PETROBRAS	TECHNICAL SPECIFICATION	Nº: I-ET-3010.2D-1400-190-P4X-001	
	CLIENT: AGUP		SHEET 1 of 55
	JOB: HIGH CAPACITY FPSO – GAS EXPORTATION ALL ELECTRIC		
	AREA: ATAPU 2 AND SÉPIA 2		
SRGE	TITLE: **TOPSIDE ARCHITECTURE MATERIALS AND EQUIPMENT SPECIFICATION**		INTERNAL
			ESUP

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SUMMARY

1 OBJECTIVE

The objective of this technical specification is to present the basic requirements for the architectural works on M13 (Power Generation), M15B (Hull Utilities), and M17 (Automation and Electrical), covering the design, construction, fabrication, assembly, inspection, testing, supply of equipment, materials and spares, all in full compliance with the provisions of this document and its attachments, all referenced applicable codes, standards and regulations and, where applicable, the Classification Society (C.S.) regulations.

2 RULES AND REGULATIONS

The design, construction, and appliances of the architectural works on M09, M13 (Power Generation), M15B (Hull Utilities), and M17 (Automation and Electrical) shall comply, but not being limited to, with the following applicable rules and regulations:

2.1 IMO – International Maritime Organization

2.1.1 IMO – RESOLUTION A-649 (16): Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU-CODE), 1989, and Annexes as amended,

2.1.2 IMO – SOLAS: International Convention for the Safety of Life at Sea, 1974, and Annexes as amended,

2.1.3 IMO - MARPOL: International Convention for the Prevention of Pollution from Ships, 1973, and Annexes as amended,

2.1.4 IMO – RESOLUTION MSC. 6 (48) / RESOLUTION MSC.1 (XLV): Amendments to the International Convention for the Safety of Life at Sea - 1993/ 1981,

2.1.5 IMO – RESOLUTION A-517 (13): Recommendation on Fire Test Procedures for A, B and F Class Division,

2.1.6 IMO – RESOLUTION A-472 (XII): Improved Recommendation on Test Method for Qualifying Marine Construction Materials as Non-Combustible,

2.1.7 ICLL – International Convention on Load Lines, 1966, and Annexes as amended.

2.2 Brazilian Legislation and Regulation

2.2.1 Regulatory norms of the Brazilian ministries whenever applicable, including NR-12 (safety in machinery and equipment), NR-17 (Ergonomia/ Ergonomics) and NR-37 (Safety and Health in Oil Platforms),

2.2.2 Regulations of the Brazilian Maritime Authority – NORMAM/DPC – whenever applicable, including NORMAM 01 (Chapter 4, Section VII – Fire Protection Requirements for Materials and Appliances used on Board of Brazilian Ships),

2.2.3 ABNT Standards whenever applicable,

2.2.4 CONAMA Resolutions of the Environment Ministry,

2.2.5 NOTA TECNICA CGPEG/DILIC/IBAMA No 01/11 Projeto de Controle de poluição.

2.3 Classification Society Rules

2.3.1 ABS Offshore Standards.

2.4 Other applicable Standards

2.4.1 EN 1869 – Fire Blankets.

3 DEFINITIONS

Besides the general technical terms defined on I-ET-3010.00-1200-940-P4X-002 (GENERAL TECHNICAL TERMS), the following definitions shall be observed:

- *Authorities*: The National Shipping Inspection Bureau of the Country of Registry under whose laws and regulations the unit will be registered,
- *C.S.:* Classification Society,
- *Design*: The specification and complementary plans resulting from this design standard,
- *POB*: People On Board.

4 GENERAL

4.1 General information:

4.1.1 General description and SELLER's scope of work related to the architectural works on the rooms and areas located on M13 (Power Generation), M15B (Hull Utilities), and M17 (Automation and Electrical) is presented on I-MD-3010.2D-1200-940-P4X-006 (DESCRIPTIVE MEMORANDUM – ARCHITECTURE).

4.1.2 The equipment and materials supplied for the rooms and areas located on M13 (Power Generation), M15B (Hull Utilities), and M17 (Automation and Electrical) shall be suitable for a 30-year design life and for use in a saline atmosphere, which additionally shall be subject to weather conditions. The products shall have been successfully tested and satisfy the requirements stated in this specification, as well as C.S. rules.

4.1.3 The potential Module Seller shall demonstrate that they have successfully supplied equipment and materials described on this specification for use on offshore marine environment equivalent to that in which the unit will be installed. Sellers interested in bidding for the above, are to provide a detailed reference list demonstrating their experience, capabilities, and expertise. A SELLER Prequalification Questionnaire shall be submitted for BUYER approval, including all data pertinent to its Scope of Supply.

4.1.4 Module SELLERs shall have an implemented Quality Management System that meets the requirements of the ISO-9000 series of Standards and a Safety Management System. SELLERs shall be also notified that all work carried out on the unit Project shall comply fully with C.S. rules and Requirements or Regulations listed in this specification. Respondents shall indicate company name, contact details, managers and key personnel, company profile, and summary of related experience according to the Module SELLER Prequalification Questionnaire.

4.1.5 All equipment and materials shall be guaranteed by the Module Seller. The equipment and materials warranty shall be clearly stated by the Module SELLER during the detailed design phase proposal analysis.

4.1.6 SELLER shall promote the preservation of every item constructed, fabricated, supplied, assembled, erected, integrated or finished, and to replace, substitute, recover or restore every item damaged or with bad functioning.

4.1.7 Wherever required by Brazilian and international regulations, all equipment shall have their calibration certificate valid for the first year of operation after leaving the shipyard. The calibration periodicity of each instrument shall be respected according to the requirements of regulatory agencies, technical standards, and manufacturers' manuals.

4.1.8 SELLER shall recalibrate any equipment replaced or damaged during any activity. All equipment shall have their calibration certificates according with regulatory and standard requirements.

4.1.9 The following general requirements shall be implemented during the detailed design phase:

4.1.9.1 The material finishing weight shall be updated during design phase in accordance with information’s manufacturer,

4.1.9.2 All components shall be adequate to offshore humidity and corrosive environment with marine salts and hydrocarbons,

4.1.9.3 Partition, lining and ceiling system, doors/ windows, floor covering system and insulation shall be provided with the characteristics stated on this specification. Equivalent material may be accepted provided the physical, chemical, and mechanical characteristics are preserved. Any deviation of the requirements stated on this specification shall be submitted during Technical proposal Analysis phase (detailing) to be analyzed and approved by BUYER,

4.1.9.4 All insulation materials, linings, ceilings, floors, upholstery materials, windows, and doors as well, shall be specified in accordance with applicable rules and regulations. All the listed material shall be non-combustible / fire-retardant type. The use of combustible materials, such as acrylic, polycarbonates, PVC, and others, is not allowed,

4.1.9.5 Batteries rooms' bulkheads and insulation mechanical protections shall be properly treated against battery fluid corrosion,

4.1.9.6 Fan coil units (if specified) shall be installed in a specific ceiling recess between the ceiling panel and the steel deck above, without weighing the support of the ceiling. The drain shall be detailed and installed to avoid any leakages. The drain itself shall not be exposed but properly covered by wall panels and kept out of sight,

4.1.9.7 Wall and ceiling panels shall be provided with access hatches and/or access doors. These accesses shall be located during the detailed design phase according to maintenance needs and requirements. The detail design phase shall present a drawing with the detail and location of these hatches,

4.1.9.8 In habitable compartments, the free height shall be, at least, 2400 mm,

4.1.9.9 Easy access to all equipment and installations shall be provided, during the construction of the Unit and also for maintenance during operation. Therefore, removable panels or access hatches shall be designed and installed whenever necessary, ensuring the good finish of the materials specified by the Basic Design,

4.1.9.10 Fire rated doors, removable panels and windows shall be certified to have the same fire rating as the wall they are installed on,

4.1.9.11 Doors and removable panel dimensions shall allow for the transit of people, stretchers, equipment parts, etc., and shall not impose an obstacle for any of these activities,

4.1.9.12 Compartments with areas exceeding 20 m² shall have two exits,

4.1.9.13 In walls, partitions, doors and furniture, all glass made visors and windows shall be composed of laminated glass, so the material shall not produce splinter whenever subjected to impact or explosion,

4.1.9.14 One key cutting machine shall be supplied onboard for duplication of lost keys. This machine shall be supplied by the door's manufacturer, together with the doors and relative keys, and shall be located on the Toolshop,

4.1.9.15 A visual communication/information design (including safety signs) shall be carried out during the detail design phase to guarantee the easy identification of all compartments by its users as well as a pleasing and safe ambient. Beginning the detailed design about this scope, BUYER shall be consulted to provide an updated version of the document below, in which is presented all information regarding BUYER standard signalization to be followed:

- PETROBRAS SIGNAGE GUIDELINES FOR ADMINISTRATIVE, INDUSTRIAL AND OFFSHORE AREAS (MANUAL DE SINALIZAÇÃO PARA AMBIENTES ADMINISTRATIVOS, INDUSTRIAIS E MARÍTIMOS BUYER).

4.1.9.16 For safety signs, shall consider the document I-ET-3010.00-5400-947-P4X-002 (SAFETY SIGNALLING).

4.1.9.17 All visual communication/information shall be in Portuguese and English language. All external communication/information shall have the visual aspects presented as indicated on the manual above but, at least, these external items shall be produced with stainless steel AISI 316L plates with protective painting and engraved lettering colored with enamel.

4.1.9.18 All pieces of equipment listed in I-ET-3000.00-8222-941-PJN-001 (LABORATORY – EQUIPMENT), shall be acquired from manufacturers that present proper contact for maintenance purposes and for supplying parts and/or spares for reposition in case of maintenance needs.

4.1.9.19 The handrails of internal staircases and corridors shall be constructed in stainless steel and shall be located during the detail design phase,

4.1.9.20 The maximum accepted angle for access stairways shall be 38°. During the detail design phase, the SELLER shall find the ways to design the inclined stairs as present on the Basic Design drawings,

4.1.9.21 Fire hydrants and extinguishers shall be inlaid in the bulkheads when installed in environment internally coated. Installation shall follow the applicable rules,

4.1.9.22 On the lay down areas, the overall and local loading capacities shall be painted on its floor and on the bottom (skirting) part of the surrounding guard-rail. The areas for the transfer of cargo shall be lined with wooden planks for industrial use,

4.1.9.23 The internal layout of the compartments shall have enough flexibility to allow adjustments required by work activities,

4.1.9.24 The internal layout design for the compartments shall be executed individually on a scale of 1:50 or 1:25 whenever possible, formatted to A1 sheet drawings or minor, including at least 2 (two) sections and any other view required for complete clarification of the space. These drawings shall contain main dimensions, furniture location, pictures, and any other object,

4.1.9.25 Compartments location (key plant) and area shall be indicated on the architectural drawings. The layout showing all furniture and equipment, as well as its quantity shall be entered into architectural drawings,

4.1.9.26 At least, two colors per material shall be submitted to BUYER approval, to define the Decoration Scheme (with color schedule), including catalogs containing specification colors and technical characteristics of all materials, besides the typical drawings,

4.1.9.27 All materials and components supplied shall be new, delivered clean and in proper use conditions and of quality compatible with the requirements in this document,

4.1.9.28 All materials, before and after installation, shall be protected against damage of any kind (abrasion, dirt, oxidation, etc.),

4.1.9.29 For Ergonomic requirements, refer to document I-ET-3010.2D-1400-196-P4X-001 (ERGONOMIC REQUIREMENTS FOR TOPSIDES),

4.1.9.30 The noise on the rooms located on M13, M15B and M17 shall be in accordance with I-ET-3010.00-1200-300-P4X-001 (NOISE AND VIBRATION CONTROL REQUIREMENTS). Items like insulation material, wall and ceiling panels, doors, windows, and floor covering shall be provided to comply with noise and vibration analysis report developed in the detailed design phase,

4.1.9.31 The Topside Automation and Electrical Panels Room (AEPR), located in M17, shall be considered as an inhabited compartment and all the covering materials shall be according to document I-DE-3010.2D-1428-190-P4X-001 (M17 - AUTOMATION & ELECTRICAL - ARCHITECTURE PLAN). For insulation materials, refer to document I-DE-3010.2D-1428-190-P4X-002 (M17 - AUTOMATION & ELECTRICAL - DOORS AND INSULATION PLAN). All the covering and insulation materials shall be confirmed in the detailed design phase, according to noise and vibration analysis report. As a reference, the document I-ET-3010.00-1200-300-P4X-001 (NOISE AND VIBRATION CONTROL REQUIREMENTS) establishes 60 dB for local control room areas,

4.1.9.32 Paints, varnishes, and other finishes used on exposed interior surfaces shall be in accordance with regulations and C.S. rules and shall not be capable of producing excessive quantities of smoke or offer an undue fire hazard,

4.1.9.33 Compartments affected by structure borne noise shall be isolated considering the following:

- Decks shall be protected making use of a primary deck (if floor finishing is required), combined with vibration damping material and steel tiles 1.5 to 2.0 mm thickness. In this case, the floor covering shall be a sandwich construction,
- Bulkheads shall be protected by a combination wall, for vibration damping and sound reduction, making use of a vibration damping material and steel tiles 1.5 to 2.0 mm thickness. When applicable, a wall panel shall be installed,

4.1.9.34 For reference, see documents:

- I-DE-3010.2D-1424-190-P4X-001 (M13 - ELECTRICAL EQUIPMENT ROOMS - ARCHITECTURE PLAN),
- I-DE-3010.2D-1424-190-P4X-001 (M-13 – DOORS AND INSULATION PLAN),
- I-DE-3010.2D-1426-190-P4X-001 (M-15B ROOMS AND LABORATORY - ARCHITECTURE LAYOUT - EQUIPMENT AND FURNITURE),
- I-DE-3010.2D-1426-190-P4X-002 (M-15B ROOMS AND LABORATORY - ARCHITECTURE ARRANGEMENT - PLANS AND SECTION),
- I-DE-3010.2D-1426-190-P4X-003 (M-15B ROOMS AND LABORATORY - ARCHITECTURE ARRANGEMENT – DOORS AND INSULATION PLAN),
- I-DE-3010.2D-1428-190-P4X-001 (M17 - AUTOMATION & ELECTRICAL - ARCHITECTURE PLAN),
- I-DE-3010.2D-1428-190-P4X-001 (M17 - AUTOMATION & ELECTRICAL – DOORS AND INSULATION PLAN),

4.1.9.35 The structure borne vibrations shall be transformed from kinetic energy into heat by the deformation in the damping layer. The damping layer consists of a polyurethane compound of 1.0 to 1.5 mm thickness and shall be low flame spread,

4.1.9.36 The detailed design shall follow the noise and vibration analysis report and provide, if required, the insulation and all components in accordance with regulations and C.S. rules,

4.1.10 Automation installation shall be provided for PN-5523007A/B, located on Operators Room.

The following definitions shall be observed during the detailed design phase regarding compartments characteristics:

4.2 Service Compartments (Rooms / Areas):

Compartments where several services are carried out to guarantee the operation, maintenance of the unit and assistance of its users.

- Laboratory (Equipment area and office), at M15B (Hull Utilities),

4.3 Industrial Compartments (Rooms / Areas):

Compartments inside M13 and M17 such as CO_2 Central Room, Topside HVAC Room, Topside Batteries Rooms, Topside Normal Transformers Room, Topside Normal Panels Room 1, Topside Normal Panel Room 2 and any other area or compartment not listed above shall be considered as industrial area/room.

4.4 Working Compartments (Rooms/Areas):

Compartments where working activities are carried out to maintain the unit production and operation:

- TLT's Room and Operation Room, at M15B (Hull Utilities),
- Topside Automation and Electrical Panels Room (AEPR), at M17.

4.5 Sanitary Rooms:

There are two restrooms at M15B (Hull Utilities).

The detailed design shall provide all equipment location considering the easy access to all parts for operation and maintenance. Cargo handling shall be provided whenever required and shall be detailed in such way that provides all facilities for entrance and exit of the equipment without disturbing the work activity in accordance with general arrangement and architectural drawings and document I-ET-3010.2D-5266-630-P4X-001 (TOPSIDE'S MECHANICAL HANDLING PROCEDURES).

5 PARTITIONS, LININGS AND CEILING SYSTEM

5.1 General

5.1.1 All materials, components, and fittings, used in construction shall be "non-combustible" type and follow current regulations. Material and finishes to components and fittings used in partitions, linings and ceiling panels shall be non-flammable, halogen-free, shall not be able to emit flame and shall have certified low surface spread of flame characteristics in accordance with current rulings.

5.1.2 Manufacturer instructions shall prevail regarding partitions requirements design and installation, unless otherwise specified.

5.1.3 Wall panel system shall be installed under the in-site supervision of the manufacturer(s).

5.2 Ceiling System

5.2.1 The ceiling panels shall be built with a flat face and constructed with galvanized steel sheet 0,5 mm thick (minimum). Halogen free material finishing shall be provided for all compartments. The ceiling panels shall have steel on both sides and be capable to hold required ventilation devices without support.

5.2.2 The ceiling system shall be self-supporting, capable to bear the weight of 25 kg load without suspension, with an inter-locking joint and easily dismounted for

maintenance purposes. The ceiling panels shall be supported by the wall panel top profiles.

5.2.3 Services shall be installed between ceiling panel and upper steel deck and shall not be supported by any part of the ceiling system.

5.2.4 Hinged inspection panels, hatches, or access, which combine with the surrounding ceiling panels, shall be provided where inspection and maintenance to installed services above the ceiling is required. The clear opening shall be minimum 500 x 500 mm.

5.2.5 Approved hinged inspection panels and access ceiling lights shall be provided to ensure the B-15 rating and full compatibility.

5.2.6 The hatch construction shall be strong enough to allow for repeated opening. Unless the hatch has a fail-safe opening mechanism, a safety chain shall be included to avoid accidental opening.

5.2.7 Insulation around ceiling penetration (e.g., lighting fixtures, diffusers, sprinklers, ducting, etc.) shall maintain the overall integrity of the ceiling fire rating. The complete ceiling shall in every respect be compatible with the wall system.

5.2.8 The ceiling panels system shall be B-15 class recognized by C.S. Extra insulation shall not be installed above the ceiling panels to achieve the B class fire rating. The mineral wool used shall be non-combustible and free of asbestos. Minimum density shall be in accordance with manufacturer's standard and suitable regarding noise aspects.

5.2.9 The ceiling panels shall be available with the following characteristics:

- Width about 600 mm, Thickness 50 mm, length of ceiling panel max. 3000 mm free span, B-15 fire class, weight about 18 kg/m².

5.2.10 Special tools required for ceiling panels' installation and maintenance shall be provided for each floor of every module in which this material is installed, such as the Laboratory and AEPR.

5.3 Partition and Lining System

5.3.1 The partition and lining systems shall be fully compatible with all installations, elements, fixtures, fittings, and penetrations, as well as all requirements to stability, sound reduction and fire class. The system shall be chemical resistant, halogen-free, low flame spread surface, low calorific value, no chlorides, no cyanides, and no dioxin.

5.3.2 Partition and lining panel colors shall be in accordance with the color Decoration Scheme. At least, two colors per deck shall be available. At least two colors per material shall be submitted to BUYER approval, including catalogs containing specifications colors, and technical characteristics of all materials.

5.3.3 Partition and lining panels shall be available with a width about 600 mm.

5.3.4 The wall system, unless otherwise specified, shall not exceed a maximum of 75 mm in overall thickness, including the thickness of applied finishes (Refer to item 5.4).

5.3.5 Partitions in wet rooms shall be completely splash-proof, non-combustible and easy to maintain and clean.

5.3.6 The internal glazed partition system shall consist of a series of fire rated glazed or solid panels, which are supported by framing members. Partitions of the same fire rating, wherever possible, shall have the same thickness, regardless of span. The system shall be finished complete with all insulation, make-up pieces and cover plates of the same material and finishes as the glazed partition system. Glazing shall be laminated security glass. Glazed partition shall be built up by a framework of stainless-steel profiles covered with insulation. The profiles shall be fixed to the framework as a “clip on” solution with no visible bolts or blind rivets. The glass type shall be clear transparent fire resistant with intumescent interlayer and sound reduction: field value of ≥ 41 dB, B class, at least 30 mm thick. Maximum glass size shall be in accordance with manufacturer standard. Glazed partition shall be replaced by glass window if previously agreed with BUYER.

5.3.7 Glazed partitions, with the same height of the room, shall be provided to the Laboratory.

5.3.8 Glazed partitions shall have the upper part in clear glass, while the bottom part (height to be defined) shall have the same characteristics of the blind partitions and lining panels.

5.3.9 Where mineral wool insulation is used, it shall be non-combustible, and fully bonded to the rear of the galvanized panels. Steel sheets used for panel faces shall be galvanized on both sides prior to construction of the complete panel.

5.4 Construction and Materials

5.4.1 The partition system shall be modular system, sandwich construction steel faced with a flush surface finishing. The system shall be capable to suppress services and each panel shall be fully dismountable for maintenance or replacement purposes.

5.4.2 The standard panel system shall include special jointing profiles that allow panels already installed to be removed. The detachable panel construction shall be used only for occasional access. For frequent access, the inspection door shall be installed.

5.4.3 The panel system shall be assembled using jointing “U” profiles to assure the wire and cables passage and also to provide a quick access when replacing the panels.

5.4.4 Self-supporting ceilings shall be fire tested with the ceiling panels fixed to the top profiles on the wall panels with screws or pop rivets.

5.4.5 The lining system shall have the same characteristics of the partition. The joints between partitions and ceiling panels as well partitions and linings shall be detailed to avoid loss of performance regarding sound and vibration transmission.

5.4.6 The wall installation may possibly use gaskets between steel coaming and wall panel to minimize the effects of noise and vibration.

5.4.7 The partition/lining system shall satisfy the requirements relating to noise, thermal and fire characteristics. The system used shall be so designed, constructed and

installed to provide internal walls of certified B-15 fire rating in accordance with SOLAS regulations and amendments.

5.4.8 The partitioning system shall consist of:

- Partition: Wall panels' thickness shall be 50 mm with 45 dB noise reduction minimum. The finishing shall be halogen free surface type and impressed directly into the galvanized steel sheet on both sides.
- Lining:Lining panels' thickness shall be 50 mm with 45 dB noise reduction minimum. The finishing shall be halogen free surface type and impressed directly into the galvanized steel sheet on one side and the other side with galvanized steel finishing.
- Ceiling: Self-supporting system with halogen free surface material finishing, impressed directly into the steel sheet, 50 mm thickness. Weighted sound reduction index (Rw) of dB, noise reduction coefficient (NRC) 0.60 (minimum).

  Note: Lining panels with 32 dB sound reduction can only be used if proven to be suitable to comply with the requirements stated in I-ET-3010.00-1200-300-P4X-001 (NOISE AND VIBRATION CONTROL REQUIREMENTS) and on the noise and vibration analysis report.

5.4.9 All material construction shall be provided to comply with noise and vibration analysis report developed.

5.4.10 In all cases, ease of removability of any panel with minimal disturbance to adjacent panels shall be assured.

5.4.11 Wall panel system colors shall be in accordance with the color scheme for rooms located on M15B (Hull Utilities), M17 (Automation and Electrical), M13 (Power Generation), to be submitted to BUYER approval.

5.4.12 Partitions in wet rooms shall be completely splash proof and easy to maintain and clean.

5.5 Thermal Properties

5.5.1 The thermal insulation factor achieved by the wall panels shall be according to I-ET-3010.2D-5250-300-P4X-001 - HVAC SYSTEM – HVAC TECHNICAL SPECIFICATIONS

5.6 Sound Reduction

5.6.1 The installed system shall be capable of providing a verified sound reduction in accordance with item 5.4 for the rooms located on M15B and any other compartment where wall and ceiling panels are required (as AEPR, in M17 Module), and shall be confirmed with noise and vibration analysis report developed in the detailed design phase.

5.6.2 All material construction shall be provided to comply with noise and vibration analysis report.

5.6.3 The detailed design phase shall verify if the partition, lining, and ceiling system stated in this specification is suitable to provide the required noise results for

inhabited compartments located in Industrial Area. If the noise values do not achieve the required values, the system shall be integrated regarding insulation (structural and airborne damping material and floating floor), floor covering system and lining/partition system to comply with the requirements stated in I-ET-3010.00-1200-300-P4X-001 (NOISE AND VIBRATION CONTROL REQUIREMENTS).

5.7 Service Conditions

5.7.1 The partitioning system shall be suitable for use in fully air-conditioned environment.

5.8 Reinforcements and Fixings

5.8.1 Wall-mounted equipment shall always be within the manufacturer's specified maximum capacity for the partition system. Wall-mounted equipment shall be directly supported by the main frame or the structure supporting the wall panels.

5.8.2 Fixings and reinforcements shall enable future removal and re-fixing of equipment. All reinforcements shall be concealed within the wall panels.

5.8.3 Irrespective of the weights of small fittings and fixtures which are to be wall mounted, panels shall be provided with suitable solid fixed backings, fully concealed within the wall construction, to accept fixings to ensure easy replacement of fittings after removal.

5.9 Miscellaneous Components, Trims and Finishes

5.9.1 All profiles, panels, trims, joints, standard and support profiles shall be supplied to ensure a complete installation.

5.9.2 As far as possible, frames, panels, trims, joints, standard and support profiles shall be supplied in available standard sizes and lengths. The joints of the system shall be installed to minimize sound conduction. The design and installation of the wall shall use standard components to the greatest extent possible, with due regard to visual appearance and functional durability. The Module SELLERs shall provide suitable heavy-duty skirting and trimmings for all wall bases and joints. All panels shall be supplied with factory applied finishing.

5.10 Supply

5.10.1 The wall and ceiling panels shall be supplied with easily removable protective foil, sufficient to protect finishing during storage, handling, construction, and commissioning.

5.10.2 All panels incorporating special items or panels designed for particular or special application shall be supplied clearly marked.

6 DOORS, HATCHES AND REMOVABLE PANELS

6.1 General

6.1.1 The preliminary schedule with characteristics (class, tightness, dimensions, accessories, etc.) of doors, hatches, and removable panels located on M13

(Power Generation), M15B (Utilities) and M17 (Automation and Electrical), is presented on the documents below:

- I-DE-3010.2D-1424-190-P4X-002 (M13 - ELECTRICAL EQUIPMENT ROOMS - DOORS AND INSULATION PLAN),
- I-DE-3010.2D-1426-190-P4X-003 (M15B – ROOMS AND LABORATORY - DOORS AND INSULATION PLAN).
- I-DE-3010.1D-1428-190-P4X-002 (M17 - AUTOMATION & ELECTRICAL - DOORS AND INSULATION PLAN),

6.1.2 This preliminary schedule developed as part of the Basic Design phase shall be verified, confirmed, and continuously updated during the detailed design phase, until all required information is specified prior to procurement of the respective openings.

6.1.3 “A”, “H” and “J” rated doors and emergency escape doors shall be fitted with permanently attached self-closing devices.

6.1.4 All doors shall preferably open outwards. The doors for all rooms opening inwards shall be equipped and supplied with an escape opening panel without this interfering with the fire resistance classification of the door. The escape opening panel shall have the minimum dimensions according to NR-37 Brazilian regulation.

6.1.5 All door lockers shall be supplied with 2 (two) keys. The door system shall be provided with a set of 3 (three) master keys. The doors located on corridors, escape routes and staircases shall not be fitted with lockers, other doors shall be fitted with lockers unless otherwise specified.

6.1.6 Locking devices shall be provided on all closures giving access to spaces or areas required to be locked. All hinged doors in emergency exits shall open outwards in the direction of the escape route and shall be easily opened from both sides by one person.

6.1.7 Padlocks shall be supplied for all external doors whose closing systems do not allow installation of lockers with keys.

6.1.8 Laboratory cargo handling door and M15B corridor door shall have magnetic locking devices with a central manual release system at the Central Control Room of the FPSO.

6.1.9 Doors with no ventilation grill shall have minimum noise reduction of 44 dB. Doors with ventilation grille shall have minimum noise reduction of 37 dB. Additionally, all doors shall have suitable doors’ sound reduction to comply with noise and vibration analysis report developed in the detailed design phase.

6.1.10 The doors between compartments with and without air-conditioning shall be provided with thermal insulation.

6.1.11 Doors, hatches, and removable panels shall be located and designed according to the needs of each case. The configuration and dimensions of the doors, hatches and removable panels shall allow, whenever necessary, the traffic of people, stretchers, equipment, pieces, and other objects and shall not represent an obstacle to any of these passages.

6.1.12 Hatches and removable panels shall be provided for areas and compartments where there is the possibility of removing equipment or large parts or pieces for handling or maintenance.

6.1.13 Hatches shall be hinged, provided for frequent or for scape passages, installed in the horizontal plane, and allowing lifting whenever necessary. Large hatches shall be supplied with unique opening devices to be used to open and keep each hatch opened. Tank hatches are not the scope of the architectural design.

6.1.14 Removable panels shall be bolted, provided for situations of eventual use, installed in the horizontal or vertical planes. Removable panels shall be supplied with eyelets that allow their lifting.

6.1.15 All doors, hatches, and removable panels shall be marked with nameplates following BUYER standard signalization according to item 4.1.9.17. The nameplate shall be affixed 1600 mm above the floor. The nameplate shall identify the Room Number and the Room Name (both to be confirmed about using provided information on architectural drawings). Name plates shall be in Portuguese and English language. Other characteristics shall follow the BUYER standard signalization.

6.1.16 Drawings shall be provided for each type of door, hatch, or removable panel. The drawings shall provide the necessary design, engineering, manufacturing, and quality assurance requirements information necessary to enable the procurement or manufacture of an interchangeable item or final product that duplicates the physical and performance characteristics of the original product, without additional design engineering effort or recourse to the original design activity.

6.1.17 All toilets cubicle and WC doors shall open outwards and shall be fitted with inside thumb-turn and outside indicator.

6.2 Doors – Material and Construction

6.2.1 Internal doors leaf surfaces shall be halogen free finishing and shall be supplied printed or painted on the door covering leaves.

6.2.2 External doors shall be 316L stainless steel material finishing with suitable painting. The doors shall be fixed on the outside of the bulkheads and open outwards. The design of doors, hatches, removable panels, and sills shall prevent water on the outside decks from passing through the corresponding opening.

6.2.3 All emergency doors shall be painted (internal side) with color Munsell 5R 4/14 according to NR-26. BUYER shall be consulted regarding location of these doors. The infirmary access door shall be painted with color Munsell notation 2.5 G 5/10 on the external face.

6.2.4 All door leaves shall be fully insulated without any air pockets. Insulation fibers shall be sealed to prevent any fibers being released to the environment, and totally impervious to moisture. External stainless-steel surfaces shall be blast cleaned with fine grade of aluminum silicate. Internal stainless-steel surface shall be brushed finish, unless otherwise specified. It is also applicable to insulated hatches and removable panels.

6.2.5 Doors, hatches, and removable panels, with associated hardware shall be designed and arranged according to ergonomic principles so that the potential for

injury to persons is reduced. Door assemblies shall be easily operable in a hazardous or accidental situation.

6.2.6 Panic bars shall be provided on doors in areas where there is a risk of congestion or panic. At least, all internal doors located in Escape routes and Muster stations shall have panic bars.

6.2.7 Trolley protection plates (800 mm height) in brushed stainless steel shall be provided for hinged doors in traffic areas to protect the Laboratory doors from passage of workers that need to pass through the doors using carts and to prevent damage to the doors that may be caused with the passage of workers using trolleys on the rooms located on M13, M15B and M17 Modules.

6.2.8 Trolley protection plates shall be mechanically fixed with flush fixings. There shall be no sharp or protruding edges.

6.2.9 Threshold detailing and door arrangement shall stop all ingress of water from decks.

6.2.10 Threshold shall be provided at wet areas, internal or external. The surface shall be finished with a homogeneous skirting board with round corner. Doors shall be placed in position after the installation of wall panels. Door closers, latches and other items shall be fully adjusted and tested for proper action, and all access panels or other removable panels shall be adjusted and operated as necessary to ensure their proper performance.

6.2.11 All required thresholds shall be dimensionally as low possible, without impairing function with regards to fire rating, noise reduction, and ability to stop ingress of water.

6.2.12 Where there shall be regular passage of trolleys, the doors shall have thresholds arranged and detailed to provide an absolute minimum of obstructions. This may be achieved using thresholds with integral ramps, or by using deck leveling screeds and associated floor finishes creating local ramps to compensate threshold heights.

6.2.13 Hinged doors shall be supplied with stainless steel hinges, closers, latches, and lever handles. Locks shall be provided whenever specified on the door's schedule. Doors with height up to 2500 mm shall be supplied with three hinges and doors with height of 2500 mm or more shall be provided with four hinges, minimum. Lever handles shall be of ergonomic shape to prevent fouling of clothing. All hardware, hinges, locks, and other fittings shall be stainless steel. Hinges shall be heavy-duty lift off butt or equal approved, to permit removal of the door leaf. Latches shall be spring mortise type, keyed or unkeyed. Door handles shall be solid with a minimum 9 mm spindle. Lock screws in spindles shall be of a type that does not need periodical re-tightening.

6.2.14 Door frames shall be installed, as appropriate, by either bolting through airtight isolation gaskets, or by a continuous fillet weld all round. Frames shall be reinforced at hinges, locks, and closer device positions. Detailing shall minimize galvanic corrosion.

6.2.15 Vision panels (or fixed windows) shall be installed as required for orientation or safety reasons and always in doors to corridors and stairways, escape route

doors and collective rooms. Vision panels shall be an integral part of the certified door. The glazed area shall be approximately 200 x 400 mm (W x H). The vision panels shall not impair the function of the sliding door sealing.

6.2.16 Door stops of chrome plated brass with rubber head and catches shall be installed for all office's doors. Doorstops shall be resilient, easily removable and shall be positioned so as not to present a tripping hazard specially to escaping personnel.

6.2.17 All hinged fire doors, emergency scape doors, stairway doors and doors of closed spaces located on M13, M15B and M17 leading outside shall be provided with an overhead heavy-duty hydraulic door closer. Door closers shall not obstruct the action of the doors or reduce the specified clear openings. Door closers shall not incorporate a stay open device. The frames and door leaves for all doors shall be delivered with pre-drilled holes for fixing of door closers. Suitable reinforcements shall be provided within the doors and doorframes.

6.2.18 Door leaves shall be properly reinforced at hinges, locks, handles, closer devices, and any other places where hardware is to be attached to the door.

6.2.19 All doors and frames shall have applied finishing compatible with the partition wall.

6.2.20 The blast resistance of doors, hatches and removable panels shall be in accordance with explosion studies.

6.2.21 B-15 door thresholds shall be made of 1 mm stainless steel and shall be flush with finished floor's level, except for wet areas. Stainless steel door leaf, door frame and hardware shall have the surface protected by plastic film during shipment and construction at the yard. Carbon steel scratching and grinding sparks shall not contaminate any of the stainless-steel surfaces. Damaged surfaces shall be chemically removed and then refinished to a bare bright surface. Door frames shall be factory finished, standard painting (Munsell or RAL) scale, and the fixing of door hardware shall be such as not to damage any applied finishes.

6.2.22 To reduce transmission of forces from bulkhead into frame, which may affect proper alignment and operation of door, maximum plate buckling at perimeter of cutout shall be 5mm along a straightedge. Alternatively, the cutout may be terminated at welded angle profile, into which the doorframe may be welded or bolted.

6.2.23 Any additional components, which are required to comply with fire rating, such as, exposed frame insulation covering and associated flashing, shall be provided. For a complete delivery, gaskets, screws, and screw cover shall be included.

6.2.24 All doors, hatches, and removable panels and their respective frames and coamings shall be designed and constructed to be as light as practicable, consistent with necessary strength, duty, tightness, rigidity requirements, and fire-retardant characteristics. They shall withstand, without permanent distortion, the specified proof test pressures, when applied to both sides (not simultaneously).

6.2.25 The material, construction and installation of hatches and removable panels shall

follow the recommendations of the discipline of Structure.

The rigidity of all closures shall be such as to prevent limberness, to maintain the gasket (or contact) surface in a single plane under normal service conditions, to prevent distortion and to seat the gasket. Opening devices for doors shall be sufficiently offset and be so located as to prevent injury to the hands of operating personnel. The handles finish shall be smooth, without flash or projections. All operating and securing devices for doors shall be so designed and constructed that they cannot be released by vibration. On quick-acting doors, the operating opening device shall be designed to cause no obstruction of the passage opening when the door is in the open condition. When hinged doors are designed to seat gaskets tightly around their entire periphery (by securing devices), the hinges shall be designed to prevent binding and damage to the hinges or closures in the tightening process.

Doors in structural bulkheads shall have rounded corners. Door frames in structural bulkheads shall be reinforced with a stiffening arrangement to match the door manufacturer's requirements to prevent leakage and exceeding the allowable stresses.

6.3 Fire rated doors

6.3.1 All doors, hatches and removable panels shall be classified as "C", "B", "A", "H" and "J" rated doors due to their resistance to fire and shall be fully compatible with the proprietary partition systems where they are installed. External doors, hatches, and removable panels shall have at least fire integrity class as required by the MODU code. "J", "H", "A" and "B" class doors shall be fully tested and certified as "J", "H", "A" or "B" doors in accordance with international applicable requirements and criteria and with the C. S. requirements. If necessary, hatches and removable panels shall also be tested and certified with the classes defined in the project, according to the requirements listed above.

6.3.2 C Rated Doors

6.3.2.1 Class C doors are all doors not required to be class B, A, H or J.

6.3.3 B-15 Rated doors

6.3.3.1 Concealed solid fixed backings shall be provided within the leaf thickness for door hardware fixing. Sound reduction value shall be compatible with the installed wall system in which the door is installed.

6.3.3.2 The construction of B-15 rated doors shall be as follows, unless otherwise specified:

- Frames - Galvanized steel profile frames to interlock with partition wall openings, incorporating over panels in the transom where necessary. Frames shall be supplied to fit all types of bulkheads and installation methods.
- Leaves - Sandwich construction, stiffened flush framed panels with facings on both sides in halogen free material surface finishing, coated galvanized steel sheets, incorporating a fully bonded core of non-combustible mineral wool insulation, and free of asbestos.

6.3.3.3 The door frame shall be provided with a resilient pad on three meeting faces to reduce the impact noise caused by the closing action of the door.

6.3.3.4 In corridor bulkheads “B” Class Divisions, ventilation openings may be allowed only in and under the doors of cabins, public spaces, offices, and sanitary spaces. This ventilation openings shall be provided only in the lower half of the door.

6.3.3.5 Where such an opening is in or under a door, the total net area of any such opening shall not exceed 0.05 m².

6.3.3.6 When such an opening is cut in a door it shall be fitted with a grille made of non-combustible material.

6.3.4 “A” Rated Doors, hatches, and removable panels

6.3.4.1 Concealed solid fixed backings shall be provided within the leaf thickness for fixing of door accessories.

6.3.4.2 “A” class doors, hatches and removable panels shall be provided with gaskets and shall be selected and arranged to guarantee the long-term sealing performance requirements. Gasket seals shall maintain the specified integrity of the door, hatch, or panel throughout the respective specified lifetime. Gaskets shall be glued or mechanically fixed in such a way that they may be easily replaced. Gaskets shall maintain the elasticity and allow for lathing and full perimeter sealing of door-the leaves during continuous heavy use, without requiring excessive force or slamming. For doors in zone 1 classified areas and for doors which shall maintain differential air pressure, the gaskets shall be selected and arranged to guarantee the long-term sealing performance requirements. “A” class door leaf shall be made of steel plate with mineral wool core, frame made of galvanized steel profile, 3-part hinges with ball bearing and grease nipples, reinforcement for door closer, magnet and cut out for lock.

6.3.4.3 The construction of “A” rated doors panels shall be as follows, considering the specified on the item 6.2 (Doors – Material and Construction):

- Frames - Galvanized profile steel frames to interlock with partition wall openings, incorporating over panels in the transom where necessary. Frames shall be supplied to fit all types of bulkheads and installation methods.
- Leaves - Sandwich construction, stiffened flush framed panels with halogen free material finishing on both sides (when internal door), coated galvanized steel sheets, incorporating a fully bonded core of non-combustible mineral wool insulation, and free of asbestos.

Sound insulation value shall be compatible with the installed wall system in which the door is installed.

6.3.5 “H” Rated Doors, hatches, and removable panels

6.3.5.1 The “H” class doors, hatches and removable panels leaf shall be stainless steel finishing 2 mm thickness and door frame 4 mm thickness unless there are something more restrictive specified by discipline of Structure.

6.3.5.2 External hinged “H” rated doors, hatches and removable panels shall be suitable for offshore constructions as protection against hydrocarbon fires and explosions. The doors and hatches leaves shall have reinforcement plates for hinges and

closers. Frames shall be constructed with a profile shaped to give maximum tightness, with 3 separate areas of impact.

6.3.5.3 The frame shall be proper for bolting or welding. The hinges shall be stainless steel, bolted to the door leaf and welded to the door frame and shall be provided with washers between the top and bottom parts to reduce friction. Air and gas tightness shall be at least 0.4m³/hm² at 50 Pa, or in accordance with design directives. Lock-case shall be operated with one center mounted handle. Sound insulation value shall be compatible with the installed wall system in which the door is installed.

6.3.6 “J” Rated Doors, hatches, and removable panels

6.3.6.1 External hinged “J” rated doors, hatches and removable panels shall be suitable for external areas and offshore constructions as protection against jet fires and explosions. The door and hatches leaves shall have reinforcement plates for hinges and closers. Frames shall be constructed with a profile shaped to give maximum tightness, with 3 separate areas of impact.

6.3.6.2 The frame shall be proper for welding.

6.3.6.3 “J” class doors shall comply with all requirements of “H” class doors and shall still be fireproofing, which shall confer a consistent protection against the jet fire over the same.

6.4 Tightness

6.4.1 The tightness of the doors and hatches may be required by regulations or studies from the disciplines of Naval, Structures or Safety.

6.4.2 Weathertight doors

6.4.2.1 A closing appliance is said to be weathertight if it is capable, under any sea conditions, of preventing the penetration of water into the unit. Doors exposed to the weather and strong winds shall be robust stainless-steel sliding or hinged doors. The door leaf shall be a sealed unit, totally impervious to moisture. Sliding doors shall be mounted on the outside of the walls.

6.4.2.2 All weathertight doors shall withstand the extreme environmental design conditions on the field location. Detailing shall prevent any water on external decks from passing through the door construction.

6.4.2.3 Weathertight doors in position 1 and 2, as defined on I-DE-3010.2E-1350-960-P4X-003 (FREEBOARD PLAN) according to ICLL (International Convention on Load Lines, 1966, and Annexes as amended), shall be designed to provide an equivalent safety level as recognized industry standard (e.g., iso 6042).

6.4.2.4 Weathertight doors shall be installed according to the Basic Design as well Classification Society rules and applicable regulations. Certificates type examination (type approval certificate) shall be provided during proposal analysis phase. If there is any inconsistence between the Doors Arrangement and C.S. rules, C.S. rules shall prevail.

6.4.2.5 All weathertight doors and their frames shall be factory finished with painting according to I-ET-3010.00-1200-956-P4X-002 – GENERAL PAINTING.

6.4.2.6 All external doors shall be installed to avoid any gas leakage and shall be, as previously required, completely sealed.

6.4.2.7 Doors or hatches within weathertight bulkheads shall be certified to meet the applicable design pressures (see applicable maritime requirements).

6.4.2.8 All weathertight “A”, “H” and “J” class hinged doors and active leaf of all hinged double doors shall be self-closing, self-latching and central release (quick-acting type).

6.4.2.9 Quick-acting doors shall be those designed to effect simultaneous closing or opening action by the operation of a single lever or hand wheel.

6.4.2.10 Weathertight doors’ dimensions and sills shall be confirmed during the detailed design phase, considering their use and location and the dimensions of equipment that may be transferred between compartments and outside.

6.4.2.11 Where weather-tightness is required, weather-tight seals shall be added. The weather tightness shall be verified by hose testing from the outside after installation. No leakage shall be accepted. On floating production units and semi-submersibles, weathertight doors may be required on or above freeboard decks. In addition to the sealing requirement stated above, these doors shall be designed for a strength equivalent to or better than that required for the weather-tightness of the structure in which they are positioned.

6.4.2.12 Weathertight closing appliances are required for those external openings being submerged at least up to an angle of heel equal to the dynamic angle. This applies to any opening within 4000 mm above the final waterline as well. Doors shall generally open outwards to provide additional security against impact of the sea.

6.4.2.13 Doorsill heights shall be from steel deck to clear opening door and shall be defined in accordance with ILLC (MSC 77/26/Add.1, ANNEX 3), as described on item 3.7 of MODU Code or applicable rule regarding F.P.S.O. or semi-submersible platform.

6.4.2.14 All weathertight doors, if specified, shall be designed to have the ability to incorporate a fixed vision glass (or window) in the panel if specified. Fixed glasses in weathertight doors shall be of sufficient strength to maintain the damage control strength requirements and resistance to damage features of the door in which it is installed. Fixed lights for doors facing the process plant shall be of heat-treated and shatterproof glass.

6.4.2.15 Doors shall have, as a minimum, the same sound reduction requirement as the wall they are installed in, unless it can be documented that a lower value is acceptable, to meet the weighted sound reduction (Rw) value of complete wall/door assembly. The sound measurement test method shall be in accordance with ISO 140/3.

Opening Pressure

6.4.2.16 The opening force required to open a door, as measured with a dynamometer or similar device, shall not exceed the following limits for doors in frequent use, (major traffic, escape route doors or doors used more than 10 times a day), when these doors are in a level position:

- Hinged doors: 65 N
- Sliding Doors: 50 N

6.4.2.17 For all other doors, the following limits shall not be exceeded:

- Hinged doors: 130 N
- Sliding Doors: 105 N

6.4.2.18 The maximum acceptable opening force in accidental situation shall never exceed 250 N, for doors defined as escape doors. Hinged doors leading to open areas shall be provided with a damping mechanism to prevent injuries.

Design Qualification Test.

6.4.2.19 Doors are required to be qualified by the Naval Technical Authority. Each weathertight door shall be tested in accordance with the following requirements:

6.4.2.20 After installation onboard all weathertight doors shall be hose tested, the door shall not permanently deform. The water pressure shall be at least 0.2 mm² (2 bar), and the nozzle shall be held at maximum 1500 mm from the door or hatch cover.

6.4.2.21 Doors shall be tested to verify compliance with design tightness pressure. No adjustment or repairs are allowed during the test. At the completion of the test no parts shall require replacement, repair, or adjustment. The door shall be re-hydrostatically tested following the cycle testing and qualify only if the hydrostatic test is successful.

6.4.2.22 Doors shall be fire tested to meet the requirements of the bulkhead in which they shall be installed.

Materials

6.4.2.23 All weathertight doors shall be of stainless-steel plate, type AISI 316L, or alternatively AISI 316 with a maximum carbon content of 0.05 %. Door leaves shall be built for minimum repair requirements.

6.4.2.24 Doors shall be supplied with temporary preservation resistant to welding spatter and angle grinding grit. The door surface finish, after preservation removal, shall be stain resistant and require minimum maintenance. A procedure for stain removal (without dismantling the door) shall be provided.

6.4.2.25 Doors shall be provided with three hinges, minimum. The hinge design shall allow for easy removal of the door. All hardware, hinges, locks, hooks, and similar fittings shall be of AISI 316 L stainless steel or alternatively AISI 316 with a maximum carbon content of 0.05 %.

6.4.2.26 The door leaf or the gasket shall be easily adjustable after the door has been installed to ensure proper closure and compression of seals when closed.

6.4.3 Gastight Doors

6.4.3.1 “A” class door shall be gastight in compartments provided with CO_2 system, where there is a differential pressure. These doors shall open outwards and shall be provided with hydraulic door closer. Leakage rate shall not exceed 0.5m³/m²h at 50 Pa over pressure following prolonged use or specified by the project. The test certificate shall be provided with each door type. If there is

any divergence between the Basic Design drawing and C.S. Rules, C.S. rules shall prevail.

6.4.3.2 Weathertight doors for rooms equipped with CO_2 firefighting system shall be supplied with limit switch (REED RELAY TYPE), hydraulic door closer and door open alarm device.

6.4.3.3 To facilitate the exit, gastight doors shall be fixed on the outside of the bulkheads and open outwards.

6.4.3.4 Gastight doors' dimensions and sills shall be confirmed during the detailed design phase, considering their use and location and the dimensions of equipment that may be transferred between compartments and outside.

7 FIRE RATED WINDOWS

7.1 General

7.1.1 The preliminary schedule with characteristics (class, tightness, dimensions, accessories, etc.) of windows located on M15B is presented on the document I-DE-3010.2D-1426-190-P4X-003 (M-15B ROOMS AND LABORATORY - DOORS AND INSULATION PLAN).

7.1.2 This preliminary schedule shall be verified, confirmed, and continuously updated during the detailed design phase, until all required information is specified prior to procurement of the windows.

7.1.3 All windows installed on steel bulkheads shall be at least "A" Class fire rated windows. All windows shall be certified to have the same fire rating as the wall they are installed in, non-opening type, designed to be welded on steel bulkheads. The window units shall consist of a 6,0 mm (minimum) main frame, a sealed condensation free glass panel, a fixing frame (made of stainless steel) and an adjustable internal frame. Gasket between steel bulkhead and outer frame shall be provided.

7.1.4 The window system shall include a telescopic internal frame for accurate and flexible installation. The windows boxes shall be insulated and made of reinforced polyester or galvanized steel painted.

7.1.5 The windows shall have type approval according to IMO Resolution A754 (18) based upon fire test against the toughened safety glass. The windows shall have toughened safety glass dimensioned as per ISO 21005 and ISO 1095 (side scuttles) and shall have mechanical strength as required by ISO 3903 and ISO 1751 (side scuttles).

7.1.6 The distance from steel deck to the window center shall be 1600 mm unless otherwise specified.

7.2 Sound Characteristics

7.2.1 The windows shall as far as possible be soft connected to the steel structure and treated with structure borne noise damping material.

Weighted sound reduction index (Rw):

- Lab tested up to Rw = 53 dB

- Tested on platform Rw = 60 dB

7.2.2 All material construction shall be provided to comply with noise and vibration analysis report developed in the detailed design phase.

7.2.3 The noise of M13 (Power Generation), M15B (Hull Utilities) and M17 (Automation and Electrical) shall be in accordance with I-ET-3010.00-1200-300-P4X-001 (NOISE AND VIBRATION CONTROL REQUIREMENTS).

8 PASSIVE FIRE PROTECTION (PFP) AND THERMAL AND/OR ACOUSTIC INSULATION

8.1 General Information

8.1.1 The basic design of Passive Fire Protection (PFP) and thermal and/or acoustic insulation on decks and bulkheads of M13 (Power Generation), M15B (Utilities) and M17 (Automation and Electrical), is presented on the documents below:

- I-DE-3010.2D-1424-190-P4X-002 (M13 - ELECTRICAL EQUIPMENT ROOMS - DOORS AND INSULATION PLAN),
- I-DE-3010.2D-1426-190-P4X-003 (M15B B ROOMS AND LABORATORY - DOORS AND INSULATION PLAN),
- I-DE-3010.2D-1428-190-P4X-002 (M17 - AUTOMATION & ELECTRICAL - DOORS AND INSULATION PLAN).

8.1.2 SELLER shall design, detail, and install all insulations or protections complying with applicable rules and regulations and following the requirements of this technical specification. All PFP systems shall be assembled according to drawings approved by the S.C. and as specified by the manufacturers.

8.1.3 Basic Design has foreseen all PFP to adequately develop the design of the referred spaces. However, SELLER shall develop its own design that shall indicate the correct solution. All inconsistences shall be solved during detailed design phase.

8.1.4 SELLER shall develop the design for all flexible thermal and/or acoustic insulation according to requirements below and others described wherever on Basic Design documents.

8.1.5 Type, degree, characteristics and dimensions of all protection and insulation shall be confirmed in the detailed design phase.

8.1.6 SELLER shall design, detail, and install all bulkhead required by safety studies or other disciplines, providing their respective insulations or fire protections.

8.1.7 Due to safety concerns, all insulation shall be faced, to minimize the release of any fibers. All cut and exposed edges shall be sealed.

8.1.8 Rock wool insulation with external cladding will not be accepted by BUYER in any conditions.

8.1.9 Special attention shall be paid to the junction between the steel deck and insulation to avoid water penetration.

8.1.10 The installation of insulation (PFP, thermal or acoustic) inside elevator box and piping trunks will not be accepted.

8.1.11 Air spaces enclosed behind ceiling, paneling, or lining shall be divided by close fitting draught stops spaced not more than 14 m apart, to avoid fire and smoke spreading.

8.1.12 Batteries rooms' bulkheads and insulation mechanical protections shall be properly treated against battery fluid corrosion.

8.2 Passive Fire Protection (PFP)

8.2.1 Passive Fire Protection (PFP) shall be applied on bulkheads, doors, windows, and penetrations, in accordance with applicable rules and regulations of IMO MODU CODE and SOLAS (1974 and amendments). All insulating materials shall be of non-combustible material and water repellent and shall be suitable for the marine environment and the context in which they will be used. The materials shall not be corrosive to metal or emit any toxic gases or harmful dust.

8.2.2 All aspects of PFP material design, including manufacture and installation shall be in accordance with the latest editions of applicable codes and standards issued by internationally recognized organizations, associations, and regulatory bodies, including, but not limited to, International Standards Organization (ISO), Inter-Governmental Maritime Consultative Organization (IMCO), International Convention for the Safety of Life at Sea (SOLAS), 1974 and amendments in Force. Also, material shall be in accordance with C.S rules.

8.2.3 Costs and maintenance requirements shall be considered as main factors in the evaluation of different PFP systems. The manufacturer shall provide information on the expected total service life costs of the proposed system, including topcoat replacement. Such data shall include experience gained to date in similar offshore installation conditions.

8.2.4 Passive protection shall guarantee to limit the temperature on the unexposed side to a level where personnel are safe or below the combustion temperature of combustible materials. It shall limit the stress levels in structural steel to a temperature where its load-bearing ability is not compromised. The Passive Fire Protection system shall be designed for the purpose of maintaining structural stability and integrity of all primary steel members for a defined period when exposed to a hydrocarbon fire. Fire protection performance shall be based on the ability of a minimum thickness of PFP material to restrict the rate at which heat is transmitted to the protected element. The criteria for the fire performance of the system shall be the acceptable steel temperature at the end of the fire exposure period to avoid collapse.

8.2.5 All PFP systems shall be tested at a recognized independent establishment to standard fire tests to classes A/B, to hydrocarbon fire test to class H and to jet fire test to class J. Suitable certification shall be available from approval authorities such as classification society to support all the fire protection requirements of the project.

8.2.6 The fireproofing material supplied for the project shall be manufactured using the same formulation as the material that has been subjected to hydrocarbon/fire tests by a recognized independent third party.

8.2.7 The fireproofing material shall be asbestos free.

8.2.8 The required thicknesses and reinforcement systems on the base of the fire protection requirements shall be provided.

8.2.9 PFP material thicknesses shall always be supported by the approval of an authority certification (e.g., by Classification Society).

8.2.10 The PFP system shall be able to maintain fire performance over the service life of the installation. In this regard, the proposed PFP system's ability to satisfy the following requirements:

- Resistance to weather cycling in offshore environments (corrosion resistance),
- Impermeability (corrosion and mechanical resistance),
- Resistance to flexing and vibration of the substrate (adhesion),
- Chemical resistance to products liable to pollute it (hydrocarbons typical to oil and gas installations),
- Mechanical shock (impact) resistance,
- Abrasion and erosion resistance,
- Resistance to wash down by high pressure water jets and typical cleaning agents,
- Resistance to substrate temperature cycling during construction and operation,

8.2.11 The PFP systems approved by BUYER, for external application, can be composed of:

- Intumescent painting, high performance reinforced epoxy, solvent free, and
- Phenolic foam system with mechanical protection composed of resin finish.

8.2.12 The PFP systems approved by BUYER, for internal application, can be composed of:

- Rock fiber system with application on the internal side of the compartment sealing bulkhead,
- Intumescent painting, in high performance reinforced epoxy, solvent free, with presentation, by the SELLER, of a C.S. certificate that the material meets the maximum emission limits for smoke, vapors and toxic gases in the event of fire, and
- Phenolic foam system with mechanical protection composed of resin finish, with presentation, by the SELLER, of a C.S. certificate that the material and its external mechanical protection meet the maximum emission limits for smoke, vapors, and toxic gases in the event of fire.

8.2.13 Other materials than those listed above can be accepted during the detailing design phase if they have a C.S. approval certificate and meet the requirements

for maintenance, operating cost, and demand for activities on board throughout the life of the Unit. BUYER may disapprove and/or reject the use of such material if no advantages are identified for the company in relation to the usual systems.

8.2.14 Protection systems with external metallic coating and silicone sealing ("cladding") are not approved for external application, since passive rock wool protection can suffer degradation if occur penetration of moisture and consequent condensation between the non-welded metal lining and the compartment sealing plate, without any noticeable damage. The use of this type of coating on external faces implies greater maintenance and inspection effort over the life of the Unit.

8.2.15 Flexible type fireproofing shall have a finishing/protection suitable to the environment conditions in which it will be installed. Bulkheads and decks that are to be insulated shall be provided with fixing pins and washers to retain the insulating material. The pins shall be welded to the structural material, e.g., steel surface. In compartments where the movement of equipment or part is possible, exposed fire insulated bulkheads shall be covered with aluminum plate from the floor to the ceiling until 3000 mm to be protected against mechanical shocks. This mechanical protection requires structural reinforcements. The aluminum plate shall be perforated in noisy environment. Galvanic corrosion shall be avoided, so, isolation shall be provided between aluminum plate and steel pieces. Exposed deck and bulkhead fireproofing insulation shall be covered, at least, with glass cloth. Blanket and plate fixations shall follow SELLERs' recommendations.

8.2.16 The mechanical aluminum protection shall be perforated in noisy environment, to contribute on reducing the acoustic levels to achieve the recommendations of the noise and vibration analysis report. In this sense, the holes in the perforated plates shall be properly dimensioned and spaced.

8.2.17 All intumescent fire protection coating shall be in high performance reinforced epoxy and without solvents.

8.2.18 Basic Design has predicted all external "H" and "J" class insulation as intumescent fire protection coating. Detailing design shall follow basic design predictions. Thickness shall be in accordance with manufacturer instructions.

8.2.19 "H" and "J" class insulation shall be able to protect the structure and bulkheads against, respectively, hydrocarbon fire and jet fire, preserving its integrity during the specified time.

8.2.20 Where applicable, SELLER can propose intumescent fire protection applied on external side of bulkheads and decks instead of the internal flexible type of protection predicted by the Basic Design. In this case, SELLER shall consider the internal application of thermal and/or acoustic insulation complying with requirements of item 8.3. The final solution shall achieve all requested levels of protection and insulation and be approved by Classification Society.

8.2.21 Intumescent fire protection coating shall not be used on ceiling and bulkheads of closed areas. See I-ET-3010.00-5400-433-P4X-001 (PASSIVE FIRE PROTECTION).

8.2.22 Stairway and lift trunk shall be enclosed by "A" class walls and be protected by self-closing "A" class doors at all decks, to avoid fire spreading from one deck to another.

8.2.23 At the intersection between a higher-class division and another one with lesser degree of protection, an extended fireproofing is to be provided to a distance of at least 1000 mm beyond the intersection, according to I-ET-3010.00-5400-433-P4X-001 (PASSIVE FIRE PROTECTION).

8.2.24 Passive Fire Protection purpose shall provide the unit with the required fire safety levels, aiming to:

- Minimize the action of fire, restraining it to its origin,
- Protect human life,
- Protect equipment and systems, mainly those essential to the safe operation of the unit,
- Safeguard the unit's structural elements, in such a way as to preserve the designed structure's mechanical strength.

8.2.25 Typical insulation details shall as far as practicable be standardized throughout the installation and shall be reflected in the wall type/deck type details and schedules. Details showing fire insulation with specific fire direction identified shall be provided.

8.2.26 Insulation details shall be suitably referenced on project documentation so that they may be used for verification of installed insulation as part of mechanical completion activities, and for repair work or modification during later phases.

8.2.27 The following issues shall be considered for determination of the type and degree of the Passive Fire Protection:

- Evaluation of the equipment layout and division of the unit into risk areas,
- Indication of the type of protection, with its respective classification, for each implementation area,
- Indication of the direction of the fire acting against shields,

8.2.28 For more information about PFP, see I-ET-3010.00-5400-433-P4X-001 (PASSIVE FIRE PROTECTION). PFP for structural elements shall be in accordance with document.

8.3 Thermal and/or Acoustic Insulation

8.3.1 The bulkheads, ceilings floors and wherever required by the HVAC discipline, shall be provided with a thermal insulation according to I-ET-3010.2D-5250-300-P4X-001 (HVAC SYSTEM – HVAC TECHNICAL SPECIFICATIONS).

8.3.2 The effect of fire protection shall be considered in the acoustical treatment. PFP and acoustical insulation may be considered as contributing to the thermal insulation.

8.3.3 The insulated floors, ceilings and bulkheads shall be of an approved type and shall be of non-combustible material. The insulation material shall be laid in such a way that condensation and noise is avoided and shall be securely fastened.

8.3.4 The insulation shall be flexible type.

8.3.5 Sound absorbing material may be mounted to bulkheads, walls, ceilings, and underside of decks in areas where additional absorption of sound is required. Sound absorption data for the insulation material shall be provided from a

recognized acoustic Laboratory. The insulation material shall have good sound absorption properties in the 63 Hz to 4 000 Hz frequency range.

8.3.6 The acoustic insulation shall be selected and detailed to achieve the sound absorption and sound reduction requirements specified on the project documentation. The insulation shall follow the NRC (Noise Reduction Coefficient) recommended by the requirements of the noise and vibration analysis report.

8.3.7 Protection systems with external metallic coating and silicone sealing (“cladding”) are not approved for external application, since passive rock wool protection can suffer degradation if occur penetration of moisture and consequent condensation between the non-welded metal lining and the compartment sealing plate, without any noticeable damage. The use of this type of coating on external faces implies greater maintenance and inspection effort over the life of the Unit.

8.3.8 Flexible thermal and/or acoustic insulation shall have a finishing/protection suitable to the environment conditions in which it will be installed. In compartments where the movement of equipment or part is possible, exposed bulkheads thermal and/or acoustic insulation shall be covered with aluminum plate from the floor to the ceiling or until 3000 mm to be protected against mechanical shocks. This mechanical protection requires structural reinforcements. The aluminum plate shall be perforated in noisy environment. Galvanic corrosion shall be avoided, so, isolation shall be provided between aluminum plate and steel pieces. Exposed deck and bulkhead thermal and/or acoustic insulation shall be covered, at least, with glass cloth. Blanket and plate fixations shall follow manufacture recommendations.

8.3.9 The mechanical aluminum protection shall be perforated in noisy environment, to contribute on reducing the acoustic levels to achieve the recommendations of the noise and vibration analysis report. In this sense, the holes in the perforated plates shall be properly dimensioned and spaced.

8.3.10 Special attention shall be paid to the junction between the steel deck and insulation to avoid water penetration.

8.3.11 Thermal insulation shall be applied on the boundary surfaces of all conditioned spaces or unconditioned spaces exposed to the weather and wherever required by HVAC project.

8.3.12 Thermal insulation design shall consider information presented in the document I-ET-3010.2D-5250-300-P4X-001 - HVAC SYSTEM - HVAC TECHNICAL SPECIFICATIONS

8.3.13 All aspects of thermal and/or acoustic insulation material design, including manufacture and installation, shall be in accordance with the latest editions of applicable codes and standards and with C.S. rules.

8.4 “B” Class Bulkhead

8.4.1 Divisions formed by ceiling or linings which comply with the following:

- They shall be constructed of approved non-combustible materials,
- All materials used in the construction and erection of "B" class divisions shall be non-combustible, with the exception that combustible veneers may be

permitted provided they meet other appropriate requirements of SOLAS chapters,

- as to be capable of preventing the passage of flame to the end of the first half-hour standard fire test,
- They shall have an insulation value so that if either face is exposed, the average temperature of the unexposed side will not rise more than 140ºC above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225ºC above the original temperature, within the time listed below:

CLASS	MINUTES
B-15	15
B-0	0

8.4.2 Acceptable test procedure: IMO Fire Test Procedures Code (FTPC).

8.5 "A" Class Bulkhead and Deck

8.5.1 Divisions formed by decks and bulkheads which comply with:

- They shall be constructed of steel or other equivalent material,
- They shall be suitably stiffened,
- They shall be constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test.
- They shall be insulated with approved non-combustible materials so that if either face is exposed, the average temperature of the unexposed side will not rise more than 140ºC above the original temperature, nor will the temperature at any one point, including any joint, rise more than 180ºC above the original temperature, within the time listed below:

CLASS	MINUTES
A-60	60
A-30	30
A-15	15
A-0	0

8.5.2 Acceptable test procedure: IMO Fire Test Procedures Code (FTPC).

8.5.3 Joints and reinforcements shall receive continuous welding to guarantee perfect tightness. Class A horizontal and vertical bulkheads shall be comprised of aluminum plate supports, duly reinforced and installed to assure gas and smoke impenetrability.

8.6 "H" Class Bulkhead and Deck

8.6.1 Those divisions formed by decks and bulkheads which comply with the following:

- They shall be constructed of steel or other equivalent material,
- They shall be suitably stiffened,
- They shall be so constructed as to be capable of preventing the passage of smoke and flame after 120 minutes exposure to a hydrocarbon fire test,

- They shall be so insulated that, if the designated exposure face(s) is (are) exposed to the hydrocarbon fire test for a specific time, the average temperature of the unexposed face will not increase at any time during the test by more than 140ºC above the original temperature, nor shall the temperature at any point of the face, including any joint, rise more than 180ºC above the original temperature, within all this specific time.
  This specific time to the respective classes is listed below:

CLASS	MINUTES
H-120	120
H-60	60
H-0	0

- Structures intended to be load bearing shall either be tested under representative conditions of loading and restraint or have the temperature of the load bearing medium monitored during the test to demonstrate that the maximum temperature reached would not have resulted in loss of strength or stiffness or excessive expansion such as to impair the load bearing capacity.

8.6.2 Fire Resistance Rating for load bearing structural elements is the ability of the structural element to withstand the effects of a defined fire (e.g., hydrocarbon time-temperature profile) for a specified time without loss of the fire separating and load bearing function of divisions and without loss of the load bearing function of structural members.

8.6.3 The Fire Resistance Rating for load bearing elements is determined based on the factors listed below:

- The structural element being considered,
- The required duration of the load bearing ability,
- The fire load (or heat flux in kw/m²),
- The restricted critical core temperature.

8.6.4 Every load bearing member shall be suitably fire protected to meet the requirements of the fire resistance rating.

8.7 "J" Class Bulkhead and Deck

8.7.1 Those divisions formed by decks and bulkheads shall comply with all requirements of "H" Class bulkheads and decks and shall still be fireproofing, which shall confer a consistent protection against the jet fire over the same.

8.7.2 The J-60 protection can be substituted for H-60 if the study of fire propagation and smoke dispersion demonstrate that the only fire typology present in the area adjacent to the protected environment is pool fire.

8.8 Delivery, Storage, Handling and Disposal

8.8.1 All PFP and thermal and/or acoustic insulation materials shall be delivered in original, sealed containers and shall be inspected for integrity.

8.8.2 PFP and thermal and/or acoustic insulation materials shall be stored in strict accordance with the manufacturer's instructions. Waste shall be kept to a

minimum and any left-over material shall be allowed to cure before being disposed of in accordance with local and/or national regulations.

9 FLOOR COVERING SYSTEM

9.1 General

9.1.1 All floor materials finishing shall be selected to comply with the conditions and functional requirements of each room/area. They shall be easy to maintain and clean. Materials, adhesives, sealing mastics, leveling screed, etc. shall be compatible and shall not emit toxic gases and dust.

9.1.2 The use of combustible materials in the rooms located on M13, M15B and M17 shall comply with SOLAS, Chapter II-2, Part B, Regulations 5 (Fire growth potential) and 6 (Smoke generation potential and toxicity). Combustible or toxic material shall not be used.

9.1.3 The colors of the finished floors shall be in accordance with the Decoration Scheme. At least, two colors per deck shall be available. At least two colors per material shall be submitted to BUYER approval, including catalogs containing specifications colors, and technical characteristics of all materials. Further, samples of the material shall be submitted to BUYER approval about the roughness level of the floor.

9.1.4 Catalogues shall be provided with technical characteristics, applicable test reports and standard floor colors and submitted to BUYER approval.

9.1.5 Deck compound shall be installed after steel decks have been thoroughly cleaned, dried, and painted with primer to prevent corrosion and obtain good adhesion. In rooms with gullies, the covering shall be inclined towards these, to obtain proper drainage.

9.1.6 Equipment foundation shall be installed before the application of floor covering system, considering the adequate levelling of work surfaces.

9.1.7 All floor covering system material shall be provided to comply with noise and vibration analysis report developed in the detailed design phase based on I-ET-3010.00-1200-300-P4X-001 (NOISE AND VIBRATION CONTROL REQUIREMENTS).

Notes:

a. Manufacturer updated information shall be considered during the detailed design phase and proposal analysis. Floor covering system properties and characteristics shall be maintained.

b. Equivalent material is accepted provided the material properties are suitable to fulfill the noise and vibration analysis report and the floor covering characteristics required for each area.

9.1.8 The following top floor coverings shall be installed according to Basic Design drawings:

- Monolithic floor (for dry and/or wet areas),
- Anti-acid ceramic tiles,

- Elevated floor systems,
- Rubber floor finishing (decorative, antistatic, or non-conductive type),
- Wooden Deck,
- Floor grating (for internal and external use),
- Painted Steel Deck (anti-skidding).

9.2 Primary Deck Covering

9.2.1 The primary deck shall be installed on interior deck areas, to level the surface prior to the application of deck finishing materials such as: tiles, rubber, or painting, only in combination with a top leveling product.

9.2.2 Primary deck covering shall be used as a self-leveling for deck, (proper for wet and/or dry area) before applying finishing materials such as rubber sheets, monolithic finishing (epoxy painting) or ceramic tiles (resistant to H2SO4).

9.2.3 The primary deck covering shall be selected according to required properties of each deck area to be covered, considering the possible and desirable properties related below:

- Fire-retardant,
- Self-leveling,
- Lightweight,
- Thermal insulation,
- Fast drying.

9.2.4 The primary deck shall be one component mortar, based on polymer modified mortar, flame resistance, flexible and able to provide a perfect flooring installation avoiding cracks and water penetration between joints. The primary covering and the top leveling product shall have high resistance to the deformations that the steel deck is submitted (bending, compression, and traction), without the use of wire mash and clamps.

9.2.5 The primary deck covering shall be manufactured in accordance with ISO 9001 / 14001 quality assurance.

9.2.6 Floating floor may be required to be integrated to the floor systems to minimize airborne noise. The detailed design shall follow the noise and vibration analysis report and provide the insulation if required so.

9.3 Monolithic floor (for dry and/or wet areas)

9.3.1 The monolithic floor covering shall consist of a self-leveling polymeric cement mortar base with an approximate density of 1.3 g/cm³ (after complete curing), followed by a two-component epoxy layer with mineral filler and coated with transparent epoxy resin, also bi-layer component. The entire monolithic floor system shall use materials certified by a classification society and approved for use in naval installations.

9.3.2 The finished floors shall have slope towards the drains, to guarantee an effective drainage, and considering the degree of inclination of the vessel, to prevent the accumulation of water from washing the floors.

9.3.3 The monolithic floor shall be designed and suitable to be used as a floor finish for indoor areas and exposed to heavy loads.

9.3.4 The monolithic floor shall have the following characteristics:

- Suitable for easy cleaning,
- Chemical resistance to the used products for hygienic cleaning, disinfection, washing, and bactericidal, which are chemically aggressive and allied to high temperatures may corrode the floor,
- Mechanical resistance to the impacts and blows in the floor, due to the efforts of transit of wheeled cars, manipulation and drags of equipment that could damage it,
- Anti-skidding properties provided by the mineral filler added to the mixture and adequate to the different ambiences of the Unit.

9.3.5 In addition to the color samples and technical catalogs, samples of the material shall also be submitted to BUYER for approval regarding the level of floor roughness, considering the necessary non-slipping properties.

9.4 Anti-Acid Ceramic Tiles (H2SO4 resistant)

9.4.1 The anti-acid ceramic tiles and correspondent skirting board shall be industrial type, chemical (H2SO4) and abrasive resistant, with high mechanical strength against impacts and protection against corrosion by aggressive substances, in light gray color.

9.4.2 Ceramic tiles shall be standard grade, impervious ceramic, porcelain type, with at least one self-finished edge for abutments to other material.

9.4.3 Floor tiles shall be slip resistant. The tiles shall be covered and turned up 100 mm at walls to form wall skirting and be finished with a rounded edge at the top and external corners. The ceramic tiles shall be laid up 100 mm against high foundations. Low height foundations (equipment close to floor, f. ex.) shall be fully covered with tiles. Horizontal and vertical exterior edges of foundation and recesses shall be provided with a rounded aluminum profile to eliminate any sharp and dangerous corners.

9.4.4 The tiles to be used shall have PEI 5 rating (abrasion resistant category), heavy duty type. Joints shall follow manufacturer's specification, and be made of washable, waterproof, and anti-fungus material. Only pre-prepared joint filler and sealant material may be used.

9.4.5 Joint gaps of anti-slip tiles shall be as specified by the tile's manufacturer. An expansion joint shall be provided at each 35 m² and around the room, close to steel coamings.

9.4.6 The deck compound shall be proper to anti-acid ceramic tile's installation and shall be provided in accordance with manufacturer's instructions.

9.4.7 An acid-resistant insulation blanket shall be applied under the ceramic tiles, suitable to the primary deck covering, to protect the steel.

9.4.8 Anti-acid ceramic tiles shall be installed in Battery Rooms (M13 and M17), as indicated on the document I-ET-3010.00-5140-700-P4X-001 (SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS): “Electric batteries rooms shall have acid resistant floor”.

9.4.9 Anti-acid ceramic tiles shall be installed in Laboratory (Equipment area and Office). The joints between tiles shall be made of impermeable material, to avoid chemical products penetration.

9.5 Elevated Floor Systems

9.5.1 The elevated floor system shall be proper to be installed where electrical, telecom and/or automation panels will be installed. Elevated floor characteristics (heights, capacities) shall be adequate to the requirements of each room where the system will be installed.

9.5.2 The elevated floor, or access floor, shall have features that make services easily accessible and shall provide quick access to all cabling that lies below the floor, such electrical, telecom or automation cabling. It shall result in faster installations and increased performance.

9.5.3 The elevated floor system shall have the following characteristics:

- Heavy duty type,
- Interchangeable with another panel strengths,
- Anti-static,
- Non-combustible,
- Grounding and electrical continuity,
- Class A flame spread and smoke development rating, and
- Lightweight.

9.5.4 The elevated floor, or access floor, shall have two possible finishing floors, according with room characteristics indicated on Basic Design drawings,

- Rubber floor finishing, antistatic type,
- Rubber floor finishing, non-conductive type (according to item 9.7).

9.5.5 The rubber floor finishing antistatic type shall be proper for IT rooms and shall be resistant to oils and greases, impact resistant, safe in fire-toxicological terms, fire-resistant and halogen free. The rubber sheet shall be 2 mm thickness and shall have anti-slip properties R 10 according to test method DIN 51 130. The deck compound shall be a cement and synthetic latex composition.

9.5.6 The rubber floor finishing antistatic type shall be applied on:

- Generators Power Panels Room (M13-401),
- Generators Control Panels Room (M13-403),
- Automation and Electrical Panels Room (M17-101).

9.5.7 The rubber floor finishing non-conductive type shall be proper for electrical rooms and shall be supplied according to specification presented on item 9.7.

9.5.8 SELLER shall provide rubber floor finishing (antistatic type or non-conductive type) of elevated floor aesthetically compatible with the decorative floor provided to the office rooms of the same elevation, what means, with the same characteristics as standard, colors, etc., be in accordance with the Decoration Scheme to be issued to BUYER approval.

9.5.9 The system indicated in this document represents the minimum requirements to be considered and shall be confirmed in the detailed design phase, according to the cargo handling design – document I-ET-3010.2D-5266-630-P4X-001 (TOPSIDE'S MECHANICAL HANDLING PROCEDURES).

9.5.10 Performance Requirements:

- Pedestals:
  a. Axial Load: Pedestal assembly shall sustain around 2200 kg (minimum) axial load without permanent deformation.
  b. Overturning Moment: Pedestal assembly shall provide an average overturning moment around 450 kg (minimum).
- Stringers:
  a. Midspan Concentrated Load: Stringer shall be capable of withstanding a concentrated load around 200 kg (minimum).
- Floor Panels:
  a. Concentrated Load: Panel shall be capable of supporting a concentrated load of 567 kg (minimum) placed on a one square inch area, at any location on the panel.
  b. Flammability: System shall meet Class A Flame spread requirements for flame spread and smoke development. Tests shall be performed in accordance with ASTM-E84-1998 (Standard Test Method for Surface Burning Characteristics for Building Materials).
  c. Combustibility: Access floor panels shall qualify as noncombustible by demonstrating compliance with requirements of ASTM E 136 (Standard Test Method for Behavior of Materials in a Vertical Tube Furnace) at 750°C.

9.5.11 Design Requirements:

- Elevated floor system: the elevated floor shall consist of modular and removable steel panels supported on all four edges by structural steel members bolted onto adjustable height pedestal assemblies forming a modular grid pattern.
- Shall consist of a top steel sheet welded to a formed steel bottom pan. Each panel shall be easily removed by one person with a lifting device and shall be interchangeable except where cut for special conditions. Mechanical or adhesive methods for attachment of the steel top and bottom sheets shall not be used.

- Quantities, finished floor thickness and location of accessories shall be specified on the detailed design drawings.

9.6 Rubber floor (decorative type)

9.6.1 The decorative floor (rubber sheet floor) shall be resistant to oils and greases, impact resistant, safe in fire-toxicological terms, fire-resistant and halogen free, tested according to the valid IMO resolutions MSC.61 (67) FTP Code, Annex 1, Part 2, and A.653 (16), regarding fire behavior, smoke density, and fire toxicological safety in case of fire.

9.6.2 Rubber sheet floor finishing shall have footfall sound absorption improvement of 6 dB. The rubber sheet flooring shall be 2,0 mm thickness, anti-slip properties and shall be B1 class fire resistance, in accordance with DIN 4102. The joints of rubber sheets rolls shall be sealed with hot welding rod. The skirting board shall be easy to clean, suitable for areas with high hygienic requirements. The deck compound for decorative floor shall be a cement and synthetic latex composition.

9.7 Rubber floor finishing (non-conductive type)

9.7.1 SELLER shall provide fixed rubber covering in front and rear sides of electrical panels with rated voltage equal to or higher than 400Vac (IEC 61892-6) installed in non-electrical closed rooms.

9.7.2 Closed rooms dedicated to electrical installations shall be provided with fixed rubber covering with rated voltage equal to or higher than 400Vac (IEC 61892-6) applied on all flooring.

9.7.3 The rubber floor finishing shall comply with the following requirements:

- NORMAM-01 and NR-10 Brazilian regulations,
- Type II – ABC (ozone, fire, and oil resistant - ASTM D 178-01),
- Be manufactured complying with IEC 61111 or ASTM D 178-01 requirements with minimum electrical class 0 (rated voltage up to 1kV and tested for 5kV),
- Halogen free,
- Smoke density test and toxicity according to ISO 5659, part 2 and IMO Res. MSC 61(67),
- Non-slip (IEC 61892-6),
- Heavy traffic.

9.7.4 The rubber floor finishing shall be installed above painted steel deck or elevated floor, according to indicated on Architectural drawings.

9.8 Wooden Deck

9.8.1 Wooden shock-protection pads shall be provided for all compartments and/or areas where cargo handling is required. For these areas, the wooden shock-protection pads design shall be proper to resist against heavy loads and impact.

9.8.2 The wooden deck shall be made of hard wood suitable for cargo handling area and shall be certified by a state environment agency. The design shall allow its use in appropriate terms of safety and maintenance.

9.8.3 The wooden decks, which are exposed to the weather, shall be protected with naval varnish.

9.9 Floor Grating (for internal and external use)

9.9.1 Floor gratings shall be installed on internal and external spaces where:

- The leveling off the floor shall be increased to the threshold height (of sills and coamings, for example) to provide an easy transit of wheeled cars and cargo handling devices and walkway from external area,
- It is needed to support objects, as boxes, drinking water gallons or any other item, and put them away from the floor.

9.9.2 Floor grating shall be made of steel or aluminum, with adequate spacing between the parts to make easier its maintenance and passage of workers and trolleys. Floor grating shall be removable wherever necessary, to allow cleaning, maintenance, or operation activities.

9.9.3 Metal grating shall be insulated to prevent corrosion.

9.9.4 Floor gratings made of fiberglass shall not be installed in closed areas.

9.9.5 Stainless steel floor grating shall be installed in Laboratory (Emergency shower area).

9.9.6 For specification, refer to I-ET-3010.00-1352-130-P4X-001 (SPECIFICATIONS FOR FLOOR GRATINGS, TRAY SYSTEMS AND GUARDRAILS MADE OF COMPOSITE MATERIALS).

9.10 Painted Steel deck (anti-skidding)

9.10.1 Painted steel deck shall be anti-skidding, high abrasion resistance and high mechanical resistance.

9.10.2 For specification, surface preparation, paint application and other relevant information, refer to I-ET-3010.00-1200-956-P4X-002 (GENERAL PAINTING).

10 FURNITURE

10.1 General

10.1.1 An expert architecture company to be approved by BUYER shall carry out the complete design and materials specification for the furniture on the rooms located on M13 (Power Generation), M15B (Hull Utilities) and M17 (Automation and Electrical). Furniture materials shall be provided in accordance with IMO FTP Code, NR-17, and NR-37 Brazilian Regulation. All materials shall be flame retardant.

10.1.2 Furniture shall be provided as indicated on Architectural drawings related on item 4.1.6.

10.1.3 All furniture finishing shall be compatible with Decoration Scheme. The furnishing of the rooms located on M13, M15B, and M17 shall meet the same line of the office furniture supplied to Accommodation Module offices.

10.1.4 During detailing phase, SELLER shall evaluate ergonomic studies about works on services and working compartments, as described in I-ET-3010.2D-1400-196-P4X-001 (ERGONOMICS REQUIREMENTS FOR TOPSIDE) and validate the layout of all areas with industrial activities, the quantity, and dimensions of all furniture. The final layout shall be approved by BUYER.

10.2 IMO-testing (marine):

10.2.1 Manufacturer shall provide the following type approval and fire test procedures:

- IMO MSC. 61(67), Annex 1, Part 5 and 6, IMO Res A.653 (16), IMO Res A.687 (17): Spread of flame,
- IMO MSC. 61(67), Annex 1, Part 2, ISO 5659-2 med FTIR: Analysis, Smoke and toxicity,
- IMO Resolution MSC. 61 (67), Annex 1, Part 1: Non-combustible,
- IMO A.471 (XII) amended by IMO Res A.563 (14): Resistance to flame of vertically supported textiles and films,
- IMO MSC. 61(67), Annex 1, Part 8, IMO Res A.652 (16): Ignitability of upholstered furniture,

10.3 Furniture requirements:

10.3.1 All wood furniture shall be built of plywood (marine grade type) covered with fire retardant melamine laminate, unless otherwise specified. All accessories shall be stainless steel made.

10.3.2 All furniture with doors and/or drawers shall be supplied with 4 keys, at least.

10.3.3 Office workstations shall be designed to achieve maximum users' comfort. All the workstations shall be provided with trays or ducts for cable routing, power and data sockets and free surface for large screens. The workstations shall be supplied according to standards specialized manufacturer (industrial production), with items that comply to ergonomics requirements (Refer to NR-17). As a result, the design may be as simple as possible and fit the worst case of physical dimension and environmental conditions for offshore environment. Location and quantity shall follow architectural drawings.

10.3.4 Workstations layout shall provide an adequate place for all equipment and materials that the users shall have at hand during their activities. The working environment shall enable computer users to avoid improper working postures. The use of computers requires the possibility of adjustments, posture changes during the work shift and organization of work area involving chair, keyboard, mouse, monitor, phone, etc.

10.3.5 Computer desks shall be provided in sufficient quantity to be used during commissioning activities that will extend after the SPU leaves the contractor's custody. These desks shall have adequate dimensions to be used in front of Telecom, Automation and Electrical panels and to be moved to different positions

inside panels rooms. Residential type equipment will not be acceptable by BUYER.

10.3.6 The following aspects for computer desk and/or workstations shall be attended (to be validated by ergonomic studies during detailing phase):

- Allow assembly of the working surfaces in a range of 540 mm to 780 mm,
- The plywood of workstations shall be industrial type, incorporating the melamine finishing without the need to use glue or similar materials. The workstations edges shall be directly impressed on working surface,
- Have adequate workspace on the working surface so that the user has the frequently used work accessories within reach without getting into stressful posture,
- Be supplied with drawers. If drawers supplied with wheels, the wheels shall have breaks to keep fixed,
- Have sufficient clearance under the desk (even with drawers) for free movement of user's knees & legs and to get close enough to the input devices,
- Have trays or ducts for cabling route,
- Have a hard trimming around working surface, industrial type, round corners. Square corners shall not be used,
- The workstations for caster chairs shall be provided with hooks under top, allowing chairs to be tied when not in use,
- Partitions 1400 mm height shall be provided between workstations. These partitions shall be part of the workstation system and able to support shelves for documents and material storage,
- Residential type furniture will not be acceptable by BUYER.

10.3.7 The following aspects for monitors shall be attended (to be validated by ergonomic studies during detailing phase):

- Position the Monitor in front of the user usually at arm's reach between 45cm (18”) and 61cm (24").
- Position lights in relation to Monitor to avoid direct glare.
- The top of the screen shall be at the same height as seated eye level.
- Monitor arm or support shall provide optimal position to ensure a relaxed head and neck posture. This item shall be provided for all workstations due to drilling unit movement.

10.3.8 The following aspects for keyboards shall be attended (to be validated by ergonomic studies during detailing phase):

- The computer keyboard shall be about as high as the elbow and in front of the user.
- The keyboard shall allow the user to rest fingers on the middle row of keys and maintain a straight (neutral) wrist posture.

- The keyboard tray shall allow the user to adjust the angle of the surface so that the user's wrists and elbows can be in neutral or slightly downward position during keying.

10.3.9 The following aspects for mouse shall be attended:

- Elbows shall be close to the body and bent at an angle around 90 degrees with straight wrists while holding the mouse.
- The user shall not be reaching out with a straight arm forward or to the side while using the mouse.

10.3.10 The following aspects for telephones shall be attended:

- Use of Headset shall be evaluated during the detailed design phase and adopted whenever the operator tasks analysis suggests so.

10.3.11 The following aspects for furniture (in general) shall be observed and implemented:

- Bookshelves and sideboards shall have adjustable bars against roll,
- All fabrics and textiles shall be flame retardant, non-fire propagating, with low toxicity when burning, washable, waterproof, and easy to clean. All Authorities requirements shall be followed,
- All stainless-steel furniture shall be AISI 304, except noted, attempting for the requirements of item 12,
- Other steel furniture shall be galvanized steel painted with anti-corrosive coat,
- There shall be no sharp or protruding edges in all furniture items,
- Sofas and 3- or 4-seater bean seating shall be provided where indicated on Architectural drawings. Sofas shall be comfortable, with all parts and textiles durable and resistant,
- Equipment, benches, and material finishing for industrial/service areas shall be compatible with the use and functionality of work activity. The design of these benches shall be developed considering the comfort of its users and be provided with facilities for material storage (shelving, drawers, etc.). The dimension of the benches shall follow the Basic Design. Ergonomic evaluation shall be developed to guarantee the work organization.

10.4 Offices chairs for workstations:

10.4.1 Finishing and color shall be according to Decoration Scheme issued to BUYER for approval.

10.4.2 Swivel caster chairs, or wheeled chairs, shall be supplied for all workstations on the rooms located on M15B (Utilities). The model of this chair shall fit all kinds of different people as it supports many different work styles.

10.4.3 The chair specification shall follow ABNT 13962 (Office furnishings - Chairs - Requirements and test methods/ Móveis para escritório - Cadeiras - Requisitos e métodos de ensaio). It is desirable to follow, also, ISO 97.140 (Furniture Including upholstery, mattresses, office furniture, school furniture, etc.).

10.4.4 The chairs for workstations shall have arms and be comfortable for sitting during long periods.

10.4.5 It shall be used swivel caster armchair, with adjustable height arms. It is recommended medium backrest, provided with the following characteristics:

- Casters: Polyamide six body (material with low friction coefficient and abrasion resistance), double pulleys in natural injected nylon with independent movements, vertical axis in steel, fixed to the base through a pressure ring in steel, the casters or wheels shall be provided with internal brakes easily actioned through hand command fixed on armrests,
- Base: Swivel, with central tube, formed by five die-cast aluminum blades, without welds, with polished aluminum finish,
- Central Column: In die-cast aluminum, pneumatic or gas height adjustment, provided with shock-absorbing device, with telescopic shielding. 2-to-1 synchronized seat and back tilt mechanism adjustments,
- Seat: Easily removable cushion, anatomically shaped, breathable, resistant, and flexible with rounded front edge, contoured support with a die-cast aluminum structure without welds. Seat shall be independent of the backrest, air weave, made of high strength injected polyurethane foam with a minimum thickness of 4 cm, depth adjustment in 5 lockable positions or more, density 56 kg/m³,
- Backrest: Easily removable cushion, anatomically shaped, made of high strength injected polyurethane foam with a minimum thickness of 4 cm, height adjustment in 5 lockable positions or more, free float with adjustable tension, density 50 kg/m³,
- Arms: With die-cast aluminum core and polyamide armrests. Height and width adjustment in 6 different positions.
- Coating: Leather (natural or synthetic) or vinyl, easy maintenance, easy cleaning, anti-allergic and anti-adherent properties,
- Shall have breathable, resistant, and flexible backrest and seat,
- Materials shall be easy maintenance and easy cleaning, anti-allergic, anti-adherent,
- Guaranteed for more than 10yrs (24h/day-7days/week),

10.4.6 No less than 90% recyclable, at least 20% recycled content.

10.4.7 Dimensions for armchair with medium backrest:

- Height from the floor to the top of the seat: 45 to 55 cm,
- Height from the floor to the top of the backrest: 99 to 106 cm,
- Seat depth: 40 to 45 cm,
- Seat width: 45 to 48 cm,
- Backrest height: 60 to 66 cm,
- Arm length: 27 cm,

- Arm width: 5 cm.

10.4.8 SELLER shall provide enough additional quantity of spare parts available for replacement, such as: seat cushion and/or backrest, armrest, headrest, casters, adjustment mechanisms, etc. This quantity shall be submitted to BUYER for approval.

10.5 Chairs without wheels

10.5.1 Chairs without wheels (or fixed chairs) shall be supplied on the rooms located on M15B (Utilities) and M17 (Automation and Electrical).

10.5.2 Chairs without wheels with arms shall be supplied in sufficient quantity for commissioning activities on Automation and Electrical Panels Room (AEPR), on M17.

10.5.3 Chairs without wheels (or fixed chairs) and arms shall be supplied for the places and quantities as below:

- For workstation's guest on Operation Room, on M15B, as indicated on architectural drawings, and
- In sufficient quantity for commissioning services on AEPR, on M17.

10.5.4 The chairs for commissioning may be not drawn or not indicated on Basic Design drawings. Quantity shall be proposed by SELLER and approved by BUYER.

10.5.5 Chairs without wheels (or fixed chairs) with and without arms shall allow stacking.

10.5.6 Finishing and color shall be according to Decoration Scheme issued to BUYER for approval.

10.5.7 The chairs for M15B and M17 shall meet the same line of the office chairs supplied to Accommodation Module offices.

10.5.8 The chairs for M15B and M17 shall be a chair that fits all kinds of different people as it supports many different work styles. The chair shall be suitable for multiple uses.

10.5.9 The chair specification shall follow ABNT 13962 (Office furnishings - Chairs - Requirements and test methods/ Móveis para escritório - Cadeiras - Requisitos e métodos de ensaio). It is desirable to follow, also, ISO 97.140 (Furniture Including upholstery, mattresses, office furniture, school furniture, etc.).

10.5.10 The chair shall be fixed chair with medium backrest, provided with the following characteristics:

- Base: Robust steel loop base, without welds, with durable polished chrome finish, features plastic caps to protect floor,
- Seat: Easily removable cushion, anatomically shaped, with rounded front edge, contoured support with a steel structure without welds. Seat shall be independent of the backrest, air weave, made of high strength injected polyurethane foam, density 56 kg/m³,
- Backrest: Easily removable cushion, anatomically shaped, made of high strength injected polyurethane foam, density 50 kg/m³,

- Arms (where applicable): With die-cast aluminum core and polyamide armrests,
- Coating: Leather (natural or synthetic) or vinyl, easy maintenance, easy cleaning, anti-allergic and anti-adherent properties,
- Shall have breathable, resistant, and flexible backrest and seat,
- Materials shall be easy maintenance and easy cleaning, anti-allergic, anti-adherent,
- Guaranteed for more than 10 years (24h/day-7days/week),
- No less than 90% recyclable, at least 20% recycled content.

10.5.11 Dimensions for armchair with medium backrest:

- Height from floor to top of seat: 45 cm,
- Height from floor to the top of the backrest: 90 to 95 cm,
- Seat depth: 45 to 48 cm,
- Seat width: 45 to 48 cm,
- Backrest height: 45 to 50 cm,
- Arm length (where applicable): 27 cm,
- Arm width (where applicable): 5 cm.

10.5.12 SELLER shall provide enough additional quantity of spare parts available for replacement, such as: seat cushion and/or backrest, armrest, etc. This quantity shall be submitted to BUYER for approval.

10.6 Areas for circuit breaker extraction trucks and cabinets for PPE and CPE

10.6.1 In the rooms of electrical panels and transformers, there shall be provided dedicated space for storage of circuit breaker extraction trucks and for cabinets dedicated to the storage of PPE (Personal Protection Equipment) and CPE (Collective Protection Equipment), such as rescue pole, portable insulating mats, insertion/extraction tools for circuit breakers, fire resistant clothes, safety gloves, etc. These cabinets and spaces shall be appropriately dimensioned and quantified during the detailing phase.

11 SANITARY WARE AND ACCESSORIES

11.1 General

11.1.1 The design shall ensure that maintenance can be achieved without undue disruption to the equipment or interconnecting services, or the need, as far as is practicable, for specialized tools and knowledge. The design shall maximize the use of interchangeable components and shall utilize the concept of device change-out wherever possible. Sanitary ware shall be furnished and installed in accordance with architectural drawings. Catalogues shall be provided and submitted to BUYER approval.

11.1.2 Restrooms, laboratory, and corridors shall have drains on the floor, preferentially under equipment such refrigerators, and drinking fountains or water gallon holders, for example. The quantity of the drains shall consider the internal layout as well the compartments located bellow, to guarantee the functionality of the drain system and avoid leakage on electrical equipment. Drains shall be avoided above electrical equipment as far as practical.

11.1.3 During Detailed Design phase, taps with rose connection (fresh water) for cleaning purpose shall be installed 500 mm above floor finishing in the restrooms.

11.2 Characteristics

11.2.1 To guarantee maintenance for water and sewage piping, access door shall be supplied for all toilet bowls on all toilets and WC, with minimum dimensions of 560 mm x 1850 mm, installed on wall panels of corridors and with the same characteristics of them. If impossible to arrange or install the access door as required, other solution shall be designed and issued for BUYER approval. If impossible to provide access from corridors, it shall be located inside the toilets or WC or even on service adjacent rooms, as other toilet, Janitor or Clean Material Store. Any other solution shall be issued for BUYER approval.

11.2.2 All the accessories listed in this specification (paper holder, soap dish, etc.) are to be of non-recessed installation type, i.e., they are not to be inlaid in the lining, requiring fitting accessories such as screws, clamps etc. Plastic materials shall not be used, unless otherwise specified.

11.2.3 All restrooms shall have coat hooks in accordance with architectural drawings.

11.2.4 On the toilets, the washbasin shall be undermount model installed in a granite countertop. It is also possible for the sink to be integrated with the countertop, both made of the same material, which shall be a solid, resistant, and durable surface material. The countertop shall have no drip edge detail and shall be supplied with cabinet with doors and shelves.

11.2.5 All washbasins shall be supplied with soap dispensers, paper towel dispensers and garbage baskets activated without manual contact. All items in stainless steel, Industrial type. For garbage baskets, see item 14.2.7. Location shall be defined during detailed design phase and issued for BUYER approval.

11.2.6 Soap dispensers, paper towel dispensers and garbage baskets shall also be supplied to the Laboratory sinks.

11.2.7 On the restrooms (men and women), the washing basins faucets shall be chromed, automatic, mechanical time delay, and for fresh water, only.

11.2.8 All toilet bowls shall have slow closure device and resistant plastic seats. All urinals shall be provided with photocell devices with hardwired batteries connected to the electrical system of the Unit. All toilets shall have handlebars. All restrooms shall have personal hygienic showers and shall be provided with cloth and towel hangers. The bench cabinets shall be made of plywood covered with melamine plastic sheet (fire retardant). The benches or countertops shall be made of granite or other solid, resistant, and durable surface materials.

11.2.9 The garbage collectors shall be located under or close to the bench but cannot be a part of it.

11.2.10 The toilet bowls shall be installed in individual compartments, separated by noncombustible partitions. Toilet bowl compartments shall have independent doors at least 600 mm wide, 1900 mm height, installed at 150 mm above floor level, and fitted with “vacant/engaged” type locks. Partitions and doors shall be C class panels provided splash resistance material finishing. The urinals shall have partitions between each other. from the same model as used to toilet bowls and showers partitions.

11.2.11 Steel coamings, welded on decks, or other applicable solutions shall be provided around collective restrooms to retain water in case of leakage from the piping connections and to protect the partitions.

12 STAINLESS STEEL FURNITURE AND ACCESSORIES

12.1 General

All stainless-steel furniture shall be AISI 304, except Laboratory benches that shall be AISI 316L. The stainless-steel furniture shall be provided and detailed in accordance with the architectural drawings.

12.2 Characteristics

12.2.1 In general, stainless steel benches shall be constructed with integrated sinks and facilities for hot and fresh water, faucets with spray rinse and flexible connections. All benches shall be provided with facilities for cleaning material.

12.2.2 All sanitary faucets shall be chrome plated.

12.2.3 There shall be no sharp or protruding edges in all furniture items.

12.2.4 All benches shall be provided with shelves and drawers whenever necessary and shall be provided with 75 mm back splash to protect the wall against water spray. Benches and countertops with washbasin or sinks shall have drip preventing edge detail. Furniture foundation shall be detailed to achieve specific safe work practices required for offshore personnel to work injury free. Benches shall be provided with devices for cable routing and be suitable for equipment installation.

12.2.5 The garbage collectors shall be located under or close to the bench but cannot be a part of it. The garbage collectors shall be stainless steel, with wheels and properly covered, unless otherwise specified.

13 LABORATORY

13.1 General

13.1.1 The Laboratory edification shall be provided complete with, at least, electrical, instrumentation, telecom, hydraulic, equipment, furniture, insulation, partition wall, ceiling, linings, floor, external/ internal doors, hoods, HVAC system installation and all interfaces required for perfect operation. All systems shall be tested and functioning.

13.1.2 Elevations of the Laboratory edification shall be confirmed in the detailed design phase. For level difference, a mean of access shall be installed in the entrances

to guarantee comfort and attend to ergonomic requirements, considering the handling necessities of material and equipment.

13.1.3 The Laboratory project shall be appropriate to guarantee the accomplishment of the necessary analysis.

13.1.4 The Laboratory equipment description and related systems are described on I-ET-3000.00-8222-941-PJN-001 (LABORATORY – EQUIPMENT).

13.1.5 In accordance with the Basic Design drawings, the Laboratory shall be provided with two distinct spaces: administrative room (or office area) and analysis room (or equipment area).

13.1.6 The equipment area shall be separated from the office by partition, floor-to-ceiling, door with hinges, opening in the direction of escape. The upper part of the partition shall be in glass with height that allows the technician to view the analysis room while performing activities in the office.

13.1.7 In walls, partitions, doors and furniture, all glass-made visors and windows shall be composed of laminated fire-resistant glass, so the material do not produce splinter whenever subjected to impact or explosion.

13.1.8 The Laboratory internal free height shall be confirmed and adjusted in the detailed design phase and shall be, at least, 3000 mm, according to Basic Design.

13.1.9 The Laboratory shall have two access doors on opposite sides, one door in the administrative room and the other in the analysis room. The opening of the doors shall be in the direction of escape. On the internal side, the Laboratory access doors shall have anti-panic bar. The outer side of the door shall be provided with a fixed knob (inoperative, which acts as a handle) and a lock that allows access by authorized persons without impeding the operation of the anti-panic bar.

13.1.10 Floor finishing shall be anti-acid ceramic tiles. The joints between tiles shall be made of impermeable material to avoid chemical products penetration.

13.1.11 Two workstations shall be provided in the office area, with space for an A4 printer and cabinet for the storage of technical documentation and calculation memories.

13.1.12 Fitting devices shall be provided for furniture and equipment. Lockers, chairs, desks, and furniture to be permanently located at the same place shall have means to be fixed on the floor/wall, considering that this is a FPSO unit.

13.1.13 Laboratory furniture shall be supplied by a specialized manufacturer (industrial type) and all dimensions shall be defined according to Ergonomic studies to be carried out in the Detail Design phase.

13.1.14 All furniture shall be made of marine grade plywood covered with fire retardant melamine laminate, unless otherwise specified.

13.1.15 There shall be provided a cabinet exclusive for the storage of personal protective equipment (PPE), subdivided individually, with at least four compartments.

13.1.16 All benches for the Laboratory shall be custom made, with drawers, shelves and/or doors, as necessary. Shelves shall have bars or stops to avoid falling objects. Above sinks, wall cabinets shall be avoided due to the installation of a pegboard for drying glasses. Access to utilities, consisting in removable panels

or doors, shall be provided under all benches to allow the easy maintenance to the installation facilities.

13.1.17 All drawer and door handles of laboratory furniture shall consist in a recessed continuum aluminum profile to protect the entire top part of door or drawer from eventual spillage.

13.1.18 All laboratory benches shall have top in AISI 316L stainless steel.

13.1.19 The furniture shall be designed and constructed without sharp edges and corners.

13.1.20 The height of the benches shall be 900 mm, except for the sections intended for the centrifuge and the thermostatic bath, which shall have a height of 600 mm. This section shall be installed on the organic bench, next to the sink, according to I-DE-3010.2D-1426-190-P4X-001 (M15B ROOMS AND LABORATORY - ARCHITECTURE LAYOUT - EQUIPMENT AND FURNITURE).

13.1.21 The benches shall be provided with 75 mm back splash to protect the wall against water spray.

13.1.22 The width of the benches, between edge and frontispiece, shall be 800 mm. The minimum width of the cabinets under the bench shall be 500 mm leaving about 300 mm for utilities behind cabinets.

13.1.23 Furniture installed under benches and fume hoods shall have a recessed base to accommodate the laboratory technicians' feet.

13.1.24 To allow the cleaning of all the glassware, each sink shall have the minimum dimensions of 500 mm x 500 mm x 500 mm and the water outlet from the taps shall be at a height between 300 mm and 350 mm above the edge of the sink.

13.1.25 The sink shall have the sides protected with material such as neoprene sheet, intended to avoid breakages of glassware during the washes.

13.1.26 A bench section with a minimum of 800 mm width shall be reserved in chromatography bench in which cabinets shall not be installed under the bench to allow the ergonomically correct position of the technician for seated work.

13.1.27 A high gyrating chair, without wheels, shall also be supplied with the following characteristics:

- Have good back rest with lumbar support,
- Seat pan wedge shaped,
- Five supporting points for better stability,
- Have height adjustability,
- Have stainless steel footrest,
- Impermeable, washable, and resistant material finishing,
- Stainless steel structure, and
- No arms.

13.1.28 Benches under equipment or high cabinets which are fixed to the wall shall be larger than such equipment or cabinets to avoid injuries to its users. The distance between the bench and the equipment or cabinets shall allow the user to work in adequate posture.

13.1.29 The equipment, hoods and high cabinets fixed to the wall shall not have any kind of support on the benches, to allow free movement to the technicians of the laboratory between all benches.

13.1.30 Local area storage for oil sample boxes shall be provided inside laboratory compartment. Laboratory casework and furniture shall be sized to allocate these samples. Cabinetry, furniture, and shelving systems shall be foreseen underneath and above benches according to ergonomics' evaluation to be developed in Detail Design phase.

13.1.31 Luminaries shall be provided under suspended cupboards or shelves whenever they project shadows on the work plans.

13.1.32 The bench of organic analyses, including its sink, shall be provided with one single suspended exhaust hood, fixed on wall or ceiling, leveled, and not divided, and shall be placed adjacent to the organic fume hood, to facilitate the proper handling, analysis and disposal of the oil samples. At the organic bench, the front part of the higher top plate (900 mm high) shall be supplied with sliding laminated and fire-resistant glass leaves to contribute to the exhaustion system, reducing the hood's demand, but considering the desirable technicians' free movement. This sliding glass leaves system shall be detailed considering different positions of operation and the most ergonomic conditions. For ergonomics' purposes, no structuring frame or post for the exhaust hood shall be placed on the bench, only the glass window frame is allowed to be fixed on the organic's analyses bench.

13.1.33 On the benches, the taps shall have mixers for dosing hot and cold water, a system for rapid triggering (elbow/ wrist action long levers) with a long rotating head (swivel swan neck) and polymer coating, which shall be resistant to all chemical agents handled in foreseen laboratory routines.

13.1.34 A bench area shall be provided for the use of a portable gas chromatograph with dedicated articulated hood. A dedicated fixed hood shall be provided for the stove for heating cylinders.

13.1.35 There shall be provided an external location for storage of gas and petroleum sample cylinder cases. The area shall be sized to store at least sixteen cases for gas and sixteen cases for petroleum, considering a maximum stacking of five units.

13.1.36 Sample cylinder cases shall be stored outside of the Laboratory for safety reasons (contains unstable oil and gas, the way they are extracted from the well), inside of their proper cases. A proper base for the cylinder stacks shall be designed and supplied.

13.1.37 Deck shall be properly fitted to allow the use of carts for handling and transporting sample cylinder cases.

13.1.38 On the Laboratory, garbage cans shall be provided to discard:

- Paper contaminated with oil,
- Recycled cotton towels contaminated with oil, and
- Common trash for the Laboratory area.

13.1.39 Disposal of glassware shall be done in specific boxes with temporary storage in the cabinet.

13.2 Equipment and Furniture Specification

13.2.1 For Laboratory equipment specifications refer to: I-ET-3000.00-8222-941-PJN-001 (LABORATORY – EQUIPMENT).

13.2.2 About equipment and furniture quantities, location, and dimensions, refer to I-DE-3010.2D-1426-190-P4X-001 (M-15B ROOMS AND LABORATORY - LAYOUT - EQUIPMENT AND FURNITURE).

13.2.3 Electrical Installation shall be provided for all Laboratory electrical equipment.

13.2.4 All Laboratory equipment shall be specified and approved by BUYER during Detail Design Phase due to the constant technology innovation which they are submitted.

13.2.5 For laboratory equipment specification see I-ET-3000.00-8222-941-PJN-001 (LABORATORY – EQUIPMENT), considering numbers and quantity as indicated on I-DE-3010.2D-1426-190-P4X-001 (M-15B ROOMS AND LABORATORY - LAYOUT - EQUIPMENT AND FURNITURE).

13.3 Installations

13.3.1 Electrical

13.3.1.1 The electrical system shall be designed for safety operation and maintenance.

13.3.1.2 The Laboratory shall be furnished with the internal power and lighting electrical installations fully done, in conformity with the Classification Society rules and connected to the distribution panels and junction boxes. The power and lighting sources will be as defined in I-ET-3010.00-5140-700-P4X-003 (ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS). Electrical Installation shall be provided for all equipment.

13.3.1.3 All panels shall be fitted with a main circuit breaker and the distribution circuits to the socket-outlets and lighting fixtures shall be 2P+E.

13.3.1.4 The 220V and 480V distribution panels or junction boxes shall be placed in the same side inside the Laboratory and shall be fitted with proper cable glands and supports for the interface cables.

13.3.1.5 It shall be provided a few socket-outlets placed close to the consumers enough to feed all expected loads plus a distributed margin of 50%. All socket-outlets shall be in accordance with the Brazilian Standard ANBT 14136 and for 10A-250V or 20A-250V, according to the load's requirements.

13.3.1.6 All lighting fixtures shall be selected and distributed to provide visual comfort in the work positions, without shadow areas or glare.

13.3.1.7 The medium illuminance to be observed at the work benches and workstations will be as defined in I-ET-3010.00-5140-700-P4X-001 (SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS). All electrical equipment

and circuits shall be duly identified, and all electrical equipment and cable routing devices shall be firmly grounded.

13.3.1.8 Wall sconces shall have reflectors to prevent glare by direct visualization of the lamps.

13.3.1.9 The electrical installations shall comply with:

- I-ET-3010.00-15140-700-P4X-001 (SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS),
- I-ET-3010.00-5140-700-P4X-003 (ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS),
- I-ET-3010.00-5140-700-P4X-005 (REQUIREMENTS FOR HUMAN ENGINEERING DESIGN FOR ELECTRICAL SYSTEMS OF OFFSHORE UNITS).

13.3.1.10 The electrical material and equipment shall comply with:

- I-ET-3010.00-5140-700-P4X-002 (SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS),
- I-ET-3010.00-5140-712-P4X-001 (LOW-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS).

13.3.2 Telecommunications

13.3.2.1 For Telecom information, refer to:

- I-DE-3010.2D-5510-760-PPT-019 – TOPSIDES M-15B MODULE TELECOMMUNICATIONS SYSTEMS ARRANGEMENT),
- I-DE-3010.2D-5515-762-PPT-002 – TOPSIDES UHF ACTIVE REPEATER ONE LINE DIAGRAM
- I-DE-3010.2D-5516-764-PPT-001 – TOPSIDES INDUSTRIAL TELEPHONY ONE LINE DIAGRAM,
- I-DE-3010.2D-5518-767-PPT-001 – TOPSIDES PUBLIC ADDRESS ONE LINE DIAGRAM,
- I-DE-3010.2D-5517-768-PPT-001 – TOPSIDES STRUCTURED CABLING ONE LINE DIAGRAM.

13.3.3 Cancelled

13.3.4 Facilities

13.3.4.1 Utility lines shall be installed in such configuration that allows easy access and maintenance.

13.3.5 HVAC System

13.3.5.1 For HVAC systems refer to:

- I-ET-3010.2D-5250-300-P4X-001 – HVAC SYSTEM – HVAC TECHNICAL SPECIFICATIONS,
- I-DE-3010.2D-5250-944-P4X-003 – HVAC SYSTEM - M-15 - LABORATORY - D&ID,

- Units Basic Design 3D Model.

13.3.6 Safety

13.3.6.1 The Laboratory shall have installed 2 (two) eyewashers and one emergency shower, as described on I-ET-3000.00-8222-941-PJN-001 – LABORATORY EQUIPMENT and I-DE-3010.2D-1426-190-P4X-001 – M-15B ROOMS AND LABORATORY - ARCHITECTURE LAYOUT - EQUIPMENT AND FURNITURE.

13.3.6.2 The Laboratory design shall have, according to the installation characteristics, a system of detection, alarm, and firefighting.

13.3.6.3 There shall be provided, at least, 2 (two) fire muffle blankets made of carbon aramid felt with edging and hemline, with high performance in activities of exposure to heat, according EN 1869, with minimum dimensions of 1800 mm x 2200 mm, minimum weight of 620 g/m², nontoxic and sterilized. These fire muffle blankets shall be provided with proper bags in the Laboratory, one next to each exit. Final location shall be foreseen in Detail Design Phase.

13.3.6.4 The Laboratory shall have the following signaling of safety: “SAÍDA”, “LAVA-OLHOS”, “CHUVEIRO DE EMERGÊNCIA”, “ESGOTO INORGÂNICO” and “ESGOTO ORGÂNICO”. Details shall follow BUYER standard signalization according to item 4.1.9.15.

13.3.6.5 All signaling shall be submitted for BUYER approval.

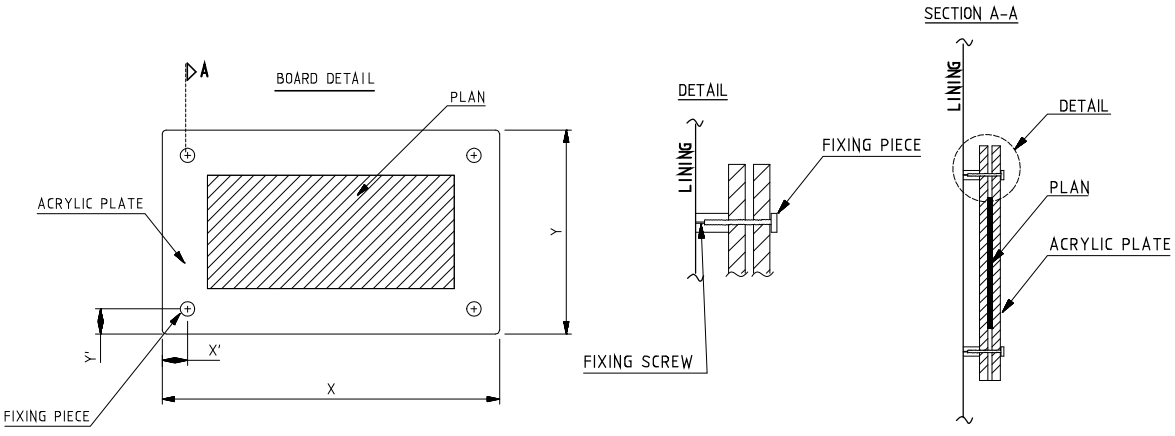
14 MISCELLANEOUS

Miscellaneous items, which require wall mounting, like decorative boards, general arrangements, etc. shall be distributed and installed in agreement with BUYER.

14.1 Boards and safety signs

14.1.1 General arrangement with location of boards and safety signs shall be submitted to BUYER approval. All boards shall have stainless steel or aluminum frames and be protected against damage.

- The boards shall be fixed as detailed below:



14.2 General items

14.2.1 All entrances to covered spaces or compartments decks from external areas shall have door mats, proper for humid and saline environment, in rubber material sheet, industrial type. Dimensions around 1200 x 600 mm. Location shall be defined during detailed design phase and submitted for BUYER approval.

14.2.2 Alcohol gel dispensers, in stainless steel, industrial type, shall be supplied and installed in the following internal areas:

- On corridor entrance of M15B Rooms from external areas, close to toilets,
- In corridors close to water gallon holders,
- Close to entrances to offices and Laboratory.

14.2.3 Wall Clock shall be supplied with battery driven, water resistant and stainless steel structure. Quantity and distribution as table below.

14.2.4 Pushing-pin magnetic board - For fixing notes, cork plate with perforated metal surface, metallic finish, able to accommodate both pushpins and magnets. With concealed mounting hardware. Dimensions: 1200 x 1000 mm (minimum). Quantity and distribution as table below.

14.2.5 Magnetic Whiteboard - Manufacturer standard, with aluminum frame. Dimensions about 1200 x 1000 mm (minimum). Quantity and distribution as table below.

14.2.6 Water gallon holders shall be supplied in marine industrial type, heavy duty, with stainless steel finishing. Quantity and distribution as table below. To be installed on floor as indicated below but on bench of Messroom and Coffee Points.

Location		Wall Clock	Pushing-pin mag. Board	White board	Water gallon holder
Corridor	-	-	1 pc	-	1 pc
TLT Room	-	-	1 pc	1 pc	-
Operator's Room	-	-	1 pc	1 pc	-
Laboratory Office	-	-	1 pc	1 pc	-
Laboratory Equipment Area	-	1 pc	1 pc	1 pc	-

14.2.7 Garbage basket and disposal bins where required on document I-ET-3010.2E-1350-190-P4X-001 (ACCOMMODATION ARCHITECTURE MATERIALS AND EQUIPMENT SPECIFICATION).

14.2.8 There shall be provided, at least, 30 (thirty) fire muffle blankets made of carbon aramid felt with edging and hemline, with high performance in activities of exposure to heat, according EN 1869, with minimum dimensions of 1800 mm x 2200 mm, minimum weight of 620 g/m², nontoxic and sterilized. These fire muffle blankets shall be provided with proper bags and distributed on the rooms located on M13, M15B, and M17, and strategically in all fire hazardous areas in the process plant. Location of bags with blankets shall be foreseen in detailed design phase according to Fire and Explosion Strategy, Emergency Response Plan for the Unit and NR-37 Brazilian Regulation.