

ESP-001- 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION		Std. / Doc. Number	
				PY51483	
				Rev. No.	00

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TECHNICAL SPECIFICATION FOR FOAM PUMPS WITH DRIVES

PROJECT :	2 X 660 MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH
CUSTOMER :	BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED (BIFPCL)
OWNER CONSULTANT:	FICHTNER GmbH & Co KG

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	 RATISH KUMAR	 GIRISH PRASAD PALO	 M. SIVA PRASAD BABU	27.08.2018

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DOCUMENTS TO BE SUBMITTED WITH THE BID:

The bidder must submit the following documents along with their bid to enable BHEL to evaluate their offer.

- i. Duly filled in Pump-Motor-Diesel Engine datasheet (**Annexure-2**)
- ii. Tentative GA Drawings for all variants Pump & Drive assembly
- iii. Performance curve of Pump
- iv. Un-priced copy of price in attached BHEL price bid formats (**Annexure-3**) indicating quoted/ not quoted against each row & column.
- v. Checklist as per (**Annexure-4**)
- vi. Equipment qualification criteria / PTR / Reference Lists as per (**Annexure-6**)
- vii. Bidder shall submit **NO DEVIATION certificate** along with their offer. Any specific deviations, which are impractical, shall be raised in form of pre-bid queries as per Annexure-11 before submission of Techno Commercial offer.

In case the above-mentioned documents are not submitted with the offer, the offer of the bidder may be liable for technical rejection.



1. INTENT OF SPECIFICATION

This specification specifies the requirement of Design, Engineering, Manufacturing, Assembling, Inspection, Testing at manufacturer's works and Delivery of properly packed and painted Foam pumps including drive assembly with all accessories as specified in the scope of work and as required for the safe and trouble-free operation of equipment to be installed at site.

2. SPECIAL NOTES TO BIDDERS

- 2.1 This specification shall be read in conjunction with its enclosures. In case of any discrepancy arising between this specification & its enclosures, the most stringent of all shall be followed and shall over-ride others. Further, if a requirement in this specification or its enclosures, calls for decision of owner/BHEL, it shall be bidder's sole responsibility to clearly bring out the same distinctively in his technical tender offer, so as to enable owner/BHEL to furnish their decision. If such a requirement is not duly addressed by bidder during tender stage and same comes out during order execution stage, it shall be binding on the bidder to comply with the decision furnished by owner/BHEL then, without any cost, delivery, or any other commercial implications.
- 2.2 Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.
- 2.3 The Bidder shall accept full responsibility for the completeness and for the faultless working of all the equipment's. These shall be executed on the basis of proven design principle and in accordance with the latest state of the art in such a manner that the purpose to be served by the Pump unit is fulfilled in every respect and a maximum of operational dependability and efficiency are assured. Standardization of equipment, materials etc. shall be employed in the design. Care shall be taken to ensure safe operation as well as simplicity of assembling and dismantling of all parts of the plant.
- 2.4 Bidder shall quote strictly as per the scope of supply and requirements of this specification.
- 2.5 Bidder offer shall be strictly as per these specification requirements. Unsolicited or Alternate offers from the bidders will not be entertained.
- 2.6 In case bidder feels that it is necessary to exclude some components of scope of supply or some of the features of specification requirements due to any technical constraints, bidder shall bring the same to the notice of purchaser during pre-bid stage and take their prior approval before submission of their bid.
- 2.7 In case Bidder is unable to offer due to any specific requirement of specification, Bidder shall bring out the same in their regret letter. Otherwise, it will be considered that non-participation by the bidder is attributable to reasons other than any specification requirements.

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3. PROJECT INFORMATION

Sl. No.	Owner	Bangladesh-India friendship power company (Pvt.) Limited (BIFPCL)
1.	Project	2 X 660 MW Maitree Super Thermal Power Project, Rampal, Bangladesh
2.	Owner's consultant	Fichtner GmbH & Co KG
3.	Location	Rampal, Division: Khulna, District: Bagerhat, Bangladesh
4.	Nearest Airport	105 km from Jessore Airport, 12 kms from proposed Khan Jahan Ali Airport
5.	Nearest Railway Station	36 km from Khulna Junction Railway Station
6.	Co-ordinates	The site is geographically located between 22° 37'0"N to 22°34'30"N and 89°32'0" E to 89°34'5" E
7.	Elevation	+5.00 meters above sea level
8.	Maximum Ambient Temperature (deg. C)	36.9
9.	Minimum Ambient Temperature (deg. C)	12.2
10.	Design Ambient for Electrical equipment / system (deg. C)	50
11.	Relative Humidity	The relative humidity varies drastically during the Monsoon Season with 80% to 90% and the lowest levels of 20% to 30% during the Summer Season.
12.	Other details	Refer enclosed specification [Annexure-2 A]

Note: Any data required for designing the equipment, bidder may ask prior to the submission of bid.

4. APPLICATION OF SYSTEM

1 No. of Electric motor driven and 1 No of Diesel Engine driven Foam Pump (Gear Pump) is envisaged for supplying foam to foam system from the foam storage tank.

5. TECHNICAL DETAILS/REQUIREMENTS

5.1. Design Parameters of the Foam Pump



Sl. No.	Description	Unit	Rated Condition
1	Temperature of Fluid	Deg. C	Ambient
3	Capacity of each pump	m ³ /hr	11.5
4	Pump Differential Head (At Discharge Flange)	Kg/cm ²	12.1
5	Available Pressure at Center line of Suction nozzle of Pump	Kg/cm ² (a)	1.0
6	NPSHA at pump suction flange	mlc	10.0
7	Margin between NPSHA & NPSHR		1 m at rated condition & NPSHR shall be less than NPSHA up to end of the curve condition.

6. SCOPE OF SUPPLY

Scope of supply shall be as per FM standard (FM 1313)/UL standard.

Please refer to the enclosed P&ID for Foam Pumps (Annexure-1) for general clarity on scope of supply. The system shall be provided as per Annexure-1 taking into all requirements including for testing, painting, documentation, sub vendor list, equipment specifications etc., specified in this specification and enclosures [Annexure- 1-10].

Quantity of Pump & Drive Assembly

- i. 2 Nos. of Foam Pumps (Gear Pump) [1 No Motor Driven +1 No Engine Driven].

The scope of supply or each Pump & Motor/ Diesel Engine drive assembly is as given below:

6.1. Pump

Gear Pump complete with all accessories as per specification.

Gear pumps shall be FM [Class Number: 1313] approved/UL listed. Scope of supply shall be as per FM standard/UL standard, Annexure-1 & subsequent clause of this specification.

6.2. Drives for pumps [Motor/Diesel Engine]

6.2.1. Motor

Voltage levels for Motors:

Motor for Gear Pump: 415 V

Electric motors designed as per NEMA MG 1, IEC 60034-1 & NFPA.

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The manufacturer shall specify which standard is to be referenced, and certify that the motor used is in compliance with said standard, providing any supporting documentation requested by FM Approvals/UL listed to verify compliance.

Note: Motors shall be specifically listed for fire pump service.

6.2.2. Diesel Engine

The Diesel Engines shall be FM approved/UL listed. The scope of supply shall be as per FM standard [Class Number: 1333]/UL standard, Annexure-1 & subsequent clause of this specification.

6.2.3. Controller

A) Foam Pump (Gear Pump):

Each driver shall have its own dedicated controller.

Electric-Drive Controllers and Engine-Drive Controllers shall be FM [Class Number 1321/1323] approved/UL listed. The scope of supply shall be as mentioned in FM/UL standard.

Controllers for electric motor driven fire pumps are designed for three phase NEMA Design “B” motors or equivalent.

Controllers for diesel engine driven fire pumps are used with FM Approved diesel engine drivers as per FM Approvals (standard Class 1333)/ UL standard.

All cabling [control/signal/power] from Controller to Motor, Controller to Engine-Battery-Battery charger etc shall be in bidder scope of supply. Bidder to furnish cable BOQ & electrical loads.

Notes:

1. All wiring on the engine, including starting circuitry, shall be sized on a continuous-duty basis. Battery cables shall be sized in accordance with the engine manufacturer’s recommendations considering the cable length required for the specific battery location.
2. The controller for the motor shall be DOL type.

B) Software:

Bidder to submit Soft copy and hard copy of logics executed in Controllers for uploading the same by end customer later.

6.2.3.1. Terminal point for power supply

BHEL shall provide 1 no of feeder [415 V, (+/-) 10%, 50 Hz] for each Controller for Motor driven Foam Pump (Gear Pump). Further distribution shall be in bidder scope of supply. Required cable glands, lugs shall be in bidder scope of supply

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BHEL shall provide 1 no of feeder [415 V, (+/-) 10%, 50 Hz] for each Controller for Engine driven Foam Pump (Gear Pump).. Further distribution shall be in bidder scope of supply.

6.2.3.2. Diesel Engine Fuel Tank

Fuel supply tank shall have a capacity at least equal to 1 gal per hp (5.07 L per kW), plus 5 percent volume for expansion and 5 percent volume for sump.

There shall be a separate fuel line and separate fuel supply tank for each engine.

An overfill protection for the tank shall be provided.

Level indicator and Level Transmitter and required piping [5 m length minimum] & valves [from tank to engine and engine to tank] for engine (as per Annexure-1) shall be included in bidder scope. Valve in the fuel feed pipe between the fuel tank and the engine shall be placed adjacent to the tank and it shall be locked in the open position. Fuel piping shall be as per NFPA. Please refer Annexure 1-B for layout of various equipment's of Pump skid.

Tanks shall be securely mounted on noncombustible supports. Accordingly, bidder to supply Fuel Tank mounting structure, all fixing accessories. Bidder to ensure sufficient leg height for flow of fuel from tank to Engine up to minimum level of fuel and ensuring engine manufacturer's fuel pump static head pressure limits not be exceeded when the level of fuel in the tank is at a maximum. .

For details [such as pipe size, fill-drain-vent connections etc.] pl refer Annexure-1 & NFPA.

6.2.3.3. Diesel Engine Exhaust System

The exhaust system shall be gas tight throughout the operating range of exhaust temperatures and pressures. It shall be designed with an outlet connection to readily duct exhaust gases outside the engine room and away from air-intake systems. The system shall be sized in accordance with the manufacturer's recommendations, and arranged to preclude the entry of water into the pump room. The exhaust manifold and turbocharger housing (when provided by the drive manufacturer) shall be suitably guarded, insulated, or cooled to prevent fire hazards and injury to operators. Each diesel engine fire pump driver in a multiple engine room shall have an independent exhaust system.

Based on layout enclosed [refer Annexure 1-B], bidder to consider suitable length of exhaust piping with silencer, SS metal expansion below & insulation with required no of bends.

6.2.3.4. Starting & Charging System

Starting & charging system shall be as per FM-1333/UL standard.

Starting system:

- i. Two (2) sets (1 working & 1 standby, 100% capacity) of 24 Volt (2x12V or 1X24 V) Automotive type battery with charger for each diesel engine driven fire water pumps shall be provided. Batteries shall be sized considering the maximum parasitic loads allowed by NFPA20 for the engine, controller, and other skid equipments.



- ii. Each engine shall be provided with 2 Nos. of Ni-Cd or Lead-acid plant battery units as per IS. Battery shall be sized as per FM-1333/UL standard.
- iii. The starting system shall be compatible with FM Approved automatic controllers, see Figure C-1 in Appendix C of FM-1333 and shall also allow manual emergency starting in the event of controller failure.
- iv. Storage batteries shall be rack supported above the floor, secured against displacement, and located where they will not be subject to excessive temperature, vibration, mechanical injury, or flooding with water. Accordingly, bidder to provide suitable stand/structure for mounting the battery.

Charging system:

All starting systems shall be rechargeable by both engine-driven and auxiliary devices. The systems shall be arranged so that a FM approved/UL listed controller maintains fully charged starting energy reservoirs by means of the auxiliary recharging device.

FM Approved electrical automatic controllers provide alternate starts on alternate batteries, so a design using battery starting shall include all necessary contactors and wiring. Alternatively, the monitoring system shall note the level of charge on both batteries, and select the battery with the highest level of charge remaining. Accordingly, each diesel engine shall be provided with two (2) battery charger units. Each charger unit shall be capable of charging one (1) set of battery at a time. Provision shall, however, be kept so that any of the charger units of a particular engine can be utilised for charging any one of the two (2) batteries of that engine.

6.3. Coupling Between Pump and Drives [motor/engine]

Coupling between pump and drive shall be as per FM standard (FM-1311)/UL standard.

6.4. Mechanical Seal

A) Firewater Pumps:

Sealing arrangement shall be as per FM standard (FM-1311)/UL standard.

6.5. Baseplate

The baseplate with fixing bolts shall be suitably designed to support the pump and driver without excessive vibration or visible distortion at all variations of load.

6.6. Interconnecting Piping & Instrumentation

Interconnecting piping and instrumentation as per P&ID [Annexure-1] & relevant standards as mentioned in this specification.

Reducer/expander, Flanges & Counter flanges with necessary gaskets & bolts at all terminal points as per annexure-1. Suction Reducer/expander shall be eccentric type. All counter flanges shall be of weld neck type.

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6.7. Necessary Foundation Bolts, Nuts, Shims/Grouting Pads Etc.

6.8. First Fill Of Lubricant

Excluded from bidder scope of supply.

6.9. All Other Items Necessary for Safe And Smooth Running of Pump & Accessories Required to Make The Supplied Equipment Complete in All Respect.

6.10. Commissioning Spares

6.10.1. For Fire Water Pump & Drives Assembly:

- i. Two sets (One set for each pump & motor assembly) of commissioning spares for Pump with drive motor shall be quoted as per manufacturer's recommendation. Commissioning spares shall contain Minimum 1 Set of O rings & gaskets for each Pump & 1 Set of Commissioning Spares for Drive as per Manufacturer recommendation.
- ii. Two sets (One set for each pump & Diesel Engine assembly) of commissioning spares for Pump with Diesel Engine shall be quoted as per manufacturer's recommendation. Commissioning spares shall contain Minimum 1 Set of O rings & gaskets for each Pump & 1 Set of Commissioning Spares for Drive as per Manufacturer recommendation.

1 set stands for requirement for one no. of skid. Bidder to furnish the list along with the offer. Bidder shall include all the required commissioning spares in their scope of supply and ensure that the erection and commissioning of the plant is not delayed for want of Commissioning spares.

Prices for the commissioning spares shall be part of main scope of supply. No separate price shall be offered for the same.

Any leftover (unused) spares after commissioning, out of those included by vendor, shall be handed over to the owner.

Note: Any commissioning spare consumed over and above the recommended commissioning Spares, during commissioning shall be supplied free of cost by the equipment vendor.

6.11. Mandatory Spares foam pump drive assembly:

i) Pump

Sl no	Description	Quantity
1	Impeller/Gear	1 No. of each size/type
2	Shaft	1 No. of each size/type

**ii) Engine**

Sl no	Description	Quantity
1	Sprayers/Injector	0
2	Piston rings & sealing rings	2 Sets
3	Exhaust valve assembly	2 Sets
4	Springs	2 Sets
5	Packings and gaskets	2 Sets
6	Fuel oil filter elements with seals	4 Sets
7	Fuel oil filter assy	2 Sets
8	Lub. oil filter elements with seals	4 Sets
9	Scrapper rings	2 Sets
10	Solenoid coil for fuel valve	2 Nos
11	Corrosion inhibitor (if provided)	2 Sets
12	Big end & small end bearing of connecting rod	2 Sets
13	Speedometer	2 Nos
14	Speedometer wire	2 Nos
15	Rubber hoses of water line with mounting clamps	2 Sets
16	Cranking starter assembly complete	2 Sets
17	Lub. oil and fuel oil hoses with end connectors	2 Sets
18	Water pump belts	4 Sets

iii) Control & Instrumentation

Sl no	Description	Quantity
1	All type of local indicators	2 Nos of each make, model & type
2	Process actuated switch devices: [All type of Pressure, Diff Pressure, Flow, temperature, Level switch devises]	2 Nos of each type & model
3	All type of Electronic Transmitters and Ultrasonic Transmitters including sensors.	10% or 1 No. of each type and model whichever is more.
4	Limit switches for isolation valves	2 Nos. of each type
PROCESS CONNECTION PIPING (For Impulse Piping / Tubing and Air Supply Piping as Applicable)		
1	Valves	1 No. of each type, class, size and model.
2	2 way, 3 way, 5 way valve manifolds	1 No. of each type, class, size and model.
3	Fittings	5% or 1 No. of each type, class, size and model whichever is more.

Special notes for Mandatory spares:

- The word "set" means the quantity required for full replacement of that part in one machine.
- The word "TYPE" means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable.
- Wherever % age is identified, bidder shall supply next rounded figure.



- iv. Part Description is the commonly used name of the part and may vary from manufacturer to manufacturer.
- v. Mandatory spares as indicated above do not cover commissioning spares.
- vi. Mandatory spares as indicated above do not cover two year O&M spares.
- vii. All Mandatory spares should be supplied separately with green color painted box.
- viii. Loose items sent by Vendor to sites shall be quantified/numbered/tagged and not merely mentioned as ONE lot of loose items.
- ix. A packing list covering items having shelf life are to be intimated to site. In addition, shelf life items shall be packed separately in black color painted box for easy identification at site.
- x. Spare rotors shall be boxed in a metal containers for vertical storage with nitrogen purging. Storage container shall be property of the owner.

6.12. Special Tools And Tackles for foam pump

2 Sets of Special tools and tackles for Pump & Drive assembly. [1 set each for Pumps with Drive Motors & Pumps with Diesel Engines]

One set (1 Set) of Special tools and tackles comprises of special tools, wrenches etc. with necessary tools boxes as required for operation and maintenance (disassemble, assemble, or maintaining the unit) of the Pump and Drive [Motor/Engine] assembly shall be quoted as per manufacturer's recommendation.

1 set stands for requirement for one no. of skid. Bidder to furnish the list along with the offer.

Prices for Special tools and tackles shall be part of main scope of supply. No separate price shall be offered for the same.

6.12.1. Conflicts in Specification Requirement:

In case of any conflict between this specification and Annexures stringent of the requirement will govern.

6.13. Supervision of Erection & Commissioning

Supervision of erection, commissioning of the supplied system shall be included in bidder's scope of service.

Bidder to note that the supervision charges for erection & commissioning shall consists of the following:

- Per day supervision charges of an Engineer including all other expenses like boarding, lodging, local travel, insurance etc.
- Travel expenses (inclusive of any clearance charges like Visa fee etc, insurance) from / to vendor works to site.

Per diem charges shall be applicable from the day bidder's representative reports to site, up to the day certified by BHEL's site.



For the purpose of tender following to be considered: [for details pls price bid format]

Foam Pump (Gear Pump) with Drives:

- 2 days for 1 no of Pump
- 2 days for 1 no of Motor & Controller
- 2 days for 1 no of Engine & Controller
- 1 visit for 1 no of Pump
- 1 visit for 1 no of Motor & Controller
- 1 visit for 1 no of Engine & Controller

Notes:

1. However, either or both of the number of man days or number of visits may change on either side based on the actual site requirement.
2. All payments towards supervision of E&C shall be made only after BHEL-site certification.
3. Bidder to mobilize concerned competent person for supervision of Erection & commissioning activities within a period of 7 days of receipt of intimation in this regard by BHEL.
4. Bidder to quote supervision of erection and commissioning activities strictly as per BHEL's price format

7. OPTIONAL PRICES

Please Refer to Attached Price Bid Format. Bidder to furnish the following as optional prices:

Bidder to furnish optional prices for 2 year recommended spares as per equipment manufacturer's recommendations. [The Bidder shall quote separately with optional price for the recommended list of spare parts for operation, with recommended quantities for the equipment covered under this specification. Bidder shall furnish such a list along with offer. The list of spares shall be as per Bidder's experience.]

8. EQUIPMENT QUALIFICATION CRITERIA (EQC)

The bidder shall be an established manufacturer of Foam pump (Gear Pump) for Fire Protection System & having adequate engineering, manufacturing & testing facilities for Pumps, Diesel Engine, Controllers confirming FM standards/UL standard. The Pump, Diesel Engine model offered shall be from the existing regular manufacturing range of bidder and same shall be listed in FM standard/UL standard. Similarly, Motor requirement shall meet relevant standards as mentioned in this specification.

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The offered pump model shall meet the minimum service & manufacturing experience specified as below:

Bidder should have engineered, manufactured, tested, supplied and commissioned at least Two (02) nos. [1 no Motor driven & 1 no Diesel Engine Driven] of identical or similar packages (or higher capacity packages) in terms of Flow, Differential Pressure, Material of construction (CS/CI/SS), speed in the last Ten years and same shall have commissioned and kept in trouble free operation. Vendor to give documentary evidence for the same. The ten years time period mentioned above shall be reckoned from the Initial bid due date.

As a proof for the same, Date of Supply/ Commissioning report/Customer Satisfaction report will be considered and same to be provided by Bidder.

Bidder to furnish dully filled in proforma as per Annexure-7.

9. QUALITY PLAN & INSPECTION AGENCY & TESTING

For details, refer Annexure 2-I.

9.1. Quality Plan

Quality plan will be reviewed during detailed Engineering stage with respect to inspection, standard Engineering practices & specification requirements and various tests and stages of inspection and appropriate agencies for Inspection will be Intimated. Bidder to abide by the same.

Pl refer Annexure: 6, ITPs for Pump, Motor, Engine etc. In addition, Annexure-6 & enclosed datasheets, specifications and applicable FM standards shall be referred.

9.2. Inspection

BHEL/ FICHTNER/Third Party appointed by BHEL. Bidder to appoint TPI agency from the following on behalf of BHEL for inspection of items sourced from outside India:

i. Lloyds Register of Industrial Services (LRIS), ii. Bureau Veritas (BV), iii. Det Norske Veritas (DNV), iv. Certification Engineers International Ltd. (CEIL), v. TUV

The various review/witness/observation stages by individual agencies (or) Group of Agencies as above will be in line with approved quality plan.

Pl refer Annexure: 6, ITPs for Pump, Motor, Engine etc. In addition, annexure-6 & enclosed datasheets, specifications and applicable FM standards shall be referred.

9.3. Testing

The design and Testing Standards, Performance tolerances of the Pumps, Motor, Diesel Engines shall be as per FM standards/UL standard.

10. PAINTING

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Painting for Pump, Motor, Engine and all other accessories shall be as per Annexure 2-J.

11. PACKING AND FORWARDING

Packing and Forwarding shall be as Annexure 8. For imported items enclosed seaworthy packing shall be followed. In addition to annexure-8, equivalent or superior seaworthy packing for imported items, packing for other items is also acceptable to us.

12. SUB VENDORS

Bidder shall follow approved sub vendors list as per Annexure 2-K.

In case of any specific practical difficulty, bidder is requested to bring out the same with proper reason for not following vendor list [Annexure 2-K] and to furnish Proven Track record , credentials for the proposed vendors for BHEL approval.

For other items for which sub vendors are not specified, bidder can follow their standard vendors with due intimation to BHEL during detailed engg stage. Also they have to ensure the Proven Track record of the sub vendors and Bidder to take prior approval of BHEL for the same.

13. INSTRUCTIONS ON PRICE BID FORMAT

Bidder to indicate his offer as per Price Bid format enclosed as Annexure 4.

All the items included in the price bid format shall be quoted as per tender specification and pre-bid clarifications as per Annexure 10, if any. Responsibility of ensuring correctness & completeness of scope of supply as per specification requirement solely lies with bidder.

The equipment supplied shall be complete in all respects. The bidder shall not be eligible for any extra payment in respect of such mountings, fittings, fixtures and accessories if required for the safe and reliable operation of the equipment. Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be in bidder scope Only. Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format. Prices quoted by the bidder shall remain firm till the successful handing over of the entire package to end customer. Any request for upward revision of price during any intermediate stage before handing over the plant to end customer will be summarily rejected by BHEL.

14. PRE-BID CLARIFICATIONS & DEVIATIONS:

Bidders shall comply with various requirements of this specification. It may please be noted that the requirements specified here in this specification are the standard practices being



followed by the bidders. However, same things are presented in a structured form so that it can be ensured that the requirements of ultimate customer are complied with.

Bidders can bring out only those deviations which are impractical to meet, for our review in pre bid clarification only.

Bidders may also please note that the data sheets for valves, instruments etc., submitted along with the offer will be considered as indicative only, as the requirements specified in the specification are standard in nature. These will not be reviewed by BHEL before award of contract. Same will be reviewed during order execution stage in line with the requirements of specification and agreed deviations.

All pre-bid clarifications & deviations shall be clear bring as per Annexure 10 only.

In case bidder doesn't bring any clarification/deviation in prebid stage, the same shall be brought in their offer with following conditions:

- a) Any deviations to Customer specifications, same are acceptable provided these deviations are also regularly accepted by Customer for their direct orders on bidders. In such cases, proof of the same shall be furnished along with the offer.
- b) Bidders may please note that unless the deviations are specifically brought out under deviations clause, it will be considered that no deviations are taken, even if they are mentioned elsewhere directly/indirectly in the offer.
- c) Price implication due to non-acceptance [by BHEL/Customer] of the deviations considered by bidder will not be permitted.
- d) Deviations [if any] shall be clear bring as per Annexure 9 only.

15. DOCUMENTATIONS

Please refer to enclosed Master Documentation List [MDL] for the list of DOCUMENTS / DRAWINGS to be submitted by the bidder as part of documentation. Bidder shall ensure submission of all documentation as per the MDL, Annexure 11.

Bidder to note that the dates of submission of all the documents shall be finalized based on PO date. It shall be solely bidder's responsibility to get approval on the entire document from purchaser to meet project schedule.

DEFINITION OF VENDOR DOCUMENT REVIEW STATUS ASSIGNED BY BHEL

The guidelines listed below are followed in assigning the document status code to the vendor documents: Final submittal of vendor documents will not be required as long as the document status code is 1 or 4 and the "AS-BUILT" condition of the component agrees with the current document.

Permission to proceed does not constitute acceptance or approval of design details, calculations, analyses, test methods, or materials developed or selected by the vendor and does not relieve the vendor from full compliance with contractual obligations.

Code-1: Work may proceed



The document conforms to procurement document requirements. The document requires no changes or additions. Matters remaining to be resolved do not require document change and will be handled by correspondence. Where it is known that the design information on a vendor document is not complete and re-submittals will be required, e.g., due to "hold" areas, the document is assigned another status code.

Code-2: Revise and resubmit

Work may proceed subject to resolution of indicated comments. The document is in basic conformance with procurement document requirements. Minor deviations from procurement document requirements have been noted or other minor technical or physical changes in the equipment are required. The vendor shall resolve comments and resubmit documents prior to shipment of commodity.

Code-3: Rejected. Revise and resubmit

The document:

- Does not conform to the procurement requirements,
- Is of a design that is technically unacceptable without significant changes,
- Does not meet project requirements, i.e., orientation of equipment, nozzles, conduit connections, etc.,
- Does not conform to project criteria or with proposal documents or data, or
- Does not meet minimum submittal requirements.

This submittal rejection does not relieve vendor of any schedule commitments.

Code-4: Review not required

The document is not subject to BHEL review. Typical uses for this status are in the review of items that are vendor standard products, small internal parts of major equipment, or vendor standardized data.

DRAWINGS REVIEW & APPROVALS:

Each drawing submitted by the bidder shall be with a title block furnished by BHEL during detailed engg stage.

All drawings / documents shall be thoroughly checked, duly signed, and stamped by the vendor including drawing /documents of sub-vendor, before submission to BHEL. Documents, which are unchecked, unsigned, and without revisions marked clearly, shall be returned without review. Any delay on account of this shall be to the vendor's account. After first review of documents, vendor to submit all the further revisions of documents along with comment resolution sheet. Successive documents submitted without comment resolution sheet shall be returned without review.

The approval and /or review by BHEL /End customer shall not be construed by the bidder as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and drawings.

Documents once reviewed in Code-1 shall not be submitted (incorporating some changes) again for review, however if some change is really necessary, the same shall be brought to the notice of BHEL separately through design change note for review / information. Finally, As – built drawings, duly updated, shall be submitted.



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PY51483

Rev. No.

00

During detailed engg stage, BHEL shall furnish check list reg minimum contents in GA drawing. Bidder to submit GAD [duly incorporating all requirements as per the check list] along with signed checklist. GAD shall not be reviewed without duly filled in checklist signed by the bidder.

NO. OF COPIES OF EACH DOCUMENT TO BE FURNISHED:

All the documents shall be submitted as given below:

SL NO.	DESCRIPTION	NO. OF COPIES / PIECES TO BE SUBMITTED	WHEN TO SUBMIT
1)	Initial drawings/documents under approval and information category.	Soft copy only	Within 2 weeks of placement of order
2)	BHEL shall furnish their observation on submitted documents	Soft copy only	Within 2 weeks of document submission
3)	*Revised drawings/documents along with compliance sheet incorporating all BHEL comments. <i>*Vendor to incorporate all BHEL comments so that further revisions can be</i>	Soft copy only	Within 1 weeks of receipt of commented Drawings from BHEL
4)	BHEL shall furnish their observation on submitted documents	Soft copy only	Within 2 weeks of document submission
5)	Final Drawings/documents	12	Within 2 months of placement of order.
6)	Erection Documentation	5	1 month before dispatch of equipment. The list of documents identified under master document list for erection to be furnished in 5 no's of folders
7)	Draft O & M Manuals for BHEL review. <i>Note: Bidder to furnish final hard copy of O&M only after getting concurrence on</i>	Soft copy	At least 2 months before the delivery date of equipment
8)	Revised O & M Manuals with Test Certificates to be submitted to BHEL (Hyderabad)	12	Within one month before the delivery date of equipment
9)	Final O&M manuals in a CD	4	Within one month after dispatch of equipment after BHEL concurrence on soft

Notes:

The O&M manuals shall contain the following as minimum:



- a) The identification details of the equipment like BHEL P.O. No., Vendor's Job Identification No., full contact address with telephone, fax, & e-mail details.
- b) Brief description of the system.
- c) All approved documents [Drawings, documents & test procedures as per MDL]
- d) Bill of material, BBU, LO schedule, sub vendor list, Mandatory & commissioning spares list etc.
- e) Operation, Instruction & maintenance manuals of all equipments / items for the complete package
- f) System unloading, storage erection, start up, commissioning, shut down requirements.
- g) Operational & environmental safety instructions.
- h) Test reports and certificates.
- i) Catalogues of the equipment & instrumentation

16. VARIANT TABLE:

Variant	Item	Material Code
01	Foam Pump Motor Driven with CS and ST	PY9751483018
02	Foam Pump engine driven with CM and ST	PY9751483026
03	Supervision of E& C of Foam Pump assembly	PY9851483036
04	Travel expenses from / to vendor works to site for Engineer	PY9851483044
05	Foam Pump mandatory spare	PY9751483050

[illegible]

ESP-001- 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION		Std. / Doc. Number	
				Annexure-1	
				Rev. No.	00

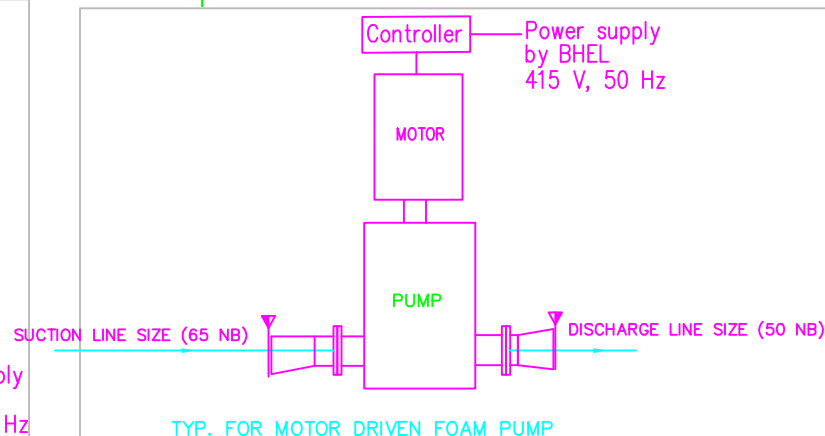
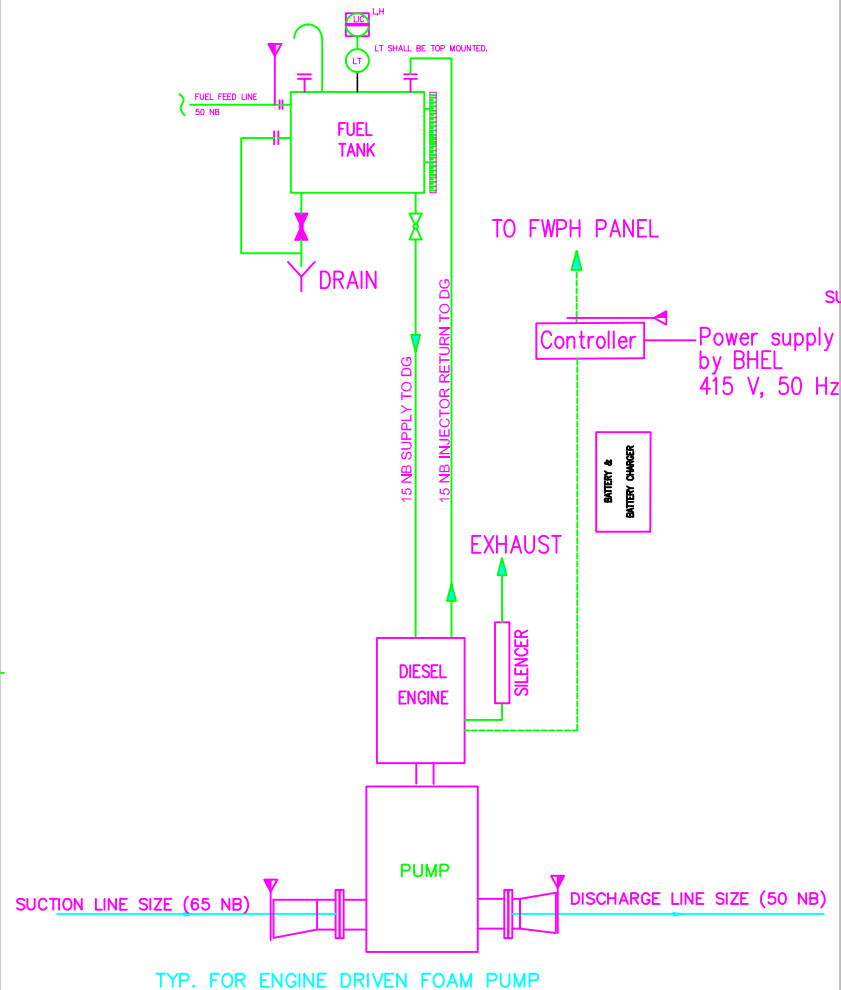
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.	Annexure-1 P&ID for Pump & Drive assembly & System P&ID			

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
	Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	11.09.2018

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

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COMPUTER FILE NAME
D:\BIDDING-SCHEMESREV. Dwg. No.
1000000000SHEET NO.
01REVISION NO.
01

ANNEXURE-1

Notes:

1. For scope of supply specification shall be referred.
2. This is typical schematic of Foam Pumps.
3. Suitable Reducer/Expander to meet BHEL pipe sizes shall be in bidder scope of supply.
4. Following standards shall be applicable:
 - Pipe: SS
 - Pipe Fitting: SS
 - Flanges/Companion Flanges: SS
5. In case of HE cooled Diesel Engine, required Piping, valves etc shall be bidder scope of supply
6. Layout shall be referred for deciding BOQ for fuel piping, Exhaust piping, cabling etc. which are in bidder scope of supply.

SCOPE DEMARCATION

BHEL BIDDER

CUSTOMER: BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED (BIFPOL)

PROJECT: 2 X 660 MW MATREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH

	BHARAT HEAVY ELECTRICALS LTD. HYDERABAD			NAME		SIGN.	DATE	NO. OF
				DRN. GIRISH		—SD—	10.09.18	VAR.
				CHD. GIRISH		—SD—	10.09.18	N.A.
APPR. MSPB		—SD—		10.09.18				
DEPT. PEASD	UNTOL. DIMS. GR. 9/11/17		SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.		ITEM NO. N.A.	NO. OF ITEMS N.A.
TITLE					DRG. NO. PESD/MAT/002		REV. 00	
SCHEME FOR FOAM PUMPS					CARD CODE NA	CUST. DRG. NO. SHT. No. 01 NO. OF SHT. 01		

SHT. 1 OF 2

CONTINUATION FROM P&ID FOR HSD UNLOADING SYSTEM	
DWG. NO.	MAITREE-00-EG-FB-421166A001-PEM

Figure 1 is a schematic diagram of the test setup. It shows a dashed box labeled "BY PUMP VENDOR" containing a motor (M) and a pump. The pump is connected to a 50NB line. This line is connected to a component labeled "00SGA12 BR001". The output of this component is connected to a component labeled "PESD".

LOCATED INSIDE HSD
UNLOADING PUMP HOUSE

REFER DETAILS "C"

FUEL TANK FOR
DIESEL ENGINE
OF FOAM PUMP

TO FIRE WATER PUMP HOUSE

AIR RELEASE VALVE

00SGF09
AA702

FH02 HOSE BOX WITH
ACCESSORIES-NOTE 11

AIR RELEASE VALVE

LEGEND: -

	FOAM SOLUTION LINE—GI		DELUGE VALVE
	FOAM LINE— STAINLESS STEEL		SAFETY RELIEF VALVE
	WATER LINE		DRAIN
	GATE VALVE(NORMALLY OPEN)		PROBE TYPE HEAT DETECTOR
	GATE VALVE(NORMALLY CLOSED)		FOAM PUMP
	NON RETURN VALVE		MOTOR
	LEVEL SWITCH		DIESEL ENGINE
	LEVEL INDICATOR		SOLENOID VALVE(N/C)
	PRESSURE GAUGE		FOAM HYDRANT VALVE
	PRESSURE SWITCH		FIRE ALARM PANEL

S. NO.	EQUIPMENT	QTY	TAG NO.	CAPACITY/SIZE
1	FOAM PUMP (MOTOR DRIVEN)	1	005GF03AP001	11.5 CMH @ 12.1KG/CM2
2	FOAM PUMP (DIESEL ENGINE DRIVEN)	1	005GF04AP001	11.5 CMH @ 12.1KG/CM2
3	FOAM STORAGE TANK	2 (1W+1S)	005GF01BB001 005GF02BB001	6500 LIT.
4	DELUGE VALVE	3	005GF06AA501 005GF07AA501 005GF08AA501	80NB 80NB 100NB
5	FOAM PROPORTIONER	3	005GF06AA502 005GF07AA502 005GF08AA502	80NB 80NB 100NB
6	FOAM CHAMBER WITH DEFLECTOR	2	005GF09AA501 005GF09AA502	100NB 100NB
7	FOAM HYDRANT VALVE WITH ACCESSORIES	2	005GF09AA701 005GF09AA702	--
8	FOAM MONITOR	2	005GF09AA703 005GF09AA704	--

NOTES:—

1. FOAM CONCENTRATE USED IN FOAM SYSTEM SHALL BE "AFF" (AQUEOUS FILM FORMING FOAM).
2. THE FOAM TANK SHALL BE OF STAINLESS STEEL CONSTRUCTION.
3. PIPING DOWNSTREAM OF DELUGE VALVE SHALL CONFORM TO M.S. GALVANISED ERW AS PER IS1239,PART-1, MEDIUM GRADE.
4. THE CAPACITY OF DIESEL TANK SHALL BE SUFFICIENT TO RUN THE ENGINE CONTINUOUSLY FOR A PERIOD OF 60 MIN.
5. MOC OF ABOVE GROUND PIPES SHALL BE 'MS' CONFORMS TO IS1239,PART-1, MEDIUM GRADE. PIPE
6. 50 NB DRAINS AND VENTS SHALL BE PROVIDED FOR PIPE SIZES 400 NB & ABOVE, AND 25 NB DRAINS & VENTS SHALL BE PROVIDED FOR PIPE SIZES UPTO 350NB AS PER LAYOUT
7. ALL PRESSURE TAPPINGS AND ROOT VALVES SHALL BE OF 15NB.
8. A MINIMUM DISTANCE OF 6 METER SHALL BE MAINTAINED FROM THE TANK TO THE DELUGE VALVE SHED.
9. PLEASE REFER OPERATION & CONTROL PHILOSOPHY OF FOAM SYSTEM FOR LOGICS AND INTERLOCK.
10. EACH HOSE BOX SHALL CONTAIN 2 NOS. OF 63MM INSIDE DIA & 25M LENGTH FIRE HOSES AND ONE NO. OF FOAM BRANCHPIPE.

BHEL REF. DRG.:

1. PLOT PLAN : MAITREE-0-MA-LD-421100M001PEM-C
2. COMPOSITE LAYOUT OF HYDRANT & SPRAY : MAITREE-0-SGA-MMB-376005-PES
3. CONTROL & OPERATION PHIL. - MAITREE-00-SGF-MDB-377044-PES-0

03	17.01.19	AMIT	KD	M.N.S.R.	REVISED AS PER M/S IFEC OBS
02	19.11.18	AMIT	KD	M.N.S.R.	REVISED AS PER TCS-488 DTD. 20.12.17
01	27.02.18	ANUPAM	A.K./V.K.	P.C./M.N.S.R	REVISED AS PER TCS-488 DTD. 20.12.17
	DATE	ALTERED	CHECKED	APPROVED	NOTE

PROJECT 2x660MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH

OWNER CONSULTANT:
FICHTNER
M/s FICHTNER GmbH
& Co KG,
Stuttgart,GERMANY

	OWNER: BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED, BANGLADESH	
	BHARAT HEAVY ELECTRICALS LTD PROJECTS ENGINEERING AND SYSTEM DIVISION HYDERABAD	SCALE SHEET

P&ID FOR FOAM SYSTEM

SIZE:	PROJECT NO.:	FILE:
ANNEX:	DRAWING NO.: MAITREE-0-SGF-MFB-377001-PES-1	REV 0

SHEET
01 OF 02

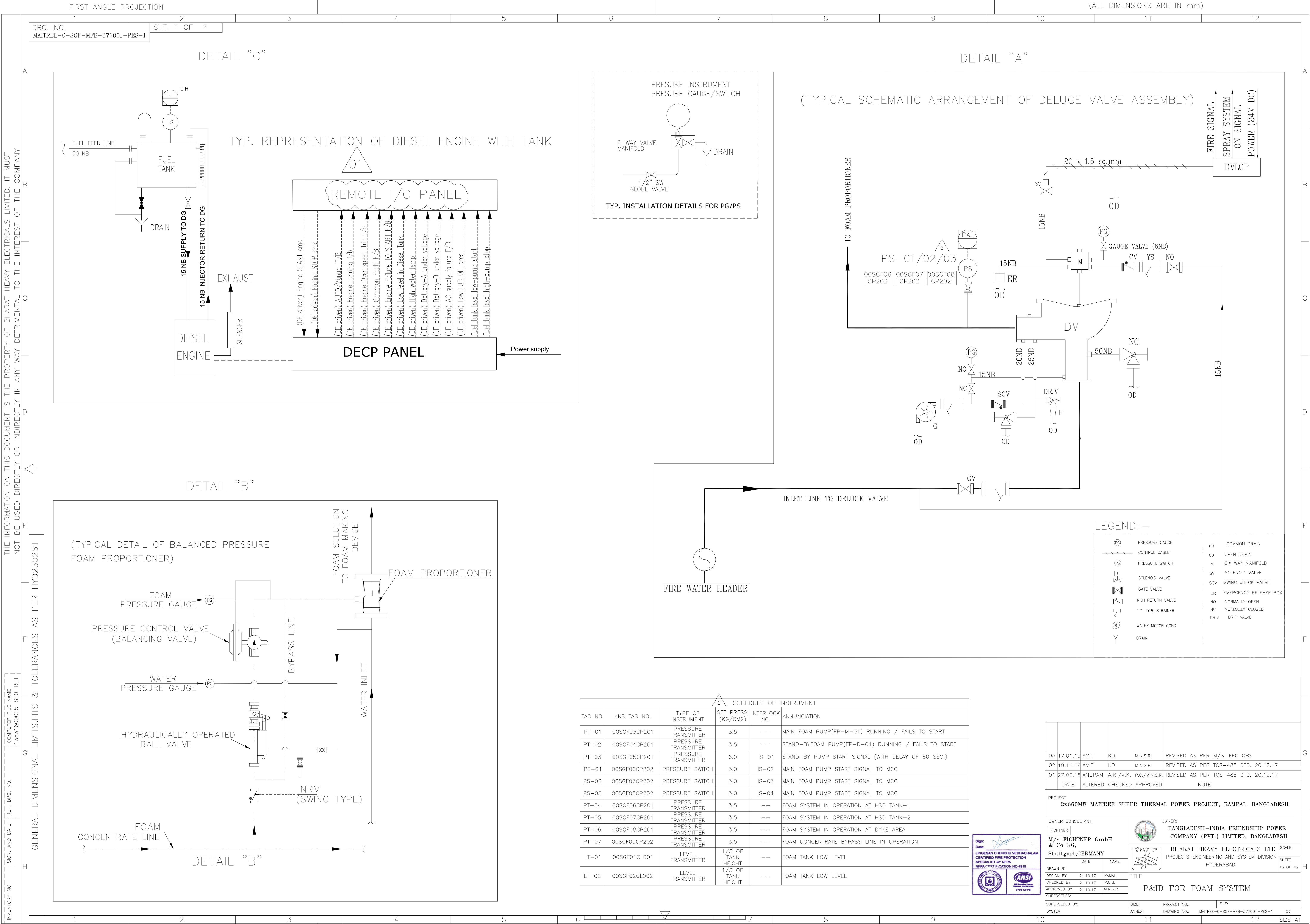
	REV 0
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GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261

INVENTORY NO.

[illegible]



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				Annexure-2	
				Rev. No.	00

Annexure-2

Customer Consultant Specifications:

- a) Site condition
- b) Fire Protection system details
- c) Pump details
- d) HT & LT Motor details
- e) Instrumentation details
- f) Battery & Battery Charger details
- g) Cable & Cable tray details
- h) Vibration requirement
- i) Testing requirements
- j) Painting & colour code
- k) Sub vendor list

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	11.09.2018

- **Auxiliary plant systems** (refer to Section B12)
 - Compressed air system
 - Hydrogen system
 - Workshop and store
 - Chemical laboratory
 - Fire fighting system
 - De-dusting system
 - HVAC system

B0.2.3 Interface points

For interface points see below.

B0.2.4 **Site conditions**

The following information on local conditions is investigated or compiled by the Employer. The Contractor is hereby in no way relieved from his duties of carrying out all investigations required for satisfactory performance of his works. The Contractor shall perform his own Site visits and investigations, prior to Contract award in order to familiarize him with the existing conditions of the Site and the surrounding area.

Location, accessibility and present condition of the Site

The site for the Maitree-STPP Project is geographically located between 22° 37'0" N to 22°34'30" N and 89°32'0" E to 89°34'5" E, approximately 14 km northeast of the Mongla Port and 14 km northwest of the Sundarbans, is infringed by the Passur and Moidara Rivers to the west and south east respectively. The project requires an area of approximately 500 acres.

The topographical survey indicates a natural ground level of +1.15 to +1.35 meters above sea level. A severe cyclone in 2009 raised the level to 4.47 meters and it was decided to raise the **Plant level to +5.00 meters.**

Politically, the site is located in Rampal Upazila of the Bagherat District in the Rajnagar Union

Currently, the Site is accessible by boat only.

The nearest inland port is Mongla port at around 14km direct distance.

The proposed Khan Jahan Ali Airport is located at a distance of approximately 12 km from the project site.

Soil conditions

First soil investigations of the Plant site and adjacent areas have been carried out. For information only the findings of these initial soil investigations are attached in Part C Annexes.



In general the subsoil conditions can be described as follows:

- top layer filled sand (with unknown silt content) in Plant area
- underlying layers of clay
- underlying fine sand.

The Contractor shall conduct soil improvement measures at site. Beside other aspects, consolidation of filling shall be incorporated in soil improvement concept.

Seismic zone

Attention shall be paid to seismic parameters. Related to soil type as identified to Soil Investigation Report, the effect of local soils on earthquake ground motion shall be determined.

For site class "S1" and "S", as expected for the Project, site specific studies shall be carried out to determine the design acceleration response spectrum. During field study minimum the following tests shall be executed:

- Seismic cross hole test; and
- Seismic refraction test.

Based on these results a site specific Response Spectra shall be established. Peak spectral acceleration shall be determined, but shall be not less than 0.12g, as mentioned in BNBC 2012, Table 2.5.2.

Site climatic conditions

The Plant site is from the climatic point of view under maritime tropical conditions. The assumed meteorological conditions for the Site are as follows:

The project site is located in the country's South Central Zone consisting of three dominant seasons:

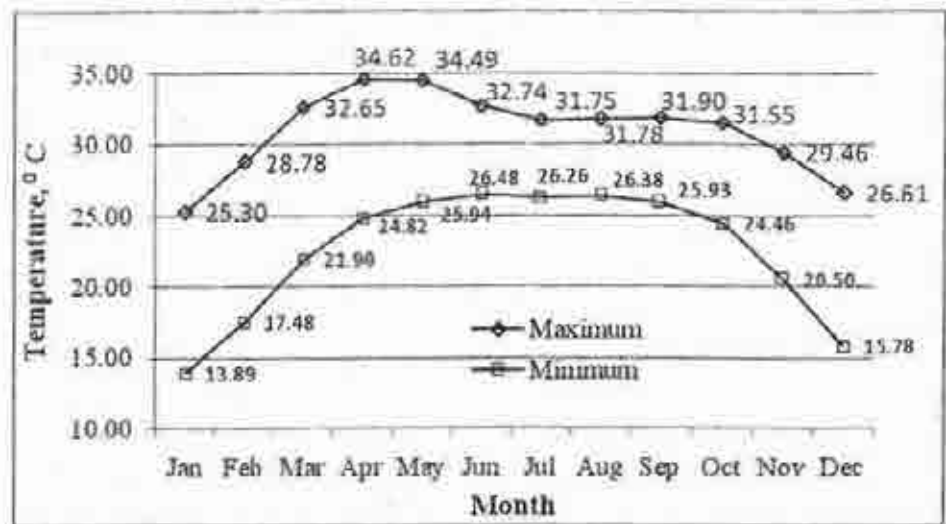
- summer season-March to May
- monsoon season-June to October
- winter season-November to February.

During the Monsoon Season occasional cyclonic storms can occur.

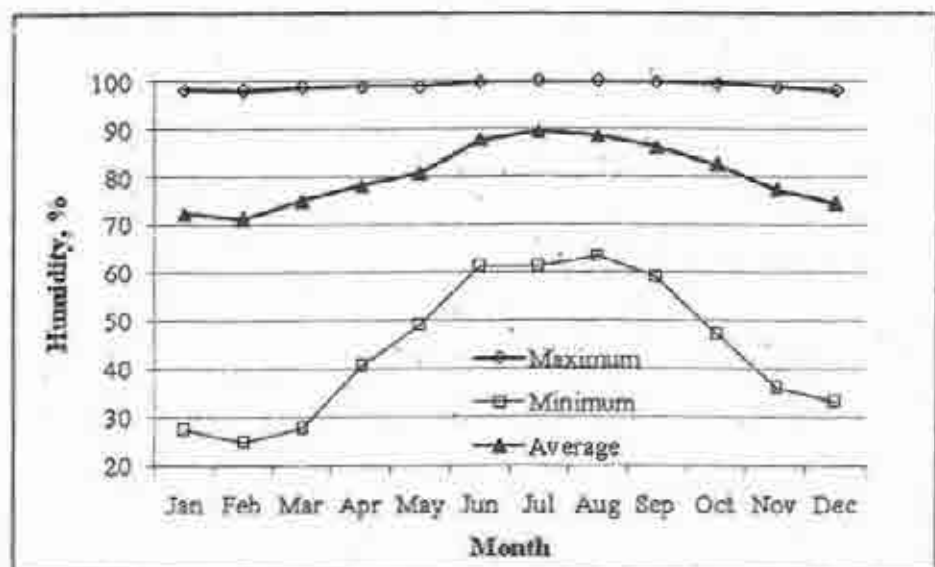
The climatic conditions in the area are continuously monitored by the Bangladesh Meteorological Department (BMD) at the Mongla Meteorological Station.

The temperature varies only slightly throughout the year with the **highest** temperature of **36.9°C** and the **lowest** temperature of **12.2°C** recorded in the period from 1989 to 2008. This distribution is depicted in figure below.



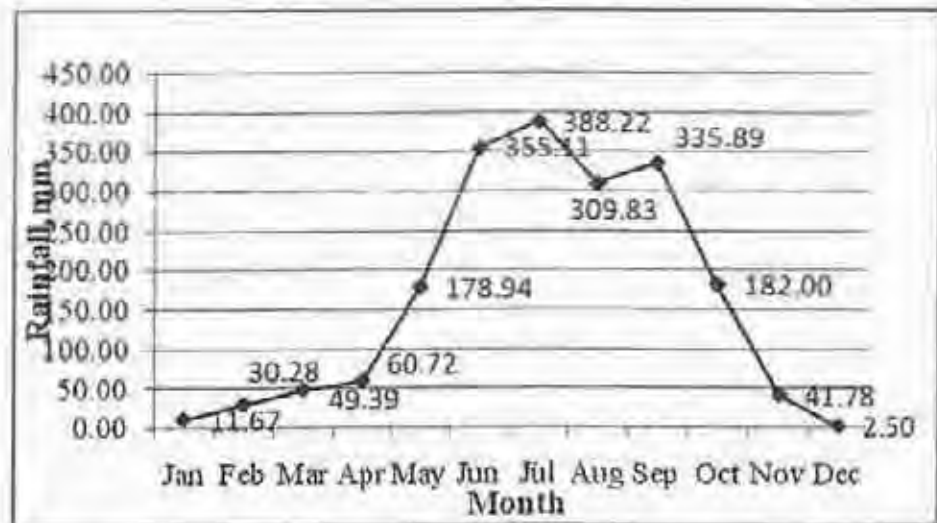


The relative humidity varies drastically during the Monsoon Season with 80% to 90% and the lowest levels of 20% to 30% during the Summer Season. The humidity profile recorded in the same period as the temperature is visualized in below figure.



The maximum rainfall occurs during the Monsoon Season by varying between 300 mm and 350 mm with almost no rainfall during the Winter Season.

The average evaporation in the project area varies between 3 - 5 mm/day with its peak of 16 mm/day during July. The average rainfall for the period between 1991 and 2008 is depicted in below figure.



Below definitions are to be used as typical data for the different climatically seasons at the site.

Average Site Condition ASC

Ambient Temperature: 27.3 °C
 Ambient Humidity: 87 %
 Ambient Pressure: 1007.6 mbar
 River Water Temperature: 29.8 °C

Summer Site Condition SSC

Ambient Temperature: 36.9 °C
 Ambient Humidity: 60 %
 Ambient Pressure: 1007.9 mbar
 River Water Temperature: 33 °C

Winter Site Conditions WSC

Ambient Temperature: 12.2 °C
 Ambient Humidity: 100 %
 Ambient Pressure: 1017.2 mbar
 River Water Temperature: 20 °C

Reference Site Conditions RSC

Ambient Temperature: 31 °C
 Ambient Humidity: 88 %
 Ambient Pressure: 1007 mbar
 River Water Temperature: 32 °C

Reference Site Condition shall apply for the Guarantee Values as well as for the Guarantee Tests/Performance Test. However, Plant must cope with the Site Conditions as specified.



Wet bulb temperature shall be calculated by Bidder/Contractor based on ambient temperature (dry bulb), ambient humidity and ambient pressure for the different cases.

Bidder/Contractor shall determine the wet bulb temperature for all site conditions and not only for reference site condition.

Design ambient conditions for Electrical Systems

- | | |
|---|--------|
| • Maximum design temperature (outdoor) | 45°C |
| • Maximum daily average ambient shade temperature | 38°C |
| • Maximum monthly average temperature (in the shade) | 34.6°C |
| • Maximum annual average temperature (in the shade) | 27.3°C |
| • Maximum design temperature of the electrical equipment installed indoors in air conditioned rooms | 40°C |
| • Maximum design temperature of the electrical equipment installed indoors non in air conditioned rooms | 45°C |
| • Minimum design temperature | 0°C |

Marine conditions

Two tides (e.g. flood and ebb) are regularly observed in the Passur River, which enters into the project site through numerous connected creeks.

The tidal range varies between 1.2 and 3.1 meters. The mean water level (CD) is about 0.87 meters (PWD=CD-1.17 meters). The mean high water level varies due to spring-neap tide conditions between +1.60 m and +2.6m PWD. The Highest High Water Level (HHW) is about +3.1m PWD and the Lowest Low Water Level (LLW) is about -1.4m PWD.

The marine conditions are detailed in **Section B11**, with details about:

- water levels
- waves
- currents
- river bathymetry, topography.



The salinity of the Passur River system varies with the amount of fresh water entering the system which is highly seasonal dependent. The surface water temperature ranges between 22.9°C and 33.0°C and the different water quality parameters are tabulated in **Part C Annexes**.

The marine conditions as recorded at Mongla Port Gauge Station (approx. 14 km south-east to the site) are as follows:

- | | | |
|----------------------------|-------|-------------|
| • Highest High Water Level | (HHW) | + 2.642 MSL |
| • Lowest Low Water Level | (LWL) | - 1.858 MSL |

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The Power Plant shall be designed for 100 years flood condition based on data provided by relevant Organization in Bangladesh and taking into account the Highest Astronomical Tide (HAT), the maximum wave conditions (including storm surges) and the potential event of Cyclone. The Contractor is responsible to verify the worst conditions.

These reference data are with respect to LAT, which corresponds to the Chart Datum (CD). The site land data is however with respect to the Bangladesh Land Survey Datum (BLSD), which corresponds to approx. +1.55 m CD (hence the MLSD corresponds to MSL).

Design Wave Height 2.0 m
Design Wave Period 6.0 sec
Sedimentation and Siltation: Soft to stiff clay and alternations of very sandy and stiff clay.

The results of bathymetric investigations of the Passur River can be found in Part C Annexes.

A water analysis from the area adjacent to the site giving salinity and water quality is shown below:

Sl. No.	Date	Time	Temp	pH	EC	DO	TSS	Calc	Fe	NO ₃	NO ₂	PO ₄	CO ₃	SO ₄	Cl ⁻	Sal
			°C		µmhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1	7-Jun	27.8	7.74	3010	879	36	48.7	1345	1510	55	5.3	0.8	55	18		
2	7-Jun	27.3	7.72	3035	878.3	36	48.3	1370	1510	60	8.1	0.8	55	18		
3	7-Jun	27.8	7.71	3030	879	36	48.8	1345	1510	55	5.1	0.8	55	18		
1	11-Feb	28.8	7.66	4380	1263	38	182	2590	2300	210	4.7	1	78	23		
2	11-Feb	29.2	7.70	4380	1268	39	178	2590	2390	200	4.7	1	76	23		
3	11-Feb	28.1	7.65	4380	1265	38	179	2580	2380	200	4.7	1	76	23		
1	8-Mar	32.6	7.56	13780	2644.4	38	176	6080	5890	190	4.7	1.2	76	47		
2	8-Mar	32.6	7.57	13780	2645.2	38	178	6080	5890	190	4.7	1.2	76	47		
3	8-Mar	32.4	7.55	13780	2644.4	38	177	6090	5890	200	4.7	1.2	78	47		
1	17-Apr	32.8	7.58	25580	8273	36	183.6	12950	12950	230	4.8	0.7	136	13.1		
2	17-Apr	32.8	7.59	25500	8273	36	188.2	12950	12700	230	4.8	0.7	138	13.5		
3	17-Apr	32.8	7.56	25500	8273	36	184.8	12950	12700	230	4.8	0.7	136	13.1		
1	5-May	32.8	7.58	28550	8480	36	186.6	14600	14600	300	4.3	1.2	170	17.6		
2	5-May	32.9	7.54	28550	8490	36	186.6	14600	14600	300	4.4	1.2	170	17.8		

Figure 1 Water quality of the Passur River at Mongla point
(Source: EIA-Report)



000027

Sl. no.	Date	Temp. (°C)	pH	EC (µmho/cm)	DO (mg/l)	Total Hardness (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Iron (mg/l)	Copper (mg/l)	Zinc (mg/l)	Manganese (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Phosphate (mg/l)	Sulfate (mg/l)	Chloride (mg/l)	Fluoride (mg/l)
1	14-May	33.2	7.57	26700	6.70	38	189.6	14000	14400	100	6.3	1.2	177	13.6				
1	15-Jun	31.8	7.69	18500	5.20	38	112.4	9300	9000	100	6.2	1.1	87	10.8				
2	16-Jun	31.8	7.69	18000	5.00	38	113.2	9200	8000	100	6.7	1.1	91	10.8				
3	18-Jun	31.8	7.69	13000	5.12	38	112.4	9200	8000	100	6.7	1.1	87	10.8				
1	1-Jul	31.8	7.69	440	31.8	38	76.6	283	320	43	5.2	0.8	24	-				
2	2-Jul	31.8	7.69	440	31.8	38	76.6	283	320	43	5.2	0.8	24	-				
2	3-Jul	31.8	7.69	440	31.8	38	76.6	283	320	43	5.2	0.8	24	-				
1	5-Aug	31.8	7.69	175	18.8	38	64.8	140	117	33	5.3	0.7	23	-				
2	6-Aug	31.8	7.69	275	18.8	38	64.8	192	117	33	5.3	0.7	23	-				
3	6-Aug	31.8	7.69	175	18.8	38	64.8	140	117	33	5.3	0.7	23	-				
1	8-Aug	31.8	7.74	270	15.8	38	63.8	140	117	43	5.3	0.7	23	-				
2	8-Aug	31.8	7.74	270	15.8	38	63.8	140	117	43	5.3	0.7	23	-				
3	8-Aug	31.8	7.74	270	15.8	38	63.8	140	117	43	5.3	0.7	23	-				
1	15-Oct	28.8	7.79	280	28.8	38	62.8	182	143	47	5.8	0.7	22	-				
2	15-Oct	28.8	7.79	280	28.8	38	62.8	182	143	47	5.8	0.7	22	-				
1	15-Nov	28.8	7.79	340	31.8	38	64.8	210	170	48	5.8	0.7	22	-				
2	15-Nov	28.8	7.79	340	31.8	38	64.8	210	170	48	5.8	0.7	22	-				
1	15-Nov	28.8	7.79	340	31.8	38	64.8	210	170	48	5.8	0.7	22	-				
1	11-Dec	21.3	7.71	328	21.8	38	72.8	218	180	68	5.3	0.9	20	8.4				
1	11-Dec	20.8	7.71	328	21.8	38	73.8	220	180	68	5.3	0.9	20	8.4				
1	12-Dec	21.1	7.72	328	21.8	38	71.8	220	180	68	5.3	0.9	20	8.4				

Figure 2 Water quality of the Passur River at Mongla point
(Source: EIA-Report)

Additional information on water quality parameters is shown in **Part C Annexes**.

Wind data

The project region is characterized by southerly winds from the Bay of Bengal during the Monsoon Season and north-westerly winds from the Himalayas during the Winter Season. During the Summer Season, the wind blows from south-southwest to north-northeast. The annual average wind speed amounts to 1.7 meter/second and the wind rose for the entire year is shown in Figure 5.5.

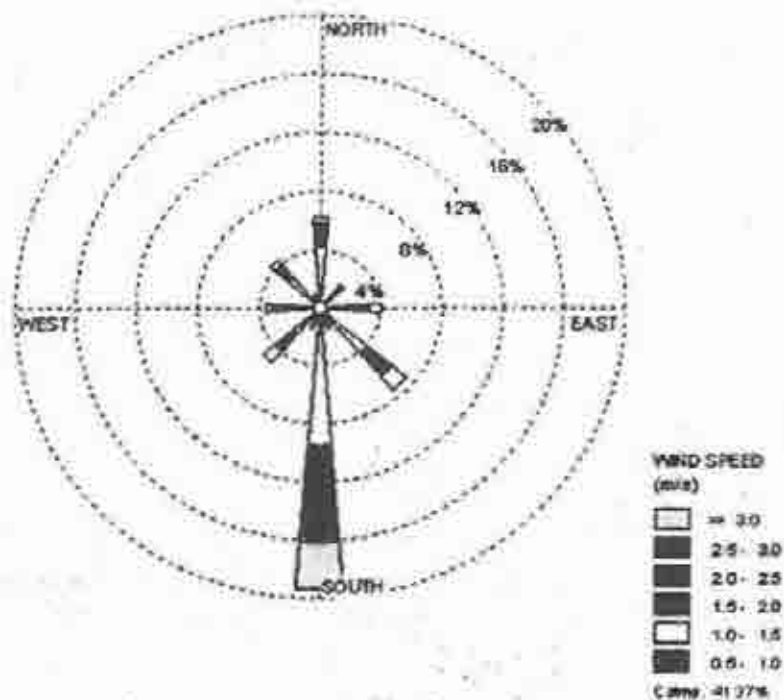
The wind load calculation for the buildings and structures shall be as per Bangladesh National Building Code -2012, Part 6, Chapter 2.4.

Basic wind Speed, V , shall be taken as 73 m/s, Three-second gust at 10 m above ground in exposure C, having a return period of 50 years.

Unquote



000028



B0.2.5 Configuration

Two (2) Plant units mainly consisting of steam generator, steam turbine generator, flue gas treatment plants and associated equipment represent the core components of the Plant. The configuration of the power units and all of its main components shall be chosen according to proven and reliable vendor configuration. In doing so, adequate safety clearances, fire compartments, favourable layout of the Plant components for monitoring and maintenance and all other requirements such as those during Power Plant construction shall be taken into account.

The cooling requirement of the Plant shall be accomplished by induced draught cooling towers. The coal unloading facilities and the ash and gypsum loading facilities to ships shall be incorporated in a new jetty structure. Other main items are the power island, the coal yard, ash pond and other balance of plant facilities.

B0.2.6 Layout



The existing conditions at the location of the Plant are shown in the site overview as per the indicative layout in Part C Annexes. The Tenderer shall perform own Site visits and investigations prior to bidding in order to familiarize himself with the existing conditions. The Contractor shall propose the Plant layout deemed most practical and cost optimized for the Power Plant.



B12

Part 2: Fire Protection Systems



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B12 Fire Protection Systems

B12.1 General

The fire fighting system shall consist of Fire Protection System and Fire Detection System.

The fire protection system equipment shall be complete in every respect and suitable for safe and reliable operation.

The fire fighting system shall cover the whole area of Maitree-STPP site. Fire protection system shall cater for all potential risks from fire and provide automatic and/ or manual response to any fire detected. Automatic and manual extinguishing systems operation is anticipated.

B12.1.1 Design standards and codes

The fire fighting protection and detection system shall be designed according to NFPA/ Equiv. International Standards. All relevant NFPA standards shall apply, including but not limited to the following:

NFPA 1	Fire Prevention Code
NFPA 2	Fire Fighting Pumps
NFPA 10	Portable Fire Extinguishers
NFPA 11	Foam Extinguishing Systems
NFPA 13	Installation of Sprinklers System
NFPA 14	Standpipe and Hose System
NFPA 15	Water Spray Fixed Systems
NFPA 16	Deluge Foam-Water Systems
NFPA 20	Standard for the Installation of Centrifugal Fire Pumps
NFPA 22	Standard for Water Tanks for Private Fire Protection
NFPA 24	Private Fire Service Mains and Their Appurtenances
NFPA 25	Water Based Fire Protection Systems
NFPA 30	Flammable and Combustible Liquid Code
NFPA 31	Oil Burning Equipment
NFPA 70	National Electric Code
NFPA 71	Central Station Signaling Systems Protected Premises Unit
NFPA 72	National Fire Alarm Code
NFPA 72A	Local Protective Signaling System
NFPA 72E	Automatic Fire Detectors
NFPA 101	Life Safety Code
NFPA 231	Standard for General Storage
NFPA 291	Recommended Practice for Fire Flow Testing and Marking of Hydrants
NFPA 307	Marine Terminals, Piers and Wharves
NFPA 600	Standards on Industrial Fire Brigades
NFPA 850	Protection for Electric Generating Plants



All fire safety facilities shall be provided in accordance with the international (i.e. ICE, CEF, EN), British (i.e. BS, BSI), German (i.e. DIN, VDS, VDE) and American (i.e. NFPA) Standards, in the latest edition.

B12.1.2 Fire safety philosophy

The Maitree-STPP shall be designed and built with provision of a safe operating environment for equipment and personnel. This shall be achieved by the separation and segregation of equipment with sufficient distances and by selection of suitable equipment and materials.

Hazardous areas shall be identified and suitable equipment shall be selected for use in such areas. Different fire fighting systems shall be adopted according to the operational characteristics of the particular plant areas and buildings to be protected.

B12.2 Fire Fighting System Description

Onsite fire protection systems shall be provided for the plant as a minimum as described herein.

The fire protection system shall generally follow NFPA 850/ Equiv. International Standards. The following main areas are considered to be protected:

BUILDING/AREA/ EQUIPMENT TO BE PROTECTED	FIRE FIGHTING INSTALLATIONS	DETECTION SYSTEMS
Boilers	Indoor hydrants with hose reel system	Manual fire alarm
Boiler burners in the boiler area	Automatic high velocity water spray fixed system	Linear beam smoke detectors, Automatic fire alarm system.
Steam Turbine Building	Indoor hydrants with hose reel system	Smoke detectors, Automatic fire alarm system and manual fire alarm stations.
Steam Turbine lube oil tanks and system and hydraulic oil tank and systems	Automatic foam/water spray fixed system for hydraulic storage tanks and areas. For turbine lubrication HYWS or fog system shall be used	Linear heat detectors and UV/IR flame detectors, Automatic fire alarm system
Steam Turbine / Generator bearings	Automatic water mist system	Linear heat detectors or combined heat/flame detectors, Automatic fire alarm system.
Fuel Oil Storage Tanks	Low expansion foam systems into the tanks and tank shell cooling systems	Linear heat detectors Inside* the tanks Automatic fire alarm system.



**BUILDING/AREA/
EQUIPMENT TO BE
PROTECTED**

(LDO/HSD)

LDO/HSD Fuel Oil
Pump
House

**FIRE FIGHTING
INSTALLATIONS**

for roof and shell

Automatic foam/water
spray fixed system

DETECTION SYSTEMS

Smoke detectors, UV/IR flame
detectors. Automatic fire
alarm system and manual fire
alarm stations

LDO/HSD Metering
Station

Automatic HWW spray
system

Smoke detectors, UV/IR flame
detectors. Automatic fire
alarm system and manual fire
alarm stations

Coal Storage

Outdoor Hydrants with hose
cabinets. Water/Foam
system in case of covered
stock pile and enclosed
areas e.g. coal bunker and
Outdoor Hydrants with hose
cabinets in case of open
stock pile

UV/IR detectors, Automatic
fire alarm system and manual
fire alarm stations, in case of
covered stock pile and
enclosed areas e.g. coal
bunker only manual fire alarm
stations. Only manual fire
alarm stations, in case of
open stock pile.

Coal conveyor,
Stacker, Reclaimer,
Coal unloader.

Automatic MWV water
spray fixed system

LHS cable with two numbers
of IR detectors are envisaged
for each conveyor. Automatic
fire alarm system and manual
fire alarm stations

Plant water pretreat-
ment facilities

Hydrants. Mobile 30 kg
CO₂ – extinguishers and
portable 5 kg CO₂
extinguishers for the
switchgears.

UV/IR flame detector,
smoke detectors. Multi-
sensor detector is also
acceptable. Automatic fire
alarm stations

Water and waste water
treatment
Buildings

Indoor hydrants with
hose reel system

Smoke detectors. Linear heat
detectors. Multi-sensor
detector is also acceptable.
Automatic fire alarm system
and manual fire alarm stations

Chlorination Buildings

Manual water spray
system and indoor
hydrants with hose reel
system

Smoke detectors. Linear heat
detectors. Multi-sensor
detector is also acceptable.
Automatic fire alarm system
and manual fire alarm
stations. Gas detection
system.

Chemical Stores

Automatic water spray
fixed system and indoor
hydrants with hose reel
system

Smoke detectors. Linear heat
detectors. Multi-sensor
detector is also acceptable.
Automatic fire alarm system
and manual fire alarm stations



**BUILDING/AREA/
EQUIPMENT TO BE
PROTECTED**

**FIRE FIGHTING
INSTALLATIONS**

DETECTION SYSTEMS

Central Control
Building and Its
Switchgear Building

Inert gas Extinguishing system employing any of the commercially available inert gas listed in NFPA-2001 shall be provided for fire protection of Control room, control equipment room areas etc. This system shall be actuated by automatic fire detection & alarm system comprising multisensor detectors. Switchgears shall be provided with portable fire extinguishers.

This system shall be actuated by automatic fire detection & alarm system comprising multisensor detectors, and manual fire alarm stations

Plant water Pump-
house

Mobile 30 kg CO₂ -
extinguishers and
portable 5 kg CO₂ -
extinguishers

Smoke detectors. Automatic
fire alarm system and manual
fire alarm stations

Switchgear Building

Mobile 30 kg CO₂ -
extinguishers and
portable 5 kg CO₂ -
extinguishers. Additional,
fixed total flooding CO₂
extinguishing system shall
be provided.

Smoke detectors. Automatic
fire alarm system and manual
fire alarm stations

LV Switchgear &
MV Switchgear
Building

Mobile 30 kg CO₂ -
extinguishers and portable
5 kg
CO₂ -extinguishers.

Automatic fire detection &
alarm system comprising
multi-sensor detectors,
manual call points shall be
provided.

All Oil Filled
Transformers

Automatic high velocity
water spray fixed
systems

Sprinkler head heat
detectors. Automatic fire
alarm system.

Dry Type
Transformers

Mobile 30 kg CO₂
extinguisher and
portable 5 kg CO₂
extinguishers

Smoke detectors. Automatic
fire alarm system and manual
fire alarm

Emergency Diesel
Generators

Automatic foam/water
spray fixed system and
mobile 50 kg dry- powder
extinguisher

UV/IR detectors. Smoke
detectors. Automatic fire
alarm system and manual fire
alarm stations

Computer, Electronic
And Switchgear
Rooms

Mobile 30 kg CO₂ -
extinguishers and
portable 5 kg CO₂ -

Smoke detectors. Automatic
fire alarm system.



BUILDING/AREA/ EQUIPMENT TO BE PROTECTED	FIRE FIGHTING INSTALLATIONS	DETECTION SYSTEMS
	Extinguishers. And also water mist system	
Cable Floors, Shafts and Tunnels	Automatic medium velocity water spray fixed systems	Combination of smoke detectors and linear heat detectors shall be used
Ventilation Systems	Automatic sprinkler system	Duct smoke detectors. Automatic fire alarm system
Administration Buildings and Service building	Indoor hydrants with hose reel system. Portable extinguishers.	Smoke detectors. Automatic fire alarm system and manual fire alarm stations
Workshop Buildings	Indoor hydrants with hose reel system. Portable extinguishers.	Smoke detectors. Automatic fire alarm system and manual fire alarm stations
Storage Buildings	Water Sprinkler system, indoor hydrants with hose reel system. Portable extinguishers.	Smoke detectors. Automatic fire alarm system and manual fire alarm stations
Canteen / Social Buildings	Indoor hydrants with hose reel system. Portable extinguishers.	Smoke detectors. Automatic fire alarm system and manual fire alarm stations
Fire Brigade Building	Indoor hydrants with hose reel system. Portable extinguishers.	Smoke detectors. Automatic fire alarm system and manual fire alarm stations
All other buildings and areas including blending plant area	Outdoor hydrants and indoor hose cabinets Additional equipment related to the fire risk.	Smoke /heat detectors Automatic fire alarm system and manual fire alarm stations
Coal transfer points and Crusher house	Automatic MV Water spray system	QBD; Automatic fire alarm system and manual fire alarm stations

Sp



Remarks to the schedule above:

- Gas detection is required for chlorination building and Hydrogen building.
- Fuel Oil Storage Tanks (LDO/HSD):**
The kind of selection inside the tank is dependent of the tank design if it is a floating tank roof or a fixed tank roof.
- Whether automatic system for ventilation areas shall be required or not, shall be proved by a Fire Risk Assessment from a notified body.

Any building or area which is protected by a "wet" fire fighting installation must also be provided with an "external fire brigade connection".



The "Siamese Breaching inlets" shall be housed in stainless steel cabinets with "wire glass" doors, located around the perimeter of the protected area.

They must be placed to allow ready access by the fire brigade tender. Upstream of the above fire brigade connection, suitable non-return valves in the main – and branch line must be provided, in order to facilitate pressurization of the "installation" from the 2 different sources.

It shall be assured that at least two (2) hour fire water supply to cover the main system design flow rate is available for the facility in accordance to NFPA/ Equiv. International Standards. Particular attention is drawn to the requirement of the deluge system for the large fuel oil storage tanks.

The power plant shall be provided with two separate fire water sources namely:

- water from service water tank – primary source
- emergency supply shall be fed from the pre-treated plant water storage – secondary source.

The fire water demand shall be stored in two (2) 100 % above-ground storage tanks.

The capacity of the storage tanks shall be calculated by the Bidder/Contractor according to NFPA 850 after a Fire Risk Assessment and shall be subject to BIFPCL approval during basic/detail engineering. MoC of tank shall be selected with regard to the water quality and in particular for saline water and shall be subject to BIFPCL approval during basic/detail engineering

There shall be two separate in-feeds into the fire ring main from the service water tank. Each in-feed shall be equipped with 2 x 100% fire water pumps, 1 x 100% electrically driven and 1 x 100% diesel driven, as well as one jockey pump, to transfer water from the raw water tanks to the fire ring main. The two in-feeds into the fire ring main shall be separated with a manual N/O valve. The diesel engine shall start up automatically after a fire alarm, but only in an event of power failure or failure of the electrical power is supplying the required pressure to the fire fighting system. The two sets of pumping equipment shall be housed in separate fire compartments (adjacent rooms or divided by a fire rated wall so that a fire on one pump does not affect the function of the other pump).

The new fire pump house, being the main supply, shall consist of:

- two (2) 100% electric jockey pumps (1 set)
- one (1) 100% electric driven main pump set
- one (1) 100% diesel engine driven main pump set
- one (1) expansion tank arrangement



Water in the pipe network shall be kept pressurized by one expansion tank and jockey pump arrangement. To maintain the nominal pressure in the fire main during normal operation, the jockey pumps shall be installed parallel to the fire water pumps with one jockey pump on each in-feed. The jockey pumps shall be of an end suction or horizontal type with sufficient capacity to supply three hose reels at the operational conditions without bringing the main water fire pumps into operation and to overcome the leakage in the system.

For the diesel-driven pumps, a daily storage tank shall be installed. This tank shall be connected with a feed line from the fuel oil storage tank including a fuel pump to refill the daily storage tank. An overfill protection for the daily storage tank shall be provided.

The main fire pumps shall be of approved design for use in fire fighting system (horizontal, split case, single stage, centrifugal type with single entry) and shall be complete with mating flanges, air releases, drain connection and base plate.

The electric motors shall be totally enclosed fan cooled motors, which shall be equipped with sleeve bearings.

A main above ground fire header shall be provided to serve strategically placed (not more than 50 m apart) outdoor hydrants and supply water to the indoor hose reel and sprinkler/spray systems.

The fire water distribution system shall incorporate sectionalizing valves so that a failure in any part of the system can be isolated while allowing the remainder of the system to function properly. A sufficient number of drain valves at low areas, which allow a sectionalized flushing/drainage of main fire header shall be installed. Contractor's concept needs to be agreed upon and approved by the OE.

B12.2.1 Fire water demand calculation

The contractor shall provide hydraulic calculations to verify that the fire water system is sufficiently designed to provide in a worst case scenario based on NFPA 850 sufficient pressure and water flow to the most remote and biggest fire water consumers, considering for this event the simultaneous use of involved systems over the requested time. A safety factor of approximately 1.15 shall be added. The calculation has to be submitted with the Tender documents.



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B12.3 Fire water distribution system

The water distribution system is mainly an above ground system and comprises of different circuits.

The ring fire water main shall be divided by gate valves into several sections, which can be isolated in case of leakages or service, to ensure a high availability of the non-concerned main segments. The gate valves must be lockable in the open/ close position.

Connection pipelines to the buildings and structures shall branch at the main, to supply risers, spray deluge systems and hose reel stations inside the buildings with fire water. Wet risers shall be provided in each staircase, but with the tapping points outside the staircase.

B12.4 Hydrants

Along the fire water main, hydrants shall be provided, especially near objects or equipment with an increased fire hazard.

The outdoor hydrants shall have a hose and equipment cabinet situated nearby. The outdoor hydrants shall be of pillar-type with 2 hose connections. The fire hydrants shall be installed such that a 50 m fire reel will provide full coverage of the area.

The water hydrant cabinets inside the buildings shall be supplied by means of connection lines filled with water. The water hydrant cabinets shall be permanently connected to the fire fighting water system via suitable isolating valve.

The water hydrant cabinets shall be generally installed in the vicinity of the staircase exit. They shall be arranged in such a way as to ensure that any points in the building to be protected can be reached with extinguishing water from two separate hydrants from the water hydrant cabinet and/or water cabinet and/or outdoor hydrants.

Some of the water hydrant cabinets shall be equipped for using both water and foam as an extinguishing agent. Foam/water hydrants shall be used where inflammable liquids are stored in such small quantities that the use of spray deluge systems would be uneconomical.

B12.5 Automatic Water Spray Systems



The design density and area of operation shall be determined to suit the risk. The tripping temperature shall be at least 30°C above the maximum anticipated ambient temperature. Higher temperature ratings shall be used where inflammable liquids are present.



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Water mist system

The water mist system shall be used where water can cause damage on equipment e.g. Computer room, clean room, telecommunication or office rooms.

High velocity spray system

The high velocity spray system shall be used where flammable liquids with a flash point more than 65°C will be stored or handled.

Medium velocity spray system

The medium velocity spray system shall be used where flammable liquids with a flash point less than 65°C will be stored or handled.

For all other areas normal water sprinkler system has to be applied.

They shall be applied at least and among others for:

- office, workshops and storage areas
- Turbine and generator bearing (high pressure water mist system as per NFPA 750), pre-activated
- auxiliary boiler
- fire fighting pump house
 - coal feeders



B12.5.1 Automatic spray water deluge systems

An automatic spray water deluge system shall be provided, e.g. for oil filled transformer, transformer-rectifier sets, and oil tanks, oil coolers, fuel packages.

Means for manual initiation shall be provided adjacent to the deluge valve for the system.

Oil tanks shall have a permanently installed top and side automatic spray water installation for cooling and fire protection as well as permanently installed foam-water extinguishing system for fire fighting (see below).

B12.5.2 Manual spray water deluge systems

A manual spray water system shall be provided to protect the rotor and stator of the regenerative air pre-heaters. The spray system shall be activated from the control room or from the air heater area.

B12.5.2.1 Foam-water extinguishing system

At least the following plant areas shall be protected with a separate and independent foam-water system:

- all fuel oil storage tanks and slop oil tanks



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- fuel oil pump station
- turbine oil room
- fire fighting pump house (diesel driven fire pump area)
- black start facility (as applicable)
- emergency diesel generators.

Foam concentrate shall be pumped from the foam concentrate storage tank by 2 x 100% foam pumps to foam proportioner skids. Pressurized water connection shall be provided to the eductor of each foam proportioner skid. In the event of fire, the foam system for respective tank shall be automatically activated on detection of fire by heat detectors. Water shall start flowing through the eductor where foam concentrate is induced and mixed with the flowing water in definite proportion.

High temperature causes breaking of one or more of the sprinkler circuit bulbs; as the sprinkler circuit, which operates as control circuit, is normally under pressure. As a result pressure in this circuit falls, causing the pilot valve to open and consequently the water is delivered from the nozzles. This continues until the valve is closed. The water output may also be actuated by operating the manual emergency release.

B12.5.2.2 Inert gas system

At least, the following areas shall be provided with an inert gas system or equivalent, to the approval of the local authorities and the Employer):

- steam turbine generator and exciter
- central control room
- local control rooms
- rooms adjacent to CCR
- UPS room
- battery room.
- Switch gear Building



The inert gas system shall consist of a battery of inert gas storage cylinders of adequate capacity and 100% reserve cylinders, which shall be located suitably at a centralized location. Discharge nozzles shall be provided on the gas distribution pipe network suitably located at the areas to be protected.

In the event of fire, the fire detectors shall initiate an alarm with coincidence (double-knock) principle (to limit false alarm gas release) in the local panel and main fire alarm panel. Simultaneously, the detection signal shall open the deluge directional valve automatically and the protected area shall be filled up by rapid injection of required quantity of inert gas through the pipe network and discharge nozzles to create a homogenous air/inert gas atmosphere.

The pipe network shall be connected to a gas manifold, through the above mentioned automatic deluge valve with manual override. The manifold shall be connected to a group of inert gas cylinders.



In case of gas release, personnel alarm system by way of bells and strobe lights above doors shall be activated.

Complete design and critical Components of this system shall be approved / listed by UL/FM/VDS/LPCB or equivalent.

The type of inert gas shall be in line with environmental norms of GOB and shall be subject to approval by BIFPCL during basic/detail engineering.

The applicable fire suppressant medium will have to be coordinated/ harmonized with the local fire brigade authorities and also reviewed during the basic/detailed engineering.

B12.5.2.3 Portable and mobile fire fighting equipment

Risk commensurate manual fire fighting equipment, portable or wheeled moveable trolley units, shall be provided. It shall be sufficiently in number and size for an fast and effective first fire fighting response. Depending on the type of fire load, adequate types of equipment and extinguishing agent shall be provided, among others:

- dry chemical fire extinguisher.
- hose reel foam units
- CO2 extinguisher
- AFFF (aqueous film forming foam) portable distinguisher,

Criteria for the selection of mobile fire extinguishers are among other the fire risk assessment, the fire load, the shortening of fire attack routes, the type of fire hazard. Only standardized fire extinguishers complying with local standards shall be used. The location, capacity, type, and number of portable and mobile fire fighting equipment shall be evaluated during detail engineering in order to adequately to cover the risk, and shall follow NFPA and local standards. It shall be described in the fire protection basic design report of approval by Employer and local fire authorities.

The following are typical and not necessarily the limit of those required:

1) Portable extinguishers

The following types of portable extinguishers shall be considered:

- a) Powder BC fire extinguishers, capacity
- b) Foam spray AFFF fire extinguisher, capacity 10 lt
- c) Carbon dioxide fire extinguisher, capacity 5 kg

Where extinguishers are mounted externally, or in other areas where they may be subjected to the weather, they shall be contained inside a protective cabinet.



The extinguishers shall be operated by means of a lever provided with a safety pin, which allows for the partial discharge.

2) Mobile extinguishers

The following types of wheeled extinguishers shall be considered:

- a) Powder ABC fire extinguisher, capacity 75 kg
- b) Carbon dioxide fire extinguisher, capacity 30 kg
- c) Foam spray fire extinguisher capacity 130 lt

Each powder unit consists of a powder container to which a carbon dioxide cylinder operating as propellant gas is attached; shall be provided with a 6 m hose with controlled nozzle. The powder unit shall be mounted on a metal frame with two wheels and a driving handle. Each carbon dioxide unit consists of a carbon dioxide cylinder, a hose, a control valve and a discharge nozzle. The cylinder and discharging devices shall be mounted on a metal frame with two wheels and a driving handle.

B12.5.2.4 Fire brigade and fire station equipment

The Maitree-STPP fire brigade shall be equipped with two (2) fire fighting trucks with foam/water tanks and one (1) ambulance car including all standard fire fighting and rescue equipment. The Contractor shall provide complete equipped Fire fighting trucks according to relevant national and international regulations.

The periodic inspections, checking and maintenance of the firefighting equipment until PAC shall be undertaken by the Contractor.

Description	Quantity
Portable gas indicator	3
Heavy duty handlamp	4
Breathing apparatus with cabinet	7
Dry powders transferring and refilling rig	1
Pneumatic vice for extinguishers locking	1
CO2 extinguishers filling and powder pressurization rig	1
Electric screwing-unscrewing	1
Hydraulic inspection unit	1
First aid kit	3
Paramedic standard equipment	2
Hose repair equipment	1
Fire fighting suits	5
Fire fighting blankets	10
Multipurpose nozzles	4



The vehicles shall be located in the fire brigade building which shall also house a command room, offices, staff rooms, a fully equipped medical station with a first aid room, workshops, stores, etc. and refilling units for portable fire extinguishers and breathing apparatus, as well as any other equipment required for the completion of the fire brigade building.

Fire safety instructions in the Bangladesh and English languages shall be provided in all zones.

The instructions shall clearly describe what personnel are required to do upon discovering a fire, hearing the fire warning signals or hearing the fire evacuate signals.

The fire safety instruction shall be specific to the zone in which they are located and marked with the zone number and name. Any special care required when using or maintain fire protection equipment within the zone shall also be indicated. The instructions shall be protected by glass or transparent plastic material secured in a metal frame in a prominent position within the zone.

B12.5.2.5 Fire exit signs

The fire safety sign described here shall consist of the words 'FIRE EXIT' in the Bangladesh and English languages, and where appropriate, directional symbol.

Fire safety signs shall be provided at all fire exits, entrances to stairways and all doors and corridors leading to fire exits or stairways, and shall have standby rechargeable batteries when it is installed inside the Building.

At junctions in corridors or other positions where the most direct means of escape is not clearly apparent directional signs shall be provided in addition to fire exit signs.

Directional signs shall indicate the most direct means of escape, and shall be made of the same material and affixed in a similar manner as the fire exit signs.

B12.5.3 Fire detection and alarm system

B12.5.3.1 Fire detection and alarm system general design



The whole plant shall be furnished with an automatic fire detection system, divided into individual alarm sections, including of Local Fire alarm control panels for each section connected to the Main Fire Alarm Control Panel. The purpose of the fire alarm system is to guarantee a reliable and fault-free early-warning system in the event of fire by means of automatically activated detectors or manual call points, so that orders for extinguishing the fire can be issued from a central point.

If the alarm is triggered by one of the installed automatic fire detectors, the alarm shall be indicated first in the control room and on the fire control panel and with delay at the control centre of the fire brigades. The delay time can be used by the control room personnel to ascertain the cause of the alarm or to reset it in case of a faulty activation.



The fire alarm system shall be designed in accordance with the relevant international standards and regulations especially NFPA 72 and DIN VDE 0833, and shall conform to the latest state-of-the-art in the field of fire alarm system engineering

The fire detection system shall be connected to an operator station at the CCR and to the repeater stations at the security/ gatehouse and the fire brigade house. Surveillance with fire detectors shall be provided for all areas of the plant. A fire alarm shall also trigger alarm sirens and sounders.

No restrictions on the proper functioning of fire alarm by reason of movement of air, optical radiation, smoke, dust, vibration, high humidity, etc. are acceptable. Moreover, fire alarms shall be located in the outgoing airflows of air-conditioning and ventilation systems.

The alarm signal receiving units must be so designed that by use of a standardized alarm unit socket, any of the types of detector may be used with equal facility on any of the fire alarm circuits

Detectors installed in inaccessible points such as cable ducts, false floors, cable basements, etc. are to be connected in parallel to external optical alarm indicators installed close by and in readily visible positions.

Detectors installed in false floors, suspended ceilings, cable ducts, air-conditioning or ventilation systems are also to be combined to form separate alarm sections.

Fire detection and alarm systems shall be arranged such that two circuits are provided, with a minimum of two detectors on each circuit. The operation of any one detector on either circuit shall initiate local "level 1" audible and visual alarms of fire repeated at the central control room. The operation of two detectors on different circuits shall initiate "level 2" alarms of fire and the following actions:

- shut-down of ventilation systems and operation of fire dampers to seal openings
- release of fire extinguisher within the enclosure.

The detectors shall be of the addressable type.

Gas detection is required for chlorination building and Hydrogen building. The term multisensory is defined among others in NFPA 72.

B12.5.3.2 Turbine hall area

The turbine hall area shall be provided with manual and automatic fire detection and alarm system utilising manual call points and combined smoke/heat detectors



The system in the turbine hall shall be suitably arranged to cover all lubrication and control oil areas – e.g. oil room, oil channels, main stop valves and turbine bearings and shall be provided with automatic fire detection and alarm system utilising flame and heat detectors and automatic fixed fire extinguishing system with alternative manual operation.

B12.5.3.3 Manual call points

Manual call points shall be of the break-glass type and shall be established in the whole power plant at emergency exits, accesses to staircases, doorways, exits on recognized access or escape routes and at hose reel stations.

They shall be painted red, with interlocking mechanism, to be reset by key.

If the push button of a manual call point will be pressed, an alarm shall be released and indicated immediately on the panel of the fire brigade control centre and on the fire control stations in the control room of the plant and the gate house.

B12.5.4 Detectors

The fire detector system elements and the associated mountings are to be provided with sturdy, corrosion-proof plastic housings.

The fire alarm detectors are to be provided with optical means for signaling their activation (e.g. light-emitting diode), and are to be suitable for the connection of an additional optical external alarm indication.

In the central control room the necessary automatic fire detectors are to be incorporated in the luminous ceiling.

Detectors belonging to a particular alarm section are to be incorporated in alarm lines, the automatic and manual fire alarms being connected via separate alarm lines to the common fire alarm central station in the central control room.

The fire alarm detectors shall reset ready for operation following each alarm, without outside intervention, and shall plug-in and be provided with suitable means to prevent unauthorized removal or disconnection and for connection to the fire alarm central station.

B12.5.4.1 Smoke detector



For early identification of visible smoke generation, consisting of photoelectric unit, alarm electronics, optical alarm indication, detector socket. Smoke detectors referred to in this Specification shall be of multisensor type and shall be incorporated into a probe sampling system.

Heat detectors referred to in this Specification shall be of the fixed temperature point type. The fixed temperature limit shall be 28 °C above maximum ambient temperatures.



Smoke/heat detectors referred to in this Specification shall be of optical beam type.

B12.5.4.2 Flame detector

For early identification of fire outbreaks and open flames consisting of: optical unit, alarm electronics, optical alarm indication, detector socket and variable response sensitivity.

Flame detectors referred to, in this Specification, shall be of the UV or black body immune solar-blind IR types.

B12.5.4.3 Thermo-differential and thermo-maximum detector

For early identification of fires as they break out with rapid temperature rise and little smoke generation, consisting of temperature sensor, alarm electronics, detector socket.

B12.5.4.4 Sirens and optical alarms

The personnel shall be alarmed and warned with acoustic and as far as necessary, e.g. in case of a high background noise level with optical devices.

Sirens for indoor and outdoor installation must be provided for warning the operating personnel.

The protection degree of the sirens for indoor and outdoor installation must be at least IP 54. The outdoor sirens are to be arranged on the boiler area, transformer area, tank farm etc. The arrangement of the indoor sirens must meet the requirements at site for satisfactory warning of the operating personnel, e.g. mounting in the turbine hall, pipe ducts etc. The control of the sirens shall be performed automatically by the fire alarm system, but manual operation from the central control room must also be possible.

B12.5.4.5 Central fire alarm station

The fire alarm central station must be housed in sheet-steel enclosed cabinets and located in the central control room or nearby in an appropriate location. Both optical and audible signals must be given when a fire alarm or fault alarm occurs.

Power supply for the fire alarm system shall comply with the requirements of NFPA 72 and shall be taken from the safe AC busbar. Emergency supply shall be maintained by a rectifier/battery set (1 x 100%), designed for four (4) hours discharge time.

The fire alarm central station is to be implemented in all-digital/ numerical electronic technology using plug-in units and assemblies on the modular

construction principle, and shall be accommodated in metalclad enclosed panels with type IP 31 enclosure for wall-mounted/free standing installation.

The fire alarm and fault annunciation system shall be designed with optical and audible alarms. Whereas the audible alarm must be resettable, the optical indication shall persist until the annunciation is finally extinguished or the fault cleared. If a fault warning is followed by a fire alarm annunciation, the fault indication must be stored and suppressed until the fire alarm condition has been cancelled.

Provision shall be made for clear audible identification of the alarm/fault signal. Furthermore, fire alarm signals and fault signals shall be strictly segregated.

An automatic fire alarm signal shall be triggered and transmitted externally to the central control room, gate house and the local fire brigade via a main alarm unit, inclusive of the digital communicator. The alarm lines to the fire brigade shall be continuously monitored.

The individual fire alarm lines and function lines of the fire-fighting equipment and facilities, as well as important functional groups of the fire alarm central station shall be continuously monitored for faults and breakdowns e.g. for:

- wire breakage of each alarm line
- short-circuit of each alarm line
- earth fault of the fire alarm system
- power supply system faulty
- main fuses and MCB's failure
- alarm modules disconnected from plug-in frame.

All fault signals shall be optically and audibly indicated.

For checking out the functioning of the complete fire alarm system including the fire alarm lines and fire alarm devices, testing facilities shall be provided. When testing a circuit, initiation of fire alarm warnings in external facilities shall be prevented. After testing, the tested circuit shall automatically reset to normal operation.

Simulation (e.g. test pins) of all relevant fault signals as listed above as well as of all fire alarms shall be possible in order to check-out the externally connected fire fighting facilities.

The fire alarm central station shall be provided with potential-free change-over contacts wired to a central terminal board as follows:

- contacts to control the fire protection doors.
- contacts to control the air-conditioning and ventilation equipment
- contacts for spare.



Activation of fire protection doors shall be signaled as a group annunciation to the fire alarm central station and included in the alarm annunciation system.

For recording all fire alarm and fault annunciations, control instructions and operator actions, a line printer shall be provided with the facilities for printing out the alarm line number, date and time of day in hours and minutes.

B12.5.4.6 Layout display board

For indicating fire alarm and fault annunciations from the fire alarm system, a layout display board has to be provided in the panel in the central control room. This board shall include a graphic display to show a simplified ground plan of the power plant and of the individual buildings and shall feature signal lamps for the separate optical indication of the alarm line, and shall include the annunciator with alarm test, reset and acknowledge buttons. Preferably a separate monitor with appropriate graphics etc. shall be installed. Additionally the gate house and fire brigade house shall be equipped with a display board.

For information and guidance of fire brigade a simplified graphic display board shall be installed in the power plant gate house and in the fire brigade house.

B12.5.5 Fighting and fire protection basic design report

In general, the arrangement, type and number of detectors, call points and alarms is determined by the by the room configuration (size, height, form of floor and roofing, etc.), the ambient conditions in the area to be monitored, the equipment to be protected and the type of combustible medium. Such details shall be determined and included in the fire fighting and fire protection basic design report.

B12.5.6 Fire water retention

8x



Spent fire fighting water shall be contained. The required retention volume shall cover the total water amount of the connected systems during defined operation time. This shall be achieved by respective thresholds and other up stands to form a containment of sufficient volume. Furthermore the rain water and fire fighting water retention basin shall be used to collect fire water from the drains of sealed outside areas (see also Section B9).

The total fire water retention volume shall be based on the fire fighting water demand and duration according to NFPA 850.

Tanks with flammable or hazardous content shall have a bund structure creating sufficient retention volume. In the assessment of the total fire extinguishing time where such tanks are involved in the fire, account shall



be taken of the collecting capacity present in this area including the volume of oil discharged in the event of a leakage.



Additional welding requirements for welding of civil steel structures are stated under Section B9.

B0.6.17 Mechanical equipment

B0.6.17.1 Pumps

General

All pumps shall be designed for continuous operation unless otherwise specified.

Pumps shall be installed in positions convenient for operation and servicing. Where multiple pump installations are required, each pump and its associated equipment shall be arranged in such a manner as to permit easy access for operation, maintenance and pump removal without interrupting plant operation.

Pumps installed for parallel operation or as stand-by sets are to be of identical design, i.e. interchangeable.

Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the pump and its components.

General design and construction

All pumps shall be designed to withstand a test pressure of 1.5 times the maximum possible pump shutoff pressure under maximum suction pressure conditions. If a pump can operate at sub-atmospheric suction conditions, the entire pump shall be designed for full vacuum.

All pump shafts shall be of ample size to transmit the maximum possible output from the prime mover. The pump shaft and coupling are to be so dimensioned that the maximum permissible torque of the shaft is higher than the maximum transmissible torque of the coupling. Directly coupled pumps shall be used preferably.

Renewable wear rings shall be provided at points of running clearance and shall be made from appropriate materials.

All pumps and accessories in contact with the pumped fluid shall be constructed of materials specifically designed for the conditions and nature of the pumped fluid, and be resistant to erosion and corrosion.

Product water flushing lines and drains are to be supplied for each pump handling the prevailing river water to avoid corrosion if the pump is out of operation for extended periods.

The pump glands or mechanical seals shall be so arranged that repackaging or fitting of replacement seals can be carried out with the minimum of disruption to plant operation. In case of operating under vacuum conditions liquid sealing is to be provided.

The pump casing shall preferably be split for ease of maintenance and be designed such that the impeller and shaft are capable of being withdrawn from the casing without disturbing any of the main pipework and valves carrying the pumped fluid. In general, all horizontal pumps with draw-out-rotors are to be fitted with a coupling to facilitate disassembly without removing the motor. Pull-out design of the shaft shall be applied to vertical wet pit and dry pit pumps as well.

Each horizontal pump shall be mounted with its drive on a common base plate of rigid construction. Vertical pumps are to be provided with foundation frames. In case of submersible pumps suitable frames shall be provided in the pump sump. It shall however be possible to remove these pumps without entering the sump.

Pumps must be carefully set to ensure that the net positive suction head available under all operating conditions will be adequate for the type of pump employed. The NPSH values are to be referred to the least favourable operating conditions - lowest atmospheric pressure, lowest level of water on the suction side of the pump, and highest temperature of the pumped fluid. An adequate safety margin of normally greater than **1 m to the max NPSH** required shall be provided unless and otherwise specified for specific pump. Pumps shall operate smoothly throughout the speed range up to their operating speeds. The first coupled critical speed must be at least 20% higher than the maximum operating speed. The determination of the shaft diameter and the distance between two consecutive bearings must include a sufficiently large safety margin to satisfy this condition.

Where necessary, the pumps are to be fitted with devices to ensure a minimum throughput.

Bearings

For large pumps the bearings shall be of automatic oil lubricated sleeve type, unless otherwise specified. Bearings on vertical shaft pumps shall be so spaced to prevent shaft whipping or vibration under any mode of operation. Vibration sensors and temperature measurements incl. temperature transmitters for continuous monitoring shall be provided for large pumps.

Bearings housings on horizontal shaft pumps shall be designed to enable the bearings to be replaced without removing the pump or motor from its mounting. Bearing housings on horizontal shaft pumps shall be effectively protected against the ingress of water, pumped fluid and dust by suitable nonferrous deflectors.

All bearing oil wells shall be fitted with visual oil level indicators. Non-pressure-oil lubricated bearings shall be equipped with constant level oilers.

Pumps characteristics

When several pumps are installed for the same service, they shall be suitable for unrestricted parallel operation.

The pump flow/head characteristics shall be such that within the operation range the head will continuously increase with decreasing flow, maximum head (shut off head) being at least 10% higher than the duty point head.

Unless otherwise specified all pumps shall be capable of operating at 110% of the rated capacity at the rated delivery head. Maximum size impellers for the pump body in question shall not be quoted for. **By installation of a new impeller a head increase of 5% minimum shall be possible.** The performance of the drive motor is to be determined according to the above mentioned technical requirements and to the requirements as specified in the electrical part.

Fittings

All pumps shall be installed with isolating valves, a non-return valve and suction and discharge pressure gauges unless otherwise stated. Accessible couplings shall be supplied with removable type guards.

Coupling halves shall be machine matched to ensure accurate alignment.

Couplings as well as gears must have a rated capacity of at least 120% of the maximum potential power transmission requirement.

All pumps other than submersible pumps shall have temporary strainers fitted in the suction pipework during all initial running and commissioning phases. Permanent strainers shall be provided where specified.

Venting valves shall be fitted to all pumps at suitable points on the pump casing unless the pump is self-venting, due to the arrangement of the suction and discharge nozzles. Drainage facilities shall be provided on the pump casing or adjacent pipework to facilitate the dismantling of pumps.

All positive displacement pumps shall be fitted with a discharge relief valve capable of passing the maximum pump delivery flow.

B0.6.17.2 Piping and accessories

Design criteria

The pipework shall be designed, fabricated, erected, inspected and tested on the basis of the applicable standards and codes, and the additional requirements as set out below.

For the plant water and cooling water system GRP is preferred, Bona-Pipe and coated carbon steel is acceptable. For saline water and the water treatment systems LPP piping will be accepted also. If a carbon steel system is offered, a cathodic protection system shall be employed for inside and

and alongside protection of human life to prevent damage not only to buildings, but also to electrical and electronic installations.

All buildings and structures are to be protected against lightning strikes by means of lightning collectors and conductors. The collectors are to be arranged in such a way that, as far as possible they collect all lightning strokes without these directly striking the parts to be protected. This condition is considered to have been fulfilled if no point on the roof surface is more than 5 m away from a collector. Collector lines suffice as collectors, e.g. along the ridge and at gables and eaves.

Ridge conductors must be taken right to the end of the ridge. Moreover roof conductors should run as natural continuations of all main conductors. Conductors at the gable extremities or eaves must be laid in the closest possible proximity thereto. In the case of steel-framed structures the ridge conductors must be connected to the roof supporting structure at least every 20 m. Lower level annexes are also to be provided with collectors.

Roof lines and other conductors are to be laid and fixed in such a way that they can withstand the stresses expected from storms, lightning strokes, roof work, etc.

One main conductor between the lightning collectors mounted on the top of the building and the potential grading ring laid in the ground is to be provided every 20 m of the before-mentioned lightning collector. The maximum spacing between conductor fixings may not exceed 1 m for horizontal runs and 1.2 m for vertical runs.

Lightning protection material

In case of buildings with steel structures and sheet steel cladding, the steel columns and the sheet steel cladding shall be used as lightning conductor. In case of masonry buildings or buildings with concrete structure, external lightning conductors made of copper or stainless steel shall be used. Lightning arrestors (arrestor tips and roof conductors) or Lightning air terminal shall also be made of copper or stainless steel rods. The conductor supports of the lightning protection system must be copper or bronze. Nuts and bolts at isolating or other points which are to remain detachable must be made of copper-nickel-silicon-bronze.



B0.6.18.7 Technical conditions for high voltage motors

If not specified otherwise all electric motors must be designed to meet IP 54 enclosures.

All motors with rated power (referred to 40° C ambient temp.) of 160 kW and above must be designed as HV motors.



B0.6.18.7.1 Constructive features

The following constructive features shall apply:

- a. Climatic protection provisions for mounting in the open in a humid and hot climate, Insulation class F. During operation at rated power of the driven machine, the motor insulation must only be stressed in accordance with the requirements of class B insulation.
- b. Motor parts made of iron internally and externally sandblasted and surface-protected.
- c. Paint finish resistant to chemicals and seawater.
- d. Bolts with adequate corrosion protection.
- e. All joint faces and gaps sealed.
- f. Anti-condensation heating to be switched into operation when the motor feed circuit is in the 'off' position. Heater supply power 'on' indicating lamp is to be provided.
- g. Special treatment of windings with resin impregnation plus immersion in varnish.
- h. Varnish-insulated laminations.
- i. Pressboard material protected by varnishing.
- j. For motor ratings the cooling air available at the specific location has to be considered.

All motors shall be either totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or closed air circuit air cooled (CACA) type. However, motors rated 3000 kW or above can be Closed Air Circuit Water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type.

- k. Condensation outlets to be provided at the lowest point in the housing.

Design and construction of the motors shall comply with IEC 60034-1, 60034-5 or VDE 0530 and DIN 40050.

B0.6.18.7.2 Electric features

The following electric features shall apply:

- 
- a. Motor rating to be at least 110% of the maximum required electric power consumption of the driven machine.
 - b. Continuous delivery of rated power at voltages of 90 - 110% of the rated voltage and allowable frequency range within the limits of thermal class F.
 - c. Rated power output at ambient temperatures existing at the particular site of installation and under continuous running conditions.
 - d. All motors shall be designed as 3-phase squirrel-cage motors suitable for direct on line starting. It must be possible, with 100% residual voltage, to switch them on to a large and stable power supply network without incurring damage or deformation. The motors must still be capable of



faultless running up to speed with a voltage drop to 80% of rated voltage and rated loading.

However, 75 % starting voltage shall be allowed for motors above 4000 kW.

Mill motor being high starting torque motor, is specially designed and shall be suitable to operate at 85% rated voltage for 1 minute only, provided that the mill motor is suitable for starting/running with voltage variations for which aux. power supply system is designed.

- e. Motor starting current must not exceed 5.5 times rated current (referred to motor rating at 45 °C ambient temperature) for motors up to 2 MW and must not exceed 4.5 times rated current (referred to motor rating at 45°C ambient temperature) for motor ratings above 2 MW. The voltage drop at direct-on-line starting should be limited to 20% at the motor terminals except rating above 4000 kW. However starting of any motor shall not cause tripping of any other consumer. However, Bidder/Contractor is free to design his system with starting currents up to 600% maximum.
- f. From the cold state four consecutive starts up to full speed must be possible. The second start must be possible immediately after the first start, the third 20 minutes after the second, the fourth 20 minutes after the third.
- g. A minimum frequency of starting cycles of 1000 per year must be guaranteed.
- h. In general, motors must be capable of running without overheating when subjected to three consecutive starts within one hour after having run for an extended period on a voltage of 95% nominal voltage. Thereby the second start must be possible immediately after the first start and the third 30 minutes after the second start. In individual cases where operation depends on signals from pressure switches or other such sources, then a more severe duty with respect to the frequency of starting cycles per hour shall be necessary and the design of the motors must be carried out accordingly.

B0.6.18.7.3 Protective features

The following protective features shall apply:



- a. High voltage motors must be fitted with measuring points for the determination of slot and bearing temperatures.
- b. Six Pt 100 resistance thermometers (2 per phase) are to be provided for slot temperature measurement, and a double thermocouple or resistance thermometer per bearing must be provided for bearing temperature measurement. Type of temperature elements shall be finalized by the manufacturer.
- c. Each Pt 100 shall be connected, potential free, to a terminal strip. The connections to the thermometer as well as the associated over-voltage cutouts shall be brought into separate terminal boxes.



- d. Where motors have closed-cycle cooling, temperature-measuring points must be fitted in the cold air stream.
- e. The winding temperatures have to be detected with RTD's at high temperature and alarm to be produced, at extra high temperature the motor to be tripped.
- f. All motor gaps and joints between it and other units must be sealed.
- g. Earthing clamps at both sides of the stator have to be provided.
- h. All HV motors bearings shall be equipped with vibration sensors for vibration monitoring.

Considering the rating of CHP HT motors vibration monitoring is not required. For Coal Crushers vibration isolation & monitoring shall be provided.

- i. Temperature transmitter to be provided for all temperature measuring devices.

B0.6.18.7.4 Other features

Terminal Boxes

The main terminal boxes on the high voltage side shall be provided with a pressure relief joint for the purpose of reducing the danger of an accident as a result of short-circuits, and shall be fitted with a terminal block suitable for any desired type of connection.

Cable connecting boxes must be longitudinally divided to facilitate fitting of cable sleeves and end caps. Protection class shall be IP 55.

Inside the terminal box an earthing clamp for connection of the cable shield must be foreseen.

The opened terminal boxes must have provision for local earthing to be carried out.

All terminal boxes shall be provided with a removable undrilled gland plate. The gland plates shall be of non-magnetic material if single core cables are to be installed.

Connections, star-point terminal boxes etc.

All motors must have the star-point connection brought out separately to terminals.

For all motors with a rating of 2000 kW or above a differential relay for winding protection shall be provided and installed in the associated switch-gear. In that case the star-point connection shall be brought out separately to terminals. The differential current transformers are to be designed to class 5 P10 with a rating matched to the protection system. The CT's shall be accommodated in the star-point terminal box.



Coupling

The motor shaft halves of the couplings, finish-bored, balanced, and complete with key ways are to be drawn on to the motor shaft and balanced out together with the rotor.

Cooling

Air cooling for the motors is the preferred method. Where water-cooling is applied, conditioned and treated, water shall be used.

Motor air exchanger circuits should be suitable for the prevailing atmospheric conditions, i.e. ambient temperature, content of humidity and salt in the air, etc. are to be considered.

Running quality

The running quality must be within the classification of "Class C, Zone A" according to the ISO 10816-1 or equivalent, i.e. the vibration velocity must be not greater than 1.8 mm/s (rms).

Reverse speed

If reverse running, can occur in the case of equipment driven by a motor (e.g. cooling water pump), the motor must be designed for maximum, possible reverse speed.

A reverse rotation alarm and starting-circuit interlock are to be provided to ensure that the equipment cannot be started while running in reverse.

Lubrication

All MV and HV Motors shall preferably be equipped with on-line lube oil purification and auto-grease facility. These systems shall preferably be procured from one single manufacturer.

The above requirements of the specification to be considered only as a preferred solution. However OEM recommendation will be accepted.

B0.6.18.8 Technical conditions for low voltage motors

If not specified otherwise all motors must be designed to meet IP 55 enclosure according IEC60034-5.

All motors with rated power (referred to 40 °C ambient temp.) less than 160 kW must be designed as LV motors with premium efficiency class IE3.

The equipments which are only operating for short period shall not be covered under IE3 such as:

- a) Sootblower Motors- operates only during sootblowing sequence
- b) Seal air fan motor for damper sealing operation-operated only during maintenance.

B0.6.18.8.1 Constructive features

The same features as for high voltage motors shall apply.

Anti-condensing heating shall be provided for motors of 55 kW and above.

B0.6.18.8.2 Electric features

All motors shall be designed as 3-phase squirrel-cage motors suitable for direct on line starting.

The motors must be capable of being switched on to a large and stable network and with phases in opposition.

The electric features a), b) and c) of high voltage motors also apply here.

Motors starting current must not exceed 7.0 times rated current (referred to the motor rating and 45 °C ambient temp).

The Starting current of LV Motor (IE3) shall be inline with IEC 60034-30. Applicable de-rating factor for design temperature of 45 Deg C shall also be applied.

B0.6.18.8.3 Protective features

An earthing clamp inside the terminal box has to be provided.

B0.6.18.8.4 Other features

Cable leads

All cable connecting boxes are to be designed to meet the requirements of IP 55 or IP 58 protection class respectively.

The cable connecting boxes are to be installed easily accessible on the motor. The connecting boxes must be capable of being turned by 90° or 180° and of being opened up longitudinally. The connection boxes are to be fitted with a terminal block.

Shafts

Where not otherwise specified, motors must be fitted with a free shaft end.

Protection against explosion hazards

Low-voltage motors, which are to be installed in areas exposed to the risk of explosion, must comply with the rules laid down in VDE 0165/0170/0171 for explosion-proof design in relation to the flash-point group classification for the particular explosive mixture.

- local control and lamps as listed above for local control cabinets, for each motor

B0.6.18.16 Terminal boxes and terminal cabinets

In order to minimize the amount of cables and distribution of signals and to centralize connections in the Plant, terminal boxes or, wherever necessary, by larger amounts of terminals, terminal cabinets shall be fitted on all the necessary

- cable crossover terminal points
- central collecting points for individual analog and binary signals and local transmitters
- signal collecting and distribution points for fire alarm, telephone, loudspeaker and clock system
- central distribution points for local signals.

Terminal boxes and cabinets must at least have class of protection IP 54 if installed indoors and IP 55W if installed outdoors and must be equipped with the necessary terminal strips, cable glands and fittings components for the connection of the cables.

The necessary earthing terminals are to be provided for the earthing of the boxes and cabinets.

In any area subject to the danger of explosion, the necessary explosion-protected terminal boxes and cabinets are to be provided in accordance with IEC 60079 and IEC 61241 and VDE 0165/0170/0171.

B0.6.19 Instrumentation and control equipment

B0.6.19.1 Main design criteria

This Section applies to the design of the general Instrumentation and Control equipment. The following general requirements shall be strictly observed with regard to design and execution. In the event of contradictions the Contractor shall be responsible for obtaining written clarification from the Employer/Engineer.

Reference within this Section does not automatically indicate that the particular form of instrumentation is required on this project or will be acceptable for a particular application. The particular requirements for control and instrumentation shall take preference in the event of any disagreement between the two Sections.



Only requirements for technical performance of the equipment are stated herein, whilst the detailed requirements of the tasks to be performed by the control systems and the scope of delivery for each individual item of plant is stated in the relevant Sections of this specification.

This specification does not however relieve the Contractor of his responsibility for the basic design and execution of the instrumentation and control system per scope of supply in relevant Sections of this specification. The rules of good engineering practice and the relevant approved standards and regulations shall be observed.

A consistent instrumentation and control philosophy shall apply throughout the Plant and shall be implemented in terms of a range of equipment exhibiting a minimum diversity of type and manufacture. The objective shall be to standardize all measurement and control equipment throughout the Plant in order to rationalize operation, maintenance and reduce spares holding.

Generally equipment shall be supplied from one composite range of measurements and control equipment as marketed by a reputable manufacturer of international standing and shall have a minimum of two years operational use on similar projects. Where particular equipment is not included in the products of the manufacturer thus necessitating diversity of supply, this equipment shall be identified by the Contractor. The equipment shall be of modern, compact design incorporating the latest developments in proven technology. All instruments whether for local indication or remote transmission shall be of good quality and shall have an accuracy and repeatability appropriate to their duty. All fittings shall use metric threads.

Measurement and control instruments shall be matched to the main plant equipment ratings in all aspects. Instrument ranges, installation codes of practice and precautionary measures for safety of the Plant and the operating and maintaining personnel shall be observed.

Special attention shall be paid to the Plant safety. As a general rule, measuring points and measuring equipment for critical protection shall be separate from and not combined with measuring equipment for the automatic control equipment.

The material of all equipment installed in pipes, tanks, etc., shall correspond to the material of the relevant pipes, tanks etc. and shall fully meet the requirements regarding safety and operational conditions of the media to be measured. All the equipment shall be suitable for the location in which it is to be mounted and in particular all outdoor equipment shall be suitable for the prevailing climatic conditions.



The diversity of makes and types shall be kept to a minimum. The Employer/Engineer reserves the right to stipulate make and type following award of contract.

Any equipment to be installed within potentially explosives atmospheres shall comply with the requirements of international standards and codes, e.g. IEC-60079, NEC 500 etc.

The instrumentation and control equipment shall have high electro-magnetic and radio frequency interference immunity and shall not be affected by portable radio transmitters operated in the vicinity of the equipment. Any limitations shall be stated.

All instruments shall be protected by cases. The cases shall have enclosure classification not less than IP 42 according to EN 60529 when mounted indoors in totally enclosed rooms with provision for limited ingress of dust, IP 54 else in a enclosed building and IP 55W for mounting outdoors.

Electronic instruments shall not be located close to hot lines, vessels or other hot equipment. Ambient air temperatures exceeding 80 °C shall not result in calibration difficulties or rapid deterioration of electronic components.

B0.6.19.2 Distributed Digital Control, Monitoring and Information System (DDCMIS)

The Plant will be controlled generally through a DDCMIS. The DDCMIS contains of process stations, operator workstations, engineering workstations, archiving facilities and signal exchange to management and third party systems. In general the DDCMIS will be DCS based hardware only in some exceptions PLC based systems may be applied.

For detailed technical specification and design requirements please refer to **Section B8** of this technical specification.

B0.6.19.3 Programmable logic controllers

Programmable logic controllers (PLC) shall be deployed in subsidiary installations and systems of higher complexity and shall provide a more open access for operation. Standard products of PLC manufacturers shall be used for which software developed by the process suppliers and proven for the specialized process is available.

The diversity of makes and types shall be kept to a minimum. The Employer/Engineer reserves the right to stipulate make and type following award of contract.



The use of auxiliary packages with PLCs or local controls for ancillary plants or systems shall be limited and minimized. Only some special cases can be considered subject to the Employer/Engineer's approval. Typical and acceptable reasons for a specialized control system can be high speed of response or special safety requirements, which may require a separate safety-related system.

For signal exchange with the main DCS, PLCs shall be compatible with this system. Depending on the amount of information to be exchanged, parallel or serial interfacing shall be considered. The sequence of events signals should be directly physically connected to Sequence of Events Recording System (SER).

If only few signals are to be exchanged, parallel interfacing is preferred. Binary signals shall be exchanged via volt free signals. Analogue signals (4 - 20 mA) must be suitably decoupled.

If serial interfacing is used, the interface equipment between the PLC and the DCS must be capable of communication using an industrial standard protocol. The transmission baud rate shall be selected dependent on the application (minimum 19200 baud or higher). If commands are issued from the DCS to the PLC, the time between operator command input and PLC signal output shall not be more than 1.5 seconds. The same requirement goes for answer back signals from the PLC and updating of displays of analogue values coming from the PLC on the DCS monitor displays.

As a minimum requirement, the offered serial link shall have a data integrity checking and retransmission facility in case of error detection, independent of the DCS or external system software. Hardware and software failures during data transmission shall be monitored and alarmed onto the DCS.

The communication link shall be redundant. In case of failure in the communication, quick manual automatic switch-over to the standby communication link shall be possible with automatic switchover and fault reporting and diagnostic facilities.

The functions realized in the PLC and the method by which they are invoked shall be represented graphically similar to IEC 61131-3.

Additionally, a verbal program description supported where required for easy understanding of complex functions with functional diagrams according to IEC 60848 shall be provided.

Programming devices with keyboard, VDU and printer for ease of programming, effective on-line monitoring and diagnostic functions, together with the necessary equipment to write in and to erase EPROMs shall be provided.

The Contractor shall guarantee that spare parts for the offered PLC system will be available for at least 15 years after commissioning of the Power



Plant as well as upward/forward compatibility for future upgrades of the system. If necessary, the Contractor shall provide successive system upgrades to ensure spare part compatibility for that time span.

For local operation and monitoring a panel or desk mounted Human Machine Interface (HMI) unit, operable by keypad or touch screen with LED-displays shall be provided. Protection class of panel mounted HMI (front side) shall be IP 22 according to IEC 60529.

B0.6.19.4 Control cubicles

DCS, PLC hardware and other associated control equipment shall be installed in suitable control cubicles. The cubicles shall be set up in local switchgear/ electronic rooms (CER or LER) or in local control centers (LCC). The protection class required is specified under **Section B0.6.18**.

Outdoor installed cubicles shall be provided with thermostatically controlled heating elements in order to prevent the formation of condensate which may occur due to large variations of ambient conditions, if necessary. Adequate lighting and sockets for hand tools protected by 30 mA Residual Current Differential Switch (RCDS) shall also be provided for cubicles and panels, if necessary.

The cubicles shall be secured in such a way that failure of one node cannot cause the failure of the whole system.

The required control elements and displays (annunciation and status lights, analogue displays, switches etc.) shall be so configured that as far as possible they can be viewed from the associated secondary system. Should it be necessary to place the control and monitoring elements in the field, these shall be installed in separate, robust housings (protection class IP 55W). All alarms/ annunciations shall as well be available in DCS.

In preference LED displays shall be used. Ease of access and operation of the equipment shall be ensured.

Visual display unit (VDUs) will be employed for field operation and monitoring.

All cubicles shall be adequately ventilated in order that the heat generated by the equipment mounted there shall remain within the specified limits, even in the case of high ambient temperatures that may occur in the event of failure of the air-conditioning system.

Locally installed cubicles shall be suitable for the location in which they are situated and shall provide adequate protection against dust, moisture or mechanical damage for the equipment mounted therein. Cubicles shall be designed in such a way that vibrations of the building shall be absorbed to a large extent. Sunshades shall be provided for all cubicle located outdoors.



Cable connections to cubicles, panels and desks shall be made via suitable seals so as to prevent the ingress of dust, vermin or the propagation of a possible fire. During installation period, a provisional sealing of cable penetrations shall be ensured.

B0.6.19.5 Racks, junction boxes

Marshalling racks

Separate cubicle type marshalling/ termination panels shall be provided, i.e. field signals shall not be terminated in the rear side of the system cabinets.

Open type racks constructed of angle steel may be used for the marshalling and termination of low voltage control cables within the Central Electronics Rooms (CER & LER). Cubicle type marshalling racks may also be considered.

For voltages exceeding 60 V, a suitably separated Section with isolation cover shall be provided.

Instrument racks

Wherever possible, instruments and devices, e.g. transmitters, thermo element cold junctions, terminal boxes, located in the field, shall be mounted on local instrument racks. The instrument racks shall be installed with due regard to control engineering needs, material-saving assembly and easy accessibility for maintenance and checking work, and shall be constructed of standard angle Section steel.

Junction boxes

In order to simplify local collection of cables and distribution of signals and to centralize connections in the Plant the junction boxes shall be fitted on all the necessary:

- cable crossover terminal points,
- electrical actuators,
- central collecting points for individual analog and binary signals and local transmitters,
- central distribution points for local signals.

The necessary intermediate terminal boxes must at least have degree of protection IP 55 in accordance with EN 60529 and must be equipped with the necessary terminal strips and attachment components for the connection of the cables. The necessary earthing terminals shall be provided for the earthing of the boxes. In hazardous areas, terminal boxes shall be in accordance with EN 50019 or 50020, depending on zone classification.

After commissioning, the junction boxes, marshalling racks, instrument racks, etc. must contain at least 10% of spare space. The Contractor shall furthermore provide at least 10% of fully fitted spare terminal capacity.



B0.6.19.6 Mimic diagrams

Mimic diagrams shall be offered where specified or alternatively where their presence would assist Plant operators in assimilating the operational state of the Plant.

Where used, the mimic diagram shall harmonize with the other equipment in the control room. Mimic diagrams shall be of the mosaic type.

On mimic diagrams for electrical systems, the different voltage levels shall be distinguished by the use of mosaic elements having an inlaid coloured strip. These elements shall be fitted together to show the location of the different busbars. The operational position of circuit breakers and isolators shall be indicated by semaphore indicators, and the operation of switchgear from the mimic diagram shall be by means of discrepancy switches or pushbuttons designed to operate in a similar manner.

On process mimic diagrams, methods shall be used to clearly indicate the path of the various media, the preferred technique being by means of raised plastic strips which shall have a distinctive colour. Also a uniform scheme of colours for different media shall be adopted.

Where pushbuttons are proposed for operation, enabling pushbuttons shall also be provided and it shall require the operation of both the pushbutton actuating the device and the enabling pushbutton to operate the device.

The Contractor shall propose the mimic colour code for process and electric system identification of the P&ID and electric single line mimics in the VDU or mimic panel.

B0.6.19.7 Power supply and fusing

The power supply for the equipment requiring uninterrupted supply (UPS) (e.g. emergency valves, flame monitors, measuring and control system, recorders, printers, VDUs, OWS and servers) shall be taken from the safe AC as described in other parts of the specification, especially **Section B0** and **Section B7**.

The 24 V DC independent supply systems shall be provided for the control cubicles of independent control systems. Ni-Cd or lead-acid planté batteries shall be used in the main plant area whereas in offsite plant areas only Ni-Cd batteries shall be used.

The 24 V DC systems shall consist of 2 sets of power supply with each set consisting of 1 x 100% battery charger, 1 x 100% batteries for 1 hour duty and 1 x 100% DC distribution board.



Each individual consumer shall be provided with an infeed from each set with diode decoupling at the consumer.

The supply voltages for the control cubicles within the central electronic rooms (CER & IER) shall preferably be 24 V DC and must be arranged as separately fused double infeeds. The individual feeders can serve either a single cubicle or several cubicles combined as a logical group.

Intelligent Battery health management system shall be provided for each set of 24VDC power supply system and UPS batteries (except mini-UPS). It shall be connected to DCS.

All battery systems shall be provided with a manual discharge resistance bank.

All equipment shall be adequately protected against overcurrent by means of fuses or other current protection devices. The main power supply fuses shall be located in functional groups within separate power distribution cubicles. Fuse ratings and time characteristics shall be such that in all cases, a fault within an individual item will cause the fuse associated with that item to rupture and thus disconnect that item from the power supply, before the main fuse is affected.

Failure of a main fuse shall affect the overall operation of the Plant as little as possible and shall be indicated in the central control room (CCR) by means of an alarm. This alarm shall state the identity of the failed main fuse.

Failure of an individual cubicle, module or component fuse shall be indicated by a general alarm and a detailed diagnostic message. The Section of the control cubicle in which the fuse is located shall be indicated. It shall also be possible to locate visually the fuse that has failed.

The design of the electrical power supplies and fusing system must ensure that any faults in modules or other devices, which may block sequence logic interlocks, automatic control systems or other control systems, are restricted to the system in which the fault has occurred.

All electronic devices shall be protected against transient voltage levels which would otherwise damage the device.

B0.6.19.8 Transmitters

All transmitters shall have an impressed output signal of 4 - 20 mA corresponding to zero to full range input. However, digital communication shall also be acceptable.

Generally, 2-wire transmitters shall be used. If for some special purposes (e.g. analyzers) 230 V AC power supply is required, the output circuit shall be isolated.

As far as possible, all transmitters shall be of the SMART-type. This applies also to field mounted temperature transmitters.

All transmitters shall be fitted with a local analog or digital indicator displaying appropriate physical units which may be read clearly from an easily accessible position.

Transmitters with accuracy class "0.5" or better must be used. The repeatability shall be within a range of $\pm 0.1\%$ of full span.

The output signal of all transmitters must be independent of the burden of the transmitter output circuit including cable resistance over a wide range.

The removal of connected devices must not open the transmitter output circuit or cause malfunction of this circuit. In the case of failure and return of the supply voltage within a measuring circuit, no false signals endangering the system shall be issued. All transmitters shall be individually fused. If not specified otherwise, local parameterization at the transmitter or via modem and PC/laptop or hand held communicator using HART-protocol shall be possible.

For the continuous remote position indication of valves, dampers etc. also transmitters with impressed output signal of 4- 20 mA shall be employed.

All transmitters shall be suitable for field installation and shall have strong, moisture and dustproof cases of IP 65 or better according to EN 60529. This applies also for temperature transmitters when installed in the field.

Diaphragm seals shall be provided to serve as a barrier for corrosive process fluids, slurries or highly viscous oils. The seal shall be of the flanged type, suitable for the same conditions as those for the transmitter. The material selection shall be according to the requirements of the fluids to be measured. The seal shall be provided with a flushing connection.

Transmitters to be used in hazardous areas shall be explosion proof. Suitable intrinsically safe circuits are to be provided in accordance with EN 60079-11.

All transmitters potentially subjected to vacuum shall be capable of withstanding 100% vacuum without damage.

No stress shall be imposed through the connections between Plant and the transmitter. As far as possible, the transmitters shall be grouped together into enclosed racks or panels for easy access. Sunshades shall be provided for all outdoor panels.

Individually installed transmitters shall have their own weather proof enclosure of robust construction and be suitable for the proposed

environment. All field equipment terminals shall be wired to a terminal box using screwed connections.

Transmitters shall be provided with all necessary isolating, vent and blow-down valves and facilities shall be provided for the connection of test instruments at the input and output of each transmitter, to enable calibration to be carried out.

In general limits (for alarms or switching actions) shall be derived from the analogue measurement value in the DCS (use of switches shall be avoided). Where binary signals cannot be derived from an analog value, **binary transmitters** e.g. temperature switches, pressure switches etc. may be used. Indicators with integrated limit switches are allowed within package units. Preferably limit switches shall be of the proximity type. All switches shall be of robust design and reliable performance. Temperature switches, pressure switches, level switches, and etc shall be of the snap-action and change over type. The switches shall have an adjustable switching hysteresis. Parity checks shall be supplied for switches. (Note: Parity checks refer to the supervision of switches, i.e. it shall be supervised that switches have one defined state and are not undefined e.g. neither open nor closed. Finally this means that there have to be 2 DI to be used for each switch, one for "open" detection and one for "closed" detection.)

The set point and the deadband (reset point) of each switch shall be adjustable from inside the case, over the full range specified. The set point and reset point shall be indicated on the adjusting mechanism.

For the sensing of level in tanks, vessels or bunkers float switches, vibration level switches or other suitable switching devices with conductive or capacitive electrodes shall be provided.

For monitoring of machine coolant or lubricant flow (dry running protection) suitable flow or level sensors shall be employed.

The switches shall be housed in robust, dust and moisture proof cases having glanded cable entries and shall be suitable for the ambient conditions local to the equipment on which they are mounted.

B0.6.19.9 Temperature measurements

Glass thermometers, hi-metallic and capillary remote thermometers are used for local temperature measurement. For both, class 1.0 shall be provided.

Glass thermometers are to be inserted into pockets provided for the purpose. The use of mercury is forbidden.

Capillary remote thermometers shall be with a case diameter of preferably 160 mm and must be mounted on fixtures or instrument panels in such a



way that they are protected from vibration, jarring and sprayed water. The capillary tube must be laid in a protected position.

If possible, resistance thermometers (Pt-100) in accordance with IEC 60751 shall be used for remote measurements. All resistance thermometers shall be wired according to the four-conductor principle.

Otherwise, thermocouples with appropriate heat resistance in accordance with DIN IEC 60584-1 or equivalent may be used for remote measurements.

All thermocouples shall be of the quick response type, ungrounded and preferably of double element type.

Thermocouples shall be arranged in such a way that the ambient temperature of the head is lower than 100 °C, and that the measuring inserts can easily be exchanged.

All thermocouples and extension leads shall be terminated with a suitable gland and the conductor to sheath resistance shall be greater than 100 M-Ohms when tested after termination.

Thermometers and thermocouples shall generally be fitted in protective wells. They shall be provided with weatherproof terminal heads and shall be installed so as to totally prevent the ingress of foreign matter.

High speed response pockets shall be provided for all applications involving control of critical process temperatures. Thermowells with high speed of response shall be used.

Where more than one temperature measurement e.g. for redundant loops, recording, indication, automatic control is to be made at one location, individual protective wells with sensors shall be provided at the common place of measurement. Protective wells for unoccupied test measuring points shall be arranged with the opening inclined downwards wherever possible and shall be provided with a screw-on protection cover.

Insofar as local conditions or extreme temperature do not require otherwise, screw-in immersion wells for exhaust gas and air shall meet the following requirements:

- nominal length not less than 0.5 m
- attachment of the well in the wall of the exhaust gas channel or air duct must be gas-proof.

For the measurement of temperature of other media the following requirements shall be observed:

For all pipework a minimum immersion depth of 55 mm in the internal pipeline cross-section and a minimum distance of 15 mm from the opposite



pipe wall must be provided. If the diameter of the pipeline does not allow the thermometer to be inserted perpendicular to the pipe axis while still maintaining the above mentioned measurements, another solution must be found in cooperation with the Employer/ Engineer. When determining the lengths of the insertion and connecting tubes the insulation thickness is to be taken into consideration.

For all remote temperature measurements (i.e. for RTDs and TCs) transmitters shall be installed locally in a transmitter protecting box on a DIN rail.

B0.6.19.10 Pressure measurements

Pressure gauges of class 1.6 or better must be used. The standard measuring ranges must be selected with regard to the maximum operating pressure.

A pressure instrument installed for measurement of steady pressure at varying pressure shall operate in a band centered on 60% of its maximum range.

When the pressure impulse line is liquid filled the measuring unit shall be compensated for static head. The head correction shall be stated on the unit.

Pressure gauges shall have a dial size of 160 mm and shall be located in such a way that they can be easily observed or shall be combined in groups on local gauge boards or cubicles.

Pressure gauges shall be resistant against vibrations. Furthermore, pressure gauges shall be designed in such a way that the measured value may reach the end of the indicating range without affecting the calibration of the gauge.

Pressures to be remotely indicated, recorded or used for automatic control loop inputs shall be measured by means of pressure transmitters (refer to relevant part of Section B0).

Pressure measurement tapping points shall generally be in accordance with the specification for the pipeline in which they are installed and shall be equipped with one, and for high pressure installations (45 bar) two, isolating valves arranged directly at the tapping point. Excluded from this stipulation are measuring points for vacuum and measuring points for combustion air and exhaust gas.

Piping shall be of approved quality and sized for the particular service. In all cases the pipe size shall be chosen to ensure strength and freedom from blockage. Instrument impulse pipework shall be manufactured from a suitable grade of stainless steel to the approval of the Employer/Engineer.

Pressure transmitters for remote measurement shall not be mounted directly at the tapping point, but shall be arranged at a distance from the tapping



point by means of enclosures. The impulse line between tapping point and transmitter shall be arranged in such a way as to form a siphon loop, when steam pressure measurements are involved.

A valve combination or multiway cock shall be provided directly on each pressure gauge or transducer connection. They shall be equipped with a connection for test gauges, and it shall be possible to shut off the test connection without isolating the service pressure gauge at the same time.

Open blowdown / drain connections shall not be arranged within panels and local equipment. Instead it shall be led to a drain external to the panel. All valves shall be installed so that they are accessible for in-situ maintenance from a floor or permanent structure landing.

Transmitters are to be protected from the measuring media, if required.

In addition to the above requirements, special valve block equipment shall be provided, where differential pressure is to be measured. Alternatively, differential pressure type transmitter can be considered.

B0.6.19.11 Flow measurements

Remote flow measurements of water, steam, combustion air, flue gas etc. shall, unless otherwise specified, be carried out by means of differential pressure, ultrasonic, electromagnetic, annubar, coriolis, turbine meters, oval-wheel flow meters.

The transmitters shall be as specified under Section B0. Changes in density, pressure or temperature of the measured medium shall be compensated wherever necessary.

Tags on orifice plates shall be stamped with the basic design information (i.e. flow rate, pressure and temperature of the passing fluid, the orifice diameter and the pressure differential generated).

Primary elements such as orifices or nozzles located in steam or high pressure feed water pipes shall be of the weld-in type. Material, dimensions and installation of orifices, nozzles and tapping points etc. shall be in accordance with the specification for the pipes in which they are installed.

Orifice Plate installation using Weldneck Flange assemblies shall be offered. Tappings shall be on the flange and not on pipe.

Isolating valves shall be provided at the tapping points of the orifices, nozzles. In the case of steam flow measurements condensing vessels (steam traps) shall be provided between the tapping point and the isolating valve.



The material and dimensions of the piping shall conform to those laid down for the piping concerned. The welds shall be executed in such a manner as to avoid turbulence that can affect the measurement.

In order to achieve exact installation, the vendor supplying the orifice plate or nozzle for high pressure pipes shall install the orifice plate or nozzle in its own works in a Section of pipe of about 3.5 times the pipe diameter (1.0 x NB in the outlet, 2.5 x NB in the inlet). For orifice plates or nozzles installed in pipes with a nominal bore smaller than 80 mm, complete meter runs shall be supplied.

Orifice plates and nozzles shall be manufactured of ANSI 316 Stainless Steel unless specified otherwise. Orifice plates shall be sized according ISO 5167-2.

Orifice plates shall be sized for a d/D ratio not less than 0.20 and not greater than 0.70. Higher rather than lower d/D ratio are preferred to minimize line restrictions. All sizing calculations shall be submitted to the Employer/ Engineer for approval.

Tags on orifice plates shall be stamped with the basic design information (i.e. flow rate, pressure and temperature of the passing fluid, the orifice diameter and the pressure differential generated).

Venturi tubes according to ASME MFC-3M shall only be considered when operating economy requires low permanent pressure losses.

The erection welding seams shall be executed in such a manner that no turbulence, which will affect the measurement, can occur.

Rectangular venturi tubes may be considered where other measuring devices are impossible or impractical (e.g. in large rectangular air duct of boilers).

For flow measurements in LP-systems e.g. water or condensate, orifice plate installation using slip-on orifice flanges shall be provided. All orifice plates for installation between flanges shall have their own tapings for differential pressure measurements incorporated in the plate. Simple orifice plates with the tapings situated in the pipe are not allowed. The flow direction shall be consistently marked on the orifice or nozzle by means of an arrow.

Special conditions may dictate the use of devices such as:

- venturi tubes for low pressure gases
- pitot tubes such as Annubar.

Ultrasonic flow sensors shall provide a double transmitter/ receiver system and be for installation with a calibrated pipe. The tube lining material shall be as required for the fluid and its temperature and be as specified in other chapters of this Section B0. The use of ultrasonic clamp on flow meters shall be avoided and requires dedicated approval of the Employer/ Engineer.



The accuracy shall be 1% of the calibrated span. An overpressure security shall be provided of 50% above the maximum pressure range.

Electromagnetic measurements may be used for flow measurements of inhomogenous liquids with or without solids content in completely filled pipes. The limits of application of the measuring system due to the medium parameters planned on a case-by-case basis shall be observed. Inductive flow sensors shall be of alternating field or pulsating DC field type and be for inline installation with a pipe.

The tube lining material shall be as required for the fluid and its temperature and be as specified in other chapters of this Section B0. The accuracy shall be 1% of the calibrated span. An overpressure security shall be provided of 50% above the maximum pressure range.

Coriolis measurements shall be used for mass flow measurements of homogenous liquids and gases without solids content in completely filled pipes, in particular for natural gases, fuel oils and solvents as well as other media with fluctuating densities. The accuracy shall be typically at 0.5% of the measured value.

B0.6.19.12 Level measurements

Where detection of discrete levels is required, the simple float operated switch should be used, however each switch shall have snap action with limited hysteresis to prevent contact bounce caused by small fluctuations in level. For sumps the level should be measured using non-contactive measuring principles such as ultra sonic with local control box.

Switches used for level detection shall provide facilities for testing the mechanical and electrical operation of the switch without its removal from the process. Isolation by means of shut-off valve will be allowable during testing.

Generally, the use of switches shall be avoided. Instead limit values shall be derived from analog transmitters.

For measurement of large storage tanks, the load indication and transmitting mechanism shall be located at the base of the tank.

For the measurements of boiler separator water level, feed water tank levels etc., differential pressure transmitters shall preferably be used.

The transmitters shall be as specified under Section B0.

For special applications such as chemical tanks, techniques such as ultrasonic, radar, capacitance probes, etc. should be considered. For level measurement in tanks with underpressure (vacuum) guided wave radar shall be used.

For level measurement of the fabric filter (FF) hopper dust radio frequency (RF) / Capacitance type level switch can be considered.



For measurements where a reference leg of process fluid is used, the design of the system shall ensure that the reference leg is fully maintained at its prescribed height during all conditions of process level change and changes in process conditions and the density of the reference leg does not vary from that of the process fluid due to temperature changes or other reasons.

All measurement transmitters for differential pressure shall be provided with:

- a. shut-off valves to be arranged directly at the condensing vessels and active pressure tapping points
- b. valve blocks enabling the transmitter to be isolated from the active pressure and enabling the transmitter zero point to be checked
- c. separate blow-off valves for cleaning the active pressure tubes.
- d. 2 ways for relative pressure, 5 ways for DP.

The aforementioned valves shall be of the weld-in type.

Where a standpipe exists, the level transmitters or level switches must be connected to the standpipe by means of shut-off valves, so that the units can be replaced easily in service.

Local level indicators for water shall be provided with an illumination device and indicators shall be designed so that the water column can be seen as whole, i.e. level indicators only showing the level as a point will not be accepted. Level indicators shall be equipped with shut-off valves which permit exchange or replacement of glasses or mica during operation.

The indicating range of local level indicators shall cover all switching points of level switches mounted on the tank or similar as a minimum requirement.

On all forms of measurement all parts of the switch, transmitter, etc. in contact with the process fluid shall be made of material compatible with the process fluid. Stainless steel shall normally be used for all corrosive duties.

B0.6.19.13 Analysers and monitoring systems



B0.6.19.13.1 Analyses of steam and water (SWAS)

The steam and water analyzer core instruments shall comply with EPRI (Electric Power Research Centre Inc.) guidelines.

The main analyzers for steam and water shall be arranged in groups in such a way that excessively long process pipes will not be necessary.



If required by the medium to be analyzed, all samples shall be adequately cooled and pressure reducing devices shall be provided where necessary. Manual sampling shall be possible.

A protective device shall be incorporated in the sample cooler to isolate the analyzer in the event of excessive temperature.

In order to eliminate the influence of conditioning agents on the conductivity measurement, cation filters shall be provided. The cation filters shall have visible colour indicators to show when they have to be regenerated.

For all analyzers temperature compensation shall be provided, with the temperature sensor being an integral part of the probe.

Chlorine residual monitors and hypochlorite concentration meters shall preferably be able to measure high and low concentrations. Measurement of hypochlorite concentration shall not be affected by the presence of other oxidizing components in the sample.

Individual or multiple prefabricated analyzer installations shall be used to reduce site installation work. This prefabrication shall include sample conditioners, analyzers, air and electrical distribution, cooling water distribution or coolant circulating system all piped and wired on a common frame. Interconnecting pipework and accessories shall be of stainless steel. The arrangement shall permit testing of the entire assembly before dispatch to site and shall be arranged for convenient removal from on-line operation to facilitate routine maintenance and calibration.

The sampling system shall include but not be limited to all probes, valves, filters, coolers, drainage facilities, flow regulators, flow meters, piping and pumps as necessary, to give the analyzer a representative and suitably conditioned sample.

Analyzers shall be provided as follows:

Sample Point

Condenser make up water
Condensate pump discharge water
Condensate at deaerator inlet water
Deaerator effluent water
Economizer inlet water
Boiler blow down steam
Saturated steam
Main steam
HP5 heater drain water
Closed cooling water

Analyzing Required

specific Conductivity
pH, cation Conductivity, DO
pH, specific Conductivity
pH, DO
pH, cation Conductivity, DO
pH, specific Conductivity
cation Conductivity, SiO₂, Na
cation Conductivity
pH, specific Conductivity
pH, specific Conductivity

Note:



DO: Dissolved Oxygen

Chemical reagent for the sampling system commissioning period but not exceeding 180 days shall be provided.

Each automatic analysis sampling point shall be provided with a manual sampling point to permit a sample to be easily taken. Manual sampling shall not interrupt automatic sampling. All sampling lines shall be run to common sampling racks on which shall be fitted all the analysis associated equipment.

The sampled points of analyzers shall be indicated and monitored at the local panel.

The corresponding analogue measuring signals (4-20 mA) and the status signals (24V DC) shall be transmitted over serial link to the DCS.

The SWAS system, for both Units should be located at ± 0.0 meters in an air conditioned room.

B0.6.19.13.2 Effluent Monitoring

The operational philosophy of water supply/ distribution system shall be based on a continuous Possur river water quality analysis, potable water quality monitoring, sampling and analyzing concept and shall consider preventive and active measures against water pollution and adaption of operating mode(s) to changes in water conditions.

Sample Extraction for Laboratory Analyses:

A tapping shaft for extraction of samples for laboratory test shall be provided and installed at the various measuring locations, before the waste waters are mixed with the circulating cooling water and discharged to the sea.

Continuous Effluent Monitoring:

A continuous monitoring shall also be implemented for water quality measurements of all kinds of discharges to the river.

The sensors for continuous monitoring of effluent parameters shall be located within the sample-tapping shaft. Additionally flow and temperature sensors shall be mounted within the discharge lines.

Following kind of analyzers shall be considered at least:

- pH analyzer
- conductivity analyzer
- chemical oxygen demand (COD) analyzer
- biological oxygen demand (BOD) analyzer



- total suspended solid (TSS) analyzer
- oil in water (OIW) analyzer

Continuous quality monitoring system shall be installed at the CES. The corresponding electronic equipment shall be mounted in a weatherproof container to be located nearby the point of measurement at the discharge pipes of waste water.

The corresponding analogue measuring signals (4-20 mA) and the status signals (24V DC) shall be transmitted by multicore cables to the DCS.

B0.6.19.13.3 Potable water quality monitoring system

Water quality control and monitoring of the Plant's drinking water shall be performed at the Plant interface (downstream the potable water tanks).

The water quality monitoring system shall at least consist of, but not be limited to the following online metering, measurement, sampling and analyzing equipment, including data acquisition and data storage facilities:

- alkalinity
- conductivity metering
- pH monitoring
- temperature measurement
- turbidity monitoring
- residual chlorine monitoring
- TDS (computed value)
- LSI (computed value)
- sampling points and equipment for potable water sampling at the online measuring units.

B0.6.19.13.4 Quality monitoring for fuel

For fuel oil a sampling point for discontinuous manual analysis shall be provided for the facility at the fuel oil storage tanks.



B0.6.19.13.5 Analysis of exhaust gas (CEMS)

The analysis of O₂, CO, CO₂, NO_x, SO₂, particulate matter (opacity) in the exhaust gas shall be performed by appropriate analyzers of proven type.

The equipment shall be constructed for operation in dusty and humid environments at high ambient and exhaust gas temperatures. The use of equipment capable of multi-parameter measurement shall be considered.

The reliability and response time of the O₂-analyzer shall be of the quality required for closed-loop control. The accuracy of the system shall be better



than 2.0% of the span and the drift shall be not more than 0.1% O₂ per week. A zirconium oxide measuring cell shall be used. Maintenance shall not be more than once a week.

Analyzers provided shall have auto-calibration for zero and span as well as self-diagnostic functions. Analyzers and sensors can be of extraction or insitu type.

All equipment of the continuous emission monitoring system (CEMS) shall be suitable for operation in dusty and humid environments at high ambient and flue gas temperatures. Continuous Emission Monitoring System (CEMS) shall be provided for each unit.

If sampling of exhaust gas is used, sampling probes shall preferably be vertically installed on the top of horizontal exhaust gas ducts, in order to avoid blockages.

In order to keep the sampling lays to acceptable limits the analyzers shall be located close to their sample take-off point, so that easy access to the sample take-off point and to the analyzers shall be provided for maintenance.

The exhaust gas sampling lines shall be heated to prevent condensation and shall not form a siphon in the case where condensate may be collected during heater failure. Condensate drainage facilities shall be provided at the analyzers.

Generally, the analyzers and the sampling probe equipment shall be suitable for mounting in ambient plant conditions, e.g. within a standard cubicle. However, if this is not feasible, the equipment shall be mounted in an air-conditioned room or container.

Power failure and system failures of analyzers shall be monitored in the DCS by a group alarm.

Measured values and certain status signals shall be processed by an emission evaluation computer via serial interface, to be installed within the central control room. The emission data shall be calculated, converted, printed out and stored according to the governmental requirements. Possibilities for line data readout for authorities shall be provided.



B0.6.19.13.6 Ambient air quality monitoring system (AAQMS)

An ambient air quality monitoring system shall be provided consisting AAQMS stations and metrological stations. A centralized data acquisition PC shall be installed to collect all information from the AAQMS. The AAQMS stations shall be suitably distributed on the Plant area.

The AAQMS stations shall contain at least the following:

- Analyzers for SO₂, NO_x, CO, O₃, mercury
- Multi gas calibration system
- PC based data logger
- UPS
- Suspended particulate monitors (TSP)
- Sampling inlet heads

Metrological station shall include at least:

- Metrological sensors such as wind speed, wind direction, air temperature, relative humidity (RH), solar radiation, rain gauge
- Metrological mast

All ambient gas analyzers and dust monitors shall conform to the US EPA reference of equivalent method. A proof of approvals and certificates of the compliance of internationally reputed agencies such as US EPA, German TUV, etc shall be provided.

A sampling system compatible with the analyzers shall be provided. The system shall be compatible with analyzers for Pb (which the Employer may procure in the future). The system shall have the facility for moisture removal.

Built-in calibration facilities shall be provided for all analyzers. To cross check the built-in calibration facilities of the analyzers/ monitors, a standard multi-gas calibration system for each AAQMS station with fast response time shall be provided.

The metrological sensors for wind speed and wind direction shall have an accuracy of 2% of full scale. The accuracy of the relative humidity sensor shall be 3% for the range between 10 and 90% RH.

The rain gauge shall be of self recording type and of reputed make. Electronic recording facilities shall be provided. The instrument shall have automatic functions for computing rainfall for pre-set time periods. The gauge shall be rugged and be of material resistant to atmospheric corrosion. The accuracy shall be 1% for rainfall ranges above 125 mm/hr and 5% below this value.

A metrological mast shall be provided for mounting of the metrological sensors. It shall be complete with all necessary hangers and holders along with electrical earthing for the installation of the sensors. Material and construction of the mast shall be robust and shall be resistant to atmospheric corrosion.

There shall be PC based data loggers for each AAQMS station. The entire data capture and mean value calculation as well as control of analyzers shall be through user friendly software and operate on the latest Windows operating system. Diagnostic features shall be included in the software and



any unauthorized access shall be prevented by appropriate measures such as password protection.

Data loggers for the metrological station shall be provided with the necessary analogue and digital inputs and internal memory for all collected parameters. The data loggers shall have the capacity for future extension with additional sensors.

Location for centralized data collection PC stations shall be decided during basic/detailed design stage

B0.6.19.14 Electrical value measurements

For the processing of electrical values such as voltage, current, power, frequency etc. electronic type transmitters shall be provided to convert the output of current and voltage transformers into an impressed direct current in the range 4 - 20 mA. The transmitters shall be housed in the switchgear.

For power measurements precision electricity meters for asymmetrical three-phase networks are to be supplied. Connection of the meters shall generally be to 3 x 1 A current transformers and 3 x 110/√3 V voltage transformers. The meter accuracy class is to be approximate to the respective transformer classes. Instrument transformers with an accuracy class of 0.5 or better shall be used for metering purposes.

For the purpose of billing for electrical energy and for acceptance tests, an instrument transformer of at least class 0.2 (precision) accuracy and high precision electricity meters of class 0.2 have to be provided. Meters for billing purposes shall be of the approved calibrated type (certified by independent testing stations). All meters for billing purposes are to be provided as double 2 x 100% meters.

At all points where power direction reversal is possible, the necessary meters for both directions are to be provided.

The meters in the local switchgear are to be arranged behind the clear plastic fronts of the cubicle doors so that the counter readings can be taken without opening the doors.

B0.6.19.15 Control valves

Control valve spindles and internals shall be made of chromium steel and shall have a high resistance to wear and corrosion. Cones and seats shall be hard faced with materials with a high resistance to wear and corrosion. Housings shall be made of forged or cast steel. A hand wheel, with provision for switching to manual operation and a local position indicator shall also be provided.



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All control valves, orifices and nozzles shall comply with the relevant international standards such as DIN, BS or any other which may be agreed to by the Employer/Engineer.

Control valve characteristic shall allow smooth and continuous control of the control parameter.

Valves shall not generate noise in excess of 85 dB(A), measured at a point 1 meter downstream of the valve outlet and 1 meter from the pipe centerline. Where this requirement must be exceeded because of physical limitation, suitable sound attenuators shall be provided in terms of special valve trim, in-line attenuators, isolators and enclosures to satisfy the noise requirement.

Valves shall have trim designed to avoid cavitation damage. If an application cannot avoid cavitation entirely, material selection shall be such as to withstand the effects without damage.

Line strainers shall be provided upstream of control valves where required.

The valve sizing shall be suitable for obtaining maximum flow conditions with valve opening at approximately 80% of total valve stem travel and minimum flow conditions with valve stem travel not less than 10% of total valve stem travel. All the valves shall be capable of handling at least 120% of the required maximum flow. The design pressure drop across the valve should be 15 to 20% of the total available pressure drop at no flow.

Although control valves shall not be used for shut-off service, to provide reasonable shut-off performance, leakage through a closed control valve shall not exceed 1% for single ported valves or 2% for balanced ported valves.

All control valve materials shall be compatible with the fluid handled. Materials shall be in accordance with the piping materials standard and/or as approved by the Employer/ Engineer.

Valve characteristics shall be selected to suit the process and control system dynamics.

All the control valves for boiler feedwater services should be of anti-cavitation type with flash-flow trims and cage type to avoid cavitation problems.

The installation shall include upstream and downstream isolating valves and, for critical control valves, a bypass valve for each control valve on all services. Unless otherwise agreed by the Employer/Engineer the bypass valve shall have a similar characteristic as the control valve but shall provide tight shut-off. Any exceptions or variations to the requirement shall be subject to the approval of the Employer/ Engineer. Where a service is subject to a pressure above 3 bar a 25 mm vent valve shall be provided, between the upstream and downstream isolating valves, in order to relieve the pressure to enable maintenance to be carried out on the control valve.



Control valves shall be adequately supported in all cases and shall be accessible for maintenance. Local pressure gauges shall be provided upstream and downstream of each control valve.

If as per steam turbine OEM's proven design, isolating valves or bypass valves are not envisaged for control valves of internal piping, same is also acceptable.

For normal duty globe type valves shall be used.

The use of butterfly valves shall be avoided in the main plant. Where very large sizes are involved (on high flows), or low pressure drops and low static pressure are a determining factor, making globe valves unattractive or impossible, butterfly valves may be used. They shall be of the "balanced torque" type disc usable to the fully open position (90° opening). The overall shaft rating shall be at least 25 % above the static pressure as differential across the closed valve.

Multi-stage valves (e.g. multi seat or multi cage valves) shall be used on services, e.g. steam and gas, having very high pressure drops which would result in supersonic velocity inside a conventional body and shock waves in the piping, creating unacceptable noise levels.

Angle valves shall be provided.

- for steam pressure reducing de-superheating stations of the "combination" type,
- for erosive services, e.g. slurries,
- on applications where solid contaminants might settle in the valve body,
- on hydrocarbon services with a tendency for "coking".

Ball valves shall be used for on-off and throttling services under moderate operating conditions.

The control valves must be provided with all data important for their identification, such as flow direction, type, nominal diameter, nominal pressure, seating, CV value.



B0.6.19.16 Actuators

Intelligent drives with integrated power switch unit and further electronics shall be installed. Actuators equipped with integral controls shall be supplied which can be operated via the operation elements on the local controls as soon as power is connected. Only operation commands and feedback signals shall be exchanged between the control system and the actuator. Motor switching shall be performed within the device and virtually without delay.

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Unless otherwise specified actuators for modulating valves and dampers shall either be pneumatic or electrically operated. Self contained sealed hydraulic units may be considered where high thrusts or high speeds of operation are required.

Actuators for ON/OFF duty or manually positioned units shall generally be electrical motor and/or pneumatic driven, however the use of solenoid types on small valves shall be allowed dependent on duty.

The various types and sizes of actuators shall be rationalized and as far as possible each type shall be from a common manufacturer to facilitate interchangeability and spares.

In order to prevent the risk of fire or explosion pneumatic actuators shall be used in hazardous areas and associated equipment (e.g. positioners) must be intrinsically safe in accordance with IEC 60079-11.

Pneumatic actuators must be designed in such a way that in the event of air failure the actuator will remain in the position immediately prior to loss of power, or assume a position which is safe for the process.

With either action the failure mode shall be suitably monitored and the Plant operator informed by some form of alarm. The failure response of all actuators in the event of the loss of the prime mover (air pressure, oil pressure, electrical power) shall be indicated on the Piping and Instrumentation (P&I) diagrams, valve schedules, etc.

All pneumatic tubing to control drives or actuators shall, unless otherwise agreed to by the Employer/Engineer, be in copper which shall be sheathed in PVC or alternatively in stainless steel.

For all actuators of control valves and dampers of main systems local indicating pointer and position transmitters for remote indication and closed loop feedback shall be provided in accordance with the most severe operating conditions to be expected. The transmitters shall be designed to withstand conditions such as high temperature, vibrations and leakage of steam and of hot water wherever required. The protection class shall be IP 65 according to IEC 60529.

All actuators shall have a handwheel for direct manual operation. The diameter of the handwheel and geared effort shall be such that they can be reasonably operated by one man. A lockable mechanical clutch mechanism shall be provided to inhibit power control of the actuators when the handwheel is operated.

The speed of response of actuators used for modulating control shall be chosen to suit each particular application. Facilities shall be provided for limiting the actuator movement in each direction.



Special attention must be paid to adequately dimensioned drives and care must be taken to avoid any unintended displacement of the actuator on sudden rises of pressure in the piping.

Actuators shall have fail safe operation and actuator locking device in the event of abnormal conditions. Any abnormality on the valve shall be transmitted to the DCS.

All electrical actuator drives necessary for the safe operation and shut-down of the Plant in the event of 0.4 kV switchgear failure shall be connected to the UPS.

B0.6.19.17 Solenoid valves

In lines with nominal diameters of up to DN 25, as well as for piloting pneumatic actuators, suitable solenoid valves shall be used. Valves with power ratings up to 30 W shall be controlled directly at 24 V DC from the DCS. For powers over 30 W, solenoid valves for 230 V AC shall be employed. Solenoid valves for 110 V, 230 V AC and above shall be secured with blade fuses. Electrical connections are made by means of plug connectors, with the mating connector forming part of the scope of supplies.

B0.6.19.18 Cabling and wiring

The general requirements for cabling are as stated under relevant chapter in Section B0.

In particular, wiring within desks and panels shall be supported on trays and shall be segregated according to voltage level. Wiring carrying AC and D.C. voltage shall also be segregated.

All desks, panels, cubicles and racks shall be factory-wired with regard to the internal connections. Where desks or panels will be supplied in more than one Section, electrical connections between the Sections shall be by terminal strips provided for this purpose.

All cables must be provided at both ends, at every 20 m and every bend with identification with identification in the form of numbered labels corresponding to the coding system. The individual cores will be numbered or identified by colour-coding.

Instrumentation cables will be identified by colour codes and band marking, follow VDE 0815. The cables must be laid to ensure that they can be replaced or renewed in a simple manner.

Spare cores shall be terminated at terminal strips in such a way as to give a maximum length of core and shall be ferruled in such a way as to indicate that they are spare cores.



All instrumentation cables including both prefabricated and non-prefabricated type shall be with Fire Retardant Low Smoke (FRLS) type Poly Vinyl Chloride (PVC) overall sheath. For cables that are exposed to ambient temperatures above 60°C, teflon or silicone cables are to be provided. For safety related equipment fire survival cables shall be provided. The cables must be suitable for laying indoors, in the open (direct or indirect sunlight), in ducts, on trays, in the ground and in water. The cables must be resistant to solar radiation, the effect of oil, seawater, bacterial action, insects and rodents. Shields for individual pair and overall shield shall be provided for cables for analogue signals. Cables for binary signals shall have an overall shield. Multipair cables of 0.5 sq. mm, shall be used extensively for I&C cables, wherever required, prefabricated cables may also be used.

For thermocouple measurements compensation cable NiCr-Ni 2x0.5sq. mm or 4x0.5 sq. mm with silicone insulation and pair screen will be used. Fiber optic cables shall be provided for Remote I/O bus, CCTV, Station LAN etc.

The fiber and cable specifications shall comply with ITU-T Recommendation G652 and the relevant IEC standards. Each fiber cable shall be supplied with at least 50% spare cores. A minimum number of four spare cores are required.

Suitable fiber optic cable junction boxes, patch panels and patch leads shall be provided. These shall conform to the following:

- They shall support, organize, and protect the optical fibers and the fiber splices whilst ensuring that the optical fiber minimum-bending radius is not exceeded.
- The splice tray shall not have any sharp edges or protrusions that may damage the optical fiber cable.
- They shall provide entry for all cables.
- Include number tags for tube and fiber identification.
- They shall provide mounting positions for the bulkhead mounted connectors on which the cable will be terminated.
- They shall allow patching of fibers.
- Outdoor mounted boxes shall be rated to IP65 in accordance with IEC 60529.



The junction boxes/ patch panels shall have a fiber capacity equal to the total number of fibers (connected and spares) for all cables to be connected. Patch panels shall be designed for 19-inch rack mounting within a standard equipment cabinet.

All unused couplings shall have protective dust covers. The patch area in patch panels shall be accessible and covered behind a door or removable cover.

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Sufficient factory manufactured patch cords with suitable colour coding shall be provided.

Fiber optic connectors shall be standardized for ease of maintenance.

B0.6.19.19 Instrument and measuring impulse piping

Instrument impulse piping shall be supported at intervals as defined in BS 6739. The correct size of tube clips shall be used to suit the tube outside diameter.

The Contractor shall fabricate and erect all mounting brackets for control and monitoring apparatus including all pressure switches and miscellaneous instrumentation. If it is found after commissioning that any mounting frame vibrates excessively under operating conditions, instruments within the frames shall be isolated with vibration dampers by the Contractor or moved to areas of low vibration.

Impulse lines shall have venting, draining and blowdown facilities. Impulse lines between process and sensor shall be as direct as possible and shall include allowance for vibration and vertical and horizontal movement. Joints in impulse lines shall be kept to a minimum.

All pneumatic instrument lines shall be soap tested and any leakage shall be rectified.

While process instrument lines are being pressure tested all instruments shall be completely isolated or disconnected.



B0.7 Inspection and Testing

B0.7.1 General

This Section contains general requirements for inspection of material, parts, equipment and workmanship of the Plant during manufacture, assembling and erection and upon completion to demonstrate compliance with specification, codes and standards and to ensure overall reliability of Plant operation and performance.

Development and implementation of test procedures for the construction inspection, start-up and performance testing and capacity demonstration of the Plant shall be the responsibility of the Contractor.

The Contractor shall be responsible for providing all supplies required for carrying out such tests, except to the high speed diesel and coal used during Reliability Test Run and Performance Tests.

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- unit not available (not engaged/test)
- unit OFF - due to fault.

The following signals shall be additionally provided in the infeed panels of the switchgear:

- no control voltage 220 V DC
- no busbar voltage
- ground fault (for the 220 V DC system only).

Circuit breakers shall be equipped with operation counters.

Control and signalization

The control of the circuit breakers and motor units shall be carried out as described in clause "Low Voltage AC Switchgear".

Local auxiliary relays and measuring instruments

All infeeds to DC switchgears shall be equipped with ammeters.

For the rectifiers and inverters, the incoming and outgoing currents and voltages are to be indicated separately. The busbar voltages of the main 220 V DC distributions are also to be indicated.

The current and voltage measurements for the 415/240 V Safe AC is to be executed in the same way as for the 0.415 kV distributions in Section "Low Voltage AC Switchgear".

Remote indications and measurements

The remote indications of the circuit breakers and motor unit shall be carried out as described in Section "Low Voltage AC Switchgear".

The minimum scope of measurement transducers for measurement in the central control room are:

- battery current and voltage
- current measuring transducers for all infeeds
- voltage measuring transducers for each half busbar voltage.

B7.3.4.3 Battery charging equipment

Each battery charger must be suitable for the charging and floating of the **nickel-cadmium battery** and for supplying of all the DC consumers or the inverters for the 415/240 V Safe AC system at the same time. Above requirements shall also be applicable if the battery was drained prior to start of charging.

The rectifiers are preferably to be provided as thyristor controlled devices with current-voltage characteristic for stand-by parallel operation with the associated batteries.

Instead of thyristor controlled chargers other state of the art and proven technology will also be accepted.

The following technical features and monitoring equipment is to be provided for the individual battery chargers:

- radio interference suppression of the battery chargers according to the appropriate IEC regulations
- monitoring the charging circuit for interruption
- voltage monitoring of the incoming three-phase supply, with an overvoltage of + 15% and an undervoltage of - 15%, automatic disconnection of the battery charger must occur
- voltage monitoring of the DC output, with an overvoltage of + 15%, automatic disconnection of the battery charger must occur.

All cases of disconnection must be indicated as a fault alarm in the front door of the unit

The local fault alarms and indications disconnections are to be connected to combined as a common alarm - rectifier fault - to the central control room (DDCMIS by serial interfaces).

The battery chargers meant for lead acid batteries are to be equipped with high rate charging stages that can be set at 2.65 V/cell or as per manufacturer's recommendation between 1 to 6 hours after input failure. For NiCad batteries High rate of charging shall be as per manufacturer's recommendation.

However the provision of adjustable boost charging features shall be provided and compliance with minimum requirements shall be ensured.

On the front of the rectifier cubicles, the Contractor has to provide all the necessary monitoring equipment, measuring instruments, other devices, switches, indicator lamps and corresponding fixings for the cables.

Alternatively the Contractor may offer an integrated numeric control device (visible during normal operation through inspection window in front door), which combines all functions.

B7.3.4.4 Batteries

For the DC and safe AC systems, the Contractor shall supply batteries of the Ni-Cd or lead-acid plant type.

Battery main fuses in a separate fuse box to be provided. The battery fuses shall be monitored.

The intercell connections shall be fully insulated. Welded intercell connections are not permitted.

The batteries are to be mounted on insulated subframes with the necessary consoles and fixing material.

Each battery shall have the capacity to supply the load for a period of at least thirty (30) minutes.

B7.3.4.5 Inverter with electronic change-over equipment

In order to be able to maintain an uninterruptable supply in the event of grid and generating failure, 2 x100% inverters with automatic static bypass -over equipment and manual bypass switch/facility is to be provided.

Each static inverter must be suitable for 100% of the power requirement.

The following features and monitoring equipment is to be provided for the AC inverter:

- radio interference suppression according to the appropriate IEC publications
- DC undervoltage monitoring
- AC overvoltage monitoring
- AC undervoltage monitoring.

On activation of the above devices, switch-over to power supply from the AC bus shall occur; the fault is to be individually indicated locally.

All individual alarms and indications are to be connected to the DDCMIS by serial interfaces.

The inverter is to be protected on the input and output sides and is to be equipped with the necessary isolating points. It must be possible to block the inverter on the input side in the case of high rate battery charging or they must be so designed that no damage will occur during this phase of charging.

In case of operation in bypass mode backfeeding into the 220 V DC system shall not be possible.

On the front of the inverter cubicles, the Contractor has to provide all the necessary monitoring equipment, measuring instruments, other devices, switches, indicator lamps and corresponding fixings for the cables. Alternatively the Contractor may offer an integrated numeric control device (visible during normal operation through inspection window in front door) which combines all functions.

In the case of a short circuit at a consumer on the safe busbar, the voltage tolerances shall not be exceeded.

Sizing of fuses and inverter output in case of short circuits shall be properly coordinated and shall be fully selective under all operating conditions.

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B0.6.18.12 Cable and cable trays

B0.6.18.12.1 Cable laying and routing requirements

The Contractor responsible for cable routing and laying has to observe a strict unit separation. The cables must be routed in different cable channels or, as the minimum requirement, on different cable trays, so that in case of a fire or any accident in a cable channel or tray two units will not be affected. Further in case of two critical drives of the same unit with both drives operating in normal conditions cable for the same shall be routed through two completely redundant routes.

On vertical cable risers, walls and ceilings the cables must be secured with corrosion-resistant cable clips (e.g. cable clamps with cable protecting cable sleeves).

Cable risers near gangways or in electrical rooms that are exposed to possible mechanical damage are to be protected up to 1 meter from ground by suitable metal cover.

All holes in ceilings, floors and wall made for cable routing must be sealed fire-resistant, when the cables have been laid. This also applies to switchgear panels and cubicles, passages between cable ducts, at vertical risers etc. As there is an increased danger of fire during the construction period the holes shall be fire-resistant sealed at that stage already. This applies especially to vertical runs.

When the cables are no longer supported on cable trays or risers etc. the power, DC and instrument transformer cables must generally be run singly in galvanized steel conduit. With lighting cables, measuring and control cables and telephone cables, several similar cables can be run in one conduit. Surface-mounted conduits must be secured every 1.5 m.

The control and communication cables must be laid sufficiently apart from the power cables so that no interference will occur and the transmission of fault signals is excluded. For this purpose the following minimum separations are to be observed:

- 300 mm between low voltage power cables and measuring and control cables at voltages of 60 V and below,
- 300 mm between power cables and measuring and control cables at voltages above 60 V,
- 600 mm between medium voltage power cables and measuring and control cables at voltages of 60 V and below.

The laying of cables outside of buildings should be preferably on cable bridges that preferably are to be naturally ventilated.

If the cables are laid in the ground, after excavating the trench a layer of sand must be introduced. On the sand the cables are laid separately from each other according to voltage systems. The cables must be laid at a depth of 0.8 m at least. The trench is filled with sand and covered with concrete covers or bricks. The thermal resistance of the backfilling shall not exceed 150 Kcm/W. A ground temperature of 28 °C has to be considered. Where cables have to pass under streets cable duct blocks with a suitable bore(s) should be provided. The marking of cable routes by cable warning tapes must be provided.

When laying the cables on cable trays, cable risers, cable channels, etc. and when choosing the size of the cables care must be taken that sufficient ventilation is available and that there is no possibility of thermal overheating, or strain on the cables.

Cables that must move with connected apparatus owing to thermal expansion (e.g. boilers) must be provided in a flexible form or they must have sufficient slack at the location.

All the ends of the cables must be prepared according to the particular requirements of the manufacturers and connected to existing terminal strips, terminal screws, apparatus terminals, etc.

The necessary cable sealing ends and the stripped and fanned-out cable ends, where no sealing ends are provided, must be fixed to the appropriate supporting structures.

B0.6.18.12.2 General cable construction requirements

The medium and low voltage cables shall be of Fire Retardant Low Smoke (FRLS) with XLPE insulation. For cables that are exposed to ambient temperatures above 60°C, teflon or silicone cables are to be provided.

For safety related equipment fire survival cables shall be provided.

The cables must be suitable for laying indoors, in the open (direct or indirect sunlight), in ducts, on trays, in the ground and in water. The cables must be resistant to solar radiation, the effect of oil, seawater, bacterial action, insects and rodents. Outer sheaths are to be manufactured from non-combustible or flame retardant low smoke material.

Cables must be provided at both ends, at every 20 m and every bend with identification in the form of numbered labels corresponding to the coding system. The individual cores will be numbered or identified by colour coding.

The cables must be laid to ensure that they can be replaced or renewed in a simple manner.



B0.6.18.12.3 Medium voltage (MV) power cables

The design of the MV cables shall be screened, stranded, single-core or three-core copper conductor cables of FRLS with XLPE insulation. The cable shall be sealed with a red, non-fading PVC outer sheath. Three-core cables shall be designed with individually screened cores.

The MV power cables must be designed for the thermal and short-circuit characteristics of the electrical systems, taking into consideration the following minimum short circuit duration:

- for incoming cables and cables to sub-distribution: fault clearing time of the back-up protection.
- for all other cables: the fault clearing time of the main protection.

The cables must be terminated and connected to the indoor metal-clad switchgear or the sealing ends are installed in cable connection hoods mounted on the power transformers.

In the event of outage of the air-conditioning plants of the switchgear buildings the internal and external conditions will become the same. Therefore, sealing ends are to be used which shall be suitable for the maximum conditions at site.

B0.6.18.12.4 Low voltage (LV) power cables

The low voltage power cables shall be standard single and multi-core cables of FRLS with copper conductor and XLPE insulation.

To ensure the elimination of excessive contact potentials on any object, effective earthing must be carried out as a safety measure and suitable 3-core, 4-core and 5-core low voltage power cables must be provided. The minimum conductor cross-section of the low voltage power cables is 2.5 mm². If 3 1/2-core cables are used, the reduced conductor for protective neutral must have a cross-section of at least 16 mm². In lighting systems (especially discharge lighting circuits) the use of a reduced conductor for the protective neutral is to be avoided.

Depending on the site conditions the DC cables must be single-core, 2-core or 4-core. Between batteries or rectifiers and the DC switchgear single-core power cables should in general be used.

The LV power cables must be designed for the dynamic and thermal characteristics of the electrical system and for continuous operation.



B0.6.18.12.5 Current carrying capacity of power cables

The ratings for continuous loading of the cables shall be calculated according to the relevant IEC regulations. The Contractor must submit corresponding tabulations for all cables to be used.

The maximum voltage drop under normal conditions shall not exceed 2.5%.

B0.6.18.12.6 Measuring and control cables above 60 V/ instrument transformer cables

For voltages above 60 V the cables shall be of Fire Retardant Low Smoke (FRLS) with PVC insulation and a minimum conductor cross-section of 1.5 mm^2 . If they lead to outlying buildings, cables with a common core screen and protection against induction must generally be used.

For instrument transformer cables inside buildings the minimum conductor cross-section must be 2.5 mm^2 .

Instrument transformer cables leading to outlying buildings must have a minimum size of 4 mm^2 and must generally have a common core screen.

The maximum voltage drop shall not exceed 2%.

B0.6.18.12.7 Measuring and control cables below 60 V

For voltages up to 60 V, measuring and control cables shall be of FRLS with PVC insulation and shall have stranded or solid copper conductors of minimum 0.8 mm diameter. Multi-pair control cables with paired lay-up of the leads and lay-up of the pairs themselves shall be used.

Instrumentation cables shall be identified by colour codes and bank marking as per VDE 0815.

Wherever necessary, e.g. for all cables leading outside the relay rooms and/or control rooms, the control cables shall have a common screen (Al-foil or Cu-foil).

Cables must generally have appropriate electrical protection against inductive/resistive influences and lightning.

The required compensating wires for temperature measurements must be at least 0.5 mm^2 .

The maximum voltage drop shall not exceed 2%.

The individual cores of the multi-pair control cables shall be identified by numbers or a colour coding system.



B0.6.18.12.8 Fiber optic cables (FOC)

All fiber optic cables as well as their deployment and the entire test procedure shall comply with IEC 60794. The cables shall be able to operate continuously in temperatures up to 70°C. The fiber optic cables shall be loose tube type with the fibers fed into tubes. The tubes shall be sufficiently strong to hold their shape and provide protection for the fibers against deformation and friction. Each fiber shall be colour coded acc. to IEC 60304.

Buried fiber optic cables shall always be laid inside adapted conduits. Installation shall ensure rodent protection and be water tight. The conduits system shall supply all equipment necessary for the deployment acc. to FOC manufacturer's specification. Occupancy shall allow future cable installation.

For out-door applications cables shall be suited for out-door deployment, longitudinally water tight, filling material standardized for all cables, yield minimum 3,000 N.

The fiber optic cables shall be complete with non metallic strain relief elements. Fiber optic cables that are installed outdoors shall be armored. Cables used indoors shall be reinforced with a steel wire braid.

Graded index fibers cables and monomode fiber cables shall comply with IEC 24702:

Graded index fibers cables shall consist of always 24 fibers

- fiber - type 50/125 μm , OM-3.

Monomode fiber cables shall consist of always 24 fibers

- fiber - type 9/125 μm , OS-1

19" patch panels shall be used for termination, connectors shall be LC-Duplex as standardized by IEC 61076-3-106 var. 4. All fibers shall be terminated / connected.

Each fiber of all FOC shall be deployed and tested according to IEC 60794. Resulting test protocols of all single fibers of all FOC shall be handed over to the Employer, stating all details in written.

B0.6.18.12.9 Cable supporting structures

Construction requirements

Basically, pre-fabricated cable trays, cable risers, hanger rods, screws, clamps and all fixing material of corrosion-resistant finish, hot-dip galvanized, shall be used. If in certain sections the use of trays and risers is not possible, cable racks are to be provided in such places. These shall be made of corrosion-resistant, steel angle sections, hot dip galvanized. The steel angles must be cut to size on site and exposed cut surfaces must be suitably treated on the spot to prevent corrosion before being fitted. The minimum requirement for this treatment is the application of an anti-corrosion layer of zinc coating.

All cable tray T-junctions, cross-overs, vertical and other shelving, bends, etc. must consist of pre-fabricated tray elements so that crushing of the cables at these transition points is avoided.

The cables laid on the trays must be carefully arranged and ordered. All cable tray routings consisting of several individual cable trays that are located outside buildings and exposed to the sunlight shall be provided with sun-shades made of the material as described for the cable tray equipment. In all areas where an accumulation of coal dust must be expected, e.g. coal handling plant, conveyor belt ways, bunker area, the cable trays shall be installed vertically.

The trays and risers must be installed in such a way that in accessible manways an escape route at least 800 mm wide by 2100 mm high is available for the personnel.

For safety reasons the lower parts of the hanger rods and all other exposed parts in manways and escape routes must be fitted with plastic covers.

In indoor installations hot dip galvanized material with an average coating thickness according to ASTM A123/123M is to be used.

In all external areas, in not complete closed buildings and in areas with corrosive gas or steam Fibre Reinforced Plastic (FRP) cable trays tested according to international standards shall be provided.

The cable trays must be designed to ensure that there is 5% spare space on trays when commissioning and handing-over is complete.

The fixing materials for the cable trays and risers must be corrosion-resistant or at least be hot-dip galvanized. The rods, brackets and risers must be fitted with appropriate support brackets to be fixed to anchor rails or fixed by dowels and screws in walls and ceilings.



Welding to steel structures and the welding together of hot-dip galvanized cable-laying accessories is not permitted.

After completion of the cable-laying work the maximum deflection of the cable trays shall not exceed 2.5 mm per 1.5 m (specified distance between two hanger rods).

B0.6.18.13 EMC measures

All EMC measures shall ensure that during subsequent operation, no impermissible malfunctions or damage to equipment occurs due to violating electromagnetic compatibility.

The description of the measures is not limited to this chapter, but also forms a part of other chapters, in particular "Protective measures", "Earthing and lightning protection" and "Cabling".

The EMC requirements are set out in the following.

Under consideration of the conditions and constraints, the equipment used shall emit the lowest interference signals and exhibit the highest immunity to interference.

All equipment items shall operate properly when connected to networks with a power supply corresponding to the maximum permissible tolerances as laid down in EN 50160 (as regards, harmonics, voltage fluctuations etc.).

Priority is given to reducing sources of interference.

Additionally, by means of high-capacity screening, generation of overvoltages due to inductive or capacitive coupling shall be reduced. Influencing by electrical and magnetic fields shall be reduced.

Earthing and potential equalization systems designed for low-impedance shall reduce generation of overvoltages due to ohmic coupling.

If EMC resulting from the measures named above is still not adequate, further measures shall be taken within buildings, for example by isolation and suppressor circuits.

Thanks to the lightning protection and screening measures taken at the buildings, within them an EMC protection zone is formed.

All installations penetrating this protection zone, that is where they pass through the external walls of buildings, shall be incorporated into a lightning protection-potential equalization system as close as possible to the points of entry and exit of the building. This applies also for conductors carrying a potential. At entry or exit, these shall be included in the lightning protection-potential equalization system by way of suppressor circuits.

B0.6.6 **Vibration****Steam turbine generator**

The steam turbine and generator have to be statically and dynamically balanced in the workshop such that the following levels of vibrations can be achieved:

- For the steam turbine and the generator the vibration level, measured on the rotating parts at each main bearing shall not exceed the upper limit of the zone "A" as defined in ISO 7919 at steady conditions.
- For the steam turbine and the generator, the vibration level, measured on the rotating parts at each main bearing shall not exceed the upper limit of zone "B" as defined in ISO 7919 for transient operation at rated speed.
- In no case (except alarm condition), the vibrations measured on the rotating parts shall exceed 0.5 of the minimal clearance of the bearings, for the measurements installed near the bearings. This requirement is valid for all speed ranges and load conditions. If conflicts exist between the different specifications, the more restrictive value shall be applied.

The location of sensor element shall be according established standards and generally recognised codes of practice.

Other rotating equipment

Unless otherwise stated or agreed by the Employer all rotating equipment must have statically and dynamically balanced in the workshop such that the following levels of vibrations can be achieved:

- For large rotating equipment (boiler feedwater pumps, main cooling water pumps, fans (PAFs, FDFs, IDF), condensate pumps, etc.) the vibration levels, measured on the non-rotating parts, shall not exceed the upper limit of zone "A" as defined in ISO 10816 at steady conditions. For other areas e.g. min flow or run out flow, zone limit "B" shall be maintained.
- For standard pumps, other rotating equipment and reciprocating pumps, the vibration levels, measured on the non-rotating parts, shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions. For equipment which is not covered by ISO 10816, the manufacturer's standard shall be applied.
- For all rotating equipment at transient conditions, the vibration levels, measured on the non-rotating parts, shall not exceed the zone limit "C" as defined in ISO 10816.
- For all motors, the vibration levels, measured on the non-rotating parts, shall not exceed the limit as described in the relevant Sections for MV and LV motors.
- The vibrations measured on the rotating parts may not exceed 0.5 of the minimal clearance of the bearings. This requirement is valid for all speed ranges and load conditions. If conflicts exist between the different specifications, the more restrictive value must be applied.



Whenever necessary, equipment shall be put on vibration dampers.

Vibration Monitoring System

Vibration shall be measured at large rotating or reciprocating machinery for protection and predictive maintenance. This includes the turbine, the generator, large rotating equipment (boiler feedwater pumps, main cooling water pumps, fans (PAFs, FDFs, IDFs), condensate pumps, etc.).

Suitable indications shall be provided in the control room for each measurement point and the measurement shall be suitably alarmed where high vibration levels may cause possible damage or affect the safety of the Plant. All the vibration signals, unprocessed, which are present on the machine as well the result of the VMS shall be available in the PADO as well as in DCS.

The vibration monitoring system (VMS) shall be reliable, accurate, easy to maintain, and suitable for use in such ambient conditions appertaining to the intended plant installation. Vibration monitoring signals for trip commands, protection functions or process interlocks shall be hardwired. The VMS shall comprise all the necessary hardware and software modules and shall be configured according the design and the needs of the specific installation and technology.

Standardization and interchangeability of components shall be implemented where feasible.

The following features and requirements shall be considered for the vibration and displacement monitoring system:

- self-checking and single fault tolerant system
- modular and reliable system
- 2 out of 3 voting, if signals shall be used for trips (shaft vibration measurement shall be as per ISO 7919-2)
- hardwired or redundant serial communication have to be foreseen
- All buffered outputs signals shall be passed through to the analysis system as unprocessed (raw) input signals.



The following criteria shall be used as a guideline for rotating machinery such as steam turbine, generator, blowers and fans, mills and main feed water pumps as well as other main pumps, in order to ascertain the monitoring points, principles of what signal shall be measured, what is displayed, and what mechanical conditions entail alarm and/or trip status:

- non-contacting proximity probes shall be provided unless otherwise specified for measuring rotor shaft vibration and axial position,
- vibration measurements shall be in displacement microns peak to peak,



- in cases which, because of process conditions, accessibility or non-critical service, may entail the use of machine casing mounted vibration transmitters, the transmitters shall be of the "acceleration" type incorporating a filter network, if necessary along with integration in the monitor unit for vibration read-out in velocity mm/sec RMS. For alarm only, one transducer may be used. For alarm and trip conditions 3 transmitters shall be used with a voting system (i.e. one high reading out of three = alarm, two out of three = trip). Contacting type of equipment shall meet the requirements of ISO 2954,
- velocity type transmitters shall be used as an alternative to velocimeters when machine rotational speed and generated vibration frequency conditions dictate,
- individual read-out of all channels shall be provided in HMI as well as in the vibration monitoring module. Display shall be by means of a multi-point indicator and digital selector,
- facilities for trend monitoring using trend functions of the DCS shall be provided on the turbo-generator bearings as an aid for predictive maintenance purposes,
- vibration parameters of the turbine shall also be fed in the turbine control system
- buffered signals at the monitor shall be a requirement to enable external data acquisition, if such is necessary,
- facilities shall be provided for the calibration of the instrumentation system.

Further requirements on the analysis functions of the VMS are given in Section B8.

B0.6.7 Standardization of makes

The works shall be designed to facilitate access and facility for inspection, cleaning, maintenance and repair. Continuity of supply is a prime concern. The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the works. The Plant shall be designed to operate satisfactorily under all variations of load, pressure, and temperature.

Corresponding parts throughout shall be made to gauge and be interchangeable wherever possible.

No prototype will be permitted. Continuity of operation and lowest maintenance requirements are of prime concern. The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the equipment and plant.

The equipment must be standardized as much as possible.



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B0.7.2.3 Mechanical equipment

Rotating units

Balance testing of rotating units

Each rotating unit shall be first statically balanced and then dynamically balanced according to ISO 1940 (in the case of impellers this shall be done before and after mounting of the service rotor shaft). However, Generator rotor will be dynamically balanced according to ISO 11342. A check balance of items that have undergone overspeed test shall also be made.

Vibration testing of rotating units

The vibration characteristics of rotating units shall be measured during performance tests. Locations of measurement and standards to be achieved shall, on request, be subject to agreement by the Employer's Representative.

Pumps

Running tests and performance tests shall be conducted on all pumps. Performance tests shall be conducted through the full operation range of the pump to closed valve conditions. Graphs indicating flow/head, flow/ power absorbed, flow/ efficiency, flow/NPSH and speed shall be produced. Results for feedpumps shall be assessed with reference to ISO 9906 class 1 (without construction tolerances), and results for other pumps to class II or III as agreed. No negative tolerance on head, capacity and efficiency and no positive tolerance on power are accepted.

The lubricating oil used in the test shall be of the same brand and grade as that recommended by the manufacturer for service use.

Dismantling of the pump for visual examination of parts for damage following test shall be done when required by the inspection standard, when considered necessary by the manufacturer, or when requested by the Employer's representative witnessing the running or performance tests. Replacement of parts following test shall necessitate repeat testing.

Clearance check of the pumps and balancing test of the impeller (acc. to VDI 20160 or eq.) shall be conducted before pump commissioning.

Pump tests shall be carried out with the motor, as supplied with the pump. In case several pumps of same size and type are supplied, test can be carried out with the same motor.

Pumps under the scope of auxiliary package/systems shall be tested with calibrated shop motor. The high energy pumps including turbine lube oil and control oil pumps shall be tested with job motor (with the motor, as supplied with the pump).

Full load full speed/back to back locked rotor torque test for one gearbox shall be ensured.



No-load mechanical run test for boiler feed pump drive turbine as per API 612 / ISO 10437 to be ensured.

Steam turbines

The turbines shall be completely assembled with their control; on a suitable erection rig at the manufacturer's works and shall be carefully inspected and measured for manufacture and assembly tolerances.

Stop and governing valves shall be delivered and installed separately. Therefore stop and governing valves will be inspected and measured for manufacture and assembly tolerance separately.

Functional tests shall be performed on the safety equipment (running with steam is not requested).

Important items of turbine control equipment which cannot be adequately tested during the main tests shall be separately bench tested. Furthermore, testing shall be in accordance with IEC 60953-1 and comprise:

- balancing and overspeed test of the assembled rotor,
- measurement of radial and axial clearances,
- assembling inspection.

Minimum clearances between shaft seal casing and shaft seal ring, radial and axial blade clearances in blading section, axial and radial alignment of rotor in respect of shaft seals, alignment of overspeed governor etc. shall be ensured and verified by Bidder/Contractor.

Testing of free standing blades natural frequency and moment weight shall be performed for IP & LP blades.

All moving blades over 225 mm of active length shall be moment weighed and assembled on shaft in a prescribed sequence to ensure optimum balancing of rotor. Natural frequency of LP turbine blades shall be determined before mounting on rotors to ensure that the same are outside operating frequency range.

 No load run test or a rig test at the workshop as per Bidder's/Contractor's/OEM's practice for the two main turbines is acceptable.

Air compressors

Air compressors shall be tested in accordance with the requirements of ISO 1217 or equivalent standards. Any request for deviation from the test conditions shall be accompanied by the manufacturers' proposals for the adjustment of the correction factors contained in the standard. Tolerances will be allowed according to ISO 5167-1.



Cooling towers

One Cooling Tower per unit shall be tested on site to an appropriate CTI standard. Any request for deviation from the test conditions shall be accompanied by the manufacturers' proposals for the adjustment of the correction factors contained in the standard.

In addition performance testing to be carried out for the whole system (all cells).

Cranes and hoists

Where size permits cranes and hoists shall be completely assembled at the manufacturers works and functional tests without load conducted.

Flue gas (IDF) and air fans (IDF, PAF, SAF)

Axial and radial fans shall be tested in accordance with the requirements of ISO 14694 or equivalent standards for vibration. ISO 12499 shall also apply. Any request for deviation from the test conditions shall be accompanied by the manufacturers' proposals for the adjustment of the correction factors contained in the standard.

Performance tests shall follow VDI 2044, ISO 5801 or equivalent standard.

Before commissioning, the following tests shall be conducted: NDT, trial assembly of casing, blue matching, and clearances.

Dampers and Gates

Large dampers and valves shall be leakage / tightness tested (type test) in the workshop and at site the whole system shall be tested.

Rotary air preheater (RAPH)

Before commissioning, the following tests shall be conducted: NDT, trial assembly of casing, blue matching, and clearances.

Coal Pulverizer

Before commissioning, the following tests shall be conducted: NDT, trial assembly, blue matching, and clearances. The tests will be carried out during manufacturing stage wherever possible.

B0.7.2.4 Electrical equipment

Electrical equipment and material which is not covered by the tests specified elsewhere in this document shall be inspected and tested in accordance with the latest edition of standards listed hereafter. Alternatively, equivalent standards approved by the Employer's Representative may be used. Type tests shall be carried out if type test certificates certified by an independent test authority are not available.

Installation Material

IEC 60130

Connectors for frequencies below 3 MHz



IEC 60364	Low voltage electrical installations/ Electrical installations of buildings
IEC 60423	Conduits for electrical purposes

Materials for earthing and lightning protection

IEEE 80	Guide for safety in AC Substation Grounding
IEEE 81	Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface potentials for Ground system
NFPA 780	Installation of lightning protection systems

Insulators and Bushings

IEC 60383	Insulators for overhead lines with a nominal voltage above 1000 V
IEC 60507	Artificial pollution tests on high voltage insulators to be used on AC systems
IEC 60137	Insulating bushings for AC voltages above 1000 V

Surge Protection Equipment

The surge protection equipment shall be tested in accordance with IEC 60099

AC Switchgear for voltages above 1 kV

IEC 62271	High-voltage switchgear and control gear
IEEC37.013	IEEE standard for AC-High-Voltage generator circuit breakers on a symmetrical current.

At least the following tests shall be performed in the manufacturer's workshop on the individual apparatus and on the complete installation, respectively, all in accordance with IEC Standards:

- Visual inspection
- Power frequency HV tests
- Dielectric tests of the auxiliary circuits
- Measurement of the main contacts resistance with dc
- Temperature rise test on circuit breakers (type test certificate)
- Test of mechanical endurance (type test certificate)
- Measurement of the contact opening period (type test certificate)
- Functional tests of the control circuits
- Check of the operational sequence
- Measurement of the instrument transformer's angle and ratio errors (according to IEC-standards 60044)
- Check of the denominations.



Note 1: All MV switchgear shall be type tested according IEC 62271-1, IEC62271-100 and IEC 62271-200 including internal arc classification IAC

= AFLR. Related type test certificates shall be provided with the Tender. If the test has already been carried out on similar type switchgear, type test certificates may also be accepted.

Note 2: All GIS above 52 kV shall be tested according IEC 62271-1, IEC 62271-203.

Type tests shall be carried out, at the expense of the Contractor and without any impact on the projects overall time schedule, if type test certificates certified by an independent test authority are not available.

Note 3: Generator circuit breakers shall be tested according IEEE Std C37.013.

High voltage fuses

IEC 60282 High voltage fuses

IEC 60644 Specification for high voltage fuse links for motor circuit applications

Oil-immersed power transformers

IEC 60076 Power transformers

IEC 60214 On-load tap-changers

IEC 60404-2 Magnetic materials

a) Tanks

- Inspection of weld preparations, approved crack detection of major strength welds.
- Hydraulic test and vacuum test
- Visual and dimensional checks
- Certification of test results.

b) Cores

• Material

- Checks on flatness
- Checks for absence of burrs such as may be caused by slitting, cropping and punching
- Electrical insulated tests
- Visual and dimensional checks.

• Assembly

- Inspection during assembly stage, whilst core is still horizontal
- Visual and dimensional checks on complete core
- Checks on straightness of clamps
- Checks on clamp welding
- High voltage tests between core packets, clamps and belts in all relevant combinations
- Check actual weight of core steel in magnetic circuit against design weight
- Check that all block and sheet insulation and all spacers are in position
- Check earthing of core packets to clamps.



c) Windings

• Windings

- Copper checks
- Fewest possible number of welds
- Quality of weld and finishing
- Insulation on copper
- Check for correct material
- Check correct application to conductor
- Visual and dimensional checks

• Winding of turns

- Checks during winding of different Sections of winding
- Checks on positions of starts and finishes of Sections
- Checks on correct directions of windings of turns (Polarity)
- Visual checks

• Assembly of windings together

- Check on relative positions and numbers of leads
- Check that vertical and horizontal coolant ducts are clear and to full design dimensions
- Visual checks

• Assembly of windings on core

- Visual and dimensional checks.

d) Leads

- Checks on disposition, insulation and support of tapping leads
- Checks on insulation support and positioning of bushing leads and provision for connection to bushings
- Checks on lead connections (cimping, brazing etc.)
- Checks on interphase connections
- General visual checks.

e) Insulation

- Checks on arrangement of petalling
- Checks on inter-phase and earth barriers
- Checks on shields
- Checks on clearance and creepage distances
- General visual checks.

f) Coolant flow ducts

- Check that vertical and horizontal passages are clear and to full design dimensions
- General visual checks.

g) Current transformers, links and connections

- Check that built-in current transformers are in the correct leads
- Check that the connections and alternative connections are clearly marked and that the marked ratios are correct.



h) Assembly of transformer in Tank

- Check insulation between transformer and tank
- Check security of fixing of transformer in tank and of any packing used
- Check electrical clearances between tank and leads and windings
- Checks for cleanliness and freedom from debris of inside of tank
- General visual check.

i) Valves

- Check action of valves after welding into position (especially butterfly valves)
- Checks for leaks under pressure.

j) Paint work

- Checks for preparation of surfaces
- Checks for use of correct paint system
- Visual checks on general finish.

k) Conservator

- Check for leakage
- Check capacity
- Visual checks.

l) Bushings

- Check against standards
- Check that routine tests have been done
- Checks for leakage when mounted on transformer
- Checks for distortion, flaws and chips.

m) Tap-changers (on-load and off-circuit as appropriate)

- Inspection on completion of manufacture, including a review of manufacturer's stage test records and procedures
- Mechanical and electrical checks in the manufacturer's works
- Tests in accordance with the appropriate IEC or other standard as applicable
- Check ten complete cycles from end to end of the range
- Check five cycles on full current
- Check five cycles at full voltage
- Check transmitters for correct number of steps and impedance values
- Check interlocks
- Check warning, alarm and trip contacts
- Visual and dimensional checks.

n) Pumps and fans

- Checks for direction of rotation against motor terminal markings



- Visual and dimensional checks.

o) Heat exchangers

- Checks on radiators for leaks
- Checks on radiators for paint finish and inner cleanliness
- Checks on oil-to-water heat exchangers for leaks at manufacturer's works
- Checks on oil-to-water heat exchangers for cleanliness of oil chambers and passages
- General visual and dimensional checks.

p) Processing

- Checks on pressures and temperatures with manufacturer's process charts available.

q) Control cubicles, kiosks and terminal boxes

- Checks on functioning of contactors, overloads isolators and general operation of control circuits for cooling gear
- Checks on operation of circuits for thermometers, thermal images, pressure relief valves, oil and gas operated relays, flow detectors, heaters, lights and power output sockets
- Checks on wiring arrangements and terminal boards
- Checks on weather sealing of doors, cable glands and other external features
- Visual and dimensional checks.

r) Workshop tests on complete transformer

The following routine test in accordance with IEC 60076:

- Measurement of winding resistance
- Measurement of voltage ratio and check of voltage vector
- Measurement of impedance voltage, short circuit impedance and load loss
- Measurement of no-load loss and current at U_r , $1.05 \times U_r$ and $1.1 \times U_r$
- Dielectric routine tests in accordance with IEC 60076-3
-
- Test on on-load tap changers
- Insulation resistance
- Separate source voltage withstand test
 - Induced overvoltage test to be carried out on all main transformers (see item 3) acc. to IEC 60076-3, table 1 (ACLD/ACSD).
 - PD test to be carried out for all generator transformers, interconnecting transformers and start-up/standby transformer together with ACLD.
- Frequency response analysis.
- FRA test to be carried out on all main transformers (see item 3).

The above tests shall be carried out on all transformers.



The following tests in accordance with IEC to be carried out as type tests (type tests shall not be repeated if type test certificates of an identical/similar rated transformer issued by a recognized test laboratory are available):

- Temperature rise test including direct measurement of hot-spot temperature
- Measurement of the harmonics of the no-load current
- Dielectric type tests in accordance with IEC 60076-3
- Measurement of zero sequence impedance
- For the above type tests, test certificates may be accepted at the discretion of the Employer/Engineer, in place of tests on the first transformer of each basic type excepting the generator transformer. In the case of generator transformers the type tests must be carried out
- Noise measurements.
- The generator step-up transformer, the 400/230 kV interconnection transformer, the unit auxiliary and the auxiliary transformers shall be dynamic short circuit withstand tested according IEC 60076-1 & -5 either in the manufacturers workshop or in a recognized 3rd party test lab (as special test).

In addition to the above tests, the following tests shall be made as routine tests:

- Tangent delta measurements on the insulation, the method to be agreed with the Employer/Engineer
- Core insulation test on magnetic circuit
- On windings of 30 kV rating or above either:
 - ration influence voltage tests, the method to be agreed with the Employer/Engineer or
 - partial discharge measurements in accordance with IEC
- Transformer oil analysis according to IEC 60296, IEC 60567 and according IEC 62535 for detection of potential corrosive sulphur in mineral oils
- Transformer tanks, conservators, oil pipework and air cooled cooling plant shall withstand without leaking or permanent distortion, the application for 24 hours of a pressure which is such that the test pressure at any point in the equipment is twice the working pressure at that point or 0.7 kg/cm² plus the working pressure at the point or 0.3 kg/cm² plus the pressure exerted at that point when the pressure relief is opened slowly by oil pressure whichever is the greatest.
- Tank vacuum & pressure test
- Pressure test of radiators
- Oil leakage test
- Pressure relief device, Buchholz relay, oil, winding meters, oil level indicator, dry cool breather, dissolved gas analyzer test / check.



Fault withstand (fault versus time) curve for all transformers shall be submitted by the Contractor.

Over-excitation curves shall be provided by the manufacturers for the station transformers.

Separate type and routine tests shall be carried out for all accessories like bushings, bushings CTs, tap changers, cooling fans, control panels, etc.

Dry type transformers

The following routine tests in accordance with IEC 60076 shall be carried out on all transformers:

- Measurement of winding resistance
- Measurement of voltage ratio and phase displacement
- Measurement of short circuit impedance and load loss
- Measurement of no-load loss and current
- Separate source AC withstand test
- Induced AC voltage test
- Lightning impulse test
- Partial discharge measurement.

The following tests in accordance with IEC 60076 to be carried out as type tests (type tests shall not be repeated if type tests certificates of an identical transformer issued by a recognized test laboratory are available):

- Temperature rise test
- Measurement of sound level
- Short circuit test
- Environmental Test according Class E2
- Climatic test according Class C1
- Fire behaviour test according to Class F1.



Also, Lightning impulse test shall be a type test.

Fault withstand (fault versus time) curve for all transformers shall be submitted by the Contractor.

Separate type and routine tests shall be carried out for all accessories like bushings, bushings CTs, tap changers, etc.

Current and voltage transformers

The current and voltage transformer shall be tested in accordance with IEC 61869

Generators

IEC 60034, IEEE 115, ISO 1680 and ISO 10816.



a) Generator test report

Comprehensive test reports for the generators are to be compiled and submitted by the Contractor, which shall include:

- Description of the test method, equipment used and any limitations of the test plant.
- Copies of the oscillographs recorded with appropriate calibration data
- Open circuit saturation, short circuit and loss curves for the generator
- A performance chart of the generator (being a diagram of constant stator and rotor current curves plotted on rectangular axis of MVar and MW load) The recommended loading, stator core end heating and stability limits shall be shown on the chart.
- Calculations of full load temperature rise for the stator, rotor and exciter. Any correction factors used to allow for different voltage current and cooling conditions shall be justified by reference to published literature or to previous type tests.
- Calculations of the efficiency of the complete generator at 100%, 75% and 50% load. Any correction factors for losses that could not be measured at routine tests shall be justified by reference to published literature or to previous type tests.
- Calculations of machine parameters (according to IEC 60034-4) such as transient reactance and time constant, sub-transient reactance and time constant, short circuit ratio, synchronous reactance, negative phase sequence reactance, zero sequence reactance, capacitance and also the harmonic analysis of the neutral current.
- Calculation of full load excitation of the machine at rated power factor lagging and at unity power factor, excitation V curves.

b) Routine tests on generator

- Generator stator frame
 - hydrostatic test (if H₂ cooling)
 - resistance check of temperature detectors
- Generator rotor
 - ultrasonic examination
 - mechanical balance
 - over-speed test
 - measurement of 50 Hz rotor impedance (at 3000 RPM).
- Stator core laminations
 - Magnetization of stator core lamination layer resistance between the layers of the core
- Generator H₂ cooler (if H₂ cooling)
 - hydrostatic test
- Generator assembled:
 - three phase short circuit characteristic test and current balance check
 - dielectric test



- measurement of insulation resistance
- measurement of winding resistance
- open circuit characteristic test and voltage balance, phase sequence check
- segregation of mechanical loss and core loss
- segregation of stray load loss
- efficiency calculation
- unbalanced load test for negative-phase sequence and zero sequence reactance
- shaft voltage measurement
- oscillographing of verified voltage wave form and harmonic analysis
- measurement of vibration
- polarization index
- tan delta measurement of complete winding
- bearing insulation resistance.

c) Type tests on generator (as far as type test certificates are not available)

- Sudden short circuit test at reduced voltage (30%, 50% and 70% of rated voltage), extrapolated to 100% voltage
- Equivalent heat run test consisting of:
 - windage and friction heat run, open circuit heat run at 105% rated voltage, short-circuit heat run at rated line current, open-circuit heat run at rated line voltage
 - measurement of open-circuit direct-axis transient time constant
 - noise measurement
 - moment of inertia
- Measurement of excitation response time*)
 - overall characteristic coupled with generator and AVQC cubicle at no load*)

*) applicable to assembled unit consisting of generator, exciter and voltage regulator, may be carried out on site

Type tests shall be carried out if type test certificates (Not older than 5 years as on date of bid opening) certified by an independent test authority are not available.

Sudden short circuit test shall be carried out in line with IEC at voltage level to be finalized during detailed engineering.

d) Routine tests on generator exciter

- Resistance of windings
- Insulation resistance
- High voltage tests
- Short-circuit characteristic
- No-load characteristic.



Motors

IEC 60034, ISO 1680, ISO 10816

- Type tests (each motor type) as far as type test certificates are not available
 - measurement of starting (locked rotor) current and torque
 - power factor and efficiency measurement
 - heat run test
 - noise measurement
 - temperature rise measurement
- Routine tests (each motor)
 - measurement of winding resistances
 - measurement of shaft current
 - no-load and current measurement
 - no-load short circuit measurement
 - open circuit secondary induced voltage test at stand still (wound rotor)
 - dielectric test (high voltage test)
 - measurement of insulation resistance
 - overspeed tests (120% for 2 minutes)
 - check of motor vibrations
 - oscillographic measurement of starting current.

Emergency diesel sets

All relevant routine and type tests according to:

ISO 3046	Reciprocating internal combustion engines - Performance
ISO 8528	Generating sets with reciprocating internal combustion engines

a) Type tests

The diesel generator unit (DGU) and all auxiliary equipment shall be fully type tested. These tests shall include all type tests as defined in the relevant latest IEC and ISO recommendation (as a minimum requirement).

Evidence shall be given that the DGU together with the auxiliary equipment to be provided, under these specifications, have successfully passed all type tests of design, service frequency, impulse, insulation level, dynamic operating range, and electrical and mechanical endurance performance, as appropriate and as specified.

However, if deemed necessary, the Employer shall decide if additional tests are required to be performed by the Tenderer/Contractor.

The Tenderer/Contractor shall supply certified copies of type test certificates covering the proposed DGU of similar capacity or higher, operating range, data features, design and construction.



b) Sample tests

Sample Tests shall be performed, comprising as a minimum the following tests:

- Visual checks and measurements of dimensions
- Functional tests.

c) Routine tests

The Tenderer/ Contractor is required to carry out routine tests on each assembled and finished diesel generator unit and its relevant auxiliary equipment to demonstrate the integrity of the system.

Routine test certificates shall be submitted for the Employer's review and approval before shipment of the DGU.

The DGU shall pass all the routine tests as laid down in the relevant latest revisions of IEC & ISO Standards. In addition, the visual inspection, which shall determine conformity of the DGU & the relevant equipment with the requirement, shall be part of the routine tests.

The acceptance test for the diesel engine at the Manufacturer's workshop test bed shall include the measurements, calculations and functional checks stated in ISO 3046-1 (E).

A test report in English shall be issued according to ISO 3046-1 (E) giving evidence of the following data:

- Engine model, order No., rated output, operating speed, number of cylinders, bore, stroke, compression ratio, cylinder displacement, no. of strokes, date of test, the Employer's name, inspector's name, ambient air temperature, relative humidity, barometric pressure, fuel specific gravity, fuel net calorific value, setting data of injection pump, firing sequence, valve timings, type of fuel oil filter, type of lube oil filter, type of turbocharger and inter-cooler, type of governor, type of injectors.

The Tenderer/Contractor shall submit together with the test report a certificate showing the emission levels of the exhaust gases: NOx, CO and PM (particulate matter).

The diesel engine shall be proven to be capable of operating in steady state condition on all above mentioned loads. If the diesel engine fails to operate in steady state condition on one or more loads, this engine type shall be not accepted for the scope of the diesel generator units.

d) Special tests

The diesel engine shall be at least tested in total for one hour at the following loads:

- | | |
|--------------------------------|-------------|
| • Warm-up of the diesel engine | as required |
| • 25 % load operation | 10 minutes |
| • 50 % load operation | 10 minutes |



- 75 % load operation 10 minutes
- Full load operation 20 minutes
- 110 % load operation 20 minutes
- Cool down of the diesel engine.

During the test run, temperatures, pressures and fuel consumption shall be measured and recorded.

The diesel engine shall be proven to be capable for operation in steady state condition on all above mentioned loads. If the diesel engine fails to operate in steady state condition on one or more loads, this engine type shall not be accepted.

Low voltage switchgear

The following standards and regulations or equivalent shall be used:

- | | |
|-----------|--|
| IEC 60947 | Low-voltage switchgear and control gear |
| IEC 61439 | Low-voltage switchgear and control gear assemblies |
| IEC 60529 | Degrees of protection provided by enclosures (IP Code) |
| IEC 60898 | Specifications for circuit-breakers |
| IEC 60079 | Electrical apparatus for potentially explosive atmospheres |
| IEC 60947 | Regulations for low-voltage switchgear |

The "Design Verification" of all low voltage switchgears/ motor control centers shall be carried out by following methods:

- "Testing" for the Pos. No. 1., 2., 3., 4., 5., 9., 10., 11., 12. and 13 of IEC 61439-1/Annex D, Table D.1
- "Assessment" for the Pos. No. 6., 7. and 8 of IEC 61439-1/Annex D, Table D.1

In addition to the above tests for which certificates shall be submitted, at least the following tests shall be performed in the manufacturer's workshop on the individual apparatus and on the complete installation, respectively, all in accordance with IEC Standards:

- Visual inspection
- Power frequency HV tests at main circuit
- Dielectric tests of the auxiliary and control circuits
- Functional test of the control circuits
- Check of the operational sequence.



Capacitors

IEC	60831	Shunt power capacitors
IEC	60871	Shunt capacitors for A.C. power systems
IEC	60931	Shunt power capacitors
IEC	60143	Series capacitors for power systems
IEC	60358	Coupling capacitors and capacitor dividers
IEC	60384	Fixed capacitors for use in electronic equipment

Batteries, charging equipment inverters and DC/DC converters

IEC	60086	Primary batteries
IEC	60119	Recommendations for polycrystalline semiconductor rectifier stacks and equipment
IEC	60146	Semiconductor converters
IEC	60896	Stationary lead-acid batteries
IEC	61204	Low voltage power supply devices DC output

Chargers and batteries shall be tested together in the factory. Testing of chargers and batteries together at site will also be accepted. All factory tests shall be repeated at site.

Chargers

- Visual inspection (to be repeated on site)
- Functional tests (to be repeated on site)
- Heat run (type test)
- Output voltage stability measured for 25% load steps
- Ripple voltage measurement without connected battery
- Ripple measurement (voltage and current) with connected battery (at site will also be accepted)
- Insulation test (to be repeated on site).

Batteries

- Visual inspection (to be repeated on site)
- Insulation test (to be repeated on site)
- Charge test and discharge tests

Fuse Box

- Visual inspection (to be repeated on site)
- Functional tests (on site)
- Insulation test (on site)

Inverters and DC/DC converters

- Visual inspection (to be repeated on site)
- Functional tests (to be repeated on site)
- Heat run (type test)
- Insulation test (to be repeated on site).



Lamps and accessories

IEC	60081	Double-capped fluorescent lamps
IEC	61347	Lamp control gear
IEC	60921	Ballasts for tubular fluorescent lamps
IEC	60155	Glow starters for fluorescent lamps
IEC	60598	Luminaries
IEC	60188	High-pressure mercury vapor lamps
IEC	60400	Lampholders and starter holders for tubular fluorescent lamps
IEC	60901	Single-capped fluorescent lamps
IEC	60662	High pressure sodium vapor lamps
IEC	60192	Low pressure sodium vapor lamps
IEC	60923	Auxiliaries for lamps
IEC	61347	Part 2-13: lamp control gear for LED Modules
IEC	62031	LED modules for general lighting - Safety specifications
IEC	62560	Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specifications
IEC	62612	Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Performance requirements
IEC	62471	Photobiological safety
IEC	62384	DC or AC supplied electronic control gear for LED modules - Performance requirements
IEC	60838	Part 2-2: miscellaneous lampholders - Connectors for LED-modules
IEC/PAS	62717	LED Modules for general lighting - Performance requirements
IEC/PAS	62722	Luminaires Performance

HV-, MV- and LV-cables

All relevant routine and type tests according to:

IEC	60060	High voltage test techniques
IEC	60071	Insulation co-ordination
IEC	60230	Impulse tests on cables and their accessories
IEC	60811	Common test methods for insulating and sheathing materials of electric cables
IEC	60840	Power cables with extruded insulation and their accessories for rated voltages above 30 kV up to 150 kV
IEC	62067	Power cables with extruded insulation and their accessories for rated voltages above 150 kV up to 500 kV
IEC	60502	Power cables with extruded insulation and their accessories for rated voltages from 1 kV up to 30 kV



a) LV-cables

LV cables shall be workshop tested as per IEC 60502-1 with the following tests as a minimum:

Type tests:

- electrical type tests acc. to: IEC 60502 - 1 Clause 17
- non electrical type tests acc. to: IEC 60502 - 2 Clause 18.

Also following additional type tests shall be carried by the Contractor at their own cost prior to the first shipment of all offered cable if no type test certificates of identical cables are available:

- Fire Resistant according to IEC 60331, BS 6387
- Flame Retardant according to IEC 60332
- Low Smoke Test according to IEC 61034
- Halogen Content Test according IEC 60754
- Water Tree Test of XLPE Insulation (accelerated)
- Test voltage = $3 \times U_0$
- Test frequency = 500 Hz
- Core environment = 400C water
- Duration of test = 4 month
- Test after 4 months: Dielectric stress withstand $> 14 \text{ kV/mm}$.

Moreover, test certificates shall be provided, proving that each cable type to be used has successfully passed type tests as required by the applicable standards during the last 12 months before award of contract. Otherwise, these tests have to be repeated on sample Sections.

Routine tests: according IEC 60502 - 1, Clause 15

- measurements of electrical resistance of conductors according to Clause 15.2
- voltage tests according to clause 15.3.

Sample tests: according IEC 60502 - 1, Clause 16

- conductor examination according Clause 16.4
- check of dimensions according Clause 16.5 to 16.8
- hot set test for EPR, HEPR and XLPE insulations and elastomeric sheath according Clause 16.9.

b) MV-cables

MV cables shall be workshop tested as per IEC 60502-2 with the following tests as a minimum:

Type tests:

- electrical type tests acc. to: IEC 60502 - 2 Clause 18
- non electrical type tests acc. to: IEC 60502 - 2 Clause 19.



Also following additional type tests shall be carried by the Contractor at their own cost prior to the first shipment of all offered cable if no type test certificates of identical cables are available;

- Fire Resistant according to IEC 60331, BS 6387
- Flame Retardant according to IEC 60332
- Low Smoke Test according to IEC 61034
- Halogen Content Test according IEC 60754
- Water Tree Test of XLPE Insulation (accelerated)
- Test voltage = $3 \times U_0$
- Test frequency = 500 Hz
- Core environment = 40°C water
- Duration of test = 4 months
- Test after 4 months: Dielectric stress withstand $> 14 \text{ kV/mm}$.

Moreover, test certificates shall be provided, proving that each cable type to be used has successfully passed type tests as required by the applicable Standards during the last 12 months before award of contract. Otherwise, these tests have to be repeated on sample Sections.

Routine tests: according IEC 60502 – 2, Clause 16

- measurements of electrical resistance of conductors according to Clause 16.2
- partial discharge test according to Clause 16.3 on cables having cores with conductor screens and insulation screens in accordance with Clause 7.1 and 7.2
- voltage tests according to clause 16.4.

Sample tests: according IEC 60502-2 Clause 17

- conductor examination according Clause 17.4
- check of dimensions according Clause 17.5 to 17.8
- voltage test for cables of rated voltages above 3.6/6 (7.2) kV according to Clause 17.9
- hot set test for EPR, HEPR and XLPE insulations and elastomeric sheath according Clause 17.10.

c) HV-cables

The 230 kV XLPE-Insulated Single-Core Underground Cables and Accessories shall be tested as per latest IEC 62067 including all subsequent amendments and relative standard. The Employer/Engineer shall witness the required type tests.

The approval of the Employer/ Engineer or the passing of any such inspection or test will not however, prejudice the right of the Employer/ Engineer to reject the 230 kV XLPE-Insulated Single-Core Cables and accessories if it does not comply with the Specification.

Defects discovered during the type/routine/sample tests shall entitle the Employer/Engineer to reject the cables/accessories fabricated for this Project.

The Tenderer/ Contractor shall fabricate without additional cost the cable lengths and accessories necessary for the tests, over and above those required to complete the Works at Site.

For the definitions of the Type Tests, Sample Tests, Routine Tests and Tests after installation, reference shall generally be made to the relevant IEC Standards.

HV cables and accessories shall be workshop tested as per IEC 62067 with the following tests as a minimum:

Type tests on cable systems: according clause 12:

- Electrical type test according Clause 12.4
 - Check of insulation thickness acc. to Clause 12.4.1
 - Bending test on the cables acc. to Clause 12.4.4 followed by installation of accessories and a partial discharge test acc. to Clause 12.4.5
 - Tan δ measurement acc. to Clause 12.4.6
 - Heating cycle voltage test acc. Clause 12.4.7
 - Partial discharge test acc. to Clause 12.4.5 (at ambient and at high temperature)
 - Switching impulse voltage test acc. to Clause 12.4.8
 - Lightning impulse voltage test followed by a power frequency voltage test acc. to Clause 12.4.9
 - Test of outer protection for joints
 - Examination of cable system with cable and accessories after completion of tests acc. to Clause 12.4.10.
 - Testivity of semi-conducting screen acc. to Clause 12.4.11.
- Non electrical type tests according to Clause 12.5
 - Check of dimensions acc. to Clause 12.5.1
 - Tests for determination the mechanical properties of insulation acc. to Clause 12.5.2
 - Tests for determination the mechanical properties of oversheats acc. to Clause 12.5.3
 - Aging tests acc. to Clause 12.5.4
 - Pressure test at high temperature on oversheats acc. to Clause 12.5.6
 - Other test on oversheats according to the type used.
 - Hot set test for XLPE insulation acc. to Clause 12.5.10
 - Measurement of carbon black of black PE oversheats acc. to Clause 12.5.12
 - Water penetration test acc. to Clause 12.5.14.

Also following additional type tests shall be carried by the Contractor at their own cost prior to the first shipment of all offered cable if no type test certificates of identical cables are available:

- Fire Resistant according to IEC 60331, BS 6387
- Flame Retardant according to IEC 60332
- Low Smoke Test according to IEC 61034
- Halogen Content Test according IEC 60754
- Water Tree Test of XLPE Insulation (accelerated)
 - Test voltage = $3 \times U_0$
 - Test frequency = 500 Hz
 - Core environment = 400C water
 - Duration of test = 4 month
 - Test after 4 months: Dielectric stress withstand $>14\text{kV/mm}$.

Cables and accessories shall have passed type approval tests in accordance with IEC Specifications and details of the cable designs offered shall be given in the appropriate place in the Technical Schedules. Type test reports shall include cable design details and design drawings of each jointing accessory included in the type test.

The Tenderer/Contractor shall submit certified copies of type test certificates covering the proposed Cables.

Routine tests: according Clause 9

- partial discharge test according to Clause 9.2
- voltage tests according to according to Clause 9.3
- electrical test on oversheath according to Clause 9.4

Sample tests: according to Clause 10

- conductor examination according Clause 10.4
- measurement of electrical resistance of conductor according to Clause 10.5
- measurement of thickness of insulation and oversheath according to Clause 10.6
- measurement of thickness of metallic sheath according to Clause 10.7
- measurement of diameters according to Clause 10.8
- hot set test XLPE insulations and elastomeric sheath according Clause 10.9
- measurement of capacitance according to Clause 10.10
- lightning impulse voltage test follows by a power frequency voltage test according to Clause 10.12
- water penetration test according Clause 12.5.14
- Lead alloy composition and behavior (BS 3908, BS EN 12548).

Type tests of accessories

All accessories shall be tested as per IEC 62067 and all subsequent amendments and relative standards considering Test of Outer protection for buried joints (if applicable).

Routine Tests, Insulation Joints

The insulation flange shall be designed to withstand tests voltages as specified in the Technical Data Sheets and shall be tested accordingly.

Routine Tests, Bonding/Earthing Leads

The Bonding/Earthing Leads shall be designed to withstand tests voltages and currents as specified in the Technical Data Sheets and shall be tested accordingly.

Telecommunication installations

IEC 60215 Safety requirements for radio transmitting equipment

Aerials

IEC 60169 Radio-frequency connectors

Power installations up to 1000 V

IEC 60364 Electrical installations of buildings

IEC 61439-4 Particular requirements for assemblies for construction sites (ACS)

Power installation above 1000 V

IEC 60060 High-voltage test techniques

IEC 62271 HV switchgear and control gear
(incl. Appendix AA "Internal Arc Test")

Protection equipment

Equipment for modular static protection systems (e.g. generator, distance, busbar, protection, etc.) pre-assembled in the relevant standardized boards/cubicles etc. shall be tested in the manufacturers' workshops according to IEC 60255 as far as wiring and proper function is concerned. Simulated inputs (binary signals, current and voltage inputs from test power supplies) shall be used.

Fire alarm system

All relevant routine and type tests according to:

NFPA National Fire Protection Association

DIN VDE 0800 Telecommunications

DIN VDE 0833 Alarm systems for fire, intrusion and hold-up



Where possible valve nameplates shall be circular and shall be fitted under the handwheel captive nut. They have to be of such a diameter that there is no danger for persons operating the valve or that they do not prevent lock-off of this valve; on check valves and small valves the Contractor may provide rectangular nameplates fitted to brackets on the valve or attached to a wall or steelwork in a convenient position adjacent to the valve.

B0.6.4 Marking and labelling

Each crate or package is to contain a packing list in a waterproof envelope. All items of material are to be clearly marked for easy identification against the packing list.

All cases, packages, etc. are to be clearly marked on the outside to indicate the total weight, where the weight is bearing and the correct position of the slings and are to bear an identification mark relating them to the appropriate shipping documents.

All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.

B0.6.5 Corrosion protection, coating and galvanizing

This specification shall be used for the corrosion protection of steel structures, components, pipings and equipment in general which are installed in confined areas (indoors) or outdoors.

Surface preparation, as well as protective coatings and coating systems are based on this specification in order to assure that structural parts of different suppliers will get a corrosion protection of similar and high quality.

Coating material shall only be supplied by manufacturers with international experience and their products can be obtained internationally.

Regarding maintenance work (storage), application and supervision of coating work, choice of coating suppliers should be minimized. At any rate, similar parts of structures/components (such as structural steel, containers, piping, etc.) shall only be coated with products of one individual manufacturer.

The materials and equipment used, the methods of application and the quality of work shall at all times be subject to the inspection and approval of the Employer or his Representative.

To mitigate crevice corrosion, the designs and construction of structures and equipment shall ensure that no collection of water occurs in crevices which could lead to crevice corrosion.



(It is the responsibility of the Contractor to ensure that, for all supplied equipment (including that from sub suppliers):

- The protection system is perfectly suitable for the Site conditions and for the specific purpose.
- The shop paints provide a sufficient protection during transport, storage and erection.
- The shop paints are suitable for handling and erection conditions (slinging, Site welding works etc.) and are compatible with the Site finishing coats
- All necessary precautions are taken in order to prevent damage to paints during storage, handling, welding.
- The necessary repairs are carefully executed as soon as possible.
- The colour RAL number of the finishing coat has been approved by the Employer, including identification code for piping.
- Standardised equipment will be painted according to the manufacturer's standard.
- All corrosion protection and coating on site shall be done in a workshop specifically for the purpose of the application of corrosion protection and coating.

Codes and standards

Applicable standards are:

- Product data of coating manufacturer
- DIN 2403 Indication of pipe-lines according to flowing material
- DIN 4762 Surface roughness
- ISO 8503 Surface roughness
- DIN 8201 Part 1-9 tight blasting agents
- DIN 50976 Corrosion protection, hot dip batch galvanizing of single parts, requirements and testing
- DIN 55928 Part 1-9 corrosion protection of structural steel work through protective coatings and topcoats
- ISO 8501 Preparation of steel substrates before application of paints and associated products
- ISO 12944 Paints and varnishes – corrosion protection of steel structures by protective paint systems
- RAL Colour card
- ISO 8501-1 Preparation of steel substrates before application of paints and related products
- SSPC Vol. 1 and 2 Steel structure painting council

Surface preparation and cleaning of surfaces in the shop

Prior to blasting, areas have to be cleaned from oil, grease, paint residues, splatters, welding splashes and welding slag using a suitable aqueous degreaser, or solvent for more severe grease contamination. The cleaning should be to provide a "water break free surface".

Sharp edges have to be rounded off.

Contaminations caused by salts, acids and alkali solutions shall be eliminated by rinsing with water up to a pH value of 6-8. Soluble salt contamination is to be tested using the Weber Reilly test method (or similar approved) and pH is to be tested using universal indicator paper strips prior to continuation with the blasting.

The preparation of substrates shall be carried out on the basis of the specifications of ISO 12944 part 4 and ISO 8501. The preparation of steel before application of paint and related products shall be in line with ISO 11124 for metallic blast cleaning abrasives and ISO 11126 for non-metallic blast cleaning abrasives. No recycled blast grit may be utilised.

After blasting, an anchor profile of 25 - 50 μm shall be achieved. Blasted surfaces have to be provided with a prime coat of the approved coating system immediately within 4 hours of blasting. All blasting and priming must take place outside of the high humidity periods of the day (i.e. maximum relative humidity of 80%).

Cleaning to be performed on site

Steel work protected by shop primer after arrival on site must be cleaned of salt, sand, oil, etc. before the first coat of paint is applied on site. Shop primer damaged during transport must be rectified by blast-cleaning and coating before application of the site coats.

Wood surfaces shall be sanded clean. All nail holes shall be puttied and sanded before priming, unless the specific coating system allows for coating onto damp concrete, in which case only with approval from the Employer.

If a protective coating of concrete is required, concrete shall be allowed to cure before painting.

Transport and erection damages, as well as damages which result out of additional welding have to be repaired as soon as possible. The damaged areas have to be derusted with rotating or steel brushes, abrasive wheels, and abrasive blasting according to DIN ISO 8501-1.

Cleaning of prime and intermediate coats (if required)

To prevent contamination by mineral oil products, areas with prime and intermediate coat have to be treated with suitable cleaning agent. Cleaning has to be done free of residues, e.g. with alkaline detergents and thorough washing done with fresh water. Rusty spots have to be removed according to required purity. Metallic areas which are provided with temporary corrosion protection have to be cleaned. No oxidation products shall remain on the surface. Further care shall be taken that on hot components, no destructive or reaction products will be released when heating which could injure insulation.

Application procedure

When using the provided coating material, strict adherence to all application instructions given in product data of coating manufacturer is necessary. To obtain the maximum performance, technical data as well as application instructions for the individual coating material have to be strictly followed. For a multi-layer coating system each layer has to have a different colour shade in order to clearly identify number of coats applied. The last finish coat has to be applied in the specified colour shade.

All paintings shall be performed according to ISO 12944. The durability of all paintings shall be "high" which corresponds to 15 years.

The interval between applying the different coats has to follow according to supplier's precautions. Each layer has to be cleaned and released from spray dust before the next layer will be applied. Prior to applying a further layer, the last one has to be repaired. All coatings have to be applied without retarding.

Following application procedures are allowed:

- prime coats by airless spray
areas like disconnections, angles, corners, etc. which are difficult to be reached can be applied by brush or roller
- repair of prime coat by brush
- finish coats
 - at works by airless spray, roller or brush
 - at site by roller or brush or airless spray.

When applying coating systems by roller, rollers have to be of kind and quality which make an appropriate application possible.

Control areas in accordance with the coating supplier's instructions have to be applied. For this procedure, a schedule for control areas has to be prepared by the Contractor and coating supplier which corresponds with the requirements of the warranty agreement.

Number and performance of the control areas have to be done in accordance with ISO 12944 part 7 and have to be documented in writing.

No application shall take place either in the condition of the relative humidity not within the given limit or in case of poor weather conditions such as fog, dust, rain, snow, hail or when it can be assumed that such conditions of poor weather will arise within 2 hours after application.

Temperature of the coated parts has always to be above 5 °C and 3 K above dew point.

All specified dry film thicknesses (DFT) are minimum thicknesses.

Welding seams executed at site have to be taped with an adhesive tape of about 30-50 mm after surface preparation (blasting or manual derusting) and prior to application in the manufacturing plant and to be coated with stripping coat.

Chequered plates, nap plates, etc. have not to be covered with adhesive tape, but have to be coated with stripping coat in a dry film thickness of at least 150 μm .

Edging lines on steel structure have to be taped prior to application and after blasting in sufficient width or have to be protected with varnish before application. Thickness of prime coat may be 50 μm maximum.

During repairing works at site on shop-primed structures, it is important that different coats will have different colour shades. Numbers of layers have to be the same as the original coating system to be used.

Application of temporary primer on structures which have to be insulated has to be in accordance with a sufficient corrosion protection for the period of storage respectively erection time.

Galvanizing

Galvanizing work shall conform in all respects to ISO 1461 or equivalent standards and shall be performed by the hot dip process unless otherwise specified.

It is essential that details of steel members and assemblies which are to be hot-dip galvanized should be designed to suit the requirements of the process. They should be in accordance with ISO 12944.

Vent holes and drain holes shall be provided to avoid high internal pressures and air locks during immersion and to ensure that molten zinc is not retained in pockets during withdrawal.

Careful cleaning of welds is necessary before welded assemblies are dipped. All defects of the steel surface including cracks, surface laminations, laps and folds shall be removed in accordance with BS 4360. All drilling, cutting, welding, forming and final fabrication of unit members and assemblies shall be completed, where feasible, before the structures are galvanized.

The minimum coating thickness shall be as specified in Table 1 of BS 729. Structural steel items shall be first grit-blasted to BS 4232, second quality, (Sa 2 1/2) or pickled in a bath, and the minimum average coating weight on steel Sections 5 mm thick and over shall be 900 g/m^2 , on steel Sections 2 - 5 mm thick 600 g/m^2 .

Galvanized contact surfaces to be joined by high-tensile friction-grip bolts shall be roughened before assembly so that the required slip factor is achieved. Care shall be taken to ensure that the roughening is confined to the area of the mating faces.

Protected slings must be used for off-loading and erection. Galvanized work, which is to be stored at the works or on site shall be stacked so as to provide adequate ventilation for all surfaces to avoid wet storage staining (white rust).

Small areas of the galvanized coating damaged in any way shall be restored by:

- cleaning the area of any weld slag and thorough wire brushing to give a clean surface
- The application of two coats of zinc-rich paint, or the application of a low melting point zinc alloy repair rod or powder to the damaged area, which is heated to 300 °C or the treatment with suitable cold galvanizing paint, such as ORAPI n.z.a.b 706. All zinc rich paint used for such repairs must contain a minimum of 81% by mass of zinc in the dry film.

Connections between galvanized surfaces and copper, copper alloy or aluminium surfaces shall be protected by suitable tape wrapping.



Coating Systems System-No.	Surface location	Temp. °C	Surface preparation	Coating systems	No. of coats	Generic type	Dry film thickness (DFT) per coat µm	Total DFT µm
1	Structural steel works, piping, vessels, tanks INDOOR	up to 120	SA 2.5	Primer Finish	1 1	Zinc-Epoxy Epoxy High Solid	80 80	80 80 160
2	Structural steel works, piping, vessels, tanks OUTDOOR	up to 120	SA 2.5	Primer Intermediate Finish	1 2 1	Zinc-Epoxy Epoxy High Solid 2-Component Polyurethane	80 160 50	80 160 50 290
3	Piping, tanks, etc. INDOOR and OUTDOOR Insulated	up to 120	SA 2.5	Primer	1	Zinc-Epoxy	50	50
4	Pumps, motors, other equipment OUTDOOR	up to 120	SA 2.5	Primer Intermediate Finish	1 1 1	Zinc-Epoxy Epoxy High Solid 2-Component Polyurethane	80 110 50	80 110 50 240
5	Pumps, motors, other equipment INDOOR	up to 120	SA 2.5	Primer Finish	1 2	Zinc-Epoxy Epoxy High Solid	80 50	80 100 180
6	Piping, reactors OUTDOOR Insulated	> 120	SA 2.5	Primer	1	Zinc Ethylsilicate	75	75
7	Stacks OUTDOOR	< 120	SA 2.5	Primer Finish	1 2	Zinc Ethylsilicate Silicone Acrylic	75 50	75 100 175

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Coating Systems									
System-No.	Surface location	Temp. °C	Surface preparation	Coating systems	No. of coats	Generic type	Dry film thickness (DFT) per coat, µm	Total DFT µm	
8	Steel surfaces Uninsulated	200 / 450	SA 2.5	Primer Finish	2	Zinc Eth. Urethane	75	75	
9	Galvanized surfaces	up to 120	Mechanical cleaning from contaminants and zinc salts by means of washing or steam jetting or sweep-blasting with fine sand	When Finish Coat is required, such as sea climate with chloride exposure	1	Epoxy High Solid*	125	125	
10	Steel surfaces permanently in contact with water, also river water splash zone	Medium Temp. C up to 60	SA 2.5	Primer and Finish Coating One	2	Glasslamin reinforced High Solid Epoxy	500	500	
11	Plant / Cooling water pipes	GRP, or steel lined concrete pipes with cathodic protection and coating according to AWWA C 203							

* Additional 1 x Finish Coat 2-Comp. Polyurethane, 50 µm, when exposed to UV or weathering conditions and colour retention is required.



All equipment performing similar duties shall be of the same type and manufacture in order to limit the stock of spare parts required and maintain uniformity of plant and equipment to be installed. Especially the number of types and manufacturers of actuators, valves and instruments shall be reduced to a minimum.

If a piece of equipment is present several times, then all of these pieces shall be identical. All their constituting parts must be exchangeable between them.

The Employer reserves the right to advise the Contractor of preferred type and manufacture to secure the above-mentioned requirements.

Bidder's/Contractor's sub-suppliers and vendors shall comply with Provennes Criteria as stipulated elsewhere in the bidding document.

Throughout the Power Plant metric units, scales and measures shall be used; this applies especially to all fittings.

B0.6.8 Accessibility

The Contractor shall supply and erect sufficiently large safe platforms, galleries, stairways or ladders and access ways necessary for providing safe and easy access to all the plant items for operation and maintenance. The Contractor shall ensure that the whole of the access ways is of uniform design and pattern throughout the works.

The design of all stairways, access ways etc. shall conform to the requirements of the relevant chapters in Section B0.

B0.6.9 Signs & colour code

General

Safety colours, safety symbols and safety signs must comply in construction, geometrical form, colour and meaning with the ISO 3864.

Signs for plant identification during the erection period must be to Employer's approval.

The signs should be of a material which is weather-resistant and of sufficient durability for the conditions prevailing on site.

Mounting and installation

The positions for the signs must be chosen so that they are within the field of vision of the persons to whom they apply. The signs should be permanently attached. Temporarily dangerous areas (e.g. construction sites, assembly areas) may also be marked by movable signs. The safety signs



must be mounted or installed in such a manner that there is no possibility of misunderstanding.

Information signs

Information signs should supply the necessary information to acquaint personnel with the physical arrangement and structure of site, buildings and equipment, e.g. floor numbers, load-carrying capacities including marking of floor areas, working loads of cranes, lifting gear and lifts, room identification, etc. The routing of underground pipes and cables is to be indicated by substantial marker blocks showing the relevant identification numbers.

In the choice of information signs in situations not covered by ISO Draft Recommendation 507 the possibility of using pictograms should be considered. Pictograms are particularly suitable for the identification of rooms, areas and buildings in the non-technical areas of the Plant, sanitary and amenities buildings, etc.

Emergency signs

In the event of accidents, all necessary information should be available immediately to those affected. Thus, a sufficient number of signs of appropriate size should be installed, e.g. escape routes (including marking of floor areas), emergency exits, fire alarms, fire extinguishers, instructions for special fire-extinguishing agents, warnings against fire-extinguishing agents (CO₂), first aid equipment, first aid points, accident reporting points, telephones, etc.

Mandatory signs

Signs indicating obligatory actions must be provided installed wherever certain action is necessary, e.g. do not obstruct the entrance; keep right, etc. Signs should also indicate when the wearing of protective clothing and equipment is necessary and obligatory, e.g., protective goggles, protective clothing, helmets, head guards, breathing equipment, ear muffs, etc.

Warning Signs

Warning signs should refer to the existence or possible existence of danger, e.g., flammable substances, explosive substances, corrosive or noxious substances, suspended loads, general danger, width/height restriction, steps, risk of trapping, slipping, falling, etc.

In addition to warning signs, appropriate black-yellow strip markings should also be used where necessary.

Equipment and Piping Colour Code

For colour code for all equipment and piping see table below, for any other items Employer's approval shall be obtained. For safety issues relevant standards and regulations shall prevail in case of discrepancy. Final selection is to be discussed and approved by Employer.



Colour Code (based on DIN 2403:2007-05 & DIN 5381)

Medium	Base	RAL	Band/ Ring	RAL	Lot- tering	RAL
Flammable liquids and solids e.g. high speed diesel, lube oil, seal oil, hydraulic oil, coal	Signal Brown	8002	Signal Red	3001	Signal White	9003
Flammable gases e.g. hydrogen	Signal Yellow	1003	Signal Red	3001	Signal Black	9004
Non-flammable liquids and solids e.g. ash	Signal Brown	8002	Signal Black	9004	Signal White	9003
Non-flammable gases e.g. nitrogen, carbon dioxide	Signal Yellow	1003	Signal Black	9004	Signal Black	9004
Fire fighting, e.g. fire fighting water	Signal Red	3001			Signal White	9003
Water e.g. for de-icing, condensate from steam cooling closed cooling water except fire fighting water	Signal Brown	8032			Signal White	9003
Steam e.g. main steam, HRH, CRH, aux. steam	Signal Red	3001			Signal White	9003
Acids e.g. dilute sulfuric sulphate	Signal Orange	2010			Signal Black	9004
Alkali, e.g. ammonia, caustic	Signal Violet	4008			Signal White	9003
Air e.g. station air, service air, instrument air	Signal White	9003			Signal Black	9004
Oxygen	Signal Blue	5005			Signal White	9003
Driven machines (e.g. fans and pumps) including motor, Vents, drains, vacuum	Follow medium color					
Structural steel, steel skids for equipment	Window Grey RAL 7040					
Safety caution, e.g. fall or trip hazards, handrails, head room clearance	Alternating stripes Signal Yellow RAL 1003 / Signal Black RAL 9004					
Panels, cubicles, junction boxes	Light Grey RAL 7035					



	PROJECT :NORTH KARANPURA STPP STPP (3X660MW) Main Supplier : BHEL PACKAGE: FDPS PACKAGE SUPPLIER: BHEL-HYDERABAD CONT. NO.:CS- 4410 -001-2			INDICATIVE LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL SUB SYSTEM: MECHANICAL		DOC. No. : CS- 4410-001-FDPS	
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1.		I		KBL	KIRLOSKARWADI	A	
2.	DIESEL ENGINE	I		GREAVES COTTON (R & H)	PUNE	A	
		I		CUMMINS	KOTHRUD / VIMAN NAGAR	A	
		I		CATERPILLAR	USA	A	
		I		ASHOK LEYLAND	CHENNAI	A	FOR BOOSTER PUMP
		I		KOEL	PUNE	A	FOR BOOSTER PUMP
3.	HYDRANT VALVE (SS)	I		SUKAN	AHMEDABAD	A	
		I		SHAH BHOGILAL	AHMEDABAD	A	
		I		NEWAGE INDUSTRIES	SURENDRA NAGAR	A	
4.	SAFETY RELIEF VALVE	III		LEADER	JULLANDHER	A	
		III		SPIRAX MARSHALL	PUNE	A	
		III		FISHER SANMAR	CHENNAI	A	
5.	STRAINER	I		OTOKLIN GLOBAL BUSINESS	MUMBAI	A	
		I		SAROJINI ENTERPRISE	HOWRAH	A	FOR SIMPLEX STRAINER UPTO 300 NB
		I		FILTRATION ENGINEERS	MUMBAI	A	
		I		HAWA ENGINEERS LTD.	AHMEDABAD	A	FOR ONLY Y TYPE STRAINER OF PRESSURE CLASS UP TO 150 & SIZE UP TO 300 MM

Antush

Amogh



PROJECT : NORTH KARANPURA STPP
STPP (3X660MW)
Main Supplier : BHEL
PACKAGE: FDPS PACKAGE
SUPPLIER: BHEL-HYDERABAD
CONT. NO.:CS-4410-001-2

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		I		GRAND PRIX	FARIDABAD	A	
		I		MULTITEX	NOIDA	A	
		I		GUJARAT OTOFILT	AHMEDABAD	A	
6.	CI BUTTER FLY VALVE (UPTO 500 NB PN 16,UPTO 900 NB PN 10)	I		INTERVALVE	PUNE	A	
		I		WEIR BDK	HUBLI	A	
		I		KIRLOSKER	KONDHAPURI	A	
		I		R & D MULTIPLE	VALSAD	A	
		I		IL	PALAKKAD	A	
		I		CRANE PROCESS FLOW	SATARA	A	UPTO 600 NB
		I		FOURESS ENGG	BANGALORE	A	
		I		PENTAIR	BARODA	A	
7.	CI GATE / GLOBE / CHECK VALVES (UPTO 600 NB PN 16)	I		H SARKAR	HOWRAH	A	
		I		BANKIM	KOLKATA	A	
		I		KIRLOSKAR BROTHERS	KONDHAPURI	A	
		I		A V VALVE	AGRA	A	UP TO 300 NB PN 10
		II		LEADER	JULLANDHER	A	
8.	SS BUTTERFLY VALVE (UP TO 400 NB - PN 10)	I		Weir -BDK	HUBLI	A	
		I		FOURESS ENGG.	BANGALORE	A	
		I		IL	PALAKKAD	A	
		I		INTERVALVE	PUNE	A	
		I		CRANE PROCESS	SATARA	A	
9.	SS GATE /GLOBE/ CHECK VALVE (UP TO 300 NB - CL 300)	I		LEADER	JULLANDHAR	A	
		I		FOURESS ENGG	AURANGABAD	A	
		I		WEIR BDK	HUBLI	A	
		I		STEEL STRONG VALVE	NAVI MUMBAI	A	
		I		HITECH	AHMEDABAD	A	
		I		KSB WATER PUMPS AND VALVES	COIMBATORE	A	
		I		BHEL	GOINDWAL	A	
10.	SEAMLESS PIPE (FOR INERT GAS SYSTEM)	II		ISMT	AHMEDNAGAR/BAR AMATI	A	AHMEDNAGAR UP TO 150 NB , BARAMATI UPTO 200 NB

Ankur

Kumar



PROJECT :NORTH KARANPURA STPP
STPP (3X660MW)
Main Supplier : BHEL
PACKAGE: FDPS PACKAGE
SUPPLIER: BHEL-HYDERABAD
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		II		MAHARASHTRA SEAMLESS	RAIGAD	A	
11.	MS PIPE (IS:1239 / IS:3589 UPTO 150 NB/ 900 NB)	I		MUKAT TANKS AND VESSELS	TARAPUR	A	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
		II		SAIL	ROURKELA	A	
		I		PSL	CHENNAI/ VIZAG/ KUTCH/DAMAN	A	SPIRAL WELD SAW AS PER IS 3589
		I		MAHARASHTRA SEAMLESS	RAIGAD	A	200 NB TO 500 NB ERW PIPES AS PER IS 3589
		I		RATNAMANI	KUTCH	A	ERW PIPES AS PER IS 3589 UPTO 400 NB
		I		JINDAL	GHAZIABAD	A	UPTO 350 NB ERW PIPES AS PER IS 1239/3589
		I		SURYA ROSHNI	BAHADURGARH	A	UPTO 400 NB ERW PIPES AS PER IS 1239/3589
		I		RATNAMANI	KUTCH	A	SPIRAL WELD SAW AS PER IS 3589
		I		RATNAMANI	CHHATRAL	A	SPIRAL WELDED SAW AS PER IS 3589 ABOVE 600 NB
		I		JCO GAS PIPES	CHINDWARA	A	SPIRAL WELDED SAW AS PER IS 3589 ABOVE 400 NB
		I		PRATIBHA PIPES & STRUCTURE PVT. LTD.	THANE	A	SPIRAL WELDED SAW AS PER IS 3589 ABOVE 400 NB
		I		LALIT PROFILE	THANE	A	SPIRAL WELDED SAW AS PER IS 3589 ABOVE 355 MM
		I		SURENDRA ENGG.	RAJPURA	A	SPIRAL WELDED SAW AS PER IS 3589 ABOVE 500 NB
		I		SAMSHI PIPES INDUSTRIES	VADODARA	A	SPIRAL WELDED SAW AS PER IS 3589 ABOVE 450 NB

Antul

Kumar



PROJECT : NORTH KARANPURA STPP
STPP (3X660MW)
Main Supplier : BHEL
PACKAGE: FDPS PACKAGE
SUPPLIER: BHEL-HYDERABAD
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		I		MUKUT PIPES	RAJPURA	A	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589 UPTO 500 NB
		I		INDUS TUBES	G B NAGAR	A	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
		I		MANN IND	INDORE	A	SPIRAL WELD SAW AS PER IS 3589
		II		TATA	JAMSHEDPUR	A	UPTO 150 NB ERW PIPES AS PER IS 1239
		I		WELSPUN	BHARUCH	A	SPIRAL WELD SAW AS PER IS 3589
		I		DADU PIPES	SIKANDRABAD	A	UP TO 300 NB ERW PIPE AS PER IS 3589
		I		JINDAL INDUSTRIES LTD.	HISSAR	A	UP TO 300 NB ERW BLACK PIPE AS PER IS 1239/3589
		I		APL APOLLO TUBES LTD.	SIKANDRABAD	A	MS pipes (Black & GI) as per IS 1239 & MS pipes (Black & GI) as per IS 3589 up to 250 NB size, 8 mm thickness and Grade up to Fe 410.
		I		LLYODS LINE PIPES LTD.	THANE	A	MS pipes (Black & GI) as per IS 1239 & MS pipes (Black) as per IS 3589 up to 350 NB size, 8 mm thickness and Grade up to Fe 410.
		I		WELPSUN	ANJAR	A	UPTO 400 NB ERW PIPES AS PER IS 1239/3589
12	FIRE HOSE	II		BIS APPROVED SOURCES WITH VALID LICENCE		A	

Arshad

Ramgopal



PROJECT : NORTH KARANPURA STPP
STPP (3X660MW)
Main Supplier : BHEL
PACKAGE: FDPS PACKAGE
SUPPLIER: BHEL-HYDERABAD
CONT. NO.: CS- 4410 -001-2

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13.	WATER MONITOR	II		HD FIRE	JALGAON	A	
		II		NEWAGE	SURENDRA NAGAR	A	
		II		SHAH BHOGILAL	AHMEDABAD	A	
14.	BRANCH PIPE, COUPLING & NOZZLE (SS & GM)	II		BIS APPROVED SOURCES WITH VALID LICENCE			
15.	DELUGE VALVE WITH TRIMS	I		HD FIRE	THANE/JALGAON	A	
		II		TYCO (GRINEEL)	UK/USA	A	
		I		UTC FIRE & SECURITY INDIA LTD.	BANGALORE	A	FOR PISTON TYPE DELUGE VALVE ONLY
16.	HV/MV SPRAY NOZZLE	II		HD FIRE	THANE	A	
		II		TYCO	UK/USA	A	
17.	QB DETECTOR	II		TYCO (GRINELL)	UK	A	
		I		HD FIRE	THANE	A	
		II		MINIMAX	GERMANY	A	
18.	WRAPPING & COATING MATERIAL	II		MP TAR PRODUCTS	BHILAI	A	
		II		PORWAL INDUSTRIES	RAIPUR	A	
		II		STP	JAMSHEDPUR	A	
		II		RUSTECH	KOLKATA	A	
19.	INERT GAS EXTINGUISHING SYSTEM (SUB-QR ITEM)	II		ANSUL	USA	A*	*SUBJECT TO SUB-QR CLEARANCE FROM ENGG.
		II		KIDDE (GINGEKERR)	DANMARK	A*	
		II		MINIMAX GmbH & Co. KG	GERMANY	A*	
		II		TOTAL WALTHER	GERMANY	A*	
		II		NOHMI BOSAI	JAPAN	A*	
20.	GM VALVE	III*		LEADER VALVES	JULLANDHER	A	*MAIN CONTRACTOR COC + MANUFACTURER STD TC AS PER IS : 778
		III*		SANT VALVES	JULLANDHER	A	
21.	FIRE EXTINGUISHER	I		BIS APPROVED SOURCES WITH VALID LICENCE			
22.	HOSE BOX	III		MAIN CONTRACTOR APPROVED SOURCES			

Amrutha

Rumargujar



PROJECT : NORTH KARANPURA STPP
STPP (3X660MW)
Main Supplier : BHEL
PACKAGE: FDPS PACKAGE
SUPPLIER: BHEL-HYDERABAD
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23.	MALLEABLE FITTINGS	III*		MAIN CONTRACTOR APPROVED & REGULAR SOURCES			*MAIN CONTRACTOR COC + MANUFACTURER STD TC AS PER IS :1879
24.	MS FITTINGS (BLACK /GI)	III		MAIN CONTRACTOR APPROVED SOURCES			
25.	FITTINGS (ASTM A 234/ A 105)	II		NL HAZRA	KOLKATA	A	
		II		GUJRAT INFRA PIPES	BARODA	A	
		II		TUBE PRODUCTS	BARODA	A	
		II		PIPEFIT ENGINEERS	BARODA	A	
		II		MS FITTINGS	KOLKATA	A	
		II		SIDDARTH & GAUTAM	FARIDABAD	A	
		II		EBY	MUMBAI	A	
26.	SS ERW/SEAMLESS PIPES	III*		APEX TUBES	BEHROR	A	*MAIN CONTRACTOR COC + MANUFACTURER STD TC AS RELEVANT STD
		III*		RATNAMANI	AHMEDABAD	A	
		III*		REMI	MUMBAI	A	
27.	EOT CRANES (UPTO 10 T) / ELECTRIC HOISTS (UPTO 10 T)	I		ARMSELL	BANGALORE	A	
		I		EDDY CRANES	PUNE	A	
		I		LIFTING EQUIPMENTS	DELHI	A	ONLY FOR ELECTRIC HOIST UPTO 5 T
		I		TRACTOR TRIFEL	PALVEL	A	FOR ELECTRIC HOIST ONLY
		I		CONSOLIDATED HOIST PVT. LTD.	SATARA / PUNE	A	
		I		ALPHA SERVICES	BHIWADI	A	
		I		TUOBRO FURGUSON INDIA PVT. Ltd	KOLKATA	A	FOR ELECTRIC HOIST UPTO 5 T
		I		MUKAND	THANE	A	FOR EOT CRANE ONLY
		I		FAFCO	VADODARA/MUMBAI	A	FOR EOT CRANE ONLY
		I		WMI	MUMBAI	A	FOR EOT CRANE ONLY

Ankur

Kumar



PROJECT : NORTH KARANPURA STPP
STPP (3X660MW)

Main Supplier : BHEL

PACKAGE: FDPS PACKAGE

SUPPLIER: BHEL-HYDERABAD

CONT. NO.:CS- 4410 -001-2

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		I		AVON CRANES	GURGAON	A	
		I		MILLARS INDIA LTD.	KARANSAD	A	FOR EOT CRANE ONLY
		I		TISCO GROWTH	JAMSHEDPUR	A	FOR EOT CRANE ONLY
		I		UNIQUE INDUSTRIAL HANDLERS	NASHIK	A	FOR EOT CRANE ONLY
		I		ANUPAM INDUSTRIES LTD.	V.U.NAGAR	A	FOR EOT CRANE ONLY
		I		HEC	RANCHI	A	FOR EOT CRANE ONLY
		I		CENTURY CRANE	BALLABHGARH	A	
		I		GRIP	FARIDABAD	A	FOR ELECTRIC HOIST ONLY
		I		HERCULES HOIST	RAIGAD	A	FOR ELECTRIC HOIST ONLY
		I		REVA INDUSTRIES	FARIDABAD	A	
		I		GRIP	HYDERABAD	A	
28.	CHAIN PULLEY BLOCK (UPTO 5 TONS)	III*		TRACTEL TRIFEL	PALVEL	A	*MAIN CONTRACTOR COC + MANUFACTURER STD TC AS PER IS : 3832
		III*		ARMSSELL	BANGALORE	A	
		III*		LEAP	DELHI	A	
		III*		HERCULES (INDEF)	RAIGAD	A	
		III*		CENTURY CRANE	BALLABHGARH	A	
29.	MULTI PURPOSE NOZZLE	II		SHAH BHOGILAL	AHMEDABAD	A	
		II		NEWAGE INDUSTRIES	SURENDRA NAGAR	A	
30.	PRESSURE RELIEF DAMPER(GRAVITY DAMPER)	III		MAIN CONTRACTOR APPROVED SOURCES			
31.	ALARM VALVE WITH TRIMS	I		HD FIRE	THANE	A	
		I		HD FIRE	JALGAON	A	
32.	PRESSURE REDUCING VALVE (PRV)	III*		RAPHEAL VALVES (TYCO VALVES)	ISREAL	A	*MANUFACTURER COC + UL/FM/LPCB/VDS APPROVAL FOR SPECIFIC MODEL SHALL BE SUBMITTED

Arkaush

Amargujar



PROJECT : NORTH KARANPURA STPP
STPP (3X660MW)
Main Supplier : BHEL
PACKAGE: FDPS PACKAGE
SUPPLIER: BHEL-HYDERABAD
CONT. NO.: CS- 4410 -001-2

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33.	AIR RELEASE VALVE	I III		DARLING MUESCO MAIN CONTRACTOR APPROVED SOURCES	AHMEDABAD	A	
34.	FOAM SYSTEM (BLADDER TANK TYPE)	I I		FIRETECH HD FIRE	MUMBAI JALGAON	DR DR	
35.	CLEAN AGENT DIRECT/INDIRECT LOW PRESSURE AUTOMATIC FIRE DETECTION & SUPPRESSION SYSTEM WITH LINEAR PNEUMATIC HEAT DETECTION TUBE	II* II*		FIRE TRACE ROTAREX	UK LUXEMBURG	DR DR	* SUBJECT TO APPROVAL OF UL/FM/VDS/LPCB
36.	CONTROL PANEL	I I I I I I I I I I I I I I I I I I I I		L&T GE SIEMENS SCHEINDER UNILEC CONTROL & SWITCHGEAR CONTROL & SCHEMATIC JACKSON ANAND-POWER PYROTECH SWITCHING CIRCUIT POSITRONICS MAKTEL TRICOLITE HINDUSTAN CONTROL & EQUIPMENT CONTROL DEVICES	MUMBAI/ COIMBATORE BANGALORE MUMBAI NASHIK GURGAON NOIDA/ HARDWAR HYDERABAD G. NOIDA NOIDA UDAIPUR KOLKATA VADODARA VADODARA SAHIBABAD/ MANESAR KOLKATA KOLKATA	A A A A A A A A A A A A A A A A A A A A	

Amruth

22/1/15
I.H. Sreelax

Amruth

	PROJECT :NORTH KARANPURA STPP STPP (3X660MW) Main Supplier : BHEL PACKAGE: FDPS PACKAGE SUPPLIER: BHEL-HYDERABAD CONT. NO.:CS- 4410 -001-2			INDICATIVE LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL SUB SYSTEM: MECHANICAL		DOC. No. : CS- 4410-001-FDPS	
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		I		VIDYUT CONTROL	GHAZIABAD	A	
		I		ADLEC POWER	ROHAD (JHAJ/HAR)	A	
		I		JOLLY ENGG.	KOLKATA	A	
		I		JASPER	NOIDA	A	
		I		HAVELL	FARIDABAD	A	WALL MOUNTED PANEL
37.	Push Button Station	III		BHEL approved source for the box. Push Button: Any make with VDE/CE/UL/CSA Marking or BIS approved with CML number.		A	
38.	For other electrical items			Please refer NOA for the Project			
39.	FQP FOR FIRE WATER TANK *	I		MAIN CONTRACTOR			*REFER NOTE 1
40.	FQP (MATL RECEIPT, STORAGE & ERECTION)	I		MAIN CONTRACTOR			

LEGENDS:

1. SYSTEM SUPPLIER / SUB-SUPPLIER STATUS CATEGORY (SHALL BE FILLED BY NTPC).

A – Indicated acceptable sub-suppliers to NTPC along with condition of approval, if any.

2. INSPECTION CATEGORY:

Cat I : For these items the quality plans are approved by NTPC and final acceptance will be after physical inspection witness by NTPC.

CAT II : For these items the quality plans are approved by NTPC. However no physical inspection will be done by NTPC. The final acceptance by NTPC shall be on the basis of review of documents as per QP.

CAT III: For these items Main Supplier approves quality plans. The final acceptance by NTPC shall be on the basis of certificate of conformance by Main Supplier

Note 1:

a) Steel Plate shall be procured from Main steel producers like SAIL/TISCO/RINL/ JINDAL Steel & Power/ESSAR Steel Ltd/ISPAT Industries Ltd/LLOYD'S Steel Industries Ltd/JSW Steel Ltd. (b) Material will be delivered directly from manufacturer's plant/stock yard/godown to NTPC project site (c) Correlation of material with MTC will be done by Main contractor before delivery and Correlated MTC along with delivery challan will be submitted to NTPC-RIO for issuance of MDCC (Category of Inspection of Plates shall be Cat-III with the above mentioned conditions). (c) Misc Supporting structural steel for Fire water tanks or other applications shall be sourced from Main Contractor Approved sources with Marking/Logo of Main Steel producers as indicated in (a) above.

Amresh
22/1/15



PROJECT : North Karanpura STPP (3 x 660 MW)
PACKAGE: FDPS Package
SUPPLIER: M/s BHEL, Hyderabad
CONT. NO.: CS-4410-001-2

List of items requiring quality plan & subcontractor approval

C&I list for FDPS Package

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SL.NO.	ITEM	QP/INS PN CAT.	QF NO.	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
1	INSTRUMENTATION CABLE (REFER NOTE-2)	I		DELTON CABLES LTD	FARIDABAD	A	PVC, FRLS TYPE
				PARAMOUNT COMMUNICATION LTD	KHUSHKHERA	A	PVC, FRLS TYPE
				CORDS CABLE INDUSTRIES LTD	BHIWADI/ KAHARANI	A	PVC, FRLS TYPE
				KEI INDUSTRIES LTD	BHIWADI	A	PVC, FRLS TYPE
				POLYCAB WIRES PVT. LTD	DAMAN	A	PVC, FRLS TYPE
				THERMOCABLES	HYDERABAD	A	PVC, FRLS TYPE
				ELKAY TEELINKS	FARIDABAD	A	PVC, FRLS TYPE
				GUPTA POWER	KHURDHA	A	PVC, FRLS TYPE
				NICCO	KOLKATA	A	PVC, FRLS TYPE
2	FIRE ALARM PANEL -MICROPROCESSOR BASED	II		UNIVERSAL CABLE	SATNA	A	PVC, FRLS TYPE
				NOTIFIER	USA	A	
				TYCO	USA	A	SIMPLEX BRAND
				AUTRONICA	NORWAY	A	
				SCHRACK	AUSTRIA	A	
				EDWARDS	USA	A	
3	ADDRESSABLE DETECTORS (MULTI SENSOR, PHOTO & HEAT DETECTORS TYPE), INTERFACE UNITS & MANNUAL CALL POINTS	II		ESSER (HONEYWELL)	GERMANY	DR	* - INSPECTION CATEGORY IS TO BE DECIDED DURING VENDOR EVALUATION
				NOTIFIER	USA	A	
				TYCO	USA	A	SIMPLEX BRAND
				AUTRONICA	NORWAY	A	
				SCHRACK	AUSTRIA	A	

Boadec

Kumarjaya



PROJECT : North Karanpura STPP (3 x 660 MW)
 PACKAGE: FDPS Package
 SUPPLIER: M/s BHEL, Hyderabad
 CONT. NO.: CS-4410-001-2

List of items requiring quality plan & subcontractor approval

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				EDWARDS	USA	A	
		*		ESSER (HONEYWELL)	GERMANY	DR	* - INSPECTION CATEGORY IS TO BE DECIDED DURING VENDOR EVALUATION
4	FIBRE OPTIC CABLES	II		BIRLA ERICSSON OPTICAL	REWA	A	
				AKSH FIBER	BHIWADI	A	
				FINOLEX	PUNE/GOA	A	
				R&M	SWITZERLAND	A	
				HFCL	GOA	A	
5	PRESSURE/ VACCUUM/ DP GAUGES	III		GLUCK(I) MANUFACTURING CO.	MUMBAI	A	
				AN INSTRUMENTS	NARENDRAPUR	A	
				MANOMETER INDIA	MUMBAI	A	
				WKA	PUNE	A	
				GIC (GAUGES BOURDON)	PANVEL	A	
				BAUMER	VAPI	A	
				H GURU INDUSTRIES LTD	RISHRA/ MUZAFFARPUR	A	
				ASHCROFT	GANDHINAGAR	A	
				H GURU (SI)	BANGALORE	A	
				FORBES MARSHALL	HYDERABAD	A	
6	LEVEL SWITCHES (FLOAT/DISPLACER)	III		LEVCON	KOLKATA	A	
				SIGMA	MUMBAI	A	
				SBEM	PUNE	A	
				FLOW STAR	FARIDABAD	A	
				D.K.INSTRUMENTS	KOLKOTTA	A	
				V-AULOMAT	NEWDELHI	A	
7	ELECTRICAL ACTUATOR	II		ROTORK CONTROLS	CHENNAI/ BANGALORE	A	
				LIMITORQUE	FARIDABAD	A	
				AUMA	BANGALORE	A	

Prateek

V. Narayanan



PROJECT : North Karanpura STPP (3 x 660 MW)
 PACKAGE: FDPS Package
 SUPPLIER: M/s BHEL, Hyderabad
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SL.NO.	ITEM	QPNs PN CAT	QF NO.	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
8	SOLENOID VALVE	III		ROTEX AVCON ASCO NUCON SMC	VADODARA MUMABI CHENNAI HYDERABAD NOIDA	A A A A A	
9	TERMINAL BLOCK	III		PHOENIX WAGO WIED MULER ELEMEX	BRAND NAME BRAND NAME BRAND NAME BRAND NAME	NOTED NOTED NOTED NOTED	
10	24V INTELLIGENT BATTERY CHARGER /DCDB & BHMS	I		ELTEK MASS TECH CHHABI EMERSON	GURGAON JALGAON JALGAON AMBERNATH	A A A A	CE MARKED ONLY MODULES FROM ELTEK MODULES FROM ELTEK MODULES FROM EMERSON WITH MODULES FROM EMERSON- CHINA
11	GRAPHICAL INTERFACE UNITS (GIU)	III		DIGITAL INSTRUMENTS & CONTROL SYSTEM ROCKWELL AUTOMATION RENU ELECTRONICS SCHNEIDER ELECTRIC RED LION	BANGALORE PUNE 	A A A A NOTED	PROFACE BRAND
12	INSTRUMENT FITTINGS	III		HP VALVES AND FITTINGS BALDOTA	CHENNAI MUMBAI	NOTED NOTED	

Q. doc 2

Signature



PROJECT : North Karanpura STPP (3 x 660 MW)
 PACKAGE: FDPS Package
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SL.NO.	ITEM	QI/INS PN CAT	QP NO.	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC/APPL STATUS	REMARKS
				HYDAIR	LONAVALA	NOTED	
				EXCEL HYDRO	MUMBAI	NOTED	
				PRECESSION	MUMBAI	NOTED	
				ASTEC	THANE	NOTED	
				VIKAS	DELHI	NOTED	
13	OWS/PC	III		COMPAQ / HP		NOTED	
				IBM / LENOVO		NOTED	
				DELL		NOTED	
14	ULTRASONIC TYPE LEVEL TRANSMITTER	III		E & H	GERMANY/ AURANGABAD	A	
				SIEMENS MILTRONICS	CANADA	A	
				EMERSON	PAWANE	A	MAIN KIT FROM MOBREY-UK
		II		NIVELCO	HUNGARY	A	FOR LIQUID APPLICATION ONLY
15	PLC SYSTEM	I		SIEMENS	NASIK	A	
				SCHNEIDER ELECTRIC	NASIK	A	
				ROCKWELL AUTOMATION	SAHIBABAD	A	
				ABB	BANGALORE	A	
				GE INTELLIGENT PLATFORM	BANGALORE	A	
				HONEYWELL	PUNE	A	
16	PRESSURE TRANSMITTER (PRESSURE, DP, FLOW, LEVEL APPLICATION)	III		EMERSON (ROSEMOUNT)	USA/ PAWANE	A	
				FUJI ELECTRIC	CHINA	A	
				SIEMENS	FRANCE/KALWA	A	
				YOKOGAWA INDIA LIMITED	BANGALORE	A	MAKE : YOKOGAWA, JAPAN
				HONEYWELL	USA / PUNE	A	
				LAXONS AUTOMATION INDIA PVT LTD	DAMAN	A	MAKE- SMAR BRAZIL
		I		ABB	BANGALORE	A	2600T SERIES ONLY
17	FLOW SWITCH	III		SWITZER	CHENNAI	NOTED	
				KHRONE MARSHALL	PUNE	NOTED	
				DK INSTRUMENT	KOLKATA	NOTED	

Prabhu

Kumar



PROJECT : North Karanpura STPP (3 x 660 MW)
PACKAGE: FDPS Package
SUPPLIER: M/s BHEL, Hyderabad
CONT. NO.: CS-4410-001-2

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SL.NO.	ITEM	QP/INS PN CAT	QP NO.	ACCEPTABLE SUPPLIER AS PER DATABASE:	PLACE	SC APPL STATUS	REMARKS
18	LEVEL INDICATOR (TRANSPARENT/ REFLEX TYPE)	III		LEVCON LEVCON SIGMA D.K.INSTRUMENTS FLOW STAR V-AUTOMAT PUNE TECHTROL	KOLKATA KOLKATA MUMBAI KOLKATA FARIDABAD NEWDELHI PUNE	NOTED NOTED NOTED NOTED NOTED NOTED NOTED	
19	NI-CD BATTERY FOR PLC SYSTEM	I		AMCO SAFT HBL POWER SYSTEM	BANGALORE HYDERABAD	A A	
		II		SAFT	FRANCE/ SWEDEN	A	
20	LEVEL INDICATOR / GAUGE (FLOAT / BOARD TYPE & TUBULAR TYPE)	III		SBEM PUNE TECHTROL V AUTOMAT GAUGES BOURDEN LEVCON D K INSTRUMENTS SCIENTIFIC DEVICES SIGMA INSTRUMENTS FLOW STAR	PUNE PUNE DELHI PANVEL KOLKATA KOLKATA MUMBAI MUMBAI FARIDABAD	NOTED NOTED NOTED NOTED NOTED NOTED NOTED NOTED NOTED	
21	IR DETECTORS	III		NEOLA CORP (ODTI) PATOL	USA/CANADA UK	A A	
22	LHS CABLE	III		KIDDE PROTECTOWIRE PATOL	UK UK UK	A A A	
		*		SYSTEM SENSOR	UK	DR	* - INSPECTION CATEGORY IS TO BE DECIDED DURING VENDOR EVALUATION
23	PROBE TYPE HEAT DETECTORS (FLAME PROOF)	III		KIDDE FENWAL	USA	A	
		*		TYCO	USA	DR	SIMPLEX BRAND

Revised

[Signature]



PROJECT : North Karanpura STPP (3 x 660 MW)
 PACKAGE: FDPS Package
 SUPPLIER: M/s BHEL, Hyderabad
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SL.NO.	ITEM	QP/INS PN CAT	QP NO.	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
24	SHORT TERM FIRE PROOF CABLES, MICC CABLES	III		TYCO WREXHAM KME	UK / CHINA UK ITALY	A A A	
25	MINI UPS (UP TO 2.5KVA)	III		APC DELTA HITACHI-HIREL EMERSON DB POWER APLAB	BANGALORE GURGAON GANDHINAGAR MUMBAI PUNE MUMBAI	NOTED NOTED NOTED NOTED NOTED NOTED	
26	DC UPS FOR PLC	III		PHOENIX / SIEMENS		NOTED	COVERED IN PLC QP
27	PRESSURE /DP / VACUUM SWITCH	II		SWITZER GIC (GAUGES BOURDON) TRAFAG ASHCROFT INDEFOS	CHENNAI PANVEL MANESAR GANDHINAGAR GHAZIABAD	A A A A A	UP TO 40KG/CM2 & NOT FOR COMPOUND SWITCH AND EXCEPT 900 SERIES UP TO 40KG/CM2 & NOT FOR COMPOUND SWITCH UP TO 40KG/CM2 & NOT FOR COMPOUND SWITCH UP TO 40KG/CM2 & NOT FOR COMPOUND SWITCH
		III		SOR ASHCROFT DELTA CONTROL	USA USA /GERMANY UK	A A A	
28	LASER PRINTER	III		HP/CANON/ IBM/ XEROX / EPSON/LEXMARK	BRAND NAME	NOTED	
29	COMPUTER FURNITURE	III		MAIN CONTRACTOR APPROVED SOURCES		NOTED	
30	LOCAL CONTROL PANEL (BLANK)	II		PYROTECH PENTAIR (HOFFMAN)	UDAIPUR BANGALORE	A A	

Booked

[Signature]



PROJECT : North Karanpura STPP (3 x 660 MW)
 PACKAGE: FDPS Package
 SUPPLIER: M/s BHEL, Hyderabad
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List of items requiring quality plan & subcontractor approval

C&I list for FDPS Package

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SL.NO.	ITEM	QP/INS PN CAT	QP NO.	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
	ENCLOSURES) FOR FIRE ALARM PANEL (NOT APPLICABLE FOR SCHEDULE -I SUPPLY)			RITTAL	BANGALORE	A	
				VENUS	MUMBAI	A	FOR ASSEMBLY/WIRING ONLY; PANEL & ACCESSORIES FROM NTPC APPROVED SOURCES
31	SMF LEAD-ACID BATTERY FOR MICROPROCESSOR BASED FIRE ALARM PANEL	III		AMARRAJA	TIRUPATI	NOTED	
				EXIDE	KOLKATTA	NOTED	
				HBL POWER SYSTEM	HYDERABAD	NOTED	
32	SIREN	III		MAIN CONTRACTOR APPROVED SOURCES		NOTED	
33	LOCAL CONTROL PANEL FOR DIESEL ENGINE/DELUGE VALVE	I		JASPER	GURGAON	A	
				KMG A TOZ	NOIDA	A	
				C & S	NOIDA/ HARIDWAR	A	
				ICA	MUMBAI	A	
				ISC	MUMBAI	A	
				PYROTECH	UDAIPUR	A	
				ANAND CONTROL	NOIDA	A	
				VIDUT CONTROL	GHAZIABAD	A	
				VENUS	MUMBAI	A	
34	LIMIT SWTCH	III		JAI BALAJI	MUMBAI	NOTED	
				VAISHNAV	CHENNAI	NOTED	
				OMRON	BRAND NAME	NOTED	
				HONEYWELL	BRAND NAME	NOTED	
35	BEAM DETECTOR	*		SYSTEM SENSOR	UK	DR	* - INSPECTION CATEGORY IS TO BE DECIDED DURING VENDOR EVALUATION
				TYCO	UK	DR	
				ESSER(HONEYWELL)	GERMANY	DR	
				EDWARD SYSTEM	USA	DR	

NOTED LEGENDS:

Rooster

Kunig



PROJECT : North Karanpura STPP (3 x 660 MW)
PACKAGE: FDPS Package
SUPPLIER: M/s BHEL, Hyderabad
CONT. NO.: CS-4410-001-2

List of items requiring quality plan &
subcontractor approval

C&I list for FDPS Package

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SL.NO.	ITEM	QP/INS PN CAT	QP NO.	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
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1. SYSTEM SUPPLIER / SUB-SUPPLIER STATUS CATEGORY (SHALL BE FILLED BY NTPC).

A - For those items, proposed Sub-vendors are acceptable to NTPC subject to meeting NTPC Technical specification requirement, along with condition of approval, if any.

DR - For those items "Details Required" for NTPC review. To be indicated with letter "DR" in the list.

Noted: For those items vendors are approved by Main Supplier and accepted by NTPC without specific sub-vendor approval from NTPC. To be indicated with "NOTED" in the list.

2. INSPECTION CATEGORY:

Cat I : For those items the quality plans are approved by NTPC and final acceptance will be on physical inspection witness by NTPC.

CAT II : For those items the quality plans are approved by NTPC. However no physical inspection will be done by NTPC. The final acceptance by NTPC shall be on the basis of review of documents as per QP.

CAT III: For those items Main Supplier approves quality plans. The final acceptance by NTPC shall be on the basis of certificate of conformance by Main Supplier.

* - Inspection category is to be decided during vendor evaluation.

NOTE-1: For item not appearing in the pre-award list, bidder and NTPC will mutually discuss in future.

NOTE-2: If Contract Quantity of Cable is less than 1KM of each type/size, NTPC Inspection CAT-III & if Contract Quantity of Cable is less than 2.5 KM of each type / size, NTPC Inspection CAT-II.

NTPC

Main Contractor

ESP-001- 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION		Std. / Doc. Number	
				Annexure-3	
				Rev. No.	00

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	11.09.2018

PROJECT: 2 X 660 MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH
CUSTOMER: BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED (BIFPCL)
CONSULTANT: FICHTNER GmbH Co KG

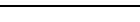
DATA SHEET FOR FOAM PUMPS (GEAR PUMPS)			
Sl.no	Description	BHEL Requirement	DETAILS
GENERAL DATA			
1	Service	Foam Pump (Gear Pump) is envisaged for supplying foam to foam system from the foam storage tank.	
2	Number of Pumps	Total : 2 Nos.[1W+1S] [1 Motor driven & 1 Engine driven]	
3	Location	Indoor	
4	Duty	Motor driven - Continuous Engine driven - Intermittent	
5	Drives	Motor & Diesel Engine	
6	Pumping fluid	Foam / 2-10 CST /1.16	
7	Fluid temp Deg C	Ambient	
PUMP PERFORMANCE & OTHER DETAILS			
8	Pump Type	Gear Pump	
9	Design Standard of pump	FM [Class Number: 1313] Standard/UL standard	
10	Rated Flow (m³/hr)	11.5	
11	Rated Differential Head (kg/cm2.)	12.1	
12	Temperature of pumping fluid	Ambient	
13	Pump Model No.	Pump model shall be same for both Motor & Engine driven pump. Bidder to indicate pump model	
14	Parallel operation	Yes	
15	Rated Speed of Pump (rpm)	Bidder To Furnish	
16	Rated speed of Motor (rpm)	Bidder To Furnish	
17	Rated speed of Engine (rpm)	Bidder To Furnish	
18	Pump Efficiency in %	Bidder To Furnish	
19	Available Pressure at centre line of Suction nozzle of Pump kg/cm2 (a)	Min. 1.0 kg/cm2	
20	NPSH(A) at pump suction nozzle (mlc)	10.0 m	
21	NPSH(R) (mlc)	Bidder to furnish.	
22	NPSH(A) - NPSH(R)	1 m at rated condition & NPSHR shall be less than NPSHA till end of the curve condition.	
23	Pump shut off head.	As per FM [Class Number: 1313] standard/UL standard	
24	Pump shut off head/rated head.	Bidder To Furnish	
25	BEP of the offered pump, m3/Hr	Bidder To Furnish	
26	Thermal minimum flow , m3/Hr	Bidder To Furnish	
27	Stable minimum flow, m3/Hr	Bidder To Furnish	
28	Pump End of the curve flow, m3/hr	Bidder To Furnish	
PUMP CONSTRUCTION FEATURES			
29	As per FM standard (FM-1313)/UL standard. Bidder to furnish MOC of all the component of pump.		
30	Sealing arrangement	As per FM standard (FM-1313)/UL standard	
31	Type of axial thrust balancing arrangement	As per FM standard (FM-1313)/UL standard	
32	Type of main bearings for pump	As per FM standard (FM-1313)/UL standard	
33	Main bearings lubrication	As per FM standard (FM-1313)/UL standard	
34	Type of thrust bearings for pump	As per FM standard (FM-1313)/UL standard	
35	Thrust bearing lubrication	As per FM standard (FM-1313)/UL standard	
36	Direction of rotation of Pump	Bidder To Furnish	
37	Direction of rotation of Motor	Bidder To Furnish	
38	Direction of rotation of Engine	Bidder To Furnish	
COUPLING			
39	As per FM standard (FM-1313)/UL standard.		
PERFORMANCE TEST STANDARD FOR PUMPS			
40	Performance requirements	As per FM standard (FM-1313)/UL standard.	
41	Performance tolerances	As per FM standard (FM-1313)/UL standard.	
42	Maximum Allowed Working Pressure (MAWP) in Kg/cm2 g	Bidder To Indicate	
43	Hydraulic test pressure of casing Kg/cm²(g)	As per FM standard (FM-1313)/UL standard.	
44	Noise level for Pump	85 DBA at 1 m distance, in any direction	
45	Vibration for Pump	As ISO 10816 [Refer Annexure 2-H]	
46	Pump Instruments	As per FM standard (FM-1313)/UL standard.	
PUMP TERMINAL POINT DETAILS			
47	Pump Suction nozzle - Size - Rating - Standard - Facing - Location	Bidder To Indicate	

PROJECT: 2 X 660 MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH
CUSTOMER: BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED (BIFPCL)
CONSULTANT: FICHTNER GmbH Co KG

Sl.no	Description	BHEL Requirement	DETAILS
48	Pump Discharge nozzle - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
49	Pump Cooling water inlet/outlet sizes - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
50	Vent/Drain connection: 1.Vent with 3 way SS isolating valve 2.Drain connection with valve	Bidder To Indicate	
MOTOR DETAILS FOR MOTOR DRIVEN PUMPS [For details, Please refer enclosed specifications & relevent standards]			
51	Drive/Installation	Motor/Horizontal	
52	BKW at the rated point	Bidder To Furnish	
53	BKW at end of curve	Bidder To Furnish	
54	Slected drive rating in kW: Requirements as per FM-1311 & NFPA	Bidder to mention motor kW rating for the motor duly taking care of the requirements.	
55	Design Standard of Motor	NEMA MG 1, IEC 60034-1 & NFPA	
56	Service Factor	These service factors shall be in accordance with NEMA MG-1, Motors and Generators.	
57	Manufacturer	Bidder To Furnish	
58	Ambient Temperature	50 Deg C All motors shall be designed to operate in humid atmosphere with a maximum ambient temperature of 50 Deg C.	
59	Area classification for motor	Safe Area	
60	Rated Voltage & Frequency	415 V & 50 Hz	
61	Permissible variations in Voltage/Frequency/Combined	Voltage: (+/-)10% Frequency:(+/-)5% Combined: Any combination of the above	
62	No of poles / synchronous speed	Bidder To Furnish	
63	Energy efficient class	IE3	
64	Starting Current as % of FLC	Motor starting current must not exceed 7.0 times rated current	
65	Method of Starting	Bidder To Indicate	
66	Method of cooling	TEFC, Ventilation shall be effective irrespective of direction of rotation.	
67	Class of Insulation & Temp. rise	Class F with Temperature rise ltd. to class B	
68	Space Heater	Required for all motors 55 kW and above	
69	Degree of protection/Canopy Required	IP 55/Yes	
70	TB Short time-Current & Short time-Time	50 kA , 0.25 Sec	
71	TB To be provided on the right hand side as viewed from the drive end.	Bidder To Furnish	
72	Cable, Cable glands & Lugs	Suitable double compression Nickel plated brass cable glands and Tinned copper lugs to be provided by the bidder.	
73	No. of Starts	Refer clause no B0.6.18.7.2, f & h of Annexure 2-D	
74	Noise	85 DBA at 1 m distance, in any direction	
75	Vibration	Refer Annexure 2-D & H	
DIESEL ENGINE DETAILS FOR ENGINE DRIVEN PUMPS [For details, Please refer enclosed specifications & relevent standards]			
76	Drive	Diesel Engine	
77	Type	Bidder To Furnish	
78	Location	Indoor	
79	BKW at the rated point	Bidder To Furnish	
80	BKW at end of curve	Bidder To Furnish	
81	Slected drive rating: Requirements as per FM-1333: Horsepower rating adjustments for installation conditions are made for increased elevation and increased operating temperature in accordance with NFPA 20, Sections 11.2.2.4 and 11.2.2.5, plus Graphs A11.2.2.4 and A11.2.2.5.	Bidder to mention engine HP rating for the Diesel Engine duly taking care of the requirements.	
82	Drive Standard	As per FM [Class Number: 1333] approved	
83	Name of Manufacturer	Bidder to furnish.	
84	Model No	Bidder to furnish.	

PROJECT: 2 X 660 MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH
CUSTOMER: BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED (BIFPCL)
CONSULTANT: FICHTNER GmbH Co KG

Sl.no	Description	BHEL Requirement	DETAILS
85	Duty	Intermittent. However, same shall be capable of operating continuously on full load at the site elevation for a period of six hours.	
86	Speed	Bidder To Furnish	
87	Type of cooling	Bidder to Furnish	
88	Noise	105 DBA at 1 m distance, in any direction	
89	Vibration	As per IS standard	
90	Note: Individual datasheets for Pump, Motor & Diesel shall be furnished during detailed engg stage. It is mandatory for the equipment supplier to furnish in format [to be submitted during detailed engg stage] in case of placement of order.		

ESP-001 - 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION		Std. / Doc. Number	
				Annexure-4	
				Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	11.09.2018

Annexure-4

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
	PROJECT ENGINEERING & SYSTEMS DIVISION				
	PRICE FORMAT (R00) FOR FOAM PUMPS (GEAR PUMPS) WITH DRIVES PROJECT: 2 X 660 MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH CUSTOMER: BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED (BIFPCL) CONSULTANT: FICHTNER GmbH & Co KG				
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
	Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. :<Bidder to indicate> BHEL Enq. No. & date :<Bidder to indicate>				
I	MAIN OFFER [Note:Prices for individual items to be quoted as indicated in the price bid format.]				
A	MATERIAL SUPPLY: FOAM PUMP WITH MOTOR [Material code:PY9751483018]				
A.1	Foam Pump with motor along with all accessories including commissioning spares, special tools & tackles as per specification.	1	Set		
A.2	MATERIAL SUPPLY: FOAM PUMP WITH ENGINE [Material code:PY9751483026]				
	Foam Pump with diesel engine along with all accessories including commissioning spares, special tools & tackles as per specification.	1	Set		
B	SUPERVISOR CHARGES FOR ERECTION & COMMISSIONING AT SITE, Refer Note-12				
B.1	Per diem rate for the supervision of Erection & commissioning of Foam pump. Material Code : PY9851483036	2	Days		
B.2	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer per visit for supervision of erection & commissioning of Foam Pump Material Code : PY9851483044	1	Visit		
B.3	Per diem rate for the supervision of Erection & commissioning of Motor & Controller for Foam Pump [Motor driven] Material Code: PY9851483036	2	Days		
B.4	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer per visit for supervision of erection & commissioning of Motor & Controller for Foam Pump [Motor driven] Material Code: PY9851483044	1	Visit		
B.5	Per diem rate for the supervision of Erection & commissioning of Diesel engine & Controller of Foam Pump (Diesel Engine driven) Material Code: PY9851483036	2	Days		
B.6	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer per visit for supervision of erection & commissioning of Diesel Engine & Controller for Foam Pump (Diesel Engine driven) Material Code: PY9851483044	1	Visit		
C	MANDATORY SPARES [Material Code: PY9751483050] Refer note-8				
C.1	Pump				
C.1-i	Impellers /Gears	1 No. of each size/type			
C.1-ii	Shaft	1 No. of each size/type			
C.2	Engine				
C.2-i	Sprayers/Injector	0	Set		
C.2-ii	Piston rings & sealing rings	2	Set		
C.2-iii	Exhaust valve assembly	2	Set		
C.2-iv	Springs	2	Set		
C.2-v	Packings and gaskets	2	Set		
C.2-vi	Fuel oil filter elements with seals	4	Set		
C.2-vii	Fuel oil filter assy	2	Set		
C.2-viii	Lub. oil filter elements with seals	4	Set		
C.2-ix	Scrapper rings	2	Set		
C.2-x	Solenoid coil for fuel valve	2	Set		
C.2-xi	Corrosion inhibitor (if provided)	2	Set		
C.2-xii	Big end & small end bearing of connecting rod	2	Set		
C.2-xiii	Speedometer	2	Set		
C.2-xiv	Speedometer wire	2	Set		
C.2-xv	Rubber hoses of water line with mounting clamps	2	Set		
C.2-xvi	Cranking starter assembly complete	2	Set		
C.2-xvii	Lub. oil and fuel oil hoses with end connectors	2	Set		

Annexure-4

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION					
PRICE FORMAT (R00) FOR FOAM PUMPS (GEAR PUMPS) WITH DRIVES PROJECT: 2 X 660 MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH CUSTOMER: BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED (BIFPCL) CONSULTANT: FICHTNER GmbH & Co KG					
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
	Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. : <Bidder to indicate> BHEL Enq. No. & date : <Bidder to indicate>				
C.2-xviii	Water pump belts	4	Set		
C.3	Control & Instrumentation				
C.3-i	All type of local indicators	2 Nos of each make, model & type			
C.3-ii	Process actuated switch devices: [All type of Pressure, Diff Pressure, Flow, temperature, Level switch devices]	2 Nos of each type & model			
C.3-iii	All type of Electronic Transmitters and Ultrasonic Transmitters including sensors.	10% or 1 No. of each type and model whichever is more.			
C.3-iv	Limit switches for isolation valves	2 Nos. of each type			
C.3-v	PROCESS CONNECTION PIPING (For Impulse Piping / Tubing and Air Supply Piping as Applicable): Valves	1 No. of each type, class, size and model.			
C.3-vi	PROCESS CONNECTION PIPING (For Impulse Piping / Tubing and Air Supply Piping as Applicable): 2 way, 3 way, 5 way valve manifolds	1 No. of each type, class, size and model.			
C.3-vii	PROCESS CONNECTION PIPING (For Impulse Piping / Tubing and Air Supply Piping as Applicable): Fittings	5% or 1 No. of each type, class, size and model whichever is more.			
II	OPTIONAL ITEMS				
	2 Years Recommended Spares				
	Recommended spares list for two years normal operation along with unit price breakup for Pump, Drives & other accessories. (List with price break up to be enclosed) (1 set stands for quantity required for the replacement of one pump, drive (or) accessories)	1 Set	Set		
	TOTAL				
III TAXES AND DUTIES:					
(Packing and Forwarding, Freight, Insurance, Taxes & Duties as applicable to be quoted below separately for both Supply and E&C)					
(A) For Supply:					
(i) Packing & Forwarding :					
(ii) Freight:					
(iii) Insurance:					
(iv) Taxes and Duties					
(v) Any other:					
(B) For E&C:					
(i) Tax:					
(ii) Any other:					
Notes:					
1) Bidder to quote strictly as per BHEL's NIT requirements.					
2) Bidder to note that this is a LUMP SUM Turn Key Order. However					
(a) Changes to the tender specification during execution of the project for successful operation of the system need to be carried out by bidder and commercial implications if any will be settled suitably.					
(b) Unit rates quoted by bidder shall be applicable for any changes in BOQ during detailed engineering stage.					
3) Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format.					
4) Prices quoted by bidders for items under main offer : Sl. No. I [A to C] will be considered for evaluation of lowest bidder. However, BHEL reserves the right.					
(a) To include any of the optional items in scope of supply (as per customer contract requirements) and accordingly consider the same in evaluation. Any such scope increase and change in evaluation will be intimated to vendor during technical evaluation (before price bid opening).					
(b) To place PO for any of the Optional items within the contract period.					
Hence bidders need to mandatorily quote reasonable prices for all optional items considering such requirement and keep the validity of the prices till the end of contract period.					
5.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection.					
5.b) Bidder must not change the indicated item description, quantity & units in the price bid format. Bidder should only fill the unit rates & total price.					
5.c) Bidder to quote for all the items as per price bid format. Incomplete/partial offer may be liable for rejection.					

Annexure-4

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION					
PRICE FORMAT (R00) FOR FOAM PUMPS (GEAR PUMPS) WITH DRIVES PROJECT: 2 X 660 MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH CUSTOMER: BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED (BIFPCL) CONSULTANT: FICHTNER GmbH & Co KG					
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. : <Bidder to indicate> BHEL Enq. No. & date : <Bidder to indicate>					
6) Bidder to quote the base rates only. All other commercial charges for packing, freight, transportation, insurance, taxes & duties etc., shall be indicated separately.					
7 a.) Commissioning spares are those spares which are required at the time of commissioning and shall be recommended (as per bidder's experience) and quoted by bidder. However commissioning spares indicated in the price bid format shall be quoted as minimum. 7.b) Commissioning spare consumed over and above the recommended commissioning spares, during commissioning shall be supplied free of cost by the equipment vendor.					
8) With respect to Mandatory Spares; A) If any of above items indicated by the specified name are not applicable, bidder to offer alternative item serving the same function as per equipment's design and indicate below the item being replaced. B) If bidder is not able to meet the above note, then bidder may mention "Not Applicable". However, if found applicable during detailed engg. stage or alternative item as per equipment design can serve the same function, bidder to supply the specified quantity with out any delivery and commercial implications to BHEL.					
9) Reference document: BHEL Specification PY51483 & all its annexures.					
10) Unpriced price bid format indicating as quoted against each applicable item shall be submitted duly signed & stamped along with technical offer by bidder as a token of concurrence that prices are submitted in this format only. The offer shall be liable for rejection in case if un-priced price bid format is not submitted or any modification is carried out in price bid format.					
11) In case the systems are being supplied from outside India , reputed Third Party Inspection like Llyods, BV, DNV, CEIL and TUV has to be considered and the charges should be included in the Main offer. For those bidders who are supplying from India, such third party inspection charges need not be considered and same will be arranged by BHEL/BHEL nominated inspection agency. Refer clause no 9.2 reg various TPI.					
12) With respect to Supervision charges, prices quoted by bidder shall be considered for L1 bidder evaluation. Referring to Sl no D.1 TO D.2, Foam pump, For the purpose of Quotation, total no of 2 man days for Pump will be covered in 1 visits have been considered. payment against Sl.No D.1 TO D.2 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates. Referring to Sl no D.3 TO D.4, Motor , For the purpose of Quotation, total no of 2 man days for Motor & Controller will be covered in 1 visits have been considered. Payment against Sl.No D.3 TO D.4 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates. Referring to Sl no D.5 TO D.6, Diesel Engine , For the purpose of Quotation, total no of 2 man days for Diesel Engine & Controller will be covered in 1 visits have been considered. Payment against Sl.No D.5 TO D.6 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates. Purchase Order for supply of main items, (A,B,C) shall be placed by BHEL- PE&SD Hyderabad. For Supervision of E&C, LOI shall be placed by PE&SD and PO By BHEL-Site.					

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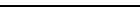
Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	11.09.2018

CHECKLIST FOR OFFER FOR FOAM PUMP WITH DRIVES (MOTOR/DIESEL ENGINE)

S.No.	Description	Bidder's Reply
1.	Bidder to confirm that Performance requirement, Design and construction of the offered Pump model shall be FM [Class Number: 1313] approved/UL listed.	
2.	Bidder to confirm that Performance requirement, Design and construction of the offered Motor shall be NEMA MG 1, IEC 60034-1 & NFPA.	
3.	Bidder to confirm that Motors shall be specifically listed for fire pump service.	
4.	Bidder to confirm that Performance requirement, Design and construction of the offered Diesel Engine shall be FM [Class Number: 1333] approved/UL standard.	
5.	Bidder to confirm that Performance requirement, Design and construction of the offered Electric-Drive Controllers and Engine-Drive Controllers shall be FM [Class Number 1321/1323] approved/UL standard.	
6.	Scope of supply as per Tender Specification. Bidder to Confirm. <u>Scope of supply furnished elsewhere in the offer submitted by bidders shall not be reviewed w.r.t scope.</u>	
7.	Bidder to confirm that Scope of supply shall be as per FM (FM-1313)/UL standard	
8.	Bidder to confirm that bidder has clarity on Layout [annexure 2-B] regarding requirement of Piping (fuel system, exhaust system), cabling etc as required by the skid.	
9.	Bidder to confirm that all cabling [control/signal/power] from Controller to Motor, Controller to Engine-Battery-Battery charger etc included in their scope of supply.	
10.	<u>Cable Glands & Lugs:</u> Suitable power, control and signal cable with glands & lugs shall be included in bidder scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
11.	Based on layout enclosed [refer Annexure 1-B], bidder to consider suitable length of exhaust piping with silencer, SS metal expansion below & insulation with required no of bends. Bidder to Confirm.	
12.	<u>Battery:</u> Each engine shall be provided with 2 Nos. of Ni-Cd or Lead-acid plante battery units as per IS. Battery shall be sized as per FM-1333. Bidder to Confirm.	
13.	<u>Battery Charger:</u> Each engine shall be provided with 2 sets of battery charger units as per specification. Bidder to Confirm.	

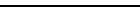
14	Suitable reducers/expanders & counter flanges along with gaskets & stud nuts at all the terminal points are considered by bidder. Deviation in this is not acceptable. Bidder to Confirm.	
15	All the list of commissioning spares indicated in price bid format are included in bidder's scope of supply. Any commissioning spare required over and above the recommended commissioning spares during commissioning shall be supplied free of cost by the equipment vendor. Deviation in this is not acceptable. Bidder to Confirm.	
16	All the special tools and tackles indicated in tender specification are included in bidder's scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
17	Bidder to confirm that seaworthy packing considered for all imported items as per specification.	
18	Bidder to appoint TPI agency from the following on behalf of BHEL for inspection of items sourced from outside India: i. Lloyds Register of Industrial Services (LRIS), ii. Bureau Veritas (BV), iii. Det Norske Veritas (DNV), iv. Certification Engineers International Ltd. (CEIL), v. TUV) Bidder to Confirm.	
19	Bidder to submit Soft copy and hard copy of logics executed in Controller for uploading the same by end customer later.	
20	2 year recommended spares list is enclosed with bidder's offer whose optional price is indicated in Annexure-4 (Price Bid Format). Bidder to Confirm.	
21	Bidder to meet the Equipment Qualification Criteria. All the references shall be submitted along with the offer as per Annexure-8 Deviation in this is not acceptable. Bidder to Confirm.	
22	Painting schedule shall be as per Annexure-2-J of Tender Specification, Bidder to Confirm.	
23	Inspection, Testing requirements for Pump & Drive assembly: Inspection, Testing requirements shall be as per BHEL QAP & specification requirement only. Bidder to note that QAP shall be as per Annexure-6 & the same shall be discussed during detail engg. However in case of practical difficulties in meeting the quality requirement, same shall be mutually discussed & agreed during detail engg. Stage. Bidder to note & confirm.	
24	Make of all the items shall be as per Annexure-2-K (Sub-Vendor List). Bidder to confirm.	
25	Bidder to confirm compliance with Annexure-11, Master Document List enclosed with Tender Specification, wrt list of documents, schedule of submission.	
26	Bidders to comment on the instrumentation requirement as per P&ID (Annexure -1) based on their experience. If any other instruments are required as per good engg practice, bidder to highlight & Consider the same.	
27	Any specific deviations, which are impractical, shall be raised in form of pre-bid queries as per Annexure-10 before submission of Techno Commercial offer. Any deviation/ queries raised during	

	technical bid submission shall not be entertained. Bidder to Confirm.	
28	Bidder to quote as per Annexure-4, Price Bid Format only. Price quoted as per the price bid format, clearly indicating all the applicable items are quoted, and not applicable items are clearly highlighted. Un priced copy of the same is enclosed with bidder's offer. Bidder to check and confirm.	
29	Bidder to quote individual price for each item mentioned in the seal priced bid. Bidder to check and confirm.	
30	Bidder to confirm that the following documents are submitted along with their offer to enable BHEL to evaluate the offer. i. Duly filled in Pump-Motor-Diesel Engine datasheet (Annexure-3) ii. Tentative GA Drawings for Pump with Motor & Engine drives iii. Performance curves for pump iv. Un-priced copy of price in attached BHEL price bid formats (Annexure-4) indicating quoted/ not quoted against each row & column. v. Equipment qualification criteria / PTR / Reference Lists (Annexure-7) vi. Checklist as per (Annexure-5) vii. Bidder shall submit <u>NO DEVIATION certificate</u> [Annexure-9] along with their offer. Any specific deviations, which are impractical, shall be raised in form of pre-bid queries as per Annexure-10 before submission of Techno Commercial offer.	
31	All-important documents such as unpriced price bid, reference list, pump performance curve, Pump & drive assembly GA drawings, CS drawings must necessarily to be furnished by bidder along with their offer for evaluation. Bidder to once again check their offer before submission and confirm.	

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				Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	11.09.2018

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				Annexure-7	
				Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	11.09.2018



भारत हेवी इलेक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

रामचन्द्रापुरम हैदराबाद - 502032

RAMACHANDRAPURAM: HYDERABAD - 502 032.

परियोजना इंजीनियरिंग विभाग

PROJECT ENGINEERING & SYSTEMS DIVISION

परियोजना / PROJECT : **2 X 660 MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH**

विषय / SUB : **PQC format for Foam Pump assembly**

The bidder shall be an established manufacturer of Foam pump (Gear Pump) for Fire Protection System & having adequate engineering, manufacturing & testing facilities for Pumps, Diesel Engine, Controllers confirming FM standards/UL standard. The Pump, Diesel Engine model offered shall be from the existing regular manufacturing range of bidder and same shall be listed in FM standard/UL standard. Similarly, Motor requirement shall meet relevant standards as mentioned in this specification.

The offered pump model shall meet the minimum service & manufacturing experience specified as below:

Bidder should have engineered, manufactured, tested, supplied and commissioned at least Two (02) nos. [1 no Motor driven & 1 no Diesel Engine Driven] of identical or similar packages (or higher capacity packages) in terms of Flow, Differential Pressure, Material of construction (CS/CI/SS), speed in the last Ten years and same shall have commissioned and kept in trouble free operation. Vendor to give documentary evidence for the same. The ten years time period mentioned above shall be reckoned from the Initial bid due date.

As a proof for the same, Date of Supply/ Commissioning report/Customer Satisfaction report will be considered and same to be provided by Bidder.

Bidders shall furnish the details as per the below mentioned table along with technical offer for assessment of Bidder with reference to PQC indicated as above.

S.no	Name of Customer	Service	Quantity	Flow (M3/HR)	Differential Head(MLC)	Speed (RPM)	Material of construction	Order ref no & date (copy to be enclosed)	Performance certificate/ Inspection Report/ Dispatch Clearance to be enclosed	Remarks

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				Annexure-8	
				Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
	Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	11.09.2018



**SHIPPING AND PACKAGING INSTRUCTIONS
FOR**

**2 x 660 MW MAITREE SUPER THERMAL POWER
PROJECT, BANGLADESH**

OF

**BANGLADESH-INDIA FRIENDSHIP COMPANY (PVT.) LTD
(BIFPCL)**

Document Revision-0

Approved by	Checked by	Prepared By
Jasvindra Pal Singh/AGM	Akhilesh Kumar/DGM	Sandeep Singh/Dy. Manager
<i>Jasvindra Pal Singh</i> 12/09/17	<i>Akhilesh</i> 11/09/17	<i>Singh</i> 11/09/17

Bharat Heavy Electricals Limited
Maitree Export Project Group
International Operation Division
Integrated Office Complex, Lodhi Road
New Delhi -110003



Ref: IO/MEPG/S&P/01
Date: 12th September 2017

2x660 MW Maitree STPP, Bangladesh: Shipping and Packaging Instructions Rev-0

Following dispatch instructions for effecting supplies under the above contract are being issued for compliance by all the units/region involved in this project.

Sr. No.	Item No.	Details	Action By
A	1	<u>Purchaser's Name and Address:</u> Bangladesh-India Friendship Power Company (Pvt.) Limited (BIFPCL), Level-17, Borak Unique Height, 117, Kazi Nazrul Islam Avenue, Eskaton Garden, Dhaka-1217, Bangladesh Attention: Mr. Ujjwal Bhattacharya Managing Director, BIFPCL Tel : +8823941805 E-mail : cto@bifpcl.com ; md@bifpcl.com	For information
B	1	<u>Delivery Terms:</u> Site Incharge, 2x660 MW Maitree Super Thermal Power Project, PO-Kalekharber, Union-Rajnagar, Upajila-Rampal, Dist: Bagerhat-9343, Bangladesh Contact No.: +8801678582823	Units to ensure proper marking on the boxes so as to Identify the final destination clearly.
C	1	<u>Seller's Name and Address:</u> Bharat Heavy Electricals Limited International Operations Division Lodhi Road, Integrated Office Complex New Delhi –110003, INDIA Through Various Units/Divisions	For information
D	1	<u>Payment Terms for Equipment, Material & Plant Supply:</u> Advance - 15% of the Contract price. Sight Payment - 65 % of total CIF Value of equipment, materials and plant on submission of shipping documents Delivery Payment - 10% of total CIF cost of supply of equipment, materials and plant against receipt cum damage report. PAC - 5% on receipt of Provisional Acceptance Certificate. FAC - 5% on the receipt of Final Acceptance Certificate	All Units

Sr. No.	Item No.	Details	Action By
E	1	<u>Shipping Marks:</u> Each package or shipping unit shall be clearly marked or stenciled on at least two sides as follows: “BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (Pvt.) LIMITED, 2X660 MW MAITREE SUPER THERMAL POWER PROJECT, BANGLADESH” EPC Contractor - Bharat Heavy Electricals Limited, India In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.	All Units
F	1	<u>Consignee:</u> BOARD BILL/S OF LADING MADE OUT TO THE ORDER OF /OR AIRWAY BILL CONSIGNED TO AND/OR CONSIGNED NOTE FOR TRANSPORT BY TRUCK CONSIGNED TO Managing Director, Bangladesh-India Friendship Power Company (Pvt.) Limited, Level-17, Borak Unique Height, 117, Kazi Nazrul Islam Avenue, Eskaton Garden, Dhaka-1217, Bangladesh Contact No.: +8823941805 ** Any change as per LC shall be taken care of.	All Units
G	1	<u>Notifying Party :</u> DGM(C&M) Bangladesh-India Friendship Power Company (Pvt.) Limited, Level-17, Borak Unique Height, 117, Kazi Nazrul Islam Avenue, Eskaton Garden, Dhaka-1217, Bangladesh Contact No.: +8801678582831 E-Mail:epcmainplant@bifpcl.com ** Any change as per LC shall be taken care of.	All Units
H		Packing Instructions & Inspection Prior to Dispatch by Supplying Units/Sub-Vendors:	
H	1	Packing (tare) shall be part of the Equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of Equipment during transportation. In case of Equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated. Hazardous goods must be packed as per international standards/practice.	All Units/Suppliers
H	2	<u>Special instructions as per BICPCL :</u>	

Sr. No.	Item No.	Details	Action By
H	2.1	All equipment and materials and other Plant shall be suitably coated wrapped, or covered and boxed or crated for export shipment and to prevent damage during handling and storage at the Site. Cardboard containers shall be enclosed in a solid wooden container.	All Units/Suppliers
H	2.2	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping In such a manner that breaking of one strap will not cause complete failure of the packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while In transit and while awaiting erection at the Site.	All Units/Suppliers
H	2.3	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventative compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.	All Units/Suppliers
H	2.4	Crates and packing material used for shipping will become the property of Employer, but the Contractor will be allowed to use the same for the Work as needed, but the remaining material shall be turned over to Employer upon completion of the Project. Provided however, shippers container used for transportation of material shall be returned to the Contractor.	All Units/Suppliers
H	2.5	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.	All Units/Suppliers
H	2.6	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.	All Units/Suppliers
H	2.7	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed .	All Units/Suppliers

Sr. No.	Item No.	Details	Action By
H	2.8	Wherever necessary besides usual Inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care", "Keep dry", etc., as well as indication of the centre of gravity (with red vertical lines) and places for attaching slings (with chain marks). For all fragile equipment , unit should take special care to pack and label with additional markings such as “ FRAGILE-HANDLE WITH CARE” , “ LIFTING POINTS” , “ THIS WAY UP” , “ DO NOT STACK” etc. to protect them from damage in transit.	All Units/Suppliers
H	2.9	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, skid, case or package shipped separately shall be labelled or tagged properly.	All Units/Suppliers
H	3	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: Destination: Package number: BHEL/MTR/BD/XXX/YYY/ZZZZZ where XXX stands for Unit abbreviation e.g. HWR , HYD ,EDN, PEM, RPT, PCRI, TBG, PC, JHS,TRY, EPD, ISG etc. and YYY stands for Vendor abbreviation. Following series of ZZZZZ should be used by different Units- HWR (10000), PCRI (17000), RDP(18000), HYD(20000), TBG(25000), PEM (30000), TRY(40000), PC(50000), HPVP(57000), PSER(60000), ISG(70000), BPL(80000), RPT(85000), EPD (90000), JHS(92000), EDN(95000). if first package is dispatched from HWR and vendor named as ABC then package should be numbered as : BHEL/MTR/BD/HWR/ABC/10001 Gross and Net weight: Dimensions: Lifting places: Handling marks and the following delivery marking: CONTRACT No. BIFPCL/EPC-MAIN PLANT/2016/01 PURCHASER: BIFPCL, Bangladesh	All Units/Suppliers
H	4	Completeness of Contents of each packing case:	
H	4.1	Concerned CQA/Unit QC/Third Party Inspection Agency shall verify the completeness of contents of each package w.r.t packing list both in terms of quality and quantity before authorising dispatch of the consignment.	All Units/Suppliers
H	4.2	Packing commensurate with international standards and accepted norms will be ensured by CQA/ Unit QC/Third Party Inspection Agency. Packing has to be sea-worthy and secure. As far as possible, the packing has to be rectangular in shape for optimum space utilization in the ship and economize on shipping costs. Projections on packages are prohibited.	CQA/All Units

Sr. No.	Item No.	Details	Action By
H	4.3	The packing list has to be checked and certified by the Inspection agency with due signatures. All packages shall be enclosed in suitable GI sheets on all sides.	CQA/All Units
H	4.4	No loose items / Gunny bag packing are allowed for shipment. Proper pallets and crates are to be used for packing of Oil drums and Structures.	CQA/All Units
H	5	<u>Routing of Packing Lists:</u> Packing list is an extremely important document, which forms a part of export documentation in connection with the processing of customs formalities. Packing List has to be generated by units/Unit vendors and sent to MEPG and ROD Chennai/Kolkata (both at the same time), two weeks in advance, for processing and obtaining shipping bills' clearances and avoiding any delay at Kolkata/Haldia/Chennai port.	All Units/ suppliers
H	6.1	<u>Advance intimation to ROD- Chennai/Kolkata & MEPG, New Delhi:</u> All supplying units/vendors will give at least 15 days advance intimation to ROD-Chennai/Kolkata & MEPG, New Delhi along with package details before actual dispatches to arrange for storage/shipping arrangements by ROD Chennai/Kolkata/Haldia. Information must be sent to consolidate the details and arrange for shipments in time.	All Units
H	6.2	<u>Telephonic Intimation to ROD Chennai/Kolkata of Movement of Vehicles:</u> Vehicle drivers to be instructed by the units to contact ROD regarding movement of vehicles on daily basis for heavy lifts. Especially 2 days before arrival at Kolkata/Haldia/Chennai so that suitable directives can be given to the driver of the vehicle for further transportation of the goods to either docks or godown.	All Units/suppliers
H	7	<u>Bond or Letter of Undertaking:</u> All units to ensure Corporate indirect taxation guidelines vide letter ref no. AA:Fin:Ind Tax:GST-17 date 10.07.2017 for compliance and CBEC Notification no. 16/2017-Central Tax Dated 07.07.2017 and CBEC Circular No. 4/4/2017-GST Dated 07.07.2017 (Circular/Notifications are enclosed). <u>Sealing of Container:</u> All units to ensure CBEC Circular 26/2017 and Corporate indirect taxation guidelines ref. no. AA:Fin:Ind Tax:GST-14 dated 05.07.2017 in this regard may please be followed(Circular/Notifications are enclosed). <u>Other Procedures w.r.t Export:</u> Various guidelines issued time to time from Corporate indirect taxation regarding export may please be referred and to be followed.	All Units/ suppliers

Sr. No.	Item No.	Details	Action By
H	8	<u>Provision of Inspection Windows on Packages:</u> Unit/Vendors should provide inspection window of size 6" x 4" (glass perplex) for customs examination for all packages (above 1.5 x 1.5 x 1.5 cu m) involving panels of any kind. Care would be taken to ensure that all packages are properly sealed to avoid ingress of moisture, rodents etc. Packing slip folders shall be attached in each box.	All Units/ Suppliers
H	9	<u>Transportation Drawings for Heavy Weight/ODC consignment: For any package/item weighing above 20000 kgs and/or size greater than 12 X 2.5 X 2.5 m :</u> Detailed engineering documents (at least 4 sets) for all items of the above category shall be furnished by respective units to issue shipment enquiries in a proper manner. This would include Turbines ,Transformers, Generators etc. The drawing has to include center of gravity of the item clearly (Units to identify such items and notify MEPG as soon as the engineering documents are released).	All units
H	10	<u>Lifting Beams:</u> All heavy lifts for which safe handling is essential at the port of dispatch shall be accompanied by lifting beam on non-returnable basis	All Units
I	1	<u>Marking for Safe Handling:</u> To ensure safe handling, packing case shall be marked to show the following: • Upright position. • Sling position and Centre of Gravity position. • Storage category. • Fragile components (to be marked properly with a clear warning for safe handling).	All Units/suppliers
J	1	<u>Marine Insurance Policy:</u> Insurance Policy for 110 percent value of the contract covering all risks including war and SRCC from Port of shipment in India/Third country direct dispatches, to site shall be taken by PSER, Kolkata and it shall indicate BIFPCL as co-insured.	PSER/Corporate Insurance
K	Shipping Documentation including those covered by customs requirements:		
K	1	GST Invoice as per approved BBU. Following details to be mentioned in GST Invoice for Export – 1. Forex Bank Account no. for all type of Shipping Bill. 2. Authorized Dealer Code no. with Name of Bank for all type of Shipping Bill. 3. Duty Drawback Account no. with IFS code of Bank for Drawback Shipping Bill. As invoice will be used for export custom clearance details like HS code; CIF value, Freight value, Insurance value, FOB value in FC ; Shipper name ;Manufacturer name; Shipping bill type;	All Units/suppliers

Sr. No.	Item No.	Details	Action By
		POL; POD; DBK serial no ; Advance authorization no ; EPCG License no as applicable should appear on invoice.	
K	2	• Packing List • LR Copy • Fumigation certificate for wooden boxes • MSDS for DGR cargo • CE certificate for DEEC shipping bill cases with original import license • Warranty Certificate • Manufacturer 's Factory Test Certificate/Inspection Waiver Certificate • Quality and Quantity Certificate • Certificate of Origin • MDCC	All Units /Sub-vendors of units
K	3	• Type of Shipping Bills. • All Units have to send their DEEC & EPCG licence details to ROD Kolkata or ROD Chennai as per cargo despatches.	All Units/Region
K	4	Chartered Engineer's Certificate, applicable to be arranged by Units. Care should be taken to ensure that usage of the materials shown in C.E. certificate out of DEPB goods is not disproportionate.	All Units/ROD
K	5	Catalogues/literature/write-up in case of customs endorsement for discharging exports obligation in case of DEEC imports to be made available to ROD before arrival of goods in the city of port of dispatch.	All Units
K	6	Commercial Documents for Customs Clearance at Destination i.e. Bangladesh	MEPG/Dhaka Office
L	1	<u>Full Set of Clean Multimodal Transport Document:</u> Complete set of shipping B/L showing freight prepaid as per the rates of regular shipping lines. In case of Air Freight consignment, one original of AWB is required together with three copies of the same. In case of road transport, one original LR is required with 3 copies of the same.	ROD/ MEPG
M	1	<u>Certified Inspection Certificate Approved by Customer:</u> The certificate signed by BIFPCL inspector (if equipment tested in presence of BIFPCL representative) is to be provided to MEPG . In case the Certificate is signed by BHEL/Third Party Inspection Agency, it is to be provided by Units/ suppliers to MEPG and MEPG will get it approved from BIFPCL.	All Units/ Suppliers
N	Shipping Carrier Specification and related Requirements:		
N	1	Certificate of Freight having been pre-paid as per the regular shipping lines is required on MTDs/BLs.	ROD/ MEPG
N	2	Subject cargo would be generally shipped under the deck. Specific confirmation/clearance of MEPG is needed for shipment on deck except wherever shipment is through Barges.	ROD/ MEPG

Sr. No.	Item No.	Details	Action By
N	3	Vessel age to be restricted as per insurance policy in force. Buyer's Reference (Contract No. BIFPCL/EPC-MAIN PLANT/2016/01 Dated 12.07.2016) is required on BLs.	ROD/ MEPG
N	4	For Third Country Supplies , concerned units will ensure all the above certificates in addition to Certificate of Origin.	All Units/ Suppliers
O	Guidelines for Dispatches from Units/Indian Vendors:		
O	1	<u>All materials to be dispatched under intimation to:</u> 1. For Shipments through Chennai Consignment shall be sent to the following address - Mr Harshal Trivedi, Engineer/Docks Bharat Heavy Electricals Ltd Near Marshalling Yard, Chennai Port trust Chennai 600 001 Ph No 044 25362247/25360446 -Mob 08680850932 E-mail trivedi@bhel.in The couriers /correspondence shall be sent to the following address - Shri S S RAJAN AGM/MS, Bharat Heavy Electricals Ltd Regional Operations Division, EVR Building 6th floor No 690(Old No 474) Anna Salai, Nandanam Chennai 600 035 Mob – 09840997089 E-mail ssrajan@bhel.in 2. For Shipments through Kolkata/Haldia Consignment shall be sent to the following address - (Storage yard to be finalized by ROD Kolkata/freight forwarder and address shall be intimated soon) The couriers /correspondence shall be sent to the following address - Mr. Abhijit Chowdhury , Sr. Engineer Bharat Heavy Electricals Ltd , Regional Operations Division DJ 9/1 SECTOR II , Saltlake , Karunamoyee West Bengal 700091 Mob – 9830441607 E-mail abhijit@bhel.in	All Units/Rod
O	2	<u>Clearing Agents:</u> All materials to be dispatched to Chennai/Kolkata/Haldia on door delivery basis, freight prepaid to the address of the clearing agents(to be specified by ROD, from time to time)	All Units/Rod

Sr. No.	Item No.	Details	Action By
O	3	<u>Customs formalities Period:</u> Packages arriving at the port shall have a minimum time of 3 working days for customs examination and other related formalities in respect of the cargo under shipment. The goods received after arrival of the ship may not be loaded if either sufficient time does not exist or space available in the ship is booked by the carrier for other exporters due to lack of availability of the goods at the port in time for shipment from BHEL. In case, where the committed cargo to the carrier based upon information received from all the units does not reach in time of scheduled shipment at the port of dispatch, MEPG would be within its right to decide the priority of loading as per the project schedule requirements given the condition that adequate space in the ship is not available to accommodate the cargo.	For information
P	1	• <u>Shipping Procedures and ROD Responsibilities:</u> Consolidation of Packages and Storage in Warehouse: ROD Chennai/Kolkata either themselves or through their CHA would ensure following: • Proper storage of goods at an elevated level if store is in open to avoid damages to the consignment during rainy season (All the packages to be covered with a proper tarpaulin in open storage). • All Electrical and C&I items to be stored indoors. • Consolidation of the goods as per summary packing lists. • Check marks and numbers on packages. Carry out the corrections, if necessary. • Label the packages linking to the proposed shipping carrier to ensure that package does not get left out.	ROD

Note:

1. Units/Regions are also requested to refer shipping and packaging instructions provided with Internal Orders and GCC Clause no 65 at contract book no. 6 for compliance.
2. Units/Regions are advised to take necessary actions for compliance of GST related issues and refer information available at GST portal of Corporate Finance.

BHARAT HEAVY ELECTRICALS LIMITED
Corporate Finance
BHEL House, Siri Fort, new Delhi-110049

From:	Suraj Prakash GM (Fin) Corporate Office	To :	All Heads of Units
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Ref No.: AA: Fin: Ind.Tax: GST-17

Dated 10.07.17

Subject: Export procedure under GST

This is in continuation to our GST Circulars No. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13,14,15,16, dated 3rd, 5th, 8th, 9th, 17th, 19th, 21st, 23rd, 27th, 30th June 2017 & 5th & 7th July 2017 respectively regarding transitory credit, job work, invoicing, GST Credit, ISD registrations, IGST on imports, exports without payment of IGST and other provisions as per GST law.

As per GST law provisions, goods or services can be exported under bond or Letter of Undertaking without payment of integrated tax. CBEC vide notification no. 16/2017 dated 07th July 2017 and Circular No.4/4/2017-GST dated 07th July 2017 have notified certain conditions and issued certain clarifications regarding modalities w.r.t. export of goods or services under bond or Letter of Undertaking without payment of IGST, which are as follows:

1. Guidelines for furnishing Letter of Undertaking (LUT)

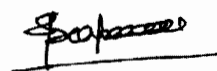
1.1. **Eligibility for issuance of LUT:** As per the notification, following registered person shall be eligible for submission of Letter of Undertaking in place of a bond: -

- (a) a status holder as per the Foreign Trade Policy 2015-2020; or
- (b) who has received the due foreign inward remittances amounting to a minimum of 10% of the export turnover, which should not be less than one crore rupees, in the preceding financial year,

and he has not been prosecuted for any offence under the Central Goods and Services Tax Act, 2017 or under any of the existing laws in case where the amount of tax evaded exceeds two hundred and fifty lakh rupees.

1.2. **Validity of LUT:** It has been clarified that LUT shall be **valid for twelve months**. In case, BHEL exporting Unit fails to comply with the conditions of the LUT, BHEL may be asked to furnish a bond. Further, Govt. has clarified that exports may be allowed under existing LUTs/Bonds till 31st July 2017. LUTs/bond in the revised format is required to be submitted latest by 31st July, 2017.

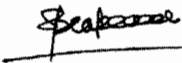
Page 1 of 2



- 1.3. **Authority to accept LUT:** It has been clarified that LUT shall be accepted by the Jurisdictional Deputy /Assistant Commissioner having jurisdiction over the principal place of business of the exporting BHEL Unit. However, till the time administrative mechanism for assigning taxpayer to Centre/State authority is implemented, the LUT can be furnished by BHEL Units either before Central Tax Authority or State Tax Authority. Further, it has been provided that, on the directions/ instructions of Commissioner of State tax, the LUT can be furnished before Central Tax Officer till the time jurisdiction is assigned.
2. Further, vide the enclosed CBEC circular (No.4/4/2017-GST dated 07th July 2017), certain clarifications have been issued by CBEC regarding furnishing of bond, amount of bond, bank guarantee to be furnished along with bond etc. and sealing of containers, which may be referred to.

The above instructions shall apply to exports on or after 1st July, 2017.

The matter may be given wide circulation so that all concerned departments can take necessary action to ensure compliances


(Suraj Prakash)

Copy to:

Heads of MM/Heads of Commercial/ Heads of Finance

ED (COM)

GM(I) (Corp. Accounts)/ED (Fin)

D(F)/D(E R&D)/D(IS&P)/D(HR)/D(Power)—for kind information please

CMD Secretariat: for kind information of CMD please

Circular No. 4/4/2017-GST

**F. No. 349/82/2017-GST
Government of India
Ministry of Finance
Department of Revenue
Central Board of Excise and Customs
(GST Policy Wing)**

New Delhi, the 7th July, 2017

To,

**The Principal Chief Commissioners / Chief Commissioners / Principal Commissioners/
Commissioners of Central Tax (All)**

Madam/Sir,

**Subject: Issues related to Bond/Letter of Undertaking for exports without payment
of integrated tax – Reg.**

Various communications have been received from the field formations and exporters that difficulties are being faced in complying with the procedure prescribed for making exports of goods and services without payment of integrated tax with respect to furnishing of bonds/Letter of Undertaking. Therefore, in exercise of powers conferred under section 168 (1) of the Central Goods and Services Tax Act, 2017, for the purpose of uniformity in the implementation of the Act, these issues are being clarified hereunder.

2. As per rule 96A of the Central Goods and Services Tax Rules, 2017 (The CGST Rules), any registered person exporting goods or services without payment of integrated tax is required to furnish a bond or a Letter of Undertaking (LUT) in FORM GST RFD-11.
3. Attention is invited to notification No. 16/2017-Central Tax dated 01-07-2017 vide which the category of exporters who are eligible to export under LUT has been specified along with the conditions and safeguards. All exporters, not covered by the said notification, would submit bond. The procedure for submission and acceptance of bond has already been prescribed vide circular No. 2/2/2017-GST dated 4th July, 2017. The bond shall be furnished on non-judicial stamp paper of the value as applicable in the State in which bond is being furnished.

4. A clarification has been sought as to whether bond to be furnished for exports is a running bond (with debit / credit facility) or a one-time bond (separate bond for each consignment / export). It is observed consignment wise bond would be a significant compliance burden on the exporters. It is directed that the exporters shall furnish a running bond, in case he is required to furnish a bond, in FORM GST RFD -11. The bond would cover the amount of tax involved in the export based on estimated tax liability as assessed by the exporter himself. The exporter shall ensure that the outstanding tax liability on exports is within the bond amount. In case the bond amount is insufficient to cover the tax liability in yet to be completed exports, the exporter shall furnish a fresh bond to cover such liability.

5. FORM RFD -11 under rule 96A of the CGST Rules requires furnishing a bank guarantee with bond. Field formations have requested for clarity on the amount of bank guarantee as a security for the bond. In this regard it is directed that the jurisdictional Commissioner may decide about the amount of bank guarantee depending upon the track record of the exporter. If Commissioner is satisfied with the track record of an exporter then furnishing of bond without bank guarantee would suffice. In any case the bank guarantee should normally not exceed 15% of the bond amount.

6. As regards LUT, it is clarified that it shall be valid for twelve months. If the exporter fails to comply with the conditions of the LUT he may be asked to furnish a bond. Exports may be allowed under existing LUTs/Bonds till 31st July 2017. Exporters shall submit the LUTs/bond in the revised format latest by 31st July, 2017.

7. It is further stated that the Bond/LUT shall be accepted by the jurisdictional Deputy/Assistant Commissioner having jurisdiction over the principal place of business of the exporter. The exporter is at liberty to furnish the bond/LUT before Central Tax Authority or State Tax Authority till the administrative mechanism for assigning of taxpayer to respective authority is implemented. However, if in a State, the Commissioner of State Tax so directs, by general instruction, to exporter, the Bond/LUT in all cases be accepted by Central tax officer till such time the said administrative mechanism is implemented. Central Tax officers are directed to take every step to facilitate the exporters.

8. Attention is further invited to circular No. 26/2017 – Customs dated 1st July 2017, vide which it has been clarified that the existing practice of sealing the container with a bottle seal

under Central Excise supervision or otherwise would continue till 01st September, 2017. Such sealing shall be done under the supervision of the officer having physical jurisdiction over the place of business where the sealing is being done. A copy of the sealing report would be forwarded to the Deputy/Assistant Commissioner having jurisdiction over the principal place of business.

9. These instructions shall apply to exports on or after 1st July, 2017. It is requested that suitable trade notices may be issued to publicize the contents of this circular. Difficulty, if any, in the implementation of the above instructions may please be brought to the notice of the Board. Hindi version would follow.

-sd-
(Upender Gupta)
Commissioner (GST)

**[TO BE PUBLISHED IN THE GAZETTE OF INDIA, EXTRAORDINARY, PART II,
SECTION 3, SUBSECTION (i)]**

**Government of India
Ministry of Finance
Department of Revenue
Central Board of Excise and Customs**

Notification No. 16/2017 – Central Tax

New Delhi, the 7th July, 2017

G.S.R... ()E.- In exercise of the powers conferred by sub-rule (5) of rule 96A of the Central Goods and Services Tax Rules, 2017, the Central Board of Excise and Customs hereby specifies the conditions and safeguards for the registered person who intends to supply goods or services for export without payment of integrated tax, for furnishing a Letter of Undertaking in place of a Bond.

i. The following registered person shall be eligible for submission of Letter of Undertaking in place of a bond:-

- (a) a status holder as specified in paragraph 5 of the Foreign Trade Policy 2015-2020; or
- (b) who has received the due foreign inward remittances amounting to a minimum of 10% of the export turnover, which should not be less than one crore rupees, in the preceding financial year,

and he has not been prosecuted for any offence under the Central Goods and Services Tax Act, 2017 (12 of 2017) or under any of the existing laws in case where the amount of tax evaded exceeds two hundred and fifty lakh rupees.

ii. The Letter of Undertaking shall be furnished in duplicate for a financial year in the annexure to FORM GST RFD – 11 referred to in sub-rule (1) of rule 96A of the Central Goods and Services Tax Rules, 2017 and it shall be executed by the working partner, the Managing Director or the Company Secretary or the proprietor or by a person duly authorised by such working partner or Board of Directors of such company or proprietor on the letter head of the registered person.

[F. No. 349/74/2017 – GST]

(Dr. Sreeparvathy S. L.)
Under Secretary to the Government of India

BHARAT HEAVY ELECTRICALS LIMITED
Corporate Finance
BHEL House, Siri Fort, new Delhi-110049

From:	Suraj Prakash GM (Fin) Corporate Office	To :	All Heads of Units
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Ref No: AA: Fin:Ind.Tax:GST-14
Dated 05.07.17

Subject: Export without payment of IGST and sealing of containers - regarding

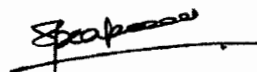
This is in continuation to our GST Circulars No. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 & 13 dated 3rd, 5th, 8th, 9th, 17th, 19th, 21st, 23rd, 27th 30th Jun & 5th July 2017 respectively regarding transitory credit, job work, invoicing, GST Credit, ISD registrations, IGST on imports and other provisions as per GST law.

As per GST law provisions, goods or services can be exported under bond or Letter of Undertaking without payment of integrated tax or with payment of IGST and refund of such IGST paid can be claimed.

CBEC vide notification no. 15/2017 dated 01st July 2017 (as clarified vide Circular dated 04th July 2017) has inserted a new rule 96A in CGST Rules prescribing conditions and other modalities w.r.t. export of goods or services under bond or Letter of Undertaking (LUT) without payment of IGST, gist of key points whereof is as follows:

1. Conditions, modalities & other requirements for Exports

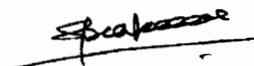
- 1.1. As per the Rules, a bond or a Letter of Undertaking in FORM GST RFD-11, is required to be submitted by BHEL **prior to export**, to the Jurisdictional Deputy/Assistant Commissioner. Though such Bond/LUT is required to be furnished electronically on the GSTN portal, however facility for furnishing the same manually till the module for furnishing of FORM RFD-11 is available on the common portal has been provided.
- 1.2. In case goods are not exported by BHEL within the prescribed period of 3 months from the date of issue of invoice for export of goods or payment in convertible foreign exchange is not realized within prescribed period of one year from the date of issue of invoice for export of service, BHEL would be required to pay IGST along with the interest as follows:



- (a) within a period of 15 days after the expiry of 3 months from the date of issue of the invoice for export of goods.
 - (b) Within a period of 15 days after the expiry of period of 1 year period from the date of issue of the invoice (or such further period as may be allowed by the Commissioner) for export of services.
- 1.3 It may be noted that for export of goods, invoice for export is required to be issued by concerned BHEL Unit/Region on or before dispatch of goods and hence time limit of 3 months for export shall be reckoned from that date.
- 1.4 Further it is provided that in case the goods are **not exported** within the time limit of 3 months from the date of invoice and the **amount of IGST and interest thereon is not paid as** specified above in Para 1.2 above, **the export as allowed** under bond or LUT **shall be withdrawn forthwith** and the said amount shall be recovered from BHEL u/s 79 of CGST law. **It is further provided that the export shall be restored ONLY when such amount is paid.**
- 1.5 Above provisions apply mutatis mutandis in respect of zero rated supply of goods/services to SEZ units/developer without payment of IGST.
- 1.6 CBEC would specify the conditions and safeguards under which LUT may be furnished in place of a bond.

Key Actions required

1. In view of above, to avoid any financial implications on BHEL, it is imperative for all concerned Units including IO and RODs to ensure that whenever goods or services are exported under bond or Letter of Undertaking, the prescribed timelines as mentioned above for export of goods or realization of foreign currency in case of export of services, are strictly complied with. Failure to meet these timelines will entail cash outgo towards IGST and interest thereon.
2. Further, all concerned Units including IO and RODs to ensure that all export related operational procedures and formalities including transportation upto port of export, documentation, arranging ship liner are completed timely and promptly to enable export of goods within the prescribed time lines. This would necessitate proper coordination among concerned Units/ROD/IO.
3. It may be seen that as per provisions of GST law, the export as allowed under bond or Letter of Undertaking shall be withdrawn forthwith in case IGST with interest thereon is not paid within time indicated above. Although no specific clarity on this aspect has been provided, however there is possibility that future export of BHEL under such bond



or Letter of Undertaking may be restricted or BHEL may be asked to pay IGST for each export thus entailing blockage of IGST till refund.

4. Moreover, said amendment does not specifically provide for refund of IGST in such cases where IGST is paid due to non-adherence to timelines indicated above and goods are subsequently exported or payment towards services realized after expiry of timelines indicated above and thus may result in permanent loss of IGST to BHEL. Hence all concerned Units/ROD/IO to ensure that prescribed timeline for export of goods are strictly complied with so as to avoid any financial implications on BHEL.

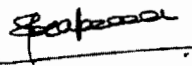
2. Procedure for Sealing of Containers

Vide circular No. 26/2017-Customs issued by CBEC (Copy enclosed), the revised procedure for Sealing of containers has been prescribed which shall be effective from 01.09.2017.

As per the procedure, the exporter shall self-seal the container with a tamper proof electronic-seal of standard specification. Units are advised to refer to the said circular for detailed guidelines and modalities in this regard for necessary compliance.

The above are some of key provisions of amendments/provisions in this regard. Units are requested to go thru detailed circulars/amendments and ensure compliance in toto.

The matter may be given wide circulation so that all concerned departments can take necessary action to ensure compliance in this regard.


(Suraj Prakash)

Copy to:

1. Heads of MM/Heads of Commercial/ Heads of Finance
2. ED (COM)
3. GM(I) (Corp. Accounts)/ED (Fin)
4. D(F)/D(E R&D)/D(IS&P)/D(HR)/D(Power): - for kind information please
5. CMD Secretariat : for kind information of CMD please

Circular No. 26/2017-Customs

F. No. 450/08/2015-Cus.IV
Government of India
Ministry of Finance
Department of Revenue
(Central Board of Excise and Customs)

New Delhi dated the 1st July, 2017

To

All Principal Chief Commissioner/Chief Commissioner of Customs & Central Excise
All Principal Commissioner/Commissioner of Customs & Central Excise
All Principal Chief Commissioner/Chief Commissioner of Customs/Customs (Preventive)
All Principal Commissioner/Commissioner of Customs / Customs (Preventive)

Sir/ Madam,

Subject: Export procedure and sealing of containerized cargo-regarding.

Goods and Service Tax has become operational from 01-07-2017. In the GST regime, the governing provisions related to exports are contained in section 16 of the Integrated Goods and Service Tax Act, 2017 (IGST Act). Supplies of goods and services for exports have been categorized as 'Zero Rated Supply' implying that goods could be exported under bond or Letter of Undertaking without payment of integrated tax followed by claim of refund of unutilized input tax credit or on payment of integrated tax with provision for refund of the tax paid.

2. With the onset of GST, extant procedures relating to export of goods viz. claim of rebate/refund, stuffing of containers at the factory, warehouse or any other place from where the goods are intended to be exported etc. would require review of the existing procedures. In this regard, attention is drawn to notification No's 42/2001-CE (N.T.) to 45/2001-CE (N.T.) both dated 26.6.2001 detailing the procedure to be followed for the export of goods on payment of terminal excise duty and 19/2004-CE (N.T.) and 20/2004-CE (N.T.), both dated 06.09.04, without payment thereof.

A. Procedure of Export

3. Any person making zero rated supply (i.e. any exporter) shall be eligible to claim refund under either of the following options, namely: –

(a) he may supply goods or services or both under bond or Letter of Undertaking, subject to such conditions, safeguards and procedure as may be prescribed, without payment of integrated tax and claim refund of unutilized input tax credit; or

(b) he may supply goods or services or both, subject to such conditions, safeguards and procedure as may be prescribed, on payment of integrated tax and claim refund of such tax paid on goods or services or both supplied, in accordance with the provisions of section 54 (Refunds) of the Central Goods and Services Tax Act or the rules made there under (i.e. the Central Goods and Service Tax Rules, 2017).

4. For the option (a) above, procedure to file refund has been outlined in the Central Goods and Service Tax Rules, 2017. The exporter claiming refund of unutilized input tax credit will file an application electronically through the Common Portal, either directly or through a Facilitation Centre notified by the GST Commissioner. The application shall be accompanied by documents as prescribed in the said rules. Application for refund shall be filed only after the export manifest or an export report, as the case may be, is delivered under section 41 of the Customs Act, 1962 in respect of such goods. The formats for furnishing bond or LUT for export of goods have been separately notified under CGST Rules, 2017. The said formats are attached herewith for easy reference.

5. For the option (b), broadly the procedure is that a registered person shall not be required to file any application for refund of *integrated goods and services tax* paid on supply of goods for exports. The shipping bill, having inter-alia GST invoice details, filed by an exporter shall be deemed to be an application for refund of integrated tax paid on the goods exported out of India and such application shall be deemed to have been filed only when the person in charge of the conveyance carrying the export goods duly files an export manifest or an export report covering the number and the date of shipping bills or bills of export and the applicant has furnished a valid return in FORM GSTR-3. The details of the relevant export invoices contained in FORM GSTR-1 shall be transmitted electronically by the common portal to the Customs system and the said system shall in turn electronically transmit back to the common portal a confirmation that the goods covered by the said invoices have been exported out of India. Upon receipt of information regarding furnishing of valid return in FORM GSTR-3 from the common portal, the Customs system shall process the claim for refund and an amount equal to the integrated tax paid in respect of each shipping bill or bill of export shall be electronically credited to the bank account of the applicant mentioned in his registration particulars. Government has allowed a grace period to the registrants to file returns under the new GST Law. Therefore, this refund procedure shall as a consequence come into operation only when the registrants file the above mentioned returns. Further, the exporters are free to avail option (a) or option (b). The refund shall be governed by the provisions of the section 16 of the IGST Act.

6. In order to ensure smooth transition from the earlier export procedure to the procedure being laid down for export of goods under the GST regime, the existing Shipping Bill formats (both manual/ electronic) have been modified to make them compliant with the IGST law. New formats of the Shipping Bill have been made applicable already. ARE-1 procedure which was being followed is dispensed with except in respect of commodities to which provisions of Central Excise Act would continue to be applicable.

B. Sealing of Containers

7. Board has in the past issued various circulars both on the Excise and Customs side on the issue of sealing of containers. A gist of these Circulars and the subject matter dealt in them is given in the annexure to this circular. At present, there are three categories of containers which arrive at the port/ICD:

- a. Containers stuffed at factory premises or warehouse under self-sealing procedure.
- b. Containers stuffed / sealed at factory premises or warehouse under supervision of central excise officer.
- c. Containers stuffed and sealed at Container Freight Stations/ Inland Container Depot.

8. For the sake of uniformity and ease of doing business, Board has decided to simplify the procedure relating to factory stuffing hitherto carried out under the supervision of the Central Excise officers. It is the endeavor of the Board to create a trust based environment where compliance in accordance with the extant laws is ensured by strengthening Risk Management System and Intelligence setup of the department. Accordingly, Board has decided to lay down a simplified procedure for stuffing and sealing of export goods in containers.

9. It has been decided to do away with the sealing of containers with export goods by CBEC officials. Instead, self-sealing procedure shall be followed subject to the following:

- i. The exporter shall be under an obligation to inform the details of the premises whether a factory or warehouse or any other place where container stuffing is to be carried out, to the jurisdictional customs officer.
- ii. The exporter should be registered under the GST and should be filing GSTR1 and GSTR2. Where exporter is not a GST registrant, he shall bring the export goods to a Container Freight Station/Inland Container Depot for stuffing and sealing of container. However, in certain situations, an exporter may follow the self-sealing procedure even if he is not required to be

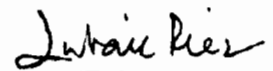
registered under GST Laws. Such an exception is available to the Status Holders recognized by DGFT under a valid status holder certificate issued in this regard.

- iii. Any exporter desirous of availing this procedure shall inform the jurisdictional Custom Officer of the rank of Superintendent or Appraiser of Customs, at least 15 days before the first planned movement of a consignment from his/her factory/ premises, about the intention to follow self- sealing procedure to export goods from the factory premises or warehouse. The jurisdictional Superintendent or an Appraiser or an Inspector of Customs shall visit the premises from where the export goods will be stuffed & sealed for export. The jurisdictional Superintendent or Inspector of Customs shall inspect the premises with regard to viability of stuffing of container in the premises and submit a report to the jurisdictional Deputy Commissioner of Customs or as the case may be the Assistant Commissioner of Customs within 48 hours. The jurisdictional Deputy Commissioner of Customs or as the case may be the Assistant Commissioner of Customs shall forward the proposal, in this regard to the Principal Commissioner/Commissioner of Customs who would grant permission for self-sealing at the approved premises. Once the permission is granted, the exporter shall furnish only intimation to the jurisdictional Superintendent or Customs each time self-sealing is carried out at approved premises. The intimation, in this regard shall clearly mention the place and address of the approved premises, description of export goods and whether or not any incentive is being claimed.
- iv. Where the visit report of the Superintendent or an Appraiser or an Inspector of Customs regarding viability of the stuffing at the factory/ premises is not favorable, the exporter shall bring the goods to the Container Freight Station /Inland Container Depot/Port for sealing purposes.
- v. Self-Sealing permission once given by a Principal Commissioner/Commissioner of Customs shall be valid for export at all the customs stations. The customs formation granting the self-sealing permission shall circulate the permission along with GSTIN of the exporter to all Custom Houses/Station concerned.
- vi. Transport document for movement of self-sealed container by an exporter from factory or warehouse shall be same as the transport document prescribed under the GST Laws. In the case of an exporter who is not a GST registrant, way bill or transport challan or lorry receipt shall be the transport document.
- vii. The exporter shall seal the container with the tamper proof electronic-seal of standard specification. The electronic seal should have a unique number which should be declared in the Shipping Bill. Before sealing the container, the exporter shall feed the data such as name of the exporter, IEC code, GSTIN number, description of the goods, tax invoice number,

name of the authorized signatory (for affixing the e-seal) and Shipping Bill number in the electronic seal. Thereafter, container shall be sealed with the same electronic seal before leaving the premises.

- viii. The exporter intending to clear export goods on self-clearance (without employing a Customs Broker) shall file the Shipping Bill under digital signature.
 - ix. All consignments in self-sealed containers shall be subject to risk based criteria and intelligence, if any, for examination / inspection at the port of export. At the port/ICD as the case may be, the customs officer would verify the integrity of the electronic seals to check for tampering if any enroute. The Risk Management System (RMS) is being suitably revamped to improvise the interdiction/ examination norms. However, random or intelligence based selection of such containers for examination/scanning would continue.
10. Board has decided that the above revised procedure regarding sealing of containers shall be effective from 01.09.2017. A future date has been prescribed since the returns under GST have been permitted to be filed by 10.09.17 and also with the purpose to give enough time to the stakeholders to adapt to the new procedures. Therefore, as a measure of facilitation, the existing practice of sealing the container with a bottle seal under Central Excise supervision or otherwise would continue. The extant circulars shall stand modified on 01.09.2017 to the extent the earlier procedure is contrary to the revised instructions given in this circular.
11. Suitable public Notices may be issued in this regard. Difficulty faced, if any, may be brought to the notice of the Board.
12. Hindi version will follow.

Yours faithfully,



(Zubair Riaz)
Director (Customs)

Annexure

Sr. No	Reference Number	Date	Subject
1	952/1 3/2011 -CX.	08-09-11	Stuffing of export containers - Procedure
2	892/1 2/2009-CX	23-07-09	Exports - Self-sealing/certification facility extended for export of non-excisable agricultural products
3	860/1 8/20,07-CX	22-11-07	Exports under Free Shipping Bills - Mandatory self-sealing of containers
4	741/57/2003-CX.	02-09-03	Exports to Nepal and Bhutan - Self-sealing and self-certification facility not applicable
5	736/52/2003-CX.	11-08-03	Exports - Self-certification and self-sealing facility extended to all categories of Manufacturer-Exporters-Extension of facility of self-sealing to all categories of manufacturer exporters.
6	481/47/99-CX	23-08-99	Containers Sealing of packages/Containers procedure Relaxed-modifies 426/59/98-CX in so far as furnishing tentative date and time of export plan by manufacturer exporter is concerned.
7	445/11/99-CX	17-03-99	Exports Special facility of self-certification and self-sealing to large manufacturer Exporter Further instructions. Para 7 (duty of customs officers at the place of export) of 426/59/98-CX is deleted in view of Circular 6/2002-Cus. [90/98-cus. was rescinded vide 31/2002-cus].
8	426/59/98-CX	12-10-98	Introduction of facility of self-sealing to manufacturers who have paid Central Excise duty exceeding Rs. 10 crores in the preceding financial year in cash or by debit in current account or manufacturer-exporters who have been accorded the status of Super Star Trading House, Star Trading House, Trading House or Export House under the provisions of the Export - Import Policy announced by the Government from time to time.
9	6/2002-Cus	23.1.2002	Export- procedure, as also norms for examination of self-sealed containers at the port of export.
10	83/99-Cus	14-12-99	Export Simplification in procedure for movement of export goods on the basis of. Self-certification and reduced percentage of physical examination-Dispensing off with routine examination at gateway ports.

FORM GST RFD-11

Furnishing of bond or Letter of Undertaking for export of goods or services

1. GSTIN				
2. Name				
3. Indicate the type of document furnished		Bond: ☐	Letter of Undertaking ☐	
4. Details of bond furnished				
Sr. No.	Reference no. of the bank guarantee	Date	Amount	Name of bank and branch
1	2	3	4	5

Note – Hard copy of the bank guarantee and bond shall be furnished to the jurisdictional officer.

5. Declaration -

- (i) The above-mentioned bank guarantee is submitted to secure the integrated tax payable on export of goods or services.
- (ii) I undertake to renew the bank guarantee well before its expiry. In case I/We fail to do so the department will be at liberty to get the payment from the bank against the bank guarantee.
- (iii) The department will be at liberty to invoke the bank guarantee provided by us to cover the amount of integrated tax payable in respect of export of goods or services.

Signature of Authorized Signatory

Name

Designation / Status -----

Date -----

Bond for export of goods or services without payment of integrated tax
(See rule 96)

I/We.....of.....,hereinafter called "obligor(s)", am/are held and firmly bound to the President of India (hereinafter called "the President") in the sum of.....rupees to be paid to the President for which payment will and truly to be made.

I/We jointly and severally bind myself/ourselves and my/our respective heirs/ executors/ administrators/ legal representatives/successors and assigns by these presents; Dated this.....day of.....;

WHEREAS the above bounden obligor has been permitted from time to time to supply goods or services for export out of India without payment of integrated tax;
and whereas the obligor desires to export goods or services in accordance with the provisions of clause (a) of sub-section (3) of section 16;

AND WHEREAS the Commissioner has required the obligor to furnish bank guarantee for an amount of..... rupees endorsed in favour of the President and whereas the obligor has furnished such guarantee by depositing with the Commissioner the bank guarantee as afore mentioned;

The condition of this bond is that the obligor and his representative observe all the provisions of the Act in respect of export of goods or services, and rules made thereunder;

AND if the relevant and specific goods or services are duly exported;
AND if all dues of Integrated tax and all other lawful charges, are duly paid to the Government along with interest, if any, within fifteen days of the date of demand thereof being made in writing by the said officer, this obligation shall be void;

OTHERWISE and on breach or failure in the performance of any part of this condition, the same shall be in full force and virtue:

AND the President shall, at his option, be competent to make good all the loss and damages, from the amount of bank guarantee or by endorsing his rights under the above-written bond or both;

I/We further declare that this bond is given under the orders of the Government for the performance of an act in which the public are interested;

IN THE WITNESS THEREOF these presents have been signed the day hereinbefore written by the obligor(s).

Signature(s) of obligor(s).

Date :

Place :

Witnesses

(1) Name and Address

Occupation

(2) Name and Address

Occupation

Accepted by me this.....day of (month).....
(year)

.....of
(Designation)

for and on behalf of the President of India."

Letter of Undertaking for export of goods or services without payment of integrated tax

(See rule 96)

To

The President of India (hereinafter called the "President"), acting through the proper officer

I/We of..... (address of the registered person)
having Goods & Services Tax Identification Number
No....., hereinafter called "the undertaker(s) including
my/our respective heirs, executors/ administrators, legal representatives/successors and assigns
by these presents, hereby jointly and severally undertake on this day of
..... to the President

(a) to export the goods or services supplied without payment of integrated tax within time
specified in sub-rule (9) of rule 96 ;

(b) to observe all the provisions of the Goods and Services Tax Act and rules made thereunder,
in respect of export of goods or services;

(c) pay the integrated tax, thereon in the event of failure to export the goods or services, along
with an amount equal to eighteen percent interest per annum on the amount of tax not paid, from
the date of invoice till the date of payment.

I/We declare that this undertaking is given under the orders of the proper officer for the
performance of enacts in which the public are interested.

IN THE WITNESS THEREOF these presents have been signed the day hereinbefore written
by the undertaker(s)

Signature(s) of undertaker(s).

Date :

Place :

Witnesses

(1) Name and Address

Occupation

(2) Name and Address

Occupation

Date

Place

Accepted by me this.....day of (month).....
(year)

.....of
..... (Designation)
for and on behalf of the President of India

Circular No. 2/2/2017-GST

**F. No. 349/82/2017-GST
Government of India
Ministry of Finance
Department of Revenue
Central Board of Excise and Customs
GST Policy Wing**

New Delhi, Dated the 4th July, 2017

To,

The Principal Chief Commissioners/Chief Commissioners/Principal Commissioners/
Commissioners of Central Tax (All)

Madam/Sir,

Subject: Issues related to furnishing of Bond/ Letter of Undertaking for Exports–Reg.

Various communications have been received from the field formations and exporters on the issue of difficulties being faced while supplying the goods or services for export without payment of integrated tax and filing the FORM GST RFD -11 on the common portal (www.gst.gov.in), because of which exports are being held up.

2. Whereas, as per rule 96A of the Central Goods and Services Tax Rules, 2017, any registered person availing the option to supply goods or services for export without payment of integrated tax shall furnish, prior to export, a bond or a Letter of Undertaking. This bond or Letter of Undertaking is required to be furnished in FORM GST RFD-11 on the common portal. Further, Circular No. 26/2017- Customs dated 1st July, 2017 has clarified that the procedure as prescribed under rule 96A of the said rules requires to be followed for the export of goods from 1st July, 2017.

3. Another issue being raised by various stakeholders is that the Bond/Letter of Undertaking is required to be given through the proper officer which is to be furnished to the jurisdictional Commissioner as per sub-rule (1) of rule 96A of the said rules. Taking cognizance of the fact that a large number of such Bonds/Letter of Undertakings would be required to be filed by the registered exporters who would be located at a distance from the office of the jurisdictional Commissioner, it is understood that the furnishing of such bonds/undertakings before the jurisdictional Commissioner may cause hardship to the exporters.

4. Thus, in exercise of the powers conferred by sub-section (3) of section 5 of the CGST Act, 2017, it is hereby stated that the acceptance of the Bond/Letter of Undertaking required to be furnished by the exporter under rule 96A of the said rules shall be done by the jurisdictional Deputy/Assistant Commissioner.

5. Further, in exercise of the powers conferred by section 168 of the said Act, for the purpose of uniformity in the implementation of the said Act, the Bond/Letter of Undertaking required to be furnished under rule 96A of the said rules may be furnished manually to the jurisdictional Deputy/Assistant Commissioner in the format specified in FORM RFD-11 till the module for furnishing of FORM RFD-11 is available on the common portal. The exporters may download the FORM GST RFD-11 from the website of the Central Board of Excise and Customs (www.cbec.gov.in) and furnish the duly filled form to the jurisdictional Deputy/Assistant Commissioner.

6. The above specified provisions shall be applicable to all applications which have been filed on or after 1st July, 2017. It is requested that suitable trade notices may be issued to publicize the contents of this circular.

7. Difficulty, if any, in the implementation of the above instructions may please be brought to the notice of the Board. Hindi version would follow.

Sd/-
(Upender Gupta)
Commissioner (GST)



CORPORATE STANDARD

AA0490004

Rev. No. 01

PAGE 1 of 8

SEAWORTHY PACKING (PACKING INSTRUCTIONS FOR GENERAL COMPONENTS / ASSEMBLIES / EQUIPMENT)

1 GENERAL

This standard lays down packing instructions for seaworthy packing of Components /Assemblies/ Equipment to be dispatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit for storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this standard, must appear in the Shipping list/Packing List.

2 SCOPE

This procedure gives minimum guidelines for seaworthy packing to be complied with for packing of Components /Assemblies / Equipment. This packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage for periods more than one year.

3 CROSS REFERED SPECIFICATION

- | | |
|---|----------------|
| – Multi-layered cross laminated plastic film | : AA51420 |
| – Packing Wood | : AA51401 |
| – Silica gel | : AA55619 |
| – Thermocole | : AA51416 |
| – Packing slip holders | : AA7240901 |
| – Corrugated Fibre Board | : AA51414 |
| – Rubber sheet | : AA59001 |
| – VCI paper | : AA51406 |
| – High quality full glossy out door finishing paint | : AA56126 |
| – Polyethylene air bubble film | : IS 12787 |
| – Structural steel - standard quality (plates, sections, strips flats & bars) | : AA10108 |
| – International Standards For Phytosanitary Measures No. 15 | : ISPM-15:2009 |

4 WOOD SPECIFICATION FOR PACKING

The wood shall conform to specification AA51401.

5 TYPE OF PACKING

The following 5 types of packings have been standardized for packing of General Components /Assemblies.

- 'OP' - Open Type
- 'PP' - Partially Packed
- 'CP' - Crate Packing - Components/Equipment requiring physical protection

Revisions: Committee changed from MRC-M&CD to PGC-Packing

APPROVED:
PROCEDURAL GUIDELINES COMMITTEE –
PGC (Packing)

Rev. No. 01	Amd. No.	Reaffirmed	Prepared	Issued	Dt. of 1 st Issue
Dt: 12-06-2018	Dt:	Year:	HPEP, Hyderabad	Corp. R&D	17-08-2013



- 'CQ' - Case Packing - Small medium Components/ Assemblies/ Equipment which require corrosion & physical protection
- 'CR' - Case Packing - Electrical Components/Assemblies which require special packing viz. Water Proof, Shock Proof, etc.

6 DESCRIPTION OF TYPES OF PACKING

The various types of packing, as standardized above, are described below.

6.1 'OP' - Open Type

In case, of components which are not affected by water & dust & do not require special protection &, are generally not machined, shall be sent as open packages. However these components may be sent in crates, wherever necessary.

6.2 'PP' - Partially Packed

Components which need special protection, at selected portions only, shall be dispatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces after application of TRP should be protected with Multi-layered cross laminated plastic film to AA51420.

6.3 'CP' - Crate Packing – General

Assemblies/Components which need only physical protection from the point of view of handling shall be dispatched duly packed in crates.

6.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

- a) Small & Medium sized components/assemblies/equipment due to size/weight & to avoid handling, and pilferage, problems shall be packed in Case/Containers.
- b) Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/ Tablets, packed in thin muslin cloth cotton bags shall be suitably placed.
- c) Small machines/components of less weight shall be provided with suitable cushioning. Wood Wool/Expanded Polyethylene Foam Sheet, if used, shall be sandwiched between polyethylene sheets and sealed.
- d) The components inside the case shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, where-ever required.

6.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons.

- a) Adequate quantity of Silica gel to AA55619 packed in cotton bags, of 100 grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, before being packed in the cases.
- b) VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.
- c) Empty space in the cartons shall be filled with small chips of Expanded Polystyrene (Thermocole), Wood Wool etc. Polyethylene air bubble film shall conform to IS 12787/AA51420 Expanded polystyrene (Thermocole) shall conform to AA51416.
- d) The cartons shall be manufactured from corrugated Fibre Board, meeting requirements of AA51414.

6.6 Volatile Corrosion Inhibitor (VCI) Paper

- a) Un-protected surfaces of steel and cast iron components, tools bearing, shaft seals etc. are covered with VCI paper. VCI paper has been impregnated with corrosion inhibitors which by evaporation and chemical conversion protect metals in an enclosed area against corrosion.
- b) 7 m³ VCI paper is necessary for 1 m³ of packed item approximately as per AA51406.



CORPORATE STANDARD

AA0490004

Rev. No. 01

PAGE 3 of 8

Application Limitation:

VCI paper shall not be used for components made of aluminium, aluminium alloys as well as Zinc, copper, brass, cadmium and silver.

VCI powder is sprinkled inside the piping components ends shall be protected with end cover as specified in plant standards, drawings.

6.7 Moisture Absorber

Silica gel is used for this purpose to protect the contents over sufficiently long time from corrosion. At the time of use, silica gel should be so dried that its colour becomes dark blue. These shall be filled in small cotton bags. Before sealing the equipment, the silica gel bags should be kept inside the polyethylene film cover at different locations. The quantity of silica gel should not be less than 1.0 kg per cubic metre volume of the packing box

7 TYPE OF CASES

For specific requirement of packing the cases are to be provided with Tongue and Groove joints.

8 PREPARATION OF PACKING CASE

- 1) The base of the case shall be made of wooden batons for planks giving necessary reinforcement, such that the bottom of the equipment is at a height of 100 to 200 mm from the ground level depending upon size, ft weight of equipment. However for packing cases of smaller size equipment can be at a height of 40 mm from the ground level.
- 2) In case of 'CR1 - Packing Viz. Electrical ft Electronic components for instruments/assemblies, a rubber sheet, Self-expanded polyethene foam sheet, preferably 10 mm thick, shall be fixed on to the base to act as cushioning to the equipment.
- 3) The four sides, shall be lined, from inside with multi-layered cross-laminated polyethylene sheet of 90GSM as per AA51420 and tacked at suitable places.

Whenever specified the top cover will have a layer of multi-layered cross laminated polyethylene sheet of 90 GSM over the cover. This should project about 100 - 250mm on all sides.

It is preferable to have a single piece of the above Multi-layered cross laminated polyethylene sheet fixed on the four sides. In case jointing is unavoidable, it should be done by overlapping of approximately 100mm.

- 4) Place the Components/cartons with corrosion inhibitors duly applied wherever necessary for place suitably, thin muslin cloths bags containing 100 grams (approx.) of activated Blue Silica Gel to AA55619, wherever necessary. Alternatively VCI Powder or Tablet may be used.
- 5) In case, depression is formed, at the top, after the equipment is lowered, provide ply board/wooden batons.
- 6) Cover the whole equipment with polyethylene sheet of at least 100 micron thickness, on all sides preferably by a single piece.
- 7) For indoor panels/equipment, provide suitable packing batons with covering of Thermocole/expanded soft polyethylene foam/polyethylene air bubble film wrapped with suitable cords, to avoid cutting of the polyethylene sheet so that finished surface is not damaged.
- 8) Empty space in the box shall be filled with adequate cushioning material e.g. Thermocole Chips, Wood Wool etc. to avoid movement for shocks. Alternatively put wooden blocks/batons wherever necessary.
- 9) The inner side of the top cover shall be lined with polyethylene sheet, of at least
- 10) 100 micron thickness, which shall project approximately 25 to 150 mm depending upon the size of the case on all sides of the top cover shall be provided below the top cover. This projection, after nailing the top cover, shall be folded over, on the sides of the crates ft tacked, to, prevent ingress of water from the top.



9 STEEL CONTAINERS

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies.

The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections.

Following precautions are to be taken during packing:

- Put the Components/Assemblies/Equipment in the steel container properly. Cover the Components/Assemblies/Equipment with polythene.
- To arrest the movement in the steel container necessary wooden Blocks/Batons may be put.
- Put cover on steel, container and Bolt Properly.

10 SEALED PACKING

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture.

The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

11 SLING PLATE

Sling plate shall be provided to prevent damage to the packing box during lifting. Size of the sling plate shall be selected depending upon the net weight of the consignment.

12 PACKING SLIP HOLDERS

Two nos. steel packing slip holders, specification no. AA7240901 containing the packing list, sealed in thick polyethylene film, shall be fixed one inside and the other outside the packing box.

13 GENERAL PRECAUTIONS

- a) While fixing nails during packing, necessary care shall be taken to ensure that materials used for protection inside the case e.g. paper, polyethylene sheet, coir etc. do not get damaged.
- b) Sling protection brackets to be provided on cases wherever required.
- c) It shall be ensured that all stencil marks external, front & rear sides of the casing shall be of water proof Material to prevent obliteration in transit.
- d) The various caution signs shall be marked with stencil on both sides of the packing box.
- e) Do not pack any other Mechanical items with this case.

THE FOLLOWING DETAILS ARE TO BE MARKED ON THE PACKING CASES.

- a) Address of consignee.
- b) Purchase Order No./ SO No/WO No.
- c) Description of item or title of packing list.
- d) Case identification Number/ Packing List No.
- e) Net Weight.
- f) Gross Weight.
- g) Dimensions of box
- h) Marking showing upright position.
- i) Marking showing sling position.
- j) Marking showing umbrella (i.e. for machines/components to be stored under covered storage.

k) Loading and unloading precautions

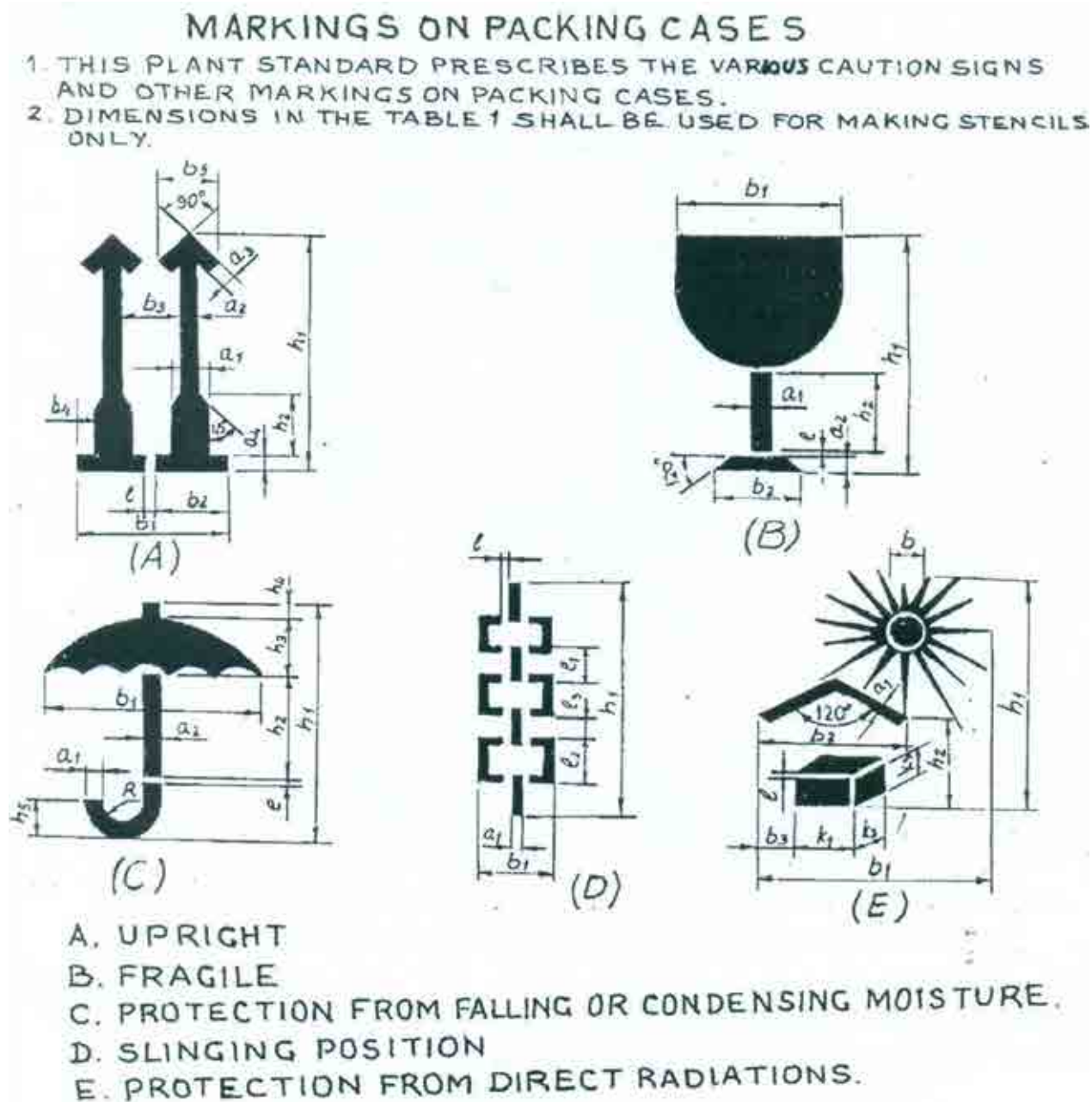


Figure 1

CENTER OF GRAVITY



Figure 2

Table 1

DESIGN- ATION		DIMENSIONS IN mm.																							
		a ₁	a ₂	a ₃	a ₄	b ₁	b ₂	b ₃	b ₄	b ₅	b	ℓ	h ₁	h ₂	h ₃	h ₄	h ₅	K ₁	K ₂	K ₃	ℓ ₁	ℓ ₂	ℓ ₃	R	
A	1	12	5	5	4	52	25	19	8	21	-	2	84	23	-	-	-	-	-	-	-	-	-	-	
	2	17	7	7	6	75	36	29	11	30	-	3	119	33	-	-	-	-	-	-	-	-	-	-	
	3	24	10	10	8	104	50	38	16	42	-	4	168	46	-	-	-	-	-	-	-	-	-	-	
	4	34	14	14	11	147	71	59	23	60	-	5	239	65	-	-	-	-	-	-	-	-	-	-	
B	1	5	5	-	-	50	33	-	-	-	-	2	84	25	-	-	-	-	-	-	-	-	-	-	
	2	7	7	-	-	71	47	-	-	-	-	3	119	36	-	-	-	-	-	-	-	-	-	-	
	3	10	10	-	-	100	66	-	-	-	-	4	168	50	-	-	-	-	-	-	-	-	-	-	
	4	14	14	-	-	142	94	-	-	-	-	5	239	71	-	-	-	-	-	-	-	-	-	-	
C	1	4	3	-	-	66	-	-	-	-	-	2	80	39	19	5	11	-	-	-	-	-	-	6	
	2	6	4	-	-	85	-	-	-	-	-	3	114	55	27	7	16	-	-	-	-	-	-	9	
	3	8	6	-	-	120	-	-	-	-	-	4	160	78	38	10	22	-	-	-	-	-	-	12	
	4	11	9	-	-	170	-	-	-	-	-	5	227	110	54	14	31	-	-	-	-	-	-	17	
D	1	6	-	-	-	30	-	-	-	-	-	4	148	-	-	-	-	-	-	-	30	30	10	-	
	2	9	-	-	-	42	-	-	-	-	-	5	209	-	-	-	-	-	-	-	42	42	14	-	
E	1	3	-	-	-	69	47	10	-	-	16	2	91	26	-	-	-	17	8	11	-	-	-	-	
	2	4	-	-	-	98	67	15	-	-	23	3	128	33	-	-	-	24	11	16	-	-	-	-	
	3	6	-	-	-	138	94	20	-	-	32	4	187	62	-	-	-	34	16	22	-	-	-	-	

Black and Red Marking Ink to IS: 1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink.

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its Package No. as given in shipping list. All caution signs shall be stencilled in higher quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel (AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks. Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: In case the size of package is small for using the stencils, then hand written letters/figures shall be allowed.



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14 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- 14.1** Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 14.2** Appropriate material handling equipment like fork lifters, cranes etc. Shall be used where needed.
- 14.3** Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. Shall be done carefully.
- 14.4** For critical items, where specified, special handling fixtures shall be used for lifting.
- 14.5** Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- 14.6** Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- 14.7** Precision machined components like blades, catches, rollers etc. Shall be lifted using suitable wooden pallets.

14.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH:

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- The markings showing the upright position.
- The markings showing the sling position
- Markings showing the fragile contents.
- Other required markings as per Clause No. 13

- 14.8.1** Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.
- 14.8.2** Handling and lifting should be done without jerks or impacts.
- 14.8.3** Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.
- 14.8.4** On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.
- 14.8.5** Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.
- 14.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

15 GI SHEET

The packing cases are covered with GI sheet on outside for sides and top; inside for bottom as per the Figure-3.

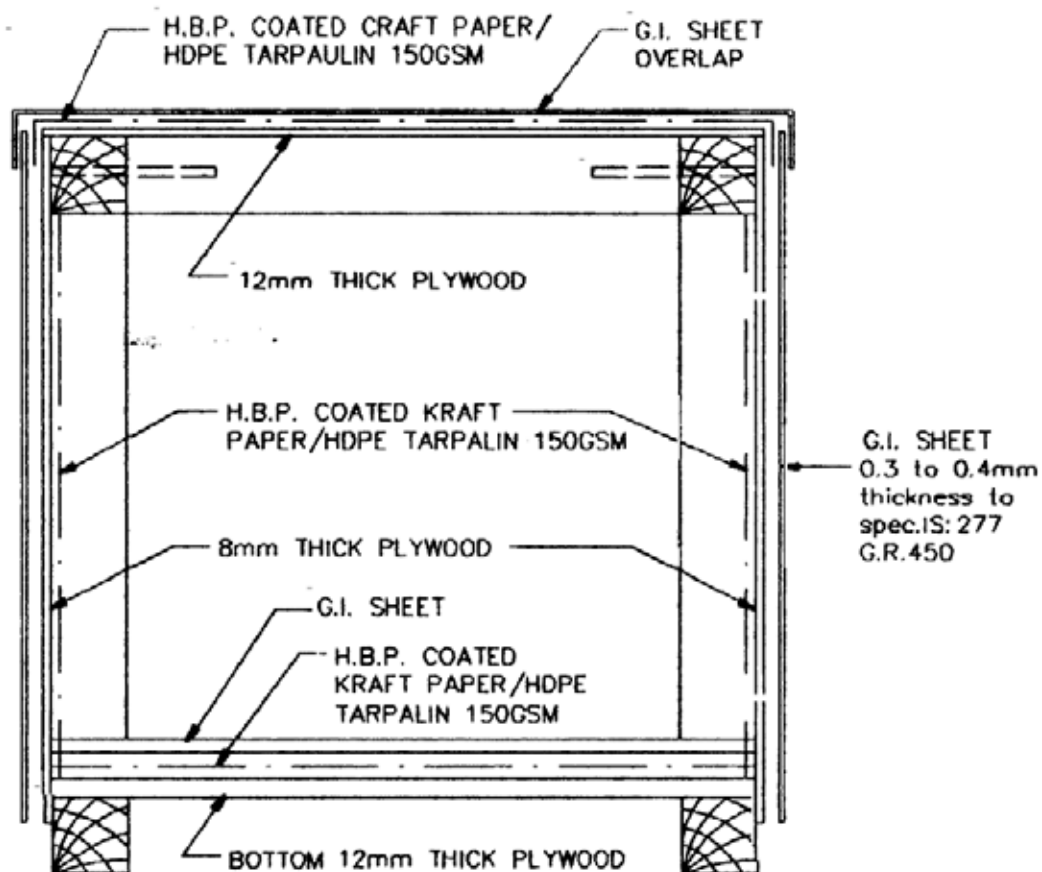
16 TREATMENT of Wood

Treatment of wood is as per ISPM 15: 2009

17 PROVISION FOR INSPECTION

This clause is applicable only where contractual requirement of customer is there. For other packings this is not applicable.

Each transportable packing's shall have provision for inspection by customer authority etc. during transport from origin of dispatched till destination. This inspection may require opening of the package and subsequently closing it again. For this purpose suitable designed opening with bolted cover shall be provided. Such an opening shall be clearly marked as "OPENING" with clear instruction for opening & closing written on this cover. For large consignment the size of the opening shall be suitable to facilitate entry of personnel.



CLOSED PACKING CASE WITH
G.I.SHEET SHOWING LAYERS
OF PACKING MATERIALS

Figure 3



CORPORATE STANDARD

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VACUUM PACKING FOR STAMPINGS

1 GENERAL

This standard lays down the packing instructions for packing of Stamping to be dispatched against Customer contracts.

2 SCOPE

This procedure covers method of packing stamping in a wooden packing boxes with vacuum packing.

3 OBJECTIVE

To establish a rust proof safe packing procedure and where the components required to protect against temperature and humidity. In general minimum temperature +5 deg C and maximum temperature 45 deg C, and relative humidity between 10% to 40%.

4 PACKING BOX

Wooden Box shall be made as per BHEL Standard AA0490010 for Domestic/ AA0490009 for Export/ AA0490004 for Seaworthy packing. Size of the box as per the contract requirement which has to be checked by QC.

5 PACKING PROCEDURE

- Only QC cleared packing wooden Boxes shall be used for Packing of stampings.
- Stampings marked by QC with "OK" stickers only need to be packed. Varnished stampings are to be brought down to room temperature before labelling them "OK" for packing. Do not pack hot/warm stampings that have just received after varnishing.
- Stampings are to be stacked in proper alignment and to be kept in packing wooden boxes of specific size.

6 Vacuum Packing

- Turbo generator stamping of HEEP-Haridwar and Hydro stator and Hydro rims stamping of HEP-Bhopal will be packed in Vacuum Bag.
- The stack of stampings shall be placed over porous plastic sheets (for Cushioning) with total thickness of at least 5mm and shall be wrapped with first layer of aluminium barrier bag (vacuum bag), second layer of VCI Paper (Vacuum Corrosion Inhibitor as per BHEL Standard AA51406). The VCI paper must contact stacked stampings. (Refer Figure-1).
- Silica gel packets are to be placed inside the vacuum bag (between stamping and VCI paper) uniformly distributed around the stampings to remove/ prevent moisture. Total quantity per box should be a minimum 1.5 kg for packing box with a single stack and minimum of 2 kg for a double stack box. In order to cover the maximum space inside the box, small quantity packets 25 gm, 50 gm and 100 gm uniformly distributed all-round the box.
- After final clearance from QC by putting green stickers on stack stampings, Vacuum bag should be secured in position and properly sealed using heat sealing machine and air to be drained using vacuum pump. At the time of the evacuation the vacuum inside the pack should be less than 0.5 ata.
- The top covers of boxes shall be sealed only after final clearance from QC for confirmation of above.

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Year:



- f) All boxes should be covered by water proof tarpaulin over top and on all sides.
- g) The packing boxes shall be covered with GI sheets (0.25-0.40mm thick) on all the sides for Export/ Seaworthy packing.
- h) Vacuum packing room temperature and Relative Humidity should be maintained as mentioned below:
Min. +5 deg. C and Max. 45 deg. C, Relative humidity between 10% to 40%.

7 Aluminium Barrier Laminated Bags

Material must be a first ply of a relatively tough, bi-axially oriented film of organic polymer adhered to second ply of metallic foil/coating and a third ply of a tough polymer such as polyethylene with proper flexibility.

Bags are to be supplied with five sides' sealed and top cover in loose form. Sealing width should be 8 mm minimum.

Properties	Units	Value
Weight	g/m ²	150+ 5 GSM
Tensile Strength	N/mm ² MD	40 (min)
	N/mm ² TD	41 (min)
Water vapour Transmission	g/m ²	0.01 in 24 hrs. at 38 degree C & 90% RH (max)
Oxygen Transmission	cm ³ /m ²	0.02 in 24 hrs at 38 degree C & 90 % RH (max)
Sealing Temp.	Degree C	180 - 220 degree C

8 MARKING OF PACKING BOX

- a) Box No.
- b) P.O. No.
- c) Product Name
- d) Project / Customer Name
- e) Consignee
- f) Water proofing (Umbrella Stencilling)
- g) Upside direction

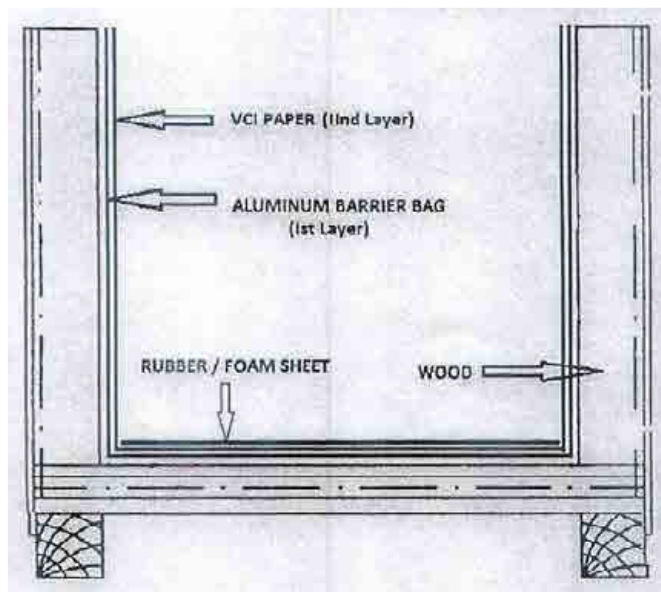


Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7



Figure 8



Figure 9



Figure 10



Figure 11



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Figure 12

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VACUUM PACKING FOR ELECTRONIC COMPONENTS

1 GENERAL

This standard lays down the packing instructions for packing of components / Electronic module / Assemblies to be dispatched against Customer contracts.

2 SCOPE

This procedure covers method of packing electronic components using vacuum packing in a wooden packing boxes.

3 OBJECTIVE

To establish a rust proof safe packing procedure and where the components required to protect against temperature and humidity. In general minimum temperature +5 deg C and maximum temperature 45 deg C, and relative humidity between 10% to 40%.

4 PACKING BOX

Wooden Box shall be made as per BHEL Standard AA0490010 for Domestic/ AA0490009 for Export/ AA0490004 for Seaworthy packing. Size of the box as per the contract requirement which has to be checked by QC.

5 PACKING PROCEDURE

- a) Cleaning parts shall be thoroughly cleaned just before VCI (Volatile Corrosion Inhibitor) Vacuum packing. Finger prints on cleaned items are to be avoided as the same are very corrosive.
- b) VCI Rust preventive oil (Ferrous grade oil base) shall be applied to all the components to withstand any corrosion.

6 VCI VACUUM PACKING

- a) Bubble wrapping the items VCI vacuum packing.
- b) Appropriate vapour corrosive packets one pouch (1 gm. /pouch) of VCI Anticorrosive Powder and one pouch (10gm./ pouch) of VCI Desiccant per 1000 cub. meter packing space shall be placed inside the VCI vacuum packing.
- c) All the components shall be separately packed using VCI laminated Aluminium foils from which air/moisture are removed by the air vacuum device and sealed thoroughly using heat sealing machine. At the time of the evacuation the vacuum inside the pack should be less than 0.5 ata.
- d) One identification slip containing component information such as description of item, Material No. Customer PO, Item No. Quantity etc. shall be put inside the VCI vacuum packing.
- e) Top cover of the wooden box shall be sealed only after final clearance from QC for confirmation of above.
- f) All boxes should be covered by water proof tarpaulin over top and on all sides.
- g) The packing boxes shall be covered with GI sheets (0.25 -0.4mm thick) on all the sides for Export / Seaworthy packing.
- h) Vacuum packing room temperature and Relative Humidity should be maintained as mentioned below:
 Min. +5 deg. C and Max. 45 deg. C, Relative humidity between 10% to 40%.

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7 COMPONENTS REQUIRED

7.1 VCI laminated Aluminium foil

Volatile Corrosion Inhibitor (VCI) safe foil shall be with aluminium barrier laminated which is flexible, heat sealable, water vapour and anticorrosion resistant barrier laminate of polyester, Aluminium foil and VCI Polyethylene. It is used as a primary packaging material for packing metal components and sealed with the help of a heat sealer after vacuuming with vacuum machine maintaining the humidity level below 40 RH inside the package.

7.2 Composition construction of VCI laminated Aluminium foil

- a) PET Film : 12 Microns
- b) Bonding layer : 2 Microns
- c) Aluminium Foil : 9 Microns
- d) Bonding layer : 2 Microns
- e) VCI Poly film : 100 Microns
- f) Total thickness : 125 Microns + or – 5%

7.3 Properties of VC Laminated Aluminium foil

- a) Basic Weight : 138 gsm +/- 8%
- b) Sealing condition : 180 C/ 2 sec
- c) Tensile strength
MD: 20 kgf
CD: 18 kgf
- d) Tear Strength
MD 4.8 kg
CD:3.4 kg
- e) Heat Seal Strength : 30.380 N/cm
- f) WVTR Value : 0.05gms/m /24 hrs.
- g) OTR Value : 0.1 cc/m/24 hrs

8 MARKING OF PACKING BOX

Mark the following information on the two adjacent sides of the each package

- a) Material No.
- b) Customer PO
- c) Item No.
- d) Quantity
- e) Storage Requirement : Indoor
- f) Content Description : Electronic Module
- g) Net weight (in kg)
- h) Dimension (L x W x H in centimetres)
- i) Project Name
- j) Consignee
- k) Water proofing (Umbrella Stencilling)
- l) Upside direction

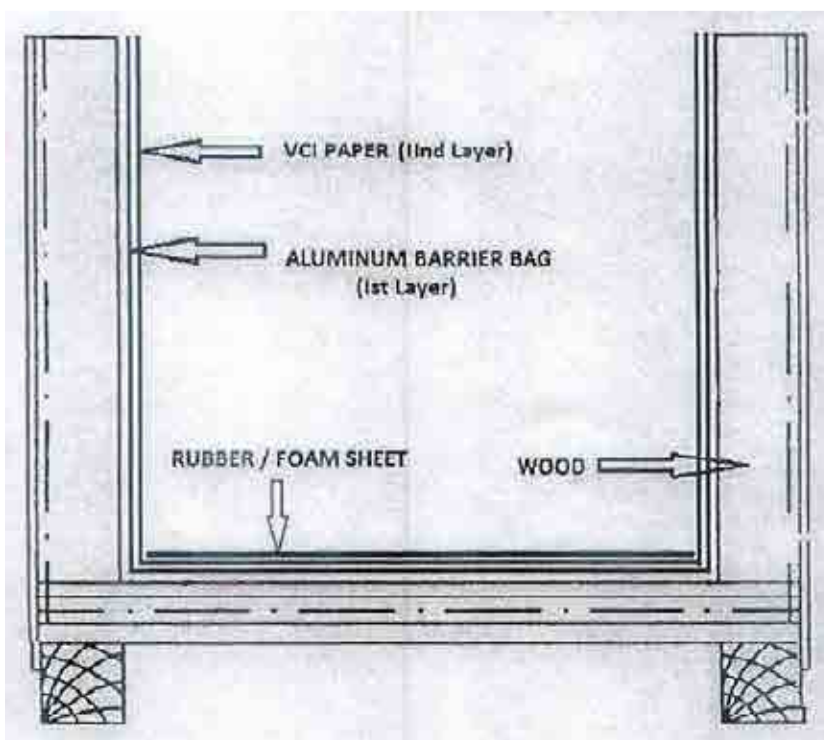


Figure 1



CORPORATE STANDARD

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VACUUM PACKING FOR ELECTRICAL COMPONENT

1 GENERAL

This standard lays down the packing instructions for packing of components / Electrical components Stator/ Rim punching, Wound Pole/ Field Coils and Stator coils / bars to be dispatched against Customer contracts.

2 SCOPE

This procedure covers method of packing component in a wooden packing boxes.

3 OBJECTIVE

To establish a rust proof safe packing procedure and where the components required to protect against temperature and humidity. In general minimum temperature +5 deg C and maximum temperature 45 deg C, and relative humidity between 10% to 40%.

4 PACKING BOX

Wooden Box shall be made as per BHEL Standard AA0490010 for Domestic/AA0490009 for Export/AA0490004 for Seaworthy packing. Size of the box as per the contract requirement, which has to be checked by QC.

5 PACKING PROCEDURE

- All items packed are to be marked by QC with "OK" stickers. Varnished stator punchings are to be brought down to room temperature before labelling them "OK" for packing. Do not pack hot/warm stator punchings that have is just received from the varnishing.
- Packing of stator punchings, wound pole/ field coils and stator coils / bars should be done in a covered shed.
- Packed materials are to be stacked in proper alignment and to be kept in wooden packing.

6 Additional Packing Methodology for Stator / Rim Punchings (Double stacking) only

In order to eliminate the use of studs avoid double stack packaging per box. Where double stacked packing boxes are unavoidable, the stator /rim punchings are to be securely tightened using GI studs, nuts and soft material washers (rubber/plastic). GI studs, nuts and soft material only to be used in case of double stacking of rim / stator punchings (with holes). Use soft rubber washers to seal the punctured opening at the bottom from where the studs pass in each layer of VCI (Volatile Corrosion Inhibitor) paper, polythene and tarpaulin sheet in case of rim /stator punchings (with holes).

- GI studs with rubber washer to be placed initially inside the wooden packing box.
- Over the wooden base, place water proof tarpaulin sheet.
- Rubber washer shall be placed after the layer of tarpaulin sheet.
- Then place a layer of porous plastic sheet with total thickness of at least 5mm (for cushioning and reduces the chances of damage to punchings).
- Place the Aluminium Barrier laminated Bags over this porous sheet, place the rubber washer over it.
- Place VCI papers on the Aluminium barrier bag and fix with rubber washer.

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- g) PVC Pipes shall be inserted over the GI studs. These pipes are to be used to cover each stud, to protect its direct contact and hence rubbing with punchings.
- h) Now place the stack of punchings over the VCI paper and securely tighten the punchings using nuts and soft material, washers.
- i) Each layer should be secured in position. Wrap the punchings with VCI paper and properly sealed separately using an adhesive tape.
- j) Silica Gel packets are to be placed over the VCI paper and uniformly distributed inside the boxes on the VCI paper to remove/prevent moisture.
- k) Aluminium barrier laminated bag has secured in position and properly sealed by using heat sealing machine and air to be drained out by using vacuum pump. At the time of the evacuation the vacuum inside the pack should be less than 0.5ata.

Use two separate VCI papers for doubled stacked boxes independently covering each stack. Similarly two Aluminium barrier laminated bag are to be used to wrap the two stacks independently, as explained above.

7 Additional Packing Methodology for Wound Pole/ Field Coils and Stator Coils/Bars only

- a) Over the wooden base, place the waterproof tarpaulin sheet.
- b) Then place a layer of porous plastic sheet with total thickness of at least 5mm (for cushioning and reduces the chances of damage to Wound pole/field coils and stator coils/ bars.
- c) Place the Aluminium barrier laminated bag over this porous sheet.
- d) Place the VCI paper (Volatile Corrosion Inhibitor as per BHEL Standard AA51406) on the Aluminium barrier laminated bag along with rubber washer.
- e) Bare copper portion of field coils and stator coils / bars to be covered by VCI paper pouch and fasten with VCI tape.
- f) Now place the wound pole, stack of field coil and stator coil / bars over the VCI paper.
- g) Each layer should be secured in position. Wrap wound pole / field coils and stator coils / bars with VCI paper and properly sealed separately using an adhesive tape.
- h) Silica Gel packets are to be placed and uniformly distributed inside the boxes on the VCI paper to remove/prevent moisture.
- i) Then Aluminium barrier laminated bag has secured in position and properly sealed by using heat sealing machine and air to be drained out by using vacuum pump. At the time of evacuation the vacuum inside the pack should be less than 0.5ata.
- j) The VCI paper must contact the stator / rim punchings, wound pole / field coils and stator coils/bars. It has to ensure that the VCI paper, Aluminium barrier bag should not get damage / puncture during the packing process.
- k) Top cover of the wooden box shall be sealed only after final clearance from QC for confirmation of above.
- l) All boxes should be covered by water proof tarpaulin over top and on all sides.
- m) The packing boxes shall be covered with GI sheets (0.25 -0.4mm thick) on all the sides for Export / Seaworthy packing.
- n) Vacuum packing room temperature and Relative Humidity should be maintained as mentioned below:
Min. +5 deg. C and Max. 45 deg. C, Relative humidity between 10% to 40%.



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8 COMPONENT REQUIRED

8.1 VCI laminated Aluminium foil

Volatile Corrosion Inhibitor (VCI) safe foil shall be with aluminium barrier laminated which is flexible, heat sealable, water vapour and anticorrosion resistant barrier laminate of polyester, Aluminium foil & VCI Polyethylene. It is used as a primary packaging material for packing metal components and sealed with the help of a heat sealer after vacuuming with vacuum machine maintaining the humidity level below 40 RH inside the package.

8.2 Composition construction of VCI laminated Aluminium foil

- a) PET Film : 12 Microns
- b) Bonding layer : 2 Microns
- c) Aluminium Foil : 9 Microns
- d) Bonding layer : 2 Microns
- e) VCI Poly film : 100 Microns
- f) Total thickness : 125 Microns + or – 5%

8.3 Properties of Aluminium Barrier laminated Bag

- a) Basic Weight : Unit: g/sq. m 150 +/- 5
- b) Tensile strength : Unit: N/sq. mm MD: 40 (min.)
Unit: N/sq. mm TD: 41 (min.)
- c) Water Vapour Transmission : Unit: g/m² 0.01 in 24 hrs. at 38 deg C & 90% RH(max)
- d) Oxygen Transmission : Unit: cm³/m² 0.02 in 24 hrs. at 38 deg C & 90% RH (max)
- e) Sealing Temp. : Unit : Degree C 180-220 deg C

9 MARKING ON PACKING BOX

Mark the following information on the two adjacent sides of the each package.

- a) Box No.
- b) Customer PO
- c) Product Name.
- d) Project Name
- e) Quantity
- f) Storage Requirement : Indoor
- g) Net weight (in kg)
- h) Dimension (L x W x H in centimetres)
- i) Consignee
- j) Water proofing (Umbrella Stencilling)
- k) Upside direction
- l) Sling position indicator

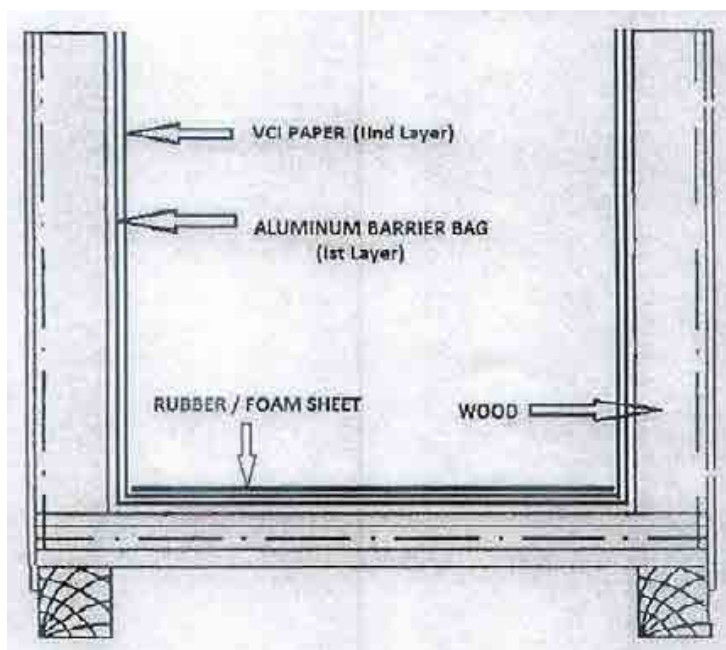


Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



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AA0490009

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EXPORT PACKING

(PACKING INSTRUCTIONS FOR GENERAL COMPONENTS / ASSEMBLIES / EQUIPMENT)

1 GENERAL

This standard lays down packing instructions for export packing of components/assemblies/equipment to be dispatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments.

The components/assemblies need to be packed suitably to avoid physical damage & corrosion during transit for storage. For specific applications, the concerned engineering department shall issue a product standard. Reference of this standard, must appear in the Shipping list/Packing List.

2 SCOPE

This procedure gives minimum guidelines for export packing to be complied with for packing of components/assemblies/equipment. This packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage for periods more than one year.

3 WOOD SPECIFICATION FOR PACKING:

- The wood shall conform to specification AA51401.
- Ply Wood planks as per specification IS:303 Gr. "MR" Type A,B are used for the sides, top & bottom of the packing cases.
- Ply Wood of marine grade as per IS:710 for packing of control equipment and for support batten pinewood to be used as per specification AA51401.

4 TYPE OF PACKING:

The following types of packings have been standardized for packing of general components/assemblies.

4.1 Open Type:

Packing subjected to BHEL approval.

4.2 Closed packing cases:

- Export packing of the specific items requiring additional protection shall be covered with G.I. sheet covering as per customer/contractual/engineering requirements. G.I. shall conform to specification AA10166.
- Any other special or export seaworthy packing (improvement or equivalent to the above) shall be subjected to BHEL Engg & QC approval).

4.3 Special Packing

Components requiring special packing (as per customer/contractual/ engineering requirements) not included in this specification shall be covered by product standards.

5 TREATMENT OF WOOD AS PER ISPM-15

As per customer requirement for export packing, wood to be treated as per International Standards for Phytosanitary Measures ISPM:15.

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**6 PREPARATION OF PACKING CASE:**

- 1) Export items are to be packed in sea worthy wooden/Ply board cases.
- 2) The base of the case shall be made of wooden battens for planks giving necessary reinforcement, such that the bottom of the equipment is at a height of 100 to 200mm from the ground level depending upon size & weight of equipment. However for packing cases of smaller size equipment can be at a height of 40mm from the ground level.
- 3) The four sides & top cover shall be lined, from inside with multi-layered cross-laminated polyethylene sheet of 90GSM as per AA51420 and tacked at suitable places.
Whenever specified the top cover will have a layer of multi-layered cross laminated polyethylene sheet of 90 GSM over the cover. This should project about 100 - 250mm on all sides.
It is preferable to have a single piece of the above Multi-layered cross laminated polyethylene sheet fixed on the four sides. In case jointing is unavoidable, it should be done by overlapping of approximately 100mm.
- 4) Put the job on the base and wherever necessary may be screwed / fastened.
- 5) In case of delicate component Packing Viz. Electrical & Electronic components for instruments/ assemblies, a rubber sheet, Self-expanded polyethene foam sheet as per AA51423, preferably 10mm thick, shall be fixed on to the base to act as cushioning to the equipment.
- 6) Place the Components/cartons with corrosion inhibitors duly applied wherever necessary for place suitably, thin muslin cloths bags containing 100grams (approx.) of activated Blue Silica Gel to AA55619, wherever necessary. Alternatively VCI Powder or Tablet may be used.
- 7) In case, depression is formed, at the top, after the equipment is lowered, provide ply board/wooden batons.
- 8) Whole Equipment shall be covered and sealed with Multi-layered cross-laminated Polyethylene sheet to AA51420.
- 9) For indoor panels/equipment, provide suitable packing batons with covering of Thermocole/ expanded soft polyethylene foam/polyethylene air bubble film wrapped with suitable cords, to avoid cutting of the polyethylene sheet so that finished surface is not damaged.
- 10) Empty space in the box shall be filled with adequate cushioning material e.g. Thermocole Chips, Wood Wool etc. to avoid movement for shocks. Alternatively put wooden blocks/batons wherever necessary.
- 11) The inner side of the top cover shall be lined with M.L.C. laminated polyethylene sheet of at least 90GSM, which shall project approximately 25 to 150mm depending upon the size of the case on all sides of the top cover shall be provided below the top cover. This projection, after nailing the top cover, shall be folded over, on the sides of the crates & tacked, to, prevent ingress of water from the top.
- 12) For specific applications requiring additional protection the packing cases are covered with GI sheet on outside for sides and top; inside for bottom as per specification AA10166, thickness of G.I. sheet shall be 0.25mm.
- 13) For specific applications requiring inspection, additional inspection window has to be provided for custom clearance for export jobs.

7 SEALED PACKING:

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture.

The components sub-assemblies and assemblies are completely covered with 2 layers of M.L.C. laminated poly film. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

Certain special precautions are required for seal tight packing of specific item have to be covered by product standard.



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8 OTHER PACKING MATERIAL

8.1 Volatile Corrosion Inhibitor (VCI) Paper as per AA51406:

- Un-protected surfaces of steel and cast iron components, tools bearing, shaft seals etc. are covered with VCI paper. VCI paper has been impregnated with corrosion inhibitors which by evaporation and chemical conversion protect metals in an enclosed area against corrosion.
- 7m³ VCI paper is necessary for 1 m³ of packed item approximately as per AA51406.

Application Limitation:

VCI paper shall not be used for components made of aluminium, aluminium alloys as well as Zinc, copper, brass, cadmium and silver. VCI powder is sprinkled inside the piping components ends shall be protected with end cover as specified in plant standards, drawings.

8.2 Moisture Absorber:

Silica gel is used for this purpose to protect the contents over sufficiently long time from corrosion. At the time of use, silica gel should be so dried that its colour becomes dark blue. These shall be filled in small cotton bags. Before sealing the equipment, the silica gel bags should be kept inside the polyethylene film cover at different locations. The quantity of silica gel depends on the dimension of the polyethylene sheet as well as transit and storage time.

8.3 Sling Plate:

Sling plate shall be provided to prevent damage to the packing box during lifting. Size of the sling plate shall be selected depending upon the net weight of the consignment.

8.4 Packing Slip Holders:

Two nos. of packing list with suitable protecting cover shall be fixed one inside and the other outside of the packing box as per specification AA7240901.

8.5 Nails

The length and diameter of the nails depends upon the size of planks

8.6 Strapping Strips:

These are used for strapping the boxes. Suitable size of box strapping strip can be used as per size and weight of consignment. The material shall be free from rust.

8.7 Brackets:

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of "L" shape, suitable holes shall be provided towards the end of each side for screwing /nailing.

8.8 Fasteners:

Bolts, double nuts, spring washers of suitable size will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box.

8.9 Polyethylene Sheet:

The polyethylene sheets are used to make covers to the jobs individually. multi-layered cross laminated polyethylene sheet as per AA 51420 can be used for packing of jobs.

8.10 Expanded Poly Foam Sheet and Air Bubble Film:

This item is used for covering the delicate items, Expanded Polyethylene Foam Sheet as per specification AA51423 and air bubble film as per specification AA51426

8.11 Thermocol (Expanded Polystyrene) Sheets:

This is used for covering delicate items. This material shall be as per spec. no AA51416

8.12 Cotton Bags:

These are used for holding silica gel.

**8.13 Marking Ink:**

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water

8.14 Polyethylene Bags:

These are to be used for keeping the, Packing slips. The bag shall be of size 70 mm X 100 mm (minimum).

8.15 Mechanical Latching Clamps:

For specific items self locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement, if needed.

9 DESIGN OF PACKING BOXES

Design/drawing of packing boxes shall be prepared based on actual weight and size of the equipment and shall be covered by concern product standards.

10 GENERAL PRECAUTIONS:

- 1) While fixing nails during packing, necessary care shall be taken to ensure that materials used for protection inside the case e.g. paper, polyethylene sheet, coir etc. do not get damaged.
- 2) Sling protection brackets to be provided on cases wherever required.
- 3) It shall be ensured that all stencil marks external, front & rear sides of the casing shall be of water proof Material to prevent obliteration in transit.
- 4) For packing of small/delicate items - Item may be wrapped properly with M.L.C. laminated polyethylene and wrapped item may be further wrapped with air bubble film as per spec. AA51426, these curtains will be subsequently packed in wooden/ply boxes as at clause 8.0.
- 5) The various caution signs shall be marked with stencil on both sides of the packing box.
- 6) Instructions on handling, storage, preservation, represervation and transport of export order components at works and site shall be covered by product standards.

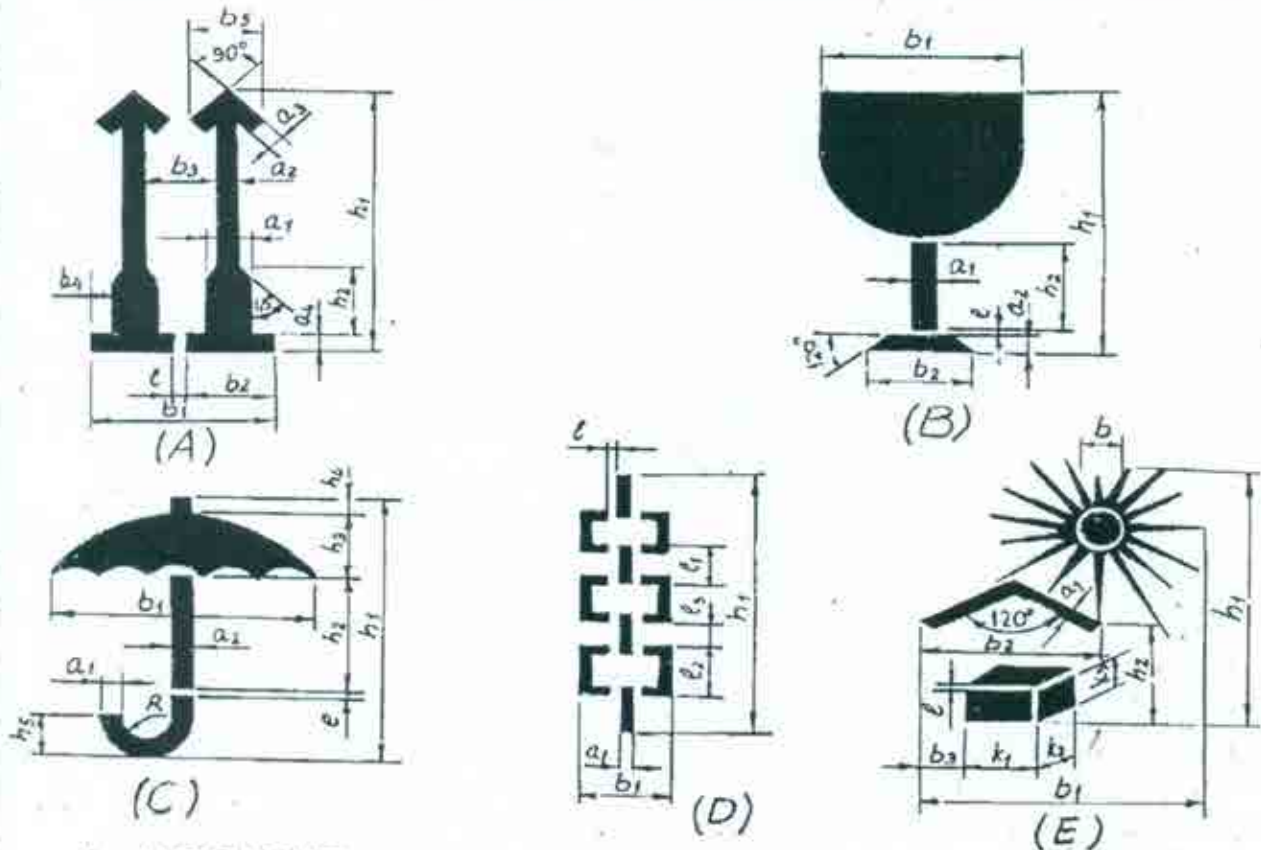
11 MARKING

The following details are to be marked on the packing cases.

- a) Address of consignee.
- b) Purchase Order No.
- c) Description of item or title of packing list.
- d) Case identification Number.
- e) Net Weight.
- f) Gross Weight.
- g) Dimensions of box
- h) Marking showing upright position.
- i) Marking showing sling position.
- j) Marking showing umbrella (i.e. for machines/components to be stored under covered storage).

MARKINGS ON PACKING CASES

1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



- A. UPRIGHT
B. FRAGILE
C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
D. SLINGING POSITION
E. PROTECTION FROM DIRECT RADIATIONS.

CENTER OF GRAVITY

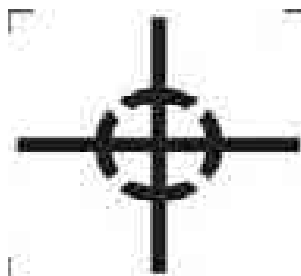


Figure 1 – Markings



DESIGN- ATION		DIMENSIONS IN mm.																							
		α_1	α_2	α_3	α_4	b_1	b_2	b_3	b_4	b_5	b	l	h_1	h_2	h_3	h_4	h_5	K_1	K_2	K_3	l_1	l_2	l_3	R	
A	1	12	5	5	4	52	25	19	8	21	-	2	84	23	-	-	-	-	-	-	-	-	-	-	
	2	17	7	7	6	75	36	29	11	30	-	3	119	33	-	-	-	-	-	-	-	-	-	-	
	3	24	10	10	8	104	50	38	16	42	-	4	168	46	-	-	-	-	-	-	-	-	-	-	
	4	34	14	14	11	147	71	59	23	60	-	5	239	65	-	-	-	-	-	-	-	-	-	-	
B	1	5	5	-	-	50	33	-	-	-	-	2	84	25	-	-	-	-	-	-	-	-	-	-	
	2	7	7	-	-	71	47	-	-	-	-	3	119	36	-	-	-	-	-	-	-	-	-	-	
	3	10	10	-	-	100	66	-	-	-	-	4	168	50	-	-	-	-	-	-	-	-	-	-	
	4	14	14	-	-	142	94	-	-	-	-	5	239	71	-	-	-	-	-	-	-	-	-	-	
C	1	4	3	-	-	66	-	-	-	-	-	2	80	39	19	5	11	-	-	-	-	-	-	6	
	2	6	4	-	-	85	-	-	-	-	-	3	114	55	27	7	16	-	-	-	-	-	-	9	
	3	8	6	-	-	120	-	-	-	-	-	4	160	78	38	10	22	-	-	-	-	-	-	12	
	4	11	9	-	-	170	-	-	-	-	-	5	227	110	54	14	31	-	-	-	-	-	-	17	
D	1	6	-	-	-	30	-	-	-	-	-	4	148	-	-	-	-	-	-	-	30	30	10	-	
	2	9	-	-	-	42	-	-	-	-	-	5	209	-	-	-	-	-	-	-	42	42	14	-	
E	1	3	-	-	-	69	47	10	-	-	16	2	91	26	-	-	-	17	8	11	-	-	-	-	
	2	4	-	-	-	98	67	15	-	-	23	3	128	33	-	-	-	24	11	16	-	-	-	-	
	3	6	-	-	-	138	94	20	-	-	32	4	182	62	-	-	-	34	16	22	-	-	-	-	

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

Incase of consignment consists of more than one package; each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in higher quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel (AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks. Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, and then hand written letters/figures shall be allowed.

12 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- 1) Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 2) Appropriate material handling equipment like fork lifters, cranes etc. Shall be used where needed.
- 3) Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. Shall be done carefully.



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- 4) For critical items, where specified, special handling fixtures shall be used for lifting.
- 5) Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- 6) Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- 7) Precision machined components like blades, catches, rollers etc. Shall be lifted using suitable wooden pallets.

8) HANDLING OF COMPONENTS ON RECEIPT/DESPATCH:

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- The markings showing the upright position.
 - The markings showing the sling position
 - Markings showing the fragile contents.
 - Other required markings as per Cl.No:11
- a) Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.
 - b) Handling and lifting should be done without jerks or impacts.
 - c) Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.
 - d) On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.
 - e) Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.
 - f) Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

13 PROVISION FOR INSPECTION:

This clause is applicable only where contractual requirement of customer is there. For other packings this is not applicable.

Each transportable packing's shall have provision for inspection by customer authority etc. during transport from origin of dispatched until destination. This inspection may require opening of the package and subsequently closing it again. For this purpose, suitable designed opening with bolted cover shall be provided. Such an opening shall be clearly marked as "OPENING" with clear instruction for opening & closing written on this cover. For large consignment, the size of the opening shall be suitable to facilitate entry of personnel.

14 REFERRED STANDARDS (Latest publications including amendments):

- | | | | |
|------------|-------------|-------------|-------------|
| 1) AA51401 | 2) IS:303 | 3) IS:710 | 4) AA10166 |
| 5) ISPM:15 | 6) AA51420 | 7) AA51423 | 8) 55619 |
| 9) AA51406 | 10) AA51416 | 11) AA51426 | 12) AA56126 |



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DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/Assemblies/Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this product standard, must appear in the Shipping list/Packing List.

2 TYPES OF PACKING:

The following 5 types of packings have been standardized for packing of General Components/Assemblies.

- 1) 'OP' - Open Type.
- 2) 'PP' - Partially Packed.
- 3) 'CP' - Crate/Box Packing - Components/Equipment requiring physical protection.
- 4) 'CQ' - Case Packing - Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
- 5) 'CR' - Case Packing - Electrical Components/Assemblies, which require special packing viz. Water Proof, Shock Proof etc...

3 DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

3.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

3.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film to Specification No.AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

3.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

3.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of

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PROCEDURAL GUIDELINES COMMITTEE –
PGC (Packing)

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silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required.

3.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel to AA55619 packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420 before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel to AA 55619.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board, meeting requirements of AA51414.

4 PREPARATION OF PACKING CASES

4.1 DOMESTIC:

Based on the availability, the wood shall be Rubber wood (Havea Brasiliensis)/Pine wood for packing of cubicles, loose items, spares and photovoltaic items meant for customers in India.

4.2 DIMENSIONS:

- Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25 +2/-3 mm.
- Width of all planks including the tongue shall be more than 125mm and after planing it shall be minimum 100mm.
- Minimum number of planks shall be used for a shook.
- Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel).
- External sides of front and rear planks to be planed to facilitate writing of address and other markings.
- Width of binding planks shall be minimum 100mm.
- Distance between any 2 binding planks shall be less than 750mm.
- diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm
- Distance of the outer edges of these planks from the edge of case shall be less than 250mm.
- Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

4.3 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

4.4 TONGUE AND GROOVE JOINTS

Two Consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

4.5 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.



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End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shooks. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

4.6 CHEMICAL TREATMENTS FOR PRESERVATION OF WOOD

- 1) This treatment provides protection to the packing wood against deterioration due to fungi and attack by termites, borers and marine organism and any kind of infections.
- 2) The wooden planks, after making tongues / grooves shall be treated with chemicals. For pine wood, treatment with ASCU/ CCA solution need not be done.
- 3) The chemical used shall be ready mix ASCU paste. This consists of Arsenic pent oxide, copper sulphate sodium dichromate. This Paste shall be mixed at the rate of 1 kg of paste per 10 liters of water to the extent of water used. Alternate this CCA paste as mentioned at Para 4.6.5) can also be used.
- 4) The chemical treatment shall be done at the premises of the contractor. A cement concrete tank of capacity to hold a minimum of 2000liters of solution shall be constructed. The solution shall be prepared in the presence of BHEL Representative by contractor. The wooden planks shall be soaked in the solution for a minimum of 12 hours. The solution shall be replenished after treating a maximum of 12 cubic meters of wood. A log book shall be maintained by the contractor to give the details of date of preparation of solution, quantity of solution prepared, quantity of chemicals used, Quantity of wood treated and the details of replenishment. Samples of solutions before mixing will be tested at the laboratories designated by BHEL. The testing fees to be paid to the laboratories will have to be borne by the contractor. The paste shall be tested as and when required.
- 5) Specifications for water soluble type wood preservatives: Copper – Chromium – Arsenic [CCA]: Copper – Chromium – Arsenic preservative formulation shall be as per IS:10013 Part – II – 1981 shall consist of following active ingredients in nominal proportions by weight as shown below:

– Arsenic Pent oxide	AS ₂ O ₅ 2H ₂ O	12.5
– Copper Sulphate	CuSO ₄ 5H ₂ O	37.5
– Sodium Dichromate	Na ₂ Cr ₂ O ₇ 5H ₂ O	50.0
– Or Potassium Dichromate	K ₂ Cr ₂ O ₇	

4.7 OTHER MATERIALS

4.7.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

4.7.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

4.7.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6 +0.01mm. The material shall be free from rust.

4.7.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

4.7.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

**4.7.6 FASTENERS**

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

4.7.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

70GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

4.7.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

4.7.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

4.7.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Details and specifications are given in Fig-4

4.7.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

4.7.12 SILICA GEL:

This shall be of indicating type to conform to IS: 3401/AA55619.

4.7.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME	PLACE-PINCODE
SILICA GEL	INDICATING TYPE
BLUE :	ACTIVE
ROSE :	REDUCED ACTIVITY
WHITE :	NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

4.7.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

4.7.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

4.7.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).



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4.7.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

4.7.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

4.7.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

1. Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
- 6) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
- 7) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
- 8) Direction sticker " Front " & " Back " - 4 nos. Size 2.0Cm x 0.75Cm
- 9) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
- 10) "Fragile " sticker: 2 Nos Size. 2.1Cm x 1.5Cm
- 11) "DO NOT STACK " sticker - 2 Nos. Size 3.0Cm x 2.2Cm

5 PACKING OF CUBICLES WITH RUBBER WOOD:

5.1 The packing is to be done as per clause 4 in all respects.

5.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

5.3 The cubicles will be of different sizes both widthwise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm. The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

5.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shoo's shall be nailed with Multi-layer cross laminated poly film (as per 4.7.7) using blue nails (as per 4.7.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 4.7.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 4.7.7).

5.5 SILICA GEL:

Silica gel (as per 4.3.15) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 4.7.13).

5.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

5.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

5.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 4.7.8) with distance between consecutive layers less than 500mm.

**5.9 CLAMPING:**

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 4.7.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

5.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 4.7.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 4.7.11) shall be nailed to front / rear of case.

5.11 MARKING PLATE:

One no. (As per 4.7.10) shall be nailed to the front side of the case.

5.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

5.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x 2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x 2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

5.14 PACKING OF CUBICLES WITH PINE WOOD

Packing of cubicles for export shall be done exactly in same manner as described at Cl.No 5 except for the following changes: -

Wood shall be Silver oak/ Pine wood instead of rubber wood.

- Double polyethylene petticoat instead of one.
- Fumigation may have to be done if required (BHEL Scope).

6 PACKING OF LOOSE ITEMS/SPARES USING RUBBER WOOD:

- 1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
- 2) Wood shall be rubber wood with Tongue and Groove joint as per clause 4.4.
- 3) Chemical treatment as per Clause 4.6 to be done.
- 4) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
- 5) External surface of planks on front and rear shall be plane 100% (except bottom plank).
- 6) Inner surfaces of all 6 sides shall be lined with bitumen coated hessian polyethylene Kraft paper (as per clause 4.7.7) using blue nails.
- 7) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
- 8) Internal packing: Items that go into the box shall be packed using 70GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left Between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect .
- 9) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.



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- 10) Silica gel as per clause 4.7.12 held in cotton bags as per clause 4.7.13 shall be kept at proper places in the box.
- 11) Packing slip kept in polyethylene bag (clause 4.7.16) shall be placed in the box.
- 12) Marking plate as per clause 4.7.10 shall be nailed to side of the box.
- 13) Two numbers of hoop iron strips as per clause 4.7.3 shall be strapped tightly on the case using clips.
- 14) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
- 15) Loose items to be kept inside the cubicle
- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.
 - Other items which are given loose in addition to cubicle shall be packed in separate boxes.

7 BOX SIZES

7.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

SNO	BOX TYPE	BOX SIZE (in mm)	BOX Wt (in KG)	Carrying Capacity
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	



7.2 BOX SIZES

Table 2 – VALVES WOODEN BOX DETAILS

BOX TYPE	BOX SIZE (in MM)	BOX Wt (in KG)	Carrying Capacity
1A	320X250X260	10	
1	320X250X430	15	
2	430X370X430	25	
3	670X670X470	65	
4	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
10	1300X770X1050	155	
11	2500X850X800	225	
12	2000X1500X1200	305	
14	1850X1050X1250	260	
15	2000X800X800	180	
17	2600X1500X1600	470	
21	250X250X600	20	
22	250X250X880	30	
23	300X300X700	25	
24	380X380X880	45	
25		25	
26	510X510X1400	60	
27	570X570X1400	80	
28	575X575X1875	105	
29	3600X1100X1100	390	
30	900X500X800	110	
52	2000X950X740	225	
53	1600X1120X700	220	
54	2500X2000X1200	490	
55	2900X1900X1400	525	
56	3000X1000X900	370	
57	3200X2200X950	450	
58	2150X1100X750	325	
61	2000X2000X700	130	
62	700X1200X1325	130	

TYPICAL PATTERN OF WOODEN BOX

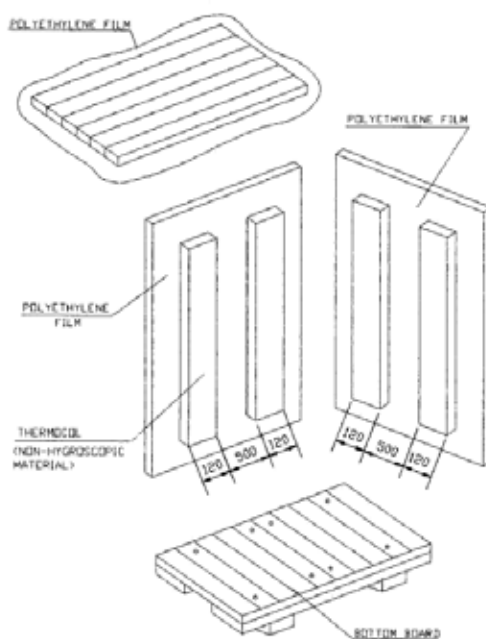


Figure 1

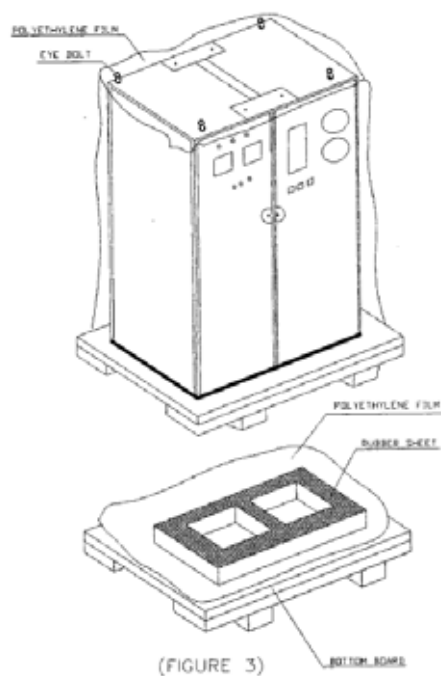


Figure 2



7.3 STANDARD BOX SIZES

WOODEN BOXES:

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
01	I	2370	1570	1650	675	4000
02	IIA	1570	720	885	200	2500
03	II	1200	900	600	150	2000
04	III	900	600	600	100	1000
05	IV	600	450	450	40	750
06	V	600	300	300	35	500

STEEL BOXES:

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
07	I	2480	1680	1500	339	4500
08	II	1200	900	600	061	2000
09	IIB	1800	850	950	115	2500
10	III	900	600	600	029	1000
11	IV	600	450	500	019	750
12	V	400	350	300	011	500

Table 3

7.4 STEEL CONTAINERS

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections.

- Following precautions are to be taken during packing: -
- Put the machine in the steel container properly,
- Cover the machine with polythene.
- To arrest the movement in the steel container necessary wooden Blocks/Battens may be put.
- Put cover on steel, container and Bolt Properly

8 MARKINGS/STENCILINGS

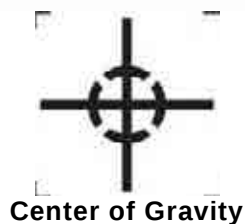
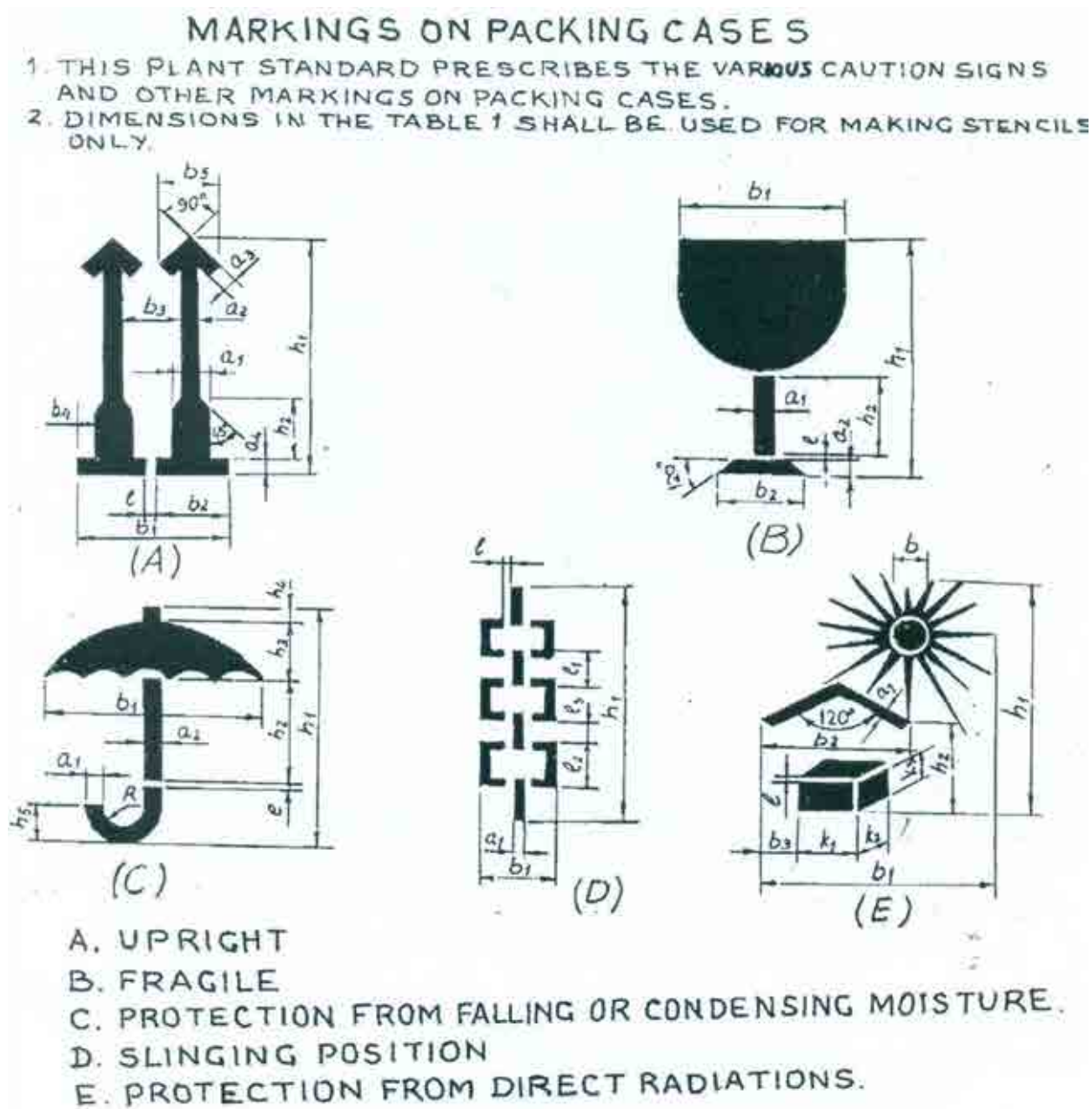


Figure 3

DESIGN- ATION		DIMENSION IN MM																							
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R	
A	1	12	5	5	4	52	25	19	8	21		2	84	23											
	2	17	7	7	6	75	36	29	11	30		3	119	33											
	3	24	10	10	8	104	50	38	16	42		4	168	46											
	4	34	14	14	11	147	71	59	23	60		5	239	65											
B	1	5	5			50	33					2	84	25											
	2	7	7			71	47					3	119	36											
	3	10	10			100	66					4	168	50											
	4	14	14			142	94					5	239	71											
C	1	4	3			66						2	80	39	19	5	11							6	
	2	6	4			85						3	114	55	27	7	16							9	
	3	8	6			120						4	160	78	38	10	22							12	
	4	11	9			170						5	227	110	54	14	31							17	
D	1	6				30						4	148								30	30	10		
	2	9				42						5	209								42	42	14		
E	1	3				69	47	10			16	2	91	26				17	8	11					
	2	4				98	67	15			23	3	128	33				24	11	16					
	3	6				138	94	20			32	4	182	62				34	16	22					

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel(AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

225		170	
BHEL-EDN-BANGALORE-26			
CONSIGNEE			
MATERIAL			
CUSTOMER REF.			MO. NO.
DESPATCH ADVICE NOTE NO.			CASE NO.
DIMENSIONS(MM) LXBXH		NET WT -KGS	GROSS WT -KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE – KEEP DRY DO NOT DROP – DO NOT TILT		

Figure 4 – TYPICAL MARKING PLATE



Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

9 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

- To utilize useable wood of incoming packing cases, for manufacturing of new packing boxes.
- To recycle incoming wooden packing cases, as such, wherever possible.



- 1) All incoming wooden packing cases received from suppliers /customers will be opened carefully, with the intention of reusing them, by Shop.
- 2) After carefully taking out the contents, the empty wooden packing cases will be shifted by Shop to the specified locations i.e. bin / nearly spaces, already earmarked in stores.
- 3) Material shifting contractor engaged by store, will collect all such wooden packing cases and scrap wood from specified points, on a regular basis.
- 4) After collecting / loading the empty packing cases/ scrap wood, contractor will take the carrier first to weighment bridge for weighment, thereafter, he will go to Carpentry, where Carpentry representative will identify the packing cases which can be used by Carpentry for manufacturing of New Packing Boxes. All such identified packing boxes will be unloaded and handed over to Carpentry by contractor.
- 5) These packing boxes will be made re-useable after necessary rectification and additional work.
- 6) Contractor will again take the carrier for weighment and this second reading will also be recorded on the same "Weighment Slip".
- 7) Weight of empty packing cases / scrap wood taken will be calculated on the basis of 1st and 2nd weighment readings recorded on the "Weighment Slip". A copy of "Weighment Slip" (where both the weighment readings are recorded) will be given by the contractor to the carpentry representative. Based on this "Weighment Slip", carpentry will maintain a register in which details of quantity received will be recorded.
- 8) All "Weighment Slips" will invariably be signed by carpentry representative (even when no boxes have been unloaded by carpentry). Store will accept the scrap wood only if "Weighment Slips" are signed by carpentry representative.
- 9) Balance empty packing cases / scrap wood will be handed over by contractor to Store, for storing in scrap yard.
- 10) A separate area in Scrap yard will be provided, for executing the work of de-nailing of wooden packing cases, under supervision of carpentry.
- 11) Carpentry contractor will identify packing cases / scrap wood for denailing, which will be handed over to him by Store, at Scrap yard, for denailing and further operation.
- 12) Quality and Carpentry will jointly inspect the wood generated by de-nailing process and will prepare "INSPECTION CUM RECEIPT REPORT OF USEABLE WOOD RECEIVED FROM TPS –STORE BY CARPENTRY".
- 13) After acceptance of the wood by Quality and Carpentry, the same will be shifted to carpentry for receipt and its record will be maintained by carpentry.
- 14) This will be a Permanent Productivity Project executed by carpentry. "Productivity Savings" duly verified at the current Purchase Order rate of wood, will be sent every month to Resource Management Department, for highlighting it in their monthly progress report.

10 STANDARD METHOD OF PACKING

Table 5 –

STANDARD METHOD OF PACKING								
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
PRESSURE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			
GASKETS	O							
FASTENERS	O							

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STANDARD METHOD OF PACKING								
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
COVERS		O						
EXCHANGERS								
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
AIR BOTTLES	O							
TITANIUM BOTTLE	O							
WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
BOILERS								

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BOILER DRUMS					O						
BOILER ITEMS											
COILS			O								
PANELS					O						
HEADERS			O		O						
FEEDERS											
MACHINED ITEMS											
SHELL SEGMENTS					O						
SHELL SEGMENTS IN STACKS					O						
SPHERE PETALS											
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					O						
ROLLERS	O										
VALVE TRAYS											
VALVE TRAY COMPONENTS	O										
LATTICE GIRDERS		O									
FASTENERS	O										
GASKETS	O										
DESCRIPTION				CA SE	CRA TE	SK ID	BUN DLE	BA RE	DR UM	METAL DRUM	FIBRE DRUM
SUB CONTRACTS											
FAB STRUCTURALS								O			
SUPPORTING STRUCTURALS								O			
STRUCTURE SUB ASSEMBLY								O			
FAB PIPES								O			
GRATINGS								O			
STAIR CASES								O			
HANDRAILS/ PLATFORMS								O			
BOUGHT OUT COMPONENTS											
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)								O			
PIPE FITTINGS											
CS PIPES, TUBES								O			
SS PIPES, TUBES								O			
FIN TUBES				O							
ELBOWS					O			O			
FLANGES				O	O						
VALVES				O							
GAUGES				O							
DEMISTERS					O						
DESCRIPTION				CA SE	CRA TE	SKI D	BUND LE	BA RE	DR UM	METAL DRUM	FIBRE DRUM



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ABSORBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)								
PAINT TINS		O						
PAINT DRUMS						O		
IGNITORS	O							
SPRAY NOZZLES	O							
ELECTRICAL INSTRUMENTATION								
MOTORS, PUMPS, COMPRESSORS, TURBINES	O							
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		O						
INDICATORS, VIBRATOR SWITCHES	O							
CABLE BUNDLES, CABLE DRUMS					O			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		O						
OPERATIONAL SPARES	O							

11 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- 11.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 11.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.
- 11.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.
- 11.4 For critical items, where specified, special handling fixtures shall be used for lifting.
- 11.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- 11.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- 11.7 Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

11.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- a) The markings showing the upright position.
- b) The markings showing the sling position
- c) Markings showing the fragile contents.
- d) Other required markings as per CI.no:08



- 11.8.1** Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.
- 11.8.2** Handling and lifting should be done without jerks or impacts.
- 11.8.3** Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.
- 11.8.4** On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.
- 11.8.5** Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.
- 11.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

12 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

12.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):

Well Bed Length:	10000mm
Over Gooseneck:	13000mm
Width:	3000mm
Carrying Capacity:	40MT

2. LOW BED TRAILERS (LB 16):

Well Bed Length:	12000mm
Over Gooseneck:	16000mm
Width:	3000mm
Carrying Capacity:	75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length (for Exceptional equipment length: 30000mm and above)

Bigger Dia equipment are loaded in the Well with overhanging.

Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.

The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

12.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

For Diameter up to 4000mm



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Wooden Saddles Length: 1836/2743mm (6'0"/9'0")
Width: 300mm (1'0")
Height: Saddle + one/two wedges a top.

For Diameter up to 4000mm

Wooden Saddles Length: 3353mm (11'0")
Width: 300mm (1'0")
Height: Saddle + three/four wedges a top.

NUMBER OF SADDLES:

Minimum: 3 in case of Loading inside Well
+ 1 when loaded on Gooseneck.
Maximum: 4 in case of Loading inside Well
+2 when loaded on Gooseneck.

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

12.3 NUMBER OF LASHINGS ARE:

	CONSIGNMENT LOADED INSIDE WELL BED	CONSIGNMENT LOADED OVER GOOSENECK
a) up to 40MT	4 (2 Single Line lashing 2 Double Line Lashing)	5 (3 Single Line Lashing 2 Double Line Lashing)
b) 40MT to 60MT	5 (3 Single Line Lashing 2 Double Line Lashing)	5 (Single Line Lashing 3 Double Line Lashing)
c) 60MT and above	5 (2 Single Line Lashing 3 Double Line Lashing)	6 (3 Single Line Lashing 3 Double Line Lashing)

13 GUIDELINES FOR HANDLING/LOADING/LASHING

13.1 HANDLING



Figure 6

Before unloading the jobs Completely painted and neatly stencilled will be checked.

Pipes with split type end cover will be checked

**Figure 7**

All Coil Tubes to be provided with End Caps.

**Figure 8**

Neatly stacked Coil Assemblies.

**Figure 9**

Columns to be lifted with Nylon belts. This protect painting, edges and attachments.

**Figure 10**

13.2 LOADING

All the components to be transported by putting inside the properly fabricated Crating

**Figure 11**

Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.

**Figure 12**

No component loaded over the crating.



Figure 13

Headers supported with wooden V blocks at 3 meters interval.



Figure 14

Spacers in between each coil assembly.

**Figure 15**

Goose pipe to be provided with rubber pad protects removal of painting and damage to the job.

**Figure 16**

13.3 LASHING

Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.

**Figure 17**

Nylon Belts used for lashing the beams.

**Figure 18**

14 PRODUCT WISE SPECIAL INSTRUCTION

Additional instructions of packing not included in this standard shall be covered by individual product standard

**15 REFERRED STANDARDS (Latest publications including amendments):**

- | | | | |
|------------|------------|------------|------------|
| 1) AA51420 | 2) AA55619 | 3) AA51414 | 4) IS:3401 |
| 5) AA10108 | 6) AA56126 | | |

ESP-001- 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION		Std. / Doc. Number	
				Annexure-9	
				Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	11.09.2018

ANNEXURE-09: DEVIATION FORMAT

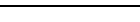
Sl. No.	Section / Part/Subsection	Page No.	Clause No.	Bid Specification Requirement	Bidder's Deviation

Notes:

1. Bidder to furnish duly filled format along with SEAL & SIGN along with their offer.
2. All the pre-bid queries (if any) shall be raised before submission of the offer as per pre-bid query format (Annexure- 10).
3. Deviations, which are impractical, and the same were raised during pre-bid stage as per pre-bid query format (Annexure-10), but still purchaser's reply/clarifications could not be met shall only be raised in this format.
4. If there are no deviations, bidders shall indicate as "No deviation" and submit the same along with their offer.
5. Deviations indicated elsewhere in bidders offer except raised through this format shall not be considered and reviewed during technical evaluation of their offer.

SIGNATURE : _____
NAME : _____
DESIGNATION : _____
COMPANY : _____
DATE : _____

COMPANY SEAL

ESP-001 - 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION		Std. / Doc. Number	
				Annexure-10	
				Rev. No.	00

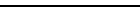
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--	--

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	11.09.2018

ANNEXURE-10: PRE-BID QUERIES FORMAT

Sl. No.	Section / Part/Subsection	Page No.	Clause No.	Bid Specification	Bidder's Query	Purchaser's Reply

Note: During Preparation of Pre-Bid Queries, Complete Tender Specification (along with all Annexures) shall also be referred.

ESP-001 - 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION		Std. / Doc. Number	
				Annexure-11	
				Rev. No.	00

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--	--

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	11.09.2018

MASTER DOCUMENT LIST - Foam Pump: Motor & Diesel Engine driven

	Vendor Name:			PROJECT:											Supplier Doc- No:									
	Vendor Contact Person:			BHEL PO No.		PO date:				PO Dly. Date:					Rev- No.									
	Vendor contact No.			Supplier's Job No.											Date:									
	SYSTEM/PACKAGE:	Hydrant Pump				TODAY-DATE	28/May/19			Submission status to BHEL														
Sl.No	DRG/DOC. NAME	DRG/ DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0			Rev-1			Rev-2			Rev-3			Rev-4		
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" /PV/PB /PC/AA	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT

A	MECHANICAL																								
1	Pump Data Sheet -Engine & Motor Driven	Later		A	Y	Y	Within 2 weeks after PO placement																		
2	Pump Performance curve-Motor Driven	Later		I	Y	Y	Within 2 weeks after PO placement																		
3	Pump Performance curve-Engine Driven	Later		I	Y	Y	Within 2 weeks after PO placement																		
4	Pump & Motor assembly GA drawing	Later		A	Y	Y	Within 2 weeks after PO placement																		
5	Pump & Engine assembly GA drawing	Later		A	Y	Y	Within 2 weeks after PO placement																		
6	Pump Cross Sectional Drawing-Motor Driven	Later		I	Y	N	Within 2 weeks after PO placement																		
7	Pump Cross Sectional Drawing-Engine Driven	Later		I	Y	N	Within 2 weeks after PO placement																		
8	Motor Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
9	Motor GA drawing	Later		A	Y	Y	Within 2 weeks after PO placement																		
10	Motor TB drawing	Later		I	Y	N	Within 2 weeks after PO placement																		
11	Motor Curves	Later		I	Y	Y	Within 2 weeks after PO placement																		
12	T-S Curve	Later		I	N	N	Within 2 weeks after PO placement																		
13	Diesel engine GA Drawing	Later		A	Y	N	Within 2 weeks after PO placement																		
14	Diesel engine Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
15	Controller GA Drawing & Wiring Diagram	Later		A	Y	Y	Within 2 weeks after PO placement																		
16	Diesel Engine Wiring Diagram	Later		I	Y	N	Within 2 weeks after PO placement																		
17	Battery Charger Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
18	Battery Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
19	Battery capacity calculation sheet	Later		I	Y	N	Within 2 weeks after PO placement																		
20	Fuel tank Drawing	Later		A	Y	N	Within 2 weeks after PO placement																		
21	Fuel tank calculation sheet	Later		I	Y	N	Within 2 weeks after PO placement																		
22	P&ID/Schematic of Diesel Engine	Later		I	N	N	Within 2 weeks after PO placement																		
23	Coupling GA Drawing for Motor Driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
24	Coupling GA Drawing for Engine Driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
25	Mechanical Seal GA Drawing and details: Motor driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
26	Mechanical Seal GA Drawing and details: Engine driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
B	INSTRUMENTAION																								
1	Data Sheet of Level transmitter	Later		I	N	N	Within 4 weeks after PO placement																		
2	Datasheet of Motor Bearing & Winding RTDs	Later		I	N	N	Within 4 weeks after PO placement																		
3	Datasheet of Motor Bearing TGs	Later		I	N	N	Within 4 weeks after PO placement																		
5	Data Sheet of Junction Box	Later		I	N	N	Within 4 weeks after PO placement																		
6	GAD of Junction Box	Later		I	N	N	Within 4 weeks after PO placement																		

MASTER DOCUMENT LIST - Foam Pump: Motor & Diesel Engine driven																									
	Vendor Name:				PROJECT:											Supplier Doc- No:									
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:						Rev- No.									
	Vendor contact No.				Supplier's Job No.											Date:									
	SYSTEM/PACKAGE:	Hydrant Pump				TODAY-DATE	28/May/19			Submission status to BHEL															
Sl.No	DRG/DOC. NAME	DRG/DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0			Rev-1			Rev-2			Rev-3			Rev-4			
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" * /PV/PB /PC/AA	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	
C	MISCELLANEOUS																								
1	Performance Test Procedure: Motor driven & Engine Driven	Later		A	Y	N	Within 8 weeks after PO placement																		
2	NPSH test procedure	Later		I	N	N	Within 8 weeks after PO placement																		
3	Vibration test procedure & Temperature rise test procedure	Later		I	N	N	Within 8 weeks after PO placement																		
5	Hydro Test Procedure	Later		I	N	N	Within 8 weeks after PO placement																		
6	NDE Test Procedure	Later		I	N	N	Within 8 weeks after PO placement																		
8	Painting proccedure	Later		A	N	N	Within 10 weeks after PO placement																		
9	Packing List	Later		I	N	N	Before Despatach																		
10	BILL OF MATERIAL	Later		A	N	N	Within 10 weeks after PO placement																		
11	BILLING BREAKUP	Later		A	N	N	Before Despatach																		
12	QUALITY ASSURANCE PLAN	Later		A	N	Y	Within 4 weeks after PO placement																		
13	SUB VENDOR LIST	Later		I	N	N	Within 4 weeks after PO placement																		
14	COMMISSIONING SPARES LIST	Later		A	N	N	Within 4 weeks after PO placement																		
15	Mandatory Spares List	Later		A	N	N	Within 4 weeks after PO placement																		
16	LUBE OIL SCHEDULE	Later		I	N	N	Within 8 weeks after PO placement																		
20	O& M Manuals(Soft Copies)	Later		A	N	N	After Approval of all engineering drawings/documents																		
21	O& M Manuals(Hard Copies)** ** hard copy shall be furnished after getting concurrence on soft copy.	Later		I	N	N	After Approval of all engineering drawings/documents																		
							TOTAL	0		^APP.CAT															
	A-Approval Category	PV-Commented and pending with vendor					TOTAL "PV"		0	A1-'Approved							Approved By:								
	I-Information Category	PB- Pending with BHEL					TOTAL "PB"		0	A2-'Mfg. Clearance given subject incorporation of comments						Sign :									
		PC- Pending with Customer					TOTAL "PC"		0	A3-Commented,Revision & resubmission required.															
		AA- Approved					TOTAL "AA"		0	A4- Retained for info.						Date :									
		OD-Overdue					TOTAL "OD"		0																
		" " - Not yet Due.							5																

Vendor documentation status									
Total No of Docs	Due as on Date	Submitted by vendor as on Dt.	Approved by BHEL as on Dt.	Commented by BHEL as on Dt.	Pending with BHEL/CUSTOMER as on date	%age of Dos Approved	%age of critical Dos Approved	Is Mfg. Clearance given?	Status/Remarks
(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	% age	% age	(Y/N)./(If Y) put Dt.	
0	0	0	0	0	0	#DIV/0!	0.00%	Y	