	344	Red
SLFH-B-750	750	1.12	670	White
SLFH-B-1000	1000	1.00	1000	Blue
SLFH-C-1000	1000	1.00	1000	Black
SLFH-C-1350	1350	1.00	1350	Yellow
SLFH-C-1750	1750	1.00	1750	Black*
SLFH-C-2100	2100	1.00	2100	Yellow*
SLFH-C-2385	2385	1.00	2385	Yellow**
SLFH-C-2650	2650	1.00	2650	Red*
SLFH-C-2935	2935	1.00	2935	Red**
SLFH-2-2700	2700	1.00	2700	Yellow
SLFH-2-3500	3500	1.00	3500	Black
SLFH-2-4200	4200	1.00	4200	Yellow*
SLFH-2-4770	4770	1.00	4770	Yellow**

* with RED core spring ** with GREEN core spring
All springs have additional travel to solid equal to 50% of the Rated Deflection. Solid Spring Height = Free Height minus 1.5 times the Rated Deflection.

TYPE SLFH DIMENSIONS (inches)

Size	Free & oper. Height	A	B	C	Locking Cap Screw
SLFH-A-45-400†	4 1/4	2 1/4	3	3 5/8	3/8 × 1
SLFH-A-510-625	4 5/8	2 1/4	3	3 5/8	3/8 × 1
SLFH-B	6	2 3/4	4 1/8	5 1/4	1/2 × 1 1/4
SLFH-C	6	3	4 3/4	6	1/2 × 1 1/4
SLFH-2	-	-	-	-	1/2 × 1 1/4

†If using 45 thru 400 with 510 or 625, Free & Operating Height is 4 5/8"

SPRING DATA

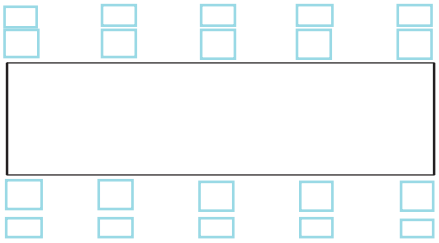
Spring OD	Free HT	Ratio K_x/K_y	Ratio OD/OH
1 3/4	3	0.70-0.90	0.88-1.25
1 3/4	3 1/8-3 3/8	0.50-0.60	0.74-0.82
2 3/8	4	0.70-0.90	0.80-1.25
2 3/8	4 1/8	0.90-1.00	0.92-0.94
2 7/8	4 1/8	0.90-1.00	0.92-0.94

CERTIFICATION DATA

TAG : _____

UNIT : _____

PLAN VIEW OF MOUNT LOCATION :



_____ **inch SPECIFIED DEFLECTION**

1 :	6 :
2 :	7 :
3 :	8 :
4 :	9 :
5 :	10 :
Material for One Set :	Sets Required

DWN :	CHKD:	DATE :

DWG NO. :

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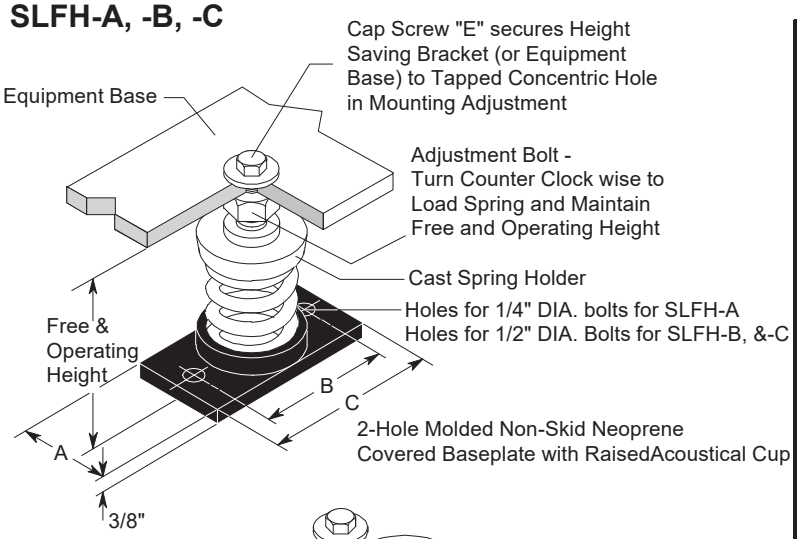
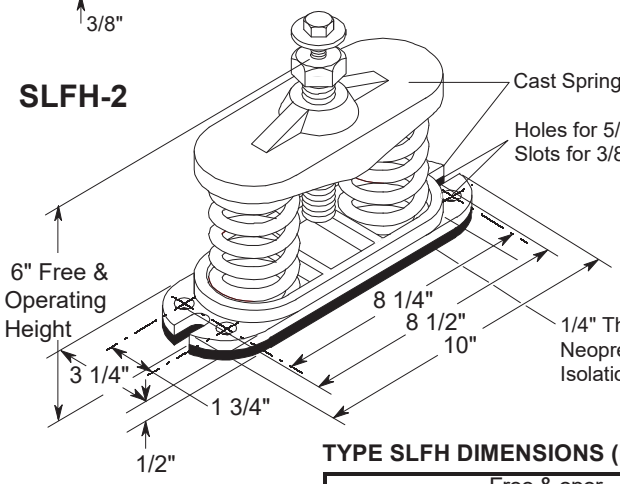
CERTIFIED FOR	
JOB NAME	:
CUSTOMER	:
CUSTOMER P.O.	:
MASON M.I.	:
DWG. NO.	:

TYPE
SLFH
1" Deflection
A, B, C & 2
Series Mountings

SLFH-A, -B, -C



SLFH-2



Multiple spring Mounts have C-size springs.
SLFH-2 indicates 2 springs.

TYPE SLFH RATINGS

Size	Rated Capacity [lbs]	Rated Defl. [in]	Mount Constant [lbs/in]	Spring Color/Stripe
SLFH-A-45	45	1.60	28	Blue
SLFH-A-75	75	1.50	50	Orange
SLFH-A-125	125	1.33	94	Brown
SLFH-A-200	200	1.15	174	Black
SLFH-A-310	310	1.00	310	Yellow
SLFH-A-400	400	1.00	400	Green
SLFH-A-510	510	1.00	510	Red
SLFH-A-625	625	1.00	625	White
SLFH-B-65	65	2.10	31	Brown
SLFH-B-85	85	2.10	40	White/Black
SLFH-B-115	115	2.00	57	Silver
SLFH-B-150	150	2.00	75	Orange
SLFH-B-280	280	1.60	174	Green
SLFH-B-450	450	1.31	344	Red
SLFH-B-750	750	1.12	670	White
SLFH-B-1000	1000	1.00	1000	Blue
SLFH-C-1000	1000	1.00	1000	Black
SLFH-C-1350	1350	1.00	1350	Yellow
SLFH-C-1750	1750	1.00	1750	Black*
SLFH-C-2100	2100	1.00	2100	Yellow*
SLFH-C-2385	2385	1.00	2385	Yellow**
SLFH-C-2650	2650	1.00	2650	Red*
SLFH-C-2935	2935	1.00	2935	Red**
SLFH-2-2700	2700	1.00	2700	Yellow
SLFH-2-3500	3500	1.00	3500	Black
SLFH-2-4200	4200	1.00	4200	Yellow*
SLFH-2-4770	4770	1.00	4770	Yellow**

* with RED core spring ** with GREEN core spring
All springs have additional travel to solid equal to 50% of the Rated Deflection. Solid Spring Height = Free Height minus 1.5 times the Rated Deflection.

TYPE SLFH DIMENSIONS (inches)

Size	Free & oper. Height	A	B	C	Locking Cap Screw
SLFH-A-45-400†	4 1/4	2 1/4	3	3 5/8	3/8 × 1
SLFH-A-510-625	4 5/8	2 1/4	3	3 5/8	3/8 × 1
SLFH-B	6	2 3/4	4 1/8	5 1/4	1/2 × 1 1/4
SLFH-C	6	3	4 3/4	6	1/2 × 1 1/4
SLFH-2	-	-	-	-	1/2 × 1 1/4

†If using 45 thru 400 with 510 or 625, Free & Operating Height is 4 5/8"

SPRING DATA

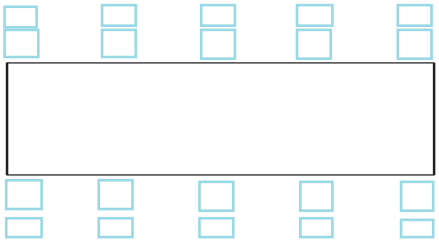
Spring OD	Free HT	Ratio K_x/K_y	Ratio OD/OH
1 3/4	3	0.70-0.90	0.88-1.25
1 3/4	3 1/8-3 3/8	0.50-0.60	0.74-0.82
2 3/8	4	0.70-0.90	0.80-1.25
2 3/8	4 1/8	0.90-1.00	0.92-0.94
2 7/8	4 1/8	0.90-1.00	0.92-0.94

CERTIFICATION DATA

TAG : _____

UNIT : _____

PLAN VIEW OF MOUNT LOCATION :



_____ **inch SPECIFIED DEFLECTION**

1 :	6 :
2 :	7 :
3 :	8 :
4 :	9 :
5 :	10 :
Material for One Set :	Sets Required

DWN :	CHKD:	DATE :

DWG NO. :

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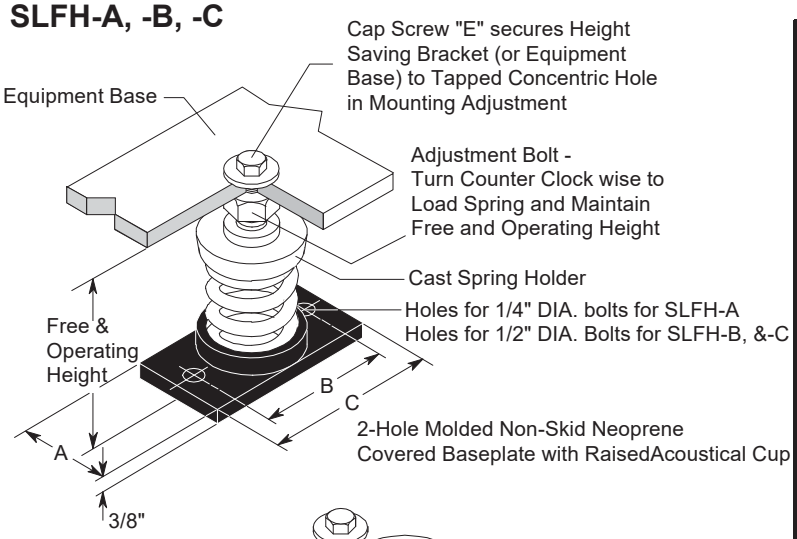
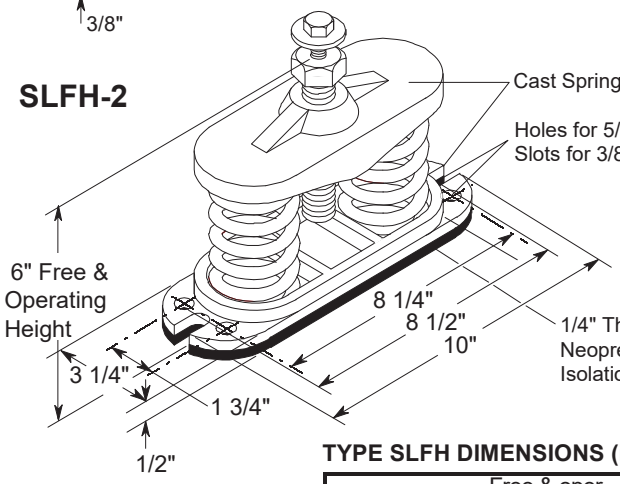
CERTIFIED FOR	
JOB NAME	:
CUSTOMER	:
CUSTOMER P.O.	:
MASON M.I.	:
DWG. NO.	:

TYPE
SLFH
1" Deflection
A, B, C & 2
Series Mountings

SLFH-A, -B, -C



SLFH-2



Multiple spring Mounts have C-size springs.
SLFH-2 indicates 2 springs.

TYPE SLFH RATINGS

Size	Rated Capacity [lbs]	Rated Defl. [in]	Mount Constant [lbs/in]	Spring Color/Stripe
SLFH-A-45	45	1.60	28	Blue
SLFH-A-75	75	1.50	50	Orange
SLFH-A-125	125	1.33	94	Brown
SLFH-A-200	200	1.15	174	Black
SLFH-A-310	310	1.00	310	Yellow
SLFH-A-400	400	1.00	400	Green
SLFH-A-510	510	1.00	510	Red
SLFH-A-625	625	1.00	625	White
SLFH-B-65	65	2.10	31	Brown
SLFH-B-85	85	2.10	40	White/Black
SLFH-B-115	115	2.00	57	Silver
SLFH-B-150	150	2.00	75	Orange
SLFH-B-280	280	1.60	174	Green
SLFH-B-450	450	1.31	344	Red
SLFH-B-750	750	1.12	670	White
SLFH-B-1000	1000	1.00	1000	Blue
SLFH-C-1000	1000	1.00	1000	Black
SLFH-C-1350	1350	1.00	1350	Yellow
SLFH-C-1750	1750	1.00	1750	Black*
SLFH-C-2100	2100	1.00	2100	Yellow*
SLFH-C-2385	2385	1.00	2385	Yellow**
SLFH-C-2650	2650	1.00	2650	Red*
SLFH-C-2935	2935	1.00	2935	Red**
SLFH-2-2700	2700	1.00	2700	Yellow
SLFH-2-3500	3500	1.00	3500	Black
SLFH-2-4200	4200	1.00	4200	Yellow*
SLFH-2-4770	4770	1.00	4770	Yellow**

* with RED core spring ** with GREEN core spring
All springs have additional travel to solid equal to 50% of the Rated Deflection. Solid Spring Height = Free Height minus 1.5 times the Rated Deflection.

TYPE SLFH DIMENSIONS (inches)

Size	Free & oper. Height	A	B	C	Locking Cap Screw
SLFH-A-45-400†	4 1/4	2 1/4	3	3 5/8	3/8 × 1
SLFH-A-510-625	4 5/8	2 1/4	3	3 5/8	3/8 × 1
SLFH-B	6	2 3/4	4 1/8	5 1/4	1/2 × 1 1/4
SLFH-C	6	3	4 3/4	6	1/2 × 1 1/4
SLFH-2	-	-	-	-	1/2 × 1 1/4

†If using 45 thru 400 with 510 or 625, Free & Operating Height is 4 5/8"

SPRING DATA

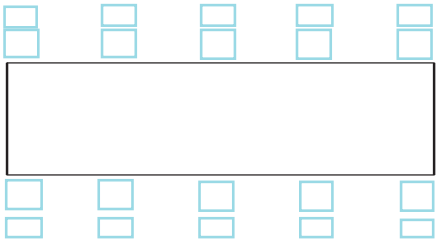
Spring OD	Free HT	Ratio K_x/K_y	Ratio OD/OH
1 3/4	3	0.70-0.90	0.88-1.25
1 3/4	3 1/8-3 3/8	0.50-0.60	0.74-0.82
2 3/8	4	0.70-0.90	0.80-1.25
2 3/8	4 1/8	0.90-1.00	0.92-0.94
2 7/8	4 1/8	0.90-1.00	0.92-0.94

CERTIFICATION DATA

TAG : _____

UNIT : _____

PLAN VIEW OF MOUNT LOCATION :



_____ **inch SPECIFIED DEFLECTION**

1 :	6 :
2 :	7 :
3 :	8 :
4 :	9 :
5 :	10 :
Material for One Set :	Sets Required

DWN :	CHKD:	DATE :

DWG NO. :

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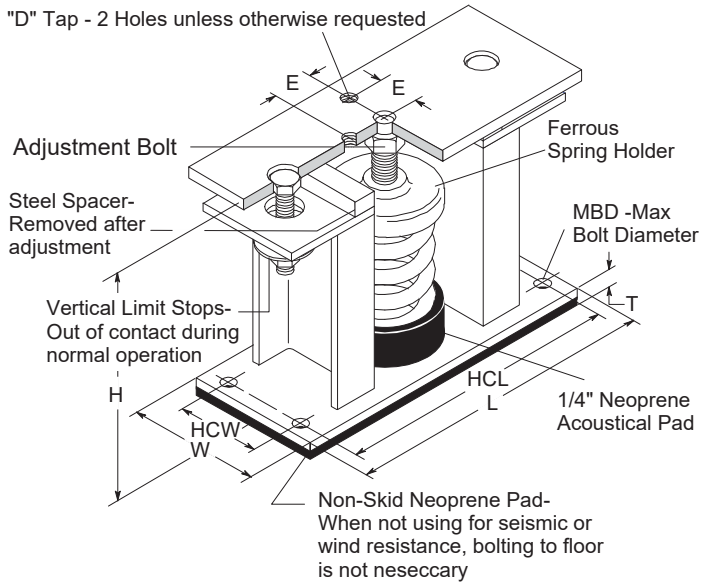
CERTIFIED FOR
JOB NAME :
CUSTOMER :
CUSTOMER P.O. :
MASON M.I. :
DWG. NO. :

TYPE
SLR
2" Deflection
B, B2 & C2 Series
Spring Mountings



TYPE SLR DIMENSIONS (inches)

Size	L	W	H	T	MBD	HCW	HCL	D	E
SLR-B & B2	10 1/4	4	7 1/2	1/2	5/8	2 3/4	9	5/8	1 3/8
SLR-C2	10 1/4	4	7 1/2	1/2	5/8	2 3/4	9	5/8	1 3/8

SPRING DATA

Size	Spring OD	Free Height	Ratio K_x/K_y	Ratio OD/OH
B & B2	2 3/8	4 1/2	0.55 - 0.90	0.95 - 1.48
C2	2 7/8	5	0.63 - 0.85	0.96 - 1.15

TYPE SLR RATINGS

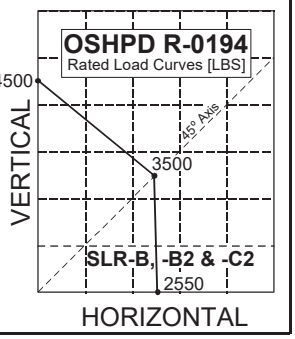
Size	Rated Capacity [lbs]	Rated Defl. [in]	Spring Const. [lbs/in]	Spring Color	Max. Hor. Static G Rating
SLR-B-20	20	2.40	8	Tan	127.5
SLR-B-26	26	2.18	12	White/Blue	98.1
SLR-B-35	35	2.20	16	Purple	72.9
SLR-B-50	50	2.20	24	White/Red	51.0
SLR-B-65	65	2.10	31	Brown	39.2
SLR-B-85	85	2.10	40	White/Blk	30.0
SLR-B-115	115	2.00	57	Silver	22.2
SLR-B-150	150	2.00	75	Orange	17.0
SLR-B2-210	210	2.12	99	Silver	12.1
SLR-B2-290	290	2.00	144	Blue	8.8
SLR-B2-450	450	2.00	224	Tan	5.7
SLR-B2-680	680	2.00	340	Gray	3.8
SLR-C2-125	125	2.50	50	Purple	20.4
SLR-C2-170	170	2.40	70	Brown	15.0
SLR-C2-210	210	2.30	90	Red	12.1
SLR-C2-260	260	2.20	120	White	9.8
SLR-C2-330	330	2.00	165	Black	7.7
SLR-C2-460	460	2.00	230	Blue	5.5
SLR-C2-610	610	2.00	305	Green	4.2
SLR-C2-880	880	2.00	440	Gray	2.9
SLR-C2-1210	1210	2.00	605	Silver	2.1
SLR-C2-1540	1540	2.00	770	Gray*	1.7
SLR-C2-1870	1870	2.00	935	Silver*	1.4
Ratings at 50% additional travel to solid:					
SLR-B2-450	410	1.83	224	Tan	5.7
SLR-B2-680	565	1.66	340	Gray	3.8
SLR-C2-880	800	1.82	440	Gray	2.9
SLR-C2-1210	1010	1.67	605	Silver	2.1
SLR-C2-1540	1285	1.67	770	Gray*	1.7
SLR-C2-1870	1560	1.67	935	Silver*	1.4

* with RED inner spring

All springs have additional travel to solid equal to 50% of the rated deflection. Mounting types SLR-B2-450, B2-680, C2-880 thru C2-1870 show a minimum 25% of rated deflection additional travel to solid in the upper part of the table. The last two rows in the table show ratings at 50% additional travel.

Solid Spring Height = Free Height minus 1.5 times Rated Deflection.

Housing load ratings in G's are based on tests with bolted connections to steel top and bottom. SLR housings require uniform support under entire base plate. Tests were performed with one bolt in top plate Horizontal and Vertical plotted Ratings are California OSHPD approved values having the OSHPD Anchorage Preapproval Number R-0194. Testing and calculations were performed to meet OSHPD criteria. **To use approved OSHPD rated load curves:**
1. Calculate Vertical and Horizontal Forces on mounting including translations and overturning moments.
2. Plot Horizontal Load vs Vertical Load.
The point must fall within the area below the OSHPD curve.

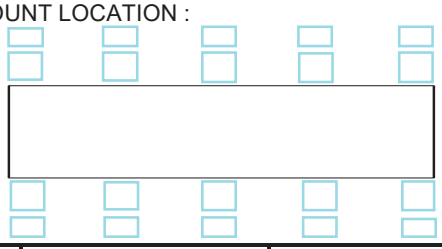


CERTIFICATION

TAG : _____

UNIT : _____

PLAN VIEW OF MOUNT LOCATION :



_____ **inch SPECIFIED DEFLECTION**

1 :	6 :
2 :	7 :
3 :	8 :
4 :	9 :
5 :	10 :
Material for One Set :	Sets Required

DWN :	CHKD :	DATE :

DWG NO. :

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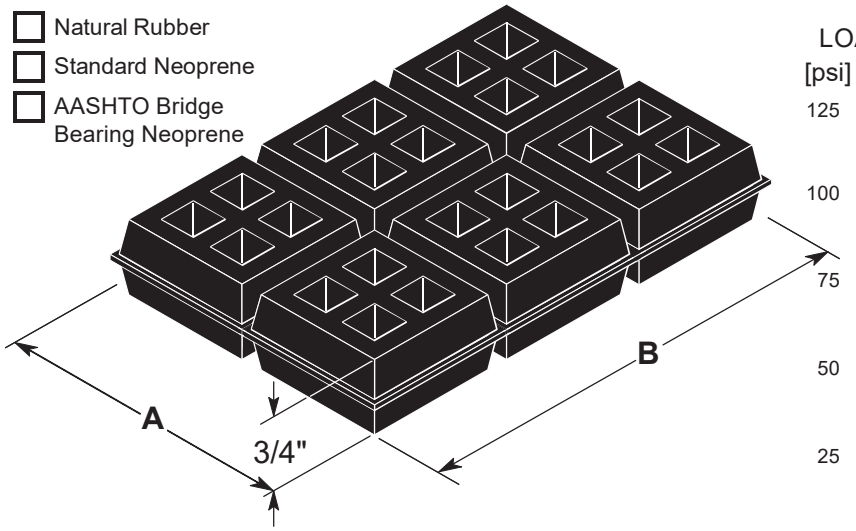
CERTIFIED FOR	
JOB NAME	:
CUSTOMER	:
CUSTOMER P.O.	:
MASON M.I.	:
DWG. NO.	:

TYPE
Super W
Waffle Pad

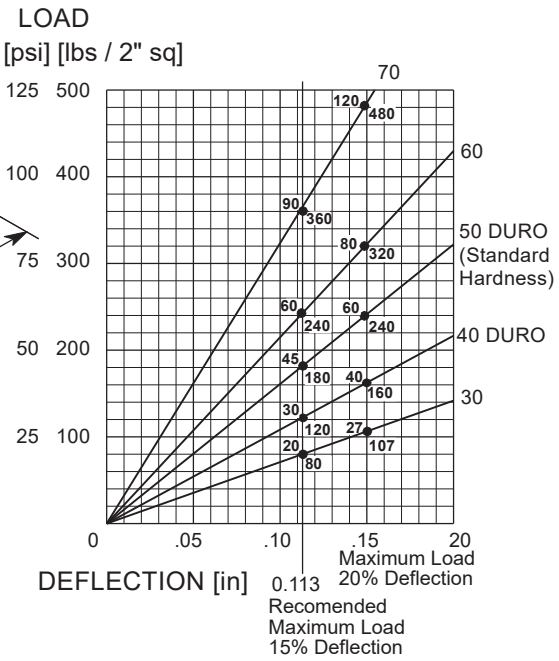
MATERIAL:

- ☐ Natural Rubber
- ☐ Standard Neoprene
- ☐ AASHTO Bridge Bearing Neoprene



FULL SIZED SHEETS
are 18 x 18 x 3/4" (450 x 450 x 19mm) consisting of 81 - 2" (50mm) square modules.
Actual pad sizes are as scheduled below.

Load Deflection Curves



TYPE Super W
LOAD RATINGS per SQUARE

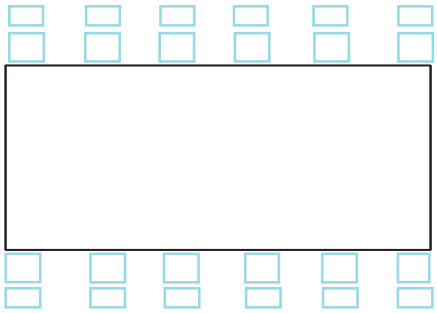
Durometer	Recommended Load per 2×2" sq. [lbs]	(kg)	Recommended Load per Area [lbs/in²]	(kg/mm^2)	{kPa}	Maximum Load per Area [lbs/in²]	(kg/mm^2)	{kPa}
30	[80]	(35)	[20]	(.014)	{138}	[27]	(.019)	{186}
40	[120]	(55)	[30]	(.021)	{207}	[40]	(.028)	{276}
Standard 50	[180]	(80)	[45]	(.032)	{310}	[60]	(.042)	{414}
60	[240]	(110)	[60]	(.042)	{414}	[80]	(.056)	{552}
70	[360]	(165)	[90]	(.063)	{621}	[120]	(.084)	{827}

CERTIFICATION DATA

TAG : _____

UNIT : _____

PLAN VIEW OF PAD LOCATION :



Hardness of Pad Material to be:	**DURO**
1 :	6 :
2 :	7 :
3 :	8 :
4 :	9 :
5 :	10 :
Material for One Set :	Sets Required

Type Super W Dimensions ☐ **mm** ☐ **inches**

A	B
	See Page 2 for

NOTE: SW PADS ARE TO BE EVENLY SPACED ON EACH SIDE.

DWN :	CHKD :	DATE :

DWG NO. :

MASON INDUSTRIES, Inc.

Manufacturers of Vibration Control Products

350 Rabro Drive
Hauppauge, NY 11788
631/348-0282
FAX 631/348-0279
Info@Mason-Ind.com

2101 W. Crescent Ave., Suite D
Anaheim, CA 92801
714/535-2727
FAX 714/535-5738
Info@MasonAnaheim.com

CERTIFIED FOR
JOB NAME :
CUSTOMER :
CUSTOMER P.O. :
MASON M.I. :
DWG. NO. :

TYPE

W

Neoprene
Waffle Pad

5/16" Neoprene Waffle Pad

TYPE W LOAD RATINGS

Duro-meter	Recommended Loading (lbs/in^2)	Max. Load (lbs/in^2)
30	40	55
40	60	85
50	90	120
60	120	170

TYPE W DIMENSIONS

Size	Average Rated Load @ 60 lbs/in^2* (lbs)
W-2 x 2	240
W-3 x 3	540
W-4 x 4	960
W-6 x 6	2160
W-12 x 12	8640
W-18 x 18	19440
W-18 x 36	38880
W-24 x 24	34560
W-24 x 48	69120

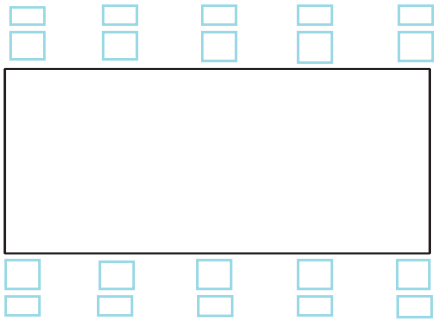
*Loads are based on 40 Duro W Pads.
Special Sizes on Request

CERTIFICATION DATA

TAG : _____

UNIT : _____

PLAN VIEW OF PAD LOCATION:



1 :	7 :
2 :	8 :
3 :	9 :
4 :	10 :
5 :	11 :
6 :	12 :
Material for One Set :	Sets Required

Durometer of Pad Material to be: DURO

DWN :	CHKD :	DATE :

DWG NO. :

Technical Literature

57) Vibration Isolator

中華製漆(一九四六)有限公司

A member of CNT Group Ltd.

Technical Specification

FLOWERPOXY Anti-Corrosive Primer #922A/Hardener #932A

September 2001

Description		Standard Method	Result
Preliminary Examination of Paint:	Ullage (% of the total Capacity of Container)	BS 3900 : A2	80%
	Surface Skin		No
	Consistency		Normal
	Separation of Phases		No
	Visible Impurities		No
	Sediment		No
Viscosity (25℃)	#922A	ASTM D 562	125~135KU
	#932A		95~105KU
Specific Gravity	#922A	BS 3900:A12	1.71 ±2%
	#932A		1.14 ±2%
Fineness of Grind(um)	#922A	BS 3900 : C6	<60um
	#932A		<10um
Drying* Times(25℃)	Surface Drying	BS 3900 : C2	45 mins
	Hard Drying	BS 3900 : C3	20 hours
Specular Gloss*(60 °)		BS 3900 : D5	≤10%
Adhesion Test*(cross-cut test)		BS 3900 : E6	≥1
Impact Resistance*(ball diameter 20mm)		ASTM D 2794	≥ 80kg.cm
Pencil Hardness*(7 days)		ASTM D 3363	≥H
Salt Spray Test*		ASTM B 117	≥ 200 hours
Natural Weathering Test*(Shenzhen)		-	≥ 10 months
Salt Water Resistance * (5% NaCl, 80um, D.F.T)		-	≥ 200 hours
Acid Resistance * (6M HCl, 80um, D.F.T)		-	≥ 3 hours

*#922A : #932A = 4 : 1(mixed by volume before testing)

Remark : This edition 9/2001 supersedes the last edition 2/2001.

THE CHINA PAINT MFG. CO. (1946), LTD.

Hong Kong.

中華製漆(一九四六)有限公司
A member of CNT Group Ltd.

Technical Specification

FLOWERTHANE Super Enamel 4500 Series /Hardener #457

September 2001

Description		Standard Method	Result
Preliminary Examination of Paint	Surface Skin	BS 3900 : A2	No
	Consistency		Normal
	Separation of Phases		No
	Visible impurities		No
	Sediment		No
Viscosity (25°C)	4500 Series	ASTM D 562	≥ 57 KU
	#457		65 -73 KU
Specific Gravity (25°C)	4500 Series	BS 3900 : A12	≈0.95
	#457		1.06 ±0.02
Fineness of Grind (μm)	4500 Series	BS 3900 : C6	By the requirement of customer
	#457		≤ 10 μm
Drying Times * (25°C)	Surface Drying	BS 3900 : C2	1 hour
	Hard Drying	BS 3900 : C3	16 hours
Specular Gloss *		BS 3900 : D5	By the requirement of customer
Adhesion Test *		BS 3900 : E6	Pass
Bend Test *		BS 3900 : E1	2mm Mandrel's diameter
Pencil Hardness *		ASTM D 3363	≥ H
Impact Resistance * (ball diameter 20mm)		ASTM D 2794	50 kg. cm pass
Cold Check Resistance *		ASTM D 1211	30 cycles pass
Artificial Weathering Test *		ASTM G 53	500 hours pass
Water Resistance *		ASTM D 870	200 hours pass
Alkali Resistance * (10% NaOH)		ASTM D 1647	24 hours pass

* 4500 Series : #457 = 5 : 1 (mix by volume before testing)

This edition 09/2001 supersedes the last edition 01/2001.

THE CHINA PAINT MFG. CO. (1946), LTD.

香港柴灣利眾街33號億京中心3樓 3/F., CNT Tower, 33 Heung To Road, Tsai Chai, Hong Kong.
Tel: (852) 2793 0662 Fax: (852) 2793 7341 E-mail: info@chinapaint.com
Factory, Kun...
PAINT CO
Tsing Kung

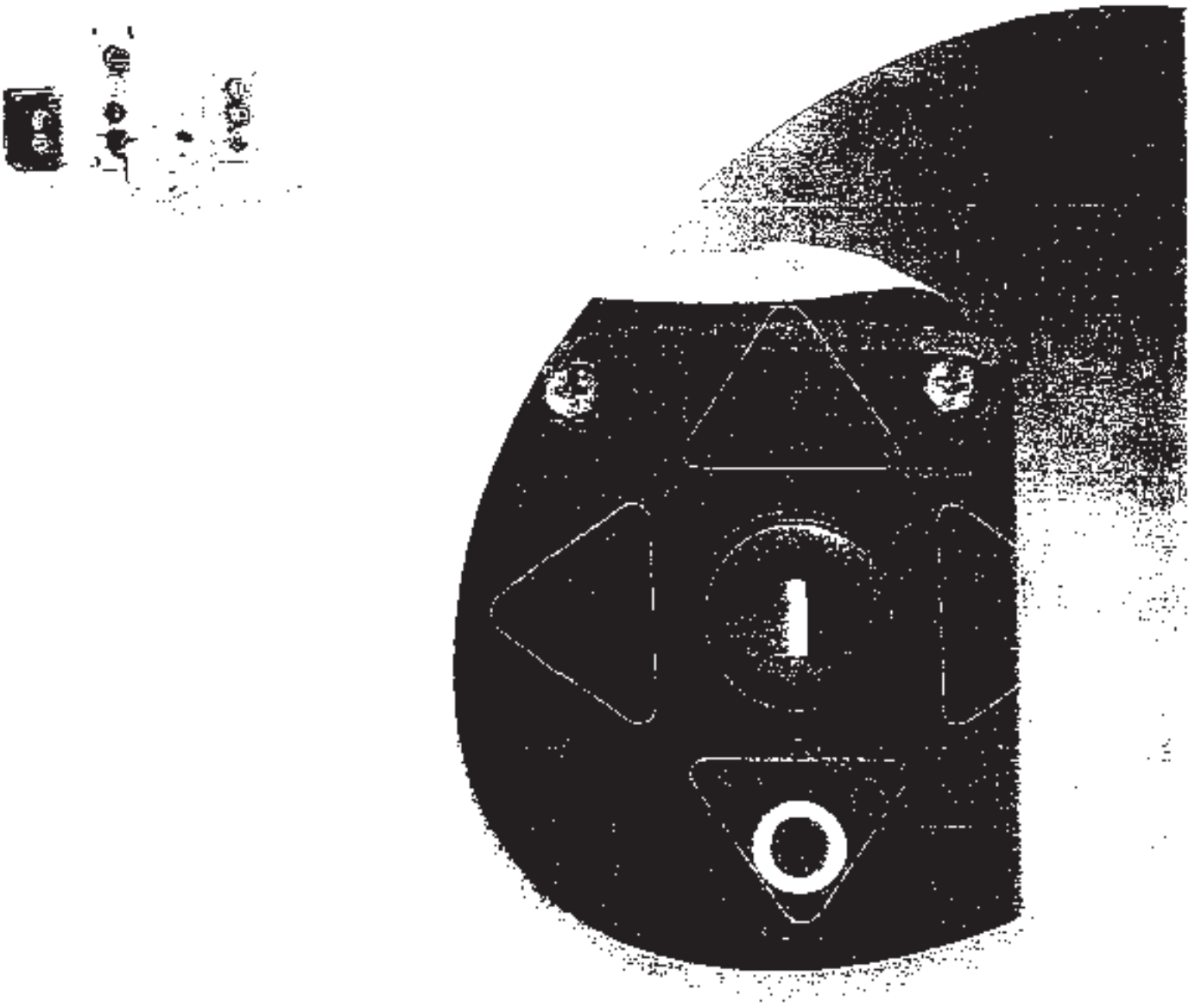
Technical Literature

58) Painting

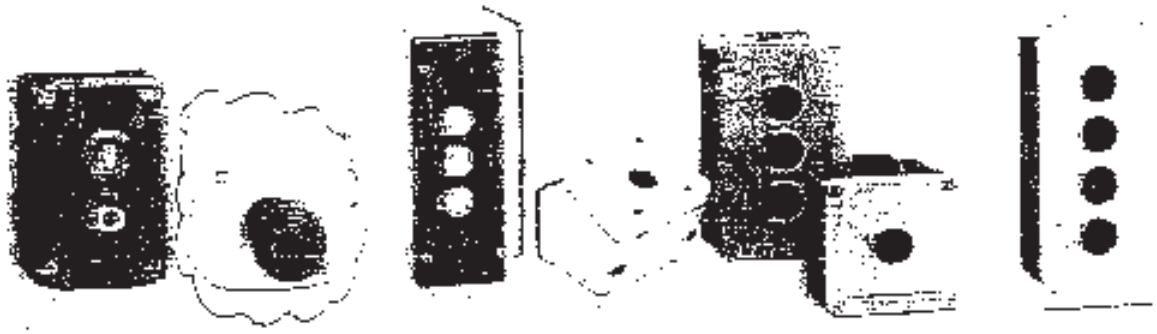
Control stations

Harmony

Your choice



Harmony



Schneider Electric

MANUFACTURER'S DECLARATION OF CONFORMITY

AUTOMATION
Control & Signaling

WE : SCHNEIDER ELECTRIC INDUSTRIES SAS
89 Boulevard Franklin Roosevelt
92500 Rueil Malmaison
FRANCE

declare under our own responsibility that the product(s):

TRADEMARK TELEMECANIQUE

NAME TYPE *Control and signaling units*
MODELS XB4-B... ZB4-B XB5-A...-C... -E... -K . ZB5-A XD4-P. XD5-P. XB6 . ZB6... XB7-E... XVL

NAME TYPE *Illuminated beacons and indicating banks*
MODELS XVB . XVD ... XVD-LS XVP XVE XVM...

NAME TYPE *Control stations*
MODELS XAL-D ... XAL-E. XAL-B XAL-K .. XAL-S. XAP. XAM

NAME TYPE *Foot switches*
MODELS XPE..

NAME TYPE *Electrical blocks*
MODELS ZBE . ZBP ZBV.. ZBZ .. ZEN-L ZAL-V

to which this declaration refers conform to :

STANDARDS OR NORMATIVE DOCUMENTS
Low-voltage switchgear and controlgear :
General rules EN60947-1 IEC60947-1
Electromechanical control circuit devices EN60947-5-1 IEC60947-5-1

Subject to installation, maintenance and use conforming to its (their) intended purpose, to the applicable regulations and standards, to the supplier's instructions and to standard practice.

the products conform to the requirements of the applicable European Directives :

Low-voltage Directive *N° 2006/95/CE*
EMC Directive *N° 2004/108/CE*

The CE marking on the products and/or their packaging signifies that Schneider Electric holds the reference technical file available to the European Union authorities.

Issued at L'Isle d'Espagnac - FRANCE : December 12, 2007 Authorised Signatory

Name Mr Arnaud Mondi
Title Department Vice President
Signature

Merlin Gerin
Square D
Telemecanique

C3

Control stations and enclosures

Plastic control stations XAL D and XAL K
For Harmony Ø 22 control and signaling units XB5
Complete stations screw clamp terminal connections

Emergency stop or Emergency switching off functions

Example: XAL D634 black/yellow, XAL K174 (1 N/C + 1 N/O) equipped with 2 contact blocks type XB5 AE142

Description	Type	Type of contact	Reference	Weight
		1 2		
		N/C N/O		kg
Unmarked				
Double mushroom head push button Ø 40 mm, red Turn to release	Screw clamp terminals	1	XAL K174	0.170
		1	XAL K178F	0.170
		1	XAL K178L	0.170
		1	XAL K178J	0.170
		1	XAL K174	0.170
		1	XAL K174F	0.170
		1	XAL K174L	0.170
		1	XAL K174J	0.170
Mushroom head pushbutton Ø 40 mm, red Key release (key n° 455)	Screw clamp terminals	1	XAL K184	0.170
		1	XAL K184F	0.170
		1	XAL K184L	0.170
		1	XAL K184J	0.170
Mushroom head pushbutton Ø 40 mm, red Push-pull	Screw clamp terminals	1	XAL K194	0.170
	Lugs	1	XAL K19S	0.170

(1) Maximum rating: 3 A, 600 V AC, 4 poles max. Consult our Customer Care Centre for a control station type XAL K•••• with maximum of four Emergency switching-off or Emergency stop pushbuttons conforming with the requirements of EN/ISO 13850 standard, paragraph 4.1.1.

(2) Maximum rating: 3 A, 600 V AC, 2 poles max. Consult our Customer Care Centre for a control station type XAL K•••• with maximum of two Emergency switching-off or Emergency stop pushbuttons conforming with the requirements of EN/ISO 13850 standard, paragraph 4.1.1.

Technical Literature

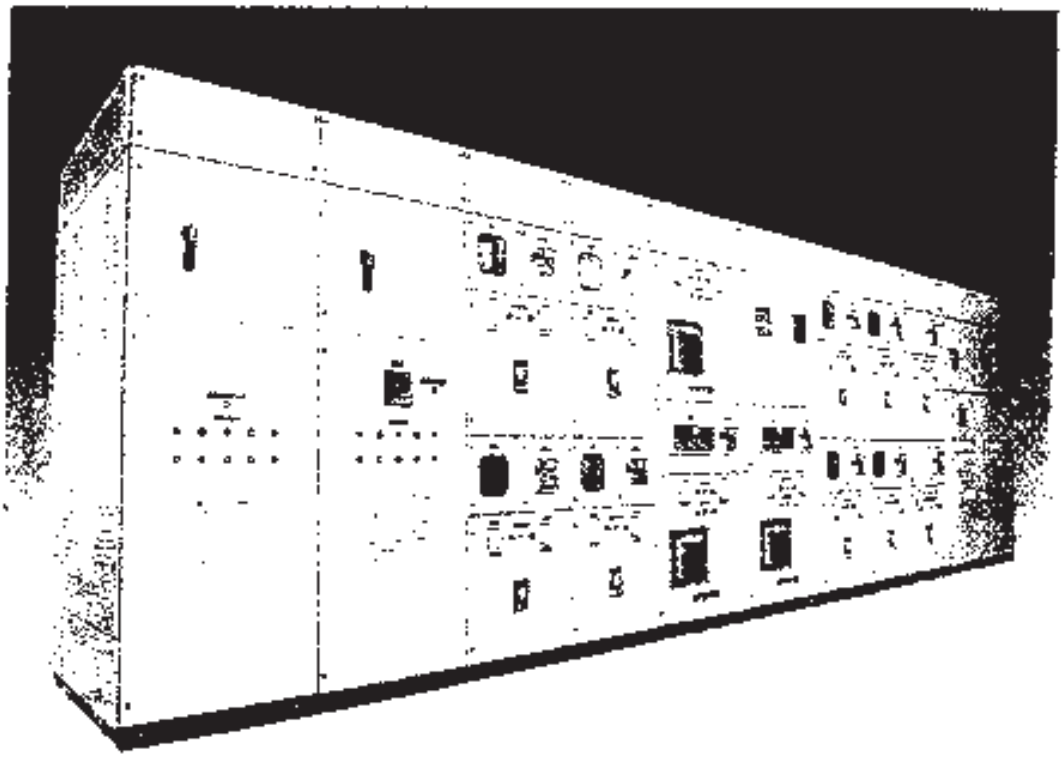
59) Emergency Stop Button

UB 聯信工程有限公司

UNION BEST ENGINEERING LIMITED

L.V. Switchboard & Motor Control Centre

ASTA Certified, Fully Type-tested to BS EN / IEC
CCC / GB / ISO Standards



By Union Best Engineering Ltd

Address: Unit B, 5/F, Phase 3, Kwun Tong Industrial Centre,
448-458 Kwun Tong Road, Kln., Hong Kong
Tel: (852) 2513 1890 Fax: (852) 2569 0072
E-mail: ubest@ubest.com.hk
Web-Site: www.ubest.com.hk

UNION BEST Low Voltage Modular Cubicle Switchboard & Motor Control Centre
BS EN 60439-1 IEC 60439-1 IEC 60529 AS 3439.1 GB (CCC) ISO

A. Union Best Engineering Ltd.
Specialize in design and manufacture of Low Voltage Modular Cubicle Switchboards and Motor Control Centres /Panels with factory situated in Dongguan City of China.

B. ASTA Certified, Type-tested to the following standards with certificates are the Union Best Low Voltage Switchboards, Motor Control Centers, and Local Motor Control Panels:

1. BS EN 60439-1 1999,
2. IEC 60439-1 1999
3. AS 3439.1-1993, and also to
4. GB 7251.1-1997,
5. GB/T19001-2000 idt ISO 9001 2000, and
6. ZBK36001-89 of China National Standards.

C. Quality Assurance, in addition, Union Best has obtained certificates including,

1. China National Compulsory Certificate to GB 7251.1-1997 issued by China Quality Certification Center on 14th August, 2003,
2. GB/T19001-2000 idt ISO 9001 2000

D. Expertise in Management of Design, Manufacture and Tests
With the implementation of Total Quality Management in production, special care has been taken for management of design, manufacture and tests of our products from concept inception to products operation after site tests.

UNION BEST Low Voltage Modular Cubicle Switchboard & Motor Control Centre
BS EN 60439-1 IEC 60439-1 IEC 60529 AS 3439.1 GB (CCC) ISO

E. Personnel Safety

The emphasis throughout is on quality and safety, and the products have been rigorously tested by independent test authorities to ensure compliance to BS EN, IEC, GB, and AS standards. Besides, personnel safety is of prime importance. This is the area we excel and emphasize to ensure that there is maximum possibility for injury during normal installation and service. This together with wide acceptance by relevant local electrical inspectorates provides you, the customer, the most comprehensive package.

F. Our Major Markets

Our products are widely accepted and used in many industrial applications in Hong Kong, Macau, and various cities in China.

G. Structure / Functions of the Switchgears and Controlgears

1. Modular Assembly
2. Extendable
3. Top Entry / Bottom Entry for Cables / Flange Ends connection
4. Rear Access / Front Access
5. Floor Standing / Wall Mounted
6. Form 3 standard, optional form 1, form 2 and form 4 are available.
7. Draw-out type / Fixed type Switchgears.
8. Busbars are hard drawn, high conductivity, electro-tinned copper
9. Busbar supports are moulded of fibre-grass reinforced polyester
10. The enclosures are manufactured from heavy gauge galvanized sheet steel finished with powder coating.
11. Base Skid: U channel with screws for levelling and fixing.

UNION BEST Low Voltage Modular Cubicle Switchboard & Motor Control Centre
BS EN 60439-1 IEC 60439-1 IEC 60529 AS 3439.1 GB (CCC) ISO

H. Electrical Characteristics

1. Rated Current: Main busbar up to 2500 A, higher current to 6000A upon request.
2. Rated Insulation Voltage: 690 V AC.
3. Rated Frequency: 50 Hz
4. Testing Voltage: 2500 V for 1 minute.
5. Short Circuit Withstand Current: 50 kA rms for 3 sec.
6. Rated Voltage: 415 V / 690 V / 6 KV AC (Ue / Ui / Uimp).
7. Degree of Protection: IP33, optional IP42, IP55 upon request
8. Service Conditions: Ambient Temperature does not exceed 40 C, Relative Humidity up to 100%.

I. Product Range

Union Best has developed a complete range of Type-tested Switchgear and Controlgear systems to cover the whole spectrum of Low Voltage applications from the main switchboard down to the smallest distribution board and control panels, and metal work and stainless steelwork including

1. Main Switchboards - model: UB-LVA-25
2. Standard & Real Time Power Factor Correction Capacitor Banks
3. Automatic Change-over Board & ATS Switchboards
4. Motor Control Center - model: UB-LMCP-50
5. Automatic Genset Load Sharing Switchboards
6. Piano-type Control Console
7. Water Pump Starter Panel
8. Fire Service Water Pump Starter Panel.
9. Remote Control Panel.
10. Automatic Production Line Equipment Control Panel
11. Distribution Boards - for GE, MG, ABB, Siemens, MCCB /MCB.
12. Cable Trays, Cable Trunkings, Cable Ladders to BS 4678 & BS 729
13. Bus Bar Trunkings.
14. All kinds of Metal Work, and Stainless Steel Work.
15. Testing, Repair, & Maintenance.
16. Pre- Sales and Post Sales Services.

UNION BEST Low Voltage Modular Cubicle Switchboard & Motor Control Centre

BS EN 60439-1 IEC 60439-1 IEC 60529 AS 3439.1 GB (CCC) ISO

3. Attachments

1 Latest Major Hong Kong Project Reference Lists:
L.V. Switchboard and Motor Control Centre & Local Motor Control Panel.

2 Copies of certificates: ASTA No. 14494, (1986), 14278, (1970), (1958).
GB/T19001:2000 idt ISO 9001:2000.
GB 7251.1-1997 (CCC)

ISO9002 國際質量體系認證企業

香港公司地址	：	香港九龍觀塘道 448-458 號 宮塘工業中心第 3 期 5 樓 B 室
電話	：	（852） 2513-1890
傳真	：	（852） 2569-0072
電子郵箱	：	ubestwl@netvigator.com
	：	ubest@ubest.com.hk
網頁	：	www.ubest.com.hk
工廠地址	：	東莞市虎門石美工業區
電話	：	（0769） 2285093 / 2172425 / 2176101
傳真	：	（0769） 2172426
電子郵箱	：	ubestchina@vip.163.com

Technical Literature

60) Motor Control Panel

Technical Literature

61) Frequency Inverter & Harmonic Filter

VLT® HVAC Drive

makes HVAC operation child's play

VLT® – an intelligent part of the intelligent building

The VLT® HVAC Drive, built on Danfoss' new modular plug-and-play platform and dedicated to HVAC applications, makes HVAC operation child's play.

Lowest cost of ownership
VLT® HVAC Drives let you:

- **Save energy**
  The VLT® HVAC Drive includes:
  – 98% basic energy efficiency
  – Sleep Mode
  – Automatic Energy Optimisation
  – Flow compensation
- **Save money**
  The modular design and a host of options allows for a low initial investment and low cost upgrades according to future needs.
- **Save time**
  Operators, equipment and control systems all communicate effortlessly with the VLT® HVAC Drive. It is fluent in all common BMS network protocols and displays every alphabet. 27 languages, including English, German, Mandarin and Cantonese are available.

  The award-winning Local Control Panel constantly improves on the intuitive man-machine interface. Automatic Motor Adaptation and Automatic Energy Optimisation support fast commissioning.

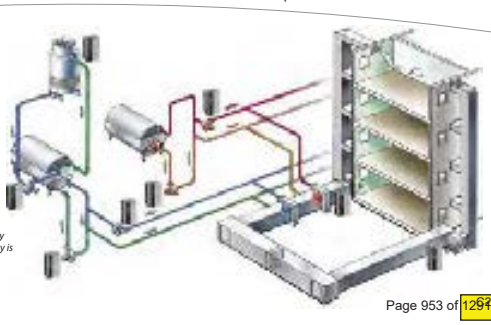
  Due to a series of self-protecting and monitoring features and a highly durable mechanical design, the VLT® HVAC Drive is practically maintenance free.
- **Save space**
  Due to its small size, the VLT® HVAC Drive is easily mounted inside a HVAC unit or panel.
- **Fire override mode**
  Fire Override Mode helps keep fire escape routes free of smoke, overrides the drives's self-protecting features and keeps the fan running as long as possible in the event of fire.
- **Save cabinet**
  Protection class IP55 requires no cabinet.

Dedicated to HVAC
Danfoss has unequalled experience in advanced drive technologies for HVAC applications.

This experience has been used to optimise features in the VLT® HVAC Drive and make it the perfect match for pumps, fans and water chillers (compressors) in buildings fitted with sophisticated HVAC solutions.

Perfect comfort levels and major energy savings can be achieved in any building by harnessing the VLT® HVAC Drive to your applications. Hotels, hospitals, airports, casinos, cleanrooms, sports facilities, concert halls, commercial buildings and residential buildings – if you can name a need, we can name a solution: the VLT® HVAC Drive.

VLT® HVAC Drive features and benefits apply to district heating applications as well – improving control and providing major energy savings.



VLT® HVAC Drive operate all HVAC operations by providing exactly the power required. No energy is consumed by valves and dampers.

The VLT® HVAC Drive unleashes the full potential of HVAC

Small investment
The VLT® HVAC Drive is available in a range of versions, from a basic serial communication and I/O configuration capable right up to a fully equipped and personalized drive, including all relevant HVAC I/O points and protocols. Delivered from factory.
No extra assembly work on-site!

50° C ambient temperature
The robust VLT® HVAC Drive is designed to work at maximum output in an ambient temperature up to 50° C.

Suitable for "slave" operation
The drive's modular structure makes it suitable for "slave" operation mastered by BMS, PLC's or DDCs.

Stand-alone unit
VLT® HVAC Drive provides intelligent stand-alone functionality via:

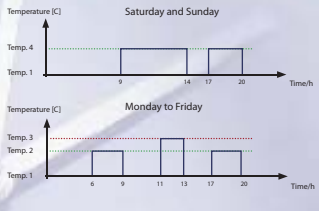
- Built-in Real Time Clock
- Programmable actions
- Smart Logic Controller
- 4 auto-tuned PID controllers.

Automatic Energy Optimisation
The standard feature AEO provides optimized motor magnetisation at all speeds and loads.

This increases energy efficiency by 5-15% at partial loads.

Real Time Clock

Real Time Clock can be used to adjust building comfort to demands that change over the week.



Flow compensation
Significant energy savings and reduced installation costs are provided by flow compensation in both fan and pumps systems. A pressure sensor mounted close to the fan or pump provides a reference enabling pressure to be kept constant at the discharge end of the system. The drive constantly adjusts the pressure reference to follow the system curve.

Energy monitoring
The VLT® HVAC Drive provides a complete range of energy consumption information. Choose to divide absolute energy consumption into hours, days or weeks. Or choose to monitor a load profile for the application.

Energy analysis
This data can even be uploaded to a VLT® Energy Box – PC software that performs in-depth real life/true energy analysis of your application and displays the payback time for the drive.

The VLT® HVAC Drive is built on Danfoss Drives, new generation modular concept. Real plug-and-play adding and exchanging of options. Just upgrade instead of buying a new drive.

No dust in electronics
The unique cooling system prevents dusty and agressive ambient airflow to damaging the drive electronics. This extends the drive's lifetime.

design award winner 2004

The VLT® HVAC Drive has an award winning Local Control Panel and a well-structured menu system that ensures fast commissioning and trouble-free operation of the many powerful functions.

The VLT® HVAC Drive can be remote commissioned and monitored through a USB pluggable cable or BMS network communications. VLT® Set up Software MCT 10 and Language Changer make drive operation child's play.

Best HVAC performance with VLT® HVAC Drive

Comfort for flight personnel and passengers
Clean air and comfortable temperature supports comfort and soothes frayed tempers. Air is moved, chilled, heated, humidified and cleaned effectively consuming a minimum of energy and financial resources. With VLT® HVAC Drive you get full control of pumps, fans and compressors.

Treated like a guest
When walking into a hotel room you should experience a mild, fresh, clean smell and a feeling of comfort and relaxation.
To provide this and at the same time go easy on energy and operating costs – choose a VLT® HVAC Drive.

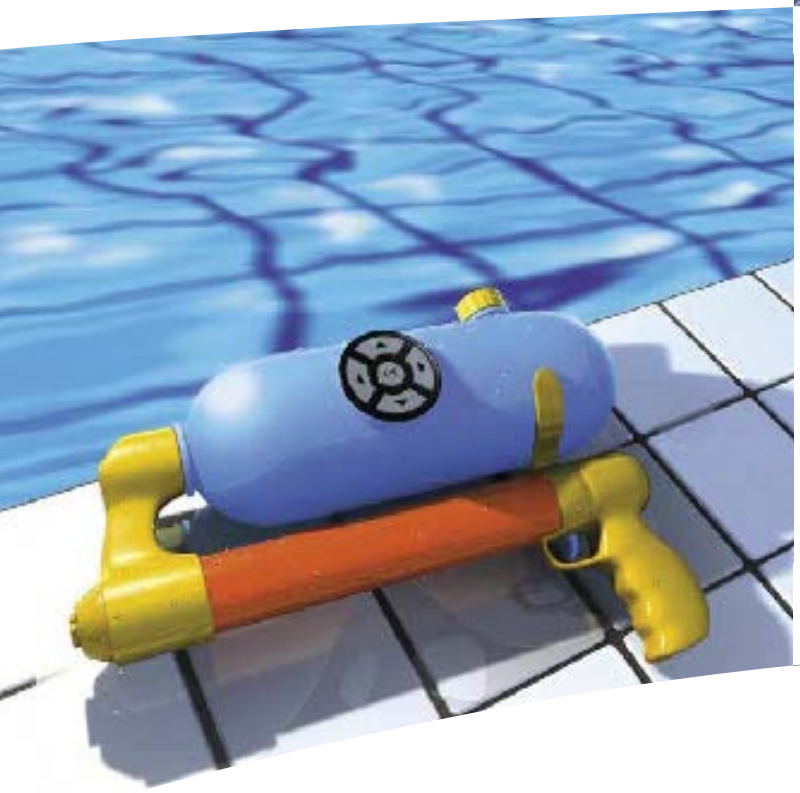
Healthy Environment
Patients thrive better breathing clean, conditioned air. Autotuning PID controllers ensure accurate control of airflow, maintaining a positive pressure in operating rooms to help maintain hygienic conditions and prevent cross contamination.
VLT® HVAC Drive can maintain a negative pressure in isolation wards as well, ensuring a healthy environment for all.

Hot business
Let VLT® HVAC Drive provide a reliable, comfortable environment for your office staff. People should be able to work efficiently without being distracted by sudden changes in temperature or humidity. Let a VLT® HVAC Drive quietly and effectively control the indoor climate, improve work efficiency and help you keep cool in a hot business environment.

Where dust is critical
Cleanroom facilities for the production of micro electronics like semiconductor chips require special precautions. The VLT® HVAC Drive can meticulously control to maintain air quality and humidity levels under a variety of operating conditions, including continued operation during mains voltage fluctuations.

The bottom line
The initial cost of HVAC is almost negligible. Energy efficient control of fans, pumps and compressors – day and night, during opening and closing hours – ensures maximum economy and low running costs.
Let VLT® HVAC Drive impact your bottom line.

District heating/Cooling
The larger the system, the larger the savings that can be derived from the use of VLT® HVAC Drive. Precise control of temperature, pressure and flow is done by speed control of pumps and fans – the best way to save natural resources. The larger system, the greater the power required – and VLT ® HVAC Drives goes all the way.



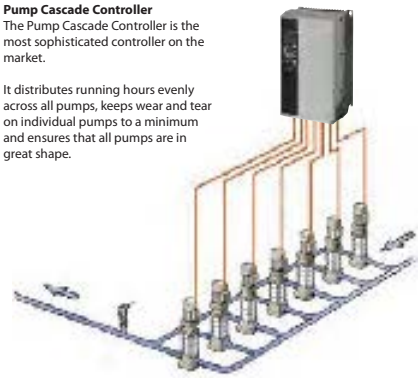
Dedicated pump features in VLT® HVAC Drive

The VLT® HVAC Drive offers a vast number of pump-specific features developed in cooperation with OEMs, contractors and manufacturers around the world.

Pump Cascade Controller
The Pump Cascade Controller is the most sophisticated controller on the market.

It distributes running hours evenly across all pumps, keeps wear and tear on individual pumps to a minimum and ensures that all pumps are in great shape.

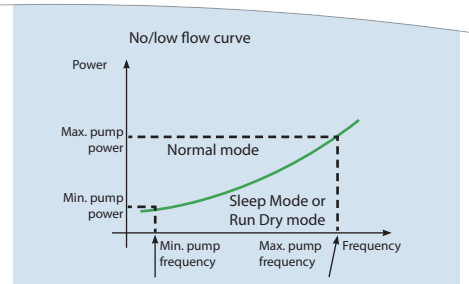
Vital water supply
Vital water supply can be assured in the event of leakage or a broken pipe. For example overload is prevented by reducing speed – and supply is secured at lower flow.



Sleep Mode
In Sleep Mode the drive detects situations with low or no flow. Instead of continuous operation it boosts the system pressure and then stops to save energy. The drive starts automatically when the pressure falls below the lower set point.

Dry Pump Protection and End of Curve
Dry Pump Protection and End of Curve relate to situations where the pump runs without creating the desired pressure – as when a well runs dry or a pipe leaks.

The drive sets off an alarm, shuts off the pump, or performs another programmed action.



An operating pump will normally consume more power the faster it runs – according to a curve determined by the pump and application design.

VLT® HVAC Drive will detect situations where the pump runs fast but is not fully loaded – and thereby not consuming adequate power. This is the case when water circulation stops, the pump runs dry or when when pipes leak.

Dedicated fan features

User-friendly, distributed intelligence and reduced power consumption are beneficial for fan applications.

Lower AHU costs
The VLT® HVAC Drive is fitted with a built-in Smart Logic Controller and 4 auto tune PID controllers and can control air handling functions with fans, valves, and dampers. The building management's DDC-'s are thereby released and valuable data points (DP) are saved.

Extends BMS capacity
When integrated into the BMS network, all the HVAC Drive I/O points are available as remote I/O's to extend BMS's capacity. For example, room temperature sensors (Pt1000/Ni1000) can be directly connected.

Resonance Monitoring
By pressing a few buttons on the Local Control Panel the drive can be set to avoid frequency bands at which connected fans create resonances in the ventilation system. This improves building comfort.

Intelligent AHU functions
The VLT® HVAC Drive handles logical rules and input from sensors, real-time functionality, and time-related actions. This enables the HVAC Drive to control a wide range of functions, including:

- Weekend and working-day operations
- Cascaded P-PI for temperature control
- Multi-zone pressure control
- Flow balancing between fresh and outlet air

Belt Monitoring
From the relation between current and speed, the VLT® HVAC Drive is able to reliably recognize a broken belt. Lack of air flow detected immediately, first cost and down-time is reduced.

Fire Override Mode
In Fire Override Mode the VLT® HVAC Drive will not react to control signals, warnings or alarms. It will continue its reliable operation as long as possible and run until it eventually selfdestruct.

Stairwell Pressurization
In the event of fire, the VLT® HVAC Drive can maintain a higher level of air pressure in stairwells than in other parts of the building and ensure that fire escapes remain free of smoke.

Meticulous control of fans saves energy and keeps noise and draft at a minimum.

Dedicated compressor features

The VLT® HVAC Drive has been designed to offer flexible, intelligent control of scroll, screw and centrifugal compressors, making it even easier to optimize cooling capacity with constant temperature and pressure levels for water chillers, and other typical compressor applications in HVAC.

Replace a cascade with a single compressor
The VLT® HVAC Drive provides the same level of flexibility with one large compressor instead of a cascade of 2 or 3 smaller compressors. The HVAC Drive operates all compressors at a far more refined range of speeds than normal – even above nominal speed – meaning that one large compressor is now enough.

Set point in temperature
The VLT® HVAC Drive calculates the actual room temperature from the pressure in the cooling media and refines compressor operation accordingly – without the need for additional software, sensors or controllers.

This calculation is also applicable to the set point as well, so the desired temperature is set via the Local Control Panel – and not a pressure value.

Fewer starts and stops
A maximum number of start/stop cycles within a given period of time can be set via the Local Control Panel. Since start-up is the most critical part of compressor operation (all parts of the unit are under mechanical stress before the system is sufficiently lubricated) this extends compressor lifetime.

Quick start-up
To extend life even further, the VLT® HVAC Drive opens a bypass valve and lets the compresser start quickly without load.

The VLT® HVAC Drive provides 130% break away torque and can give 110% torque for 60 seconds in normal operation. This torque demand would normally require larger and more expensive drives.

VLT® HVAC drive allows you to rethink your compressor operation.

Flexible compressor mode operation even above nominal speed and high break away torque for start-ups allow for better control and major savings.

C7

Toronto Airport, Canada
Toronto Pearson International Airport is Canada's busiest airport, welcoming close to 29 million passengers in 2004. The airport is currently in the middle of an ambitious 10-year, almost $5 billion dollar Airport Development Program which began in 1998 – and Danfoss has provided hundreds of HVAC drives as part of this program.

Orlando Medical Center, Florida, USA
Danfoss drives are part of the economical and energy smart solution that helps keep staff and patients cool and comfortable in the 20,000 m^2 Orlando Regional Medical Center in the middle of sunny Florida.

National Theatre, Hungary
In the new National Theatre of Hungary Danfoss HVAC drives in the air handling system ensure that audiences can enjoy performances in a tranquil and pleasant environment. The 20,800 m^2 building housing 620 visitors, was built in 15 months which required easy installing equipment.

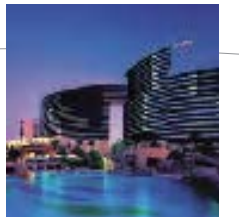
Proven HVAC experience

Torre Mayor, Mexico City
With its 55 floors and a height of 225 m the Torre Mayor is the highest building in Latin America. Danfoss drives control the heating and ventilation.

Tropical Islands Resort near Berlin, Germany
A steady 25° C air temperature, 31° C water temperature, no rain, and a pleasant 40% to 60% humidity for the resort's tropical plants. Everyone's idea of perfect weather!
All this is possible with a first class climate and water control system driven by VLT® HVAC Drives.

Opera House in Sydney, Australia
The Sydney Opera House is one of the architectural wonders of the world, and perhaps the best known building of the 20th century. In 2001, the NSW Government provided $69 million for several projects to improve the facilities and environment for performing arts companies, patrons and visitors. Danfoss provided the drives.

Shanghai General Motors, China
Shanghai General Motors Co Ltd. is a 50-50% joint venture between General Motors and the Shanghai Automotive Industry Corporation Group (SAIC). Shanghai GM has an annual production capacity of 200,000 vehicles. Danfoss provides the VLT® HVAC drives to maintain the production environment.



Grand Hyatt, Dubai
Set within a lush oasis of 37 acres of landscaped gardens, the Grand Hyatt Dubai is an outstanding combination of resort facilities, luxury hotel guest rooms and suites, residential apartments and one of the most advanced conference centers in the Middle East. Danfoss provided the VLT® HVAC Drives.

Guangzhou Baiyun Pharmaceutical Factory, China
Guangzhou Baiyunshan Pharmaceutical Manufacturer was established in 1993 and is a listed company with a good reputation in the pharmaceutical field in China. Its share value is around RMB 374 million and sales turnover in 2004 was RMB 2,5 billion. Danfoss provided the drives.

HVAC users participated in developing the user interface

Graphical display
- International letters and signs
- Showing bars and graphs
- Easy overview
- Possible to select 27 languages
- iF awarded design

Other benefits
- Removable during operation
- Up- and download functionality
- IP65 rating when mounted in a panel door
- Numerical version also available

Illumination
- Important buttons are now illuminated when active

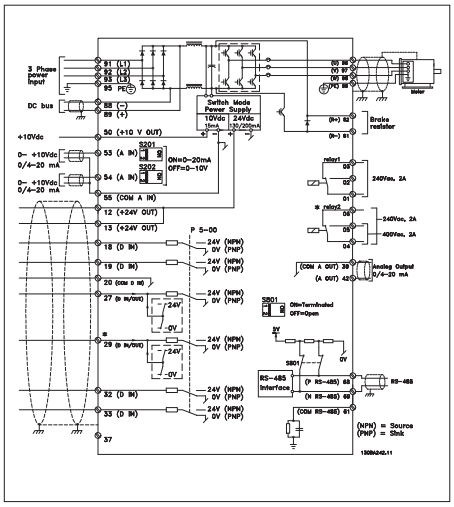
Menu structure
- Based on the well known matrix system in today's VLT® drives
- Easy short cut for the experienced user
- Edit and operate in different set-ups simultaneously

Quick Menus
- A Danfoss defined Quick Menu
- A Personal defined Quick Menu
- A Changes Made Menu lists the parameters unique for your application
- A Function Setup menu provides quick and easy setup for specific applications
- A Logging menu provides access to operation history

New buttons
- Info ("on board manual")
- Cancel ("undo")
- Alarm log (quick access)

Connection overview

This diagram shows a typical installation of the VLT® HVAC Drive.
Power is connected to the terminals 91 (L1), 92 (L2) and 93 (L3) and the motor is connected to 96 (U), 97 (V) and 98 (W).
Terminals 88 and 89 are used for load sharing between drives.
Analog inputs can be connected to the 53 (V or mA), 54 (V or mA) terminals.
These inputs can be set up to either reference, feedback or termistor.
There are 6 digital inputs to be connected to terminals 18, 19, 27, 29, 32, and 33. Two digital input/output terminals (27 and 29) can be set up as digital outputs to show an actual status or warning. The terminal 42 analog output can show process values such as 0 - I_{MAX}.
On the 68 (P+) and 69 (N-) terminals' RS 485 interface, the drive can be controlled and monitored via serial communication.



Mains supply 3 x 200 – 240 VAC

Type	Typical shaft output		Output current [A] 3x200-240V		Enclosure Weight IP20/21**		Enclosure Weight IP55		Dimensions IP20/21**	Dimensions IP55
	kW	HP	Cont.	60s*	kg	Lbs.	kg	Lbs.	H x W x D	H x W x D
FC102P1K1T2	1.1	1.5	6.6	7.3	4.8	10.6	14.2	31.4	268x90x205	420x242x195
FC102P1K5T2	1.5	2.0	7.5	8.3	4.9	10.8	14.2	31.4	268x90x205	420x242x195
FC102P2K2T2	2.2	3.0	10.6	11.7	4.9	10.8	14.2	31.4	268x90x205	420x242x195
FC102P3K0T2	3.0	4.0	12.5	13.8	6.6	14.6	14.2	31.4	268x130x205	420x242x195
FC102P3K7T2	3.7	5.0	16.7	18.4	6.6	14.6	14.2	31.4	268x130x205	420x242x195
FC102P5K5T2	5.5	7.5	24.2	26.6	22	49	23	51	480x242x260	480x242x260
FC102P7K5T2	7.5	10	30.8	33.9	22	49	23	51	480x242x260	480x242x260
FC102P11KT2	11	15	46.2	50.8	27	60	28	62	650x242x260	650x242x260
FC102P15KT2	15	20	59.4	65.3	27	60	28	62	650x242x260	650x242x260
FC102P18KT2	18.5	25	74.8	82.3	62	137	65	144	680x308x310	680x308x310
FC102P22KT2	22	30	88.0	96.8	62	137	65	144	680x308x310	680x308x310
FC102P30KT2	30	40	115	126.5	62	137	65	144	775x370x335	775x370x335
FC102P37KT2	37	50	143	157.3	43	95	45	100	775x370x335	775x370x335
FC102P45KT2	45	60	170	187	43	95	45	100	775x370x335	775x370x335

* I max for 60 s – ** IP21 from 5.5 kW to 45 kW – H x W x D means Height x Depth x Width

Mains supply 3 x 380 – 480 VAC

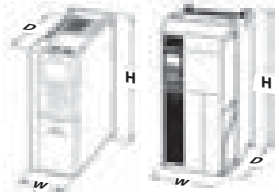
Type	Typical shaft output		Output current [A] 3x380-440V		Output current [A] 3x440-480V		Enclosure Weight IP20/21**		Enclosure Weight IP55***		Dimensions IP20/21**	Dimensions IP55***
	kW	HP	Cont.	60s*	Cont.	60s*	kg	Lbs.	kg	Lbs.	H x W x D	H x W x D
FC102P1K1T4	1.1	1.5	3.0	3.3	2.7	3	4.8	10.6	14.2	31.4	268x90x205	420x242x195
FC102P1K5T4	1.5	2.0	4.1	4.5	3.4	3.7	4.9	10.8	14.2	31.4	268x90x205	420x242x195
FC102P2K2T4	2.2	3.0	5.6	6.2	4.8	5.3	4.9	10.8	14.2	31.4	268x90x205	420x242x195
FC102P3K0T4	3.0	4.0	7.2	7.9	6.3	6.9	4.9	10.8	14.2	31.4	268x90x205	420x242x195
FC102P4K0T4	4.0	5.5	10.0	11	8.2	9	4.9	10.8	14.2	31.4	268x90x205	420x242x195
FC102P5K5T4	5.5	7.5	13.0	15.2	11.0	12.2	6.6	14.6	14.2	31.4	268x130x205	420x242x195
FC102P7K5T4	7.5	10	16.0	17.6	14.5	16	6.6	14.6	14.2	31.4	268x130x205	420x242x195
FC102P11KT4	11	15	24.0	26.4	21.0	23.1	22	49	23	51	480x242x260	480x242x260
FC102P15KT4	15	20	32.0	35.2	27.0	29.7	22	49	23	51	480x242x260	480x242x260
FC102P18KT4	18.5	25	37.5	41.3	34.0	37.4	22	49	23	51	480x242x260	480x242x260
FC102P22KT4	22	30	44.0	48.4	40.0	44.0	27	60	28	62	650x242x260	650x242x260
FC102P30KT4	30	40	61.0	67.1	52.0	57.2	27	60	28	62	650x242x260	650x242x260
FC102P37KT4	37	50	73.0	80.3	65.0	71.5	43	95	45	100	680x308x310	680x308x310
FC102P45KT4	45	60	90.0	99	80.0	88	43	95	45	100	680x308x310	680x308x310
FC102P55KT4	55	75	106	116.6	105	115.5	43	95	45	100	680x308x310	680x308x310
FC102P75KT4	75	100	147	161.7	130	143	62	137	65	144	775x370x335	775x370x335
FC102P90KT4	90	125	177	194.7	160	176	62	137	65	144	775x370x335	775x370x335
FC102P110T4	110	150	212	233	190	209	96	212	96	212	1208x420x373	1208x420x373
FC102P132T4	132	200	260	286	240	264	104	230	104	230	1208x420x373	1208x420x373
FC102P160T4	160	250	315	347	302	332.2	125	277	125	277	1588x420x373	1588x420x373
FC102P200T4	200	300	395	434	361	397.1	136	301	136	301	1588x420x373	1588x420x373
FC102P250T4	250	350	480	528	443	487.3	151	334	151	334	1588x420x373	1588x420x373
FC102P315T4	315	450	600	660	540	594	263	582	263	582	2000x600x494	2000x600x494
FC102P355T4	355	500	658	724	590	649	270	597	270	597	2000x600x494	2000x600x494
FC102P400T4	400	600	745	820	678	745.8	272	602	272	602	2000x600x494	2000x600x494
FC102P450T4	450	600	800	880	730	803	313	693	313	693	2000x600x494	2000x600x494

* I max for 60 s – ** IP21 from 11 kW to 90 kW – *** IP54 from 110kW – H x W x D means Height x Dept x Width

Mains supply 3 x 525 – 600 VAC

Type	Typical shaft output		Output current [A] 3x525-550V		Output current [A] 3x551-575V		Enclosure Weight IP20		Dimensions IP20
	kW	HP	Cont.	60s*	Cont.	60s*	kg	Lbs.	H x W x D
FC102P1K1T6	1.1	1.5	2.6	2.9	2.4	2.6	6.5	14.3	268x130x205
FC102P1K5T6	1.5	2.0	2.9	3.2	2.7	3	6.5	14.3	268x130x205
FC102P2K2T6	2.2	3.0	4.1	4.5	3.9	4.3	6.5	14.3	268x130x205
FC102P3K0T6	3.0	4.0	5.2	5.7	4.9	5.4	6.5	14.3	268x130x205
FC102P4K0T6	4.0	5.5	6.4	7	6.1	6.7	6.5	14.3	268x130x205
FC102P5K5T6	5.5	7.5	9.5	10.5	9.0	9.9	6.6	14.6	268x130x205
FC102P7K5T6	7.5	10	11.5	12.7	11.0	12.1	6.6	14.6	268x130x205

* I max for 60 s
** Planned
H x W x D means Height x Dept x Width



Specifications

Mains supply (L1, L2, L3):

Supply voltage:	200-240 V ±10%
Supply voltage:	380-500 V ±10%
Supply voltage:	525-600 V ±10%*
Supply frequency	50/60 Hz
Displacement Power Factor (cos φ) near unity	(> 0.98)
Switching on input supply L1, L2, L3	1-2 times/min.

Output data (U, V, W):

Output voltage	0-100% of supply voltage
Switching on output	Unlimited
Ramp times	1 - 3600 sec.
Closed loop	0-132 Hz

Digital inputs:

Programmable digital inputs:	6*
Logic	PNP or NPN
Voltage level	0 - 24 VDC

* 2 can be used as digital outs

Analog inputs:

Analog inputs	2
Modes	Voltage or current
Voltage level:	-10 to +10 V (scaleable)
Current level	0/4 to 20 mA (scaleable)

Pulse inputs:

Programmable pulse inputs	2
Voltage level	0 - 24 VDC (PNP positive logic)
Pulse input accuracy (0.1 - 110 kHz)	
Utize some of the digital inputs	

Analog output:

Programmable analog outputs	1
Current range at analog output	0/4 - 20 mA

Relay outputs:

Programmable relay outputs:	2
(240 VAC, 2 A and 400 VAC, 2 A)	

Fieldbus communication:

Standard built in:	Optional:
• FC Protocol	• LonWorks
• N2 Metasys	• BACnet
• FLN Apogee	• DeviceNet
• Modbus RTU	• Profibus

* planned

Application options:

A wide range of integrated HVAC options can be fitted in the drive:

General purpose I/O option:
3 digital inputs, 2 digital outputs, 1 analog current output, 2 analog voltage inputs

Relay option:
3 relay outputs

Analogue I/O option:
3 Pt1000 / Ni1000 inputs, 3 analog voltage outputs

External 24 VDC supply option :
24 VDC external supply can be connected to supply control- and option cards

Brake chopper option:
Connected to an external brake resistor, the built in brake chopper limits the load on the intermediate circuit in case the motor acts as generator.

Power options

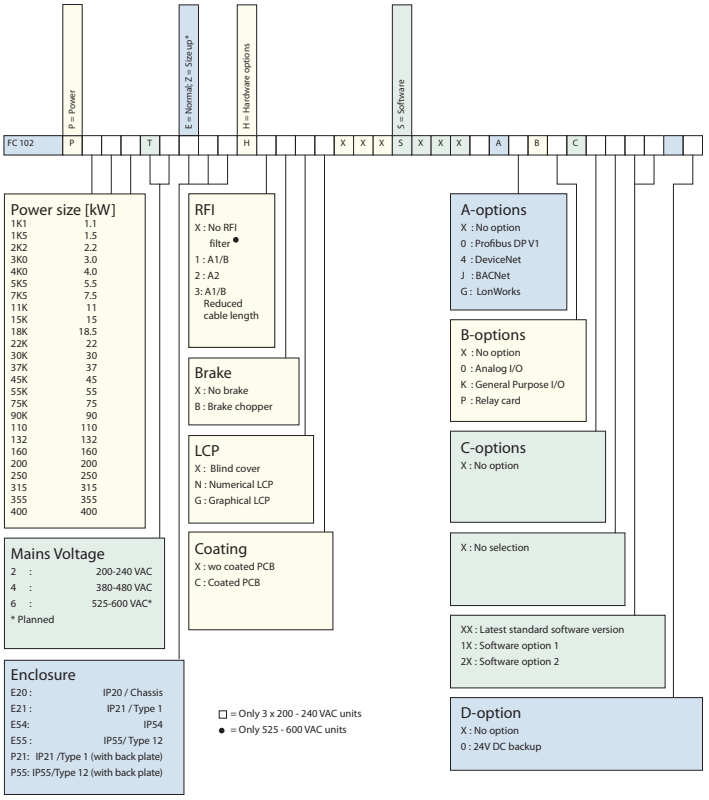
Danfoss Drives offers a wide range of external power options for use together with our drive in critical networks or applications:

- **Advanced harmonic filters**: For critical demands on harmonic distortion
- **dv/dt filters**: For special demands on motor isolation protection
- **Sine filters** (LC filters): For noiseless motor

HVAC PC software

- **MCT 10**
  – ideal for commissioning and servicing the drive
- **VLT HVAC Planet**
  – an interactive design guide including application examples.
- **VLT Energy Box**
  – comprehensive energy analysis tool, shows the drive pay-back time
- **MCT 31**
  – harmonics calculations tool

Choose freely from thousands of configurations delivered from factory



An overview showing the thousands of ways to configure a VLT® HVAC Drive. Choosing between options creates a unique drive number.

The drive is factory built using this number.

You can configure online at www.Danfoss.com/Drives.

What VLT® is all about

Danfoss Drives is the world leader among dedicated drives providers – and still gaining market shares.

Dedicated to drives
Dedication has been a key word since 1968, when Danfoss introduced the world's first mass produced variable speed drive for AC motors – and named it VLT®.
Two thousand employees develop, manufacture, sell and service drives and softstarters in more than one hundred countries – and nothing but drives and softstarters.

Intelligent and innovative
Developers at Danfoss Drives have fully adopted modular principles in development as well as design, production and configuration.
Tomorrow's features are developed in parallel using dedicated technology platforms. This allows the development of each element to take in parallel, at the same time reducing time to market and ensuring that customers always enjoy the benefits of the latest features.

Local backup – globally
VLT® motor controls are operating in applications all over the world and Danfoss Drives, experts are ready to support our customers with application advice and service wherever they may be.

Depend on the experts
We take responsibility for every element in our products. The fact that we develop and produce our own features, hardware, software, power modules, printed circuit boards, and accessories is your guarantee for reliable products.

Danfoss Drives experts only ever stop when the customer's drive problems are solved.

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www.Danfoss.com/Drives • E-mail: info@danfoss.com

C11

DKDD.PB.100.A1.02 VLT® is a trademark of Danfoss A/S www.simpatico.dk.2005.12

Contents

1 How to Read this Design Guide

This Design Guide will introduce all aspects of the Advanced Harmonic Filters for your VLT® FC Series Drive. It describes Harmonics and how to mitigate them, provide installation instructions and guidance about how to programme the frequency converter.

Danfoss technical literature is also available online at www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/Technical+Documentation.

2 Safety and Conformity

2

2.1.1 Symbols

Symbols used in this manual:

NOTE
Indicates something to be noted by the reader.

CAUTION
Indicates a general warning.

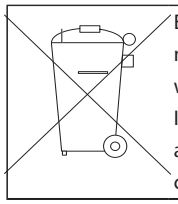
WARNING
Indicates a high-voltage warning.

★	Indicates default setting

2

2.1.2 Abbreviations

Active Power	P
Advanced Harmonic Filter	AHF
Alternating current	AC
American wire gauge	AWG
Ampere/AMP	A
Apparent Power	S
Degrees Celsius	°C
Direct current	DC
Displacement Power Factor	DPF
Electro Magnetic Compatibility	EMC
Drive	FC
Gram	g
Harmonic Calculation Software	HCS
Hertz	Hz
Kilohertz	kHz
Local Control Panel	LCP
Meter	m
Millihenry Inductance	mH
Milliampere	mA
Millisecond	ms
Minute	min
Motion Control Tool	MCT
Nanofarad	nF
Newton Meters	Nm
Nominal motor current	$I_{M,N}$
Nominal motor frequency	$f_{M,N}$
Nominal motor power	$P_{M,N}$
Nominal motor voltage	$U_{M,N}$
Parameter	par.
Partial Weighted Harmonic Distortion	PWHD
Point of Common Coupling	PCC
Power Factor	PF
Protective Extra Low Voltage	PELV
Rated Inverter Output Current	I_{INV}
Reactive Power	Q
Revolutions Per Minute	RPM
Second	s
Short circuit ratio	R_{SCE}
Total Demand Distortion	TDD
Total Harmonic Distortion	THD
Total Harmonic Current Distortior	THiD
Total Harmonic Voltage Distortior	THvD
True Power Factor	TPF
Volts	V
$I_{VLT,MAX}$	The maximum output current.
$I_{VLT,N}$	The rated output current supplied by the frequency converter.



Equipment containing electrical components may not be disposed of together with domestic waste.
It must be separately collected with electrical and electronic waste according to local and currently valid legislation.

MCC 101/102
Design Guide

CE

2.1.3 CE Conformity and Labelling

What is CE Conformity and Labelling?
The purpose of CE labelling is to avoid technical trade obstacles within EFTA and the EU. The EU has introduced the CE label as a simple way of showing whether a product complies with the relevant EU directives. The CE label says nothing about the specifications or quality of the product.
The low-voltage directive (73/23/EEC)
Frequency converters must be CE labelled in accordance with the low-voltage directive of January 1, 1997. The directive applies to all electrical equipment and appliances used in the 50 - 1000 V AC and the 75 - 1500 V DC voltage ranges. Danfoss CE-labels in accordance with the directive and issues a declaration of conformity upon request.

2.1.4 Warnings

WARNING

Improper installation of the filter or the frequency converter may cause equipment failure, serious injury or death. Follow this Design Guide and install according to National and Local Electrical Codes.

WARNING

Never work on a filter in operation. Touching the electrical parts may be fatal - even after the equipment has been disconnected from the drive or motor.

WARNING

Before disconnecting the filter, wait at least the voltage discharge time stated in the Design Guide for the corresponding frequency converter to avoid electrical shock hazard.

2

CAUTION

When in use the filter surface temperature rises. DO NOT touch filter during operation.

CAUTION

To prevent resonances in the DC-link, it is recommended to disable the dynamic DC-link compensation by setting par. 14-51 to OFF.Se chapter *Ho to Programme the Frequency Converter*.

CAUTION

Temperature contactor must be used to prevent damage of the filter caused by over temperature. An immediate stop or a controlled ramp down within 30 seconds has to be performed to prevent filter damage.

NOTE

Never attempt to repair a defect filter.

NOTE

The filters represented in this Design Guide are specially designed and tested for operation with Danfoss frequency converters (FC 102/202/301 and 302) Danfoss takes no responsibility for the use of the filters with third party frequency converters.

WARNING

Non - authorized removal of required cover, inappropriate use, incorrect installation or operation, creates the risk of severe injury to persons or damage to material assets.

CAUTION

All operations concerning transport, installation and commissioning as well as maintenance must be carried out by qualified, skilled personnel (IEC 60364 and CENELEC HD 384 or IEC 60364 and IEC-Report 664 or DIN VDE 0110. National regulations for the prevention of accidents must be observed).

NOTE

According to this basic safety information qualified skilled personnel are persons who are familiar with the assembly, commissioning and operation of the product and who have the qualifications necessary for their occupation .

NOTE

The filters are components, that are designed for installation in electrical systems or machinery.
When installing in machines, commissioning of the filters (i.e. the starting of operation as directed) is prohibited until it is proven, that the machine corresponds to the regulations of the EC Directive 83/392/EEC (Machinery Directive); EN 60204 must be observed.

NOTE

Commissioning (i.e. starting operation as directed) is only allowed when there is compliance with the EMC-Directive 89/336/EEC.
The filters meet the requirements of the Low-Voltage Directive 73/23/EEC. The technical data and information on the connection conditions must be obtained from the nameplate and the documentation and must be observed in all cases.

NOTE

The filter must be protected from inappropriate loads. In particular; during transport and handling: Components are not allowed to be bent. Distance between isolation must not be altered. Touching of electronic components and contacts must be avoided.

NOTE

When measuring on live filters, the valid national regulations for the prevention of accidents (e.g. VBG 4) must be observed.
The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE-connection). When using the filters with frequency converters without safe separation from the supply line (to VDE 0100) all control wiring has to be included in further protective measures (e.g. double insulated or shielded, grounded and insulated).

NOTE

Systems where filters are installed, if applicable, have to be equipped with additional monitoring and protective devices according to the valid safety regulations e.g. law on technical tools, regulations for the prevention of accidents, etc.

3 Introduction to Harmonics and Mitigation

3.1 What are Harmonics?

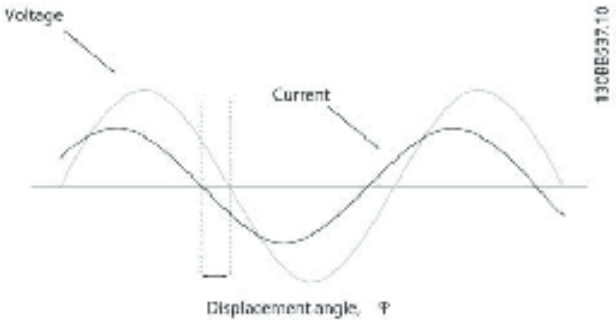
3.1.1 Linear Loads

On a sinusoidal AC supply a purely resistive loads (for example an incandescent light bulb) will draw a sinusoidal current, in phase with the supply voltage.

The power dissipated by the load is:

$P = U \times I$

For reactive loads (such as an induction motor) the current will no longer be in phase with the voltage, but will lag the voltage creating a lagging true power factor with a value less than 1. In the case of capacitive loads the current is in advance of the voltage, creating a leading true power factor with a value less than 1.



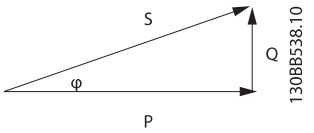
In this case, the AC power has three components: real power (P), reactive power (Q) and apparent power (S). The apparent power is:

$S = U \times I$

(where S=[kVA], P=[kW] and Q=[kVAR])

In the case of a perfectly sinusoidal waveform P, Q and S can be expressed as vectors that form a triangle:

$S^2 = P^2 + Q^2$



The displacement angle between current and voltage is φ. The displacement power factor is the ratio between the active power (P) and apparent power (S):

$DPF = \frac{P}{S} = cos(\varphi)$

3.1.2 Non-linear Loads

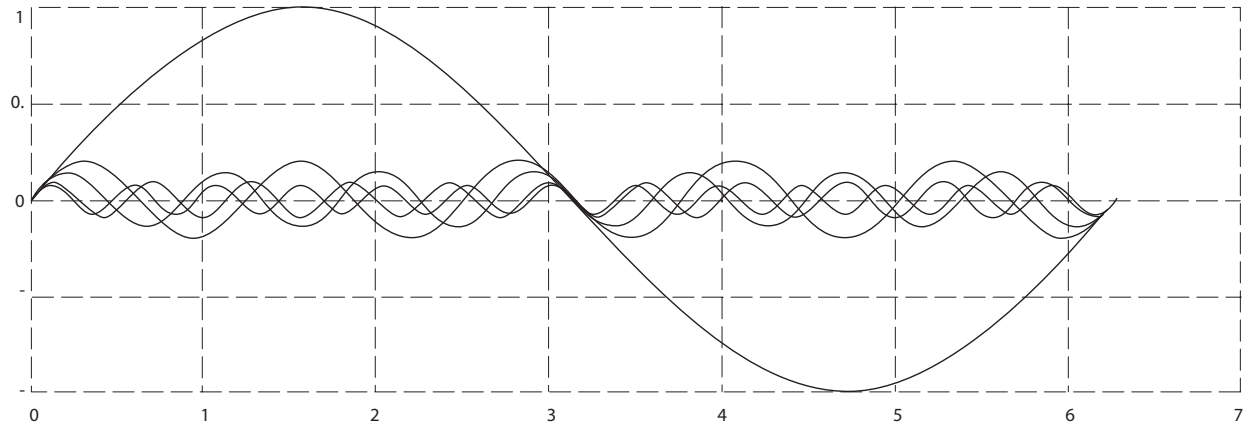
Non-linear loads (such as diode rectifiers) draw a non-sinusoidal current. The figure below shows the current drawn by a 6-pulse rectifier on a three phase supply.

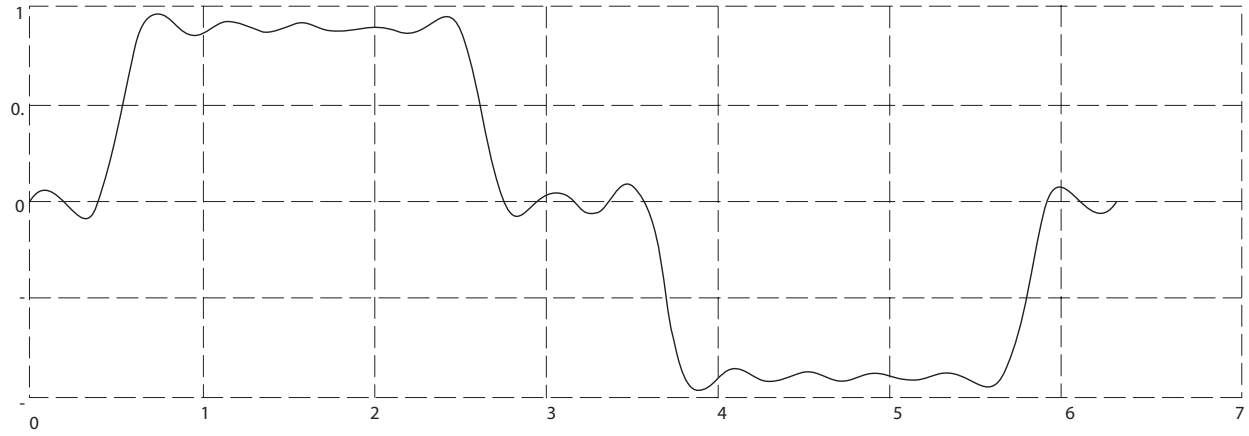
A non-sinusoidal waveform can be decomposed in a sum of sinusoidal waveforms with periods equal to integer multiples of the fundamental waveform.

$f(t) = \Sigma\, a_h \times sin(h\omega_1 t)$

See following illustrations.

3





The integer multiples of the fundamental frequency ω1 are called harmonics. The RMS value of a non-sinusoidal waveform (current or voltage) is expressed as:

$$I_{RMS} = \sqrt{\sum_{h=1}^{h_{max}} I_{(h)}^2}$$

The amount of harmonics in a waveform gives the distortion factor, or total harmonic distortion (THD), represented by the ratio of RMS of the harmonic content to the RMS value of the fundamental quantity, expressed as a percentage of the fundamental:

$$THD = \sqrt{\sum_{h=2}^{h_{max}} \left(\frac{I_h}{I_1}\right)^2} \times 100\,\%$$

Using the THD, the relationship between the RMS current I_{RMS} and the fundamental current I_1 can be expressed as:

$$I_{RMS} = I_1 \times \sqrt{1 + THD^2}$$

The same applies for voltage.

The true power factor PF (λ) is:

$$PF = \frac{P}{S}$$

In a linear system the true power factor is equal to the displacement power factor:

$$PF = DPF = cos(\varphi)$$

In non-linear systems the relationship between true power factor and displacement power factor is:

$$PF = \frac{DPF}{\sqrt{1 + THD^2}}$$

The power factor is decreased by reactive power and harmonic loads. Low power factor results in a high RMS current that produces higher losses in the supply cables and transformers.

In the power quality context, the total demand distortion (TDD) term is often encountered. The TDD does not characterize the load, but it is a system parameter. TDD expresses the current harmonic distortion in percentage of the maximum demand current I_L.

$$TDD = \sqrt{\sum_{h=2}^{h_{max}} \left(\frac{I_h}{I_L}\right)^2} \times 100\,\%$$

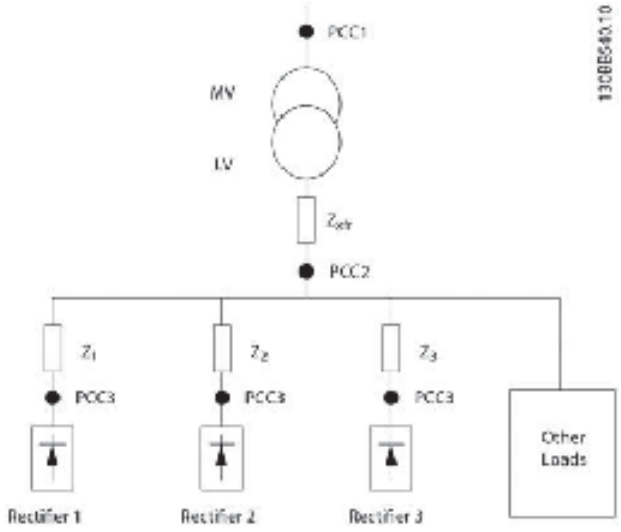
Another term often encountered in literature is the partial weighted harmonic distortion (PWHD). PWHD represents a weighted harmonic distortion that contains only the

harmonics between the 14th and the 40th, as shown in the following definition:

$$PWHD = \sqrt{\sum_{h=14}^{40} \left(\frac{I_h}{I_1}\right)^2} \times 100\,\%$$

3.1.3 The Effect of Harmonics in a Power Distribution System

The figure below shows an example of a small distribution system. A transformer is connected on the primary side to a point of common coupling PCC1, on the medium voltage supply. The transformer has an impedance Z_{xfr} and feeds a number of loads. The point of common coupling where all loads are connected together is PCC2. Each load is connected through cables that have an impedance Z_1, Z_2, Z_3.



Harmonic currents drawn by non-linear loads cause distortion of the voltage because of the voltage drop on the impedances of the distribution system. Higher impedances result in higher levels of voltage distortion.

Current distortion relates to apparatus performance and it relates to the individual load. Voltage distortion relates to system performance. It is not possible to determine the voltage distortion in the PCC knowing only the load's harmonic performance. In order to predict the distortion in the PCC the configuration of the distribution system and relevant impedances must be known.

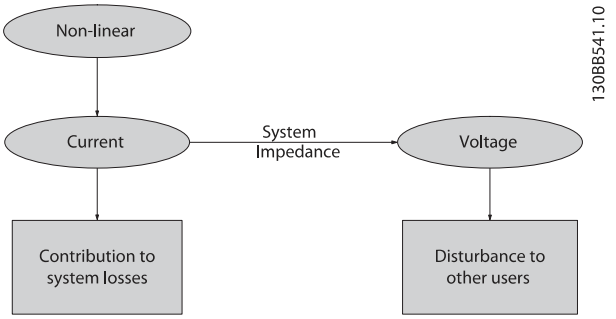
A commonly used term for describing the impedance of a grid is the short circuit ratio R_{sce}, defined as the ratio between the short circuit apparent power of the supply at the PCC (S_{sc}) and the rated apparent power of the load (S_{equ}):

$$R_{sce} = \frac{S_{ce}}{S_{equ}}$$

where $S_{sc} = \frac{U^2}{Z_{supply}}$ and $S_{equ} = U \times I_{equ}$

The negative effect of harmonics is twofold:

- Harmonic currents contribute to system losses (in cabling, transformer)
- Harmonic voltage distortion causes disturbance to other loads and increase losses in other loads



3.2 Harmonic Limitation Standards and Requirements

The requirements for harmonic limitation can be:

- Application specific requirements
- Requirements from standards that have to be observed

The application specific requirements are related to a specific installation where there are technical reasons for limiting the harmonics.

For example on a 250 kVA transformer with two 110 kW motors connected. One is connected direct on-line and the other one is supplied through a frequency converter. If the direct on-line motor should also be supplied through a frequency converter the transformer will, in this case, be undersized. In order to retrofit, without changing the transformer, the harmonic distortion from the two drives has to be mitigated using AHF filters.

There are various harmonic mitigation standards, regulations and recommendations. Different standards apply in different geographical areas and industries. The following four commonly encountered standards will be presented:

- IEC61000-3-2
- IEC61000-3-12
- IEC61000-3-4
- IEEE 519
- G5/4

3

IEC61000-3-2, Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
The scope of IEC61000-3-2 is equipment connected to the public low-voltage distribution system having an input current up to and including 16 A per phase. Four emission classes are defined: Class A through D. The VLT drives are in Class A. However, there are no limits for professional equipment with a total rated power greater than 1 kW.

IEC61000-3-12, Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤75 A
The scope of IEC61000-3-12 is equipment connected to the public low-voltage distribution system having an input current between 16 A and 75 A. The emission limits are currently only for 230/400 V 50 Hz systems and limits for other systems will be added in the future. The emission limits that apply for drives are given in Table 4 in the standard. There are requirements for individual harmonics (5th, 7th, 11th, and 13th) and for THD and PWHD. Frequency converters from the Automation Drive series (FC 102 HVAC, FC 202 Aqua and FC 302 Industry) comply with these limits without additional filtering.

IEC61000-3-4, Limits, Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 16 A
IEC61000-3-12 supersedes IEC61000-3-4 for currents up to 75 A. Therefore the scope of IEC61000-3-4 is equipment with rated current greater than 75 A connected to the public low-voltage distribution system. It has the status of *Technical report* and should not be seen as an international standard. A three-stage assessment procedure is described for the connection of equipment to the public supply and equipment above 75 A is limited to stage 3 *connection based on the load's agreed power*. The supply authority may accept the connection of the equipment on the basis of the agreed active power of the load's installation and local requirements of the power supply authority apply. The manufacturer shall provide individual harmonics and the values for THD and PWHD.

IEEE519, IEEE recommended practices and requirements for harmonic control in electrical power systems
IEEE519 establishes goals for the design of electrical systems that include both linear and nonlinear loads. Waveform distortion goals are established and the interface between sources and loads is described as point of common coupling (PCC).

IEEE519 is a system standard that aims the control of the voltage distortion at the PCC to a THD of 5 % and limits the maximum individual frequency voltage harmonic to 3 %. The development of harmonic current limits aims the limitation of harmonic injection from individual customers so they will not cause unacceptable voltage distortion levels and the limitation of the overall harmonic distortion of the system voltage supplied by the utility.

The current distortion limits are given in Table 10.3 in the standard and depend on the ratio I_{SC}/I_L where I_{SC} is the short circuit current at the utility PCC and I_L is the maximum demand load current. The limits are given for individual harmonics up to the 35th and total demand distortion (TDD). Please note that these limits apply at the PCC to the utility. While requiring individual loads to comply with these limits also ensures the compliance at the PCC, this is rarely the most economic solution, being unnecessarily expensive. The most effective way to meet the harmonic distortion requirements is to mitigate at the individual loads and measure at the PCC.

However, if in a specific application it is required that the individual drive should comply with the IEEE519 current distortion limits, an AHF can be employed to meet these limits.

G5/4, Engineering recommendation, planning levels for harmonic voltage distortion and the connection of non-linear equipment to transmission systems and distribution networks in the United Kingdom
G5/4 sets planning levels for harmonic voltage distortion to be used in the process of connecting non-linear equipment. A process for establishing individual customer emission limits based on these planning levels is described. G5/4 is a system level standard.

For 400 V the voltage THD planning level is 5 % at the PCC. Limits for odd and even harmonics in 400 V systems are given in Table 2 in the standard. An assessment procedure for the connection of non-linear equipment is described. The procedure follows three stages, aiming to balance the level of detail required by the assessment process with the degree of risk that the connection of particular equipment will result in unacceptable voltage harmonic distortion.

Compliance of a system containing VLT® frequency converters depends on the specific topology and population of non-linear loads. AHF can be employed to meet the requirements of G5/4.

3.3 Harmonic Mitigation

To mitigate the harmonics caused by the frequency converter 6-pulse recitifier several solutions exist and they all have their advantages and disadvantages. The choice of the right solution depends on several factors:

- The grid (background distortion, mains unbalance, resonance and type of supply - transformer/ generator)
- Application (load profile, number of loads and load size)
- Local/national requirements/regulations (IEEE519, IEC, G5/4, etc.)
- Total cost of ownership (initial cost, efficiency, maintenance, etc.)

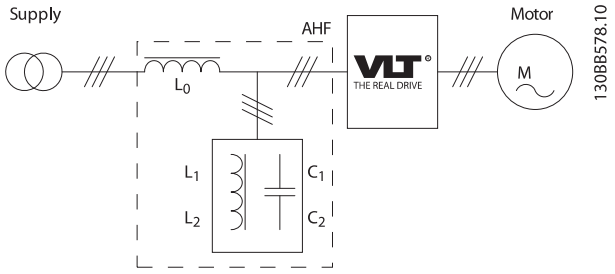
Harmonic solutions can be divided into two main categories: passive and active. Where the passive solutions consist of capacitors, inductors or a combination of the two in different arrangements.
The simplest solution is to add inductors/reactors of typically 3 % to 5 % in front of the frequency converter. This added inductance reduces the amount of harmonic currents produced by the drive. More advanced passive solutions combine capacitors and inductors in trap arrangement specially tuned to eliminate harmonics starting from e.g. the 5^{th} harmonic.

The active solutions determine the exact current that would cancel the harmonics present in the circuit and synthesizes and injects that current into the system. Thus the active solution can mitigate the real-time harmonic disturbances, which makes these solutions very effective at any load profile. To read more about the Danfoss active solutions Low Harmonic Drive (LHD) or Active Filters (AAF) please see MG. 34.Ox.yy and MG.90.Vx.yy.

4 Introduction to Advanced Harmonic Filters

4.1 Operation Principle

The Danfoss Advanced Harmonic Filters (AHF) consist of a main inductor L_0 and a two-stage absorption circuit with the inductors L_1 and L_2 and the capacitors C_1 and C_2. The absorption circuit is specially tuned to eliminate harmonics starting with the 5th harmonic and is specific for the designed supply frequency. Consequently the circuit for 50 Hz has different parameters than the circuit for 60 Hz.



AHFs are available in two variants for two performance levels: AHF005 with 5 % THiD (total current harmonic distortion) and AHF010 with 10 % THiD. The strategy behind the two levels is to offer a performance similar to 12 pulse rectifiers with the AHF010 and a performance similar to 18 pulse rectifiers with AHF005.

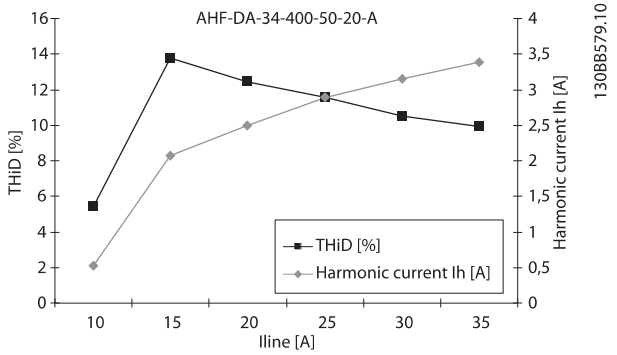
The filter performance in terms of THiD varies as a function of the load. At nominal load the performance of the filter should be equal or better than 10 % THiD for AHF010 and 5 % THiD for AHF005.

At partial load the THiD has higher values. However, the absolute value of the harmonic current is lower at partial loads, even if the THiD has a higher value. Consequently, the negative effect of the harmonics at partial loads will be lower than at full load.

Example:
An 18.5 kW drive is installed on a 400 V/50 Hz grid with a 34 A AHF010 (type code AHF-DA-34-400-50-20-A).
Following values are measured for different load currents, using a harmonic analyzer:

I line RMS [A]	Fundamental current at 50 Hz I[1] RMS [A]	THiD [%]	Total harmonic current Ih RMS [A][1]
9.6	9.59	5.45	0.52
15.24	15.09	13.78	2.07
20.24	20.08	12.46	2.5
25.17	25	11.56	2.89
30.27	30.1	10.5	3.15
34.2	34.03	9.95	3.39

[1])The total harmonic current has been calculated. The THiD vs. load plot is shown in the following figure:



It can be observed that at partial load, 15 A, the THiD is approximately 14 %, compared to 10 % at the nominal load of 34 A. On the other hand, the total harmonic current is only 2.07 A at 15 A line current against 3.39 A harmonic current at 34 A line current. Thus, THiD is only a relative indicator of the harmonic performance. The harmonic distortion of the voltage will be less at partial load than at nominal load.

Factors such as background distortion and grid unbalance can affect the performance of AHF filters. The specific figures are different from filter to filter and the graphs below show typical performance characteristics. For specific details a harmonic design tool such as MCT 31 or Harmonic Calculation Software (HCS) should be used.

Background distortion: The design of the filters aims to achieve 10 % respectively 5 % THiD levels with a background distortion of THvD = 2 %. Practical measurements on typical grid conditions in installations with frequency converters show that often the performance of the filter is slightly better with a 2 % background distortion. However, the complexity of the grid conditions and mix of specific harmonics can not allow a general rule about the performance on a distorted grid. Therefore we have chosen to present worst-case performance deterioration characteristics with the background distortion.

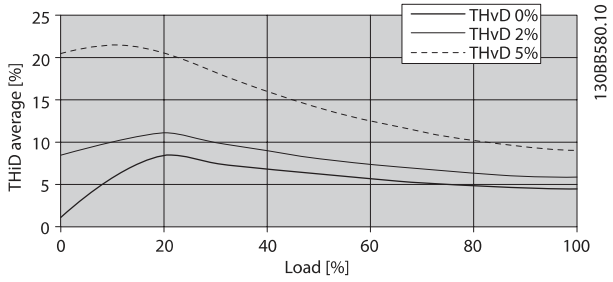


Illustration 4.1 AHF005

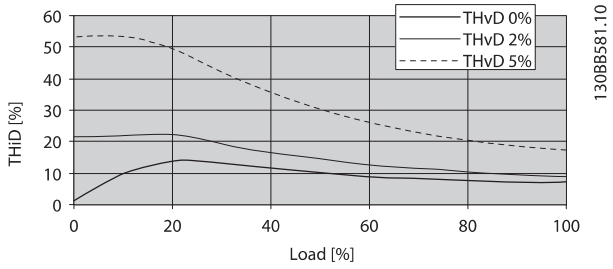


Illustration 4.2 AHF010

Performance at 10% THvD has not been plotted. However, the filters have been tested and can operate at 10% THvD but the filter performance can no longer be guaranteed.

The filter performance also deteriorates with the unbalance of the supply. Typical performance is shown in the graphs below:

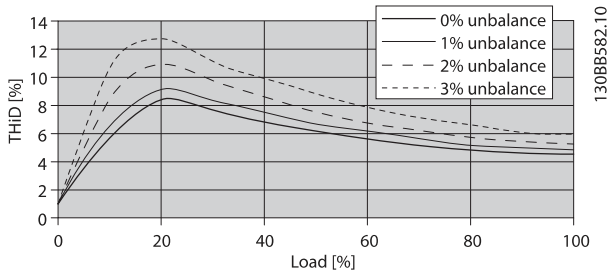


Illustration 4.3 AHF005

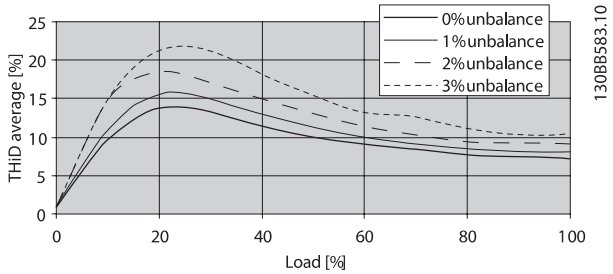


Illustration 4.4 AHF010

4.1.1 Power Factor

In no load conditions (the frequency converter is in stand-by) the frequency converter current is negligible and the main current drawn from the grid is the current through the capacitors in the harmonic filter. Therefore the power factor is close to 0, capacitive. The capacitive current is approximately 25 % of the filter nominal current (depends on filter size, typical values between 20 and 25 %). The power factor increases with the load. Because of the higher value of the main inductor L0 in the AHF005, the power factor is slightly higher than in the AHF010.

Following graphs show typical values for the true power factor on AHF010 and AHF005.

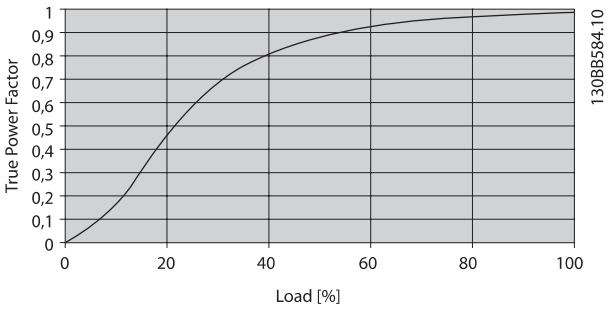


Illustration 4.5 AHF005

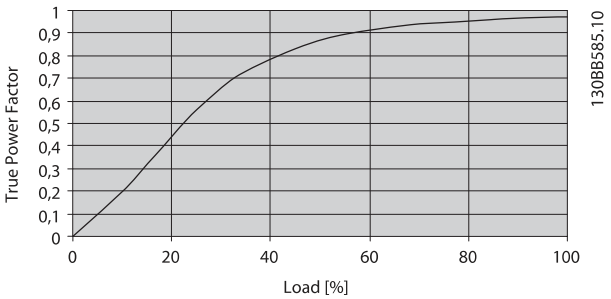


Illustration 4.6 AHF010

4.1.2 Capacitor Disconnect

If the specific application requires a higher power factor at no-load and the reduction of the capacitive current in stand-by, a capacitor disconnect should be used. A contactor disconnects the capacitor at loads below 20 %. It is important to note that the capacitors may not be connected at full load or disconnected at no load.

4

It is very important to consider the capacitive current in the design of applications where the harmonic filter is supplied by a generator. The capacitive current can overexcite the generator in no-load and low-load condition. The over-excitation causes an increase of the voltage that can exceed the allowed voltage for the AHF and the frequency converter. Therefore a capacitor disconnect should always be used in generator applications and the design carefully considered.

Compared to multi-pulse rectifiers, passive harmonic filter (such as AHF) are more robust against background distortion and supply imbalance. However, the performance of passive filters is inferior to the performance of active filters when it comes to partial load performance and power factor. For details about the performance positioning of the various harmonic mitigation solutions offered by Danfoss, please consult the relevant harmonic mitigation literature.

5 Selection of Advanced Harmonic Filter

This chapter will provide guidance about how to choose the right filter size and contains calculation examples, electrical data and the general specification of the filters.

5.1 How to Select the Correct AHF

For optimal performance the AHF should be sized for the mains input current to the frequency converter. This is the input current drawn based on the expected load of the frequency converter and not the size of the frequency converter itself.

5.1.1 Calculation of the Correct Filter Size Needed

The mains input current of the frequency converter ($I_{FC,L}$) can be calculated using the nominal motor current ($I_{M,N}$) and the displacement factor (Cos φ) of the motor. Both values are normally printed on the name plate of the motor. In case the nominal motor voltage ($U_{M,N}$) is unequal to the actual mains voltage (U_L), the calculated current must be corrected with the ratio between these voltages as shown in the following equation: $I_{FC.L} = 1.1 \times I_{M,N} \times cos(\rho) \times \frac{U_{M,N}}{U_L}$

The AHF chosen must have a nominal current ($I_{AHF,N}$) equal to or larger than the calculated frequency converter mains input current ($I_{FC,L}$).

NOTE

Do not oversize the AHF. The best harmonic performance is obtained at nominal filter load. Using an oversized filter will most likely result in reduced THiD performance.

If several frequency converters are to be connected to the same filter, the AHF must be sized according to the sum of the calculated mains input currents.

NOTE

If the AHF is sized for a specific load and the motor is changed, the current must be recalculated to avoid overloading the AHF.

5.1.2 Calculation Example

System mains voltage (U_L):	380 V
Motor name plate power(P_M):	55 kW
Motor efficiency (η_M):	0.96
FC efficiency (η_{FC}):	0.97
AHF effiency (η_{AHF})(worst case estimate):	0.98

Maximum line current (RMS):

$$\frac{P_M \times 1000}{U_L \times \eta_M \times \eta_{FC} \times \eta_{AHF} \times \sqrt{3}} = \frac{55 \times 1000}{380 \times 0.96 \times 0.97 \times 0.98 \times \sqrt{3}} = 91.57\ A$$

In this case a 96 A filter must be chosen.

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5.2 Electrical Data

380 V - 415 V, 50 Hz

Code number AHF005 IP00/IP20	Code number AHF010 IP00/IP20	Filter current rating A	Typical motor kW	VLT power and current ratings kW	A	Losses AHF005 W	AHF010 W	Acoustic noise dBA	Frame size AHF005	AHF010
130B1392	130B1262	10	3	PK37-P4K0	1.2-9	131	93	<70	X1	X1
130B1229	130B1027									
130B1393	130B1263	14	7.5	P5K5-P7K5	14.4	184	118	<70	X1	X1
130B1231	130B1058									
130B1394	~~130B1268~~	22	11	P11K	22	258	206	<70	X2	X2
130B1232	130B1059									
130B1395	130B1270	29	15	P15K	29	298	224	<70	X2	X2
130B1233	~~130B1089~~									
130B1396	~~130B1273~~	34	18.5	P18K	34	335	233	<72	X3	X3
130B1238	130B1094									
130B1397	130B1274	40	22	P22K	40	396	242	<72	X3	X3
130B1239	~~130B1111~~									
130B1398	~~130B1275~~	55	30	P30K	55	482	274	<72	X3	X3
130B1240	130B1176									
130B1399	130B1281	66	37	P37K	66	574	352	<72	X4	X4
130B1241	130B1180									
130B1442	130B1291	82	45	P45K	82	688	374	<72	X4	X4
130B1247	130B1201									
130B1443	130B1292	96	55	P55K	96	747	428	<75	X5	X5
130B1248	130B1204									
130B1444	130B1293	133	75	P75K	133	841	488	<75	X5	X5
130B1249	130B1207									
130B1445	130B1294	171	90	P90K	171	962	692	<75	X6	X6
130B1250	130B1213									
130B1446	130B1295	204	110	P110	204	1080	742	<75	X6	X6
130B1251	130B1214									
130B1447	130B1369	251	132	P132	251	1195	864	<75	X7	X7
130B1258	130B1215									
130B1448	130B1370	304	160	P160	304	1288	905	<75	X7	X7
130B1259	130B1216									
130B1449	130B1389	381	200	P200	381	1510	1175	<77	X8	X7
130B1260	130B1217									
130B1469	130B1391	480	250	P250	472	1852	1542	<77	X8	X8
130B1261	130B1228									

Code number AHF005 IP00/IP20	Code number AHF010 IP00/IP20	Filter current rating A	Typical motor kW	VLT power and current ratings kW	A	Losses AHF005 W	AHF010 W	Acoustic noise dBA	Frame size AHF005	AHF010
2 x 130B1448 2 x 130B1259	2 x 130B1370 2 x 130B1216	608	315	P315	590	2576	1810	<80		
2 x 130B3153 2 x 130B3152	2 x 130B3151 2 x 130B3136	650	355	P355	647	2812	1904	<80		
130B1448 + 130B1449 130B1259 + 130B1260	130B1370 + 130B1389 130B1216 + 130B1217	685	400	P400	684	2798	2080	<80		
2 x 130B1449 2 x 130B1260	2 x 130B1389 2 x 130B1217	762	450	P450	779	3020	2350	<80		
130B1449 + 130B1469 130B1260 + 130B1261	130B1389 + 130B1391 130B1217 + 130B1228	861	500	P500	857	3362	2717	<80		
2 x 130B1469 2 x 130B1261	2 x 130B1391 2 x 130B1228	960	560	P560	964	3704	3084	<80		
3 x 130B1449 3 x 130B1260	3 x 130B1389 3 x 130B1217	1140	630	P630	1090	4530	3525	<80		
2 x 130B1449 + 130B1469 2 x 130B1260 + 130B1261	2 x 130B1389 + 130B1391 2 x 130B1217 + 130B1228	1240	710	P710	1227	4872	3892	<80		
3 x 130B1469 3 x 1301261	3 x 130B1391 3 x 130B1228	1440	800	P800	1422	5556	4626	<80		
2 x 130B1449 + 2 x 130B1469 2 x 130B1260 + 2 x 130B1261	2 x 130B1389 + 2 x 130B1391 2 x 130B1217 + 2 x 130B1228	1720	1000	P1000	1675	6724	5434	<80		

380 V - 415 V, 60 Hz

Code number AHF005 IP00/IP20	Codenumber AHF010 IP00/IP20	Filter current rating	Typical motor	VLT power and current ratings		Losses AHF005	AHF010	Acoustic noise	Frame size	
		A	kW	kW	A	W	W	dBA	AHF005	AHF010
130B3095	130B2874	10	3	PK37-P4K0	1.2-9	131	93	<70	X1	X1
130B1257	130B2262									
130B3096	130B2875	14	7.5	P5K5-P7K5	14.14	184	118	<70	X1	X1
130B2858	130B2265									
130B3097	130B2876	22	11	P11K	22	258	206	<70	X2	X2
130B2859	130B2268									
130B3098	130B2877	29	15	P15K	29	298	224	<70	X2	X2
130B2860	130B2294									
130B3099	130B3000	34	18.5	P18K	34	335	233	<72	X3	X3
130B2861	130B2297									
130B3124	130B3083	40	22	P22K	40	396	242	<72	X3	X3
130B2862	130B2303									
130B3125	130B3084	55	30	P30K	55	482	274	<72	X3	X3
130B2863	130B2445									
130B3026	130B3085	66	37	P37K	66	574	352	<72	X4	X4
130B2864	130B2459									
130B3127	130B3086	82	45	P45K	82	688	374	<72	X4	X4
130B2865	130B2488									
130B3128	130B3087	96	55	P55K	96	747	427	<75	X5	X5
130B2866	130B2489									
130B3129	130B3088	133	75	P75K	133	841	488	<75	X5	X5
130B2867	130B2498									
130B3130	130B3089	171	90	P90K	171	962	692	<75	X6	X6
130B2868	130B2499									
130B3131	130B3090	204	110	P110	204	1080	743	<75	X6	X6
130B2869	130B2500									
130B3132	130B3091	251	132	P132	251	1194	864	<75	X7	X7
130B2870	130B2700									
130B3133	130B3092	304	160	P160	304	1288	905	<75	X7	X7
130B2871	130B2819									
130B3134	130B3093	381	200	P200	381	1510	1175	<77	X8	X8
130B2872	130B2855									
130B3135	130B3094	480	250	P250	472	1850	1542	<77	X8	X8
130B2873	130B2856									

Code number AHF005 IP00/IP20	Codenumber AHF010 IP00/IP20	Filter current rating A	Typical motor kW	VLT power and current ratings kW	A	Losses AHF005 W	AHF010 W	Acoustic noise dBA	Frame size AHF005	AHF010
2 x 130B3133 2 x 130B2871	2 x 130B3092 2 x 130B2819	608	315	P315	590	2576	1810	<80		
2 x 130B3157 2 x 130B3156	2 x 130B3155 2 x 130B3154	650	315	P355	647	2812	1904	<80		
130B3133 + 130B3134 130B2871 + 130B2872	130B3092 + 130B3093 130B2819 + 130B2855	685	355	P400	684	2798	2080	<80		
2 x 130B3134 2 x 130B2872	2 x 130B3093 2 x 130B2855	762	400	P450	779	3020	2350	<80		
130B3134 + 130B3135 130B2872 + 130B3135	130B3093 + 130B3094 130B2855 + 130B2856	861	450	P500	857	3362	2717	<80		
2 x 130B3135 2 x 130B2873	2 x 130B3094 2 x 130B2856	960	500	P560	964	3704	3084	<80		
3 x 130B3134 3 x 130B2872	3 x 130B3093 3 x 130B2855	1140	560	P630	1090	4530	3525	<80		
2 x 130B3134 + 130B3135 2 x 130B2872 + 130B2873	2 x 130B3093 + 130B3094 2 x 130B2855 + 130B2856	1240	630	P710	1227	4872	3892	<80		
3 x 130B3135 3 x 130B2873	3 x 130B3094 3 x 130B2856	1440	710	P800	1422	5556	4626	<80		
2 x 130B3134 + 2 x 130B3135 2 x 130B2872 + 2 x 130B2873	2 x 130B3093 + 2 x 130B3094 2 x 130B2855 + 2 x 130B2856	1722	800	P1000	1675	6724	5434	<80		

440 V - 480 V, 60 Hz

Code number AHF005 IP00/IP20	Codenumber AHF010 IP00/IP20	Filter current rating A	Typical motor kW	VLT power and current ratings kW	A	Losses AHF005 W	AHF010 W	Acoustic noise dBA	Frame size AHF005	AHF010
130B1787	130B1770	10	3	PK37-P4K0	1-7.4	131	93	<70	X1	X1
130B1752	130B1482									
130B1788	130B1771	17	7.5	P5K5-P7K5	9.9+13	184	188	<70	X1	X1
130B1753	130B1483									
130B1789	130B1772	19	11	P11K	19	258	206	<70	X2	X2
130B1754	130B1484									
130B1790	130B1773	25	15	P15K	25	298	224	<70	X2	X2
130B1755	130B1485									
130B1791	130B1774	31	18.5	P18K	31	335	233	<72	X3	X3
130B1756	130B1486									
130B1792	130B1775	36	22	P22K	36	396	242	<72	X3	X3
130B1757	130B1487									
130B1793	130B1776	48	30	P30K	47	482	374	<72	X3	X3
130B1758	130B1488									
130B1794	130B1777	60	37	P37K	59	574	352	<72	X4	X4
130B1759	130B1491									
130B1795	130B1778	73	45	P45K	73	688	374	<72	X4	X4
130B1760	130B1492									
130B1796	130B1779	95	55	P55K	95	747	428	<75	X5	X5
130B1761	130B1793									
130B1797	130B1780	118	75	P75K	118	841	488	<75	X5	X5
130B1762	130B1494									
130B1798	130B1781	154	90	P90K	154	962	692	<75	X6	X6
130B1763	130B1495									
130B1799	130B1782	183	110	P110	183	1080	743	<75	X6	X6
130B1764	130B1496									
130B1900	130B1783	231	132	P132	231	1194	864	<75	X7	X7
130B1765	130B1497									
130B2200	130B1784	291	160	P160	291	1288	905	<75	X7	X7
130B1766	130B1498									
130B2257	130B1785	355	200	P200	348	1406	952	<75	X8	X8
130B1768	130B1499									
130B2259	130B1786	436	250	P250	436	1852	1542	<77	X8	X7
130B1769	130B1751									

Code number AHF005 IP00/IP20	Code number AHF010 IP00/IP20	Filter current rating A	Typical motor kW	VLT power and current ratings kW	A	Losses AHF005 W	AHF010 W	Acoustic noise dBA	Frame size AHF005	AHF010
130B1900 + 130B2200	130B1783 + 130B1784	522	315	P315	531	2482	1769	<80		
130B1765 + 130B1766	130B1497 + 130B1498									
2 x 130B2200	2 x 130B1784	582	355	P355	580	2576	1810	<80		
2 x 130B1766	2 x 130B1498									
130B2200 + 130B3166	130B1784 + 130B3166	671	400	P400	667	2798	2080	<80		
130B1766 + 130B3167	130B1498 + 130B3165									
2 x 130B2257	2 x 130B1785	710	450	P450	711	2812	1904	<80		
2 x 130B1768	2 x 130B1499									
2 x 130B3168	2 x 130B3166	760	500	P500	759	3020	2350	<80		
2 x 130B3167	2 x 130B3165									
2 x 130B2259	2 x 130B1786	872	560	P560	867	3704	3084	<80		
2 x 130B1769	2 x 130B1751									
3 x 130B2257	3 x 130B1785	1065	630	P630	1022	4218	2856	<80		
3 x 130B1768	3 x 130B1499									
3 x 130B3168	3 x 130B3166	1140	710	P710	1129	4530	3525	<80		
3 x 130B3167	3 x 130B3165									
3 x 130B2259	3 x 130B1786	1308	800	P800	1344	5556	4626	<80		
3 x 130B1769	3 x 130B1751									
2 x 130B2257 + 2 x 130B2259	2 x 130B1785 + 2 x 130B1786	1582	1000	P1000	1490	6516	5988	<80		
2 x 130B1768 + 2 x 130B1768	2 x 130B1499 + 2 x 130B1751									

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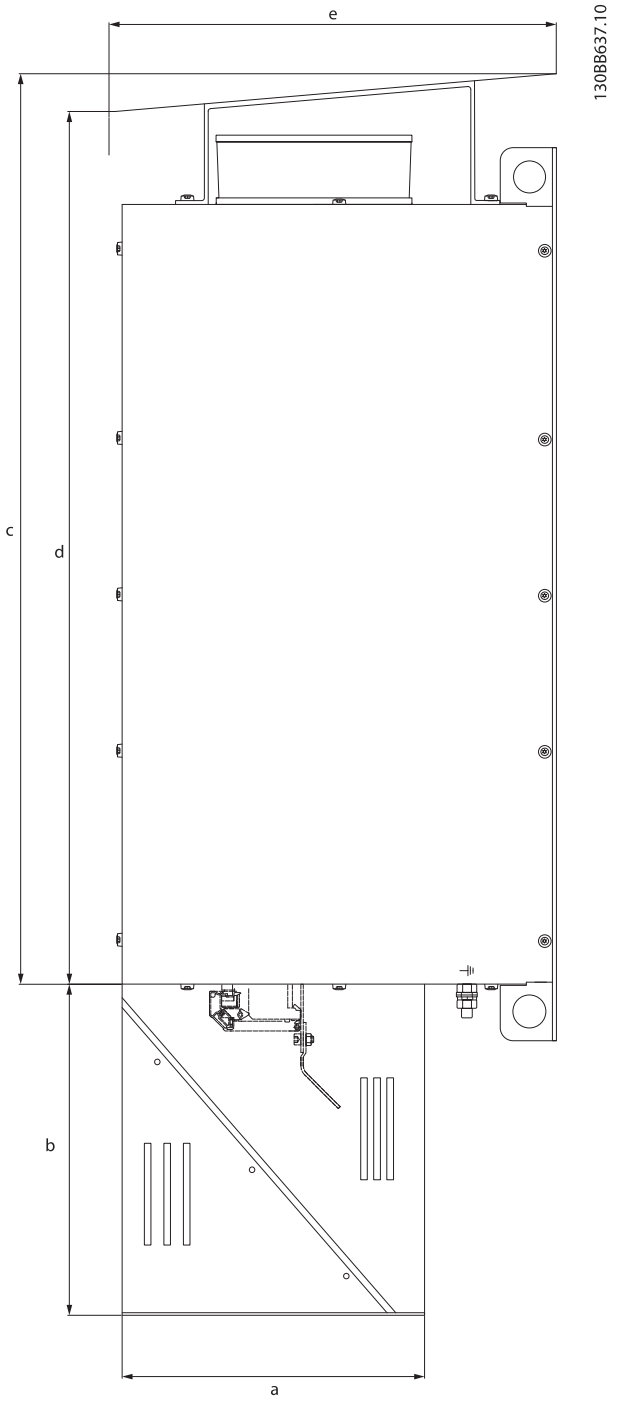
5

5.2.1 Accessories

IP21/NEMA1 enclosure kits for the IP20 filters are available and listed here:

Danfoss part number	IP21/NEMA1 kit for IP20 enclosure
130B3274	X1
130B3275	X2
130B3276	X3
130B3277	X4
130B3278	X5
130B3279	X6
130B3281	X7
130B3282	X8

The kit consists of two parts:
A top plate that prevents vertically falling drops of water and dirt from entering the filter and a terminal cover ensuring touch safe terminals. The terminal cover is prepared for installation of a contactor for capacitor disconnect.



Enclosure type	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)
X1	120	160	329.5	344.5	215.5
X2	190	180	433.5	448.5	257.5
X3	145	210	543.5	558.5	252
X4	230	230	573.5	558.5	343
X5	230	250	681.5	696.5	343
X6	300	270	681.5	696.5	410
X7	300	320	796.5	811.5	458.5
X8	400	350	796.5	811.5	553

NOTE
The NEMA 1 cover is designed for the mounting of Danfoss contactors.
When using non Danfoss contactors, please observe the dimensions of the NEMA 1 terminal cover and ensure that there is space for the contactor.

5.3 General Specification

5.3.1 General Technical Data

Supply voltage tolerance	+/- 10 %
Supply frequency tolerance	+5 %/-1.5 %
Overload capability	160 % for 60 seconds
Efficiency	>0.98
THiD*	AHF005 < 5 % AHF010 < 10 %
Cos φ of I_L	0.5 cap at 25 % $I_{AHF,N}$ 0.8 cap at 50 % $I_{AHF,N}$ 0.85 cap at 75 % $I_{AHF,N}$ 0.99 cap at 100 % $I_{AHF,N}$ 1.00 cap at 160 % $I_{AHF,N}$
Power derating	Temperature - see derating curve below. 1000 m altitude above sea level < h < 2000 m = 5 % per 1000 m

NOTE
The reduction of the low harmonic current emission to the rated THiD implies that the THvD of the non-influenced mains voltage is lower than 2% and the ratio of short circuit power to installed load (R_{SCE}) is at least 66. Under these conditions the THiD of the mains current of the frequency converter is reduced to 10 % or 5 % (typical values at nominal load). If these conditions are not or only partially fulfilled, a significant reduction of the harmonic components can still be achieved, but the rated THiD values may not be observed.

	Dimensions in mm		
Enclosure Type	A (height)	B (width)	C (depth)
X1	332	190	206
X2	436	232	248
X3	594	378	242
X4	634	378	333
X5	747	418	333
X6	778	418	396
X7	909	468	449
X8	911	468	549

Table 5.1 Enclosure dimensions

5.3.2 Environmental Data

Surroundings	
Ambient temperature during full-scale operation	5˚C... + 45˚C - without derating 5˚C... + 60˚C - with derating
Temperature during storage/transport	-25˚C... + 65˚C - transport -25˚C... + 55˚C - storage
Max. altitude above sea level	1000 m (without derating) Between 1000 m and 2000 m (with derating)
Max. relative humidity	Humidity class F without condensation - 5 % - 85 % - Class 3K3 (non-sondensing) during operation
Insulation strength	Overvoltage category III according to ENG61800-5-1
Packaging	DIN55468 for transport packaging materials

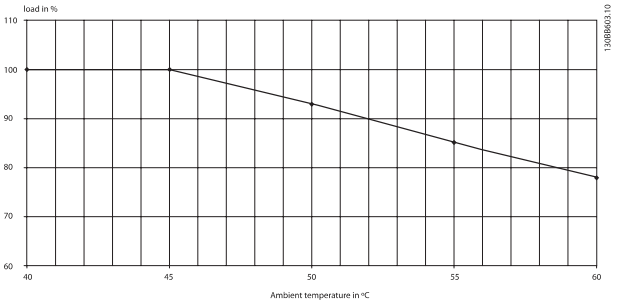


Illustration 5.1 Temperature derating curve

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6 How to Install

6.1 Mechanical Mounting

6.1.1 Safety Requirements of Mechanical Installation

NOTE
Please observe the filter weight and ensure that proper lifting equipment is used.

6

NOTE
When installing the filter use the lifting eyes on both sides to lift the filter.

NOTE
Do not use other parts (terminals, enclosures, etc.).

6.1.2 Mounting

The filters are available in IP00 and IP20 and for both IP ratings the following guidance must be followed during installation:

- All filters must be mounted vertically with the terminals at the bottom
- Do not mount the filter close to other heating elements or heat sensitive material (such as wood)

IP00:

- The surface temperature of the IP00 filters can exceed 70°C and a hot surface warning label is placed on the filter

IP20:

- Top and bottom clearance is minimum 150 mm
- The surface temperature of the IP20 filters does not exceed 70°C
- The filter can be side-by-side mounted with the frequency converter and there is no requirement for spacing between then

6.1.3 Recommendations for Installation in Industrial Enclosures

To avoid high frequency noise coupling keep a minimum distance of 150 mm (5.91 inches) to:

- mains/supply wires
- motor wires of frequency converter
- control- and signal wires (voltage range < 48 V)

To obtain low impedance HF-connections, grounding, screening and other metallic connections (e.g. mounting plates, mounted units) should have a surface as large as possible to metallic ground. Use grounding and potential equalisation wires with a cross section as large as possible (min. 10 mm^2) or thick grounding tapes. Use copper or tinned copper screened wires only, as steel screened wires are not suitable for high frequency applications. Connect the screen with metal clamps or metal glands to the equalisation bars or PE-connections.

Inductive switching units (relay, magnetic contactor etc.) must always be equipped with varistors, RC-circuits or suppressor diodes.

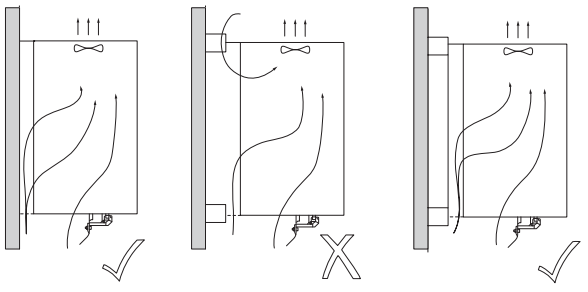
6.1.4 Ventilation

The filters are cooled by means of air circulation. Consequently the air needs to be able to move freely above and below the filter.

When mounting the filters in panels or other industrial enclosures it must be ensured that there is a sufficient airflow through the filter to reduce the risk of overheating the filter and the surrounding components.

If other heat sources (such as frequency converters) are installed in the same enclosure, the heat they generate also needs to be taken into account when dimensioning the cooling of the enclosure.

The filters have to be mounted on a wall in order to guide air through the gap between the wall and the filter. In installations (e.g. panels) where the filter is mounted on rails, the filter will not be sufficiently cooled because of false airflow and therefore a back plate can be ordered separately. See following illustration.



Danfoss part number	Back plate
130B3283	X1
130B3284	X2
130B3285	X3
130B3286	X4
130B3287	X5 and X6
130B3288	X7 and X8

6.2 Electrical Installation

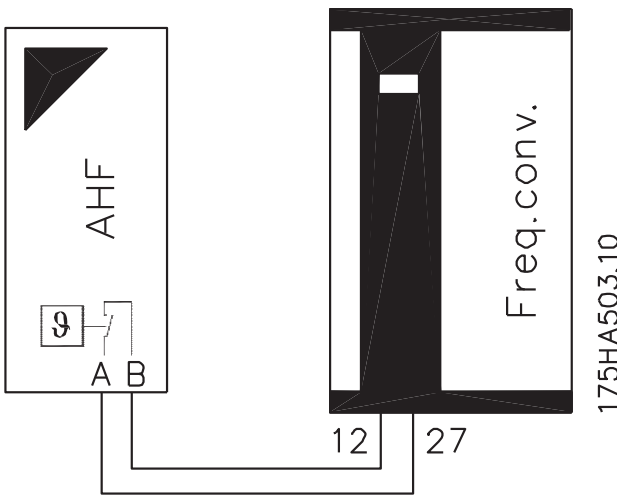
6.2.1 Over Temperature Protection

The Danfoss harmonic filters AHF005 and AHF010 are all equipped with a galvanic isolated switch (PELV) that is closed under normal operating conditions and open if the filter is overheated.

NOTE

The over temperature protection must be used to prevent damage of the filter caused by over temperature. An immediate stop or a controlled ramp down within max. 30 s has to be performed to prevent filter damage.

There are many ways the switch can be used and one example is to connect terminal A of the harmonic filter to terminal 12 or 13 (voltage supply digital input, 24 V) of the Danfoss frequency converter and terminal B to terminal 27. Program digital input terminal 27 to *Coast Inverse*. The frequency converter will coast the motor and thereby unload the filter if an over temperature is detected. Alternatively use terminal 12/33 and set par. 1-90 to *motor terminal protection*.



NOTE

The maximum rating of the over temperature contactor is 250 V AC and 10 A.

6.2.2 Capacitor Disconnect

The power factor of the harmonic filter AHF 005/010 is decreasing with decreasing load. At no load the power factor is zero and the capacitors produce leading current of approximately 25 % of rated the filter current. In applications where this reactive current is not acceptable the terminals X3.1, X3.2, X3.3 and X4.1, X4, X4.3 provide access to the capacitor bank, so it can be disconnected.

Default (on delivery) the wiring will shorten terminal X3.1 with X4.1, X3.2 with X4.2 and X3.3 with X.4.3. In the case that no capacitor disconnect is required, no changes should be made to these shorted terminals.

If a disconnection of the capacitors is required a three-phase contactor should be placed between terminals X3 and X4. It is recommended to use AC3 contactors.

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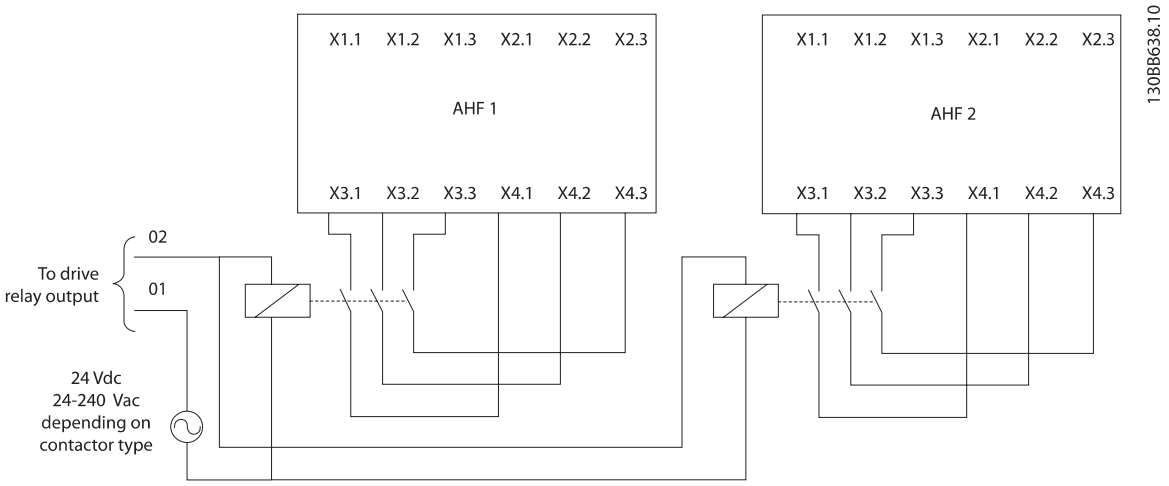

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NOTE

It is not allowed to use one common 3 poled contactor with several paralleled Advanced Harmonic Filters.

NOTE

The AHF filters in stand-by and under low load conditions, when the capacitors are not disconnected, boost the input voltage with up to 5 %. That means that the voltage at the drive terminals is up to 5 % higher than the voltage at the input of the filter. This should be considered at the design of the installation. Special care should be taken in 690 V applications where the voltage tolerance of the drive is reduced to + 5 %, unless a capacitor disconnect is used.

NOTE

Only switch the contactor at less than 20 % output power. Allow minimum 25 s for the capacitors to discharge before re-connecting

Current rating 380-415 V, 50 and 60 Hz	Current rating 440-480 V, 60 Hz	Danfoss Contactors for AHF005 and AHF010	Alternative type AC3
A	A	Type	Contactor rating[1] KVAr
10	10	CI 9	1
14	14	CI 9	2
22	19	CI 9	4
29	25	CI 9	6
34	31	CI 16	7
40	36	CI 16	7
55	48	CI 16	9
66	60	CI 61	11
82	73	CI 61	15
96	95	CI 61	17
133	118	CI 61	22
171	154	CI 61	29
204	183	CI 61	36
251	231	CI 110	44
304	291	CI 110	51
325	355	CI 110	58
380	380	CI 110	66
480	436	CI 141	88

[1] min. 50 % of the nominal load

6.2.3 Wiring

Supply voltage must be connected to the terminals X1.1, X1.2 and X1.3. The frequency converter supply terminals L1, L2 and L3 must be connected to the filter terminals X2.1, X2.2 and X2.3

Paralleling of frequency converters
If several frequency converters are to be connected to one harmonic filter, the connection method is similar to the connection described above. The supply terminals L1, L2 and L3 of the frequency converters must be connected to the filter terminals X2.1, X2.2 and X2.3.

Paralleling of filters
If the mains input current of the frequency converter exceeds the nominal current of the largest harmonic filter, several harmonic filters can be paralleled to achieve the necessary current rating – see *Electrical Data* tabels.

Supply voltage be connected to the terminals X1.1, X1.2 and X1.3 of the filters. The frequency converter supply terminals L1, L2 and L3 must be connected to the filters terminals X2.1, X2.2 and X2.3

Terminals and cables
The following tabels show the terminal types, cable cross section, tightening torque, etc.

NOTE
Use cables complying with local regulations.

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	Main terminals				Capacitor disconnect terminals			
Current in A	Clamp mains terminals	Cable cross-section	Cable end	Torque in Nm	Clamp capacitor disconnect terminals	Cable cross-section	Cable end	Torque in Nm
10	WDU 6	0.5-10 mm^2	cable end sleeve	1.6	WDU 2.5	0.5-4 mm^2	cable end sleeve	0.8
14	WDU 6	0.5-10 mm^2	cable end sleeve	1.6	WDU 2.5	0.5-4 mm^2	cable end sleeve	0.8
22	WDU 6	0.5-10 mm^2	cable end sleeve	1.6	WDU 2.5	0.5-4 mm^2	cable end sleeve	0.8
29	WDU 6	0.5-10 mm^2	cable end sleeve	1.6	WDU 2.5	0.5-4 mm^2	cable end sleeve	0.8
34	WDU 16	1.5-25 mm^2	cable end sleeve	2.4	WDU 10	1.5-16 mm^2	cable end sleeve	2.4
40	WDU 16	1.5-25 mm^2	cable end sleeve	2.4	WDU 10	1.5-16 mm^2	cable end sleeve	2.4
55	WDU 16	1.5-25 mm^2	cable end sleeve	2.4	WDU 10	1.5-16 mm^2	cable end sleeve	2.4
66	WDU 35	2.5-50 mm^2	cable end sleeve	4.5	WDU 16	1.5-16 mm^2	cable end sleeve	2.4
82	WDU 35	2.5-50 mm^2	cable end sleeve	4.5	WDU 16	1.5-16 mm^2	cable end sleeve	2.4
96	WDU 50 N	10-70 mm^2	cable end sleeve	6	WDU 16	1.5-16 mm^2	cable end sleeve	2.4
133	WDU 50 N	10-70 mm^2	cable end sleeve	6	WDU 16	1.5-16 mm^2	cable end sleeve	2.4
171	WFF 70	2.5-95 mm^2	cable lug M8	12	WDU 35	2.5-50 mm^2	cable end sleeve	4.5
204	WFF 70	2.5-95 mm^2	cable lug M8	12	WDU 35	2.5-50 mm^2	cable end sleeve	4.5
251	WFF 300	25-300 mm^2	cable lug M16	60	WDU 95 N	16-150 mm^2	cable end sleeve	20
304	WFF 300	25-300 mm^2	cable lug M16	60	WDU 95 N	16-150 mm^2	cable end sleeve	20
325	WFF 300	25-300 mm^2	cable lug M16	60	WDU 95 N	16-150 mm^2	cable end sleeve	20
380	WFF 300	25-300 mm^2	cable lug M16	60	WDU 95 N	16-150 mm^2	cable end sleeve	20
480	WFF 300	25-300 mm^2	cable lug M16	60	WDU 95 N	16-150 mm^2	cable end sleeve	20

Table 6.1 380 - 415 V, 50 and 60 Hz

	Main terminals				Capacitor disconnect terminals			
Current in A	Clamp mains terminals	Cable cross-section	Cable end	Torque in Nm	Clamp capacitor disconnect terminals	Cable cross-section	Cable end	Torque in Nm
10	WDU 6	0.5-10 mm^2	cable end sleeve	1.6	WDU 2.5	0.5-4 mm^2	cable end sleeve	0.8
14	WDU 6	0.5-10 mm^2	cable end sleeve	1.6	WDU 2.5	0.5-4 mm^2	cable end sleeve	0.8
19	WDU 6	0.5-10 mm^2	cable end sleeve	1.6	WDU 2.5	0.5-4 mm^2	cable end sleeve	0.8
25	WDU 6	0.5-10 mm^2	cable end sleeve	1.6	WDU 2.5	0.5-4 mm^2	cable end sleeve	0.8
31	WDU 16	1.5-25mm^2	cable end sleeve	2.4	WDU 10	1.5-16 mm^2	cable end sleeve	2.4
36	WDU 16	1.5-25mm^2	cable end sleeve	2.4	WDU 10	1.5-16 mm^2	cable end sleeve	2.4
48	WDU 16	1.5-25mm^2	cable end sleeve	2.4	WDU 10	1.5-16 mm^2	cable end sleeve	2.4
60	WDU 35	2.5-50 mm^2	cable end sleeve	4.5	WDU 16	1.5-25 mm^2	cable end sleeve	2.4
73	WDU 35	2.5-50 mm^2	cable end sleeve	4.5	WDU 16	1.5-25 mm^2	cable end sleeve	2.4
95	WDU 50 N	10-70 mm^2	cable end sleeve	6	WDU 16	1.5-25 mm^2	cable end sleeve	2.4
118	WDU 50 N	10-70 mm^2	cable end sleeve	6	WDU 16	1.5-25 mm^2	cable end sleeve	2.4
154	WFF 70	2.5-95 mm^2	cable lug M8	12	WDU 35	2.5-50 mm^2	cable end sleeve	4.5
183	WFF 70	2.5-95 mm^2	cable lug M8	12	WDU 35	2.5-50 mm^2	cable end sleeve	4.5
231	WFF 300	25-300 mm^2	cable lug M16	60	WDU 95 N	16-150 mm^2	cable end sleeve	20
291	WFF 300	25-300 mm^2	cable lug M16	60	WDU 95 N	16-150 mm^2	cable end sleeve	20
355	WFF 300	25-300 mm^2	cable lug M16	60	WDU 95 N	16-150 mm^2	cable end sleeve	20
380	WFF 300	25-300 mm^2	cable lug M16	60	WDU 95 N	16-150 mm^2	cable end sleeve	20
436	WFF 300	25-300 mm^2	cable lug M16	60	WDU 95 N	16-150 mm^2	cable end sleeve	20

Table 6.2 440 - 480 V, 60 Hz

6.2.4 Fuses

In order to protect the installation against electrical and fire hazards, all filters in an installation must be short-circuit and over-current protected according to national/international regulations.

To protect both drive and filter please choose the type of fuses recommended in the VLT® Design Guide. The maximum fuse rating per filter size is listed below.

Filter current		
380 V, 60 Hz 400 V, 50 Hz	460 V, 60 Hz	Maximum size of fuse
[A]	[A]	[A]
10	10	16
14	14	35
22	19	35
29	25	50
34	31	50
40	36	63
55	48	80
66	60	125
82	73	160
96	95	250
133	118	250
171	154	315
204	183	350
251	231	400
304	291	500
325	355	630
380	380	630
480	436	800

In applications where filters are paralleled it might be necessary to install fuses in front of each filter and in front of the drive.

6.3 Mechanical Dimensions

6.3.1 Sketches

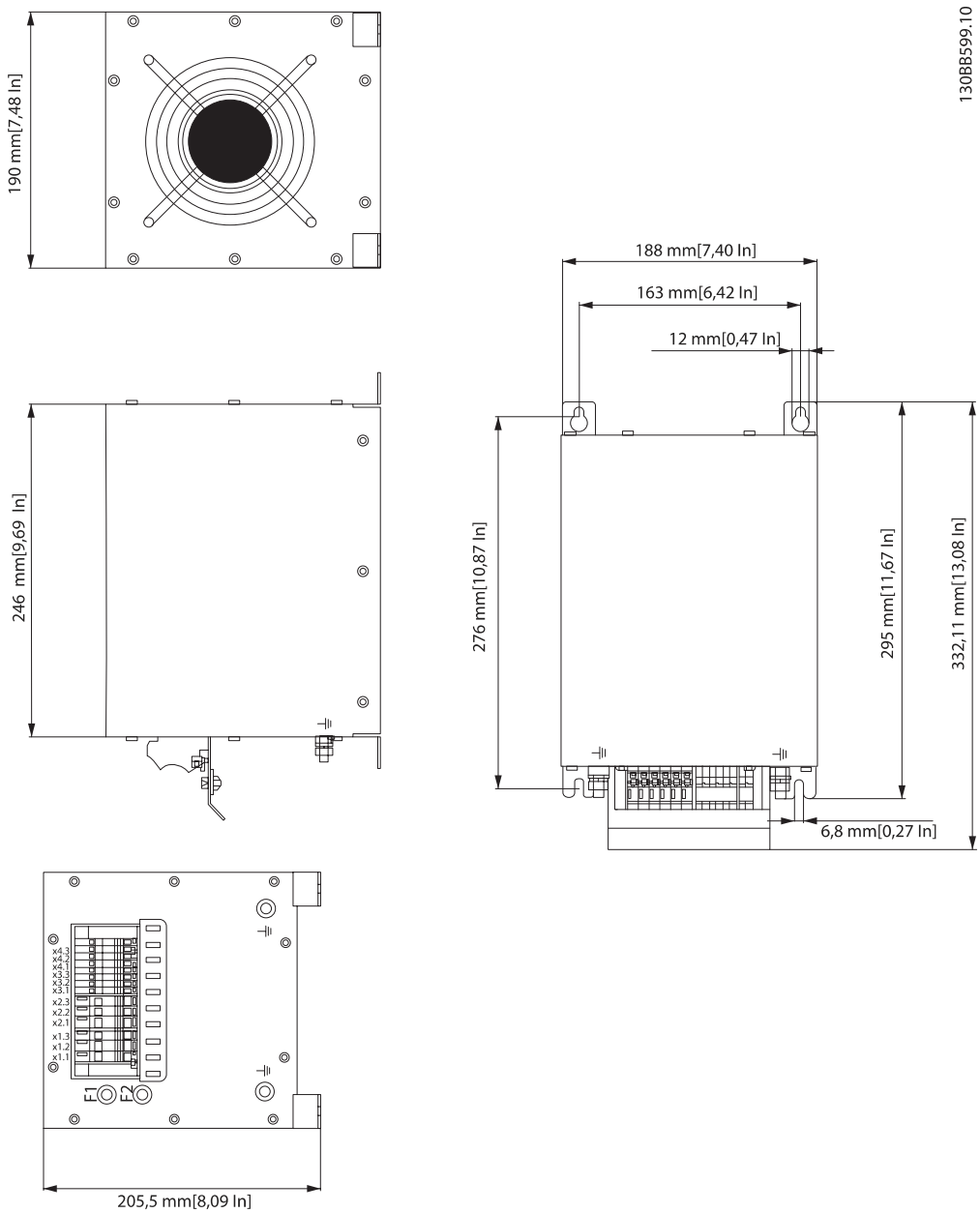


Illustration 6.1 X1 no fan

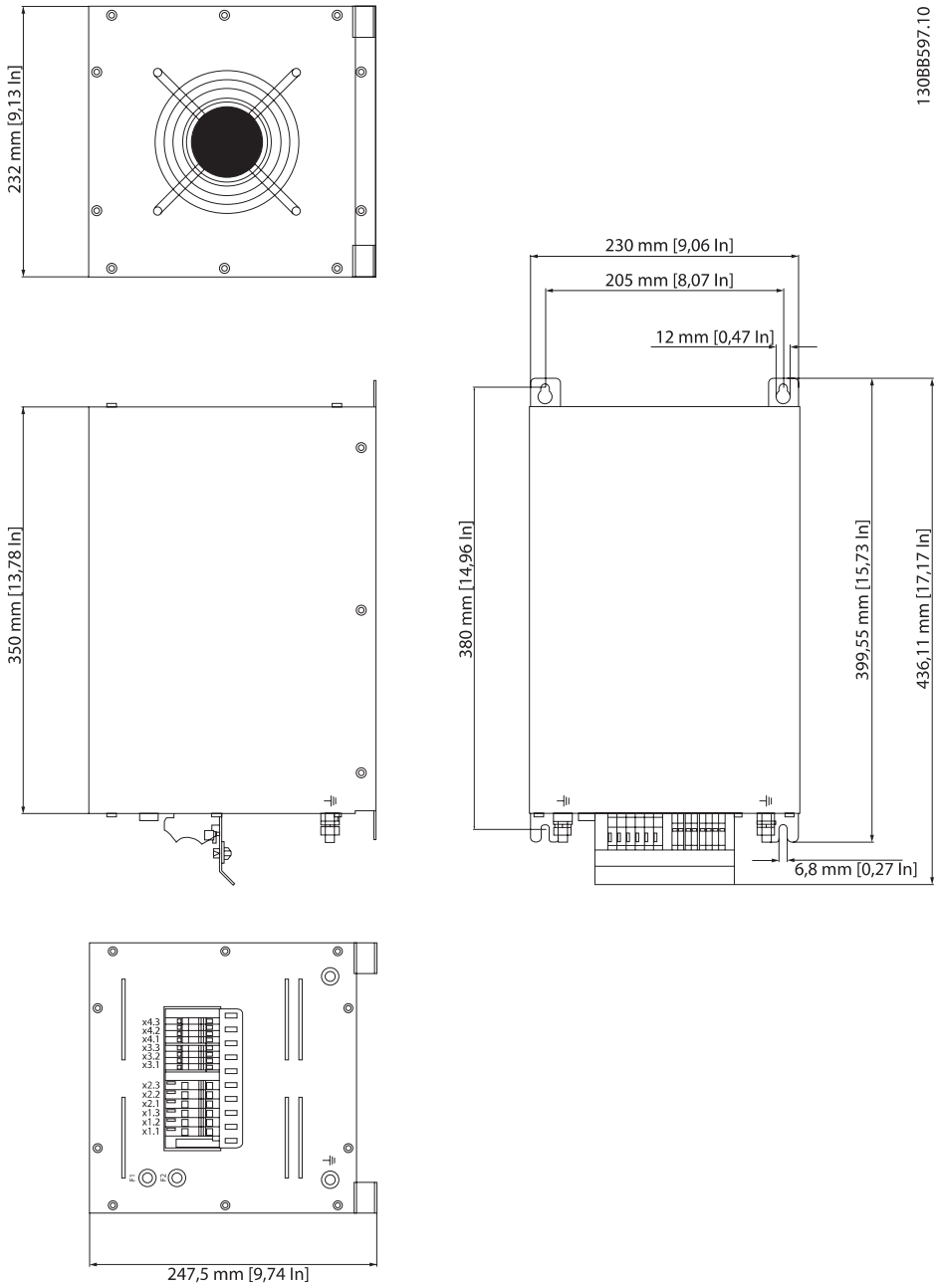


Illustration 6.2 X2 internal fan

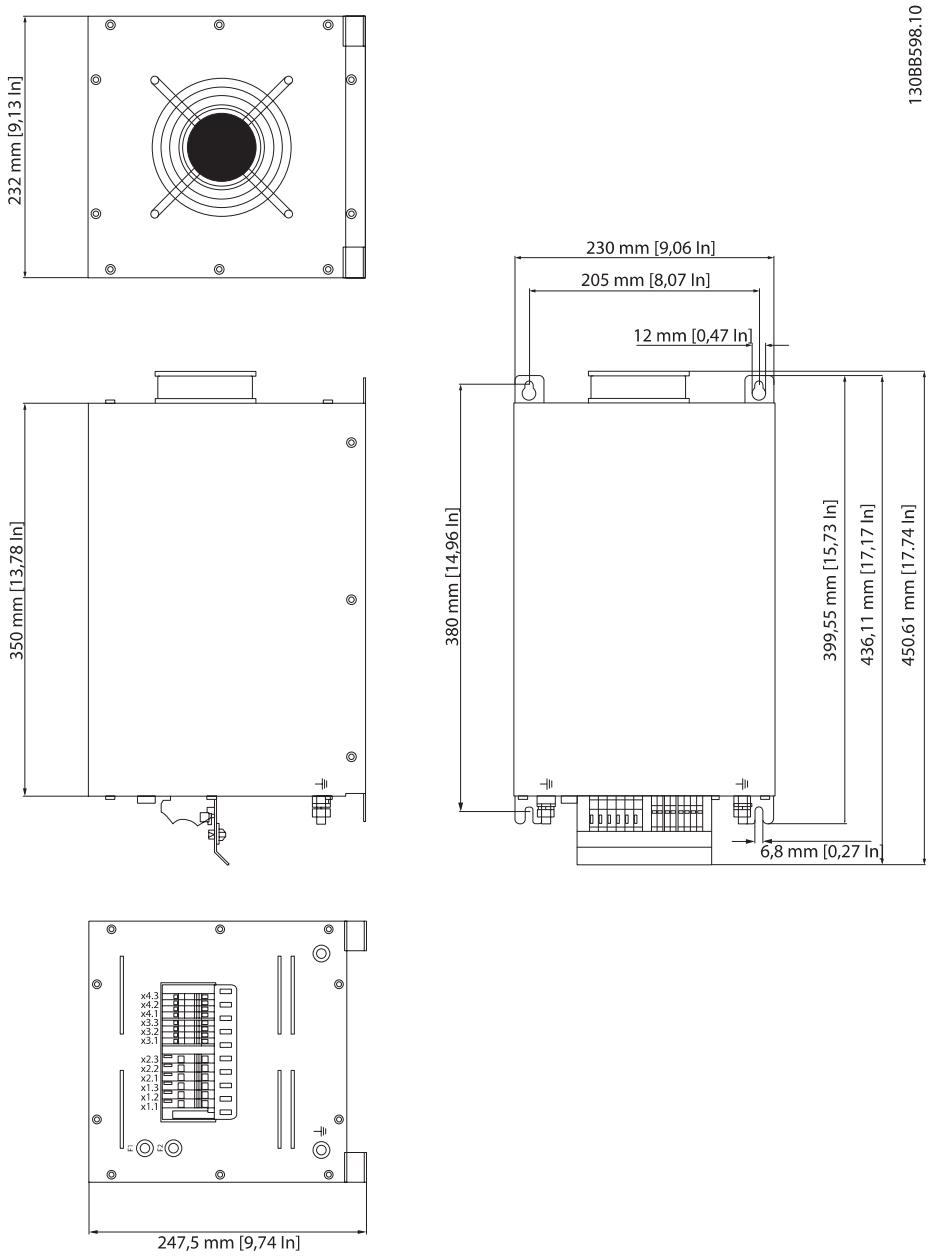


Illustration 6.3 X2 external fan

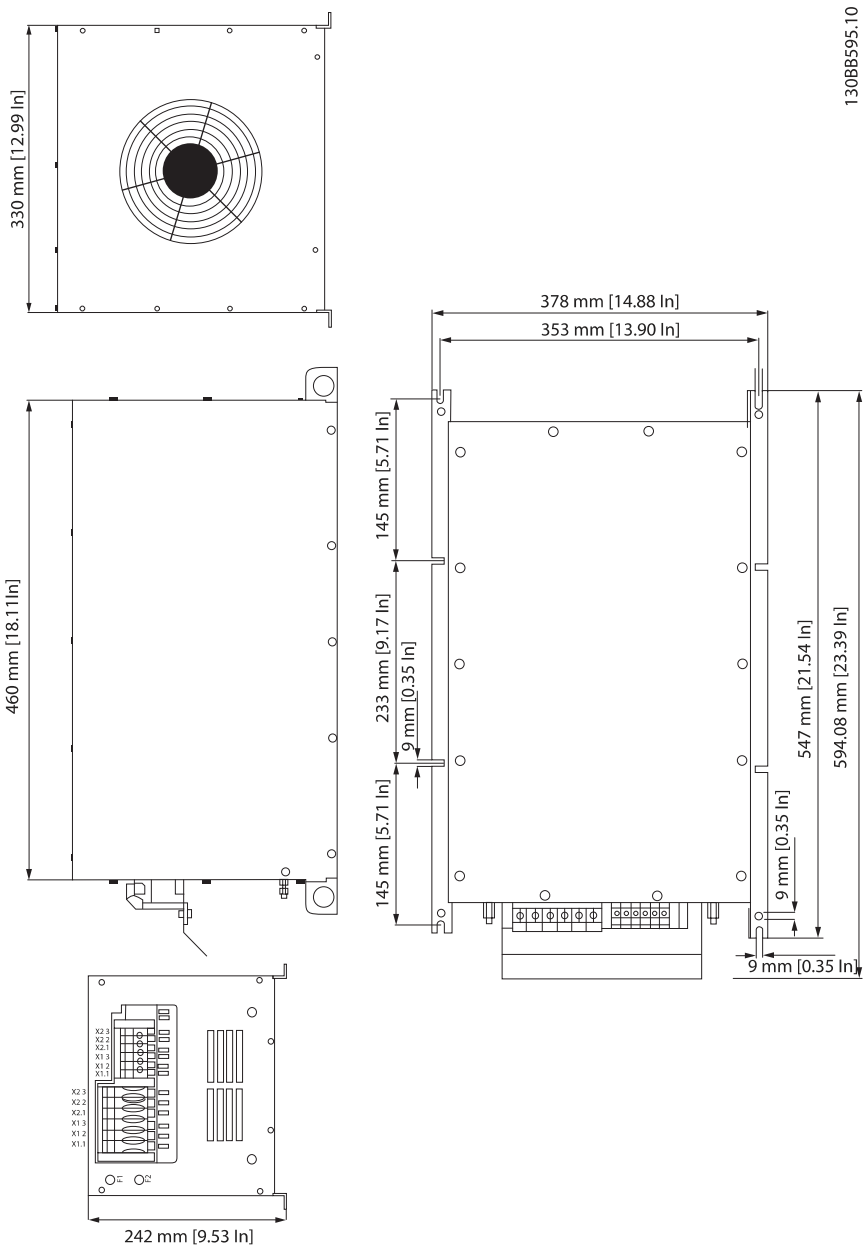


Illustration 6.4 X3 internal fan

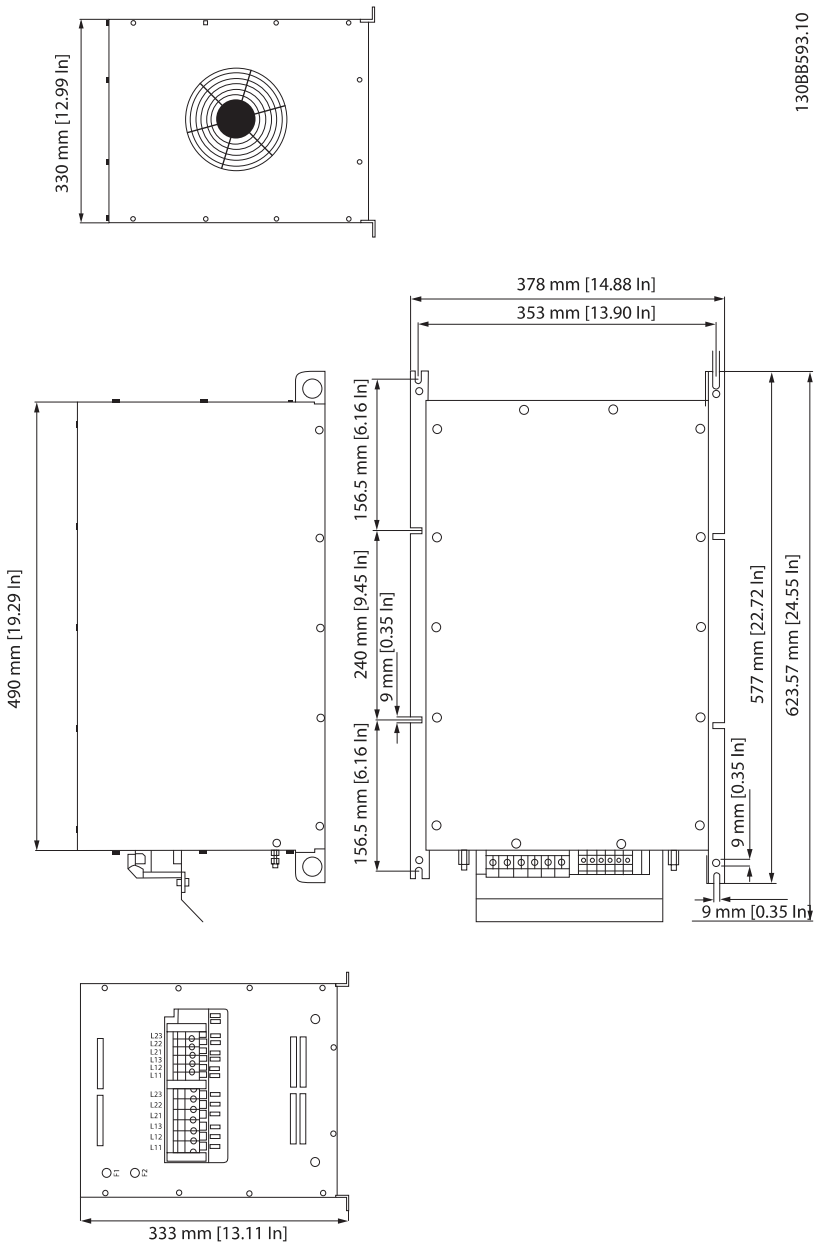


Illustration 6.5 X4 internal fan

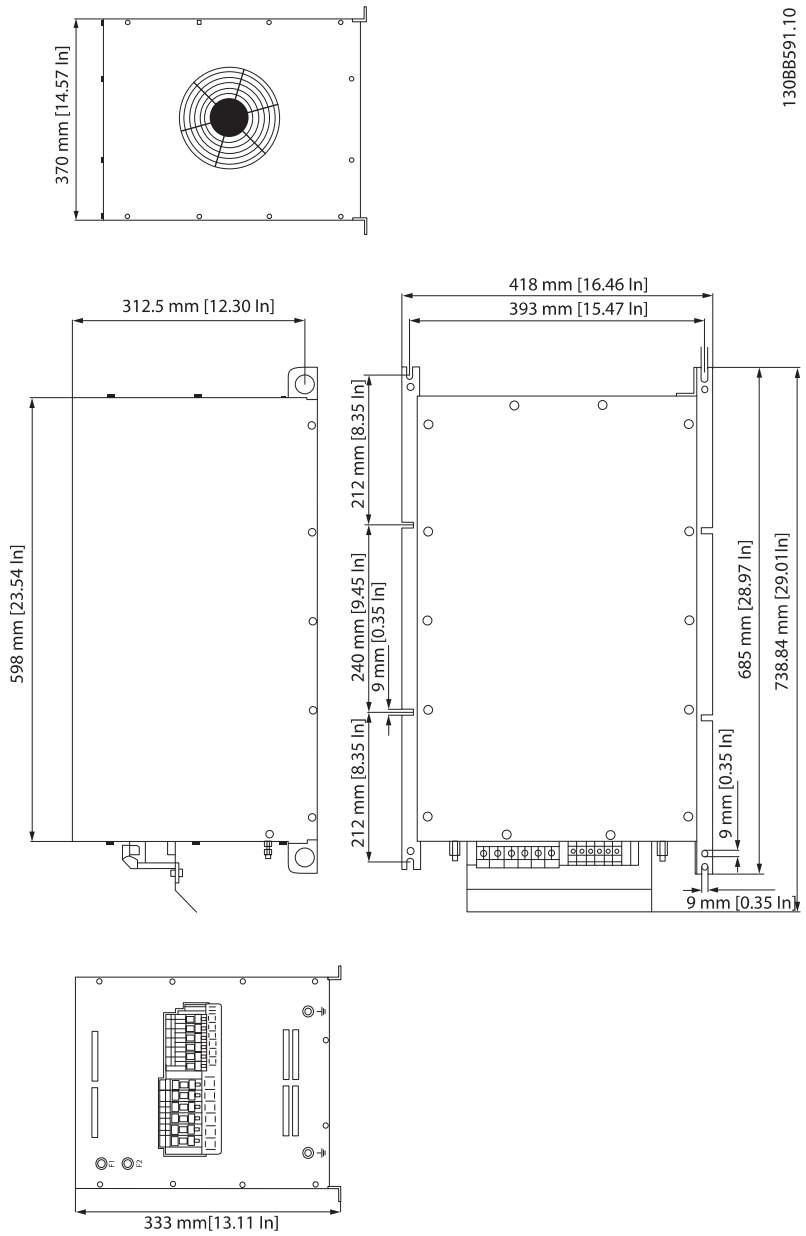


Illustration 6.6 X5 internal fan

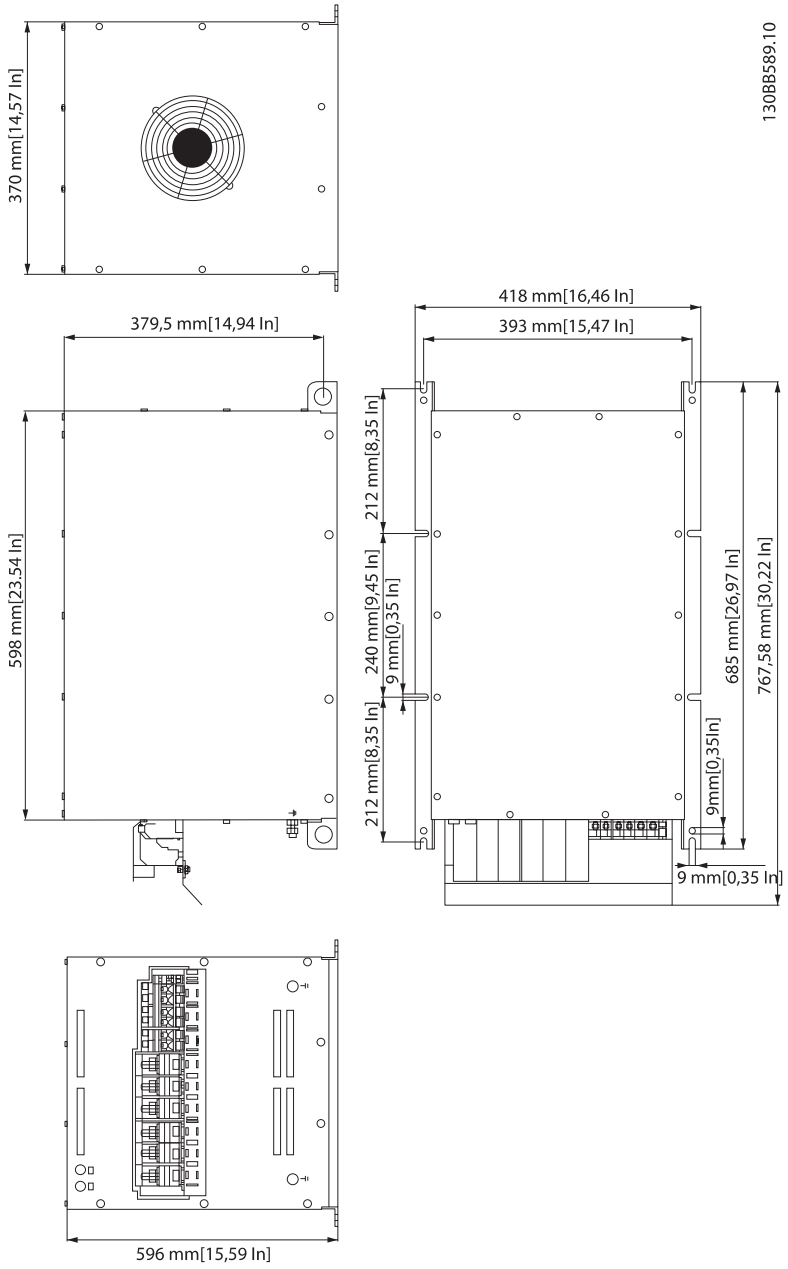


Illustration 6.7 X6 internal fan

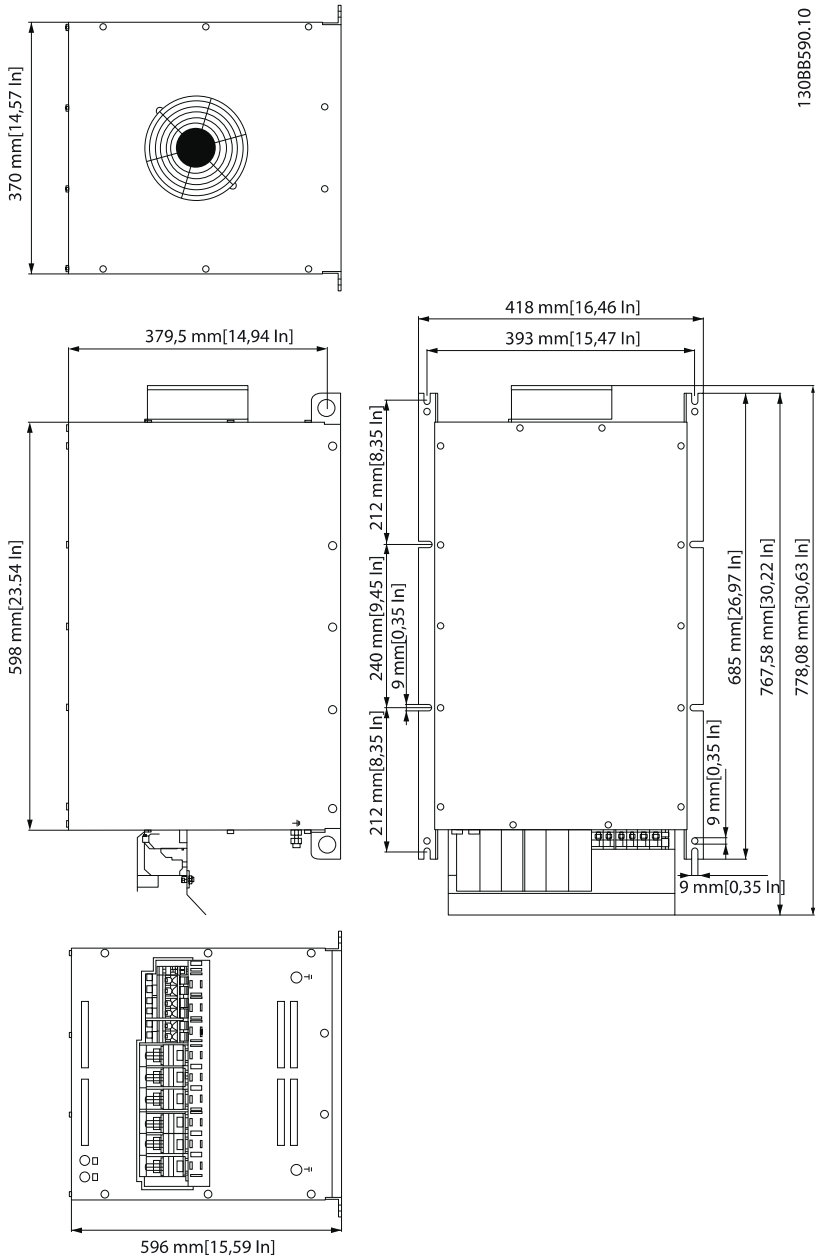


Illustration 6.8 X6 external fan

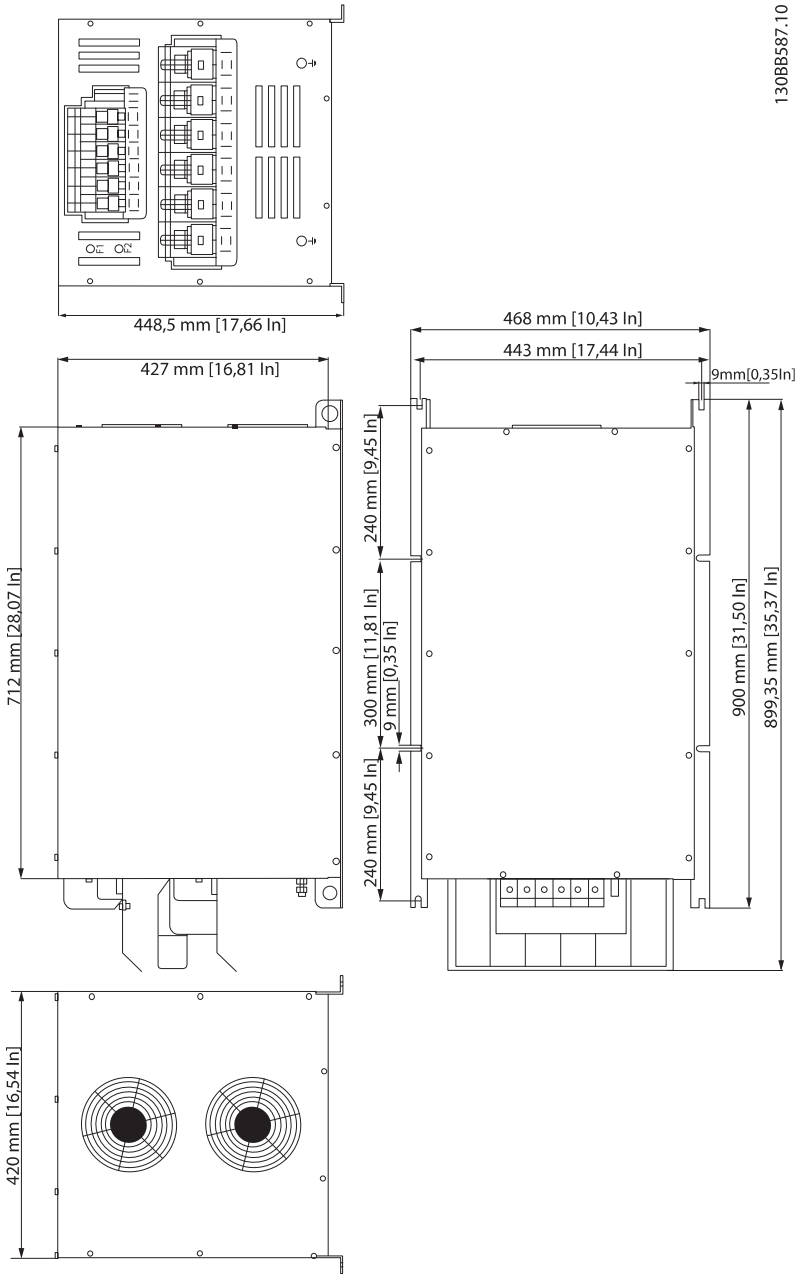


Illustration 6.9 X7 internal fan

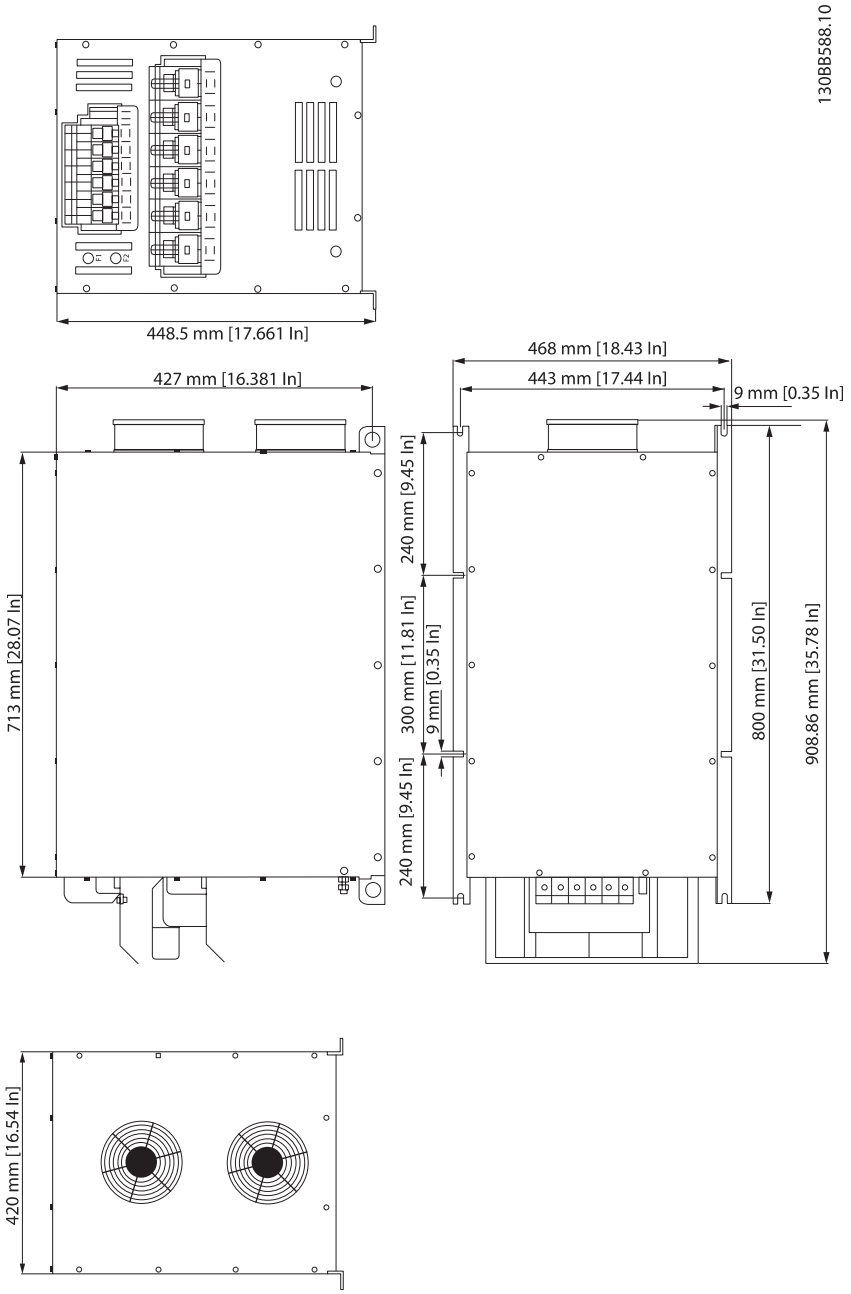


Illustration 6.10 X7 external fan

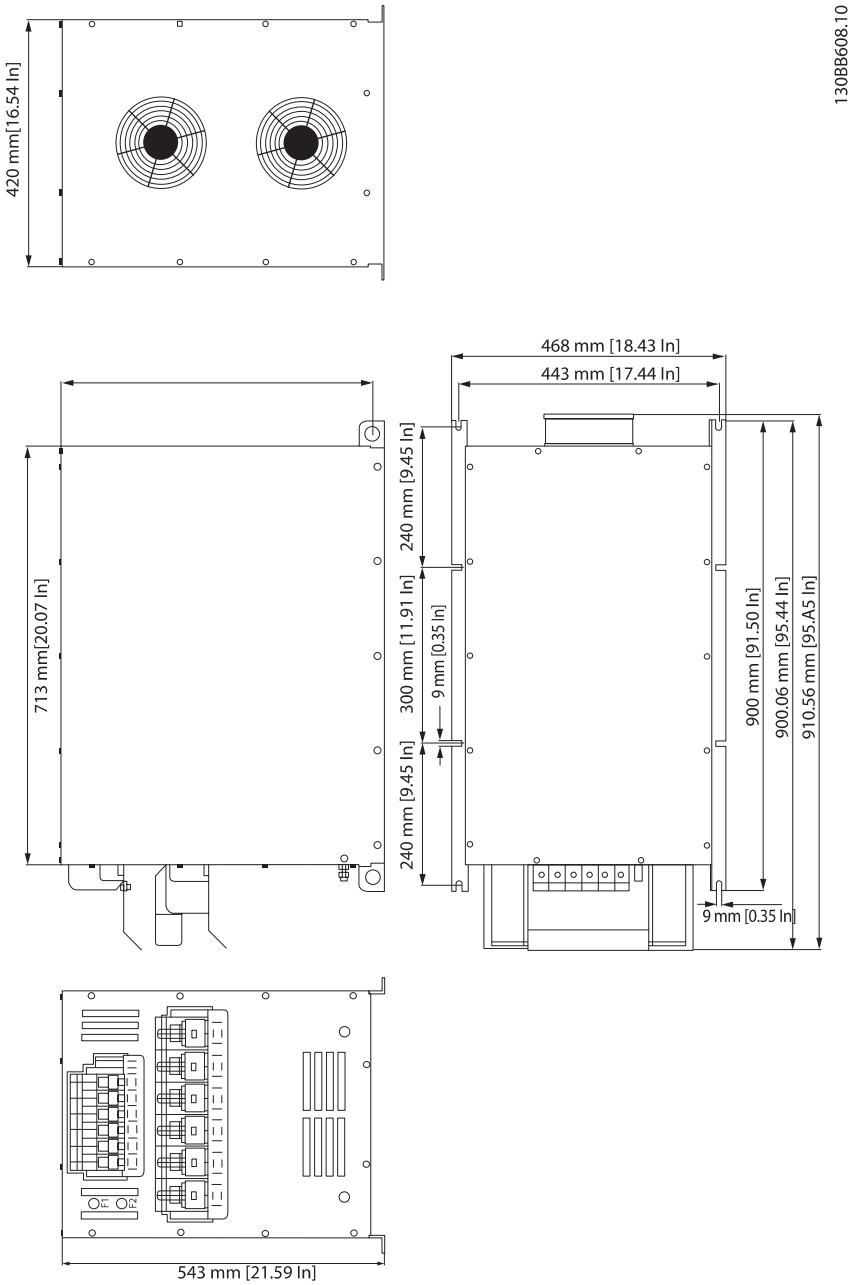


Illustration 6.11 X8 internal fan

6

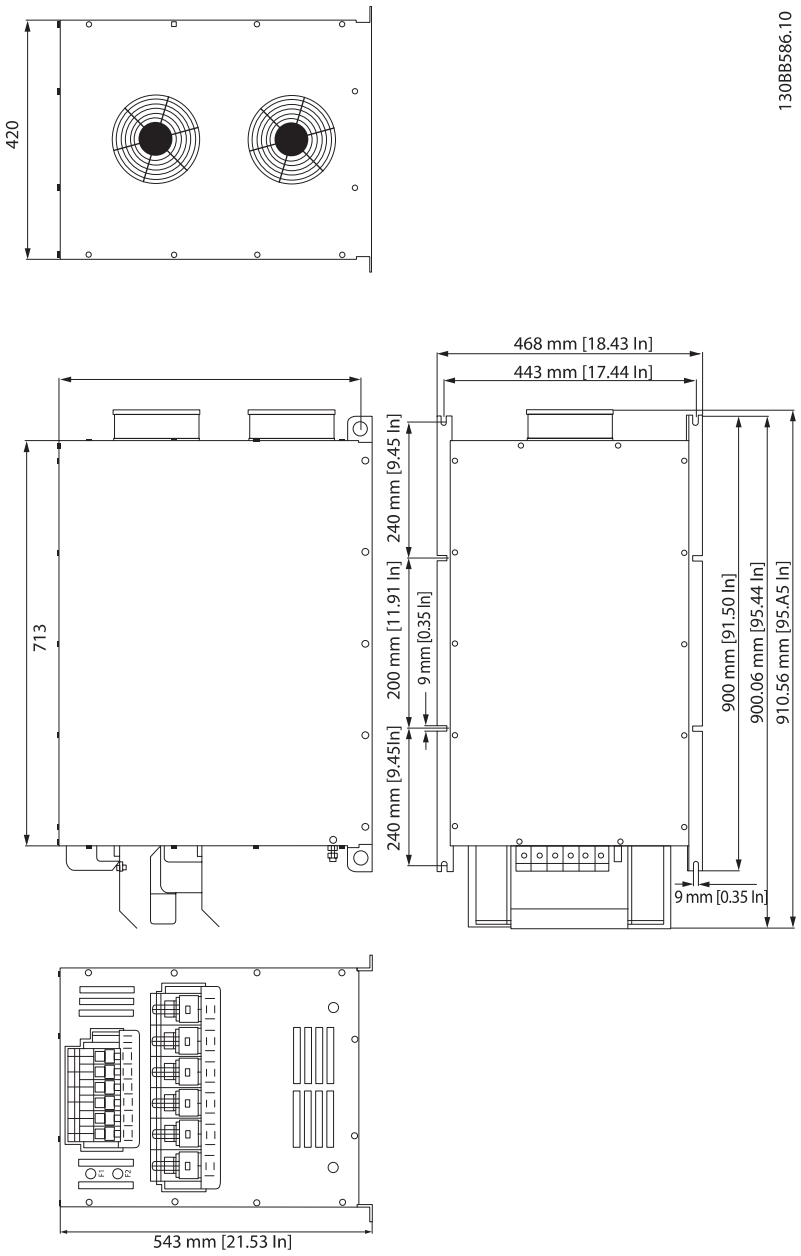


Illustration 6.12 X8 external fan

6.3.2 Physical Dimension

Enclosure type	Dimensions in mm		
	A (height)	B (width)	C (Depth)
X1	245	190	205
X2	350	230	248
X3	460	330	242
X4	490	330	333
X5	747	370	333
X6	778	370	400
X7	909	468	450
X8	911	468	550

6.3.3 Weight

	AHF010 380 - 415 V, 50 Hz			AHF005 380 - 415 V, 50 Hz		
Current rating	frame	weight IP20	weight IP00	frame	weight IP20	weight IP00
[A]	size	[kg]	[kg]	size	[kg]	[kg]
10	X1	12	8	X1	16	12
14	X1	13	9	X1	20	16
22	X2	22	17	X2	34	29
29	X2	25	20	X2	42	37
34	X3	36	30	X3	50	44
40	X3	40	33	X3	52	45
55	X3	42	35	X3	75	68
66	X4	52	45	X4	82	75
82	X4	56	47	X4	96	87
96	X5	62	52	X5	104	94
133	X5	74	64	X5	130	120
171	X6	85	74	X6	135	124
204	X6	105	94	X6	168	157
251	X7	123	106	X7	197	180
304	X7	136	120	X7	220	204
325	X7	142	126	X7	228	212
381	X7	163	147	X8	260	244
480	X8	205	186	X8	328	309

	AHF010 380 - 415 V, 60 Hz			AHF005 380 - 415 V, 60 Hz		
Current rating	frame	weight IP20	weight IP00	frame	weight IP20	weight IP00
[A]	size	[kg]	[kg]	size	[kg]	[kg]
10	X1	12	8	X1	16	12
14	X1	13	9	X1	20	16
22	X2	22	17	X2	34	29
29	X2	25	20	X2	42	37
34	X3	36	30	X3	50	44
40	X3	40	33	X3	52	45
55	X3	42	35	X3	75	68
66	X4	52	45	X4	82	75
82	X4	56	47	X4	96	87
96	X5	62	52	X5	104	94
133	X5	74	64	X5	130	120
171	X6	85	74	X6	135	124
204	X6	105	94	X6	168	157
251	X7	123	106	X7	197	180
304	X7	136	120	X7	220	204
325	X7	142	126	X7	228	212
381	X7	163	147	X8	260	244
480	X8	205	186	X8	328	309

	AHF010 440 - 480 V, 60 Hz			AHF005 440 - 480 V, 60 Hz		
Current rating	frame	weight IP20	weight IP00	frame	weight IP20	weight IP00
[A]	size	[kg]	[kg]	size	[kg]	[kg]
10	X1	12	8	X1	16	12
14	X1	13	9	X1	20	16
19	X2	22	17	X2	34	29
25	X2	25	20	X2	42	37
31	X3	36	30	X3	50	44
36	X3	40	33	X3	52	45
48	X3	42	35	X3	75	68
60	X4	52	45	X4	82	75
73	X4	56	47	X4	96	87
95	X5	62	52	X5	104	84
118	X5	74	64	X5	130	120
154	X6	85	74	X6	135	124
183	X6	105	94	X6	168	157
231	X7	123	106	X7	197	180
291	X7	136	120	X7	220	204
355	X7	163	126	X7	260	212
380	X7	178	147	X8	295	244
436	X8	205	186	X8	328	309

7 How to Programme the Frequency Converter

7.1.1 DC-link Compensation Disabling

The FC series include a feature which ensures that the output voltage is independent of any voltage fluctuation in the DC link, e.g. caused by fast fluctuation in the mains supply voltage. In some cases this very dynamic compensation can produce resonances in the DC link and should then be disabled. Typical cases are where AHF005/010 is used on supply grids with high short circuit ratio. Fluctuations can often be recognized by increased acoustical noise and in extreme cases by unintended tripping. To prevent resonances in the DC-link, it is recommended to disable the dynamic DC-link compensation by setting par. 14-51 to off.

14-51 DC Link Compensation		
Option:		**Function:**
[0]	Off	Disables DC Link Compensation.
[1] *	On	Enables DC Link Compensation.

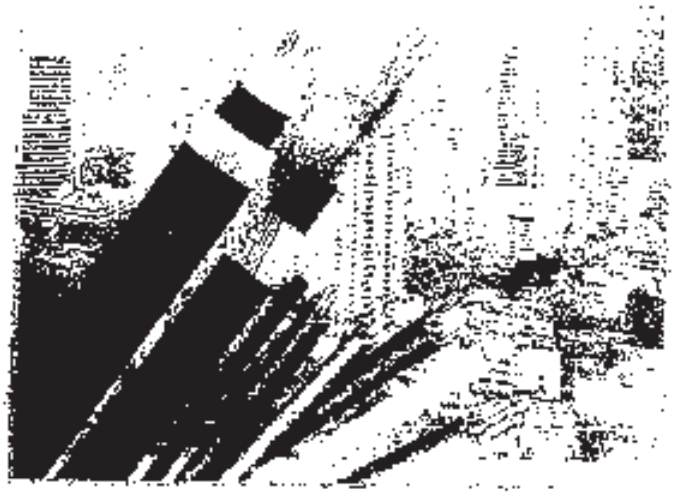
Index

Technical Literature

62) CCMS Digital Input / Output Cable

سموكماستر - كابلات أقل دخانا وغازا

Smokemaster - Low Smoke & Fume Cables



POLYGON CABLE SUPPLIES LTD.
保利高電器材料有限公司

حلول متقدمة للكابلات من خلال التقنية والابداع

Advanced Cable Solutions Through Technology and Innovation

Smokemaster

Quality Management at Ducab

إدارة الجـــودة في دوكاب

Ducab: Where Quality is a Way of Life

دوكاب: حيث الجودة نهج للحياة

TESTING FACILITIES

سموكماستر

Technical Data
Ducab Smokemaster Wiring Cables to BS 7211

Construction

Identification
Ducab Smokemaster **Ducab Smokemaster LSF**

Installation

Current Ratings

البيانات الفنية
أسلاك التمديدات دوكاب سموكماستر المتوافقة مع المواصفة البريطانية BS 7211

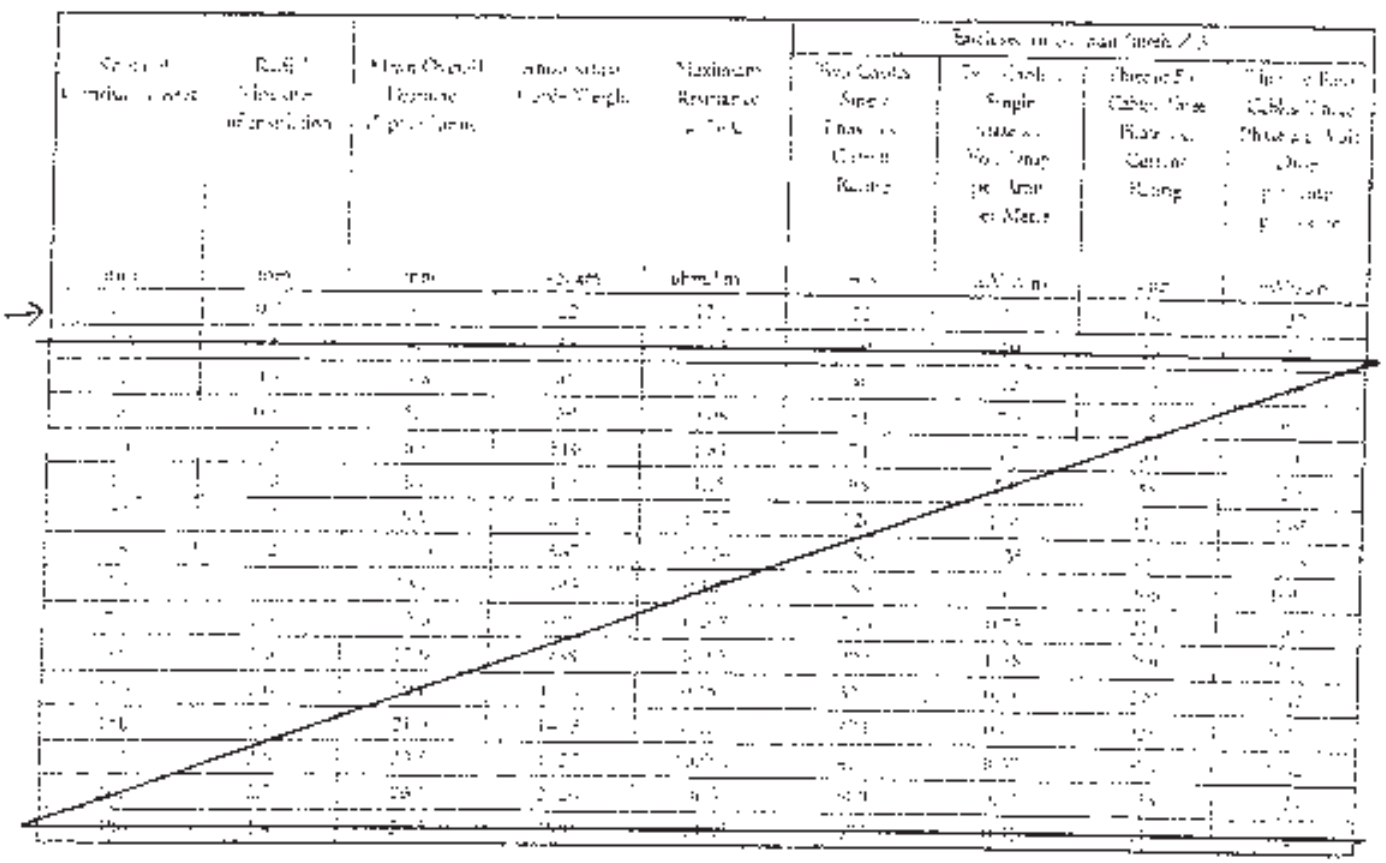
البنية

علامات التعريف

التركيب

المعايرة

Table 1 **Ducab Smokemaster Wiring Cables 450/750V Grade**

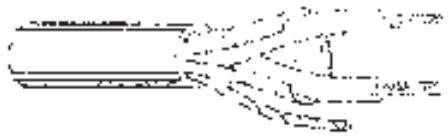


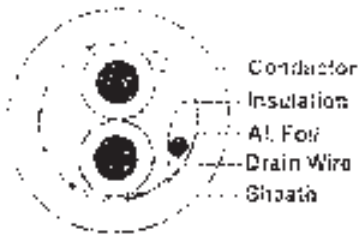
Technical Literature

63) CCMS Analogue Input / Output Cable

Wire and Cable Technical Specification

133-0601C-005X (SC-8761/LS)
Fire Retardant Shielded Twist Pair Cable





DESCRIPTION

Stranded Tinned Annealed Copper Wire, PE Insulation, Single Twisted Pair, Aluminum Polyester Tape Overall Screen, 22AWG Stranded Tinned Annealed Copper Drain Wire, LSHF Sheath.

APPLICATION

Audio, Control & Industrial Data, Interconnecting.

CONSTRUCTION

Conductor

Material : Stranded Tinned Annealed Copper Wire

Stranding : 7/0.23mm (22AWG)

Insulation

Material : PE compound

Nominal O.D : 1.65mm

Color : Black, Clear

Screen

Material : Al. Polyester tape, 100% Coverage

Drain Wire

Material : 22AWG Stranded Tinned Annealed Copper Wire

Sheath

Material : LSHF compound

Nominal O.D : 4.45mm

Color : Grey

PHYSICAL PROPERTIES

Min. Bend Radius : 15mm

Operating Temperature : -25°C to 70°C

ELECTRICAL PROPERTIES

Nominal DC resistance : 55 Ω/km

Characteristic Impedance : 60+/-3Ω

Max. Mutual Capacitance (Core to Core) : 79pF/m @ 1kHz

Voltage test : Core to Core : 1000V a.c / 1min

Voltage test : Core to Screen : 1000V a.c / 1min

FLAME TEST

Halogen content test : IEC 60754-1

Smoke density : IEC 61034-2

Flam retardant : IEC 60332-1-2

Samson makes up ensure their accuracy at the time of issue. Reserves the right to change the details of the products in these notes.

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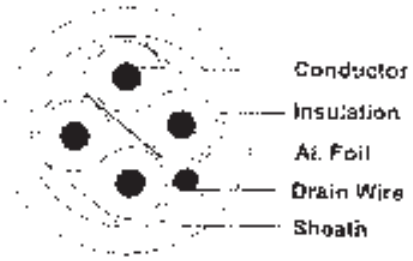
SAMSON

Wire and Cable Technical Specification

132-0002C-004X (SC-8723/LS)

Fire Retardant Shielded Twist Pair Cable



DESCRIPTION

Stranded Tinned Annealed Copper Wire, 2 Twisted Pairs, PP Insulation, Aluminium Overall Screen, 24AWG Stranded Tinned Annealed Copper Drain Wire, LSHF Sheath.

APPLICATION

Use extensively for remote signaling circuits, broadcast systems, sound systems, intercom systems, audio systems, and instrumentation.

CONSTRUCTION

Conductor

Material : Stranded Tinned Annealed Copper Wire

Stranding : 7/0.25mm (22AWG)

Insulation

Material : PP compound

Nominal O.D : 1.2mm

Color : Red/Black, Green/White

Drain Wire

Material : 24AWG Stranded Tinned Annealed Copper Wire

Screen

Material : Al. Polyester Tape, 100% Coverage

Sheath

Material : LSHF compound

Nominal O.D : 4.2mm

Color : Grey

PHYSICAL PROPERTIES

Min. Bend Radius : 42mm

Operating Temperature : -25°C to 70°C

ELECTRICAL PROPERTIES

Nominal DC resistance : 55.0Ω/km

Voltage test : Core to Core : 1000V a.c. / 1min

Voltage test : Core to Screen : 1000V a.c / 1min

FLAME TEST

Halogen content test : IEC 60754-1

Smoke density : IEC 61034-2

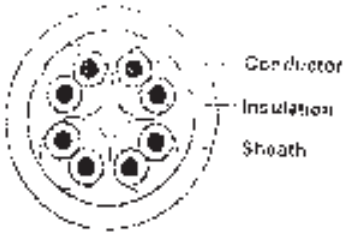
Flam retardant : IEC 60332-1-2

Technical Literature

64) CCMS LAN Cable

Wire and Cable Technical Specification

CJ0001B (CAT.5E/LS)
Fire Resistance LAN Cable



DESCRIPTION

Unshielded Twisted Pair, Solid Plain Annealed Copper Wire, 4 Pairs, Polyethylene Insulation, LSHF Sheath.

APPLICATION

For high speed data transmission. Suitable for external & underground using. Use in duct and for aerial lashing.

- IEEE802.3 10BASE-T (ETHERNET)
- IEEE802.3 100BASE-T (Fast ETHERNET)
- IEEE802.3 1000BASE-T (Gigabit ETHERNET)
- IEEE802.5 4/16 Mbps Token Ring
- 52/155Mbps ATM
- 100VG-AnyLAN
- ANSI X3T9.5 100Mbps TP-PMD

APPLICABLE STANDARD

ANSI/TIA/EIA 568B.2 and ISO11801

CONSTRUCTION

Conductor

Material & AWG : Solid Plain Annealed Copper Wire 24AWG

Insulation

Material : Thermoplastic Polyethylene

Nominal O.D : 0.92mm

Color :

NO.	Pair Color	NO.	Pair Color
1	WH/BU Stripe, BU	3	WH/GN Stripe, GN
2	WH/OR Stripe, OR	4	WH/BN Stripe, BN

Sheath

Material : LSHF compound

Nominal O.D : 4.8mm

Color : Grey

PHYSICAL PROPERTIES

Min. Bend Radius : 48mm

Operating Temperature : -25°C to 70°C

ELECTRICAL PROPERTIES

Conductor DCR @20°C : Max. 9.38Ω/100m

Max. DCR Unbalance@20°C : 5%

Mutual Capacitance : Max. 56pF/m

Voltage Test : Conductor to Conductor : 1500V a.c/1min.

FLAME TEST

Halogen Content Test : IEC 60754-1

Smoke Density : IEC 61034-2

Flame Retardant : IEC 60332-1-2

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Appendix II – As-fitted Drawings

1 MVAC Services Legends, Notes and Abbreviations (As-fitted)
2 MVAC Services Motor Control Schematic (Sheet 1)
3 MVAC Services Motor Control Schematic (Sheet 2)
4 MVAC Services Motor Control Schematic (Sheet 3)
5 BMS System Configuration
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7 MVAC Services Control Schematic (Sheet 3)
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9 Water-side Schematic - Sheet 2 (As-fitted)
10 Air-side Schematic (As-fitted)
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12 MVAC Services Ground Floor Layout (As-fitted)
13 MVAC Services Mezzanine Floor, Roof, Eco-Café Layout (As-fitted)
14 MVAC Services Ground Floor Raised Floor Layout (As-fitted)
15 MVAC Services Mezzanine Floor Raised Floor Layout (As-fitted)
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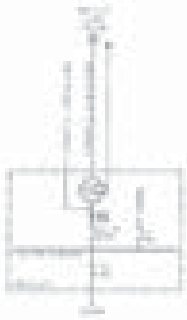
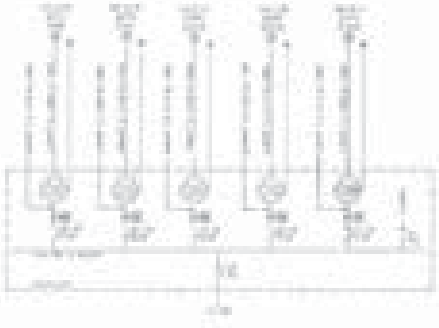
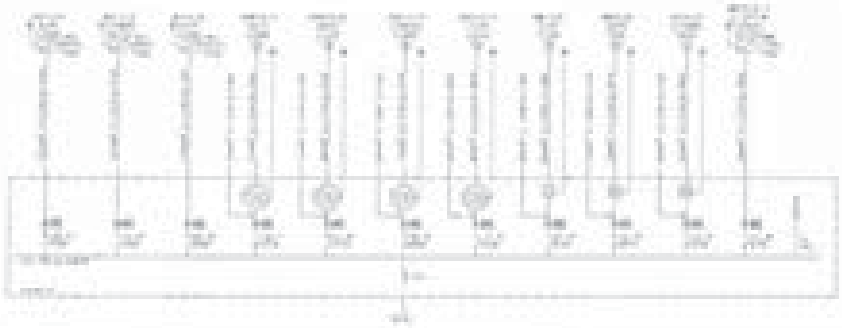
17 MVAC Services Plantroom Details - Sheet 1 (As-fitted)
18 MVAC Services Plantroom Details - Sheet 2 (As-fitted)
19 MVAC Services Plantroom Details - Sheet 3 (As-fitted)
20 MVAC Services Plantroom Details - Sheet 4 (As-fitted)

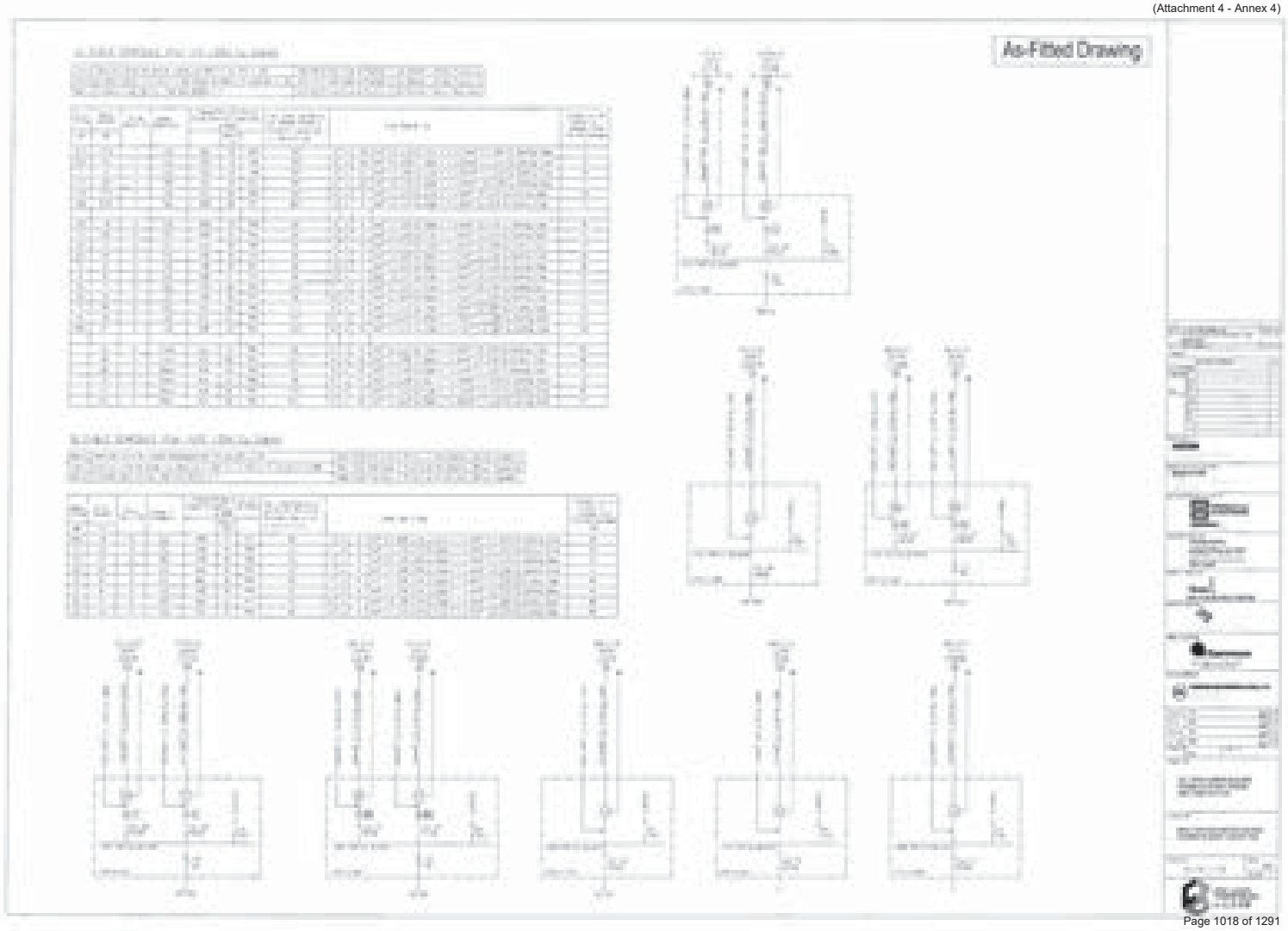
As-Fitted Drawing

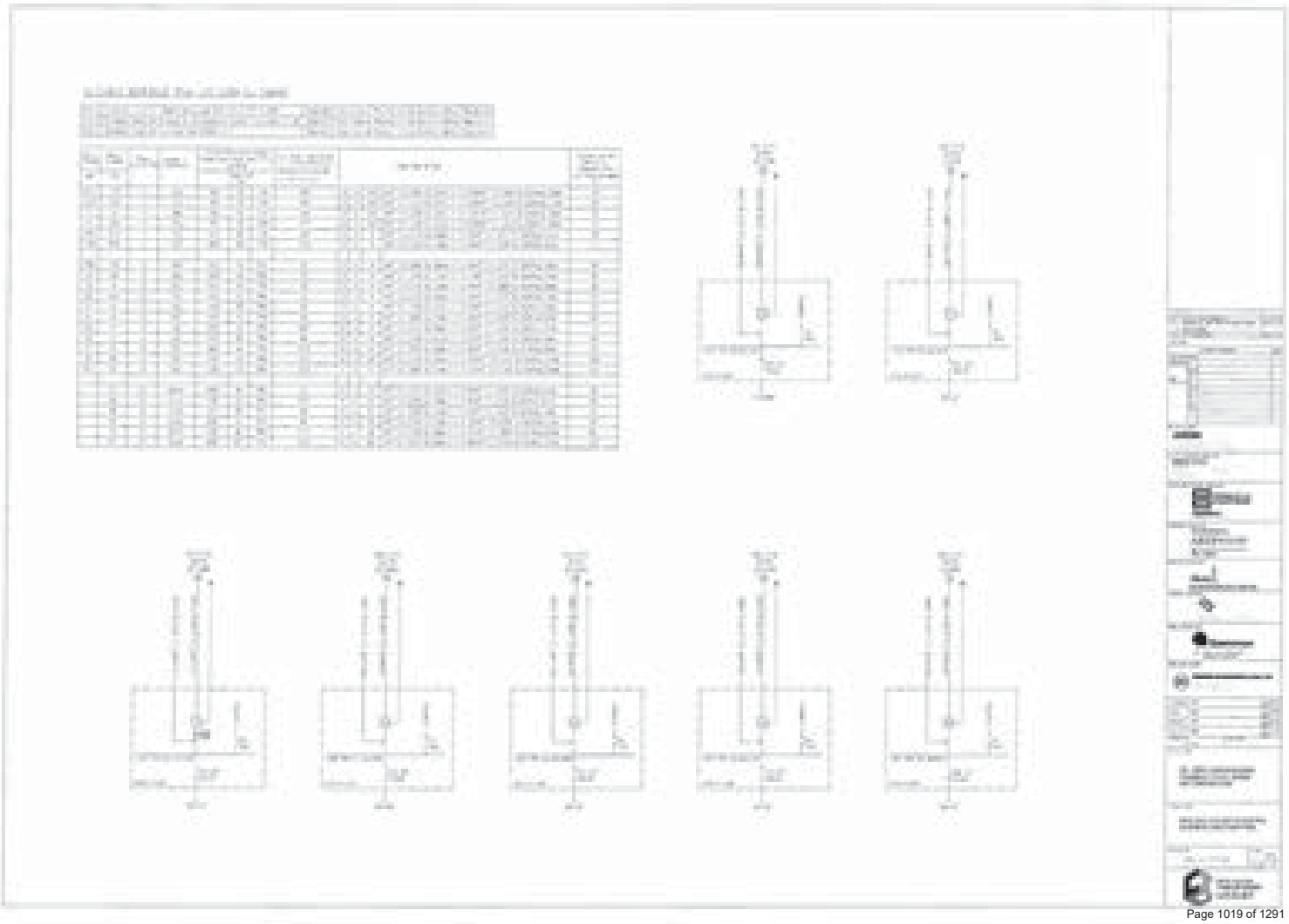
As-Fitted Drawing

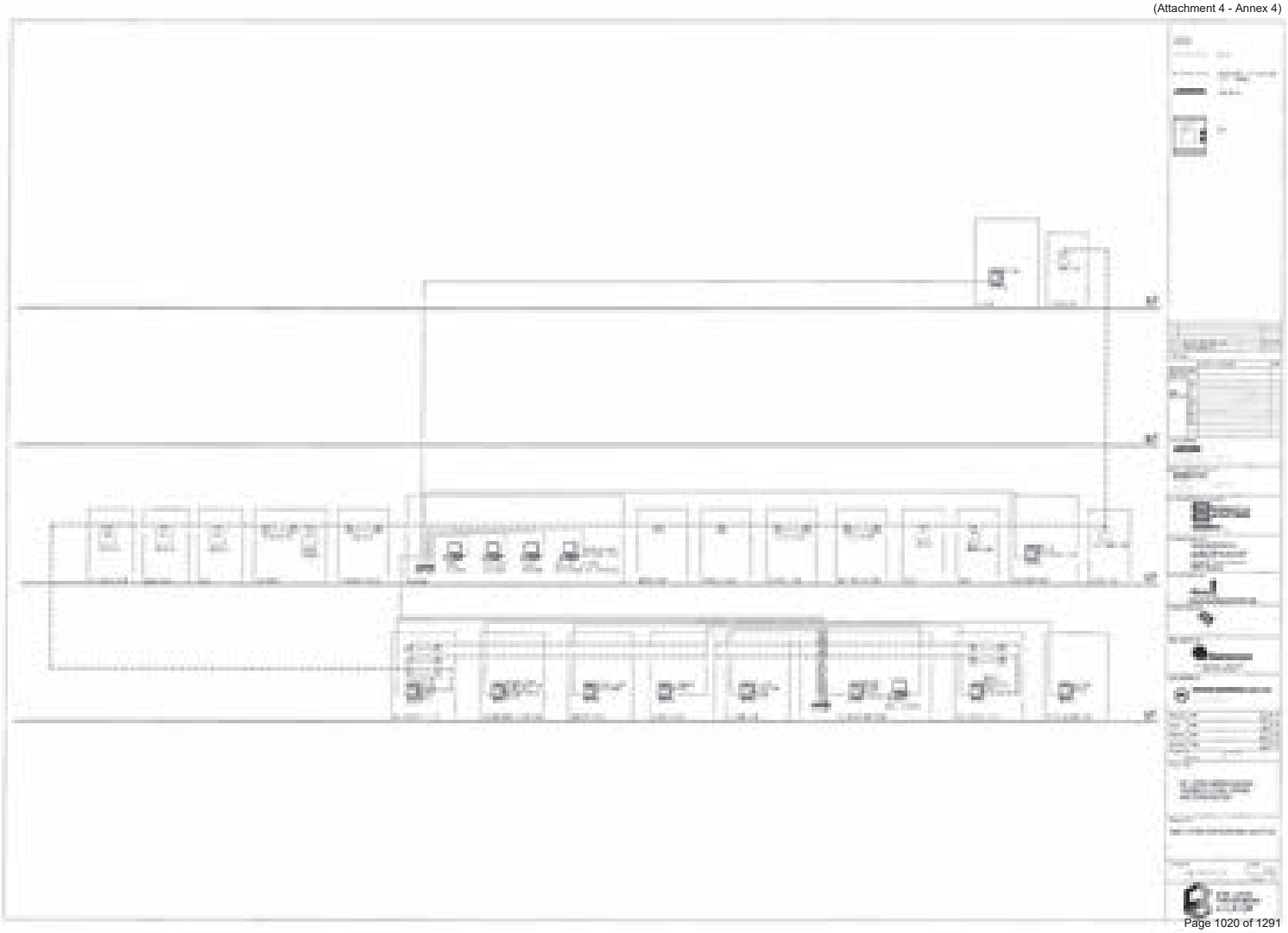


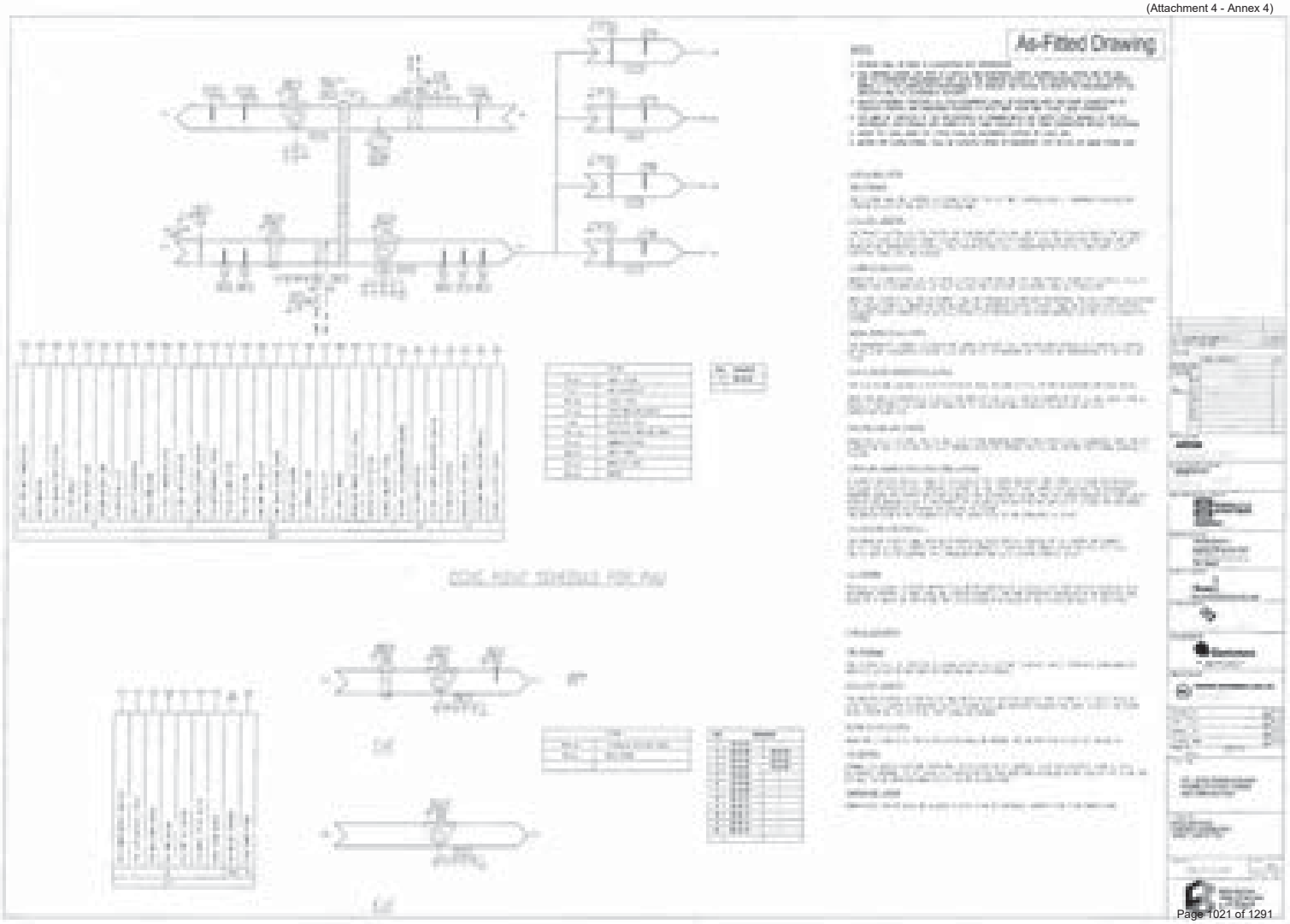


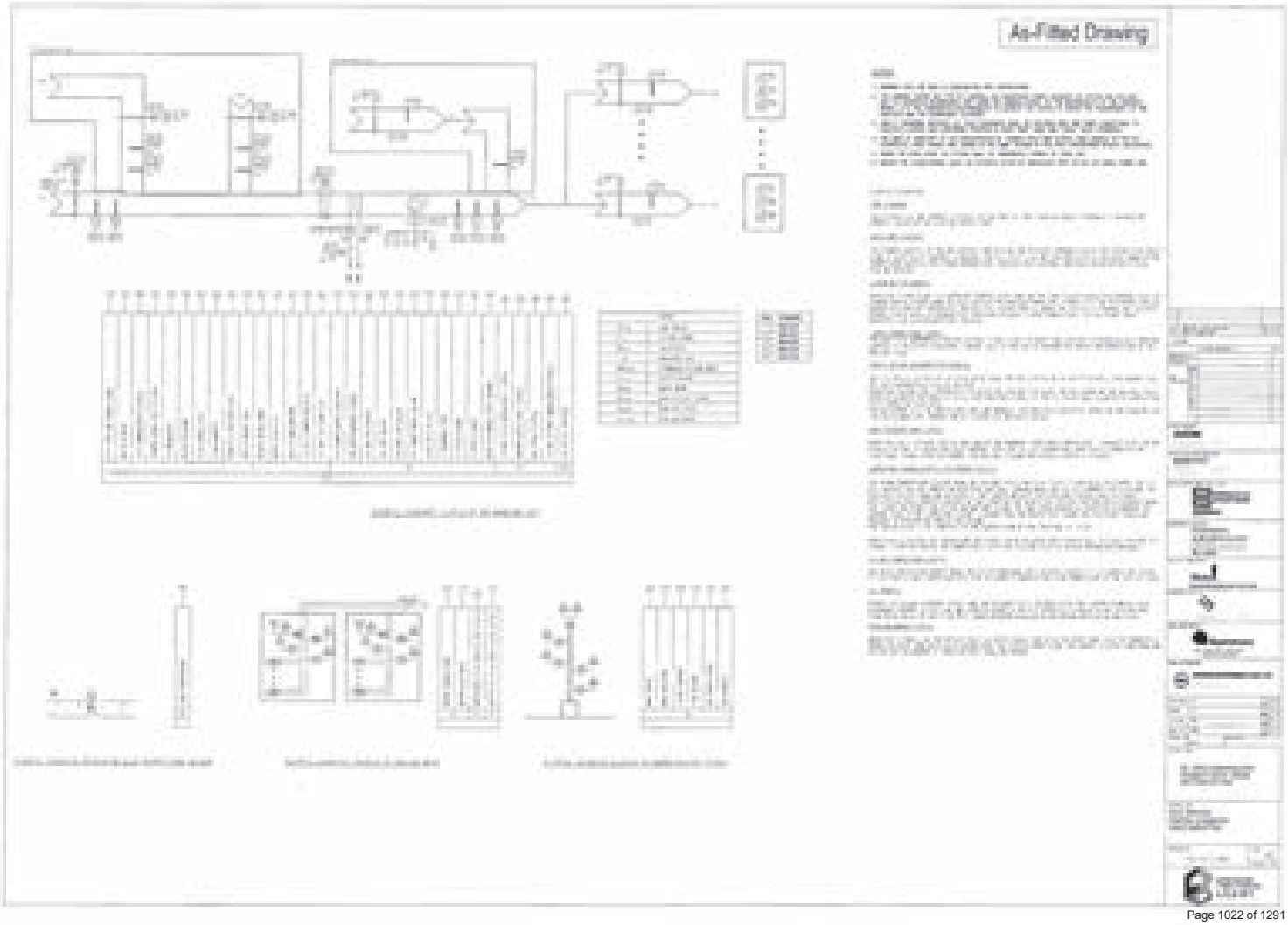



As-Fitted Drawing






As-Fitted Drawing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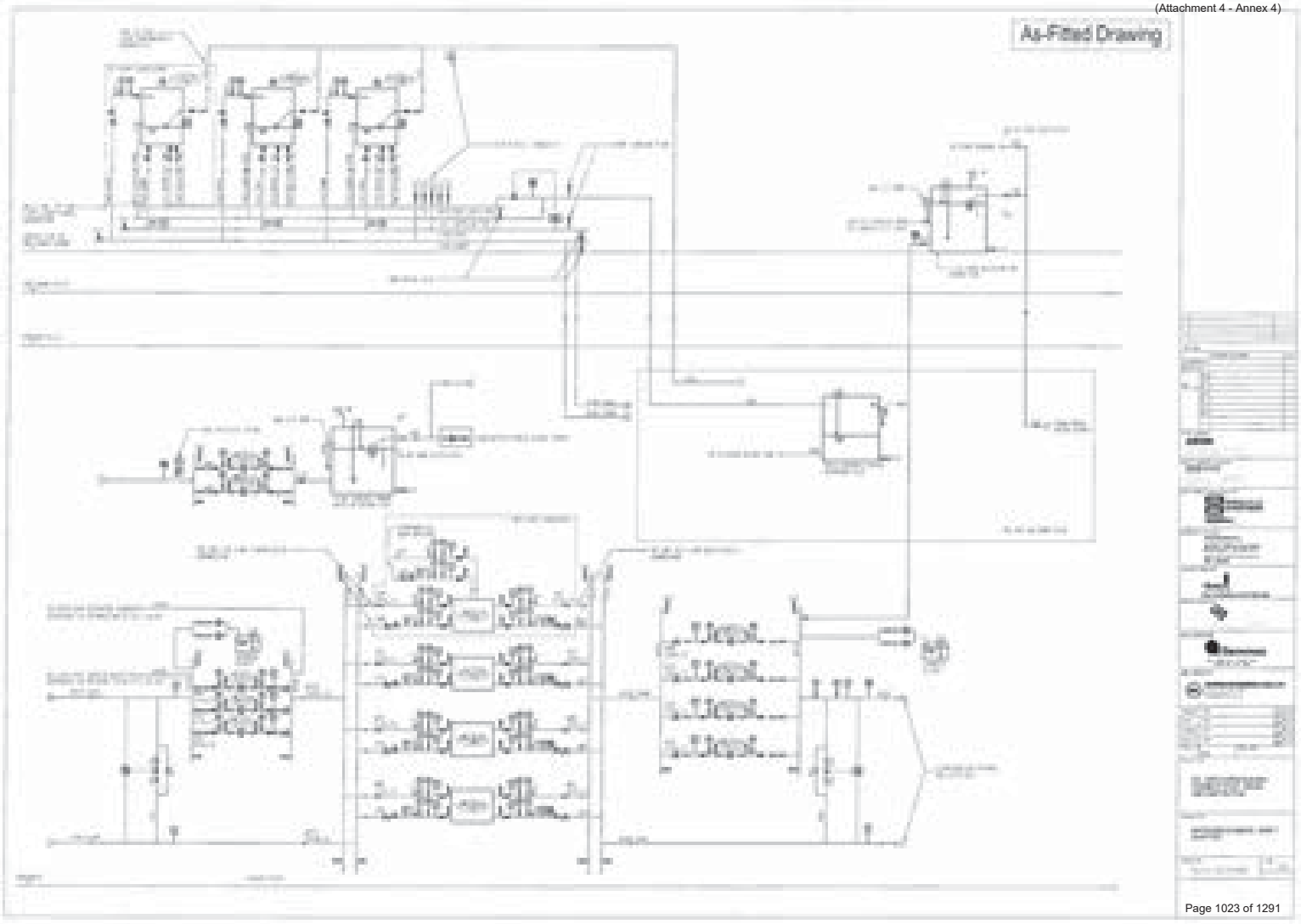
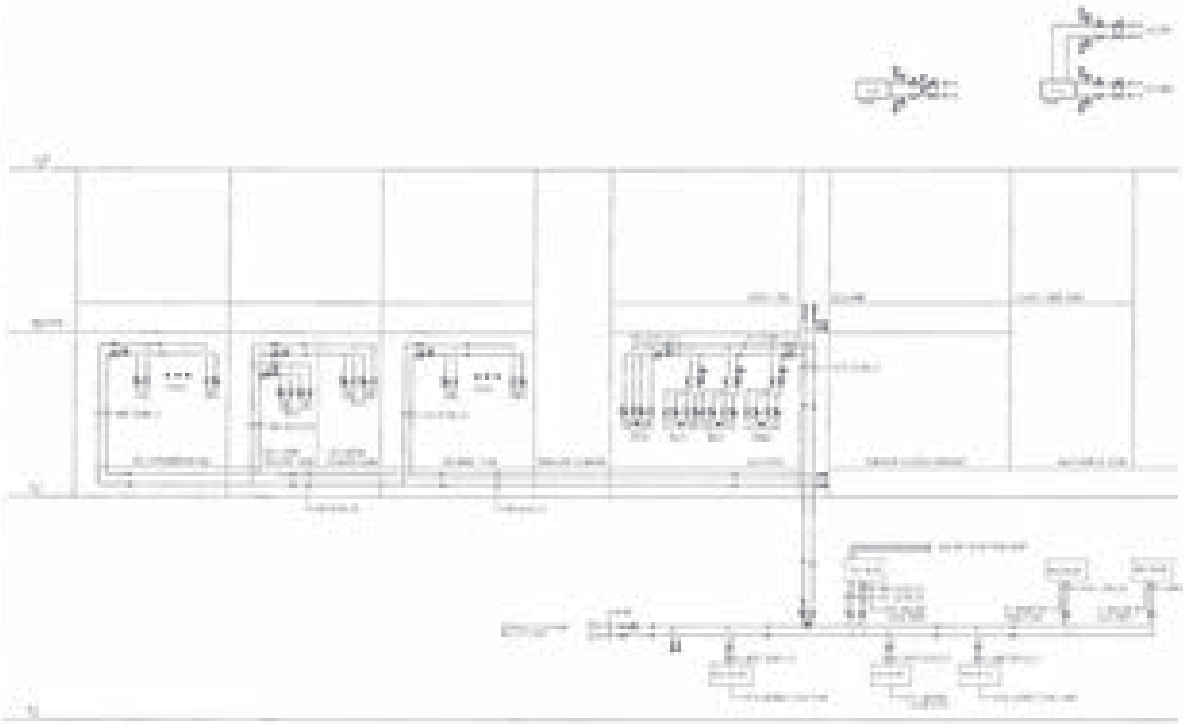
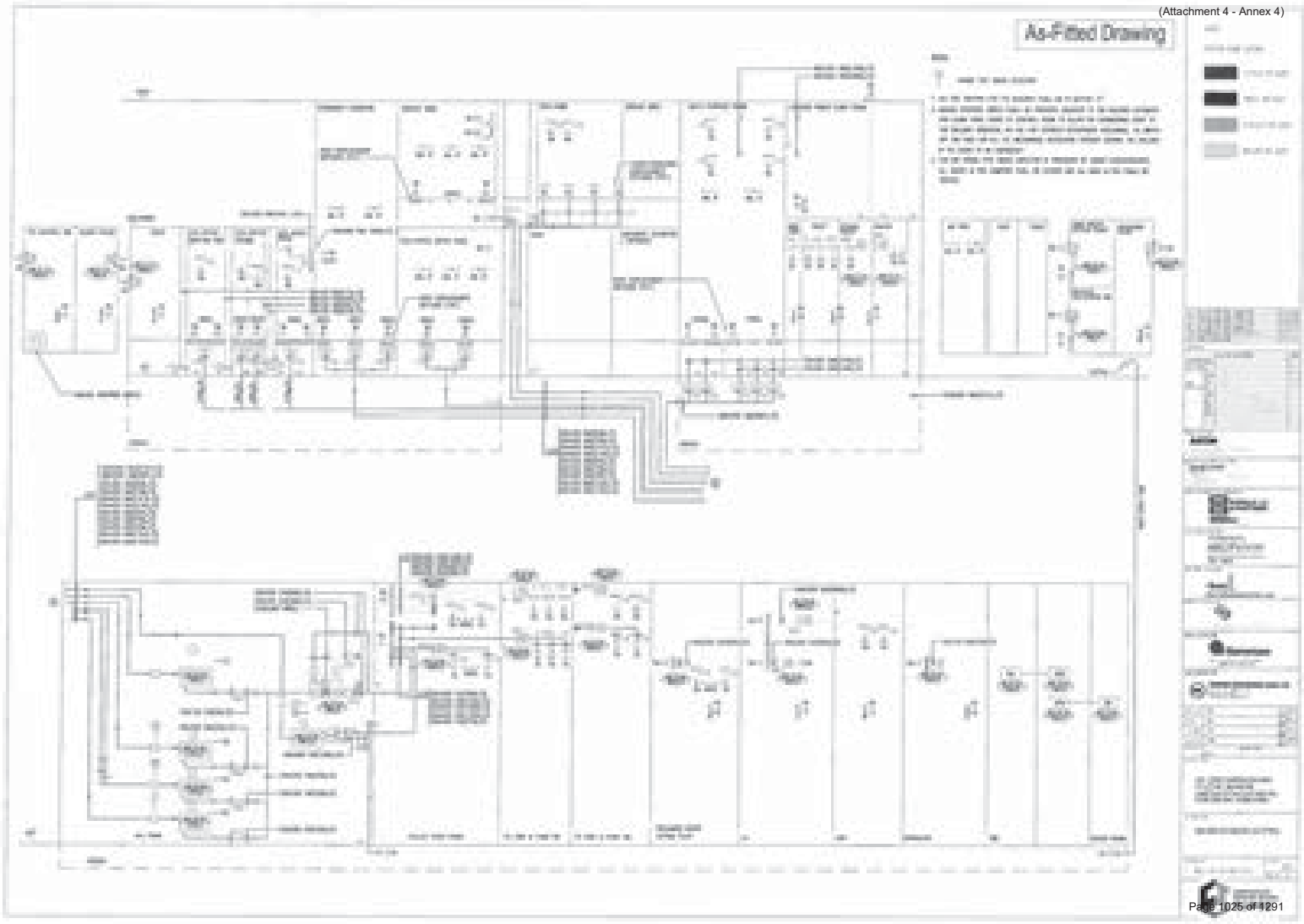

As-Fitted Drawing

As-Fitted Drawing

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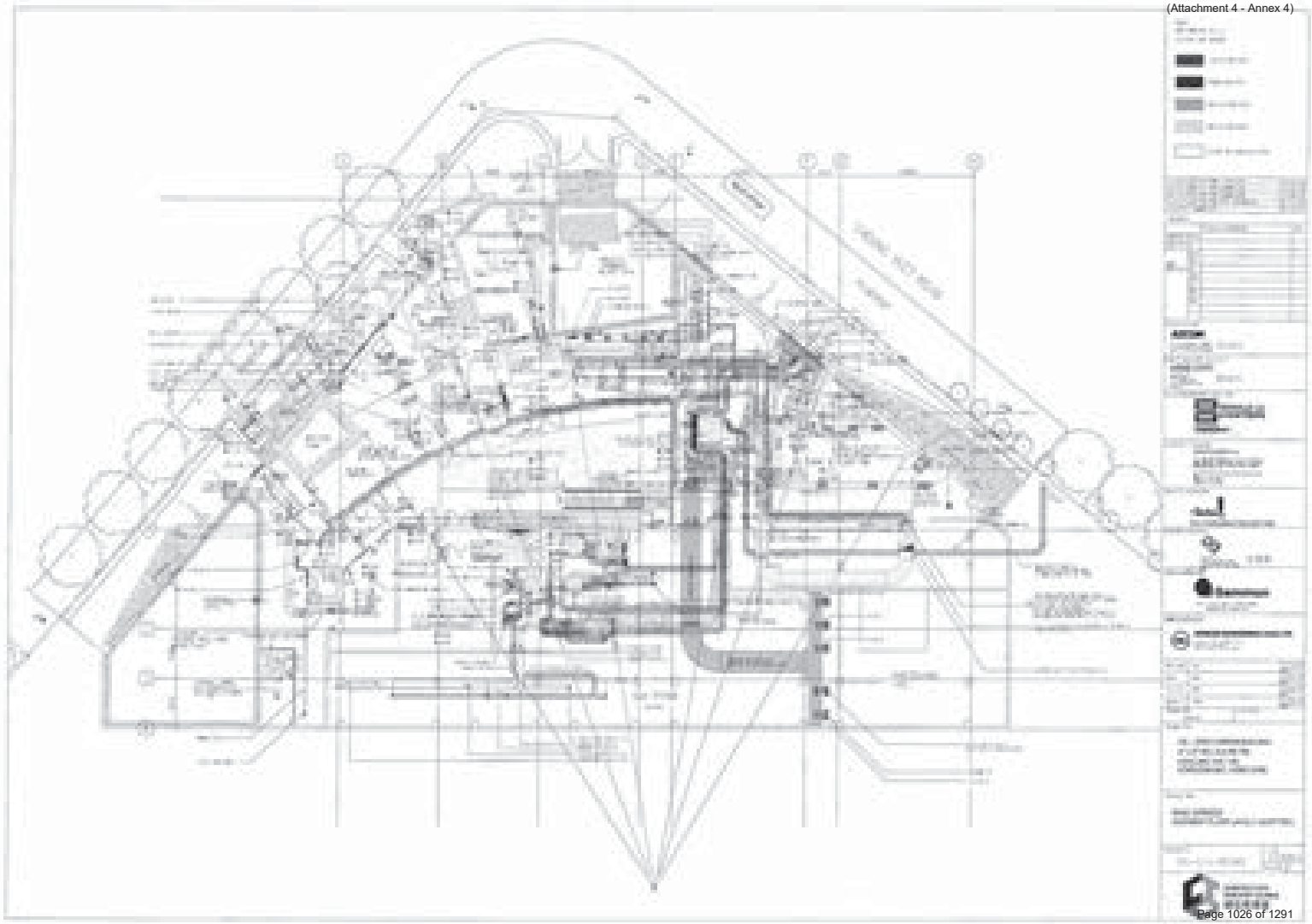
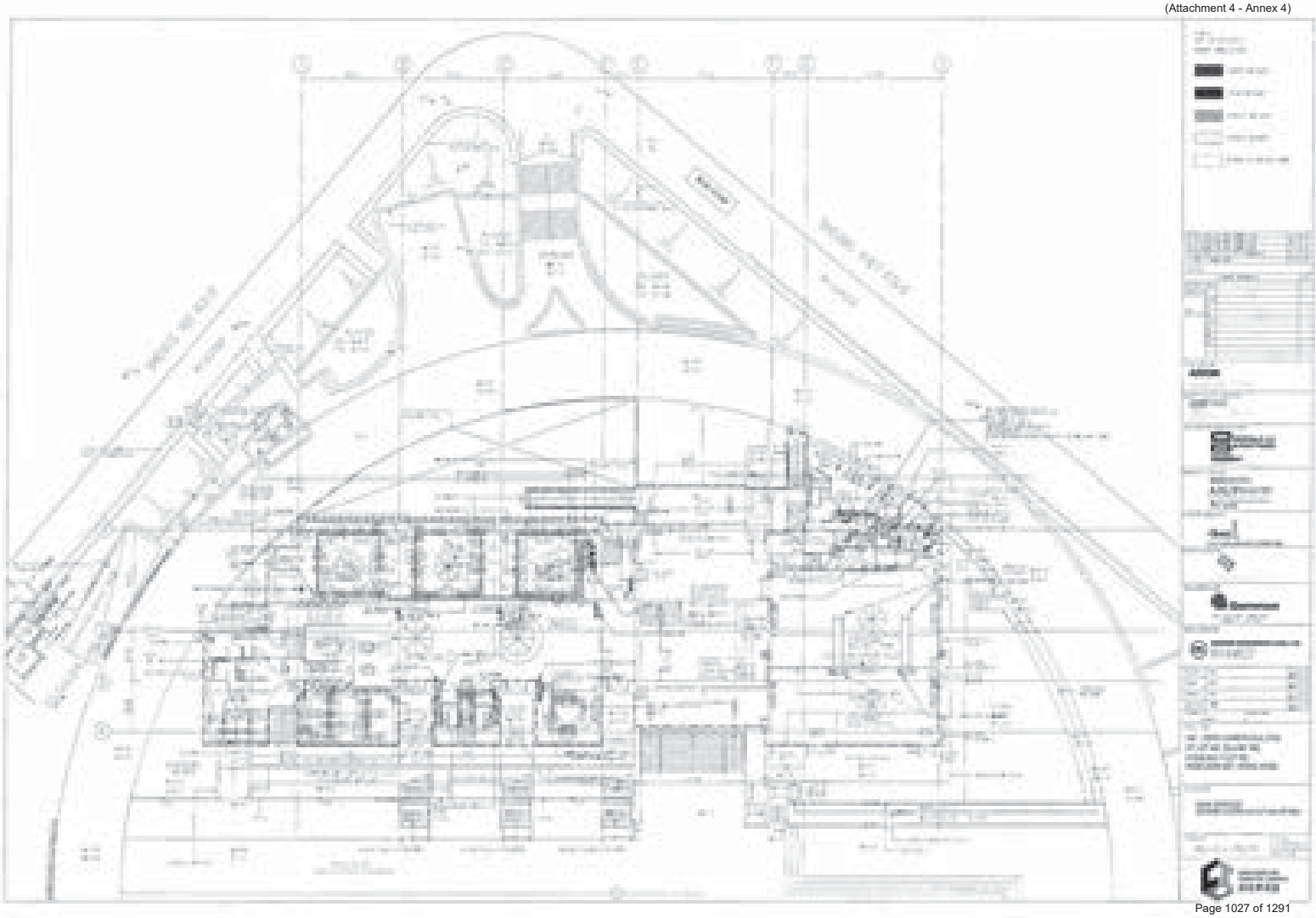
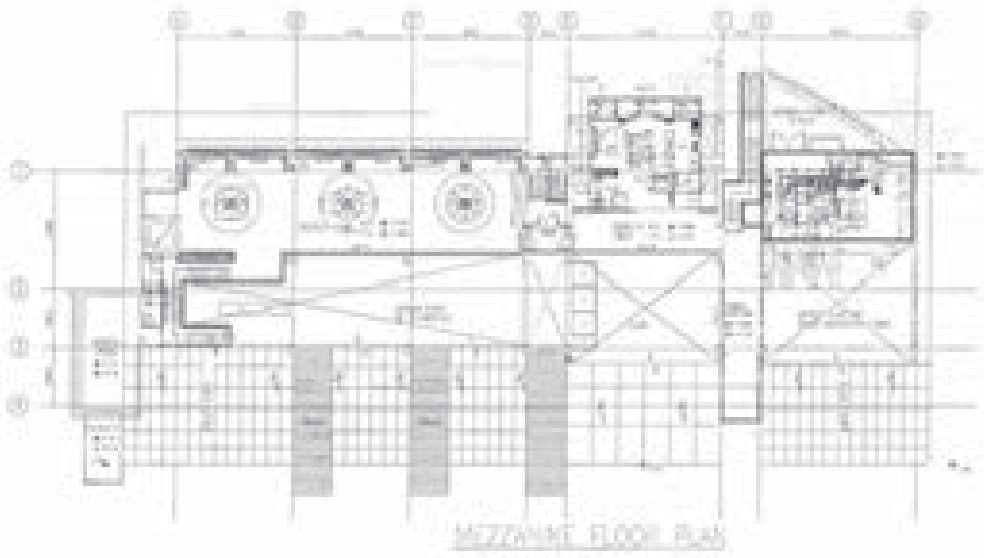
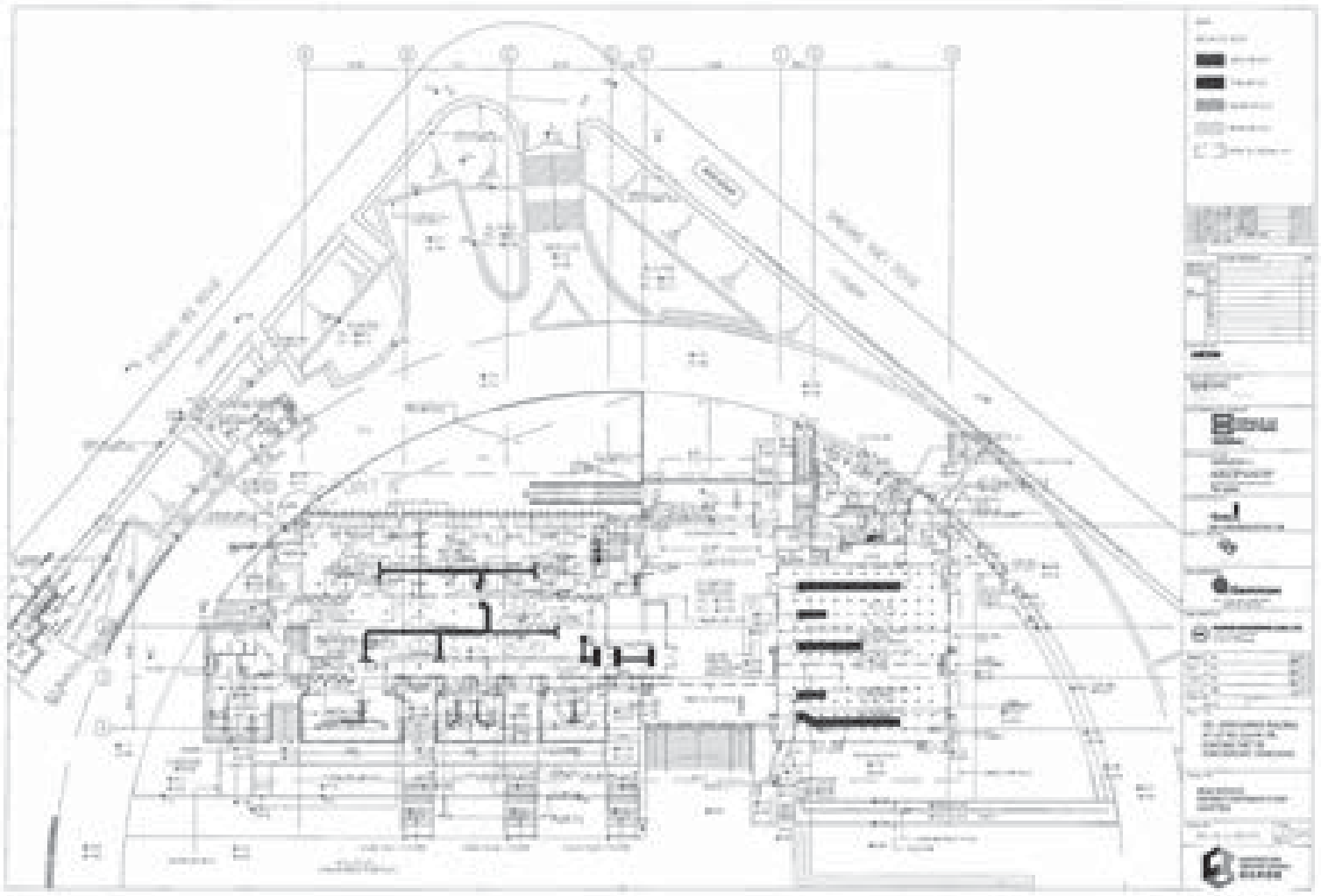
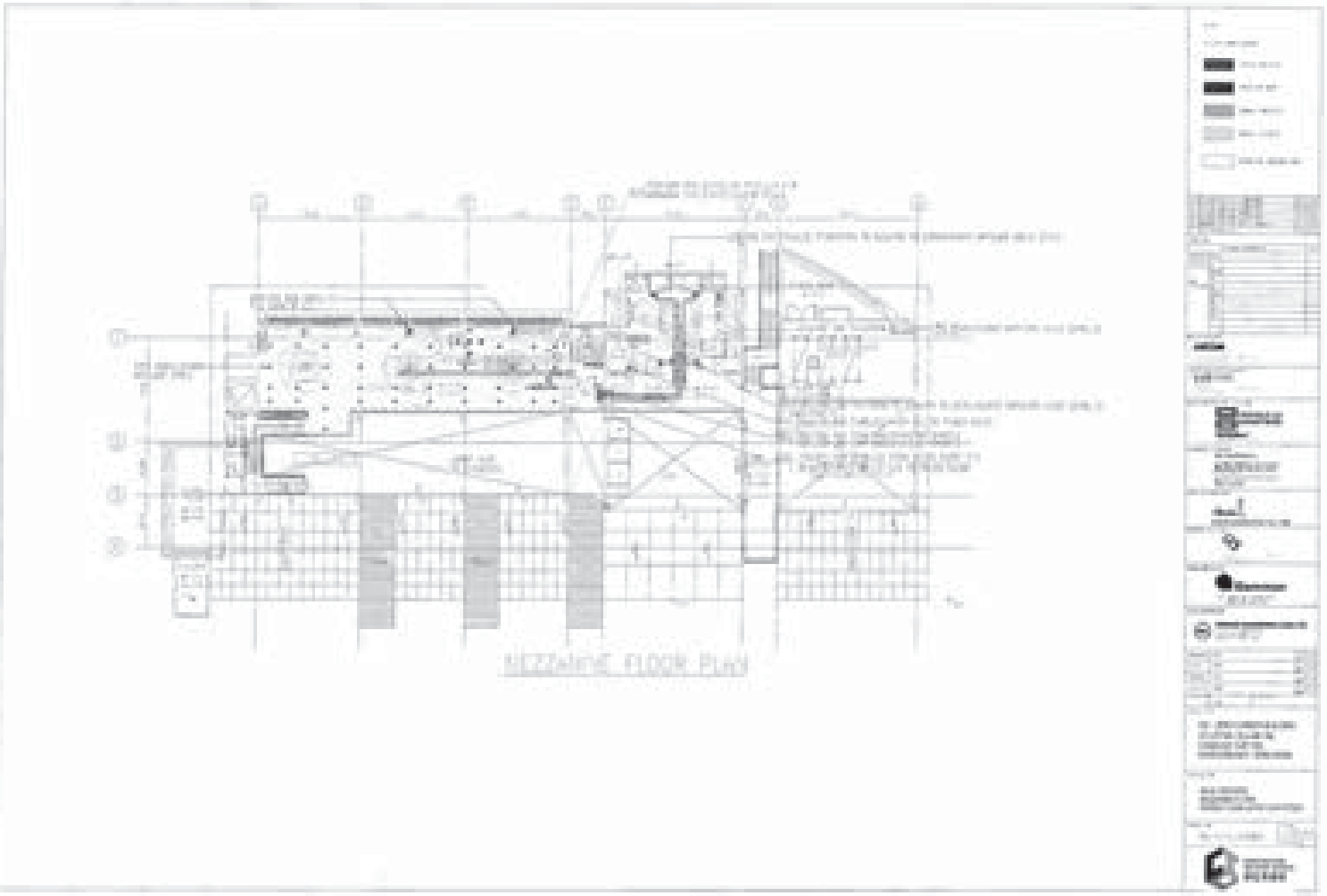
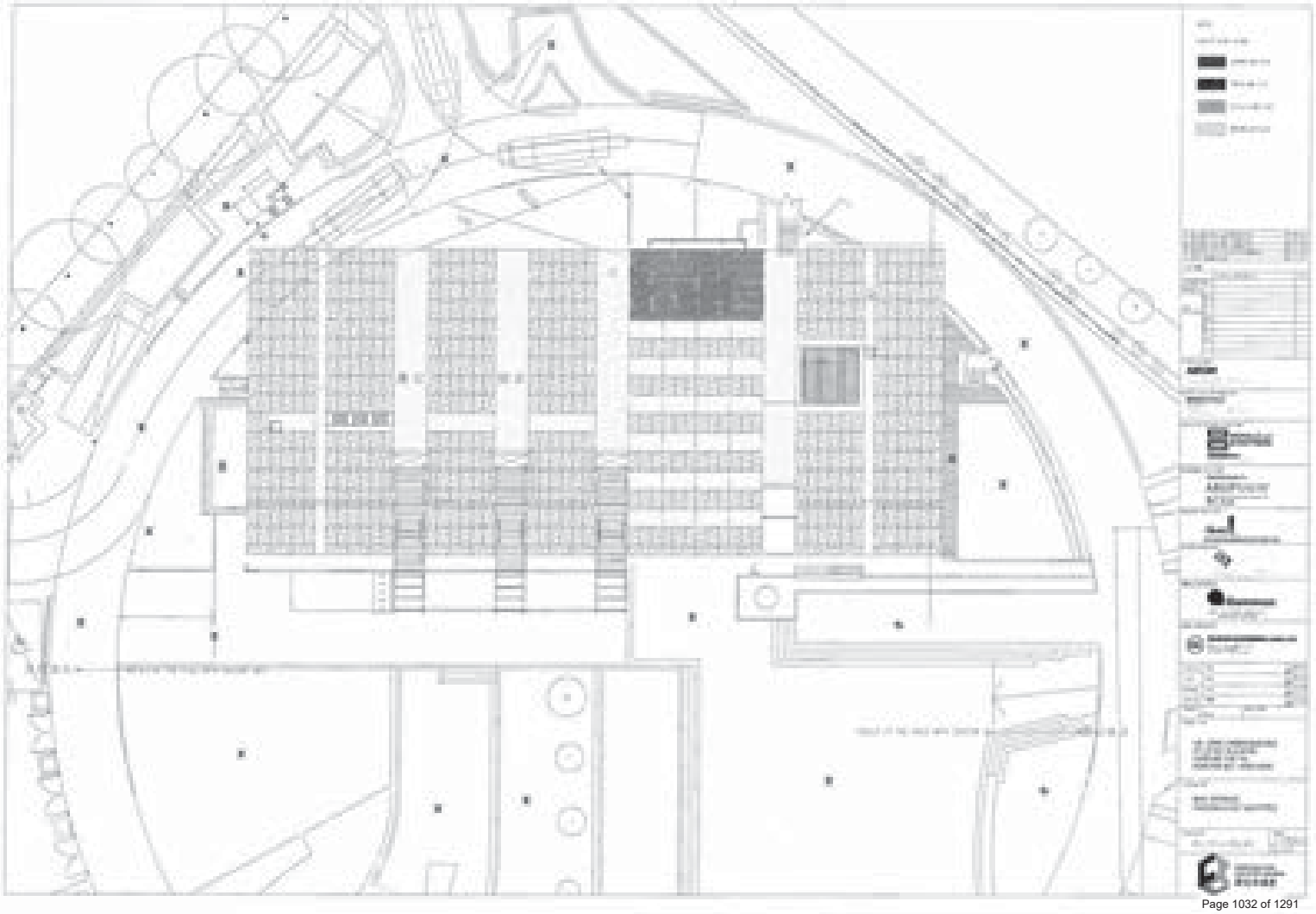





MEZZANINE FLOOR Plan







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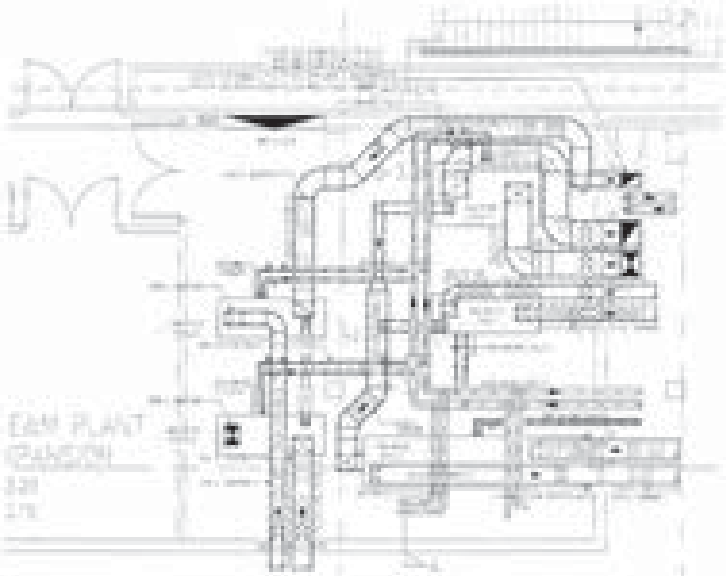
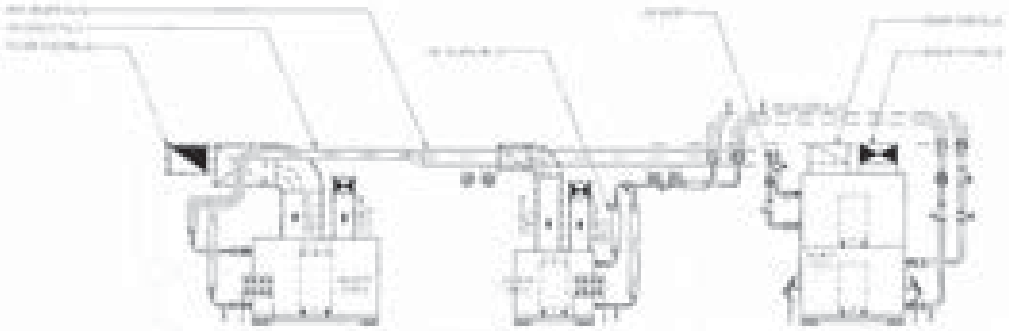
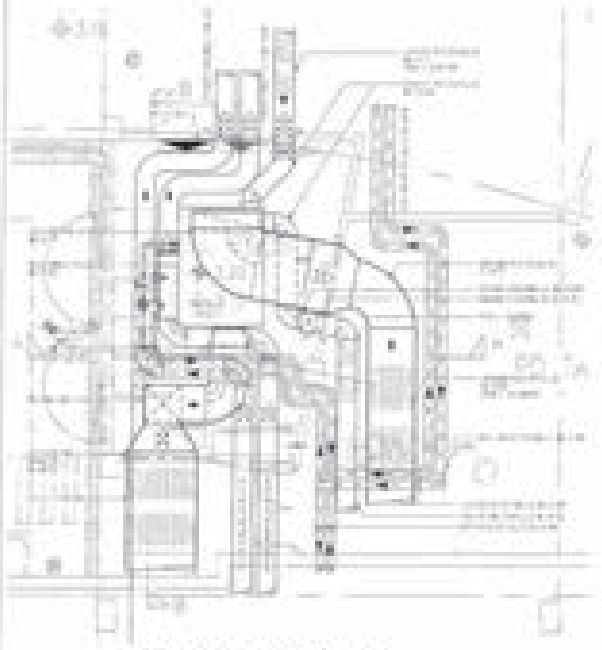


DETAILS OF AHU ROOM AT GL 1-2 / C-D

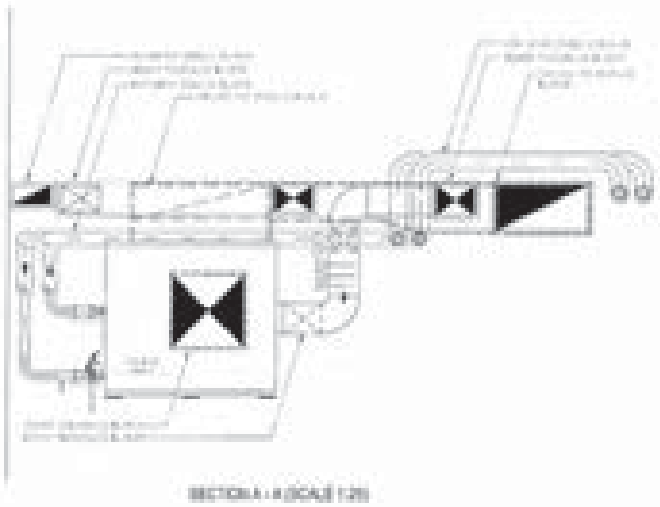


SECTION A - A (SCALE 1:25)

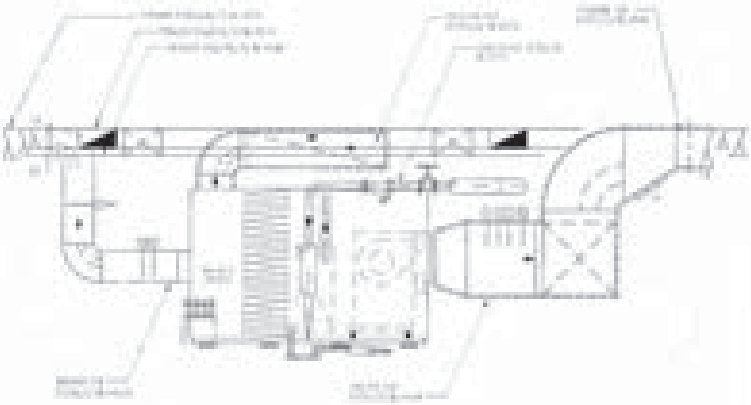
As-Fitted Drawing



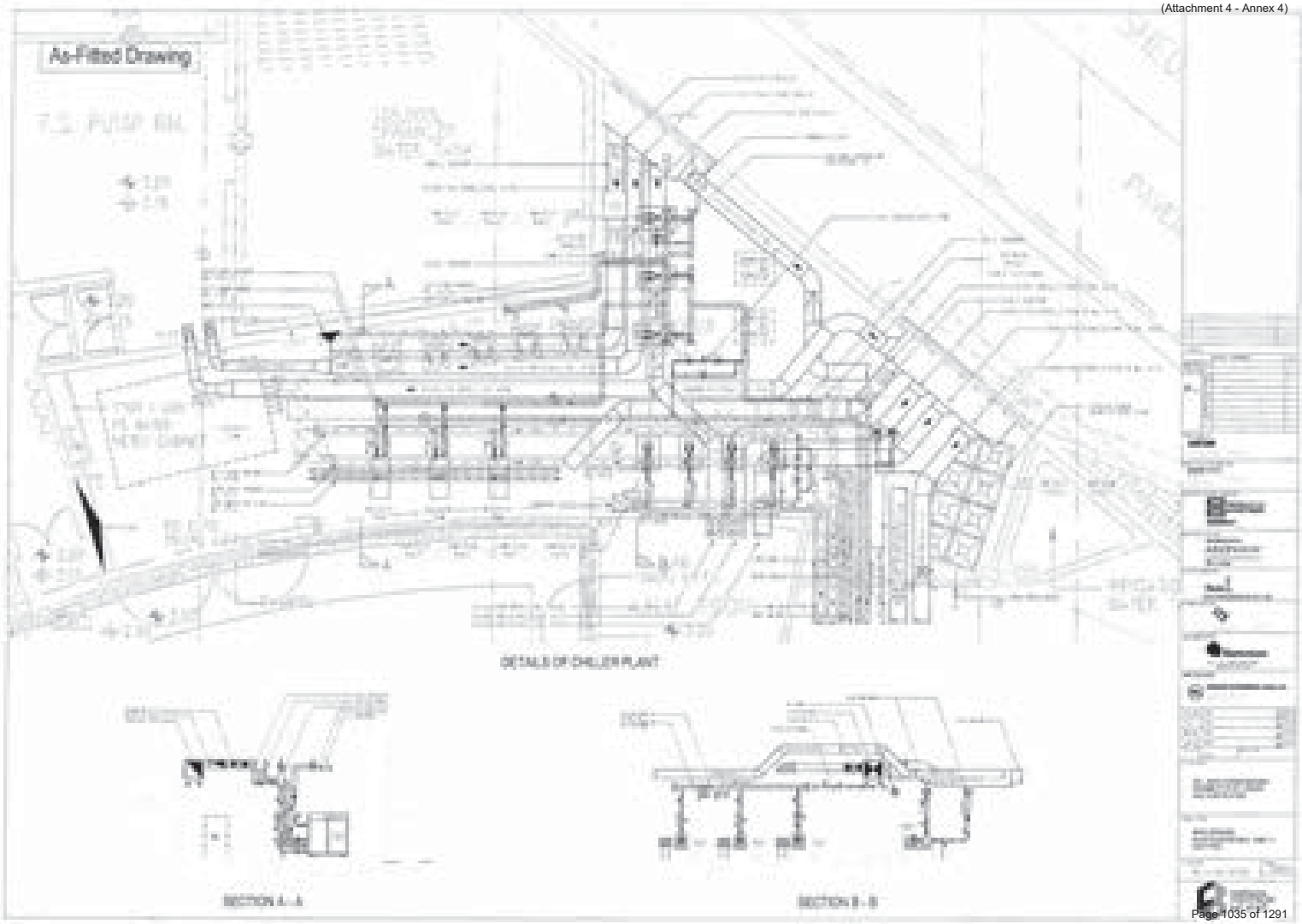
DETAILS OF AHU ROOM AT G.L 1 / E-F



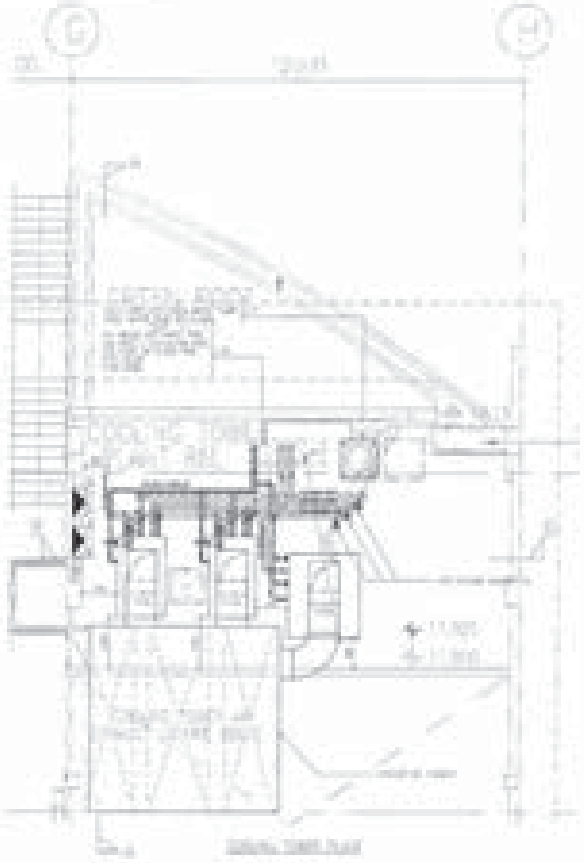
SECTION A - A (SCALE 1:25)

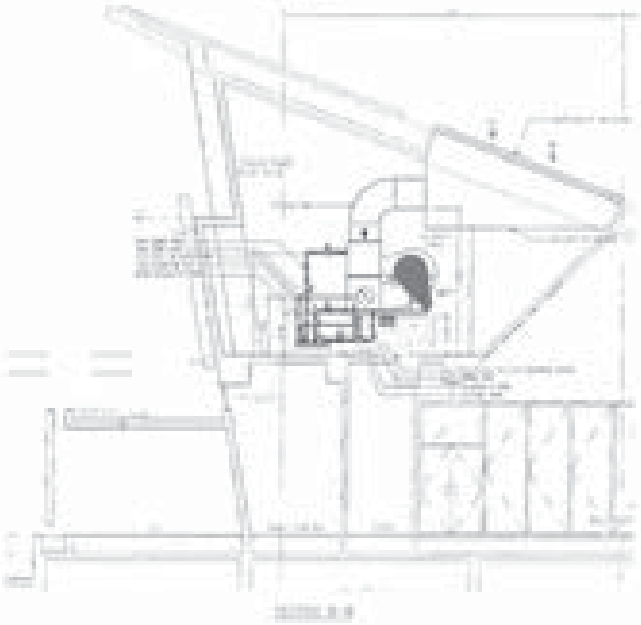


SECTION B - B (SCALE 1:25)


As-Fitted Drawing
T.S. PUMP RM.
DETAILS OF CHILLER PLANT
SECTION A - A
SECTION B - B

As-Fitted Drawing





Appendix III – Testing and Commissioning Records

1 Cooling Tower
2 Air Balancing
3 AHU/ PAU
4 Water Pumps
5 Exhaust Air Fans
6 Split-Type Unit
7 Water Treatment
8 Chiller
9 IAQ Noise Measurement
10 CCMS

Form RLP/RFI/rqs

Project: OC - Zero Carbon Building Feasibility Study, Design and Construction
Works: E&M Services
Contract No.: P11024KL
Contractor:

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No. : RFIN . AC-030
To/ Attn : Mr. Patrick Lui
Date of Request :
Subject : MVAC INSTALLATION

Anticipated date of response :

Completed works for Inspection : Functional Test of Cooling Tower

Locations : Cooling Tower Plant Rm. G.L. G-H/1-2

Referred Document: : KEL/AC/L/003(B)
All/TS/Drg/Specifications

Next Activities / Works :

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

Project Manager:
For and on behalf of Contractor's Name

Received by RLP/Date

Received by WK/Date

Received by WEC/Date

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken : 20. JUN. 2012
Response / Comments :
: PASS.

Remarks:-

Replied by RLP/ Date

Replied by / Date

Replied by WEC/ Date

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

cc
KCS w/o
WK w/o
WEC w/o
TLS w/o

Test Procedure for Cooling Tower

(A1) Physical Check

Check the following items:

1. General Condition of Unit
2. Cleanliness of Basin
3. Fixing of Drift Eliminator
4. Fixing of Fill
5. Fans Rotation without Obstruction
6. Fan & Pump Motor for Proper Rotation
7. Noise / Vibration
8. Drive Alignment / Belt Tension
9. Other Components, Bolts, Fixing, etc.
10. Bearings Lubrication
11. Drainage & Fall
12. Strainer Cleanliness
13. Ball Valve Function
14. Tower Water Level
15. Water Distribution
16. Water Treatment Equipment
17. Electrical Supply Connection
18. Earth Bonding

(A2) Thermal Performance Check

Check the following parameters:

1. Heat Rejection Capacity
2. Air Flow Rate
3. Entering Air Dry Bulb Temperature
4. Entering Air Wet Bulb Temperature
5. Leaving Air Dry Bulb Temperature
6. Leaving Air Wet Bulb Temperature
7. Cooling Water Flow Rate
8. Cooling Water Entering Temperature
9. Cooling Water Leaving Temperature
10. Make-up Water Quantity
11. Constant Bleed Water Quantity

(A3) Fan Check

Check the following parameters:

1. Fan Diameter
2. Fan Volume
3. Fan Power
4. Fan Pressure

(A4) Electrical Test

Check the following parameters:

1. Supply Voltage
2. Motor Starting Current
3. Motor Running Current
4. Motor / Fan Speed
5. Phase – Phase Motor Insulation (L1-L2/L1 –L3/L2-L3)
6. Phase – Earth Motor Insulation (L1-E/L2-E/L3-E)

RECORD of Functional Test for Cooling Tower

COOLING TOWER DATE 20/6/2012

PROJECT : CIC ZERO CARBON BUILDING

LOCATION : M/P — SYSTEM/EQUIP. REF. : CoT-M-01

ITEM	DESIGN	ACTUAL
1. COOLING TOWER MODEL / TYPE	VTL-059-H	VTL-059-H
2. COOLING TOWER SERIAL NO.	EU1200332	EU1200332
3. FAN MAKE AND MODEL NO.	/	/
4. FAN SERIAL NO.	/	/
5. FAN SIZE	630mm	630mm
6. FAN DRIVE TYPE	Belt Drive	Belt Drive
7. FAN AT FULL SPEED (r.p.m.) (High Speed)	/	520 RPM
8. MOTOR MAKE & FRAME NO. (DUTY/STANDBY)	TECO AEHPPA003	TECO AEHPPA003
9. MOTOR VOLTAGE (V) / PHASE / FREQUENCY (Hz)	380/3/50	380/3/50
10. MOTOR POWER (KW)	High kW Low kW	High kW Low kW
11. MOTOR FULL LOAD CURRENT (Amp)	/	High 11.2 Low 3.97
12. MOTOR RUNNING CURRENT (Amp)	/	High 7.6A Low 2.7A
13. MOTOR OVERLOAD SETTING & RANGE	/	4-6A(4) 12-18A(12)
14. MOTOR SPEED (r.p.m.)	/	High 1464 Low 715
15. STARTER TYPE	DOL	High YY Low Y (DOL)
16. MOTOR INSULATION TEST (U-E V-E W-E) (SE/SERVICE) (M Ohm)	/	100MΩ 100MΩ 100MΩ
(U-V, V-W, W-U, U-E, V-E, W-E) (SE/SERVICE) (M Ohm)	/	100MΩ 100MΩ 100MΩ
	/	T-E T-E T-E 380 380 380
17. BELT SIZE, NUMBER, TYPE & ALIGNMENT	/	TX2965 B-97 X 2 No.s
18. MOTOR & FAN PULLEY DIAMETER	/	140mm / 150 mm
19. SUPPLY AIR VOLUME FLOW RATE (m^3/s)	4.13	4.19
20. FRESH AIR FLOW RATE (m^3/s)	/	/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER — NAME LAU WAI TAK — SIGNATURE _____

WITNESSED BY ARUP — NAME _____ — SIGNATURE _____

WITNESSED BY — NAME _____ — SIGNATURE _____

RECORD of Function Test for COOLING TOWER

COOLING TOWER DATE : 20/6/2012

PROJECT : CIC ZERO CARBON BUILDING

LOCATION : R/F	SYSTEM/EQUIP. REF. : CT-R-01	
ITEM	DESIGN	ACTUAL
21. RETURN AIR VOLUME FLOW RATE (m^3/s)		✓
22. FAN STATIC PRESSURE (Pa)		✓
23. AHU EXTERNAL STATIC PRESSURE (Pa)		✓
24. AIR PRESSURE DROP ACROSS COIL (Pa)		✓
25. AIR PRESSURE DROP ACROSS FILTER		✓
26. WATER FLOW RATE (L/S)		8.5 L/s
27. WATER PRESSURE DROP (Kpa)		20
28. INLET AIR TEMPERATURE (DB/WB) C		31
29. OUTLET AIR TEMPERATURE (DB/WB) C		28
30. WATER INLET TEMPERATURE (C)		45
31. WATER OUTLET TEMPERATURE (C)		35
32. TYPE OF CONTROL VALVE		on/off type
33. FILTER TYPE (PRE/BAG FILTER)		✓
FUNCTION TEST		**STATUS**
34. THERMOSTAT		✓
35. CONTROL VALVE		O.K
36. EMERGENCY STOP		O.K
37. FILTER CLOG		✓
38. OVERLOAD TRIPPING		O.K
39. DELAY OFF		O.K
40. SOUND PRESSURE LEVEL (dBA)		✓
41. CHANGEOVER		✓

REMARKS : _____

TESTED BY KRUEGER NAME Lee Wai Hok SIGNATURE

WITNESSED BY ARUP NAME _____ SIGNATURE

WITNESSED BY NAME _____ SIGNATURE _____

RECORD of Functional Test for Cooling Tower

COOLING TOWER DATE : 20/6/2012

PROJECT : CIC ZERO CARBON BUILDING

LOCATION : M/F	SYSTEM/EQUIP. REF : CoT-M-02	
ITEM	DESIGN	ACTUAL
1. COOLING TOWER MODEL / TYPE	VTL-039-H	VTL-039-H
2. COOLING TOWER SERIAL NO.	EM120033-01	EM120033-01
3. FAN MAKE AND MODEL NO.	/	/
4. FAN SERIAL NO.	/	/
5. FAN SIZE	Ø6300 mm	Ø6300 mm
6. FAN DRIVE TYPE	Belt Drive	Belt Drive
7. FAN AT FULL SPEED (r.p.m.) (High Speed)	/	60 Rpm
8. MOTOR MADE & FRAME NO. (DUTY/STANDBY)	TECO AEHPP4003	TECO AEHPP4003
9. MOTOR VOLTAGE (V) / PHASE / FREQUENCY (Hz)	380/3/50	380/3/50
10. MOTOR POWER (KW)	High 18.5 Low 4	High 18.5 Low 4
11. MOTOR FULL LOAD CURRENT (Amp)	/	High 41.2 Low 9.7
12. MOTOR RUNNING CURRENT (Amp)	/	High 37.8 Low 2.8 A
13. MOTOR OVERLOAD SETTING & RANGE (Setting)	/	4-6A (4) 12-18A (12)
14. MOTOR SPEED (r.p.m.)	/	High 1455 Low 715
15. STARTER TYPE	DOL	High YY Low Y (DOL)
16. MOTOR INSULATION TEST (R-E W-E B-E) (MΩ)	/	100MΩ 100MΩ 100MΩ
(R-W, W-B, B-R) (MΩ)	/	100MΩ 100MΩ 100MΩ
17. BELT SIZE, NUMBER, TYPE & ALIGNMENT	/	7 No 3 No 3 No
18. MOTOR & FAN PULLEY DIAMETER	/	4 No B-97X 2No-5
19. SUPPLY AIR VOLUME FLOW RATE (m^3/s)	4.13	4.13
20. FRESH AIR FLOW RATE (m^3/s)	/	/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible]

WITNESSED BY ARUP NAME _____ SIGNATURE [illegible]

WITNESSED BY NAME _____ SIGNATURE _____

RECORD of Function Test for COOLING TOWER

COOLING TOWER DATE : 26/6/2012

PROJECT : CIC ZERO CARBON BUILDING

LOCATION : M/F	SYSTEM/EQUIP. REF. : CT-M-02	
ITEM	DESIGN	ACTUAL
21. RETURN AIR VOLUME FLOW RATE (m^3/s)		—
22. FAN STATIC PRESSURE (Pa)		—
23. AHU EXTERNAL STATIC PRESSURE (Pa)		—
24. AIR PRESSURE DROP ACROSS COIL (Pa)		—
25. AIR PRESSURE DROP ACROSS FILTER		—
26. WATER FLOW RATE (L/S)		8.58 L/s
27. WATER PRESSURE DROP (Kpa)		22
28. INLET AIR TEMPERATURE (DB/WB) C		31
29. OUTLET AIR TEMPERATURE (DB/WB) C		41
30. WATER INLET TEMPERATURE (C)		44
31. WATER OUTLET TEMPERATURE (C)		39
32. TYPE OF CONTROL VALVE		ON/OFF type
33. FILTER TYPE (PRE/BAG FILTER)		—

FUNCTION TEST		STATUS
34. THERMOSTAT		—
35. CONTROL VALVE		O-K
36. EMERGENCY STOP		O-K
37. FILTER CLOG		—
38. OVERLOAD TRIPPING		O-K
39. DELAY OFF		O-K
40. SOUND PRESSURE LEVEL (dBA)		—
41. CHANGEOVER		—

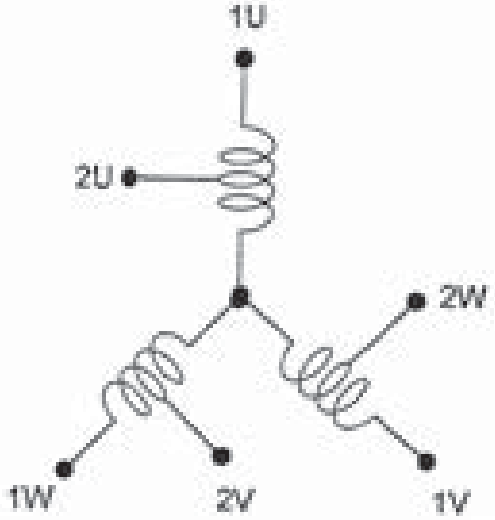
REMARKS : —

TESTED BY KRUEGER NAME AT and TBK SIGNATURE TBK

WITNESSED BY ARUP NAME _____ SIGNATURE _____

WITNESSED BY NAME _____ SIGNATURE _____

TECO	CONNECTION DIAGRAM	MODEL
DATE : 07.23.2003	For 2Y / Y Connection	DAC-1599

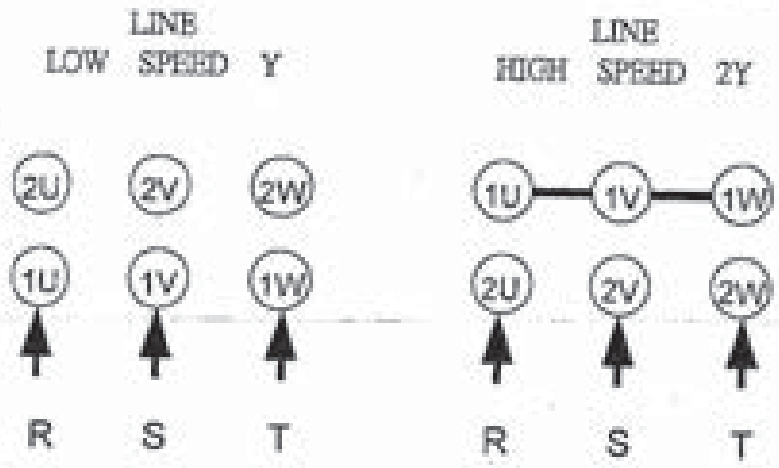


SCHEMATIC – 2Y / Y CONNECTION

ROTATION

(VIEWED FROM DRIVE END)

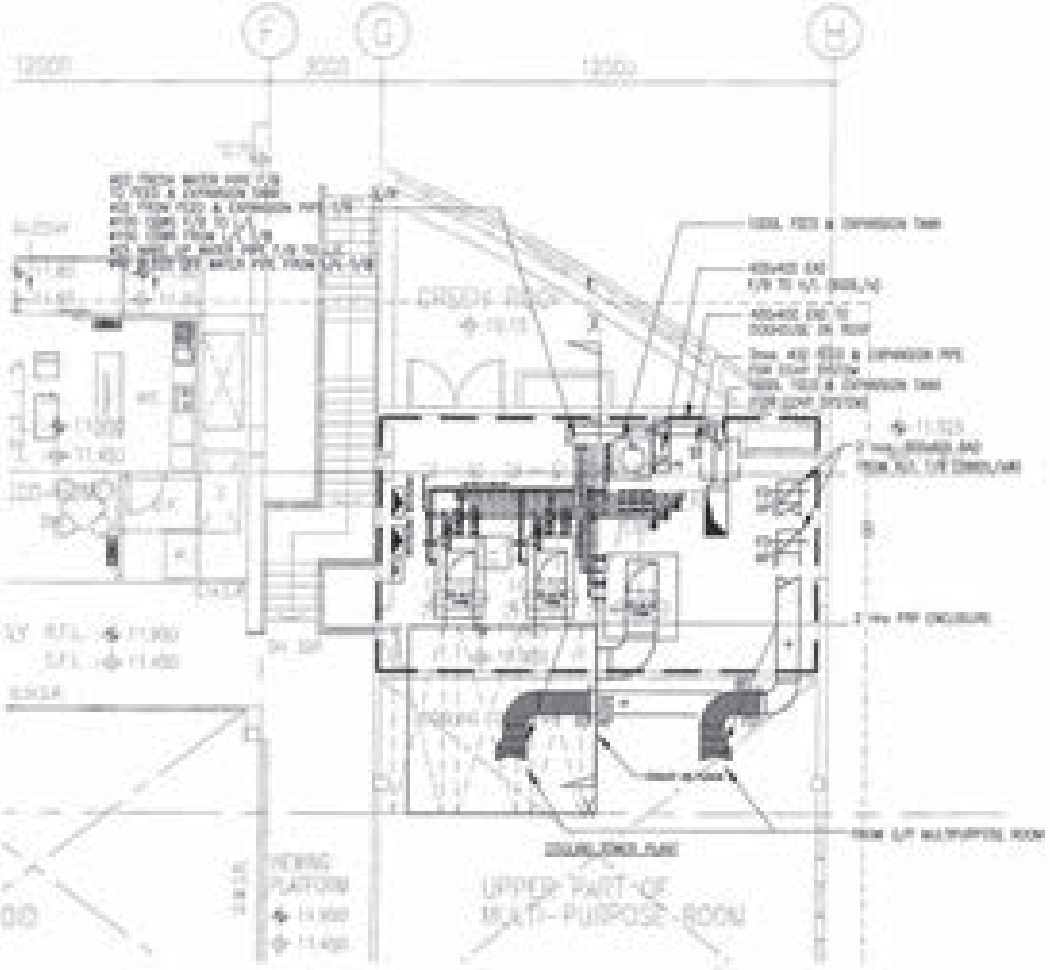
CONNECTION

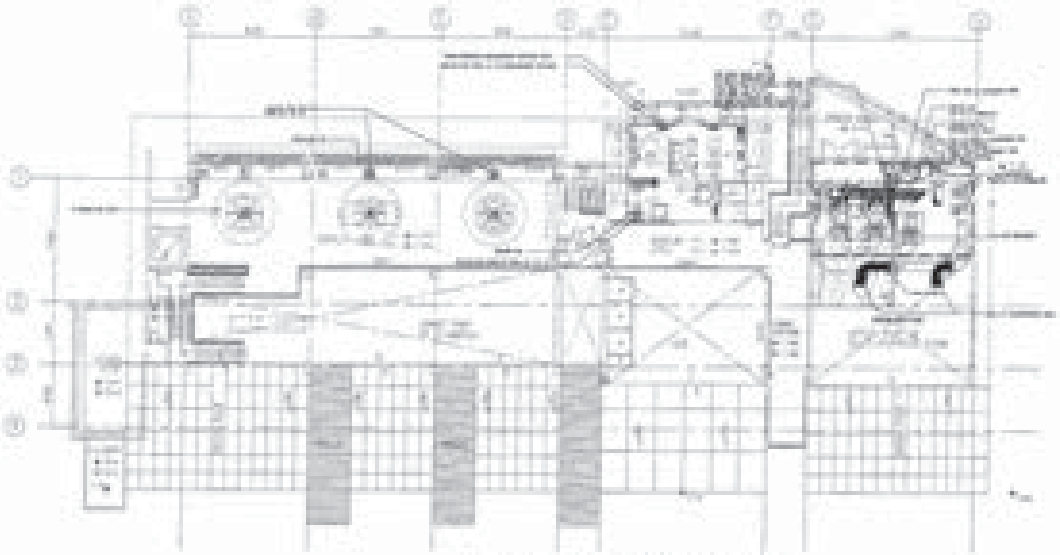


承認		
審核	Chung	07.23.'03
校對	—	—
繪製	Chih	07.23.'03

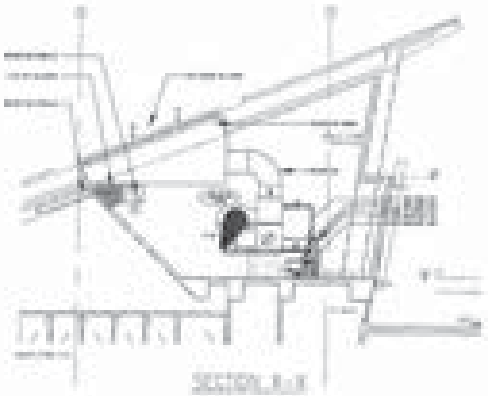
東元電機股份有限公司
TECO ELECTRIC & MACHINERY CO. LTD.
TAIWAN R.O.C.

圖號：DAC-1599


F
G
H
12000
9000
13500
GRIDDA RAIL
UPPER PART OF
MULTI-PURPOSE ROOM



MEZZANINE FLOOR PLAN



SECTION A-A

Form RLP/Site/AC

Project: CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works: E&M Services
Contract No.: P11024KL
Contractor:

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No. : RFIN – AC-041
To/ Attn : Mr. Patrick Lui
Date of Request :
Subject : MVAC INSTALLATION
Anticipated date of response :
Completed works for inspection : Air Balancing
Location's : G/F Eco Office, Multi-purpose Room, Display Area
Referred Document. : KEL/AC/L/004(B), KEL/AC/L/005(B)
All/TS/ISS/Specifications
Next Activities / Works :

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

25 Feb 11

Project Manager
For and on behalf of Contractor's Name

Received by RLP/Date
Received by WK/Date
Received by WEC/Date

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken :
F esponse / Comments :
:

Remarks:-

Design flow has a great different from actual flow due to air leakage and at installation.

Replied by RLP/Date
Replied by [illegible] / Date
Replied by WEC/ Date

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

KSN/WHY/JYE

cc.
KCS n/a
WK n/a
WEC n/a
TLS n/a

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: [redacted] AHU B-03 Date : 6/8/2012

Area Served : G/F MP Room Drawing Ref. : _____

Floor : B/F

1. AIR BALANCING RECORD :

Design data & flow rate as 6980 L/s ÷ 1217 Grille = 57.6 L/s

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s) initial	MEASURED VELOCITY (m/s) final	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
1	0.024m²	0.65	1.47	35.3	57.6
2	"	0.69	1.49	35.8	"
3	"	0.45	1.48	35.5	"
4	"	0.71	1.48	35.5	"
5	"	0.88	1.49	35.8	"
6	"	0.75	1.47	35.3	"
7	"	0.85	1.48	35.5	"
8	"	1.05	1.49	35.8	"
9	"	1.05	1.46	35.0	"
10	"	1.08	1.48	35.5	"
11	"	1.2	1.47	35.3	"
12	"	1.24	1.49	35.8	"
13	"	1.15	1.48	35.5	"

Remark : Grille Area = 24cmx10cm ; 0.24mx0.12mx3.14 x 0.5
Grille factor = 0.049m² x 0.5 = 0.024m²

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Ho T Lee SIGNATURE [signature]

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation : AHU-B-03 Date : 6/8/2012

Area Served : G/F MP Room Drawing Ref. : _____

Floor : B/F

1. AIR BALANCING RECORD :-

Actual (m/s) → 1.46 (m/s)

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)		ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
14	0.024 m²	1.1	1.46	35.6	37.6
15	〃	1.1	1.45	34.8	〃
16	〃	1.1	1.48	35.5	〃
17	〃	1.03	1.47	35.3	〃
18	〃	1.02	1.49	35.8	〃
19	〃	0.8	1.48	35.5	〃
20	〃	0.8	1.45	34.8	〃
21	〃	0.8	1.44	34.6	〃
22	〃	0.8	1.48	35.5	〃
23	〃	1.23	1.49	35.8	〃
24	〃	1.5	1.5	36.0	〃
25	〃	1.28	1.45	34.8	〃
26	〃	1.19	1.47	35.3	〃

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lo. T Sai SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation : AHU-B-03 Date : 6/8/2012

Area Served : G/F MP Room Drawing Ref. : _____

Floor : R/F

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s) Initial(m/s)	MEASURED VELOCITY (m/s) Final(m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
27	0.02418 m^2	1.12	1.51	36.6	37.C
28	〃	1.27	1.43	34.3	〃
29	〃	0.93	1.44	34.8	〃
30	〃	0.5	1.49	35.8	〃
31	〃	0.5	1.46	35.6	〃
32	〃	0.78	1.44	34.6	〃
33	〃	0.9	1.48	35.5	〃
34	〃	1.18	1.51	36.6	〃
35	〃	1.01	1.44	34.8	〃
36	〃	1.15	1.46	35.6	〃
37	〃	1.19	1.49	35.8	〃
38	〃	1.23	1.52	36.4	〃
39	〃	1.12	1.53	36.7	〃

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME WONG CHI SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building

AIR BALANCING COMMISSIONING REPORT

Designation: AHU-B-03 Date : 6/8/2022

Area Served : B/F MD Room Drawing Ref. : _____

Floor : B/F

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s) Initial	MEASURED VELOCITY (m/s) Final	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
40	0.024m²	0.91	1.41	33.8	57.6
41	"	0.94	1.42	34.1	"
42	"	1.09	1.91	33.8	"
43	"	0.81	1.5	36.0	"
44	"	0.6	1.99	35.8	"
45	"	1.08	1.97	35.3	"
46	"	0.99	1.55	37.2	"
47	"	1.13	1.39	33.4	"
48	"	1.08	1.95	34.8	"
49	"	0.96	1.99	35.8	"
50	"	1.36	1.98	35.5	"
51	"	1.1	1.51	36.0	"
52	"	0.99	1.95	34.8	"

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lau T Lai SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation : AHU-B-03 Date : 6/8/2012

Area Served : G/F MPR ROOM Drawing Ref. : _____

Floor : B/F

1. AIR BALANCING RECORD :

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)		ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
S3	0.024m²	0.9	1.37	32.9	47.6
S4	"	0.99	1.38	33.1	"
S5	"	0.73	1.44	34.8	"
S6	"	1.09	1.49	35.8	"
S7	"	1.03	1.53	36.7	"
S8	"	0.97	1.54	36.9	"
S9	"	1.07	1.37	32.9	"
60	"	0.91	1.35	32.4	"
61	"	0.95	1.51	36.2	"
62	"	0.96	1.53	36.7	"
63	"	1	1.47	35.3	"
64	"	0.9	1.44	34.8	"
65	"	0.96	1.49	35.8	"

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lo T Lai SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: AHU-B-03 Date : 6/3/2012

Area Served : G/F MP Room Drawing Ref. :

Floor : B/F

1. AIR BALANCING RECORD :

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s) Initial (m/s)	MEASURED VELOCITY (m/s) Final (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
66	0.029 m²	0.66	1.54	36.9	37.6
67	"	1.13	1.38	33.1	"
68	"	1.09	1.98	33.1	"
69	"	1.15	1.33	31.9	"
70	"	1.1	1.96	35.0	"
71	"	1.08	1.55	37.3	"
72	"	1.07	1.53	36.7	"
73	"	1.06	1.35	32.4	"
74	"	0.94	1.43	34.3	"
75	"	2.96	1.51	36.2	"
76	"	0.97	1.98	35.5	"
77	"	0.96	1.44	34.8	"
78	"	3.11	1.93	35.3	"

Remark :

TYPE OF INSTRUMENT :

TESTED BY KRUEGER NAME Sky Lee SIGNATURE

WITNESSED BY OAP NAME SIGNATURE

WITNESSED BY ( ) NAME SIGNATURE

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation : AHU-B-03 Date : 6/8/2012

Area Served : S/F MP Room Drawing Ref. : _____

Floor : B/F

1. AIR BALANCING RECORD :

Initial(m/s)

Final(m/s)

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)		ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
T9	0.0244m²	2.82	1.41	33.8	37.6
80	〃	2.83	1.48	35.5	〃
81	〃	2.7	1.52	36.5	〃
82	〃	2.6	1.39	33.4	〃
83	〃	2.7	1.38	33.1	〃
84	〃	2.6	1.46	35.0	〃
85	〃	3.3	1.49	35.8	〃
86	〃	1.6F	1.47	35.3	〃
87	〃	2.1	1.37	32.9	〃
88	〃	2.2	1.51	36.2	〃
89	〃	2.7	1.54	36.9	〃
90	〃	2.9	1.46	35.0	〃
91	〃	2.6	1.55	37.2	〃

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME W.T Lee SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: AHU-B-03 Date : 6/5/2022

Area Served : O/F MP Room Drawing Ref. : _____

Floor : B/F

1. AIR BALANCING RECORD :

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s) Initial	MEASURED VELOCITY (m/s) Final	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
92	0.024m²	2.7	1.51	36.2	37.6
93	〃	2.8	1.48	35.5	〃
94	〃	2.1	1.52	36.5	〃
95	〃	2.4	1.54	36.9	〃
96	〃	1.8	1.43	34.3	〃
97	〃	2.5	1.39	33.4	〃
98	〃	2.4	1.36	32.6	〃
99	〃	2.4	1.51	36.2	〃
100	〃	3.1	1.44	34.6	〃
101	〃	2.2	1.48	35.5	〃
102	〃	2.3	1.47	35.8	〃
103	〃	1.5	1.37	32.9	〃
104	〃	1.2	1.45	34.8	〃

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lo.T Lap SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: AHU-B-03 Date : 6/8/2012

Area Served : GF MP Room Drawing Ref. :

Floor : B/F

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)		ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
105	0.024 m²	1.3	1.46	35.0	57.6
106	"	2.2	1.51	36.2	"
107	"	2.1	1.37	32.9	"
108	"	2.07	1.47	35.3	"
109	"	1.9	1.39	33.4	"
110	"	2.06	1.55	37.2	"
111	"	2.7	1.51	36.2	"
112	"	2.7	1.47	35.3	"
113	"	2.6	1.44	34.6	"
114	"	3	1.38	33.1	"
115	"	2.4	1.53	36.7	"
116	"	2.4	1.59	38.2	"
117	"	2.5	1.43	34.3	"

Remark :

TYPE OF INSTRUMENT :

TESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible]

WITNESSED BY OAP NAME SIGNATURE

WITNESSED BY ( ) NAME SIGNATURE

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: Ahu-B-03 Date : 6/2/2012

Area Served : G/F MP Plant Drawing Ref. : _____

Floor : B/P

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)		ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
118	0.029m²	2.2	1.39	33.9	42.6
119	〃	2.1	1.51	36.2	〃
120	〃	2.1	1.46	35.0	〃
121	〃	2.2	1.49	35.8	〃
Measured Total Initial Velocity m/s = 179.79					
Measured Initial Total flow = 179.79 X 0.029m² = 6.7415 m³/s					

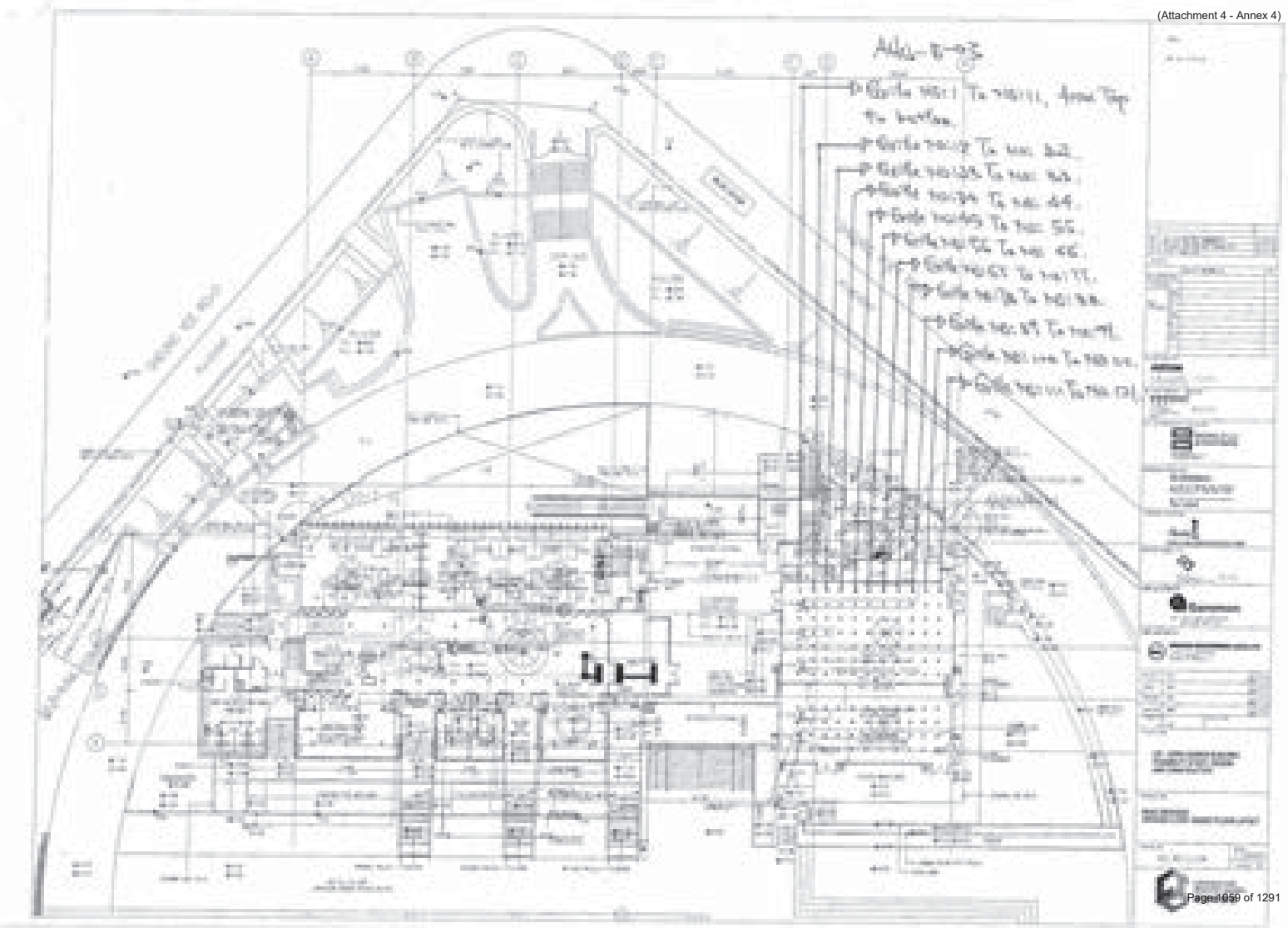
Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Wong Tak Lap SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____



Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: AHU-B-01 Date : 6/8/2012

Area Served : M/E-C.O. Display. Drawing Ref. : _____

Floor : B/F

1. AIR BALANCING RECORD :-

Design Total Flow-Rate = 2160 l/s ± 38 l/s. Grille = 56.8 l/s.

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)		ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
		Initial (m/s)	Final (m/s)		
1	0.024m²	1.3	1.15	25.2	56.8
2	"	0.9	0.94	22.8	"
3	"	0.8	0.99	23.8	"
4	"	0.6	0.97	23.3	"
5	"	1.15	1.14	27.4	"
6	"	0.4	1.2	28.8	"
7	"	0.4	1.07	25.7	"
8	"	0.65	0.88	21.1	"
9	"	0.9	0.95	22.8	"
10	"	0.95	0.99	23.8	"
11	"	0.7	1.18	28.3	"
12	"	0.9	1.08	25.9	"
13	"	1	1.2	28.8	"

Remark : Grille Area = ϕ 210mm ; 0.15m x 0.15m x 3.14 x 0.5
Grille factor = 0.0449m² x 0.5 = 0.024m²

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lot Lap SIGNATURE TBK.

WITNESSED BY DAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: AHU-B-01 Date : 6/8/2012

Area Served M/E-Co Display Drawing Ref. _____

Floor : B/F

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s) Initial(m/s)	MEASURED VELOCITY (m/s) Final(m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
14	0.0248	0.9	1.18	28.3	56.8
15	〃	0.8	1.11	26.6	〃
16	〃	1	1.05	25.2	〃
17	〃	1	1.08	25.9	〃
18	〃	0.9	0.95	22.8	〃
19	〃	0.97	0.97	23.3	〃
20	〃	1	0.99	23.8	〃
21	〃	1.08	1.17	28.1	〃
22	〃	0.9	1.15	27.6	〃
23	〃	1.3	0.97	23.3	〃
24	〃	1.05	0.95	22.8	〃
25	〃	1.1	0.93	22.3	〃
26	〃	1.25	0.98	23.5	〃

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Ho T Hui SIGNATURE Tek.

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: AHU-B-03 Date : 6/8/2012

Area Served : M/E-Q Display Drawing Ref. : _____

Floor : B/F

1. AIR BALANCING RECORD :-

Design Total flow-Rate = 160 l/s ÷ 28 No.'s Grille = 56.8 l/s

Initial (m/s) Final (m/s)

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)		ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
27	0.024 m²	1.5	1.22	29.3	56.8
28	"	1.7	1.18	28.3	"
29	"	1.5	1.17	28.1	"
30	"	2.0	1.15	27.6	"
31	"	1.75	1.1	26.4	"
32	"	1.6	1.09	26.2	"
33	"	1.7	1.05	25.2	"
34	"	1.7	1.1	26.4	"
35	"	1.8	1.19	27.4	"
36	"	1.9	1.13	27.1	"
37	"	1.9	1.15	27.6	"
38	"	1.8	1.16	27.8	"
Measured Total		Initial Velocity m/s =		42.95	

Measured Initial Total flow = 42.95 x 0.024 = 1.0308 m³/s

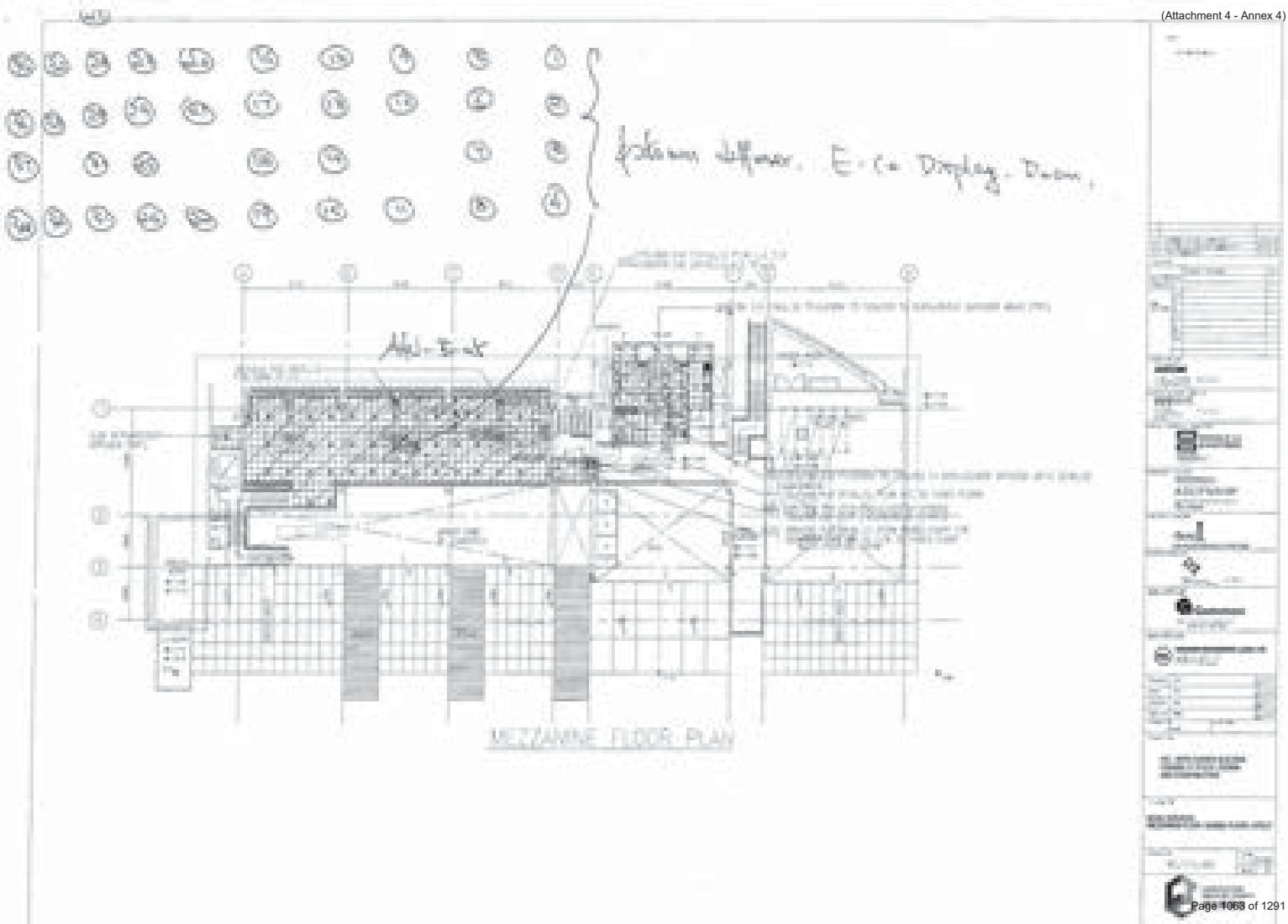
Remark : [redacted]

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lo-T Lee SIGNATURE Tee

WITNESSED BY GAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____


MEZZANINE FLOOR PLAN

Project: CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works: E&M Services
Contract No.: P110284(L
Contractor:

Form RLP/RFI/rev.

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No. : RFIN – AC-031
To/ Attn : Mr. Patrick Lui
Date of Request :
Subject : MVAC INSTALLATION
Anticipated date of response :
Completed works for inspection : Functional Test of EAF and AIR Balancing
Locations : B/F – G/F
Referred Document: : KEL/AC/L/001(B), KEL/AC/L/002(B)
AI/TS/RSR/Specifications
Next Activities / Works :

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

Project Manager:
For and on behalf of Contractor's Name

Received by RLP/Date
Received by WK/Date
Received by WEC/Date

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken :
Response / Comments :

Remarks:-

PLEASE PROVIDE PHOTOS WITH DATE.

Replied by RLP/ Date
Replied by WK / Date
Replied by WEC/ Date

cc
KCS w/o
WK w/o
WEC w/o
TLS w/o

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

RSW/WWY/CHE

AEROTECH Industrial Company Limited
Unit 411, 4/F, Park Sun Bldg., 103-107 Wo Yi Hop Road, Kwai Chung, N.T.
Tel: (852) 2421 3179 Fax: (852) 2421 3930 Email: info@aerotech.com.hk

AIDC005

FAX TRANSMISSION

To : Krueger
Attn. : W Y Leung
From : Can Li
c.c. :

Fax No. :
Ref. : FA1018-12
Date : 13 June, 2012
Total Page : 1 (including this page)

RE: CIC Zero Carbon Building – 'Aerotech' Air Grille / Diffuser / Louver

Further to above project, we wish to advise the effective area as follows:

Single deflection air grille
Model: SG-A-S-H, 80%.

Double deflection air grille
Model: SG-A-D-H, 70%.

4 ways ceiling diffuser
Model: CD-A-4S, 70%.

Hinged type return louver
Model: HRL-A, 50% at 40mm blade spacing.
Model: HRL-A, 65% at 50mm blade spacing.

Return air louver
Model: REL-A, 65% at 50mm blade spacing.

If you have any queries, please contact me at tel: 21523203.

Regards,

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: EAT-B-01 Date :

Area Served Basement Area Zone 2, Plant & Entry Lobby Floor Drawing Ref. : KEL/HC/L/1-1 Rev B

Floor : B/F

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
1	0.6x0.3x0.8=0.144	1.8	259	233
2	0.4x0.3x0.8=0.096	1.7	109	100
3	0.6x0.3x0.8=0.144	1.7	245	233
4	0.6x0.3x0.8=0.144	1.7	245	233

Remark :

TYPE OF INSTRUMENT :

TESTED BY KRUEGER NAME Kelvin Wk Yeh SIGNATURE

APPROVED BY OAP NAME SIGNATURE

WITNESSED BY ( ) NAME SIGNATURE

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation : EAF - B06 Date : _____

Area Served : GENERATOR Rm. Drawing Ref. : _____

Floor : B/F

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
5	1.5x0.6 x0.8=0.72	2.2	1584	1470
6	1.5x0.6 x0.8=0.72	2.3	1656	1470
7	1.5x0.4x0.8=0.48	2.2	1056	980
8	1.5x0.4x0.8=0.48	2.1	1008	980

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME JE Lab with CP SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation : EAF-B-02

Area Served : E.S. Pump Rm

Floor : B/F

Date : _____

Drawing Ref. : _____

1. AIR BALANCING RECORD :

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
9	0.6x0.3x0.8	1.8	259	250
10	0.6x0.3x0.8	1.9	274	250

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Leung Wai Yip SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation : EA - B02

Area Served : E.S. Plant Rm

Floor : B/F

Date :

Drawing Ref. :

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
11	0.6x0.3x0.8 = 144	1.8	259	250
12	0.6x0.3x0.8 = 144	1.8	259	250

Remark :

TYPE OF INSTRUMENT :

TESTED BY KRUEGER NAME Mech with KP SIGNATURE

APPROVED BY OAP NAME SIGNATURE

WITNESSED BY ( ) NAME SIGNATURE

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: EAF-B-04 Date :

Area Served : Central Plant Rm Drawing Ref. :

Floor : B/F

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
13	0.5x0.5x0.8=0.2	2	400	360
14	0.3x0.6x0.8=0.2	2.1	420	360
15	0.5x0.6x0.8=0.2	2	400	360
16	0.5x0.5x0.8=0.2	2.2	440	360
17	0.5x0.6x0.8=0.2	2.1	420	360

Remark :

TYPE OF INSTRUMENT :

TESTED BY KRUEGER NAME Jeriah WR Yip SIGNATURE

APPROVED BY OAP NAME SIGNATURE

WITNESSED BY ( ) NAME SIGNATURE

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation : FAF-R-04 Date : _____

Area Served : Cricket Blog Bin Drawing Ref. : _____

Floor : BF

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
18	0.5x0.5x0.7=0.175	2.1	368	360
19	0.5x0.5x0.7=0.175	2.2	385	360
20	0.5x0.5x0.7=0.175	2.3	403	360
21	0.5x0.5x0.7=0.175	2.1	368	360
22	0.5x0.5x0.7=0.175	2.3	403	360

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Flash Wk YAP SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: FAF - B - 03

Area Served : FD TANK AND PUMP RM

Floor : B/F

Date :

Drawing Ref. :

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
23	0.3x0.4x0.8=0.096	1.6	46	400
24	0.3x0.4x0.8=0.096	1.7	435	400
25	0.3x0.4x0.8=0.096	1.6	410	400

Remark :

TYPE OF INSTRUMENT :

TESTED BY KRUEGER NAME LEE WAI YIP SIGNATURE

APPROVED BY OAP NAME SIGNATURE

WITNESSED BY ( ) NAME SIGNATURE

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: F/T - B-03 Date :

Area Served : PD TOILET AND PANTRY Drawing Ref. :

Floor : B/F

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
26	0.3x0.4x0.3=0.036	1.6	410	400
27	0.3x0.4x0.3=0.036	1.7	435	400
28	0.3x0.4x0.3=0.036	1.7	435	400

Remark :

TYPE OF INSTRUMENT :

TESTED BY KRUEGER NAME [illegible] SIGNATURE

APPROVED BY OAP NAME SIGNATURE

WITNESSED BY ( ) NAME SIGNATURE

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation : EAF - 6 - 12 Date : _____

Area Served : JAV. Drawing Ref. : _____

Floor : 6/F

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
29	0.75x0.2x0.8=0.056	1.5	84	83
30	0.35x0.2x0.8=0.056	1.6	90	83
31	0.35x0.2x0.8=0.056	1.5	84	83
32	0.2x0.2x0.8=0.032	1.6	51	50
33	0.2x0.2x0.8=0.032	1.7	54	50

Remark : _____

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME LEUNG WAI KIT SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Record of Air Balancing

CIC-Zero Carbon Building
AIR BALANCING COMMISSIONING REPORT

Designation: EAT-G-11 Date :

Area Served : TOILET Drawing Ref. :

Floor : G/F

1. AIR BALANCING RECORD :-

AIR GRILLE NO.	GRILLE AREA (mm X mm)	MEASURED VELOCITY (m/s)	ACTUAL FLOW (l/s)	DESIGN FLOW (l/s)
34	0.45x0.35x0.8=0.07	1.7	163	150
35	0.45x0.35x0.8=0.07	1.8	173	150

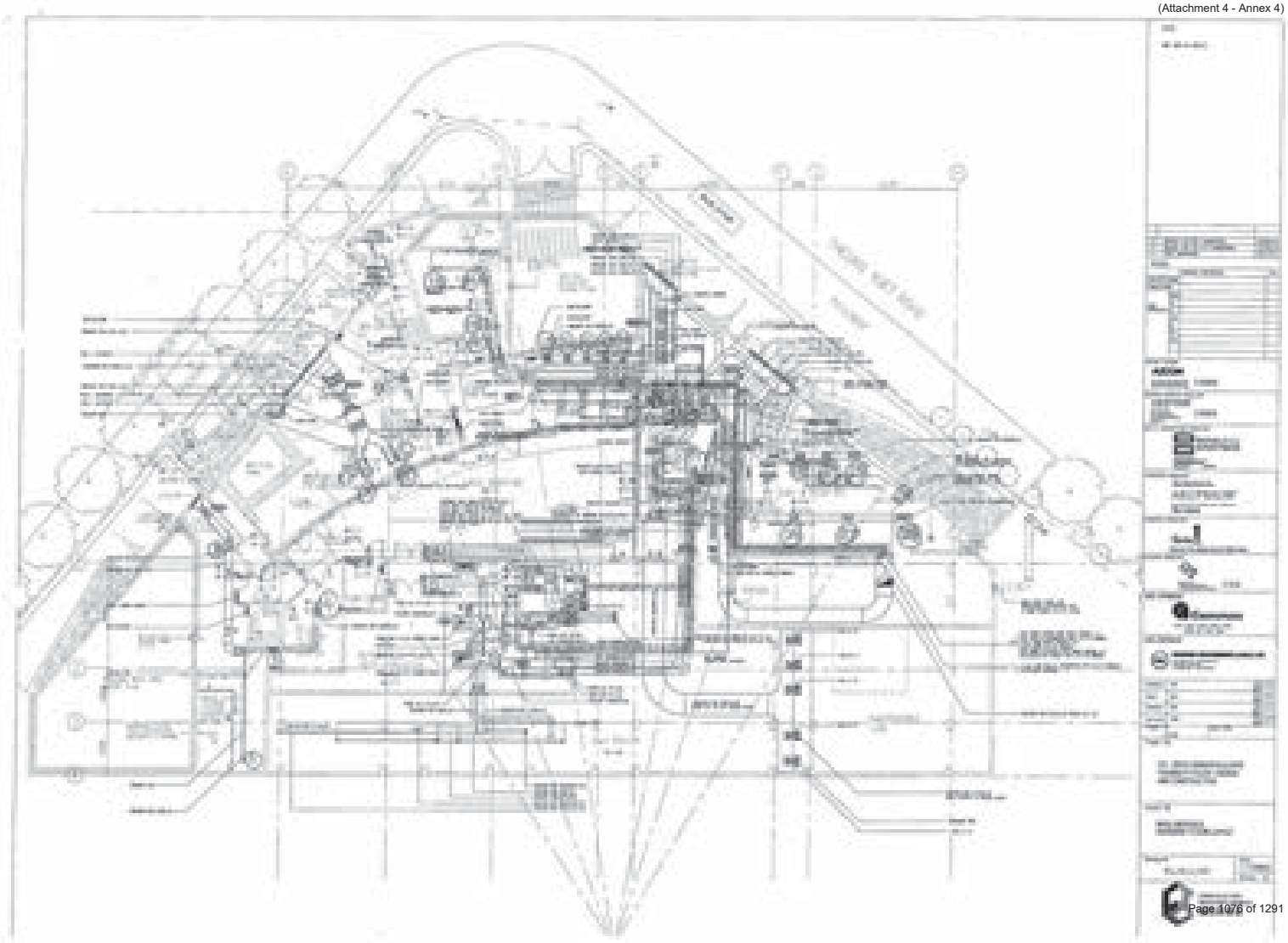
Remark :

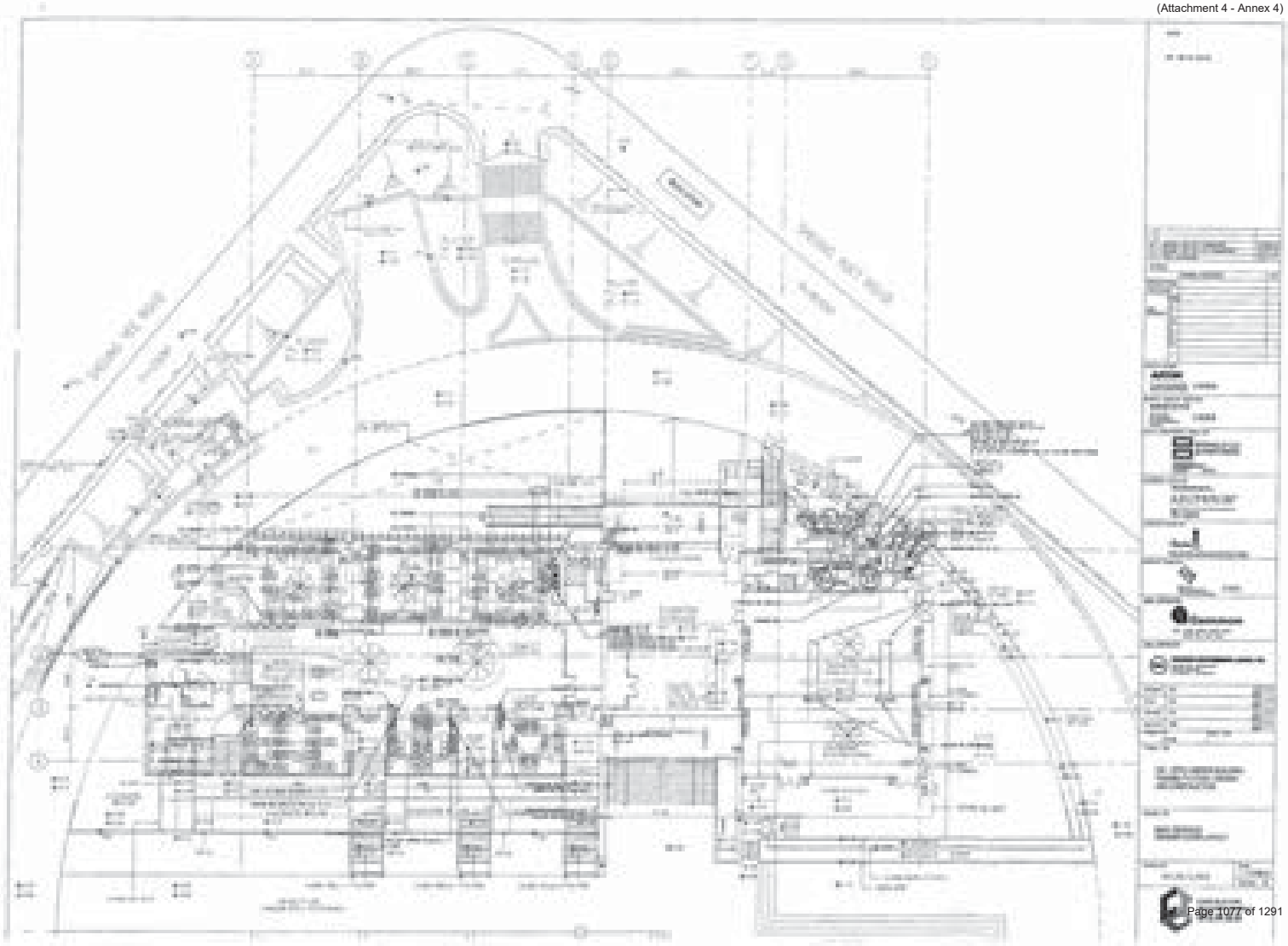
TYPE OF INSTRUMENT :

TESTED BY KRUEGER NAME [illegible] SIGNATURE

APPROVED BY QAP NAME SIGNATURE

WITNESSED BY ( ) NAME SIGNATURE





RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 2a/6/20R

PROJECT : CIC-Zero Carbon Building

LOCATION : 3/F Reclaimed water ITEM System plant Rm	SYSTEM/EQUIP. REF. : EAF-B-01 DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Gelec DDM 9/9	Gelec DDM 9/9
2. FAN TYPE	Tin Line Duct	Tin Line Duct
3. FAN SIZE	—	9"
4. FAN DRIVE TYPE	—	Direct
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	—	—
7. VOLTAGE/PHASE	220/1/50	220/1/50
8. MOTOR POWER (KW)	0.3K	0.3K
9. MOTOR STARTER TYPE	—	DOL
10. MOTOR FULL LOAD CURRENT (A)	—	3.K
11. MOTOR RUNNING CURRENT (A)	—	3.1
12. MOTOR SPEED (R.P.M.)	—	—
13. OVER LOAD SETTING AND RANGE	—	2.5-4 (4)
14. AIR VOLUME FLOW RATE (L/S)	800	859
15. FAN STATIC PRESSURE (Pa)	—	—
16. FAN PULLEY DIAMETER (mm)	—	—
17. MOTOR PULLEY DIAMETER (mm)	—	—
18. NO. OF BELTS, TYPE	—	—

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Kwok Tsuk SIGNATURE [signature]

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 20/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/E Reclaimed water	SYSTEM/EQUIP. REF. : SAF-B-01	
ITEM System start Up	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP	-	O.K
22. OVERLOAD TRIPPING	-	O.K
23. FIRE TRIP		

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Chk SIGNATURE Tchk

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 23/6/2022

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F F.S Tank & Pump Room

SYSTEM/EQUIP. REF. : SAF-B-02

ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Gelee DDM 9/E	Gelee DDM 9/E
2. FAN TYPE	In Line Duct	In Line Duct
3. FAN SIZE	✓	7"
4. FAN DRIVE TYPE	✓	Direct
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	✓	✓
7. VOLTAGE/PHASE	220/1/50	220/1/50
8. MOTOR POWER (KW)	0.42	0.42
9. MOTOR STARTER TYPE	✓	DOL
10. MOTOR FULL LOAD CURRENT (A)	✓	3.5
11. MOTOR RUNNING CURRENT (A)	✓	2.5
12. MOTOR SPEED (R.P.M.)	✓	✓
13. OVER LOAD SETTING AND RANGE	✓	2.5-4 (3)
14. AIR VOLUME FLOW RATE (L/S)	500	518
15. FAN STATIC PRESSURE (Pa)	✓	✓
16. FAN PULLEY DIAMETER (mm)	✓	✓
17. MOTOR PULLEY DIAMETER (mm)	✓	✓
18. NO. OF BELTS, TYPE	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lim Wai Tek SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 28/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F F.S Tank & Pump	SYSTEM/EQUIP. REF. : EAF-B-02	
ITEM Room	DESIGN	MEASUREMENT
FUNCTIONAL TEST	Solec DDM a/c	Solec DDM a/c
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP	-	ok
22. OVERLOAD TRIPPING	-	ok
23. FIRE TRIP		

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lot Sok Tek SIGNATURE Tek

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 2/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/E F.S Tank & Pump Room	SYSTEM/EQUIP. REF. : FAF-B-02	
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Gelec DDM 9/T	Gelec DDM 9/T
2. FAN TYPE	In Line Duct	In Line Duct
3. FAN SIZE	✓	T
4. FAN DRIVE TYPE	✓	Direct
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	✓	✓
7. VOLTAGE/PHASE	220/1/50	220/1/50
8. MOTOR POWER (KW)	0.42	0.42
9. MOTOR STARTER TYPE	✓	DOL
10. MOTOR FULL LOAD CURRENT (A)	✓	3
11. MOTOR RUNNING CURRENT (A)	✓	2
12. MOTOR SPEED (R.P.M.)	✓	✓
13. OVER LOAD SETTING AND RANGE	✓	1.6-2.5 (2.4)
14. AIR VOLUME FLOW RATE (L/S)	500	533
15. FAN STATIC PRESSURE (Pa)	✓	✓
16. FAN PULLEY DIAMETER (mm)	✓	✓
17. MOTOR PULLEY DIAMETER (mm)	✓	✓
18. NO. OF BELTS, TYPE	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lau Kwa Tek SIGNATURE Tek

APPROVED BY DAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 23/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F F.S Tank & Pump		SYSTEM/EQUIP. REF. : EAF-B-02
ITEM Room	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP	-	O.K
22. OVERLOAD TRIPPING	-	O.K
23. FIRE TRIP		

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE TWK

WITNESSED BY DAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 20/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F PD Tank & Pump Rm | SYSTEM/EQUIP. REF. : EAF-R-03

ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Gelec DDM 10/10	Gelec DDM 10/10
2. FAN TYPE	In Line Duct	In Line Duct
3. FAN SIZE	/	10"
4. FAN DRIVE TYPE	/	Direct
5. FAN CORRECT ROTATION	/	✓
6. FAN SPEED (R.P.M.)	/	/
7. VOLTAGE/PHASE	220/1/50	220/1/50
8. MOTOR POWER (KW)	0.6	0.6
9. MOTOR STARTER TYPE	/	DOL
10. MOTOR FULL LOAD CURRENT (A)	/	6.8A
11. MOTOR RUNNING CURRENT (A)	/	6.4 6.5 6.4
12. MOTOR SPEED (R.P.M.)	/	/
13. OVER LOAD SETTING AND RANGE	/	4.4-8A (8)
14. AIR VOLUME FLOW RATE (L/S)	1200	1280
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (mm)	/	/
17. MOTOR PULLEY DIAMETER (mm)	/	/
18. NO. OF BELTS, TYPE	/	/

TYPE OF INSTRUMENT : _____

TESTED BY KAUEGER NAME Lai Wai Tak SIGNATURE TAK

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 24/6/2024

PROJECT : CIC-Zero Carbon Building

LOCATION : B/E P.D Tank & Pump Room		SYSTEM/EQUIP. REF : SAF B 03
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP	-	O.K
22. OVERLOAD TRIPPING	-	O.K
23. FIRE TRIP		O.K

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lee Wai Tak SIGNATURE

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 20/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F P.D Tank & Pump Rm | SYSTEM/EQUIP. REF. : EAF – 5-03

ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Fisher DDM 10/10	Fisher DDM 10/10
2. FAN TYPE	In Line Duct	In Line Duct
3. FAN SIZE	✓	10"
4. FAN DRIVE TYPE	✓	Direct
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	✓	✓
7. VOLTAGE/PHASE	220/1/50	220/1/50
8. MOTOR POWER (KW)	0.6	0.6
9. MOTOR STARTER TYPE	✓	DOL
10. MOTOR FULL LOAD CURRENT (A)	✓	6.84
11. MOTOR RUNNING CURRENT (A)	✓	4.6 A
12. MOTOR SPEED (R.P.M.)	✓	✓
13. OVER LOAD SETTING AND RANGE	✓	8A (6)
14. AIR VOLUME FLOW RATE (L/S)	1200	1255
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (mm)	✓	✓
17. MOTOR PULLEY DIAMETER (mm)	✓	✓
18. NO. OF BELTS, TYPE	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 20/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/E D.D Tank & Pump ITEM R.M	SYSTEM/EQUIP. REF : EAF-B-03	
	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER		✓
20. FILTER CLOG TEST		✓
21. EMERGENCY STOP		O-K
22. OVERLOAD TRIPPING		O-K
23. FIRE TRIP		O-K

TYPE OF INSTRUMENT : _____

ESTED BY KRUEGER NAME Lal Chand Tak SIGNATURE TAK

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 20/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F clothes plant Rm SYSTEM/EQUIP. REF. : SAF-B-04

ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	ADH 280R	ADH 280R
2. FAN TYPE	Centrifugal	Centrifugal
3. FAN SIZE	/	ϕ 280 mm
4. FAN DRIVE TYPE	/	Belt Drive
5. FAN CORRECT ROTATION	/	✓
6. FAN SPEED (R.P.M.)	/	1244
7. VOLTAGE/PHASE	380/3/50	380/3/50
8. MOTOR POWER (KW)	2.2	2.2
9. MOTOR STARTER TYPE	/	DOL
10. MOTOR FULL LOAD CURRENT (A)	/	4.88
11. MOTOR RUNNING CURRENT (A)	/	2.2, 2.1, 2.1
12. MOTOR SPEED (R.P.M.)	/	1425
13. OVER LOAD SETTING AND RANGE	/	4-6A (4)
14. AIR VOLUME FLOW RATE (L/S)	1800	2080
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (mm) (Inch)	/	B2 4.5"
17. MOTOR PULLEY DIAMETER (mm) (Inch)	/	B2 4"
18. NO. OF BELTS, TYPE	/	2nos B48

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Ho Wai Tak SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

PROJECT : CIC-Zero Carbon Building

DATE : 2a/6/2012

LOCATION : B/F Chiller Plant Rm		SYSTEM/EQUIP. REF. : SAF-B-04
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER		✓
20. FILTER CLOG TEST		✓
21. EMERGENCY STOP		O.K
22. OVERLOAD TRIPPING		O.K
23. FIRE TRIP		O.K

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME LAI WAI LAK SIGNATURE

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

PROJECT : CIC-Zero Carbon Building

DATE : 20/6/202

ITEM	DESIGN	ACTUAL
LOCATION : B/E chiller plant Rm	SYSTEM/EQUIP. REF. :	FAF – B – 01
1. MAKE AND MODEL NO.	ADH 280R	ADH 280R
2. FAN TYPE	Centrifugal	Centrifugal
3. FAN SIZE		ø280 mm
4. FAN DRIVE TYPE	✓	Belt Drive
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	✓	1244
7. VOLTAGE/PHASE	380/3/50	380/3/50
8. MOTOR POWER (KW)	2.2	2.2
9. MOTOR STARTER TYPE	✓	DOL
10. MOTOR FULL LOAD CURRENT (A)	✓	4.88
11. MOTOR RUNNING CURRENT (A)	✓	3.2 3.1 3.1
12. MOTOR SPEED (R.P.M.)	✓	1425
13. OVER LOAD SETTING AND RANGE	✓	4 (4) (4)
14. AIR VOLUME FLOW RATE (L/S)	1800	1927
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (inch)	✓	B 4.5"
17. MOTOR PULLEY DIAMETER (inch)	✓	B2 4"
18. NO. OF BELTS, TYPE	✓	2 NOS B48

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Lok SIGNATURE _____

APPROVED BY QAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 29/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/E CHILLER PLANT ROOM	SYSTEM/EQUIP. REF. :	EAF-B-04
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP	-	O.K
22. OVERLOAD TRIPPING	-	O.K
23. FIRE TRIP		O.K

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME LAI WAI TAK SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN DATE : 26/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F L.V Switch Rm	SYSTEM/EQUIP. REF. : SAF-R-01	
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Gelec DDM 7/9	Gelec DDM 7/9
2. FAN TYPE	In Line Duct	In Line Duct
3. FAN SIZE	✓	7"
4. FAN DRIVE TYPE	✓	Direct
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	✓	✓
7. VOLTAGE/PHASE	220/1/50	220/1/50
8. MOTOR POWER (KW)	0.3	0.3
9. MOTOR STARTER TYPE	✓	DOL
10. MOTOR FULL LOAD CURRENT (A)	✓	3.4
11. MOTOR RUNNING CURRENT (A)	✓	2.4
12. MOTOR SPEED (R.P.M.)	✓	✓
13. OVER LOAD SETTING AND RANGE	✓	2.4 (4)
14. AIR VOLUME FLOW RATE (L/S)	600	612
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (mm)	✓	✓
17. MOTOR PULLEY DIAMETER (mm)	✓	✓
18. NO. OF BELTS, TYPE	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME LAU WAI TAK SIGNATURE TAK

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 2/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F L-V Switch Rm SYSTEM/EQUIP. REF. : SAF-B-01

ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	/
20. FILTER CLOG TEST	-	/
21. EMERGENCY STOP	-	OK
22. OVERLOAD TRIPPING	-	OK
23. FIRE TRIP		/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible]

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 23/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F Carpark R-M SYSTEM/EQUIP. REF. : EAF – B-06

ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Flat Woods	Flat Woods 1.5M/3PH 3P.
2. FAN TYPE	Axial	Axial
3. FAN SIZE	/	ϕ710mm
4. FAN DRIVE TYPE	/	Direct
5. FAN CORRECT ROTATION	/	✓
6. FAN SPEED (R.P.M.)	/	1440
7. VOLTAGE/PHASE	380/3/50	380/3/50
8. MOTOR POWER (KW)	1.5	1.5
9. MOTOR STARTER TYPE	/	DOL
10. MOTOR FULL LOAD CURRENT (A)	/	11.9
11. MOTOR RUNNING CURRENT (A)	/	T-1 6.9 T
12. MOTOR SPEED (R.P.M.)	/	1440
13. OVER LOAD SETTING AND RANGE	/	9-BA (13)
14. AIR VOLUME FLOW RATE (L/S)	4900	5304
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (mm)	/	/
17. MOTOR PULLEY DIAMETER (mm)	/	/
18. NO. OF BELTS, TYPE	/	/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Kwok Tak SIGNATURE TKL.

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 28/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F Genset Rm		SYSTEM/EQUIP. REF. : SAP B-SC
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	/
20. FILTER CLOG TEST	-	/
21. EMERGENCY STOP	-	O.K
22. OVERLOAD TRIPPING	-	O.K
23. FIRE TRIP		/

TYPE OF INSTRAUMENT : _____

TESTED BY KRUEGER NAME Lai Loh Tak SIGNATURE TAK

WITNESSED BY GAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 26/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/E workshop	SYSTEM/EQUIP. REF. : EAF-B-01	
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Gelec P25a/4	Gelec P25a/4-1
2. FAN TYPE	Propeller	Propeller
3. FAN SIZE	✓	4 25a
4. FAN DRIVE TYPE	✓	Direct
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	✓	✓
7. VOLTAGE/PHASE	230/1/50	230/1/50
8. MOTOR POWER (KW)	0.04	0.05
9. MOTOR STARTER TYPE	✓	DOL
10. MOTOR FULL LOAD CURRENT (A)	✓	0.23
11. MOTOR RUNNING CURRENT (A)	✓	0.20
12. MOTOR SPEED (R.P.M.)	✓	✓
13. OVER LOAD SETTING AND RANGE	✓	0.16 - 0.28 (0.28)
14. AIR VOLUME FLOW RATE (L/S)	100	100
15. FAN STATIC PRESSURE (Pa)	✓	✓
16. FAN PULLEY DIAMETER (mm)	✓	✓
17. MOTOR PULLEY DIAMETER (mm)	✓	✓
18. NO. OF BELTS, TYPE	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wah Tak SIGNATURE Tak

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 24/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F Workshop		SYSTEM/EQUIP. REF. : EAF-B-01
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	/
20. FILTER CLOG TEST	-	/
21. EMERGENCY STOP	-	O.K
22. OVERLOAD TRIPPING	-	O.K
23. FIRE TRIP		/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wah Tak SIGNATURE Tak

WITNESSED BY QAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN DATE : 20/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F Parking	SYSTEM/EQUIP. REF. : EAF-G-11	
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Gulec DXM 9/T	Gulec DXM 9/T
2. FAN TYPE	In Line Duct	In Line Duct
3. FAN SIZE	✓	9"
4. FAN DRIVE TYPE	✓	Diverse
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	✓	✓
7. VOLTAGE/PHASE	220/1/50	220/1/50
8. MOTOR POWER (KW)	0.12	0.12
9. MOTOR STARTER TYPE	✓	DOL
10. MOTOR FULL LOAD CURRENT (A)	✓	3.1
11. MOTOR RUNNING CURRENT (A)	✓	2.4
12. MOTOR SPEED (R.P.M.)	✓	✓
13. OVER LOAD SETTING AND RANGE	✓	2.4 - 4.1 (A)
14. AIR VOLUME FLOW RATE (L/S)	300	336
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (mm)	✓	✓
17. MOTOR PULLEY DIAMETER (mm)	✓	✓
18. NO. OF BELTS, TYPE	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Sik Tak SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

PROJECT : CIC-Zero Carbon Building

DATE : 28/6/2012

LOCATION : G/F Pantry	SYSTEM/EQUIP. REF. : SAF-G-11	
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	/
20. FILTER CLOG TEST	-	/
21. EMERGENCY STOP	-	O.K
22. OVERLOAD TRIPPING	-	O.K
23. FIRE TRIP		/

TYPE OF INSTRUMENT : _____

ESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible]

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

PROJECT : CIC-Zero Carbon Building

DATE : 20/6/2012

LOCATION : G/F Toilet & shaft	SYSTEM/EQUIP. REF. : EAF-G-12	
ITEM No.	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Selec DMA/t	Selec DMA/t
2. FAN TYPE	In Line Duct	In line Duct
3. FAN SIZE	/	T4
4. FAN DRIVE TYPE	/	Direct
5. FAN CORRECT ROTATION	/	✓
6. FAN SPEED (R.P.M.)	/	/
7. VOLTAGE/PHASE	220/1/50	220/1/50
8. MOTOR POWER (KW)	0.42	0.42
9. MOTOR STARTER TYPE	/	DOL
10. MOTOR FULL LOAD CURRENT (A)	/	3.5
11. MOTOR RUNNING CURRENT (A)	/	2.5 R
12. MOTOR SPEED (R.P.M.)	/	/
13. OVER LOAD SETTING AND RANGE	/	DH-9A (4)
14. AIR VOLUME FLOW RATE (L/S)	300	363
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (mm)	/	/
17. MOTOR PULLEY DIAMETER (mm)	/	/
18. NO. OF BELTS, TYPE	/	/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lft Wai Tak SIGNATURE _____

APPROVED BY GAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

PROJECT : CIC-Zero Carbon Building

DATE : 29/6/2012

LOCATION : G/F Toilet & Janitor	SYSTEM/EQUIP. REF. : GAF-G-1	
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER		✓
20. FILTER CLOG TEST		✓
21. EMERGENCY STOP		O.K
22. OVERLOAD TRIPPING		O.K
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Pak SIGNATURE _____

WITNESSED BY CAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F - E.S Control Room SYSTEM/EQUIP. REF. : EAF - G - 13

ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Fele PXT0/4H	Fele P 250/4-1
2. FAN TYPE	Propeller	Propeller
3. FAN SIZE	✓	ϕ 250
4. FAN DRIVE TYPE	✓	Direct
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	✓	✓
7. VOLTAGE/PHASE	220 / 1 / 50	230 / 1 / 50
8. MOTOR POWER (KW)	0.01	0.05
9. MOTOR STARTER TYPE	✓	DOL
10. MOTOR FULL LOAD CURRENT (A)	✓	0.23
11. MOTOR RUNNING CURRENT (A)	✓	0.22
12. MOTOR SPEED (R.P.M.)	✓	✓
13. OVER LOAD SETTING AND RANGE	✓	0.16 - 0.28 (0.28)
14. AIR VOLUME FLOW RATE (L/S)	100	121
15. FAN STATIC PRESSURE (Pa)	✓	✓
16. FAN PULLEY DIAMETER (mm)	✓	✓
17. MOTOR PULLEY DIAMETER (mm)	✓	✓
18. NO. OF BELTS, TYPE	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Cheuk Tak SIGNATURE Tak

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 26/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F FS Control Room		SYSTEM/EQUIP. REF. : EAF - G - 13
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP	-	O.K
22. OVERLOAD TRIPPING	-	O.K
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wa Tak SIGNATURE Tak

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 20/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F Electrical Room SYSTEM/EQUIP. REF. : EAF-G-14

ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Gelec pro 4/4	Gelec pro 4/4
2. FAN TYPE	Propeller	Propeller
3. FAN SIZE	/	ϕ 250
4. FAN DRIVE TYPE	/	Direct
5. FAN CORRECT ROTATION	/	✓
6. FAN SPEED (R.P.M.)	/	/
7. VOLTAGE/PHASE	230/1/50	230/1/50
8. MOTOR POWER (KW)	0.04	0.05
9. MOTOR STARTER TYPE	/	DOL
10. MOTOR FULL LOAD CURRENT (A)	/	0.33
11. MOTOR RUNNING CURRENT (A)	/	0.21
12. MOTOR SPEED (R.P.M.)	/	/
13. OVER LOAD SETTING AND RANGE	/	0.16~0.28 (0.28)
14. AIR VOLUME FLOW RATE (L/S)	100	130
15. FAN STATIC PRESSURE (Pa)	/	/
16. FAN PULLEY DIAMETER (mm)	/	/
17. MOTOR PULLEY DIAMETER (mm)	/	/
18. NO. OF BELTS, TYPE	/	/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 24/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : 6/F Guard Rm		SYSTEM/EQUIP. REF. : EAF-6-14
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	—
20. FILTER CLOG TEST	-	—
21. EMERGENCY STOP	-	O.K
22. OVERLOAD TRIPPING	-	O.K
23. FIRE TRIP		—

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 30/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : Cafe G/F Black Water		SYSTEM/EQUIP. REF. : EF-G-15
ITEM Toilet Exh.	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Osthberg Lasa	Osthberg Lasa
2. FAN TYPE	In Line Duct	In Line Duct
3. FAN SIZE	✓	ϕ200 mm
4. FAN DRIVE TYPE	✓	Direct
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	✓	924
7. VOLTAGE/PHASE	230/1/50	230/1/50
8. MOTOR POWER (KW)	0.11	0.11
9. MOTOR STARTER TYPE	✓	DOL
10. MOTOR FULL LOAD CURRENT (A)	✓	0.55
11. MOTOR RUNNING CURRENT (A)	✓	0.5
12. MOTOR SPEED (R.P.M.)	✓	924
13. OVER LOAD SETTING AND RANGE	✓	0.4-0.6 (0.6)
14. AIR VOLUME FLOW RATE (L/S)	100	130
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (mm)	✓	✓
17. MOTOR PULLEY DIAMETER (mm)	✓	✓
18. NO. OF BELTS, TYPE	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wah Tak SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 28/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : Cafe G/F Block 1 SYSTEM/EQUIP. REF. : EAF-G-15

ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP	-	O.K
22. OVERLOAD TRIPPING	-	O.K
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Ir Wai Tak SIGNATURE

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 26/6/202

PROJECT : CIC-Zero Carbon Building

LOCATION : Cafe G/F Irrigation Plant Room		SYSTEM/EQUIP. REF. : EAF-G-1C
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Ostberg RF R1dk/Ostberg RF R1D 004	
2. FAN TYPE	Centrifugal	Centrifugal
3. FAN SIZE	/	ϕ 160 mm
4. FAN DRIVE TYPE	/	Direct
5. FAN CORRECT ROTATION	/	✓
6. FAN SPEED (R.P.M.)	/	1366
7. VOLTAGE/PHASE	400 / 3 / 50	400 / 3 / 50
8. MOTOR POWER (KW)	0.27	0.27
9. MOTOR STARTER TYPE	/	DOL
10. MOTOR FULL LOAD CURRENT (A)	/	0.63
11. MOTOR RUNNING CURRENT (A)	/	0.6 0.6 0.61
12. MOTOR SPEED (R.P.M.)	/	1366
13. OVER LOAD SETTING AND RANGE	/	1-1.6 (1)
14. AIR VOLUME FLOW RATE (L/S)	100	130
15. FAN STATIC PRESSURE (Pa)	/	/
16. FAN PULLEY DIAMETER (mm)	/	/
17. MOTOR PULLEY DIAMETER (mm)	/	/
18. NO. OF BELTS, TYPE	/	/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wah Tak SIGNATURE TAK

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 2nd/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : Outside Ground Irrigation	ITEM Plant Room	SYSTEM/EQUIP. REF. : EAF-G-16 DESIGN	MEASUREMENT
FUNCTIONAL TEST			
19. DAMPER		-	✓
20. FILTER CLOG TEST		-	✓
21. EMERGENCY STOP		-	O.K
22. OVERLOAD TRIPPING		-	O.K
23. FIRE TRIP			

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Liz Cuaresma SIGNATURE

WITNESSED BY CAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 2/6/2022

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F Toilet, Shower		SYSTEM/EQUIP. REF. : EAF-G-17
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Gelec 200M T/T	Gelec 200M T/T
2. FAN TYPE	In Line Duct	In Line Duct
3. FAN SIZE	[redacted]	7"
4. FAN DRIVE TYPE	/	Direct
5. FAN CORRECT ROTATION	/	✓
6. FAN SPEED (R.P.M.)	/	/
7. VOLTAGE/PHASE	220/1/50	220/1/50
8. MOTOR POWER (KW)	0.3	[redacted] 0.3
9. MOTOR STARTER TYPE	/	DOL
10. MOTOR FULL LOAD CURRENT (A)	/	[redacted] 3.4
11. MOTOR RUNNING CURRENT (A)	/	[redacted] 1.9
12. MOTOR SPEED (R.P.M.)	/	/
13. OVER LOAD SETTING AND RANGE	/	2.4-4 (3)
14. AIR VOLUME FLOW RATE (L/S)	200	231
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (mm)	/	/
17. MOTOR PULLEY DIAMETER (mm)	/	/
18. NO. OF BELTS, TYPE	/	/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [redacted] SIGNATURE [redacted]

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 28/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F Toilet, shower		SYSTEM/EQUIP. REF. : SAF-G-01
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	.	✓
20. FILTER CLOG TEST	.	✓
21. EMERGENCY STOP	.	O.K
22. OVERLOAD TRIPPING	.	O.K
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lo Kah Tak SIGNATURE

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

DATE : 20/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : Cafe G/F Refuse Rm. SYSTEM/EQUIP. REF. : EVF-G-18

ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.	Ostberg LPK125	Ostberg LPK 125 B
2. FAN TYPE	In Line Duct	In Line Duct
3. FAN SIZE	✓	ϕ 125 mm
4. FAN DRIVE TYPE	✓	Direct
5. FAN CORRECT ROTATION	✓	✓
6. FAN SPEED (R.P.M.)	✓	1450
7. VOLTAGE/PHASE	230/1/50	230/1/50
8. MOTOR POWER (KW)	0.1	0.1
9. MOTOR STARTER TYPE	✓	Fuse Spur on/off switch
10. MOTOR FULL LOAD CURRENT (A)	✓	0.44
11. MOTOR RUNNING CURRENT (A)	✓	0.43
12. MOTOR SPEED (R.P.M.)	✓	1450
13. OVER LOAD SETTING AND RANGE	✓	✓
14. AIR VOLUME FLOW RATE (L/S)		
15. FAN STATIC PRESSURE (Pa)		
16. FAN PULLEY DIAMETER (mm)	✓	✓
17. MOTOR PULLEY DIAMETER (mm)	✓	✓
18. NO. OF BELTS, TYPE	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE _____

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for Ventilation Fan

VENTILATION FAN

PROJECT : CIC-Zero Carbon Building

DATE : 26/6/2012

LOCATION : Cafe GA Podium 2nd	SYSTEM/EQUIP. REF. : EAF-G-18	
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER		✓
20. FILTER CLOG TEST		✓
21. EMERGENCY STOP		O.K
22. OVERLOAD TRIPPING		✓
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Ishq Lutfi Tak SIGNATURE

WITNESSED BY GAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Form RLP/Site/req

Project	CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works	E&M Services
Contract No.	P1102/KL
Contractor	

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No. : RFIN – AC-034

To/ Attn : Mr. Patrick Lui

Date of Request :

Subject : MVAC INSTALLATION

Anticipated date of response :

Completed works for Inspection : Functional Test of AHU PAU

Locations : B/F

Referred Document : KEL/AC/L/001(B)

A/T/S/SS/Specifications

Next Activities / Works :

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

Project Manager
For and on behalf of Contractor's Name

Received by RLP/Date

Received by WK/Date

Received by WEC/Date

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken : 10.12.2012

Response / Comments :

Remarks :-

Replied by RLP/ Date

Replied by / Date

Replied by WEC/ Date

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

KSM/MWY/JYE

cc

KCS	w/o
WK	w/o
WEC	w/o
TLS	w/o

RECORD of Functional Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 9-7-2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU B-01 SYSTEM/EQUIP. REF. : AHU-B-01

ITEM	DESIGN	ACTUAL
1. AHU MODEL / TYPE	Solver	Solver A1-1170H-1050
2. FAN MAKE AND MODEL NO.	✓	NICOTRA A32 400 K
3. FAN SIZE	✓	ø400
4. FAN DRIVE TYPE	✓	Belt Drive
5. FAN AT FULL SPEED (r.p.m.)	1417	1620
6. MOTOR MADE & FRAME NO.	✓	TECO
7. MOTOR VOLTAGE (V) / PHASE / FREQUENCY (Hz)	380/3/50	380/3/50
8. MOTOR POWER (KW)	4 Kw	4 Kw
9. MOTOR FULL LOAD CURRENT (Amp)	✓	8.2A
10. MOTOR RUNNING CURRENT (Amp)	✓	6.8 6.9 7.0 A.
11. MOTOR OVERLOAD SETTING & RANGE	✓	T-10A / 9-1A
12. MOTOR SPEED (r.p.m.)	1440	1448
13. STARTER TYPE	✓	DOL & VSD
14. BELT SIZE, NUMBER, TYPE	✓	Spz 1327 X3 NO.S
15. MOTOR & FAN PULLEY DIAMETER (Dia.)	✓	Spz 180 Spz2 160
16. SUPPLY AIR VOLUME FLOW RATE (m^3/s)	1.35	1.373
17. FRESH AIR FLOW RATE (m^3/s)	0.15	0.15

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME LAU WK IP&C SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Function Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 9-7-2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU Rm		SYSTEM/EQUIP. REF. : AHU-B-01
ITEM	DESIGN	ACTUAL
18. RETURN AIR VOLUME FLOW RATE (m^3/s)	1.2	1.223
19. FAN STATIC PRESSURE (Pa)	1319	1285
20. AHU EXTERNAL STATIC PRESSURE (Pa)	/	
21. AIR PRESSURE DROP ACROSS COIL (Pa)	/	
22. AIR PRESSURE DROP ACROSS FILTER	/	
23. WATER FLOW RATE (L/S)	0.61	0.615 } diversity factor 0.8
24. WATER PRESSURE DROP (Kpa)	31.41	32
25. INLET AIR TEMPERATURE (DB/WB) C	25.5	25
26. OUTLET AIR TEMPERATURE (DB/WB) C	18	18
27. WATER INLET TEMPERATURE (C)	11	10
28. WATER OUTLET TEMPERATURE (C)	16	15
29. TYPE OF CONTROL VALVE	/	Modulating
30. FILTER TYPE (PRE/BAG FILTER)	/	Pre & Bag filter

FUNCTION TEST		STATUS
31. THERMOSTAT		O.K
32. CONTROL VALVE		O.K
33. EMERGENCY STOP		O.K
34. FILTER CLOG		O.K
35. OVERLOAD TRIPPING		O.K
36. DELAY OFF		/
37. SOUND PRESSURE LEVEL (dBA)		/
38. CHANGEOVER USD, change DCL (starter)		O.K

REMARKS : Spare

TESTED BY KRUEGER NAME Lee Wai Tak SIGNATURE

WITNESSED BY OAP NAME SIGNATURE

WITNESSED BY ( ) NAME SIGNATURE

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Total Flow Test Sheet

Location: B/E AHU Room Plant Ref.: AHU-B-01

Drawing No.: KEL/AE/L/001 Service: E/A Permanent Exhibition

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
RAD	1.35	600 x 400	0.2	6.8
Inlet Static (Pa) /	Outlet Static (Pa) /			

6.9	6.8	6.7								
6.7	7.2	7.2								
7	6.4	6.9								

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
61.8	6.86	1.373	102	/

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	[illegible]				
Signature	[illegible]				
Date	9/7/2012				

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Total Flow Test Sheet

Location: B/F AHU Room Plant Ref.: AHU-B-01

Drawing No.: KEL/AC/L/001 Service: E/P Permanent Exhibition.

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
PAD	0.15	200 x 200	0.04	3.8
Inlet Static (Pa) ✓	Outlet Static (Pa) ✓			

3.7	3.6									
3.9	3.8									

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
15	3.8	150	100	✓

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	[illegible]				
Signature	[illegible]				
Date	9/4/2018				

SAIVER
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DATA SHEET

31/08/2011 28/11/2011 P 1 / 5 31195053

Project: CIC Zero Carbon Bldg-AHU

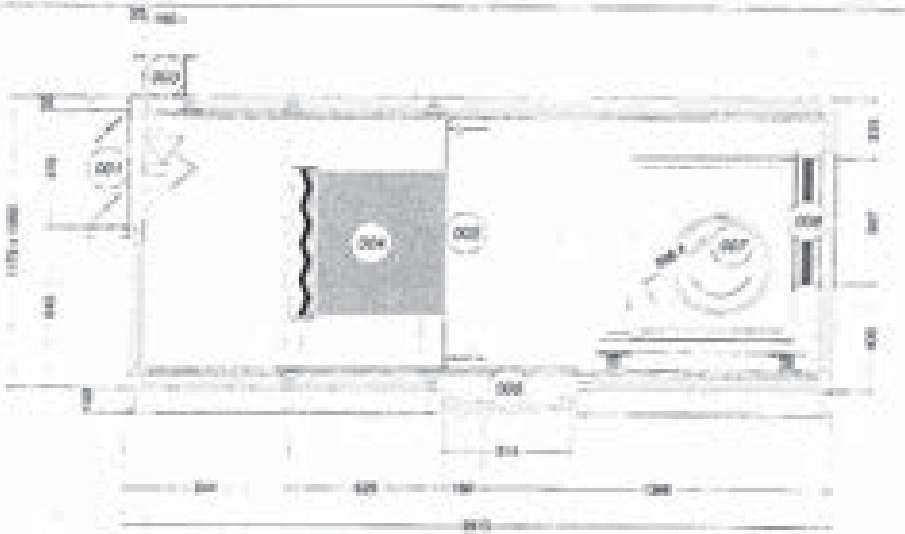
Type: A1-1170H-1050W

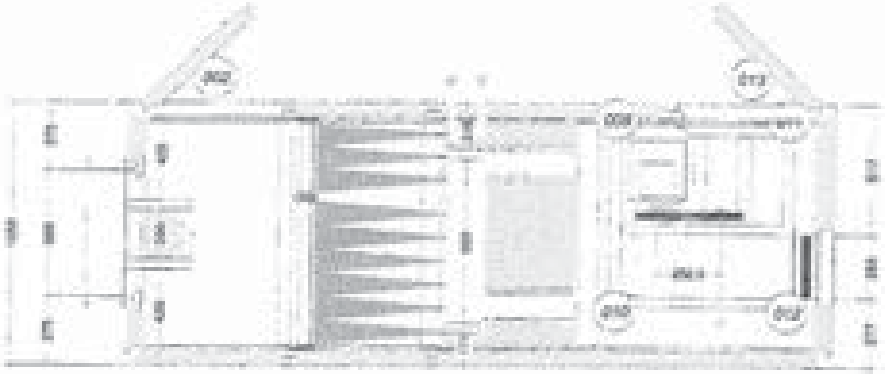
Ref: AHU-B-01

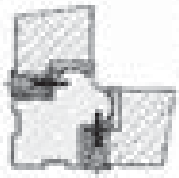
Flow: 1.35 m3/s

01 IN DAMPER: 475 x 800 mm 02 IN DAMPER: 150 x 250 mm 04 SHUT 05 Pre-filter (G-EN779:2002) 0.8Pa Cycle

07 HEATER : 14.00 KPa 4.00 KW







PANELS / FRAME

PART CODE		PU60SSTS
Insulation		PUFOAM
External sheet	CB1-08	Preplasticized steel sheet 0.8 mm - BLU B1
Internal sheet	CA45A08	Preplasticized steel sheet 0.8 mm - WHITE A45A
ALUMINIUM FRAME		PR55TT
FEET		C100

Break out Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
70.5	68	75	65	58	51	40	35

Mixin Box Mechanical characteristics (EN1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP (W/l/s)

NOTE :

OPERATING CONDITIONS

UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
0.0 °C @ 80 %	33.1 °C @ 80 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
V1 (1.35 m/s)	V1 (1.39 m/s)

Total weight: 509 kg

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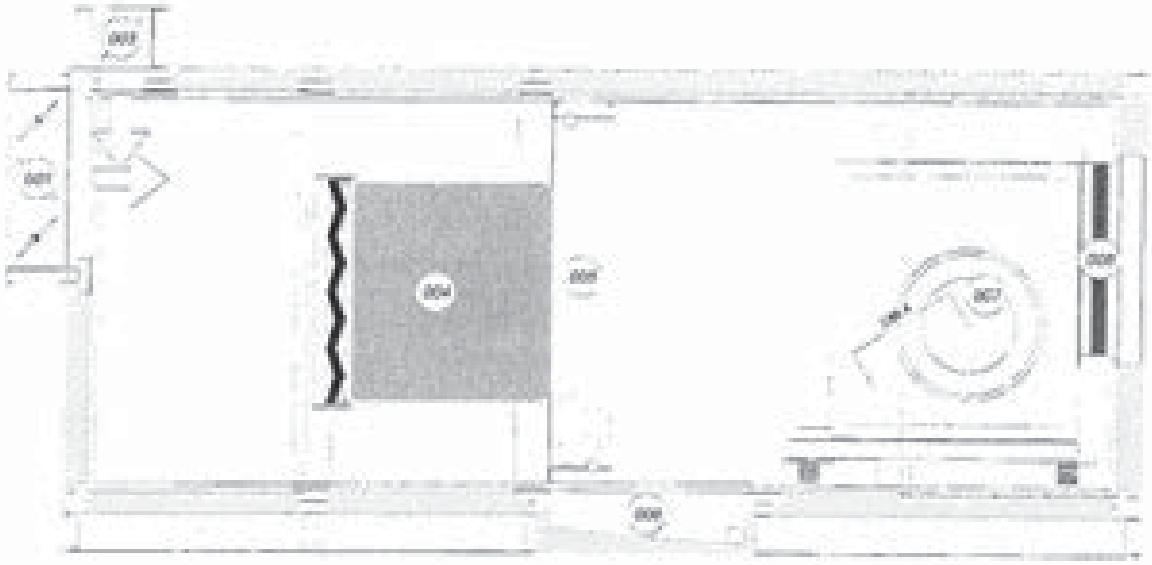
SOUND DATA

31/08/2011 26/10/2011 P 3/ 5 31155039

Project: CIC Zero Carbon Bldg-AHU — Type: A1-1170H-1050W

For: AHU-B-01 — Flow: 1.35 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	93	91	82	73	69	60	56	85.2
004	G3+F7	-3	-6	-7	-10	-11	-16	-14	
005	P40-16AB 3K-23T-650A-2.00m Cu/Al	-3	-2	-2	-3	-3	-3	-3	
007	ASZ400K - 1416 RPM - 4.00 kW	98	97	91	85	83	77	73	93.2
	OUTLET	98	97	91	85	83	77	73	93.2

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
88	75	65	58	51	40	35	73.5

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DATA SHEET

31/08/2011	28/10/2011	P.S./ 5	31165033	

Project: CIC Zero Carbon Bldg-AHU

Mark: A1-117084-1050W

Act: AHU-B-01

Flow: 1.35 m3/s

COOLING COIL

Flow	Qty	Model			
1.35 m3/s	1	P/40-16AR 3R-2ST-6SGA-2.0Pa Cu/Al [6 rr]	11.76 dm3	94.46 m2	1.225 kg/m3

Air side	Dt	wb	UR	Tower load	Sensible load	air vel.	Pressure drop
In	35.50 °C	18.20 °C		1x13.7 kW	1x12.7 kW	2.26 m/s	53 Pa
Out	18.00 °C		78.50 %				

WATER	temp.	Water flow	Water P.D	Water vel.	Connection size
In	11.00 °C	1 x 0.61 l/s	31.41 kPa	1.05 m/s	1"
Out	16.00 °C				1"

NC	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
9	Al@0.15mm	Cu@0.40mm	Copper	Galvanized steel	NO	NO

DRAIN PAN

Material: C304-12

Depth: 48.00 mm

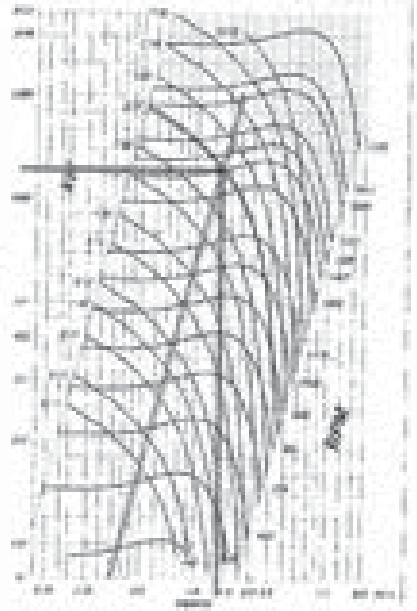
SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
Model: 1 x AS7400K	Qty & motor model: 1xD112M-4P-40KW	Fan pulley: 180SPZ2+8U2001235	Belt drive
Flow: 1 x 1.35 m3/s	SI2-D112M-4P-40KW	Motor pulley: 180SPZ2+8U2001228	2 belts x 1
Fan outlet vel.: 10.42 m/s	Nominal motor power: 4.00 kW	Belts: 2 x SPZ1162	
Fan static: 850 Pa	Motor RPM: 1420(400V/3/50)		
Min. LP.S: 246 Pa	Motor efficiency: 84.50 %		
Max LP.S: 492 Pa	In: 8.60 Amp		
Avg. LP.S: 369 Pa	Ip/In: 7.00		
Avg. VP.S: 369 Pa	Power factor: 0.80		
Total static pressure: 1219 Pa	Start Power factor: 0.59		
RPM: 1417 rpm	Nominal torque: 27.00 Nm		
Efficiency: 59.74 %	Locked rotor torque T1/Tn: 2.80		
Shaft power@ 50 Hz: 1 x 2.91 kW	Maximum torque Tmax/Tn: 3.00		

		-5%	-2.5%	100%	+2.5	+5%
Air volume	l/s	0.000	0.000	1.353	0.000	0.000
Total static pressure	Pa	0	0	1219	0	0
Shaft power	kW	0.000	0.000	2.910	0.000	0.000
Electrical Power Input	kW	0.000	0.000	3.995	0.000	0.000
				2.151		
				2.953		

In duct sound power, dB

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
93.2	98	97	91	85	83	77	73



Vibration monitoring (sensor/vibration cable/BNC terminator box): NO

Fan type plate: BV-3 ISO 9364 2003 3.5 meets AMCA filter in @ rot. freq.

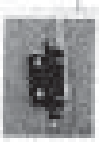
Spring Deflection: 20 mm

Bearing life: 20000 HRS

ACCESS DOOR

Dimensions: 1060 x 575 mm

Handles + Hinges



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DATA SHEET

31/08/2011	28/11/2011	P.4 / 5	31165553

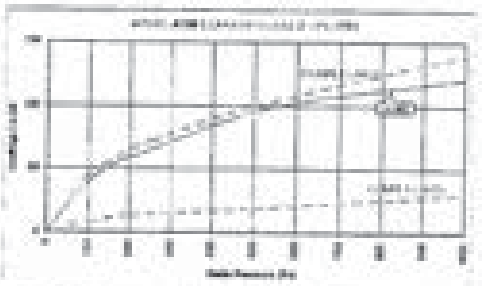
Project: CIC Zero Carbon Bldg-AHU — Model: A1-1170H-1050W

Tag: AHU-B-01 — Flow: 1.35 m3/s

001 RETURN AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
1.20 m3/s	470 x 500 mm	A150	5.11 m/s	16 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



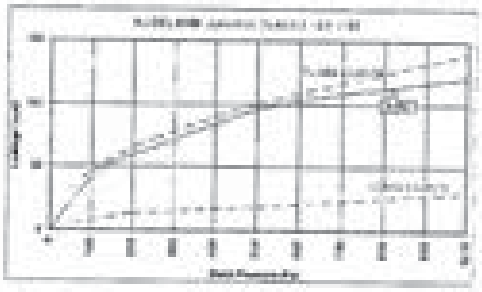
002 ACCESS DOOR

Dimensions: 1050 x 569 mm — Handles + Hinges


003 FRESH AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.15 m3/s	160 x 200 mm	A150	4.69 m/s	13 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



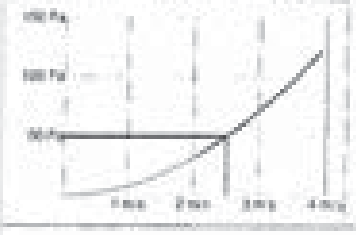
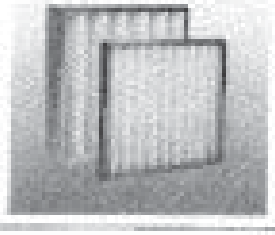
004 FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	1.35 m3/s	G3	PANEL	MCF 48	1	1	48 mm
2	1.35 m3/s	F7	BAG	BSP 535-8	1	1	535 mm

Frame: Galvanized Steel

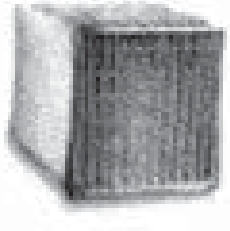
1

Clean	Dirty	Δ p
49 Pa	150 Pa	99 Pa

2

Clean	Dirty	Δ p
104 Pa	250 Pa	177 Pa

ACCESSORIES

www.saver.com

SOUND DATA

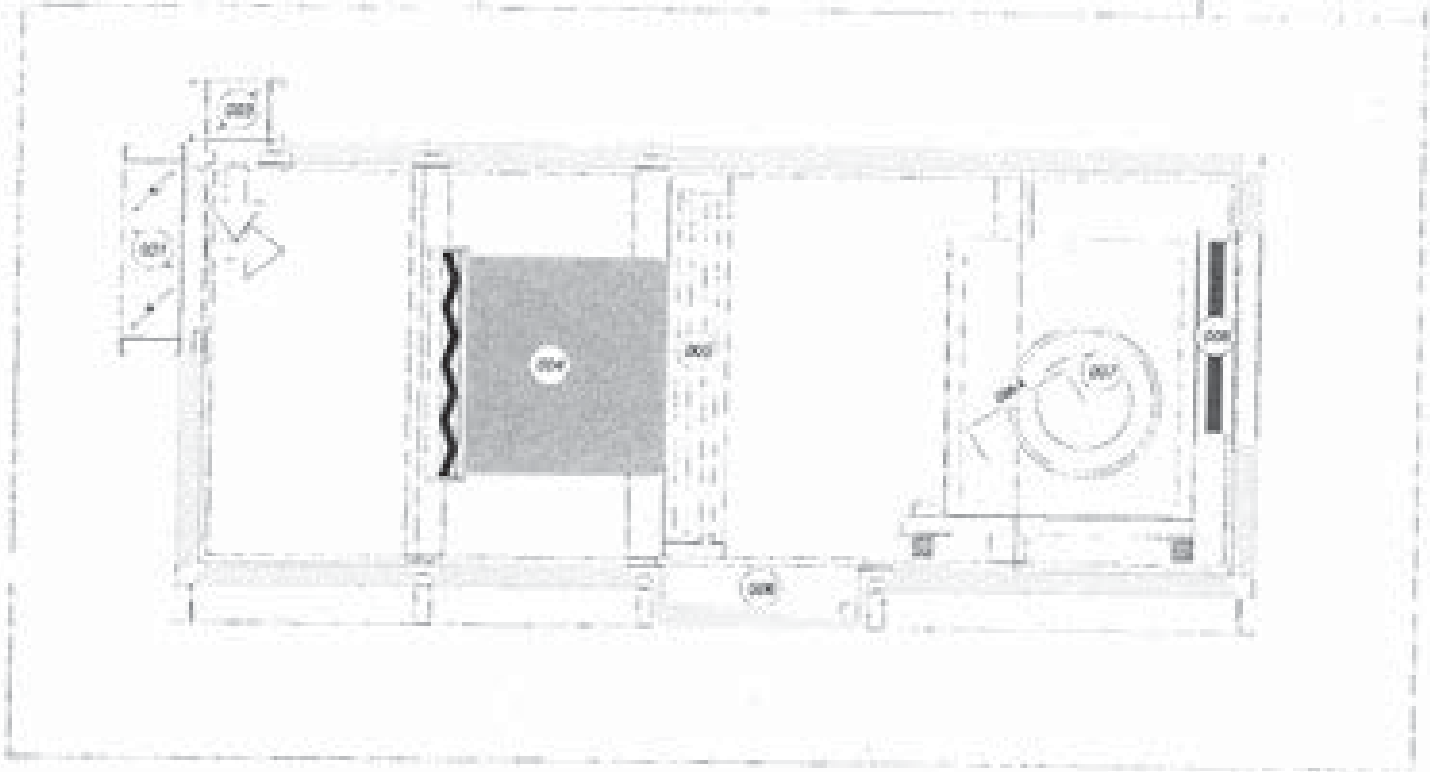
31/08/2011	28/11/2011	P 3/ 5	31/30039	

Project: CIC Zero Carbon Bldg-AHU

Model: A1-11704-1050W

Tag: AHU-B-01

Flow: 1.35 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	93	91	82	73	69	60	56	85.2
004	G3+F7	-3	-4	-7	-10	-11	-14	-24	
005	F40-16AR 38-231-6566-2.6Pa Cw/Al	-2	-2	-2	-2	-3	-3	-3	
007	AS2400K - 1416 RPM - 4.00 kW	98	97	91	85	83	77	73	93.2
	OUTLET	98	97	91	85	83	77	73	93.2

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
88	75	65	58	51	40	35	73.5

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DATA SHEET

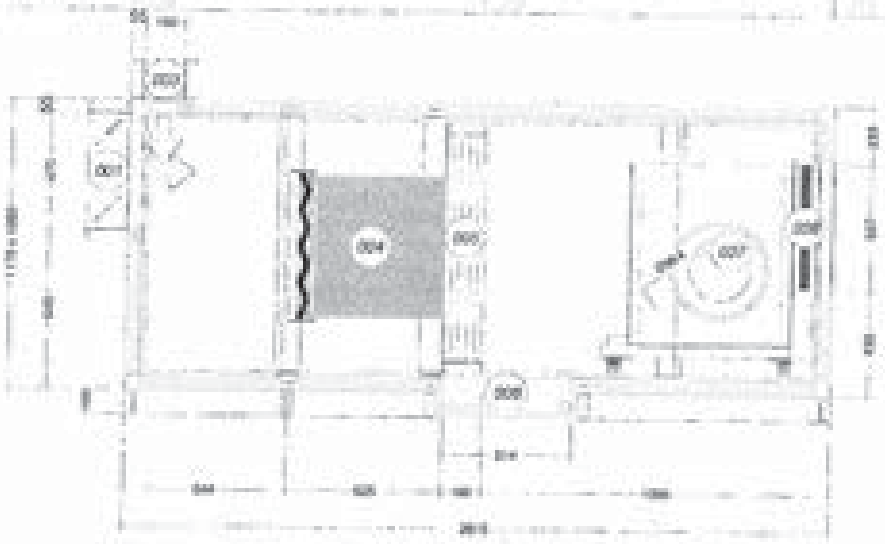
31/08/2011	26/11/2011	F 1 / 5	31185/03	

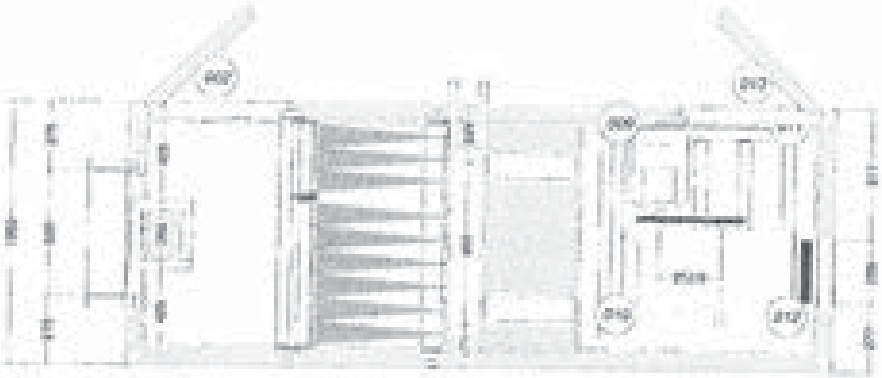
Project: CIC Zero Carbon Bldg-AHU

Order: A1-11704-1050W

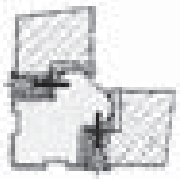
Ref.: AHU-B-01

Flow: 1.35 m3/s





PANELS / FRAME



PART CODE	PU60/57B	
Insulation	PUF-GMF	
External sheet	CD1--08	Prepainted steel sheet 0.8 mm - BLU B1
Internal sheet	CA40A08	Prepainted steel sheet 0.8 mm - WHITE A40A
ALUMINIUM FRAME	PRSSIT	
FEET	C100	

Break out Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
73.5	88	75	65	58	51	40	35

Model Box Mechanical characteristics (EN1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP (W/l/s)

OPERATING CONDITIONS

UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 80 %	35.0 °C @ 50 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
V1 (1.39 m/s)	V1 (1.39 m/s)

NOTE :

509 kg

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DATA SHEET

31/08/2011	28/11/2011	P.e.r. 0	31165033

Project: CIC Zero Carbon Bldg-AHU

Model: A1-1170H-1050W

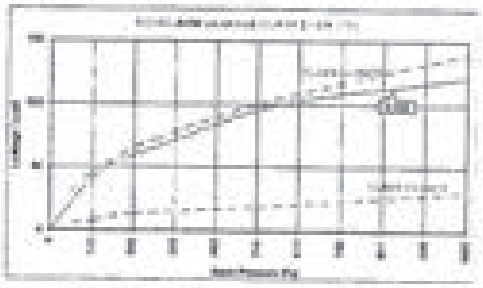
Tag: AHU-B-01

Flow: 1.35 m3/s

001 RETURN AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
1.35 m3/s	470 x 900 mm	A160	5.11 m/s	16 Pa

Damper	Flexible connection	Louvre	Mosquito
Yes	NO	No	NO



002 ACCESS DOOR

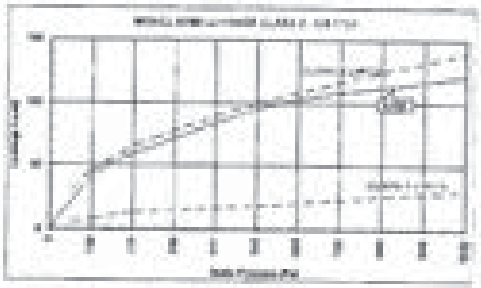
Dimensions: 1050 x 569 mm

Handles + Hinges

003 FRESH AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.15 m3/s	160 x 355 mm	A160	4.60 m/s	13 Pa

Damper	Flexible connection	Louvre	Mosquito
Yes	No	No	NO



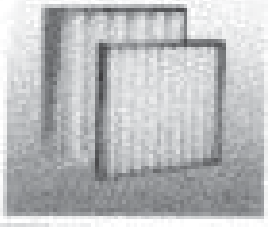
004 FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	1.35 m3/s	G3	PANEL	MC2-48	1	1	48 mm
2	1.35 m3/s	F7	BAG	BSF-535-8	1	1	535 mm

Frame: Galvanised Steel

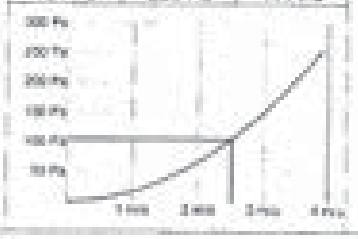
1

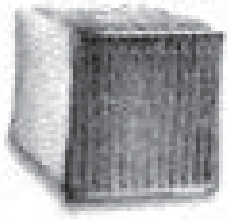
Clean	Dirty	Avg
49 Pa	150 Pa	99 Pa



2

Clean	Dirty	Avg
104 Pa	250 Pa	177 Pa





ACCESSORIES

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COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV =ISO 9001:2000=
WWW.SAIVER.COM

DATA SHEET

31/08/2011	28/11/2011	P 5/ 5	31195353

Project: CIC Zero Carbon Bldg-AHU
Model: A1-1170H-1050W
Tag: AHU-B-01
Flow: 1.35 m3/s

COOLING COIL

Flow	Qty	Model				
1.35 m3/s	1	P40-16AR 3R-2ST-650A-2.0Pa CuAl [0 mt]	11.76 dm3	34.46 m2	Air dens. 1.225 kg/m3	

Air side	Unit	MIN	MAX	Tube Inlet	Sensible load	Air vel.	Pressure Drop
In	25.50 °C	18.20 °C		1x12.7 kW	1x12.7 kW	2.26 m/s	63 Pa
Out	18.00 °C		79.50 %				

WATER	Units	Water flow	Water P.D.	Water vel.		Connection size
In	11.00 °C	1 x 0.61 l/s	31.41 kPa	1.00 m/s		1"
Out	16.00 °C					1"

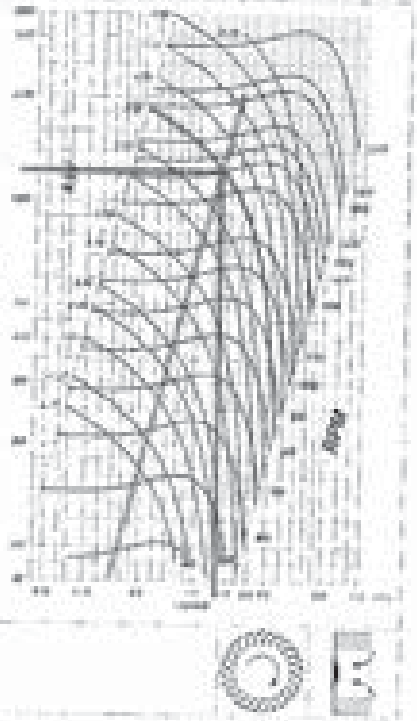
NC	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
3	Al @2.13mm	Cu@0.40mm	Copper	Galvanised steel	NO	NO

DRAIN PAN

Material: C304-1.2
Drain size: 40.00 mm

SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
Model: 1 x AS2400K	Qty & Poles/ model: 1xD112M-4P-4kW	Fan pulley: 180SPZ2+8U2012/35	Belt drive
Flow: 1 x 1.35 m3/s	S92-D112M-4P-4KW	Motor pulley: 180SPZ2+8U2012/28	Belts = 1
Fan outlet vel.: 10.42 m/s	Nominal motor power: 4.00 kW	Belts: 2 x SPZ1162	
Est. static: 850 Pa	Motor Duty: 14.20(400V/3/50)		
Min. LP.D: 248 Pa	Motor efficiency: 88.30 %		
Max. LP.D: 492 Pa	In: 8.50 Amp		
Avg. LP.D: 369 Pa	Ia/In: 7.00		
Avg. LP.D: 369 Pa	Power factor: 0.80		
Total static pressure: 1219 Pa	Start Power factor: 0.59		
RPM: 1417 rpm	Nominal torque: 27.00 Nm		
Efficiency: 59.74 %	Locked rotor torque Ta/In: 2.80		
Shaft power(s kW): 1 x 2.91 kW	Maximum torque Tmax/Tn: 3.00		



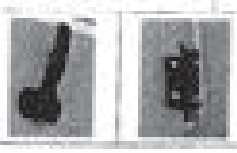
		-5%	-2.5%	100%	+2.5	+5%
Air volume	m3 s	0.000	0.000	1.353	0.000	0.000
Total static pressure	Pa	0	0	1219	0	0
Shaft power	kW	0.000	0.000	2.910	0.000	0.000
Electrical Power Input	kW	0.000	0.000	3.995	0.000	0.000
				2.151		
				2.953		

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
93.2	98	97	91	85	80	77	73

Vibration level (using centrifugal fan with DHC termination box): NO
V-belt class: 8V-2 (ISO1604:2002) 3.5 mm/s RMS Risk in @ std. temp
Spring Deflection: 25 mm
Bearing life: 25000 HRS

ACCESS DOOR

Dimensions: 1060 x 570 mm
Handles + Hinges



RECORD of Functional Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 9-7-2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU Rm		SYSTEM/EQUIP. REF. AHU-B-02
ITEM	DESIGN	ACTUAL
1. AHU MODEL / TYPE	Salwex	Salwex AH-1010H-1050
2. FAN MAKE AND MODEL NO.	/	NICOTRA ABZ-355
3. FAN SIZE	/	355
4. FAN DRIVE TYPE	/	Belt Drive
5. FAN AT FULL SPEED (r.p.m.)	1428	1788
6. MOTOR MADE & FRAME NO.	/	TECO
7. MOTOR VOLTAGE (V) / PHASE / FREQUENCY (Hz)	380/3/50	380/3/50
8. MOTOR POWER (KW)	3 Kw	3 Kw
9. MOTOR FULL LOAD CURRENT (Amp)	/	6.64A
10. MOTOR RUNNING CURRENT (Amp)	/	4.9 5.0 5.1
11. MOTOR OVERLOAD SETTING & RANGE	/	4.4-8A, 7-3A
12. MOTOR SPEED (r.p.m.)	1430	1430
13. STARTER TYPE	/	DOL & VSD
14. BELT SIZE, NUMBER, TYPE	/	Spz 1100 X2 No.s
15. MOTOR & FAN PULLEY DIAMETER (mm)	/	Spz 140 Spz 112
16. SUPPLY AIR VOLUME FLOW RATE (m^3/s)	1.19	1.217
17. FRESH AIR FLOW RATE (m^3/s)	0.2	0.203

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Ho Wai Tak SIGNATURE Tak

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Function Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 9-7-2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU Room		SYSTEM/EQUIP. REF. : AHU-B-02
ITEM	DESIGN	ACTUAL
18. RETURN AIR VOLUME FLOW RATE (m^3/s)	0.99	1.014
19. FAN STATIC PRESSURE (Pa)	1035	1042
20. AHU EXTERNAL STATIC PRESSURE (Pa)	/	
21. AIR PRESSURE DROP ACROSS COIL (Pa)	/	
22. AIR PRESSURE DROP ACROSS FILTER	/	
23. WATER FLOW RATE (L/S)	0.53	0.43 Flowmeter 0-1
24. WATER PRESSURE DROP (Kpa)	21.67	33
25. INLET AIR TEMPERATURE (DB/WB) C	25.5	25
26. OUTLET AIR TEMPERATURE (DB/WB) C	18	18
27. WATER INLET TEMPERATURE (C)	11	10-K
28. WATER OUTLET TEMPERATURE (C)	16	15.5
29. TYPE OF CONTROL VALVE		Modulating
30. FILTER TYPE (PRE/BAG FILTER)		Pre & Bag filter

FUNCTION TEST		STATUS
31. THERMOSTAT		
32. CONTROL VALVE		
33. EMERGENCY STOP		O.K
34. FILTER CLOG		O.K
35. OVERLOAD TRIPPING		O.K
36. DELAY OFF		/
37. SOUND PRESSURE LEVEL (dBA)		/
38. CHANGEOVER VSD fault change to 1 (starter)		O.K

REMARKS :

TESTED BY KRUEGER NAME LAI WAI TENG SIGNATURE TENG

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Total Flow Test Sheet

Location: B/F Ahu Room Plant Ref.: AHU-B-02

Drawing No.: KEL/AE/L/001 Service: G/F office & Manager Rm.

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
RAD	1.19	400x500	0.2	6
Inlet Static (Pa) ✓	Outlet Static (Pa) ✓			

5.8	5.7	5.6								
6.1	5.9	6.2								
6.4	6.6	6.5								

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
54.5	6.05	1217	102	✓

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	LAU WAI TAK				
Signature	TAK				
Date	9/5/2012				

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Total Flow Test Sheet

Location: B/F AHU Room. Plant Ref.: AHU-B-02

Drawing No.: KEL/AC/1/001 Service S/F office & Manager Room

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
PAD	0.2	200 x 250	0.05	4
Inlet Static (Pa) ✓	Outlet Static (Pa) ✓			

3.7	3.9									
4.5	4.2									

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
16.3	4.075	203	102	✓

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	LAI WAI KIT				
Signature					
Date	9/7/2012				

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DATA SHEET

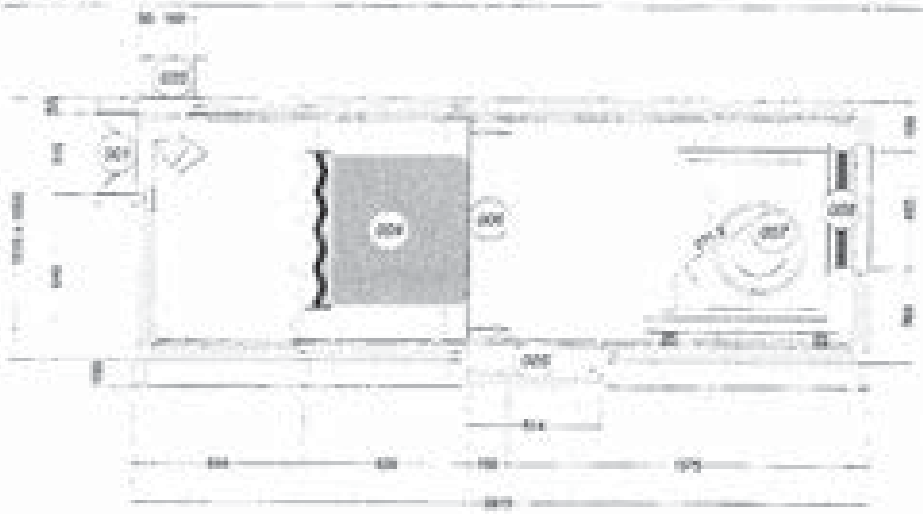
31/08/2011 28/11/2011 P 1 / 5 31195034

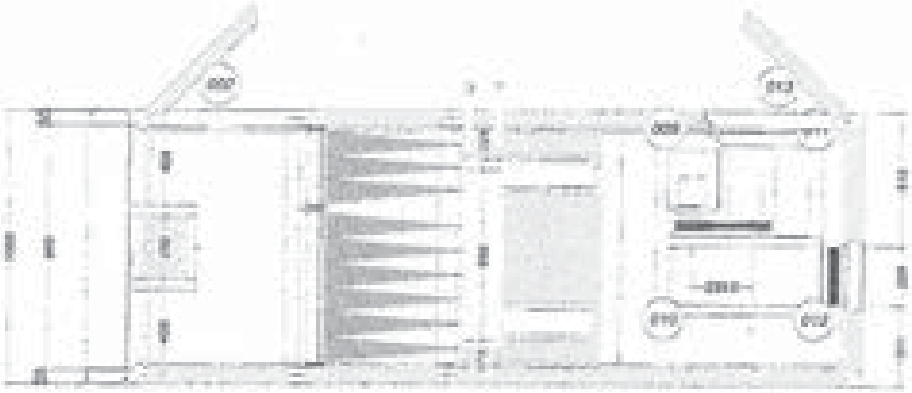
Project: CIC Zero Carbon Bldg AHU — Type: A1-1010H-1050W

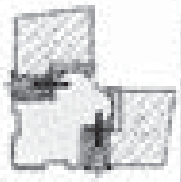
No: AHU-B-02 — Flow: 1.19 m3/s

01 [illegible] 02 [illegible] 04 [illegible] 05 [illegible]

07 [illegible]







PANELS / FRAME

PART CODE		PUI505TB
Insulation		PUFOAM
External sheet	CB1--08	Prepainticoted steel sheet 0.6 mm - BLU 51
Internal sheet	CA45A08	Prepainticoted steel sheet 0.6 mm - WHITE A45A
ALUMINIUM FRAME		PRSSTT
FELT		C150

NOTE :

Total weight: 457 kg

Break out Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
71.5	86	79	83	56	49	38	33

Model Size Mechanical characteristics (EN1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP (W/l/s)

OPERATING CONDITIONS

LAV&/OMN LAM&/OMN	latitude	Unit&/OMN
	longitude	Unit&/OMN
	elevation	Unit&/OMN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 80 %	35.0 °C @ 40 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
V1 (1.44 m/s)	V1 (1.44 m/s)

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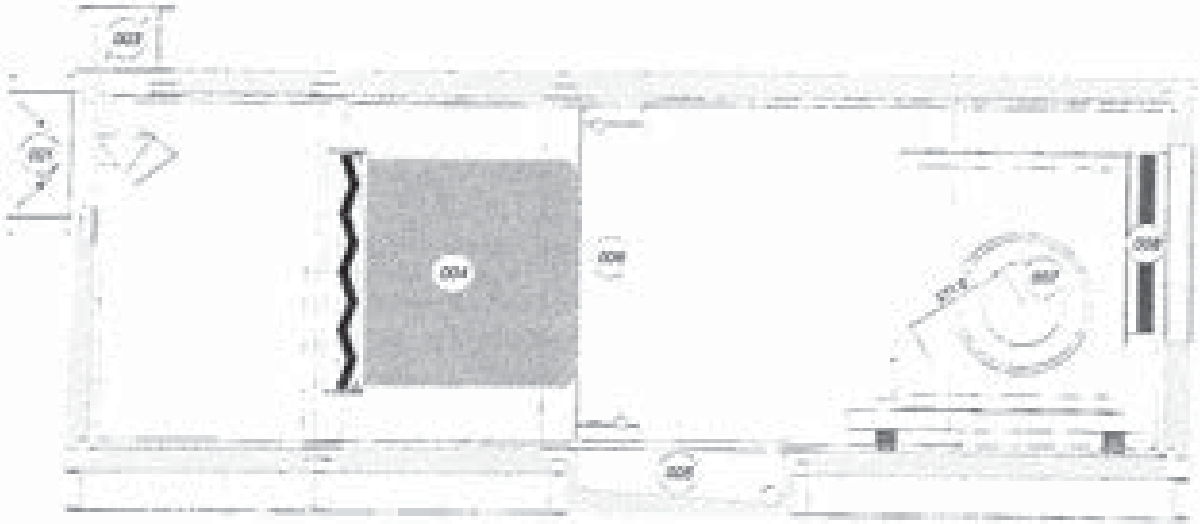
SOUND DATA

31/08/2011	28/10/2011	P.1/ 5	31/8/2011	
Project	CIC Zero Carbon Bldg-AHU		Type	A1-1010H-1050W
No	AHU-B-02		Flow	1.19 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	91	89	80	71	67	58	54	83.2
004	G3+F7	-3	-6	-7	-10	-11	-14	-14	
008	P40-16AR 3R-195-610A-2.0Pa Cu/Al	-2	-2	-2	-2	-3	-3	-3	
007	ASZ355K - 1420 RPM - 3.00 kW	96	95	89	83	81	75	71	91.2
	OUTLET	96	95	89	83	81	75	71	91.2

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
86	73	63	56	49	38	33	71.5

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COMPANY WITH QUALITY SYSTEM CERTIFIED BY SMQ N°ISO 9001/2008

DATA SHEET

31/08/2011 29/11/2011 P 4/ 5 311850s

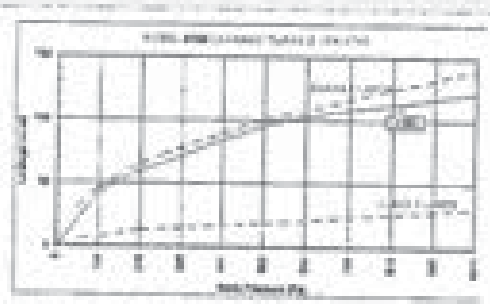
Project: CIC Zero Carbon Bldg-AHU — Model: A1-1010H-1050W

Ref: AHU-B-02 — Flow: 1.19 m3/s

001 RETURN AIR DAMPER

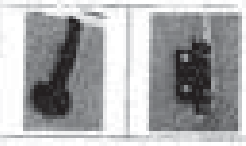
Flow	Dimensions	Size	Air vel.	Pressure drop
0.99 m3/s	315 x 940 mm	A100	3.34 m/s	6 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



002 ACCESS DOOR

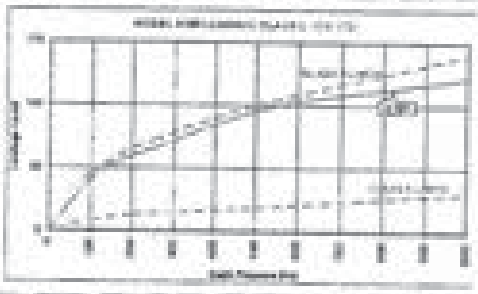
Dimensions: 900 x 559 mm — Handles + Hinges



003 FRESH AIR DAMPER

Flow	Dimensions	Size	Air vel.	Pressure drop
0.20 m3/s	160 x 250 mm	A100	5.00 m/s	15 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



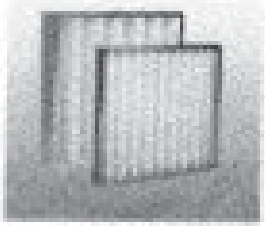
004 FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	1.19 m3/s	G3	PANEL	MCZ-48	1	1	48 mm
2	1.19 m3/s	F7	BAG	BSP-535-8	1	1	535 mm

Frame: Galvanised Steel

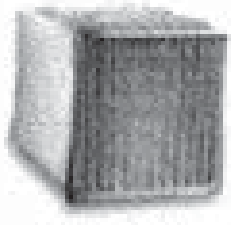
1

Clean: 38 Pa — Five: 150 Pa — Avg: 94 Pa



2

Clean: 61 Pa — Five: 250 Pa — Avg: 155 Pa



ACCESSORIES

005 DRAIN PAN

Material: C304-12 — Drain pan: 48.00 mm

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DATA SHEET

31/08/2021 28/10/2021 P.1 / 1 31/05/2021

Project: CIC Zero Carbon Bldg AHU — Code: A1-1010H-1050W

Tag: AHU-B-02 — Flow: 1.19 m3/s

COOLING COIL

Flow	Qty	Model				
1.19 m3/s	1	P60-16AR 3R-19T-650A-2.0Pa CuAl [0 mi]	9.74 dm3	44.99 m2	Air Density	1.225 kg/m3

Air side	Ht	Wt	Ut	Total load	Sensible load	Air vel.	Pressure drop
In	25.50 °C	18.20 °C		1x11.2 kW	1x11.2 kW	2.41 m/s	70 Pa
Out	18.00 °C		78.50 %				

WATER	temp.	Water flow	Water P.D.	Water vel.	Connections
In	11.00 °C	1 x 0.53 l/s	21.67 kPa	0.92 m/s	1"
Out	16.00 °C				1"

NO	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
3	Al@1.15mm	Cu@0.40mm	Copper	Galvanised steel	NO	NO

SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
Model: 1 x AGZ050K	Qty & motor model: 1xD100LB-4P-3KW	Fan pulley: 1403PA2+8U201235	Belt drive
Flow: 1 x 1.19 m3/s	SI2-D100LB-4P-3KW	Motor pulley: 1405PA3+8U201226	Inverter
Fan outlet vel.: 11.47 m/s	Nominal motor power: 3.00 kW	Belts: 2 x SPA982	
Calc. fan s.p.: 885 Pa	Motor RPM: 1450(460V/3/60)		
Nom. fan s.p.: 210 Pa	Motor efficiency: 87.40 %		
Max. fan s.p.: 491 Pa	Amps: 6.48 Amp		
Avg. fan s.p.: 350 Pa	Pulley: 5.50		
Req. fan s.p.: 350 Pa	Power factor: 0.81		
Total static pressure: 1035 Pa	Start Power factor:		
RPM: 1428 rpm	Nominal torque: 20.00 Nm		
Efficiency: 58.52 %	Locked rotor torque %/Tn: 2.50		
Shaft power(kW): 1 x 2.27 kW	Max run torque %/Tn: 2.90		

		0%	-0.5%	100%	+0%	+0%
Air volume	m3/s	0.000	0.000	1.190	0.000	0.000
Total static pressure	Pa	0	0	1035	0	0
Shaft power	kW	0.000	0.000	2.267	0.000	0.000
Electrical Power Input	kW	0.000	0.000	3.084	0.000	0.000
				1.905		
				2.600		

Fan Sound power (dB)

A	63 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
91.2	96	95	89	83	81	75	71

Vibration monitoring (sensor location, cable, accessories): NO

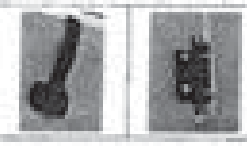
Vibration grade: BV-2 ISO10816-3:2009 3.6 mm/s RMS filter in @ run freq.

Spring Deflection: 20 mm

Bearing life: 20000 HRS

ACCESS DOOR

Dimensions: 900 x 500 mm — Handles + Hinges



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DATA SHEET

31/08/2011	28/11/2011	P.s./ 0	31100204	

Project: CIC Zero Carbon Bldg-AHU — Model: A1-1010H-1050W

Ref: AHU-B-02 — Flow: 1.19 m3/s

COOLING COIL

Air flow	Qty	Model						
1.19 m3/s	1	P40-16A/R 2R-10T-650A 2.0Pa Cu/Al [0 ml]				9.74 cm3	44.99 m2	Air density 1.225 kg/m3

Air side	Dir.	Wet	DP	Thermal load	Sensible load	Air vel.	Pressure Drop
In	35.50 °C	18.20 °C		1x11.2 kW	1x11.2 kW	2.41 m/s	70 Pa
Out	18.00 °C		78.50 %				
WATER	Temp.	Water flow		Water in h.	Water vel.		Connection size
In	11.00 °C	1 x 0.53 l/s		31.67 kPa	0.92 m/s		1"
Out	16.00 °C						1"

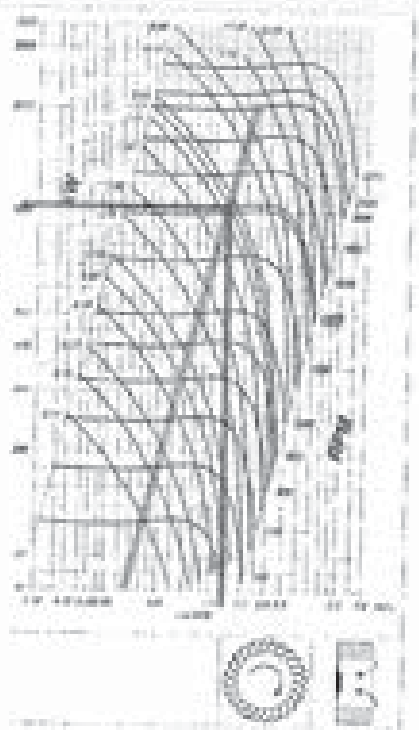
NC	Fins material	T-duct material	Headers	Frame	Flange	Counterflange
3	Al@9.1fpi	Cu@0.40mm	Copper	Galvanised steel	NO	NO

SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
Model: 1 x AS.Z355K	Qty & model: 1xD100LB-4P-3KW	Fan pulley: 140SPA3+8U201235	Belt drive
Flow: 1 x 1.19 m3/s	D3-D100LB-4P-3KW	Motor pulley: 140SPA3+8U201208	
Tip speed: 31.47 m/s	Nominal motor power: 3.00 kW	Belts: 2 x SPA982	
Fan static: 685 Pa	Motor turns: 1420(400V/3/50)		
Max. LPS: 210 Pa	Motor efficiency: 85.00 %		
Max. LPS: 491 Pa	In: 6.48 Amp		
Avg. LPS: 350 Pa	Ins: 5.50		
Reg. LPS: 350 Pa	Power factor: 0.81		
Total static pressure: 1035 Pa	Start Power factor:		
RPM: 1428 rpm	Starting torque: 20.00 Nm		
Efficiency: 58.52 %	Locked rotor torque Tl/Tn: 2.50		
Shaft power(kW): 1 x 2.27 kW	Maximum torque Tmax/Tn: 2.90		

		-5%	-10%	100%	+5	+10%
Air volume	m3/s	0.000	0.000	1.190	0.000	0.000
Total static pressure	Pa	0	0	1035	0	0
Shaft power	kW	0.000	0.000	2.267	0.000	0.000
Electrical Power input	kW	0.000	0.000	3.094	0.000	0.000
				1.785		
				2.600		

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
91.2	98	96	89	83	81	75	71



Vibration monitoring (standard/other) + cable-BNC connection (yes/no): NO

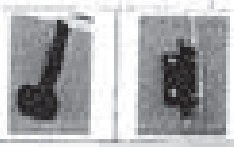
Vibration criteria: BV-2 ISO10816-3:2003 5.6 mm/s (RMS) filter in @ rot. freq.

Bearing Distribution: 25 mm

Bearing life: 20000 HRS

ACCESS DOOR

Dimensions: 800 x 550 mm — Handles + Hinges



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DATA SHEET

31/08/2011	26/11/2011	P 4 / 5	31195004

Project: CIC Zero Carbon Bldg AHU

Model: A1-1010H-1050W

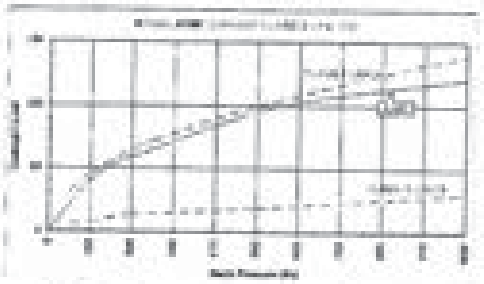
Tag: AHU-B-02

Flow: 1.19 m3/s

001 RETURN AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.99 m3/s	315 x 940 mm	A150	3.34 m/s	0 Pa

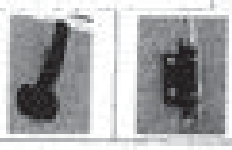
Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



002 ACCESS DOOR

Dimensions: 900 x 589 mm

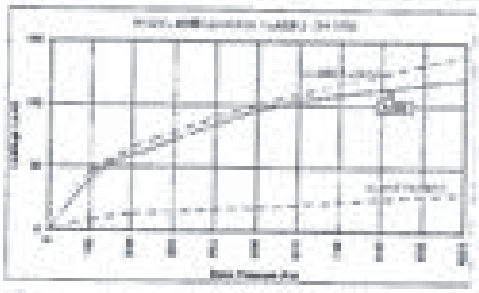
Handles + Hinges



003 FRESH AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.20 m3/s	163 x 253 mm	A150	5.00 m/s	15 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



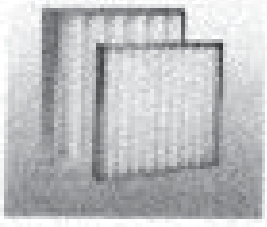
004 FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	1.19 m3/s	G3	PANEL	MCZ-48	1	1	48 mm
2	1.19 m3/s	F7	BAG	65P-535-8	1	1	535 mm

Frame: Galvanized Steel

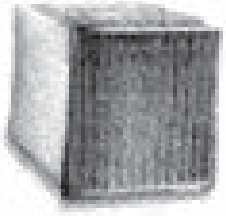
1

Clean	Final	Avg
38 Pa	150 Pa	94 Pa



2

Clean	Final	Avg
81 Pa	250 Pa	165 Pa



ACCESSORIES

005 DRAIN PAN

Material: C304-02

Diameter: 48.00 mm

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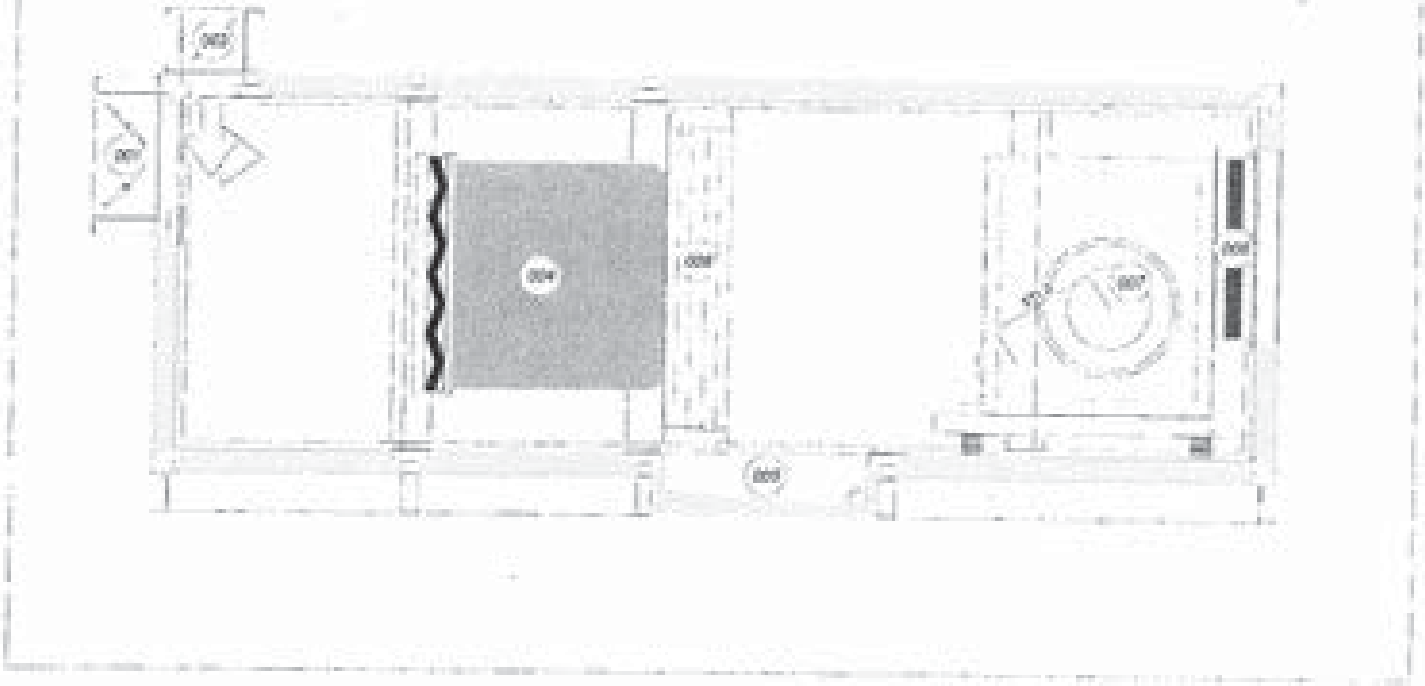
SOUND DATA

31060011	28/11/2011	F.S./ S	31160034	

Project: CIC Zero Carbon Bldg AHU — Model: A1-1010H-1050W

Ref: AHU-B-02 — Flow: 1.19 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	91	89	80	71	67	58	54	83.2
004	C3-F1	-3	-6	-7	-10	-11	-14	-18	
006	F40-16AR 3R-193-65EA-2.0Pa Cw/Al	-2	-2	-2	-2	-3	-3	-3	
007	ASE355K - 1428 RPM - 3.00 kW	96	95	89	83	81	75	71	91.2
	OUTLET	96	95	89	83	81	75	71	91.2

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
86	73	63	56	49	38	33	71.5

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DATA SHEET

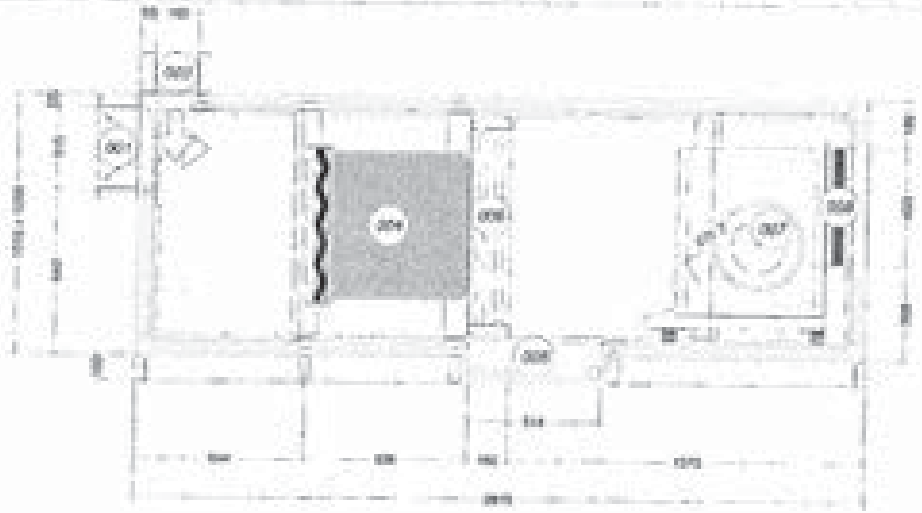
31/08/2011	28/11/2011	P.1 / 5	31105284	

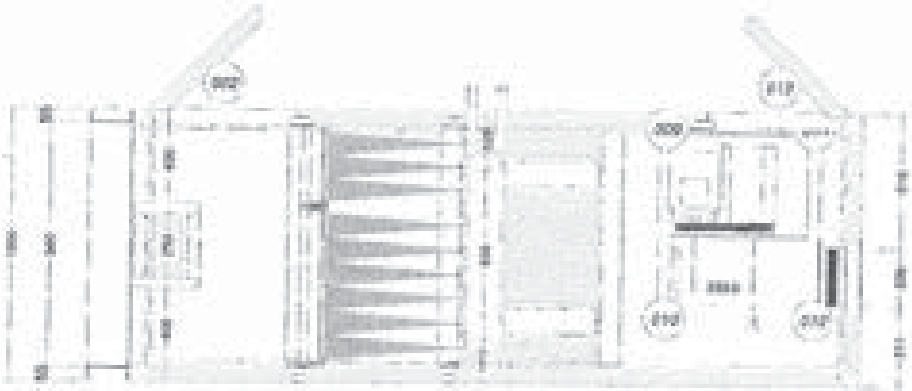
Project: CIC Zero Carbon Bldg AHU

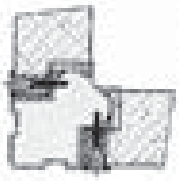
Model: A1-1010H-1050W

Plan: AHU-B-02

Flow: 1.19 m3/s







PANELS / FRAME

PART CODE	PU60/55TB	
Insulation	PUFOAM	
External sheet	CB1--08	Prepainticoed steel sheet 0.6 mm - BLU B1
Internal sheet	CA40A08	Prepainticoed steel sheet 0.6 mm - WHITE A45A
ALUMINIUM FRAME	P/60/TT	
FEET	C100	

Noise: Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
71.5	86	79	83	56	49	38	33

Mullin Box Mechanical characteristics (EN 1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP (W/m3/s)

NOTE :

OPERATING CONDITIONS

UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 80 %	35.0 °C @ 50 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
9? (1.44 m/s)	9? (1.44 m/s)

Unit weight: 457 kg

RECORD of Functional Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 9/1/2012

PROJECT : CIC Zero Carbon Building

LOCATION : B/F AHU Rm SYSTEM/EQUIP. REF. : AHU-B-03

ITEM	DESIGN	ACTUAL
1. AHU MODEL / TYPE	Sailor	Sailor AI-1930H-22K6U
2. FAN MAKE AND MODEL NO.	/	NUOTRA R.D.H-630
3. FAN SIZE	/	9630
4. FAN DRIVE TYPE	/	Belt Drive
5. FAN AT FULL SPEED (r.p.m.)	1578	1588
6. MOTOR MADE & FRAME NO.	/	TECO
7. MOTOR VOLTAGE (V) / PHASE / FREQUENCY (Hz)	380/3/50	380/3/50
8. MOTOR POWER (KW)	18.5 Kw	18.5 Kw
9. MOTOR FULL LOAD CURRENT (Amp)	/	34.1
10. MOTOR RUNNING CURRENT (Amp)	/	21.26 25
11. MOTOR OVERLOAD SETTING & RANGE	/	16-24A, 21-9A.
12. MOTOR SPEED (r.p.m.)	1465	1465
13. STARTER TYPE	/	Star Delta & VSD
14. BELT SIZE, NUMBER, TYPE	/	3PC2240X3 NO.S
15. MOTOR & FAN PULLEY DIAMETER (mm)	/	3PC3400, 3PC3375
16. SUPPLY AIR VOLUME FLOW RATE (m^3/s)	6.98	7.041
17. FRESH AIR FLOW RATE (m^3/s)	1.22	1.213

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Hir wai Tok SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Function Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 9/7/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU R-m		SYSTEM/EQUIP. REF. : AHU-B-03
ITEM	DESIGN	ACTUAL
18. RETURN AIR VOLUME FLOW RATE (m^3/s)	5.76	5.788
19. FAN STATIC PRESSURE (Pa)	1416	1428
20. AHU EXTERNAL STATIC PRESSURE (Pa)	/	
21. AIR PRESSURE DROP ACROSS COIL (Pa)	/	
22. AIR PRESSURE DROP ACROSS FILTER	/	
23. WATER FLOW RATE (L/S)	5.81	4.84 } adjusted by Hydro-O.
24. WATER PRESSURE DROP (Kpa)	29.98	30.5
25. INLET AIR TEMPERATURE (DB/~~WB~~) C	28	26
26. OUTLET AIR TEMPERATURE (DB/~~WB~~) C	16	15
27. WATER INLET TEMPERATURE (C)	11	10
28. WATER OUTLET TEMPERATURE (C)	16	15
29. TYPE OF CONTROL VALVE	/	Modulating
30. FILTER TYPE (PRE/BAG FILTER)	/	Pre & Bag filter
FUNCTION TEST		**STATUS**
31. THERMOSTAT		O.K
32. CONTROL VALVE		O.K
33. EMERGENCY STOP		O.K
34. FILTER CLOG		O.K
35. OVERLOAD TRIPPING		O.K
36. DELAY OFF		/
37. SOUND PRESSURE LEVEL (dBA)		/
38. CHANGEOVER VSD fault change to auto(standby)		O.K

REMARKS :

TESTED BY KRUEGER NAME LAU WAI TAK SIGNATURE TAK.

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Test Flow Test Sheet

Location: B/F AHU Room Plant Ref.: AHU-B-03

Drawing No.: KEL/AE/L/001 Service S/F Multi Purpose Room.

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
RAD	5.76	1200X900	1.08	5.3
Inlet Static (Pa) /	Outlet Static (Pa) /			

4.8	4.7	4.6	4.2	4.4						
5.6	5.2	5.5	5.4	5.2						
5.6	5.5	5.3	5.6	5.6						
5.8	5.9	5.7	5.8	5.8						

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
101.2	5.36	5788	101	/

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	LAU SIU TAK				
Signature					
Date					

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Total Flow Test Sheet

Location: B/F Attd Room Plant Ref.: Attd-B-03

Drawing No.: KEL/AC/L/001 Service: B/F Multi Purpose Room.

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
FAD	1.22	400x500	0.2	6.1
Inlet Static (Pa) ✓	Outlet Static (Pa) ✓			

From outside to-be Attd Lounge.

6.4	6.7	6.8								
6.7	6.3	6.2								
5.8	5.7	5.8								

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
86.4	6.26	1243	102	✓

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	LAU WAI TAK				
Signature	TAK				
Date	9/7/2012				

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Total Flow Test Sheet

Location: B/F AHU Room Plant Ref.: AHU-B-03

Drawing No.: KEL/AC/L/001 Service G/F Multi Purpose Room.

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
FAD	1.22	400x600	0.2	6.1
Inlet Static (Pa) ✓	Outlet Static (Pa) ✓			

from var' & fumit Trench. (Earth Tube)

		6.8	6.9	6.4						
		6.4	5.9	6.0						
		5.6	6.7	5.9						

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
56.7	6.3	1260	103	✓

Comments

	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	LAU WAI TAK				
Signature	TAK				
Date	9/7/2013				

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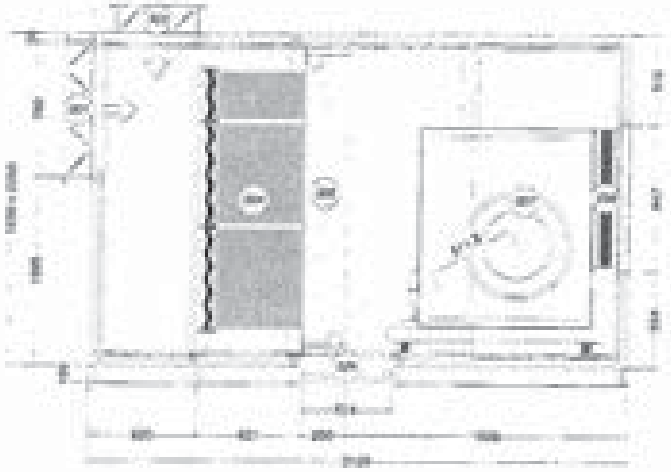
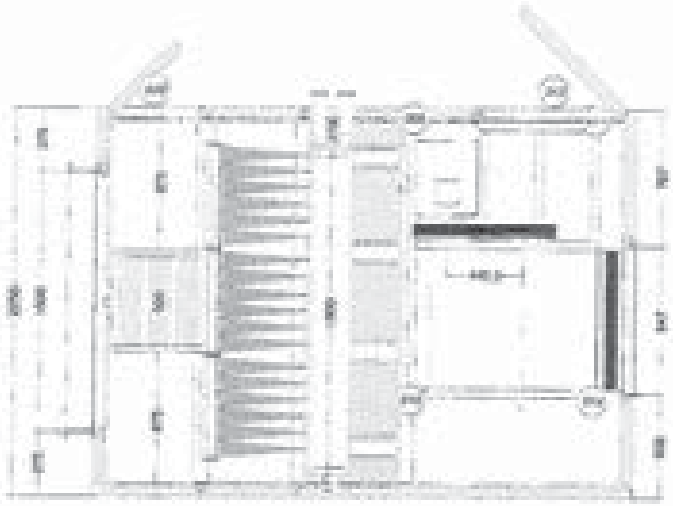
www.saiver.com

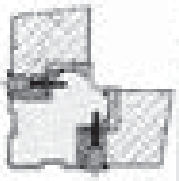
DATA SHEET

Project: CIC Zero Carbon Bldg-AHU — Code: A1-1930H-2250W

Ref: AHU-S-03 — Flow: 6.98 m3/s







PANELS / FRAME		
PART CODE		PU505TB
Insulation		PUFOAM
External sheet	CB1--06	Preplasticized steel sheet 0.6 mm - BLU 91
Internal sheet	CACSA06	Preplasticized steel sheet 0.6 mm - WHITE AASA
ALUMINIUM FRAME		PR55TT
FEET		C100

Break out Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
71.2	84	71	66	63	51	41	37

Model Box Mechanical characteristics (EN1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP (W/l/s)

2.14

NOTE :

OPERATING CONDITIONS

UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 80 %	35.0 °C @ 60 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
V2 (1.81 m/s)	V2 (1.81 m/s)

Total weight: 1448 kg

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www.saiver.com

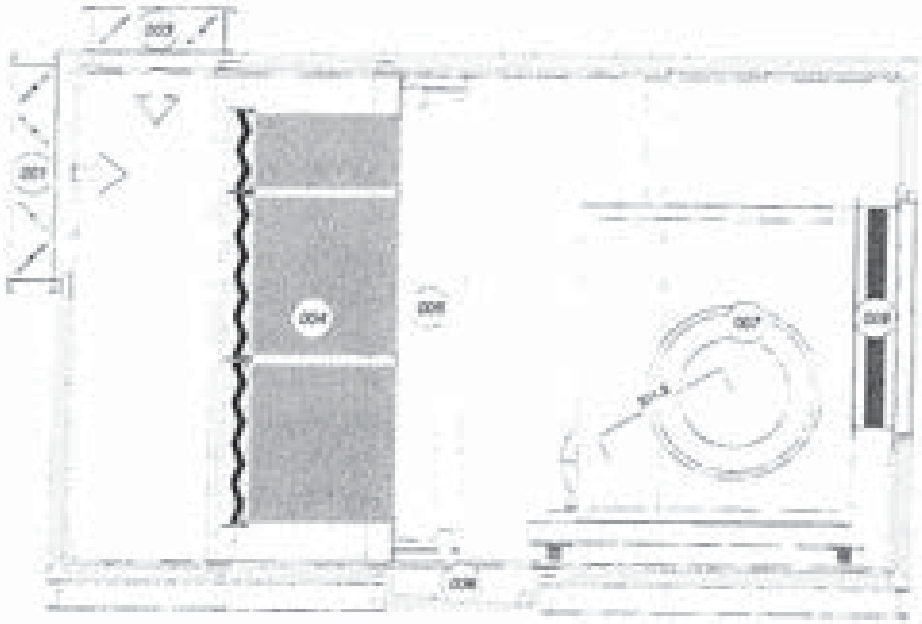
SOUND DATA

CIC Zero Carbon Bldg-AHU

A1-1930H-2250W

AHU-B-03

6.98 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	89	86	82	77	68	61	56	83.8
004	G3+F7	-3	-4	-7	-10	-11	-14	-14	
005	F40-16AR 3R-42T-1400A-3.0Pa Cu/Al	-2	-3	-3	-3	-4	-3	-3	
007	ZH 630 K - 1578 RPM - 18.50 kW	94	93	92	90	83	78	75	94.6
	OUTLET	94	93	92	90	83	78	75	94.6

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
84	71	66	63	51	41	37	71.2

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CONFORMITY WITH QUALITY SYSTEM CERTIFIED BY DNV ISO 9001:2000
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DATA SHEET

31/08/2011 28/11/2011 P.4 / 5 31105026

Project: CIC Zero Carbon Bldg-AHU

Model: A1-1930H-2250W

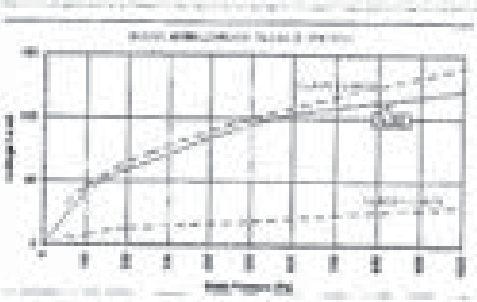
No: AHU-B-03

Flow: 6.98 m3/s

0001 RETURN AIR DAMPER

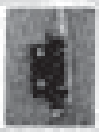
Flow	Dimensions	Model	Air vel.	Pressure drop
5.76 m3/s	780 x 1500 mm	A160	4.92 m/s	14 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



0002 ACCESS DOOR

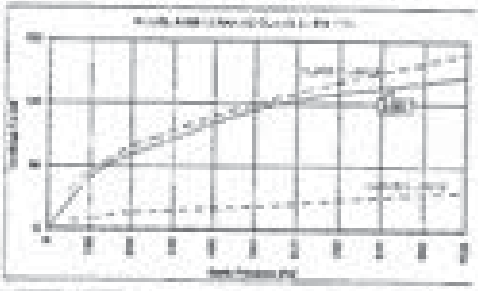
Dimensions: 1605 x 545 mm Handles + Hinges

0003 FRESH AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
1.22 m3/s	470 x 500 mm	A160	5.19 m/s	16 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



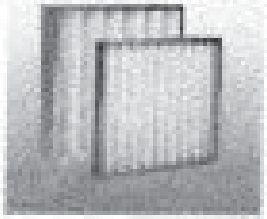
0004 FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	6.98 m3/s	G3	PANEL	MCZ-48	6	3	48 mm
2	6.98 m3/s	F7	BAG	BSP-535-6	6	3	535 mm

Frame: Galvanised Steel

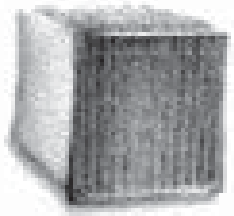
1

Clean	Final	Avg
53 Pa	150 Pa	101 Pa

2

Clean	Final	Avg
111 Pa	250 Pa	180 Pa

ACCESSORIES

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COMPANY WITH QUALITY SYSTEM CERTIFIED BY SIAI ISO 9001/2000

DATA SHEET

31/08/2011 08/11/2011 P.5/ 5 31185005

Project: CIC Zero Carbon Bldg-AHU

Order: A1-1930H-2250W

No: AHU-B-03

Flow: 6.98 m3/s

COOLING COIL

Flow: 6.98 m3/s | Qty: 1 | Model: P40-16AR SR-42T-1802A-3.0Ps CuAl [0 mt] | 99.34 dm3 | 312.62 m2 | Air density: 1.225 kg/m3

Air side	dB	WB	dB	Frontal Vel.	Sensible load	Air vel.	Pressure Drop
In	28.00 °C	24.00 °C					
Out	17.98 °C		88.21 %	h=166.8 kW	1466.3 kW	2.31 m/s	131 Pa

WATER	temp.	Water flow	Water P.D.	Water vel.	Connection size
In	11.00 °C	1 x 8.93 l/s	29.56 kPa	1.52 m/s	3"
Out	16.00 °C				3"

NC	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
15	Al.60.13mm	Cu.Ø16.42mm	Copper	Galvanised steel	NO	NO

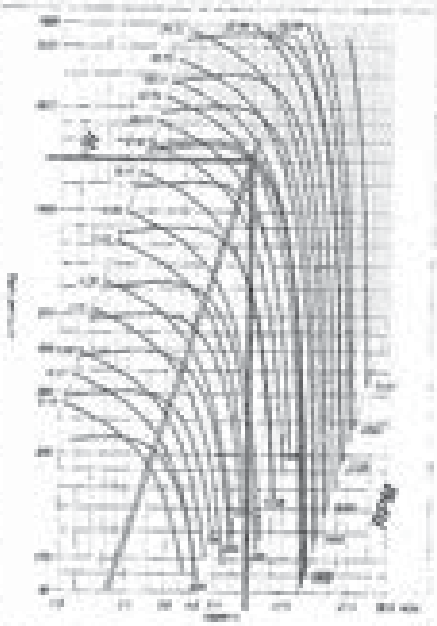
DRAIN PAN

Model: C304-12

Drain size: 48.00 mm

SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
Model: 1 x RDH 630 K	Qty & motor model: 1xG1160M-4P-18.5KW	Part number: 3755PC3+8U3535/50	Belt drive
Flow: 1 x 6.98 m3/s	S02-D160M-4P-18.5KW	Service factor: 4000/PC3+8U355/48	n. belts = 3
Fan motor rpm: 10.88 m/s	Nominal motor power: 18.50 kW	Belts: 3 x SPC2240	
Tot. pres.: 979 Pa	Motor RPM: 1465(400V/3/50)		
Stat. (-P.): 825 Pa	Motor efficiency: 91.10 %		
Max (-P.): 561 Pa	In: 36.50 Amp		
Avg. (-P.): 443 Pa	kW: 7.60		
Avg. (+P.): 443 Pa	Power factor: 0.81		
Fixed tech. preference: 1416 Pa	Start Power ratio: 0.59		
RPM: 1578 rpm	Nominal torque: 121.00 Nm		
Efficiency: 81.48 %	Locked rotor torque Tp/Tn: 3.10		
Shaft power(kW): 1 x 12.74 kW	Maximum torque Tmax/Tn: 3.50		



		-5%	-9%	RPM	+5%	+9%
Air volume	m3/s	6.632	6.806	6.981	7.155	7.330
Total static pressure	Pa	1448	1431	1416	1391	1369
Shaft power	kW	12.447	12.568	12.741	12.881	13.014
Maximum Power input	kW	15.849	16.041	16.224	16.401	16.571
				1.825		
				2.324		

In from sound groups: dB

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
94.6	94	93	92	90	83	78	75

Vibration monitoring: Cable+weather cable+BNC terminal (yellow): NO

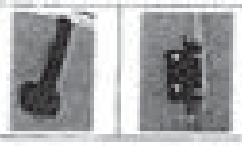
Vibration class: BV-3 ISO10816-3:2003 3.5- series, RMS filter in @ rot. freq.

Spring Deflection: 20 mm

Bearing life: 25000 HRS

ACCESS DOOR

Dimensions: 1820 x 850 mm | Handles + Hinges



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DATA SHEET

31/08/2011 28/1/2011 P 1 / 5

Project: CIC Zero Carbon Bldg-AHU

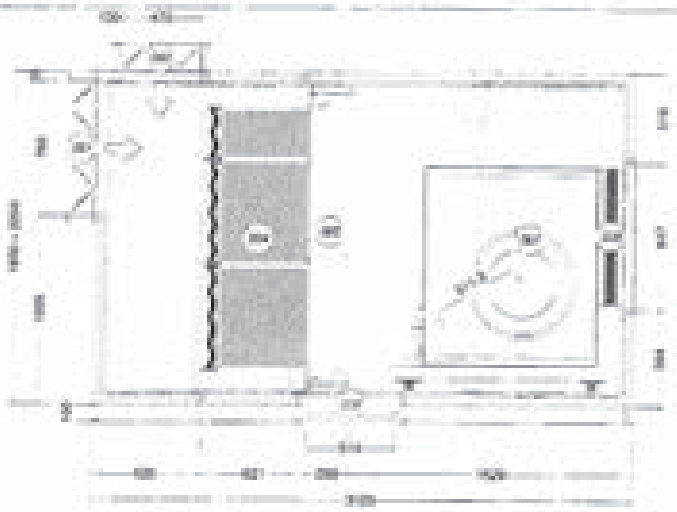
Mark: A1-1930H-2250W

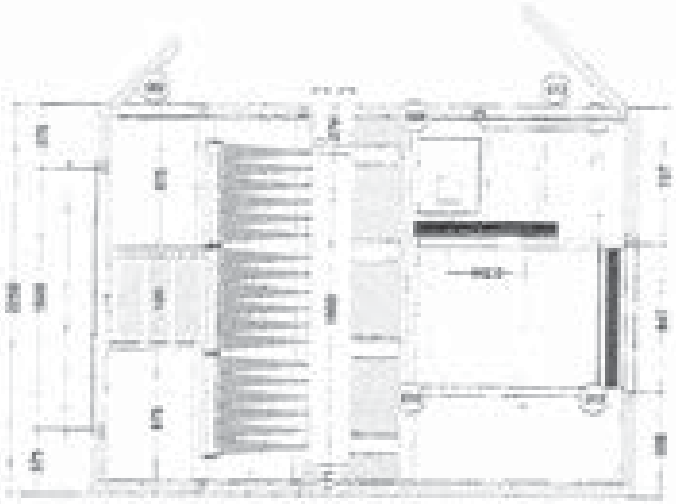
Rif: AHU-B-03

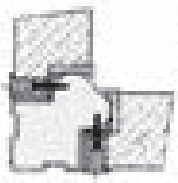
Air flow: 6.98 m3/s

01 [illegible] 03 [illegible] 04 [illegible] 05 [illegible]

07 [illegible]







PANELS / FRAME		
PART CODE		PU60STB
Insulation		PUFOAM
External sheet	CB1--08	Preplasticized steel sheet 0.6 mm - BLU B1
Internal sheet	CA45A08	Preplasticized steel sheet 0.6 mm - WHITE A45A
ALUMINIUM FRAME		PR60TT
FEET		C100

Break out Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
71.2	64	71	66	63	51	41	37

Water tight Mechanical characteristics (EN 1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP (W/l/s)

2.14

NOTE :

OPERATING CONDITIONS

0 UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 90 %	35.0 °C @ 60 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
V2 (1.81 m/s)	V2 (1.81 m/s)

Total weight: 1448 kg

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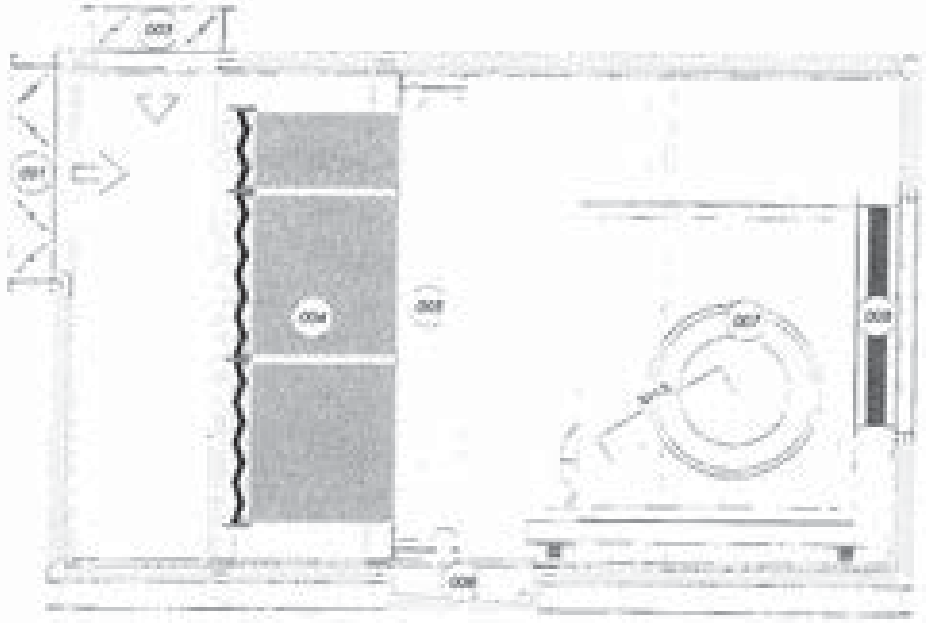
SOUND DATA

31/08/2011 28/10/2011 P.S./ S. 31185335

Project: CIC Zero Carbon Bldg-AHU — Model: A1-1930H-2250W

Ref: AHU-B-03 — Q=: 5.98 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	89	86	82	77	68	61	58	83.8
004	03+8"I	-3	-4	-7	-10	-13	-16	-14	
005	P40-16AR SR-427-1800A-3.0Pa Cu/Al	-2	-3	-3	-3	-4	-3	-3	
007	SW 630 K - 1578 RPM - 18.50 kW	94	93	92	90	83	78	75	94.6
	OUTLET	94	93	92	90	83	78	75	94.6

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
84	71	66	63	51	41	37	71.2

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DATA SHEET

31/08/2011 26/10/2011 Pág. 5 3118/009

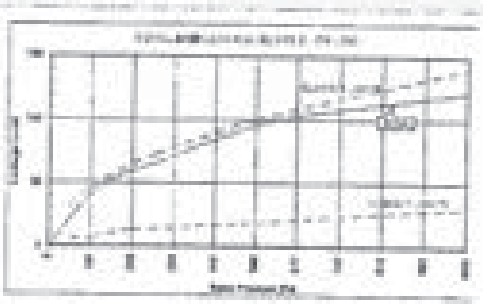
Project: CIC Zero Carbon Bldg-AHU — Model: A1-1930H-2250W

Tag: AHU-B-03 — Flow: 6.98 m3/s

001 RETURN AIR DAMPER

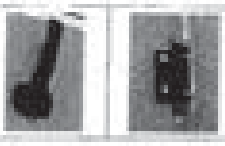
Flow	Dimensions	Model	Air vel.	Pressure drop
5.76 m3/s	780 x 1500 mm	A160	4.92 m/s	14 Pa

Damper	Flexible connection	Lock	Actuator
Yes	No	No	NO



002 ACCESS DOOR

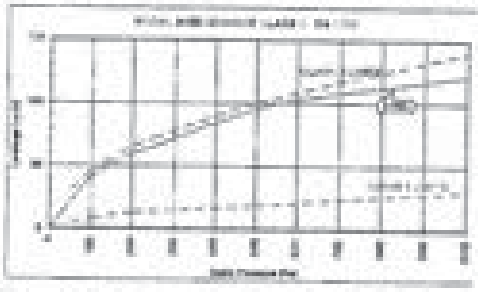
Door size: 1800 x 645 mm — Handles + Hinges



003 FRESH AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
1.22 m3/s	478 x 500 mm	A160	5.19 m/s	16 Pa

Damper	Flexible connection	Lock	Actuator
Yes	No	No	NO



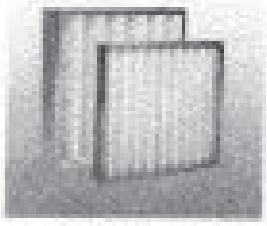
004 FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	6.98 m3/s	G3	PANEL	MG2-48	6	3	48 mm
2	6.98 m3/s	F7	BAG	BSP-535-8	6	3	535 mm

Frame: Galvanised Steel

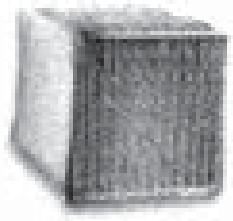
1

Clean	Final	Δp
50 Pa	150 Pa	101 Pa



2

Clean	Final	Δp
111 Pa	250 Pa	180 Pa



ACCESSORIES

SAIVER

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DATA SHEET

31/08/2011 28/11/2011 P.S./ S. SI195835

Project: CIC Zero Carbon Bldg-AHU — Model: A1-1930H-2250W

Tag: AHU-B-03 — Flow: 6.98 m3/s

COOLING COIL

Flow: 6.98 m3/s — Qty: 1 — Model: FHD-ISAR SR-42T-1805A-3.0Pa CuAl [0 mt] — 99.54 dm3 — 312.62 m2 — Air density: 1.225 kg/m3

	Air side	dt	wg	Lift	Tweter load	Sensible load	Air vel.	Pressure Drop
	In	28.00 °C	24.00 °C					
	Out	17.98 °C		98.21 %	1x1186.8 kW	1x859.2 kW	2.31 m/s	131 Pa

WATER	Water flow	Water P.D.	Water vel.	Connection size
In 11.00 °C	1 x 9.93 l/s	29.98 kPa	1.32 m/s	3"
Out 16.00 °C				3"

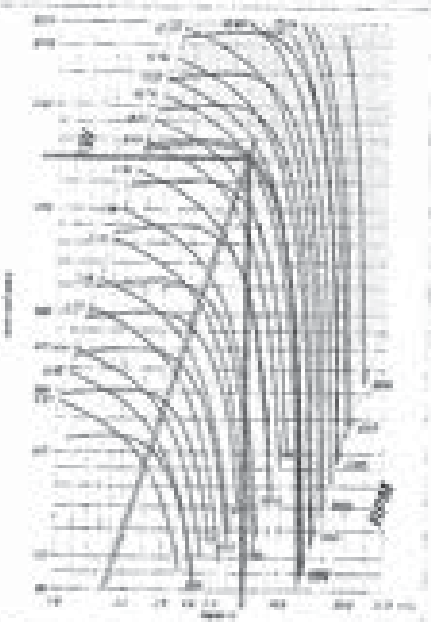
RC	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
30	ALU@0.13mm	CU@0.45mm	Copper	Galvanized steel	NO	NO

DRAIN PAN

Material: C304-12 — Drain size: 48.00 mm

SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
Model: 1 x RDH 630 K	Qty & motor model: 1xD180M-4P-18.5KW	Fan pulley: 3TB5PC3+8U353550	Base: mm
Fluid: 1 x 6.98 m3/s	5t2-D180M-4P-18.5KW	Motor pulley: 4005PC3+8U353548	n. belts = 1
Fan outlet vel.: 10.88 m/s	Nominal motor power: 18.50 kW	Belts: 3 x SPC2240	
Fan stat. press.: 873 Pa	Motor rating: 1465/460V/3/50		
Fan T.P.D.: 325 Pa	Motor efficiency: 92.20 %		
Max T.P.D.: 561 Pa	In: 36.50 Amp		
Avg T.P.D.: 443 Pa	SF: 7.50		
Avg T.P.D.: 443 Pa	Power factor: 0.81		
Total fan T.P.: 1416 Pa	Start Power factor: 0.53		
RPM: 1578 rpm	Nominal torque: 121.00 Nm		
Efficiency: 81.48 %	Locked rotor torque T.L/Tn: 3.10		
Shaft power(kW): 1 x 12.74 kW	Max Push torque Tmax/Tn: 3.50		



		dh	-dh	100%	+dh	+2dh
Air volume	m3/s	6.632	6.809	6.987	7.156	7.330
Total static pressure	Pa	1448	1431	1416	1391	1369
Shaft power	kW	12.447	12.599	12.741	12.881	13.014
Electrical Power input	kW	15.849	16.041	16.224	16.401	16.571
				1.825		
				2.324		

A	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
94.8	94	93	92	90	83	78	75

Material: NO

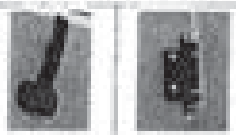
Vibration class: SV-3 ISO14694/2003 3.5 mm/s rms filter in @ min. freq.

Spring Deflection: 20 mm

Bearing life: 70000 HRS

ACCESS DOOR

Dimensions: 1820 x 850 mm — Handles + Hinges



RECORD of Functional Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 16/7/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU B-04		SYSTEM/EQUIP. REF. : AHU-B-04
ITEM	DESIGN	ACTUAL
1. AHU MODEL / TYPE	Sailver	Sailver AI-0850H. 10R
2. FAN MAKE AND MODEL NO.	/	NICOTRA ASZ-280K
3. FAN SIZE	/	# 280
4. FAN DRIVE TYPE	/	BELT DRIVE
5. FAN AT FULL SPEED (r.p.m.)	1980	1986
6. MOTOR MAKE & FRAME NO.	/	TECO
7. MOTOR VOLTAGE (V) / PHASE / FREQUENCY (Hz)	380/3/50	380/3/50
8. MOTOR POWER (KW)	2.2KW	2.2 KW
9. MOTOR FULL LOAD CURRENT (Amp)	/	4.1A
10. MOTOR RUNNING CURRENT (Amp)	/	3.4 3.4 3.5
11. MOTOR OVERLOAD SETTING & RANGE	/	4-6A, 5.2A
12. MOTOR SPEED (r.p.m.)	1435	1435
13. STARTER TYPE	/	DOL & USD
14. BELT SIZE, NUMBER, TYPE	/	3PZ 882X3NO.S
15. MOTOR & FAN PULLEY DIAMETER (mm)	/	3pz 140, 3pz 100.
16. SUPPLY AIR VOLUME FLOW RATE (m^3/s)	0.76	0.763
17. FRESH AIR FLOW RATE (m^3/s)	0.09	0.093

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lau Wai Kit SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Function Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 10/5/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU Room		SYSTEM/EQUIP. REF. : AHU-B-04
ITEM	DESIGN	ACTUAL
18. RETURN AIR VOLUME FLOW RATE (m^3/s)	0.67	0.67
19. FAN STATIC PRESSURE (Pa)	1199	1201
20. AHU EXTERNAL STATIC PRESSURE (Pa)	/	
21. AIR PRESSURE DROP ACROSS COIL (Pa)	/	
22. AIR PRESSURE DROP ACROSS FILTER	/	
23. WATER FLOW RATE (L/S)	0.34	0.27 Balancing Valve 0.7
24. WATER PRESSURE DROP (Kpa)	22.66	23
25. INLET AIR TEMPERATURE (DB/WB) C	25.4	26
26. OUTLET AIR TEMPERATURE (DB/WB) C	18	17.4
27. WATER INLET TEMPERATURE (C)	11	10
28. WATER OUTLET TEMPERATURE (C)	16	15
29. TYPE OF CONTROL VALVE	/	Modulating
30. FILTER TYPE (PRE/BAG FILTER)	/	Pre & Bag Filter

FUNCTION TEST		STATUS
31. THERMOSTAT		O.K
32. CONTROL VALVE		OK
33. EMERGENCY STOP		ok
34. FILTER CLOG		O.K
35. OVERLOAD TRIPPING		O.K
36. DELAY OFF		/
37. SOUND PRESSURE LEVEL (dBA)		/
38. CHANGEOVER VSD fault change DOL (Starter)		O.K

REMARKS :

TESTED BY KRUEGER NAME Lee Wah Teik SIGNATURE TWK

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Final Flow Test Sheet

Location: B/E AHU Room
Drawing No.: KEL/AE/12/001
Plant Ref.: AHU-B-04
Service: T/F 1-Home Area

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
SAD	8.76	300x350	0.105	7.23
Inlet Static (Pa) /	Outlet Static (Pa) /			

7.3	7.2	6.9								
7.1	7.2	7.3								
7.4	7.4	7.5								

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
65.4	7.26	763	100	/

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	[illegible]				
Signature	[illegible]				
Date	10/7/20[illegible]				

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Test Flow Test Sheet

Location: B/F AHU Room Plant Ref.: 4/L1-B.04

Drawing No.: KEL/AC/L/001 Service M/E 1- Home Area.

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
PAD	0.09	200x200	0.04	2.25
Inlet Static (Pa) ✓	Outlet Static (Pa) ✓			

2.14	2.3									
2.4	2.2									

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
9.3	2.31	93	103	✓

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	LAI WAI TEK				
Signature	TEK				
Date	10/1/2012				

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DATA SHEET

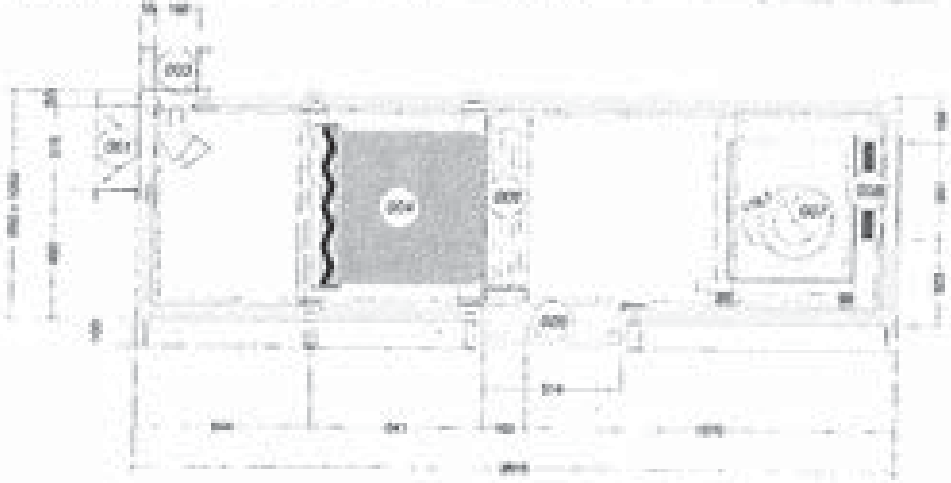
31/08/2011	28/11/2011	F 1 / 5	31195206

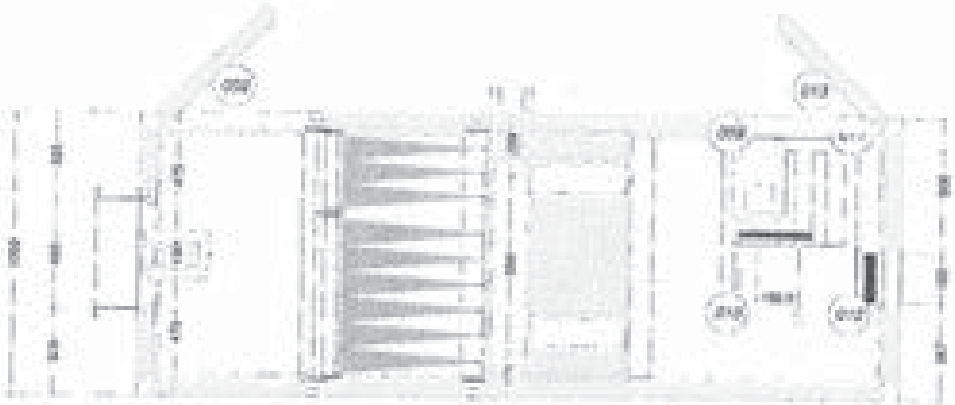
Project: CIC Zero Carbon Bldg-AHU

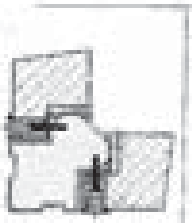
Model: A1-0850H-1050W

No: AHU-S-04

Flow: 0.76 m3/s







PANELS / FRAME

PART CODE		PU60/STB
Insulation		PUFOAM
External sheet	CB1-08	Preplasticized steel sheet 0.8 mm - BLU B1
Internal sheet	CA4GA08	Preplasticized steel sheet 0.8 mm - WHITE AkSA
ALUMINUM FRAME		PR5TT
FEET		C100

Break out Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
70.5	66	72	62	55	48	37	32

Meller Box Mechanical characteristics (EN1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP [W/l/s]

NOTE :

OPERATING CONDITIONS

0 UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 90 %	35.0 °C @ 40 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
V1 (1.15 m/s)	V1 (1.15 m/s)

421 kg

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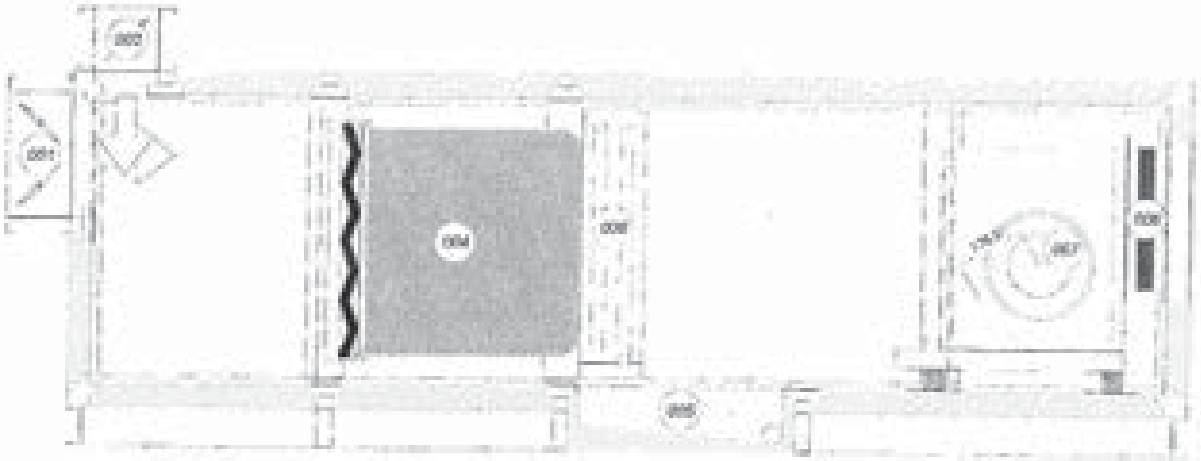
SOUND DATA

Project	CIC Zero Carbon Bldg-AHU			Model	A1-085DH-105DW
No	AHU-B-04			Flow	0.76 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	90	88	79	70	66	57	53	82.2
004	G3+F7	-3	-4	-7	-10	-13	-24	-24	
006	P40-16AR 3R-157-650A-2.0Pa Cu/Al	-2	-3	-5	-8	-9	-9	-9	
007	AS1280K - 1979 RPM - 2.20 kW	95	94	88	82	80	74	70	90.2
	OUTLET	95	94	88	82	80	74	70	90.2

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
85	72	62	55	48	37	32	70.5

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DATA SHEET

31/08/2011	28/11/2011	P 4 / 5	31165/00	

Project: CIC Zero Carbon Bldg-AHU — Model: A1-0850H-1050W

Ref: AHU B-04 — Flow: 0.76 m3/s

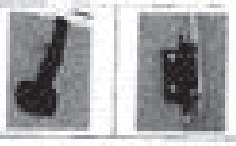
001 RETURN AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure loss
0.67 m3/s	315 x 450 mm	A150	5.29 m/s	17 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO

002 ACCESS DOOR

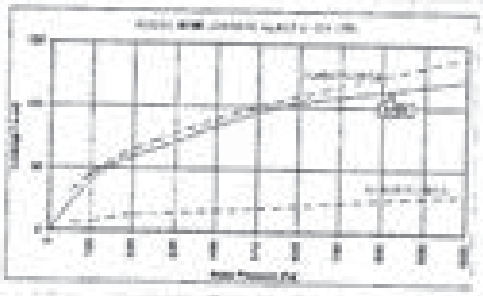
Dimensions: 740 x 569 mm — Handles + Hinges



003 FRESH AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.09 m3/s	160 x 160 mm	A150	5.63 m/s	19 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



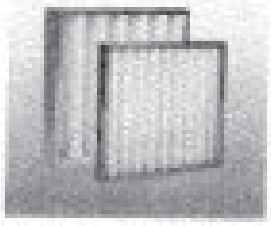
004 FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	0.76 m3/s	G3	PANEL	MCZ-48	1	1	48 mm
2	0.76 m3/s	F7	BAG	RSF-535-8	1	1	535 mm

Frame: Galvanised Steel

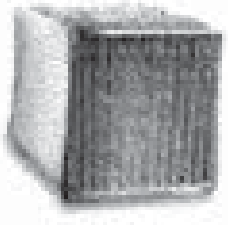
1

Clean: 15 Pa — Dirty: 150 Pa — Avg: 82 Pa



2

Clean: 32 Pa — Dirty: 250 Pa — Avg: 141 Pa



ACCESSORIES

005 DRAIN PAN

Material: C304-12 — Drain size: 48.00 mm

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DATA SHEET

31/05/2011	26/11/2011	P.S.I. S	31195036	

Project: CIC Zero Carbon Bldg-AHU

Model: A1-085GH-1050W

Ref: AHU-B-04

Flow: 0.76 m3/s

COOLING COIL

Flow	Qty	Model					
0.76 m3/s	1	P40-1SAR 3R-1ST-6SSA-2.0Pa Cu/Al [5 mt]		7.79 dm3	39.52 m2	Air density	1.225 kg/m3

Air side	tdb	twb	rh	Total load	Sensible load	Air vel	Pressure drop
In	35.50 °C	18.20 °C		1x 7.1 kW	1x 7.1 kW	1.94 m/s	48 Pa
Out	18.00 °C		78.50 %				

WATER	temp	Water flow	Water P.D.	Water vel	Connection size
In	11.00 °C	1 x 0.34 l/s	32.66 kPa	0.68 m/s	1"
Out	16.00 °C				1"

NC	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
8	AL@0.12mm	CU@0.45mm	Copper	Galvanised steel	NO	NO

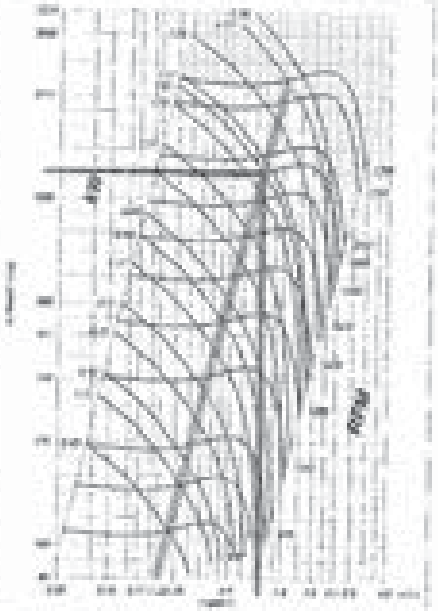
SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
1 x ASZ280K	1xD100LA-4P-2.2KW	100SPZ2+BU1810030	Belt drive
1 x 0.76 m3/s	S02-D100LA-4P-2.2KW	140SPZ2xBU1810038	2 belts x 1
11.47 m/s	2.20 kW	2 x SPZ750	
891 Pa	1420/(400V/3/50)		
132 Pa	86.40 %		
484 Pa	4.80 Amp		
358 Pa	5.50		
306 Pa	0.81		
1195 Pa			
1980 rpm	15.00 Nm		
53.99 %	2.40		
1 x 1.80 kW	2.90		

		-5%	-2.5%	100%	+2.5	+5%
Air volume	m3/s	0.000	0.000	0.758	0.000	0.000
Total static pressure	Pa	0	0	1199	0	0
Shaft power	kW	0.000	0.000	1.795	0.000	0.000
Electrical Power Input	kW	0.000	0.000	2.509	0.000	0.000
				2.369		
				3.310		

In-duct sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
90.2	95	94	88	82	80	74	70



Vibration monitoring: harness-wired, cable-effect, termination box: NO

Vibration class: MV-2 (ISO14694:2003) 5.6 mm/s RMS filter in @ vol. freq.

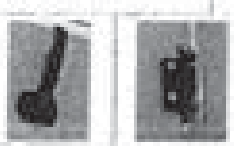
Spring Deflection: 20 mm

Bearing life: 200000 HRS

ACCESS DOOR

Dimensions: 740 x 550 mm

Handles + Hinges



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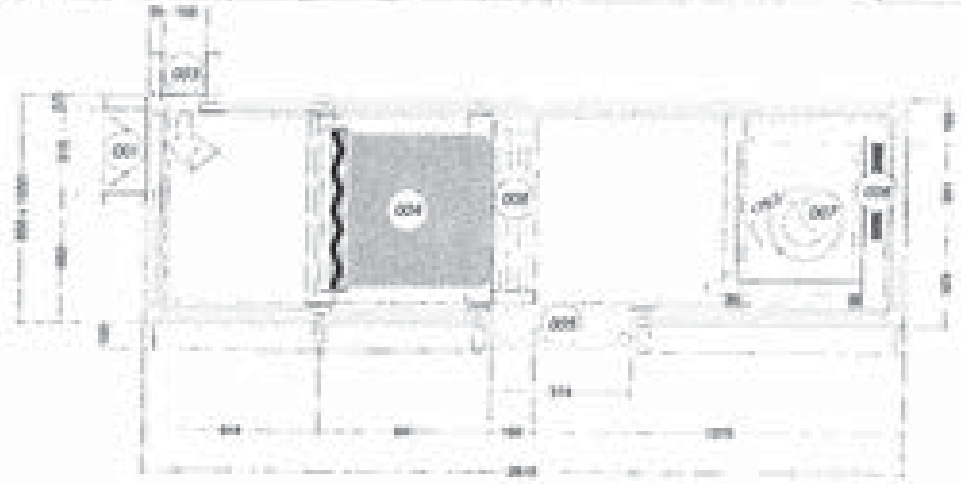
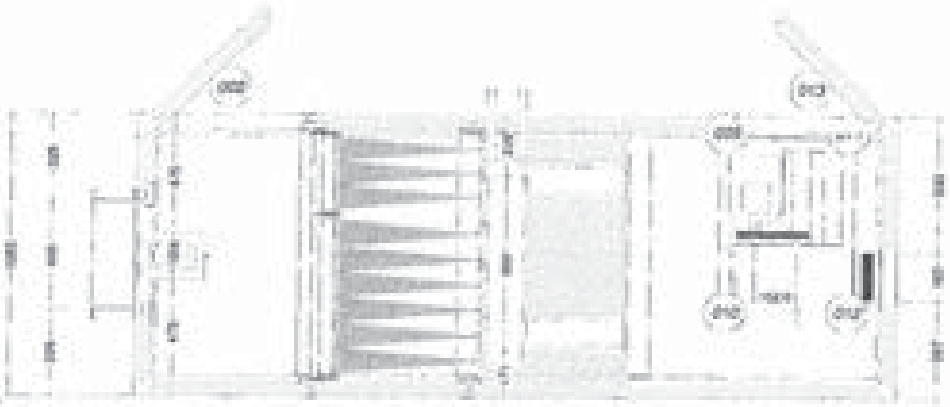
DATA SHEET

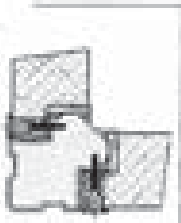
31/08/2011	29/11/2011	P 1 / 5	31195036	

CIC Zero Carbon Bldg-AHU — A1-0850H-1050W

AHU-B-04 — 0.76 m3/s







PANELS / FRAME

PART CODE		PU605578
Insulation		PUFOAM
External sheet	CB1-08	Prepainted steel sheet 0.8 mm - BLU B1
Internal sheet	CAISA08	Prepainted steel sheet 0.8 mm - WHITE AASA
ALUMINIUM FRAME		PRSETT
FEET		C100

Sheet (s) Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
70.5	65	72	62	55	48	37	32

Model Box Mechanical characteristics (EN1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP (W/l/s)

NOTE :

OPERATING CONDITIONS

UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 80 %	35.0 °C @ 60 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
V1 (1.12 m/s)	V1 (1.12 m/s)

421 kg

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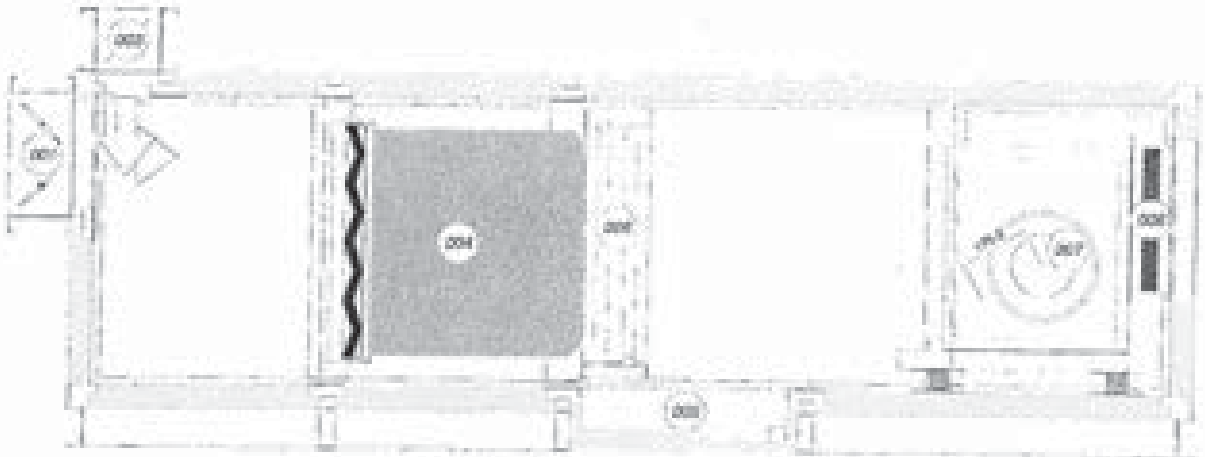
SOUND DATA

31/08/2011	28/11/2011	P.3/ 5	31/08/08	
Project: CIC Zero Carbon Bldg-AHU			Model: A1-085GH-1050W	
Ref: AHU-B-04			Flow: 0.76 m3/s	



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	90	86	79	70	66	57	53	82.2
004	G3+F7	-3	-4	-7	-10	-11	-14	-14	
006	P40-16AR 39-15T-630A-2.0Pa Cw/il	-2	-2	-2	-2	-3	-3	-3	
007	AS1200K - 1979 RPM - 2.20 kW	95	94	88	82	80	74	70	90.2
	OUTLET	95	94	88	82	80	74	70	90.2

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
85	72	62	55	48	37	32	70.5

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COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV ISO 9001:2000
WWW.SAIVER.COM

DATA SHEET

31/08/2011	28/11/2011	P.4 / 5	31/05/2006	

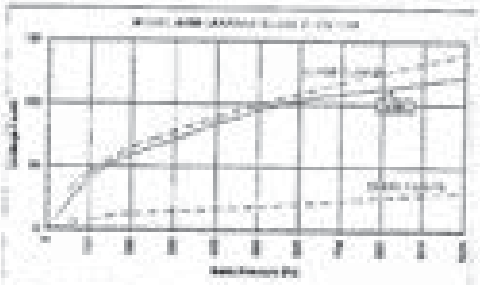
Project: CIC Zero Carbon Bldg-AHU — Model: A1-080H-1050W

No: AHU-B-04 — Flow: 0.76 m3/s

RETURN AIR DAMPER

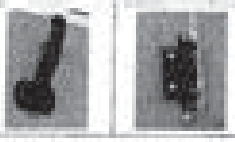
Flow	Dimensions	Model	Air vel.	Pressure Drop
0.67 m3/s	315 x 400 mm	A160	5.29 m/s	17 Pa

Damper	Flexible connection	Louver	Actuator
Yes	No	No	NO



ACCESS DOOR

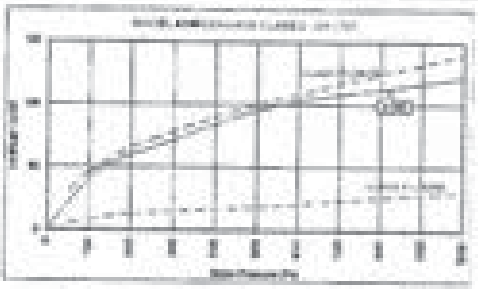
Dimensions: 740 x 369 mm — Handles + Hinges



FRESH AIR DAMPER

Type	Dimensions	Model	Air vel.	Pressure Drop
0.09 m3/s	160 x 100 mm	A160	5.63 m/s	19 Pa

Damper	Flexible connection	Louver	Actuator
Yes	No	No	NO



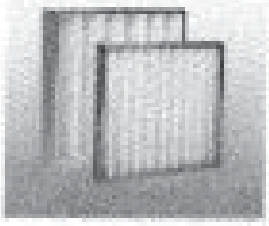
FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	0.76 m3/s	G3	PANEL	MCZ-48	1	1	48 mm
2	0.75 m3/s	F7	BAG	BSP-5/5-8	1	1	535 mm

Frame: Galvanised Steel

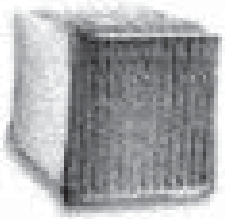
1

Start	Final	Avg
15 Pa	150 Pa	82 Pa



2

Start	Final	Avg
32 Pa	250 Pa	141 Pa



ACCESSORIES

DRAIN PAN

Material: C304-12 — Drain size: 48.00 mm

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DATA SHEET

31/08/2011	28/11/2011	FS/ S	3119S06	

Project: C4C Zero Carbon Bldg-AHU

Model: A1-0850H-1050W

Ref: AHU-B-04

Flow: 0.76 m3/s

COOLING COIL

Flow	Qty	Model				Air dens.
0.76 m3/s	1	P40-16AR 3R-1ST-650A-2.0Pa CuAl [0 m]	7.73 dm3	35.52 m2		1.225 kg/m3

Air side	db	wb	DR	Tonal load	Sensible load	Air vel.	Pressure Drop
In	25.50 °C	18.00 °C		1x 7.1 kW	1x 7.1 kW	1.94 m/s	48 Pa
Out	18.00 °C		78.50 %				
WATER	temp	Water flow		Water P.D	Water vel.		Connection size
In	11.00 °C	1 x 0.34 l/s		22.66 kPa	0.68 m/s		1"
Out	16.00 °C						1"

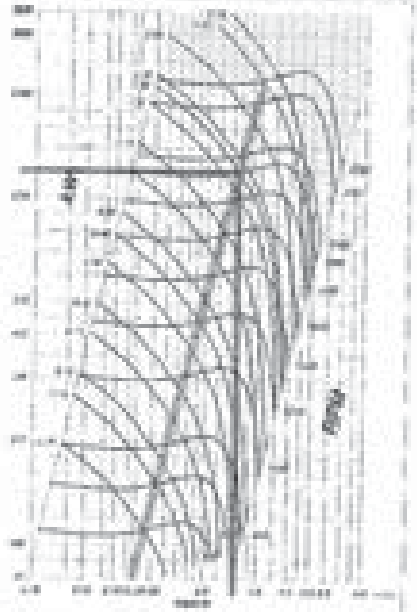
NC	Fins material	Tubes material	Headers	Fluids	Flange	Counterflange
2	ALB0.12mm	CU@0.45mm	Copper	Galvanised steel	NO	NO

SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
Model: 1 x ASZ280K	Qty & motor model: 1xD100LA-4P-2.2KW	Fan pulley: 100SPZ2+BU1610	Belt drive
Flow: 1 x 0.76 m3/s	Spd:D100LA-4P-2.2KW	Motor pulley: 140SPZ2+BU1610	
Fan outlet vel: 11.47 m/s	Nominal motor power: 2.20 kW	Belts: 2 x SPZ710	
Ext. static: 891 Pa	Motor speed: 1420(400V/3/50)		
Min. SP.S: 132 Pa	Motor efficiency: 83.00 %		
Max SP.S: 484 Pa	In: 4.80 Amp		
Avg. SP.S: 308 Pa	Pole: 5.50		
Avg. SP.S: 308 Pa	Power factor: 0.81		
Total static pressure: 1199 Pa	Start Power factor:		
RPM: 1980 rpm	Nominal torque: 15.00 Nm		
Efficiency: 53.99 %	Locked rotor torque Tp/Tn: 2.40		
Shaft power(kW): 1 x 1.80 kW	Maximum torque Tmax/Tn: 2.80		

		-5%	0.0%	100%	+5.0	+0%
Air volume	m3/s	0.000	0.000	0.758	0.000	0.000
Total static pressure	Pa	0	0	1199	0	0
Shaft power	kW	0.000	0.000	1.795	0.000	0.000
Electrical Power Input	kW	0.000	0.000	2.009	0.000	0.000
				2.369		
				3.319		

A	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
90.2	95	94	88	82	80	74	70



Vibration Monitoring (sensor/cable/BoC termination box): NO

Vibration class: 5kV-2 ISO7-S84-2003 5.6 mm/s (RMS) filter on @ rot. freq.

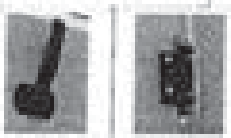
Spring Deflection: 20 mm

Bearing life: 20000 HRS

ACCESS DOOR

Dimensions: 740 x 500 mm

Handles + Hinges



RECORD of Functional Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 10-7-2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU R-11A SYSTEM/EQUIP. REF. : AHU-B-CT

ITEM	DESIGN	ACTUAL
1. AHU MODEL / TYPE	Salver	Salver A1-1010H-16K0
2. FAN MAKE AND MODEL NO.	/	NICOTRA ADH 355R
3. FAN SIZE	/	Ø3KK
4. FAN DRIVE TYPE	/	Belt Drive
5. FAN AT FULL SPEED (r.p.m.)	1518	1522
6. MOTOR MADE & FRAME NO.	/	TECO
7. MOTOR VOLTAGE (V) / PHASE / FREQUENCY (Hz)	380/3/50	380/3/50
8. MOTOR POWER (KW)	5.5 Kw	5.5 Kw
9. MOTOR FULL LOAD CURRENT (Amp)	/	11.2 A
10. MOTOR RUNNING CURRENT (Amp)	/	8.3 & 8.7A
11. MOTOR OVERLOAD SETTING & RANGE	/	K.K-8A, T-1A.
12. MOTOR SPEED (r.p.m.)	1450	1450
13. STARTER TYPE	/	Star Delta & VSD
14. BELT SIZE, NUMBER, TYPE	/	8PA 1180 X2 NO. 8
15. MOTOR & FAN PULLEY DIAMETER (mm)	/	8PA2 190, 8PA2180
16. SUPPLY AIR VOLUME FLOW RATE (m^3/s)	2.16	2.22
17. FRESH AIR FLOW RATE (m^3/s)	0.25	0.254

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME LAU WAI TAK SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Function Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 10-7-2012

PROJECT : CIC-Zero Carbon Building.

LOCATION : B/F AHU Rm		SYSTEM/EQUIP. REF. : AHU-B-05
ITEM	DESIGN	ACTUAL
18. RETURN AIR VOLUME FLOW RATE (m^3/s)	1.91	1.911
19. FAN STATIC PRESSURE (Pa)	1048	1058
20. AHU EXTERNAL STATIC PRESSURE (Pa)	/	
21. AIR PRESSURE DROP ACROSS COIL (Pa)	/	
22. AIR PRESSURE DROP ACROSS FILTER	/	
23. WATER FLOW RATE (L/S)	0.97	0.84 (Balancing Valve o.)
24. WATER PRESSURE DROP (Kpa)	41.52	43
25. INLET AIR TEMPERATURE (DB/WB) C	25.5	26
26. OUTLET AIR TEMPERATURE (DB/WB) C	18	18.4
27. WATER INLET TEMPERATURE (C)	11	10.4
28. WATER OUTLET TEMPERATURE (C)	16	15.5
29. TYPE OF CONTROL VALVE	/	Modulating
30. FILTER TYPE (PRE/BAG FILTER)	/	Pre & Bag filter

FUNCTION TEST		STATUS
31. THERMOSTAT		O.K
32. CONTROL VALVE		O.K
33. EMERGENCY STOP		O.K
34. FILTER CLOG		O.K
35. OVERLOAD TRIPPING		O.K
36. DELAY OFF		/
37. SOUND PRESSURE LEVEL (dBA)		/
38. CHANGEOVER VSD fault change flow rate (Standby)		O.K

REMARKS :

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE Tak.

WITNESSED BY QAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Total Flow Test Sheet

Location: B/E AHU Room, Plant Ref.: AHU-B-05

Drawing No.: KEL/AEL/001 Service M/E Display Area.

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
RAD	1.91	700X450	0.385	4.96
Inlet Static (Pa) /	Outlet Static (Pa) /			

5.9	5.8	6.1								
5.1	5.3	4.9								
4.4	4.2	4.3								

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
46.1	5.12	1971	103	-

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	LAU CHI MING				
Signature					
Date	10/7/2012				

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Total Flow Test Sheet

Location: B/F Atkl Room Plant Ref.: Atkl - B-05

Drawing No.: KEL/AE/L/001 Service: B/F Display Area.

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
DAD	0.25	200x350	0.07	3.57
Inlet Static (Pa) ✓	Outlet Static (Pa) ✓			

3.7	3.3	3.8								
3.4	3.6	3.9								

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
21.8	3.63	214	102	✓

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	[illegible]				
Signature	[illegible]				
Date	16/5/2012				

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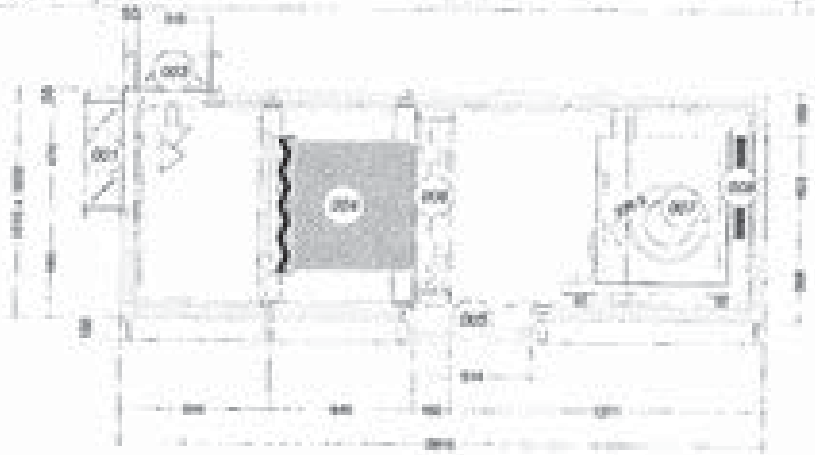
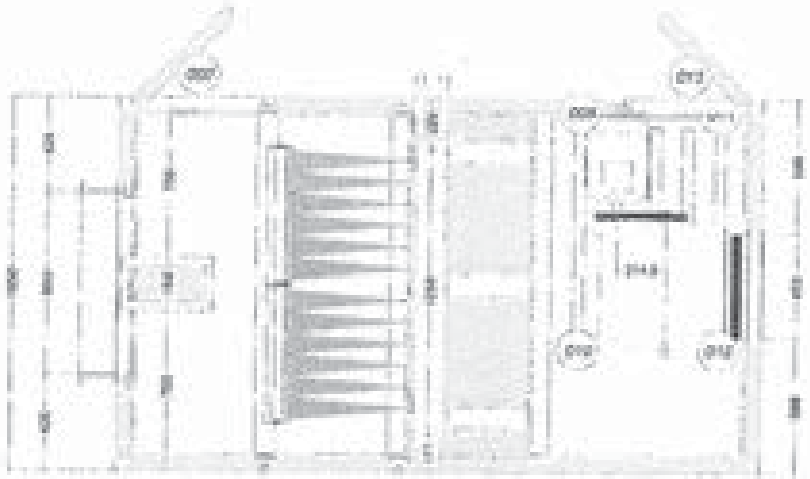
DATA SHEET

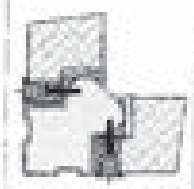
31/05/2011	28/11/2011	P 1 / 5	31/05/07	

Project: CIC Zero Carbon Bldg-AHU
Model: A1-1010H-1650W
Tag: AHU-B-05
Flow: 2.16 m3/s





PANELS / FRAME



PART CODE		PU60/58TB
Insulation		PUFOAM
External sheet	CB1-08	Preplasticized steel sheet 0.8 mm - BLU B1
Internal sheet	CA45A08	Preplasticized steel sheet 0.8 mm - WHITE A45A
ALUMINIUM FRAME		PRSTT
FEET		C155

Break out Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
69.2	83	71	59	55	47	41	36

Water Box Mechanical characteristics (EN1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP (W/l/s)
2.32

NOTE :

OPERATING CONDITIONS

UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 80 %	35.0 °C @ 40 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXHAUST)
V2 (1.39 m/s)	V2 (1.39 m/s)

Total weight: 622 kg

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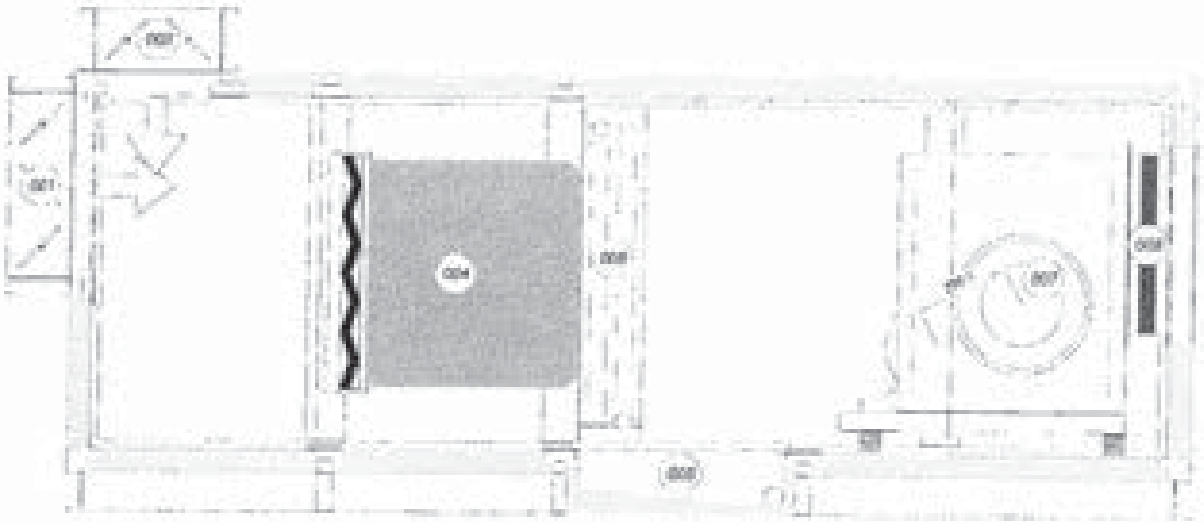
SOUND DATA

31/08/2011	28/11/2011	P.3/ 5	31/08037	
Project:	CIC Zero Carbon Bldg-AHU		Model:	A1-1010H-1650W
Ref:	AHU-B-65		Flow:	2.16 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	88	87	76	70	65	61	57	81.1
004	G3+F7	-3	-4	-7	-10	-11	-14	-14	
006	PSP-1RAR 3R-19T-1250A-2.0Pa Cu/Al	-2	-2	-2	-2	-3	-3	-3	
007	ADH 355 R - 1517 RPM - 5.50 kW	93	93	85	82	79	78	74	89.7
	OUTLET	93	93	85	82	79	78	74	89.7

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
93	71	59	55	47	41	36	69.2

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DATA SHEET

31/05/2011	28/11/2011	P.4 / 5	31165007	

Project: CIC Zero Carbon Bldg-AHU

Unit: A1-101DH-1650W

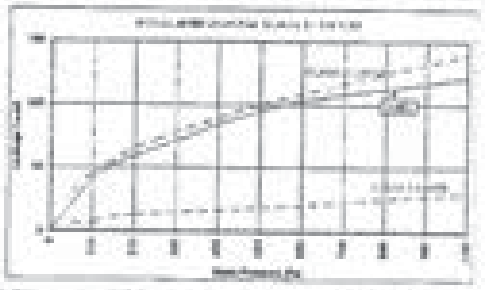
No: AHU-B-05

Flow: 2.16 m3/s

001 RETURN AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
1.91 m3/s	470 x 800 mm	A160	5.09 m/s	15 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



002 ACCESS DOOR

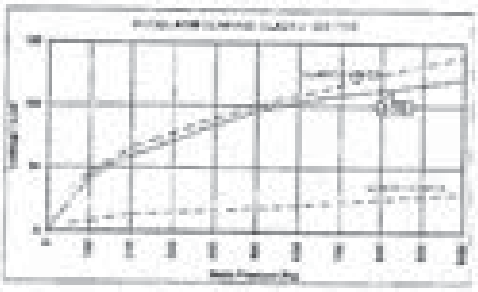
Dimensions: 600 x 569 mm

Handles + Hinges

003 FRESH AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.25 m3/s	315 x 150 mm	A160	5.29 m/s	17 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



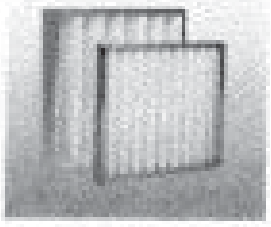
004 FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	2.17 m3/s	G3	PANEL	MGZ-48	2	0	48 mm
2	2.17 m3/s	F7	BAG	BSP-535-8	2	0	535 mm

Frame: Galvanised Steel

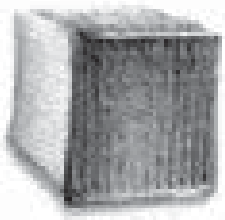
1

Clean: 71 Pa | Final: 150 Pa | Avg: 110 Pa



2

Clean: 151 Pa | Final: 250 Pa | Avg: 200 Pa



ACCESSORIES

005 DRAIN PAN

Material: C304-12

Drain size: 48.00 mm

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DATA SHEET

31/08/2011	28/11/2011	P.5 / 5	31185237

Project: CIC Zero Carbon Bldg-AHU

Model: A1-1010H-1650W

Tag: AHU-B-05

Flow: 2.16 m3/s

COOLING COIL

Flow	Qty	Model				
2.16 m3/s	1	P4D-16AR 3R-19T-1250A-2.0Pa Cu/Al [0 mi]	17.27 dm3	86.51 m2	Air density 1.229 kg/m3	

Air side	dB	wet	Lat.	Total kW	Sensible kW	Air vel.	Pressure Drop
In	25.50 °C	18.20 °C		105.4 kW	103.4 kW	2.26 m/s	84 Pa
Out	17.97 °C		78.77 %				

WATER	temp	Water flow	Water P.D.	Water vel.	Connection size
In	11.00 °C	1 x 0.97 l/s	41.52 kPa	1.26 m/s	1 1/4"
Out	16.00 °C				1 1/4"

NC	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
4	Al.@0.1.9mm	Cu.@0.45mm	Copper	Galvanised steel	NO	NO

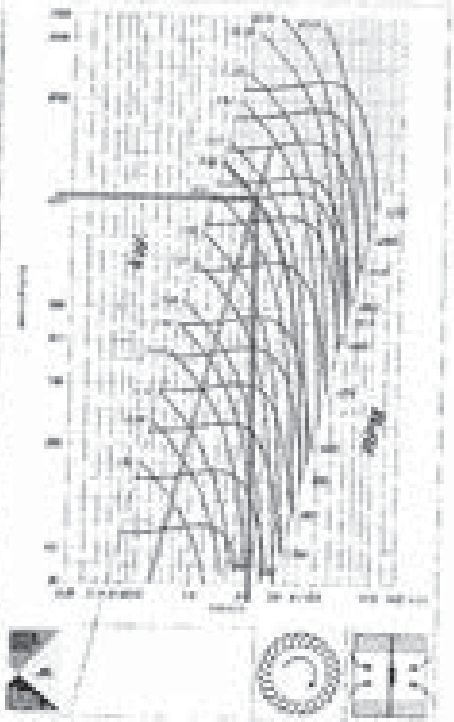
SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
Model: 1 x ADH 355 R	Qty & motor model: 1xD132S-4P-5.5KW	Pulley dia.: 190SPA2-8U201230	Belt drive
Flow: 1 x 2.16 m3/s	5S-D132S-4P-5.5KW	Motor pulley: 190SPA2-8U201238	n. belts = 1
Fan outlet vel.: 10.55 m/s	Nominal motor power: 5.50 kW	Belts: 2 x SPA1060	
Fan static: 641 Pa	Motor rating: 1445(400V/3/50)		
Min. I.P.S.: 318 Pa	Motor efficiency: 89.20 %		
Max I.P.S.: 496 Pa	In: 11.10 A/hp		
Avg. I.P.S.: 407 Pa	Ipm: 6.90		
Avg. I.T.S.: 407 Pa	Power factor: 0.85		
Total fan pressure: 1048 Pa	Start/Power ratio: 6.55		
RPM: 1518 rpm	Nominal Motor: 36.00 N/m		
Efficiency: 58.48 %	Locked rotor torque Tr/Tn: 2.20		
Shaft power(Lab): 1 x 4.13 kW	Maximum torque Tmax/Tn: 3.00		

		-5%	0.9%	100%	+5%	+10%
Air volume	m3/s	2.057	2.111	2.165	2.219	2.273
Total static pressure	Pa	1044	1046	1048	1050	1052
Shaft power	kW	3.963	4.047	4.128	4.225	4.331
Electrical Power Input	kW	5.284	5.396	5.504	5.633	5.774
				1.907		
				2.543		

Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
89.7	93	93	85	82	79	78	74



Vibration monitoring (sensor location cable duct): accessories: None

NO

Vibration class: BV-3 ISO10816/7002 3.5 mm/s RMS filter in @ nat. freq

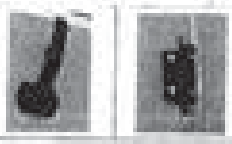
Bearing Calculation: 20 mm

Bearing life: 25000 HRS

ACCESS DOOR

Dimensions: 800 x 550 mm

Handles + Hinges



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DATA SHEET

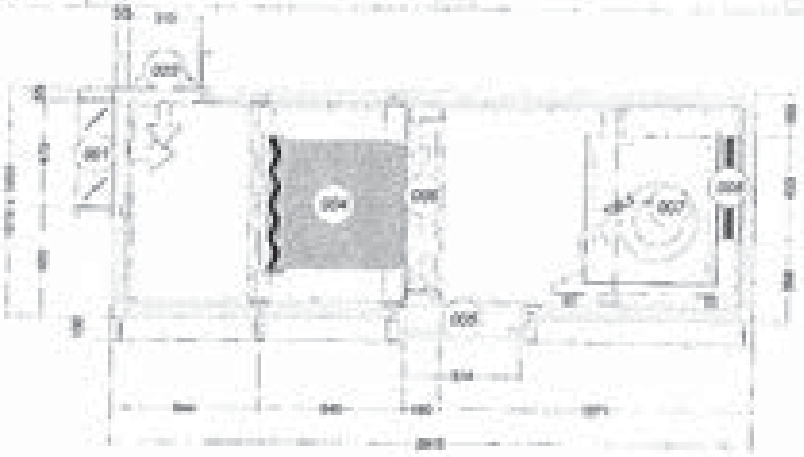
31/08/2011	28/11/2011	P. 1 / 5	21/09/2017	

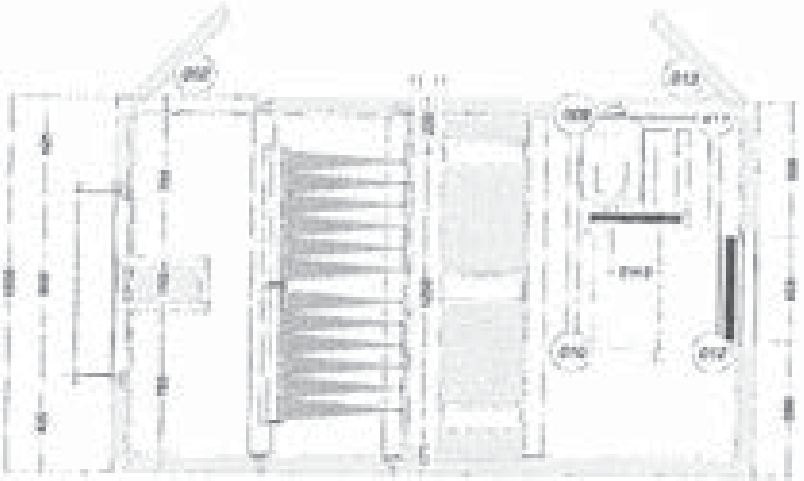
Project: CIC Zero Carbon Bldg AHU

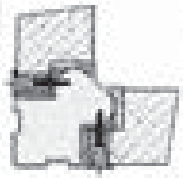
Model: A1-10/3H-1650W

Tag: AHU-B-05

Flow: 2.16 m3/s







PANELS / FRAME		
PART CODE		PU50/STB
Insulation		PUFOAM
External sheet	CB1--08	Prepainticized steel sheet 0.8 mm - BLU B1
Internal sheet	CA4SA08	Prepainticized steel sheet 0.8 mm - WHITE A4SA
ALUMINIUM FRAME		PRSETT
FEET		C100

Break out Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
69.2	60	71	59	55	47	41	36

Model Box Mechanical characteristics (EN1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP (W/l/s)

2.32

NOTE :

OPERATING CONDITIONS

0 UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 80 %	35.0 °C @ 60 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
V2 (1.59 m/s)	V2 (1.59 m/s)

Unit weight: 622 kg

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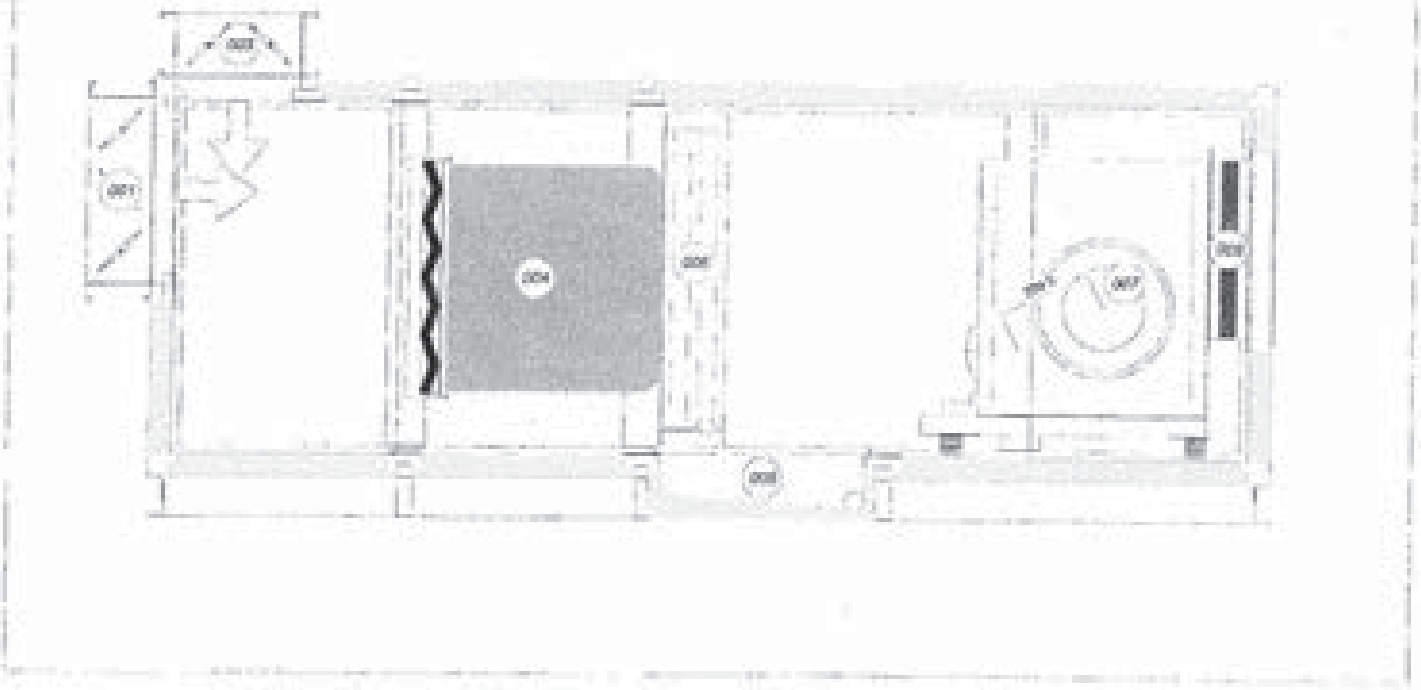
SOUND DATA

31/08/2011	28/11/2011	P.0 / 0	31/05/2007		
Project	CIC Zero Carbon Bldg-AHU			Model	A1-1010H-1650W
No	AHU-B-05			Flow	2.16 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	88	87	76	70	65	61	57	81.1
004	03+F1	-3	-4	-7	-10	-13	-14	-16	
006	F40-16AR 3R-19T-1150A-2.0Pa Cu/Al	-2	-2	-2	-3	-3	-3	-3	
007	MDH 355 R - 1517 RPM - 5.50 kW	93	93	85	82	79	78	74	89.7
	OUTLET	93	93	85	82	79	78	74	89.7

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
83	71	59	55	47	41	36	69.2

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COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV ISO 9001:2000

DATA SHEET

21/09/2011	28/11/2011	P 4 / 5	31195037

Project: CIC Zero Carbon Bldg-AHU

Model: A1-101GH-1650W

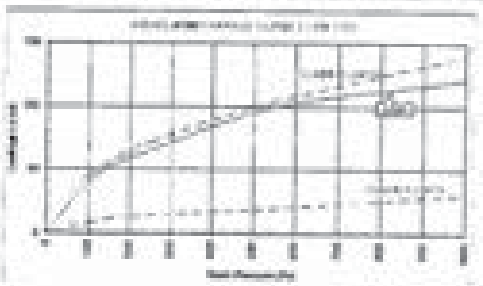
Ref: AHU-B-05

Flow: 2.16 m3/s

001 RETURN AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
1.91 m3/s	470 x 800 mm	A150	5.09 m/s	15 Pa

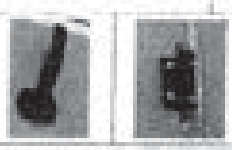
Damper	Flexible connection	Lock	Actuator
Yes	No	No	NO



002 ACCESS DOOR

Dimensions: 900 x 509 mm

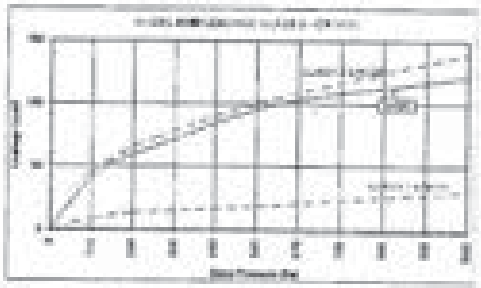
Handles + Hinges



003 FRESH AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.25 m3/s	315 x 150 mm	A150	5.29 m/s	17 Pa

Damper	Flexible connection	Lock	Actuator
Yes	No	No	NO



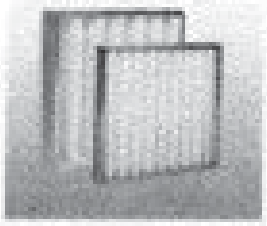
004 FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	2.17 m3/s	G3	PANEL	MCZ-48	2	0	48 mm
2	2.17 m3/s	F7	BAG	BSP-595-8	2	0	535 mm

Frame: Galvanged Steel

1

Clean	Final	Avg
71 Pa	150 Pa	110 Pa



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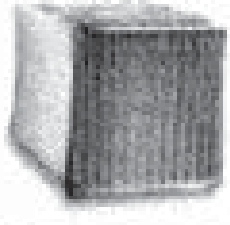
Clean	Final	Avg
151 Pa	250 Pa	200 Pa



ACCESSORIES

005 DRAIN PAN

Material: C304-12

Drain size: 48.00 mm

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DATA SHEET

31/08/2011	26/11/2011	P.5 / 5	31/05/07	

Project: CIC Zero Carbon Bldg-AHU — Model: A1-1010H-1650W

Ref: AHU-B-05 — Flow: 2.16 m3/s

COOLING COIL

2.16 m3/s | Qty: 1 | Model: P4D-16AR 3R-19T-1250A-2.0Pa CoilM [0 mt] | 17.27 dm3 | 86.51 m2 | Air density: 1.225 kg/m3

	db	wb	UR	Total load	Sensible load	Air vel.	Pressure drop
In	26.50 °C	18.20 °C	78.77 %	1x80.4 kW	1x80.4 kW	2.28 m/s	84 Pa
Out	17.97 °C						

WATER	temp	Water flow	Water P.D	Water vel.	Connection size
In	11.00 °C	1 x 0.97 l/s	41.52 kPa	1.26 m/s	1 1/4"
Out	16.00 °C				1 1/4"

NC	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
4	Al.Ø0.13mm	CU.Ø0.40mm	Copper	Galvanized steel	NO	NO

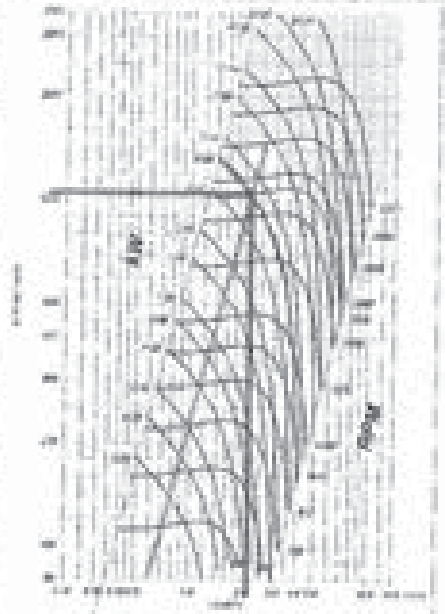
SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
1 x ADH 35/5 R	1xD132S-4P-5.5KW	1SPZ/A2+8U201230	
1 x 2.16 m3/s	S/2-D132S-4P-5.5KW	1SPZ/A2+8U201238	
10.55 m/s	5.50 kW	2 x SPA1050	
641 Pa	1440(400V/3/50)		
318 Pa	87.00 %		
496 Pa	11.10 Amp		
407 Pa	6.90		
407 Pa	0.83		
1048 Pa	0.55		
1518 rpm	36.00 Nm		
58.48 %	2.20		
1 x 4.13 kW	3.00		

		-5%	-2.5%	100%	+2.5	+5%
Air volume	m3/s	2.057	2.111	2.165	2.218	2.273
Total static pressure	Pa	1046	1046	1048	1050	1052
Shaft power	kW	3.963	4.047	4.128	4.225	4.331
Electrical Power input	kW	5.284	5.396	5.504	5.633	5.774
				1.907		
				2.542		

P. room sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
89.7	93	93	85	82	79	78	74



Vibration monitoring (sensor/actuator cable (EHC) termination box: NO

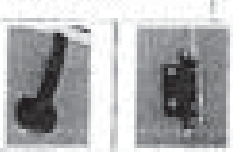
Emergency stop: EN 2 (ISO13850+2002) 2.5 mm2 RHO filter on @ rot. freq.

Spring Deflection: 20 mm

Starting kit: 2000 cm3

ACCESS DOOR

Dimensions: 900 x 550 mm — Handles + Hinges



RECORD of Functional Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 10/1/202

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU R-1A		SYSTEM/EQUIP. REF. : PAU-B-01 SA (Heatwhe
ITEM	DESIGN	ACTUAL
1. AHU MODEL / TYPE	Solver	Solver AL-1010H-135(
2. FAN MAKE AND MODEL NO.	✓	NICOTRA ASZ-280 H
3. FAN SIZE	✓	ϕ 280
4. FAN DRIVE TYPE	✓	Belt Drive
5. FAN AT FULL SPEED (r.p.m.)	1991	1998
6. MOTOR MAKE & FRAME NO.	✓	TECO
7. MOTOR VOLTAGE (V) / PHASE / FREQUENCY (Hz)	380/3/50	380/3/50
8. MOTOR POWER (KW)	2.2 kw	2.2 kw
9. MOTOR FULL LOAD CURRENT (Amp)	✓	4.7 SA
10. MOTOR RUNNING CURRENT (Amp)	✓	3.1 3.2 3.3
11. MOTOR OVERLOAD SETTING & RANGE	✓	4.6A, 5.2A
12. MOTOR SPEED (r.p.m.)	1435	1435
13. STARTER TYPE	✓	DOL & VSD
14. BELT SIZE, NUMBER, TYPE	✓	SPZ 1331X2 NO.8
15. MOTOR & FAN PULLEY DIAMETER (mm)	✓	SPZ 2 K40, SPZ 100
16. SUPPLY AIR VOLUME FLOW RATE (m^3/s)	0.69	0.711
17. FRESH AIR FLOW RATE (m^3/s)	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME LAI WA TAK SIGNATURE TAK

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Function Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 10/3/2012

PROJECT : CIC - Zero Carbon Building

LOCATION : B/F AHU Rm		SYSTEM/EQUIP. REF. : PAU-B-01 SA	
ITEM		DESIGN	ACTUAL
18. RETURN AIR VOLUME FLOW RATE (m^3/s)		/	/
19. FAN STATIC PRESSURE (Pa)		1189	1208
20. AHU EXTERNAL STATIC PRESSURE (Pa)		/	
21. AIR PRESSURE DROP ACROSS COIL (Pa)		/	
22. AIR PRESSURE DROP ACROSS FILTER		/	
23. WATER FLOW RATE (L/S)	Pre Cool Cool	2.32 2.1	1.812
24. WATER PRESSURE DROP (Kpa)	Pre Cool Cool	43.51 31.61	1.68
25. INLET AIR TEMPERATURE (DB/WB) C		35	33
26. OUTLET AIR TEMPERATURE (DB/WB) C		18.24	18.4
27. WATER INLET TEMPERATURE (C)		11	10.4
28. WATER OUTLET TEMPERATURE (C)		16	17.5
29. TYPE OF CONTROL VALVE		/	Modulating
30. FILTER TYPE (PRE/BAG FILTER)		/	Pre & Bag filter

FUNCTION TEST		STATUS
31. THERMOSTAT		o.k
32. CONTROL VALVE		o.k
33. EMERGENCY STOP		o.k
34. FILTER CLOG		o.k
35. OVERLOAD TRIPPING		o.k
36. DELAY OFF		/
37. SOUND PRESSURE LEVEL (dBA)		/
38. CHANGEOVER VSD four change DOL (starter)		o.k

REMARKS : Sensible factor 0.8

TESTED BY KRUEGER NAME LAI WAI YEE SIGNATURE

WITNESSED BY OAP NAME SIGNATURE

WITNESSED BY ( ) NAME SIGNATURE

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Total Flow Test Sheet

Location: SJE Ahu Room Plant Ref.: PAhu-B-01 SA

Drawing No.: YEL 16/11/201 Service: AHU-B-01, AHU-B-02, AHU-B-04, AHU-B-05

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
FAD	0.76	500 x 350	0.175	4.3
Inlet Static (Pa) /	Outlet Static (Pa) /			

4.8	4.5	4.5								
4.3	4.2	4.2								
4.4	4.3	4.5								

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
39.7	4.41	771	102	/

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	[illegible]				
Signature					
Date	10 Jul 12				

RECORD of Functional Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 10/11/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU R-11		SYSTEM/EQUIP. REF. : PAU-B-01 (Extract)
ITEM	DESIGN	ACTUAL (As Tested)
1. AHU MODEL / TYPE	Sahler	Sahler AI-1016 H-1350
2. FAN MAKE AND MODEL NO.	✓	NICOTRA AST-280 K
3. FAN SIZE	✓	ϕ=800
4. FAN DRIVE TYPE	✓	Belt Drive
5. FAN AT FULL SPEED (r.p.m.)		
6. MOTOR MADE & FRAME NO.	✓	Teco
7. MOTOR VOLTAGE (V) / PHASE / FREQUENCY (Hz)	380/3/50	380/3/50
8. MOTOR POWER (KW)	2.2 kW	2.2 kW
9. MOTOR FULL LOAD CURRENT (Amp)	✓	4.7 5A
10. MOTOR RUNNING CURRENT (Amp)	✓	2.3 2.7 2.9A
11. MOTOR OVERLOAD SETTING & RANGE	✓	4-6A, 5.2A
12. MOTOR SPEED (r.p.m.)	1435	1435
13. STARTER TYPE	✓	DOL
14. BELT SIZE, NUMBER, TYPE	✓	SPA 1470 X 2 NO. 8
15. MOTOR & FAN PULLEY DIAMETER (mm)	✓	SPA 200, SPA 100
16. SUPPLY AIR VOLUME FLOW RATE (m^3/s)	0.28	0.286
17. FRESH AIR FLOW RATE (m^3/s)	✓	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME LAI WAI TAK SIGNATURE _____

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Function Test for AHU/ PAU

AIR HANDLING UNIT/PRIMARY AIR HANDLING UNIT DATE : 10/7/2015

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F AHU Room	SYSTEM/EQUIP. REF. : PAU-B-01 Exhaust (Heat wheel)	
ITEM	DESIGN	ACTUAL
18. RETURN AIR VOLUME FLOW RATE (m^3/s)	/	/
19. FAN STATIC PRESSURE (Pa)	/	
20. AHU EXTERNAL STATIC PRESSURE (Pa)	/	
21. AIR PRESSURE DROP ACROSS COIL (Pa)	/	
22. AIR PRESSURE DROP ACROSS FILTER	/	
23. WATER FLOW RATE (L/S)	Heat Coil 2.32 l/s	2.38
24. WATER PRESSURE DROP (Kpa)	Heat Coil 43.5 l	44
25. INLET AIR TEMPERATURE (DB/WB) C	35	33
26. OUTLET AIR TEMPERATURE (DB/WB) C	24-21	24
27. WATER INLET TEMPERATURE (C)	90	92
28. WATER OUTLET TEMPERATURE (C)	80	81
29. TYPE OF CONTROL VALVE	/	Modulating
30. FILTER TYPE (PRE/BAG FILTER)	/	Pre-Bag Filter

FUNCTION TEST		STATUS
31. THERMOSTAT		O.K
32. CONTROL VALVE		O.K
33. EMERGENCY STOP		O.K
34. FILTER CLOG		O.K
35. OVERLOAD TRIPPING		O.K
36. DELAY OFF		/
37. SOUND PRESSURE LEVEL (dBA)		/
38. CHANGEOVER		/

REMARKS : _____

TESTED BY KRUEGER NAME Ali Wali Mk SIGNATURE [signature]

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Krueger Engineering (Asia) Ltd.

Air Flow Measurement for Total Flow Test Sheet

Location: B/F Ahu Room Plant Ref.: PAhu-B-01 Exhaust

Drawing No.: KEL/Ac/11001 Service: Ahu-B-01, Ahu-B-02, Ahu-B-04, Ahu-B-05

Duct Destination	Design Volume (m3/s)	Duct Size (mm x mm)	Duct Area (m2)	Design Velocity (m/s)
EAD	0.28	500x250	0.125	2.24
Inlet Static (Pa) /	Outlet Static (Pa) /			

2.3	2.2	2.4								
2.2	2.4	2.1								
2.4	2.3	2.3								

Total of All Velocity (m/s)	Average Velocity (m/s)	Measured Flow Rate (l/s)	% Design	Measure Static Pressure (Pa)
20.6	2.28	286	102	

Comments					
	Tested by	Witnessed	Witnessed	Witnessed	Test Ref.:
Company	Krueger				
Print Name	Kwok Wai Hip				
Signature					
Date	10/Jul/12				

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COMPANY WITH QUALITY SYSTEM CERTIFIED BY CSQ IQNet ISO 9001:2008
www.saiver.com

DATA SHEET

23/09/2011	06/10/2011	P.1 / 7	9001:2008	

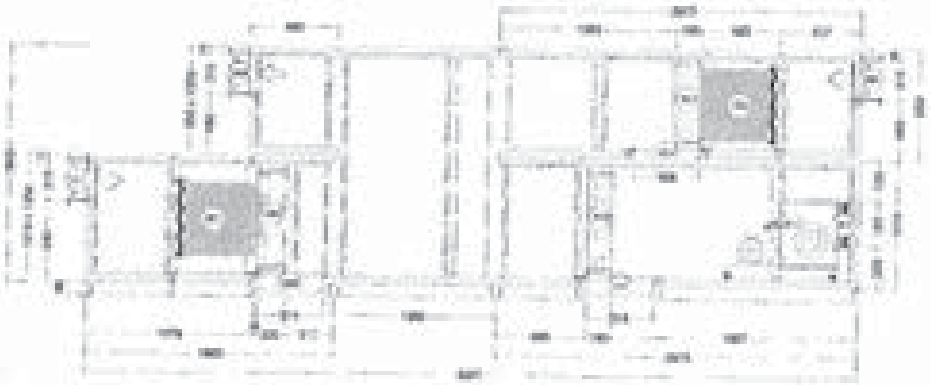
Project: CIC Zero Carbon Bldg AHU

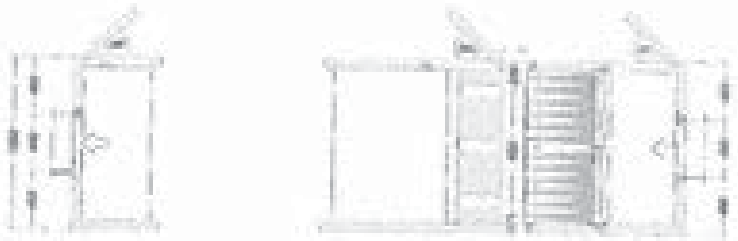
Model: A1-1010H-1350W

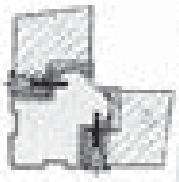
Ref: PAU-B-01 (Heatwheel)

Flow: 0.69 m3/s

01		02		04		06	
12		13		20		22	
23							







PANELS / FRAME

PART CODE	PU60SSTB	
Insulation	PUFOAM	
External sheet	CB1--06	Prepainted/coined steel sheet 0.6 mm - BLU B1
Internal sheet	CA4SA06	Preplasticized steel sheet 0.6 mm - WHITE A45A
ALUMINUM FRAME	PA95TT	
FEET	C100	

Break out Airborne sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
69.5	64	71	61	54	47	39	31

Mortar Box Mechanical characteristics (CEN 1886)

Casing strength	Casing air leakage	Thermal transmit.	Thermal bridging
D1M	L1	T2	TB2

UNIT SFP (W/(m3/s))

NOTE :

OPERATING CONDITIONS

0 UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

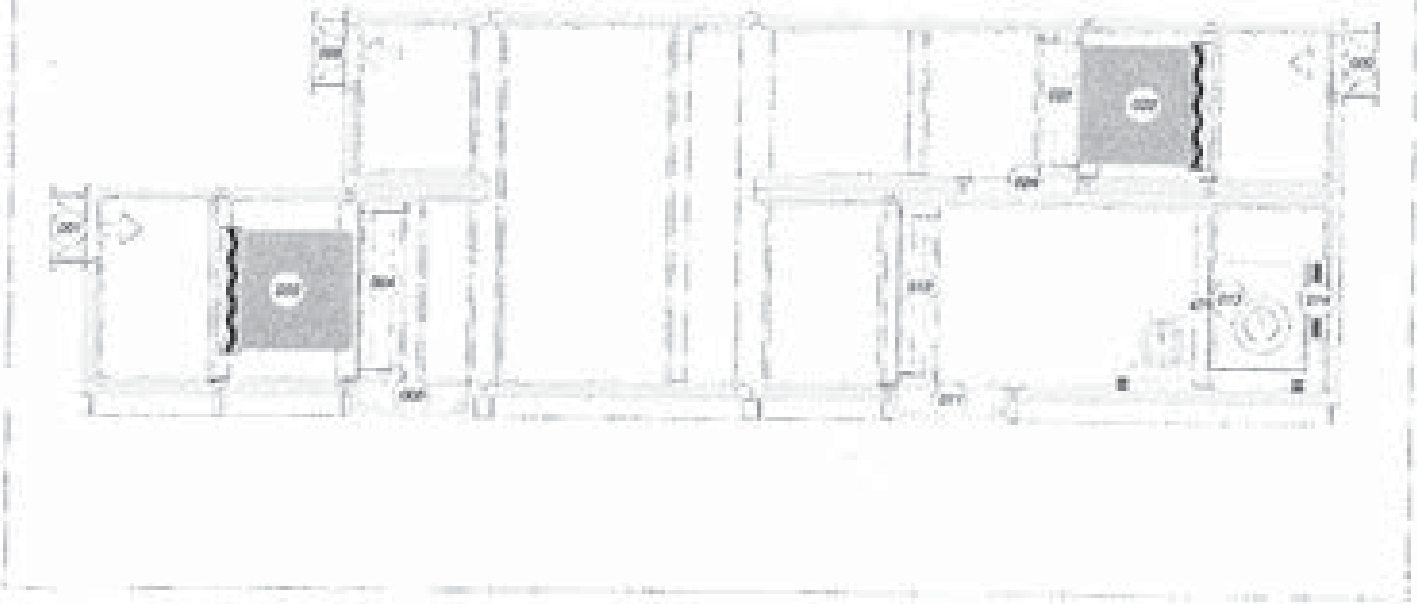
LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 90 %	35.0 °C @ 60 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
V1 (0.63 m/s)	V1 (0.30 m/s)

Total weight: 1525 kg

www.saiver.com

SOUND DATA

23/09/2011	08/12/2011	P.S./ ?	2351/2229	
Project	CIC Zero Carbon Bldg-AHU			Model A1-1010H-1350W
No	PAU-B-01 (Heat wheel)			Flow 0.69 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	87	84	75	66	60	53	49	78.3
003	03+F7	-3	-4	-7	-10	-11	-14	-14	
004	F40-16AR 5R-19T-950A-3.0Pa Cu/Al	-2	-3	-3	-3	-4	-3	-3	
012	F40-16AR 4R-19T-950A-3.0Pa Cu/Al	-2	-2	-2	-2	-4	-3	-3	
013	ASI280K - 1980 RPM - 2.20 kW	94	93	87	81	79	73	69	89.2
	OUTLET	94	93	87	81	79	73	69	89.2

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
84	71	61	56	47	36	31	69.5

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DATA SHEET

23/08/2011	06/10/2011	P 4 / 7	225/12209	

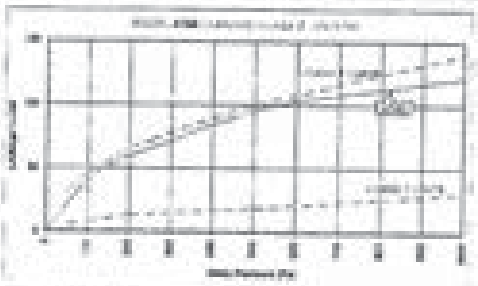
Project: CIC Zero Carbon Bldg AHU — Model: A1-1010H-1350W

Ref: PAU-B-01 (Heatwheel) — Flow: 0.69 m3/s

001 FRESH AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.69 m3/s	315 x 450 mm	A160	4.88 m/s	14 Pa

Damper	Air-tite connection	Louvre	Actuator
Yes	No	No	NO



002 ACCESS DOOR

Dimensions: 900 x 568 mm — Handles + Hinges

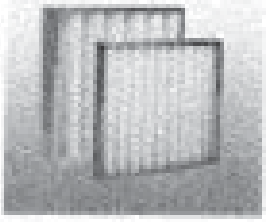

003 FILTERS

STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	0.69 m3/s	G3	PANEL	MGZ-48	2	0	48 mm
2	0.69 m3/s	F7	BAG	BSP-535-8	2	0	535 mm

Frame: Galvanised Steel

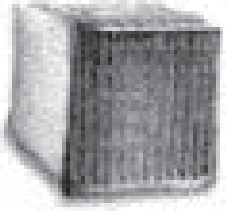
1

Drop	Final	Avg
7 Pa	150 Pa	78 Pa

2

Drop	Final	Avg
15 Pa	250 Pa	132 Pa

ACCESSORIES

004 PRE-COOLING COIL

Flow	Qty	Model			
0.69 m3/s	1	P40-16AR 5R/19T-60SA-3.0Pa Cu/Al [0 ml]	22.41 dm3	74.71 m2	1.225 kg/m3

Air side	DB	WB	RH	Tube load	Sensible load	Air vel.	Pressure Drop
In	35.00 °C		80.00 %	1kW8.5 kW	1kW4.6 kW	0.95 m/s	33 Pa
Out	18.24 °C		100.00 %				

WATER	temp	Water flow	Water P.D.	Water vel.		Connection size
In	11.00 °C	1 x 2.33 l/s	43.51 kPa	1.50 m/s		1 1/2"
Out	16.00 °C					1 1/2"

NC	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
8	Al@0.15mm	Cu@0.46mm	Copper	Galvanised steel	NO	NO

005 DRAIN PAN

Material: C016812 — Drain size: 48.00 mm

SAIVER
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DATA SHEET

03/08/2011	06/10/2011	F.S./ 7	325/2208	

Project: CIC Zero Carbon Bldg-AHU

Model: A1-10104-1350W

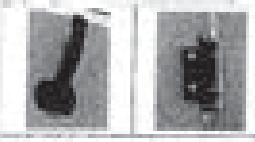
Ref: PAU-B-01 (Heatwheel)

Flow: 0.69 m3/s

006 ACCESS DOOR

Dimensions: 900 x 200 mm

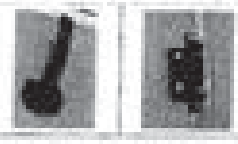
Handles



007 ACCESS DOOR

Dimensions: 740 x 570 mm

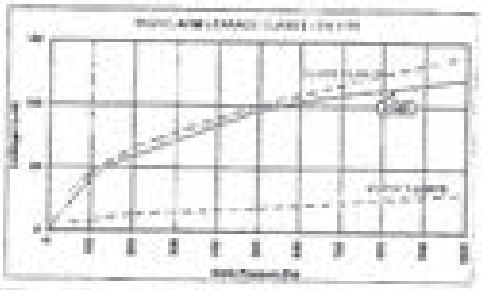
Handles + Hinges



008 RETURN AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure Drop
0.69 m3/s	315 x 450 mm	A160	4.87 m/s	14 Pa

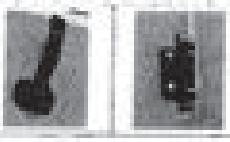
Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



009 ACCESS DOOR

Dimensions: 1750 x 850 mm

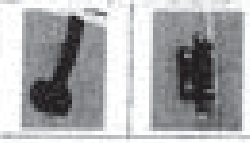
Handles



010 ACCESS DOOR

Dimensions: 900 x 575 mm

Handles + Hinges



011 DRAIN PAN

Material: C316/12

Drain size: 48.00 mm

012 POST COOLING COIL

Flow	Qty	Model			
0.69 m3/s	1	P40-16AR 4R-19T-950A-3.0Pa Cu/Al [0 m]	18.55 dm3	59.77 m2	1.225 kg/m3

Air side	Int.	W.B.	I.R.	Total load	Sensible load	Air vel.	Pressure Drop
In	35.00 °C		80.00 %	1x44.0 kW	1x13.2 kW	0.95 m/s	29 Pa
Out	19.93 °C		100.00 %				

WATER	Inlet	Water flow	Water P.D.	Water vel.		Connection size
In	11.00 °C	1 x 2.10 l/s	31.61 kPa	1.36 m/s		1 1/2"
Out	16.00 °C					1 1/2"

NC	Fins material	Tubes expanded	Nozzles	Finned	Flange	Counterflange
8	Al.@0.13mm	Cu.@0.40mm	Copper	Galvanized steel	NO	NC

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DATA SHEET

Project: CIC Zero Carbon Bldg-AHU

Model: A1-1010H-1350W

Type: PAU-B-01 (Heatwheel) (Supply)

Flow: 0.69 m3/s

SUPPLY Fan

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
1 x ASZ280K	1xD100LA-4P-2.2KW	100SPZ2+BU1810/30	
1 x 0.69 m3/s	S2:D100LA-4P-2.2KW	140SPZ2+BU1810/28	
10.44 m/s	2.20 kW	2 x 8PZ1037	
902 Pa	1420(400V/3/50)		
98 Pa	83.00 %		
475 Pa	4.80 Amp		
287 Pa	5.50		
287 Pa	0.81		
1189 Pa			
1981 rpm	15.00 N/m		
52.29 %	2.40		
1 x 1.66 kW	2.90		

		-5%	-0.5%	100%	+5%	+0%
Air volume	m3/s	0.000	0.000	0.690	0.000	0.000
Total static pressure	Pa	0	0	1189	0	0
Shaft power	kW	0.000	0.000	1.656	0.000	0.000
Electrical Power Input	kW	0.000	0.000	2.914	0.000	0.000
				2.400		
				3.354		

In Duct sound power (dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
89.2	94	93	87	81	79	73	69

Vibration monitoring (bearing without optional) termination (typ.)
NO

Guidance class
9V-2 ISO10816-3:2003 5.6 mm/s RMS filter in @ nor. freq.

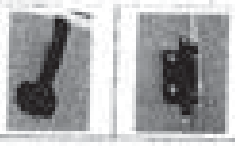
Spring Deflection: 23 mm

Bearing life: 50000 HRS

ACCESS DOOR

Panel opening: 900 x 579 mm

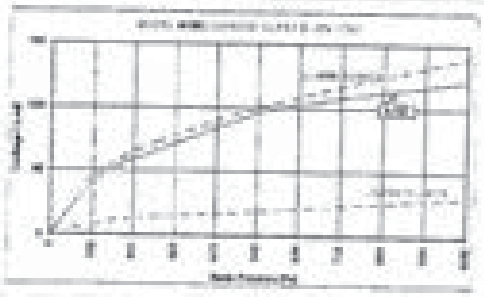
Handles + Hinges



RETURN AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.69 m3/s	315 x 450 mm	A160	4.86 m/s	14 Pa

Damper	Flexible connection	Louvre	Actuator
Yes	No	No	NO



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DATA SHEET

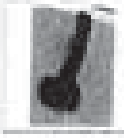
30/09/2011 | 06/10/2011 | P.1 / 3 | 3251/2328

Project: CIC Zero Carbon Bldg-AHU | Model: A1-1010H-1350W

Tag: PAU-B-01 (Hastwheel) | Flow: 0.69 m3/s

ACCESS DOOR

Dimensions: 740 x 362 mm | Handles + Hinges



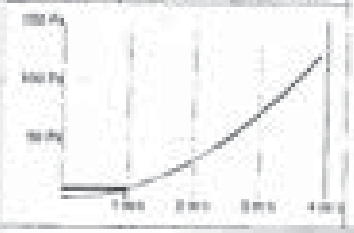
FILTERS

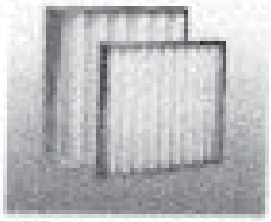
STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	0.69 m3/s	G3	PANEL	MCF-48	2	0	48 mm
2	0.69 m3/s	F7	BAG	60P-525-6	3	0	535 mm

Frame: Galvanised Steel

1

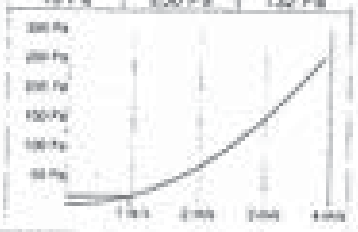
Clean: 7 Pa | Dirty: 150 Pa | Avg: 78 Pa

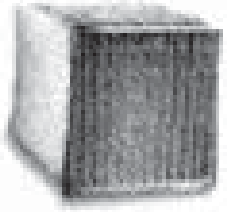




2

Clean: 15 Pa | Dirty: 250 Pa | Avg: 132 Pa





ACCESSORIES

HEATING COIL

Flow: 0.69 m3/s | Qty: 1 | Model: P40-16AC-4R-15T-850A-2.0Pa Cu/Al [0 m] | 14.72 dm3 | 69.21 m2 | Air dens: 1.225 kg/m3

Air side	Dt	Mm	Ufs	Total load	Sensible load	Air vel.	Pressure Drop
In	35.00 °C		80.00 %	144.8 kW		1.21 m/s	39 Pa
Out	84.21 °C		8.01 %				

WATER	Mm	Water flow	Water P.D.	Water vel.		Connection size
In	80.00 °C	1 x 2.10 l/s	30.10 kPa	1.55 m/s		1 1/2"
Out	85.00 °C					1 1/2"

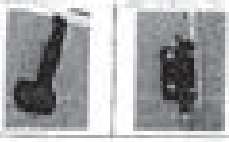
NC	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
7	Al@0.12mm	Cu@0.45mm	Copper	Galvanised steel	NO	NO

DRAIN PAN

Material: C316/12 | Drain size: 21.00 mm

ACCESS DOOR

Dimensions: 740 x 570 mm | Handles + Hinges



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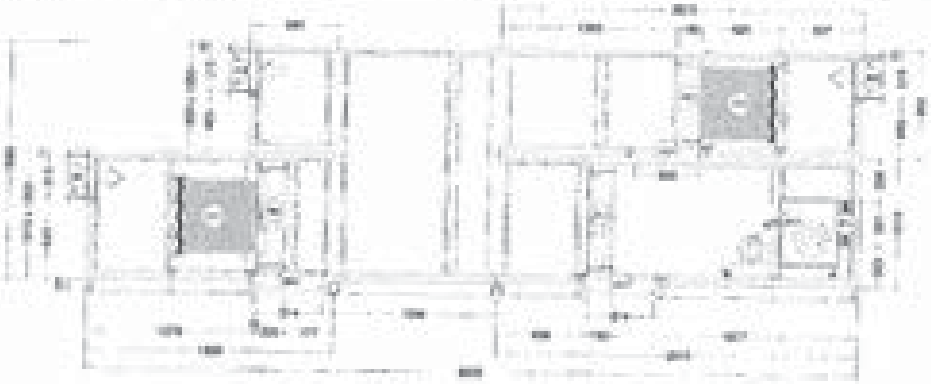
DATA SHEET

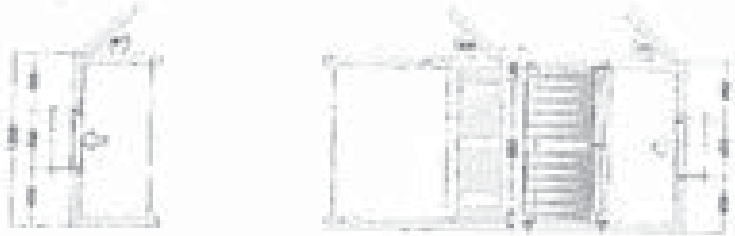
23/09/2011	06/10/2011	P. 1 / 7	0251/239

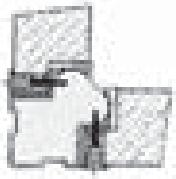
Project: CIC Zero Carbon Bldg-AHU — Code: A1-1010H-1350W

Ref: PAU-B-01 (Heatwheel) — Flow: 0.69 m3/s

01	FA DAMPER 315 x 400 mm	03	SHAFT	04	PAS 1535 SR-WF-IBSK 0.25% CLASS	06	RA DAMPER 315 x 400 mm
12	PAS 6.000 4R-WF-IBSK 0.8Pa CLASS	13	HEEMAN - 1080 RPM - 1.25 kW	20	RA DAMPER 315 x 400 mm	22	SHAFT
23	PAS 6.AC 4R-WF-IBSK 0.8Pa CLASS						







PANELS / FRAME

PART CODE		PUNSSTB
Insulation		PUFOAM
External sheet	CB1-08	Prepainticoed steel sheet 0.8 mm - BLU B1
Internal sheet	CA4SA08	Prepainticoed steel sheet 0.8 mm - WHITE A4SA
ALUMINIUM FRAME		PRSSTT
FEET		C150

Break-out Airborne sound (power dB)

A	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz
69.5	64	71	61	54	47	39	31

Metal Box Mechanical characteristics (EN1886)

Casing strength	Casing air leakage	Thermal transmi.	Thermal bridging
D1M	L1	T2	TB2

Unit SFP (W/l/s)

NOTE :

OPERATING CONDITIONS

0 UNKNOWN UNKNOWN	latitude	UNKNOWN
	longitude	UNKNOWN
	elevation	UNKNOWN m

LOWER OPERATING CONDITIONS	UPPER OPERATING CONDITIONS
-5.0 °C @ 80 %	35.0 °C @ 60 %
VELOCITY CLASS(SUPPLY)	VELOCITY CLASS(EXTRACT)
V1 (0.53 m/s)	V1 (0.30 m/s)

Unit weight: 1525 kg

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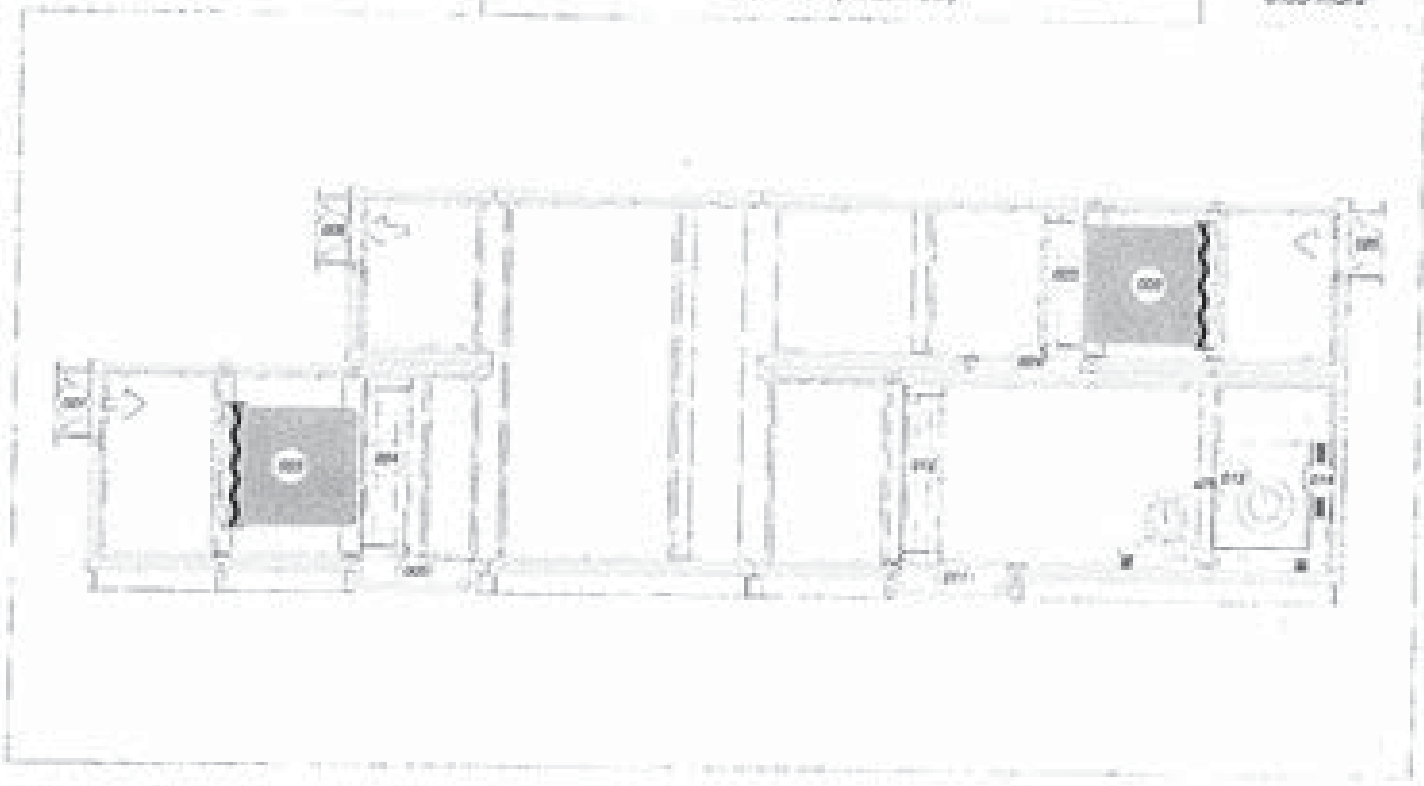
SOUND DATA

CIC Zero Carbon Bldg AHU

A1-1010H-1350W

PAU-B-01 (Heatwheel)

0.69 m3/s



IN-DUCT SOUND POWER LEVEL dB

		125	250	500	1000	2000	4000	8000	A
	INLET	87	84	75	66	60	53	49	78.3
005	G3+F7	-3	-4	-7	-10	-11	-14	-14	
006	P4S-16AA 5R-19T-950A-3.0Pa Cu/Al	-2	-3	-3	-3	-4	-3	-3	
012	P4S-16AA 6R-19T-950A-3.0Pa Cu/Al	-2	-2	-2	-2	-4	-3	-3	
013	ASE280K - 1980 RPM - 2.20 kW	94	93	87	81	79	73	69	89.2
	OUTLET	94	93	87	81	79	73	69	89.2

AIRBORNE SOUND POWER LEVEL dB

125	250	500	1000	2000	4000	8000	A
84	71	61	54	47	36	31	69.5

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DATA SHEET

23/09/2011	06/12/2011	P 4 / 7	52613208

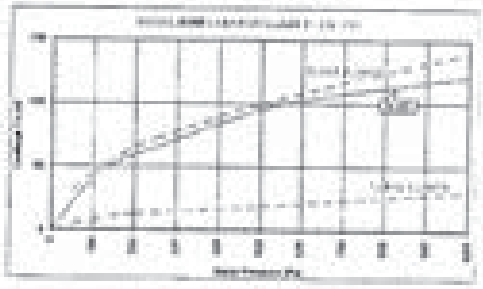
Project: CIC Zero Carbon Bldg-AHU — Model: A1-1010H-1350W

Ref: PAU-B-01 (Heatwheel) — Flow: 0.69 m3/s

601 FRESH AIR DAMPER

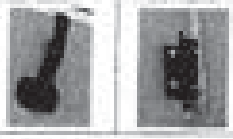
Flow	Dimensions	Frame	Air vel.	Pressure drop
0.69 m3/s	315 x 450 mm	A160	4.88 m/s	16 Pa

Storage	Flexible connection	Low leak	Actuator
Yes	No	No	NO



602 ACCESS DOOR

Dimensions: 900 x 568 mm — Handles + Hinges



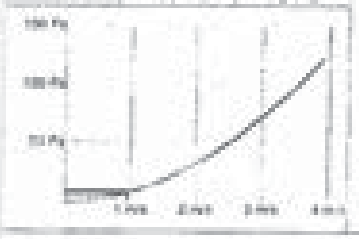
603 FILTERS

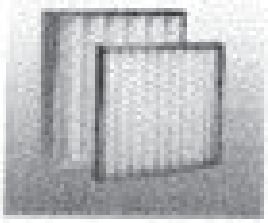
STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	0.69 m3/s	G3	PANEL	MCZ-48	2	0	48 mm
2	0.69 m3/s	F7	BAG	BSP-535-8	2	0	535 mm

Frame: Galvanised Steel

1

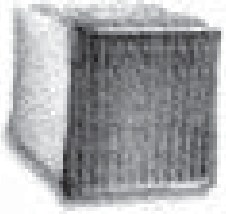
Clean: 7 Pa — Final: 150 Pa — Avg: 78 Pa





2

Clean: 15 Pa — Final: 250 Pa — Avg: 132 Pa



ACCESSORIES

604 PRE-COOLING COIL

Flow: 0.69 m3/s — Qty: 1 — Model: P40-16AR-5R-19T-050A-3.0Pa CuAl [0 rd] — 22.41 dm3 — 74.71 m2 — Density: 1.225 kg/m3

Air side	db			Tempr.load	Sensible load	Air vel.	Pressure Drop
In	35.00 °C		80.00 %	1x42.5 kW	1x14.8 kW	0.55 m/s	33 Pa
Out	18.24 °C		100.00 %				

WATER	temp.	Water flow	Water P.D.	Water vel.		Connections
In	11.00 °C	1 x 2.32 l/s	49.51 kPa	1.50 m/s		1 1/2"
Out	16.00 °C					1 1/2"

NC	Fins material	Tubes material	Headers	Frame	Flange	Circuits/Range
8	AC@2.13mm	CU@9.45mm	Copper	Galvanised steel	NO	NO

605 DRAIN PAN

Material: C31-SB12 — Drain out: 48.00 m/s

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DATA SHEET

25/03/2011 | 30/12/2011 | P.5 / 7 | 295-2226

Project: CIC Zero Carbon Bldg-AHU

Model: A1-101DH-1350W

Ref.: PAU-B-01 (Heatwheel)

Flow: 0.69 m3/s

006 ACCESS DOOR

Dimensions: 900 x 760 mm

Handles

007 ACCESS DOOR

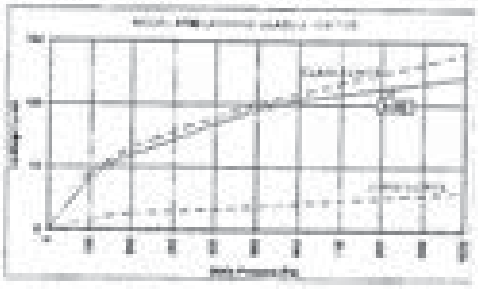
Dimensions: 760 x 570 mm

Handles + Hinges

008 RETURN AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.69 m3/s	315 x 450 mm	A550	4.87 m/s	14 Pa

Damper	Fire detector connection	Louvers	Actuator
Yes	No	No	NO



009 ACCESS DOOR

Dimensions: 1750 x 850 mm

Handles

010 ACCESS DOOR

Dimensions: 900 x 575 mm

Handles + Hinges

011 DRAIN PAN

Material: C316/316

Drain size: 48.00 mm

012 POST COOLING COIL

Flow: 0.69 m3/s | Qty: 1 | Model: P40-16AR-4R-15T-050A-3.0Pa Cu/Al [0 mt]

18.55 dm3 | 59.77 m2 | Air dens.: 1.225 kg/m3

Air side	Dry	Wet	UR	Total load	Sensible load	Air vel.	Pressure Drop
In	35.00 °C		80.00 %	1444.0 MW	1x13.2 kW	0.55 m/s	29 Pa
Out	19.89 °C		100.00 %				

WATER	Temp	Water flow	Water P.D.	Water vel.		Connections
In	11.00 °C	1 x 2.10 l/s	31.61 kPa	1.36 m/s		1 1/2"
Out	16.00 °C					1 1/2"

NC	Fins material	Tubes material	Headers	Frame	Flange	Counterflange
8	Al@0.19mm	Cu@0.40mm	Copper	Galvanized steel	NO	NO

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DATA SHEET

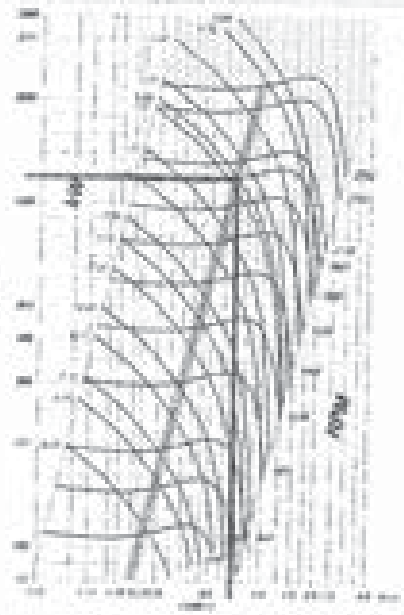
21/09/2011	06/12/2011	F.6./ 7	225/12/09	

Project: CIC Zero Carbon Bldg-AHU — Code: A1-1010H-1350W

Ref.: PAU-B-01 (Heatwheel) — Flow: 0.69 m3/s

SUPPLY FAN

FAN	MOTOR	V-BELT DRIVE	ACCESSORIES
Model: 1 x AIZ280K	Qty & motor model: 1xD100LA-4P-2.2KW	Part number: 100SPZ2-BU161030	
Flow: 1 x 0.69 m3/s	S2-D100LA 4P-2.2KW	Motor pulley: 140SPZ2-BU161028	
Fan outlet vel.: 10.44 m/s	Nominal motor power: 2.20 kW	Belts: 2 x SPZ1337	
Ext. static: 900 Pa	Motor RPM: 1420/400V/50Hz		
Min. LPS: 98 Pa	Motor efficiency: 86.40 %		
High LPS: 478 Pa	In: 4.80 Amp		
Avg. LPS: 287 Pa	S/In: 5.80		
Avg. LPS: 287 Pa	Power factor: 0.81		
Total static pressure: 1188 Pa	Start Power factor:		
RPM: 1981 rpm	Nominal torque: 15.00 Nm		
Efficiency: 52.29 %	Locked rotor torque Tp/Tn: 2.40		
Shaft power(LHS): 1 x 1.65 kW	Maximum torque Tmax/Tn: 2.90		



		-5%	-2.5%	100%	+2.5	+5%
Air volume	m3/s	0.000	0.000	0.690	0.000	0.000
Total static pressure	Pa	0	0	1188	0	0
Shaft power	kW	0.000	0.000	1.858	0.000	0.000
Electrical Power input	kW	0.000	0.000	2.314	0.000	0.000
				2.400		
				3.364		

Power levels (dB)

A	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
89.2	94	93	87	81	79	73	69

Vibration monitoring (sensors option 4-20mA) on motor/pump side: NO

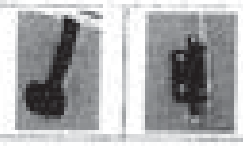
Vibration class: BV-2 ISO10816-3:98 in mm/s RMS filter in @ ctr. freq.

Spring Deflection: 20 mm

Bearing life: 200000 HRS

ACCESS DOOR

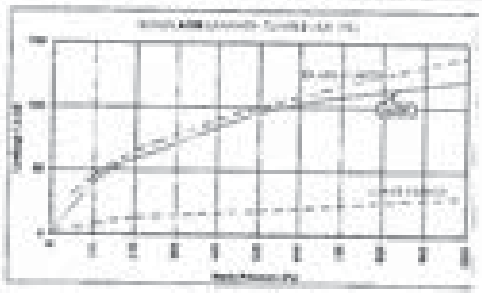
Dimensions: 800 x 570 mm — Handles + Hinges



RETURN AIR DAMPER

Flow	Dimensions	Model	Air vel.	Pressure drop
0.69 m3/s	315 x 450 mm	A150	4.86 m/s	14 Pa

Damper	Handle connection	Lock on	Actuator
Yes	No	No	NO



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DATA SHEET

CIC Zero Carbon Bldg AHU

A1-1010H-1350W

PAU-B-01 (Heatwheel)

0.69 m3/s

ACCESS DOOR

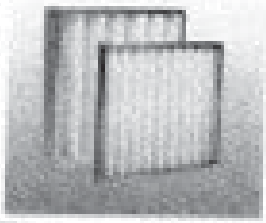
740 x 562 mm — Handles + Hinges

FILTERS

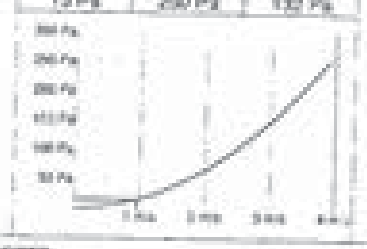
STAGE #	Air Volume	CLASS	TYPE	Model	QTY. FULL SIZE	QTY. HALF SIZE	LENGTH MM
1	0.69 m3/s	G3	PANEL	MCZ-48	2	0	48 mm
2	0.69 m3/s	F7	BAG	BSP 595-8	2	0	535 mm

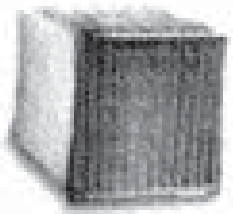
Galvanized Steel

Clean 7 Pa — Final 150 Pa — Avg 78 Pa



Clean 15 Pa — Final 250 Pa — Avg 132 Pa





ACCESSORIES

HEATING COIL

0.69 m3/s — Qty 1 — P40-16AC-6R-15T-950A-2.0Pa Cu/Al [0 ml] — 14.72 dm3 — 60.21 m2 — 1.225 kg/m3

Air side	DB	WB	RH	Capacity	Sensible load	Air vel	Pressure Drop
In	35.00 °C		80.00 %	144.0 kW		1.21 m/s	33 Pa
Out	64.21 °C		8.01 %				

WATER	temp.	Water flow	Water P.D.	Water vel	Connection size
In	80.00 °C	1 x 2.10 l/s	30.16 kPa	1.55 m/s	1 1/2"
Out	85.00 °C				1 1/2"

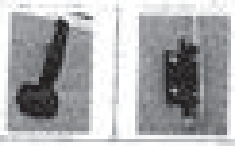
NC	Fins material	Tubes material	Headers	Frame	Flanges	Counterflange
7	Al @0.19 mm	Cu @0.40mm	Copper	Galvanized steel	NO	NO

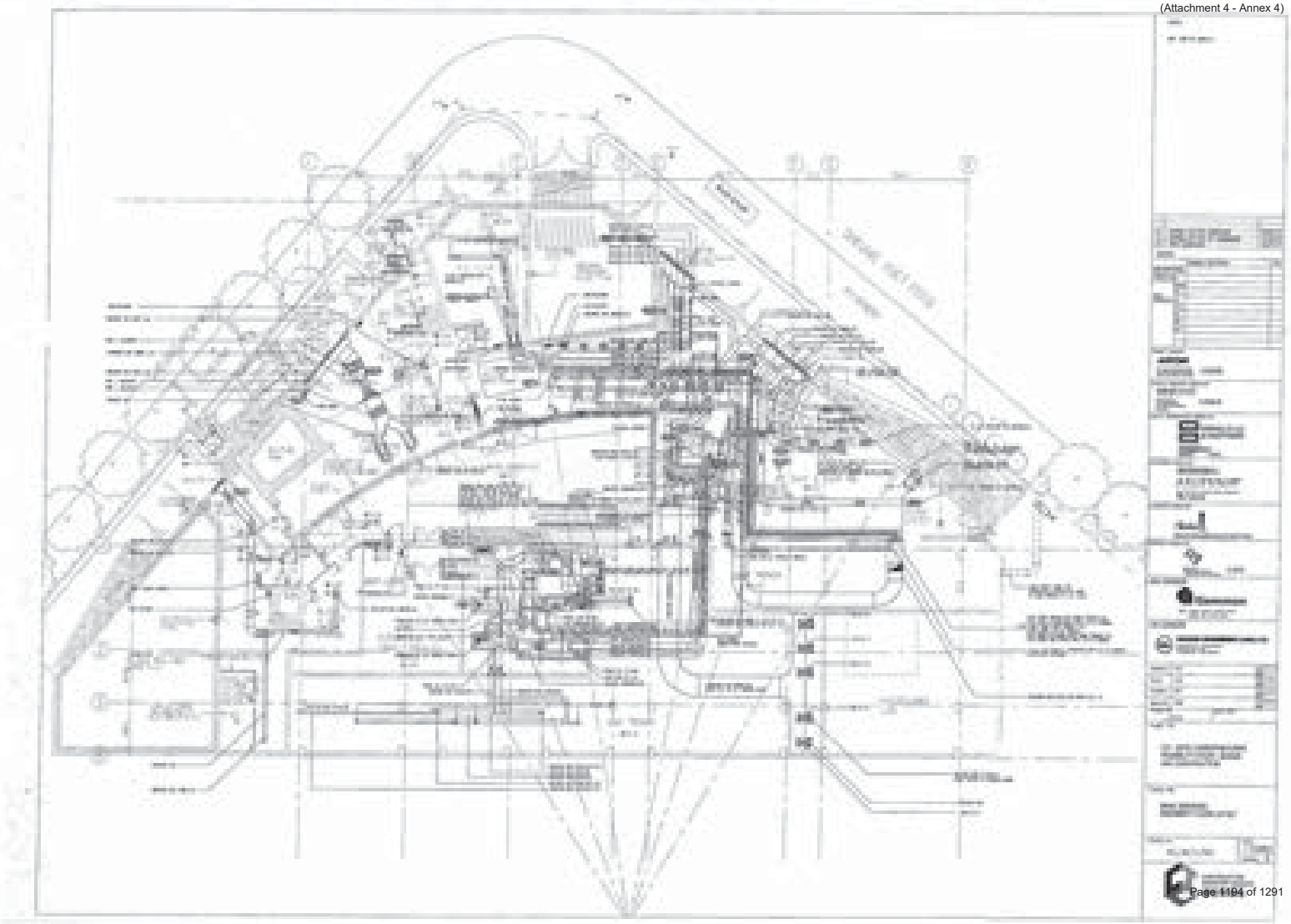
DRAIN PAN

C316Ti2 — 21.00 mm

ACCESS DOOR

740 x 570 mm — Handles + Hinges





Form RLP/RFI/rev

Project: CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works: E&M Services
Contract No.: P110204/L
Contractor:

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No. : RFIN – AC-028
To/ Attn : Mr. Patrick Lui
Date of Request :
Subject : MVAC INSTALLATION

Anticipated date of response :

Completed works for inspection : Functional Test of Water Pump

Locations : Basement Chiller Plant Rm. G.L. C-E/1

Referred Document: : KEL/AC/L/001(B)
AMTS/FSS/Specifications

Next Activities / Works :

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

Project Manager:
For and on behalf of Contractor's Name

Received by RLP/Date

Received by WK/Date

Received by WEC/Date

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken : 15 JUN 2012
Response / Comments :
:

Remarks:-

PLEASE SUBMIT INSTRUMENT CERTIFICATE.

Replied by RLP/ Date

Replied by WK / Date

Replied by WEC/ Date

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

KSW/NW/YL/PE

cc
KCS w/o
WK w/o
WEC w/o
TLS w/o

Method Statement

Testing and Commissioning of Water Pumps

For

Zero-Carbon Building at Sheung Yee Road Kowloon Bay

Method Statement – Testing and Commissioning of Water Pumps

Water Pumps Test Procedure

(A1) Pre-start Check

Check:
(a) the external cleanliness of pumps;
(b) that the flow direction is correct;
(c) that all components, bolts, fixing, etc. are secured;
(d) that the impeller is free to rotate;
(e) the anti-vibration mountings for correct deflection;
(f) that the correct drive is fitted;
(g) the securing and alignment of couplings (pump alignment tests have been performed satisfactorily);
(h) the cleanliness of the bearing;
(i) that the valves are installed the correct way round;
(j) that all normally open isolating and regulating valves are fully open and that all normally close valves are closed;
(k) that fuse ratings are correct;
(l) that starter overloads are set correctly in relation to motor name-plate full load current;
(m)that all wirings have been completed in detail to circuit diagram;
(n) that all wiring connections are tight;

(A2) Start-up Procedure

Charge the system with water by filling from the bottom upwards forcing the air to high points – for venting to atmosphere. When the whole system is filled, disconnect the filling source, open the permanent supply and adjust the tank levels.

On activating the motor, check:
(a) that the direction and speed rotation of motor shaft are correct;
(b) that the motor, pump and drive are free from vibration or undue noise;
(c) the motor starting current;
(d) the motor running current on all phases to ensure that they are balanced between phases.

Record of Functional Test for Water Pump

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F Chiller Plant Rm		SYSTEM/EQUIP. REF. : CHWP-B.01
ITEM	DESIGN	ACTUAL
1. PUMP MAKE & MODEL NO.	PUMKS	Lpp/S 32-250
2. PUMP TYPE	END SUCTION	END SUCTION
3. PUMP DRIVE TYPE	DIRECT	Direct
4. PUMP CORRECT ROTATION	✓	✓
5. PUMP SPEED (RPM)	1450	1450
6. SUCTION/DISCHARGE PRESSURE (KPa)		80 / 280
7. WATER VOLUME FLOW RATE (Litre/sec)	34	3.48
8. PUMP WORKING PRESSURE (KPA)		300
9. WATER INLET TEMPERATURE (deg C)		✓
10. WATER OUTLET TEMPERATURE (deg C)		✓
11. MOTOR VOLTAGE (PHASE)	3Φ/380 V/50Hz	385 / 3 / 50
12. MOTOR FULL LOAD CURRENT (AMPS)	5.2	5.2
13. MOTOR RUNNING CURRENT (AMPS)	—	4.4 4.4 4.6
14. STARTER TYPE		DOL / VSD
15. STARTER OVERLOAD SETTING (AMPS)		6 A
16. OVER LOAD RANGE		4-6 A
17. EMERGENCY STOP		✓
18. OVERLOAD TRIPPING		✓

TYPE OF INSTRUMENT : Computerized Balancing Instrument (Mfg: Sato)

TESTED BY KRUEGER NAME Lai Wah Tak SIGNATURE [signature] 4/6/2012

APPROVED BY OAP NAME _____ SIGNATURE [signature]

WITNESSED BY ( ) NAME _____ SIGNATURE _____

(19) VSD failure change over by-pass starter Run Tested / OK
(AE Auto mode)

Record of Functional Test for Water Pump

PROJECT : CIC-Zero Carbon Building

LOCATION : Roof Chiller Plant Rm		SYSTEM/EQUIP. REF. : CHWP-B-02
ITEM	DESIGN	ACTUAL
1. PUMP MAKE & MODEL NO.	PUMOS	LNP/3 32.2 KS
2. PUMP TYPE	End Suction	End Suction
3. PUMP DRIVE TYPE	DIRECT	Direct
4. PUMP CORRECT ROTATION	/	✓
5. PUMP SPEED (RPM)	1450	1450
6. SUCTION/DISCHARGE PRESSURE (Kpa)		84 / 383
7. WATER VOLUME FLOW RATE (Litre/sec)	3.4	3.51
8. PUMP WORKING PRESSURE (KPA)		295
9. WATER INLET TEMPERATURE (deg C)		/
10. WATER OUTLET TEMPERATURE (deg C)		/
11. MOTOR VOLTAGE (PHASE)	3φ / 380V / 50Hz	386 / 3 / 50
12. MOTOR FULL LOAD CURRENT (AMPS)	5.2	5.2
13. MOTOR RUNNING CURRENT (AMPS)	/	4.3 4.4 4.2
14. STARTER TYPE		DOL / VSD
15. STARTER OVERLOAD SETTING (AMPS)		6A
16. OVER LOAD RANGE		4-6A
17. EMERGENCY STOP		✓
18. OVERLOAD TRIPPING		✓

TYPE OF INSTRUMENT : Clamp meter and Balancing instrument (INTE 024)

TESTED BY KRUEGER NAME Lai Loon Tiok SIGNATURE Tiok 14/6/2012

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

(19) VSD fault change over bypass starter Run Tested ✓ O.K
(At Auto Mode)

Record of Functional Test for Water Pump

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F Exhaust Plant Rm	SYSTEM/EQUIP. REF. : CHWP-B-03	
ITEM	DESIGN	ACTUAL
1. PUMP MAKE & MODEL NO.	Wilo	Lpp/3 32.3K6
2. PUMP TYPE	End Suction	(SND Suction)
3. PUMP DRIVE TYPE	Direct	Direct
4. PUMP CORRECT ROTATION	✓	✓
5. PUMP SPEED (RPM)	1450	1450
6. SUCTION/DISCHARGE PRESSURE		80 / 284
7. WATER VOLUME FLOW RATE (Litre/sec)	3.4	3.58
8. PUMP WORKING PRESSURE (KPA)		300
9. WATER INLET TEMPERATURE (deg C)		✓
10. WATER OUTLET TEMPERATURE (deg C)		✓
11. MOTOR VOLTAGE (PHASE)	3Φ / 38v / 50Hz	38T / 3 / 50
12. MOTOR FULL LOAD CURRENT (AMPS)	5.2	5.2
13. MOTOR RUNNING CURRENT (AMPS)	✓	4.4 to 4.6
14. STARTER TYPE		DOL / VSD
15. STARTER OVERLOAD SETTING (AMPS)		6A
16. OVER LOAD RANGE		4-6A
17. EMERGENCY STOP		✓
18. OVERLOAD TRIPPING		✓

TYPE OF INSTRUMENT : Computerized Balancing instrument (TRITE 624)

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE Tak 14/6/2012

APPROVED BY QAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

(19) VSD fault charge over bypass starter Run (At Auto Mode)

Tested 16.6

Record of Functional Test for Water Pump

PROJECT : CIC-Zero Carbon Building

LOCATION : B2F Chiller Plant Rm	SYSTEM/EQUIP. REF. : CHWP-B-04	
ITEM	DESIGN	ACTUAL
1. PUMP MAKE & MODEL NO.	DRMS	LPP/3 32.25
2. PUMP TYPE	End Suction	End Suction
3. PUMP DRIVE TYPE	DIRECT	Direct
4. PUMP CORRECT ROTATION	/	V
5. PUMP SPEED (RPM)	1450	1454
6. SUCTION/DISCHARGE PRESSURE		BK /386
7. WATER VOLUME FLOW RATE (Litre/sec)	34	3.61
8. PUMP WORKING PRESSURE (KPA)		300
9. WATER INLET TEMPERATURE (deg C)		/
10. WATER OUTLET TEMPERATURE (deg C)		/
11. MOTOR VOLTAGE (PHASE)	3ϕ 380V/50Hz	386/3/50
12. MOTOR FULL LOAD CURRENT (AMPS)	5.2	5.2
13. MOTOR RUNNING CURRENT (AMPS)	/	4.3 4.9 4.6
14. STARTER TYPE		DOL /VSD
15. STARTER OVERLOAD SETTING (AMPS)		6A
16. OVER LOAD RANGE		4-6A
17. EMERGENCY STOP		V
18. OVERLOAD TRIPPING		V

TYPE OF INSTRUMENT : Computerized Balancing instrument (Testo 420)

TESTED BY KRUEGER NAME LEE WA TEK SIGNATURE TEK 14/6/2022

APPROVED BY QAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

(19) VSD fault change over by-pass starter Run Tested V OK (At Auto mode)

Record of Functional Test for Water Pump

PROJECT : CIC-Zero Carbon Building

LOCATION : B1F Chiller Room B		SYSTEM/EQUIP. REF. : CWP-B-01
ITEM	DESIGN	ACTUAL
1. PUMP MAKE & MODEL NO.	PRIMO	LDP/3 50.315
2. PUMP TYPE	End Suction	End Suction
3. PUMP DRIVE TYPE	DIRECT	Direct
4. PUMP CORRECT ROTATION	/	✓
5. PUMP SPEED (RPM)	1450	1450
6. SUCTION/DISCHARGE PRESSURE (KPA)		20 / 330
7. WATER VOLUME FLOW RATE (Litre/sec)	8.4	8.83
8. PUMP WORKING PRESSURE (KPA)		360
9. WATER INLET TEMPERATURE (deg C)		/
10. WATER OUTLET TEMPERATURE (deg C)		/
11. MOTOR VOLTAGE (PHASE)	3φ / 380V / 50Hz	388 / 3 / 50
12. MOTOR FULL LOAD CURRENT (AMPS)	10.3	~~10.3~~ 10.8
13. MOTOR RUNNING CURRENT (AMPS)	/	10.3 10.4 10.4
14. STARTER TYPE		Y/Δ
15. STARTER OVERLOAD SETTING (AMPS)		4.4 – 8A
16. OVER LOAD RANGE		6-9A
17. EMERGENCY STOP		✓
18. OVERLOAD TRIPPING		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Ha Tuck Tek SIGNATURE THK 14/6/2022

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

(19) ~~Temp sensor change over by pass Flow Rate Test OK~~

(14) Data made Tested Run OK

Record of Functional Test for Water Pump

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F Chiller Plant Rm	SYSTEM/EQUIP. REF. : CWP-B-02	
ITEM	DESIGN	ACTUAL
1. PUMP MAKE & MODEL NO.	DBLOS	LDP/3 40-315
2. PUMP TYPE	End Suction	End Suction
3. PUMP DRIVE TYPE	Direct	Direct
4. PUMP CORRECT ROTATION		✓
5. PUMP SPEED (RPM)	1450	1450
6. SUCTION/DISCHARGE PRESSURE (Kpa)		90/370
7. WATER VOLUME FLOW RATE (Litre/sec)	42	4.82
8. PUMP WORKING PRESSURE (KPA)		400
9. WATER INLET TEMPERATURE (deg C)		✓
10. WATER OUTLET TEMPERATURE (deg C)		✓
11. MOTOR VOLTAGE (PHASE)	3ϕ/380V/50Hz	386/3/50
12. MOTOR FULL LOAD CURRENT (AMPS)	8.5	8.5
13. MOTOR RUNNING CURRENT (AMPS)	/	6.8 6.8 6.9
14. STARTER TYPE		DOL
15. STARTER OVERLOAD SETTING (AMPS)		9.4A
16. OVER LOAD RANGE		7-10A
17. EMERGENCY STOP		✓
18. OVERLOAD TRIPPING		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible] 16/6/2012

APPROVED BY QAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

(19) [illegible] ok

(19) Auto mode Tested Run ✓ o.k

Record of Functional Test for Water Pump

PROJECT : CIC-Zero Carbon Building

LOCATION : B/F Chiller Plant Rm		SYSTEM/EQUIP. REF. : CWP-B-03
ITEM	DESIGN	ACTUAL
1. PUMP MAKE & MODEL NO.	DAB	LDP/B 40.315
2. PUMP TYPE	End Suction	End Suction
3. PUMP DRIVE TYPE	Direct	Direct
4. PUMP CORRECT ROTATION		✓
5. PUMP SPEED (RPM)	1450	1450
6. SUCTION/DISCHARGE PRESSURE (Kpa)		8.0/38.5
7. WATER VOLUME FLOW RATE (Litre/sec)	4.2	4.84
8. PUMP WORKING PRESSURE (KPA)		400
9. WATER INLET TEMPERATURE (deg C)		/
10. WATER OUTLET TEMPERATURE (deg C)		/
11. MOTOR VOLTAGE (PHASE)	3Φ/380V/15Kw	384/3/50
12. MOTOR FULL LOAD CURRENT (AMPS)	8.5	8.5
13. MOTOR RUNNING CURRENT (AMPS)	/	6.3 6.2 6.5
14. STARTER TYPE		DOL
15. STARTER OVERLOAD SETTING (AMPS)		9.4 A
16. OVER LOAD RANGE		7-10A
17. EMERGENCY STOP		✓
18. OVERLOAD TRIPPING		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wah Tak SIGNATURE Tak 14/6/202

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

(19) Auto mode Tested Run ✓ ok

RECORD of Functional Test for Transfer Water Pump Set System

Cooling Tower Makeup Water System DATE : 14/6/2022

PROJECT: CIC-Zero Carbon Building

UNIT MAKE	: AE9	PUMP MAKE	: DP Pump
MODEL NO.	: AM712-BA4	TYPE	: Vertical Pump
SERIAL NO.	: ✓	MODEL NO.	: SV2-10
MOTOR KW/ FLA	: 0.37 1.2A	SERIAL NO.	: 29877
VOLT / PH / Hz	: 380 / 3 / 50	PUMP IN / OUT DIA.	: 2" / 2" mm
MOTOR SPEED	: 1370 rpm		:

LOCATION : B/F Chiller Plant Rm SYSTEM/EQUIP. REF. : MWP-B-01

ITEM	DESIGN	ACTUAL
Transfer Water Pump		
1. SUPPLY VOLTAGE (V)	3P/380V/50Hz	386/3/50
2. RUNNING CURRENT (A)		0.75A
3. PUMP SPEED (RPM)	1450	1370
4. PUMP CORRECT ROTATION		✓
5. SUCTION/DISCHARGE PRESSURE (kPa)	136	0/190
6. PUMP WORKING PRESSURE (bar) kPa		200
7. MOTOR STARTER TYPE		DOL
8. STARTER OVERLOAD SETTING (A)		1A
9. OVER LOAD RANGE		0.3 — 1A
10. EMERGENCY STOP		✓
11. OVERLOAD TRIPPING		✓
(12) Charge cable Running		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE

APPROVED BY OAP NAME _____ SIGNATURE

WITNESSED BY ( ) NAME _____ SIGNATURE _____

(13) Auto make pressure control Cut in 100 kPa Cut out 200 kPa.

(14) Hi & Lo water Level Tested ✓ O.K

RECORD of Functional Test for Transfer Water Pump Set System

Cooling Tower Makeup Water System DATE : _____

PROJECT: CIC-Zero Carbon Building

UNIT MAKE	: AEG	PUMP MAKE	: DP Pump
MODEL NO.	: AM 712-B4P	TYPE	: Vertical Pump
SERIAL NO.	: /	MODEL NO.	: SV2-10
MOTOR KW/ FLA	: 0-37 1-2A	SERIAL NO.	: 29878
VOLT / PH / Hz	: 380/3/50	PUMP IN / OUT DIA.	: 25 / 24 mm
MOTOR SPEED	: 1370 rpm		:

LOCATION : BF Chiller Plant Rm	SYSTEM/EQUIP. REF. : MWP-B-02	
ITEM	DESIGN	ACTUAL
Transfer Water Pump		
1. SUPPLY VOLTAGE (V)	380/3/50	385/3/50
2. RUNNING CURRENT (A)		0-76A
3. PUMP SPEED (RPM)	1450	1370
4. PUMP CORRECT ROTATION		✓
5. SUCTION/DISCHARGE PRESSURE (kPa)	136	0/90
6. PUMP WORKING PRESSURE (bar/ kpa		300
7. MOTOR STARTER TYPE		DOL
8. STARTER OVERLOAD SETTING (A)		1A
9. OVER LOAD RANGE		0.3 – 1A
10. EMERGENCY STOP		✓
11. OVERLOAD TRIPPING		✓
(12) change over Running		✓

TYPE OF INSTRUMENT : _____

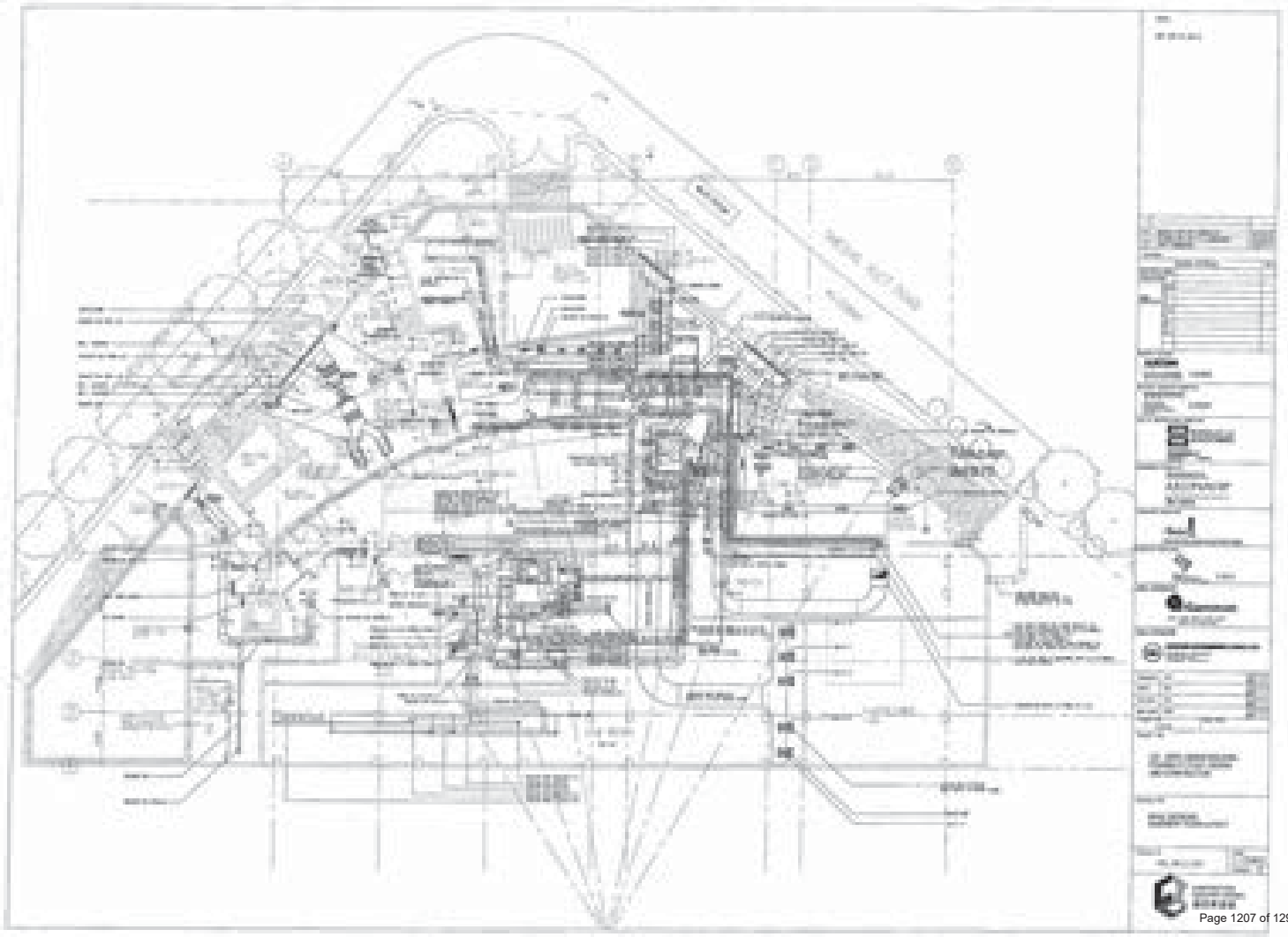
TESTED BY KRUEGER NAME _____ SIGNATURE _____

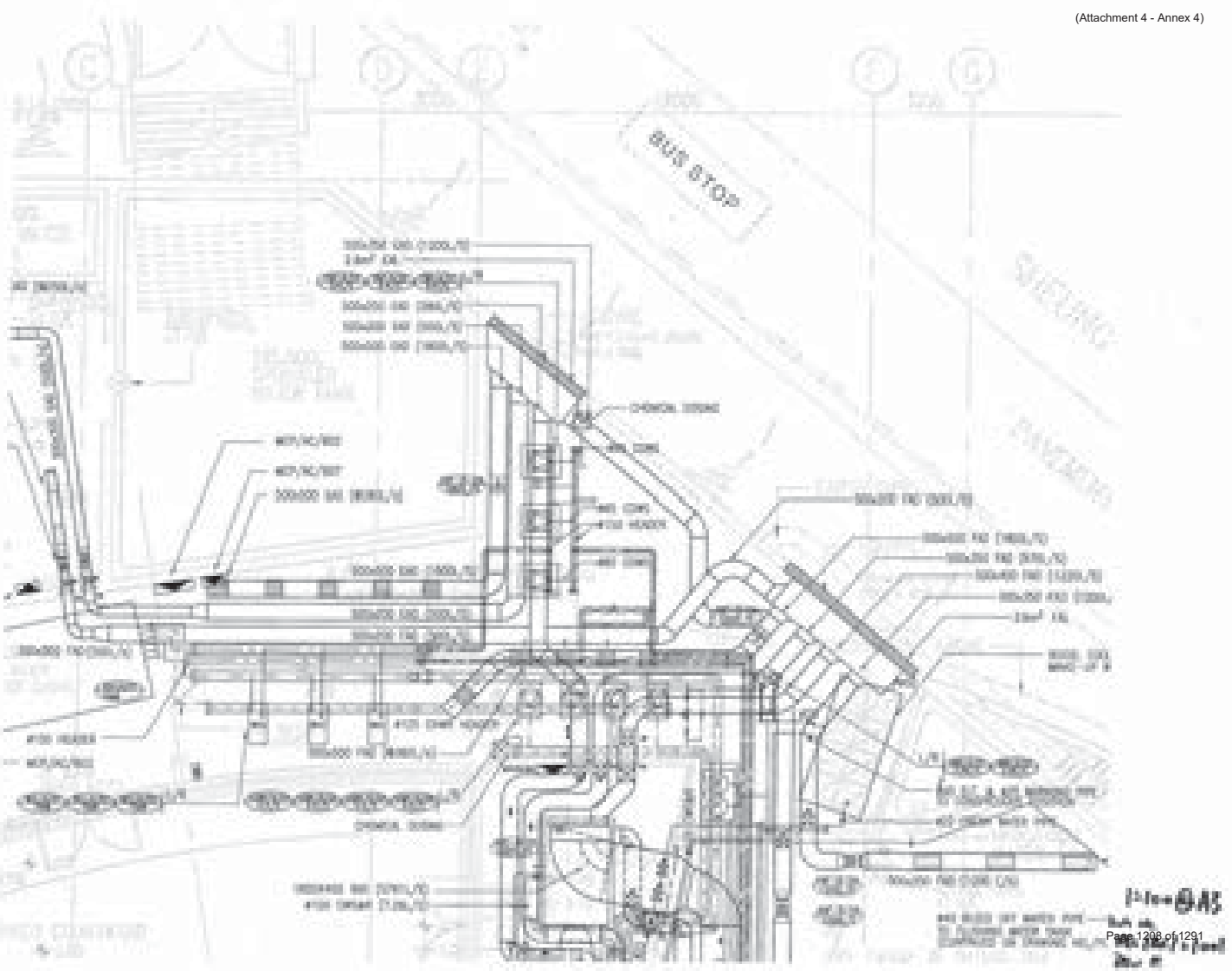
APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

(13) Auto make pressure Control Cut in 100kpa Cut out 300kpa.

(14) Hi & Lo water Level Tested ✓ O-K




BUS STOP

Form RLP/RFI/xx

Project: CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works: E&M Services
Contract No.: P11024KL
Contractor:

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No. : RFIN – AC-035
To/ Attn : Mr. Patrick Lui
Date of Request :
Subject : MVAC INSTALLATION

Anticipated date of response :

Completed works for inspection : Functional Test of Ceiling Fan

Locations : G/F-M/F

Referred Document: : KEL/AC/L/002(B), KEL/AC/L/003(B)
A/T/E/I/S/S/F/Specifications

Next Activities / Works :

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

Project Manager:
For and on behalf of Contractor's Name

Received by RLP/Date

Received by WK/Date

Received by WEC/Date

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken :
Response / Comments :
:

Remarks:-

→ Ceiling Fan at ~~outlet~~ Escalator will be tested

→ Fixing needed to be provided for CF-G-06

Replied by RLP/ Date

Replied by [illegible] Date

Replied by WEC/ Date

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

KSW/WYK/JYE

cc
KCS w/a
WK w/a
WEC w/a
TLS w/a

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : M/F Display Area		SYSTEM/EQUIP. REF. : CF-M-01
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.		BSB ASS Fans
2. FAN TYPE		OX-C3.12 NUFB
3. FAN SIZE		Ø24"
4. FAN DRIVE TYPE		Direct
5. FAN CORRECT ROTATION		✓
6. FAN SPEED (R.P.M.)		
7. VOLTAGE/PHASE		230/1/60
8. MOTOR POWER (KW)		0.75
9. MOTOR STARTER TYPE		VFD
10. MOTOR FULL LOAD CURRENT (A)		3.24
11. MOTOR RUNNING CURRENT (A)		2.6
12. MOTOR SPEED (R.P.M.)		1725
13. OVER LOAD SETTING AND RANGE		✓
14. AIR VOLUME FLOW RATE (L/S)		
15. FAN STATIC PRESSURE (Pa)		✓
16. FAN PULLEY DIAMETER (mm)		✓
17. MOTOR PULLEY DIAMETER (mm)		✓
18. NO. OF BELTS, TYPE		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lim Wah Tek SIGNATURE Tek

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Megger Test for motor U - E 100MΩ U - V ∞Ω
V - E 100MΩ U - W ∞Ω
W - E 100MΩ V - W ∞Ω

RECORD of Functional Test for CEILING Fan

CEILING FAN

DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : M/F Display Area		SYSTEM/EQUIP. REF. : CF-M-01
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP	-	O-K
22. OVERLOAD TRIPPING	-	✓
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible]

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : M/F Display Area		SYSTEM/EQUIP. REF. : CF-M-07
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.		Big Ass Fans
2. FAN TYPE		XQ C212 NUFB
3. FAN SIZE		ϕ 24"
4. FAN DRIVE TYPE		Direct
5. FAN CORRECT ROTATION		✓
6. FAN SPEED (R.P.M.)		
7. VOLTAGE/PHASE		230/1/60
8. MOTOR POWER (KW)		0.75
9. MOTOR STARTER TYPE		VFD
10. MOTOR FULL LOAD CURRENT (A)		3.24
11. MOTOR RUNNING CURRENT (A)		2.68
12. MOTOR SPEED (R.P.M.)		1124
13. OVER LOAD SETTING AND RANGE		✓
14. AIR VOLUME FLOW RATE (L/S)		
15. FAN STATIC PRESSURE (Pa)		✓
16. FAN PULLEY DIAMETER (mm)		✓
17. MOTOR PULLEY DIAMETER (mm)		✓
18. NO. OF BELTS, TYPE		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE Tak

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Megger Test for motor U-E 100 MΩ U-V 6.0 Ω
V-E 100 MΩ U-W 6.0 Ω
W-E 100 MΩ V-W 6.0 Ω

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : M/E Display Area SYSTEM/EQUIP. REF. : CF-M-02

ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP (Fuse Spur Switch)	-	O.K
22. OVERLOAD TRIPPING	-	✓
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lee Wai Tak SIGNATURE Tak.

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : M/F Display Area		SYSTEM/EQUIP. REF. : CF-M-03
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.		Big Ass Fans
2. FAN TYPE		Haiku C212 MUFR
3. FAN SIZE		8 24'
4. FAN DRIVE TYPE		Direct
5. FAN CORRECT ROTATION		✓
6. FAN SPEED (R.P.M.)		
7. VOLTAGE/PHASE		230/1/60
8. MOTOR POWER (KW)		0.74
9. MOTOR STARTER TYPE		VFD
10. MOTOR FULL LOAD CURRENT (A)		3.24
11. MOTOR RUNNING CURRENT (A)		2.58
12. MOTOR SPEED (R.P.M.)		1124
13. OVER LOAD SETTING AND RANGE		✓
14. AIR VOLUME FLOW RATE (L/S)		
15. FAN STATIC PRESSURE (Pa)		✓
16. FAN PULLEY DIAMETER (mm)		✓
17. MOTOR PULLEY DIAMETER (mm)		✓
18. NO. OF BELTS, TYPE		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME LAU WAI TAK SIGNATURE TAK

APPROVED BY QAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Megger Test for motor U-E 80 MΩ U-V 1.7 Ω
V-E 80 MΩ U-W 1.7 Ω
W-E 80 MΩ V-W 1.7 Ω

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 23/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : M/F Display Area	SYSTEM/EQUIP. REF : CF-M-03	
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER		✓
20. FILTER CLOG TEST		✓
21. EMERGENCY STOP Fuse Spur Switch		O.K
22. OVERLOAD TRIPPING		✓
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible]

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for CEILING Fan

CEILING FAN

DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

(High Level)

LOCATION G/F Permanent Exhibition	SYSTEM/EQUIP. REF. : CF-G-01	
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.		Big Ass Fans
2. FAN TYPE		DX-E212 NUFB
3. FAN SIZE		Ø 24"
4. FAN DRIVE TYPE		Direct
5. FAN CORRECT ROTATION		✓
6. FAN SPEED (R.P.M.)		
7. VOLTAGE/PHASE		230/1/60
8. MOTOR POWER (KW)		0.75
9. MOTOR STARTER TYPE		VRD
10. MOTOR FULL LOAD CURRENT (A)		3.24
11. MOTOR RUNNING CURRENT (A)		2.61
12. MOTOR SPEED (R.P.M.)		1725
13. OVER LOAD SETTING AND RANGE		✓
14. AIR VOLUME FLOW RATE (L/S)		
15. FAN STATIC PRESSURE (Pa)		✓
16. FAN PULLEY DIAMETER (mm)		✓
17. MOTOR PULLEY DIAMETER (mm)		✓
18. NO. OF BELTS, TYPE		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lee Wai Tak SIGNATURE

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Megger Test for Motor U-E 100 MΩ U-V ∞ Ω

V-E 100 MΩ U-W ∞ Ω

W-E 100 MΩ V-W ∞ Ω

RECORD of Functional Test for CEILING Fan

CEILING FAN

PROJECT : CIC-Zero Carbon Building

(High Level)

LOCATION : G/F Permanent Exhibition	SYSTEM/EQ.
ITEM	DES
FUNCTIONAL TEST	
19. DAMPER	-
20. FILTER CLOG TEST	-
21. EMERGENCY STOP — Use Spur Switch	-
22. OVERLOAD TRIPPING	-
23. FIRE TRIP	

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [illegible]

WITNESSED BY OAP NAME _____

WITNESSED BY ( ) NAME _____

ventilation Fans

16/2012

G-01

MEASUREMENT
✓
✓
O.K
✓
✓
T&C

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

(High Level)

LOCATION : G/F Permanent Exhibition		SYSTEM/EQUIP. REF. : CF-G-02
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.		Big Ass Fans
2. FAN TYPE		Haiku 12 ft
3. FAN SIZE		ø24"
4. FAN DRIVE TYPE		Direct
5. FAN CORRECT ROTATION		✓
6. FAN SPEED (R.P.M.)		
7. VOLTAGE/PHASE		230/1/60
8. MOTOR POWER (KW)		0.75
9. MOTOR STARTER TYPE		VFD
10. MOTOR FULL LOAD CURRENT (A)		3.24
11. MOTOR RUNNING CURRENT (A)		2.93
12. MOTOR SPEED (R.P.M.)		172
13. OVER LOAD SETTING AND RANGE		/
14. AIR VOLUME FLOW RATE (L/S)		
15. FAN STATIC PRESSURE (Pa)		/
16. FAN PULLEY DIAMETER (mm)		/
17. MOTOR PULLEY DIAMETER (mm)		/
18. NO. OF BELTS, TYPE		/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lam Wai Tak SIGNATURE Tak.

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Megger Tester for Motor U-E 100 MΩ U-V ∞Ω
V-E 100 MΩ U-W ∞Ω
W-E 100 MΩ V-W ∞Ω

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

(High Level)

LOCATION GF Dry Transport Exhibition SYSTEM/EQUIP. REF. : CP-G-02

ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER		✓
20. FILTER CLOG TEST		✓
21. EMERGENCY STOP — Fuse & Isolator Switch		OK
22. OVERLOAD TRIPPING		✓
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Mr. Wah Tin SIGNATURE

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 23/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F E Co office	SYSTEM/EQUIP. REF : CF-G-[redacted]02
ITEM	DESIGN / ACTUAL
1. MAKE AND MODEL NO.	Big Ass Fans [redacted] X-52 2 NUFB
2. FAN TYPE	
3. FAN SIZE	ø 24"
4. FAN DRIVE TYPE	Direct
5. FAN CORRECT ROTATION	✓
6. FAN SPEED (R.P.M.)	
7. VOLTAGE/PHASE	230 / 1 / 60
8. MOTOR POWER (KW)	0.75
9. MOTOR STARTER TYPE	VFD
10. MOTOR FULL LOAD CURRENT (A)	3.24
11. MOTOR RUNNING CURRENT (A)	2.71
12. MOTOR SPEED (R.P.M.)	1725
13. OVER LOAD SETTING AND RANGE	✓
14. AIR VOLUME FLOW RATE (L/S)	
15. FAN STATIC PRESSURE (Pa)	✓
16. FAN PULLEY DIAMETER (mm)	✓
17. MOTOR PULLEY DIAMETER (mm)	✓
18. NO. OF BELTS, TYPE	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [redacted] SIGNATURE [redacted]

APPROVED BY GAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Megger Test for Motor U-G 100 MΩ U-V ∞ Ω
V-G 100 MΩ U-W ∞ Ω
W-G 100 MΩ V-W ∞ Ω

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F ECO office	SYSTEM/EQUIP. REF. : OF-G-03	
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		✓
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP - Fuse Spur Switch	-	O.K
22. OVERLOAD TRIPPING	-	✓
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lam Wai Tak SIGNATURE [signature]

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for CEILING Fan

CEILING FAN

DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION G/F Eco-office	SYSTEM/EQUIP. REF. : CF-G-04	
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.		Big Ass Fans Vortex 212 White
2. FAN TYPE		
3. FAN SIZE		ϕ 24"
4. FAN DRIVE TYPE		Direct
5. FAN CORRECT ROTATION		✓
6. FAN SPEED (R.P.M.)		
7. VOLTAGE/PHASE		230/1/60
8. MOTOR POWER (KW)		0.75
9. MOTOR STARTER TYPE		~~VFD~~
10. MOTOR FULL LOAD CURRENT (A)		~~3.2~~
11. MOTOR RUNNING CURRENT (A)		~~2.4~~
12. MOTOR SPEED (R.P.M.)		1725
13. OVER LOAD SETTING AND RANGE		✓
14. AIR VOLUME FLOW RATE (L/S)		
15. FAN STATIC PRESSURE (Pa)		✓
16. FAN PULLEY DIAMETER (mm)		✓
17. MOTOR PULLEY DIAMETER (mm)		✓
18. NO. OF BELTS, TYPE		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible]

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Megger Test for motor U-G 100 MΩ U-V 6.0 Ω
V-G 100 MΩ U-W 6.0 Ω
W-G 100 MΩ V-W 6.0 Ω

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION G/F E/O-office	SYSTEM/EQUIP. REF. : CF-G-04	
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER		✓
20. FILTER CLOG TEST		✓
21. EMERGENCY STOP		O.K
22. OVERLOAD TRIPPING		✓
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible]

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 23/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : E/F Eco-office		SYSTEM/EQUIP. REF. : EF-G-01
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.		Big Ass Fans
2. FAN TYPE		X2 0212 HUF B
3. FAN SIZE		4 24"
4. FAN DRIVE TYPE		Direct
5. FAN CORRECT ROTATION		✓
6. FAN SPEED (R.P.M.)		
7. VOLTAGE/PHASE		230 / 1 / 60
8. MOTOR POWER (KW)		0.75
9. MOTOR STARTER TYPE		VFD
10. MOTOR FULL LOAD CURRENT (A)		3.24
11. MOTOR RUNNING CURRENT (A)		2.63
12. MOTOR SPEED (R.P.M.)		1725
13. OVER LOAD SETTING AND RANGE		—
14. AIR VOLUME FLOW RATE (L/S)		
15. FAN STATIC PRESSURE (Pa)		—
16. FAN PULLEY DIAMETER (mm)		—
17. MOTOR PULLEY DIAMETER (mm)		—
18. NO. OF BELTS, TYPE		—

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE Tak

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Megger Test for Motor U - E 100 MΩ U - V ∞ Ω
V - E 100 MΩ U - W ∞ Ω
W - E 100 MΩ V - W ∞ Ω

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F E/Coffice	SYSTEM/EQUIP. REF. : CF-G-04	
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER		✓
20. FILTER CLOG TEST		✓
21. EMERGENCY STOP - Fire Sprinkler		O.K
22. OVERLOAD TRIPPING		✓
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lai Wai Tak SIGNATURE

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F Multi-purpose Room SYSTEM/EQUIP. REF. : CF-G-06

ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.		Big Ass Fans
2. FAN TYPE		XS CF12 MUP B
3. FAN SIZE		Ø24"
4. FAN DRIVE TYPE		Direct.
5. FAN CORRECT ROTATION		✓
6. FAN SPEED (R.P.M.)		
7. VOLTAGE/PHASE		N30 / 1 / 60
8. MOTOR POWER (KW)		0.1t
9. MOTOR STARTER TYPE		[redacted] VFD
10. MOTOR FULL LOAD CURRENT (A)		[redacted] 3.24
11. MOTOR RUNNING CURRENT (A)		[redacted] 2.69
12. MOTOR SPEED (R.P.M.)		1725
13. OVER LOAD SETTING AND RANGE		/
14. AIR VOLUME FLOW RATE (L/S)		
15. FAN STATIC PRESSURE (Pa)		/
16. FAN PULLEY DIAMETER (mm)		/
17. MOTOR PULLEY DIAMETER (mm)		/
18. NO. OF BELTS, TYPE		/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lee Wai Tak SIGNATURE Tak

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Megger Test for motor U-E 200 MΩ U-V 6.1 MΩ
V-E 200 MΩ U-W 6.1 MΩ
W-E 200 MΩ V-W 6.1 MΩ

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 22/6/202

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F Multi-Purpose Room		SYSTEM/EQUIP. REF. : CF-G-06
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER		✓
20. FILTER CLOG TEST		✓
21. EMERGENCY STOP Fuse Spur Switch		OK
22. OVERLOAD TRIPPING		✓
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME Lo Kwok Tak SIGNATURE Tak

WITNESSED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 23/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F Multi-Purpose P-M	SYSTEM/EQUIP. REF. : CF-G-07	
ITEM	DESIGN	ACTUAL
1. MAKE AND MODEL NO.		Big Ass Fans VSD C212-WUF TR
2. FAN TYPE		
3. FAN SIZE		ϕ 24"
4. FAN DRIVE TYPE		Direct
5. FAN CORRECT ROTATION		✓
6. FAN SPEED (R.P.M.)		
7. VOLTAGE/PHASE		230/1/60
8. MOTOR POWER (KW)		0.75
9. MOTOR STARTER TYPE		VFD
10. MOTOR FULL LOAD CURRENT (A)		3.24
11. MOTOR RUNNING CURRENT (A)		2.58
12. MOTOR SPEED (R.P.M.)		172k
13. OVER LOAD SETTING AND RANGE		/
14. AIR VOLUME FLOW RATE (L/S)		
15. FAN STATIC PRESSURE (Pa)		/
16. FAN PULLEY DIAMETER (mm)		/
17. MOTOR PULLEY DIAMETER (mm)		/
18. NO. OF BELTS, TYPE		/

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME LAI WAI TAK SIGNATURE TAK

APPROVED BY OAP NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

Megger Test for Motor U-E 200 MΩ U-V 6.0Ω
V-E 200 MΩ U-W 6.0Ω
W-E 200 MΩ V-W 6.0Ω

RECORD of Functional Test for CEILING Fan

CEILING FAN DATE : 23/6/2012

PROJECT : CIC-Zero Carbon Building

LOCATION : G/F Multi-Purpose Rm SYSTEM/EQUIP. REF. : CF-G-07

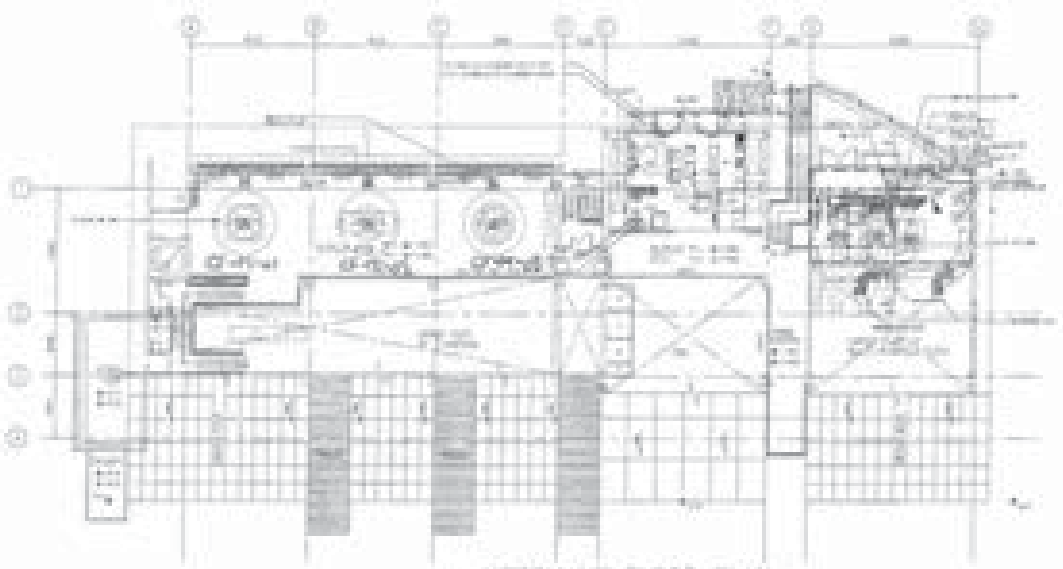
ITEM	DESIGN	MEASUREMENT
FUNCTIONAL TEST		
19. DAMPER	-	✓
20. FILTER CLOG TEST	-	✓
21. EMERGENCY STOP Fuse Spur Switch	-	O.K
22. OVERLOAD TRIPPING	-	✓
23. FIRE TRIP		✓

TYPE OF INSTRUMENT : _____

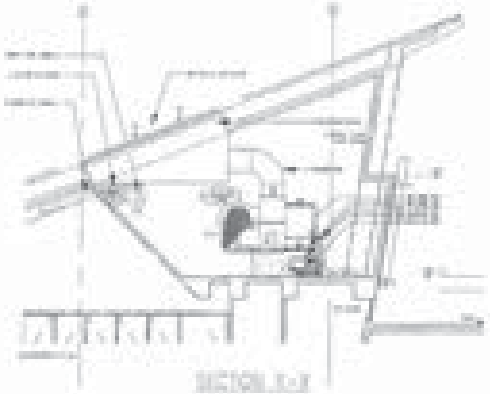
TESTED BY KRUEGER NAME LAI WAI TAK SIGNATURE TAK

WITNESSED BY OAP NAME _____ SIGNATURE _____

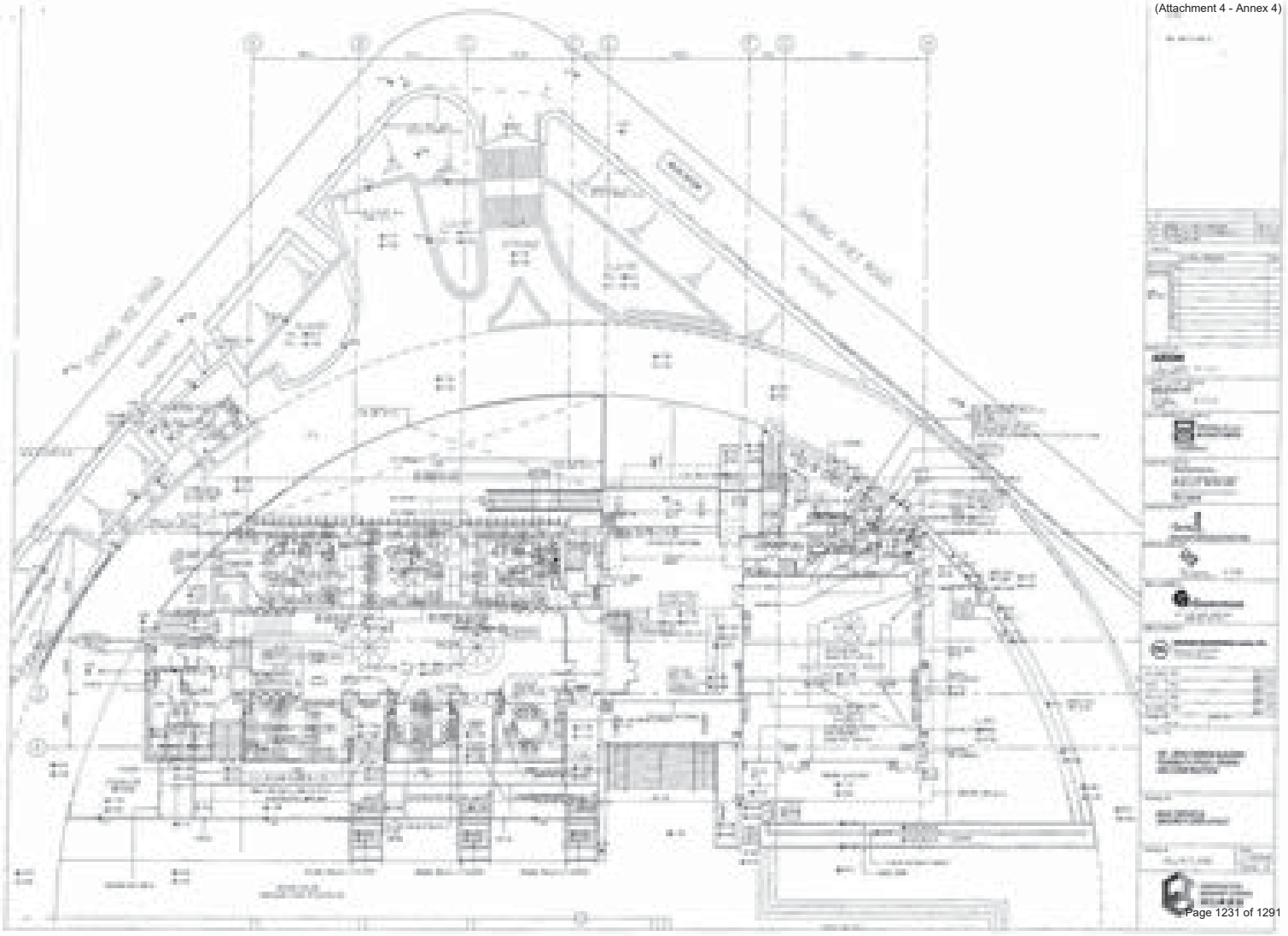
WITNESSED BY ( ) NAME _____ SIGNATURE _____



MEZZANINE FLOOR PLAN



SECTION X-X



Form RLP/RFI/rev

Project: CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works: E&M Services
Contract No.: P11024KL
Contractor:

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No. : RFIN – AC-038
To/ Attn : Mr. Patrick Lui
Date of Request :
Subject : MVAC INSTALLATION

Anticipated date of response :

Completed works for inspection : Functional Test of Split-Type Unit

Locations : B/F TBE Room & Server Room

Referred Document: : KEL/AC/L/001(B)
AI/T&P/S&F/Specifications

Next Activities / Works :

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection;

Project Manager:
For and on behalf of Contractor's Name

Received by RLP/Date

Received by WK/Date

Received by WEC/Date

RESPONSE AND INSPECTION RECORD

Date of Inspection Taken : 9 July 2012.
Response / Comments :
: PASS.
Remarks:-

Review Status

Replied by RLP/ Date

Replied by / Date

Replied by WEC/ Date

cc
KCS w/o
WK w/o
WEC w/o
TLS w/o

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

RECORD of Functional Test for Split Type Unit

SPLIT TYPE UNIT DATE : 10-7-2012

PROJECT CIC- Zero Carbon Building.

LOCATION : B/F Server Room SYSTEM/EQUIP. REF. : SU-B-01

ITEM	DESIGN	ACTUAL
1. UNIT MAKE & MODEL NO.	DAIKIN	DAIKIN RXS25FBVMA
2. REFRIGERANT		R 410A. 1.0 kg
INDOOR UNIT		
3. AIR ENTERING TEMP (°C) DB/WB		29+ / 23+
4. AIR LEAVING TEMP. (°C) DB/WB		16+ / 15
5. FAN MOTOR VOLTAGE/PHASE		220-240 / 1 / 50
6. COOLING CAPACITY (KW)		0.6 kw
7. FULL LOAD CURRENT (AMPS)		0.8 A
8. RUNNING CURRENT (AMPS)		0.48 A
OUTDOOR UNIT		
9. MOTOR FULL LOAD CURRENT (AMPS)		3.1 A
10. MOTOR RUNNING CURRENT (AMPS)		3.38 A
11. HI PRESSUER CUT OUT		✓
12. LO PRESSURE CUT OUT		✓
13. CONDENSER AIR TEMP. IN/OUT (C)		32°/ 45°C
14. AMBIENT TEMPERATURE (C)		32°C
15. DISCHARGE PRESSURE (~~Kpa~~ PSI		287
16. SUCTION PRESSURE (~~Kpa~~ PSI		78
17. PUMP DOWN	N/A	✓

TYPE OF INSTRUMENT : _____

TESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible]

APPROVED BY NAME _____ SIGNATURE _____

WITNESSED BY NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

*(1) Booster Condensation water pump Tested on/off ✓ok

(2) outdoor unit E-stop Tested ✓ok.

RECORD of Functional Test for Split Type Unit

SPLIT TYPE UNIT DATE : 10-7-2012

PROJECT CIC-Zero Carbon Building

LOCATION : B/E TRE ROOM SYSTEM/EQUIP. REF. : SJ-B-02

ITEM	DESIGN	ACTUAL
1. UNIT MAKE & MODEL NO.	DAIKIN	DAIKIN FXSQ15EBVMA
2. REFRIGERANT		R410A. 1.0 kg.
INDOOR UNIT		
3. AIR ENTERING TEMP (°C) DB/WB		24 / 23.5
4. AIR LEAVING TEMP. (°C) DB/WB		16 / 15
5. FAN MOTOR VOLTAGE/PHASE		220-240 / 1/50
6. COOLING CAPACITY (KW)		0.6 kw
7. FULL LOAD CURRENT (AMPS)		0.8 A
8. RUNNING CURRENT (AMPS)		0.46 A
OUTDOOR UNIT		
9. MOTOR FULL LOAD CURRENT (AMPS)		3.5 A
10. MOTOR RUNNING CURRENT (AMPS)		3.28 A
11. HI PRESSUER CUT OUT		/
12. LO PRESSURE CUT OUT		/
13. CONDENSER AIR TEMP. IN/OUT (C)		32°C / 43°C
14. AMBIENT TEMPERATURE (C)		32°C
15. DISCHARGE PRESSURE (~~Kpa~~) PSI		285
16. SUCTION PRESSURE (~~Kpa~~) PSI		77
17. PUMP DOWN	N/A	/

TYPE OF INSTRUMENT : _____

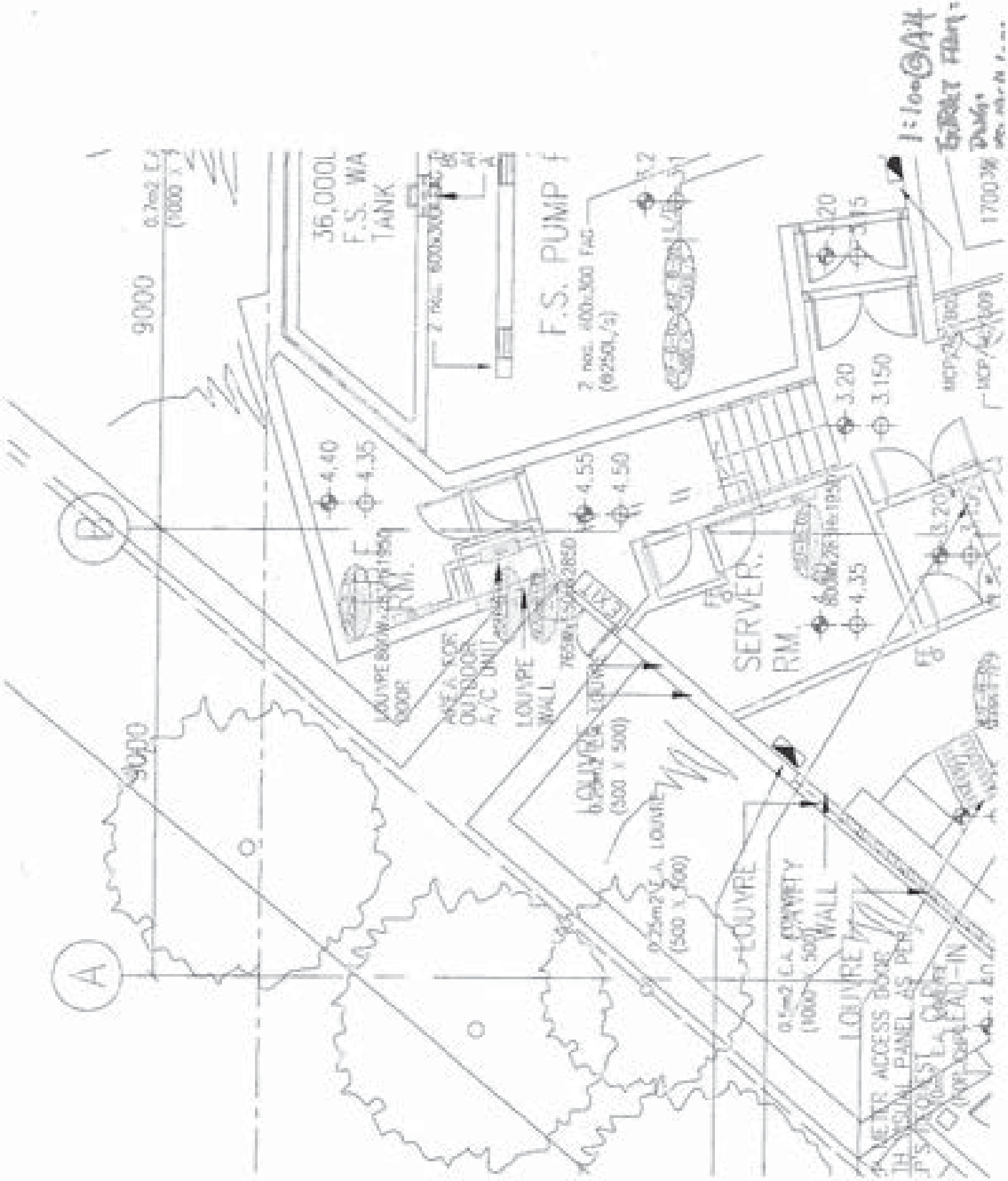
TESTED BY KRUEGER NAME [illegible] SIGNATURE [illegible]

APPROVED BY NAME _____ SIGNATURE _____

WITNESSED BY NAME _____ SIGNATURE _____

WITNESSED BY ( ) NAME _____ SIGNATURE _____

* ① outdoor unit E. stop Tested ✓ O.K


36,000L
F.S. WA
TANK
F.S. PUMP
SERVER
RM.
LOUVRE
WALL
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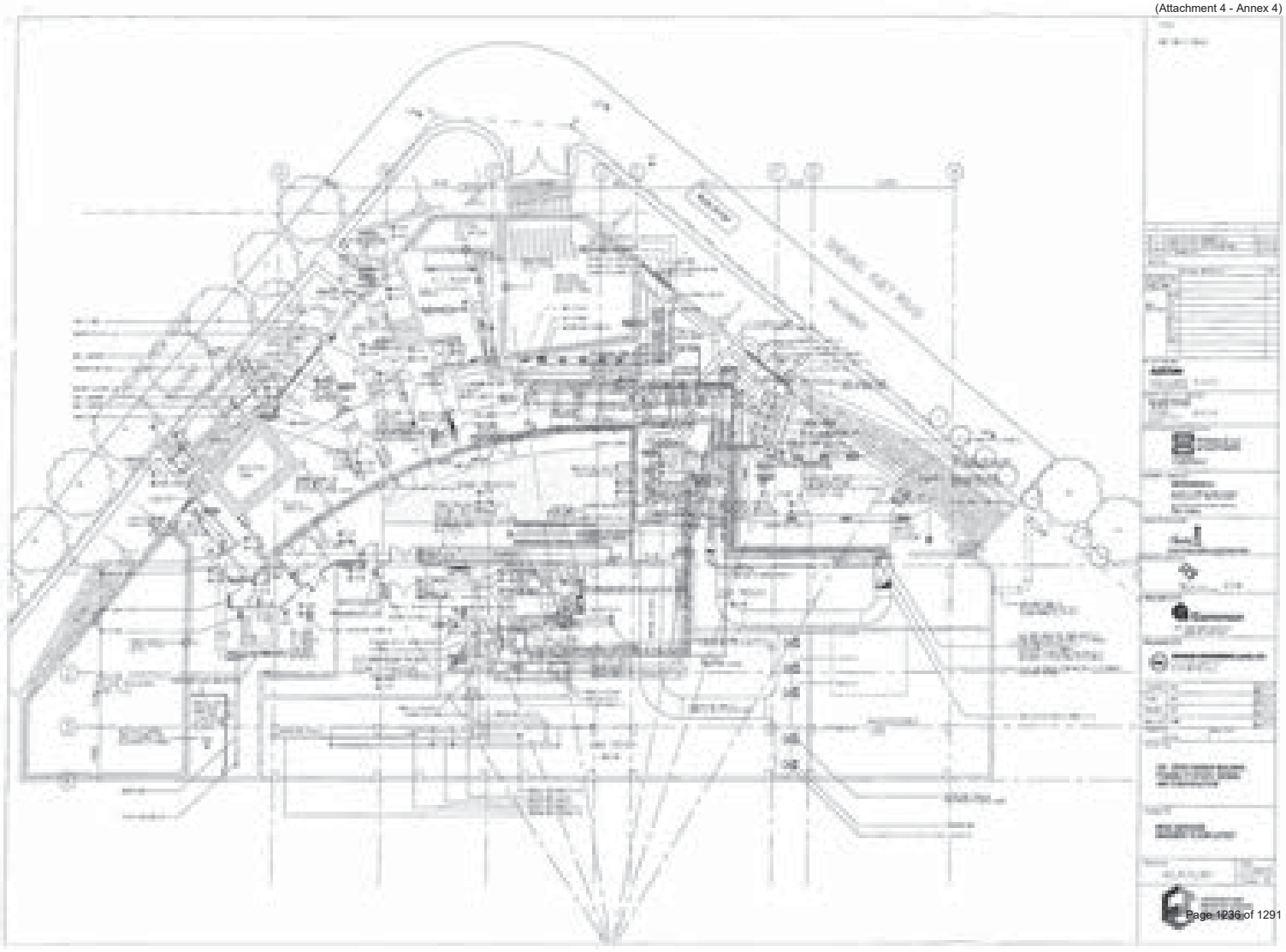


Form RLP/RFI/rep

Project	CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works	E&M Services
Contract No.	P11024KL
Contractor	

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No.	:	RFIN – AC-040
To/ Attn	:	Mr. Patrick Lui
Date of Request	:	
Subject	:	MVAC INSTALLIATION
Anticipated date of response	:	
Completed works for inspection	:	Water treatment functional test
Locations	:	B/F Chiller Room
Referred Document: A/T/S/P/SS#/Specifications	:	KEL/AC/L/001(B),
Nipid Activities / Works	:	

Received by RLP/Date

Received by W/K/Date

Received by W/E/C/Date

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

Project Manager/
For and on behalf of Contractor's Name

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken : 18 July 2017.

Response / Comments :

: PASS

Remarks:-

Replied by RLP/ Date

Replied by W/K / Date

Replied by W/E/C/ Date

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

K/S/W/W/T/J/T/E

cc

KCS	w/o
W/K	w/o
W/E/C	w/o
TLS	w/o

LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

TEST & COMMISSIOING REPORT
TRASAR CONTROLLER & AUTOMATIC CHEMICAL DOSING DEVICE

DATE: 25/7/2012		REF.:									
PROJECT/SITE		Zero Carbon Building at Kowloon Bay									
SYSTEM		Cooling Tower Water System									
DRAWING / OTHER INFO		Nil									
EQUIPMENT / MODEL NO.		TRASAR 5000 6581GVC									
ITEM	**DESCRIPTION**	**RESULT & REMARKS**									
1.	**Visual Inspections:**										
1.1.	**Electrical Wiring**	Ok									
1.2.	**Mechanical Installation**	Ok									
1.3.	**Apparent Defect**	NIL									
2.	**Status Indications:**										
2.1.	**Lamp Test**	Ok									
2.2.	**Power Healthy**	Ok									
2.3.	**Dosing Pump**	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
a)	Corresponding Chemical	NALCO 3DT 225		NALCO 3DT 204		NALCO 7330		NALCO 3DT 88.6		NALCO ST7a	
b)	Pump Selector	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
c)	Pump Running	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
d)	Pump Trip	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.4.	**Tank Low Level**	ok		ok		ok		ok		ok	
3.	**DDC Signal Output:**										
5.1	**Power Healthy**										
5.2	**Pump Running**										
5.3	**Pump Trip**										
5.4	**Tank Low Level**										
4.	**Tank LL Cut-out**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

COMMENTS: ① P6 TRIP BUT NO INDICATION (BUZZER).
② PUMP CONTROL PANEL (INSIDE) & PUMP LABELLING NOT COMPLETED.

CONDUCTED BY: BEN TSANG (Leblanc)	SIGNATURE:
WITNESSED BY: LEUNG WAI YIP (KCL)	SIGNATURE:
CONFIRMED BY:	SIGNATURE:

Flat C, 15/F., Superluck Industrial Centre, Phase 2, No. 57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong
Tel.: (852) 2408 2000 Fax: (852) 2408 1740 Email: servicesdept@leblanc.com.hk

LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

ITEM	DESCRIPTION	RESULT & REMARKS									
5.	**TRASAR Controller:**										
5.1	**Chemical Dosing Control:**										
a)	Dosing Pump Setting	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
b)	Corresponding Chemical	NALCO 73029		NALCO 73029		NALCO 7350		NALCO 3DT 6R06		NALCO 3T 70	
c)	Control Range	40ppm		60ppm		Timer		default.		Bio-Index	
d)	Cut-in Set point	39 ppm		57 ppm		1400				default.	
e)	Cut-out Set Point	41 ppm		63 ppm		1430					
5.2	**Conductivity Control:**										
a)	Control Range	1000 µs/cm ± 15 µs/cm									
b)	Bleed Set Point	@ 1015 µs/cm ON, 985 µs/cm OFF									
c)	Response of Bleed Valve	ok.									
5.3	**Calibrations:**										
a)	pH Instrumentation	Done ON 18-7-2012									
b)	ORP Instrumentation	Done. ON 18-7-2012									
c)	Conductivity Instrumentation	Done. ON 18-7-2012									
d)	Trasar Instrumentation	Done ON 18-7-2012									
6.	**Others:**										

COMMENTS:

CONDUCTED BY: BENJ TSANG (LEBLANC)	SIGNATURE:
WITNESSED BY: [illegible]	SIGNATURE:
CONFIRMED BY:	SIGNATURE:

LeBLANC WATER TREATMENT & CHEMICALS LTD.
利邦化工水處理有限公司

TEST & COMMISSIOING REPORT
AUTOMATIC CHEMICAL DOSING DEVICE

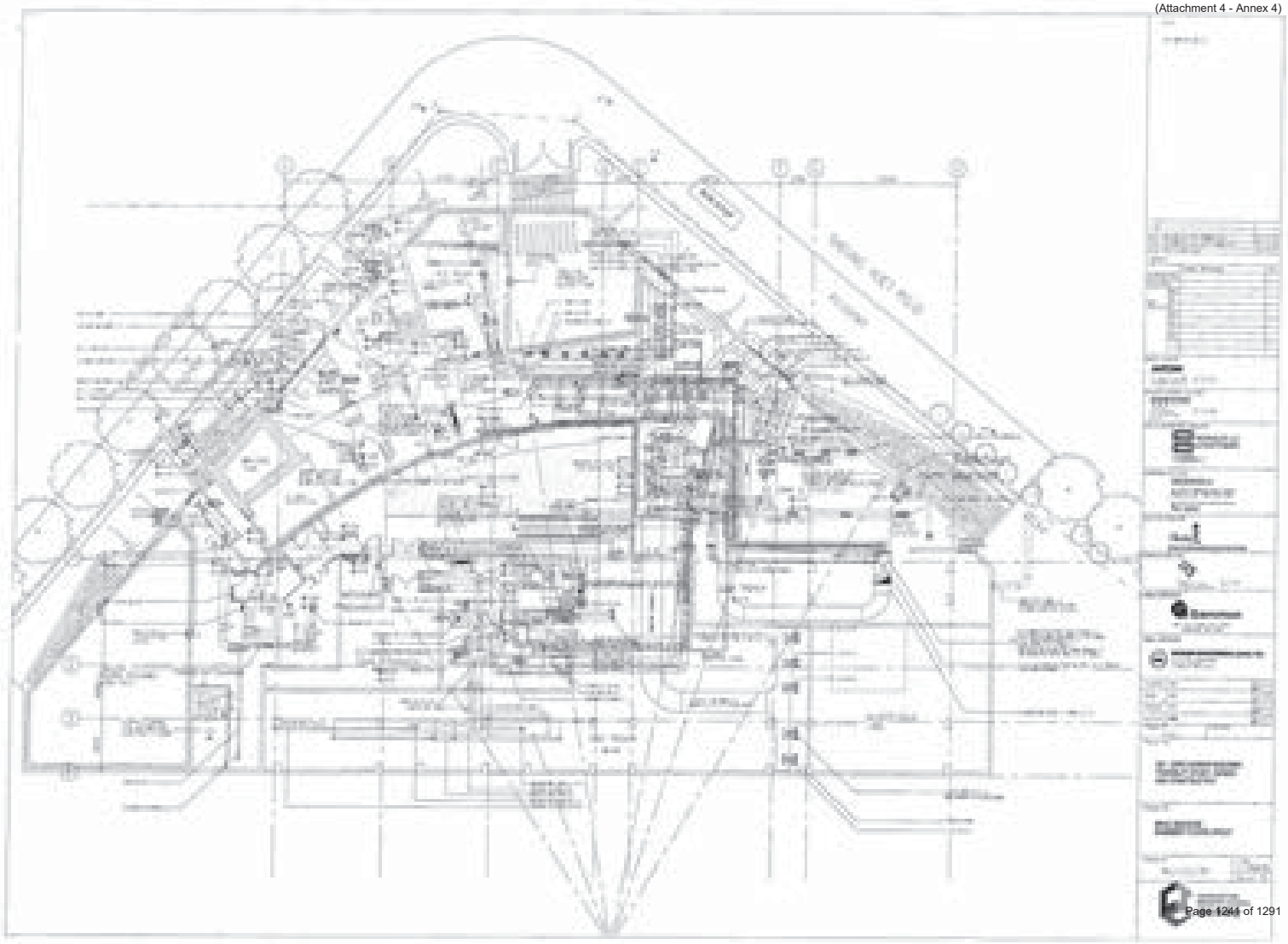
DATE: 25/7/2012	REF.:			
PROJECT/SITE	Zero Carbon Building at Kowloon Bay			
SYSTEM	Chilled Water System			
DRAWING / OTHER INFO	Nil			
EQUIPMENT / MODEL NO.	GSB16UH			

ITEM	DESCRIPTION	RESULT &REMARKS		
1.0	**Visual Inspections:**			
1.1	Electrical Wiring	ok		
1.2	Mechanical Installation	ok		
1.3	Apparent Defect	NIL		
2.0	**Status Indications:**			
2.1	Lamp Test	ok		
2.2	Power Healthy	ok		
2.3	Dosing Pump	P1	P2	
a.	Pump Selector	ok	ok	
b.	Pump Running	ok	ok	
c.	Pump Trip	ok	ok	
2.4	Tank Low Level	ok	ok.	
3.0	**Timer Setting / Control**	EVERYDAY on From 10:00 To 11:00		
4.0	**Low Level Cut-out**	ok	ok	
5.0	**DDC Signal Output**			
5.1	Power Healthy			
5.2	Pump Running			
5.3	Pump Trip			
5.4	Tank Low Level			
6.0	Others:			

COMMENTS: ① Pump control panel wiring & pump upgrading not completed.

CONDUCTED BY: Ben Tsang (Leblanc)	SIGNATURE:
WITNESSED BY:	SIGNATURE:
CONFIRMED BY:	SIGNATURE:

Flat C, 15/F., Superlux Industrial Centre, Phase 2, No. 57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong
Tel : (852) 2408 2000 Fax: (852) 2408 1740 Email: service@leblanc.com.hk



Form RLP/RFI/xxx

Project: CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works: E&M Services
Contract No.: P1102490L
Contractor:

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No.	:	RFIN – AC-024
To/ Attn	:	Mr. Patrick Lui
Date of Request	:	30 May 2012
Subject	:	MVAC INSTALLATION
Anticipated date of response	:	31 May 2012
Completed works for inspection	:	Water flushing and initial chemical cleaning for chilled water system
Locations	:	Chilled Water System
Referred Document: A/T/S/R&S/Specifications	:	KEL/AC/L/001(B), 002(B), 004(B), 005(B) & KEL/AC/S/001(0), 002(0); and method statement of water treatment
Next Activities / Works	:	Initial treatment

Received by RLP/Date

Received by WK/Date

Received by WEC/Date

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

Project Manager
For and on behalf of Contractor's Name

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken :
Response / Comments :
:

Remarks:-

Report from LaBLANC will be submit separately.

Replied by RLP/ Date

Replied by WK / Date

Replied by WEC/ Date

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

KSW/WYK/JYE

cc
KCS w/o
WK w/o
WEC w/o
TLS w/o

3. THREE STEPS OF WATER TREATMENT PROGRAM

3.1 Initial Chemical Cleaning:

After installation of the water pipe work, physical cleaning is impossible to remove the foreign materials such as grease, dust and mill scale. Even after water flushing, contaminants such as iron oxide and grease cannot be removed completely. For this reason, chemical cleaning is introduced. Acidic Detergent and Defoamer are served to remove rust scale, oil, silt & sludge.

Start water pump to conduct water flushing first to remove large suspended solids and dirt prior to the chemical cleaning. The procedures of the chemical cleaning are as follows:

a) Collect water samples from the make-up water tank and each water system before chemical cleaning.

b) Test the pH value, T.D.S. and metal content of the above water samples on site. The results will then be as a reference.

c) Apply the cleaning chemicals into the make-up water tank. Then drain some of the system water so that the make-up water with the cleaning chemicals will be fed into the system gradually.

d) Water test to confirm the concentration of chemical solution is within the control range.

e) Circulating the chemical solution in the system for 24 hours. While cleaning, water sample will be taken for analysis so that the pH value shall be kept not less than 5.5.

f) After cleaning, the whole system fluid is drained at the lowest point rapidly.

g) Refill and flush the system with city water 3 – 4 times until the system water quality meet with the city water standard.

h) Collect water samples to our laboratory for complete analysis and issue a fully water analysis report to consultant and engineer for reference.

The following chemicals are proposed for the initial chemical cleaning:

Chemical	Function	Dosage for Initial Chemical Cleaning	Quantity Required	
			Cooling Tower Water System	Chilled Water System
'AQUAMAG' AD 50	Acidic Detergent	0.25% Solution (please see the data sheet of AD 50 attached in section 9)	6 m^3 x 0.25% = 15 Litres	3 m^3 x 0.25% = 7.5 Litres
'AQUAMAG' Defoamer	Anti-Foam	10% of AD50 Dosage (please see the data sheet of AD 50 attached in section 9)	6 m^3 x 0.25% x 10% = 1.5 Litres	3 m^3 x 0.25%x 10% = 0.75 Litres

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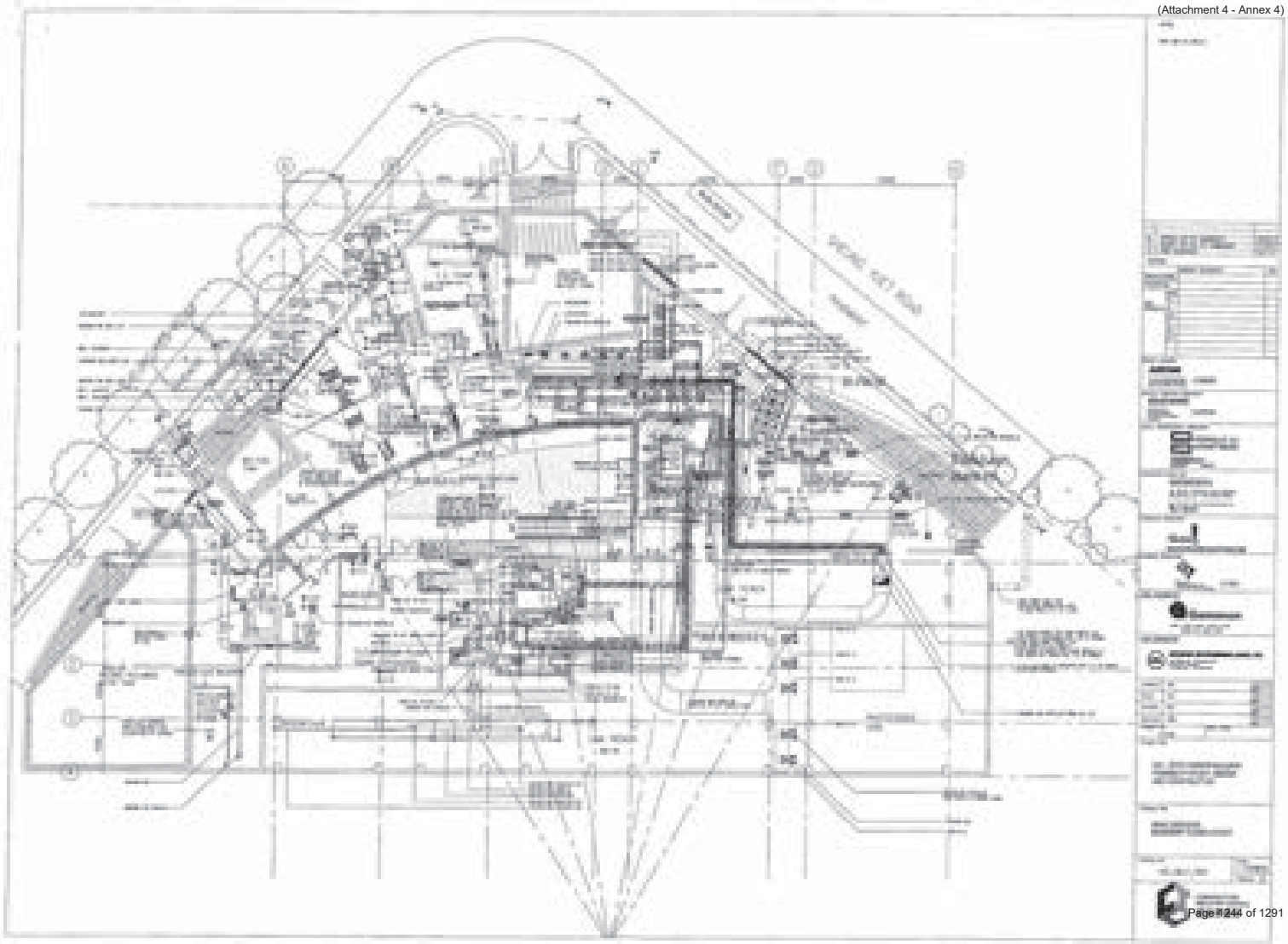
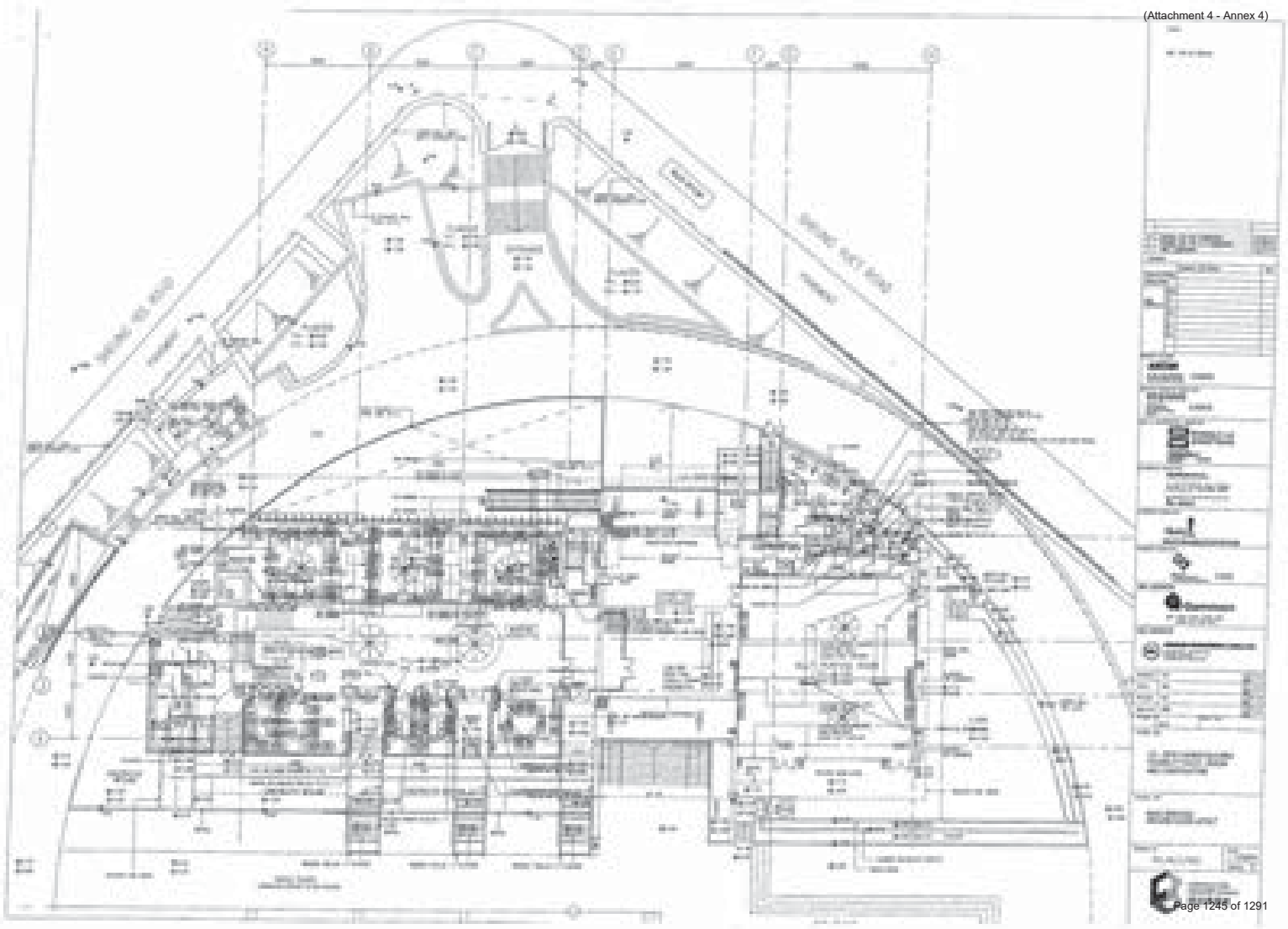
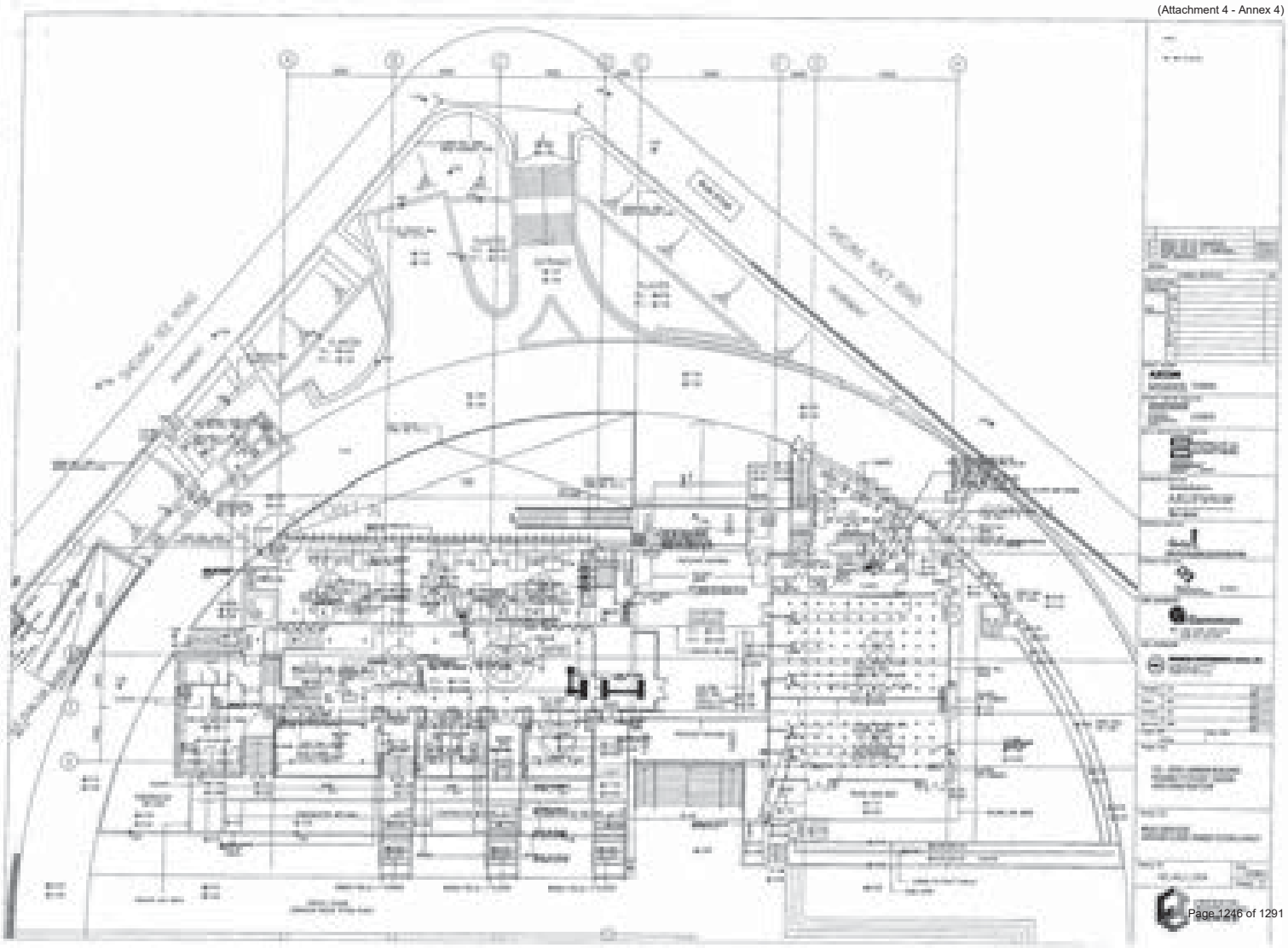
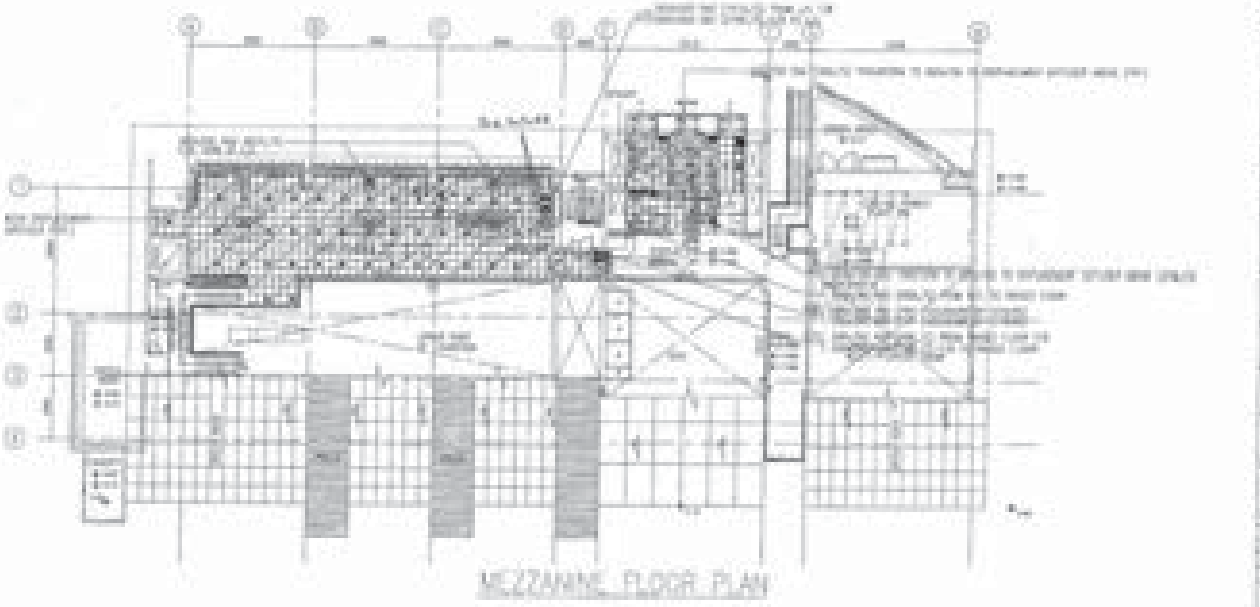
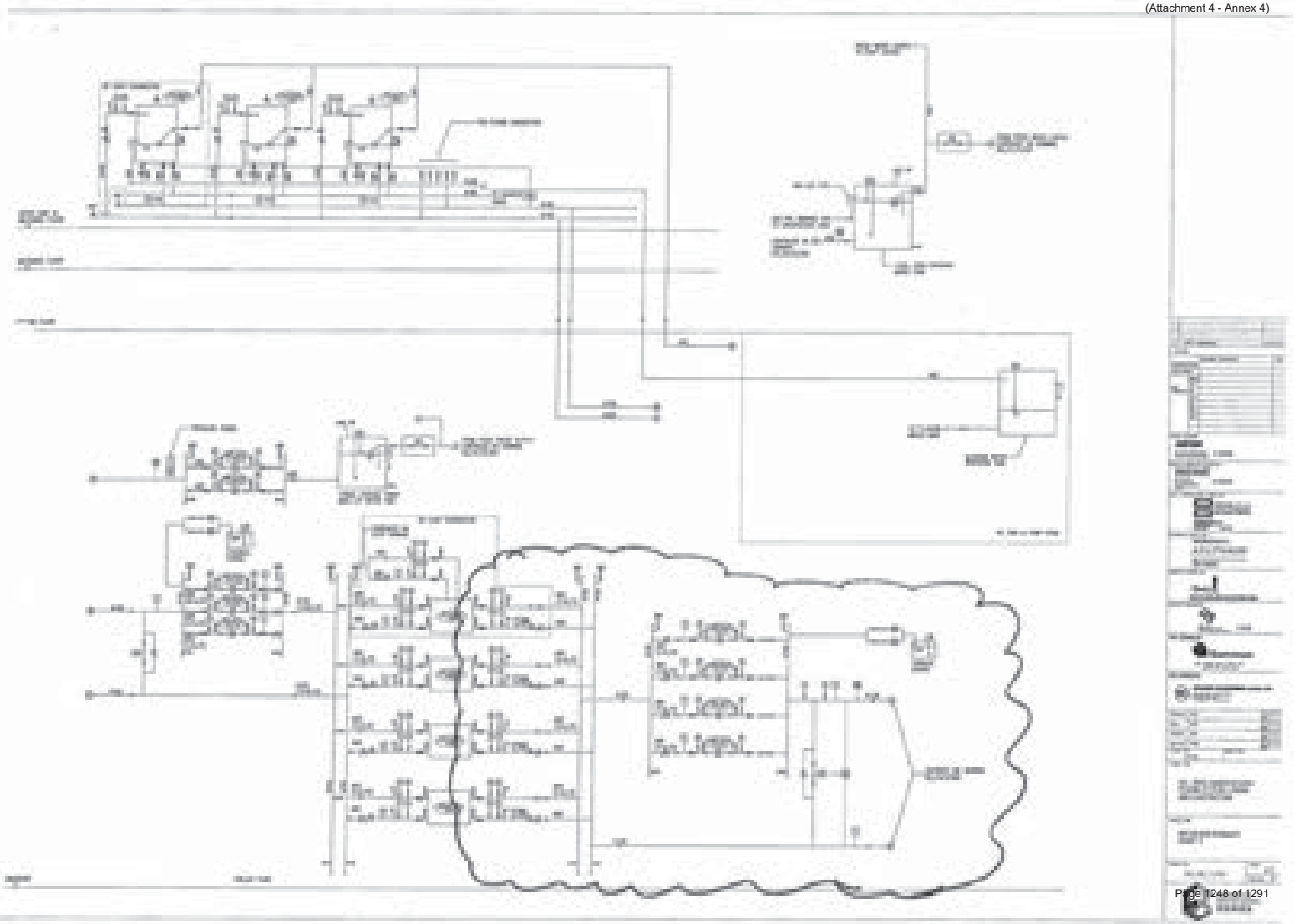


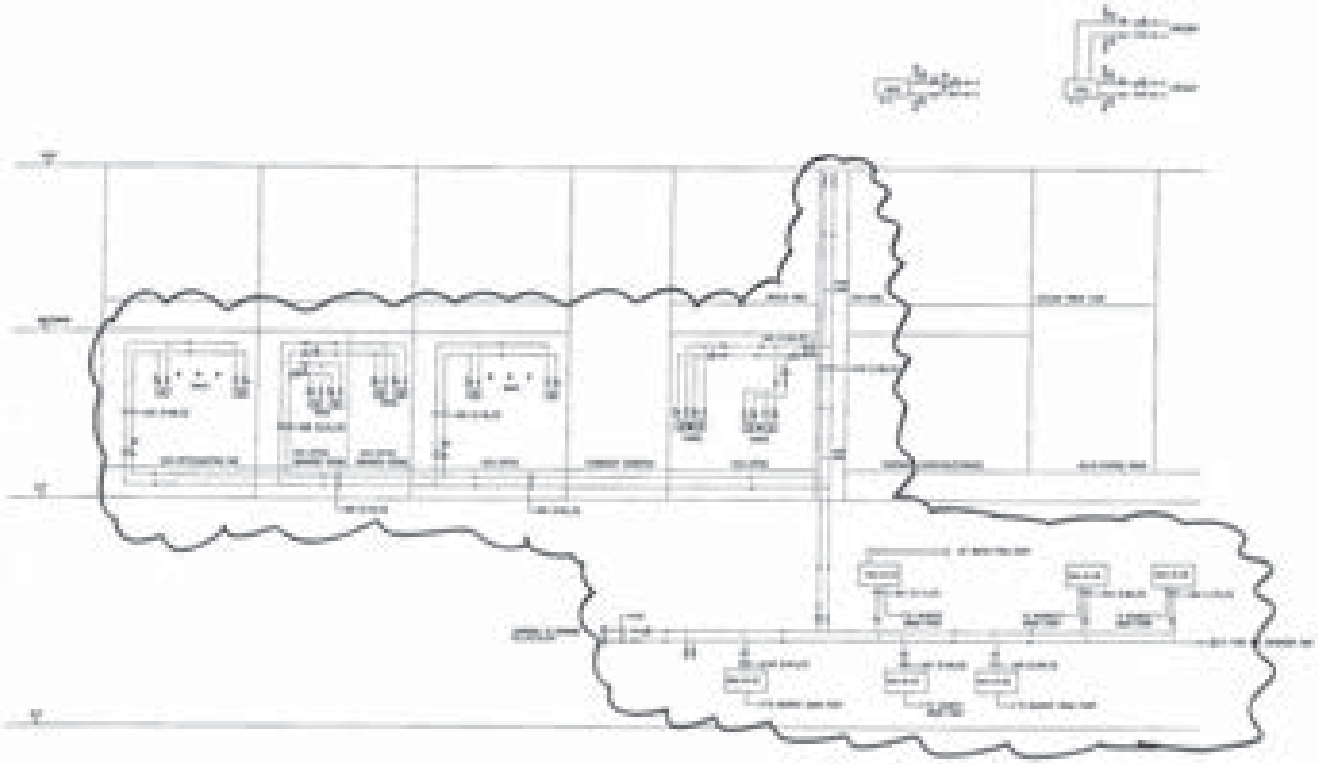






MEZZANINE FLOOR PLAN





Form RLP/Rfinsp

Project	CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works	E&M Services
Contract No.	P1102840
Contractor	

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No.	:	RFIN – AC-025
To/ Attn	:	Mr. Patrick Lui
Date of Request	:	30 May 2012
Subject	:	MVAC INSTALLATION
Anticipated date of response	:	31 May 2012
Completed works for inspection	:	Water flushing and initial chemical cleaning for condensing water system
Locations	:	Condensing Water System
Referred Document: A/T/S/F/SS/P/Specifications	:	KEL/AC/L/001(B), 002(B), 003(B), 004(B) & KEL/AC/S/001(0); and method statement of water treatment
Next Activities / Works	:	Initial treatment

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

Project Manager:
For and on behalf of Contractor's Name

Received by RLP/Date

Received by WK/Date

Received by WEC/Date

RESPONSE AND INSPECTION RECORD

Date of Inspection Taken :

Response / Comments :

Remarks:-

Report from La Chance will be submit seperately.

Review Status

Replied by RLP/ Date

Replied by [illegible] Date

Replied by WEC/ Date

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

cc

KCS	w/o
WK	w/o
WEC	w/o
TLS	w/o

3. THREE STEPS OF WATER TREATMENT PROGRAM

3.1 Initial Chemical Cleaning:

After installation of the water pipe work, physical cleaning is impossible to remove the foreign materials such as grease, dust and mill scale. Even after water flushing, contaminants such as iron oxide and grease cannot be removed completely. For this reason, chemical cleaning is introduced. Acidic Detergent and Defoamer are served to remove rust scale, oil, silt & sludge.

Start water pump to conduct water flushing first to remove large suspended solids and dirt prior to the chemical cleaning. The procedures of the chemical cleaning are as follows:

a) Collect water samples from the make-up water tank and each water system before chemical cleaning.

b) Test the pH value, T.D.S. and metal content of the above water samples on site. The results will then be as a reference.

c) Apply the cleaning chemicals into the make-up water tank. Then drain some of the system water so that the make-up water with the cleaning chemicals will be fed into the system gradually.

d) Water test to confirm the concentration of chemical solution is within the control range.

e) Circulating the chemical solution in the system for 24 hours. While cleaning, water sample will be taken for analysis so that the pH value shall be kept not less than 5.5.

f) After cleaning, the whole system fluid is drained at the lowest point rapidly.

g) Refill and flush the system with city water 3 – 4 times until the system water quality meet with the city water standard.

h) Collect water samples to our laboratory for complete analysis and issue a fully water analysis report to consultant and engineer for reference.

The following chemicals are proposed for the initial chemical cleaning:

Chemical	Function	Dosage for Initial Chemical Cleaning	Quantity Required	
			Cooling Tower Water System	Chilled Water System
'AQUAMAG' AD 50	Acidic Detergent	0.25% Solution (please see the data sheet of AD 50 attached in section 9)	6 m^3 x 0.25% = 15 Litres	3 m^3 x 0.25% = 7.5 Litres
'AQUAMAG' Defoamer	Anti-Foam	10% of AD50 Dosage (please see the data sheet of AD 50 attached in section 9)	6 m^3 x 0.25% x 10% = 1.5 Litres	3 m^3 x 0.25%x 10% = 0.75 Litres

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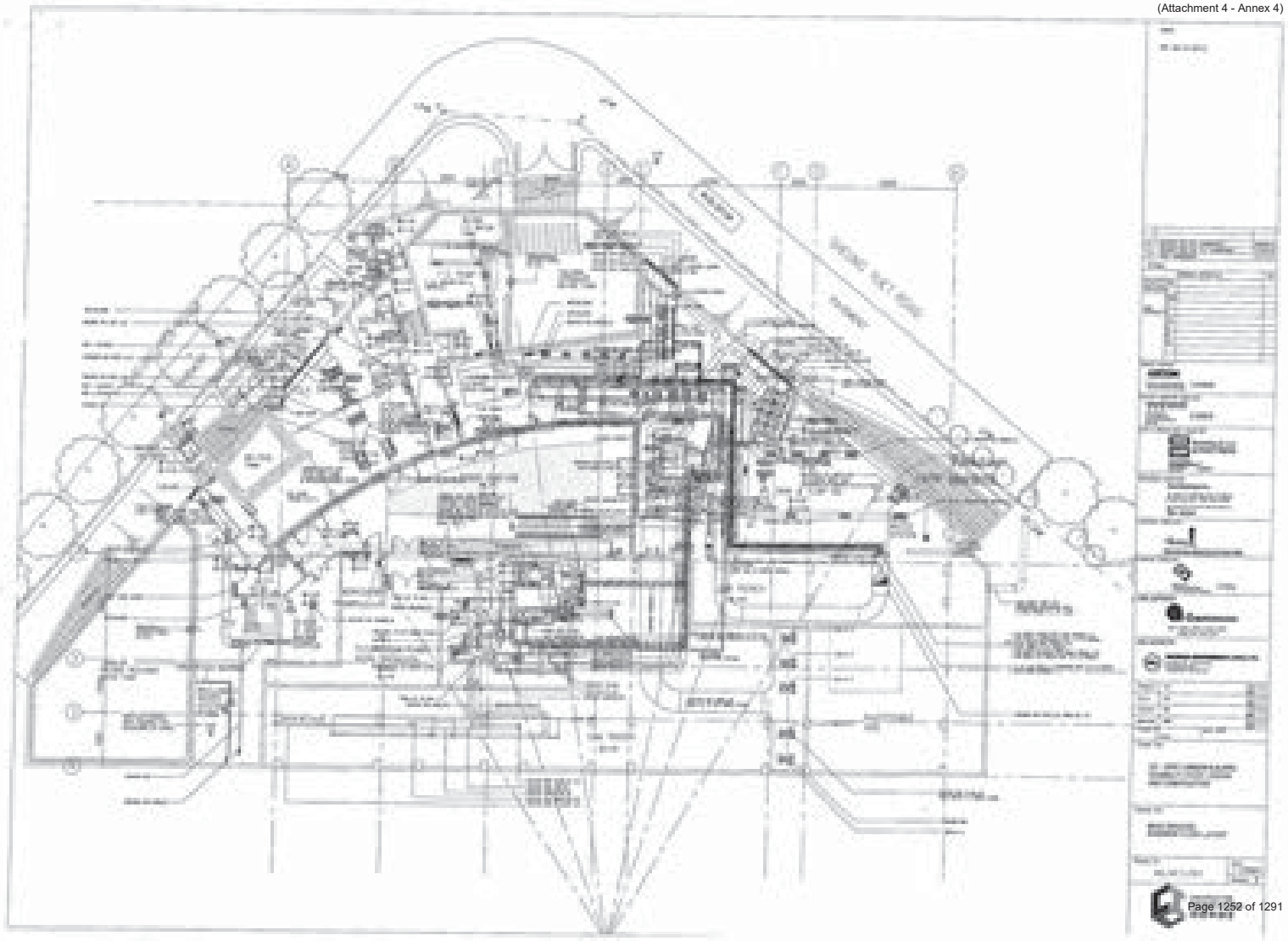
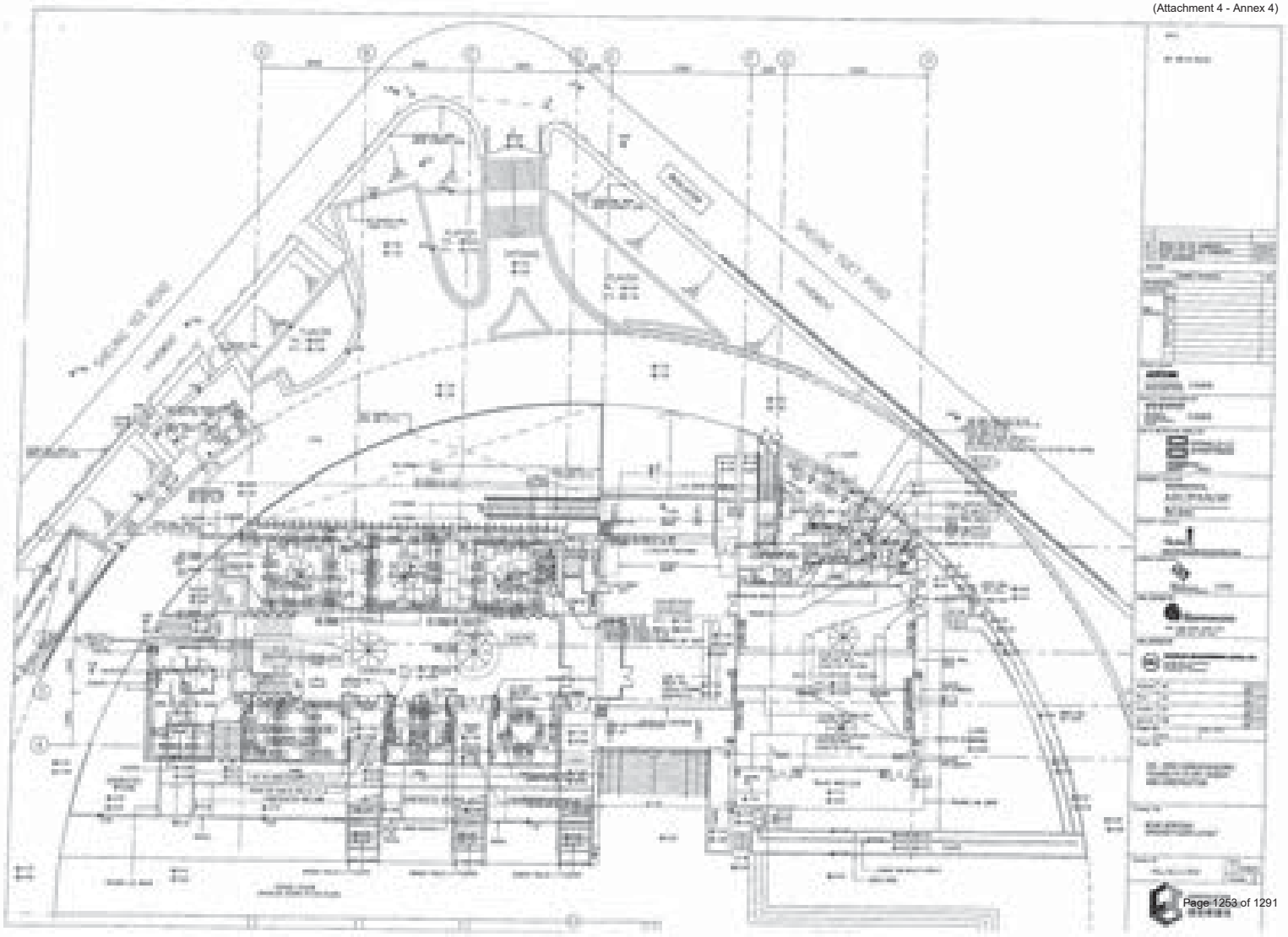
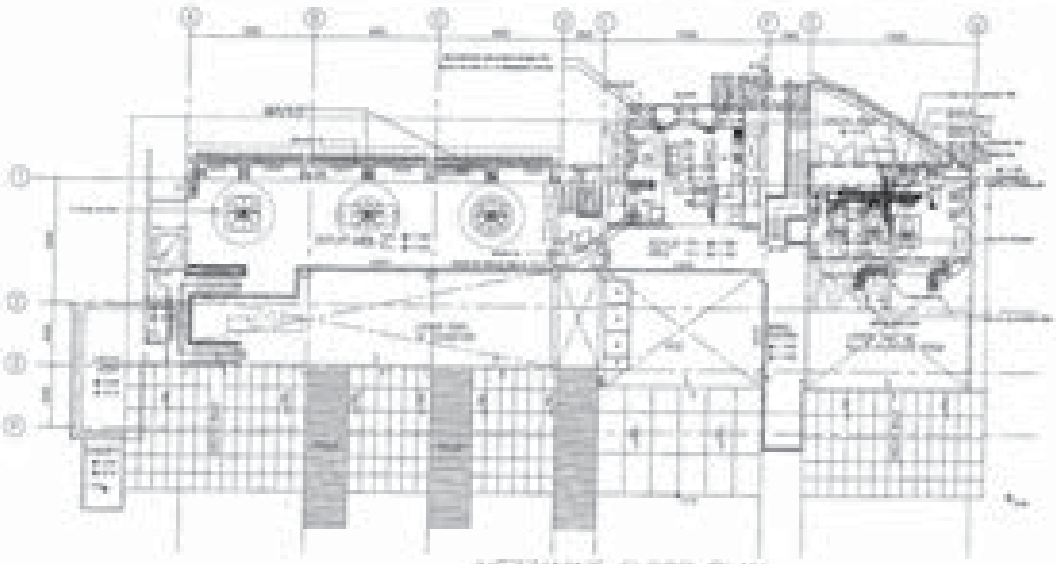
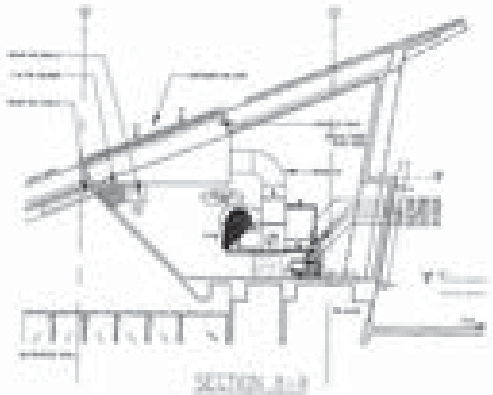


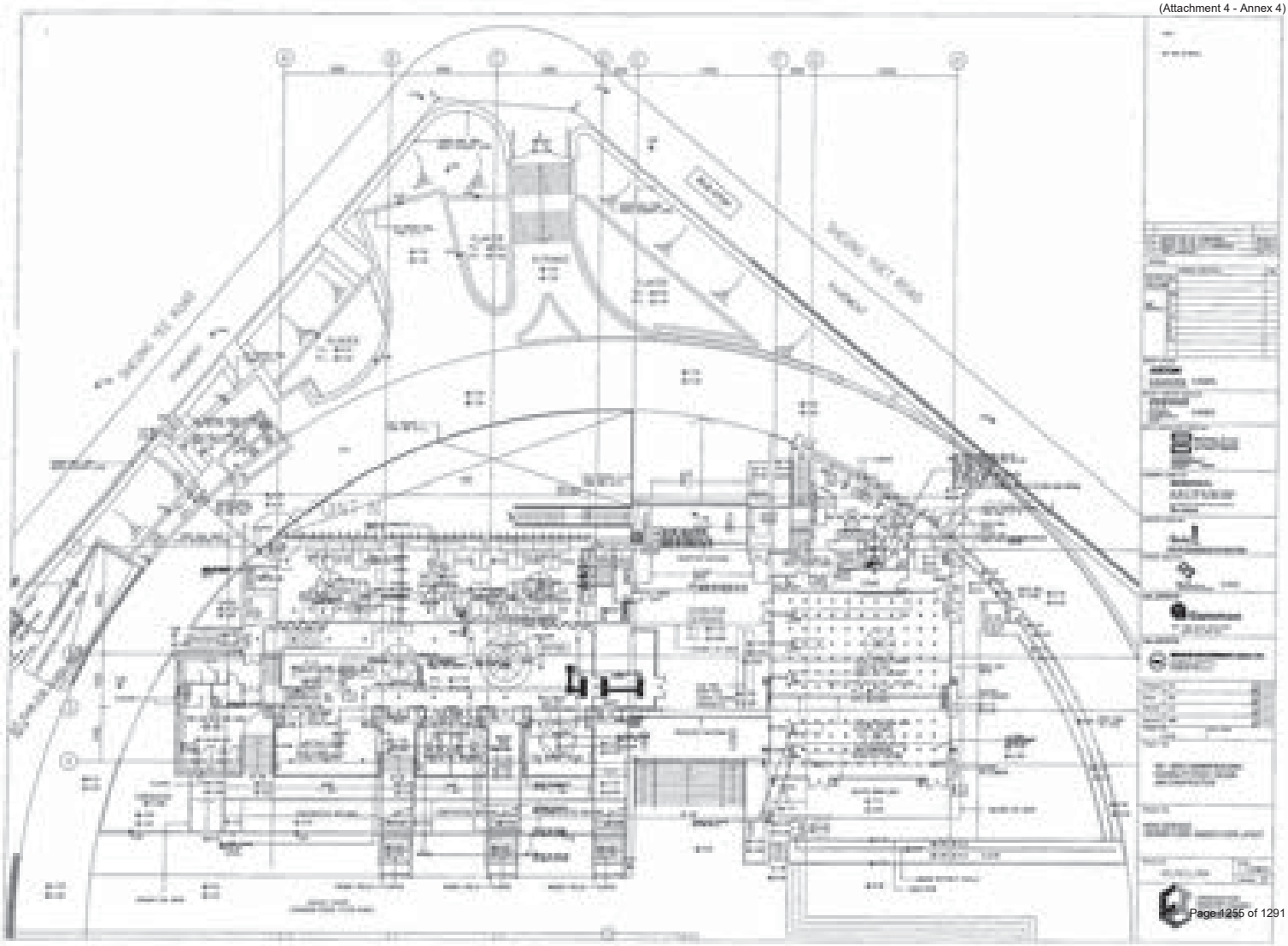


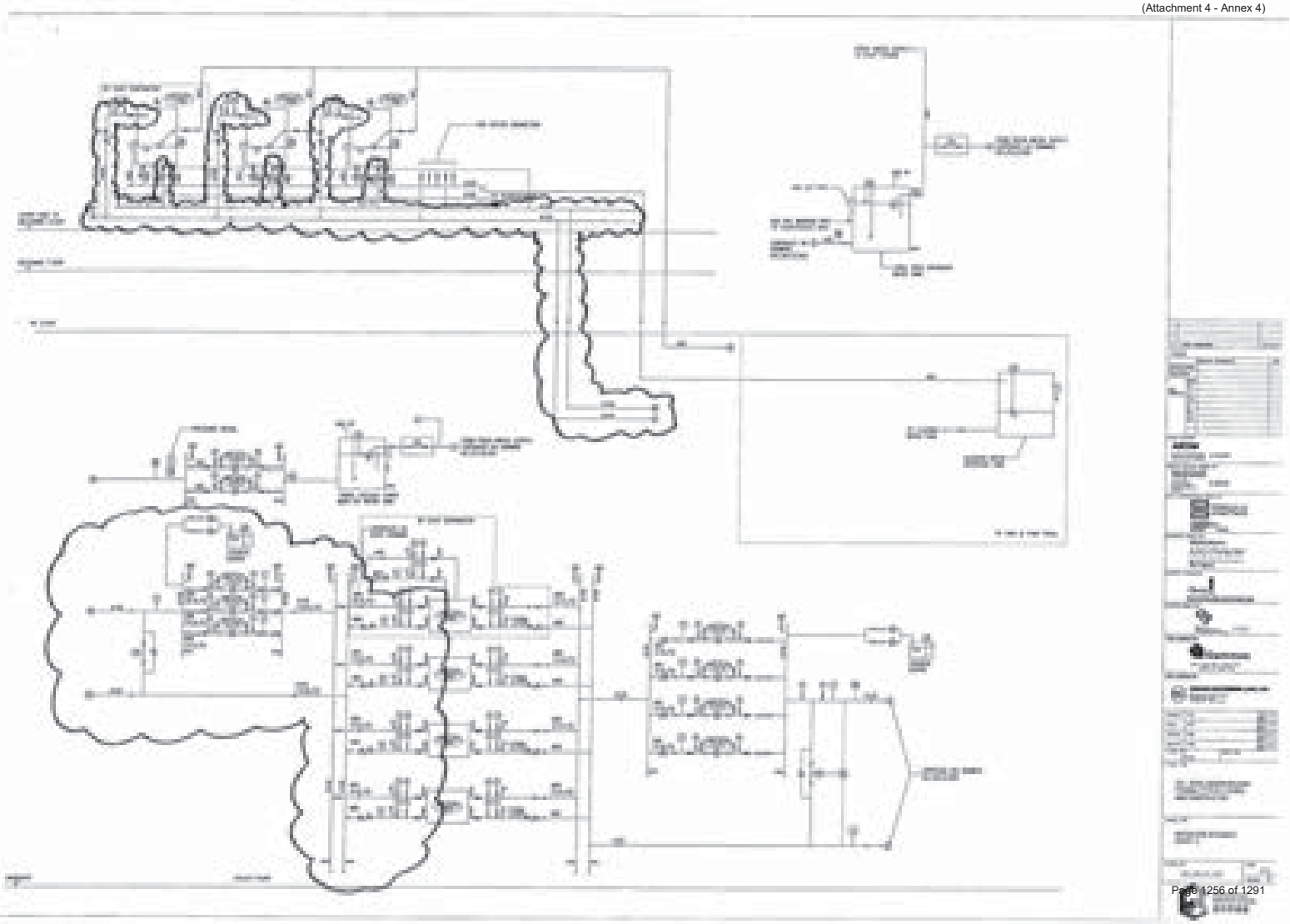


MEZZANINE FLOOR PLAN



SECTION A-A





Form Rt_P/RFinsp

Project: CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works: E&M Services
Contract No.: P1102AKL
Contractor:

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No. : RFIN – AC-027
To/ Attn : Mr. Patrick Lui
Date of Request : 07 June 2012
Subject : MVAC INSTALLATION
Anticipated date of response : 08 June 2012
Completed works for inspection : Functional Test of Chiller
Locations : Basement Chiller Plant Rm. G.L. C-E/1
Referred Document: AiTS/F/S/P/Specifications : KEL/AC/L/001(B)
Next Activities / Works :

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

Edward
Project Manager
For and on behalf of Contractor's Rams

Received by Rt_P/Date
Received by WK/Date
Received by WEC/Date

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken : 8 Jun 2012
Response / Comments :

Remarks:-
Report will be prepared and submitted by TRANE.

Replied by RLP/ Date
Replied by WK / Date
Replied by WEC/ Date

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

KSW/WH/JYE

cc
KCS w/o
WK w/o
WEC w/o
TLS w/o

Method Statement

Testing and Commissioning of Water-cooled Chiller

For

Zero-Carbon Building at Sheung Yee Road Kowloon Bay

Water-cooled Chiller Test Procedure

(A1) Test Procedure

(1) Disconnect the power.
(2) Check the refrigerant pressure of the chiller (if chiller is pre-charged with refrigerant).
(3) Check the unit closely for any signs of refrigerant leakage.
(4) Check all refrigerant and oil service valves.
(5) Check water valves and verify that the evaporator & condenser are filled with water.
(6) Meg-test the motor.
(7) Check main power to starter & starter to motor connections for correctness.
(8) Check compressor terminals tightness.
(9) Check contactors & relays freedom of movement.
(10) Power up the control panel. Check & record the settings.
(11) Check valves and switches for proper operation.
(12) Energize the compressor sumo heaters for at least 24 hours prior to chiller start (if chiller has heaters equipped).
(13) Check motor starter.
(14) Check operating parameters.
(15) Allow the unit to start & run, log the unit with 15 minutes intervals.

TRANE

Trane Service Hong Kong
A division of TYS Limited

15/F Dragon Centre, 79 Wing Hong Street
Cheung Sha Wan, Kowloon
Hong Kong

Tel : (852) 2143 9010
Fax: (852) 2785 0694
Website: http://www.tshk.com

工程單 SERVICE ORDER

No. S 256965

Job No. (if applicable)
工作編號（如適用）

Customer
客戶 LIL ZERO Carbon Building

Date
日期 8-6-12

Address
地址

Tel
電話

Subject
事項 LHT Room/panel 控制盒維修

P/N: LG LWF0315 00RF WEG-HQ

S/N: 3A121 - 00166

Working Time
工作時間

In
到達

Out
離開

Report & Estimate of Repair
維 修 報 告

(1) Work Completion Criteria & Test Record 完工準則

1A ☐ Visual-audio test 視聽檢查測試
☐ Normal 正常
☐ Abnormal 不正常

1B ☐ Other Test 其他方法測試正常
Testing Method
方法為

Test record (if applicable)
測試證數為（如適用）

☐ Normal 正常
☐ Abnormal 不正常

(2) Work Status 工程狀況

☐ Work completed 工作已完成
☐ Work pended for further follow up
工作暫未完成，有待跟進

(3) Other Comments 其他意見

需更換 Room/panel 聯一個全新部件

Customer
客戶簽署

Please sign / stamp if the work is attended
以上工作已處理，請簽名 / 蓋章

Date
日期 8/6/2012

Technician
技工簽署

Date
日期 8-6-12

Checked by
主任簽署

Date
日期

TSHK Form

Jointly owned by Jardines and Trane

TRANE

Trane Service Hong Kong
A division of TYS Limited

15/F Dragon Centre, 79 Wing Hong Street
Cheung Sha Wan, Kowloon
Hong Kong

Tel : (852) 2743 9838
Fax: (852) 2785 0694
Website: http://www.tshk.com

工程單 SERVICE ORDER

No. S 256966

Job No. (if applicable)
工作編號（如適用）

Customer
客戶 LIL Zeko Lochen Building

Date
日期 8-6-12

Address
地址

Tel
電話

Subject
事項 CH-1
維護保養
M/N: CGAMP0250D0BFNNB-HA
S/N: ZA12H-00101
CH-2
M/N: ZACGU-D0C99
S/N: ZA12H-00102
CH-3

Working Time 工作時間	In 到達	Out 離開

Report & Estimate of Repair
維 修 報 告

(1) Work Completion Criteria & Test Record 完工準則

1A ☐ Visual-audio test 視聽檢查測試
- ☐ Normal 正常
- ☐ Abnormal 不正常

1B ☐ Other Test 其他方法測試正常
Testing Method
方法為

Test record (if applicable)
測試讀數為（如適用）

- ☐ Normal 正常
- ☐ Abnormal 不正常

(2) Work Status 工程狀況

- ☐ Work completed 工作已完成
- ☐ Work pended for further follow up 工作暫未完成，有待跟進

(3) Other Comments 其他意見

CH-1 Low temp mode Top cabinet, Inlet 21°C, OK
High coil CK-1: 325 psi CK-2 360 psi
E-Kon O.K.
CH-2 Low temp mode Top Cabinet, Inlet 21°C OK
High coil CK-1: 315 psi CK-2: 360 psi E-Kon OK
CH-3 Low temp mode Top cabinet, Inlet 22°C O.K.
High coil CK-1 - 360 psi CK-2 360 psi E-Kon OK

Customer
客戶簽署 Please sign / stamp if the work is attended
以上工作已進行，請簽名 / 蓋章

Date
日期 8/6/2012

Technician
技工簽署

Date
日期 8-6-12

Checked by
主任簽署

Date
日期

TSHK Form: TSHK/FR/01 (08/2008)

TRANE

Trane Service Hong Kong
A division of THS Limited

19/F Dragon Centre, 79 Wing Hong Street
Cheung Sha Wan, Kowloon
Hong Kong

Tel : (852) 2743 9010
Fax: (852) 2785 0694
Website: http://www.tshk.com

LOCATION 地點 _____ UNIT #機號 _____
MODEL # 型號 _____ SERIAL # 序號 _____
MANUFACTURER 生產商 _____ SALES ORDER # 銷售訂單 _____

Design specification 設計資料	RUNNING CONDITION 行駛狀況		1ST READING	2ND READING	3RD READING
	TIME 時間		(a.m./p.m.)	(a.m./p.m.)	(a.m./p.m.)
11.0 (°C)	CHILLED / HOT) WATER SETPOINT 凍水/熱水設定 (°C)		11.0	11.0	11.0
16.5 (°C)	EVAP LEAVING WATER TEMP 蒸發器出水溫度 (°C)		13.0	12.9	11.0
	EVAP ENTERING WATER TEMP 蒸發器入水溫度 (°C)		/	/	/
	EVAP LEAVING WATER PRES 蒸發器出水壓力 (kPa/psi)		227	227	227
	EVAP ENTERING WATER PRES 蒸發器入水壓力 (kPa/psi)		257	257	257
	OUTDOOR AIR TEMP 室外溫度 (°C)		/	/	/
R-134a (Kg/Lb) 冷媒	CIRCUIT 系統 1	EVAP RFGT PRES 蒸發器冷媒壓力 (bar)	3.0	3.8	3.8
		SATURATED EVAP TEMP 蒸發器飽和溫度 (°C)	10	9	9
Oil / (Ltr) 油		COND RFGT PRES 冷凝器冷媒壓力 (bar)	2.50	2.45	2.45
		SATURATED COND TEMP 冷凝器飽和溫度 (°C)	42	42	42
38o (A)		COMPRESSOR VOLTAGE 壓縮機電壓 (V)	390	394	396
		OIL LEVEL 油位	A1 ● A2 ○ A3 ○	A1 ● A2 ○ A3 ○	A1 ● A2 ○ A3 ○
15 (A)		RUNNING CURRENT 行駛電流 (RLA) COMP 壓縮機 A1 (A)	15.2	15.3	15.6
(A)		COMP 壓縮機 A2 (A)	/	/	/
(A)		COMP 壓縮機 A3 (A)	/	/	/
		COMP STARTS 壓縮機起動次數	A1 7 A2	A1 7 A2	A1 7 A2
		COMP RUNNING TIME 壓縮機行駛時間	A1 1 A2	A1 1 A2	A1 1 A2
	CIRCUIT 系統 2	EVAP RFGT PRES 蒸發器冷媒壓力 (bar)	3.2	3.8	3.8
		SATURATED EVAP TEMP 蒸發器飽和溫度 (°C)	10	9	9
		COND RFGT PRES 冷凝器冷媒壓力 (bar)	2.50	2.45	2.45
		SATURATED COND TEMP 冷凝器飽和溫度 (°C)	43	43	42
35 (A)		OIL LEVEL 油位	B1 ● B2 ○ B3 ○	B1 ● B2 ○ B3 ○	B1 ● B2 ○ B3 ○
(A)		RUNNING CURRENT 行駛電流 (RLA) COMP 壓縮機 B1 (A)	21.9	21.7	21.6
(A)		COMP 壓縮機 B2 (A)	/	/	/
		COMP 壓縮機 B3 (A)	/	/	/
		COMP STARTS 壓縮機起動次數	B1 3 B2	B1 3 B2	B1 3 B2
		COMP RUNNING TIME 壓縮機行駛時間	B1 0 B2	B1 0 B2	B1 0 B2

EVAP WATER PRES DROP 蒸發器水壓差

DESIGN 設計壓力差 34.5 (kPa/psi)
ACTUAL 實際壓力差 34.0/3.7 (kPa/psi)

MEGGER TEST 壓縮機絕緣測試

A1:	L1-G 2000MΩ	L2-G 2000MΩ	L3-G 2000MΩ	B1:	L1-G 2000MΩ	L2-G 2000MΩ	L3-G 2000MΩ
	L1-L2 2000MΩ	L1-L3 2000MΩ	L2-L3 2000MΩ		L1-L2 2000MΩ	L1-L3 2000MΩ	L2-L3 2000MΩ
A2:	L1-G	L2-G	L3-G	B2:	L1-G	L2-G	L3-G
	L1-L2	L1-L3	L2-L3		L1-L2	L1-L3	L2-L3
A3:	L1-G	L2-G	L3-G	B3:	L1-G	L2-G	L3-G
	L1-L2	L1-L3	L2-L3		L1-L2	L1-L3	L2-L3

COMMENTS 評語: Load Water Pass P-up 244/7.1 kPa Load Water Drop 31/5°C 34/5°C 34/5°C
Evap 水出口壓力表 / 壓力表 Evap 水入口壓力表 / 壓力表
Please measure against operating data / equipment name plate. Low any condition is not regarded as within the readings that is / are normal.
The status of the test is 'normal / abnormal'. (Please delete where appropriate)
請以作業資料/銘牌為標準作為量度標準，如任何讀數不在標準內，請將該不正常讀數

TECHNICIAN 技工簽署 _____
DATE 日期 7-6-12
CHECKED BY 核對簽署 _____
DATE 日期 _____

CUSTOMER 客戶簽署 _____
PLEASE SIGN/STAMP IF THE WORK IS ATTENDED
以上工作已獲客戶簽署/蓋章確認
DATE 日期 7/6/2012

TRANE

Trane Service Hong Kong
A division of TYS Limited

15/F Dragon Centre, 79 Wing Hong Street
Cheung Sha Wan, Kowloon
Hong Kong

Tel : (852) 2743 9939
Fax: (852) 2785 0694
Website: http://www.tshk.com

LOCATION 地點: 6/F. Shiu Cedar Bldg. UNIT 機號: AC-3
MODEL # 型號: CGWF455CD3FAA0 - HQ SERIAL # 序號: 3F13111 - 5+1 S.O
MANUFACTURER 生產商: TRANE SALES ORDER # 銷售訂單:

Design specification 設計資料	RUNNING CONDITION 行機狀況		1ST READING	2ND READING	3RD READING
	TIME 時間		[a.m./p.m.]	[a.m./p.m.]	[a.m./p.m.]
11.0 (°C)	CHILLED / HOT) WATER SETPOINT 冰水/熱水溫度設定 (°C)		11.0	11.0	11.0
16.5 (°C)	EVAP LEAVING WATER TEMP 蒸發器出水溫度 (°C)		12.9	11.5	11.0
	EVAP ENTERING WATER TEMP 蒸發器入水溫度 (°C)		/	/	/
	EVAP LEAVING WATER PRES 蒸發器出水壓力 (kPa/psi)		320	230	224
	EVAP ENTERING WATER PRES 蒸發器入水壓力 (kPa/psi)		351	261	257
R407C 13 (Refrigerant) (kg/lbs)	OUTDOOR AIR TEMP 室外溫度 (°C)		/	/	/
冷媒	CIRCUIT 系統 1	EVAP RFGT PRES 蒸發器冷媒壓力 (bar)	85	83	80
OIL (kg/lbs)		SATURATED EVAP TEMP 蒸發器飽和溫度 (°C)	13.0	11.0	10.3
潤滑		COND RFGT PRES 冷凝器冷媒壓力 (bar)	250	250	250
3.80 (M)		SATURATED COND TEMP 冷凝器飽和溫度 (°C)	42	46	42
		COMPRESSOR VOLTAGE 壓縮機電壓 (V)	387	386	387
		OIL LEVEL 油位	A1 A2 A3	A1 A2 A3	A1 A2 A3
35 (A)		RUNNING CURRENT 行機電流 (FLA) COMP 壓縮機 A1 (A)	13.5	13.5	13.5
(A)		COMP 壓縮機 A2 (A)	/	/	/
(A)		COMP 壓縮機 A3 (A)	/	/	/
		COMP STARTS 壓縮機啟動次數	A1 2 A2	A1 2 A2	A1 2 A2
		COMP RUNNING TIME 壓縮機行機時間	A1 0 A2	A1 0 A2	A1 0 A2
	CIRCUIT 系統 2	EVAP RFGT PRES 蒸發器冷媒壓力 (bar)	85	84	78
		SATURATED EVAP TEMP 蒸發器飽和溫度 (°C)	12.0	11.0	9.6
		COND RFGT PRES 冷凝器冷媒壓力 (bar)	245	230	230
		SATURATED COND TEMP 冷凝器飽和溫度 (°C)	42	39	39
		OIL LEVEL 油位	B1 B2 B3	B1 B2 B3	B1 B2 B3
85 (A)		RUNNING CURRENT 行機電流 (FLA) COMP 壓縮機 B1 (A)	20.2	20.1/2	20.7
(A)		COMP 壓縮機 B2 (A)	/	/	/
(A)		COMP 壓縮機 B3 (A)	/	/	/
		COMP STARTS 壓縮機啟動次數	B1 1 B2	B1 1 B2	B1 1 B2
		COMP RUNNING TIME 壓縮機行機時間	B1 0 B2	B1 0 B2	B1 0 B2

EVAP WATER PRES DROP 蒸發器水壓降

DESIGN 設計壓力降: 71.1a (kPa/psi)
ACTUAL 實際壓力降: 71.0 (kPa/psi)

MEGGER TEST 壓縮機絕緣測試

A1:	L1-G 2mΩ	L2-G 2mΩ	L3-G 2mΩ
	L1-L2 9MΩ	L1-L3 9MΩ	L2-L3 9MΩ
A2:	L1-G	L2-G	L3-G
	L1-L2	L1-L3	L2-L3
A3:	L1-G	L2-G	L3-G
	L1-L2	L1-L3	L2-L3
B1:	L1-G 2mΩ	L2-G 2mΩ	L3-G 2mΩ
	L1-L2 9MΩ	L1-L3 9MΩ	L2-L3 9MΩ
B2:	L1-G	L2-G	L3-G
	L1-L2	L1-L3	L2-L3
B3:	L1-G	L2-G	L3-G
	L1-L2	L1-L3	L2-L3

COMMENTS 備註: Cond water temp drop 2.8/5°C Cond water drop 12/27°C 11.5/27°C 11/27°C

Evap 入水口 量度位置, 螺絲鎖 冰 cond 量度出水位置 水溫度.

(Please measure water/ condition guide / equipment name plate / other information... Tick the box(es) that is / are normal. The status of the item is "normal / abnormal." (Please make where appropriate)

TECHNICIAN 技工簽署: [signature]
DATE 日期: 7-6-12
CHECKED BY 主任簽署:
DATE 日期:

CUSTOMER 客戶簽署: [signature]
PLEASE SIGN/STAMP IF THE WORK IS ATTENDED 如上工作已進行,請簽名/蓋章
DATE 日期: 7/6/2012

TRANE

Trane Service Hong Kong
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Website: http://www.ashk.com

LOCATION 地點 _____ UNIT 機號 _____
MODEL # 型號 _____ SERIAL # 序號 _____
MANUFACTURER 生產商 _____ SALES ORDER # 銷售號碼 _____

Design specification 設計資料	RUNNING CONDITION 行機狀況			1ST READING	2ND READING	3RD READING
	TIME 時間			(a.m./p.m.)	(a.m./p.m.)	(a.m./p.m.)
11.0 (°C)	(CHILLED / HOT) WATER SETPOINT 凍水/熱水設定 (°C)			11.0	11.0	11.0
16.5 (°C)	EVAP LEAVING WATER TEMP 蒸發器出水溫度 (°C)			14.0	10.9	11.0
	EVAP ENTERING WATER TEMP 蒸發器入水溫度 (°C)			/	/	/
	EVAP LEAVING WATER PRES 蒸發器出水壓力 (kPa/psi)			244	284	274
	EVAP ENTERING WATER PRES 蒸發器入水壓力 (kPa/psi)			344	344	344
	OUTDOOR AIR TEMP 室外溫度 (°C)			/	/	/
Refrigerant R-134a (Fig/Size) 冷媒	CIRCUIT 迴路 1	EVAP RFGT PRES 蒸發器冷媒壓力 (kPa/psi)		90	80	78
Oil (gal) 油		SATURATED EVAP TEMP 蒸發器飽和溫度 (°C)		13.0	9.0	9.0
380 (V) 電壓		COND RFGT PRES 冷凝器冷媒壓力 (kPa/psi)		265	260	260
		SATURATED COND TEMP 冷凝器飽和溫度 (°C)		44	44	44
		COMPRESSOR VOLTAGE 壓縮機電壓 (V)		389	389	389
85 (A)		OIL LEVEL 油位		A1 (●) A2 ( ) A3 ( )	A1 (●) A2 ( ) A3 ( )	A1 (●) A2 ( ) A3 ( )
(A)		RUNNING CURRENT 行機電流 (RLA)	COMP 壓縮機 A1 (A)	13.6	14.4	13.4
(A)			COMP 壓縮機 A2 (A)	/	/	/
			COMP 壓縮機 A3 (A)	/	/	/
		COMP STARTS 壓縮機起動次數		A1 4 A2	A1 4 A2	A1 4 A2
		COMP RUNNING TIME 壓縮機行機時間		A1 0 A2	A1 0 A2	A1 1 A2
	CIRCUIT 迴路 2	EVAP RFGT PRES 蒸發器冷媒壓力 (kPa/psi)		89	72	70
		SATURATED EVAP TEMP 蒸發器飽和溫度 (°C)		13.0	7.5	7.0
		COND RFGT PRES 冷凝器冷媒壓力 (kPa/psi)		260	250	250
		SATURATED COND TEMP 冷凝器飽和溫度 (°C)		44	42	42
		OIL LEVEL 油位		B1 (●) B2 ( ) B3 ( )	B1 (●) B2 ( ) B3 ( )	B1 (●) B2 ( ) B3 ( )
85 (A)		RUNNING CURRENT 行機電流 (RLA)	COMP 壓縮機 B1 (A)	21.6	21.8	21.9
(A)			COMP 壓縮機 B2 (A)	/	/	/
(A)			COMP 壓縮機 B3 (A)	/	/	/
		COMP STARTS 壓縮機起動次數		B1 4 B2	B1 4 B2	B1 4 B2
		COMP RUNNING TIME 壓縮機行機時間		B1 0 B2	B1 0 B2	B1 0 B2

EVAP WATER PRES DROP 蒸發器水壓差		MEGGER TEST 絕緣測試			
DESIGN 設計壓力差 29.6 (kPa/psi)		A1: L1-G 200 L2-G 200 L3-G 200	B1: L1-G 200 L2-G 200 L3-G 200		
ACTUAL 實際壓力差 29.6/285 (kPa/psi)		L1-L2 0 L1-L3 0 L2-L3 0	L1-L3 0 L1-L3 0 L2-L3 0		
	A2:	L1-G ____ L2-G ____ L3-G ____	B2:	L1-G ____ L2-G ____ L3-G ____	
		L1-L2 ____ L1-L3 ____ L2-L3 ____		L1-L2 ____ L1-L3 ____ L2-L3 ____	
	A3:	L1-G ____ L2-G ____ L3-G ____	B3:	L1-G ____ L2-G ____ L3-G ____	
		L1-L2 ____ L1-L3 ____ L2-L3 ____		L1-L2 ____ L1-L3 ____ L2-L3 ____	

COMMENTS 評語: Cond water Press drop - 150/199 kpa Cond water temp 13/55°C 14/58°C 55/59°C

Please measure external operating (suite / equipment name plate / other) parameters ... as relevant and endorse by (all the readings) that (it) are normal.
The status of the test is "normal / abnormal." ("Please delete where appropriate)

TECHNICIAN 技工簽署 _____
DATE 日期 7-6-12
CHECKED BY 主任簽署 _____
DATE 日期 _____

CUSTOMER 客戶簽署 _____
PLEASE SIGN/STAMP IF THE WORK IS ATTENDED
DATE 日期 7/6/2012

Trane Service Hong Kong
A division of TIS Limited

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Cheung Sha Wan, Kowloon
Hong Kong

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Website: http://www.tshk.com

水冷涡轮式冷凝器(CGWP) PLC設定記錄表
WATER COOLED SCROLL CHILLER(CGWP) PLC SETTING RECORD

	PLC Configuration Record	
	User Setting	Setting
		Actual
1	Temperature Target	Chilled Leaving WT
2	Chilled Leaving WT Setpoint (°C)	7.0
3	Chilled Entering WT Setpoint (°C)	/
4	Cooling Leaving WT Setpoint (°C)	/
5	Cooling Entering WT Setpoint (°C)	/
6	Start by	Local HMI
7	Delay Run (Sec)	1.0
8	Comp Sequence	Rotation
9	Regular Service Reminders	Not Req.
10	Service Period (Hr)	/
11	Chilled Water Pump	Chilled water Only
12	Ice Making Start/Stop	/
13	Chill LWT Using Stop Temp (°C)	/
14	Ice Making by Schedule	/
	Advanced Setting	Actual
1	Chill LWT-1	8.0
2	Chill LWT-2	9.0
3	Ambient	/
4	Chill EWT	/
5	Cooling LWT	/
6	Cooling EWT	/
7	Power Up Resume	Not Resume
8	Chiller Pump Up	Continuous
9	On Duty Time Set (Hr)	/
10	Off Duty Time Set (Hr)	/
11	Neutral Band Width (°C)	1.0
12	Cooling Fan Start Temp (°C)	35.0
13	Cooling Fan Stop Temp (°C)	30.0
14	Fan 1 Stop Amb Temp (°C)	/
15	Fan 2 Stop Amb Temp (°C)	/
16	Fan 3 Stop Amb Temp (°C)	/
17	Setpoint Reset	Control to Water
18	Chill LWT Freeze Trip Temp (°C)	2.0
19	Cooling LWT Over Heat Temp (°C)	50.0
20	Min Time to Add/Remove Comp (s)	60.0
21	Minimum Comp Run Time (Sec)	120.0
22	Minimum Comp Rest Time (Sec)	180.0
23	Fault Lock Time (Minute)	5m
24	Run Status Output	Water Flow
	Manual Control	Actual
1	Compressor 1A	Auto
2	Compressor 1B	Auto
3	Compressor 2A	/
4	Compressor 2B	/
	Comm Setting (Serial Port 1, RS-485)	Actual
1	Protocol	Trane
2	Parity	None
3	Data Bit	7 bit
4	Parity Check	With Parity
5	Stop Bit	1 bit
6	Baud Rate	9600
	Comm Setting (Serial Port 2, RS-485)	Actual
1	Protocol	Modbus
2	Parity	Even
3	Data Bit	8bit
4	Parity Check	With Parity
5	Stop Bit	1 bit
6	Baud Rate	9600
	Config Setting	Actual
1	Tandem Circuit	2 Ref. Circuit
2	Compressor	2 Comp
3	Condenser	Water Cooled
4	Power Phase	3 Phase
5	Refrigerant	R-134a
6	Chilled Fluid	Water
7	Anal Input	Not Used
8	Power Check	Enabled
9	Serial Comm	Enabled

TSHK Form : TSHKF063(16/03/12)

TRANE

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水冷涡輪式冷凝機(CGWP) PLC設定記錄表
WATER COOLED SCROLL CHILLER(CGWP) PLC SETTING RECORD

PLC Configuration Record		Setting / Actual
	User Setting	
1	Temperature Target	Chilled Leaving W/T
2	Chilled Leaving W/T Setpoint (°C)	7.0
3	Chilled Entering W/T Setpoint (°C)	/
4	Cooling Leaving W/T Setpoint (°C)	/
5	Cooling Entering W/T Setpoint (°C)	/
6	Start by	Local Host
7	Delay Start (Sec)	0
8	Comp Sequence	Rotation
9	Regular Service Reminding	Not Used.
10	Service Period (Hr)	/
11	Chilled Water/Ice/Ing	Chilled water only
12	Ice Making Start/Stop	/
13	Chill LWT Ice/ng Stop Temp (°C)	/
14	Ice Making by Schedule	/
	Advanced Setting	Actual
1	Chill LWT-1	0.0
2	Chill LWT-2	0.0
3	Antifreeze	/
4	Chill EWT	/
5	Cooling LWT	/
6	Cooling EWT	/
7	Power Up Resume	Auto Restart Configure
8	Chiller Run/Stop	/
9	On Duty Time Set (Hr)	/
10	Off Duty Time Set (Hr)	/
11	Neutral Band Width (°C)	5.0
12	Cooling Fan Start Temp (°C)	30.0
13	Cooling Fan Stop Temp (°C)	18.0
14	Fan 1 Stop Amb Temp (°C)	/
15	Fan 2 Stop Amb Temp (°C)	/
16	Fan 3 Stop Amb Temp (°C)	/
17	Setpoint Reset	Constant in Chill
18	Chill LWT Freeze Trip Temp (°C)	3.0
19	Cooling LWT Over Heat Temp (°C)	Fix 0
20	Min Time to Add/Remove Comp (s)	180
21	Minimum Comp Run Time (Sec)	180.0
22	Minimum Comp Rest Time (Sec)	180.0
23	Fault Lock Time (Minute)	10
24	Run Status Output	Chiller Start
	Manual Control	Actual
1	Compressor 1A	Auto
2	Compressor 1B	/
3	Compressor 2A	Auto
4	Compressor 2B	/
	Comm Setting (Serial Port 1, RS-485)	Actual
1	Protocol	Trane
2	Parity	Even
3	Data Bit	7bit
4	Parity Check	With Parity
5	Stop Bit	1bit
6	Baud Rate	9600
	Comm Setting (Serial Port 2, RS-485)	Actual
1	Protocol	Modbus
2	Parity	None
3	Data Bit	8bit
4	Parity Check	Non Parity
5	Stop Bit	1bit
6	Baud Rate	9600
	Config Setting	Actual
1	System Circuit	1 Ckt. Circuit
2	Compressor	2 Comp.
3	Condenser	Water Cooled
4	Power Phase	3 Phase
5	Refrigerant	R407C
6	Chilled Fluid	Water
7	Anal Input	10K-3 Sen.
8	Power Check	Enabled
9	Serial Comm	To Chiller

TSHK Form : TSHKF068(10/10)(1/2)

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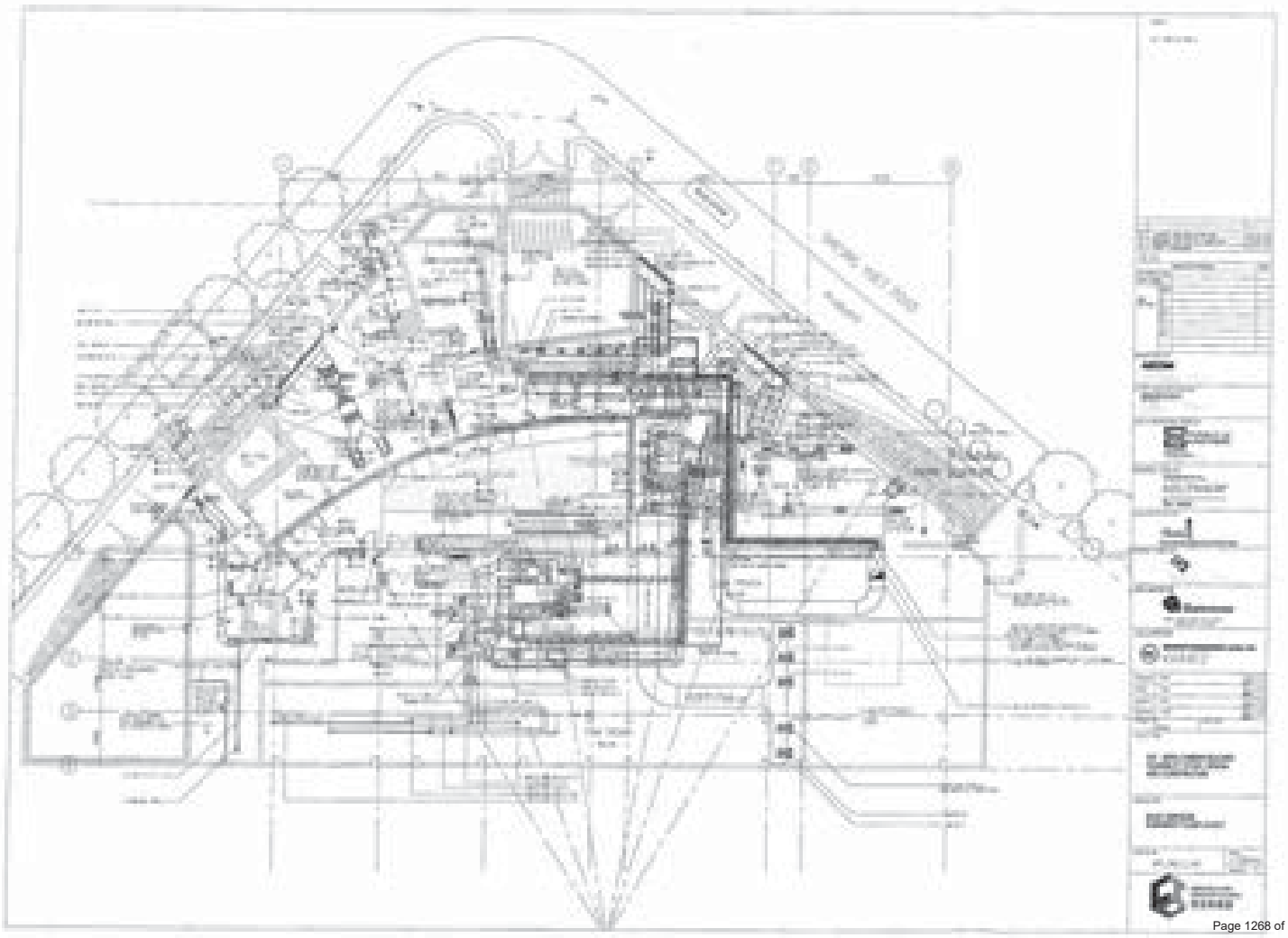
水冷涡轮式冷凍機(CGWP) PLC設定記錄表
WATER COOLED SCROLL CHILLER(CGWP) PLC SETTING RECORD

	PLC Configuration Record	Setting
	User Setting	**Actual**
1	Temperature Target	Chilled Leaving WT
2	Chilled Leaving WT Setpoint (°C)	7.0
3	Chilled Entering WT Setpoint (°C)	/
4	Cooling Leaving WT Setpoint (°C)	/
5	Cooling Entering WT Setpoint (°C)	/
6	Start by	Local Mode
7	Delay Run (Sec)	120
8	Comp Sequence	Rotation
9	Regular Service Reminding	Not Requ.
10	Service Period (Hr)	/
11	Chilled Water Only	Chilled water Only
12	Ice Making Start/Stop	/
13	Chill EWT Ramp Stop Temp (°C)	/
14	Ice Making by Schedule	/
	Advanced Setting	**Actual**
1	Chill LWT-1	0.0
2	Chill LWT-2	0.0
3	Ambient	/
4	Chill EWT	/
5	Cooling LWT	/
6	Cooling EWT	/
7	Power Up Resume	Auto Restart Controller
8	Chiller Run/Stop	/
9	On Delay Time Set (Hr)	/
10	Off Delay Time Set (Hr)	/
11	Neutral Band Width (°C)	4.0
12	Cooling Fan Start Temp (°C)	30.0
13	Cooling Fan Stop Temp (°C)	28.0
14	Fan 1 Stop Amb Temp (°C)	/
15	Fan 2 Stop Amb Temp (°C)	/
16	Fan 3 Stop Amb Temp (°C)	/
17	Setpoint Reset	Constant No Reset
18	Chill LWT Freeze Tol Temp (°C)	2.0
19	Cooling LWT Over Heat Temp (°C)	35.0
20	Min Time to Add/Remove Comp (s)	30.0
21	Minimum Comp Run Time (Sec)	60.0
22	Minimum Comp Rest Time (Sec)	180.0
23	Fault Lock Time (Minute)	60
24	Run Status Output	Chiller Start
	Manual Control	**Actual**
1	Compressor 1A	Auto
2	Compressor 1B	/
3	Compressor 2A	Auto
4	Compressor 2B	/
	Comm Setting (Serial Port 1, RS-485)	**Actual**
1	Protocol	Batch
2	Parity	Even
3	Data Bit	7bit
4	Parity Check	with Parity
5	Stop Bit	1bit
6	Baud Rate	9600
	Comm Setting (Serial Port 2, RS-485)	**Actual**
1	Protocol	Modbus
2	Parity	even
3	Data Bit	8 bit
4	Parity Check	Have Parity
5	Stop Bit	1bit
6	Baud Rate	9600
	Config Setting	**Actual**
1	System Circuit	2 Ref. Circuit
2	Compressor	2 Comp
3	Condenser	Water Cooled
4	Power Phase	3 Phase
5	Refrigerant	R407C
6	Chilled Fluid	Water
7	Anal Input	Not Set
8	Power Check	Installed
9	Serial Comm	Installed

TShK Form : TSHKF(MS)(10/10)(3)



Form RLP/SF/xxxx

Project	CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works	E&M Services
Contract No.	P1102/4KL
Contractor	

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No.	:	RFIN – AC-039
To/ Attn	:	Mr. Patrick Lui
Date of Request	:	
Subject	:	MWAC INSTALLATION
Anticipated date of response	:	
Completed works for inspection	:	IAQ Noise measurement
Locations	:	Exhibition Area, Multi-Purpose Room, Eco Café, Entrance Lobby, Eco Office and Eco Home
Referred Document: A/T/S/F/SS/Specifications	:	KEL/AC/L/002(B), KEL/AC/L/003(B), KEL/AC/L/007(B)
Next Activities / Works	:	

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection;

15 July 2012

Project Manager
For and on behalf of Contractor's Name

Received by RLP/Date

Received by WK/Date

Received by WEC/Date

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken : 21 July 2012

Response / Comments :

Remarks:-

Replied by RLP/ Date

Replied by [illegible] Date

Replied by WEC/ Date

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

KSW/WY/JYE

cc

KCS	w/o
WK	w/o
WEC	w/o
TLS	w/o

After Stop (Background).

Kwantpe Engineering (Asia) Ltd.
Title: Acoustics and Noise Measurement Report
Project: CIC-Zero Carbon Building

Location	Octave Band Center Frequency(Hz)								
	63	125	250	500	1000	2000	4000	8000	Remarks
	Sound Pressure Levels (dB)								
Exhibition Area	29.4	28.2	23.2	24.7	29.5	37.8	38.1	29.1	
Multi Purpose Room	29.1	33.6	23.5	28.3	29.4	34.9	37.8	30.7	
Eco Cafe	27	35	30	31.6	38	38.7	37.9	26.6	
Entrance Lobby	28.5	25.7	29.8	24.9	40	33.6	37.7	26.5	
Eco Office	27.5	25.6	33.1	23.8	31.5	28.2	31.4	26.4	
Eco Home	28.4	26	27.5	24.9		34.9	37.8	28.7	

TESTED BY KKJBGER NAME [illegible] SIGNATURE [signature] Date 31 Jul 12

CHECKED BY NAME SIGNATURE Date

WITNESSED BY OAF NAME [illegible] SIGNATURE [signature] Date 31/7/2012

WITNESSED BY NAME SIGNATURE Date

AHUs IN OPERATION

Kreuger Engineering (Asia) Ltd.
Title: Acoustics and Noise Measurement Report
Project: CIC-Zero Carbon Building

Location	Octave Band Center Frequency(Hz)								
	63	125	250	500	1000	2000	4000	8000	Remarks
	Sound Pressure Levels (dB)								
Exhibition Area	45.6	38.1	25	27.6	33.7	37.5	37	36.7	
Multi Purpose Room	32.8	37.7	27.8	29.1	33.2	38.7	36.3	35.2	
Eco Cafe									
Entrance Lobby									
Eco Office	46.1	29.1	24.5	24.3	27.5	36.6	37.7	34.3	No EQ/Machine
Eco Home	37.6	37.2	25.2	25.6	32.1	37.5	36.9	39.8	No EQ/Machine

TESTED BY KRUEGER NAME [illegible] SIGNATURE [signature] Date 31 Jul 12

CHECKED BY NAME SIGNATURE Date

WITNESSED BY OAP NAME [illegible] SIGNATURE [signature] Date 31/7/2012

WITNESSED BY NAME SIGNATURE Date

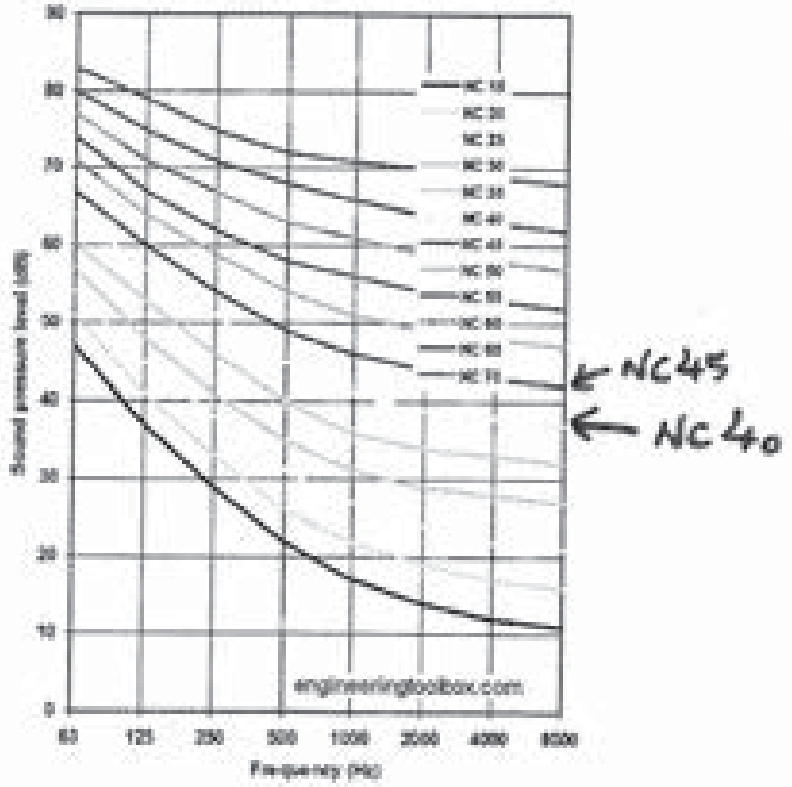
NC - Noise Criterion

For a given noise spectrum, the NC rating can be obtained by plotting its octave band levels on the set of NC curves

Noise Criterion - NC - were established in U.S. for rating indoor noise, noise from air-conditioning equipment etc. In Europe it is common to use Noise Rating Curves - NR.

The method consists of a set of criteria curves extending from 63 to 8000 Hz, and a tangency rating procedure. The criteria curves define the limits of octave band spectra that must not be exceeded to meet occupant acceptance in certain spaces.

The NC rating can be obtained by plotting the octave band levels for a given noise spectrum - the NC curves. The noise spectrum is specified as having a NC rating same as the lowest NC curve which is not exceeded by the spectrum.



- Print NC-diagram

Noise Criterion	Octave Band Center Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
	Sound Pressure Levels (dB)							
NC-15	47	36	29	22	17	14	12	11
NC-20	51	40	33	26	22	19	17	16
NC-25	54	44	37	31	27	24	22	21
NC-30	57	48	41	35	31	29	28	27
NC-35	60	52	45	40	36	34	33	32
NC-40	64	56	50	45	41	39	38	37
NC-45	67	60	54	49	46	44	43	42
NC-50	71	64	58	54	51	49	48	47
NC-55	74	67	63	58	56	54	53	52
NC-60	77	71	67	63	61	59	58	57
NC-65	80	75	71	68	66	64	63	62

Recommended Noise Criterion - NC

The noise in different types of rooms should not exceed the Noise Criterion limits listed below:

Type of Room - Space Type	Recommended NC Level	Equivalent Sound Level

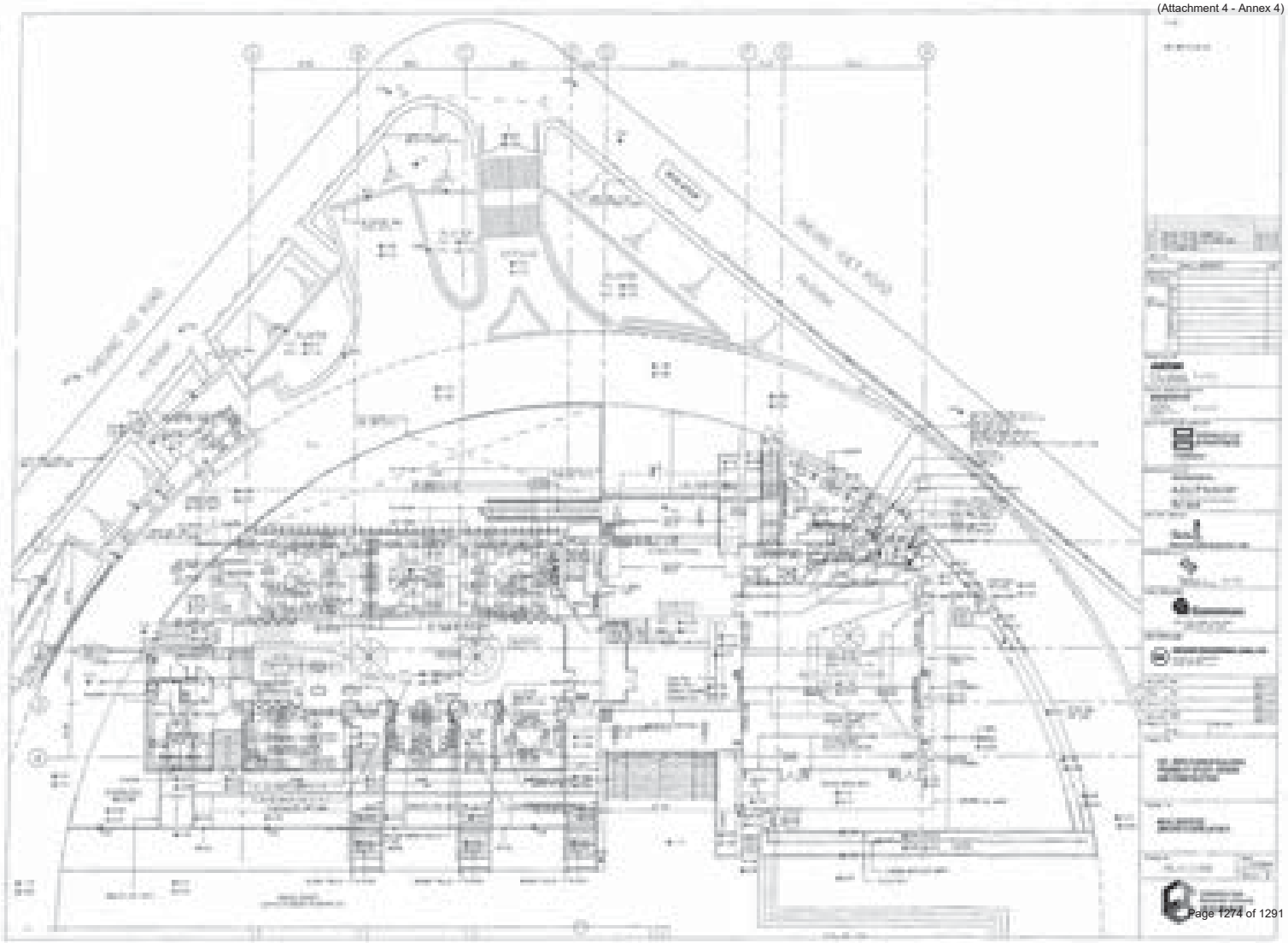
Noise Criteria Schedule

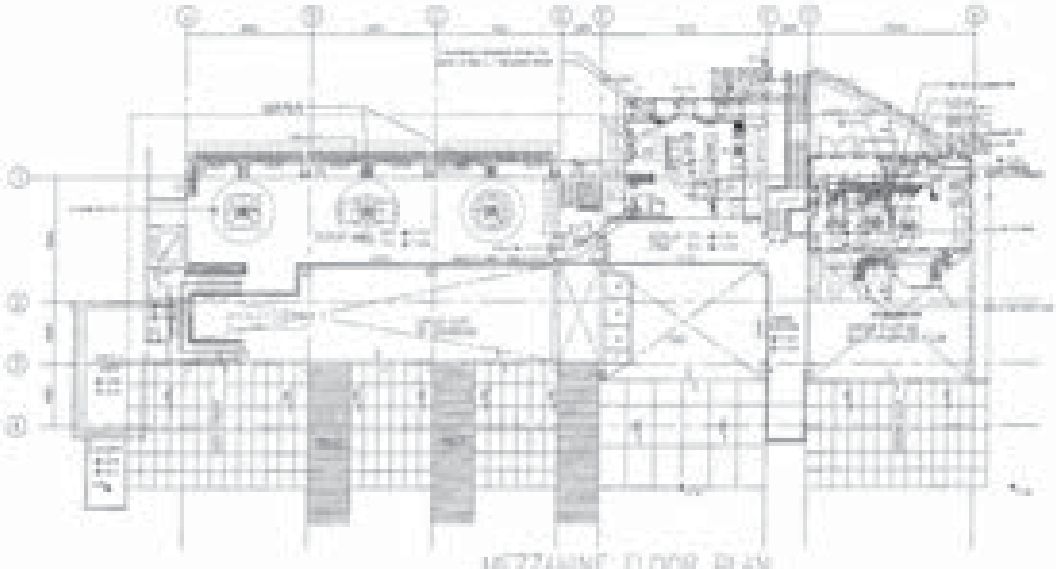
Room	Noise Criteria, NC (dB)
Exhibition Area	NC 45
Multi Function Room	NC 40
Eco Cafe	NC 40
Entrance lobby	NC 40
Eco office	NC 40
Eco-home	NC 40

3.1.4 Other Design Criteria

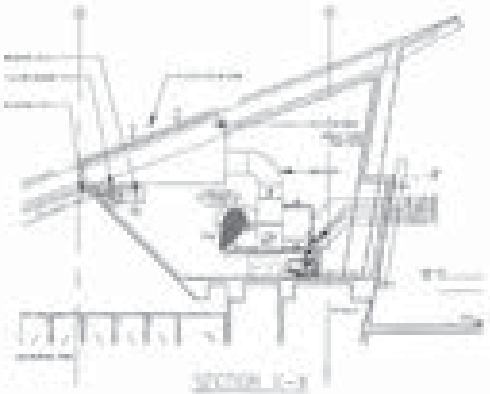
Design criteria and cooling load calculation assumptions are listed in the following table:

Design parameters	Design criteria / assumption	Remarks
Design indoor temperature in AC mode	25.5°C	
Maximum no. of visitor	150	
Maximum no. of people in office	46	
Lighting load (office)	6W/m^2	200lux + task lighting
Lighting load (exhibition area)	6W/m^2	200lux + task lighting
Lighting load (multi-purpose room)	6W/m^2	300lux
Equipment load (office)	20W/m^2	50nos. × computer & monitor 5nos. × photocopier 2nos. x fax machine 5nos. x printer 1no. × microwave oven 1no. × refrigerator
Equipment load (exhibition area)	10kW	50nos. × 55" LCD monitor
Equipment load (multi-purpose room)	5W/m^2	
People load (office)	130W/person	Moderately active office work
People load (exhibition area)	130W/person	Moderately active office work
People load (multi-purpose room)	95W/person	Seated
Fresh air flowrate (office)	2.5L/s/person 0.5L/s/m^2	
Fresh air flowrate (exhibition area)	3.8L/s/person 0.5L/s/m^2	
Fresh air flowrate (multi-purpose room)	3.8L/s/person 0.5L/s/m^2	

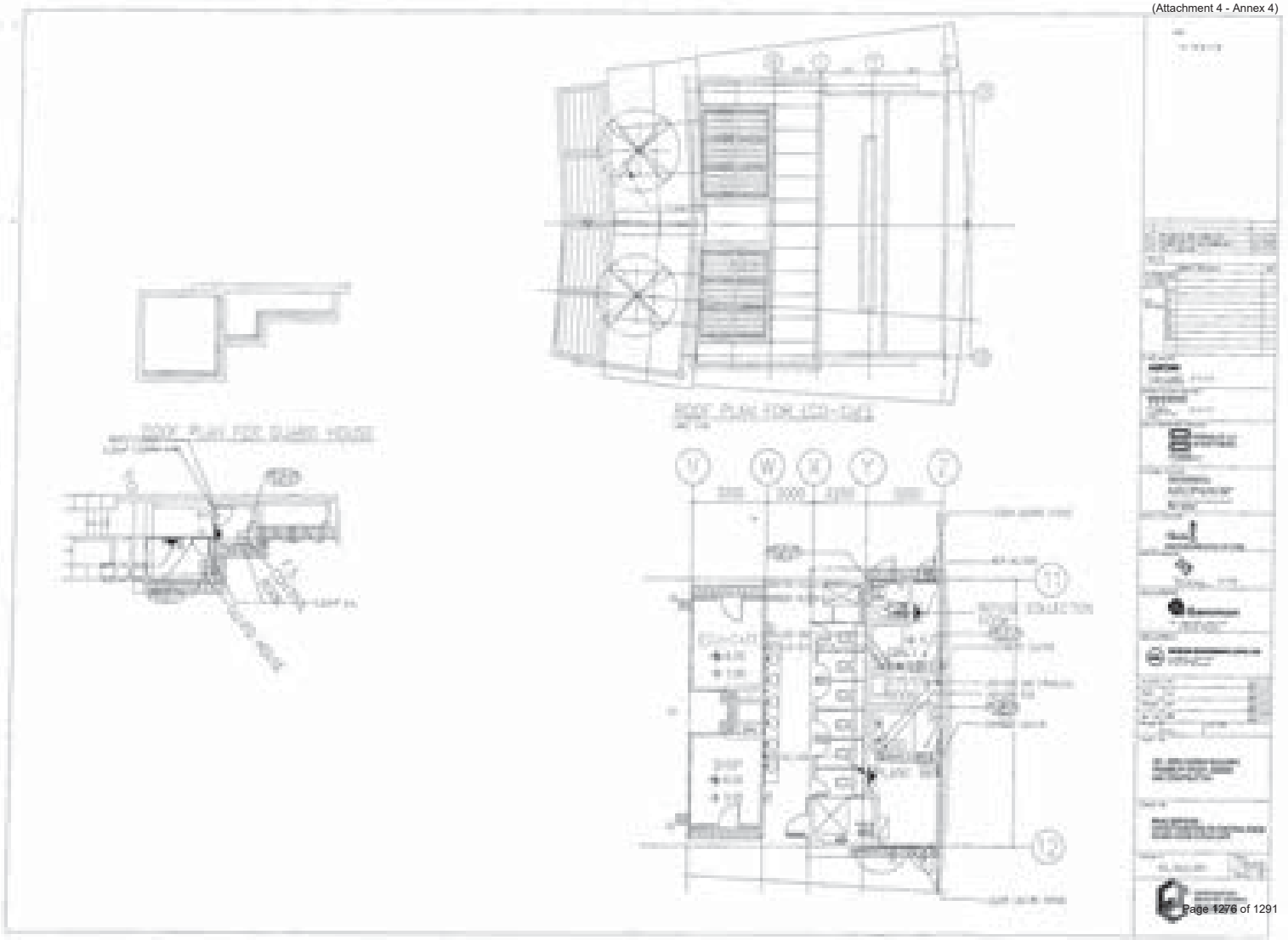




MEZZANINE FLOOR PLAN



SECTION X-X



Form RLP/RFI/sup

Project	CIC - Zero Carbon Building Feasibility Study, Design and Construction
Works	E&M Services
Contract No.	P1102/4KL
Contractor	

CONTRACTOR'S REQUEST FOR INSPECTION

Ref No.	:	RFIN – AC-033
To/ Attn	:	Mr. Patrick Lui
Date of Request	:	
Subject	:	MVAC INSTALLATION
Anticipated date of response	:	
Completed works for Inspection	:	CCMS Test of EAF & FAF
Locations	:	B/F – G/F
Referred Document: A/T/SF/SSP/Specifications	:	KEL/AC/L/001(B), KEL/AC/L/002(B)
Next Activities / Works	:	

Received by RLP/Date

Received by W/C/Date

Received by W/C/Date

We certify that the works done above are in full compliance with the Contract and Specification requirements and are ready for inspection.

Project Manager:
For and on behalf of Contractor's Name

RESPONSE AND INSPECTION RECORD

Review Status

Date of Inspection Taken : 20 JUN 2012

Response / Comments :

Remarks:-

Replied by RLP/ Date

Replied by QRT Date

Replied by W/C/ Date

cc

KCS	w/o
WK	w/o
WSC	w/o
TLS	w/o

ronald lu & partners

For and on behalf of
Ronald Lu & Partners (HK) Ltd.

KSW/WIY/JYE

BMS Testing Form

VENTIATION FAN SYSTEM	BMS Control/ Status/ Reading	Result	Testing Date	Remarks
EAF-B-01 Auto / Manual Status		☑ PASS ☐ FAIL		
EAF-B-01 Trip Alarm		☑ PASS ☐ FAIL		
EAF-B-01 Power On / Off Status		☑ PASS ☐ FAIL		
EAF-B-01 Running / Stop		☑ PASS ☐ FAIL		
EAF-B-01 Emergency Stop Alarm		☑ PASS ☐ FAIL		
~~EAF-B-01 Room Temperature~~		☐ ~~PASS~~ ☐ ~~FAIL~~		
EAF-B-01 Start / Stop Control		☑ PASS ☐ FAIL		
EAF-B-02 Auto / Manual Status		☑ PASS ☐ FAIL		
EAF-B-02 Trip Alarm		☑ PASS ☐ FAIL		
EAF-B-02 Power On / Off Status		☑ PASS ☐ FAIL		
EAF-B-02 Running / Stop		☑ PASS ☐ FAIL		
EAF-B-02 Emergency Stop Alarm		☑ PASS ☐ FAIL		
~~EAF-B-02 Room Temperature~~		☐ ~~PASS~~ ☐ ~~FAIL~~		
EAF-B-02 Start / Stop Control		☑ PASS ☐ FAIL		
EAF-B-03 Auto / Manual Status		☐ PASS ☐ FAIL		
EAF-B-03 Trip Alarm		☑ PASS ☐ FAIL		
EAF-B-03 Power On / Off Status		☑ PASS ☐ FAIL		
EAF-B-03 Running / Stop		☑ PASS ☐ FAIL		
EAF-B-03 Emergency Stop Alarm		☑ PASS ☐ FAIL		
EAF-B-03 Fire Alarm		☑ PASS ☐ FAIL		
~~EAF-B-03 Room Temperature~~		☐ ~~PASS~~ ☐ ~~FAIL~~		
EAF-B-03 Start / Stop Control		☑ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		

NAME SIGNATURE

Tested and Checked By : (SIEMENS LTD) _____ _____

Witnessed By : (Kuenyen Ltd) _____ _____

Witnessed By : ( ) _____ _____

Witnessed By : ( ) _____ _____

Date : _____

VENTIATION FAN SYSTEM	BMS Control/ Status/ Reading	Result	Testing Date	Remarks
EAF-B-04 Auto / Manual Status		☑ PASS ☐ FAIL		
EAF-B-04 Trip Alarm		☑ PASS ☐ FAIL		
EAF-B-04 Power On / Off Status		☑ PASS ☐ FAIL		
EAF-B-04 Running / Stop		☑ PASS ☐ FAIL		
EAF-B-04 Emergency Stop Alarm		☑ PASS ☐ FAIL		
EAF-B-04 Fire Alarm		☑ PASS ☐ FAIL		
~~EAF-B-04 Room Temperature~~		☐ ~~PASS~~ ☐ ~~FAIL~~		
EAF-B-04 Start / Stop Control		☑ PASS ☐ FAIL		
EAF-B-05 Auto / Manual Status		☑ PASS ☐ FAIL		
EAF-B-05 Trip Alarm		☑ PASS ☐ FAIL		
EAF-B-05 Power On / Off Status		☑ PASS ☐ FAIL		
EAF-B-05 Running / Stop		☑ PASS ☐ FAIL		
EAF-B-05 Emergency Stop Alarm		☑ PASS ☐ FAIL		
~~EAF-B-05 Room Temperature~~		☐ ~~PASS~~ ☐ ~~FAIL~~		
EAF-B-05 Start / Stop Control		☑ PASS ☐ FAIL		
EAF-B-06 Auto / Manual Status		☑ PASS ☐ FAIL		
EAF-B-06 Trip Alarm		☑ PASS ☐ FAIL		
EAF-B-06 Power On / Off Status		☑ PASS ☐ FAIL		
EAF-B-06 Running / Stop		☑ PASS ☐ FAIL		
EAF-B-06 Emergency Stop Alarm		☑ PASS ☐ FAIL		
EAF-B-06 Fire Trip Alarm		☑ PASS ☐ FAIL		
~~EAF-B-06 Room Temperature~~		☐ ~~PASS~~ ☐ ~~FAIL~~		
EAF-B-06 Start / Stop Control		☑ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		

NAME SIGNATURE

Tested and Checked By : (SIEMENS LTD) _____ _____

Witnessed By : (Kaiser Ltd) Kevin Wu _____ _____

Witnessed By : ( ) _____ _____

Witnessed By : ( ) _____ _____

Date : _____

VENTIATION FAN SYSTEM	BMS Control/ Status/ Reading	Result	Testing Date	Remarks
EAF-B-07 Auto / Manual Status		☑ PASS ☐ FAIL		
EAF-B-07 Trip Alarm		☑ PASS ☐ FAIL		
EAF-B-07 Power On / Off Status		☑ PASS ☐ FAIL		
EAF-B-07 Running / Stop		☑ PASS ☐ FAIL		
EAF-B-07 Emergency Stop Alarm		☑ PASS ☐ FAIL		
EAF-B-07 Room Temperature		☐ PASS ☐ FAIL		
EAF-B-07 Start / Stop Control		☑ PASS ☐ FAIL		
EAF-G-08 Auto / Manual Status		☐ PASS ☐ FAIL		
EAF-G-08 Trip Alarm		☐ PASS ☐ FAIL		
EAF-G-08 Power On / Off Status		☐ PASS ☐ FAIL		
EAF-G-08 Running / Stop		☐ PASS ☐ FAIL		
EAF-G-08 Emergency Stop Alarm		☐ PASS ☐ FAIL		
EAF-G-08 Start / Stop Control		☐ PASS ☐ FAIL		
EAF-G-11 Auto / Manual Status		☐ PASS ☐ FAIL		
EAF-G-11 Trip Alarm		☑ PASS ☐ FAIL		
EAF-G-11 Power On / Off Status		☑ PASS ☐ FAIL		
EAF-G-11 Running / Stop		☑ PASS ☐ FAIL		
EAF-G-11 Emergency Stop Alarm		☑ PASS ☐ FAIL		
EAF-G-11 Start / Stop Control		☑ PASS ☐ FAIL		
EAF-G-12 Auto / Manual Status		☑ PASS ☐ FAIL		
EAF-G-12 Trip Alarm		☑ PASS ☐ FAIL		
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EAF-G-12 Emergency Stop Alarm		☑ PASS ☐ FAIL		
EAF-G-12 Start / Stop Control		☑ PASS ☐ FAIL		

NAME SIGNATURE

Tested and Checked By : (SIEMENS LTD) _____ _____

Witnessed By : (Kaiser Ltd) Edwin Wai Yip _____

Witnessed By : ( ) _____ _____

Witnessed By : ( ) _____ _____

Date : _____

VENTIATION FAN SYSTEM	BMS Control/ Status/ Reading	Result	Testing Date	Remarks
EAF-G-16 Auto / Manual Status		☐ PASS ☐ FAIL		
EAF-G-16 Trip Alarm		☐ PASS ☐ FAIL		
EAF-G-16 Power On / Off Status		☐ PASS ☐ FAIL		
EAF-G-16 Running / Stop		☐ PASS ☐ FAIL		
EAF-G-16 Emergency Stop Alarm		☐ PASS ☐ FAIL		
EAF-G-16 Room Temperature		☐ PASS ☐ FAIL		
EAF-G-16 Start / Stop Control		☐ PASS ☐ FAIL		
EAF-G-17 Auto / Manual Status		☐ PASS ☐ FAIL		
EAF-G-17 Trip Alarm		☑ PASS ☐ FAIL		
EAF-G-17 Power On / Off Status		☑ PASS ☐ FAIL		
EAF-G-17 Running / Stop		☑ PASS ☐ FAIL		
EAF-G-17 Emergency Stop Alarm		☑ PASS ☐ FAIL		
EAF-G-17 Start / Stop Control		☑ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		
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		☐ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		

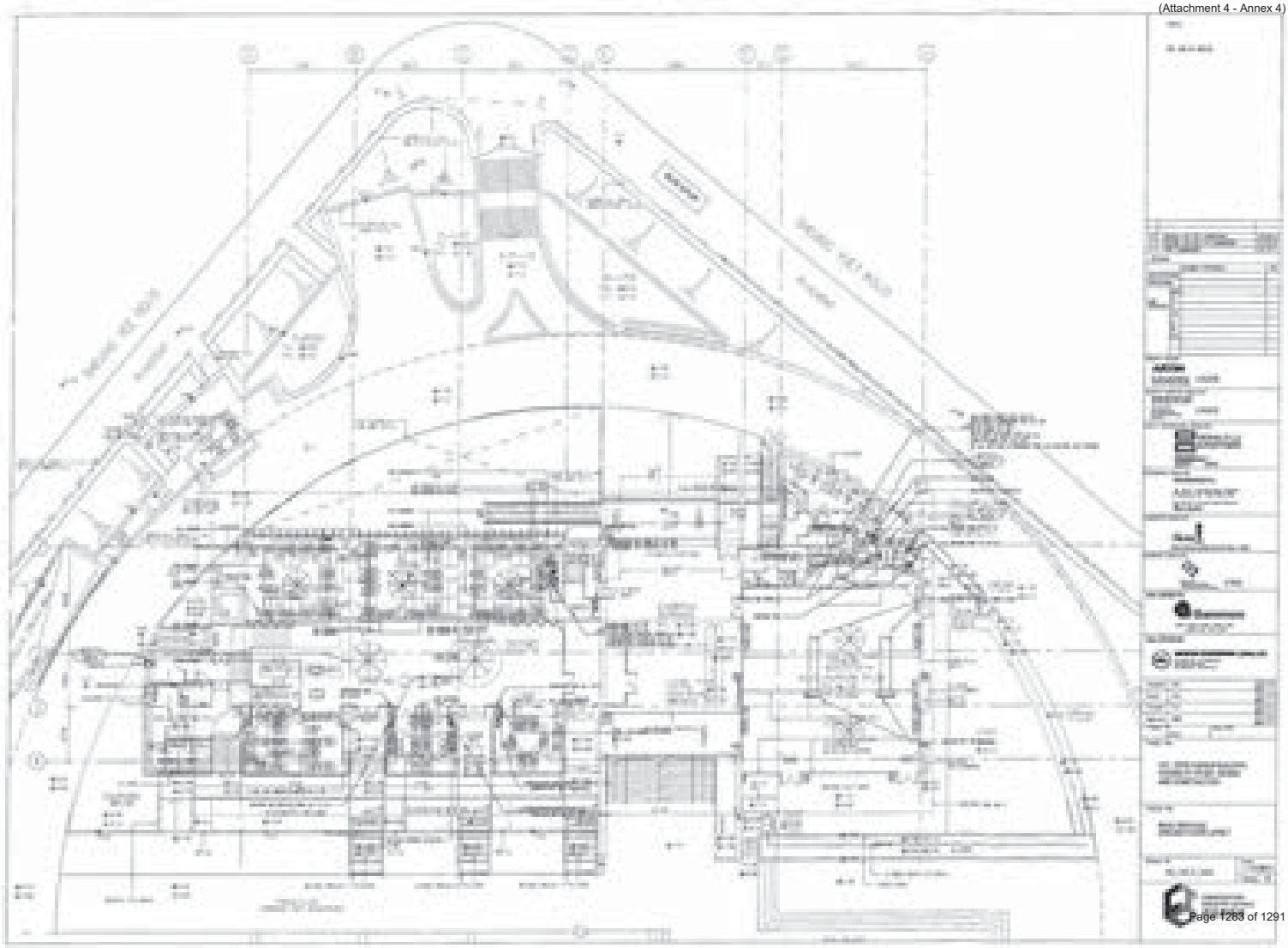
		NAME	SIGNATURE
Tested and Checked By : (	SIEMENS LTD)		
Witnessed By : (	Kaeger Ltd)		
Witnessed By : (	)		
Witnessed By : (	)		

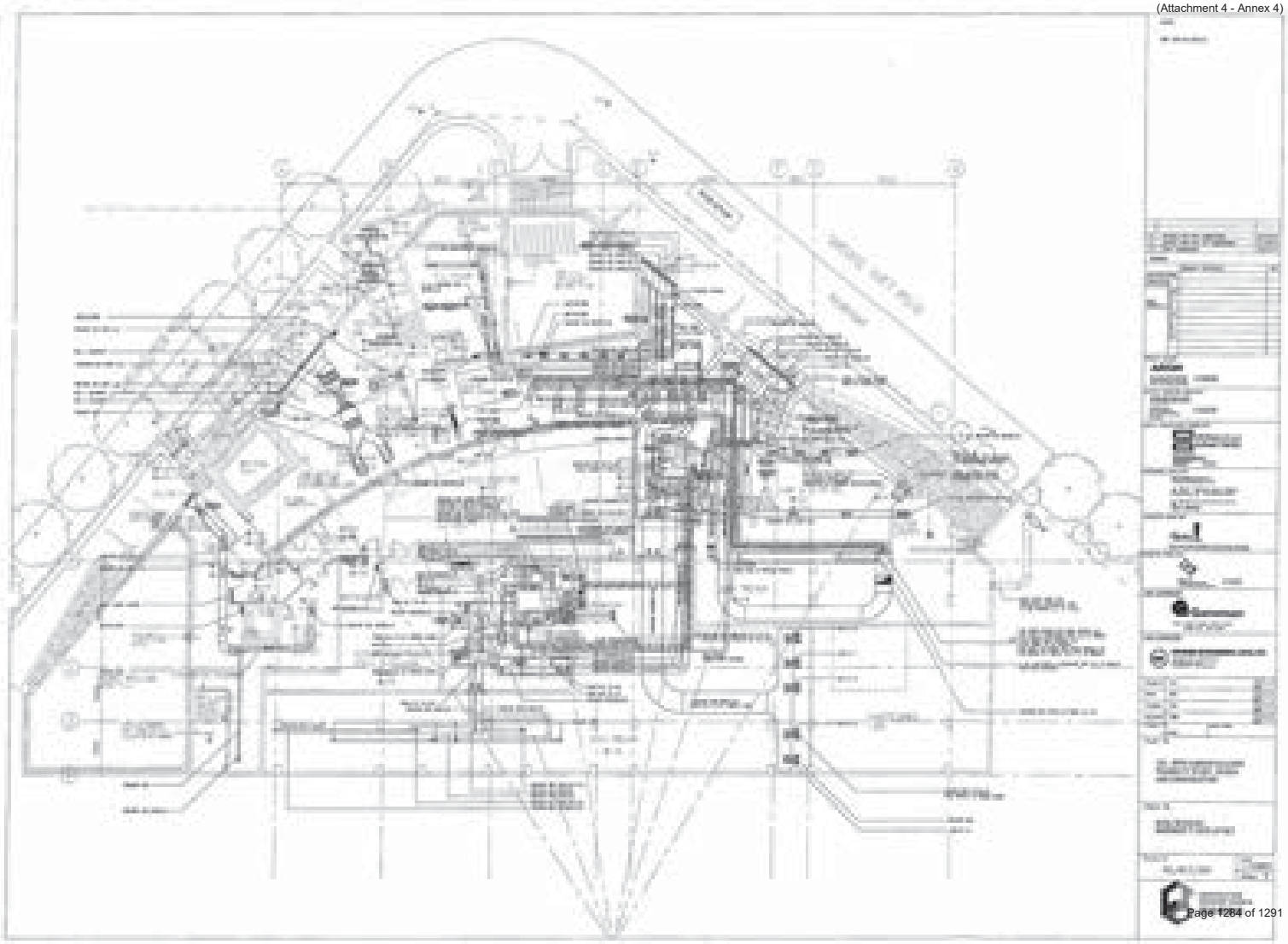
Date : _____

VENTIATION FAN SYSTEM	BMS Control/ Status/ Reading	Result	Testing Date	Remarks
FAF-B-02 Auto / Manual Status		☑ PASS ☐ FAIL		
FAF-B-02 Trip Alarm		☑ PASS ☐ FAIL		
FAF-B-02 Power On / Off Status		☑ PASS ☐ FAIL		
FAF-B-02 Running / Stop		☑ PASS ☐ FAIL		
FAF-B-02 Emergency Stop Alarm		☑ PASS ☐ FAIL		
FAF-B-02 Pre-filter Clog Alarm		☑ PASS ☐ FAIL		
FAF-B-02 Start / Stop Control		☑ PASS ☐ FAIL		
FAF-B-03 Auto / Manual Status		☑ PASS ☐ FAIL		
FAF-B-03 Trip Alarm		☑ PASS ☐ FAIL		
FAF-B-03 Power On / Off Status		☑ PASS ☐ FAIL		
FAF-B-03 Running / Stop		☑ PASS ☐ FAIL		
FAF-B-03 Emergency Stop Alarm		☑ PASS ☐ FAIL		
FAF-B-03 Fire Alarm		☑ PASS ☐ FAIL		
FAF-B-03 Pre-filter Clog Alarm		☐ PASS ☐ FAIL		
FAF-B-03 Start / Stop Control		☑ PASS ☐ FAIL		
FAF-B-04 Auto / Manual Status		☑ PASS ☐ FAIL		
FAF-B-04 Trip Alarm		☑ PASS ☐ FAIL		
FAF-B-04 Power On / Off Status		☑ PASS ☐ FAIL		
FAF-B-04 Running / Stop		☑ PASS ☐ FAIL		
FAF-B-04 Emergency Stop Alarm		☑ PASS ☐ FAIL		
FAF-B-04 Fire Alarm		☑ PASS ☐ FAIL		
FAF-B-04 Pre-filter Clog Alarm		☐ PASS ☐ FAIL		
FAF-B-04 Start / Stop Control		☑ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		
		☐ PASS ☐ FAIL		

		NAME	SIGNATURE
Tested and Checked By : (	SIEMENS LTD)		
Witnessed By : (	Kwoger Ltd)	Kwok Wai Yip	
Witnessed By : (	)		
Witnessed By : (	)		

Date : _____





Appendix IV – Spare Part List

10L Lubricating Oil for all plant and equipment
1 set spanner to fit nuts on fans, air handling unit & primary air unit
10 nos. of 6A HRC cartridge control fuse
5 numbers of white, amber, red & green indication lamps and red, green, black push button respectively.
10 nos. of each type of pre-filter and bag filter for AHU & PAU
1 no. gland packing mechanical seals for each pump
30 nos. fusible links
3 nos. electrothermal links
2 set each type of AHU & PAU motor belts
2 nos. pressure sensors, 2 nos. duct type and 2 nos. room type temperature sensors
5 nos. of 220V AC relays
1L of paint

Appendix V – Supplier Contact List

Project : CIC - Zero Carbon Building at Sheung Yee Road, Kowloon Bay, Kowloon
Trade : MVAC Installation
Title : Supplier Contact List

Item	Description	Manufacturer	Country of Origin	Supplier / Distributor			
				Company Name	Company Address	Contact Name	Contact Tel.
1	Water Cooled Chiller	Trane	Taiwan	Trane Hong Kong	12/F Dragon Centre, 79 Wing Hong Street, Cheung Sha Wan, Kowloon, Hong Kong.	Tom Cheung	(852) 3128-4756
2	Cooling Tower	BAC	PRC	Oxprime (International) Limited	Room 901, Eastern Harbour Centre, 28 Hoi Chak Street, Quarry Bay, Hong Kong.	Horace Lee	(852) 2590-8088
3	Chilled Water Pump	D.P.	Greece	New Way Engineering Co., Ltd.	Flat F, 22/F, Luk Hop Industrial Building, 8 Luk Hop Street, San Po Kong, Kowloon, Hong Kong.	H.C. Chan	(852) 2325-6892
4	Condensing Water Pump	D.P.	Greece				
5	Packaged Pressurization Unit and Expansion Tank	Reflex	Germany				
6	Water Treatment	Aquamag	Hong Kong	LeBlanc Water Treatment & Chemical Limited	Flat C, 15/F, Superluck Industrial Centre, Phase 2, No. 57 Sha Tsui Road, Tsuen Wan, N.T., Hong Kong.	Philip Ho	(852) 2408-1740
7	Air Handling Unit / Primary Air Unit	Savier	PRC	Welcome Air-Tech Ltd.	Unit B300 Sea View Estate, No. 2-8 Watson Road, North Point, Hong Kong.	Tong Ng	(852) 2806-8316
8	Chilled Beam	Flakwoods	Sweden	Gelec (HK) Ltd.	31/F, One Kowloon, 1 Wang Yuen Street, Kowloon Bay, Hong Kong.	Rachel Lam	(852) 2919-8383
9	Direct Expansion Split Type A/C Unit	Daikin	Thailand	Chung Yuen E&M Ltd.	11/F Acme Building, 33 Nanking Street, Kowloon, Hong Kong.	Arvy Wong	(852) 2359-6373
10	Propeller Fan	Gelec	UK	Gelec (HK) Ltd.	31/F, One Kowloon, 1 Wang Yuen Street, Kowloon Bay, Hong Kong.	Daniel Cheung	(852) 2919-8383
11	Centrifugal Fan	Nicotra	PRC				
12	In-line Centrifugal Fan	Ostberg / Nicotra	PRC / Italy				
13	Ceiling Fan	Big ASS Fans	PRC	Big ASS Fans	800 Winchester Road, Lexington KT 40505 (ivanderveeken@bigassfans.com)	Ilse van der Veeken	(859) 977-0715

Project : CIC - Zero Carbon Building at Sheung Yee Road, Kowloon Bay, Kowloon
Trade : MVAC Installation
Title : Supplier Contact List

Item	Description	Manufacturer	Country of Origin	Supplier / Distributor			
				Company Name	Company Address	Contact Name	Contact Tel.
14	Black Steel Pipe	PSP	South Korea	Bun Kee (International) Ltd.	12/F, Phase 1, Austin Tower, 22-26 Austin Avenue, Tsim Sha Tsui, Kowloon, Hong Kong.	Barry Ku	(852) 2728-7237
15	Black Steel Pipe Fittings	PSF	South Korea				
16	Carbon Steel Pipes	PSP	South Korea				
17	Galvanised Steel Pipe	PSP	South Korea				
18	Galvanised Steel Pipe Fittings	TM	Thailand				
19	Copper Pipe	Kembla	Australia	Kembla (HK) Limited	16/F, Caltex House, 258 Hennessy Road, Wanchai, Hong Kong.	Dennis Sheung	(852) 2528-0999
20	Copper Pipe Fittings	Kembla	Australia				
21	Pipework Phenolic Foam Insulation	Phenotherm	PRC	Fook Loong (HK) Ltd.	19/F, Skyline Tower, 18 Tong Mi Road, Mongkok, Kowloon, Hong Kong.	Y.K. Ng	(852) 2393-7773
22	Pipework Flexible Closed Cell Elastomeric Insulation	Armflex	PRC	Oxprime (International) Limited	Room 901, Eastern Harbour Centre, 28 Hoi Chak Street, Quarry Bay, Hong Kong.	Larry Ho	(852) 2590-8088

Project : CIC - Zero Carbon Building at Sheung Yee Road, Kowloon Bay, Kowloon
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Item	Description	Manufacturer	Country of Origin	Supplier / Distributor			
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23	Swing Check Valve	Toyo	Thailand	Gate Way Valve & Fitting Ltd.	Flat A1, 4/F, Galaxy Factory Building, 25-27 Luk Hop Street, San Po Kong, Kowloon, Hong Kong	Thomas Kwong	(852) 2688-2666
24	Dual Plate Check Valve	Toyo	Taiwan				
25	Gate Valve	Toyo	Thailand / PRC				
26	Globe Valve	Toyo	Thailand				
27	Double Regulating Valve	Honeywell	Czech Republic / PRC				
28	Pressure Gauge	Wise	Malaysia				
29	Temperature Gauge	Wise	Korea				
30	Flexible Connector (Water Side)	Proco	Indonesia				
31	Ball Float Valve	Pegler	UK				
32	Y Strainer	Toyo	PRC				
33	Automatic Air Vent	Caleffi	Italy				
34	Test Plug (Water Side)	Sisco	USA				
35	Galvanized Steel Ductwork	Moonstar	Japan	Wo Lee Steel Co. Ltd.	81-87, Tung Chau Street, Tai Kok Tsui, Kowloon, Hong Kong	Alex Wu	(852) 2393-0131
36	Duct Flexible Connector	Ductflex	PRC	Sunwacork Insulation Material Supplies Ltd.	G/F., 58-60 Larch street, Tai Kok Tsui, Kowloon, Hong Kong.	Ms. Lau	(852) 2398-0288

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Trade : MVAC Installation
Title : Supplier Contact List

Item	Description	Manufacturer	Country of Origin	Supplier / Distributor			
				Company Name	Company Address	Contact Name	Contact Tel.
37	Ductwork Flange	Luen Ming	PRC	Luen Ming Pengshan Air Conditioning Factory Limited	Flat 9, 7/F, Ricky Centre, 36 Chong Yip Street, Kwun Tong, Kowloon, Hong Kong	K.H. Shum	(852) 2797-2168
38	Test Point (Air Side)	Luen Ming	PRC				
39	Fusible Link	K.W.	PRC	K-Win Metal Works MFY. CO.	Flat H, 13/F, Yue Cheung Centre, 1-3 Wong Chuk Yeung Street, Fotan, Shatin, Hong Kong	K.K. Ng	(852) 9169-2953
40	Volume Control Damper	Aerotech	PRC	Aerotech Industrial Co. Ltd.	Unit 411, 4/F, Park Sun Building, 103-107 Wo Yi Hop Road, Kwai Chung, N.T., Hong Kong	Can Li	(852) 2421-3379
41	Motorized Volume Control Damper	Aerotech	PRC				
42	Fire and Smoke Damper	Ruskin	Thailand	Applied Technology International Ltd.	Unit 703, 7/F, Metro Centre II, 21 Lam Hing Street, Kowloon Bay, Hong Kong	Henry Lau	(852) 2881-6587
43	Fire Damper	Luen Ming	PRC	Luen Ming Pengshan Air Conditioning Factory Limited	Flat 9, 7/F, Ricky Centre, 36 Chong Yip Street, Kwun Tong, Kowloon, Hong Kong	K.H. Shum	(852) 2797-2168
44	Bag Filter	AAF	PRC	Eaxon Environmental Technology Co. Ltd.	Unit 8, 8/F, Westley Square, 48 Hoi Yuen Road, Kwun Tong, Kowloon, Hong Kong	Jessica Tang	(852) 3590-4656
45	Washable Filter	AAF	PRC	Eaxon Environmental Technology Co. Ltd.	Unit 8, 8/F, Westley Square, 48 Hoi Yuen Road, Kwun Tong, Kowloon, Hong Kong	Jessica Tang	(852) 3590-4656
46	Fire Resistance Sealant	Firetherm	UK	Thermtech Building Products Ltd.	Room 11-12, 10/F, International Plaza, 20 Sheung Yuet Road, Kowloon, Hong Kong	Ellan Ma	(852) 2756-3837
47	Duct Sealant	Foster	USA				
48	Sealing Strip for Access Panel, Fire Damper & all Ductwork Cross Joint	AmTape	PRC	Talentech Ltd.	Units 2, 6 & 7, 5th Floor Wah Chun Industrial Centre, 54 Tai Chung Road, Tsuen Wan, N.T., Hong Kong	Mr. Wong	(852) 2741 5714
49	Air Grille & Air Lourve	Aerotech	PRC	Aerotech Industrial Co. Ltd.	Unit 411, 4/F, Park Sun Building, 103-107 Wo Yi Hop Road, Kwai Chung, N.T., Hong Kong	Can Li	(852) 2421-3379
50	Duct Insulation	Phenotherm	PRC	Fook Loong (HK) Ltd.	19/F, Skyline Tower, 18 Tong Mi Road, Mongkok, Kowloon, Hong Kong.	Y.K. Ng	(852) 2393-7773

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				Company Name	Company Address	Contact Name	Contact Tel.
51	Vibration Isolator	IAC	PRC	Industrial Acoustic Company (H.K.) Ltd.	Suite 1601, 148 Electric Road, North Point, Hong Kong	Issac Mok	(852) 2528-1138
52	Duct Silencer	Vibro-Acoustics	PRC	Mason Industries (Hong Kong) Limited	Unit 1710, Fortress Tower, 250 King's Road, North Point, Hong Kong	Wallace Chan	(852) 2967-9639
53	Painting	Flower	Malaysia	The China Paint Mfg. Co. (1932). Ltd.	31/F., CNT Tower, 338 Hennessary Road, Wan Chai, Hong Kong	Mr. Chan	(852) 2792-0663
54	Emergency Stop Button	Schneider Electric	Czech Republic	Chung Hing Electric Co. Ltd.	Blk G&H, 3/F, Gematar Tower, 23 Man Lok Street, Hung Hom, Kowloon, Hong Kong	Mr. Wong	(852) 2363-5203
55	Motor Control Panel	Union Best	PRC	Union Best Engineering Limited	Unit B, 5/F, Phase 3, Kwun Tong Industrial Centre, 448-458 Kwun Tong Road, Kowloon, Hong Kong	Lor Wai Leung	(852) 2513-1890
56	Frequency Inverter	Danfoss	Denmark	Danfoss (Shanghai) Automatic Controls Co. Ltd.	8/F, Gloucester Tower, The Landmark, 15 Queen's Road Central, Hong Kong	Ringo Chin	(852) 2517-3872
57	CCMS Digital Input/Output Cable	BICC-Ducab	Dubai	Polygon Cable Supplies Ltd.	Flat C, 5/F, Derrick Industrial Building, 49 Wong Chuk Hang Road, Aberdeen, Hong Kong	Michael Lee	(852) 2870-0922
58	CCMS Analogue Input/Output Cable	Samson Cable	PRC	Siemens Limited	22/F, Two Landmark East, 100 How Ming Street, Kwun Tong, Hong Kong	Nelson Chow	(852) 2870-7888
59	CCMS Lan Cable	Samson Cable	PRC				