



Exploration & Production

GENERAL SPECIFICATION

HVAC

GS EP HVA 301

HVAC Plant Room(s)

03	01/2012	Details for emergency push buttons - Ventilation - Electrical architecture
02	01/2011	General arrangement, safety valves, ventilation
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1. Scope

The purpose of this document is to define the requirements for the design of the *HVAC PLANT ROOMS*. For other rooms containing *REFRIGERANT*, *HVAC ENGINEERING* must refer to *COMPANY HVAC SPECIALIST*.

The words and expressions in capital characters and italic are defined inside the general specification **GS EP HVA 801**.

When other words require a restrictive definition only applicable for that document, the definition is given in a paragraph of that document. Moreover defined word is written in small and *italic* letters.

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**.

Documents order of precedence is defined in **GS EP HVA 100**.

Notes:

- In case of discrepancy between documents (whatever the documents and/or whatever origins), the most expensive solution must be quoted by the *BIDDER*. During the studies (Basic Engineering and/or Detailed Engineering) *CONTRACTOR(s)* shall raise the discrepancy noted to the *COMPANY's HVAC SPECIALIST*. This last shall review and advise which document(s) is (are) to be unforced for the project
- The *HVAC VENDOR* or *CONTRACTOR* may propose proven improvements to the reference documents but must obtain written approval of the *COMPANY* prior to *implementation*.
- An International Standard is a good "engineering practice" which shall be recognised and taken into consideration by *VENDOR*, *SUPPLIER*, *MANUFACTURER* and/or *CONTRACTOR*. If required, the translation of the standards must be included into *HVAC* scope.

The latest revision of Standards, codes, regulations and the published errata, if any, must be used and applied by *VENDOR*, *SUPPLIER*, *MANUFACTURER* and *CONTRACTOR*.

Standards

Reference	Title
EN 378 (Parts 1; 3)	Refrigerating systems and heat pumps - Safety and environmental requirements - (Parts 1; 3)

Professional Documents

Reference	Title
Not applicable	

**Regulations**

Reference	Title
Directive 94/9/EC, referred to a ATEX 100a / 95	Directive of the European parliament and the council on the approximation of the laws of the member states concerning equipment and protective systems intended for use in potentially explosives atmospheres
Directive 97/23/EC dated 29 May 1997	Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment
Directive 98/37/EC dated 27 June 1988	Directive 98/37/EC of the European Parliament and of the Council of 22 June 1998 on the approximation of the laws of the Member States relating to machinery
Directive 2004/108/EC dated 15 December 2004	Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC Text with EEA relevance
Directive 2006/95 dated 12 December 2006	Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP HVA 100	HVAC Basis of design
GS EP HVA 202	Air Handling Unit(s) (AHU)
GS EP HVA 801	Terminology, definitions, abbreviations

3. General

Note 1: Section 1.1 of [EN 378-3](#) is not applicable.

Note 2: The terms "machinery room" and "special machinery room" as defined in [EN 378-1](#) and [EN 378-3](#) shall be understood as an *HVAC PLANT ROOM*.

For the definition of an *HVAC PLANT ROOM*, refer to [GS EP HVA 801](#).

A label "*HVAC PLANT ROOM - RESTRICTED ACCESS*", engraved on stainless steel plate, shall be fixed on *HVAC PLANT ROOM* access / escape doors (outside face of doors) by the main *CONTRACTOR* or, if any, by the *HVAC CONTRACTOR*.

REFRIGERANT gas escaping from refrigerating equipment shall be prevented to enter in adjacent rooms and staircases. The escaping *REFRIGERANT* gas shall be vented outdoor without inducing a new hazard.

A minimum of two doors shall be installed for each *HVAC PLANT ROOM*. In case an access door is giving a direct access to an outside area which is not classified as "safe", an airlock shall be foreseen.

REFRIGERANT gas must not be stored in *HVAC PLANT ROOM*. The *HVAC CONTRACTOR* is in charge to provide a engraved announcement label indicating that *REFRIGERANT* storage is forbidden in the *HVAC PLANT ROOM*. This label engraved on a stainless steel plate, shall be fixed on *HVAC PLANT ROOM* access / escape doors by the main *CONTRACTOR* or, if any, by the *HVAC CONTRACTOR*.

All piping, ducting and cables passing through *WALLS* shall be tightly sealed ("MCT" type).

The access doors to an *HVAC PLANT ROOM* shall be fire resistant and shall be fire classified with the same fire class as *WALLS*.

"The doors shall have at least a one-hour fire resistance construction, using materials and construction tested in accordance with EN 1634", as indicated in paragraph 5.15.1 of [EN 378-3](#) Standard, is not applicable.

3.1 Emergency push buttons

3.1.1 General emergency push button

One general emergency push button shall be placed near each *HVAC PLANT ROOM* access door (refer to *HVAC* interfaces - Project specification and/or General Specifications), outside the *HVAC PLANT ROOM*.

Actions of each general emergency push button are:

- To stop the *HVAC* equipment installed inside the *HVAC PLANT ROOM*
- To stop the *HVAC* equipment located outside the *HVAC PLANT ROOM*, when this equipment is supplied from a *HVAC MCC* and/or from a *HVAC CC* located within the *HVAC PLANT ROOM*
- To de-energize the *HVAC* equipment installed inside the *HVAC PLANT ROOM* (*HVAC* equipment means any device, component which is part of a *HVAC* system). The *HVAC MCC* and *HVAC CC* are part of *HVAC* system. Therefore they shall be de-energized from the switchboard(s) which supplies(y) them.

Each general emergency push button shall be provided with one normally closed contact and one normally open contact. The normally-closed contacts of the general emergency push buttons must be hardwired in series.

The general emergency push button loop shall be hardwired to relay(s). The free voltage contacts of the relay(s) shall be wired to the switchboard(s).

An engraved red label shall be fixed near each general emergency push button, with the following marking: "HVAC PLANT ROOM GENERAL SHUT-DOWN".

An engraved tagging plate (*HVAC PLANT ROOM* general emergency push button tag number) shall be fixed on each general emergency push button.

3.1.2 Equipment individual emergency push button

A dedicated emergency push button shall be installed for each of the following *HVAC* equipment:

HVAC equipment	Remark
Air cooled condenser	
Air cooled condensing unit	
<i>AIR HANDLING UNIT</i>	
Boiler without combustible	
<i>CHILLED WATER UNIT</i>	
Cooling tower	
Dry cooler	
<i>FAN UNIT</i>	
<i>HVAC CC</i>	
<i>HVAC MCC</i>	
Pressurization system	Applicable to water pressurization systems equipped with pump(s)
Pump	Applicable for pump having a motor rated ≥ 5.5 kW
Refrigerating unit	
Water cooled condensing unit	

Action of each individual emergency push button is:

- To stop the *HVAC* equipment associated to the individual emergency push button
- To stop the *HVAC* equipment associated to the equipment tripped by the individual emergency push button, in case of the de-energization of this last leads to damage or/and dangerous situation for people, on associated equipment.

Each general emergency push button shall be provided with one normally closed contact and one normally open contact.



The individual emergency push buttons shall be hardwired to relay(s).

The free voltage contacts of the relay(s) shall be wired to the switchboard(s) supplying the HVAC equipment or to the HVAC MCC, according to the location of equipment MCC.

An engraved red label shall be fixed near each individual emergency push button, with the following marking: "XXX SHUT-DOWN", where "XXX" is the current name and tag of equipment which is de-energized by the push button.

An engraved tagging plate (individual emergency push button tag number) shall be fixed on each individual emergency push button.

3.2 HVAC equipment arrangement and room arrangement

The HVAC equipment shall be designed in order to enable installation in, and removal from the HVAC PLANT ROOM. The HVAC equipment shall also be designed to enable installation in, and removal from the HVAC PLANT ROOM of any of its components.

In addition to the above requirement, both the architectural room layout and HVAC equipment design shall enable the installation / removal without dismantling the following components in pieces:

- Condenser (of chilled water unit)
- Evaporator (of chilled water unit)
- Pump and associated motor
- AHU module or AHU section
- FAN UNIT
- Heat exchanger
- Tank.

The arrangement shall enable the maintenance, the dismantling and the removal of the duty HVAC equipment without stopping the stand-by equipment (HVAC equipment or other equipment).

The availability of a HVAC system shall not be reduced by the dismantling, the removal and/or the installation (after equipment is repaired) of a component from this system or from another system.

4. Ventilation

The following requirements prevail over those of paragraph 5.16 of [EN 378-3](#), in case of discrepancy between the present General Specification and [EN 378-3](#).

4.1 General

HVAC PLANT ROOM shall be ventilated by mechanical ventilation.

Provision shall be made for a sufficient supply of outside air (ODA), supply air (SUP) or transferred air (TRA). In case of transferred air (TRA), it shall not contain any pollutant(s) other than from human pollution (except from sanitary, toilets). Equipment located in a "non safe" area shall be designed and installed according to the [ATEX Directive](#).

In order to maintain the required pressure and/or to avoid negative pressure inside the *HVAC PLANT ROOM*, a compensation of the *EXHAUST* air, taking into account the leakage air flow rate, shall be provided.

The compensation of the *EXHAUST* air shall be ensured by means of a set of two *AHUs* (1 x 100% duty, 1 x 100% stand-by). *SUPPLY* air can be issued from another *HVAC ESSENTIAL* system, in case it is associated to an EHA2 (refer to **GS EP HVA 100**) *EXHAUST AIR* system (serving the *HVAC PLANT ROOM*). In case the *SUPPLY* air system is associated to an EHA3 (refer to **GS EP HVA 100**) *EXHAUST AIR* system (serving the *HVAC PLANT ROOM*), it shall be independent from another *HVAC* system.

According to the service required from these units, the design of each *AHU* can include cooling coil and/or heating coil. The minimum arrangement to be provided, in case heating and/or cooling and/or de-humidification are not required, is a double filtering stage (F7 + F9) and a *FAN UNIT*. The *AHUs* shall be fully compliant with **GS EP HVA 202**.

In case these *AHUs* are located in a "non safe" area, they shall be ATEX certified in compliance with the concerned area. In this case, a certificate, issued by a notified body has to be provided, indicating the compliance with the above requirement.

According to the meteocean report, the two independent *OUTDOOR* air intakes, connected to the *AHUs*, shall be equipped with sand filters.

In case of the *AHUs* serving the *HVAC PLANT ROOM* for *SUPPLY* air are associated to an EHA3 *EXHAUST AIR* system (serving the *HVAC PLANT ROOM*), these *AHUs* shall be located outside the *HVAC PLANT ROOM*.

4.2 Diffusers and grilles

OUTDOOR air (*ODA*) or *SUPPLY* air (*SUP*) entering in the *HVAC PLANT ROOM* shall be distributed at low level in the room with air displacement diffusers (every time this principle is applicable). Number and location of diffusers shall be defined to distribute air on the complete floor surface of the *HVAC PLANT ROOM*. Air diffusers shall be installed near the access door(s) of the room and at other places, where it is required, to cover the complete area of room. The air distribution criteria is thus, for the *HVAC PLANT ROOM*, not to obtain an homogeneous temperature inside the room, (considering the location of the heat dissipations) but to obtain an acceptable temperature in the *OCCUPIED AREA* while still complying with *OUTDOOR* air flow rates required within **GS EP HVA 100**.

EXHAUST grilles shall be located at high level in the room (for *HVAC PLANT ROOM* containing *REFRIGERANT*, refer hereafter). The grilles shall be evenly distributed on room surface.

For room housing equipment containing *REFRIGERANT*:

- If *REFRIGERANT* is heavier than air, a minimum of 50% of *EXHAUST* air (*EHA*) volume shall be taken at low level of the *HVAC PLANT ROOM*. In this case, the *OUTDOOR* air or *SUPPLY* air inlet(s) shall be installed at the high level of the *HVAC PLANT ROOM*
- If *REFRIGERANT* is lighter than air, *EXHAUST* air (*EHA*) volume shall be taken at the high level of the *HVAC PLANT ROOM*. The *OUTDOOR* air or *SUPPLY* air inlet(s) shall be installed at the low level of the *HVAC PLANT ROOM*.

4.3 EXHAUST air flow rates

Whatever the type of *EXHAUST* air (*EHA2* or *EHA3*), two *EXHAUST* air *FANS UNITS*, both designed for 100% of the requested capacity (one duty, one stand-by), shall be installed.

EXHAUST FANS UNITS shall be designed to operate 2 hours at 400°C in order to exhaust air and/or smoke and/or *REFRIGERANT* gas. *EXHAUST FANS UNITS* certificate, issued by a notified body, has to be provided, indicating the compliance with the above requirement.

In case the *EXHAUST FAN UNITS* are located in a "non safe" area, *COMPANY HVAC SPECIALIST* will advise which requirement prevails (ATEX certificate or operation capacity of 2 hours at 400°C).

For *EHA3 EXHAUST* air system, *EXHAUST FANS UNITS*, shut-off dampers and air flow rate controller(s) shall be located outside the *HVAC PLANT ROOM*. They shall be designed in accordance with the area classification where they are installed. In case of ducting passing through a "non safe" area, the part of ducting which is located within the "non safe" area shall be fully welded (flanges, Pittsburgh seam... are prohibited).

4.3.1 HVAC PLANT ROOM not containing REFRIGERANT gas

EXHAUST air is classified *EHA 2* (Refer to **GS EP HVA 100**).

EXHAUST air flow rate shall be at least one volume of room per hour. For calculation, "VOLUME OF ROOM" has to be understood as the volume comprised between floor, ceiling and walls. In case of suspended ceiling and or raised floor, their gross volume has to be included in the "VOLUME OF ROOM".

4.3.2 HVAC PLANT ROOM containing REFRIGERANT (refrigerating system partially or fully located inside the HVAC PLANT ROOM)

EXHAUST air is classified *EHA 3* (Refer to **GS EP HVA 100**).

Ventilation system to outside of building has to be designed such as to not cause inconvenience or danger to personal.

For *EHA3 EXHAUST* air system, *EXHAUST FANS UNITS*, shut-off dampers and air flow rate controller(s) shall be located outside the *HVAC PLANT ROOM*. They shall be designed in accordance with the area classification where they are installed. In case of ducting passing through a "non safe" area, the part of ducting which is located within the "non safe" area shall be fully welded (flanges, Pittsburgh seam... are prohibited).

The following formula shall be used for *EXHAUST* air flow calculation:

$$V = 14 \cdot \sqrt[3]{m^2}$$

Where:

- V = exhaust air flow rate in litre per second
- m = mass of *REFRIGERANT* charge, in kilogram, in the refrigerating system having the higher *REFRIGERANT* mass.

A 100% duty and 100% stand-by *EXHAUST* air systems arrangement shall be installed with a minimum *EXHAUST* air flow rate (litre per second) per *EXHAUST FAN* of:

$$\frac{V}{N_{EHA} - 1}$$

Where:

- V = required exhaust air flow rate in liter per second for the *HVAC PLANT ROOM*
- N_{EHA} = number of *EXHAUST FANS UNITS* on the *EXHAUST* air system.

4.3.3 *HVAC PLANT ROOM* containing equipment operating with fluids designed for heat transfer (excepted water)

Refer to the Material Data Sheet.

4.4 *REFRIGERANT* leakage monitoring

When *HVAC* equipment using *REFRIGERANT* gas is located within the *HVAC PLANT ROOM*, a *REFRIGERANT* leakage alarm system shall be installed in accordance with the requirements of the [EN 378-3](#) standard, paragraph 8. These requirements are applicable whatever the *REFRIGERANT* gas charge (the [EN 378-3](#) standard limitation of 25 kg is not applicable).

In addition to the [EN 378-3](#) requirements, the following action shall be implemented:

- Klaxon + flashing light near each access door to the *HVAC PLANT ROOM*
- Power supply tripping from switchboard, for *HVAC* equipment located inside the *HVAC PLANT ROOM*
- Alarm to control room (free-voltage change-over switch).

4.5 *Automation*

In normal situation, *HVAC PLANT ROOM* ventilation is continuously operating.

4.5.1 *HVAC PLANT ROOM* with *EHA2 EXHAUST* air system

For *EHA2* classification, there is no specific requirement for the *EXHAUST* air system and for the *SUPPLY* air system dedicated to *HVAC PLANT ROOM*.

4.5.2 *HVAC PLANT ROOM* with *EHA3 EXHAUST* air system

When the *HVAC PLANT ROOM* is ventilated by an *EHA3* system, On/Off push buttons (one per *EXHAUST FAN UNIT* and one per *AHU*) shall be installed outside the *HVAC PLANT ROOM*, near each access door of the *HVAC PLANT ROOM*.

In case the *HVAC PLANT ROOM* is at an underground level of a building, On/Off push buttons shall be installed at the ground floor level, close to the stair accessing to the *HVAC PLANT ROOM*.

5. Power supplies (to HVAC PLANT ROOM)

Depending on project specification, one of the following architecture shall be applied:

- Architecture 1 (refer to schematics 1 & 2): the Main HVAC MCC (drawers dedicated to HVAC) is located in an electrical room (this Main HVAC MCC can be part of the main switchboard).

In this case, the HVAC MCC located in the HVAC PLANT ROOM shall be installed to supply the equipment for which the nominal absorbed power is lower than 250 W. However, it shall be provided a dedicated HVAC MCC for:

- Each NON ESSENTIAL HVAC system, if any
- Each ESSENTIAL HVAC system, if any
- The chilled water production system dedicated to Topsides modules, if any
- Each HVAC system of TOPSIDES, if any.
- Architecture 2 (refer to schematics 3 & 4): the Main HVAC MCC cabinet is located in HVAC PLANT ROOM.

In this case, the Main HVAC MCC cabinet shall be fed from the main switchboard located in electrical room.

Drawers shall be used for consumers with an absorbed power equal or greater than 250 W.

It shall be provided a dedicated an HVAC MCC cabinet for:

- Each NON ESSENTIAL HVAC system, if any
- Each ESSENTIAL HVAC system, if any
- The chilled water production system dedicated to Topsides modules, if any
- Each TOPSIDES HVAC system, if any.

In case the HVAC system(s) are classified as HVAC ESSENTIAL SYSTEM, two redundant feeders shall supply the ESSENTIAL HVAC MCC and two redundant feeders shall supply the ESSENTIAL HVAC CC.

The two redundant cables feeding the ESSENTIAL HVAC MCC shall be routed in separated trays and shall not pass through the same rooms. Same philosophy shall be applied for ESSENTIAL HVAC CC feeding.

For HVAC CC, whatever the classification of HVAC system (NON ESSENTIAL or ESSENTIAL), the power supplies shall be issued from UPS.

For EXHAUST FANS UNITS and for AHUs for HVAC PLANT ROOM (when EHA3 classification), a MCC HVAC cabinet and a HVAC CC, dedicated to the HVAC PLANT ROOM EXHAUST FANS UNITS and associated AHUs, shall be installed out of the HVAC PLANT ROOM. This cabinet shall be supplied from the Essential or Emergency main switchboard.

Dedicated power supplies shall be provided for:

- The HVAC PLANT ROOM lighting
- Emergency lighting



- *REFRIGERANT* leak alarm system
- *HVAC PLANT ROOM SUPPLY* and/or *EXHAUST* dedicated systems.

Note: Power supply for lighting is part of the scope of Electrical discipline.

6. Utility supplies

Each *HVAC PLANT ROOM* shall be supplied with:

- Fresh water (Utility Water)
- Industrial compressed air
- Sea water, when heat rejection from chilled water units is realized by means of sea water
- Cooling water, when heat rejection from chilled water units is realized by means of plant cooling water system.

6.1 Fresh water

The fresh water network shall supply the *HVAC PLANT ROOM* with minimum following performance:

- Flow rate: minimum of 12 l/mn
- Pressure: 3 bar gauge minimum, when supplying.

After penetration of fresh water piping inside *HVAC PLANT ROOM*, the network shall be equipped with:

- Manual isolating valve
- Pressure gauge with manifold for purging and isolation
- Backflow preventer with verifiable reduced pressure zone with funnel attached, connected to the grey water pipework
- Pressure reducing valve
- Pressure gauge with manifold for purging and isolation
- Manual isolating valve.

Fresh water (Utility Water) shall be distributed to the different *HVAC* systems, for filling up. Flexible piping is forbidden.

The backflow preventer with verifiable reduced pressure zone with funnel attached shall be physically disconnected from the grey water pipework to avoid any contact between the two pipeworks. A siphon, located inside the *HVAC PLANT ROOM* shall equip the grey water pipework.

7. Discharge of safety valves

In case the safety valve(s) is (are) installed on equipment located within the *HVAC PLANT ROOM*, the discharge of safety valve(s) shall be connected to discharge pipe(s). The end of the discharge piping shall be located according to the following table.



The end of the discharge piping shall be located at a minimum of 8 meters from any *OUTDOOR* air intakes, doors, windows, natural air discharge and, more generally, at a minimum of 8 meters from any opening and open duct.

The end of discharge piping shall be protected to prevent introduction of water, dust, sand, and any foreign object / animal.

The safety valves discharges shall be connected to individual piping or to a common piping, according to their service:

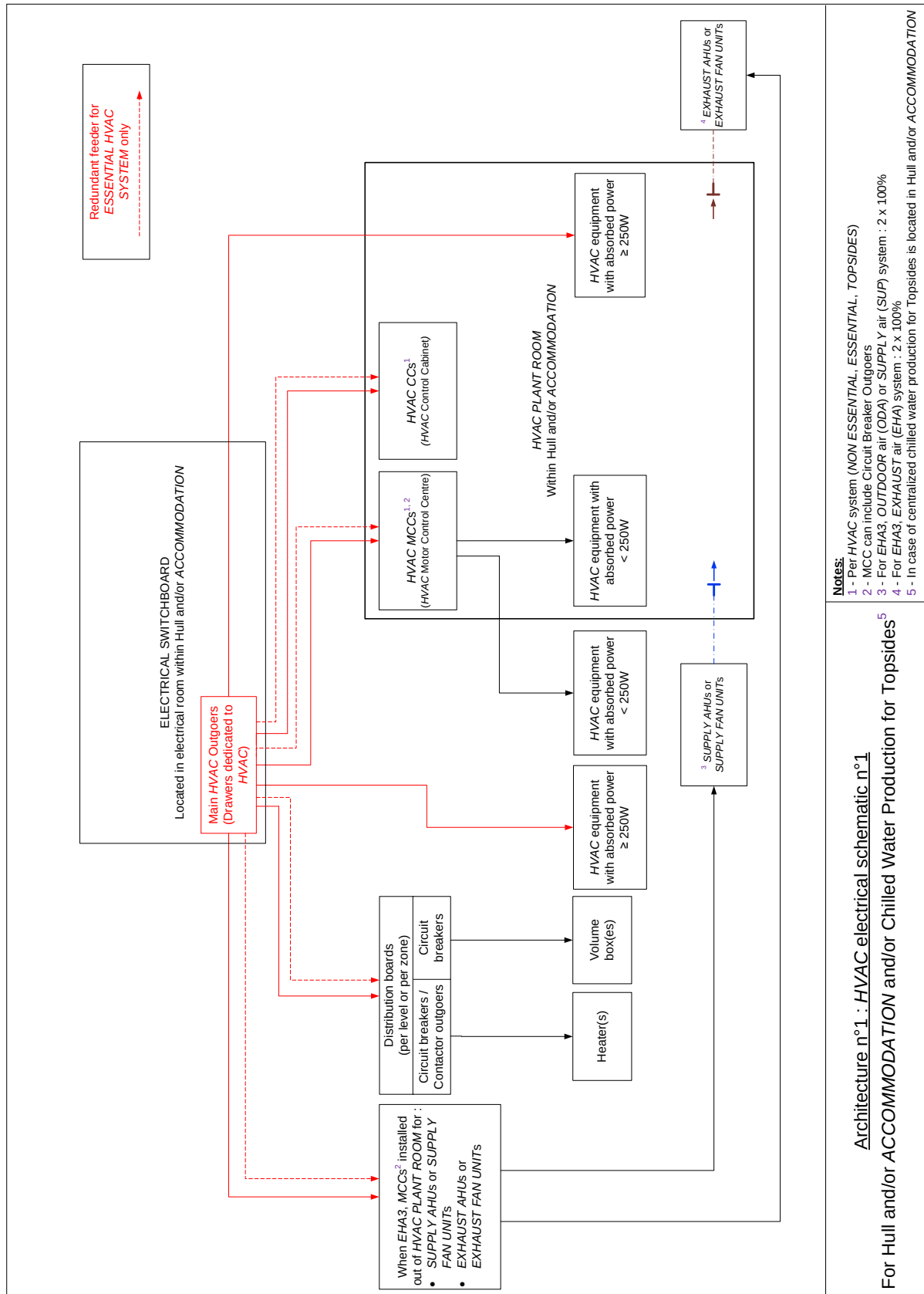
Fluid	Discharge piping	Discharge location
<i>REFRIGERANT</i>	One piping per safety valve	Outdoor
Steam	One piping per safety valve	Outdoor
Chilled water	Common piping (after disconnection between the safety valve discharge and the common piping)	Grey water pipework
Hot water	One piping per safety valve	Grey water pipework
Gas (toxic)	One piping per safety valve	Outdoor, out of safe area
Other fluids	One piping per safety valve	To be defined with COMPANY Safety Engineer and <i>HVAC SPECIALIST</i> Engineer

8. Information regarding *HVAC PLANT ROOM*

A plastic-coated colored poster (readable format A1 minimum) with *HVAC* Flow Diagram, *HVAC* P&ID and *HVAC D&ID*, for *HVAC* equipment, shall be fixed in *HVAC PLANT ROOM*.

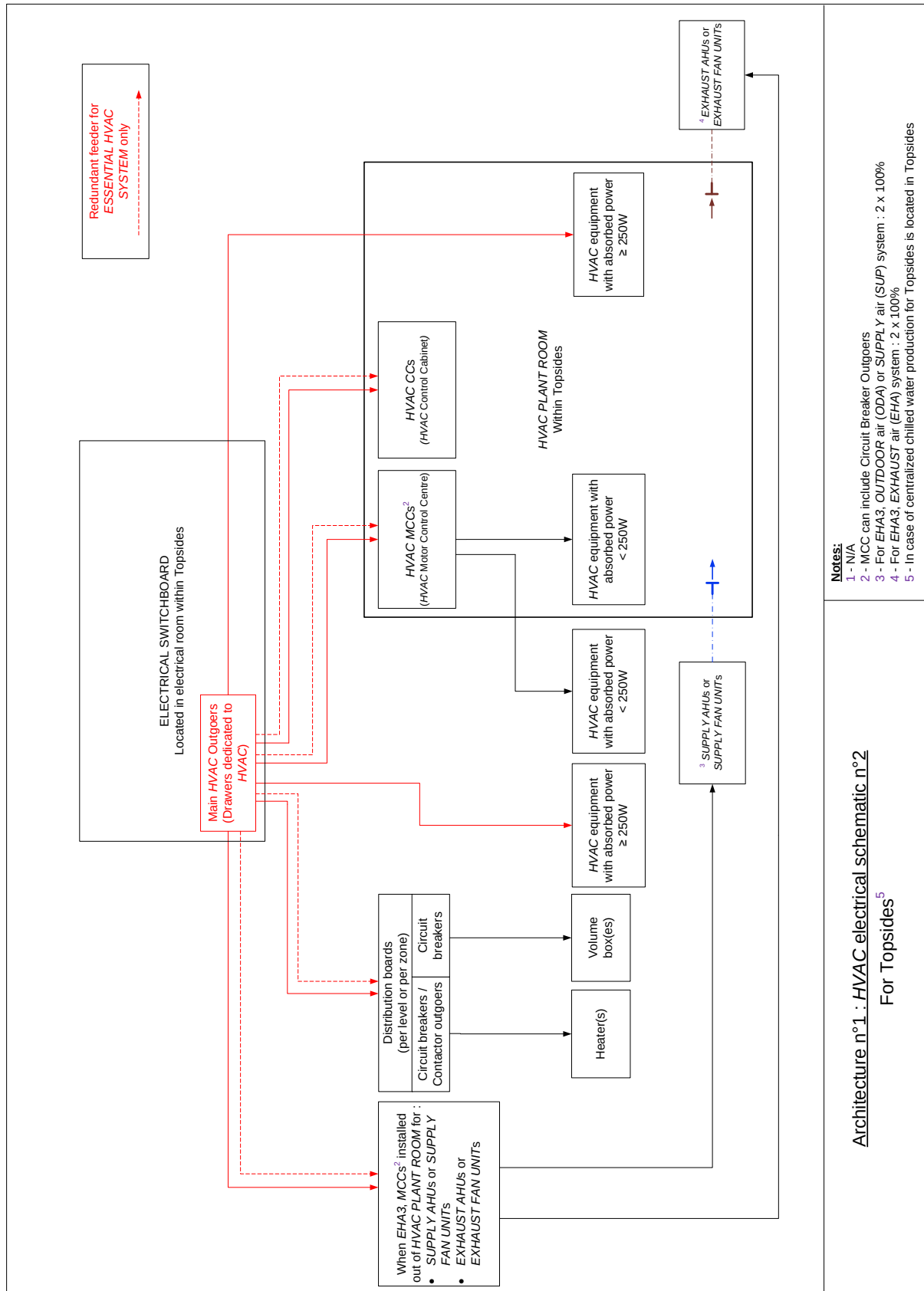
The *HVAC* Flow Diagram, *HVAC* P&ID and *HVAC D&ID* shall be "As-Built" documents, with equipment tag numbers.

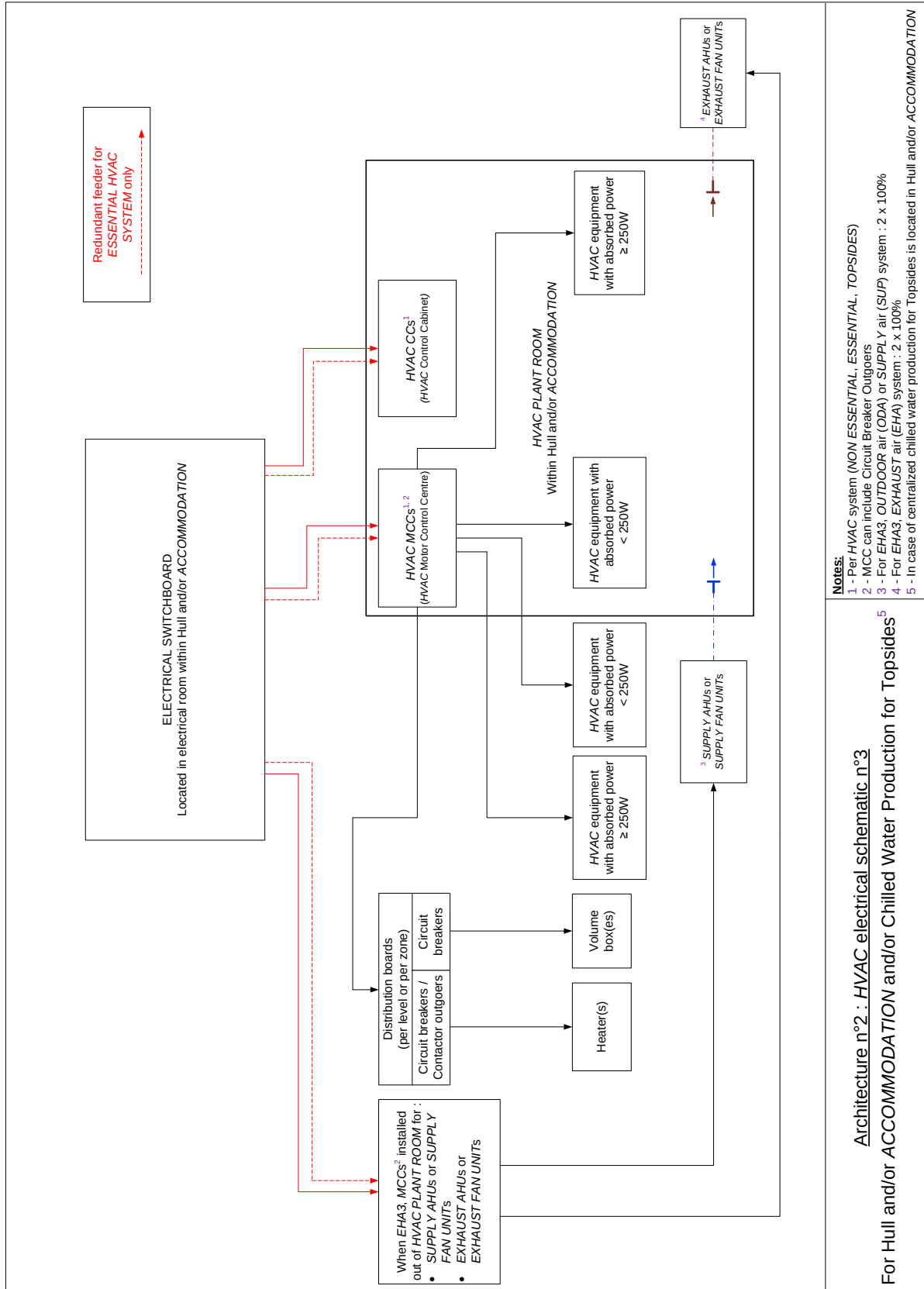
9. Schematics



Architecture n°1 : HVAC electrical schematic n°1

For Hull and/or ACCOMMODATION and/or Chilled Water Production for Topsides⁵





Architecture n°2 : HVAC electrical schematic n°3

For Hull and/or ACCOMMODATION and/or Chilled Water Production for Topsides⁵

