



CONSTRUCTION  
INDUSTRY COUNCIL  
建造業議會



## Reference Materials - Use of Digital Technologies for QA/QC of MiC Modules in MiC Factories

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## PREFACE

The Construction Industry Council (CIC) is committed to seeking continuous improvement in all aspects of the construction industry in Hong Kong. To achieve this aim, the CIC forms Committees, Task Forces and other forums to review specific areas of work with the intention of producing Alerts, Reference Materials, Guidelines and Codes of Conduct to assist participants in the industry to strive for excellence.

The CIC appreciates that some improvements and practices can be implemented immediately whilst others may take more time for implementation. It is for this reason that four separate categories of publication have been adopted, the purposes of which are as follows:

- |                     |  |
|---------------------|--|
| Alerts              | The Alerts are reminders in the form of brief leaflets produced quickly to draw the immediate attention of relevant stakeholders to the need to follow some good practices or to implement some preventive measures in relation to the construction industry.  |
| Reference Materials | The Reference Materials are standards or methodologies generally adopted and regarded by the industry as good practices. The CIC recommends the adoption of the Reference Materials by industry stakeholders where appropriate.  |
| Guidelines          | The Guidelines provide information and guidance on particular topics relevant to the construction industry. The CIC expects all industry stakeholders to adopt the recommendations set out in the Guidelines where applicable.   |
| Codes of Conduct    | The Codes of Conduct set out the principles that all relevant industry participants should follow. Under the Construction Industry Council Ordinance (Cap. 587), the CIC is tasked to formulate codes of conduct and enforce such codes. The CIC may take necessary actions to ensure compliance with the codes. |

If you have read this publication, we encourage you to share your feedback with us. Please take a moment to fill out the Feedback Form attached to this publication in order that we can further enhance it for the benefit of all concerned. With our joint efforts, we believe our construction industry will develop further and will continue to prosper for years to come.

## ABBREVIATIONS

AP	Authorized Person registered under the Buildings Ordinance
AR	Augmented Reality
AS	Authorized Signatory of Registered General Building Contractor or Registered Specialist Contractor
BA	Building Authority
BD	Buildings Department
BO	Buildings Ordinance
BIM	Building Information Modelling
CDE	Common Data Environment
CoP	Code of Practice
DWSS	Digital Works Supervision System
EIMS	e-Inspection Management System
EMSD	Electrical and Mechanical Services Department
FSD	Fire Services Department
FSI	Fire Service Installations
HKAS	Hong Kong Accreditation Service
HOKLAS	Hong Kong Laboratory Accreditation Scheme
IIoT	Industrial Internet of Things
ICAC	Independent Commission Against Corruption
ITP	Inspection and Test Plan
KPI	Key Performance Indicator
LP	Licensed Plumber
MEP	Mechanical, Electrical and Plumbing
MiC	Modular Integrated Construction
OP	Occupation Permit
PNAP	Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers issued by BD
PPE	Personal Protective Equipment
QA	Quality Assurance
QAS	Quality Assurance Scheme
QC	Quality Control
QCCT	Quality Control Co-ordination Team
QCST	Quality Control Supervisory Team

QR	Quick Response
QSPSC	Quality Scheme for the Production and Supply of Concrete
REC	Registered Electrical Contractor
REW	Registered Electrical Worker
RFID	Radio Frequency Identification
RFSIC	Registered Fire Service Installation Contractor
RGBC	Registered General Building Contractor registered under the Buildings Ordinance
RGC	Registered Gas Contractor
RGI	Registered Gas Installer
RISC	Request for Inspection and Survey Check
RPW	Registered Plumbing Worker
RSC	Registered Specialist Contractor registered under the Buildings Ordinance
RSC-V	Registered Specialist Contractor (Ventilation Works) registered under the Buildings Ordinance
RSE	Registered Structural Engineer registered under the Buildings Ordinance
RTC	Robotic Total Station
TCP T1	Technically Competent Person T1
TCP T3	Technically Competent Person T3
WSD	Water Supplies Department



## 1. INTRODUCTION

Many different processes are involved in the production of building modules by Modular Integrated Construction (MiC). For private development projects, to ensure that the modules produced are up to the standards required and in compliance with the approved plans, supervision checks and inspection requirements have been laid down by different government regulatory departments, including Buildings Department (BD), Water Supplies Department (WSD), Fire Services Department (FSD) and Electrical and Mechanical Services Department (EMSD). BD also requires that for private development projects, the MiC factory should be ISO 9001 or equivalent quality certified, and that a Quality Assurance Scheme (QAS) of the MiC Supplier has to be submitted. For public projects, the practice and approach laid down in this publication could also be adopted if found applicable.

In the current inspection practice, requests for inspection/survey checks are made on paper forms and checks are carried out physically on site. There is also a specific requirement for certain supervision personnel to make periodic inspections of the production work at the MiC factory. It is resource demanding for these personnel to make inspections at MiC factories located outside Hong Kong. Also, the inspection records, even if they are in digital form, are stored separately and used individually. There is no facility for sharing/review of the data/records collected amongst different parties.

With the advent of modern technologies, such as in cybersecurity, cloud computing, mobile technologies, 5G, Internet of Things, Radio Frequency Identification (RFID), Quick Response (QR) codes, big data and analytics, augmented reality, blockchain, etc., all of which form the technological pillars of Industry 4.0, it has now become possible to turn the inspection process into a digital process. There are now many web-based inspection application programs available in the market, which makes it easier to do the work. It has now become mandatory to adopt Digital Works Supervision Systems (DWSS) in government capital works contracts, including capital subventions contracts, with a pre-tender estimate exceeding \$300 million<sup>1</sup>. To echo the implementation of the DWSS, BD will develop a Common Digital Platform for Site Supervision for storing and maintaining digitalised site records for the purposes of the Buildings Ordinance on a centralised common platform for private development sites. It is targeted to complete the pilot system in 2022, after which the system will be put on trial and the findings and experience will form the basis for the development of the full scale system.

This publication sets out some important quality assurance (QA)/quality control (QC) aspects and good practices for MiC pursuant to the ISO 9001 or equivalent requirements, and the parties involved in the supervision checks and inspections as required by different government regulatory departments for MiC private projects. It includes (i) the critical inspection activities involved in the production of MiC modules and typical Inspection and Test Plans for structural, architectural, mechanical, hydraulic and drainage, and electrical works for a MiC project, and (ii) an approach to turn the paper submission and physical checking process into a digital process making use of the latest technologies, and recommendations to take forward the use of an e-Inspection Management System (EIMS).

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<sup>1</sup> DEVB (2020). DEVB TC(W) No. 3/2020. Digital Works Supervision System.

Typical Inspection and Test Plans (ITP) for different types of works are given in Appendix A for reference.

A suggested naming convention for MiC/offsite modules and components is included in Appendix B for reference. The naming convention is prepared by Professor Wilson Lu, Department of Real Estate and Construction, Faculty of Architecture, the University of Hong Kong.

To assist project clients and/or their consultants in strengthening the corruption prevention measures in the integrity management of inspecting staff and the quality control of MiC modules in factories, the Corruption Prevention Department of the Independent Commission Against Corruption (ICAC) has prepared a corruption prevention checklist for reference by project clients and/or their consultants when undertaking building projects adopting MiC (ICAC, 2021).

## 2. MODULE PRODUCTION FOR PRIVATE DEVELOPMENT PROJECTS

### 2.1 Parties Involved

The parties involved in the production of MiC modules in a private development project are shown in Figure 1<sup>2</sup>.

The government regulatory departments involved are BD, FSD, WSD and EMSD.

A MiC building project is similar to a conventional building project in that building professionals and contractors registered under the Buildings Ordinance (Cap. 123) (BO) have the duties and responsibilities to ensure the carrying out of works are in accordance with the BO. For such projects, Authorized Persons (AP) and Registered Structural Engineers (RSE) are engaged to develop, plan, design and supervise the works, and Registered General Building Contractors (RGBC) and Registered Specialist Contractors (RSC) are engaged to carry out and supervise each particular category of works.

The RGBC will engage a MiC Supplier to carry out the production of MiC modules, and other specialist subcontractors, such as the Registered Specialist Contractors (Ventilation Works) (RSC-V), Registered Fire Service Installation Contractors (RFSIC), Licensed Plumbers (LP)/Registered Plumbing Workers (RPWs), Registered Electricity Contractors (REC)/Registered Electrical Workers (REW), Registered Gas Contractors (GRC)/Registered Gas Installers (RGI), etc., for the Fire Service Installations (FSI) and Mechanical, Electrical and Plumbing (MEP) works in the modules. The MiC Supplier will source materials from various Material Suppliers for the MiC production.

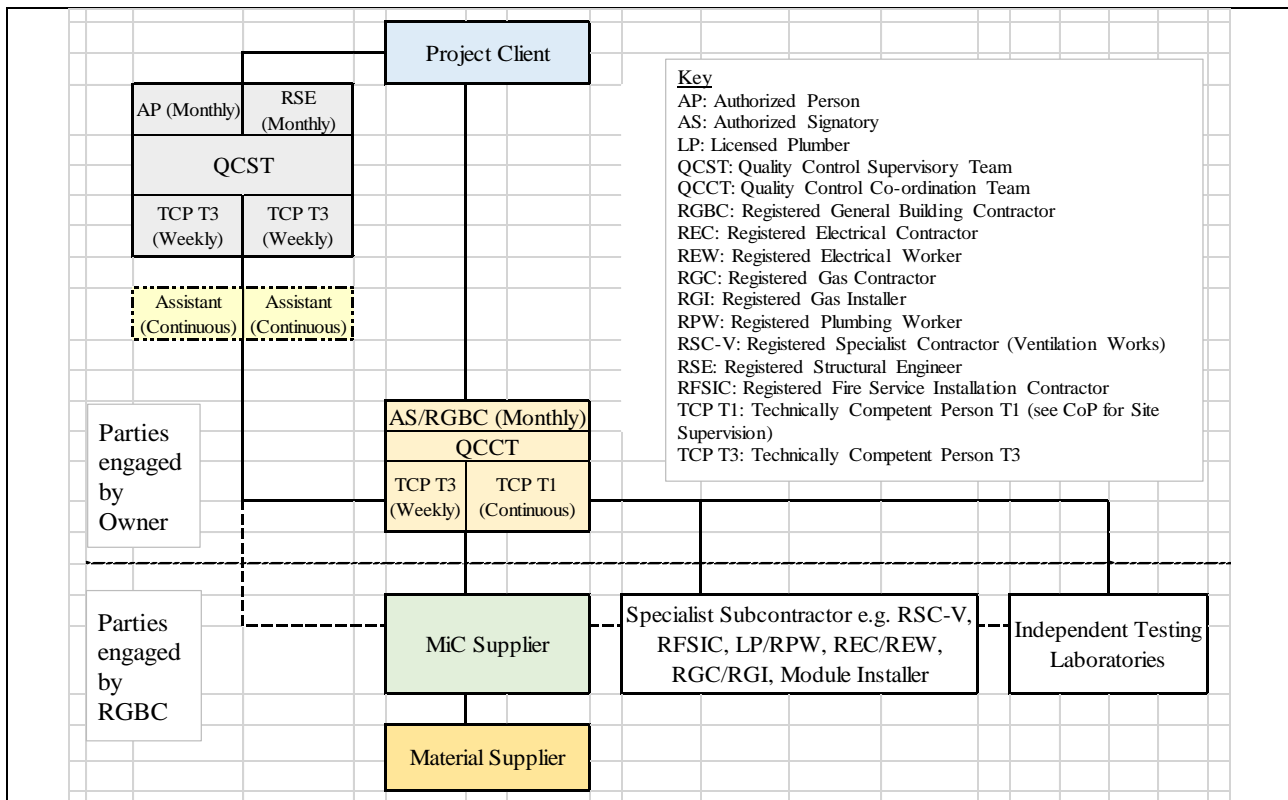


Figure 1 - Parties Involved in the Production of MiC Modules

<sup>2</sup> CIC (2020). Reference Materials on the Statutory Requirements for Modular Integrated Construction Projects.

Sampling of materials for testing and selection of inspection and test locations at the modules should be carried out by the AP/RSE or their Technically Competent Persons (TCP). Testing of materials and the completed modules should be carried out by laboratories independent of the contractor and MiC supplier. These laboratories should be accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS) or a national laboratory accreditation scheme which has a mutual recognition agreement with HOKLAS for issue of HOKLAS or equivalent endorsed test certificates for the particular tests concerned.

## 2.2 Requirements by Buildings Department

### 2.2.1 General

General guidelines on the design and quality control requirements under the BO for MiC are set out in the Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers (PNAP) ADV-36. Upon approval of the general building plans by BD, the following conditions and requirements in respect of quality control and supervision of MiC will be imposed:

#### Quality Assurance Scheme

- (a) All the MiC modules should be fabricated by a factory with ISO 9001<sup>3</sup> or equivalent quality assurance certification;
- (b) A copy of the Quality Assurance Scheme of the MiC supplier should be submitted at least 14 days before the commencement of the production work in the prefabrication factory;

#### Quality and Qualified Supervision

- (c) Qualified supervision of the MiC works should be provided by the AP, RSE and the RGBC for the fabrication, assembly, installation and examination of the MiC modules and pre-installed finishes;
- (d) A MiC Supervision Plan should be submitted at least 14 days before the commencement of the production work in the prefabrication factory; and
- (e) A copy of the AP, RSE and Authorized Signatory of the RGBC (AS)'s audit reports of the prefabrication factory duly endorsed by the AP, RSE and AS respectively should be submitted to BD for record purpose.

### 2.2.2 Quality Assurance Scheme

A copy of the QAS of the MiC Supplier should be submitted to BD at least 14 days before the commencement of the production in the MiC factory. The project AP or RSE should provide written confirmation that the submitted QAS has adequate provisions in ensuring the quality of production and in complying with the provisions of the BO and the approved plans.

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<sup>3</sup> For information, please see Section 2.4 on the quality assurance and control aspects pursuant to the ISO 9001 requirements.

The QAS establishes control procedures for the production activities in fabrication, inspection, testing, etc. The following aspects should be covered in the QAS according to Appendix B to PNAP ADV-36:

- (a) Quality control tests of materials;
- (b) Calibration of laboratory equipment for quality control tests;
- (c) Efficiency and proper operation of equipment at the prefabrications factory;
- (d) Production work processes;
- (e) Testing procedures and requirements;
- (f) Frequency and extent of inspection by the factory's in-house and supervisory staff and independent parties<sup>4</sup>; and
- (g) Frequency and extent of audit by the factory's in-house audit staff and independent parties.

### 2.2.3 MiC Supervision Plan

For the production of the modules, supervision by appropriate parties is needed to ensure that the works are carried out in compliance with the BO and the approved plans. A MiC Supervision Plan should be submitted to BD at least 14 days before commencement of production in the MiC factory. The following aspects should be included in the Plan (see PNAP ADV-36 (BD, 2019)):

- (a) Particulars of a Quality Control Supervisory Team. The AP and RSE should each set up a Quality Control Supervisory Team (QCST), consisting of supervisory personnel with minimum qualification equivalent to Technically Competent Person (TCP) T3 from their respective streams, to provide periodic supervision on the production work in the MiC factory in respect of fire resisting construction, drainage works, structures, etc., in accordance with the requirements stipulated in PNAP APP-158 (BD, 2021). TCP T3 refers to the Grade TCP T3 as stipulated in the Technical Memorandum for Supervision Plans 2009 (BD, 2009). Details of the supervisory personnel assigned by the AP and RSE, including their names, qualifications, experience and inspection frequency, should be included in the MiC Supervision Plan. The QCST is responsible for supervising and

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<sup>4</sup> "Independent parties" refer to parties not under the direct employment of the prefabrication factory, i.e. either a certification body under the Hong Kong Certification Body Accreditation Scheme of the Hong Kong Accreditation Service (HKAS) or an inspection body under HKAS's Hong Kong Inspection Body Accreditation Scheme. Arrangement in some pilot projects can be taken as examples. If independent parties, which are not under the direct employment of the MiC factory, are engaged in the testing, certification of construction products (e.g. aluminium windows, ceramic tiles, etc.) and inspection of construction products (e.g. paint, welding and waterworks products, etc.), the details, frequency and extent of the inspections should be provided. The testing should be carried out by a laboratory accredited by HOKLAS, or other laboratory accreditation bodies which have reached mutual recognition agreements with HOKLAS, for issue of HOKLAS or equivalent endorsed test certificates for the particular test concerned. The certification body and inspection body should be under the Hong Kong Certification Body Accreditation Scheme and the Hong Kong Inspection Body Accreditation Scheme respectively of the Hong Kong Accreditation Service (HKAS).

checking the manufacturing quality assurance. The team should give advice on the QA requirements and procedures, and any special steps needed in a particular process. The QCST should work closely with the Quality Control Co-ordination Team (QCCT) on the QA inspection and test activities, and prepare periodic reports on the QC aspects.

- (b) Particulars of a Quality Control Coordination Team. The RGBC should set up a Quality Control Coordination Team (QCCT), consisting of supervisory personnel of TCP T3 and T1 from RGBC's stream, to provide continuous supervision on the production work in the MiC factory. Details of the TCP T3 and T1, assigned by the AS of RGBC, including their names, qualifications, experience and inspection frequency, should be included in the MiC Supervision Plan. The QCCT should inform the RGBC and the QCST of the scheduling and occurrence of the inspection, test and fabrication activities. .
- (c) Minimum qualifications and supervision frequency of QCST and QCCT. The supervisory personnel engaged should be competent, and their qualifications and relevant experience should be assessed by the respective AP, RSE and AS prior to their engagement. Reference should be made to the Technical Memorandum for Supervision Plans 2009 (BD, 2009) on the minimum qualifications of TCP T3 and T1. The minimum supervision frequency of the TCPs of the QCST and QCCT are included in Table 1 in Appendix B of PNAP ADV-36.

#### 2.2.4 Audit Checks by the AP, RSE and the AS of RGBC

The AP, RSE and the AS of the RGBC should inspect and carry out audit checks at the prefabrication factory at least once every month. A copy of the AP, RSE and AS's audit reports of the prefabrication factory duly endorsed by the AP, RSE and AS respectively are to be submitted to BD for record purpose. These audit reports should also cover the quality and qualified supervisions by the respective QCST and QCCT.

As an alternative to the requirement for the audit checks by AP/RSE at the prefabrication factory, the AP/RSE may consider carrying out on-site audit checks to the quality of the MiC modules delivered to the building site. In such situation, the AP/RSE is required to notify BD in writing before the commencement of the production work in the prefabrication factory, and to submit a copy of on-site audit reports on the quality of the MiC modules delivered to the building site to BD for record purpose, covering the quality and qualified supervisions by the QCST. The minimum requirements of the on-site audit checks by the AP/RSE are given in the Annex of Appendix B of PNAP ADV-36.

#### 2.3 Requirements by Other Government Regulatory Departments

In respect of the FSI in the modules, the RFSIC engaged should conduct regular supervision of the fabrication process in the MiC factory to ensure that the equipment and materials used in the FSI comply with the relevant statutory requirements (see FSD Circular Letter No. 3/2019 (FSD, 2019) and FSD Circular Letter No. 2/2021 (FSD, 2021)).

For the plumbing works, a Supervision Plan should be submitted to WSD for agreement prior to commencement of the plumbing works in the MiC factory (see WSD's website on Water Supply

for New Buildings adopting Modular Integrated Construction<sup>5</sup>). The concealed parts of the plumbing works have to be inspected and tested by the WSD Inspection Agent before they are covered up<sup>6</sup>. The responsible LP should coordinate and liaise with the WSD Inspection Agent regarding the inspection dates and times of this aspect of the plumbing works.

The electrical work in the modules should be carried out by a REC/REW<sup>7</sup>. Electrical work refers to installation, commissioning, inspection, testing, maintenance, modification or repair of a low voltage or high voltage fixed electrical installation, and includes the supervision and certification of the work and the design of the installation.

The gas installation works conducted in Hong Kong should be carried out by a RGC/RGI<sup>8</sup>. The works include installation, testing and commissioning of gas pipes/fittings/gas appliances in buildings, installation, testing and commissioning of gas pipes/fittings in the MiC modules, and assembling of pre-laid gas pipes/fittings in MiC modules. For the gas installations in the MiC modules installed at factory locally or outside Hong Kong, the RGC is recommended to liaise with the MiC Supplier for the establishment and implementation of a quality control and supervision system to ensure that the gas installations are installed, inspected and tested at the factory with good workmanship and suitable materials.

#### 2.4 Requirements by Accreditation Body of ISO 9001

Some important QA/QC aspects pursuant to the ISO 9001 or equivalent requirements for a MiC factory are given below:

- (a) **Organisation**. An organisational chart of a MiC Factory should be provided. A typical organisational structure is shown in Figure 2. In general, the factory is headed by a Factory Manager<sup>9</sup>, who has the overall authority and responsibility for the execution of

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<sup>5</sup> <https://www.wsd.gov.hk/en/customer-services/application-for-water-supply/water-supply-for-new-buildings-adopting-mic/index.html>

<sup>6</sup> Waterworks Regulations (Cap. 102A).

<sup>7</sup> Electricity Ordinance (Cap. 406).

<sup>8</sup> Gas Safety Ordinance (Cap. 51).

<sup>9</sup> The responsibilities of the MiC Factory Manager are, among others, to:

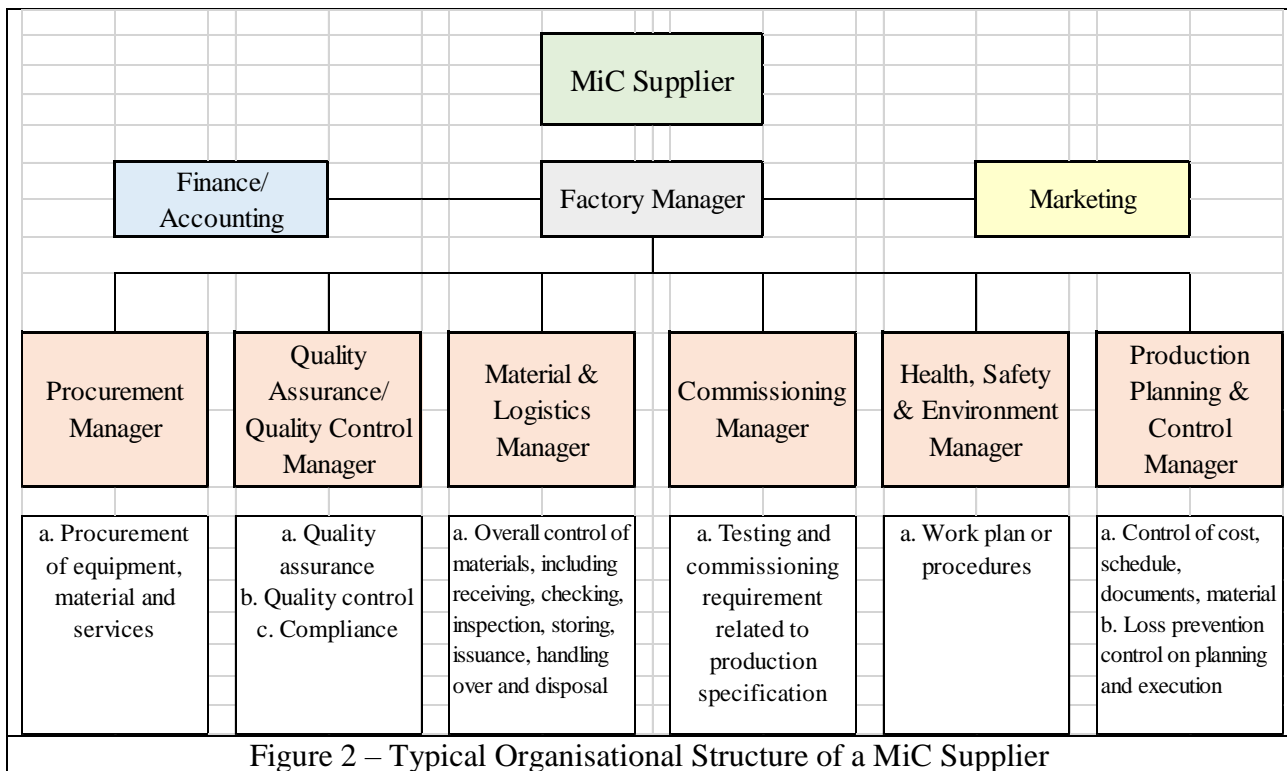
- ensure health and safety for all operations in the factory
- ensure compliance of module production with programme and factory operations and quality standards with specified requirements
- screen, recruit and train factory workers and assess their competence
- plan and control factory machinery and arrangement to meet production needs
- plan, establish and execute quality control processes
- ensure that factory machinery is in good working order
- inspect finished MiC products to determine whether they meet established quality standards
- plan and organise resources (materials and labour) to ensure the production programme fulfils the contract requirements

The following are typical recruitment criteria for a Factory Manager:

- a recognised degree in architecture, engineering, surveying, business administration, industrial management, logistics, or related field, and knowledge in QA certification of factory production and inventory management, as well as QC
- proven experience in a managerial or supervisory role within a factory (preferably a MiC or construction product production factory), with a sound knowledge of industry-specific factory equipment

the contract for the production of modules in the factory, establishment of the factory organisation and coordination, implementation and maintenance of a QA plan, etc. Under the Factory Manager, there are normally different teams responsible for Procurement, Quality Assurance/Quality Control (QA/QC), Material & Logistics, Commissioning, Health, Safety & Environment, and Production Planning & Control, etc.

In the organisational structure documentation, the name, authority, qualifications, experience and job descriptions of the key personnel, and the training and competence assessment required for them to carry out their tasks, should be included. In particular, the documents should confirm that the required training and competence assessment of the personnel responsible for QA/QC has been undertaken, and should also cover the reporting path to upper management. The training and the competence assessment of the different types and levels of factory workers should also be provided.



- (b) **Document Control**. All documents affecting quality should be processed properly, and the latest applicable documents should be made available to the personnel or organisation concerned on schedule. Prior to commencement of the production work, all documents prepared for the work, such as procedures, instructions, approved plans, checklists, etc., should be listed and categorised (for approval, comment, information, etc.). An individual should be assigned and made responsible for collecting, distributing and control of documents.
- (c) **Procurement Control**. All purchased materials and services should conform to the specified requirements. Some control measures used include control of procurement

- excellent analytical, problem solving, interpersonal and communication skills



documents, selection of suppliers, evaluation and verification of supplier's performance, etc.

- (d) **Material Control**. All materials should be properly identified to assure their correctness and traceability, and to prevent the use of incorrect materials in the production of modules. Identification marking and procedure, transfer of marking, identification during storage, identification of non-conforming materials, inspection and test status, etc., should be controlled. The record should be traceable to the material and checked by appropriate inspection personnel. To prevent installation of incorrect material, details of examination methods, qualifications of inspection personnel, sampling methods, acceptance criteria, identification marks, inspection and test records, etc., should be defined.
- (e) **Shop Fabrication and Installation Control**. Control measures to keep the working area clean and in suitably controlled conditions should be implemented to prevent mixing-in of foreign materials in the production. Appropriate checklists, records, etc., to monitor and confirm the compliance of workmanship and material requirements should be prepared.
- (f) **Inspection and Test Plan (ITP)**. An ITP is a document prepared to describe the minimum requirements of the quality control activities, inspection and test items during fabrication, reference documents, required acceptance criteria, certifying or verifying documents, and inspection parties involved, etc., to assure that the products will be built in accordance with approved plans, specifications, code and standard requirements, and government regulations.

An ITP should be based on relevant material, fitting, component and equipment specifications and quality level of activities, and should cover the following items: subjects of inspection/test item (such as parts, subassembly, and assembly), characteristics and/or kinds of inspection (such as material test, welding inspection, non-destructive examination, hydrostatic test and dimensional inspection), inspection/test witness points and hold points, inspection and sampling/test records required, sampling rate, frequency of inspection, acceptance criteria, qualification of the representative responsible for each respective item, etc. The ITP should be reviewed by the Project Client or his/her representative, and the approved ITP should be confirmed at a pre-inspection meeting.

The inspection personnel employed by the MiC Supplier for implementing the QA/QC at the factory should have relevant experience and qualification. The competence of these inspection personnel should be assessed by the RGBC or an inspection body recognised by the Hong Kong Inspection Body Accreditation Scheme or its mutual recognition agreement partner.

In determining the frequency of inspections/tests and audits, and the provision of inspection and audits, account should be taken of the production rate of the modules and the factory operating hours (some factories operate 24 hours round the clock with

multiple production lines). Use of digital technologies can facilitate the inspection and auditing work.

- (g) **Pre-commissioning Control**. A pre-commissioning plan should be prepared to cover the following: identifying the activity sequences, characteristics to be tested, measuring methods to be employed and the acceptance limits, appropriate measuring and test equipment to be used, inspection and test witness points and hold points, frequency and extent of inspection/audit by the factory's in-house and supervisory staff and independent parties, record forms and checklists to be used, etc.

The equipment, jigs or such devices to verify the acceptability of the modules should be controlled, calibrated and/or adjusted at specified intervals to maintain the accuracy and precision within the required limits.

- (h) **Non-conformity Control and Corrective Action**. When any deviation from the specified requirements is detected or reported, the MiC Supplier should confirm the status and direct to withhold the production process and to identify the product by marking or affixing a hold tag to preclude inadvertent use or installation. For the purpose of precluding recurrence of similar non-conformance, the information pertaining to the non-conformance should be investigated, analysed, rectified where appropriate and made known to relevant parties.
- (i) **Control of Quality Records**. All relevant evidence of production quality should be well prepared and maintained. The records should be identifiable, traceable, easily retrievable, and stored in a manner and at a suitable location to prevent deterioration or loss.
- (j) **Audit**. Audits should be carried out regularly to ensure the proper execution of quality-related activities and to evaluate the effectiveness of the QA/QC program. Auditors should be suitably trained and qualified and, as far as possible, be independent of the activity being audited.

Audit results should be recorded in an audit checklist, and reported to the QA/QC Manager together with the audit reports. Audit reports should include the areas of activity audited, audit findings and corrective actions. The audit reports should be reviewed by the QA/QC Manager, and corrective actions for the highlighted items should be taken and completed by the factory within an agreed timescale.

The Quality Management System should include a Management Review Committee, led by senior management of the MiC factory. The functions of the Management Review Committee should include review of the suitability of policies and procedures, outcomes from internal audits, corrective and preventive actions, recommendations for improvements, resources and staff training, etc.

### 3. CRITICAL INSPECTION ACTIVITIES IN MODULE PRODUCTION

#### 3.1 Critical Inspection Activities

The factory QC inspection procedures should be reviewed by the Factory Manager to complete the inspection framework. A checklist of the factory inspection items is given in Table 1.

Table 1 – Factory Inspection Checklist		
Inspection Item		Scope
QM1	Factory quality inspection	<ul style="list-style-type: none"><li>• Check relevance of the factory quality inspection procedures to the project nature</li><li>• Check accreditation details of testing laboratories</li><li>• Check factory QC on schedule of materials used as compared with those submitted</li><li>• Check factory QC on material verification and pre-treatment, fabrication and assembly of MIC modules, and façade if fabricated by another factory</li><li>• Check factory QC on floor slab construction inspection hold points</li><li>• Check factory QC on module levelling before commencement of fitting-out work</li><li>• Check factory QC on window and door opening dimensions</li><li>• Check factory QC on architectural, structural and MEP work inspection checklists</li></ul>

A complete set of fabrication shop drawings and a method statement for the module production work should also be prepared, giving a detailed description of the work to be carried out, including the materials used, a step by step guide, workflow, acceptance criteria, safety precautions put in place to control risks, equipment to use, and the control equipment and Personal Protective Equipment (PPE) required to keep workers and visitors safe while the tasks are ongoing, etc.

Based on the drawings and method statement, critical inspection activities are then identified. This is important for formulation of the Inspection and Test Plan (ITP), assignment of QC personnel for inspection/audit, and arrangement of external parties for inspection checks/tests, etc. The inspection should cover activities for (i) pre-production inspection (e.g. inspection/testing of materials entering production), (ii) in-line inspection (i.e. inspections during various stages of production), and (iii) final inspection. Collaborative inspections with other trades and subcontractors on the specific activities, if required, should be elaborated and included. Witness points and hold points for inspection and test should be set up.

Three main types of works are involved in the module production: structural, MEP and architectural.

##### 3.1.1 Structural Works

In structural works, the following critical activities for fabrication of steel modules should be inspected/audited (see PNAP APP-158, PNAP APP-37, PNAP APP-116, PNAP APP-118, PNAP ADV-36 and relevant sections of the Code of Practice for the Structural Use of Steel 2011, Code of Practice for Structural Use of Glass 2018):

- SS1 quality of materials on receipt, e.g. material delivery records, batch size, sampling and testing (for structural steel components: (i) mill certificates, including grade, ductility, weldability; (ii) corrosion protection, including type, required thickness, photos after work done; (iii) bolts and accessory parts, including mill certificates, test certificate on elongation; and (iv) fire protection, including type, thickness, required Fire Resisting Rating);
- SS2 welding procedure and specification;
- SS3 dimension and accuracy of 2D and 3D jigs used to produce 2D frame and 3D shell;
- SS4 welding integrity (e.g. using non-destructive tests by means of visual inspection, magnetic particle inspection/dye penetration inspection and ultrasonic examination, where appropriate);
- SS5 overall dimensions and accuracy of modules at trial stacking;
- SS6 material surface preparation and corrosion protection system;
- SS7 module carcass dimension check after delivery between factories (if applicable); and
- SS8 any other items considered essential by the project RSE.

For fabrication of concrete modules, the following critical activities should be inspected/ audited (see PNAP ADV-15, PNAP APP-143, PNAP APP-158, PNAP ADV-36, PNAP APP-37, PNAP APP-45, PNAP APP-116, PNAP APP-118 and relevant sections of the Code of Practice for Structural Use of Concrete 2013, Code of Practice for Precast Concrete Construction 2016 and Code of Practice for Structural Use of Glass 2018):

- SC1 conditions of mould, including dimension, squareness, verticality, cleanliness, use of mould releasing agents, etc.;
- SC2 quality of reinforcing bars, including material delivery records and batch size, sampling and tensile strength testing of reinforcing bars, material properties including chemical composition, etc.;
- SC3 fixing of reinforcing bars, including size, position, quantity, fixing and layout, concrete covers, spacers, etc.;
- SC4 MEP and other cast-in or embedment items, installation, including concealed plumbing works;
- SC5 conditions prior to concreting;
- SC6 quality of concrete, including material delivery records, sampling of concrete for testing, complying with the standard of the Quality Scheme for the Production and Supply of Concrete (QSPSC) or equivalent concrete quality assurance system (including a comparison/justification report for a factory outside Hong Kong to show that the quality is equivalent or not less than the standard of QSPSC);
- SC7 placing, compaction and curing of concrete, including quality and workmanship of concrete works;
- SC8 quality of concrete after stripping of mould (e.g. concrete surface, exposed steel surface/ corrosion protection, sizes, dimensions and fabrication tolerances);
- SC9 vertical and horizontal alignments and continuity of MEP services at trial stacking, etc.;
- SC10 module carcass dimension check after delivery between factories (if applicable); and
- SC11 any other items considered essential by the project RSE.

SC1 to SC8 are also applicable to fabrication of steel modules constructed with a concrete slab.

### 3.1.2 MEP Works

MEP works include installation of electrical conduits, cable trunking, cable trays, water pipes/fittings, and air-conditioning pipes, etc. The following critical inspections/tests should be carried out:

- MEP1 cable trunking and wiring;
- MEP2 setting out and alignment for electricity fixtures, including TV points, socket outlets, telephone points, switches, double pole switches, connection units, etc.;
- MEP3 cable continuity test for cable and wiring;
- MEP4 earth megger test for conductors and lightning protection device;
- MEP5 electrical phase check for electrical circuit;
- MEP6 plumbing works layout, including concealed plumbing works;
- MEP7 watertightness and pressure tests for pipe works; and
- MEP8 ventilation fans, AC units and associated ductwork and accessories.

### 3.1.3 Architectural Works

In architectural works, the following activities should be inspected/ audited (see Figure 3):

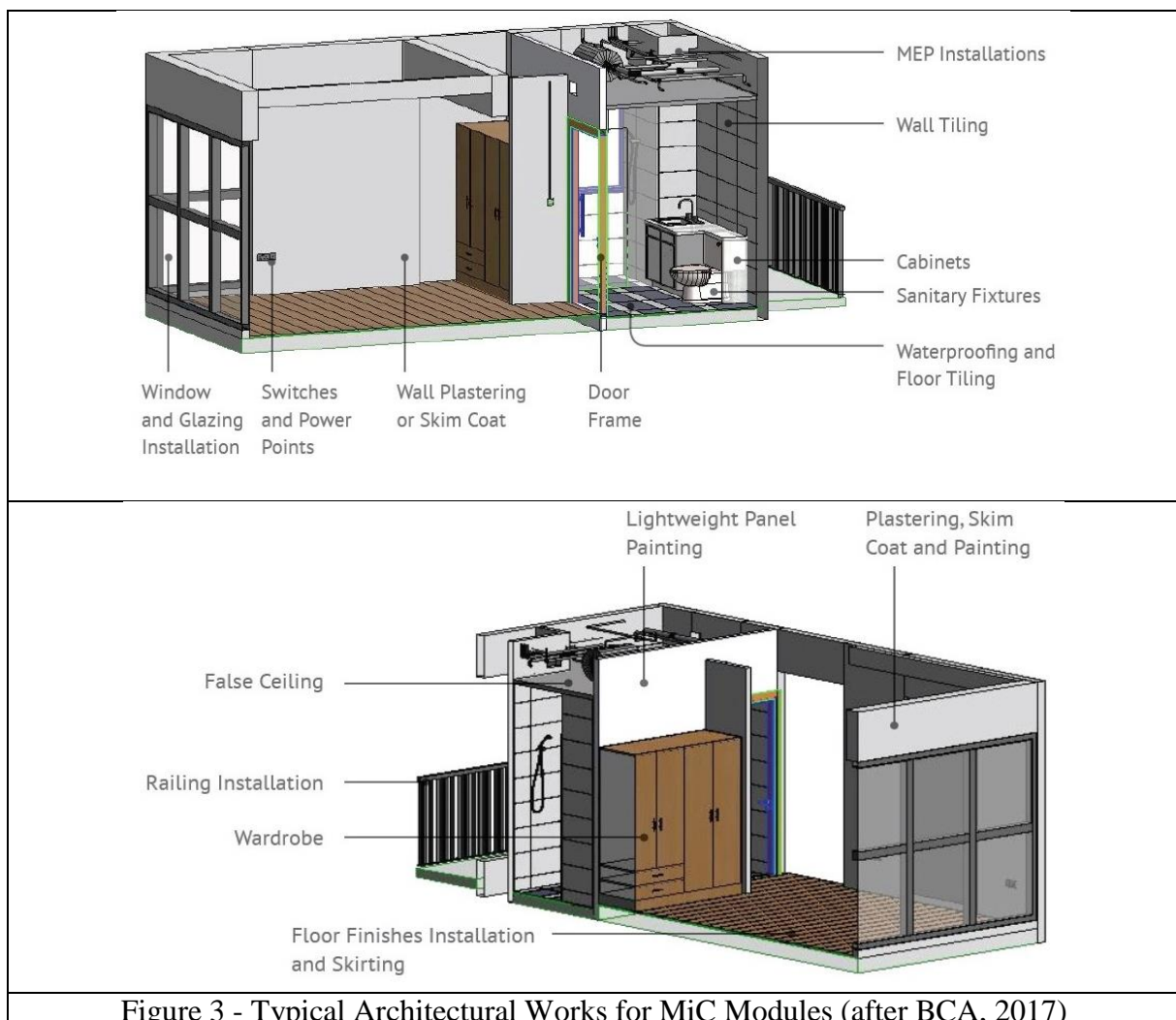


Figure 3 - Typical Architectural Works for MiC Modules (after BCA, 2017)

- AR1 setting out and critical dimensions (e.g. storey height, height of windows, dimensions of projections, balconies, utility platforms and A/C platform, protective barriers, internal areas, exit routes, etc.);
- AR2 installation of windows and flue apertures (e.g. minimum areas of glazing and openable areas of prescribed windows and windows for room containing soil or waste fitment and water tightness in accordance with PNAP APP-116; position and dimensions of windows and flue apertures; provisions required under modification/exemption, etc.), facade and curtain walling system and water leakage test;
- AR3 drainage (e.g. provision of sanitary fitments, drainage works including material, dimensions, water seal trap, vent or anti-siphonic pipes and any other necessary components);
- AR4 fire resisting construction (e.g. materials and fire protection of structural elements and construction of fire barriers and installation of proprietary products such as FRR of fire doors, smoke seal, self-closing device, pipe collars, etc.);
- AR5 finishes and fittings (e.g. water proofing such as roof, shower areas, including water ponding test/spray test reports for impermeable construction; provision of required mechanical ventilation and artificial lighting; provision of required fire services installations such as smoke detectors and sprinkler heads for open kitchen, etc.);
- AR6 provision of barrier free access and facilities (e.g. dimensions of bathrooms, toilets, ramps, corridors, lobbies, doors, handrails, signage, tactile guide path, etc.) and
- AR7 any other items considered essential by the project AP.

The typical items for inspection upon completion of the modules and prior to delivery to the site are given in Table 2.

Inspection Item		Scope
FIN1	Setting out and interior	<ul style="list-style-type: none"> <li>• Check critical dimensions including storey height, projections, balconies, utility platforms, A/C platforms, protective barriers, internal areas, exit routes, etc.</li> <li>• Check conformity with general layout</li> </ul>
FIN2	Visual Inspection of joints	<ul style="list-style-type: none"> <li>• Check joints</li> </ul>
FIN3	Visual inspection of physical damage	<ul style="list-style-type: none"> <li>• Check for physical damage (e.g. corrosion, damage, paint work and insulation)</li> </ul>
FIN4	Packaging for delivery	<ul style="list-style-type: none"> <li>• Check protective packaging for delivery</li> </ul>
FIN5	Installation of windows and flue apertures	<ul style="list-style-type: none"> <li>• Check minimum areas of glazing and openable areas of prescribed windows and windows for rooms containing soil or waste fitment and watertightness in accordance with PNAP APP-116</li> <li>• Check positions and dimensions of flue apertures</li> <li>• Check provisions required under modification/exemption</li> </ul>
FIN6	Provision of Barrier Free Access	<ul style="list-style-type: none"> <li>• Check provisions and critical dimensions of bathroom, toilets, Barrier Free ramps, corridors, lobbies, doors, handrails, signage, tactile access guide path, etc.</li> </ul>

FIN7	Drainage	<ul style="list-style-type: none"> <li>• Check provision of sanitary fitments</li> <li>• Check drainage works including materials, dimensions, water seal traps, vents or anti-siphonic pipes and any other necessary components</li> </ul>
FIN8	Fire resisting construction <sup>10</sup>	<ul style="list-style-type: none"> <li>• Check materials, fire protection of structural elements and construction of fire barriers and installation of proprietary products such as Fire Resisting Rating of fire doors, smoke seal, self-closing device, pipe collars, etc.</li> </ul>
FIN9	Finishes and fittings	<ul style="list-style-type: none"> <li>• Check waterproofing where appropriate such as roof, shower areas, etc., including reports on water ponding test/spray test for impermeable construction</li> <li>• Check provision of required mechanical ventilation and artificial lighting</li> <li>• Check provision of required fire services installations such as smoke detectors and sprinkler heads for open kitchens, etc.</li> </ul>
FINn	Others	<ul style="list-style-type: none"> <li>• Check any other items considered essential for quality supervision of the superstructure works</li> </ul>

### 3.2 Inspection and Test Plan

Based on the critical activities established, an Inspection and Test Plan (ITP) can be formulated. A sample Structural ITP for fabrication of steel modules is given in Figure 4.

<b>Inspection and Test Plan</b>											
<b>Structural Inspection and Test Plan</b>											
Project Name:											
Project Client:											
Project AP:					Project RSE:						
Contractor:					MiC Supplier:						
Contract Title:					Document No.:						
Contract No.:					Revision No.:						
							Inspection by				
Item No.	Task Description	Timing	Type of Inspection	Specificaion/ Reference Documents	Acceptance Criteria	MiC Supplier	Contractor	RSE Rep.	AP Rep.	Remarks	
1	2	3	4	5	6	7	8	9	10	11	
						H: Hold Point R: Review of documentation A1: 100% implementation of activity/testing A2: Random implementation of activity/testing W1: 100% Witness of activity/testing W2: Random witness of activity/testing W3: Witness of activity/testing upon request by the AP Rep. RISC: Request for inspection & survey check					
SS1	Materials	Each batch upon delivery	C/A	e.g. a. Approved plans b. Secifications c. Codes & standards d. Data sheet	e.g. a. Approved plans b. Specifications c. Codes & standards d. Relevant regulations	A1	W1	W1	W3		
SS2	Welding procedure & specification	Review & check	C			R	R	R	R	R	RISC
SS3	Dimension & accuracy	Review & check prior to works	C/A			A1	W1	W1	H/W1	H/W1	RISC
SS4	Welding integrity	Test & check	C/A			A1	W1	H/W1	W3	W3	RISC
SS5	Overall dimension & accuracy	Review & check	C/A			A1	W1	H/W1	H/W1	H/W1	RISC
SS6	Material surface preparation & corrosion protection system	Review & check prior to works	C/A			A1	W1	H/W1	H/W3	H/W3	RISC

Figure 4 – Sample Structural Inspection and Test Plan for Fabrication of Steel Modules

<sup>10</sup> Open-up audit check of fire resisting dry walls is required.

In the ITP, 100% witnessing inspection point (W1) refers to an activity during fabrication, where the inspection, measurement or tests must be done in place and documented. Random witnessing inspection point (W2) refers to an activity during fabrication where inspection, measurement or witnessing of work normally takes place but there is no requirement for 100% witnessing. Formal written notification of W2 is not required, although oral advice or an informal memo should normally be given. If the QCCT does not inspect the work at this point, the work may continue. However, inspection data must be recorded. W3 is the witnessing inspection as requested by the AP Representative. Before performing the inspection, measurement or tests, a written notice must be given to the QCCT and QCCT/QCST should normally attend the inspection. Hold point (H) is an activity during fabrication, where the inspection, measurement or tests must be done with mandatory attendance by the QCCT/QCST and, where required, the appointed independent party (see footnote 3 in Section 2.2.2). The works cannot proceed to the next work step activity until the inspection, measurement or tests have been witnessed and approved by all attending parties. The MiC Supplier should give written notification to the QCCT of the upcoming inspection. The QCCT must give formal written notification to the QCST for their attendance prior to the inspection/test or sampling for test.

Typical ITPs for structural, architectural, mechanical, hydraulic and drainage and electrical works for a MiC project using steel modules are given in Appendices A1 to A5 for reference. These ITPs are based on those used in the Innocell Project, provided at the courtesy of the Hong Kong Science and Technology Parks Corporation.

There may be situations where the materials/products are rejected when they are found not complying with the specification and/or acceptance criteria. Details of the materials/products rejected should be put on record to facilitate rejection analysis to be carried out for continuous improvement. A sample Material/Product Rejection Report is given in Figure 5.

<b>Material/Product Rejection Report</b>					
Project Name:					
Project Client:					
Project AP:		Project RSE:			
Contractor:		MiC Supplier:			
Contract Title:				Document No.	
Contract No.:				Revision No.:	
Reject Report Period:				Report No.:	
				Report Date:	
Serial No.	Name of Material/ Product Rejected	Batch No.	Date Rejected	Reason for Rejection (Report to be signed by the parties concerned, including those in witness or attendance)	Photo of Rejected Material/ Product
1	2	3	4	5	6

Figure 5 – Sample Material/ Product Reject Report



#### 4. CURRENT INSPECTION PRACTICE

##### 4.1 Role of Quality Control Co-ordination Team (QCCT)

The QCCT, consisting of the TCP T3 and T1, is assigned by the AS of the RGBC to provide continuous supervision of the modular unit production work in the prefabrication factory.

The QCCT, consisting of the AS, TCP T3 and T1, is responsible for coordinating the scheduling of inspection and carrying out the inspection.

The TCP T1 working continuously at the MiC factory is responsible for the day-to-day supervision and inspection of the production work. Based on the ITP, the MiC Supplier should arrange inspection and submit a request form to the QCCT in making a Request for Inspection and Survey Check (RISC). The workflow is given in Figure 6.

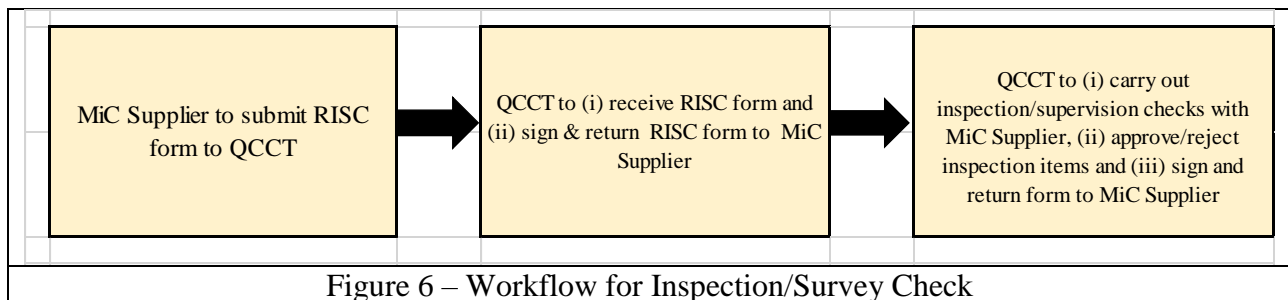


Figure 6 – Workflow for Inspection/Survey Check

The following details should be included in the RISC form:

- (a) BD Reference/Contract No. and Request No.
- (b) Name and designation of the person of the MiC Supplier making the request, location and nature of the work inspected/surveyed, work proposed after approval, and date and time of the request.
- (c) Name, designation and signature of the person in the QCCT receiving the form, and date and time of the receipt.
- (d) Name, designation and signature of the person in the QCCT performing the inspection/survey check, decision of the inspection, date and time of the inspection, and designation and signature of the person for critical activities.
- (e) Name and designation of the person of the MiC Supplier receiving the completed form.
- (f) Drawing number, including revision mark and title, used for the fabrication/manufacture of the item being inspected, supported by a photograph of the title block of the drawing.

The TCP T1 should check the details as constructed with those shown on the approved plans and specification, and collect the necessary evidence (e.g. by means of photos and video). Details of production, inspection, auditing and testing of MiC modules should be included in the records kept by the TCP T1.

#### 4.2 Role of Quality Control Supervisory Team (QCST)

For the structural and architectural works, the TCP T3 of the AP and RSE stream should carry out inspection on a weekly basis, and based on the ITP, make inspection of the critical activities as needed. An inspection log book or other robust forms of inspection records should be kept in the MiC prefabrication factory. A copy of the inspection records should be kept at the building site office and, when required, produced to officers of BD for inspection. Details of the periodic inspections carried out by the TCP T3s of the AP and RSE streams, including BD Reference/Contract No., name and grade of the person doing the inspection, location and nature of work inspected, inspection findings, date and time of inspection, and photos (if any), should be entered in the log book.

#### 4.3 Audit Checks of AP, RSE and AS of RGBC

Details of the audit checks in prefabrication factory carried out by the AP, RSE and the AS of the RGBC should be recorded in the AP, RSE and the AS's audit reports. A copy of the AP, RSE and AS's QA/QC audit reports of the MiC factory (including the QAS record), duly endorsed by the AP, RSE and AS respectively, has to be submitted to BD after the MiC modules are delivered to the building site. These audit reports should cover the quality and qualified supervisions by the respective QCST and QCCT.

Alternatively, the AP and RSE may carry out on-site audit checks of the quality of the MiC modules delivered to the building site according to the requirements stipulated in the Annex of Appendix B of PNAP ADV-36, but they need to notify BD in writing before commencement of the production in the MiC factory, and to submit a copy of the on-site audit reports on the MiC modules delivered to the building site to BD for record purposes. The reports should cover the quality of the MiC modules and qualified supervisions by the QCST.

#### 4.4 Role of RFSIC, LP/RPWs, WSD Inspection Agent and REC/REWs

For the FSI and plumbing works, the RFSIC and LP/RPWs respectively should conduct supervision checks/tests on a regular basis, and based on the ITP, make inspection of the critical activities as needed. A supervision/inspection log book should be kept, including names of the personnel conducting the supervision checks and tests, date and time of inspections, and details of the supervision checks and tests conducted. The WSD Inspection Agent should also inspect and test the concealed parts of the plumbing works at the factory on a needs basis.

For any part of the electrical installations being constructed and installed in a module at the MiC factory, non-RECs can be used to carry out the work. These installations should be inspected and tested as satisfactory in accordance with the factory test requirements set out by the REC (e.g. the items listed in Code 21B of the CoP for the Electricity (Wiring) Regulations (EMSD, 2020)) before they are delivered to the site for permanent module fixing. The REC is recommended to establish and implement a quality control and supervision system, including the factory test requirements, to ensure that the electrical installations are being constructed and installed at the MiC factory with good workmanship and quality.

#### 4.5 Issues Identified

It is time consuming and resource demanding, and sometimes impractical, for these supervision personnel to make physical supervision checks in MiC factories located outside Hong Kong.

In current practice, the data/records obtained from the supervision checks/inspections are normally processed and stored separately. This makes it difficult for different parties to view the data/records and track the inspection process, and to use the data/records for preparation of inspection/audit reports and submission at a later stage. It is also time-consuming to prepare inspection forms prior to inspection and process the data manually after inspections are completed.

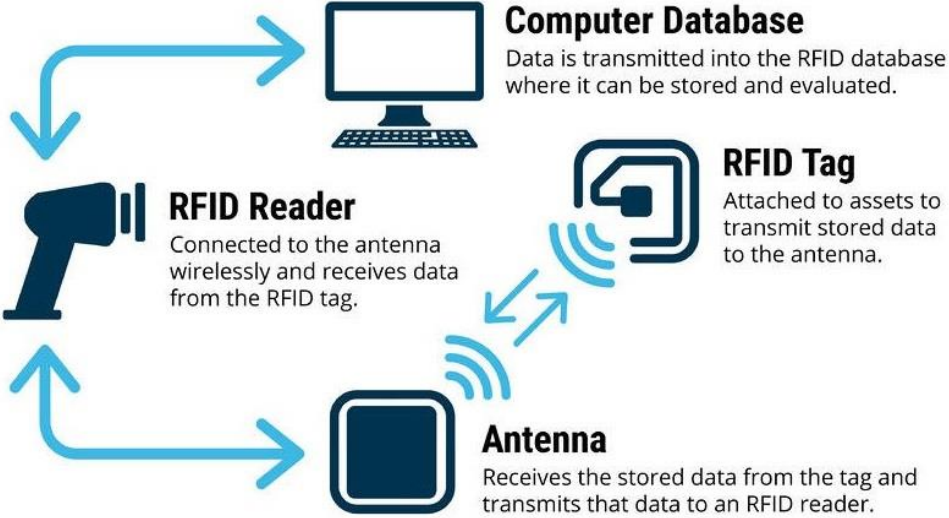
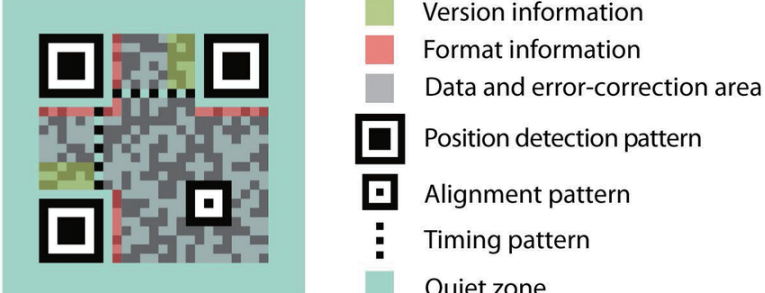
It is normal practice for MiC factories to operate continuously on a 24-hours-a-day and 7-days-a-week basis, and frequent re-inspection of each new task by QCCT/QCST is not uncommon. It may not be easy to recruit additional staff for a short duration of production once the production has commenced. Hence, it is prudent to factor all these aspects into the development of a staff deployment plan, including provision of TCP T3s and professionals in the inspection and an inspection programme, prior to commencement of the production.

## 5. INSPECTION PRACTICE USING DIGITAL TECHNOLOGIES

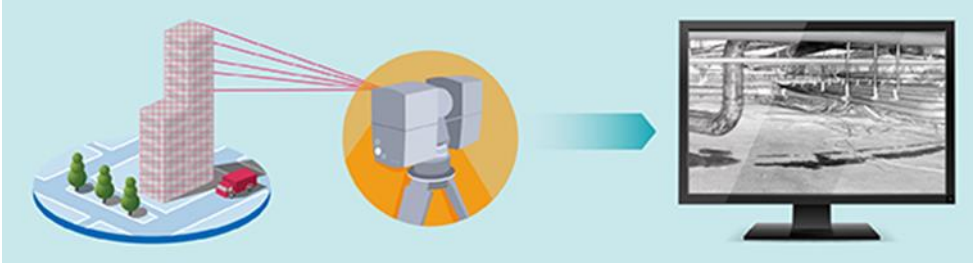

### 5.1 Digitalisation of Data

There are technologies available to digitalise the inspection process for enhanced efficiency and quality performance<sup>11</sup>.

The first step is to establish means to collect the data/records required in digital form from each of the inspection processes in the production work. The technologies that can be engaged include Radio Frequency Identification (RFID) technology, QR codes, Industrial Internet of Things (IIoT), photogrammetry, 3D laser scanning, Robotic Total Station (RTS), blockchain, etc. A brief description of some of these technologies is given in Figure 7.

Technology	Description
Radio Frequency Identification (RFID)	<p>In the RFID technology, a RFID tag is attached to an object, which could be incoming building materials, key components or completed modules. An RFID tag consists of a tiny radio transponder, a radio receiver and transmitter. Radio waves are used to read and capture information stored on the tag. This technology enables tracking and management of incoming and outgoing materials, and facilitates just-in-time delivery based on actual usage conditions. For finished products, the tracking data can be used for traceability and life cycle management of the project.</p>  <p>The diagram illustrates the RFID system components and their interactions. It shows an <b>RFID Reader</b> (a handheld device) connected to a <b>Computer Database</b> (represented by a monitor and keyboard). The <b>RFID Reader</b> is connected to an <b>Antenna</b> (a square device). The <b>Antenna</b> receives data from an <b>RFID Tag</b> (a small square device with a chip) and transmits that data to the <b>RFID Reader</b>. The <b>RFID Reader</b> then transmits the data to the <b>Computer Database</b>. The <b>RFID Tag</b> is described as being attached to assets to transmit stored data to the antenna.</p>
Quick Response (QR) code	<p>A QR code is a type of barcode that can be read easily by a digital device and which stores information as a series of pixels in a square-shaped grid. QR codes are frequently used to track information about products in a supply chain. Like RFID, this technology can also be used for tracking and management of incoming and outgoing materials and completed products.</p>  <p>The diagram shows a QR code with a legend explaining its components. The QR code is a square grid of pixels. The legend includes: <ul style="list-style-type: none"> <li>Version information (green square)</li> <li>Format information (red square)</li> <li>Data and error-correction area (grey square)</li> <li>Position detection pattern (large black square)</li> <li>Alignment pattern (small black square)</li> <li>Timing pattern (vertical dots)</li> <li>Quiet zone (light blue area)</li> </ul> </p>

<sup>11</sup> Reference should be made to the CIC's CITF website (<https://www.citf.cic.hk/?lang=1>) and CITAC website (<https://www.citac.cic.hk/en-hk/exhibitions/why-innovate>) on the latest technologies available.

Industrial Internet of Things (IIoT)	<p>IIoT refers to a network of devices that are digitally connected, facilitating the communication and exchange of data through the Internet. IIoT is a subset of the Internet of Things, which include sensors, RFID tags, software and electronics that are integrated with industrial machines and systems to collect real-time data about their condition and performance. The IIoT infrastructure can be connected to a Wi-Fi or 5G network for mobile connection.</p>
Photogrammetry and 3D Laser Scanning	<p>Dimensions of the moulds used, modules completed, etc., can be measured using photogrammetry or 3D laser scanning.</p> <p>The input to photogrammetry is photographs, and the output is typically a map, a drawing, a measurement, or a 3D model of some real world object or scene. In 3D laser scanning, a laser beam is emitted onto a surface and sensors are used to capture the beam that bounces off from the surface. The system will calculate the distance between the sensor and surface. The distance measured is then used to calculate a coordinate for a tiny section of the surface hit by the laser beam. During a single scan, millions of 3D coordinates are collected. When the point cloud data are processed, they will form a digital representation of the scanned surface, giving the dimensions and spatial relationships of the topographic features and structures.</p> 
Robotic Total Station (RTS)	<p>A total station is an optical instrument used in construction, surveying and civil engineering. It is used for measuring horizontal angles, vertical angles and distance. A total station camera combines surveying, imaging and high-speed 3D scanning into one precise and reliable instrument. A total station contains the following components:</p> <ul style="list-style-type: none"> <li>• electronic transit theodolite</li> <li>• electronic distance meter (EDM)</li> <li>• microprocessor</li> <li>• electronic data collector and storage system</li> </ul> <p>A RTS can allow for more technological convenience by offering extended remote control abilities. In the operation of a RTS, only one operator is needed, and far more calculations and inspections can be performed in a shorter time as compared with a traditional total station.</p> <p>RTS can be used for setting out for MiC fabrication. BIM data can be input to the RTS for surveying.</p> 
Blockchain	<p>The data/records collected are stored in database fields. Blockchain technology can be used for enhanced data security. Blockchain is a specific type of database which differs from a typical database in that data are stored in blocks and chained together. Each block in the chain is given a time stamp when it is added to the chain. After a</p>

block has been added to the end of the blockchain, it will be very difficult to go back and alter the contents of the block. With this system, the document time stamps could not be tampered with.

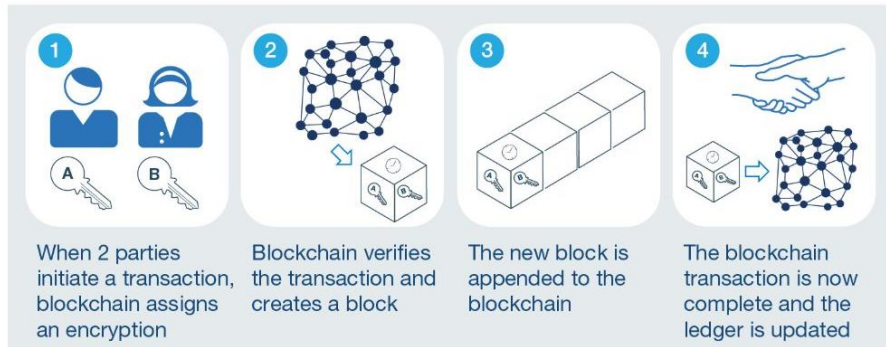


Figure 7 – Brief Description of Some Relevant Digital Technologies

Figure 8 gives a summary of the application of the digital technologies, based on the specified scope of application, for checking of the critical inspection activities given in Section 3.

Inspection Item No. (Note: See Chapter 3)	BIM	RFID	QR Code	IIoT Sensors	Photogrammetry	3D Laser Scanning	RTS	Blockchain	Image (Note 1)	Video
SS1	Quality of materials on receipt		Y	Y				Y	Y	Y
SS2	Welding procedure & specification							Y	Y	
SS3	Dimension & accuracy of 2D and 3D jigs				Y	Y	Y			
SS4	Welding integrity			Y				Y	Y	Y
SS5	Overall dimension & accuracy of modules	Y			Y	Y	Y			
SS6	Material surface preparation & corrosion protection system							Y	Y	Y
SC1	Conditions of mould				Y	Y	Y		Y	
SC2	Quality of reinforcing bars		Y	Y						
SC3	Fixing of reinforcing bars							Y	Y	Y
SC4	MEP and cast-in item installation							Y	Y	Y
SC5	Conditions prior to concreting							Y	Y	Y
SC6	Quality of concrete		Y	Y				Y	Y	Y
SC7	Placing, compaction & curing of concrete							Y	Y	Y
SC8	Quality of concrete after stripping of mould							Y	Y	Y
SC9	Vertical and horizontal alignments & continuity of MEP services	Y			Y	Y	Y			
MEP1	Cable trunking & wiring				Y		Y	Y	Y	Y
MEP2	Setting out and alignment check for electricity fixture				Y		Y		Y	Y
MEP3	Cable continuity test			Y				Y	Y	Y
MEP4	Earth megger test			Y				Y	Y	Y
MEP5	Electrical phase check			Y				Y	Y	Y
MEP6	Plumbing works layout, including covered up plumbing works			Y				Y	Y	Y
MEP7	Water tightness & pressure tests			Y				Y	Y	Y
MEP8	Ventilation fans, AC units and associated ductwork and accessories.							Y	Y	Y
AR1	Setting out and interior	Y			Y	Y	Y			
AR2	Windows & flue apertures, facade & curtain walling system & water leakage test							Y	Y	Y
AR3	Drainage							Y	Y	Y
AR4	Fire resisting construction		Y	Y				Y	Y	Y
AR5	Finishes & fittings			Y				Y	Y	Y
FIN1	Setting out & interior	Y			Y	Y	Y			
FIN2	Visual inspection of all joints							Y	Y	Y
FIN3	Visual inspection for physical damage							Y	Y	Y
FIN4	Packaging for delivery							Y	Y	Y

Legend: Y: Yes

Note 1: The function of image recognition can be added to the camera to enhance visual inspection.

Figure 8 – Application of Digital Technologies for Checking of Critical Inspection Activities



The standards, requirements and level of details for inspection activities should follow those specified in the contract.

## 5.2 Digitalisation Process

### 5.2.1 e-Platform

The next step in the digitalisation process is to establish a web-based centralised platform (e-platform) for collection of the production work information and management of the workflows of production and inspection activities. The e-platform should be accessible through a secure network and capable of being operated on desktop and laptop computers and mobile devices, as shown in Figure 9.

The e-platform can be used for many functions, such as keeping safety records and factory cleanliness records<sup>12</sup>, etc. In these records, focus is placed on the inspection process for QA/QC acceptance of modules produced in MiC factories, in particular on the submission and approval of the inspection records in the production activities.

With an e-platform, the inspection process as shown in Figure 6, taking account of the ITP as detailed in Figure 4, can be turned into a digital process.

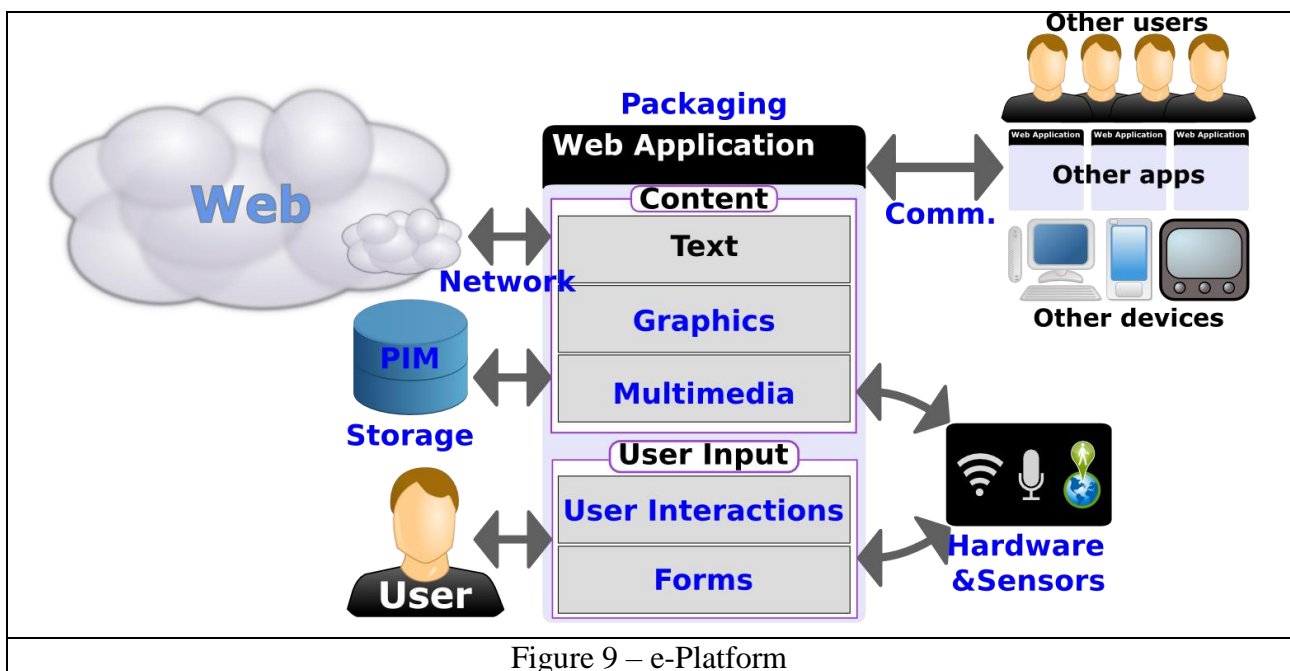


Figure 9 – e-Platform

### 5.2.2. e-RISC

The e-RISC forms can be submitted online by the MiC Supplier via a desktop or laptop computer, or a mobile device with personal authentication or a digital signing function. The receipt of the request by the QCCT can be confirmed by an e-notification. Prior to the inspection, all necessary documents (e.g. HOKLAS or equivalent endorsed test/calibration certificates) should have been provided and uploaded to the e-platform for checking by the QCCT. The person in the QCCT conducting the inspection can download the e-RISC form, audit checklist (if applicable) and other relevant details, such as approved plans, using a mobile device. The mobile device can also be used

<sup>12</sup> DEVB (2020). DEVB TC(W) No. 3/2020. Digital Works Supervision System.

to collect evidence (e.g. images, video and data) during the inspection and walkthrough. The decision and/or any comment of the inspection personnel and checking personnel should be passed on to the MiC Supplier on the spot via the e-platform. The data/inspection records should be stored in the e-platform to allow different parties with different duties and responsibilities and the appropriate access rights to inspect the data/records and track the inspection process, and for preparation of inspection/audit reports and submission. The data/inspection records collected should be stored in database fields.

If needed, laser scanning and AR visualisation incorporating BIM can be used to assist the inspection and checking.

### 5.2.3 e-Inspection<sup>13</sup>

The process of the periodic supervision checks by the supervision personnel, such as TCP T3, AP, RSE, AS, RFSIC, LP/RPWs, etc., can also be digitalised. The supervision personnel can make the check online via the e-platform. While in the office, they can make direct calls using the desktop or laptop computer or a mobile device to their assistant in the MiC factory (not a member of the RGBC's QCCT), who can then arrange inspection checks of the activities required with the MiC Supplier using a mobile device by videotelephony<sup>14</sup>. The inspection data/records (e.g. photo, video and voice) can be transmitted in real-time for reviewing by the supervision personnel. The inspection process should be recorded and the data should be stored in the e-platform.

For the inspection and testing of the concealed parts of the plumbing works, the WSD Inspection Agent can, through the e-platform, order and direct the assistant of the supervision personnel under the QCST to arrange inspection and testing with TCP T1 of the QCCT and LP by videotelephony, and witness the process online. The inspection data/records (e.g. photo, video and voice) should be transmitted in real-time for reviewing by the WSD Inspection Agent. The inspection and testing process should be recorded and the data should be stored in the e-platform. This will save the travelling time of the WSD Inspection Agent to the MiC factory to carry out the inspection, checking and testing.

### 5.2.4 e-Inspection Management Systems

Many e-platforms are now available<sup>15</sup> (e.g. FieldConnect v3.0, InfoSMART, Novade, SnagR, VHSmart, etc.) to enable the inspection process. These e-platforms or e-Inspection Management Systems (EIMSs) can be deployable from any mobile device, with electronic standardised or government-issued forms built in. The evidence captured/collected during inspection and checking (e.g. photo, video, voice and GPS location information) can be stored and uploaded. Facilities for real-time push technology, automatic reporting, data analysis, team chatroom, dashboard, electronic authentication, notifications and alert, dynamic workflow, workflow enabled form, etc., are also available.

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<sup>13</sup> E-inspection has not yet been accepted by BD in all projects. BD has accepted this practice under special circumstances, such as during times of COVID-19, in which e-inspection of the production work at the MiC factory has been accepted (see BD's Circular Letter dated 7.2.2020).

<sup>14</sup> Videotelephony means two-way simultaneous communication with both audio and video in real-time through telephone or computer network connections. The video should be recorded in colour with resolution of not less than 480 pixels (see BD's Circular Letter dated 7.2.2020 (BD, 2020)).

<sup>15</sup> See <http://www.citf.cic.hk/?route=search-key>



### 5.2.5 Data Security

Blockchain technology to strengthen data security is very useful and now widely available, but it can be fairly costly at the current state of market development. This may change as the market matures.

At this stage, as an alternative, reference can be made to the recommendations given in DEVB TC(W) No. 3/2020 (DEVB, 2020) for ensuring data security and tamper-proof data. In general, the data stored on the EIMS should be encrypted in transit and at rest, and appropriate arrangements should be implemented for preventing unauthorised access. To ensure the data is tamper-proof, the contract specification should also require each of the responsible parties in the contract to add their digital signature (e.g. one supported by an e-Cert issued by the Hongkong Post), biometrics (e.g. facial recognition or fingerprint) or other ID (e.g. the first four digits of an HKID card plus clearly-written full name) in each of the encrypted data files produced during the inspection, checking, review and acceptance process. Each of the encrypted files should be sent instantly and simultaneously to all relevant users (client, AP/RSE/RGBC, TCPs, factory staff, etc.) and kept in their servers, in order to maintain traceability and prevent tampering of data.

### 5.2.6 Benefits

The continuous inspection data/records from the TCP T1 in the MiC factory, as well as the periodic inspection data/records collected by the AP, RSE, AS, TCP T3, RFSI, LP/RPWs, etc., frequency of inspection and the observations/recommendations made by each of the supervision personnel, can be stored centrally in the e-platform and can be made available for review/check by the authorised parties. Human error will be reduced and productivity enhanced since no manual data manipulation is involved.

Alert/notification can also be made to the relevant parties for follow-up action in case of non-compliance. The data/records can be maintained more conveniently and simply, and corrective actions taken more promptly.

## 5.3 Improved Quality Management

Use of digital technologies can help improve quality in the following ways:

- (a) Production processes can be monitored and data collected in real-time to enable data analytics to be applied to predict quality issues and maintenance needs. This will enhance efficiency and allow early completion of the work at a reduced cost.
- (b) On procurement control, with suitable Key Performance Indicators (KPIs) and the quantities of materials ordered and received, digital dashboards can be used to track supplier performance. The data on supplier performance can be used to assess quality risks in the supply chain, for deployment of supplier development resources as needed, and in procurement negotiations and contracting.
- (c) Movement and location of delivery vehicles can be tracked in real-time. This provides good information for logistics and transportation planning and updating for delivery of modules.

- (d) Remote inspection of modules using real-time video live feed will save resources and allow participation and inspection by multiple parties concurrently, if needed.
- (e) Traceability of the details of the parties who have carried out the inspection, testing and acceptance of the module will be enhanced if the digital data related to QA/QC and module transportation collected for each module (which should be identifiable with a unique machine readable identification mark or code on the modules, see for example Appendix B) is stored in a digital platform such as a Common Data Environment (CDE) designated by the project client. The digital platform could either be installed on the premises of the project client, or in a data centre (preferably located in Hong Kong) to be specified by the project client.

## 6. ACCEPTANCE OF E-INSPECTION MANAGEMENT SYSTEM AND DIGITAL TECHNOLOGIES FOR INSPECTION WORK

Major developments in digital technologies have been made in recent years. With the advent of digital technologies, the manufacturing industry has moved from Industry 3.0 to Industry 4.0, which puts focus on the use of cloud computing, mobile technologies, 5G, Internet of Things, Radio Frequency Identification (RFID) technologies, QR codes, big data and analytics, augmented reality, etc., in the manufacturing process.

The use of EIMS and digital technologies during the inspection for QA/QC of modules produced in MiC factories for private projects is a new endeavour.

Owing to COVID-19, since 2020 BD has adopted a pragmatic and flexible approach for supervision and inspection checks for the production work carried out in MiC factories. As a special temporary measure during the pandemic, the TCP T3 of AP's and RSE's streams and the AS of the RGBC, working with their assistant in the MiC factory (who is not a member of the RGBC's supervisory personnel team or the MiC Supplier), can employ videotelephony to conduct supervision and inspection checks (see BD's Circular Letter dated 7.2.2020 (BD, 2020)), instead of carrying out the supervision and inspection check physically at the MiC factory. The AP, RSE and AS are required to submit the DVD-ROM discs for the videos taken to BD within 14 days after completion of the supervision. Currently, BD is conducting a review on the effectiveness of the above temporary measure and the way forward in respect of the quality supervision in offsite factories.

Private sector industry practitioners, including those in developers and AP/RSE/ASs, should take the initiative to adopt an EIMS and digital technologies in the inspection work for their projects.

As a start, the industry should adopt both approaches (i.e. both the paper-based and physical check system and the digital process) in their work to give their supervision and inspection personnel time to gain experience and confidence in using the digital system. Once familiarised, the whole process can become fully digitalised. This approach also has the potential to be used in future for on-site building works, including site formation, foundation, excavation and lateral support works, etc.

BD is open-minded to the use of digital technology for supervision of development sites and offsite factories as well as cloud technology for submission of supervision records or material submission. However, since the on-site and offsite inspection and supervision involve many works procedures, data manipulation and sharing, data security, etc., as well as other regulatory departments, such as FSD, WSD and EMSD, there is a need to conduct a more thorough study to explore the feasibility and consequences of using digital technology as a complete replacement to on-site and offsite inspection and supervision. The experience and confidence gained in the use of EIMS and digital technologies for QA/QC inspection work will provide a good basis to set the future direction.

## 7. RECOMMENDATIONS

The following recommendations are made in order to take forward the use of EIMSs and digital technologies for QA/QC of MiC modules in the industry:

- (a) It is accepted that there are many challenges in introducing new technologies to the industry. The most notable is resistance to change by the site supervision and inspection personnel. Appropriate change management strategies, involving a top-down approach, better communication, training, buying-in, etc., should be adopted. Suitable training should be provided to construction personnel to promote the use of MiC, and make them convinced of the long-term benefits gained in using EIMSs and digital technologies in supervision and inspection checks, to gain their buy-in.
- (b) Many EIMSs with different frameworks and functions are now available in the market. Suitable EIMSs should be identified and unified for their functionality, user-friendliness and ease of operation for the frontline personnel, and then earmarked for specific use. A single digital platform (or an App) to interlink the different systems in one or a few portals should be developed/provided, where document approval control, team instruction chat-box, automatic progress reporting and digital twin can be incorporated. This will enhance user friendliness, and the legitimacy of it acting as a single source of truth for Governmental recognition.
- (c) Careful evaluation of the EIMSs identified is also needed in selecting a suitable system for a construction contract, and for use to support contract and regulatory acceptance. Consideration should be given to the introduction of a requirement on product certification by a reputable certification body, to ensure the quality of the system's functionalities and compliance with recognised standards.
- (d) The EIMSs available in the market may not suit the needs of all stakeholders. For example, an EIMS used by manufacturers may have functions different from that used by contractors/project clients, e.g. for internal QA/QC checking versus a defect tracking e-system. Multiple systems (e.g. inspection system, document management system, mail system, BIM and IoT) may be used in parallel. The manufacturers may be reluctant to operate on dual systems or to use new systems. A digital platform, such as a CDE, which would allow storage of digital data from different EIMSs, is needed for storage and retrieval of the digital data for MiC projects, in which the production is fast and dynamic. Further work on standardisation of data standards and structure for common data types, to facilitate the consolidation of the collected digital data into a single platform, is needed.
- (e) Ways to further enhance the quality of inspections by videotelephony should be explored, e.g. by limiting the speed of camera movement while videoing, ensuring adequate lighting conditions in enclosed areas of factories, and clearly defining the roles and responsibilities of the different personnel involved, in terms of data ownership, data input, data review, data acceptance, etc.

- (f) According to PNAP ADV-36, open-up inspections are to be conducted after delivery of MiC modules to the building site and they serve as audit-checks arising from the absence of supervision by the AP/RSE in the MiC factory. However, there are concerns about this kind of inspections, in particular at the OP stage, because they could be destructive. With the latest digital technologies available, it is now possible to synchronise the digital data from the required statutory inspections with that from the QCST inspections, while the modules are still in the MiC factory and where any necessary remedial works can be handled immediately after inspection. Alternatively, some open-up inspections could be carried out for randomly selected MiC modules while they are stored in the factory, so that rectification works if found required could be made in the factory before delivery to site. Hence, it has opened up the opportunity for reviewing the scope of the open-up inspections with the objective of streamlining and minimising the amount of destructive works while not compromising the standard and quality of the works.
- (g) To provide confidence to government regulators in the use of EIMSs and digital technologies, the possibility of granting access rights to their designated personnel to participate in real-time inspection checks at MiC factories, and to access and download the data/records directly from the system, if required, should be explored. Reference should be made to the relevant specifications, and in particular to the system requirements given in DEVB TC (W) No. 3/2020 (DEVB, 2020).
- (h) The feasibility of modifying production lines to facilitate automatic/semi-automatic inspection, incorporating the technology of image recognition, should be explored, as this will further shorten the cycle in the check and act plan, help maintain closer monitoring than manual checking at intermediate stages of production, and enhance the overall quality control process. To ensure quality, the QA/QC check process should be extended to include the delivery of items from the factory to the building site, as some fixed installations (e.g. water pipes, electrical appliances), may become loosened/damaged due to vibration during delivery.

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# APPENDIX A1 – TYPICAL INSPECTION AND TEST PLAN FOR STRUCTURAL WORK FOR A MIC PROJECT USING STEEL MODULES

ITP Document No.: 驗收方案文檔號:		Revision: 版本:		Date: 日期:							
Task No. 編號	Task Description 任務描述	Timing 時機	Type of Inspection 檢驗類型	Specification/Reference Documents 規格/參考文件	Acceptance Criteria 接受標準	Inspection Requirement 檢驗要求					Remarks 註釋
						MIC Supplier 構架供應商	Sub contractor (facade) 分包商(幕牆)	Contractor 承建商	RSE Rep. 註冊結構工程師代表	AP Rep. 認可人士代表	
1.0	Acceptance of ITP 驗收	Review & check prior to Works 開工前檢查/核對	Approved Submission Form 已批准的表格	[ITP Document No.] [驗收方案編號/編號]	ITP reviewed by all parties and accepted to use in Project 各方通過審核並同意該專案使用的ITP	R	R	R	R	R	
2.0	Documentation review 覆審表										
2.1	Shop Drawing / Fabrication Drawing 施工圖/生產圖紙	Review & check prior to Works 驗收工作開始前	Review 審查	Approved Submission Form 已批准的表格	Ensure all drawings are at Construction Issue 確保所有圖紙為施工圖	R	R	R	R	R	
2.2	Work Method Statement 作業指導書	Review & check prior to Works 驗收工作開始前	Review 審查	Approved Submission Form, ADV-36 PS S1 - CL5.4 已批准的表格, ADV-36 PS S1 - CL5.4	The method statements to be submitted by the Contractor shall: - describe the methods of design, construction and/or manufacture and installation proposed for all normal activities associated with the relevant part or phase of the Works; - 包括所有工序的設計、施工和/或生產、安裝; - detail any special activities or processes required or proposed for the relevant part or phase of the Works; - 仔細列明相關工序在何特別的活動或過程; - identify the amount and nature of the Contractor's equipment and temporary Works which the Contractor proposes to use; - 標明承建商所需的機械或臨時工程的量和性質; - describe the supervision policy which the Contractor proposes to follow, particularly with regard to the work of Sub-Contractors of any tier; - 描述承建商監督的政策或程序, 特別是有關任何級別的分包商的工作; - contain sufficient information to enable the Architect to understand and appraise the Contractor's plan for the execution of the Works and for the control of the quality of the Works; - 含足夠的信息, 使建築師能夠理解 and 評估承包商的計劃, 以執行工程並控制工程質量; - contain details for traffic management and/or road closures if required, and - 包含交通管理和/或封路的詳細信息, 如需要; 和 - include other relevant information. - 其他相關信息	R	R	R	R	R	
2.3	Proposed Testing Laboratory / Fabrication Factory 建議的測試實驗室/生產工廠 - Welding Test, Material Test, Concrete Cube Test, Rebar Test, etc. - 焊接檢測、材料檢測、混凝土試塊檢測、鋼筋檢測等 - Factory of MIC Fabrication/Galvanization / Heat Soak Treatment / Façade Fabrication, etc. - 構架生產工廠/電鍍/熱浸處理/幕牆生產等	Review & check prior to Works 驗收工作開始前	Review 審查	Approved Submission Form 已批准的表格	Ensure Proposed laboratory are HOKLAS / CNAS Lab or MRA Partners Factories are under ISO9000 or equivalent 確保擬定的實驗室HOKLAS / CNAS實驗室或MRA合作夥伴工廠均符合ISO9000或同等標準	R	R	R	R	R	
2.4	Material against material submission schedule 根據提交材料日程所提交的材料 - Structural Steel, Welding Consumable, Aluminum, Steel reinforcement, Concrete, others Accessories, etc. - 鋼結構、焊接材料、鋁、鋼筋、混凝土、其他配件等	Review & check prior to Works 驗收工作開始前	Review 審查	Approved Submission Form 已批准的表格	As per corresponding requirement 按照相應要求	R	R	R	R	R	
2.5	Other Document Submission 其他文件提交 - Welding Procedure and Welder Test Certificate, Calibration Report of the Heat Soak Treatment Oven, Material Supplier Information, etc. - 焊接流程及焊工資格證書、熱浸處理爐校準報告、材料供應商信息、等	Review & check prior to Works 驗收工作開始前	Review 審查	Approved Submission Form 已批准的表格	As per corresponding requirement 按照相應要求	R	R	R	R	R	
3.0	Prefabrication of Façade (Curtain Wall - Cladding) (for information only) 外立面上生產(幕牆+保潔層)(僅供參考)										
3.1	Material Verification and Pre-treatment 材料覆核及預處理										
a	Structural Steel Delivery 鋼結構運輸 - Hot-rolled Steel Section - 熱軋鋼結構鋼 - Hot-finished Hollow Steel Section - 熱加工空心管	Each Batch / Upon Delivery 每批/交貨時	Measure and Visual inspection 測量和目視	PS S2, BS EN 10025-1:2004 PS S2, BS EN 10210-1:2006	- Straightness of Section by Visual Inspection 通過目測檢查截面的平直度 - Mill certificate of steel Grade comply with approved drawings 符合已批准圖紙的鋼材級別證書 - Dimension of Section in compliance with Section Table 符合截面尺寸的截面尺寸 - Condition of Steel for Fabrication is not to be more heavily pitted or rusted than Grade C of Swedish Standard SIS 055900 製造鋼的條件應比瑞典標準SIS 055900的級更強 - Material Tolerances Clause 15.1 to 15.9 of HKCSUS - HKCSUS的材料公差條款15.1至15.9	-	A1	W2	W3	W3	

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						MIC Supplier 提供供應商	Sub contractor (Facade) 分包商 (幕牆)	Contractor 承建商	RSE Rep. 駐持結構工程師代表	AP Rep. 認可人士代表	
b	Structural Steel Sampling 鋼結構試樣	Upon Delivery ADV-36: One specimen for every 40tonnes of each section or plates of same thickness from the same cast to be used 交貨時 ADV-36: 每節每40噸一個樣品, 或則將使用於相同條件的相同厚度的板材	Laboratory Test 實驗室測試	BS EN ISO 6892-1:2016, BS EN 10002-1:2001	Laboratory Testing Procedure 實驗室測試程序 - Required Tensile Strength and Elongation percentage - 要求的拉伸強度和伸長率 - Chemical Composition - 化學成分	-	A1	W2	W3	W3	
c	Hot-dip Galvanizing 熱浸鍍鋅	Every Batch 每批	Lab procedure 實驗步驟	BS EN ISO 1461	Table 3 of BS EN ISO 1461 BS EN ISO 1461 的表3 - Min. coating thickness and Mass on samples - 最小樣品的塗層厚度和質量	-	W1	W2	W2	W3	RISC
d	Aluminum Delivery 鋁材運轉 - Aluminum Extrusion - 鋁擠型材 - Aluminum Sheet - 鋁板	Each Batch / Upon Delivery 每批/交貨時	Measure and Visual inspection 測量和目視	Approved Drawing, 已批准的圖紙 BS EN 8118, BS EN 755, BS EN 573-3, AAMA 2605.5 BS EN 485-2, BS EN 573-3	Comply with Approval Drawing 符合批准圖紙 1. check grade, dimension, pattern, colour and visible surface defects 1. 檢查等級、尺寸、圖案、顏色和可見的表面缺陷 2. check coating thickness with Coating Thickness Gauge 2. 使用塗層測厚儀檢查塗層厚度 3. conduct cross cut adhesion test 3. 導橫切附着力測試	-	A1	W2	W3	W3	
e	Structural Sealant 結構密封胶	Each Batch / Upon Delivery 每批/交貨時	Measure and Visual inspection 測量和目視	Dow Corning Quality Assurance 道康寧質量保證	1. check label on the product, shelf life, color and type 1. 檢查產品上的標籤、保質期、顏色和類型 2. conduct Sealant Butterfly Test 2. 進行密封膠蝴蝶試驗	-	A1	W2	W3	W3	
f	Heat Soak Treatment for Tempered Glass 鋼化玻璃的熱處理	Every Batch 每批	Inspection refer to Factory Test Procedure 參考工廠測試程序檢驗	Factory Test Procedure 工廠測試程序 BS EN 14179-1, PNAP APP-37 ASTM 1376, ASTM 1036, ASTM 1048	A minimum spacing of 20mm for separation of glass panels 分隔玻璃面板的最小間距為20mm 1. Heating Phase: from 0°C to 280°C (not exceeds 320°C) 1. 加熱階段: 從0°C到280°C (不超過320°C) 2. Holding Temperature: 280°C 2. 保溫溫度: 280°C 3. Holding Time: 2 hours 3. 保溫時間: 2小時 4. Finishing Temperature: 290°C ±10°C 4. 加工溫度: 290°C±10°C 5. Cooling Phase: from 290°C ±10°C to 70°C 5. 冷卻階段: 從290°C±10°C到70°C	-	A1	W2	W2 (30%min.) (最少30%)	W3	RISC
3.2	Fabrication and Assembly 製作與組裝										
a	Setting Out / Level / Verticality of Connection Members 連接件的尺寸/水平/垂直度	Prior to Connection 連接之前	Measure and Visual inspection 測量和目視	Approved Shop Drawing 已批准的生產圖紙 PS S2, BS EN 1090-2	- Comply with Approved Drawings - 符合已批准圖紙 - Tolerance: BS5606, Clause 15.11 and 15.12 if HKCSUS - 公差: BS5606, 15.11 及 15.12, HKCSUS如適用	-	A1	W2	W3	W3	
b	Welding for Hot-rolled / Hot-finished sections 熱軋/熱加工型材的焊接	Weld Joints / After hold time and before delivery for hot-dip galvanizing 焊接接頭(保溫時間後和交貨前)進行熱浸鍍鋅	Visual inspection by a suitably qualified person 由合格的人員進行目視  NDT by Laboratory 實驗室無損檢測	ADV-36(Section 14.3.6 of COP for SUS 2011), PS S2, BS EN ISO 17637(VT),  ADV-36(Section 14.3.6 of COP for SUS 2011), BS EN ISO 17638 (MPI), BS EN ISO 17640 (UT)	*All welds - 100% Visual Inspection *所有焊接:100%外觀檢查  Refer to Laboratory Testing Procedure FPBW and FSBW - 100%UT and 100%MPI 請參考實驗室測試程序FPBW和FSBW-100%UT和100%MPI PPBW and FW with leg length>12mm - 20%UT and 20%MPI FW with leg length <=12mm - 10%MPI 焊腳長>12mm的PPBW和FW-UT的20%和MPI <20mm, 焊腳長<=12mm的FW-10%MPI	-	H & A1	W2	W2	W3	RISC RE to instruct test location 駐地驗工程師告知檢驗地點
c	Bolt and Nut Connection for Aluminum and Structural Steel Member 鋁和鋼結構構件的螺栓和螺母連接	Connection Members 連接件	Measure and Visual inspection 測量和目視	PS S2, BS 4190, BS 4320, Approved Drawing 已批准的圖紙	- Comply with Approved Drawings - 符合已批准圖紙	-	A1	W2	W3	W3	
d	Install Glass Window (Structural Sealant) 安裝玻璃窗(結構密封胶)	Random 隨機	Measure and Visual inspection 測量和目視	BS 3712	- Comply with Approved Drawings - 符合已批准圖紙	-	A1	W2	W3	W3	
e	Final Check-up for Façade Size 幕牆尺寸的最終檢查	Every Batch (Prior to delivery to Modules Prefabrication Yard 每一批/交付到塊預製工場之前)	Measure and Visual inspection 測量和目視	Approved shop drawing 已批准的生產圖紙	- Approved shop drawing - 已批准的圖紙	-	H/A1	W2	W3	W3	
4	Modules Prefabrication Check (Off Site Factory) 構件預製檢查 (場外工廠)										
4.1	Material Verification 材料驗證										
a	Material Delivery 材料交付										
	- Hot-rolled Steel Section - 熱軋鋼型材			PS S2, BS EN 10025-1:2004	- Straightness of Section by Visual inspection - 通過目視檢查截面的平直度	A1	-	W1	W1	W3	
	- Hot-finished Hollow Steel Section - 熱軋空心鋼			PS S2, BS EN 10210-1:2006	- Mill certificate of steel Grade comply with approved drawings - 鋼廠的熱軋證書符合批准的圖紙	A1	-	W1	W1	W3	
	- Cold Formed Steel Section - 冷軋鋼			PS S2, BS EN 1993-1-3	- Measure Dimension of Section comply with Section Table - 截面尺寸符合截面表	A1	-	W1	W1	W3	
	- Cold Formed Hollow Steel Section - 冷軋空心鋼型材	Each Batch / Upon Delivery 每批/交貨時	Measure and Visual inspection	PS S2, BS EN 10219 Parts 1 & 2		A1	-	W1	W1	W3	



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						MIC Supplier 模或供應商	Sub contractor (Facade) 分包商 (幕牆)	Contractor 承建商	RSE Rep. 註冊驗構工程師代表	AP Rep. 認可人士代表	
	- Pre Galvanized Steel Sheet 預鍍鋅鋼板		測量和目視	PS.S2, BS EN 10346	- Condition of Steel for Fabrication is not to be more heavily pitted or rusted than Grade C of Swedish Standard SIS 05 59 00 (S 9 of HKCSUS) 加工用鋼的狀態不應比瑞典標準SIS 05 59 00的C級更嚴重地凹陷或生鏽 HKCSUS 15.9	A1	-	W1	W1	W3	
	- Steel plate, Sheet and Strip under 3mm thickness -厚度小於3mm的鋼板, 鋼板及鋼帶		測量和目視	PS.S2, BS 1449-1.1, BS EN 10111, BS EN 10209, BS EN 1993-1-3		A1	-	W1	W1	W3	
	- Castings 鑄件	Each Batch / Check prior to Works 每批/裝修工作開始前	Measure and Visual inspection 測量和目視	PS.S2, JIS G 5102:1991, Clause 9.5 of HKCSUS	- Dimension of Casting in compliance with approved drawings 鑄件尺寸符合批准的圖紙 - JIS G 5102: 1991 Steel castings for welded structure - JIS G 5102: 1991 焊接結構用鋼鑄件 - Condition of Steel for Fabrication is not to be more heavily pitted or rusted than Grade C of Swedish Standard SIS 055900 - 鋼鑄件的條件應比瑞典標準SIS 055900的C級更強	A1	-	W1	W1	W3	
	- Welding Consumables - 焊接材料	Check prior to works 裝修工作開始前	Visual inspection 目視	PS.S2 - CL 4.9, BS EN ISO 14341: 2011, BS EN 13479 Supplier's docs. "Product Identification & Traceability Control Procedure" and "Welding Material Management Procedure" 供應商文件: "產品識別與追溯控制程序"和"焊接材料管理程序"	- Comply with approved material submission - 符合批准的材料提交 - Packing Labeling: Welding consumables must be supplied with both a Declaration of Performance and CE Marking in accordance with BS EN 13479 - 包裝標籤: 焊接材料必須同時提供性能聲明和CE標記, 符合BS EN 13479	A1	-	W1	W1	W3	
	- Shear Studs - 剪力釘	Random / Check prior to Works 隨機/裝修工作開始前	Measure and Visual inspection 測量和目視	PS.S2, BS EN 13918	- Diameter and nominal length as noted in the approved drawings - 批准圖紙中註明的直徑和標稱長度	A1	-	W1	W1	W3	
	- Bolt, Nut & Screws - 螺栓, 螺母和螺絲	Random / Check prior to Works 隨機/裝修工作開始前	Visual inspection 目視	PS.S2, BS 4190	- Diameter and length as noted in the approved drawings - 批准的圖紙中註明的直徑和長度	A1	-	W1	W1	W3	
	- Washer - 墊圈	Random / Check prior to Works 隨機/裝修工作開始前	Visual inspection 目視	PS.S2, BS 4320	- Dimension as noted in the approved drawings - 批准圖紙中註明的尺寸	A1	-	W1	W1	W3	
	- Pre-fabricated Facade Panel - 預製幕牆板	Upon Delivery 交貨時	Measure and Visual inspection 測量和目視	Prefabricated Record 預製記錄	- Dimension as noted in the approved drawings - 批准圖紙中註明的尺寸	-	A1	W1	H/W1	W3	RISC
b	Structural Steel Sampling 結構鋼取樣	Upon Delivery 交貨時 ADV-36: One specimen for every 40 tonnes of each section or plates of same thickness from the same cast to be used ADV-36: 每段40噸的試樣或從使用相同條件的相同厚度鋼板中	Laboratory Test 實驗室測試	BS EN ISO 6892-1:2016, BS EN 10002-1:2001	Laboratory Testing Procedure 實驗室測試程序 - Required Tensile Strength and Elongation percentage - 要求的拉伸強度和伸長率 - Chemical Composition - 化學成分	A1	-	W1	H/W1	W3	RISC
c	Steel Reinforcement Sampling 鋼筋取樣	Each Batch / Upon Delivery 每批/交貨時	Laboratory Test 實驗室測試	PS.S1, CS2, BS4449	All test specimens shall comply with the requirement of CS2 所有試樣應符合CS2的要求	A1	-	W1	H/W1	W3	RISC
d	Concrete 混凝土										
	- Concrete grade - 混凝土等級	Every truck 每車	Check document/ Delivery note 文件 注釋	General Notes 一般注意事項	Same as required concrete grade in approved drawing 與批准圖紙中要求的混凝土等級相同	A1	-	W1	W2	W3	
	- Workability - slump - 和易性- 坍落度	Every truck 每車	Slump test & CS1 坍落度測試和CS1	PS.S1, CS1	Slump Value: per supplier's recommendation Acceptance Criteria: 坍落度值: 根據供應商的建議驗收標準: For slump value <100mm, ±25 mm or ±1/3 of the design value, which is more stringent 坍落度值 <100mm, 設計值的±25 mm或±1/3取更嚴格; For slump value ≥ 100mm, ±50 mm or ±1/3 of the design value, which is more stringent 坍落度值 ≥ 100mm, 設計值的±50 mm或±1/3取更嚴格。	A1	-	W1	W2	W3	
	- Temperature - 溫度	Every truck 每車	Thermometer measure 溫度計測量	PS.S1, CS1	Temperature of the concrete at planning shall not exceed 30 °C 計劃中的混凝土溫度不得超過30°C	A1	-	W1	W2	W3	
4.2	Material Pre-Treatment 材料預處理										
a	Steel Processing (Punching, Shearing, Cutting, Bending, etc.) 鋼板加工 (沖孔, 剪切, 切割, 彎曲等)	Every Connection Members / Prior to Connection 每個連接件/連接之前	Measure and Visual inspection 測量和目視	Approved Shop Drawings, Clause 14.2.3 of HKCSUS, Supplier's docs. "Cutting Procedure", "Cold Forming Control Procedure" and "Product Identification & Traceability Control Procedure" 批准的生產圖紙, HKCSUS 14.2.3條, 供應商文件, "冷成型控制程序"和"產品識別與追溯控制程序"	- Comply with Approved Shop Drawings 符合批准的生產圖紙 - Material parts dimensions meet requirements. Tolerance - 材料零件尺寸符合要求。 - Thin Steel Plate: BS EN 10051 - 薄鋼板: BS EN 10051 - Hot Finished Hollow Sections: BS EN 10210-2 BS EN 10210-2 - 熱加工空心型材: BS EN 10210-2 BS EN 10210-2 - Cold Formed Hollow Sections: BS EN 10219-2 BS EN 10219-2 - 冷成型空心型材: BS EN 10219-2 BS EN 10219-2 - Cold Rolled Sections: BS EN 10162 - 冷軋型材: BS EN 10162	A1	-	W2	W2	W3	

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						MiC Supplier 核准供應商	Sub contractor (Facade) 分包商 (幕牆)	Contractor 承建商	RSE Rep. 註冊驗構工程師代表	AP Rep. 認可人士代表	
b	Part Assembly 零件組裝 - Setting Out / Level / Verticality - 尺寸/水平/垂直度	Each Assembly Portion / Prior to Connection 每個組裝零件/連接之前	Measure and Visual Inspection 測量和目測	Approved Shop Drawing PS.S2, BS EN 1090-2, Supplier's docs. "Product Identification & Traceability Control Procedure" and processing drawings 批准的生圖紙 PS.S2, BS EN 1090-2, 供應商文件, "產品識別和追溯控制程序" 和加工圖紙	Comply with Approved Drawings 符合批准的圖紙 - Tolerance : BS5606, Clause 15.11 and 15.12 if HKCSUS 公差: BS5606, 第15.11和15.12條 (HKCSUS)	A1	-	W1	W2	W3	
c	Welding of Modular structural components 模塊化結構件的焊接			Supplier's docs. "Welder Register", "Welding Quality Manual & WPQR", "WPS" 供應商文件, "焊接登記", "焊接質量手冊和WPQR", "WPS"							
			Visual inspection by a suitably qualified person in factory 由合格的工廠人員進行外觀檢查	ADV-36(Section 14.3.6 of COP for SUS 2011), PS.S2, BS EN ISO 17637(VT), ADV-36 (適用於SUS 2011的COP第14.3.6節), PS.S2, BS EN ISO 17637 (VT),	"All welds - 100% Visual Inspection "所有焊接-100%外觀檢查	A1	-	W1	HW1	W3	RISC
	- Hot-rolled / Hot-finished sections - 熱軋/熱加工型材	Weld Joints / After hold time and before delivery for hot-dip galvanizing 焊接接頭/保溫時間後和交貨前進行熱浸鍍鋅	NDT by Laboratory 實驗室無損檢測	ADV-36(Section 14.3.6 of COP for SUS 2011), BS EN ISO 17638 (MPI), BS EN ISO 17640 (UT) ADV-36 (適用於SUS 2011的COP第14.3.6節), BS EN ISO 17638 (MPI), BS EN ISO 17640 (UT)	Refer to Laboratory Testing Procedure FPBW and FSBW - 100%UT and 100%MPI 請參考實驗室測試步驟FPBW和FSBW-100%UT和100%MPI PPBW and FW with leg length>12mm - 20%UT and 20%MPI FW with leg length <=12mm - 10%MPI 焊腳長>12mm的PPBW和FW-UT的20%和MPI <20mm, 焊腳長<=12mm的FW-10%MPI	A1	-	W1	HW1	W3	RISC
	- Cold Formed sections - 冷成型材	Weld Joints / After hold time and before delivery for hot-dip galvanizing 焊接接頭/保溫時間後和交貨前進行熱浸鍍鋅	Visual and NDT by Laboratory 實驗室的視覺和無損檢測	ADV-36(Section 14.3.6 of COP for SUS 2011), PS.S2, BS EN 1011-1, BS EN 1011-2 ADV-36 (適用於SUS 2011的COP第14.3.6節), PS.S2, BS EN 1011-1, BS EN 1011-2	Laboratory Testing Procedure 實驗室測試步驟 BS EN 1011-1 & BS EN 1011-2	A1	-	W1	HW1	W3	RISC
d	Hot-dip Galvanize - Hot-rolled / Hot-finished sections - 熱軋/熱加工型材 - Cold formed sections - 冷成型材	Each Batches returned from Galvanizing Factory 鍍鋅廠返回的每批產品	Lab procedure 實驗室程序 ISO 2808 / ISO2178 / ISO3682	(HR/HR) BS EN ISO 1461 (CF) BS EN 10143, BS EN 10346	Table 3 of BS EN ISO 1461 BS EN ISO 1461的表3 - Min. coating thickness and Mass on samples 最小的鍍鋅塗層厚度和質量	A1	-	W1	HW1	W3	RISC
4.3	<b>Fabrication and Assembly 生產及安裝</b>										
a	Assembly (Main Assembly) 安裝 (主安裝) - Setting Out / Level / Verticality - 尺寸/水平/垂直度	Prior to Connection 連接之前	Measure and Visual Inspection 測量和目測	Approval Shop Drawing Supplier's docs. "Product Identification & Traceability Control Procedure" and processing drawings, steel structure tolerance dimension checklist. 審批生產圖紙 供應商的文件, "產品識別和追溯控制程序" 和加工圖紙, 鋼結構公差尺寸控制表	Comply with Approved Drawings 符合批准的圖紙 - Tolerance : BS5606, Clause 15.11 and 15.12 if HKCSUS 公差: BS5606, 第15.11和15.12條 (HKCSUS)	A1	-	W1	W2	W3	
b	Welding Test 焊接實驗			Supplier's docs. "Welder Register", "Welding Quality Manual & WPQR", "WPS" 供應商文件, "焊接登記", "焊接質量手冊和WPQR", "WPS"							
			Visual inspection by a suitably qualified person in factory 由工廠合格人員目測	ADV-36(Section 14.3.6 of COP for SUS 2011), PS.S2, BS EN ISO 17637(VT), ADV-36 (適用於SUS 2011的COP第14.3.6節), PS.S2, BS EN ISO 17637 (VT),	"All welds - 100% Visual Inspection "所有焊接-100%外觀檢查	A1	-	W1	HW1	W3	RISC
	- Hot-rolled / Hot-finished sections - 熱軋/熱加工型材	Every Weld Joints 每個焊接接頭	NDT by Laboratory 實驗室無損檢測	ADV-36(Section 14.3.6 of COP for SUS 2011), BS EN ISO 17638 (MPI), BS EN ISO 17640 (UT) ADV-36 (適用於SUS 2011的COP第14.3.6節), BS EN ISO 17638 (MPI), BS EN ISO 17640 (UT)	Refer to Laboratory Testing Procedure FPBW and FSBW - 100%UT and 100%MPI 請參考實驗室測試步驟FPBW和FSBW-100%UT和100%MPI PPBW and FW with leg length>12mm - 20%UT and 20%MPI FW with leg length <=12mm - 10%MPI 焊腳長>12mm的PPBW和FW-UT的20%和MPI <20mm, 焊腳長<=12mm的FW-10%MPI	A1	-	W1	HW1	W3	RISC
	- Cold Formed sections - 冷成型材	Every Weld Joints 每個焊接接頭	Visual and NDT by Laboratory 目測和實驗室無損檢測	ADV-36(Section 14.3.6 of COP for SUS 2011), PS.S2, BS EN 1011-1, BS EN 1011-2 ADV-36 (適用於SUS 2011的COP第14.3.6節), PS.S2, BS EN 1011-1, BS EN 1011-2	Laboratory Testing Procedure 實驗室測試步驟 BS EN 1011-1 & BS EN 1011-2	HA1	-	W1	HW1	W3	RISC
c	Bolt and Nut Connection for Pre-fabricated Façade Panel 預製幕牆的螺栓和螺母連接	Connection Members 連接件	Measure and Visual Inspection 測量和目測	PS.S2, BS 4190, BS 4320, Approved Drawing批准圖紙	Comply with approved drawings 符合批准的圖紙	W2	A1	W1	W2	W3	
d	Shear Stud 剪力釘	Check during works 工作時檢驗	Visual and Bend Test by Laboratory 實驗室視覺和彎曲測試	PS.S2 - CL.9.8., BS EN ISO 13918, BS EN ISO14555, HKCSUS2011 - CL.14.3.7.3	Laboratory Testing Procedure 實驗室測試步驟 BS EN ISO 13918 100% Visual and 5% Bend Test (15 Degree Bend test) 100%目測和5%彎曲測試 (15度彎曲測試)	HA1	-	W1	HW1	W3	RISC
e	Surface Repairs / Welding Main Assembly 表面維修/焊接安裝										

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						MIC Supplier 提供供應商	Sub contractor (Facade) 分包商(幕牆)	Contractor 承建商	RSE Rep. 註冊結構工程師代表	AP Rep. 認可人士代表	
	- Repair works 維修工作	Damage / Non-conformance 損壞/不合格	Surface Treatment Procedure 表面處理程序	WPS, "Surface Treatment Procedure (painting)" WPS, "表面處理程序(油漆)"	Repairs (if applicable) meet requirements 維修(如適用)符合要求	A1	-	W1	W2	W3	
	- Zinc-rich paint 含鋅的油漆	After application to Damaged, Galvanizing Surface 應用於損壞的鍍鋅表面後	Measure and Visual Inspection 測量和目測	PS S2, BS 4652, BS EN ISO 12944-5, Supplier's doc. "Surface Treatment Procedure (painting)" PS S2, BS 4652, BS EN ISO 12944-5, 供應商的文件"表面處理程序(油漆)"	200µm thick 200µm 厚	A1	-	W1	W2	W3	
4.4	Slab Construction in Modular and part of Corridor 樓道和樓分處層附設施工										
	- Steel Decking Formwork (Bondek) 鋼樓板 (Bondek)	Each Batch / Check prior to Works 每批/開工前檢驗	Measure and Visual inspection 測量和目測	PS.S1	- Comply with approved material submission and catalogue 符合批准的材料提交和目錄 - fixed to structural steel supports as specified by the manufacturer and as shown on the drawings 按說明書固定並按圖紙所示固定在結構鋼安裝上	A1	-	W1	W1	W3	
	- Rebar Fixing, Starter bar 鋼筋綁扎, 端頭鋼筋	Every Pour 每倉	Measure and Visual inspection 測量和目測	Construction Drawings 施工圖紙	- Comply with Construction Drawings 符合施工圖	H/A1	-	W1	H/W1	W3	RISC
	- General Cleaning 一般清理	Every Pour 每倉	Measure and Visual inspection 測量和目測	Construction Drawings 施工圖紙	- Comply with Construction drawings 符合施工圖	H/A1	-	W1	W3	H/W1	RISC
	- Concrete Compressive Strength - Cube Test 混凝土抗压强度-立方體測試	Every Pour, no less than every 25m3 每倉, 不少於25立方米	Laboratory Test 實驗室測試	PS.S1, CS1	All test specimens shall comply with the requirement of CSI 所有試樣應符合CSI的要求	R	-	R	R	R	
5	Final Inspection / Trial Assembly 最終檢查/試組裝										
5.1	Final Check-up for Modular Structural Size and Trial Assembly 模塊結構尺寸和試組裝的最終檢查	Each Modules / Prior to interior fitting out and ESM works 每個模塊/在進行室內裝修和擴電工程之前	Visual check. 目測	Approved Shop Drawing 已批准的生產圖紙	- Comply with Approved Drawing 符合批准的圖紙 - Fit the fixed spot at fabricated factory - 在生產工廠放好定位 - Tolerance: BS5606, Clause 15.11 and 15.12 of HKCSUS 公差: HKCSUS的BS5606, 第15.11和15.12條	H/A1	-	H	H/W1	W3	RISC

**Legends of Inspection Requirement:**

**檢驗要求圖例說明:**

H: Hold Point

H: 停止點

A1: 100% implementation of activity/testing

A1: 100% 採取項目/檢驗

A2: Random implementation of activity/testing

A2: 隨機採取項目/檢驗

R: Review of Documentation

R: 文件審核

W1: 100% Witness of activity/testing

W1: 100% 見證項目/檢測

W2: Random witness of activity/testing

W2: 隨機見證項目/檢測

W3: Witness of activity/testing upon request by COW

W3: 應工程監督要求見證項目/檢測

RISC: Request for inspection & survey check

RISC: 要求檢查/調查

MIC Supplier:

提供供應商

Sub contractor (Facade):

分包商(幕牆)

Contractor:

承建商:

RSE Rep.:

註冊結構工程師代表:

AP Rep.:

認可人士代表:

PS.S1: Particular Specification - Structural Concrete PS.S1: 特殊規格-結構混凝土

PS.S2: Particular Specification - Structural Steelwork PS.S2: 特殊規格-結構鋼製品

# APPENDIX A2 – TYPICAL INSPECTION AND TEST PLAN FOR ARCHITECTURAL WORK FOR A MIC PROJECT USING STEEL MODULES

Task No.	Task Description	Revision:		Specification/Reference Documents	Acceptance Criteria	Date:						Remarks
		Timing	Type of Inspection			MiC Supplier	Sub contractor (Facade)	Sub contractor (E&M)	Contractor	AP Rep.	RSE Rep.	
1.0	Acceptance of ITP ITP驗收	Review & check prior to Works 開工前審核/核對	Review & Wet Sign 審核和簽收	1812-DC-IF-0001.2	ITP reviewed by all parties and accepted to use in Project 各方通過審核並同意該專案使用的ITP	R	R	R	R	R	R	
2.0	Documentation review 檔案審核											
2.1	Review & verify architectural and fitout Construction Issue drawings 審核以及確認建築以及裝修批發圖紙	Review & check prior to Works 裝修工作開始前	Visual check 目測	Up-to-date project drawing register Approved project drawings 最新圖紙登記表專案批發圖紙	Ensure all drawings are approved 確認所有圖紙已批發	R	R	R	R	R	R	
2.2	Review & verify workshop Work Method Statement 檢查及確認作業指導書	Review & check prior to Works 裝修工作開始前	Visual check 目測	Method Statement 施工作業指導書	Ensure approved method statement are communicated to the workforce and verified by senior Supplier's QC 確保Supplier's QC主管理設備師工作指導書交達	R	R	R	R	R	R	
3.0	Material verification 材料確認											
3.1	Review & verify material against material submission schedule 針對專業材料清單審核以及檢查材料	Review & check prior to Works 裝修工作開始前	Visual check 目測	Approved Material Submission Form and / or with material board 通過批准的材料表	Ensure the material supplied as per the material submission / method statement 確保材料符合材料審核及施工作業指導書	R	R	R	R	W1	W2 (2% min.)	
4.0	Module leveling and inspection 吊櫃調平檢驗											
4.1	Module leveling for fitout work 吊櫃調平	After module delivered to fitout site 吊櫃運往裝修現場後	Visual check/measure with RISC form record 以驗收表格記錄目測以及測量紀錄	Steel Leveling Work Method Statement 鋼架調平作業指導書	Tolerance ±5mm 公差±5mm	A1	N/A	N/A	HW1	W2 (10% min.)	H, W1	
4.2	Window and door opening dimensions 窗戶以及門開孔尺寸	After module delivered to fitout site 吊櫃運往裝修現場後	Visual check/measure with RISC form record 以驗收表格記錄目測以及測量紀錄	Design drawings 設計圖紙	To be checked against drawings 按照圖紙尺寸檢查	A1	N/A	N/A	HW1	HW1	N/A	
5.0	Setting Out 設線											
5.1	Center line of the room to be set out 房間的中心線放線	Check during works 過程中檢查	Visual check/measure with Internal checklist 以清單形式記錄目測以及測量紀錄	Approved Shop Drawing 設計圖紙	Staff to be used to check accuracy against center lines 使用尺規檢驗放線的精確度	A1	N/A	N/A	W2 (2% min.)	W2 (2% min.)	N/A	
5.2	Check critical dimensions including storey height, projections, balconies, utility platforms, A/C platforms, protective barriers, internal areas, exit routes, etc. 檢查關鍵尺寸(層高、設備平臺架、隔牆尺寸等)	Check during works 過程中檢查	Visual check/measure with RISC form record 以驗收表格記錄目測以及測量紀錄	Approved Shop Drawing 設計圖紙	Staff to be used to check accuracy against center lines 使用尺規檢驗放線的精確度	A1	N/A	N/A	W1	W1	W3	
5.3	Check critical dimensions for external dimension 檢查視室外部關鍵尺寸	Check during works 過程中檢查	Visual check/measure with RISC form record 以驗收表格記錄目測以及測量紀錄	Approved Shop Drawing 設計圖紙	Staff to be used to check accuracy against center lines 使用尺規檢驗放線的精確度	A1	N/A	N/A	W1	W1	W1	
5.4	Check conformity with general layout 檢查總體佈局是否符合要求	Check during works 過程中檢查	Visual check/measure with RISC form record 以驗收表格記錄目測以及測量紀錄	Approved Shop Drawing 設計圖紙	Comply with drawings 符合設計圖紙要求	A1	N/A	N/A	W1	W1	N/A	
6.0	Light Metal Framing & Thermal Insulation 輕鋼安裝以及保溫玻璃格安裝											
6.1	Fire lining to ceiling, wall and protection of structural elements 防火氣安裝	Check during works 過程中檢查	Visual check with RISC form record 以驗收表格形式記錄目測	Approved Shop Drawing BD PNAP ADV-36 Work Method Statement 設計圖紙及作業指導書	As per fire strategy requirements 符合防火策略、要求	A1	N/A	N/A	W1	W1	W2	
6.2	Light framing, Patresses & wool installation 輕鋼、加隔板及岩棉安裝	Check during works 過程中檢查	Visual check/measure with RISC form record 以驗收表格記錄目測以及測量紀錄	Approved Shop Drawing 設計圖紙	As per design drawings and manufacture recommendation 符合設計圖紙及按照製造商的建議安裝	A1	N/A	N/A	W1	W1	N/A	
7.0	Plasterboard installation 石膏板安裝											
7.1	Plasterboard layout and screw pattern 石膏板排布以及螺釘排布 石膏板頂部、底部邊緣控制	Check during works 過程中檢查	Visual check/measure with Internal checklist 以清單形式記錄目測以及測量紀錄	Design drawings Plasterboard Manufacturer's installation guide 石膏板設計圖紙 石膏板/製造商安裝指導	As per manufacturer's recommendation Gaps to be measured against Design drawings and fire strategy requirements 符合製造商的建議 繼續按照設計圖紙以及防火策略的要求進行測量	A1	N/A	N/A	W2 (2% min.)	W2 (2% min.)	N/A	
7.2	Joint treatment 接縫處理	Check during works 過程中檢查	Visual check with Internal checklist 以清單形式記錄目測	Manufacturer's installation guide 製造商安裝指導	As per manufacturer's recommendation 符合製造商的建議	A1	N/A	N/A	W2 (2% min.)	W2 (2% min.)	N/A	
8.0	Joinery 櫥木工											
8.1	Door frames, architraves and skirting (plus any other joinery items) 門框、收邊以及地腳線(以及其它櫥木工工序)	Check prior to fitting 安裝前檢查	Visual check with Internal checklist 以清單形式記錄目測	Design drawings & Work Method Statement 設計圖紙及作業指導書	As per Design drawings 符合設計圖紙	A1	N/A	N/A	W2 (2% min.)	W2 (2% min.)	N/A	
9.0	Decoration 裝飾											
9.1	Skimming & sanding, evenness of surfaces prior to painting 批灰打磨、刷漆之前確保表面平整度	Check during works 過程中檢查	Visual check with Internal checklist 以清單形式記錄目測	Work Method Statement 作業指導書	All holes etc. MUST be filled and sanded flat prior to any decoration commencing 在開始任何裝修之前所有的孔洞或其他瑕疵必須填補、打磨	A1	N/A	N/A	W2 (2% min.)	W2 (2% min.)	N/A	
9.2	Caulk application to skirting and architraves 填膠線和收邊條打了可上油漆膠	Check during works 過程中檢查	Visual check with Internal checklist 以清單形式記錄目測	Work Method Statement 作業指導書	All holes etc. MUST be filled and sanded flat prior to any decoration commencing Only white filler to be used. 在開始任何裝修之前所有的孔洞或其他瑕疵必須填補、打磨。只能使用白色膩子。	A1	N/A	N/A	W2 (2% min.)	W2 (2% min.)	N/A	



ITP Document No.:		Revision:		Date:								
Task No.	Task Description	Timing	Type of Inspection	Specification/Reference Documents	Acceptance Criteria	Inspection Requirement					Remarks	
						MIC Supplier	Sub contractor (Façade)	Sub contractor (E&M)	Contractor	AP Rep.		RSE Rep.
9.3	Top coats to walls, ceilings and woodwork 牆面、天花以及木構件的油漆	Check during works 過程中檢查	Visual check with Internal checklist 以清單形式記錄目測	Work Method Statement 作業指導書	As per Work Method Statement & Manufacturer's recommendations 符合作業指導書和製造商的建議	A1	N/A	N/A	W2 (2% min.)	W2 (2% min.)	N/A	
<b>10.0 Tiling 瓷磚</b>												
10.1	Waterproofing application 防水	Testing during works 過程中檢查	Refer to method statement	Approved Shop Drawing Manufacturer's installation guide and Work Method Statement 設計圖紙 製造商安裝指導以及作業指導書	Be measured according to design drawing and Manufacturer's installation requirement. Waterproofing 100% coverage to required areas and even surface with inspection form record 符合設計圖和製造商的安裝建議要求進行測量；防水100%覆蓋到需塗刷區域，表面平整；提供測試檢查記錄；	A1	N/A	N/A	HW1	HW1	N/A	
10.2	Tile installation and gap control Tile grout application 瓷磚安裝和縫隙控制 勾縫應用	Check during works 過程中檢查	Visual check/measure with Internal checklist 以清單形式記錄目測以及測量紀錄	Design drawings 設計圖紙	Internal corner gaps shall be 2mm (+1mm), Tile grout lines to be 2mm (+1mm) The finished grout should be uniform in colour, smooth and without voids, pinholes or low spots. Surface shall be clean and no damage. No void allowed. 陰角縫隙應為2mm(+1mm)，瓷磚縫隙2mm(+1mm)，勾縫顏色一致，平滑，無空鼓，針眼或凹坑，瓷磚表面應清潔，無破損，無空鼓	A1	N/A	N/A	W2 (2% min.)	W2 (2% min.)	N/A	
<b>11.0 Door and window installation 門以及窗戶安裝</b>												
11.1	Check minimum areas of glazing and openable areas of prescribed windows and windows for rooms containing soil or waste fitment and water tightness in accordance with PNAP APP-116 根據PNAP APP-116，檢查規定窗戶的最小玻璃面積和可開啟面積和水密性	Check before fabrication , upon material arrival and water test during work 來料檢查和過程檢查	Visual check/measure with RISC form record 以檢驗表格記錄目測以及測量紀錄	Approved Shop Drawing & Manufacturer's installation guide BD PNAP ADV-36 BD PNAP APP-116 設計圖紙以及製造商安裝指導	Comply with drawings with inspection form record 滿足設計圖紙要求和提供過程檢查記錄表格	N/A	A1	N/A	HW1	HW1	N/A	
11.2	Door installation & operability Door acoustic seal & ironmongery function Check construction and installation of proprietary products such as FRR of fire doors, smoke seal, self-closing device, pipe collars, etc. 門安裝和開關靈活性 門隔音密封條&五金件功能	Check during works 過程中檢查	Visual check/measure with Internal checklist 以清單形式記錄目測以及測量紀錄	Design drawings & Manufacturer's installation guide 設計圖紙以及製造商安裝指導	Square and plumb Door correctly latch into plate and snag free Lockable and key works Acoustic drop down seal to be checked for function and no gap under door when closed. 方正度和垂直度 門能與合理，順暢的開關 門下隔音密封條功能正常，關閉時沒有縫隙。	A1	N/A	N/A	W2 (2% min.)	W2 (10% min.)	N/A	
11.3	Surface finish off 表面完工	Check after Works 安裝後檢查	Visual check with Internal checklist 以清單形式記錄目測	Supplier's installation guide 供應商安裝指導	As per supplier's recommendation & acceptance prototype 符合供應商建議和已接受的樣板標準	A1	N/A	N/A	W1	W1	N/A	
11.4	Water test for curtain wall and cladding system	Check after Works 安裝後檢查	Refer to method statement	To be carried out according to standard AAMA 501.2	As per standard AAMA 501.2	N/A	A1	N/A	HW1	HW1	N/A	
<b>12.0 Furniture 傢俱</b>												
12.1	Furniture gap control Furniture secure and fixed to wall 傢俱縫隙控制 傢俱安裝、固定到牆上	Check during works 過程中檢查	Visual check/measure with Internal checklist 以清單形式記錄目測以及測量紀錄	Design drawings & Work Method Statement 設計圖紙 & 作業指導書	2mm to plasterboard walls and 1mm panel to panel Fix is secure, furniture is level and plumb 傢俱與牆面之間的縫隙2mm，傢俱板之間縫隙1mm 安裝緊固，傢俱水準，垂直	A1	N/A	N/A	W1	W1	N/A	
<b>13.0 Drainage 溢排水</b>												
13.1	Check provision of sanitary fittings	Check during works 過程中檢查	Visual check with Internal checklist 以清單形式記錄目測	Approved Shop Drawing BD PNAP ADV-36 設計圖紙&作業指導書	Comply with drawings	N/A	N/A	A1	W2 (2% min.)	W2 (2% min.)	N/A	
13.2	Check drainage works including material, dimensions, water seal trap, vent or anti-siphonic pipes and any other necessary components	Check during works 過程中檢查	Visual check with Internal checklist 以清單形式記錄目測	Approved Shop Drawing BD PNAP ADV-36 設計圖紙&作業指導書	Comply with drawings	N/A	N/A	A1	W2 (2% min.)	W2 (2% min.)	N/A	
<b>14.0 Lighting &amp; Mechanical Ventilation 電氣照明</b>												
14.1	Check provision of required mechanical ventilation and artificial lighting	Check during works 過程中檢查	Visual check with Internal checklist 以清單形式記錄目測	Approved Shop Drawing BD PNAP ADV-36 設計圖紙&作業指導書	Comply with drawings	N/A	N/A	A1	W2 (2% min.)	W2 (2% min.)	N/A	
<b>15.0 Final Inspection 最終</b>												

ITP Document No.:		Revision:				Date:						
Task No.	Task Description	Timing	Type of Inspection	Specification/Reference Documents	Acceptance Criteria	Inspection Requirement					Remarks	
						MIC Supplier	Sub contractor (Façade)	Sub contractor (E&M)	Contractor	AP Rep.		RSE Rep.
15.1	<p>Final inspection of the module to ensure that all fittings are secure. Loose items packaging and crates are secure in each module. Check that window openings have been effectively infilled with Tarpaulin.</p> <p>Check that the outside of the module is fully sealed with weatherproof materials and that there are no openings in the weatherproofing.</p> <p>Check to ensure that the unique module and building reference are attached to the module in a visible location prior to covering.</p> <p>Check to ensure that the centre lines are still clearly visible.</p> <p>整箱裝檢確所有配件安裝牢固 每箱內鬆散的物品打包並且紙板塞固 檢查窗戶開口已有效用防水布填充；檢查箱體週邊已經用防風雨材料完全密封並且防風雨材料無開口 在遮蓋前檢查確保每箱獨特的箱號以及建築參考材料附在顯眼位置，檢查確保中心線仍清晰可見</p>	Check once all works completed and defects rectified 所有施工完成並且問題整改後	Visual check with Internal checklist 以清單形式記錄目測	Work Method Statement Packing list Design drawings 作業指導書打包清單 設計圖紙	<p>All items secure for shipping; especially items which are hooked-on (MUST have a mechanical fixing so that they cannot dislodge during shipping)</p> <p>All items packaged securely and not liable to move during transportation. Module must be fully weathertight. Module number and centre lines MUST be visible after weatherproofing for transit is completed.</p> <p>所有物品安裝牢固可發運，尤其是用於掛、鉤的物品（必須有機械性的繫固，確保在發運的時候不會松出） 所有物品打包牢固，並在發運期間不易移動。箱體必須完全不透風雨。 在供運輸的防風雨措施完成後，箱體號碼以及中心線必須可見。</p>	H/A1	H/A1	H/A1	H/W1	W2 (2% min.)	W2 (2% min.)	

<p><b>Legends of Inspection Requirement:</b>  H: Hold Point  A1: 100% implementation of activity, testing  A2: Random implementation of activity, testing  R: Review of Documentation</p>	<p>W1: 100% Witness of activity, testing  W2: Random witness of activity, testing  W3: Witness of activity, testing upon request by COW  For % of W2, according to ADV-36, 1% minimum inspection is requirement</p>	<p>Supplier:  Sub contractor:  Contractor:  RSE Rep.:  AP Rep.:</p>
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## APPENDIX A3 – TYPICAL INSPECTION AND TEST PLAN FOR MECHANICAL WORK FOR A MIC PROJECT USING STEEL MODULES

Main Works Contract for								
Contract No 合同号:		ITP Document No.:		Revision:		Description of Goods:		
Sub-Contractor:				Module Type: Module No.:				
Task No.	Task Description 任务描述	Timing 时间	Type of Inspection 检查类型	Reference Documents 参考文件	Acceptance Criteria 接受标准	Inspection Requirement		
						Sub contractor (E&M)	Contractor	Inspection Agent
1.0	Acceptance of ITP ITP确认	Review & check prior to Works 开工前确认和检查	Review & Wet Sign 确认签名	MEP Sub-Contractor's-ITP-AC	ITP reviewed by all parties and accepted to use in Project 项目ITP经过各方确认, 认可使用	A1	R	R
2.0	Documentation review 文件确认							
2.1	Review & verify Mechanical Issue drawings 检查确认冷机发布的图纸	Review & check prior to Works 开工前确认和检查	Visual check 目测	Up-to-date project drawing register Approved project drawings 最新的项目图纸签名表	Ensure all drawings are at Construction Issue 确保所有的图纸是符合建造需要的	A1	R	R
2.2	Review & verify workshop Work Method 检查确认作业指导书和检验指导书	Review & check prior to Works 开工前确认和检查	Visual check 目测	Work Method Statement 作业指导书和检验指导书	Ensure WMS are communicated to the workforce and verified by senior MEP Sub-Contractor's QC 确保作业指导书和检验指导书传达给工人, 并且由高级QC确认	A1	R	R
2.3	Review and verify certificate of Registration of Electrical Worker 检查确认电业工程人员注册证明书	Review & check prior to Works 开工前确认和检查	Visual check 目测	R.E.W. Card 电业工程人员注册证	Ensure REW card is effective 确保电业工程人员注册证有效	A1	R	R
3.0	Material Verification 材料确认							
3.1	Review & verify material against project material list 根据项目材料列表审核和确认项目材料 BSAC-INOCEL-DE001 to DE002 BSAC-INOCEL-DE011 to DE018	Review & check prior to Works 开工前确认和检查	Visual check 目测	Approved materials submission, sample board and cMEP Sub-Contractor's catalogues / specification 已批准的物资文件, 物资样板和目錄 / 规格	Ensure the material supplied as per the approved materials submission, sample board and cMEP Sub-Contractor's catalogues / specification 确保材料供應滿足已批准的物资文件, 物资样板和目錄 / 规格	A1	W2	WH
4.0	Mechanical - 1st Fix inspection 冷机一次安装检查							
4.1	Install pipe / duct bracket 安装风管支架	Check during work 工作中检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书 / 已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
4.2	Fix split type unit flexible duct to neck of split type unit . Ensure mechanical fasteners and duct sealant are used 安装软管到分體機口, 确保使用了冷机加固件和风管密封胶	Checking before installing split type unit 安装分體機前检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书 / 已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
4.3	Install ventilation fan and ductwork 安装通风扇和风管	Check during work 工作中检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书/已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
4.4	Install fire damper / VCD assembly and fire stop according to manufacturers recommendations 根据厂家建议安装防火阀 / 排风阀和打防火胶	Check during work 工作中检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书 / 已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
4.5	Install refrigerant pipework from split type unit to outdoor 安装从分體機到室外的空调铜管	Check during work 工作中检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书 / 已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
4.6	Install condensation pipework from split type unit to outdoor 安装分體機到室外的冷凝管	Check during work 工作中检查	Visual check and measure 目测和测量	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书 / 已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
4.7	Install pipe sleeve passing through outdoor / pipe duct 安装过外墙 / 服务井套通	Check during work 工作中检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书 / 已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1

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Contract No 合同号:		ITP Document No.:		Revision:	Description of Goods:			
Sub-Contractor:				Module Type:				
				Module No.:				
Task No.	Task Description 任务描述	Timing 时间	Type of Inspection 检查类型	Reference Documents 参考文件	Acceptance Criteria 接受标准	Inspection Requirement		
						Sub contractor (E&M)	Contractor	Inspection Agent
4.8	Install concealed conduit 安装隐藏导管	Check during work 工作中检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书 / 已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
4.9	Wiring works 布线	Check during work 工作中检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书 / 已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
4.10	Install thermal insulation and fire stop refrigerant pipework 安装空调铜管保温棉和防火胶	Check during work 工作中检查	Visual / Record 目测 / 记录	Approved Work Method Statement 已批准的作业指导书	Design drawings & Work Method Statement 设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
<b>5.0 Mechanical - Pipework test 冷媒管道测试</b>								
5.1	Condensation pipework water flow test 冷凝管灌水测试	Check during work 工作中检查	Visual check / drain test 目测 / 灌水测试	Design drawings & approved installation details 设计图纸 & 已批准的详图	1. Ensure pipework slope ratio is correct 2. Ensure no leakage at full length of pipework 3. Acceptance criteria shall be shown on approved Work Method Statement 1. 确保管道的坡度正确 2. 确保管道全长没有泄露 3. 验收标准应显示在已批准的作业指导书中	A1	W1	W1/H
5.2	Copper pipe nitrogen pressure test. 铜管氮气压力测试	Check during work 工作中检查	Visual / Record 目测 / 记录 (Split A/C Test Form)	Approved Work Method Statement 已批准的作业指导书	1. Nitrogen pressure to achieve 3.8 MPa 2. Zero drop in pressure over test period 3. Acceptance criteria shall be shown on approved Work Method Statement 4. Approved test procedures with valid cert. for measurement equipment 1. 氮气压力测试3.8 MPa 2. 测试期间压力没有掉压 3. 验收标准应显示在已批准的作业指导书中 4. 已批准的测试流程和测量仪器有效证书	A1	W1	W1/H
5.3	Split type unit copper pipe vacuum test 分体机铜管抽真空测试	Check during work 工作中检查	Visual / Record 目测 / 记录 (Split A/C Test Form)	Approved Work Method Statement 已批准的作业指导书	1. Hold vacuum 1 hour to achieve min 2 Torr 2. Acceptance criteria shall be shown on approved Work Method Statement 3. Approved test procedures with valid cert. for measurement equipment 1. 1小时内保持最小2托压力 2. 验收标准应显示在已批准的作业指导书中 3. 已批准的测试流程和测量仪器有效证书	A1	W1	W1/H
5.4	Fire damper drop test for functional 防火阀功能试验	Check during work 工作中检查	Visual / Record 目测 / 记录	Approved Work Method Statement 已批准的作业指导书	Acceptance criteria shall be shown on approved Work Method Statement 验收标准应显示在已批准的作业指导书中	A1	W1	W1/H
<b>6.0 Mechanical - 2nd Fix inspection 冷媒二次安装检查</b>								
6.1	Install supply air grille / toilet air valve 安装格栅送风口/厕所排气阀	Check after painting 油漆后检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书/已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
6.2	Install controller wall box and wire. Confirm height and wiring installation. 安装墙面控制盒和布线, 确认高度和布线安装		Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书/已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
6.3	Check termination between leak detection and split type unit 检验检漏装置和分体机盘管之间的接线	Check during work 工作中检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书/已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
6.4	Install split type indoor unit. 安装分体机内机	Check during work 工作中检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书/已批准的详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1



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Contract No 合同号:		ITP Document No.:		Revision:	Description of Goods:			
Sub-Contractor:				Module Type:				
				Module No.:				
Task No.	Task Description 任务描述	Timing 时间	Type of Inspection 检查类型	Reference Documents 参考文件	Acceptance Criteria 接受标准	Inspection Requirement		
						Sub contractor (E&M)	Contractor	Inspection Agent
6.5	Install split type outdoor unit. 安装分體機外機	Check during work 工作中检查	Visual check 目测	Design drawings & Work Method Statement / approved details 设计图纸和作业指导书/已批准的安裝详图	1. Design drawings & Work Method Statement 2. Acceptance criteria shall be shown on approved Work Method Statement 1.设计图纸和作业指导书 2.验收标准应显示在已批准的作业指导书中	A1	W1	W1
<b>7.0 Mechanical - Testing &amp; Commissioning 冷氣测试</b>								
7.1	Electrical cabling insulation resistance test 电气绝缘测试	Before cover up of false ceiling 装天花板盖和假天花板之前	Visual check 目测 500v AC Test 500V直流电压 (LMCP Test Report)	Approved Work Method Statement 已批准的作业指导书	Approved test procedures with valid cert. for measurement equipment 已批准的测试流程并附测量仪器有效证书	A1	W1	W1/H
7.2	Ventilation fan functional test / performance test 通风扇功能 / 性能测试	Before cover up of false ceiling 装天花板盖和假天花板之前	Visual check 目测	1. Approved Work Method Statement 2. Provide WR1(A) 1. 已批准的作业指导书 2.提供WR1(A)	Approved test procedures with valid cert. for measurement equipment 已批准的测试流程并附测量仪器有效证书	A1	W1	W1
7.3	Split type unit functional test / performance test 分體機功能 / 性能测试	Before delivery of HK 交付香港之前	Visual check 目测	Approved Work Method Statement 已批准的作业指导书	Approved test procedures with valid cert. for measurement equipment 已批准的测试流程并附测量仪器有效证书	A1	W1	W1/H
7.4	Ventilation / air-conditioning control test 通风 / 冷气控制测试	Before delivery of HK 交付香港之前	Visual check 目测	Approved Work Method Statement 已批准的作业指导书	Approved Work Method Statement 已批准的作业指导书	A1	W1	W1/H
7.5	Noise measurement for the flat 噪音测试	Before delivery of HK 交付香港之前	Visual check 目测	Approved Work Method Statement 已批准的作业指导书	Approved test procedures with valid cert. for measurement equipment 已批准的测试流程并附测量仪器有效证书	A1	W1	W1/H
<b>8.0 Protection 保護</b>								
8.1	Protection of split type unit 分體機保護	Before delivery of HK 交付香港之前	Visual check 目测	Approved Method Statement 已批准的作业指导书	Approved Work Method Statement 已批准的作业指导书	A1	W2	W2
8.2	Protection of ductwork opening 风管开口保護	Before delivery of HK 交付香港之前	Visual check 目测	Approved Method Statement 已批准的作业指导书	Approved Work Method Statement 已批准的作业指导书	A1	W2	W2
<b>9.0 Work Completion 完工</b>								
9.1	WR1(A) for electrical installation 电气安裝完工证明书	Before delivery of HK 交付香港之前	Visual check 目测	Approved Method Statement 已批准的作业指导书	Approved Work Method Statement 已批准的作业指导书	A1	W1	W1
H: Hold Point A1: 100% implementation of activity, testing A2: Random implementation of activity, testing R: Review S: Statutory Inspection				W1: 100% Witness of activity/testing W2: Random witness of activity/testing W3: Witness of activity/testing upon requested by BSI / ABSI For % OF W2, according to ADV-36, 1% min. inspection is required. The Main Contractor proposes 5% inspection. Exact % subject to the approved method statement.				

## APPENDIX A4 – TYPICAL INSPECTION AND TEST PLAN FOR HYDRAULIC AND DRAINAGE WORK FOR A MIC PROJECT USING STEEL MODULES

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Contract No 合同号:		ITP Document No.:		Revision:	Description of Goods:			
Sub-Contractor:				Module Type:				
				Module No.:				
Task No.	Task Description 任务描述	Timing 时间	Type of Inspection 检查类型	Reference Documents 参考文件	Acceptance Criteria 接受标准	Inspection Requirement		
						Sub contractor (Mechanical)	Contractor	BSI/ABSI
1	Acceptance of ITP ITP 验收	Review & check prior to Works 开工前审核和核对	Review & Wet Sign 审核和签收		ITP reviewed by all parties and accepted to use in Project 各方审核和同意项目的ITP	A1	R	R
2.0 Documentation review 文件审核								
2.1	Review & verify Hydraulic & Drainage Services Construction Issue drawings 审核和确认给排水系统图纸	Review & check prior to Works 开工前审核和核对	Visual check 目测	Up-to-date project drawing register Approved project drawings 最新的项目图纸目录、批准的项目图纸	Ensure all drawings are at Construction Issue 确保所有图纸符合建筑标准	A1	R	R
2.2	Review & verify workshop Work Method Statement 审核和确认施工作业指导书	Review & check prior to Works 开工前审核和核对	Visual check 目测	Work Method Statement 施工作业指导书	Ensure WMS are communicated to the workforce and verified by senior MEP Sub-Contractor's QC 确保作业指导书由机电供应商高级QC审核通过，传达给工人	A1	R	R
2.3	Check registered plumbing worker card (检查认可水暖工人注册证)	Review & check prior to Works 开工前审核和核对	Visual check 目测	License 执照	Ensure Registered Plumbing Worker Card within the expiry date. 确保认可水暖工人注册证未到期	A1	R	R
3.0 Material verification 材料检验								
3.1	Review & verify material against project material list 根据项目材料列表审核和确认项目材料 BSPL-INOCEL-DE004 to DE006 BSPL-INOCEL-DE011 to DE014 BSPL-INOCEL-SC001 BDR-INOCEL-SC001 BDR-INOCEL-DE011 to DE014	Review & check prior to Works 开工前审核和核对	Visual check 目测	Approved material submission, sample board and catalogues/ specification 批准的物资文件、样板和目录/规格	Ensure the material supplied as per the approved materials submission, sample board and catalogues/ specification 确保材料供应满足已批准的物资文件、物资样板和目录/规格验收标准应显示作业指导书中	A1	W2	W2
3.2	Welding rod for copper pipework sample test 钢管焊接样品试验	Review & check prior to Works 开工前审核和核对	Visual check 目测	NA	ensure the material supplied as per the required standard 确保按照要求的标准供应材料	A1	W1	W1
4.0 Hot and Cold Services Installation Inspection								
4.1	Hot & cold pipework runs checked, and terminated at their correct positions and filling material which penetrated to wall 检查冷热水管布管和连接位置正确和填充材料渗透到墙壁	Check during Works 过程检查	Visual check/measure 目测/测量	Design drawings & manufacturer's recommendations 设计图纸和厂家建议	As per Design drawings 符合设计图纸	A1	W1	W1
4.2	Shower mixer valve securely fixed to patress 淋浴器牢固安装在加面板上	Check during Works 过程检查	Visual check/measure 目测/测量	Design drawings & manufacturer's recommendations 设计图纸和厂家建议	As per Design drawings 符合设计图纸	A1	W1	W1
4.3	Cistern and pipework all securely fixed and supported 所有水箱和管道牢固安装和支撑	Check during Works 过程检查	Visual check 目测	Design drawings & Work Method Statement 设计图纸和施工作业指导书	As per Design drawings 符合设计图纸	A1	W1	W1
4.4	Correct pipe size to all items 所有水管的尺寸正确	Check during Works 过程检查	Visual check/measure 目测/测量	Design drawings 设计图纸	As per Design drawings 符合设计图纸	A1	W1	W1
4.5	In riser - ball valves fitted to hot and cold services and to pipework serving cistern 在服务井中的冷热水系统和水箱系统安装球阀	Check during Works 过程检查	Visual check/measure 目测/测量	Design drawings 设计图纸	As per Design drawings 符合设计图纸	A1	W1	W1
4.6	W/C cistern correctly installed and secure 卫生间水箱安装牢固和正确	Check during Works 过程检查	Visual check/measure 目测/测量	Design drawings 设计图纸	As per Design drawings 符合设计图纸	A1	W1	W1
4.7	Angle valves, basin mixer, and flexible connections to basin fitted 角阀、洗手盆混合阀和洗手盆软管已安装	Check during Works 过程检查	Visual check/test 目测/测试	Design drawings & Work Method Statement 设计图纸和施工作业指导书	As per Work Method Statement 符合作业指导书	A1	W1	W1

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Sub-Contractor:				Module Type:				
				Module No.:				
Task No.	Task Description 任务描述	Timing 时间	Type of Inspection 检查类型	Reference Documents 参考文件	Acceptance Criteria 接受标准	Inspection Requirement		
						Sub contractor (Mechanical)	Contractor	BSI/ABSI
4.8	Shower flex and shower head fitted 淋浴软管和喷头安装	Check during Works 过程检查	Visual check/test 目测/测试	Design drawings & Work Method Statement 设计图纸和施工作业指导书	As per Work Method Statement 符合作业指导书	A1	W1	W1
<b>5.0 Hot &amp; Cold services Test &amp; Commissioning 冷热服务测试和调试</b>								
5.1	Hot and cold services to be subjected to hydraulic test of 6 bar for a period of 1 hour 冷热供水系统用10 bar的水压保压6小时	Check during Works 过程检查	Visual check/test 目测/测试	Design drawings & Work Method Statement 设计图纸和施工作业指导书	As per Work Method Statement 符合作业指导书	A1	W1	W1/H
5.2	WSD inspection of covered up pipework (水务署于隐蔽喉管之检查)	Check during Works 过程检查	Visual check/test 目测/测试	Design drawings & Work Method Statement 设计图纸和施工作业指导书	As per Work Method Statement 符合作业指导书	A1	W1	W1/H
5.3	Non-destructive test on pipe joints, lead check(非破坏性的喉管接驳位测试, 含铅反应)	Check during Works 过程检查	3M Lead check test sheet (3M 含铅反应测试)	Work Method Statement 施工作业指导书	As per Work Method Statement 符合作业指导书	A2	W2	W2/H
<b>6.0 Drainage Services Installation/Inspection 排水系统安装检查</b>								
6.1	DN100 W/C pipe fire sealant application 马桶DN100排水管口填充防火胶	Check during Works 过程检查	Visual check 目测	Design drawings & manufacturer's recommendations 设计图纸和厂家建议	As per Design drawings 符合设计图纸	A1	W1	W1
6.2	Correct pipe size from all items 所有管道尺寸正确	Check during Works 过程检查	Visual check/measure 目测/测量	Design drawings 设计图纸	As per Design drawings 符合设计图纸	A1	W1	W1
6.3	Gravity fall on pipe work 排水管坡度	Check during Works 过程检查	Visual check/measure 目测/测量	Design drawings 设计图纸	As per Design drawings 符合设计图纸	A1	W1	W1
6.4	Basin trap fitted to waste 洗手盆存水弯安装到排水管	Check during Works 过程检查	Visual check 目测	Design drawings & manufacturer's recommendations 设计图纸和厂家建议	As per Design drawings 符合设计图纸	A1	W1	W1
6.5	Pipes securely supported 水管支撑牢固	Check during Works 过程检查	Visual check/measure 目测/测量	Design drawings 设计图纸	As per Design drawings 符合设计图纸	A1	W1	W1
6.6	shower waste trap fitted 淋浴下水器安装	Check during Works 过程检查	Visual check/measure 目测/测量	Design drawings 设计图纸	As per Design drawings 符合设计图纸	A1	W1	W1
6.7	W/C and basin fitted 马桶和洗手盆安装	Check during Works 过程检查	Visual check 目测	Design drawings & manufacturer's recommendations 设计图纸和厂家建议	As per Design drawings 符合设计图纸	A1	W1	W1
6.9	Check level & secure of relevant fixtures 检查相关给排水配件的水平和安装牢固	Check during Works 过程检查	Visual & manual check 目测&动手测试	Design drawings & manufacturer's recommendations 设计图纸和厂家建议	Fixtures shall be secure and level; Location as per IFC drawing 配件安装牢固和水平; 安装位置和图纸一致。	A1	W1	W1
6.1	Test all sanitary fixtures to check all correct connection and operation 检查和测试所有的给排水配件正确连接和操作	Check during Works 过程检查	Visual check/test 目测/测试	Design drawings & manufacturer's recommendations 设计图纸和厂家建议	All valves, cistern, taps and other components shall be checked to confirm connection performance 所有球阀, 水箱, 水龙头和其他组件应检查确认连接性能	A1	W1	W1
<b>7.0 Drainage service Test &amp; Commissioning 排水服务测试和调试</b>								
7.1	Drain test (去水渠检查)	Check during Works 过程检查	Visual check/test 目测/测试	Design drawings & manufacturer's recommendations 设计图纸和厂家建议	All drainage pipes and fittings and other componets shall be check to confirm connecton performance. (所有去水渠喉管和配件, 和其他组件应检查确认连接性能)	A1	W1	W1/H
7.2	BD inspection/notification of drain pipes inside sunken prior to covered up (AP representatives endorsement), (于隐蔽的去水渠管道在被遮盖前需给屋宇署检查和通知, 并由认可的授权人士负责)	Check during Works 过程检查	Visual check/test 目测/测试	Design drawings & Work Method Statement 设计图纸和作业指导书	All drainage pipes and fittings and other componets shall be check to confirm connecton performance. (所有去水渠喉管和配件, 和其他组件应检查确认连接性能)	A1	W1	W1/H
7.3	Basin, shower waste, W/C and drainage services to be water tested 洗手盆、淋浴地漏、马桶和排水系统进行灌水测试	Check during Works 过程检查	Visual check/test 目测/测试	Work Method Statement 作业指导书	As per Work Method Statement 符合作业指导书	A1	W1	W1/H

Main Works Contract for								
Contract No 合同号:		ITP Document No.:		Revision:	Description of Goods:			
Sub-Contractor:			Module Type:					
			Module No.:					
Task No.	Task Description 任务描述	Timing 时间	Type of Inspection 检查类型	Reference Documents 参考文件	Acceptance Criteria 接受标准	Inspection Requirement		
						Sub contractor (Mechanical)	Contractor	BSI/ABSI
8.0	Protection 保护							
8.1	Protection before move to Hong Kong outlet/end shall be covered avoid ingree of dirt & dust 移至香港出口/末端前的保护应覆盖，避免污垢和灰尘	before delivery to Hong Kong 交付香港之前	Visual check/test 目测/测试	Work Method Statement 作业指导书	As per Work Method Statement 符合作业指导书	A1	W2	W2
H: Hold Point A1: 100% implementation of activity, testing A2: Random implementation of activity, testing R: Review S: Statutory Inspection						W1: 100% Witness of activity/testing W2: Random witness of activity/testing W3: Witness of activity/testing upon requested by BSI / ABSI For % OF W2, according to ADV-36, 1% min. inspection is required. Exact % subject to the approved method statement.		



## APPENDIX A5 – TYPICAL INSPECTION AND TEST PLAN FOR ELECTRICAL WORK FOR A MIC PROJECT USING STEEL MODULES

Main Works Contract for								
Contract No 合同号:		ITP Document No.:		Revision:		Description of Goods:		
Sub-Contractor:				Module Type:		Module No.:		
Task No.	Task Description 任务描述	Timing 时间	Type of Inspection 检查类型	Reference Documents 参考文件	Acceptance Criteria 接受标准	Inspection Requirement		
						Sub contractor (E&M)	Contractor	Inspection Agent
1	Acceptance of ITP ITP验收确认	Review & check prior to Works 开工前检查确认	Review & Wet Sign 核查 & 签字确认	MEP Sub-Contractor's-ITP-EL	ITP reviewed by all parties and accepted to use in Project 各方核查ITP并通过在项目中使用时。	A1	R	R
2.0 Documentation review 文件核查								
2.1	Review & verify Electrical Issue drawings 检验确认电气图纸	Review & check prior to Works 开工前检查确认	Visual check 目测	Up-to-date project drawing register Approved project drawings 更新的项目图纸簿 审核通过的项目图纸	Ensure all drawings are at Construction Issue 确认所有图纸满足建造内容条款	A1	R	R
2.2	Review & verify workshop Work Method Statement 检验确认相关作业指导书	Review & check prior to Works 开工前检查确认	Visual check 目测	MEP Sub-Contractor's Work Method Statement MEP Sub-Contractor's作业指导书	Ensure WMS are communicated to the workforce and verified by senior MEP Sub-Contractor's QC 确保作业指导书已同作业工人沟通并由MEP Sub-Contractor's高级QC确认。	A1	R	R
2.3	Check the Registered Electrical Worker Card 查看注册电气工程师卡	Review & check prior to Works 开工前检查确认	Visual check 目测	The Registered Electrical Worker Card license 注册电气工程师卡许可证	Ensure Registered Electrical Worker Card within the expiry date. 确保注册电气工程师卡未到期	A1	R	R
3.0 Material verification 材料确认								
3.1	Review & verify material against below project drawing: 检查确认以下项目图纸中的材料; BSEL-INOCEL-DE001 BSEL-INOCEL-DE002 BSEL-INOCEL-DE003 BSEL-INOCEL-DE004 BSEL-INOCEL-DE005	Review & check prior to Works 开工前检查确认	Visual check 目测	Approved materials submission, sample board and catalogues/specification 已批准的物资文件,物资样板和目錄/規格	Ensure the material supplied as per the approved materials submission, sample board and catalogues/specification 確保材料供應滿足已批准的物資文件,物資样板和目錄/規格驗收標準應顯示在作业指导书中。	A1	W2	W2
4.0 Electrical 1st Fix Inspection 电气一次布线								
4.1	Check cable type & size 检查电线型号及尺寸	Check during works 作业阶段检查	Visual check/measure 目测/测量	EMSD COP & approved Method Statement 機電工程署電力(線路)規例工作守則,和已批准的作业指导书	1. 2.5mm cable for power/1.5mm cable for lighting/10mm cable for water heater/6mm cable for AC unit 2. Acceptance criteria should be show on method statement 1. 电源线 (插座) 使用2.5平方毫米, 灯具线使用1.5平方毫米, 熱水器線使用10平方毫米, 空調機線使用6平方毫米。 2. 驗收標準應顯示在作业指导书中。	A1	W1	W1

Main Works Contract for								
Contract No 合同号:		ITP Document No.:		Revision:	Description of Goods:			
Sub-Contractor:				Module Type:				
				Module No.:				
Task No.	Task Description 任务描述	Timing 时间	Type of Inspection 检查类型	Reference Documents 参考文件	Acceptance Criteria 接受标准	Inspection Requirement		
						Sub contractor (E&M)	Contractor	Inspection Agent
4.2	Check conduit/bracket/flexible conduit/bonding, cable location & route, back box and MCB Board setting out/size 检查金属导管/支架/软管/接地线, 电缆的位置及布线路径, 底箱和微型断路器配電箱定位/尺寸	Check during works 作业阶段检查	Visual check/measure 目测/测量	EMSD COP & approved Method Statement 机电工程署電力(线路) 規例工作守則, 和已批准的作业指导书	1. Adaptable boxes should be provided immediately after every two bends, or after a bend plus a total maximum straight run of 10m or after a maximum straight run of 15m; 2. Cables should be drawn into a conduit by using drawn-in tape or steel wire of the appropriate size. If cable lubricant is used, it should not negatively interact with the cable they lubricate and should not increase the flame spread or decrease the fire resistant properties of the cable; 3. The neutral cable of a lighting final circuit using single core cables may be routed in the conduit direct to the lighting point without passing through the switch box; 4. Conduit bends should have an internal radius of at least 4 times the outside diameter of the conduit; 5. Acceptance criteria should be show on method statement. 1. 應在每兩個彎道後立即提供過路箱, 或在彎道加上總最大直線行程10米或最大直線行程15米後提供。 2. 應使用適當尺寸的拉入帶或鋼絲將電纜拉入導管。如果使用電纜潤滑劑, 它不應與它們潤滑的電纜產生負面的相互作用, 也不應該增加火焰蔓延或降低電纜的耐火性能。 3. 使用單芯電纜的照明終端電路的中性電纜, 可以在導管中直接佈線到照明點而不通過開關盒。 4. 管道彎曲的內半徑至少應為導管外徑的4倍。 5. 驗收標準應顯示在作业指导书中。	A1	W1	W1
4.3	Check quantity of cables at each outlet 检查电线在各出口的数量正确	Check during works 作业阶段检查	Visual check 目测	Design drawings/ approved drawing 设计图纸/ 已批准的图纸	1. Correct quantities installed at each outlet 2. Acceptance criteria should be show on method statement 1. 各个出线孔线束数量正确 2. 驗收標準應顯示在作业指导书中。	A1	W1	W1
4.4	Check conduits & draw cords are installed for data/TV cables etc 确认网络、电视的预埋管和拉线等已安装到位	Check during works 作业阶段检查	Visual check 目测	Design drawings/ approved drawing 设计图纸/ 已批准的图纸	1. Radius bends that draw cords can freely pulled through. All labels on both ends are correct and in English. 2. Acceptance criteria should be show on method statement 1. 拉线处半径保证能平顺拉线。拉线两端的标签英文且正确 2. 驗收標準應顯示在作业指导书中。	A1	W1	W1
4.5	Check filling fireproof material inside wall opening 确认牆壁填充防火物料已應用	Check during works 作业阶段检查	Visual check 目测	Design drawings/ approved drawing 设计图纸/ 已批准的图纸	1. Ensure filling fireproof material covered whole wall opening; 1. 確保填充防火材料覆蓋整個牆壁開口。	A1	W1	W1
5.0 Electrical 2nd fix Inspection 电气二次安装								
5.1	Check termination of all cables to switches/light fixtures 确认所有开关及灯具的接线质量	Check during works 作业阶段检查	Visual check 目测	Approval drawings & Work Method Statement 已批准的图纸 & 作业指导书	1. As per Manufacturer's instructions/Work Method Statement. Correct switching arrangement for lighting. 2. Acceptance criteria should be show on method statement 1. 按照生产指导/作业指导书。灯具正确的开关布置。 2. 驗收標準應顯示在作业指导书中。	A1	W1	W1
5.2	Check termination of all cables to DBs 确认所有连接到电箱电线的接线质量	Check during works 作业阶段检查	Visual check 目测	Approval drawings & Work Method Statement 已批准的图纸 & 作业指导书	1. Ensure proper cable connection; 2. Acceptance criteria should be show on method statement. 1. 確保接線穩固 2. 驗收標準應顯示在作业指导书中。	A1	W1	W1

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Contract No 合同号:		ITP Document No.:		Revision:	Description of Goods:			
Sub-Contractor:				Module Type:				
				Module No.:				
Task No.	Task Description 任务描述	Timing 时间	Type of Inspection 检查类型	Reference Documents 参考文件	Acceptance Criteria 接受标准	Inspection Requirement		
						Sub contractor (E&M)	Contractor	Inspection Agent
5.3	Check for correct ferrrels on cores inside sockets switches and inside the consumer unit 检查插座、开关和电箱内电线的号码管	Check during works 作业阶段检查	Visual check/measure 目测/测量	Approval drawings & Work Method Statement 已批准的图纸 & 作业指导书	1. As per Manufacturers instructions/work method statement. Correct labelling to what the drawings specifies 2. Acceptance criteria should be show on method statement. 1. 按照生产指导/作业指导书、图纸指定的正确标记。 2. 验收标准应显示在作业指导书中。	A1	W1	W1
5.4	Check all light fittings are secure/plumb and level 确认所有灯具安装牢固及水平	Check during works 作业阶段检查	Visual check/measure 目测/测量	Approval Work Method Statement 已批准的作业指导书	1. Work Method Statement; 2. Acceptance criteria should be show on method statement. 1. 作业指导书; 2. 验收标准应显示在作业指导书中。	A1	W1	W1
5.5	Check all faceplates are secure/plumb and level 确认所有面板安装牢固及水平	Check during works 作业阶段检查	Visual check/measure 目测/测量	Approval Work Method Statement 已批准的作业指导书	1. Work Method Statement; 2. Acceptance criteria should be show on method statement. 1. 作业指导书 2. 验收标准应显示在作业指导书中。	A1	W1	W1
5.6	Check Home Automation equipment installation 确认家居自动化设备安装质量	Check during works 作业阶段检查	Visual check/measure 目测/测量	Approval Work Method Statement 已批准的作业指导书	1. Work Method Statement; 2. Acceptance criteria should be show on method statement. 1. 作业指导书 2. 验收标准应显示在作业指导书中。	A1	W1	W1
<b>6.0 Pre-energisation testing 预通电测试</b>								
6.1	Continuity test of protective conductors 保护通路的连续性测试	Check during works 作业阶段检查	Visual/measure 目测/测量 (Elect. Test Form)	EMSD COP & T&C Method Statement 机电工程署电力(线路) 规程工作守则, 和检验&测试 作业指导书	1. Compliance to EMSD COP Code 21(Valid cert.); 2. Acceptance criteria should be show on method statement. 1. 符合机电工程署电力(线路) 规程工作守则21(有效證書); 2. 验收标准应显示在作业指导书中。	A1	W1	W1 / H
6.2	Continuity test of ring final circuit 环形最终电路導體的連續性测试	Check during works 作业阶段检查	Visual/measure 目测/测量 (Elect. Test Form)	EMSD COP & T&C Method Statement 机电工程署电力(线路) 规程工作守则, 和检验&测试 作业指导书	1. Compliance to EMSD COP Code 21(Valid cert.); 2. Acceptance criteria should be show on method statement. 1. 符合机电工程署电力(线路) 规程工作守则21(有效證書); 2. 验收标准应显示在作业指导书中。	A1	W1	W1 / H
6.3	Insulation Resistance Test 绝缘电阻测试	Check during Works 作业阶段检查	Measure test 测量 (Elect. Test Form)	EMSD COP & T&C Method Statement 机电工程署电力(线路) 规程工作守则, 和检验&测试 作业指导书	1. Compliance to EMSD COP Code 21(Valid cert.); 2. Acceptance criteria should be show on method statement. 1. 符合机电工程署电力(线路) 规程工作守则21; 2. 验收标准应显示在作业指导书中。	A1	W1	W1 / H
6.4	Polarity Test, Voltage Test 相序, 电压测试	Check during Works 作业阶段检查	Measure test 测量 (Elect. Test Form)	EMSD COP & T&C Method Statement 机电工程署电力(线路) 规程工作守则, 和检验&测试 作业指导书	1. Compliance to EMSD COP Code 21(Valid cert.) 2. Acceptance criteria should be show on method statement and approved. 1. 符合机电工程署电力(线路) 规程工作守则21(有效證書); 2. 验收标准应显示在已批准作业指导书中。	A1	W1	W1
6.5	Bonding test 接地线测试	Before ceiling cover and false ceiling 装天花板蓋和假天花板之前	Measure test 测量 (Elect. Test Form)	EMSD COP & approved T&C Method Statement 机电工程署电力(线路) 规程工作守则和已批准的检验&测试 作业指导书	Acceptance criteria should be show on method statement and approved. 验收标准应显示在已批准作业指导书中。	A1	W1	W1
6.6	Continuity test of Home Automation final circuit 家居自动化最终电路導體的連續性测试	Check during works 作业阶段检查	Visual/measure 目测/测量 (HA Test Form)	Home Automation System wiring diagram 家居自动化系統接線圖	Acceptance criteria should be show on method statement and approved. 验收标准应显示在已批准作业指导书中。	A1	W1	W1
<b>7.0 Live test 通电测试</b>								

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Contract No 合同号:		ITP Document No.:		Revision:		Description of Goods:		
Sub-Contractor:				Module Type:				
				Module No.:				
Task No.	Task Description 任务描述	Timing 时间	Type of Inspection 检查类型	Reference Documents 参考文件	Acceptance Criteria 接受标准	Inspection Requirement		
						Sub contractor (E&M)	Contractor	Inspection Agent
7.1	Earth loop impedance test 地线回路阻抗测试	Check during Works 作业阶段检查	Measure test 测量 (Elect. Test Form)	EMSD COP & T&C Method Statement 機電工程署電力(線路) 規例工作守則, 和檢驗&測試 作业指导书	Compliance to EMSD COP Code 21 符合機電工程署電力(線路) 規例工作守則21	A1	W1	W1/H
7.2	Operation of RCDs. Function test of all devices including protective devices& test RCD trip times RCD断路器的功能, 及RCD跳闸时间的测试	Check during Works 作业阶段检查	Measure test 测量 (Elect. Test Form)	EMSD COP & T&C Method Statement 機電工程署電力(線路) 規例工作守則, 和檢驗&測試 作业指导书	Compliance to EMSD COP Code 21. RCD having a rated residual operating current not exceeding specified current, MIC EL Layout (DE-00X) 符合機電工程署電力(線路) 規例工作守則21, 電流式漏電斷路器額定剩餘工作電流 不超過指明大小的電, 組合單位電氣圖 (DE-0X)	A1	W2	W2
7.3	Function test sockets 插座功能性测试	Check during Works 作业阶段检查	Measure test 测量 (Elect. Test Form)	EMSD COP & T&C Method Statement 機電工程署電力(線路) 規例工作守則, 和檢驗&測試 作业指导书	Compliance to EMSD COP Code 21 符合機電工程署電力(線路) 規例工作守則20	A1	W2	W2
7.4	Function test switches & luminaries 开关灯具功能性测试	Check during Works 作业阶段检查	Measure test 测量	EMSD COP & T&C Method Statement 機電工程署電力(線路) 規例工作守則, 和檢驗&測試 作业指导书	Compliance to EMSD COP Code 21. MIC EL Layout (DE-00X) 符合機電工程署電力(線路) 規例工作守則21, 組合單位電氣圖 (DE-0X)	A1	W2	W2
7.5	Home Automation function test	Check during Works 作业阶段检查	Measure test 测量	Home Automation System T&C Method Statement 家庭自動化系統規例工作守則, 和檢驗&測試 作业指导书	Compliance to Home Automation System specification 符合家庭自动化系統 规范要求	A1	W2	W2
7.6	Lux level measurement	Check during Works 作业阶段检查	Measure test 测量	Comply with CIBSE Lighting Guide 遵守CIBSE照明指南	Approved method statement/procedure 已批准的作业指导书/流程。	A1	W2	W2
<b>8.0 Protection 保護</b>								
8.1	Protection of computed Downlight Wall lighting 筒燈牆燈的保護	Before delivery of HK 交付香港之前	Visual check 目測	Approved Method Statement 已批准的作业指导书	Approved method statement/procedure 已批准的作业指导书/流程。	A1	W2	W2
<b>9.0 Work completion certificate 完工證明書</b>								
9.1	Certification of WR1A WR1A完工證明書	Before delivery of HK 交付香港之前	Visual check 目測	Signed Form WR1(A) 已簽署的WR1(A)完工證明書	Signed Form WR1(A) 已簽署的WR1(A)完工證明書	A1	W1	W1
<p>H: Hold Point A1: 100% implementation of activity, testing A2: Random implementation of activity, testing R: Review S: Statutory Inspection</p> <p>W1: 100% Witness of activity/testing W2: Random witness of activity/testing W3: Witness of activity/testing upon requested by BSI / ABSI For % OF W2, according to A.DV-36, 1% min. inspection is required. Exact % subject to the approved method statement.</p>								



## APPENDIX B – A SUGGESTED NAMING CONVENTION FOR MIC/OFFSITE MODULES AND COMPONENTS

(Version: 0.3.1)<sup>16</sup>

### 1. General Requirements

It is highly recommendable to establish a naming convention for a Modular Integrated Construction (MiC)/offsite project when the project is commenced. Such naming convention will bestow a qualified name to every component in the project and its digital representation (i.e., Building information model [BIM]). This good practice will help connect physical projects and digital BIM worlds to further enhance project information management throughout a project lifecycle ranging from design, manufacturing, logistics and supply chain, construction to operation & maintenance.

The naming convention below is formulated to support a suitable naming method for a particular project to facilitate documentation and management of its important information, including Project Name, Location, Module, Component, Production, Transportation, and Installation.

Here, a **name** is the unique identifier of the module/component in both the cyber world (e.g., building information models) and the physical world. It is the key to manage the project information throughout its design, construction, and operation & maintenance stages.

A **module** refers to a freestanding volumetric module (with finishes, fixtures, fittings, etc.) manufactured off-site and then transported to site for assembly.

A **component** (a.k.a. element) refers to an individual entity at a particular location and orientation within a module.

This naming convention needs to meet the following general requirements:

1. It should be easily followed in local construction practices.
2. It should comply with existing local standards (e.g., *CIC Production of BIM Object Guide General Requirements*, and *CIC BIM Standards – General (Version 2 – December 2020)*).
3. The names of MiC modules/components should be unique to differentiate themselves and allow retrieval of relevant project information.
4. The names of MiC modules/components should contain enough information that is understandable for professionals, laymen, and computers (i.e., machine-readable).
5. The names of MiC modules/components should contain concise information that could be organised systematically and logically in various fields.
6. Abbreviations are strongly recommended to avoid lengthy names. It is encouraged to adopt the existing resources on abbreviations, e.g., *Family Library Interchange Program (FLIP) Master Type List* provided by Autodesk Industry Advisory Board (AIAB) (<http://www.aiab.org/index.php/flip-guideline>).
7. It is recommended to use the underline ( \_ ) as delimiters.
8. Each field should include only the following characters:

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<sup>16</sup> Prepared by Prof. W. Lu, Department of Real Estate and Construction, Faculty of Architecture, The University of Hong Kong. Email: wilsonlu@hku.hk

- Uppercase letters (A to Z) from the ISO basic Latin alphabet.
- Lowercase letters (a to z) from the ISO basic Latin alphabet.
- Numbers (0 to 9).
- Underscore (\_), used only for separating fields within a name.
- Hyphen (-), used to separate each field further into subfields.
- Decimal point (.), used to display the floating numbers.

9. The following characters should be avoided:

- Special characters, including, but not limited to, (! “ , £ \$ % ^ & \* { } [ ] + = < > ? | \ / @ ' ~ # ~ ` ´ ).
- Spaces.

10. Pascal Case should be used to join separate words within naming fields.

## 2. Naming Convention

This section gives the naming convention for MiC modules and components.

		<b>Naming Convention in Multiple Lines</b>	<b>Field Codification</b>
<b>Basic Information</b>	<b>Project Information</b>	<Owner>_<Contractor>_<Sub-contractor>_<Manufacturer>	§ 3.1.1 - § 3.1.4
		<Project code>_<Project location>_<Project type>	§ 3.1.5 - § 3.1.7
	<b>Location Information</b>	<Block>_<Zone>_<Floor>_<Unit>	§ 3.2.1 - § 3.2.4
	<b>Module Information</b>	<Module ID>_<Module type>_<Module function description>_<Module structure type>_<Module dimensions>_<Module weight>_<Module quality inspection and test history and result>	§ 3.3.1 - § 3.3.7
	<b>Component Information</b>	<Component type>_<Component subtype>_<Component description>_<Sequential number>	§ 3.4.1 - § 3.4.4
		<Component classification code>_<Component material>_<Component quality inspection and test history and result>	§ 3.4.5 - § 3.4.7
<b>Additional Information</b>	<b>Production Information</b>	<Factory code>_<Product acceptance date>	§ 3.5.1 - § 3.5.2
		<Mold type>_<Mold ID>_<Product sequential number>	§ 3.5.3 - § 3.5.5
	<b>Transport Information</b>	<Transporter>_<Pickup location>_<Delivery location>_<Loading order>_<Unloading order>	§ 3.6.1 - § 3.6.5
		<Transportation method>_<Protection method>_<Custom clearance status>	§ 3.6.6 - § 3.6.8

	<b>Installation Information</b>	<On-site installation date>	§ 3.7.1
		<Installation crew>_<Inspector>_<Installation quality inspection and test history and result>	§ 3.7.2 - § 3.7.4

An example is given below.

		<b>Example</b>	<b>Explanation</b>
<b>Basic Information</b>	<b>Project information</b>	MMM_NNN_XXX_YYY	<ul style="list-style-type: none"> <li>• MMM (Owner)</li> <li>• NNN (Contractor)</li> <li>• XXX (Subcontractor)</li> <li>• YYY (Manufacturer)</li> </ul>
		WCH_SO_PB	<ul style="list-style-type: none"> <li>• WCH: Wong Chuk Hang Project (Project code)</li> <li>• SO: Southern District (Project location)</li> <li>• PB: Public project (Project type)</li> </ul>
	<b>Location information</b>	B1_H_10_A1	<ul style="list-style-type: none"> <li>• B1: Block 1 (Block)</li> <li>• H: High zone (Zone)</li> <li>• 10: 10<sup>th</sup> floor (Floor)</li> <li>• A1: Unit labeled with “A1” (Unit)</li> </ul>
	<b>Module information</b>	27_A1S1_KIT_SteelFrame_8400x2500x3000_W2.237T_P	<ul style="list-style-type: none"> <li>• 27 (Module ID)</li> <li>• A1S1: Module type with “A1” architectural layout and “S1” structural frame (Module type)</li> <li>• KIT: Kitchen (Module function description)</li> <li>• SteelFrame: Steel-framed module (Module structure type)</li> <li>• 8400x2500x3000: Length, width, and height of the module (Module dimensions)</li> <li>• W2.237T: Module weight of 2.237 tonnes (Module weight)</li> <li>• P: Pass the quality inspection and test (Module quality)</li> </ul>

			inspection and test history and result)
	<b>Component information</b>	DOR_SGL_900x2100_001	<ul style="list-style-type: none"> <li>• DOR: Door (Component type)</li> <li>• SGL: Single panel (Component subtype)</li> <li>• 900x2100: Length and width of the component (Component description)</li> <li>• 001(Sequential number)</li> </ul>
		23-171115_Wood_P	<ul style="list-style-type: none"> <li>• 23-171115 (Component classification code)</li> <li>• Wood (Component material)</li> <li>• P: Pass the quality inspection and test (Component quality inspection and test history and result)</li> </ul>
<b>Additional Information</b>	<b>Production information</b>	F01_2018-07-05	<ul style="list-style-type: none"> <li>• F01: Factory ID (Factory code)</li> <li>• 2018-07-05 (Product acceptance date)</li> </ul>
		MD1_01_010	<ul style="list-style-type: none"> <li>• MD1 (Mold type)</li> <li>• 01 (Mold ID)</li> <li>• 010 (Product sequential number)</li> </ul>
	<b>Transport information</b>	ZZZ_GD_HK_01_08	<ul style="list-style-type: none"> <li>• ZZZ (Transporter)</li> <li>• GD: Guangdong (Pickup location)</li> <li>• HK: Hong Kong (Delivery location)</li> <li>• 01 (Loading order)</li> <li>• 08 (Unloading order)</li> </ul>
		Sea_SP_P	<ul style="list-style-type: none"> <li>• Sea: Sea transportation (Transportation method)</li> <li>• SP: Soft packing (Protection method)</li> <li>• P: Status of custom clearance - pass (Custom clearance status)</li> </ul>
	<b>Installation Information</b>	2018-06-28	<ul style="list-style-type: none"> <li>• 2018-06-28 (On-site installation date)</li> </ul>

		AAA_BBB_P	<ul style="list-style-type: none"> <li>• AAA (Installation crew)</li> <li>• BBB (Inspector)</li> <li>• P: Pass the installation quality inspection and test (Installation quality inspection and test history and result)</li> </ul>
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Figure B.1 gives an example of naming a door component in a module.

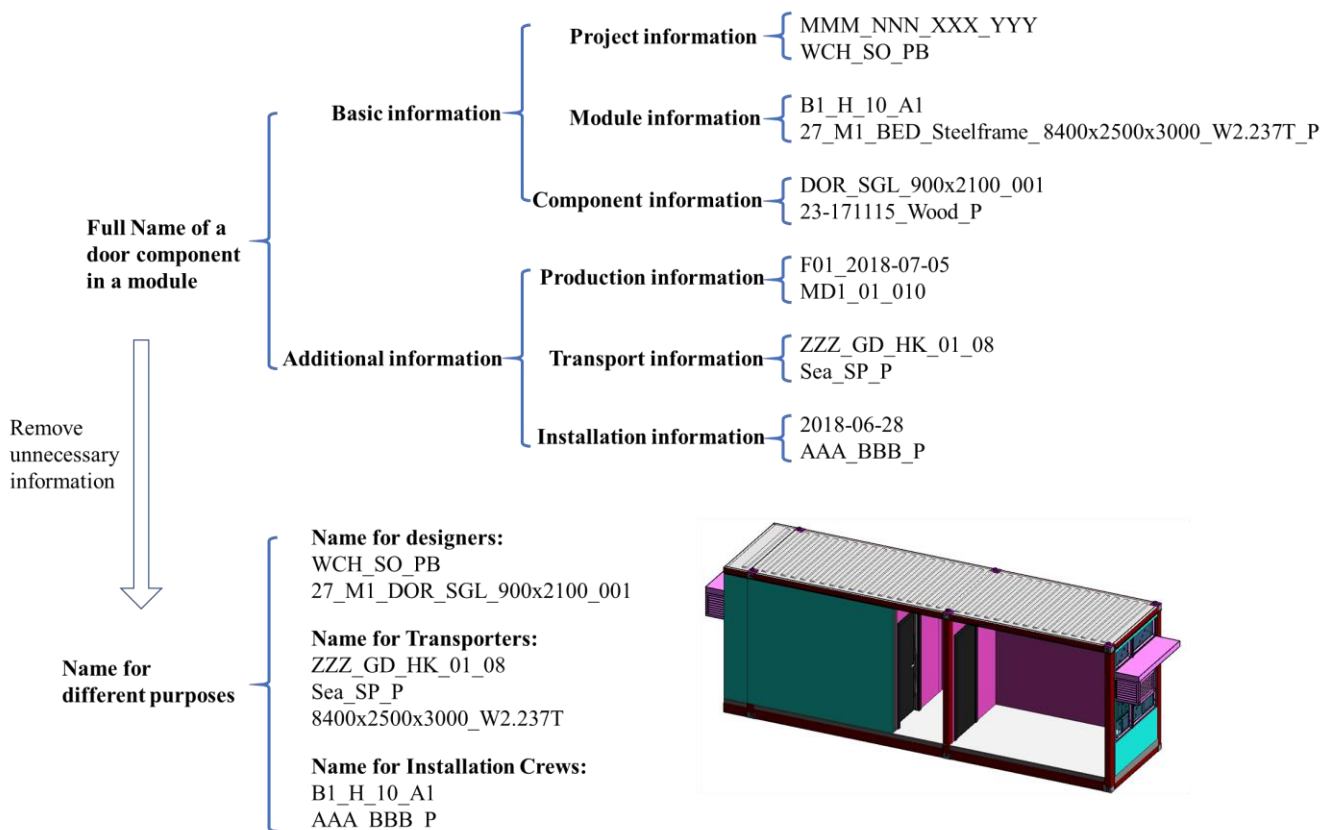


Figure B.1 The illustration of name usage

### 3. Field Codification

#### 3.1 Project Information

##### 3.1.1 Owner (3 characters)

A unique identifier should be used to indicate the owner (or client) of the project. The Agent Responsible Code (ARC) is recommended to be used if appropriate. See *CAD Standard for Works Projects - Agent Responsible Codes* for more information ([https://www.devb.gov.hk/filemanager/en/content\\_203/CSWP\\_ARC\\_V3.09.00.pdf](https://www.devb.gov.hk/filemanager/en/content_203/CSWP_ARC_V3.09.00.pdf)).

### 3.1.2 Contractor (3 characters)

A unique identifier should be used to indicate the main contractor of the project. The Agent Responsible Code (ARC) is recommended to be used if appropriate. See *CAD Standard for Works Projects - Agent Responsible Codes* for more information ([https://www.devb.gov.hk/filemanager/en/content\\_203/CSWP\\_ARC\\_V3.09.00.pdf](https://www.devb.gov.hk/filemanager/en/content_203/CSWP_ARC_V3.09.00.pdf)).

### 3.1.3 Subcontractor (3 characters)

A unique identifier should be used to indicate the subcontractor of the project. The Agent Responsible Code (ARC) is recommended to be used if appropriate. See *CAD Standard for Works Projects - Agent Responsible Codes* for more information ([https://www.devb.gov.hk/filemanager/en/content\\_203/CSWP\\_ARC\\_V3.09.00.pdf](https://www.devb.gov.hk/filemanager/en/content_203/CSWP_ARC_V3.09.00.pdf)).

### 3.1.4 Manufacturer (3 characters)

A unique identifier should be used to indicate the manufacturer of the project. The Agent Responsible Code (ARC) is recommended to be used if appropriate. See *CAD Standard for Works Projects - Agent Responsible Codes* for more information ([https://www.devb.gov.hk/filemanager/en/content\\_203/CSWP\\_ARC\\_V3.09.00.pdf](https://www.devb.gov.hk/filemanager/en/content_203/CSWP_ARC_V3.09.00.pdf)).

### 3.1.5 Project Code (3 characters)

The project code should be a unique identifier, which could be derived from the consultancy agreement or construction contract.

### 3.1.6 Project Location (1 characters)

The project location should be the district where the project resides. The 2019 District Council Ordinary Election Constituency Boundaries should be referenced to indicate the project location.

<b>District</b>	<b>Code</b>
Central & Western	A
Wan Chai	B
Eastern	C
Southern	D
Yau Tsim Mong	E
Sham Shui Po	F
Kowloon City	G
Wong Tai Sin	H
Kwun Tong	J
Tsuen Wan	K
Tuen Mun	L
Yuen Long	M
North	N
Tai Po	P
Sai Kung	Q
Sha Tin	R
Kwai Tsing	S
Islands	T

### 3.1.7 Project Type (2 characters)

The project type is used to show whether the project is a public or a private funded project.

<b>Project Type</b>	<b>Abbr.</b>
Public funded	PB
Private funded	PV

## 3.2 Location Information

### 3.2.1 Block (2 characters)

Block should be a capital letter “B” followed by a sequential number, e.g., “B1” to distinguish the different blocks in the project.

### 3.2.2 Zone (2 characters)

Zone (or volume) is to consider the load bearing capacity of the modules. The modules on the lower floors require a higher load bearing capacity. Floors with modules of the same load bearing capacity are grouped into one zone or volume. It is recommended to label the zone or volume as “HG” (High), “MD” (Middle), “LW” (Low), “ZZ” (all zones or volumes), and “XX” (no zones or volumes applicable).

### 3.2.3 Floor (2 characters)

Floor should be a sequential number, e.g., “10” to distinguish the different floor levels in the block. In addition, the generic codes are recommended, including “ZZ” (all floors) and “XX” (no floor applicable).

### 3.2.4 Unit (2 characters)

Unit should indicate the specific unit or flat on a certain floor. It can be named using a capital letters, numbers, or their combinations, such as “01” or “A1”. In addition, the generic codes are recommended, including “ZZ” (all units) and “XX” (no unit applicable).

## 3.3 Module Information

### 3.3.1 Module ID (2 characters)

Module ID should indicate the specific location on a certain floor. Module ID can be named in sequential number.

### 3.3.2 Module Type (4 characters)

Module type should uniquely distinguish the type of a module in a project. Modules in a project can be classified into different types in terms of architectural and structural fabrication. The same structural type can be used for various architectural types, and vice versa. For example, Type “S1” structural frames can be used for Type “A1” and “A2” modules of different architectural layout. Each architectural and structural type should be labeled with a capital letter followed by a sequential number, e.g., “S1” or “A1”. The module type could be represented by the combination of the architectural and structural type codes, e.g., “A1S1”. Sometimes the module type could only be marked with either the architectural or structural type codes, e.g., “A1” or “S1”, which is enough to uniquely distinguish the module type.

### 3.3.3 Module Function Description (3 characters)

Module function description should indicate the functional usage of the module. The following example codes illustrate how these could be applied.

<b>Functional Usage</b>	<b>Abbr.</b>
Alcove	ALC
Amenity	AME
Art Gallery	ART
Banking Hall	BAN
Bathroom	BAT
Bedroom	BED
Billiard Room	BIL
Boiler Room	BOI
Bowling Alley	BOW
Cafe	CAF
Childcare Room and Kindergarten	CHI
Church	CHU
Cinema	CIN
Classroom	CLA
Cold Storage Room	CSR
Computer Room	COM
Concert Hall	CCH
Conference Room	CFR
Corridor	COR
Dance Room	DAN
Discotheque	DIS
Double Garage	DBG
Double Bedroom	DBR
Dining Room	DIN
Double Lock-up Garage	DLG
Electrical Room	ELE
Ensuite Bathroom	ENS
Entrance, Entry	ENT
Fan Room	FAN
Garage	GGE



General Storage Room	GSR
Gymnasia	GYM
Ice Rink	ICE
Karaoke Establishment	KRK
Kitchenette	KET
Kitchen	KIT
Laboratory	LAB
Lavatory	LAV
Library with Book Storage	LBS
Lounge Dining Room	LDR
Laundry	LAU
Living Room	LIV
Lounge	LOU
Lock-up Garage	LUG
Maisonette	MAI
Massage Room	MAS
Master Bedroom	MBR
Medical Consulting Room	MCR
Medical Treatment Room	MTR
Motor Room	MOT
Museum	MUS
Office for General Use	OGE
Operating Theatre in Hospitals	OTH
Plant Room	PLA
Power Supply Room	PSR
Projection Room	PRO
Public Hall	PUB
Reading Room	REA
Refuse Storage Room	RSR
Room	ROM
Sauna Room	SAU
Shopping Store	SHS
Staircase	STA

Store	STO
Television Studio	TEL
Terrace	TCE
Theatre	THE
Verandah	VER
Waiting Room	WAI
Walk-in Pantry	WPT
Ward	WAR
X-ray Room	XRR
Other	OTR

### 3.3.4 Module Structure Type (10 characters)

Module structure type should indicate the structure type of each module. An example is “SteelFrame”.

### 3.3.5 Module Dimensions (15 characters)

Module dimensions should indicate the size of the module in three dimensions, i.e., length, width, and height. The sizes should be displayed in the unit of millimeters. An example is “8400x2500x3000”, where “8400” refers to the length of the module, “2500” refers to the width of the module, and “3000” refers to the height of the module. They are concatenated by the character “x”, meaning the multiplication of three dimensions.

### 3.3.6 Module Weight (7 characters)

Module weight should be indicated for the arrangement of transportation and assembly. Module weight should begin with a capital letter “W”, followed by a weight value with three digits after the decimal point and a capital letter “T” (tonnes), e.g., W2.237T.

### 3.3.7 Module Quality Inspection and Test History and Result (1 character)

Module quality inspection and test history and result should indicate whether the module has passed the quality inspection and test. A capital letter “P” should be used if the module has passed the test. If the module fails the test, an integer should be used to show the number of times of re-testing, e.g., “1” or “2”.

## 3.4 Component Information

### 3.4.1 Component Type (3 characters)

Component type should indicate the general category based on the same classification system. Other classification systems could be used for description if necessary. Existing classification systems that can be used include OmniClass, Uniclass, UniFormat, IfcType, and others.

### 3.4.2 Component Subtype (3 characters)

Component subtype should indicate the next logical level of information to describe the component. This might vary greatly depending on the type of component and the kind of information one wishes to convey. The following example codes illustrate how this could be applied.

<b>Component Type</b>	<b>Component Subtype</b>	<b>Abbr.</b>
Column	Chamfered	CHF
	Concrete	CCR
	Metal Clad	MCD
	Rectangular	RCT
	Round	RND
	Wood Timber	WDT
	Other	OTR
Door	Asymmetric	ASM
	Bifold	BFD
	Bulkhead	BLK
	Cold Room	CRM
	Curtain Wall	CWL
	Double Acting	DBA
	Double Concealed	DBC
	Double	DBL
	Decorative	DCO
	Detention	DTN
	Entry	ETY
	Overhead	OVH
	Passage	PSG
	Revolving	RVL
	Sidelight	SDL
	Single	SGL
	Sliding	SLD
Other	OTR	
Window	Awning	AWN
	Casement	CSM
	Double Hung	DBH
	Fixed	FXD
	Grill	GLL
	Louver	LVR
	Single Hung	SGH
	Skylight	SKY
	Sliding	SLD
	Acoustic window	AWW
	Other	OTR
Floor	Architectural Floor	AFL
	Architectural Floor Finish	AFF
	On-Grade Slab	OGS
	Slope	SLP

	Structural Slab	SRS
	Transfer Structure (Transfer Plate, Truss)	TRN
	Slab Edge	SBE
	Sunken Wall	SKW
Roof	Basic Roof	BRF
	Fascia	FSC
	Cutters	GUT
	Roof Finish	RFF
	Roof Slab	RFS
	Roof Soffit	RSF
	Sloped Glazing	SGZ
	Other	OTR
Wall	Architectural Wall	AWL
	Architectural Wall_Finishes	AWF
	Architectural Partition	AWP
	Basement Wall	BSW
	Curb	CUB
	Diaphragm Wall, Retaining Wall	DWL
	Exterior Wall	EWL
	Furring Wall	FRW
	Guide Wall	GDW
	Interior Wall	IWL
	Precast Facade	CLD
	Screen Wall	SCW
	Slurry Wall	SLW
	Structural Wall	STW
	Curtain Wall	CUW
	Shopfront	SFT
	Stacked Wall	SCK
	Block Wall	BLW
Other	OTR	

#### 3.4.3 Component Description (10 characters)

Component description should indicate the supplementary information about the component, such as the dimensions information “900x2100”. This may vary among projects and components, and could be considered optional.

#### 3.4.4 Sequential Number (2 characters)

Sequential Number should be the ultimate differentiator to distinguish between the same components in the same module.

#### 3.4.5 Component Classification Code (9 characters)

The classification code of the component under the adopted classification system should be indicated, e.g., “23-170000”.

### 3.4.6 Component Material (10 characters)

Component material should indicate the main material contained in the component, e.g., “Concrete” or “Steel”.

### 3.4.7 Component Quality Inspection and Test History and Result (1 character)

Component quality inspection and test history and result should indicate whether the component has passed the quality inspection and test. A capital letter “P” should be used if the component has passed the inspection and test. If the component fails the test, an integer should be used to show the number of times of re-testing, e.g., “1” or “2”.

## 3.5 Production Information

### 3.5.1 Factory Code (3 characters)

One manufacturing company may have several factories dispersed in different geographical locations. The information to be included should clearly indicate in which factory the module/component has been produced. The ID or abbreviated name of the factory should be used, e.g., “F01”. The Agent Responsible Code (ARC) is also recommended to be used if appropriate. See *CAD Standard for Works Projects - Agent Responsible Codes* for more information ([https://www.devb.gov.hk/filemanager/en/content\\_203/CSWP\\_ARC\\_V3.09.00.pdf](https://www.devb.gov.hk/filemanager/en/content_203/CSWP_ARC_V3.09.00.pdf)).

### 3.5.2 Product Acceptance Date (10 characters)

Product acceptance date should indicate the acceptance date of the product. It should be in the form of “YYYY-MM-DD”, such as “2018-07-05”.

### 3.5.3 Mold Type (3 characters)

Mold type is to distinguish between different types of molds. Mold type could be in two capital letters “MD” followed by a sequential number, e.g., “MD1”.

### 3.5.4 Mold ID (2 characters)

The project may have multiple molds of the same type. Mold ID is to differentiate different individual molds within the same type. It can be a sequential number, e.g., “01”.

### 3.5.5 Product Sequential Number (3 characters)

Product sequential number is to label the product number produced by the same mold, e.g., “010”.

## 3.6 Transportation Information

### 3.6.1 Transporter (3 characters)

Multiple transporters (transportation companies) may be engaged in a single project. A unique identifier should be used to indicate every transporter employed under the project. The Agent Responsible Code (ARC) is recommended to be used if appropriate. See *CAD Standard for Works Projects - Agent Responsible Codes* for more information ([https://www.devb.gov.hk/filemanager/en/content\\_203/CSWP\\_ARC\\_V3.09.00.pdf](https://www.devb.gov.hk/filemanager/en/content_203/CSWP_ARC_V3.09.00.pdf)).

### 3.6.2 Pickup Location (2 characters)

Pickup location should indicate the beginning city of the transportation of the prefabricated products. It should be an abbreviation of the city's name, which is recommended by ISO3166-1 (*Codes for the representation of names of countries and their subdivisions – Part 1: Country codes*).

### 3.6.3 Delivery Location (2 characters)

Delivery location should indicate the end city of the transportation of the prefabricated products. It should be an abbreviation of the city's name, which is recommended by ISO3166-1 (*Codes for the representation of names of countries and their subdivisions – Part 1: Country codes*).

### 3.6.4 Loading Order (2 characters)

Loading order should be a sequential number to indicate the order of loading the products, e.g., "01".

### 3.6.5 Unloading Order (2 characters)

Unloading order should be a sequential number to indicate the order of unloading the products, e.g., "08".

### 3.6.6 Transportation Method (5 characters)

Transportation method should indicate the way in which the products are transported. Examples of transportation method are "Road" and "Sea".

### 3.6.7 Protection Method (5 characters)

Protection method should indicate the way in which the products are to be protected. An example is "SP" (Soft Packing).

### 3.6.8 Custom Clearance Status (1 character)

Custom clearance status should indicate the current status of custom clearance. Examples of Custom Clearance are "D" (for "Declared"), "P" (for "Pass"), and "F" (for "Fail").

## 3.7 Installation Information

### 3.7.1 On-site Installation Date (10 characters)

On-site installation date should indicate the installation data of the module at the site. It should be in the form of "YYYY-MM-DD", such as "2018-07-05".

### 3.7.2 Installation Crew (3 characters)

Installation crew should indicate the name/ID of the crew who is responsible for the installation, e.g., "AAA".

### 3.7.3 Inspector (3 characters)

Inspector should indicate the name/ID of the inspector who is responsible for the inspection, e.g., "BBB".

#### 3.7.4 Installation Quality Inspection and Test History and Result (1 character)

Installation quality inspection and test history and result should indicate whether the installation has passed the quality inspection and test. A capital letter “P” should be used if the installation has passed the inspection and test. If the installation fails the test, an integer should be used to show the number of times of re-testing, e.g., “1” or “2”.

#### 4. Implementation

Basic information related to names should be proposed and agreed by different stakeholders, e.g., client, in-house/consultant designer, contractor and manufacturer at the design and contract implementation stages.

Additional information related to names should be proposed and agreed upon by all, in particular, when the downstream stakeholders’ information becomes available (e.g., manufacturer, transporters, and installation crews).

It does not need to have all the segments/fields in place at the outset. The information will be continuously enriched as a project progresses.

Some of the fields can be removed or added to suit the practical needs of a project.

Both the basic and the additional information can work alone in physical construction, or be annotated into BIM, or both.

Automatic or semi-automatic tools can be developed to facilitate the naming tasks, which could be a challenge if there are a large number of modules and components in a sizable project.

## Useful References

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## Feedback Form

### Reference Materials - Use of Digital Technologies for QA/QC of MiC Modules in MiC Factories (September 2021)

Thank you for reading this publication. To help us improve our future versions, we would appreciate your suggestions/feedback on the publication.

( Please put a “ ✓ ” in the appropriate box)

<b>1. As a whole, I feel that this publication is:</b>	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
<b>Informative</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comprehensive</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Useful</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Practical</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>2. Does this publication enable you to understand more about the Use of Digital Technologies for QA/QC of MiC Modules in MiC Factories?</b>	Yes	No	No Comment		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
<b>3. Have you made reference to this publication in your work?</b>	Quite Often	Sometimes	Never		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
<b>4. To what extent have you incorporated the recommendations of this publication in your work?</b>	Most	Some	None		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
<b>5. Overall, how would you rate this publication?</b>	Excellent	Very Good	Satisfactory	Fair	Poor
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>6. Other comments and suggestions (please specify and use separate sheets if necessary).</b>					
<b>Personal Particulars (optional):*</b>					
Name:	<u>Mr. / Mrs./ Ms./ Dr./ Prof./ Ir / Sr ^</u>				
Company:	_____				
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E-mail:	_____				

\* The personal data collected will be used only for this survey. Your data will be kept confidential and dealt with only by the Construction Industry Council.

^ Circle the appropriate option.

Please send this feedback form to :

MiC Department, Industry Development Division, CIC

Email : mic@cic.hk

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