CAUTION

修改单号 REVISON NO.	记号 SYMBOL	数量 QTY.	区段位置 GRID REF.	签名 SIGNATURE	日期 DATE	修改单号 REVISON NO.	记号 SYMBOL	数量 QTY.	区段位置 GRID REF.	签名 SIGNATURE	日期 DATE

职别 TITLE	签名 SIGNATURE	日期 DATE	**ORDER SPECIFICATION FOR GENERAL REQUIREMENT** 订货说明书总则	工程名称 PROJECT TITLE 174,000M^3 LNGC
编制 COMPILED				
校对 CHECKED				CONTRACT 合同 / DESIGN 设计 / 工程编号 PROJECT NO. H1993A-98A
标检 STANDARD CONTROL				
审核 CONFIRMED				第 1 页 共 48 页 SHEET 1 OF 48
审定 APPROVED				
批 准			**沪东中华造船(集团)有限公司** HUDONG－ZHONGHUA SHIPBUILDING (GROUP) CO . , LTD.	图号： 5000503K / 版本 REV. **02**
幅面号 A4				

CONTENT

Acronyms

AIS	Automatic Identification System	**ESB**	Emergency Switch Board
ARCS	Admiralty Raster Charts Service	**ESD**	Emergency Shut-Down
ARPA	Automatic RADAR Plotting Aid	**EUC**	Equipment Under Control
AVR	Automatic Voltage Regulator	**FAD**	Free air delivery
BOG	Boil-Off Gas	**FAT**	Factory Acceptance Test
BOR	Boil-Off Rate	**FBOG**	Forced Boil Off Gas
BSRA	British Ship Research Association	**FCC**	Fire Control Centre
Builder	Shipyard bidding for contract	**FCS**	Fire Control Station
CACC	Centralized Administrative and Control Centre	**FEA**	Finite Element Analysis
CCR	Cargo Control Room	**Flag State**	Country of ship registration
CCTV	Close Circuit Television	**FRP**	Fiber Reinforced Plastic
CFD	Computational Fluid Dynamics	**FW**	Fresh Water
CH4	Methane	**GCU**	Gas Combustion Unit
Class or Classification Society	Nominated classification society	**GMDSS**	Global Maritime Distress and Safety System
CMR	Cargo Machinery Room	**GPS**	Global Positioning System
CO2	Carbon Dioxide	**GRE**	Glassfibre Reinforced Epoxy -- Non-metallic composite material pipe
Contract	Shipbuilding contract	**GRP**	Glassfibre Reinforced Plastic/Glassfiber Reinforced Epoxy (GRE)– Non-metallic composite material
CTMS	Custody Transfer Measurement System	**GTT**	Gaz Transport and Technigaz
CTS	Custody Transfer System	**GVU**	Gas Valve Units
DFT	Dry Film Thickness	**HD**	High Duty
DGPS	Differential Global Positioning System	**HMPE**	High Modulus Polyethylene
DMB	Marine Distillate Fuel(B)	**HV**	High Voltage (>1KV)
ECDIS	Electronic Chart Display Information System	**IACS**	International Association of Classification Societies
ECR	Engine Control Room	**IAS**	Integrated Automation System

EEDI	Energy Efficiency Design index	**ICCP**	Impressed Current Cathodic Protection
EPIRB	Emergency Position Indicating Radio Beacon	**IEC**	International Electro-Technical Commission
ER	Engine Room (Main Machinery Room)	**IGC**	IMO International Gas Code
ERSB	Engine Room Switchboard	**IGG**	Inert Gas Generator
IMO	International Maritime Organization	**PCB**	Polychlorinated Biphenyl
INS	Integrated Navigation System	**PSPC**	Protective Coating Performance Standard
ISO	International Standards Organization	**PVC**	Polyvinyl Chloride
ISPS	International Ship and Port Facility Security Code	**QA**	Quality Assurance
ITTC	International Towing Tank Conference	**QC**	Quality Control
KG	Height of Center of Gravity above Base Line	**RS**	Russian Maritime Register of Shipping
LNG	Liquefied Natural Gas	**SAS**	Shipboard Administration System
LO	Lube Oil	**SCBA**	Self Contained Breathing Apparatus
LOA	Length Overall	**SECA**	Sulfur Emission Control Area
LSA	Life saving Appliances	**SEEMP**	Ship Energy Efficiency Management Plan
LV	Low Voltage (<1000V)	**SIGTTO**	Society of International Gas Tanker and Terminal Operators
Maker	A manufacturer or supplier of equipment	**SMCR**	Specified Maximum Continuous Rating
MARPOL	International Convention for Prevention of Pollution from Ships	**SOPEP**	Shipboard Oil Pollution Emergency Plan
MBL	Maximum Breaking Load	**SSPC**	Steel Structures Painting Council (Society of
MCR	Maximum Continuous Rating	**SUS**	Stainless Steel per Japanese Industrial Standard
MCT	Multi-cable transits	**SW**	Sea Water
MDO	Marine Diesel Oil	**TEFC**	Totally Enclosed Fan Cooled TEFC
ME	Main Engine	**TFT**	Thin Film Transistor
MEPC	Marine Environmental Protection Committee	**THD**	Total Harmonic Distortion

MGO	Marine Gas Oil	**UHF**	Ultra High Frequency
MSB	Main Switch Board	**UPS**	Uninterruptable Power Supply
MSC	Marine Safety Committee	**UMS**	Unmanned Machinery Space (used generically in context)
NBOG	Natural Boil Off Gas	**USCG**	United States Coast Guard
NBOR	Natural Boil Off Rate	**VDU**	Visual Display Unit
NDE	Non-Destructive Examination	**VDR**	Voyage Data Recorder
NDT	Non destructive Testing	**VHF**	Very High Frequency
NCR	Normal Continuous Rating	**WB**	Water Ballast
OCIMF	Oil Companies International Marine Forum	**XLPE**	Cross-linked Polyethylene
ABS	American Bureau of Shipping	**IG**	Inert Gas
ACB	Air Circuit Breaker	**IGC**	IMO International Gas Code
ACCU*	Automatic Centralized Control Unmanned	**IGG**	Inert Gas Generator
ARCS	Admiralty Raster Charts Service	**IMO**	International Maritime Organization
AMS*	Machinery Constructed Under Survey	**INS**	Integrated Navigation System
APS*	Bow Thruster Constructed Under Survey	**ISPS**	International Ship and Port Facility Security Code
ARPA	Automatic RADAR Plotting Aid	**LNG**	Liquefied Natural Gas
ASNT	American Society For Non-Destructive Testing	**ISO**	International Standards Organization
ASME	American Society of Mechanical Engineers	**LO**	Lube Oil
AWS	American Welding Society	**LOA**	Length Overall
AVR	Automatic Voltage Regulator	**LPDT**	Low Pressure Differential Test
BOG	Boil Off Gas	**LRS**	Lloyd's Register of Shipping
BOR	Boil Off Rate	**LSA**	Life Saving Appliances
BS	British Standards	**LSFO**	Low Sulphur Fuel Oil
CACC	Centralized Administrative and Control Centre	**MARPOL**	International Convention for Prevention of Pollution from Ships
CCR	Cargo Control Room	**MBL**	Maximum Breaking Load
CCTV	Closed Circuit Television	**MCCB**	Molded Case Circuit Breakers
ECR	Engine Control Room	**MCR**	Maximum Continuous Revolutions
CFCs	Chlorofluorocarbons	**MCT**	Multi-cable transits
CFD	Computational Fluid Dynamics	**MDO**	Marine Diesel Oil

CH4	Methane	**MEPC**	Marine Environmental Protection Committee
CM*	Condition Monitoring	**MGO**	Marine Gas Oil
CMR	Cargo Machinery Room	**MGPS**	Marine Growth Prevention System
CO2	Carbon Dioxide	**MPI**	Magnetic Particle Inspection
CPS*	Coating Performance Standard	**MSC**	Marine Safety Committee
CTS	Custody Transfer System	**NBOG**	Natural Boil Off Gas
DBPP	Double Bottom Pipe Passage	**NDE**	Non-Destructive Examination
DFD*	Duel Fuel Diesel	**NIBS***	Navigation Integrated Bridge System
DFDE	Duel Fuel Diesel Electric	**OCIMF**	Oil Companies Intl Marine Forum
DGPS	Differential Global Positioning System	**OCMA**	Oil Companies Materials Association
DFT	Dry Film Thickness	**OSHA**	Occupational Health and Safety Act
DMB	Marine Distillate Fuel (B)	**OWS**	oily water separator
DNV	Det Norske Veritas	**PXB**	Private Branch Exchange
DO	Diesel Oil	**PCB**	Polychlorinated Biphenyl
ECDIS	Electronic Chart Display and Info System	**PCN**	Personal Certificate in Non-Destructive Testing
ECR	Engine Control Room	**PLC's**	Printed Logic Circuits
EEDI	Energy Efficiency Design Index	**PMG**	Permanent Magnet Generator
EMC	Electro-magnetic Compatibility	**PMS***	Planned Maintenance System
EPA	Environmental Protection Agency	**PRC**	People's Republic of China
ER	Engine Room (Main Machinery Room)	**PSPC**	Protective Coating Performance Standard
ES*	Environmental Safety	**PTFE**	Polytetrafluoroethlyene
ESB	Emergency Switchboard	**PVC**	Polyvinyl Chloride
ESD	Emergency Shut-Down	**+R***	Data Recording
FDA2	Fatigue Design Assessment Level 2	**R***	Propulsion Redundancy
FF	Fire-Fighting	**R1***	Propulsion Redundancy (single shaft)
F-AMC*	DNV Enhanced Fire Protection Notation	**R2***	Propulsion Redundancy (twin shaft)
FMEA	Failure Modes & Effects Analysis	**RE-GAS***	Re-gasfication Unit

FO	Fuel Oil	**RRDA***	Rapid Response Damage Assessment
FRC	Foul Release Coating	**SBTT**	Secondary Barrier Tightness Test
FRP	Fiber Reinforced Plastic	**SEEMP**	Ship Energy Efficiency Management Plan
FSRU	Floating Storage Re-gasification Unit	**SFA***	Spectral Fatigue Analysis
FW	Fresh Water	**SH-DLA***	Safe-Hull Dynamic Loading Analysis
GCU*	Gas Combustion Unit	**SHCM***	Safe Hull Construction Monitoring
GMDSS	Global Maritime Distress and Safety System	**SIGTTO**	Society of International Gas Tanker and Terminal Operators
GRP	Glass Reinforced Plastic	**SMS**	Ship Management System
GP*	Green Passport	**SPC**	Self-Polishing Co-polymer
GRE	Glass-Reinforced Epoxy	**SPOR**	Single point of Responsibility
GTT	Gaz Transport and Technigaz	**SPS**	Ship Performance System
GVU	Gas Valve Units	**SW**	Sea Water
HAB+*	Stringent Habitation Standards For Sea Staff.	**SWBM**	Still Water Bending Moment
HCFC	Hydro chlorofluorocarbons	**TCM***	Tail shaft Condition Monitoring
HD	High Duty	**TMCP**	Thermo-Mechanically Controlled Process
HFO	Heavy Fuel Oil	**UDPP**	Under-Deck Pipe Passageway
HHV	Highest Heat Value	**UHF**	Ultra High Frequency
HM*	Hull monitoring	**UPS**	Uninterruptable Power Supply
HMPE	High Modulus Polyethylene	**USCG**	United States Coast Guard
HSQE*	Health, Safety, Environmental and Quality Cert.	**UWILD***	Under-water Inspection In Lieu of Dry-Docking
HSSE	Health Safety Security and Environment	**VFD**	variable frequency drive
HV	High Voltage (>1 kV)	**VHF**	Very High Frequency
IACS	International Association of Classification Societies	**VDR**	Voyage Data Recorder
IAS	Integrated Automation System	**WB**	Water Ballast
ICCP	Impressed Current Cathodic Protection	**WL**	Water-line
IEC	International Electro-Technical Commission	**XLPE**	Cross-linked Polyethylene

IEEE	Institute of Electrical and Electronic Engineers		

* Classification Society Notation

1. General specification

1.1 General

1) Kind of ship : 174,000 M3 LNGC
2) Quantity : 3+3

1.2 Registration and Classification

1.2.1 Registration

Bermuda

1.2.2 Classification

The classification Society shall be LR.

LR: +100A1, Liquefied Gas Tanker, Ship Type 2G, Methane(LNG) in Membrane tanks, Maximum vapour pressure 0.035MPa, Minimum cargo temperature -163℃, ShipRight(SDA, FDA Plus(40, WW), CM, ACS(B)), *IWS, LI, +LMC, BWTS, UMS, LFPF(GC,NG), EGCN(EGR, SCR), Lloyd's RMC(LG), NAV-1, ***CAC3*** With Descriptive Notes "ShipRight (IHM,BWMP(T), SCM), CYBER RESILIENCE

1.2.3 Rules and Recommendations

The vessel is to comply with the following rules, regulations, recommendations and guideline including any circular set into force published at the date of signing of the Contract. This shall include those amendments officially declared and published by the relevant regulatory authority but awaiting ratification, enactment or implementation.
Vessel to be constructed in accordance with the applicable known published incoming rules and regulations ***coming into force in five (5) years from contract signing date or before the first vessel delivery date, as indicated in part 1 of LR document future IMO legislation published before contract signing date, whichever is longer.***

a) Maritime Rules and Regulations of the country of registry ***and Class society***.
b) International Convention on Load Lines, 1966 with the Protocol of 1988 up to ***the latest Amendment***.
c) International Convention for the Safety of Life at Sea, 1974 with the Protocol of 1978/1988 and Amendments except Chapter XIV (Safety Measures for Ships Operating in Polar Waters).
d) International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC-code).
e) International Convention for the Prevention of Pollution from Ships, 1973 (Annex I, IV, V & VI), as modified by the Protocol 1978/1997 and ***latest Amendments*** (herein called "MARPOL 73/78").

f) Convention on the International Regulations for Preventing Collisions at Sea, 1972 with the ***latest Amendments***.

g) International Convention on Tonnage Measurement of Ships, 1969 and all latest amendments.

h) International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 and ***all latest amendments***.

i) International Telecommunication Union(ITU) Radio Regulation, ***2024 including all amendments***.

j) Rules of Navigation of the Suez Canal Authority, including Regulations for the Measurement of Tonnage.

k) Rules and Regulations of USCG for Foreign Vessels Operating in the Navigable Waters of the United States (CFR title 33 - Navigation and Navigable Waters, Part 151 Subpart D (installation of BWTS),155, 156, 159 and 164, CFR title 46 – Shipping, Part 154, ***Part 127***, Part 34.15 (CO2 extinguishing system), 34.15-10 and 34.15-30***(if applicable)***, Part 162.060-20 (Design and construction requirements), CFR title 29 – Labor, Part 1918(Safety and Health Regulations for Longshoring), without Certificate nor Inspection).

l) Maritime Labour Convention 2006 (MLC 2006), Title 3, Regulation Standard A 3.1 (except swimming pool and separate sanitary facilities for men and for women).

m) ILO Codes of Practice, Safety and Health in Dockwork, 1979 with modifications 1998.

n) International Convention on Standards of Training, Certification and Watchkeeping (STCW) 1995 and all later amendments. (Buyer's scope)

o) Panama Canal Regulations of Navigation including tonnage measurement. Including OP Notice to Shipping No. ***N-1-2025*** (Revision 1).

p) IMO International Code on Intact Stability (IS Code),2008 (applicable part A only) and all latest Amendments.(any exceptions such as part A Chapter 1.2 Dynamic stability Phenomena are to be stated)

q) International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 and all latest amendments.

r) IMO MEPC.1/Circ.511 Integrated Bilge Water Treatment Systems

s) International Ship and Port Facility Security (ISPS) Code 2003, the application of ISPS to be limited to below:

-Automatic Identification System (AIS)

-Ship Security Alert System (SSAS)

-IMO number

t) IMO Protective Coating Performance Standard (PSPC) (IMO MSC 215)

u) IMO Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 and IMO Res. MEPC.379(80) – 2023 Guidelines for the Development of the Inventory of Hazardous Materials and (EU) No 1257/2013 of the European Parliament and of the Council on Ship Recycling (EU SRR).

v) ***IMO Code on noise levels on board ships 2012 Adoption of Resolution MSC 337 (91) (for mandatory requirements only, substitute IMO A.468(XII)).***

w) IACS UR E26(Rev.1) Cyber resilience of ships, IACS UR E27(Rev.1) Cyber resilience of on-board systems and equipment.

1.2.4 Industry Guidelines and Recommendations

The Guidelines shall be limited to those which are required in essence and as far as applicable to this kind of Vessel.

1) IMO Resolution A.330(IX) "Safe Access to and Working in Large Ballast Space"(except inclined ladder requirements)
2) IMO Resolution A.343(IX) "Recommendation on Methods of Measuring Noise Levels at Listening Posts"
3) IMO Resolution A.601(15) "Provision and Display of Manoeuvring Information on Board Ships"
4) IMO Resolution A.694(17) General Requirements for GMDSS
5) IMO Resolution A.708 (17) "Navigation Bridge Visibility and Function"
6) IMO Resolution A.719 (XVII) "Prevention of air pollution on ships"
7) IMO Resolution A.861(20) "Performance Standards for Shipborne Voyage Data Record"
8) IMO Resolution A.962 (23) "IMO Guidelines on ship recycling"
9) ***IMO "Code on Alerts and Indicators, Resolution A.1021(26) 2009 and latest amendment"***
10) IMO MSC Circular 982 "Principles relating to Bridge Design" (Compliance with the guidelines shall be as specified in the Specifications)
11) IMO MSC Circular 1053 "Explanatory Notes to the Standards for Ship Manoeuvrability"
12) IMO Resolution MSC.137(76) "Standards for Ship Manoeuvrability".
13) IMO Publication No.978 "Performance Standards for Navigational Equipment (1997 Edition)"
14) Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM), 2004 including MEPC Res.127(53) "Guidelines for Ballast Water Management and Development of Ballast Water Management Plans (G4), and USCG requirements for type approval (phase-1)
15) ***IMO Code for Approval of Ballast Water Management Systems (BWMS Code), IMO Resolution MEPC.300(72).***
16) OCIMF "Ship to Ship Transfer Guide for Petroleum, Chemicals and Liquefied Gases, 2013" (Fixed fittings only for receiving ship)
17) OCIMF "Standardization of Manifolds for Refrigerated Liquefied Gas Carriers (LNG)".

18) OCIMF "Mooring Equipment Guidelines (MEG4)" ***Unjacketed Mooring Lines -Must Have MEG4***. (As per section 3.7.)
19) OCIMF/SIGTTO " Recommendations for Liquefied Gas Carriers Manifold, 2nd edition, 2018".
20) SIGTTO "Guidelines for the Alleviation of Excessive Surge Pressures on ESD, 1987"
21) SIGTTO "Recommendations for the Installation of the Pressure Relief Devices 1999"
22) SIGTTO ESD Systems – Recommendations for Emergency Shutdown and Related Safety systems (2021)
23) SIGITTO Guidelines for the Alleviation of Excessive Surge Pressures on ESD for Liquefied Gas Transfer Systems (2018)
24) SIGITTO Recommendations for Management of Cargo Alarm Systems (2019)
25) SIGTTO "Selection and Testing of Valves for LNG Applications"
26) SIGTTO Recommendations for Valves on Liquefied Gas Carriers, Second Edition 2023
27) SIGTTO Recommendations for the installation of Cargo Strainers on LNG Carriers
28) SIGTTO Thermo wells in LNG Liquid Lines, April 2011
29) SIGTTO, LNG Marine Loading Arms and Manifold Draining, Purging and Disconnection Procedures. (2017).
30) GIIGNL Custody Transfer Handbook 6th Edition (2021)
31) Marine Environmental, Safety and Quality Assurance Criteria for International Ocean/Seagoing Tanker Vessels in ExxonMobil Affiliate Service, 2017 Edition, Permanent provision only for "MUST" & "Strongly Preferred" items applicable to this size vessel except followings:

- ***Ship operating policy/procedure including maintenance procedure, risk assessment, rule publication, SEEMP, oil test kit to check water content, viscosity and TBN meter for LO, planned maintenance system, copies of the admiralty maritime security planning charts and, drug and alcohol policy shall be prepared/ provided by the Buyer.***
- ***Risk assessment and security measures for safety and security management at a piracy-infested area to be prepared/ provided by the Buyer.***
- ***Pollution control equipment i.e., sorbents, protective cloth, portable pumps, etc. shall be provided by the Buyer.***
- ***Portable gas detectors and toxic gas detectors, in excess of those specified in this Specification, shall be provided by the Buyer.***
- ***Fuel oil, lube oil and system oil quality test device shall be provided by the Buyer.***

32) IMO Resolution MEPC 364(79) - 2022 Guidelines on the method of Calculation of the attained Energy Efficiency Design Index (EEDI) and all amendments

33) IMO Resolution MEPC.365(79) and MEPC. 374(80) - 2022 Guidelines on the survey and certification of the Energy Efficiency Design Index (EEDI) and all amendments.

34) Maritime and Port Authority of Singapore, port marine circular No. 04 of 2013, Recommendatory Measure for vessels crossing the traffic separation scheme (TSS) and precautionary areas in the Singapore strait during the hours of darkness.

35) IEC Publication 60092. "Electrical Installations in Ships"(2002) (required by the Classification Society)

36) IEC 60533 "Electromagnetic Compatibility of Electrical and Electronic Equipment in ships"

37) Arc Flash Assessment for the 440V IEC 61641

38) ISO 17894: 2005 Ships and Marine Technology – Computer Applications.

39) ISO 14726:2008 - Ships and marine technology -- Identification colours for the content of piping systems

40) ISO 21984:2018 "Ships and marine technology – Guidelines for measurement, evaluation and reporting of vibration with regard to habitability on specific ships"

41) ISO 4406: 1999 "Hydraulic Fluid Power Fluids Method for Coding Level of Contamination by Solid Particles" (Flushing grade as per shipBuilder's & vender's standard practices)

42) ISO 8573-1: 2001 "Compressed Air for General Use - Part 1 : Contaminant and Quality Classes"

43) ISO 7547:2002 "Ships and Marine Technology - Air-conditioning and Ventilation of Accommodation Spaces - Design Conditions and Basis of Calculations"

44) ISO 2923:1996 plus Cor 1:1997 "Acoustics - Measurement of noise onboard vessels"(only for measurement method)

45) ISO 4867-1984(E) and 4868-1984(E) (or updated version) Code for the measurement and reporting of local and global vibration data of ship structures and equipment

46) ISO 10816-1/3/6:2009, Evaluation of machine vibration by measurements on non-rotating parts(FAT only), and confirmed by the Maker

47) ISO 8861 Engine room ventilation in diesel engine ships

48) ICS "Guide to Helicopter/Ship Operations, 2008" (Winching Area for Day Operation only)

49) "International Maritime Pilots Association (IMPA)" Recommendations regarding Pilot Boarding Arrangement

50) International Telecommunication Convention (Nairobi 1982) and Radio Regulation, 1982 Edition, 1973 with Annex and Revisions 1974, 1982 and 1983/87.
51) IACS Recommendations No. 121 “Uniform application of MARPOL Annex I, Revised Reg.12”
52) IACS Unified Requirements for New buildings, which has been formally published and in force at the date of signing contract
53) Ship recycling and amending Regulation(EC) No 1013/2006 and Directive 2009/16/EC
54) SNAME Technical & Research Bulletin 3-47 "Guide for sea trials"
55) SNAME Technical & Research Bulletin 5-2 "Gas trial guide for LNG vessels"
56) SIGTTO Guide for Gas Trials on LNG Carriers, 2023
57) United States Environmental Protection Agency (EPA) Vessels General Permit (VGP) 2013 VGP issued by US EPA, the requirement compulsorily applicable to foreign flag vessel calling US ports, including the use of Environmentally Acceptable Lubricants (EALs), where applicable
58) IMO LSA Code – Life Saving Appliances and all latest amendments
59) IMO FSS Code – Fire Safety Systems and all latest amendments
60) IMO NOx Technical Code(2008)-Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines and all Amendments

1.2.5 Certificates

All necessary certificates and/or documents covering and indicating compliance with the foregoing requirements and regulations are obtained by the Builder at his expense and delivered to the Buyer according to following list:

The Builder shall obtain the following certificates and deliver to the Buyer at the time of the Vessel's delivery in quadruplicate, one (1) original and two (2) copies:

1) Builder's Certificate issued by the Builder
2) Classification Certificate issued by the Classification Society
3) Cargo Ship Safety Radio certificate issued by the Classification Society or other assigned Authority
4) Cargo Ship Safety Construction Certificate issued by the Classification Society or other assigned Authority
5) Cargo Ship Safety Equipment Certificate issued by the Classification Society or the assigned Authority
6) International Load Line Certificate issued by the Classification Society
7) International Tonnage Certificate issued by the Classification Society or other assigned Authority
8) International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk issued by the Classification Society or other assigned Authority

9) International Oil Pollution Prevention Certificate issued by the Classification Society or other assigned Authority
10) International Air Pollution Prevention Certificate issued by the Classification Society or other assigned Authority
11) International Energy Efficiency Certificate issued by the Classification Society or other assigned Authority
12) International Sewage Pollution Prevention Certificate issued by the Classification Society or other assigned Authority
13) Deadweight Certificate issued by Builder
14) Certificate of International Convention on the Control of harmful AFS on Ships issued by the Classification Society or other assigned Authority
15) Suez Canal special Tonnage Certificate issued by the Classification Society or other assigned Authority
16) Statement of compliance with USCG Rules and Regulations for Foreign Vessels carrying liquefied gases in bulk issued by the Classification Society
17) Cargo gear Certificate corresponding to ILO forms issued by the Builder for Provision Cranes and Deck Cranes
18) Test Certificate for Anchor and Anchor chain cable issued by the Classification Society
19) Certificates for lifting devices and equipment, issued by the Classification Society.
20) EIAPP Certificate for diesel engines (Letter of compliance issued by assigned Authority)
21) Adjustment certificates for magnetic compass issued by the Builder
22) Navigation Lights Certificates issued by assigned Authority
23) Crew Accommodation Certificate corresponding to MLC 2006
24) IHM-EU statement issued by the Classification Society
25) Panama canal tonnage certificate issued by the Classification Society or other assigned Authority

1.3 Design, construction and workmanship

1) Rotating parts shall be covered with protective cover.

2) Operating Environment:

Design Environmental condition for all machinery and equipment shall be in accordance with:
Maximum temperatures 46°C for equipment without performance degradation for electric motors.

(i) All machinery and equipment located in engine room

Ambient temperature	0-45 °C
Sea water temperature	32℃
Cooling fresh water temperature	36 °C
Sea water SG	1.025
Humidity	60%RH

(ii) All machinery and equipment on deck

Ambient temperature	-18 °C to 46 °C
Sea water temperature	0 °C to 32 °C
Humidity	60%RH

3) Materials, machineries and equipment to be designed generally in accordance with the ISO Standard, Chinese Industrial Standard (GB), (CB)/(CBM), the Builder's Engineering Standard (HZ) and/or the current manufacturer's standards and Classification requirement, unless otherwise agreed or stated herein.

Whenever the term "or equal" is used after a brand or a type of machinery equipment or component, the term "or equal" to be understood to mean that any substitute shall be of equivalent standard and quality. If any specified article or material cannot be obtained or supplied due to contractual or other practical reasons (i.e. not due to cost), then the Builder has the right to substitute suitable equivalent material provided that such alternatives do not impair the function, efficiency and reliability of the Vessel or any of its parts. Such substitutions and alternatives shall be subject to mutual agreement with Buyer.

4) Only environmentally safe and hazard-free materials are to be used in the construction of the Vessel according to internationally recognized best practice.

All materials and system contents used during construction and fitted to the Vessel shall be non-toxic smoke-emitting, and fire retardant as well as being Halon, CFC (Chloro-fluorocarbon), HCFC (Hydro-Chloro-Fluorocarbon), PCB (polychlorinated biphenyl) and asbestos free throughout, with particular attention being paid to insulation systems and pipe flange gasket/jointing material.

The Suppliers shall provide MD/SDoC files to complete IHM for approval by Class Society. Statement confirms that the vessel is free of hazard materials as above mentioned shall be provided by the maker.

Equipments, such as spare parts, components，packages etc，or materials containing flammable constituents shall be locally or fully protected with fire-proof materials.

Materials containing CFC or HCFC not to be used. No materials which are not allowed as per US EPA VGP 2013 to be used. Provision of certification confirming that no forbidden materials are used to be provided and also specified in the IHM.

5) Equipment for the ship shall only be sourced from reputable and recognized manufacturers and all sub-contractors and suppliers to them shall be traceable and submitted to the Purchaser for approval. Purchaser shall have the right to inspect and witness the Quality Assurance / Quality Control (QA/QC) taking place in subcontractor facilities.

New equipment or designs may be introduced only with the agreement of the Purchaser following a demonstration of appropriate due diligence being undertaken or agreement that necessary technical qualification shall be applied to a degree as agreed with the Purchaser. This action may include, as appropriate, engineering surveillance, construction surveillance, (qualification of component materials, welding methods and procedures, component manufacturing), equipment testing and post-test inspections.

Flanged Joint Electrical Bonding – Bonding straps are not required between flanges if two or more bolts give metal to metal contact between the bolts and the parts to be bonded.

6) Identification of Equipment

All units of equipment installed in the Vessel shall be identified by name and, in case of multiple units numeral allocation of numerals shall be as follows:

Fwd	No.1	Aft	No.2
Starboard	No.1	Port	No.2
Upper	No.1	Lower	No.2

1.4 Material

In general, all equipment and materials used in the construction of the Vessel shall be of good shipbuilding and marine engineering quality. Materials shall be tested, inspected, and certified by the Classification Society and other regulatory bodies concerned. Where deficiencies are evident additional testing, as designated by the Class surveyor, shall be carried out.

No asbestos, CFC, HCFC or PCB materials shall be used in the construction and outfitting of this vessel. Statement confirms that the vessel is free of asbestos and PCB shall be provided by Builder. Asbestos shall not be used as a working material during ship’s construction onboard.

General grease nipples throughout shall be of ball type (JIS B 1575 A-PT 1/8) or ISO standard fabricated from stainless steel 316 as far as applicable.

Manufacturers' standard type, size and materials of machinery, equipment and fittings shall be adopted, unless otherwise specifically described in the Specifications.

For piping, where “stainless steel” mentioned in the specification without grade it shall be 304 for non weather-exposed items and 316 for weather-exposed items.

Material List – Pipelines and Valves

System		Pipe material & thickness	Valves		Pressure rating of flange (MPa)
			Type	Body	
Cargo, Stripping/spray(LNG) On weather deck and in cargo machinery room		TP316L Sch.10S Equal and below DN 40mm，Sch.40S	Butterfly Globe, Ball,	stainless steel CF3M or CF8M	1.0
Vapour & gas main		TP316L Sch.10S	Butterfly Globe, Ball,	stainless steel CF3M or CF8M	1.0
Gas vent		TP316L Sch.10S Equal and below DN 40mm，Sch.40S			/
ME fuel gas line, including single wall pipe, double wall pipe		Stainless steel 316L, Sch.10S	Butterfly Globe, Ball,	stainless steel CF3M or CF8M	1.6
GE and GCU fuel gas line, including single wall pipe, double wall pipe		Stainless steel 316L, Sch.10S	Butterfly Globe, Ball,	stainless steel CF3M or CF8M	1.0
Tank safety valve exhaust line		TP316L Sch.10S			1.0
Liquid pressure relief valve exhaust line		TP316L Sch.10S Equal and below DN 40mm，Sch.40S			1.0
Cargo sampling line		TP316L Sch.10S	Globe, Ball	Stainless steel	1.0
Water drain for secondary insulation space		TP316L Sch. 80			/
Gas detection system sampling		TP316L	Ball Globe	Stainless steel	/
Nitrogen	Pressure gaseous in passage way	TP316L Sch.10S	Globe, ball	Stainless steel	1.0
	Pressure gaseous on weather deck and purge (including purge line for ME and GE)	TP316L Sch.10S	Globe, ball	Stainless steel	1.0
	Nitrogen	TP316L	Globe,	Stainless	1.0

	Pressurization Main	Sch.10S	Ball	steel	
Inert gas pipe	From drier to cargo part	Steel-s/w,Sch. 40 Galvanized for enclosed part, TP316L Sch.10S for weather part	Butterfly	Cast steel rubber lined	1.0
	From combustion chamber/washing tower to drier	TP 316L Sch.10S	Butterfly	Cast steel rubber lined	1.0
	Washing tower drain water pipe	Steel – w/s Sch.80 Polyethylene	Butterfly,	Cast steel rubber lined	1.0
Water ballast in engine room & penetration, suction line in each WBTK		Steel-w/s, Sch40, Polyethylene for pipes above DN65mm. Sch80， Galvanized for pipes equal or below DN65mm.	Butterfly	Nodular cast iron	0.6
Water ballast in WBTK (Pipe duct)		GRE maker standard	Butterfly	Nodular cast iron	0.6
Hydraulic lines for deck machinery		316L (for weather exposed deck) Carbon steel (for enclosed space)	As maker standard.	Maker's standard	Maker's standard
Hydraulic system for Valve control. Pressure & Return lines		316L w/s	Maker's standard		Maker's standard
Dry powder exposed parts (external)		SUS 316L Sch.10S		Maker's standard	Maker's standard
Fire main /Foam (outside E/R,include ACCOMMODATION)		Steel- w/s, Sch40 polyethylene for pipes above DN 65mm diameter, Sch80 Galvanized for pipes equal and below DN65mm	Butterfly, Globe	Cast steel or bronze	1.6/1.0
Fire main /Foam in E/R		Steel-s/w, Sch40 polyethylene for pipes above DN 65mm diameter, Sch80 Galvanized for pipes equal and below DN65mm	Butterfly, Globe	Cast steel with rubber liner(Bronze for under 200mm)	1.6/1.0
Spray water system		Steel-s/w, ***Sch80***, Galvanized	Butterfly, Globe	Cast steel or bronze	1.0
Bilge system		Steel-s/w Sch.80	Butterfly,	Cast iron or	0.6

	galvanized.	Globe	bronze	
All sea water systems of continuous or Intermittent duty (except water ballast, fire water/foam, spray water, ,sea water cooling)	Steel-s/w, Sch40, polyethylene for pipes above DN 65mm diameter, Steel-s/w, Sch80,Galvanized for pipes equal and below DN65mm	Butterfly, Globe	Cast iron or ductile cast Iron (bronze body under 50 mm diameter)	0.6
Sea water cooling system	Steel-s/w, Sch40, polyethylene for pipes above DN 65mm diameter, Steel-s/w, Sch80,Galvanized for pipes equal and below DN 65mm	Butterfly, Globe	Cast iron or ductile cast Iron with Ni-Al bronze or equivalent disc	
Domestic water system in accommodation	Copper	Globe, Ball	Maker standard	0.6
Fresh water Service for deck, technical working	Steel-s/w, Sch40, galvanized	Globe, Ball, Butterfly	Cast iron or steel or bronze	0.6
Fresh water service for drinking in ER	Stainless steel 304, Sch.10S	Globe	Bronze	1.0
Boiler water blow-down	Steel-s/w Sch80			
Boiler water general	Steel-s/w, Sch40,			
Steam	Steel-s/w, Sch40,		Cast steel or bronze	
High Expansion Foam system	Steel-w/s Sch40	Globe, Ball Butterfly	Ductile or Stainless steel	1.6
Condensate	Steel-w/s Sch40			
Scupper pipes	Steel-s/w Sch80 galv. (except ballast TK & shipside)	Globe	bronze	0.6
Ballast vents	Steel-w/s Sch80 galvanized			0.6
Sounding tubes	Steel-s/w Sch80 galvanized (except oil tank)			0.6
Air Vent for Hull tanks	Thickness acc. to Rule. Galvanized except for oil tank			0.6
Exhaust Gas uptake	t=8mm corten steel, from one meter			

	below funnel top cover to end t=6mm carbon steel up to one meter below funnel top cover SUS316L mixing tube from urea injection to GE SCR			
Heating coil in tank	Steel-s/w Sch80			1.0
F.O. pipe	Steel-s/w Sch40 Pickling+ anti-rust	Globe Butterfly Ball	Cast steel	
Drain pipe for LO & FO	Steel-s/w Sch40			
Compressed air for starting	Steel-s/w Sch. 40	Globe Ball Needle	Cast steel	3.0
Compressed air inside engine room for control & general service	Steel-s/w (Sch. 40) for 15mm and above Seamless copper for below 15mm	Globe Ball Needle	Cast steel or bronze	1.0
Emergency shut-off compressed air	Steel-s/w (Sch. 40) for 15mm and above SUS316L for below 15mm	Globe Ball Needle	Cast steel or bronze	1.0
Pneumatic control lines on weather deck	Copper for ND10mm and below thickness as per rule. SUS 316L Sch.10S ND15 mm and above			
Compressed air outside ER (general service)	Steel-s/w, Sch40, galvanized for enclosed part. 316L for weather part.	Globe Ball Needle	Cast steel or bronze	1.6
Heating Coils within cofferdams	SUS 304 Sch10S	Globe, Ball,	Cast steel or bronze	1.0
Fresh water cooling	Steel-s/w (Sch. 40) Phosphate treatment	Globe Butterfly Ball	Cast iron or steel or bronze	0.6
Lubricating oil	Steel-s/w (Sch. 40)	Globe Butterfly Ball	Cast iron or steel or bronze	
Remote level and draft	Air purge pipe	Globe	Bronze	1.0

gauging system	Steel-w/s Sch80			
	Control air pipe weather deck 316L	Ball Globe	Bronze	1.0
Soil drains in accommodation	Steel-s/w, Sch40, galvanized	Globe Ball	Cast iron or bronze	0.6
Soil drains in engine room	Steel-s/w Sch80 Galvanized	Globe Ball	Cast iron or bronze	0.6
Air-con & refrigeration system	Copper Thickness as per rule.	Maker's standard		Maker's standard
Chill water pipe	Steel-s/w (Sch. 40)	Globe Ball	Cast iron or steel or bronze	0.6
Electric cable protection pipe	Steel-s/w (Sch. 40)			0.6
Hypochlorite Injection System	Carbon steel with polyethylene coating		Rubber lined	
NaOH solution, urea solution	Stainless steel 316L. Sch.10S			
ICER circulation water,	Stainless steel 316L. Sch.10S			
ICER drain water discharge overboard distance piece	Duplex stainless steel SS2205			
Shipside pipe in ER	Steel-s/w Sch160 Galvanized	Globe Butterfly Ball	Cast steel	
1. Steel-s: Seamless type steel pipe Steel-w: Welded type steel pipe 2. Fuel oil pipes will be painted same as tank. 3. The outside surface of all uncoated stainless steel piping located at weather part will be properly pickled and passivated for improving the resistance against saline corrosion.				

NOTE 1: Fire safe valve packing shall be used in cargo, liquid and gas fuel, LO, hydraulic, fire and foam systems, as required by Class.

NOTE 2: In all weather exposed areas and other sea water immersion areas, bolts and nuts for piping flanges of which the diameter is less than M20 shall be of stainless steel 316L, For non-weather exposed areas, bolts and nuts for piping shall follow Builder's standard.

NOTE 3: Cargo System Bolts and studs/nuts shall be complied with ASTM A320 B8M Class II /ASTM A 194 8M.

NOTE 4: All piping materials pertain to equipment shall follow makers' standard.

NOTE 5: Buyer may require to apply superior materials than this list subject to extra cost born by Buyer.

Carbon steel pipe to be applied with Builder’s standard H&Z500002-2021.
Stainless steel pipe to be applied with Builder’s standard HZ500001-2022.
Pipe table (copper pipe) to be applied with Builder’s standard H&Z500005-2021.

GRP materials used in cargo or other designated hazardous areas shall be of the conductive type to prevent the build-up of static electricity.

Piping exterior coatings shall be to the same standard as the compartment in which they are located and compatible with fluid temperatures, unless coating is indicated in the specification.

Outside of stainless steel piping on weather deck, (except insulated piping) shall be solvent cleaned and coated with one coat of epoxy primer and top coating. Other stainless steel surfaces such as vent masts and drip trays exposed to the weather shall be blasted as per coating manufacturer's recommendations and coated with one coat of epoxy primer and top coating. Any un-coated areas such as cargo valves, bellows, etc. shall be treated by passivation or maker’s equivalent practice.

In case hot dipped galvanization is applied for piping, it shall fulfill GB standard. Each section length and number of bends shall be limited and spool pieces shall be flanged to allow galvanized surface inspection and subsequent assembly without hotwork. Where galvanized piping is damaged by welding and dismantle is not possible, repair will be done, generally the damaged coating shall be touch up with zinc epoxy primer.

1.5 Noise

Noise levels in accommodation and working spaces shall be in accordance with IMO Resolution MSC.337(91) - "Adoption of the Code on noise levels on board ships" 2012.

Where the measured noise levels exceed the specified maximum limits, the Builder shall make necessary improvement, which shall be mutually agreed between the Buyer and the Builder.

1.6 Vibration

The vibration levels in living quarters during normal operating conditions shall be in according to ISO 21984:2018 Guidelines.

Vibration analysis report of hull structure to be submitted in detail design stage.

Vibration measurement shall be carried out at sea trial draught even keel during the sea trial in accordance with the sea trial procedure.

Where the measured Vibration levels exceed the defined criteria, the Builder shall make necessary improvements to a practical extent, which shall be mutually agreed between the Buyer and the Builder.

If the equipment needs resiliently mounting or silencers, the supplier shall provide the calculation of the elastic mounting, and/or the attenuation per octave band of the silencers.

1.7 Weight

Each issue of drawing shall precise the exact weight of the equipment.

All elements in a delivery shall be weighed beforehand. A report on the weighing shall be supplied.

1.8 Inspections and tests

1) Vibration and noise measurement of all rotating machinery shall be carried out during shop test on demand of the Purchaser. Records of the results shall be submitted to the Purchaser.

2) Shop test shall be carried out in accordance with the classification society, maker's inspection standard and inspection and test plan which shall be developed by maker and approved by Shipyard for all main activities.

   The supplier shall prepare and submit a document to HZ for approval with the scope of testing, test procedures for the equipment or supply, and safety measures during the test, at least three months before any testing taking place.

   The supplier shall give notification of such tests by giving fourteen (14) days preliminary notice and then seven (7) days final confirmation notice.

   The supplier shall ensure that HSE and quality standards are met. All FAT results including deviations/variations shall be recorded and made available to HZ within two weeks of the tests being carried out.

   For FATs that are carried out by the supplier without attendance of HZ's representative, a full report including test documentation shall still be provided.

3) The self check report includes noise and vibration data shall be submitted to the yard before shop test to prevent failure of the shop test.

   If the result of shop test is not accepted, the necessary personal expenses such as accommodation, transportation for attendance of Yard and Ship owner for re-test shall be charged by maker.

4) Maintenance procedure and inspection for long term storage

- As it will take long term for shipbuilding at Buyer (around twenty months or over), package of machine & equipment should be suitable for outdoor storage and its protection should be provided under consideration of long term layup.

- Maker should submit the maintenance procedure and instruction for long-term storage when submitting working plan.

- Maintenance instruction for long term storage should include control points concerned with period from shipping to delivery of ship such as shipping, outdoor storage, installation on board, periodical idle operation, etc.

- Unless noticed by maintenance instruction as above, Maker shall take responsibility for any kind of defects.

5) The vendor should provide preliminary schedule for FAT at early stage.

6) Pre-commissioning check list and commissioning check list should be provided as a separate file and included in approval drawing.

1.9 Guarantee

The applicable periods of Guarantee against all defects whether attributable to materials, workmanship, construction or design, are as follows:

1) unless otherwise specified as follows the applicable Guarantee Period shall be twenty-four (24) months after the date of Vessel Delivery;
2) The Builder guarantees that the anti-corrosive external hull coatings and the ballast tank paint system shall be without defect for a period of sixty (60) months after Delivery of the Vessel. The anti-fouling external hull coating shall be without defect for a period of sixty (60) months after Delivery.
3) The Builder guarantees that the performance of the cargo system shall be free of defects, including those defects of the cargo and boil-off gas handling equipment that can only be discovered while the Vessel is in dry dock, until completion of the first special survey refit in dry dock but in any event not exceeding a period of sixty (60) months after Delivery.
   Final guarantee claims and details shall refer to commercial contract between Maker and Purchaser.

1.10 Electric equipment general requirement

1.10.1 General

In addition to compliance with the standards specified in Section 1.2, and in IEC publications 60092, 60533, IEC 60079 and other IEC and ISO standards mentioned in this specification, all materials and equipment shall be of good quality and shall have been proven suitable for marine application on board LNG Carriers for unrestricted

worldwide service. In addition, all equipment shall comply with a recognized national or international standard, revised where necessary to comply with IEC 60092- 101 for ambient conditions.

A single electrical philosophy and single set of standards shall be adopted throughout the installation to ensure that repair and maintenance procedures can be consistently and safely applied. Equipment design shall also be consistent, with the minimum of suppliers involved, to achieve maximum inter-changeability of components.

Equipment shall be standardized within the vessel as far as practicable on the type, size, components and make of electrical equipment. All Switchboards and Group Starter Panels shall be from the same manufacturer.

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All skid-mounted or packaged equipment that does not fully comply with this specification shall be subject to Purchaser's approval on a case to case basis.

The electrical equipment shall be sited so as to obtain maximum protection from accidental damage, consistent with accessibility for servicing and safety of operation.

Sufficient space shall be allowed for opening doors, removing covers and, where applicable, withdrawing equipment from its housing. There shall be sufficient room for personnel to work on the equipment in site.

In general, all electrical equipment located in a machinery space shall have IP44 protection, located in air conditioned spaces shall have IP22 protection, and located on the weather deck shall have IP56 protection.

All electrical equipment shall be designed for an ambient temperature not less than 45 deg C. ~~Electric motors 50 deg C.~~ Maximum temperatures 46℃ for equipment without performance degradation for electric motors.

All labels shall be in the English language.

All electrical equipment shall be equipped with ID TAG referring to the dwgs.

All cables, conductors and terminals shall be labelled for easy identification in dwgs. Interconnecting cables between equipment shall be labelled in both ends.

All electrical equipment shall be equipped with a Name Plate with manufacturing data.

Switchboards, Distribution boards, Starters, Local Panels, Junction Boxes etc. shall be equipped with engraved labels on the outside surface.

Indicating signals not mentioned in this spec shall follow the IMO “Code on Alarms and Indicators”.

All indicating and pilot lamps shall be of LED type.

All intrinsically safe, flameproof, increased safety and other safe type equipment shall be certified as such by an approved testing authority, coded, and tagged. All certified equipment shall be listed in a register.

Comprehensive control facilities and status information of the total supply and distribution network throughout the Vessel shall be presented within the Integrated Automation System (IAS).

Uninterrupted power supplies shall be provided for essential loads such as computers and control circuits.

All control circuits, including components such as relays, timers, and electronic control units shall be fail safe. No single fault shall result in complete loss of electrical power or loss of propulsion, steering, navigation, communication, or cargo discharge capability.
Except where approved otherwise, the supplies to all equipment and control circuits shall be switched and protected in each insulated pole.

The electrical installation shall be designed to minimize the effects of electromagnetic and supply interference. Sensitive equipment, which may be susceptible to interference, shall be designed to operate in the electromagnetic environment on the Vessel without degradation or limit on performance. Electromagnetic compatibility (EMC) shall be ensured in accordance with IMO Resolution A.813 and the requirements of IEC 60533. Due attention shall be paid to harmonics generated in the electrical system when frequency conversion equipment is used. The builder shall submit a statement on the measures to be taken to fulfill these requirements, prior to design work being started. In addition, they shall demonstrate that the Total Harmonic Distortion (THD) is within the Class limits.

The system or equipment shall be designed to make sure THD can fulfill the Class requirement.

Emergency stopping functions shall be individually cabled and switched. They shall not operate shunt trips. Emergency stop facilities shall be provided in accordance with statutory regulations and shall include the trip of workshop machinery and purifiers.

All transducers shall be capable of easy removal without recourse to shutting down the affected or any other process.

All equipment shall be designed for ease of testing and repair by vessel staff, with full isolation facilities at both root and instrument/gauge/transducer positions. Function test facilities and equipment (intrinsically safe, where applicable) shall be provided and a list of such equipment shall be supplied for approval by the Purchaser and Owner. Where appropriate, facilities shall be provided for field testing of devices, such as float switches, pressure switches, etc., without removal from the process loop.

All circuit breakers and switches on proprietary equipment intended for disconnection of electrical supplies, shall interrupt all poles (on insulated neutral systems only).

For machinery equipment/s using common alarm to the ships IAS: second-up alarm arrangements to be verified as per Class requirements.

Equipment is to be designed on the 'fail safe' principle and a single fault should not render alarm, control or safety systems, inoperative.

All metallic non-current carrying equipment must be locally earthed. Green with yellow stripes shall be used for the earth conductor.

1) Working voltage and frequency

Main supply	6600V 60Hz 3 wire, insulated neutral or high resistor earthed (confirmed by HV switchboard vendor)
Auxiliaries equipment	440V 60Hz 3 wire, insulated neutral
Galley/laundry equipment	440V, 220V earthed neutral with RCCB protection
General lighting	220V 60Hz 3 wire, unearthed neutral
Instrumentation	220V, 110V 60Hz unearthed neutral and 24V DC
Low voltage controls	24V DC (ship's alarms, batteries)

2) Colour scheme and painting

(1) Painting color:

Surfaces of steel enclosures or cast iron enclosures for electric equipment shall be painted with rust-proof paint and finish paint, and the others are not to be painted, in general.

Painting colors of inner surfaces of metal enclosures and colors of plastics shall be in accordance with the maker's standard.

EQUIPMENT	COLOUR
Outer surface of metal enclosure for Generator, motor, switchboard, starter, and other panel/console form equipment	Grayish blue green Munsell No. 7.5BG 7/2 or similar)
Emergency caution plate (color of letters) and emergency use instrument Red	(Munsell No. 5R 4/13 or similar)
Navigation equipment, radio and communication equipment, automation equipment, lighting equipment, small electrical equipment and galley/laundry equipment	Maker's standard
Outfit for emergency operation	Red

(2) Color of terminals in switchboard:

AC System

Source	Load	Designated Color	Arrangement		
Phase R	Phase U	**Red**	Left	Top	Front
Phase S	Phase V	**White**	Mid	Mid	Mid
Phase T	Phase W	**Blue**	Right	Bottom	Rear

DC System

Pole	Color	Arrangement		
Positive (+)	Red	Left	Top	Front
Negative (-)	**Blue**	Right	Bottom	Rear

(3) Standard color of indicating lamps and push buttons

Indicating lamps

Colour	Application
White	Power source on
Blue	Space heater on
Green	Running, turning gear disengaged etc.
Yellow	Standby and shore power on
Red	Alarm

Pushbutton

Colour	Application
Green	Start
Red	Stop

3) Nameplate

Name plate, caution plates shall be in English language.

Rotating Machines	Non Corrosive material ID plate
Panel and Controllers	Internal - Phenolic plate External- Metal plate, non corrosive for equipment exposed to weather.
Miscellaneous other equipment	As per Manufacturer’s Standard.

4) Protection

Enclosure of electrical equipment shall, in general, be as follows or better:

IP22	Inside control room, switchboard room, emergency generator room and accommodation
IP23	Other dry places
IP44	Inside Engine Room, Steering Gear Room, and other enclosed machinery spaces, Galley and Laundry
IP56	Weather exposed area.

In general, all electrical equipment located in a machinery space shall have IP44 protection, located in air-conditioned spaces shall have IP22 protection, and located on the weather deck shall have IP56 protection.

Ingress protection of equipment and enclosures are to be selected in accordance with Classification Rule guidelines and IEC 60529: 2001 standards.

Where equipment enclosures are provided with integral fans to support ventilation, the consequence of a fan failure is to be established, and the failure alarmed to a manned location.

5) Voltage alive light

Each electrical cabinet must be equipped with "voltage alive light" indicating that the cabinet is powered.

6) Electrical boards internal wiring and front panel devices

(1) Wires class 75 ℃, 750 V MX type (XLPE insulated) IEC, flame retardant according IEC 332.3, minimum sectional area 1,5 mm^2 (exceptionally 0,75 mm^2 for electronic equipment). Wiring of intrinsically safe circuits inside switchboards in light blue colour. Other wires in black colour. Each end of wire to be marked with circuit number in accordance with circuit diagram. Wires generally to be laid down in plastic ducts.

(2) All bus bar fastenings and power cables are to be fitted with an anti-vibration locking device.

(3) All emergency stop buttons, throughout vessels, to be fitted with protective covers, or similar provision.

(4) All instruments, circuit breakers, relays, control switches, fuses etc.., shall be tallied using engraved or similar labels, to indicate application circuit details and position number related to wiring diagram internally in the switchboard.

(5) All instruments are preferably to be of the same standard design. Min. size 72 x 72 mm. Red mark on rated value of consumers.

(6) Control voltage will be generally 230V inside switchboards or starters and for remote control, protection of control circuit by fuses.

1.10.2 Electric motors

1) General

In general all motors over 300 kW shall be a high-voltage type.
Motors shall be designed for S1 duty (continuous duty) in general.

In general motors shall be of the totally enclosed fan cooled (TEFC) induction type. Motor dimension shall be in accordance with IEC publication 60072. Insulation shall be class "F" with Class "~~B~~F" temperature rise, ~~based on ambient temperature of + 50 deg.C.~~ and motors shall be rated for continuous 110% of full load duty(shaft power). It shall be applied for 3rd party packaged equipment as well, except cryogenic cargo pumps.

Motors shall be of cast iron squirrel cage type with sealed bearings, except below items.
a) Mono Pump Motors (aluminum casting, as per maker standard)
b) Elec. Motor for Gas Compressor (mild steel plate motor body, as per maker standard)

The power factor shall be above 0.8 at least for all water and oil pump motor, fan motor, cargo pump and compressor motor.

Fixed vibration monitoring system should be provided for High Duty Compressors, Fuel Gas Compressors, Gas Combustion Unit (GCU) fans. High Duty Compressors, Fuel Gas Compressors will be monitored in condition monitoring system or IAS, GCU will be monitored in IAS.

2) Low voltage motors

In general motors shall be of totally enclosed fan cooled (TEFC) induction type. The enclosures for motors located in machinery space shall be at least to IP44 standard, with or without fan cooling. Terminal box enclosures shall be to IP55 standard in all instances. Motors exposed to the weather shall be IP56.

The rated power of the motor shall be selected to meet the torque characteristics requirements of the driven machine over the entire working range.

Motors which power above 5kW (except short time duty, fans, submerged type and explosion protected type, small motors forming and integrated part of machinery) to be marked with a test point to facilitate the same test condition for measurement every time for the portable vibration monitoring equipment. Portable vibration measurement instrument will be provided for on board various motors detection.

3) Mechanical characteristics

Motors in general not to have higher speed than 1800rpm, unless specifically agreed by the Purchaser.

Earthing terminal welded on frame.

Generally, all motors shall be fitted with pre-lubricated sealed type ball bearings, except on larger machines, where force lubricated sleeve bearings shall be employed, designed to inhibit shaft circulating currents when necessary.

Bearing compulsory of deep groove spring pre-loaded ball bearing type. Interdiction to use roller bearings. Grease lubricated either for lifetime or by means of marine lubricators (Tecalemit type or equivalent). Lifetime to be at least 20000h.

Those of vertical motor shall be radial ball bearings or angular contact bearings considering thrust load.

For motors which are not grease packed for life, the grease used for the bearings is to be lithium based.

All ball bearings except sealed type shall be greased with grease nipple.

Lifting arrangement for all electric motors above 15Kg will be provided.

1.10.3 Electric motors starters

Starters shall be of magnetic control except that motors with capacity 0.5 kW and below may be manually operated by line switch with fuse on each pole. Each starter shall be provided with the following components, in general:

- Disconnecting Three (3) pole switch or MCCB
- White source lamp
- Magnetic contactor
- Start and stop push buttons
- Green "Running" lamp
- Ammeter marked with the maximum current rating, and running hours meters for motors of 5 kW and above and any single continuous running motor(or done in IAS), Instrumentation class 2.5 shall be used.
- Running hour meter for motors of 5 kW and above
- Transformer for control circuit 440/220V
- Thermal over current relay of manual reset type
- Space heater indicating light and control, if applicable
- Necessary relays, controls, etc.

The starter for each motor shall be installed within an enclosed metal cubicle complete with hinged door, constructed so as to provide the following:

a) Safe and easy access for maintenance without affecting adjacent starters.

b) Any faults within the cubicle shall not propagate to adjacent starters.

c) Upon removal no live terminals shall be left exposed.

Starters shall be of the direct-on-line starting type except where excessively high starting currents are expected or experienced. In this case alternative methods shall be used to reduce the starting current.

One spare starter enclosure (size to be agreed with Purchaser) shall be provided in each MCC.

The safety interlocking of door and isolating switch shall be provided for the starters. Starters shall have provision for testing and fault finding.

Control voltage of starters shall be AC 220V derived from individual control transformer in each starter with fuse. In general, control circuits shall be insulated from earth.

With the exception of any essential interlocking connections, each starter control circuit shall be completely independent.

Vacuum type contactors shall be used for circuits operating at voltages higher than 1000V.

Overload protection shall be provided by thermal element, with an element in each phase.

Motor of 15KW and above shall be fitted with heater, as well as for all motors located on the weather deck, forward space, cargo motor room, steering gear spaces and any spaces that have direct access to the weather deck. Space heaters shall automatically be switched “on” when the motor stops. A selector switch on the starter shall make it possible to switch the heater “auto/off” manually. Space heater lamp shall be blue.

The drawings for the starter circuit shall be enclosed in a vinyl envelope and kept in pockets inside starters.

1.10.4 Insulation resistance

During operating conditions, each equipment shall have at least 10MΩ insulation resistance.

1.10.5 Cables

In general, cables supplied by manufacturers within their equipment shall be in accordance with maker’s standard.

Permissible voltage drops, as defined by the rules and regulations, shall be applied to all voltage levels.

Cable current ratings shall be in accordance with IEC 60092-352 (from 2005).

The conductors supplying a group of two (2) or more loads shall have a current carrying capacity calculated by the application of a demand factor and/or diversity factor to the connected loads.

Current rating of power cables which refer to generators and switchboards should be at least 125% of the maximum current carried during normal circumstances, and other power cable shall be at least 110%. These will conform to IEC 60332-1 & 60332-3 category A with halogen free type approved by Class.

Cable runs to external decks or hazardous area, it shall have copper/steel wire braiding and zero halogen outer sheath.

Cables shall be arranged a suitable distance from hot surfaces, in accordance with the cable manufacturers recommendations. Cable protection may be applied, subject to agreement from the Buyer.

Cable shall comply with IEC 61034.

The end of cable conductors, in general, shall be connected to the terminal block by solderless type terminal lugs, pin type terminals, or sleeve type terminals, depending upon the type of terminal block.

All cable installation shall be subject to inspection by Purchaser. HV cables shall be subjected to a dielectric test after installation is complete but before final termination.

Multiconductor cables shall have 15% spare conductors for cables exceeding 20 cores at design stage. And distribution board feeder cables shall be oversized by 15% of connected load to account for spares at design stage.

All cables except on package equipment, in general, shall coloured outer sheaths for ease of identification:

- Red: Cables 1kV and above
- Blue: Intrinsically safe cables
- Orange or grey according to maker’s standard: Control, instrumentation and communication cables (non IS)
- Black: Low power supply, lighting
- Manufacturer’s standard colour: network, coaxial & manufacturer supplied cables

For electrical enclosures using cable glands:

- In general, metallic enclosures to be fitted with metallic cable glands.
- In general, plastic enclosures to be fitted with plastic cable glands.

- Alternative arrangements to be agreed between vender and buyer in advance, paying particular attention to the earthing and earth bonding requirements of the Classification Society.

All wall mounted electrical cabinets must be delivered fitted with glands for external cables.

All cables, conductors and terminals shall be labelled for easy identification in dwgs. Interconnecting cables between equipment shall be labelled in both ends.

1.10.6 Programmable Electronic Systems (PLC's)

All programmable electric systems shall be designed and constructed according ISO 17894 (General principles for the development and use of programmable electronic systems in marine applications).

In case portable or other computers or software are needed for replacing PLCs, they must be included in the scope of delivery with appropriate training.

1.10.7 Instrumentation Standards

All instrumentation and control systems shall be built from standard electronic modules, type approved by the Classification Society and additionally all electronic instruments must conform to the IEC 60092 recommendations and requirements.

All instrumentation and control systems shall use the minimum number of different module types.

Particular care shall be taken to ensure that the materials and equipment, including casings, supports and fixing arrangements, are resistant to corrosion. They shall also comply with all relevant details given in the various sections of this specification.

Electronic instruments must conform to the IEC 60092 recommendations and to classification requirements. Particular attention shall be paid to IEC publication 60533 on electromagnetic compatibility of electrical and electronic installations, with regard to guidance on immunity from noise, and installation details.

All equipment shall be designed for ease of testing and repair by Vessel staff, with full isolation facilities at both root and instrument/gauge/transducer positions.

The minimum electronic instrument accuracy requirements (unless otherwise specified) shall be:

Pressure	±	0.75% of span reading
Temperature (thermocouple)	±	0.75% of span reading
Temperature (RTD)	±	(0.3+0.005｜t｜)
Level	±	0.5% (Except cargo tank)

Flow	±	1.5% of span reading
Controller/receivers	±	2%

All gauges and HMI panels shall be fitted at a height of no more than 1.70 m above the deck, or working platform, for ease of reading by the crew.

Cargo instrumentation
The surface type of temperature sensor to be applied on cargo liquid lines.

Accuracy of all instruments (except cryogenic instrument) shall be according to the ISO standard or equivalent.

In general, all pressure transmitters and pressure switches shall be provided with a local test point (test cock) to enable to connect a test instrument.

Instruments shall be equipped with name plates showing tag No. and name plate shall be used suitable material for environment conditions which they are exposed to.

One(1) test kit of the analogue type calibration of temperature sensors and pressure sensors shall be provided.

Arrangements and numbers of temperature sensors shall be in accordance with the recommendations of GTT.

1.10.8 Hazardous areas

Equipment located in such area will be qualified in accordance with the area qualifications Instruments, control and monitoring circuit will be intrinsically safe type.

All electrical equipment will have type approval certificates in accordance with IEC standards and ATEX rules by appropriate authority.

The hazardous area electric equipment shall be designed, commissioned and tested by certified EX personnel or recognized authority.

Vender to provide a safe type equipment list to include all electrical equipment (including simple apparatus) fitted in the hazardous areas for Buyers approval.

Descriptive system documents to be submitted for all I.S. circuits to confirm suitability of system for use in the hazardous spaces.

The spare cores in I.S. multi-core cables to be arranged per IEC 60079 (connected to spare terminals at both ends).

Plastic enclosures are to be resistant to sunlight, chemicals and made from proven anti-static materials.

Certified Ex d cable blanking plugs are to be used with Ex d equipment; unused or spare cable glands are not allowed by the equipment certification.

1.11 Cyber Security-LR Cyber Resilience

1.11.1 General

Supplier/maker shall be responsible for the submission, testing and certification for the equipment to meet the "LR Notation-Cyber Resilience" requirements, and to establish a common set of minimum functional and performance criteria to deliver a ship that can indeed be described as cyber resilient, and in accordance with the following:

1) IACS UR E26 (Rev.1)
2) IACS UR E27 (Rev.1)

1.11.2 Supplier/maker shall get the certificate or approval from Class according to Class requirement and IACS UR E27.

1.11.3 Definition

Computer Based System (CBS): A programmable electronic device, or interoperable set of programmable electronic devices, organized to achieve one or more specified purposes such as collection, processing, maintenance, use, sharing, dissemination, or disposition of information. CBSs onboard include IT and OT systems. A CBS may be a combination of subsystems connected via network. Onboard CBSs may be connected directly or via public means of communications (e.g. Internet) to ashore CBSs, other vessels' CBSs and/or other facilities.

Information Technology (IT): Devices, software and associated networking focusing on the use of data as information, as opposed to Operational Technology (OT).

Operational Technology (OT): Devices, sensors, software and associated networking that monitor and control onboard systems. Operational technology systems may be thought of as focusing on the use of data to control or monitor physical processes.

In particular, the CBSs used for the operation of the following ship functions and systems, if present onboard, shall be considered (including but not limited):

1) Integrated Automation System
2) Propulsion
3) Steering
4) Anchoring and mooring
5) Electrical power generation and distribution
6) Fire detection and extinguishing systems
7) Bilge and ballast systems, loading computer
8) Watertight integrity and flooding detection if applicable
9) Lighting (e.g. emergency lighting, navigation lights, etc.)
10) Any required safety system whose disruption or functional impairing may pose risks to ship operations (e.g. emergency shutdown system, cargo safety system, gas detection system, etc.)

In addition, the following systems shall be included in the scope of applicability of IACS UR E26 & E27 Cyber Security:

1) Navigational systems required by statutory regulations
2) Internal and external communication systems required by class rules and statutory regulations

Computer Based System (CBS) should follow below characteristics according to IACS UR E26:

1) Identify: Develop an organizational understanding to manage cybersecurity risk to onboard systems, people, assets, data, and capabilities.
2) Protect: Develop and implement appropriate safeguards to protect the ship against cyber incidents and maximize continuity of shipping operations.
3) Detect: Develop and implement appropriate measures to detect and identify the occurrence of a cyber incident onboard.
4) Respond: Develop and implement appropriate measures and activities to take action regarding a detected cyber incident onboard.
5) Recover: Develop and implement appropriate measures and activities to restore any capabilities or services necessary for shipping operations that were impaired due to a cyber incident.

1.11.4 Cyber security design and test

Supplier/maker shall provide necessary documents/data according to shipyard's request for preparing the following documentation submitted to Class for approval, it as a reference and shall be updated according to class requirements.

1) Inventory List
2) Topology Diagrams
3) Description security capabilities
4) Test procedure of security capabilities
5) Security configuration guidelines
6) Security development lifecycle documents
7) Plans for maintenance and verification of the CBS
8) Information supporting response and recovery plan
9) Management of change plan
10) Test reports
11) Software register (as required in the specification)

Supplier/maker shall provide all necessary documents of equipment which are related to CBS. The following documents, but not limited to, shall be provided by Supplier/maker:

1) List of Supplier/maker supplied hardware and software components, for assisting in the preparation of Asset Inventory
2) Physical and logical topology diagrams, for assisting in the preparation of Cyber Security Topology Diagrams
3) Network interfaces, data flows, communication protocols and others in the scope of applicability of UR E27&E26, for assisting in the preparation of Cyber Security Design Description
4) Management documents for control of remote access to onboard IT and OT systems, for assisting in the preparation of Ship Cyber Security Manual

Supplier/maker shall assist shipyard to conduct the cyber security test as per Class's requirements in commissioning phase, including:

1) Submit Ship cyber resilience test procedure to Class describing how to demonstrate compliance with UR E26 by testing and/or analytic evaluation.
2) Carry out testing, which shall be witnessed and accepted by Class, in accordance with the approved Ship cyber resilience test procedure.

The above work scope of the Ship cyber resilience test is as follows, which is for reference only but not limited to, and it shall be updated according to Class requirements.

1) Penetration test
2) DDOS attack tool
3) Vulnerability assessment
4) Pressure test
5) Network storm test

1.12 Standard of fittings / instruments

1) Pipe and fittings such as flanges and thread connection etc. shall be in ISO/DIN standard, otherwise a counter flange with name tag, bolts/nuts and gasket shall be supplied by maker separately within the specified time before the equipment delivery. The flange for lube oil pipe line to be of flat type without recess to prevent debris from accumulating in pipe line. In general flanges throughout the vessels shall be selected within the standard of ISO, DIN, JIS, GB, HZ and CBM standards.

2) All thermometers and/or temperature sensors shall be fitted with thermowell (protector) for replacing without leaking-out of liquid in system.

3) No asbestos or PCB materials shall be used. Statement confirms that the vessel is free of asbestos and PCB shall be provided by the maker.

4) All control valves to be provided with manual operating device.

5) All valves and fittings shall be fitted with brass or stainless steel name plates with engraved letters.

6) Flexible hoses shall be of Classification society's approved type for the intended service, if required by class.

7) Pressure gauge & Thermometer

Description	Pressure gauge	Thermometer

Unit Type Fittings Scale Color	MPa, kPa Marine(safety type) Root v/v and test section 150% of operating range Black figure on white face red figures for vacuum	℃ Bar or dial type (Anti-vibration type) Brass thermo well (s.w: sus) 150% of operating range Black figure on white face

Note

1. Press. Gauges/sensors for heavy fuel oil shall be provided with glycerine bottle for anti clogging in sensing line.
2. Root valve with test connection shall be provided for each pressure gauge,, transmitter and switch.
3. The pressure gauges shall be filled with glycerine.
4. Pressure gauges on the pipe line which supplied by the Builder shall have diameter of 100mm.
5. Dial type thermometer shall be provided for high temperature steam line and exhaust gas line.
6. All pressure gauges shall be delivered with protection cover (plastic cap or wooden cap) to prevent gauge glass from external damage.

8) In general, filters for fuel oil and lubricating oil shall be designed such that they cannot be open whist in use and can be drained and primed manually in a controlled manner as far as practicable.

9) All level switches shall be provided with test rod or other alternative facility.

10) Grease nipples throughout shall be of ball type (JIS B 1575 A-PT 1/8) or ISO standard fabricated from stainless steel 316 as far as applicable.

1.13 Spare parts and tools

1) Equipment for first two (2) years operation spares recommended by class & manufacturer shall be provided. Recommended running hours for two (2) years operation shall be informed by manufacturer for intermittent operating equipment.

2) Sufficient spare parts for each item of machinery to cover class & manufacturer's recommended inspections and overhauls for two (2) years to be provided.

3) Spare parts shall be supplied by the manufacturer according to the Specifications which meets the requirements of the specified Classification Society, the Regulatory bodies or the normal standards of the Builder and the manufacturers, whichever is greater.

4) All spares shall be obtained from original equipment manufacturer.

5) All spares shall be properly stored and protected during construction so as not to allow

any deterioration during time of storage. On-board spares shall be stored appropriately on the Vessel to avoid deterioration and secured properly considering Vessel motion. All temperature and humidity sensitive equipment shall be stored in a climate controlled storage space. Items fabricated from stainless steel shall be suitably protected against ferrous grinding inclusions or other surface contaminants.

6) All spare parts supplied by Maker shall be included in a Master Inventory of On-board Spare Parts. It shall be a printed copy and in electronic version (unlocked to be able to be modified). The list of spares shall include special purpose tools and tools normally associated with particular vendors' equipment. Similarly, the vendor shall provide overhauling equipment as per maker's requirement necessary to facilitate any of the above maintenance or breakdown situations.

7) If any component fails before or after the delivery of the Vessel and verified as design defect for the same component used for sister vessels, within two (2) years warranty period, the following shall take place:
The component failure shall be acknowledged by Builder/vendor as design defect then the component be replaced with modified design and supplied to all sister Vessels of the series.

8) Mechanical spare parts shall be packaged separately from electrical spares parts within the engine spares room.

9) The stowage provisions for tools and spare parts shall be provided in engine room.

Especially, the detail drawings of large spare parts for inboard storage shall be submitted. (The stowage arrangements on board are design tasks of the shipyard. Request to be reconsidered.)

10) Special purpose tools and tools normally associated with particular Makers' equipment shall be provided. Similarly, the Builder shall provide overhauling equipment necessary to facilitate any of the above maintenance or breakdown situations.

11) Commissioning spare parts during dock period and sea/gas trail before ship delivery shall be provided.

12) Container for spare parts and tools.

- Labels shall be fitted on the boxes with water proof protection and indicating the Buyer's hull No., the name of equipment and serial No., etc.
- Weight of contents in the box shall be less than 90kg.
- Box shall be made of mild steel and shall be fitted with a hand grip of a 10 mm round bar.
- Maker shall indicate the available container box size in approval drawing for Purchaser selection.

13) Spare parts list shall be submitted in accordance with following format.

No	Description (sketch)	Material	Q'ty/ship		Drawing		Weight	Remark
			Work	Spare	No	Part No		

Two (2) copies of the packing list in plastic covers shall be packed together with spare parts.

1.14 Final painting colour

In general finish painting colour of the machinery and equipment shall be as follows except makers who only apply their own standard colour:

Item	**Finish painting colour**
Main engine, auxiliaries & cargo machineries	Light green (Munsell NO.7.5 BG 7/2)
Boiler and heaters	Silver
Cooler and air vessel	White

1.15 Name plates, caution plates and instruction plates

1) Necessary name plates, caution plates, and instruction plates for machinery and control panels, electric equipments, valves, gauges etc, to be provided by maker. Especially in case that two or more equipments are installed, the mark of No.1, No.2, No.3 to be shown on all of the related name plates.

   All name plates and notices including those for main engine, auxiliaries, electrical equipment and necessary valves shall be described in English language and in SI system. In addition, caution plates shall be prepared in English.

2) The hull No to be marked on main body package when delivered.

3) Materials to be as follows.

   For all plates on machinery equipment located inside equipment BRASS; all plates weather exposed/external equipment SUS.

4) All valves, taps, gauges, ammeters, switches, transmitters, cabinets, distribution panels, electrical switchboards, etc. shall be supplied with identification plates.

5) Loosen plates are forbidden: they shall be screwed, bolted or riveted.

1.16 Drawing documents and certificates

1) All drawings, specifications and other documents relating to the vessel shall be written in English.

2) Unit

Measurement Units and Language – The SI system of measurement shall be used for all equipment procured for these vessels. In any case, the following units shall be used for all drawings, plans, manuals, and instrumentation: Length in Meters and mm, Mass in Kg, Time in seconds and hours, Weight in MT, Pressure MPa or Pa, flow rate in MT/h, kg/h, m3/h or Nm3/h, Velocity in m/s, Heat transfer and Power in kW, Heating Value in kcal/kg, Specific Fuel Consumption in g/kW/h, Energy in calories or kilocalories, and Temperature in degrees C.

All ship's plans, manuals and other documents shall be marked with the IMO ship identification number (see MSC Circ. 1142/MEPC Circ. 425 dated 20/12/04 for details).

3) The first language of the technical author shall be English.

4) Abbreviation List – A standard abbreviation list will be applied to the documentation for these vessels. Attach the Abbreviation list provided by the Buyer as an Appendix to the RFQs and Purchase Orders whose vendors will need this information in their equipment supply, such as IAS, Diesel Generators, Main Propulsion Electrical Equipment, Cargo and Machinery Operating Manuals, etc.

5) For approval and working drawing, the General Outline drawing including dimensions with scale to be submitted by E-mail (Attn.: sjs-lng@hz-shipgroup.com, CC: kfs@hz-shipgroup.com).

6) The file name shall be as follows.
- Auto CAD file: *. DWG
- P-CAD or HOST-CAD(UNIX version) : as original
- Other CAD tool:*. DXF (2D drawing), *. IGES(3D drawing) drawings shall contain the following as a minimum

7) Deviation list as per below format shall be submitted.

No.	Item	Shipyard's O.S.	Maker's proposal	Reason	Remarks

8) Required number of drawings and documents

Kinds of documents	Hard copies	Submission schedule	Remark
Drawings for approval including test schedule	7/series (including 3 copies to owner)	Within 10 working days after contract	*1 With PDF format
Drawings for working	5/series	Within 10 working days after receipt of approved plan	With PDF format
Installation an instruction manual for working	5/series	Within 10 working days after receipt of approved plan	With PDF format
Finished plan	4/ship to be	Send to design department	With PDF

(including Dwg. and instruction manual)	delivered to owner	of H&Z at the time of shipping	format with CD ROMS or USB
Shop test report	3/ ship		With PDF format
Classification society's certificate: □ Required □ Not required	3/ship		With PDF format

Note *1: Following Information to be included.
- Installation Guidelines
- Commissioning & Testing Procedure

- Drawings and documents shall be submitted to H&Z design dept.
- Operating document shall be supplied well in advance of shop test and commissioning.
- All documents shall be sent to the Purchaser by separate express mail (shall not be packed with the equipment).
- Items shall be applied and/or supplied by the maker shall be marked with (*) on the maker's drawings.
  Any items not supplied by the maker shall not be shown on the maker's drawing, or shall be clearly marked with block marks or dotted line for the buyer's supply items, if those are necessary to show the schematic function or relation with the maker's supply item.
  If any items are shown without above mark by error, mistake, and/or intention, those shall be supplied by the maker without adjustment of contract price.
- Instruction manual to include all operating procedure, maintenance procedure, scheduled maintenance intervals, caution/notice plate, operating limit of tolerance for wearing parts for main parts and accessories from sub-suppliers.
- Instructions shall have full trouble shooting and repair sections, such that service men called on the vessel will not need to bring their own instruction books.

9) Drawings and documents shall be original copies (including color documents) and must be cleanly legible. They shall be firmly bound as a booklet with a table of contents and a complete index.

10) Copies of any correspondences made for approval by the Classification Society or regulatory body, which may cause any modification of the Buyer's work scope should be submitted to the Buyer.

11) Drawings shall contain the following as a minimum, but are not limited to:

Contents	Dwg for approval	Dwg for working	Dwg for final
Deviation list, if any	o	-	-
Specification & scope of supply	o	o	o

General assembly drawing	o	o	o
System layout drawing for Electric & piping system	o	o	o
Connection drawing for electric & piping	o	o	o
Weight list of each part, Center of gravity	o	o	o
Detail drawing of main parts Including origin of components	o	o	o
Spare part & tool list	o	o	o
Instrument list	o	o	o
Packing details	-	o	o
Lubrication oil chart	-	o	o
Shop test & on board test procedures	-	o	o
Shop test report	-	-	o
Certificate	o	o	o

1.17 Subsidiary requirement

1) MED certificate to be submitted for such equipments as incinerator, oily water separator, firefighting equipment, sewage treatment plant, oil content meter, oil/water interface detector. The other manufacturers shall submit the certificate of MED for the equipment itself or necessary parts, if required by MED certification

2) All lifting lug or plates which are used for lifting of other weights shall be tested and SWL shall be marked adjacent to the plate and test certificate is required.

3) Eye bolts fitted on large pump, motor or other machinery shall submit its certificate from original eye bolt supplier, in case of 0.5 ton and above of rated weight of eye bolt.

4) All safety devices shall be fully operative and proved at commencement of shop test.

5) With regard to the equipment shall be approved and/or certified by the Class, approval letters and/or certificates shall be submitted to the Buyer.

6) If any transport or conservation appliances have to be removed from the equipment prior to installation or commissioning, instruction plates for their removal shall be attached to the equipment.

7) The vendor should open what kinds of troubles happen immediately after each vender has trouble experiences.

1.18 Safety

For all applications concerning Ship safety, the supplier shall follow the criteria

recommended to be applied to sub-systems of safety equipment.

1.19 Interfaces and FMEA

The supplier shall undertake a system of electronic interfaces with other systems installed on the Ship. An analysis summarizing all these interfaces with other systems shall be submitted to the HZ, at the same time as the approval drawings.

The suppliers related to propulsion redundancy, fuel gas supply system, cargo handling system, integrated automatic control system of the Vessel shall dispatch experienced engineer to attend the technical meeting which will be executed by third party and held in shipyard, such as HAZID, HAZOP, FMEA meeting/workshop at HZ`s request.

1.20 Quay and sea trials

The supplier shall assist HZ in developing trial procedures and shall supply all necessary information such as sub-contractor document references, prerequisites, precautions and limits, detailed test procedures, inspection lists and lists of special equipment.

At HZ's request, the supplier shall ensure that all necessary experienced and qualified personnel are available to carry out the commissioning tests.

1.21 Confidentiality

All information and documentation disclosed by HUDONG-ZONGHUA under this order are and remain the exclusive property of HUDONG-ZONGHUA. This information and documentation cannot be used in any way, divulged to a third party nor reproduced in any form whatsoever without prior written consent from HUDONG-ZONGHUA.

To the extent where confidential information is no longer necessary to the Supplier or is considered by HZ to be no longer necessary for the project, upon written request of HZ, the Supplier shall return to HZ this confidential information and destroy all copies.

The supplier shall disclose information only to its employees having a need to know, provided that such personnel uses at least as great as the standard of care in protecting its own confidential information.

1.22 Parts delivery - logistics

The equipment parts shall be delivered according to HUDONG-ZHONGHUA's requests.

1.23 Responsible engineers

The name of HUDONG-ZONGHUA responsible engineer for the equipment specified is shown on all technical agreements and shall be mentioned in all communications (letter, fax, email and telex) and all dispatch of diagrams.

Direct contact with the Ship owner concerning deliveries for the Ship is forbidden unless

carried out through HUDONG-ZONGHUA as an intermediary.

The vender shall support builder in the engineering phase by review / recommend / confirm related piping diagram, wire diagram, installation and arrangement plans.

1.24 Remarks

The Maker should provide the relevant POS and necessary drawings & documents to shipyard at least five days prior to TA meeting.

Once the vendor participates in the T/A meeting, it will be deemed that all parts consented to accept this POS eventually forming part of the official T/A.

Before the ship contract signing, shipyard has the right to add new items or revise the technical agreement.

The vendor shall dispatch qualified/authorized technical engineers to attend the T/A meeting. The vendor will be evaluated negative in the bidding course if the engineers are found not eligible for the T/A meeting. The buyer can terminate such un-efficient meeting and withdraw the bidding offer.

The vendor shall propose its solution a.s.a.p. (max. within 14 days) after receiving the POS, otherwise the buyer will deem the vendor give up his chance for this project bidding.