**LIST OF QUESTIONNAIRES & CLARIFICATIONS**

**EMDC BOE 320K LNG FSRU**

**Date : Sep. 25, 2008**

**Ref. No. : LN0819-CL(A)-R0**

**Total 8 Sheets incl. Cover & Attachment**

**Note : This document has been prepared for the clarifications of EMDC’s Functional Requirements for Blue Ocean Energy FSRU project, dated August 22th, 2008.**



**DAEWOO SHIPBUILDING &**

**MARINE ENGINEERING CO., LTD.**

| **Ser.**  **No.** | **Code/**  **Page** | **Item** | **Questionnaire / Clarifications**  **(DSME & GTT)** | **EMDC’s Replies** | **Remarks** |
| --- | --- | --- | --- | --- | --- |
| D-1 | 1/  1 | Code & Standards | As to the design of FSRU hull side, the high grade Marine Shipbuilding Standards & Codes will be applied as discussed on last meeting (Aug. 27, 2008) held in Okpo Korea.  However, which standard (Marine or Offshore) will be utilized in design of topside ? |  |  |
| D-2 | 9 /  12 | Rule & Regulations | EMDC’s Functional Specification indicates to apply the following Rule & Regulations :   * USCG Regulation for offshore application * NJ Department of Environmental protection * US Army Corp of Engineers * National Marine Fishers Service * Company Standards (Global Practices)   Please provide us above rules and regulations in electric file and also advise us of the differences and specific requirements, which to be considered into the design, compared to the normal shipbuilding marine Standards and Practices. |  |  |
| D-3 | - | Model test | Who shall carry out the analysis and model test with regards to the ship motion and operability of the Vessel against environment condition?  DSME or EMDC or Next stage ? |  |  |
| D-4 | 7/  8 | Emission control | Any requirement of the emission control for the exhaust gas from the gas turbine, process heaters and essential/ em’cy generators?  Necessity of SCR or other control unit? |  |  |
| D-5 | 2 /  4 | Manifold for Q-Flex | Standard Q-flex has the manifold arrangement of  L-L-V-L-L, whiles EMDC Functional Spec. describes as like V-L-L-L-V.  Please clarify which one is correct. |  |  |
| D-6 | 7.8 & 7.9 / 9 | Sea water intake velocity for ballast system and SW cooling system | Specified maximum fluid velocity of 0.15 m/sec to be clarified. Probably 1.5 m/sec would be correct. |  |  |
| D-7 | 6/  6 | Technical information for topside equipment | Please provide us detail technical information including dimension, weight, power consumption (rated KW/ actual SHP/ efficiency) etc. for the following topside equipment of which design already had been done by EMDC :   * Regasification unit * BOG recondenser unit * Flare tower & tank vent system * N2 blending unit * Metering unit * Ordorization unit * Etc. |  |  |
| D-8 | 10/  12 | Environmental Data | Following information are urgently required for the preparation of sloshing analysis and model test.   * Wave scatter diagram of targeted field * “On-site” time series of waves, wind & current * Heading analysis if needed |  |  |
| D-9 | - | Deliverable  (DSME-GTT Joint Study, Scopes of work and schedule Aug.27, 2008) | Among the technical deliverables requested by EMDC, the purpose of “Technical Design Brief (design basis, codes and standards, class rules used) + impacts to ......…” is not clear to DSME.  Please advise us of the purpose of this document and send us a sample document if available.  However, DSME understands that the “Technical Proposal” prepared by DSME for the Contract of service agreement and “Hull Outline Specifications” which will be provided later will cover the deliverables requested by EMDC. |  |  |
| D-10 | 2/  3 | Offloading | According to Functional Requirement, loading operation can occur in sea up to 3.5 meters.  We would like to know what is the basis of the limitation  We thinks that following in-depth studies shall be conducted at least to set up the operation limitation;   1. Hydrodynamic of multi-bodies 2. Mooring analysis of side-by-side    1. Tension on mooring line    2. Reaction force on fender 3. Aerodynamics of multi-bodies   What’s the EMDC’s opinion? |  | Dh Kang |
| D-11 | 3/  4 | Mooring system type | It is mentioned in Functional Requirement that the internal turret mooring system will be installed.  Which type of mooring system shall be installed?   * Permanent Internal turret mooring * Disconnectable submerged turret mooring |  | Dh Kang |
| D-12 | 1/  3 | Ship motion in shallow water | The FSRU will be moored at a water depth of approximately 40-60 m., by means of an internal turret mooring system.  In case of shallow water depth at regas operation site, Vessel motions, STL mooring system and side by side motion estimations are very carefully carried out.  However, they are NOT able to be properly estimated by using the present commercial software, in shallow water depth. Please advise us. |  | Ds Kim |
| D-13 | 2/  3 | Side-by-side loading system | According to Functional Requirement, the FSRU design features a side-by-side loading system designed such that loading operations can occur in seas up to 3.5 meters.  Cargo transfer hard arm systems are dependant on the relative motions between Vessels.  Especially, wave periods are the most important factor to decide the relative motions between Vessels so that the wave height can NOT be defined at this stage.  Please advise us. |  | Ds Kim |
| D-14 | 2/  4 | Berthing & Offloading | It is mentioned in Functional Requirement that the operating envelope of the loading arms shall be designed for a vertical motion of +/- 2 m from the static condition.  Vertical motion +/- 2m of offloading arms will be confirmed by the tentative loading arm maker later.  Please advise us whether above criteria had been already confirmed by relevant maker or not.  And also please let us know preferred vendor if any. |  | Ds Kim |
| D-15 | 10.5/  13 | Prevailing wind, wave and currents | The environmental conditions in Functional Requirement are presented only the magnitude without prevailing directions.  We believe that the main direction of each environment is also important to design the mooring system.  Please provide us the prevailing directions of each environment. |  | Ds Kim |
| D-16 | 6.4/  6 | Technical data for process heating | Please inform us the followings to design the process heater :   * Required heat per regasification capacity * Required amount of the water glycol intermediate fluid per regasification capacity * Total pressure drop for regasification plant * Temperature range of the water glycol intermediate fluid per regasification capacity * Specification of the water glycol intermediate fluid * Any material of the process heater if you already studied it. |  |  |
| D-17 | 7.3/  8 | Gas turbines | Would you inform us of any material for the  gas turbine if you already studied it. |  |  |
| D-18 | 7/  9 | Cooling water system | Heat dissipation, cooling water amount and expected total pressure drop for top side equipments to be informed to design cooling water system, if cooling water is required. |  |  |
| D-19 | 7/  9 | Steam service system | Steam amount and required pressure to be informed for top side equipments to decide the capacity of aux. boiler, if general service steam is required.  For reference, 7 bar g. of steam will be incorporated in this moment. |  |  |