



Exploration & Production

## GENERAL SPECIFICATION

### ELECTRICAL

#### GS ELE 213

**Electrical cabin for safe area  
Construction and equipment**

|      |       |             |
|------|-------|-------------|
|      |       |             |
|      |       |             |
|      |       |             |
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## 1. Scope

The purpose of this specification is to define the minimum requirements for design, fabrication, testing, sea fastening, packing and transportation of a fully equipped electrical cabin for offshore or onshore installation in non hazardous areas.

The above requirements include installation, connection and testing of all equipment inside the cabin.

## 2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Should there be any technical difficulties or any conflict between this specification and the standards listed hereafter, CABIN SUPPLIER shall request clarification.

Design and engineering shall conform as a minimum to the following in order of preference:

- Applicable laws and regulations of the country in which the system will be operated. In cases where no "local" regulations exist, then French laws and regulations shall be used.
- COMPANY Particular Specifications and data sheet (if any)
- COMPANY General Specifications
- Applicable International Electrotechnical Commission (IEC) publications
- Applicable CENELEC Standards
- Applicable recognised standards and codes (e.g. UTE-NFC, BSI, VDE, etc.) where IEC publications have not yet been issued.

### Standards

| Reference | Title                                  |
|-----------|----------------------------------------|
| IEC 60364 | Electrical installations of buildings. |

### Professional Documents

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

### Regulations

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

## Codes

| Reference | Title                                                                                                           |
|-----------|-----------------------------------------------------------------------------------------------------------------|
| D.O.E     | Offshore installations – Guidance on design, construction and certification (4 <sup>th</sup> ed., 1990).        |
| NFPA      | National Fire Protection Association                                                                            |
| SOLAS     | Consolidated text of international convention for Safety Of Life At Sea (SOLAS) 1974 and subsequent amendments. |

## Other documents

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

## Total General Specifications

| Reference  | Title                                                                            |
|------------|----------------------------------------------------------------------------------|
|            | <b>Corrosion</b>                                                                 |
| GS COR 350 | External protection of offshore and related structures and equipment by painting |
|            | <b>Electrical</b>                                                                |
| GS ELE 131 | High voltage switchgear                                                          |
| GS ELE 135 | Low voltage switchgear                                                           |
| GS ELE 137 | Distribution board                                                               |
| GS ELE 141 | Power transformers                                                               |
| GS ELE 151 | DC uninterruptible power supply systems                                          |
| GS ELE 152 | AC uninterruptible power supply (UPS) systems                                    |
| GS ELE 161 | Electrical cables                                                                |
|            | <b>HVAC</b>                                                                      |
| GS HVA 000 | List of HVAC specifications                                                      |
| GS HVA 100 | Basis of design                                                                  |
| GS HVA 202 | Air handling unit (AHU)                                                          |
| GS HVA 204 | Anti-blast HVAC installations                                                    |
| GS HVA 208 | Ducts and accessories for HVAC systems                                           |
| GS HVA 211 | Electrical heaters                                                               |
| GS HVA 212 | Fire dampers                                                                     |
| GS HVA 217 | Sound attenuator                                                                 |
| GS HVA 801 | Terminology, definitions, abbreviations                                          |
| GS HVA 802 | Documents to supply for Basic Engineering and Detail Engineering                 |

| Reference  | Title                                                                        |
|------------|------------------------------------------------------------------------------|
|            | <b>Instrumentation</b>                                                       |
| GS INS 102 | Instrument symbols and identification                                        |
|            | <b>Safety</b>                                                                |
| GS SAF 312 | Guidelines for selecting and installing fire and gas detection systems       |
| GS SAF 337 | Passive fire protection                                                      |
|            | <b>Structure</b>                                                             |
| GS STR 104 | Design and fabrication of technical cubicles for offshore oil installations. |

### 3. Environmental conditions

Cabin shall be designed in accordance with the data given in the "Environmental conditions particular specification".

## 4. Cabin, technical characteristics

### 4.1 Cabin, construction requirements

#### 4.1.1 General

Unless otherwise specified, walls, roof, and floor of the electrical cabin shall be constructed from steel plate and shall have coating and cladding arrangements to provide a passive fire protection with minimum rating A60 as per § 4.2.3.1 of **GS SAF 337**.

Cabin shall be air conditioned to control temperature and humidity.

In case of HVAC failure:

All equipment shall be designed to operate for a minimum period of 24 hours with doors open, at the maximum outside site temperature.

Cabin construction materials (internal and external) shall be designed to withstand permanently extreme site temperature and humidity conditions.

Cabin shall be sized to be safely transported to its final destination under compliance to local government rules pertaining to such transport.

Large cabin shall be designed in separated modules to be assembled on site.

Each cabin / module shall be designed to be lifted and transported in one piece, complete with all equipment.

Temporary partitions shall be installed in the open sides of the modules in order to protect the equipment during transportation.

#### 4.1.2 Structural works

##### 4.1.2.1 Steel works

Unless otherwise specified Structural calculations shall be based on following data:

- Environmental loads (wind, earthquake, water, thermal effect, etc...).

- Dead loads (unless otherwise specified 5.0 kN/m<sup>2</sup> shall be considered)
- Lifting loads
- Transportation loads

Walls shall be made of steel sheets, 5 mm thick minimum.

Floor and roof shall be made of steel sheets, 6 mm thick minimum.

All openings for doors, cable penetrations, HVAC, etc., made in walls and floor shall be framed to keep the structural integrity.

Roof penetration shall be prohibited.

A safety ladder shall be provided to get access to roof mounted equipment. In this case removable hand rail shall be installed.

#### 4.1.2.2 Lifting

Cabin shall be designed to withstand all shipping and erection loads in addition to normal dead and live loads.

Accessories for lifting the cabin, shipping and erection shall be provided.

Four skidding pad-eyes (one at each corner) shall be welded at the base of the cabin structure for cabin skidding.

#### 4.1.3 Architectural works

##### 4.1.3.1 Cabin dimensions

Internal cabin dimensions shall take into account identified future expansion, if any, or at least 20% of free surface area.

##### 4.1.3.2 Walls

External walls shall be properly insulated to get a minimum “U” value of 0.6 W/m<sup>2</sup>/°C.

Unless otherwise specified, insulation material shall be “rock-wool” type (Class M0).

Walls shall be designed to support wall mounted equipment up to 50 kg.

Unless otherwise specified in particular specification, painting shall be carried out with system “P16” of **GS COR 350** for offshore or coastal installation. Regarding inland onshore installation, painting shall be certified for a corrosive atmosphere of class “C4”. A list of certified systems can be found on [www.ACQPA.com](http://www.ACQPA.com).

##### 4.1.3.3 Doors

Doors shall maintain cabin integrity level and shall be properly insulated to get a minimum “U” value of 3.5 W/m<sup>2</sup>/°C.

Doors shall be equipped with lock, anti-panic bars, rubber cushions and automatic closing system.

All hardware shall be of AISI 316 L stainless steel quality and shall be provided with lifetime grease lubrication.

Adequate warning signs related to electrical hazards and a notice summarising first aids methods shall be posted on the doors.

The minimum dimensions shall be as follows:

- Doors staff access: 2100 mm \* 900 mm
- Doors material access: 2500 mm \* 1400 mm.

Door material access shall be suitable to handle the largest piece of equipment.

Unless otherwise stated, the doors shall be so located as any travel distance to exit does not exceed 10m.

#### **4.1.3.4 Internal partitioning**

If required in particular specification, the partitioning shall be as follows:

- It shall provide minimum passive fire protection with B15 rating.
- Surface finishes shall be hard, non reflective, tastefully patterned and in accordance with the "painting" particular specification
- In battery room (if any) the surface finishes shall be resistant to electrolyte leakage.

#### **4.1.3.5 Floor and raised floor**

##### **4.1.3.5.1 Floors**

Floor of electrical cabin shall be constructed from 6 mm steel plate, stiffened by sectional steels, unless otherwise determined by calculation note.

##### **4.1.3.5.2 Technical raised floor**

A minimum 600 mm raised floor shall be provided.

It shall be composed of removable tiles, approximately 40 mm thick, supported on adjustable jacks.

Tiles shall be flame retardant.

Raised floor shall be able to support a 450 daN spot load at any point on a tile.

All equipment shall be installed on dedicated steel frames made in one piece and no equipment shall be directly installed on the tiles.

##### **4.1.3.6 Ceiling**

From raised floor to ceiling, there shall be a minimum clearance of 2900 mm.

##### **4.1.3.7 Roof**

Roof shall be constructed with a slope for drainage.

#### **4.1.4 Piping works**

##### **4.1.4.1 Materials**

Unless otherwise specified, piping inside building shall be carbon steel made.

Outside building, instrument tubing class shall be stainless steel:

- For offshore installations, AISI 904L.
- For onshore installations, AISI 316L.

#### 4.1.4.2 Supports and location

All piping shall be supported, guided and anchored.

Supports shall be designed as dismantling type.

Piping mounted on ceiling shall be avoided wherever possible.

As far as possible, piping running behind the inner walls or partition walls shall be avoided.

### 4.2 Pressurisation - Heating, Ventilation and Air Conditioning system

#### 4.2.1.1 Design criteria

Refer to COMPANY Specification **GS HVA 100** for instructions related to "Basis of design".

Inside electrical cabin:

- Temperature operating range shall be  $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ .
- Relative humidity shall be between 40% and 60%.

#### 4.2.1.2 HVAC operation

HVAC system shall operate automatically.

HVAC shall be redundant with automatic change over.

### 4.3 Fire detection and protection system

#### 4.3.1 Fire detection

Automatic detection shall be carried out by a minimum of two smoke detectors located on the ceiling and two others inside the raised floor, to make two separate loops.

Smoke detector spacing shall be according to table 3 of § 5.3 of **GS SAF 312**.

Detection logic shall be done according to "Causes and Effects Matrix" document.

#### 4.3.2 Control systems

When required by the project particular specification, the cabin shall be protected from fire, by an automatic "CO<sub>2</sub>" fire extinguishing system.

Near the main access door, following devices shall be installed:

- One manual/automatic selector switch, to prevent the CO<sub>2</sub> release whilst the cabin is manned.
- One manual break glass (CO<sub>2</sub> release).

A fire control cabinet shall enable various actions, such as:

- Fire Alarms
- Shutdown of ventilation
- Closing of fire dampers
- Shutdown of all electrical sources
- Triggering of automatic fire-extinguishing system

Pre-release CO<sub>2</sub> audible and visible warning devices shall be installed indoor and outdoor, near the main access door.

Warning devices shall consist of a buzzer and two indicating lamps (green for normal operation, red for fire detection & CO2 release).

#### 4.3.3 Protection system

When an automatic "CO2" fire extinguishing system is required, the diffusion of CO2 shall be done simultaneously under and above the raised floor.

One CO2 skid equipped of two sets of CO2 bottles (one on duty and the other one on stand by).

The CO2 skid shall be installed on the outside wall of the building, in a shelter adequately designed for weather protection and sun radiation (paint colour: red).

Each unit shall be equipped as follows:

- One automatic bottles weighing.
- One mechanical CO2 release.

Electrical cables for the fire protection system shall be of fire resistant type as described in the electrical cables specification **GS ELE 161**.

#### 4.4 Electrical equipment, description

Electrical equipment including power transformers, switchgears, DC UPS, AC UPS, batteries and distribution boards, cables... etc shall comply with COMPANY General Specifications listed in § 2.

##### 4.4.1 Lighting circuits and socket outlets

###### 4.4.1.1 Interior switch-room lighting

It consists of:

- Industrial type fluorescent luminaires, supplied from the 230 V lighting panel and controlled by switches located at the doors of the cabin.  
Illuminance to be maintained shall be 300 Lux at 0.85 m above the floor level.
- "Exit" lighting above each door  
Emergency exit lighting, battery powered, permanently charged (autonomy 1h30 minimum).
- Category 2, portable lighting suitable for use in hazardous area, battery powered with the rechargeable device supplied from a 230 V socket, permanently charged (autonomy: 4 h minimum).
- Industrial type fluorescent self contained luminaires (approx. 30% of the quantity installed), autonomy: 3h minimum, located at working areas and controlled by switches located at the doors of the cabin.

###### 4.4.1.2 Outdoor lighting

Fluorescent type luminaire supplied from the 230 V lighting panel shall be factory installed close to each door of the cabin and transformer area.

#### 4.4.1.3 Socket outlets

A minimum of 2 sockets “2 poles 16 A + earth” - 230 V shall be provided.

Upon request, clearly identified sockets shall be powered from 230 V panel from UPS.

One “3 poles 63A + earth” - 400 V - AC –and IP55 IK08 shall be installed on cabin structure, outside and preferably near the main door access.

Sockets not powered from UPS, shall be fitted with 30 mA earth leakage protection.

#### 4.4.2 Safety equipment

Safety devices shall be grouped together on a rack fixed to the wall close to the main door access, and shall include as a minimum:

- One pair of gloves (in a box)
- Safety anti-flash glasses
- One isolating stool. + rubber mat
- One isolating pole
- One voltage detector
- “First aid” resuscitation instructions and warning posters
- Eye wash

#### 4.4.3 Telephone

Upon request, one telephone outlet shall be installed.

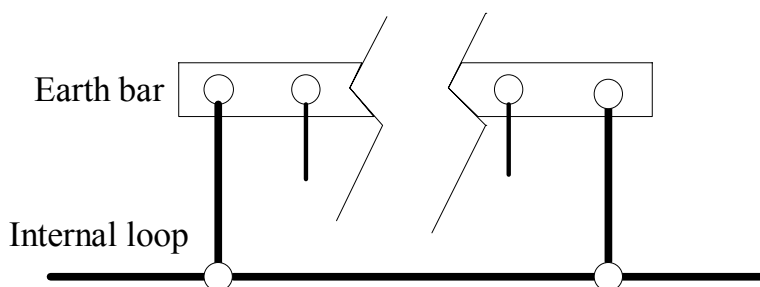
### 4.5 Earthing system

#### 4.5.1 General

Unless otherwise specified in particular specification, one earth loop made of 95 mm<sup>2</sup> bare copper conductor shall be provided internal to the cabin.

Instrument and electrical protective earthing shall be connected to this loop through copper earth bars.

Earthing loop shall be connected at both ends of each earth bar as shown hereunder.



When earth bars are installed under false floor, marking shall be provided above floor to indicate location.

Supporting jacks (one out of four) shall be interconnected to each other and to the earth loop.

Two external earthing studs located at two opposite sides of the cabin shall be provided for connection of the internal loop to the general grid.

#### 4.5.2 Protective earth (PE)

Any metallic parts, electrical equipment that is not class II rated or powered by a system operating at a voltage other than the safety extra low voltage, shall be connected to the equipotential bonding system by its own earthing conductor.

In TNS systems, the protective conductor shall be included in the multi core power supply cable and it may be separate from the power supply cable in other cases.

Earthing conductors shall be copper made and PVC insulated (coloured green/yellow) with suitable size according to section 543.1.1 of [IEC 60364.5.54](#).

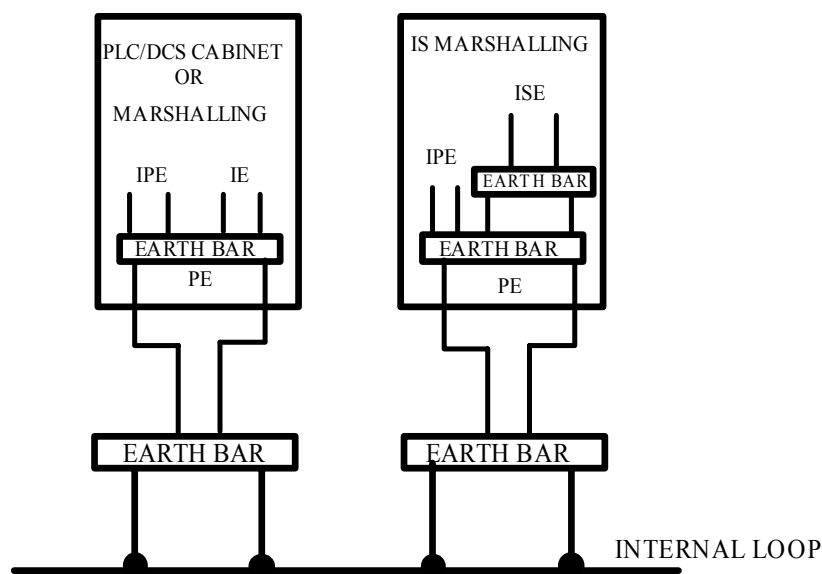
Metal ducting (cable tray, conduit, etc.) shall be connected to the protective earth system at both ends (minimum conductor size is 4 mm<sup>2</sup>). Full continuity shall be ensured. The use of metal ducting as earthing conductor is strictly prohibited.

#### 4.5.3 Instrument earth (IPE, IE and ISE)

Instrument earthing is identified as three different systems but they shall not have different earthing bars in the same marshalling or cabinet. Nevertheless it shall be necessary to apply the [IEC 60079-14](#) in case of intrinsically safe circuit.

Three different instrument earthing:

1. Instrument Protective Earth (IPE): for earthing frames, jackets, plates, cable armouring (for protection of personnel)
2. Instrument Earth (IE): for earthing voltage references of electronic systems and cable shields and/or screens
3. Intrinsically Safe Earth (ISE): for earthing intrinsically safe devices (shields and/or screens, voltage references, etc.)



## 4.6 Lightning protection

Cabin structure shall withstand the direct lightning strike (kA) as specified in environmental conditions.

Lightning protection of the cabin shall be part of a specific study carried out by others.

Implementation of the relevant recommendations shall be done as far as possible during cabin construction or on site after installation.

## 5. Installation and connections

### 5.1 Distribution boards, cabinets, panels and enclosures installation

Distribution boards, cabinets, panels and electrical or instrumentation enclosures, shall be fixed on steel supports welded to the cabin structure. Supports shall be sandblasted and painted in the same way as the rest of the cabin steelwork.

When the electrical room is not built in one piece, its design shall be as follows:

- The arrangement of switchboards, cabinets, panels and electrical or instrumentation enclosures, shall reduce the wiring between modules to be done on site.
- An example of arrangement is shown in Appendix 1.

### 5.2 Cables installation and connections

#### 5.2.1 General

Cables interconnecting the equipment within the cabin shall be of non armoured type.

Cables interconnecting the outdoor installed equipment (roof, transformer bay...) shall be fitted with adequate mechanical protection.

Cables under the raised floor shall be laid on cable trays.

### 5.2.2 Segregation

Minimum distances for parallel routings between LV power and electronic signal wiring shall be 300 mm.

For cable crossings (at right angle), minimum distance shall be 200 mm

As far as possible, HV cable shall have direct access to the cubicles.

### 5.2.3 Cable trays and cables fixation

Internal cable-trays shall be made of hot dip galvanised, hot perforated steel plate.

External cable trays shall be:

- Offshore: glass reinforced polyester (GRP), or aluminium 5754 or stainless steel 316L
- Onshore: hot dip galvanised steel.

Fixation of external cable trays shall be achieved by standard steel supports having a minimum thickness of 5 mm. These supports shall be welded to the structure, sandblasted and painted same as the structure.

Cable trays shall be sized with 20% spare capacity.

Changes in direction and crossing shall be done without interrupting the continuity of cable trays, and taking into account the minimum cable bending radii.

Elbows, tees, etc., shall be supplied in form of pre-fabricated components of the same material as the cable tray.

HV Cables shall be laid in a single layer. Two layers will be acceptable for LV power cables.

Fixation of cables on cable trays shall be done as follows:

- Every 30 cm for vertical routings
- Every 1 m for horizontal routings, plus fixation points at direction changes
- At a distance of 20/30 cm of each connecting point
- In general, where lack of fixation may cause cable deterioration.

### 5.2.4 Cable penetrations

- They shall be provided and sized to accommodate all the cables entering the cabin.
- 20% spare capacity shall be provided.
- They shall be of the same fire-rating as the wall
- They shall be mounted on the wall under the raised floor level.

### 5.2.5 Cable marking

Cable marking shall be achieved by means of stainless steel tags, embossed or graved.

Tags shall be clamped to each cable, at both ends and at both side of cable penetrations.

### 5.2.6 Cable glands

Cable gland MANUFACTURER and type shall be approved by COMPANY.

Cable glands shall be properly sized.

In case of metallic gland plate, cable glands shall be bronze marine for offshore and brass for onshore applications.

In case of GRP boxes connected by armoured cable, cable gland shall be Nickel plate brass type for onshore and bronze marine or stainless steel 316 L for offshore installation. If the cable is non-armoured, cable glands may be of polyamide type.

Spare and unused entries shall be properly plugged or sealed

### 5.2.7 Cable connections

- Lugs and terminations shall be crimped
- Control wires and power conductors shall be tagged
- Cable armours and shields shall be connected to relevant switchboard, cabinet, panel, etc., earth bar or terminal.

## 6. Engineering

The engineering services shall issue the following deliverables:

**Note:** See particular specification for additional required documents.

### 6.1 Structure documents

- Cabin structural calculations
- Welding specification and procedures
- Cabin structural detailed drawings
- Cabin architectural detailed drawings and specifications, showing:
  - Internal partitions
  - Access doors
  - False floor supporting structures
  - Equipment supporting frames.
- Cabin weight follow-up report
- Cabin loading/unloading/slides/spreader frame, calculation
- Cabin certificates (A60 Fire resistance, etc.)
- Equipment lay-out drawings in cabin with dimensions and weights
- Drawings showing penetrations inside the cabin (cables, pipe, HVAC, ducts).

### 6.2 Pressurization and HVAC documents

- HVAC detailed drawings and specification and data sheets
- Pressurization (if any), HVAC, calculation note
- Trouble shooting diagrams
- PID's

### 6.3 Fire protection system documents

Detailed drawings, specifications and documents as required in the particular specification.

### 6.4 Electrical documents

#### 6.4.1 Studies

- Up-dated one line diagram
- Consumer list and load balance
- Relay coordination study
- Cable sizing calculation note
- Battery sizing calculation note

#### 6.4.2 Detailed drawings, specifications and documents

- Equipment dimensions lay out and installation drawings
- Equipment (switchboard, cabinet, etc.) dimensions and installation drawings
- Equipment (switchboard, cabinet, etc.) data sheets
- Equipment (switchboard, cabinet, etc.) schematic and wiring diagrams
- Cabin internal interconnecting diagram
- Cabin cable schedule
- Cabin earthing circuits, detailed drawings
- Cabin lighting circuits, detailed drawings
- Cabin cable penetration drawings.

#### 6.4.3 Final documentation

Cabin SUPPLIER shall establish a final dossier including:

- As-built drawings
- FAT reports
- Operating and maintenance manuals
- Sub-supplier documentation (including type test certificates)
- Spare part list

The cabin SUPPLIER dossier shall be delivered at the same time as the cabin

## 7. Factory Acceptance Tests (FAT)

### 7.1 Acceptance tests

Acceptance tests must be performed by Cabin SUPPLIER in the presence of COMPANY, or his representative.

The factory acceptance tests shall include, but not limited to the following:

- Inspection of equipment and installation to check for mechanical integrity, including painting.
- Inspection of equipment and installation to check for compliance with specifications, drawings, regulations and codes of practices
- Inspection of earthing circuit (continuity and connections)
- Inspection of lighting circuits and illumination level checking
- HVAC functional tests:
  - Conformity with specifications and drawings
  - Functional tests
- Fire system functional tests:
  - Conformity with specifications and drawings
  - Functional tests (without CO<sub>2</sub> release)
- HV and LV cables:
  - Insulation tests
- HV and main LV switchboards tests:
  - Conformity with specifications and drawings
  - Protection relays test and calibration (secondary current injection)
  - Functional tests (closing, tripping and signalling circuits)
- Secondary LV switchboards and panels tests:
  - Conformity with specifications and drawings
  - Functional tests (relaying and signalling circuits)
- Battery chargers and 230 VAC UPS tests:
  - Conformity with specifications and drawings
  - Functional tests

## 8. Weighing

Before load-out the cabin SUPPLIER shall weigh the complete cabin with all equipment installed. The load figures shall be given in a written report, including the coordinates of the centre of gravity of the complete cabin.

Cabin weight follow-up shall also be established.

## 9. Sea fastening

Cabin SUPPLIER shall provide sea fastening of equipment installed in the cabin or directly associated with the cabin (roof mounted equipment).

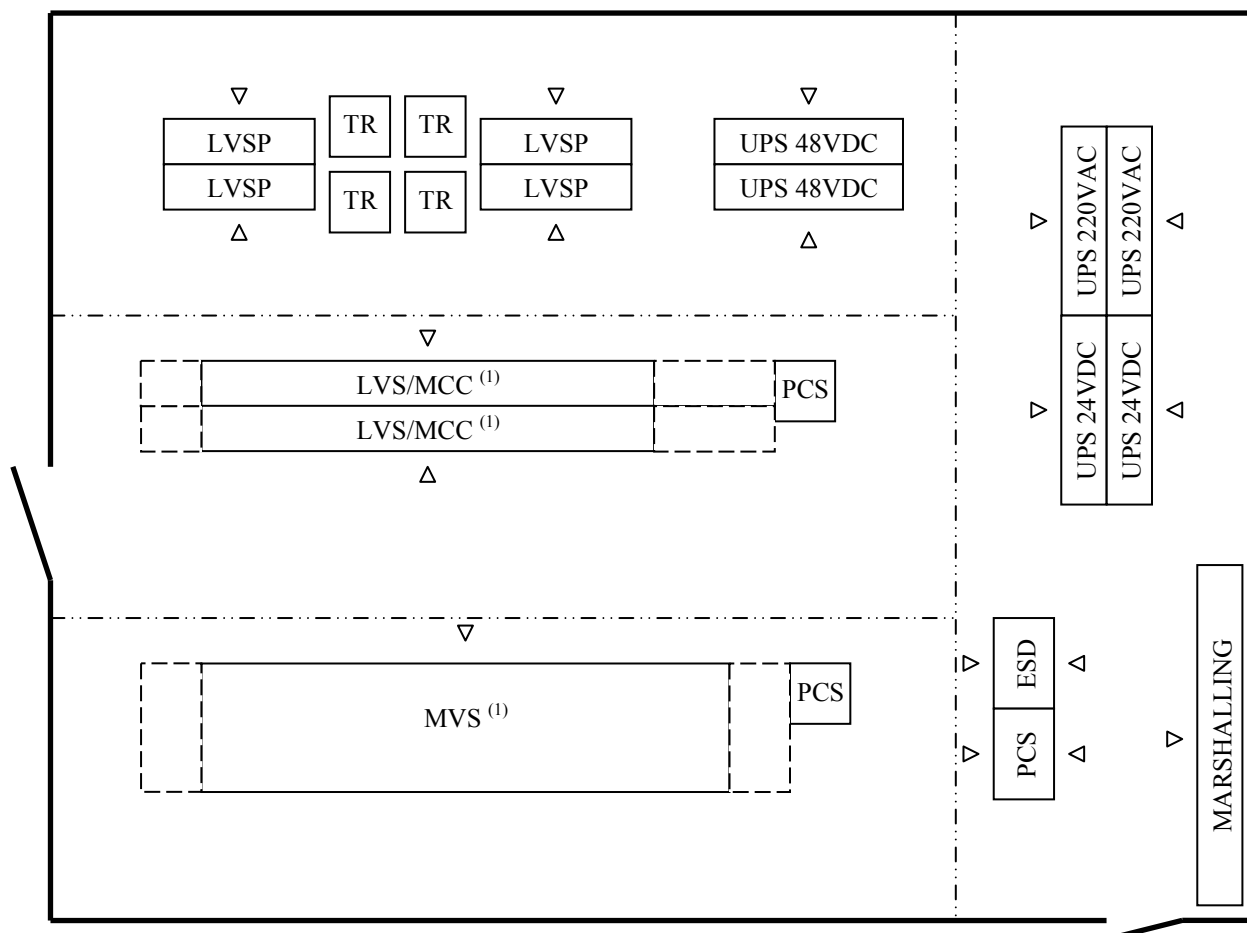
Sea fastening shall be achieved in compliance with instructions given by equipment manufacturers.

Sea fastening shall be submitted to COMPANY for approval.

All withdrawable and removable equipment shall be shipped in sea worthy packed cases. This is also applicable to equipment that must be shipped separately (batteries, HVAC units, etc.).

Sufficient quantities of desiccant shall be placed in electrical switchboards, panels, etc., prior to sea transportation.

## Appendix 1 Modular cabin arrangement Example



### NOTES:

- 1) PDCS or ECS and interposing relays shall be included in the switchgears.
- 2) Space from wall to equipment or between equipment shall not interfere with opening of doors or withdrawal of switchboard trays and as minimum shall be as follows:
  - Minimum space from wall to equipment: 800 mm
  - Minimum space from MV switchboard to LV switchboard: 1700 mm
  - Minimum space from LV switchboard (front) to other panels: 1500 mm
  - Minimum space from LV switchboard (rear) to other panels: 800 mm

### LEGEND:

- Space for future equipment
- Module limit