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| PLAN RECORD | | | | | | | | |
| REV. NO. | DESCRIPTION | DRAWN BY | DATE | CHECKED | | | | |
| ORIG. | ORIGINALLY PREPARED FOR 3454-3457 | B.B. SON | 2023.12.05 | S.H. LEE | | | | |
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| | | | | | SEC. NO. C2I3 | SHIPBUILDING DIVISION MACH OUTFITTING DESIGN DEP'T | 174,000 CBM CLASS LNG CARRIER | |
| | | | | | DATE | 2023.12.05 | PURCHASE ORDER SPECIFICATION FOR | |
| | | | | | TEL. NO. 3-6161 | SHIP NO. 3454-3457 | UNIT COOLER | |
| | | | | | | APPROVED Sangho Lee CHECKED Dongguen Shin DRAWN Byeongbeom Son | REFERENCE DRAWING NO. DRAWING SCALE | |
| HYUNDAI HEAVY INDUSTRIES CO., LTD. ULSAN SHIPYARD. KOREA | | SEQUENCE NO. | | | | | | |

PACKAGE LIST

HULL NO. : **3454-3457**

PAGE : 0

| POR NO. | | DESCRIPTION | Q'TY | REMARK |
|-------------|-----------|--|----------|--------|
| SER. NO. | SEQ. NO. | | | |
| M511 | AA | UNIT COOLER FOR ENGINE CONTROL ROOM PACKAGE TYPE | 2 | |
| M511 | BB | UNIT COOLER FOR SWITCHBOARD ROOM PACKAGE TYPE | 4 | |
| M511 | CC | UNIT COOLER FOR WORKSHOP PACKAGE TYPE | 1 | |
| M511 | EE | SPARE PARTS & TOOLS FOR UNIT COOLER | 1 | |
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1. EACH UNIT WITHIN A PACKAGE OR SHIPPING CONTAINER SHALL BE CLEARLY MARKED IN A MANNER AS MAY BE DESIGNATED BY THE BUYER BY STAMPING, TAGGING OR OTHER SUITABLE MEANS WITH IDENTIFICATION OF SUPPLY.
THE OUTSIDE OF EACH PACKAGE AND OR PROTECTIVE DEVICES SHALL BE CLEARLY MARKED, REFERING SHIPPING MARK.
2. ABOVE POR NO. (SER. NO. - SEQ. NO.) AND DESCRIPTION MUST BE MARKED ON EACH PACKAGE AND PACKING LIST.

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IMPORTANT NOTICE

Supplier should fully comply with the technical specifications as well as “General Information and Requirements” without any deviations. Those suppliers who cannot meet the requirements both in technical specification and the GI&R completely should not offer for this bid.

1 Type : Packaged type for marine use.

2 Particular

| | UNIT COOLER FOR ENGINE CONTROL ROOM | UNIT COOLER FOR SWITCHBOARD ROOM | UNIT COOLER FOR WORKSHOP |
|------------------|--|-------------------------------------|-----------------------------------|
| Q'ty / Ship | Two(2) sets | Four(4) sets | One(1) set |
| Cooling Capacity | 15,000 kcal/h | 60,000 kcal/h | 15,000 kcal/h |
| Refrigerant | R-407C | R-407C | R-407C |
| Air Flow | Maker's standard | Maker's standard | Maker's standard |
| Remark | #, #### | ## | Without thermal insulation |

*** The capacity of unit cooler to be decided during detail design stage.**

: Unit cooler for engine control room to be of duct type and installed outside of ECR

: Unit coolers for SWBD room to be of duct type

: One(1) spare compressor to be provided (loose supply)

1) Design condition

| <u>Condition</u> | <u>Summer</u> | <u>Winter</u> |
|--------------------------------|--------------------|-------------------|
| Atmos. temp./R.H. | 40°C / 70% | -20°C |
| Inside temp./R.H. | 25°C / 55% | 22°C / 50% |
| Cooling F.W./S.W. temp. | 36°C / 32°C | |
| E/R ambient temp./ R.H. | 45°C / 60% | |

2) Heating medium : Electric heating coil.

2 Construction and Material.

- 1) The air to be sucked and discharged through air grille.
- 2) The construction to be in accordance with classification society (**LR**) regulatory bodies, and maker's standard including compressor, condenser, air filter, blower, electric heater, temperature control device, and etc. in a steel casing.

3 Accessory and fittings

Maker's standard including followings.

- a. Flow regulating valve for fresh water, if necessary.
- b. Electric heater.
- c. Temp. control device.

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- d. Control panel. (To be equipped in the unit)
- e. Lifting lug.
- f. Refrigerant recharging port.
- g. All of necessary items and fittings to perform function/operation of the unit.

4 Spare parts and tools

- 1) **Two(2) years spare parts. Tools and accessories to be furnished in accordance with the requirements of the Classification Society and the Regulatory Bodies concerned and in accordance with the Maker's.**
- 2) **The spare parts, tools and accessories to be properly protected.**
- 3) **The steel box to be supplied to store on shelves and drawers for storing spare parts.**

5 Remark

- 1) **The final painting color of machinery external surface, bed frame and foundation to be informed at drawing approval stage.**
- 2) Packing method
 - a. All components/fittings to be supplied as one unit with the assembled condition without any loose supply items.
 - b. The packing case for spare part/tools to be made separately.
 - c. The packing/content list to be prepared for each packing.
 - d. Each group of packages shall be delivered on the required time by purchase order dep't.
 - e. **The protection cover to be of flame resistance type.**
- 3) **Please refer to noise limit for each space and provide suitable equipment not to exceed each noise level.**

| SPACE | dB (A) |
|---|---------------------------------------|
| Workshop in engine room | 82 |
| Machinery control room (Incl. engine control room, cargo control room) | 72 for 1 set 68 for 2 sets |

- 4) The other general requirements which are not shown on this technical spec. of P.O.R and the detail of electric spec to be complied with General Information & Requirement which is separately distributed by Material Purchasing Department.

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General Remark

- 1) Design conditions for the engine room machinery and equipment to be based on the maximum sea water temperature of 32 °C, the engine room temperature of 45 °C and the relative humidity of 60 %, unless otherwise especially stated.
- 2) *The equipment except electric equipment in engine room to be able to operate at engine room air temperature of 50°C and S.W. temperature of 35°C. However, the output or performance of the machinery and equipment to be reduced or limited to the certain level according to the relevant manufacturer's recommendations.*
- 3) The material of insulation, gasket and/or gland packing shall be of asbestos-free type.
- 4) All instruments to be of suitable construction for max. operating value and to be of graduation in metric units and normal reading should be between 50% and 75% of the value as far as practicable. *The unit for pressure to be kg/cm², bar and milibar.*
- 5) Temp. sensor for remote reading & supervision to be of the electric analogue type.
- 6) Sensor cables to have a loop of excess cable at the sensor end to facilitate replacement of sensor.
- 7) Thermometers and temp. sensors for monitoring of fluid temp. only to be equipped with pockets of suitable material or to be element exchangeable type Pocket to be filled with heat conductive compound.
- 8) All pneumatic control loops to have air filter regulators.
- 9) All control valves, if adopted, shall be provided with manual handle.
- 10) Local pressure gauge to be of bourdon tube type with body of brass or SUS.
- 11) All root valves for pressure gauges shall be of bite type joint, not brazing type.
- 12) Name plate for instrument (press., level, temp. sensors) to be fitted an suitable place of main equipment or to be attached to instrument by using stainless steel (SUS) wire / lug similarly to tag.
- 13) Spare parts and tools to be supplied with suitable rust preventive coating where necessary.
- 14) Grease nipples to be of ball type (JIS B 1575 A-PT 1/8 or equivalent type). *(Material : Brass)* or maker's standard which is provided by the equipment supplier as a package.
- 15) Glass tube thermometers to be used, except those specially specified.
- 16) Glass tube thermometers to be protected by a separate socket made of suitable corrosion resisting materials to suit their service condition.
- 17) Removal space (if required) for maintenance to be mentioned on approval drawing.
- 18) All opening(i.e. in/out connection etc.) to be packed by blank flanges made of hard material after suitable treatment to corrosion attack.
- 19) Stainless steel described without grade notation means SUS 304.
- 20) Name plate showing valve's purpose to be fitted on hand wheel of the valve. (Tag or identification plate fitted with wire on the valve can also be acceptable for small valve)
- 21) Spare parts & tools for ancillary equipment to be also shown on "List of spare parts & tools" together with those of main unit. And working q'ty, spare q'ty, part number to be shown definitely with sketch of shape.
- 22) Control air pipe connection (if required) to be suitable for yard's 8Φ copper pipe.
- 23) Drawing of general layout showing plan / elevation / section view shall be included in the approval drawing.
- 24) Eye-plate to be suitably fitted for rotor of generator, ~~steam turbines~~, electric motors,

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heat exchanger's cover/tube/bundles and heavy strainer's cover/filter/element of about 40 kg & above (And lifting eyes to have a min. diameter of 23 mm).

- 25) Test provision such as three way test cock to be provided for pressure switches and pressure transmitters.
- 26) The surfaces having normal operating temperatures above 60 °C to be insulated by "Supplier", except valves and flanges, where required, for maintaining internal fluid temperature and for personal protection and at least the a preparation work(insulation stopper and/or pin) should be done by supplier before equipment delivery.
- 27) The information of loose supply items (Yard Supply Scope) & connections to be separately listed and reflected on the approval drawing.
- 28) The deviation from yard's P.O.S. to be notified by the deviation list and clarified at the quotation stage. **(IMPORTANT)**
Items not notified in the deviation list should be considered as fully satisfied with this technical specification.
Even in case there is no deviation, such a term as 'no deviation' should be stated in the deviation list. **(IMPORTANT)**
- 29) Any necessitate modification and/or changes from the submitted specifications and/or official performance data released at the time being, MUST be informed separately and agreed by YARD prior to application. **(IMPORTANT)**
- 30) For the explosion proof equipment installed in hazardous area, item list of explosion proof electric component (such as sensor, motor) and specific general arrangement drawing including location of the component and copy or picture of Certificate No./Classification to be submitted prior to FAT.
- 31) Cable way to be provided on equipment body or additional cable tray to be provided for each yard cable connection. And standardized cable way/tray should be indicated and represented clearly on approval drawing.
- 32) Others not mentioned in P.O.S. to be satisfied with PGI&R, SGI&R and Classification Society's rule requirement.
- 33) ***FAT procedure has to be submitted to our QM before FAT -30days.***
The mentioned documents for FAT have to be submitted at the initial stage.
 - ***Piing & Instrument Diagram***
 - ***Operation manual***
 - ***Alarm & manual***
 - ***Function manual(FDS)***
 - ***I/O List (If possible)******Owner`s approval comments have to be closed before FAT.***
- 34) ***For all machinery & equipment applicable to shop tests, the results of such tests to be included in the relevant instruction manual, and to be submitted as finished plan onboard.***
- 35) ***Pump suction pressure gauges to be of compound gauges.***
- 36) ***The bearing type to be marked at the pump motor name plate for motor bearing only.***
- 37) ***Electric equipment to be able to operate at air temperature 50°C. However, the performance of the electric equipment to be reduced or limited to certain level according to manufacturer's recommendation.***

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- 38) When starters contained in the group starter panels are located far away from corresponding motors, a start push button with running indication lamp and a lock type stop push button to be provided near motor side or on other adjacent other starter panels except motors for fans.
- 39) Interlock handle to be provided on starter panel door in order not to panel door open without operating it as per Maker's standard.
- 40) If vibration levels exceeds defined criteria, then the Maker to investigate basic reason for vibration by way of FEA associated structures and rectify to practical extent in affected vessel to the satisfaction of the Owner and make necessary amendments in drawings subject to approval by the Owner & the Classification Society & HHI in subsequent vessel(s). Any additional cost to be the Maker's account.
- 41) All material and system components used during construction and fitted on the Vessel are to be non-toxic emitting (as far as practicable excluding cable and certain material in accommodation which to anyway comply with relevant international rules and regulations), fire retardant as well as being Halon free, Chlorofluorocarbons (CFCs) free, Polychlorinated Biphenyls (PCBs) free and asbestos free throughout as far as practicable.
- 42) Equipment suppliers to guarantee availability of spare parts for at least twenty five (25) years from the delivery of the Vessel, at the TBA stage.
- 43) Concerning the electric/electronic systems the latest version of equipment and software to be applied ensuring at least ten(10) years support of systems after vessel's delivery, without renewal of main units as far as practicable.
- 44) Commissioning engineer reports to clearly state that systems and their associated auxiliaries installation has been checked and found in compliance with the Maker's instructions and recommendations.
- 45) All name plates and caution plates to be written in English.
- 46) O-ring to be applied to flange joint for high pressure pipe which design pressure is 100 bar and above.
- 47) Stainless steel pipe to be passivated before installation. Installation pieces and repaired parts to be passivated as far as practicable.
- 48) Shop test and coating inspection of piping to be carried out in accordance with class rules and regulations with Buyer's representative and to be included in the inspection & test plan.
- 49) Cable spare length for sensor (temperature switch, pressure switch, pressure transmitter) to be provided with on turn (loop).
- 50) Local pressure gauges to be filled in with glycerin or equivalent for anti-vibration purposes.
- 51) Voltage drop calculation to be provided for motors above 100kW in order to prove that in heavy load starting voltage drop to be less than 15% of nominal value.