C) TECHNICAL REQUIREMENTS (ERT)

7) PLATFORM SCREEN DOOR (PSD) SYSTEM AT STATIONS

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7 PLATFORM SCREEN DOORS (PSD)

7.1 SCOPE OF WORK

7.1.1 General

(1) Platform Screen Doors (PSD) system shall ensure that passenger safety is paramount to prevent people falling onto or gaining unauthorized access to the track.

(2) The Contract shall comprise of, but shall not be limited to the design, manufacturing, factory testing, installation, integration testing with Interfacing Parties, site testing, commissioning, training, defects liability, spare parts, consumables, special tools and jigs for maintenance.

7.1.2 Abbreviations

Abbreviations used in this section of the document are tabled below.

Table 7.1 Abbreviations

Abbreviations	Definition
ATO	Automatic Train Operation system
CIP	Center Interface Panel
EED	Emergency Egress Doors
IEC	International Electrotechnical Commission
ILCP	Individual Local Control Panel
ISO	International Organization for Standardization
JIS	Japanese Industrial Standard
LCPD	Local Control Panel for Driver
LCPS	Local Control Panel for Station staff
MCP	Monitoring and Control Panel
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
OCC	Operation Control Center
PSD	Platform Screen Door
UPS	Uninterruptible Power Supply

7.1.3 Employers Requirements

(1) The PSD system provided by the Contractor shall comprise of but not be limited to platform screen doors and associated control equipment. PSD system shall comply with Employer's Requirements and any applicable Philippines Standards equivalent to appropriate Japanese Standards or alternative International Standards reviewed without any objection by the Employer's nominated Engineer and shall be designed for safe and efficient operation.

(2) All doors shall have a locking system operable automatically and manually.

(3) PSD system shall include all the associated control and operation mechanisms for the safe operation of the platform screen doors.

(4) The Contractor shall be responsible for the integration of PSD system into the overall operations of the project and for the design, manufacture, installation, testing and commissioning of PSD system including all the associated control and interfacing equipment.

(5) The Contractor shall provide enough spares when a part needs replacement based on predicted MTBF. The Contractor shall submit a detailed list with supporting calculations including the records of MTBF data for The Engineer's review not later than 6 months after the contract is awarded.

(6) The Contractor shall prepare a plan that identifies in detail the sequence of evaluation and testing of the prototype equipment at the Contractor's factory and testing of the final product onsite.

(7) The Contractor shall submit equipment operation training plan and maintenance training plan which describe the content, duration, timing and location of all training activities in accordance with the Employer's Requirements.

(8) The Contractor shall prepare and supply operation and maintenance manuals.

(9) Display text for the monitoring facilities shall be written in English.

7.1.4 System Overview

(1) The stations at which PSD system shall be installed are shown in Table 7.2 below.

Table 7.2 Stations

No	Line	Station Name	Station Type	PSD Type	Sets	Doors
1	MMSP	Quirino Highway	Underground	Full-height	2 *1	64
2	MMSP	Tandang Sora	Underground	Full-height	2 *1	64

No	Line	Station Name	Station Type	PSD Type	Sets	Doors
3	MMSP	North Avenue	Underground	Full-height	2 *1	64
4	MMSP	Quezon Avenue	Underground	Full-height	2 *1	64
5	MMSP	East Avenue	Underground	Full-height	2 *1	64
6	MMSP	Anonas	Underground	Full-height	2 *1	64
7	MMSP	Katipunan	Underground	Full-height	2 *1	64
8	MMSP	Ortigas North	Underground	Full-height	2 *1	64
9	MMSP	Ortigas South	Underground	Full-height	2 *1	64
10	MMSP	Kalayaan	Underground	Full-height	2 *1	64
11	MMSP	BGC	Underground	Full-height	4 *1	128
12	MMSP	Lawton East	Underground	Full-height	2 *1	64
13	MMSP	Lawton West	Underground	Full-height	4 *1	128
14	MMSP	NAIA T3	Underground	Full-height	2 *1	64
15	MMSP	FTI	Underground	Full-height	4 *1	128
16	MMSP	Bicutan	Elevated	Full-height	2 *1	64
17	MMSP	Test line in Depot	Overground	Full-height	2 *2	4
18	PRI	Philippines Railway Institute	Overground	Full-height	1 *3	16
Total					41	1,236

Note: *1 – One set consist of 32 doors

*2 – One set consist of 2 doors

*3 – One set consist of 16 doors

(2) PSD system shall include but is not limited to:

a) Sliding screen doors

b) Entry/Exit doors for driver's cab with suitable locking system

c) Appropriate individual and integrated control and monitoring system for driver and station staff

d) Safety System with sensors, alarms and indicators

e) Power supply system with appropriate backup

f) Power supply, control and monitoring cables laid and terminated appropriately in cable rack or cable duct

g) Structural frame and fixing accessories

h) Decoration board harmonized with the station design

(3) The Contractor shall submit their proposal of system configuration of PSD systems in accordance with the Employer's Requirements to the Engineer for review. The proposal can include non-documents such as material samples and prototypes.

7.1.5 Full-height PSD system

(1) Full-height PSD system shall include structural frame, sliding screen door, emergency door, fixed screen, entry/exit screen doors for driver's cab, device for door opening in emergency at each car end, sensors, control/monitoring system, alarms, signage, power supply and other necessary facilities.

(2) The Contractor shall submit interface table with technical proposal. At detail design, the Contractor shall coordinate with Interfacing Contractors for detailed interface requirements such as the civil, structural, station power supply, signaling and boundaries of provision in accordance with Employer's Requirements and station design criteria.

(3) Pairs of sliding screen doors (door-sets) shall be installed in the structural frames and aligned against each set of train passenger doors.

(4) A series of fixed screens shall be installed between each pair of sliding screen doors.

(5) A pair of Emergency Egress Doors (EED) shall be installed adjacent to the PSDs to provide a means of agress from and towards the track, especially in the case of misalignment.

7.2 DESIGN CRITERIA AND STANDARD

7.2.1 Design Life, Reliability and Maintainability

(1) Design life for PSD system shall be more than 20 years with the need for refurbishment running not less than 15 years into this period.

(2) The Contractor shall guarantee and supply spare parts during design life.

(3) PSD system shall have failure rate of less than 1 in 2,000,000 operations per door.

(4) PSD system shall have MTTR as 60 minutes unless otherwise specified. This time shall not include the time taken for the technican to arrive at the fault reported site.

(5) With the exception of the structural frame and glass panels, replacement or rectification of faults of all components, sub-assemblies, or major assemblies shall be accessible entirely from the platform side. They shall be capable of maintenance or replacement

within a time frame of 1 hour excluding delivery time. The contractor shall include the replacement and maintenance activity as part of training.

(6) If glass panels cannot be replaced from the platform side, it shall be possible to install a temporary safety screen from the platform side and such temporary safety screens shall be supplied at every station in adequate quantity.

(7) Power supplies required to control and operate PSD system at each station shall be provided in accordance with the product requirements and shall be terminated by means of isolation by circuit breakers.

(8) PSD system shall be designed to prevent any stray current corrosion arising from environmental conditions.

In addition, refer to Appendix 18 of CP106 RAMS Assurance Employers requirements document for details.

7.2.2 Design Standard

(1) The Contractor shall submit the standards for review to the Employer's nominated Engineer which they propose to adopt for PSD. In general, Philippines Standards equivalent to appropriate Japanese Standards or alternative International Standards applicable shall be reviewed without objection by The Engineer and include the following:

a) IEC 60529 : Water protection specifications

b) IEC 60228 : Conductor in insulated cables

c) IEC 61000 : Electromagnetic compatibility

d) ISO 9001 : Quality management

e) Standard on Fire Safety

f) Standard on Loading performance

7.3 DESIGN REQUIREMENTS

7.3.1 General Requirements

(1) PSDs shall be installed in the range of 210 meters on each platform.

(2) PSD system shall be designed to accommodate 8-car train. Each door-set shall comprise of a pair of sliding screen doors, equally spaced to correspond with the door openings of 8-car train.

(3) It is proposed to operate a 10-car train in the future. Therefore, PSD system shall have the provision to accommodate 10-car train with minimum modification. The Contractor shall design a provisional system to accommodate 10-car in the future.

(4) PSD system shall be designed in conjunction with the signaling system for 8-car train.

(5) The weight of Full-height PSD shall be less than 3,500 kg per 4 doors.

(6) PSD system shall have control and monitoring panels as specified below and shall include but not be limited to:

a) Center Interface Panel (CIP): This panel shall be installed in equipment room and have the following functions: -

i) Control the functions

ii) Interface between signaling system and PSD system

iii) Output the alarm and monitoring signal

iv) Provide Maintenance status indication

v) Interface with other systems

b) Monitoring and Control Panel (MCP): This panel shall be installed in station office and have the following functions.

i) Individual and group control of sliding screen door

ii) Individual and group monitoring including alarm

c) Local Control Panel for Driver (LCPD): This panel shall be installed on the track side of PSD and have the following functions.

i) Control of sliding screen door

ii) Monitoring of sliding screen door

iii) The LCPDs on both sides shall be combined in the interlocking and not be operated simultaneously.

d) Local Control Panel for Station Staff (LCPS): This panel shall be installed on the platform side of PSD and have the following functions. In case of emergency, station staff shall be able to control (Open/Close) sliding screen doors using this panel. The Local Control Panel shall carry out,

i) Control of sliding screen door

ii) Monitoring of sliding screen door

e) Individual Local Control Panel (ILCP): This panel shall be installed on each PSD sliding screen door and have the following functions: -

i) Local/Remote control changeover

ii) Manual/Auto Changeover

iii) Control (Open/Close) of sliding screen door

iv) Maintenance status indication

f) The priority of operation shall be as follows.

i) 1: Manual release, 2: ILCP, 3: LCPS, 4: LCPD, 5: MCP, 6: CIP (Control from Signaling system)

ii) The failure of any control shall not affect other controls.

(7) Each fully equipped door-set shall consist of bi-parting, power operated sliding screen doors. The sliding screen doors shall be synchronously controlled throughout the length of the platform. The sliding screen doors shall provide a clear opening of 2000mm. The width is 700mm wider than the clear opening width (1300mm) of the train passenger doors considering the train's stop accuracy.

(8) Each door mechanism shall incorporate a mechanical latch, which shall automatically engage when the door is fully closed, preventing the doors from being opened by passengers on the platform. The mechanical latch shall release automatically when the door opening mechanism is operated.

(9) PSD shall be electrically insulated from passengers and cars. To prevent electric shock due to the electric leakage from PSD, the Contractor shall design the system to safeguard passengers from electric shock.

(10) All electrical equipment interconnections of PSD shall be made with mechanically retainable plugs and sockets, and all terminations shall be clearly marked with labels and tags. When similar plugs are situated adjacent to each other they shall be constructed in such a manner so as to prevent a plug being inserted into an incorrect socket.

(11) PSD screens and walls shall comply with the fire resistance regulations defined in the Ordinance of Japanese Ministry of Land, Infrastructure, Transport and Tourism.

(12) The Contractor's design shall include small window for operating train doors in case of emergency. The window shall be opened only with a key by an authorized person. The location of the mechanism shall correspond to the location of the release installed on the train.

(13) PSD system shall have an interface to transmit door condition status and data to the OCC and/or PSD maintenance base via optical fiber network.

(14) PSD system shall interface with the cab or signaling system to identify and open the correct side doors of the train.

(15) Data communicating between PSD and Train shall include the following contents as shown in Table 7.3 Data from Train to PSD and Table 7.4 Data from PSD to Train but is not limited to.

Table 7.3 Data from Train to PSD

No	Name of Data
1	Traveling Direction
2	Train Number
3	Service Type (Rapid or Local or Out of Service and so on)
4	Service Number
5	Open command to PSD on right side
6	Open command to PSD on left side
7	Close command to PSD on right side
8	Close command to PSD on left side
9	Train type (commuter or limited express train)
10	Train configuration (8 cars or 10 cars)
11	Pattern of Door opening
12	Information of train door status "All Train doors on right side Closed"
13	Information of train door status "All Train doors on left side Closed"
14	Stop detection
15	Other acknowledgement to PSD

Table 7.4 Data from PSD to Train

No	Name of Data
1	Ground antenna type
2	Information of Line and station
3	Detection of stopping at fixed position
4	Information of PSD status "PSD all closed"

No	Name of Data
5	Information of PSD status "All PSD on right side not closed"
6	Information of PSD status "All PSD on left side not closed"
7	Acknowledgement of Open Command to PSD of right side
8	Acknowledgement of Open Command to PSD of left side
9	Alarm of trouble on PSD on right side
10	Alarm of trouble on PSD on left side
11	Acknowledgement of Close Command to PSD of right side
12	Acknowledgement of Close Command to PSD of left side
13	Information of PSD status "PSD on right side recovered"
14	Information of PSD status "PSD on left side recovered"
15	Other acknowledgement to Cars

7.3.2 Safety Requirements

(1) Passenger safety is the prime consideration in the design and construction of PSD system. In performance, door control and monitoring shall be safe in accordance with the Safety Plan.

(2) No part of any sliding screen door or its control system or any other component used in PSD system shall be capable of causing injury to passengers or personnel because of door operation. Particular attention shall be given for detecting trapped obstacles in the sliding screen doors.

(3) No single defect or failure of any part of PSD system shall produce a situation capable of causing injury to personnel. No spurious electrical signals shall cause any sliding screen door to be activated accidentally.

(4) PSD system shall contain sliding screen door monitoring devices for proving that all the sliding screen doors and emergency door are closed and latched. The mechanism to check the status of the sliding screen doors and other door shall be designed to be Safety Critical. Once all the sliding screen doors and other doors are proved to be closed and latched, a corresponding signal shall be transmitted to the Train, via the signaling system, to enable train departure.

(5) The closed and latched status of all sliding screen doors shall be continuously monitored by PSD system.

(6) In the event of a failure causing the loss of the 'closed' or 'latched' signal, even though it has been ascertained that the sliding screen doors are physically closed, the mechanism shall be provided to enable authorized staff to temporarily override the door status. A manual facility shall be provided on the platform and/or PSD, accessible only by authorized staff and adjacent to the door controls, to transmit a pseudo 'closed' and 'latched' signal to the train, via the signaling system. The pseudo signal shall be identical to the genuine 'closed' or 'latched' signal, to enable the Train to depart from the station. Use of the pseudo signal shall be recorded in the system.

(7) Once the Train has completely left the station zone, following an activation of the pseudo signal, the PSD system shall immediately cancel/reset the pseudo signal, to ensure that the monitoring circuit reverts back to the normal condition, including the fault condition, if any. Each time the pseudo signal is activated a corresponding signal shall trigger an alarm at the station office.

(8) Monitoring of sliding screen door with current door condition (Open/close, failure, etc.) shall be implemented through PSD monitoring system. This monitoring shall include door position (open/close), normal/failure condition, power on/off, etc. In the event of failure, the monitoring system shall raise an alarm by sound and flag it on the OCC screen for the attention of operating staff. The monitoring system shall be provided at each station office.

(9) PSD shall maintain required insulation between PSD screen and passengers to prevent possible electric shock due to an electric potential difference between passenger in train and PSD screen. The required insulation value shall be more than 10M ohm when measured with a test voltage of 500V DC when applied between PSD surface and platform structure. In addition, to prevent electric shock due to the leakage current from the PSD system, PSD structure shall be earthed or connected to the station earth. The earth wire, plate, rod and other necessary equipment shall be provided and installed by the Contractor.

(10) The Contractor shall provide a specification and type test results to demonstrate that the glass to be provided meets the requirements of the Hazard Analysis.

(11) In order to make passenger's aware, chime or sound shall be automatically activated during the time of opening and closing of sliding screen doors. The appropriate sounding system shall be provided by the Contractor.

7.3.3 Passenger Interface

(1) The sliding screen doors shall not exert a combined closing force greater than 140 N and a closing kinetic energy greater than 9.5 J. The limiting value of sliding screen door

movement kinetic energy for the last 150 mm of door travel shall be less than 2 J per door.

(2) The time for unlatching and opening shall be no longer than 3 seconds. The time for closing and latching shall be no longer than 3.5 seconds and shall be achieved within a maximum speed of 0.5 m/s. Each door opening or closing speed shall not vary by more than +/-10% when compared with the speed of adjacent doors of the same platform. The opening/closing speeds of each sliding screen door shall be capable of individual adjustment.

(3) During all operating modes and under all power supply conditions, sliding screen door movements shall be smooth, controlled and free of jerks or any violent motion.

(4) The sliding screen doors shall include an obstruction detection system, which shall be capable of detecting any obstruction between a pair of sliding screen doors, and between sliding screen and train body. At a minimum, the obstruction sensor between sliding screen doors shall be able to detect a blind person's stick (Diameter: min.19mm) when it is trapped between sliding screen doors.

(5) If a door-set whilst closing detects an obstruction prior to achieving locked status according to the door monitoring device, then the door-set shall reopen to 0.5 m to enable removal of the obstruction. Following a short delay the door-set shall attempt to close again. In the event that the door set fails to close following 3 consecutive attempts, further door set movement shall cease on the offending door in the open position. In the event that a door has stopped movement following this condition, further door set closure shall require another activation of the door close command. The sliding screen doors shall not slam after the removal of an obstruction or on loss of power supply. The number of attempts that the door-sets make to close in the event of an obstruction shall be adjustable from 1 to 20. The minimum reopening distance shall be adjustable from 0.3 m to full width.

(6) A means shall be provided on the trackside of each door-set, whether fully equipped or not, for the passengers to easily release the latch and open a door-set so as to gain access to the platform in an emergency. The manual release of the latch shall be achieved without the use of any tools or key or the need to break any seal. It shall be possible for authorized persons on the platform side to manually release the latch and open any door-set using a key without any objection from the Employer's nominated Engineer. No component failure shall inhibit manual opening of any sliding screen door when the release mechanism is operated.

(7) PSD system shall not have any impact on the safety of the train operation.

7.3.4 Power Failure

(1) In case of loss of normal power supply to the PSD system, it shall continue to operate from the uninterruptible power supply provided by the Contractor at each station for not less than three operations (open/close). In the event of total power failure, the sliding screen doors shall remain in their same status, i.e. if the sliding screen doors were open, they shall remain open, and similarly if they were closed, they shall remain closed.

(2) In the event of failure of the normal power supply and/or the UPS supply to PSD system, the mechanism to manually unlatch the sliding screen doors, either by an authorized person on the platform side or from the trackside, shall not be affected.

7.4 CONTROL AND MONITORING

7.4.1 Opening and Closing Operation

(1) When a Train is correctly positioned along the platform, PSD system shall receive door command signals, which originate from the Train via the signaling system, to either open or close the sliding screen doors. The open and close command signals shall correspond with the operation of the train passenger doors, ensuring that the train passenger door operation synchronize with the sliding screen doors.

(2) The opening of the sliding screen doors shall be synchronized with the train passenger doors following a short delay, provided by the Train, ensuring that the sliding screens open first. The closing operation shall also be synchronized with the train passenger doors to ensure that the train passenger doors close first, again following a short delay provided by the Train. The time difference of both opening and closing of the sliding screen doors, compared with the operation of the train passenger doors, shall be identical at every station.

(3) In the event of a trackside signal transmission failure, preventing the Train from transmitting door control commands, local means shall be provided on the platform or in the PSD unit, which shall be accessible only to the authorized staff, to manually activate either an open or close command of the sliding screen doors. In the event that a local door command is activated, a corresponding message shall be transmitted to the monitoring system.

7.4.2 Door Monitoring

(1) **Door-set numbering**

a) Each door-set shall be assigned and marked with an individual door number. In the event of a door-set failure, a corresponding message shall be triggered in the station office identifying a failure with the door number and the relative platform location.

The number sequence allocated for each door-set shall be identical on each platform and at each station.

(2) **Sliding screen door open indicator light**

a) Each sliding screen door shall include an associated 'door open' indicator light, amber in color that shall be illuminated when the sliding screen door is open. It shall extinguish when the sliding screen door is proved closed and latched, and flash when the sliding screen door is moving.

b) The indicator shall be placed in a position above the associated sliding screen door and shall be clearly visible to the station personnel when standing at the end of a platform.

(3) **Sliding screen door monitoring devices**

a) Sliding screen door monitoring devices shall be positioned to ensure that they are not affected by displacement of the sliding screen door, or by normal wear of any part of the sliding screen doors in service. The sliding screen door monitoring device shall detect and prove that the sliding screen doors are fully closed.

b) The indication of all closed, locked and failure of doors and associated equipment with alarm shall be repeated in the station office for the fully equipped and controlled door-sets on each platform.

(4) **Out of service indicator light**

a) Each sliding screen door shall also include an additional red status indicator light to identify either an 'out of service' condition or malfunction of that sliding screen door e.g. failure to open or close when instructed. The 'out of service' indicator light shall be installed, so as not to be confused with the 'door open' indicator.

b) If a sliding screen door is 'out of service', then a remote indication for 'out of service' condition shall be transmitted to the station office.

(5) **PSD status monitoring and alarms in station office and OCC**

a) The Contractor shall provide a means of monitoring PSD status in the station office at each station and in the OCC. It shall include an audible alarm to draw the attention of the operator when an unexpected event occurs. It shall also have a simple means of alarm acknowledgement to silence an incoming alarm.

7.4.3 Door-set Isolation

(1) Each door-set shall be provided with a manual isolation device, which shall be used to mechanically lock the door-set 'out of service', isolate the power supply and bypass the system monitoring for closed and latched status. The manual isolation device shall also

prevent the respective door-set from being opened by normal means, including the trackside release mechanism.

(2) The manual isolation device shall be capable of locking a door-set in either the closed or open position, with no effect on the operation of any other door-set. Access to the manual isolation device shall be achieved by means of a lockable cover requiring the use of a key without any objection by the Employer's nominated Engineer. The key shall not be capable of being removed when it is in the 'unlock' position. The key shall be the same type as used for other purposes. The contractor shall supply five or more sets of keys to each station and PRI.

7.5 STRUCTURAL INTEGRITY AND DURABILITY

7.5.1 General Requirements

(1) The PSD system shall be designed and installed to provide satisfactory operation and integrity under all specified loading conditions throughout the design life of the installation.

The design loads shall be as follows:

a) Crowd Loading: +1.5kN/m at a height from 1.1m to 1.5m for screens and sliding doors, without any deformation or reduction in operating performance.

b) Train Generated Loading: +1.0kN/m2 ～ -1.0kN/m2

Pressure loading or wind loading to the local requirement, whichever is higher.

Pressure loading or wind loading to the local requirement, whichever is higher.

"+" means from platform towards train, "-" means from train towards platform.

The contractor shall calculate and ensure that the PSD withstands the loading for a maximum speed of 80 km/h for a 10-car train.

c) Seismic Loading: ±0.18G (G : acceleration due to Gravity)

(2) The structural works shall include all the elements required to support, house or frame PSD installation.

(3) The structural frame shall be designed to resist torsion, lateral and vertical loading to prevent excessive deflection in any direction.

(4) Sliding screen doors shall be adjustable in the event of any long-term vertical loading on support elements causing vertical downward deflections. The door weight shall be kept to a practical minimum.

(5) The installation of PSD system shall accommodate the constructional and movement tolerances of the supporting and surrounding structures.

(6) The design of PSD system shall be able to resist all expected combinations of loading conditions, throughout the Service Life of the system. As a minimum, PSD system shall provide a satisfactory door operation when subjected to any combination of the design loads namely, air pressure generated by loading when trains enter into and departs from or when they pass through any station. The Contractor shall carry out an analysis of the design value to be adopted taking into consideration the most onerous train operation speed and the physical characteristics of the train and the civil infrastructure.

(7) The design of PSD system shall also ensure that no permanent deformation is caused from the effects of cyclic and repetitive loading associated with crowd load, impact, wind and/or train movements thought the Service Life of PSD system.

7.5.2 Drop wall structure requirements

(1) The contractor shall design and construct the drop wall structure between concrete slab and PSD in the range of 210 m on the platform.

(2) The drop wall structure shall be constructed of fire-resistance materials.

(3) The weight of the drop wall structure shall be less than 4,500 kg per 20m. The weight shall be supported by concrete slab and not by PSD.

7.6 ARCHITECTURAL TREATMENT

7.6.1 General Requirements

(1) PSD system shall be constructed of robust, low maintenance, easily cleaning materials and harmonized with the station design.

(2) The materials used in PSD system shall:

a) not introduce a significant fire load into the station and shall not contravene appropriate codes and standards;

b) not be a cause of fire spread;

c) be constructed of materials, which minimize smoke and heat emission and shall not generate toxic gases during fires.

(3) The material of screen doors (sliding screen and fixed screen) shall be fireproof. The incombustibility shall be achieved by using materials as defined in relevant standards and shall be acceptable to the fire services department of Philippines.

(4) Where control equipment is installed in separate equipment cubicles, it shall be easily accessible from the platform for operation and maintenance purposes without requiring a track possession but secured against unauthorized access by means of lockable doors.

(5) The door thresholds shall be flush with the platform floor finished surfaces. The edges shall be resistant to wear, non-skid type and readily cleanable.

(6) The Full-height PSD system shall be equipped with a mechanism or a countermeasure to limit the loss of conditioned air past the edges of all doors when they are fully closed.

(7) All Full-height screens shall be constructed of toughened glass or laminated glass for safety. The glass shall be compliant with relevant international and local standards.

7.6.2 Signage

(1) The Contractor shall provide all platform screen doors with appropriate signs relating to key features and the information requirements of passengers associated with the platform screen doors. All signs shall be provided with appropriate symbol and in English text. The contractor shall discuss with the civil contractor interface arrangements before commensing detail design.

(2) Warning signage shall include but not be limited to:

a) "Do Not Lean Against the Door" on all sliding screens;

b) "Keep Fingers Away from Gap Between Sliding Screen and Fixed Screen" on all sliding screens;

c) "Warning that door may be opened inwards during an emergency" on all emergency hinged screens and the end walkway doors;

(3) The Contractor shall coordinate with Interfacing Contractors on provision of signage and shall submit proposals for the overall signage requirements to the Employer's nominated Engineer for review.

7.7 TESTING, COMMISSIONING AND VERIFICATION

7.7.1 General

(1) The Contractor shall provide and perform all forms of tests applicable to the Works.

(2) The materials, goods, equipment shall be subjected to inspection and witnessing of tests by the Employer and/or The Engineer.

(3) The Engineer and/or any of his staff shall be given the opportunity to monitor all tests and provided with all test records. Sufficient time shall be allowed within the testing

programs for necessary alternations to equipment, systems, and designs to be undertaken, together with re-testing prior to final commissioning.

(4) Tests to be conducted by the Contractor shall be carried out in accordance with the Contractor's Test Plan reviewed without any objection by the Employer's nominated Engineer.

(5) Inspections and tests shall be divided into four (4) basic stages:

a) Type test;

b) Factory acceptance tests carried out before delivery of equipment;

c) Site acceptance and integration testing;

d) Trial running

(6) The inspection and passing of work or equipment by the Employer's nominated Engineer shall not relieve the Contractor from its obligations, responsibilities and liabilities to complete the Works in accordance with the Contract nor relieve them of any of its obligations, responsibilities and liabilities under the Contract.

7.7.2 Test Plan and Procedures

(1) All test plans and procedures shall be submitted to The Engineer for review at least 30 days prior to conducting any test, together with the exact time and date of such a test. Test procedure shall explicitly list the following: -

a) the date on which the Contractor proposes to conduct each tests;

b) the nature and purpose of the test;

c) the extent of testing covered by each submission;

d) the method of testing and the test requirements with the relevant standards;

e) the relevant drawing and document (or modification) status;

f) the location of testing;

g) test parameters to be measured with the relevant standards;

h) constraints to be applied during the test with the relevant standards;

i) defined pass/fail criteria with relevant standards;

j) format of the raw data for processing by the Contractor;

k) test instrumentation and test circuitry to be used during the test with the relevant standards.

(2) Test procedures shall be amended during the duration of the Contract to reflect changes in design or the identification of additional testing requirement.

7.7.3 Records of Tests

(1) Within 14 days after completion of any test all necessary information regarding the test shall be submitted in a report to the Employer's nominated Engineer for review. If required by The Engineer, a manuscript copy of the test record shall be made available at the time of the test and given to The Engineer or at the earliest opportunity if the test has not been witnessed. On completion of each test or group of tests, the Contactor shall provide a test report detailing but not limited to:

a) The numbers and types of tests which are required under the Contract and the result to be achieved;

b) The tests carried out and the results actually achieved;

c) Confirmation of pass and fail, if necessary a schedule of further tests or actions to be carried out by the Contractor.

(2) In addition to any other requirements, the report, and its supporting documentation held by the Contractor for the Employer's nominated Engineer review and audit, shall contain but not be limited to the following details:-

a) Material, system, facilities or part of the Works tested;

b) Reference to test procedures and test schedule;

c) Place of testing;

d) Date and time of tests;

e) Weather conditions in the case of onsite tests;

f) Technical personnel supervising or carrying out the tests;

g) Method of sampling;

h) Properties tested;

i) Readings and measurements taken during the tests;

j) Test results, including any calculations and graphs;

k) Specified acceptance criteria;

7.7.4 Type Tests

(1) Should the Contractor include any equipment not previously proven in service, then the Contractor shall undertake thorough type testing of pre-production units to the satisfaction of The Engineer. The Contractor shall identify in its design submissions any

equipment in this category, or equipment that differs significantly from that already in service elsewhere.

(2) Type tests shall be carried out on specific items to ensure that they perform their intended functions when subjected to all permutations and combinations of external conditions as defined in their design criteria. Type testing for specific items may be omitted where the Contractor is able to produce documentation from previous test that meets the requirements of the Contract.

(3) In addition to the above, Type tests also may be performed for subsystems, components and items of equipment installed in the overall system in substantial numbers. In this case the Test Program shall foresee a combined schedule of Type Tests and corresponding Routine Tests of individual units.

(4) Type tests Reports and Certificates shall explicitly state the mandatory contents of the routine test program and the individual inspection and measurement procedures that need to be performed on each individual item of identical series production devices or components.

7.7.5 Hardware Test

(1) General

a) All hardware equipment and materials shall be tested during manufacture and before delivery

b) Four types of test are required for all the material and equipment supplied namely,

i) Equipment test;

ii) Environment test;

iii) Factory acceptance test;

iv) Site acceptance and integrated test;

v) Trial running

(2) Equipment test

a) Routine tests shall be applied to all equipment during the process of manufacture. The routine tests shall include:

i) **Visual inspection**

Visual inspections shall be carried out to ensure that the equipment is of sound construction and meets the requirement.

ii) **Diagnostic tests**

Hardware diagnostic tests shall be carried out on each element of the system including all workstations, computers, computer peripherals, devices etc.

iii) **Performance tests**

Performance tests shall consist of a comprehensive series of measurements on the characteristics of the individual equipment to check if its performance is complying with the performance and functional requirements of the particular equipment concerned.

iv) **Soak (Running) tests**

Equipment shall be set up in a manner to simulate normal operating conditions, switch on, and to allow continuous operation for a minimum period of 100 hours. This period may be broken down into shorter period if compatible with the function of the equipment.

(3) Environmental test

a) All equipment supplied shall be met and tested in accordance to the EMC requirements (IEC 62236: Railway applications – Electromagnetic Compatibility).

b) All equipment supplied shall be tested for full operational ability under the conceivable environmental conditions.

c) Environmental tests may not be required if previous independent tests have been witnessed, successfully carried out and documented.

d) If any failure occurs during the environmental tests or the equipment design is changed, it shall be reported to The Engineer who may at his discretion require repetition of the tests.

7.7.6 Software Test

(1) The Contractor shall carry out the software proofing tests based on the Test Plan reviewed without any objection by The Engineer. Tests shall include but is not limited to:

a) Software communication protocol tests for each type of interface;

b) Functional tests;

c) Performance tests;

d) Interface between master controller and slave controller including operation and monitoring devices.

7.7.7 Factory Acceptance Tests

(1) All materials, components, sub-assemblies, unit assemblies (including software, cables and wiring) shall be subject to factory acceptance test. Notification of these tests shall be submitted to The Engineer 30 days in advance of carrying out any test together with information on any previous testing which relates to the items being tested and the Engineer will then determine which test to witness or which, if any, items may be accepted based on previous supply or experience.

(2) Factory acceptance tests shall include but is not limited to:

a) Physical inspection;

b) Dimension check;

c) Electrical check;

d) Calibration;

e) Output check;

f) Operational performance including full functional software testing;

g) Insulation test;

h) Soak (running) test.

7.7.8 Site Acceptance Test and Integrated Test

(1) The site acceptance and Integrated tests shall be carried out on site after installation, which shall demonstrate that system and software meets the requirements of the Test Plan reviewed without objection, in terms of functionality and performance.

(2) Site acceptance and Integrated tests shall include but not be limited to the following categories of tests:

a) Site acceptance test

i) The tests shall ensure all the equipment supplied under this Contract satisfy the function and performance requirements of the Contract when operated in a standalone manner without any interface to equipment/system supplied by other Contractors.

b) Integrated tests with other Contractors

i) The tests shall ensure all the interfaces with Interfacing Contractors satisfy the functional and performance requirements of the interface requirement.

c) Total system integration tests

i) Having completed the integrated tests with Interfacing Contractors individually, total system integration tests shall be performed to demonstrate that all system modules coordinate their works with each other in harmony and that all functional and performance requirements are satisfied. No clash, crash or abnormality shall result from having various combinations of possible operation being carried out simultaneously.

(3) The scope of the site acceptance and integrated tests shall cover but not be limited to the following:

a) Visual inspection to ensure the equipment is installed properly in accordance with the installation guidelines;

b) Electrical tests to ensure that the electrical connections of the cables, power modules, electronic modules, etc are correct;

c) Operational performance including full functional software testing;

d) Communication test among data transmission equipment;

e) Functional tests of all control requirements;

f) Point-to-Point tests to ensure correct mapping among the database and the physical equipment I/O points. Failed I/O points to be listed to show that routing is still functioning;

g) End- to- End tests to ensure all the connected epuipments can be controlled and/or monitored.

7.8 OPERATION AND MAINTENANCE SUPPORT

7.8.1 General

(1) The Contractor shall investigate all failures including major failures, repetitive failures and design defects and provide all necessary corrective actions during the Contract period.

(2) Operation shall investigate interference problems either from or to the systems of other Contract packages and provide all necessary corrective actions during the Contract period.

7.8.2 Operation and Maintenance Document

The Operation and specially the Maintenance Plan shall be prepared by the Contractor and submitted to the Employer for approval not later than 6 months after the agreement of the Contract.

7.8.3 Operation and Maintenance Plan

(1) The Maintenance Plan shall describe the Contractor's proposed maintenance regime for preventive and corrective maintenance of the system, including, but not be limited to the followings:

a) Maintenance philosophy and approach

b) Frequency of each maintenance task

(2) The contractor shall include the following information on each maintenance task described in the Maintenance Plan:

a) The equipment, sub-systems covered in the task;

b) Step-by Step procedure to carry out the task;

c) Tools and test equipment list of each task;

d) Diagrams and flowcharts by illustration, if applicable;

e) Recovery procedures, if applicable;

f) Precautions the maintenance personnel must follow; and

g) Estimated duration and required manpower.

(3) In addition to the Maintenance Plan, the Contractor shall also submit a Yearly Routine Maintenance Schedule to the Employer for review and indicate the schedule of maintenance tasks in a calendar year.

7.8.4 Software Support

(1) General

1) In order to maintain the normal operational requirements given in this Particular Specification, the Contractor shall provide all changes, debugging, updates, modifications and upgrade of all the software developed (or delivered) for PSD including data configuration tables if such changes are necessary.

2) All changes and modifications of the software shall not degrade the performance of the software developedhe software developed (or delivered) for PSD including data configuration tables if such changes are necessary.

3) All changes and modifications of the software shall not degrade the performance or cause any adverse impacts for the system.

4) The Contractor shall maintain backup copies of all software developed (or delivered) for PSD.

5) The Contractor shall ensure that all new versions are fully tested, validated and reviewed without objection by the Employer prior to loading into the system.

6) The Contractor shall provide training for the Employer's staff for the use of new version of software.

(2) Monthly Maintenance Meeting

1) The Contractor shall attend the Monthly Maintenance Meeting with the Employer to discuss the maintenance issues during the Defect Notification Period. The dates and agenda of the meeting shall be agreed with the Employer.

7.8.5 Spares, Consumables, Special Tools and Test Equipment

(1) Spares and Consumables

1) The Contractor shall provide their own spares during installation and commissioning period as well as for support purpose during the Defects Notification Period. The Contractor shall also provide separate spares for the Employer to operate and maintain PSD.

2) The Contractor shall submit a list of spares within 6 months after the Commencement Date of the work to the Employer for review.

3) The Contractor shall submit a list of Commissioning Spares, with the types and quantities of spares the Contractor intends to hold, at least 3 months before the commencement of the installation activity to The Engineer for review.

4) The Contractor shall submit the list of Defects Liability Spares, with the types and quantities of spares the Contractor intends to hold, at least 3 months before the commencement of the Defects Notification Period to The Engineer for review.

5) The Contractor shall include details of the stock of the Contractor's own spares in the Monthly Progress Report. The status of the spares, either in store or under workshop repair, shall also be included.

(2) Contract Spares for Employer's Operational and Maintenance Requirement

1) The Contract spares shall include, but is not limited to, spare module, sub-assemblies, special components and fuses.

2) The Contractor shall submit item's unit price with quantities of each type of spare modules, sub-assemblies, and parts in the list of the Employer's Requirements and those recommended by the Contractor.

(3) Special tools, jigs and test equipment

1) The Contractor shall provide the special tools and test equipment.

2) The Contractor shall submit item's unit price with quantities of each type of special tools and test equipment and those recommended by the Contractor.

7.8.6 Documentation

(1) General

1) The Contractor shall prepare a submission program. The submission program shall identify all submission to be furnished, submission titles, submission numbers and target submission dates.

2) The Contractor shall provide configuration management which is permanently maintained to ensure that system is correctly configured. The program shall ensure that the configuration of each item is recorded and maintained during the life of the Contract and Defects Notification Period.

3) The contractor shall submit a Project Management Plan to the Employer for review. Project Management Plan shall identify persons to be responsible, methods and arrangements as well to carry out the Project Management.

(2) Submission requirement

1) The Contract shall include records of amendment in each submission with the following details:

a) Revision history and status of the submissions;

b) Description of changes for each revision; and

c) The Contractor's signature for authorization of the submission indicating propoer design check has been carried out before submitting it to the Employer.

2) The revision status and date of preparation of the submission shall be clearly indicated in the header of the document.

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