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JOB SPECIFICATION OF
COOLING WATER TREATMENT SYSTEM

PROJECT	40 MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT
CUSTOMER	TATA STEEL LTD. JAMSHEDPUR
CONSULTANT	TATA CONSULTING ENGINEERS LIMITED, KOLKATA

Form No.



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PROJECT ENGINEERING & SYSTEMS DIVISION

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SECTION-I

1.0 LIST OF TENDER DRAWINGS/DOCUMENTS ATTACHED WITH JOB SPECIFICATION

Sl No.	Description	Drg. / Doc. No.
1	Technical Purchase Spec. Of Cooling Water Treatment Plant	PY51084
2	Price Bid Format	Annexure – P
3	Project Information	Section B
4	Water Analysis	Data Sheet – A15
5	Data Sheet for CWT System	Section C27
6	Motors and Actuators	Section C7
7	Data Sheet for LT Motors	Section D05
8	Piping Material Specification (PMS)	--
9	Data sheet for Valves	Section D
10	Specific Piping Requirement	Section C21
11	E&C and Testing Requirement	Section C22
12	Spares	Section C23
13	Welding Specification	Section D19
14	Min. Inspection requirement for Dosing pumps	Section D30
15	Min. Inspection requirement for Strainers/Filters	Section D34
16	Sketch for Eye wash and safety shower	
17	Drive Control Philosophy	PY-SC-4-M085-9301-01
18	Instruments – Data sheet	--
19	General Specification for Painting	Appendix 5
20	Power plant layout for CW Treatment	--
21	P&ID of Cooling Water System	PY-DP-1-M085-1031-01
22	P&ID of CW Treatment System	PY-DP-1-M085-1043-01
23	Sub-Vendor List	--
24	Master document List Format	--
25	Check List	--
26	QAP Guidelines & Format	--

NOTE: The bidder to comply with all the above specifications without any deviation.

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SECTION-II

DETAILED TECHNICAL SPECIFICATION

2.0 INTRODUCTION:

The circulating water is used as the cooling medium in Surface Condenser and other auxiliary equipment of STG. The hot water is cooled in RCC cooling tower (2W+1S) cells of overall working capacity 8116 m³/hr. 2.5% of the circulating water is taken for side stream filtration. The COC of the cooling water system is maintained as 5 by proper blowdown in the system and side stream filtration. Cooling water make-up is done to make up for the blow down, evaporation and drift losses in the cooling tower.

The **Cooling water treatment plant** shall be provided to control the following.

a) Acid Dosing:

Sulphuric Acid will be dosed in the CW bay to convert scale forming calcium and magnesium bi-carbonate into corresponding sulphate compounds having higher solubility. Based on make-up water flow, 5 cycles of concentration in CW Circuit and to maintain maximum of 150 ppm of M-alkalinity in CW Circuit, 98% Sulphuric Acid needs to be dosed. The recommended rate of dosage shall be furnished by the Bidders. Adequate facilities to take care of spillage and accidental overflow of H₂SO₄ shall be provided.

b) Biocide / bio dispersant dosing:

For additional protection against microbiological growth in the circulating water system, it is proposed to shock dose some biocide in addition to chlorine at least once in a week for at least an hour.

c) Scale control Dosing:

For additional safeguard against scaling, synthetic polymer based anti-scalant will also be dosed in CW bay.

d) Corrosion control Dosing:

For additional safeguard against corrosion, some corrosion inhibitor will also be dosed in CW bay.

e) Hypochlorite Dosing:

Sodium Hypochlorite (NaOCl) shall be dosed regular as well as shot dosing to control slime and bacteria in the system.

The acid and chemical waste water from chemical treatment station will be discharged to local drain collection pits within the package area. Necessary provisions for the same are in bidders scope.

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2.1 SYSTEM DESIGN DATA :

The design of the CW treatment shall be done based on the following data of cooling water system:

RCC cooling tower capacity	: 8116 m ³ /hr. with 3 cells (2W+1S)
Hold up volume of cooling tower basin	: (approx. 2300 m ³)
Side stream filters available	: 204 m ³ /hr. (2x 100% capacity)
COC of cooling water	: 5
Hot water temperature	: 43°C
Cold water temperature	: 33°C
Make up water	: 172 m ³ /hr.
Blow down	: 32 m ³ /hr.
Evaporation and drift loss	: 140 m ³ /hr.

All the chemicals to be used in the Circulating Water Treatment Plant need to generally conform to the requirements of technical grade as applicable.

A minimum of 300 mm freeboard shall be provided for all the units and chemical solution tanks of the Circulating Water Treatment Plant.

Storage facilities needs to accommodate each of the chemicals required for fifteen (15) days, continuous at full load.

All effluents from Sulphuric Acid Injection System will pass through a lime pit for neutralization before discharge into plant drain.

The Hypochlorite Dosing system shall be designed considering total flow of circulating water required for the CW & ACW Systems. Sodium Hypochlorite solution will be dosed at CW common sump.

The Scale Inhibitor Dosing system shall be designed considering total flow of blowdown water for the CW & ACW Systems. Scale Inhibitor solutions (10%) will be dosed in CW common sump.

The Corrosion Inhibitor Dosing system shall be designed considering total flow of blowdown water for the CW & ACW Systems. Corrosion Inhibitor solutions (10%) will be dosed in CW common sump.

The Bio-dispersant Dosing System shall be designed considering the total hold up volume for the CW & ACW Systems. Bio-dispersant solutions (10%) will be dosed in CW common sump.

Based on total make up water flow rate for the CW & ACW Systems, Sulphuric Acid (98%) will be dosed in CW common sump to maintain the alkalinity as 150 ppm in circulating water.

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Various chemical storage, preparation and injection systems in the Circulating Water Treatment Plant needs to be designed for the dosage rates as follows:

Sl. No.	Chemical	Dosage Rates
1	Sulphuric Acid	To be indicated by the Bidder.
2	Biocide	To be selected and specified by the manufacturer of chemical with reference to features of CW System. However the design level of dosage shall not be considered as less than 3 ppm.
3	Scale Inhibitor	To be selected and specified by the manufacturer of chemical with reference to features of CW System. However the design level of dosage shall not be considered as less than 10 ppm.
4	Corrosion Inhibitor	To be selected and specified by the manufacturer of chemical with reference to features of CW System. However the design level of dosage shall not be considered as less than 10 ppm.
5	Sodium Hypochlorite	1. Continuous Dosage – 1 ppm for 7 hrs. in a shift. 2. Shock Dosage – 3 ppm for 1 hrs. in a shift.

a) VALVES – REQUIREMENTS

All valves, gates etc. used in complete plant shall be “rising spindle type” as much as possible. All valves shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required to operate. The valves shall be of standard pressure rating as per the relevant code/ standard.

For pipe size 50NB & below ball valve and pipe size above 50NB butterfly valve or slice gate/ gate valve shall be used for isolation purposes in water systems. Globe valves may also be provided for the application of water services for sizes 50 NB and below. Butterfly valves shall be of double flanged or lugged water type of low leakage rate confirming to AWWA-C-504 class 150 or EN-593 Class 150.

Manually operated valves shall be provided with reduction gear unit for valves of size 250 NB and above. Valve provided with motorized or pneumatic actuator shall be provided with a hand wheel for manual operation. The valve operators (Hand wheel or Gear reduction unit or Motor actuator etc.) shall be designed as per relevant International/ Indian Standard.

For air services ball valves/globe valves shall be used for sizes below 50 NB. For sizes 50 NB and above ball valves/ or butterfly valve shall be used.



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The safety valves / relief valves at the downstream of positive displacement type metering pumps shall be of the standard type manufactured by the pump manufacturer and the material of construction shall suit the fluid handled.

Check valve for Clarified water to be Gun Metal construction with threaded ends for size 50 NB & below as per IS 778 or eqv.

Valves for Acid/Alkali service shall be proven patented diaphragm type. Diaphragm shall be of re-inforced Teflon, EPDM/black Butile/Approved equivalent acid service and re-inforced Neoprene/Hypalon/ Approved equivalent alkali service.

For galvanized pipe line (for air application), size 50NB & below body material of ball valves shall be of leaded Tin Bronze (IS: 318 Gr.2) /SS (AISI 304/316).

Butterfly Valve – Body & Disc of CI lined with elastomer such as PVDF or PTFE or SS (AISI 304/316).

All valves located at elevations shall be provided with chain sprocket arrangement.

b) PIPING – REQUIREMENTS

Materials of Construction of pipes as envisaged for various services are reproduced below:

Service	Recommended Material
Circulating Water, Filtered Water, Service Water, Back-wash Waste Water, Non-corrosive waste water	ERW Carbon Steel Pipe to ASTM 53 Gr. B / IS-1239, Part-I heavy grade for pipe size up to 150 mm NB and IS-3589 for 200 mm NB and above
Sodium Hypochlorite/ Scale Inhibitor/ Corrosion Inhibitor/ Bio Dispersant Solution	CPVC
Sulphuric Acid	Carbon Steel as per IS 1239 Part 1, Heavy grade/ IS 3589 Fe 410
Instrument Air/Service Air/Potable Water	Galvanised Steel(CS as per IS 1239 Part 1, galvanized as per IS 4736/CS as per IS 3589 Fe 410, galvanized as per IS 4736)

c) EYE WASH AND SAFETY SHOWER

Eye wash and safety shower shall be provided conforming to IS 10592.

a) This unit shall contain two types of showers i.e., one for eye wash at lower level and second for full body shower. Both the shower shall either be operated simultaneously or singularly as per requirement.

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- b) The twin fountainhead shall give soft, controlled drenching of eye/face when the foot pedal is pressed.
- c) Showerhead should give uniform shower of water as soon as the weight is applied on the footboard.
- d) All mild steel parts shall be properly painted with 3 coats of anticorrosive paints.
- e) Material of Construction:

Pipe	: GI heavy grade conforming to IS: 1239
Self-closing Valve	: Stainless steel / Gun Metal
Bowl for eyewash	: Stainless steel
Eye wash nozzles	: Copper / S.S. / Plastic
Shower head	: C.P.Brass
Foot Pedal	: M.S. with aluminium top
Spring	: M.S. Galvanised
Pull chain	: M.S. Galvanised / S.S.

- f) Inspection And Testing:

The whole assembly shall be tested for its hydraulic performance and shall be capable of withstanding hydraulic test pressure of 7.0 kg/cm²(g).

- g) Vendor shall furnish drawings and data as per requirement and submit for approval prior to manufacturing.

d) ELECTRICAL

- i) Motor Requirement:

- Motor rating shall be more than 0.18 kW. The power supply of 415V, 50Hz, 3 phase, 3 wire up to the motor terminal shall be provided by BHEL. Refer specification for motor and actuator attached with this specification.
- All electrical equipment shall be suitable for the power supplies, fault levels and climatic condition indicated in project information enclosed with the specification.
- All drawings, Datasheets, Electrical load list, Quality plans, calculations, test reports, test certificates, etc. shall be submitted during detailed engineering stage. The same shall be subject to approval without any commercial implications.

- ii) Glands & Lugs at equipment end.

2.2 BRIEF SCOPE OF WORK

This specification is intended to cover the design, engineering, procurement, manufacture, inspection and testing at contractor's and/or sub-contractor's works, packing, loading, forwarding, transport and delivery at site, unloading, handing and

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storage at site, intra site transport, complete erection, painting, testing and commissioning of the Circulating Water Treatment plant, with all accessories inclusive of all mechanical, electrical, instrumentation and control systems training related to jobs and furnishing input data to put into commercial operation a highly reliable safe, efficient and environmentally compliant of CW treatment system.

The equipment and accessories to be furnished and put into operation and all other required services are detailed herein under. The items, though not specifically mentioned but needed to make the system complete in all respects and reliable for safe and smooth operation and guaranteed performance shall also be treated as though included and the same shall be furnished, unless otherwise specifically excluded elsewhere.

It is not the intent to completely specify all details of design and construction herein. Nevertheless, the equipment and installation shall conform to high standard of engineering design and workmanship in all respect and shall be capable of performing continuous satisfactory commercial operation.

A. SYSTEM WISE

a) Mechanical

- i) Acid dosing system for pH control.
 - One (1) no. hose station for unloading 98% Sulphuric Acid. The hose station shall have one (1) no. HDPE hose connections (50 NB).
 - Two (2) nos. Sulphuric Acid Transfer Pumps, each complete with drive motor and all other necessary accessories.
 - One (1) no. Sulphuric Acid Storage Tank, complete with all necessary accessories.
 - One (1) no. Sulphuric Acid Day Tank, complete with all necessary accessories.
 - Two (2) nos. Sulphuric Acid Dosing Pumps, each complete with drive motor and all other necessary accessories.
 -
- ii) Hypochlorite dosing system including regular as well as shot dosing in the Circulating cooling water system.
 - One (1) no. FRP Bulk Sodium Hypochlorite Storage Tank, complete with integral pipe works, valves and all other accessories as required.
 - Two (2) nos. Sodium Hypochlorite Dosing Pumps, each complete with drive motor and all other necessary accessories.
 -
- iii) Biocide dosing systems for controlling the growth of bacteria, fungi and algae in the system. s
 - One (1) no. Biocide Tank, complete with all necessary accessories.
 - Two (2) nos. Biocide Injection Pumps, each complete with drive motor and all other necessary accessories.
 -
- iv) Scale inhibitor dosing system for avoiding scale.

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- One (1) no. Scale Inhibitor Tank, complete with all necessary accessories.
- Two (2) nos. Scale Inhibitor Injection Pumps, each complete with drive motor and all other necessary accessories.
- v) Corrosion inhibitor dosing system for avoiding corrosion
 - One (1) no. Corrosion Inhibitor Tank, complete with all necessary accessories.
 - Two (2) nos. Corrosion Inhibitor Injection Pumps, each complete with drive motor and all other necessary accessories.
- vi) All integral and interconnected piping including pipe fittings, valves, instrumentations, pipe supports, specialties, etc.
- vii) Corrosion racks and deposit monitors to monitor the water characteristic in CW system.
- viii) Biofilms shall be provided to measure the presence of bio organisms in water.
- ix) Unloading pumps and piping
- x) Monitoring equipment
- xi) One new set of special tools and tackles, fixtures etc., as required for regular operation and maintenance of the equipment offered. Adequate means shall be provided for lifting and handling of each item of plant and equipment. The scope shall also include supply of mandatory spares as per list enclosed elsewhere.

b) Civil

For bulk acid tank, acid and chemicals day tanks and its associated system, all the required civil works (including equipment foundation) will be in the scope of Customer. However, necessary civil input shall be provided by bidder to enable Customer to do civil design and works.

Bidder shall supply all foundation bolts, all embedments (of non-corroding materials suitable for acid/alkali/chemicals), levelling plates/shims and grout material required for grouting of equipment.

c) Control & Instrumentation

- i) All field instrumentation as per enclosed P&IDs. Any other additional instrumentation required for completeness of the system shall also be provided. Refer data sheet for instruments attached with the specification.
- ii) The pumps shall be protected from dry running by providing level switches on the tanks with hooter signal in DCS.

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iii) All instrument hook-up material for installation of instruments shall be supplied by bidder.

d) Electrical

i) Electrical Cable Glands & Lugs

B. SERVICES WISE

The services as addressed below need also to be considered as included with reference to Circulating Water Treatment Plant under the scope of Contract:

- i) Arrangement for the different specified stage inspection / testing at manufacturer's works by Purchasers/Engineer's representatives.
- ii) Arrangement for dispatch of all the materials by road to sites.
- iii) Project engineering and management till handing over the complete CW Treatment System.
- iv) Receiving and unloading of all equipment and materials at site, checking with consignment note and reporting for missing or damaged items.
- v) Proper stacking, storing under CONTRACTOR's custody and security, providing proper maintenance of stored items and keeping proper records of materials at store for convenience and proper scheduling of erection work and for quick identification and when required.
- vi) Issue of materials from stores and maintaining detail c\n account of the same as required.
- vii) Transportation / Shifting of materials from stores to erection site.
- viii) Submission of a phased time schedule for various stages of completion of work, which will be the essence of the contract and guaranteed.
- ix) Arrangement for availability of all erection tools plant like cranes, hoists, welding sets, gas electrodes, compressed air, sump pumps, paints, putty, and all consumable stores required for erection, testing and conlmissioning purpose except for chemicals.
- x) Pre-assembly at site after proper checking/overhauling, as required.
- xi) Erection and subsequent cleaning/flushing as required.
- xii) Pre-start check of the installation to ensure correctness of the erection.

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- xiii) Installation, testing and commissioning of all equipment, piping, instrumentation and control, etc. supplied under this package and as specified. This will include necessary Cleaning, reliability run and performance guarantee & acceptance test of the individual equipment as well as the entire Plant as a whole including coordination as needed for interfacing with other units as given in the contract elsewhere.
- xiv) Deployment of all skilled, semi-skilled/unskilled workmen/labor, supervisory staff, inspectors, erection and commissioning engineer, clerical staff, watch and ward staff, store-keeper, driver etc. as required for all services till handing over of the plant.
- xv) Submission of all drawings, data, test certificates, etc. as necessary.
- xvi) Compilation and Submission of different manufacturer's operating and instruction manuals in a comprehensive manner, proposed for use by operating and/or maintenance personnel.
- xvii) Submission of complete "AS-BUILT" drawings for the system/subsystem/equipment/ material as erected and installed at site incorporating change or modifications in the executed works.

C. EXCLUSIONS

- i) Supply of construction water and construction power.
- ii) Complete ventilation system of CW Treatment Plant Building and air-conditioning of Control Room. However the input data for design need to be provided by the Bidder.
- iii) All civil works related to this package except embedded items e.g. inserts, bolts, embedded plate, base plate, edge protection angles, ladders, epoxy screening, chipping etc. complete for all items required to be embedded in civil works and supervision of civil works for entire CW Treatment Plant package. All bolts for fixing of equipment will be supplied for the civil construction, conforming to IS: 1367.

2.3 MONITORING WATER CHARACTERISTICS

Monitoring equipment with reference to scale formation, corrosion and biological growth need to be provided to supervise the performance of the treatment systems.

- a) pH shall be tested for water analysis once in 4 hrs.
- b) Bio films shall be used to measure the presence of bio organisms in water.
- c) Evaluation of general corrosion rate from corrosion coupons installed in corrosion racks.
- d) Deposit monitor shall be installed to monitor water deposit characteristics

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2.4 MONITORING EQUIPMENT LIST

- a) Bio fouling monitor and Bio films
- b) Corrosion racks with corrosion coupon for MS, SS and Cu – 3 nos. each.
- c) Deposit monitor
- d) Chlorotex kit
- e) Dip slide – 6 nos.
- f) Level gauge at the each tank
- g) Pressure safety valve at pump discharge
- h) Level switches for low level and high level alarm

pH transmitter (BHEL scope) and Bio fouling monitor shall be installed in CW pump discharge header whereas deposit monitor and corrosion racks shall be installed in CW return header to cooling tower. Two tap offs per equipment shall be provided in CW line, however the isolation valves and necessary pipe and pipe fittings for Bio fouling monitor, Deposit monitor and corrosion racks shall be in Bidder's scope of supply.

2.5 FILTERED WATER ANALYSIS

Sl. No.	Parameters	Quantity
1	Turbidity (NTU)	11-15
2	pH	7.6-8.0
3	TDS (mg/l)	160
4	Total Hardness (mg/l)	84-98
5	Chloride (mg/l)	6.2-9.0
6	Alkalinity as CaCO ₃	78-86
7	Aluminum (mg/l)	0.03-0.06
8	Iron (mg/l)	0.04-0.07
9	Calcium concentration	< 50 mg/l

2.6 OPERATION AND CONTROL PHILOSOPHY

The operation of the Circulating Water Treatment Plants shall be semi-automatic. The control of the plant shall be done through main plant DCS.

The pumps shall trip on low-level switch in dosing tanks with alarm. Adjustment of chemical dosing rate shall be manual.

The control of complete acid dosing system shall be from the STG DCS. The stroke length of acid dosing pumps shall be automatically controlled in proportion to pH of circulating water system. Acid dosing pumps will also be interlocked with low level of acid measuring tanks for tripping of the acid dosing pumps.

2.7 CONSUMABLES

- a) Bidder to include all the chemicals and consumables required for erection, start up, commissioning and test run of CW treatment system in their scope of supply.
- b) Bidder to supply chemicals and consumables for initial filling and topping up for first three (3) months of initial operation after successful commissioning.
- c) Spares required for erection and commissioning of complete Plant.

2.8 SPECIAL CLEANING, PROTECTION & PAINTING

Refer Appendix 5- for surface preparation and painting attached with this specification.

2.9 SPARES (OPTIONAL):

Bidder has to quote optional price for spares listed below:

Sl. No.	Item	Quantity
Safety and Relief Valves		
1	Bonnet Gasket	One (1) no. for each type of valve
2	Disc & Stem assembly	One (1) set for every type and size of valves required
Globe/ Gate/ Check/ Safety valves (Applicable to Hand Operated)		
3	50 NB below size Valves	2% of the total population subject to Minimum 1 no, for each type size, material, grade and class.
4	65 NB and above size valves (for each type, size material grade and class valve)	
4.1	Valve Stem	1 no. for every similar Set of 5 valves subject to min. 1 no.
4.2	Valve Disc /Wedge	1 no. for every similar Set of 5 valves subject to min. 1 no.
4.3	Valve Bonnet Gasket	1 no. for every similar Set of 2 valves subject to min. 1 no.
4.4	Valve Pressure Sealing Ring	1 no. for each valve
4.5	Yoke Bush	1 no. for every similar Set of 5 valves subject to min. 1 no.
4.6	Spring for Safety Valve	1 no. for each safety valve
4.7	Stem & Disc Assembly for Safety Valve	1 no. for each safety valve
Piping and insulation spares		
5	50 NB and below Size Piping	Pipe and fittings 5% of the total quantity for each size and material grade.
6	65 NB and above Size Pipe	Pipe 5% of the total quantity or 2 meter, whichever is higher for each size and material grade.

2.10 RECOMMENDED SPARES

A minimum requirement of spare parts based on the experience of the Bidder sufficient for two (2) years of normal trouble free operation shall be recommended and quoted separately as optional item. Bidder shall furnish the description along with recommended quantity for each item in the offer.

2.11 STARTUP/COMMISSIONING SPARES

The start-up spares are those spares which will be required during start-up and commissioning of the equipment/systems, and until performance testing. It is the responsibility of the SUPPLIER to supply all the necessary spares as required until the equipment/systems are handed over to the PURCHASER.

Bidder shall be responsible for the ready and timely availability for all the startup and commissioning spares as required during various stages of testing, cleaning and commissioning.

An adequate stock of start-up spares should be available at the site such that the start-up and commissioning of the equipment/systems, performance testing and handling of the equipment/systems to the PURCHASER will be carried out without hindrance and delay. All startup spares which remain unused after the taking over the plant will remain the 'property of The PURCHASER.

The list of startup / Commissioning spares considered for each unit is to be furnished.

2.12 TERMINAL POINTS FOR SCOPE (Piping)

- a) Service water tap-off at one point near CW treatment area
- b) Acid drain piping at one point near CW treatment area
- c) Acid filling piping at one point for connection to acid tanker hose pipe

2.13 INSPECTION, TESTING AND COMMISSIONING, PERFORMANCE GUARANTEE

Tests at Manufacturer's Works

Shop tests shall include all tests to be carried out at Bidder's works, works of their sub-vendors and at works where raw materials to be used for fabrication of equipment are manufactured.

Tests at Site Before Trial Run

Bidder shall carry out tests at site to prove to the Purchaser that the equipment of the plant complies with the requirements stipulated and is erected in accordance with requirements. Before the plant is put on trial run the Bidder will be required to conduct tests to demonstrate to the Purchaser that each item of the plant is capable of correctly performing the functions for which it was specified to. These tests may be conducted concurrently with those required under commissioning sequence.

Performance test requirements & guarantees:

- a) Each pump shall be guaranteed for capacity, total dynamic head and power consumption.
- b) The following parameters are the maximum recommended allowable limits in the circulating water
 - i) Corrosion rate:

On MS	< 3.0 mpy
On Cu	< 0.5 mpy
On SS (304)	< 0.5 mpy
 - ii) Scaling < 15mg/dm²/day
 - iii) Ni-Cr mesh should be clean when visually inspected
 - iv) Pitting corrosion rate on MS/Brass < 20 mpy.
 - v) Micro/Bio fouling conditions

Total Viable Count (TVC)	< 1x10 ⁵ Counts/ ml
Sulphate reducing bacteria (SRB)	< 1x10 ⁵ Counts/ 100 ml
 - vi) Various instruments, equipment, chemicals etc. shall conform to the accuracy, ranges and specifications as indicated in specifications of this package.

Note: Any special instruments required for PG Test brought by the Bidder.

2.14 QUALITY CONTROL & SURVEILLANCE

The plant / equipment to be supplied under this specification shall have assured quality and workmanship. In the proposal, the Bidder shall submit the Quality Assurance Plan containing quality assurance program and quality assurance documents for Purchaser's approval. The Bidder shall be bound to conduct all stage inspections on various equipment / material during manufacturing process in accordance with the approved copy of this document. Purchaser shall have the right to carry out Quality Audit and Quality Surveillance by witnessing any or all such tests to be carried out at Bidder's / Sub-Bidder's works as and when desired. The procedure applicable to Bidder's works will also apply to the works of his sub-Bidders. For items coming under the purview of any Indian Statutory Regulation during the course of manufacture, all stage inspections and tests shall be witnessed by an inspecting authority recognized under the statutory regulation. All unpriced copies of Bids of all major bought-out items giving technical details shall be sent to Purchaser for approval prior to placement of orders on sub-vendors.



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These audit/surveillance/approvals shall however, do not relieve the manufacturer / sub-vendors of their responsibility of the Quality Assurance of their product and overall guarantee and responsibility shall wholly be confined on the Bidder. Tests/inspections shall be carried out during and after the completion of manufacture of different components and assembly as applicable in accordance with relevant codes and standards. Test Certificates for all such tests/inspections shall be made available to the Purchaser for approval.

Purchaser or his authorised representative shall have his full access to witness any or all tests/inspections to be carried out at manufacturer's shop. In case, the job is sub-contracted, it will be Bidder's responsibility to make all arrangements so that Purchaser or his authorised representative can attend such tests at Sub-Bidder's premises. Inspection (including inter-stage inspection) and other tests shall be done as per Approved Quality Plan.

After erection at site, the CW Treatment Systems shall be operated for a period of at least two (2) weeks to prove satisfactory, performance and guarantee data.

QAP Guideline & QAP format are attached herewith as a part of specification. Positive material identification (PMI) is applicable for all SS & AS material.

2.15 PRE-CLEANING AND PASSIVATION

Bidders shall prove cooling water treatment system guarantees after pre-cleaning and passivation of cooling water system.

Pre Cleaning of the cooling water system and equipment shall be done by BHEL standard practice. Water flushing, acid cleaning and passivation of the cooling water system, cooling water basin and sump shall be in the scope of BHEL.

2.16 DOCUMENTS TO BE FURNISHED

a) Along with the offer : Bidders to submit the following documents / drawings along with their offer:

- i) Filled in Check-list
- ii) Electric Load list
- iii) List of Guaranteed data
- iv) Schedule of terminal points
- v) Filled in Annexures I, II, III & IV enclosed in PY-051084
- vi) Unpriced bid indicating items quoted for

b) After award of contract: All the drawings and documents to be submitted as per the Master Document List enclosed with PEMC-06861. Also submit the following documents during detail engineering:

- i) P&ID with equipment list and Instrumentation & control diagram.

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- ii) Piping layout with suitable sectional views of plant.
- iii) Detailed dimensional drawing of all equipment of the plant.
- iv) Civil assignment drawings with reference to Civil & Structural works (to be undertaken by Purchaser) of SSF system
- v) Detailed cross- sectional drawings of all equipment and bill of materials.
- vi) Detailed dimensional drawings of electric drive motor frame, bearing cable boxes, cable termination arrangements, etc.
- vii) Detailed interlocks, logic diagrams (incorporating Boolean Concepts) and schematics for C. W. Treatment plant.
- viii) Dimensioned drawings of Control panels showing arrangement of instruments, switches, push buttons, lamps, etc. along with the schematics and wiring diagram.
- ix) Design calculation in respect of process and mechanical design.
- x) Detailed procedures of testing will be submitted to the Purchaser for approval before performance tests.
- xi) Detailed technical particulars of electric drive motors, will be furnished in the proforma exhibited in relevant section of the contract.
- xii) Detailed technical particulars of valve actuators/control.
- xiii) General arrangement drawing with maintenance space.
- xiv) Equipment layout with shed/ building.
- xv) Data sheet pump/motor.
- xvi) Equipment / instrument list with makes of all bought out items.
- xvii) Details of metering pump with capacity, pump catalogue with model selected
- xviii) Equipment list with skid P&ID.
- xix) Commissioning manuals.
- xx) O&M manual with product catalogue of all bought out items.
- xxi) Spares list and ordering information.

- xxii) Following test certificates/test curves/data will be furnished :
 - Material test certificates.
 - Performance tests results and characteristics curves of pumps, fans and electric drive motors.
 - Hydraulic test results of pressure vessel, non-pressure, vessels, pipes, valves, fittings etc.
 - Test results to anti-corrosive coatings.
 - Non-destructive test results as applicable.
- xxiii) Following lists/tables will be furnished, complete with tag nos. and brief contract
 - Instrument list.
 - Valve list.
 - Pipe list.

Note: Approval does not relieve the bidder from responsibility for correctness of design, details and dimensions.

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2.17 ORDER OF PRECEDENCE

This specification shall be read in conjunction with all other specifications and documents enclosed to it. Any conflict between referenced documents shall be identified and indicated. When resolving conflicts the following order of precedence shall govern.

- a) Job specifications (PEMC-06861 Rev.00)
- b) P&ID's referred
- c) Annexures
- d) Standard specifications (PY-51084 R01)
- e) Standards and codes as applicable


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	Rev. No.	Date	Revision Details	Prepared By	Checked By	Approved By
	00	11.06.16	First issue	CHP	AKS	MSSN
	Ref. Doc.					


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<p style="text-align: center;"> <u>TECHNICAL PURCHASE SPECIFICATION</u> <u>FOR COOLING WATER</u> <u>TREATMENT SYSTEM</u> </p>					
Ref.	Date	Revisions : Refer to record of revisions :	Prepared : Pradeepa	Approved : Radhika Sista	Date : 11.06.14


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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.		<p>1.0.0. INTENT OF SPECIFICATION:</p> <p>This specification is intended to cover the design, manufacture, delivery to site properly packed and forwarded, unloading at site, site storage, handling at site including three months O&M of the system along with all accessories as specified in the scope of work and as required for the safe and trouble-free operation of system at site.</p> <p>1.1.0. This specification shall be read in conjunction with its enclosures. In case of any discrepancy arising between this job specification & its enclosures, wherein more than one level (i.e. both less stringent level and more stringent levels) of same requirement have been indicated for a particular item, the most stringent of all shall be followed and shall relevantly over-ride others. Otherwise, the requirements indicated in this job specification shall be considered as additional requirements to the ones indicated in the enclosures. 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.</p> <p>1.2.0. 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.</p> <p>2.0.0. GENERAL REQUIREMENTS:</p> <p>2.1.0. All materials supplied under this contract shall be new and unused. Any special approvals that may be applicable for certain items, like for explosion-proof items from CMERI-Dhanbad, etc., shall be have to be duly considered and ensured. All imported equipment/materials should have an approval of ASME / API / BS / LPC / FM / UL / BASEEFA / NEC / IEC / NFPA / AWWA /other-applicable-authority, as may be applicable.</p> <p>2.2.0. All equipment/items supplied shall conform to the provisions of statutory & other regulations in force in India and the State/Province where the project is executed, such as the Indian Factories Act, Indian Electricity (Supply) Act, Indian Electricity Act, Indian Electricity Rules, International Electric Technical Commission (IEC) Publication, Environmental Rules, etc.</p> <p>2.3.0. Supplies shall be rendered in conformity with proven design principles. The purpose of this contract must be fulfilled in its entirety and the maximum of reliability and economy guaranteed. All the components shall be so designed that repairs and overhauling is minimum and can be carried out easily in the shortest possible time.</p> <p>3.0.0. SCOPE OF WORK:</p> <p>3.1.0 The scope of work covered under this specification shall include but not limited to</p> <p>Design, manufacture, assembly, delivery to site properly packed and forwarded, unloading at site, site storage, handling at site (including performance test and three months O&M), of the system along with all accessories as specified in the scope of work and as required for the safe and trouble-free operation of CW system.</p>		
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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.		<p>3.2.0 Scope of Supply</p> <p>This section sets out the scope of supply of Cooling Water Treatment plant, covered by the enclosures but without excluding other necessary components, which are not mentioned. By signing this contract, the Bidder shall be deemed to have accepted the obligations of supplying (with the exception of materials specifically described so as to be supplied by others) and executing everything necessary to complete the work in all respects, stipulated, regardless of any omissions in this specifications or drawings. All materials supplied under this contract shall be new and unused.</p> <p>3.2.1. General scope of supply</p> <ol style="list-style-type: none"> a) Cooling water Treatment plant listed out in the specification. b) Three months O&M of the treatment system (if applicable as per Job specification). <p>3.2.2 Scope of services</p> <ol style="list-style-type: none"> 3.2.2.1 Receipt of material at site, site storage and handling, complete erection of all equipment commissioning and performance testing of the complete system. 3.2.2.2. Pre-commissioning, testing, startup and run tests, performance and acceptance test. 3.2.2.3. Submission of all interface data required for design and engineering of systems which are not included in the scope of supply defined above. 3.2.2.4. Preparation and submission of drawings/documents for approval / information to Purchaser/ Consultant as per the drawing/documents submission schedule. 3.2.2.5. QA/QC plan, inspection and testing of equipment at works, submission of test certificates. 3.2.2.6. Submission of monthly progress report. 3.2.2.7. Training of Purchaser's personnel in operation and maintenance of the complete system. <p>3.3.0. Consumables</p> <p>Supply of all consumables required as per the job specification (PEMC), shall be included in the scope and the same shall be supplied by the successful Bidder at appropriate time. Bidder shall also quote for the monthly rates for O&M of the system after erection, commissioning and successful PG test of the system by the Bidder.</p> <p>NOTE: Refer to Job specification for applicability</p> <p>3.4.0. Lubricants</p> <p>All flushing oil required, together with first fill of oil and/or grease for all parts of equipment requiring lubrication, shall be provided by the Bidder. For all types of lubricants, equivalent grade of other makes shall be readily obtainable locally.</p> <p>NOTE: Refer to Job specification for applicability</p> <p>3.5.0. Erection & Commissioning Spares</p> <p>The Bidder shall also supply erection & commissioning spares along with his main equipment as per his experience, for replacement of damaged or unserviceable ones during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main</p>		
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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.		<p>equipment supply. The initial fill of lubricants, oil etc. shall also be supplied by the Bidder. Bidder shall not be allowed to use Mandatory Spares for Erection and Commissioning.</p> <p>3.6.0. Special Maintenance Tools and Tackles</p> <p>One set of special tools and tackles required for operation, maintenance, inspection and repair, neatly packed in steel boxes complete with operating instructions for the complete Cooling Water Dosing Plant shall form part of the main equipment supply and a separate list for the same shall be furnished along with bid.</p> <p>3.7.0. Recommended Spares</p> <p>A minimum requirement of spare parts based on the experience of the Bidder sufficient for two (2) years of normal trouble free operation shall be recommended and quoted separately as optional item. Bidder shall furnish the description along with recommended quantity for each item in the offer.</p> <p>4.0.0. TESTS, INSPECTION & QUALITY PLAN:</p> <p>4.1.0 General:</p> <p>The manufacturer shall conduct all tests required to ensure that the equipment furnished shall conform to the requirements of this specification and in compliance with requirements of applicable codes and standards. The particulars of the proposed tests and the procedures for the tests shall be submitted to the Purchaser/Consultant for approval before conducting the tests.</p> <p>Where stage inspection is to be witnessed by Purchaser, the Bidder shall indicate period where presence of Purchaser or his authorized inspecting agency is required, in the Bar Chart.</p> <p>4.2.0 Test at Manufacturer’s work (as applicable):</p> <p>4.2.1 Shop tests shall include all tests to be carried out at contractor's works; works of his sub-contractor and at works where raw materials supplied for manufacture of equipment is manufactured. The tests to be carried out shall include but not limited to the tests as follows:</p> <p>4.2.2 Composition of all material, castings, forgings, etc. correlation certificates for the same for each equipment and component shall be furnished.</p> <p>4.2.3 Hydraulic test for vessels, pipes, valves, specialties, pump casting, etc.</p> <p>4.2.4 Test to check faults in rubber lining [as per IS: 4682 (Part-I) 1968 or its equivalent] and painting.</p> <p>4.2.5 Static balancing test on agitators, stirrers, paddles, etc.</p> <p>4.2.6 Static and dynamic balancing test on all impellers.</p> <p>4.2.7 Performance test (Head, Capacity and Power) on pumps in line with applicable codes.</p> <p>4.2.8 Tests on all electrical equipment/accessories as specified in respective electrical sub-sections.</p> <p>4.2.9 Control panels are to be checked for dimensions, wiring continuity, insulation, tubing leakages etc.</p>		
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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.		<p>4.2.10 All panel mounted instruments, local instruments and accessories are to be checked for performance, over range protection etc. as per I.S.A. or other relevant standards.</p> <p>4.2.11 Control valves are to be tested for body/seat/diaphragm chamber leakage, lift characteristics, body, seat bonnet and material composition.</p> <p>4.2.12 Load test on monorail hoists.</p> <p>4.2.13 Calibration tests for weight/load indicator.</p> <p>4.2.14 Calibration tests of all standard orifices, nozzles, level switches and other instruments.</p> <p>4.2.15 Functional test of the control system.</p> <p>4.3.0 Material Tests</p> <p>All materials used for construction shall be of tested quality. All materials shall be tested as required by such standard, and test certificates shall be made available to the Purchaser.</p> <p>Where stage inspection is to be witnessed by the Purchaser before starting the fabrication, all material test certificates shall be correlated and verified with the actual material used for construction by Purchaser's inspector who shall stamp the material. In case mill test certificates for the material are not available, the Bidder shall carry out physical and chemical tests at his own cost from a testing agency, approved by the Purchaser, as per the requirement of specified material standard. The samples for physical and chemical testing shall be drawn up in presence of Purchaser's inspector who shall also witness the testing.</p> <p>Wherever, the components shall be subjected to Non-Destructive Examination (NDE). The requirements of NDE shall comply with the relevant standards. All components subjected to NDE shall be identified and stamped by Purchaser's inspector on successful completion of testing.</p> <p>4.4.0 Other Tests</p> <p>Bidder to conduct all other tests as per this specification, applicable codes /standards and as per standard engineering practices.</p> <p>4.5.0 Site Performance Test:</p> <p>The equipment shall be guaranteed to meet performance requirements required by this specification and rectification shall be carried out until satisfactory results are obtained. The purchaser reserves the right to reject the equipment should the performance values fall short of those indicated in the schedule of Technical data sheets.</p> <p>4.6.0 Test at Sites:</p> <p>i) Bidder shall carry out tests at site to prove to the Purchaser/Customer that the equipment of the plant complies with the requirements stipulated and is erected in accordance with requirements. Before the plant is put on trial run the contractor will be required to conduct tests to demonstrate to the Purchaser/Customer that each item of the plant is capable of correctly performing the functions for which it was specified to. These tests may be conducted concurrently with those required under commissioning sequence. Tests required shall generally be as follows:</p> <p>ii) All piping and valves, after installation, will be tested hydraulically at a pressure, 1½ times of the maximum attainable pressure in the system, to check against leak tightness.</p>		
Ref.	Doc	All storage tanks shall be tested for leak tightness as per IS: 803.		

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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.		<p>All pressure vessels shall be hydraulically tested at 1½ times the design pressure or 2 times the working pressure, whichever is higher for a period of not less than 1 hr.</p> <p>iii) All valves/gates (Manual/automatic/remotely operated) shall be operated throughout 100% of the travel and these should function without any trouble whatsoever.</p> <p>iv) All pumps shall be run with the specified fluid from shut off conditions to valve wide open condition. Head developed will be checked from the discharge pressure gauge reading. Capacity may be checked from flow indicators where applicable. If flow indicators are not available in the system capacity can be checked from the volume of fluid handled (determined from level indicator reading of concerned tank) and duration of test.</p> <p style="padding-left: 40px;">During the test, the pumps and drive motors shall run smoothly without any undue vibration, flow pulsation, leakage through gland, temperature rise in the bearing parts, noise etc.</p> <p>v) The tests to be carried out for storage vessels are to include:</p> <ol style="list-style-type: none"> 1. During fabrication and before lining: <ol style="list-style-type: none"> a) Bottom testing for leakage by soap solution, after the bottom course of the shell plate has been welded. b) Hydraulic shell testing for leakage. c) Fixed roof test for leakage by soap solution. 2. After rubber lining: Water leakage test for storage tank by filling it with water up to the overflow level. <p style="padding-left: 40px;">All the rubber lining are to be subjected to the following tests as per IS: 4682 (Part-I)</p> <ul style="list-style-type: none"> • Adhesion test. • Resistance to bleeding. • Thickness measurement. • Shore hardness. • High voltage spark test. <p style="padding-left: 40px;">Epoxy painting shall be checked by dry type thickness gauge.</p> <p>vi) Visual check on all structural components, welding, rubber lining, and painting etc. and if doubt arises these will be tested again.</p> <p>vii) All testing and calibrating instruments and equipment shall be furnished on load basis to the satisfaction of the Purchaser/Customer.</p> <p>viii) All the rotating/moving components like agitators, paddles, etc. shall be run at the rated speed with water/chemicals up to the normal water level for a period of twenty four (24) hours. During this period all the components shall function smoothly without any unbalance, vibration, overheating at bearing parts etc.</p>		
Ref.	Doc	ix) Checks on electrical items as mentioned under electrical specification.		

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5.0.0. QUALITY & INSPECTION

5.1.0 Quality Assurance Program

To ensure that the equipment and services under the Scope of Contract whether manufactured or performed within the Bidder's works or at his Sub-Vendor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Bidder shall adopt suitable quality assurance program to control such activities at all points, as necessary. Such program shall be outlined by the Bidder and shall be finally accepted by the Owner / Authorized representative after discussions before the award of Contract. The QA program shall be generally in line with ISO-9002/IS-14001. A quality assurance program of the Bidder shall generally cover the following:

System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

- Inspection and test procedure both for manufacture and field activities.
- Control of calibration and testing of measuring, testing equipment.
- System for indication and appraisal of inspection status.
- System for authorizing release of manufactured product to the Owner.
- System for handling, storage and delivery.
- Furnishing quality plans for manufacturing and field activities and detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment / component.

5.2.0 Quality Assurance Documents

The Bidder shall be required to submit required no. of copies of the following Quality Assurance documents as required.


1. Material mill test reports on components as specified by the specification and approved Quality Plans.
2. The inspection plan with verification, inspection plan check points, verification sketches, if used and method used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.
3. Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
4. Non-destructive examination results, reports including radiography interpretation reports.
5. Factory tests results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
6. Inspection reports duly signed by QA personnel of the Owner and Bidder for the agreed customer hold points.


During the course of inspection, the following will also be recorded.


- a) When some important repair work is involved to make the job acceptable:
- b) The repair work for the remaining part of the accepted product quality.

All the accepted deviations shall be included with complete technical details.

The equipment shall be guaranteed to meet performance requirements required by this specification and rectification shall be carried out until satisfactory results are obtained. The Owner reserves the right to reject the equipment should the performance values fall short of those indicated in the schedule of Technical data sheets.

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<div style="display: flex; justify-content: space-between;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: small;"> <p>COPYRIGHT AND CONFIDENTIAL</p> <p>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.</p> </div> <div style="flex-grow: 1;"> <p>5.3.0 Quality Plan:</p> <p>Bidder to furnish Quality Plan [Supply Quality plan as well as Erection & Commissioning Quality Plan] to BHEL along with offer in their standard format for general review by BHEL.</p> <p>However, after award of contract Bidder shall submit Quality plan [Both supply as well as Erection & Commissioning Quality Plan] for approval. The Quality plan shall be submitted in the BHEL quality plan format, During Detailed engineering, in addition to various tests indicated in this specification, Quality plan will be reviewed with respect to standard Inspection, standard Engineering practices, applicable standards, code etc. Accordingly, various tests required, stages of inspection and appropriate agencies for Inspection will be intimated. Bidder to abide by the same.</p> <p>5.4.0 Inspection agency:</p> <p>BHEL/Third Party appointed by BHEL/Customer / Customer’s consultant</p> <p>The various inspection stages will be witnessed by individual agencies (or) Group of Agencies as per above, in line with approved quality plan.</p> <p>6.0.0. PROTECTION FOR SHOP FABRICATED ITEMS:</p> <p>6.1.0 All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or non- metallic protecting device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted due to exposure to weather, should also be properly treated and protected in a suitable manner. All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall beforehand be treated and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scale, oxide and other coatings and prepared in the shop.</p> <p>6.1.1 The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Transformers and other electrical equipment, if included, shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer’s standards to be selected and specified by the Purchaser at a later date.</p> <p>6.1.2 Shop primer for all steel surfaces which will be exposed to operating temperature below 95°C shall be selected by the Bidder after obtaining specific approval of the Purchaser regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95°C and such primers shall also be subject to the approval of the Purchaser.</p> <p>6.1.3 All other steel surfaces which are not to be painted shall be coated with suitable rust preventive compound subject to the approval of the Purchaser.</p> <p>6.1.4 Internal piping system cleanliness to be assured by flushing or equivalent method and means provided to clean condition.</p> <p>6.1.5 All material shall be delivered in a clean and usable condition. Openings shall be securely covered against entry of foreign material where appropriate.</p> </div> </div>				
Ref. Doc.				

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<div style="display: flex; justify-content: space-between;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: small;"> 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. </div> <div style="flex-grow: 1;"> <p>7.0.0. PACKING AND TRANSPORTATION:</p> <p>All equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials the limitations from the point of view of availability of railway wagon sizes in India should be taken into account. Bidder shall follow necessary road safety rules and shall obtain permission from highway authorities for goods movement, if the transportation in their scope. However, these aspects shall be taken into consideration in the design of the packing for the system.</p> <p>8.0.0. NAME PLATES & TAG PLATES:</p> <p>8.1.0 Components whose identity is important for operation and maintenance of the plant viz., all apparatus, motors, signal tapping points, instruments and control equipment, cubicles, as well as the terminal boards etc., installed shall be provided with permanently attached tag bearing the Purchaser’s coding together with relevant text clearly inscribed. The tags shall be as given below:</p> <p>8.2.0 A corrosion-resistant nameplate shall be attached to each unit in a clearly visible, easily accessible location. The nameplate shall be stamped with the following information:</p> <ul style="list-style-type: none"> a) Manufacturer’s name b) Manufacturer’s model number c) Manufacturer’s shop order number d) Manufacturer’s serial number e) Purchaser’s equipment tag number (item No.) f) Service name g) Weight (kg) h) Hydrostatic test pressure, Bar. (g) i) Other design information of the flow media like flow rate, temperature, pressure etc. <p>8.3.0 Nameplates shall be 3 mm (0.12”) thick engraved plate of sufficient rigidity with lettering of a minimum height of 4 mm (0.16”). The method of implementation and labelling will be informed for all components after award of contract.</p> <p>8.4.0 Identification tags shall be provided and placed on all Bidder furnished items. Tags shall be corrosion resistance, having a larger than diameter of 3 cm, and shall have black identification figures stamped thereon. Figure height shall be larger than 0.5 cm. Tags shall bear the component system designation symbol shown on the Bidder’s drawings.</p> <p>9.0.0. GENERAL CONDITIONS OF CONTRACT</p> <p>9.1.0 Location/Positioning Of Works</p> <p>The CONTRACTOR shall be responsible for the true and proper setting out of the WORKs in relation to points, levels of reference co-ordinates, orientation, alignment and marks given in the CONTRACT DOCUMENT in writing and for correctness of the positions, levels, dimensions, orientation and alignment of all parts of the WORKs, and for the provision of all necessary instruments, appliance and labour in connection therewith. If, at any time during the progress of WORKs, any error appears or arises in the position, orientation, alignment, levels or dimensions or dimensions or any part of the WORKs, the CONTRACTOR shall rectify the error at his own cost to the satisfaction of Purchaser/Customer. The checking of any setting out of any line, level, co-ordinate, depth, orientation or alignment or position of a marker by the Purchaser/Customer shall not in any way relieve the CONTRACTOR of his responsibility for the correctness thereof. CONTRACTOR shall carefully protect and preserve all bench marks, sight rails, pegs and other things used in setting out the WORKs.</p> </div> </div>				
Ref.	Doc			

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9.2.0 Safety Procedures And Restrictions				
<p>The CONTRACTOR shall adhere to the following safety requirements at SITE during execution of WORKs:</p>				
<p>(i) Safety Regulations</p> <p>a) In respect of all labour, directly, or indirectly employed in the WORKs for the performance of CONTRACTOR's part of this agreement, the CONTRACTOR shall at his own expense arrange for all the safety provisions as per safety CODES of CPWD, Indian Standards Institute, The Electricity Act, The Mines Act and such other Acts as applicable.</p> <p>b) The CONTRACTOR shall observe and abide by all fire and safety regulations of the COMPANY before starting construction WORK. CONTRACTOR shall consult with OWNER's Safety ENGINEERs and must make good to the satisfaction of the OWNER</p>				
<p>(ii) General</p> <p>a) No labour below the age of eighteen years shall be employed on the WORK.</p> <p>b) The CONTRACTOR shall not pay less than what is provided under laws to labourers engaged by him on the work.</p> <p>c) The CONTRACTOR shall at his own expense comply with all labour laws and keep the OWNER indemnified in respect thereof.</p>				
<p>(iii) Watching And Lighting</p> <p>The CONTRACTOR shall, in connection with the WORK, provide and maintain at his own cost all lights, guards, fencing, safety equipment, markers and watching when and where necessary or required by the Purchaser/Customer or by any duly constituted authority for the protection of the WORKs or for the safety and convenience of the public or others.</p>				
<p>(iv) Time Span For Responsibility Of Works</p> <p>From the time of commencement of the WORKs till the issuance of a CERTIFICATE OF COMPLETION AND ACCEPTANCE of the WORKs , CONTRACTOR shall be fully responsible for the care of WORKs and of all Temporary WORKs, in case any damage or loss happens to the WORKs or to any part of them or to any Temporary WORKs from any cause whatsoever other than war risks in respect of which insurance cover is not available even with payment of additional premium including damage caused by the CONTRACTOR himself during the execution of the CONTRACT, the CONTRACTOR shall repair and make good the same as his own cost. The CERTIFICATE OF COMPLETION AND ACCEPTANCE will be issued by the Purchaser/Customer only if the WORKs are in good order and conditions and conform in every respect with the requirements of the CONTRACT and OWNER's REPRESENTATIVE's instructions in accordance with the CONTRACT .</p>				
<p>(v) Use Of Owner's Facilities</p> <p>Notwithstanding anything contained elsewhere in the CONTRACT, the CONTRACTOR shall make its own arrangements for all the facilities/resources required to carry out the WORK including but not limited to crane and Material Handling, living accommodation, etc. OWNER's Crane and any other hoists, living accommodation etc. shall not be available for CONTRACTOR's use.</p>				
Ref. Doc.				

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(vi) Compliance Of Local Laws & Regulations

The CONTRACTOR shall comply with all the laws, rules and regulations including but not limited to CONTRACT Labour (REA) Act, Minimum Wages Act etc. and shall keep the OWNER harmless and indemnified for any action brought against it for any violation non-compliance of any of the Acts etc.

9.3.0 Pollution Responsibility

In the performance of any and all services and the WORKs by the CONTRACTOR or his sub-Contractors, the CONTRACTOR shall accept full responsibility for compliance with all applicable laws and governmental orders, rules and regulations as amended/in force from time to time relating to pollution. CONTRACTOR and his sub-contractors shall also comply additional provisions as may be notified to the CONTRACTOR by the OWNER.

The CONTRACTOR agrees to inform himself and his supervisors of such Laws, Orders and Regulations and to make all his employees and the sub-contractors fully cognizant of their responsibilities there under.

The CONTRACTOR shall:-

- i) Clean up and remove any pollution resulting from its non-compliance with the provisions of this section, at his cost and expense
- ii) If the CONTRACTOR fails to do so, the COMPANY may clean up and remove the pollution. In which case the CONTRACTOR shall reimburse the OWNER upon receipt of bill from the OWNER, the cost of such clean up and removal.

10.0.0. VENDOR DOCUMENTATION PROCEDURE

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities	No. of Sets Required- For Site & Customer Submission
1	(a) Drgs, , Data Sheets , Catalogues. BOM etc. (b) PIDs , SLDs, Block-Schematics etc. (wherever applicable)	Adequate Information & essential for proper Technical Evaluation of the Offers. Other Information to be furnished as defined in the applicable Tech Specs.	2 (Addl. Copies Required - wherever Offer Docs. are subject to Review by Customer . See Spec. Requirement)	-	-
2	Terminal Point (s)	List of Scope Terminal Point (s) & Process Datra etc. - wherever applicable.	2 (See also SI-1 above)	-	-



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Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities	No. of Sets Required- For Site & Customer Submission
3	Deviations if any	To be clearly listed, furnishing reasons for non-compliance	2 (See also SI-1 above)	–	–
4	Master Document List (MDL)- (Blank format Attached with this specification)	a) List of all Documents & Drgs., Spares Items etc. which are applicable for the Project . They shall be group wise enlisted in MDL Doc. b) Submission of Up-dated MDL Doc.is required at the time of each submission of Drgs./Doc or group of Drgs. / Docs..	-	3	16
5	Project completion activity “Bar-chart” matching with BHEL Project Schedule	Required for packages & for contracts and also for projects where Erection & Commissioning activities are in vendor scope.	Compliance required to meet BHEL Delivery Sch.	3	16
6	(a) Drgs, , Data Sheets , Catalogues. BOM etc. (b) PIDs , SLDs, Block-Schematics etc. (wherever applicable)	While carrying out Detailed Engg. during Post-Ordering Stage.	-	10	16
7	Information Reg. “INITIAL - FILL” Items & Consumable Items – List - As Required (for each applicable systems)	a) Confirmation from Vendor Required. The Items shall be considered as Part of main scope of supply. b) A Separate Doc. to be furnished with Detail List & Quantity. (Applicable Items & Qty subject to Review during detail Engg.)	a) Supply Confirmation Required from Vendor b) Doc. to be Enlisted in MDL.	10	16
8	SPARES for Erection / Commissioning	a) Informative List required with Technical & Commercial bids. a.1) To consider as Part of main scope of Supply. b) Such Spares List is subject to Review during Detail Engg.	Vendor to Confirm Supply in their Offer.	6	16



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Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities	No. of Sets Required- For Site & Customer Submission
9	“Operation and Maintenance Spares” / “Mandatory Spares” List	a) Recommended List by Vendor b) List with Other Data – if Specified in Tech. Spec.	1) To Enclose with Offer. 2) To indicate price for the listed items in commercial offer & with extended validity	6	16
10	Vendor’s “Bill of Material” Doc. (BOM) -Blank format attached with this specification) This Doc. shall be Enlisted in MDL Doc.	1) The Engg. Part of Information in this Doc. shall be approved by BHEL 2) Submission of this Document is essential during initial Submission stage of Engg. Docs. & the same be progressively Updated as the Detail Engg. progresses. 3) All Dispatchable Units shall be identified in this Doc with “Dispatch Tag-No.” (5 Chr. BHEL Des. No. with 3 Chr. Running Item SI No. - e.g. “Jxxxx / 001” , max. upto 999) 4) The Despatch Tag no. shall be written on an ‘AI- Strip’ and tied to the dispatchable Unit or be prominently painted on each Item with washable paint. PL. NOTE – This Standard Unified System shall be followed being an essential part of Field Quality Assurance Practices & for proper Identification of Items at Site.	-	6	16
11	Quality Assurance Plan (QAP) & Factory Testing Procedure Documents	1) Approval from BHEL required. 2) Submission along with the Engg. Docs.	A) Submission -if already standardized with BHEL / Draft proposal & it may be finalized after Review.	6	4



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Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities	No. of Sets Required- For Site & Customer Submission
			B) Submission compliance from Vendor required		
12	FQAP (Field Quality Assurance Plan) & Site Erection, Testing & Commissioning Procedure documents	1) Approval from BHEL required 2) Submission along with the Engg. Docs.	same as for Sl-11 above	6	4
13	Erection Documents & Drawings:-	1) To contain final MDL, BOM, Handling & Storage Instructions Doc., Initial-Fill & Consumables Items list, Erection & Commissioning Spares List , Operation & Maintenance spares list / Mandatory Spares List etc. 2) Submission minimum 6 – weeks before eqpt. schedule dispatch. 3) The drgs. shall be kept in plastic pouches and neatly arranged, submitted in an aesthetic, appropriate & durable folder(s). Documents filed appropriately in Folder in – seriatim of MDL.	-	-	16

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	Sl. No.	Document Name / Type	To Contain	Compliances from Vendor & No. of Sets Req'd.	No. of Sets Required – Engg. & Approval /Review Activities	No. of Sets Required- For Site & Customer Submission
	14	O&M Manual Document Folder(s)	<p>1) Submission 1-month before schedule eqpt. dispatch (Draft copy shall be submitted beforehand for review by BHEL)</p> <p>2) The manual shall be submitted in an aesthetic, appropriate & durable folder(s). Each vol. shall be marked with its Vol. No.</p> <p>3) <u>This Manual shall include primarily following information:</u></p> <p>i) Operational & safety instructions.</p> <p>ii) Environmental Safety instructions & indicating compliances of the Regulations in-force.</p> <p>iii) Guidelines incorporating requirements for Operation of the Equipment in Hazardous Environment- wherever applicable.</p> <p>iv) Master document List (MDL) doc.</p> <p>v) Bill of material (BOM) doc.</p> <p>vi) Erection Instructions.</p> <p>vii) Operational & Maintenance s / Items with adequate etc., Catalogue information Model no. marked therein),</p> <p>viii) Lubrication Schedule</p> <p>ix) Initial-Fill Items List</p> <p>x) Approved QAP's Shop Tests & Calibration Reports.</p> <p>x) Approved FQAP - along with related docs. , with site testing & commissioning Protocols etc.</p>	-	Adv. Copy (2 sets)- for review by BHEL	Final Copies – (16 sets)
15	“As –Built” Drawings & Documents	Submission within three weeks -after commissioning at site	-	-	16	
Ref. Doc.						

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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.						<table border="1"> <thead> <tr> <th rowspan="2">Sl. No.</th> <th rowspan="2">Document Name / Type</th> <th rowspan="2">To Contain</th> <th>Required With Offer</th> <th colspan="2">Required After P.O</th> </tr> <tr> <th>Compliances from Vendor & No. of Sets Reqd.</th> <th>No. of Sets Required – Engg. & Approval /Review Activities</th> <th>No. of Sets Required- For Site & Customer Submission</th> </tr> </thead> <tbody> <tr> <td>16</td> <td>Compact Disc (CD)</td> <td> 1) MDL, All drawings, Documents, Data sheets – as Listed in Approved MDL Doc. , all applicable Catalogues (Scanned), BOM & all items covered in the O&M Manuals & the “As-built” Drgs. 2) To submit along with the submission of “As-built” drgs. & docs. </td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">3</td> </tr> </tbody> </table>	Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O		Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities	No. of Sets Required- For Site & Customer Submission	16	Compact Disc (CD)	1) MDL, All drawings, Documents, Data sheets – as Listed in Approved MDL Doc. , all applicable Catalogues (Scanned), BOM & all items covered in the O&M Manuals & the “As-built” Drgs. 2) To submit along with the submission of “As-built” drgs. & docs.	-	-	3
Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O																	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities	No. of Sets Required- For Site & Customer Submission																
16	Compact Disc (CD)	1) MDL, All drawings, Documents, Data sheets – as Listed in Approved MDL Doc. , all applicable Catalogues (Scanned), BOM & all items covered in the O&M Manuals & the “As-built” Drgs. 2) To submit along with the submission of “As-built” drgs. & docs.	-	-	3																
<p>Notes:</p> <p>10.1.0 BHEL will furnish their approvals / comments within 15 days after submission of drawings/ documents.</p> <p>10.2.0 The O&M manuals shall contain the following details as minimum in addition to those indicated in the above table:-</p> <ul style="list-style-type: none"> ➤ Identification details of the equipment like BHEL PO NO., Vendor’s SI. No., Vendors contact address with tel., fax details. ➤ Description of the equipment. ➤ Final Data sheets and Drawings of the equipment as per the list mentioned in this specification. ➤ O&M Manuals of the equipment. ➤ Recommended 2 years operational spares. ➤ Test reports. <p>10.3.0 The erection documentation shall consist of</p> <ul style="list-style-type: none"> ➤ All drawings/documents, ➤ All such drawings/documents, not submitted for review, but essential for erection/ commissioning, e.g. cooling plan, flushing plan, assembly drawings, etc. ➤ Master document list ➤ Site dispatchable B.O.M. ➤ Any special safety/erection/commissioning requirements, vendor would like to specify. <p>10.4.0 For drawings, data, sheets and all graphic works Auto Cad release 2006 or later versions and for all texts, MS Word 2000 shall only be used.</p>																					
Ref.	Doc.																				

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<div style="display: flex; justify-content: space-between;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: small;"> <p>COPYRIGHT AND CONFIDENTIAL</p> <p>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.</p> </div> <div style="flex-grow: 1;"> <p>11.0.0. Deviations from the specification:</p> <ul style="list-style-type: none"> a) Bidders shall comply with various requirements of this specification. Bidders to bring out only those deviations which are impractical to meet, (or) not advisable as per the experience of bidder, for our review. as part of their 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. <p>12.0.0. GENERAL:</p> <p>Even though, the requirements are specified in detail to the extent possible, bidder to apply good engineering practices in the design, selection of equipment, dispatch of the system, wherever same is not clearly spelt out.</p> <p>Compliance with this specification shall not relieve bidder of the responsibility of furnishing material and workmanship to meet the specified conditions. Accordingly, bidder to furnish their comments if any on this specification in their offer.</p> <p>13.0.0. PROPOSAL EXHIBIT SHEETS</p> <p>Instructions to Bidder for submitting technical proposal:</p> <p>13.1 The bidder may provide technical proposal as per his convenience. However, following things are to be ensured:</p> <p style="padding-left: 40px;">A list of deviations or exceptions, if any, to technical specification PY51199, Job Specification and the enclosures including reference documents as attached shall be provided as per Annexure-I V</p> <p style="padding-left: 40px;">It is hereby informed that only those deviations which are listed by the bidder in Annexure-IV and subsequently accepted by BHEL will be considered for evaluation of the bid and for finalisation of the order. No other deviations or exceptions even if mentioned elsewhere will be considered for any technical/ commercial evaluation or for ordering.</p> <p style="padding-left: 40px;">Bidder will need to sign Annexure- IV specifically endorsing the above understanding.</p> <p>13.2 Guarantees</p> <p style="padding-left: 40px;">Guarantees envisaged for the project are to be separately furnished as per Job Specification. These guarantees shall form contract guarantees to be demonstrated through an Approved performance test after the completion of the Water Treatment Plant. The schedule shall be finalized during the contract execution stage.</p> <p>13.3 Special Tools & Tackles</p> <p style="padding-left: 40px;">Bidder to confirm the supply of Special Tools and Tackles as per Annexure- III furnishing model nos./Types.</p> </div> </div>				
Ref. Doc				

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<u>ANNEXURE – I</u>				
<u>KEY INFORMATION</u>				
<p>1.00.00 Name of the Bidding Company :</p> <p>2.00.00 Registered in (mention the name of the Country) :</p> <p>3.00.00 Name, designation, telex & telephone number and postal address of responsible officer of Bidder to whom all reference shall be made for expeditious coordination. :</p> <p>4.00.00 Name, designation, telex & telephone number and postal address of responsible officer of Indian Agent. :</p> <p>5.00.00 Bidder's proposal number :</p> <p>6.00.00 Bidder's proposal date :</p> <p>7.00.00 Validity of offer, counted from the date of opening of bid :</p> <p>8.00.00 Guaranteed completion period, counted from date of issuance of LOI/TOI :</p> <p>9.00.00 Confirm that Scope of supply and services are exactly as per specification requirement. : Yes/No</p> <p>10.00.00 Confirm Technical Compliance with Specification : Yes/No</p> <p>11.00.00 Confirm that Guarantees are as per Job Specification : Yes/No</p> <p>12.00.00 Confirm that List of Recommended Spares has been furnished as per Annexure-II : Yes/No</p> <p>13.00.00 Confirm that List of Special Tools & Tackles has been furnished as per Annexure-III : Yes/No</p> <p>14.00.0 Confirm that deviations ,if applicable, have been furnished as per Annexure-IV : Yes/No</p> <p style="text-align: center;">Signature of Bidder's Authorized representative .with date.....</p> <p style="text-align: center;">Date.....</p>				
Ref. Doc				

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ANNEXURE – II

LIST OF RECOMMENDED SPARE PARTS

Bidder shall tabulate in the proforma below list of all spare parts as recommended by the respective manufacturer for regular, reliable operation. In case the Bidder has to add any other relevant information, the same shall be indicated herein. Continuation sheets of like size and format may be used as per Bidder's requirements.

Sl. No	Description	Quantity	Unit Price	Total Price	Delivery Period	Remarks

ANNEXURE -III

SPECIAL TOOLS AND TACKLES

Bidder shall list the tools and tackles required for operation, maintenance and replacement of equipment and component and being supplied under the specification.

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Sl.No.	Description	Quantity	Remarks
a			
b			
c			
d			

Ref.
Doc.

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ANNEXURE – IV

DEVIATION FROM SPECIFICATION

If the proposal submitted has got any deviation from the technical stipulations in the bidding document, the Bidder shall tabulate below the full particulars of such deviations and shall sign below. Additional sheets may be enclosed, if necessary. Deviation is to be furnished with mention of specific clause numbers. Technical and commercial deviations to scope of supply and services, shall be indicated separately. Bidders shall bring put only those deviations which are impractical to meet (or) not advisable

Sl.No	CLAUSE NO.	DESCRIPTION AS PER SPECIFICATION	DEVIATION BY BIDDER

We confirm that all the deviations/exceptions to the Technical Specification PY51084, Job Specification and enclosures including reference documents attached are listed in this Annexure only. No other deviations or exceptions even if mentioned elsewhere shall be considered for any technical/ commercial evaluation or for ordering.

Signature of Bidder's
 Authorized representative .with date.....

Date

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PRODUCT STANDARD
BHEL, HYDERABAD -32.
PROJECT ENGINEERING – MECHANICAL

VARIANT TABLE

Var. No	Item	Chlorinati on system	Acid Dosing	Biocide dosing	Anti-scalant Dosing	Matl. Code	Ref. docs /drqs
01	Cooling Water Treatment Chemicals	Yes	Yes	yes	yes	PY975108401	PEMC-(MRPL-III)
02	Supply of Cooling water Treatment system	No	Yes	Yes	Yes		ONGC Hazira 1 x 51 MW CCPP
03	E&C for CW Treatment System						
04	Supply of cooling water treatment sys.	Yes	Yes	yes	yes	PY9751084059	TATA STEEL 1X 40MW STG
05	E&C for cooling water treatment system					PY9851084069	



Form No.

BHARAT HEAVY ELECTRICALS LIMITED
RC PURAM, HYDERABAD - 32
PROJECT ENGINEERING & SYSTEMS DIVISION

Annexure P
of PEMC-06861

Rev No. 00

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PRICE BID FORMAT

L. NO	DESCRIPTION	QTY.	UNIT PRICE (Rs)	TOTAL PRICE (Rs)
1.0	DESIGN, ENGINEERING, MANUFACTURE, SUPPLY AND ERECTION & COMMISSIONING			
1.1	Design, Engineering, Manufacture, Supply, Erection and commissioning (Trial run and Performance Testing) & All the Chemicals and Consumables required for erection, start up, commissioning and test) of the CW treatment system as per BHEL specification PEMC-06861 and its enclosures	1		
1.2	Special Tools & Tackles	1 set		
1.3	Commissioning and erection spares [Item wise list of commissioning and erection spares with unit rate and quantity for sl. 1.1 above to be furnished by bidder)	1 set		
2.0	CHEMICALS REQUIRED FOR FULL LOAD 24 HOURS PER DAY FOR EACH DOSING SYSTEM			
2.1	Acid (H ₂ SO ₄)	3 months of operation		
2.2	Biocide			
2.3	Corrosion inhibitor			
2.4	Scale inhibitor			
2.5	Sodium Hypochlorite (NaOCl)			
	Total Price			
3.0	Optional Price for following spares:			
	Safety and Relief Valves			
1	Bonnet Gasket	One (1) no. for each type of valve		
2	Disc & Stem assembly	One (1) set for every type and size of valves required		
	Globe/ Gate/ Check/ Safety valves			

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Form No.

**BHARAT HEAVY ELECTRICALS LIMITED
RC PURAM, HYDERABAD - 32
PROJECT ENGINEERING & SYSTEMS DIVISION**

**Annexure P
of PEMC-06861**

Rev No. 00

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3	50 NB below size Valves	2% of the total population subject to Minimum 1 no, for each type size, material, grade and class.		
4	65 NB and above size valves (for each type, size material grade and class valve)			
4.1	Valve Stem	1 no. for every similar Set of 5 valves subject to min. 1 no.		
4.2	Valve Disc /Wedge	1 no. for every similar Set of 5 valves subject to min. 1 no.		
4.3	Valve Bonnet Gasket	1 no. for every similar Set of 2 valves subject to min. 1 no.		
4.4	Valve Pressure Sealing Ring	1 no. for each valve		
4.5	Yoke Bush	1 no. for every similar Set of 5 valves subject to min. 1 no.		
4.6	Spring for Safety Valve	1 no. for each safety valve		
4.7	Stem & Disc Assembly for Safety Valve	1 no. for each safety valve		
	Piping and insulation spares			
5	50 NB and below Size Piping	Pipe and fittings 5% of the total quantity for each size and material grade.		
6	65 NB and above Size Pipe	Pipe 5% of the total quantity or 2 meter, whichever is higher for each size and material grade.		

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Form No.

**BHARAT HEAVY ELECTRICALS LIMITED
RC PURAM, HYDERABAD - 32
PROJECT ENGINEERING & SYSTEMS DIVISION**

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Optional Price: 2 years Recommended Spares along with their quantities and unit rate for normal trouble free operation of the system described in Sl. No. 1.1 above based on bidders' experience.
[List for recommended spares and it's unit rate to be furnished by bidder)

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. Any additional claim after placement of order will not be entertained under any circumstances.
3. Offer will be evaluated based on total price for Supply and Erection & commissioning and Supply of Chemicals (i.e. Sl. No. 1 + Sl. No. 2 of price format).
4. Bidders have to quote for optional items compulsorily. Failing to do so shall disqualify the vendor for this tender and their offer will not be considered for Price evaluation.
5. Based on Project requirement, Optional price for Sl. No. 3 (Supply of Mandatory Spares) quoted by Bidder shall be considered for Bid evaluation. This shall be intimated to Bidders before Price bid opening.
6. For purpose of ordering of complete CW treatment system by BHEL, the prices of all Supply and E&C portions shall be considered as follows:
 - i) For Supply of complete System including Chemicals:
Shall be 85 % of the Total Price quoted by the bidder for complete CW Treatment System as per Sl. no 1 of price bid format plus Price quoted by the bidder for Supply of Chemicals as per Sl. no 2 of price bid format.
i.e. Total Price for the Supply shall be considered as $(0.85 \times \text{Sl. No. 1}) + \text{Sl. 2}$.
 - ii) For Erection & commissioning Services :
Shall be 15% of the Total Prices quoted by the bidder for complete System as per Sl. No. 1 of price bid format.
i.e. Total Price for E & C Services shall be considered as $(0.15 \times \text{Sl.no. 1})$.
7. Separate Purchase Orders will be issued for Supply portion and for Erection & Commissioning works of this project. The Purchase Order for Supply portion will be issued by BHEL-PE&SD whereas the Purchase Order for E&C portion will be issued by BHEL-PSER (BHEL's Construction Management Division)
8. Bidder to quote the base rates only. All Applicable taxes and duties to be indicated shall be indicated separately for the Supply Portion and Erection & Commissioning Portion as follows:
 - i) All Applicable Taxes and duties for Supply of Main Items shall be computed for the value of $0.85 \times \text{Sl. No. 1}$.
 - ii) All Applicable Taxes and duties for Erection & commissioning Part shall be computed for the value of $0.15 \times \text{Sl. No.1}$.

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- iii) All Applicable Taxes and duties for Supply of Chemicals shall be computed for the value of Sl. No. 2.
- 9. Bidder to quote separately, in an identical format, 2 years operational spares item wise with recommended quantity and unit rate. However ordering of the same shall be at the sole discretion of BHEL.

BIDDER'S SIGNATURE
 NAME:
 DATE:
 COMPANY SEAL.

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SPECIFICATION.NO. TCE.7742B-C-540-001	TATA CONSULTING ENGINEERS LIMITED	SECTION: B
	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR PROJECT INFORMATION	SHEET 1 OF 3

Tata Steel Limited (TSL) planned to set up new coke oven batteries (COB), COB 10 and 11 to meet the coke requirement of the steel plant at Jamshedpur. Initially wet quenching of hot coke was envisaged. As coke wet quenching is not much environment friendly dry quenching of coke was planned for COB 10 and 11 in addition to wet quenching facilities originally provided. Coke Dry Quenching (CDQ) facility includes boiler which is known as CDQ Boiler. This is actually a waste heat recovery boiler. For COB 10 and 11 there will be two CDQ boilers, CDQ 10 and 11. Each CDQ boiler shall have the steaming capacity of around 60 TPH. Additional 25 TPH steam shall be sourced from CDQ 5/6/7 boiler and shall be mixed with CDQ 10/11 HP team header. By mixing 25 TPH (max) additional HP steam, total (120+25) 145 TPH HP steam can be transported to CDQ 10, 11 power plant steam turbine, having power generation potential of around 40 MW.

Climatic conditions / Data relevant to site:

Project Information

1. General

1.0	Client	Tata Steel Ltd, Jamshedpur Works
2.0	Project title	Coke Dry Quenching Plant for Coke Oven Battery No. 10, & 11
3.0	Location	Tata Steel Works – Jamshedpur
4.0	Altitude from mean sea level	129 M
5.0	Nearest railway station	Tatanagar, (South Eastern Railway)
6.0	Nearest airport	Kolkata
7.0	Nearest port	Haldia / Diamond harbour
8.0	Major road access in the vicinity	National highway NH-33 which branches off from the national highway NH-6 connecting Kolkata with Mumbai
9.0	Air Temperatures	
	Ambient air Temperatures	33.3 °C
	Max. of mean daily temp.	47.2 °C
	Min. of mean daily temp.	20.7 °C
	Absolute min. temp.	3.9 °C
	Max. wet bulb temp.	28.9 °C

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SPECIFICATION.NO. TCE.7742B-C-540-001	TATA CONSULTING ENGINEERS LIMITED	SECTION: B
	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR PROJECT INFORMATION	SHEET 2 OF 3

10.0	Relative humidity	
	Maximum	84%
	Minimum	24%
	Average	53%
11.0	Wind Data	
	Max. wind speed	160 Km/hr
	Max.mean monthly wind speed	5.4 Km/hr
	Wind direction	Predominantly from west in winter and from east in summer
12.0	Seismic data	
	As per IS:1893-2002, Zone-II.	

2. Electrical

A. 33 kV level

Voltage	33 kV
Variation	+ 10% , -15%
Frequency	50 Hz
Variation	+/- 6%
Combined variation of voltage & frequency	10% (absolute)
Design fault level	31.5 kA

B. 6.6 kV level

Voltage	6.6 kV
Variation	+ 10%, -15%
Frequency	50 Hz
Variation	+/- 6%
Combined variation of voltage & frequency	+/-10% (absolute)
Design fault level	40 kA

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SPECIFICATION.NO.

TATA CONSULTING ENGINEERS LIMITED

SECTION: B

TCE.7742B-C-540-001

1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11
TATA STEEL LIMITED, JAMSHEDPUR
PROJECT INFORMATION

SHEET 3 OF 3

C. 415 V level

Voltage	415 V
Variation	+ 10%, -15%
Frequency	50 Hz
Variation	+/- 6%
Combined variation of voltage &	+/-10%
Design fault level	50 kA

3. Power supply

- 240V 50 Hz for lighting distribution/sockets-utility distribution.
- 110V AC for control voltage.
- 220V DC for control voltage within the switchgear.

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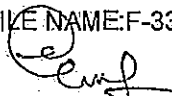
	TATA CONSULTING ENGINEERS LIMITED	SECTION: D
ENQUIRY NO. TCE.7742B-C-540-001	DATA SHEET - A15 WATER ANALYSIS	SHEET 1 OF 1

WATER ANALYSIS

Clarified Water

Sl. No.	Parameters	Quality
1	Turbidity (NTU)	11-15
2	pH	7.6 -8.0
3	TDS (mg/l)	160
4	Total Hardness(mg/l)	84-98
5	Chloride (mg/l)	6.2 - 9.0
6	Alkalinity as CaCO ₃	78-86
7	Aluminium (mg/l)	0.03-0.06
8	Iron (mg/l)	0.04 -0.07
9	Calcium concentration	< 50 mg/l

REV. NO.	R0	R1			JOB NO.	CLIENT: TATA STEEL LIMITED	
PPD. BY.	PC	PC/SG			TCE.774 2B		
CHD. BY	RM	RM				PROJECT: 1x 40 MW POWER CAPTIVE PLANT FOR CDQ 10&11	ISSUE R1
DATE	APR-2015	DEC-2015				TATA STEEL LIMITED JAMSHEDPUR	






ANNEXURE - 5

SPECIFICATION. NO. TCE.7742B-C-540-001	TATA CONSULTING ENGINEERS LIMITED 1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 TATA STEEL LIMITED, JAMSHEDPUR CIRCULATING WATER TREATMENT AND SIDE STREAM FILTRATION SYSTEM	SECTION: C27 SHEET 20 OF 26
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SODIUM HYPOCHLORITE STORAGE TANK	
Quantity	One(1) no.
Description for each tank	
Type	Vertical cylindrical with dished ends.
Type of fluid to be handled	Commercial Sodium Hypochlorite Solution
Total Capacity, in m3	Total effective capacity of the tank will be adequate to hold the quantity required for Seven (7) days operation of 30 MW Unit at full load.
Minimum Free Board, in mm	300
Design pressure	Atmospheric
Design code	As per Contract
Size	CONTRACTOR to indicate
MOC	Poly Ethylene / FRP (Biphenyl/Vinyl ester based)
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Contract and Drawings, enclosed with it.
SODIUM HYPOCHLORITE DOSING PUMP	
Number	Two (2) [One (1) no. to be under operation and other as standby]
Description for each Pump	
Type of Pump	Positive displacement, constant speed and plunger operated reciprocating type.
Location	Indoor
Fluid to be handled	Commercial Scale Inhibitor Solution.
Service	To inject Sodium Hypochlorite Solution into CW common sump.
Duty	Continuous and to be suitable for parallel operation.
Suction Condition	Flooded
Capacity	CONTRACTOR to indicate
Head	CONTRACTOR to indicate.
Facility for Capacity Adjustment	Local manual through Micrometer Dial
Range of capacity Adjustment	0% - 100%
MOC	Casing & Plunger in cast Steel WCB, shaft in SS 304
Type of drive	Electrical Motor
Rated speed (RPM)	1500 (Sync.) maximum
Noise level (for complete set of Pump & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of motor)
Painting for complete set of Pump & Motor	
a) Primer	As per the requirements of Painting Contract.
b) Finish paint	As per the requirements of Painting Contract.
c) Shade	As approved by Purchaser.

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SPECIFICATION. NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION: C27
TCE.7742B-C-540-001	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 TATA STEEL LIMITED, JAMSHEDPUR CIRCULATING WATER TREATMENT AND SIDE STREAM FILTRATION SYSTEM	SHEET 21 OF 26

Tests and Inspection	
Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
Hydro-test	As per IS-1520 and IS-5120.
Dynamic Balancing Test	To be provided
Performance Test	Required as per Bid Contract
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Contract and Drawings, enclosed with it.
Accessories to be provided	
a) Pulsation Dampener	To be provided.
b) Pressure Relief Valve	To be provided.
SCALE INHIBITOR DOSING TANK	
Numbers To be provided	One (1)
Description for each Tank	
Type	Vertical cylindrical with dished bottom.
Type of fluid to be handled	Commercial Scale Inhibitor Solution.
Effective Capacity, in m3	Total effective capacity will be adequate to hold the quantity required for one (1) Day operation of 30 MW Unit at full load.
Minimum Free Board, in mm	300
Size	CONTRACTOR to indicate.
Design code	As per Contract
MOC	FRP
Agitator	
a) Number	One (1) no.
b) Material of Construction	SS-316
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Contract and Drawings, enclosed with it.
SCALE INHIBITOR DOSING PUMP	
Number	Two (2) [One (1) no. to be under operation and other as standby]
Description for each Pump	
Type of Pump	Positive displacement, constant speed and plunger operated reciprocating type.
Location	Indoor
Fluid to be handled	Commercial Scale Inhibitor Solution.
Service	To inject Scale Inhibitor Solution into CW common sump.
Duty	Continuous and to be suitable for parallel operation.
Suction Condition	Flooded
Capacity	CONTRACTOR to indicate
Head	CONTRACTOR to indicate.

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SPECIFICATION. NO. TCE.7742B-C-540-001	TATA CONSULTING ENGINEERS LIMITED	SECTION: C27
	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 TATA STEEL LIMITED, JAMSHEDPUR CIRCULATING WATER TREATMENT AND SIDE STREAM FILTRATION SYSTEM	SHEET 22 OF 26

Facility for Capacity Adjustment	Local manual through Micrometer Dial
Range of capacity Adjustment	0% - 100%
MOC	Casing & Plunger in cast Steel WCB, shaft in SS 304
Type of drive	Electrical Motor
Rated speed (RPM)	1500 (Sync.) maximum
Noise level (for complete set of Pump & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of motor)
Painting for complete set of Pump & Motor	
a) Primer	As per the requirements of Painting Contract.
b) Finish paint	As per the requirements of Painting Contract.
c) Shade	As approved by Purchaser.
Tests and Inspection	
Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
Hydro-test	As per IS-1520 and IS-5120.
Dynamic Balancing Test	To be provided
Performance Test	Required as per Contract
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Contract and Drawings, enclosed with it.
Accessories to be provided	
a) Pulsation Dampener	To be provided.
b) Pressure Relief Valve	To be provided.
CORROSION INHIBITOR DOSING TANK	
Numbers To be provided	One (1)
Description for each Tank	
Type	Vertical cylindrical with dished bottom.
Type of fluid to be handled	Commercial Corrosion Inhibitor Solution.
Effective Capacity, in m3	Total effective capacity will be adequate to hold the quantity required for one (1) Day operation of 30 MW Unit at full load.
Minimum Free Board, in mm	300
Size	CONTRACTOR to indicate.
Design code	As per Bid Contract
MOC	FRP
Agitator	
c) Number	One (1) no.
d) Material of Construction	SS-316
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Bid Contract and Drawings, enclosed with it.
CORROSION INHIBITOR DOSING PUMP	

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SPECIFICATION. NO. TCE.7742B-C-540-001	TATA CONSULTING ENGINEERS LIMITED	SECTION: C27
	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 TATA STEEL LIMITED, JAMSHEDPUR CIRCULATING WATER TREATMENT AND SIDE STREAM FILTRATION SYSTEM	SHEET 23 OF 26

Number	Two (2) [One (1) no. to be under operation and other as standby]
Description for each Pump	
Type of Pump	Positive displacement, constant speed and plunger operated reciprocating type.
Location	Indoor
Fluid to be handled	Commercial Corrosion Inhibitor Solution.
Service	To inject Corrosion Inhibitor Solution into CW common sump
Duty	Continuous and to be suitable for parallel operation.
Suction Condition	Flooded
Capacity	CONTRACTOR to indicate.
Head	CONTRACTOR to indicate.
Facility for Capacity Adjustment	Local manual through Micrometer Dial
Range of capacity Adjustment	0% - 100%
MOC	Casing & Plunger in cast Steel WCB, shaft in SS 304
Type of drive	Electrical Motor
Rated speed (RPM)	1500 (Sync.) maximum
Noise level (for complete set of Pump & Motor)	Not more than 85 db. (At a distance of 1.0 m from the outer surface of motor)
Painting for complete set of Pump & Motor	
a) Primer	As per the requirements of Painting Contract.
b) Finish paint	As per the requirements of Painting Contract.
c) Shade	As approved by Purchaser.
Tests and Inspection	
Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
Hydro-test	As per IS-1520 and IS-5120.
Dynamic Balancing Test	To be provided
Performance Test	Required as per Contract
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Contract and Drawings, enclosed with it.
Accessories to be provided	
a) Pulsation Dampener	To be provided.
b) Pressure Relief Valve	To be provided.
BIO-DISPERSANT DOSING TANK	
Numbers To be provided	One (1)
Description for each Tank	
Type	Vertical cylindrical with dished bottom.
Type of fluid to be handled	Commercial Bio- dispersant Solution.

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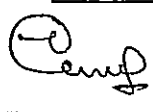
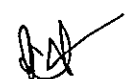


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SPECIFICATION. NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION: C27
TCE.7742B-C-540-001	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 TATA STEEL LIMITED, JAMSHEDPUR CIRCULATING WATER TREATMENT AND SIDE STREAM FILTRATION SYSTEM	SHEET 24 OF 26

Effective Capacity, in m3	Total effective capacity will be adequate to hold the quantity required for one (1) Day operation of 30 MW Unit at full load.
Minimum Free Board, in mm	300
Size	CONTRACTOR to indicate.
Design code	As per Contract
MOC	FRP
Agitator	
e) Number	One (1) no.
f) Material of Construction	SS-316
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Contract and Drawings, enclosed with it.
BIO-DISPERSANT DOSING PUMP	
Number	Two (2) [One (1) no. to be under operation and other as standby]
Description for each Pump	
Type of Pump	Positive displacement, constant speed and plunger operated reciprocating type.
Location	Indoor
Fluid to be handled	Commercial Bio- Dispersant Solution.
Service	To inject Bio- Dispersant solution into CW common sump.
Duty	Continuous and to be suitable for parallel operation.
Suction Condition	Flooded
Capacity	CONTRACTOR to indicate
Head	CONTRACTOR to indicate.
Facility for Capacity Adjustment	Local manual through Micrometer Dial
Range of capacity Adjustment	0% - 100%
MOC	Casing & Plunger in cast Steel WCB, shaft in SS 304
Type of drive	Electrical Motor
Rated speed (RPM)	1500 (Sync.) maximum
Noise level (for complete set of Pump & Motor)	Not more that 85 db (At a distance of 1.0 m from the outer surface of motor)
Painting for complete set of Pump & Motor	
a) Primer	As per the requirements of Painting Contract.
b) Finish paint	As per the requirements of Painting Contract.
c) Shade	As approved by Purchaser.
Tests and Inspection	
Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
Hydro-test	As per IS-1520 and IS-5120.
Dynamic Balancing Test	To be provided





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SPECIFICATION. NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION: C27
TCE.7742B-C-540-001	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 TATA STEEL LIMITED, JAMSHEDPUR CIRCULATING WATER TREATMENT AND SIDE STREAM FILTRATION SYSTEM	SHEET 25 OF 26

Performance Test	Required as per Contract
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Contract and Drawings, enclosed with it.
Accessories to be provided	
a) Pulsation Dampener	To be provided.
b) Pressure Relief Valve	To be provided.
BULK SULPHURIC ACID STORAGE TANK	
Quantity	One(1) no.
Description for each tank	
Type	Horizontal cylindrical with dished ends.
Type of fluid to be handled	98% Sulphuric Acid.
Total Capacity, in m3	15
Minimum Free Board, in mm	300
Design pressure	Atmospheric
Design code	As per Contract
Size	CONTRACTOR to indicate
MOC	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
Painting	Will be as per Contract.
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Contract and Drawings, enclosed with it.
SULPHURIC ACID DAY TANKS	
Numbers To be provided	One (1)
Description for each Tank	
Type	Vertical cylindrical with dished bottom.
Type of fluid to be handled	98% w/w Sulphuric Acid.
Effective Capacity, in m3	Total effective capacity will be adequate to hold the quantity required for one (1) Day operation of 30 MW Unit at full load.
Minimum Free Board, in mm	300
Size	CONTRACTOR to indicate.
Design code	As per Contract
MOC	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Contract and Drawings, enclosed with it.
SULPHURIC ACID DOSING PUMPS	
Number	Two (2) [One (1) no. to be under operation and other as standby]
Description for each Pump	
Type of Pump	Positive displacement, constant speed and plunger operated reciprocating type.
Location	Indoor
Fluid to be handled	98% w/w Concentrated Sulphuric Acid.

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SPECIFICATION. NO. TCE.7742B-C-540-001	TATA CONSULTING ENGINEERS LIMITED	SECTION: C27
	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 TATA STEEL LIMITED, JAMSHEDPUR CIRCULATING WATER TREATMENT AND SIDE STREAM FILTRATION SYSTEM	SHEET 26 OF 26

Service	To inject Concentrated Sulphuric Acid into CW common sump
Duty	Continuous and to be suitable for parallel operation.
Suction Condition	Flooded
Capacity	CONTRACTOR to indicate.
Head	CONTRACTOR to indicate.
Facility for Capacity Adjustment	Local manual through Micrometer Dial and remote from Control Panel
Range of capacity Adjustment	0% - 100%
MOC	Alloy-20.
Type of drive	Electrical Motor
Rated speed (RPM)	1500 (Sync.) maximum
Noise level (for complete set of Pump & Motor)	Not more that 85 db (At a distance of 1.0 m from the outer surface of motor)
Painting for complete set of Pump & Motor	
a) Primer	As per the requirements of Painting Contract.
b) Finish paint	As per the requirements of Painting Contract.
c) Shade	As approved by Purchaser.
Tests and Inspection:	
Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
Hydro-test	As per IS-1520 and IS-5120.
Dynamic Balancing Test	To be provided.
Performance Test	Required as per Contract
Instruments along with alarms, interlocks and accessories	To be provided as per the requirements of the Contract and Drawings, enclosed with it.
Accessories to be provided	
a) Pulsation Dampener	To be provided.
b) Pressure Relief Valve	To be provided.

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SPECIFICATION NO	TATA CONSULTING ENGINEERS LIMITED	SECTION : C7
TCE.7742B-C-540-001	1X 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR STEAM TURBINE GENERATOR AND AUXILIARIES ELECTRICAL DESIGN REQUIREMENTS	SHEET 92 OF 126

7.13 MOTORS & ACTUATOR

7.13.1 DESIGN CRITERIA

7.13.1.1 MOTORS

- (a) All AC motors will be squirrel cage three / single phase induction motors. Lifts / Crane motors may be of slip ring type. DC motor will generally be of shunt / compound wound type rated for 220V DC. All motors will be rated for continuous duty. Lifts / Crane motors will be rated for intermittent duty. Inching type motors as per the requirement will be provided.
- (b) All motors will be suitable for an ambient temperature of 50 deg C and relative humidity of 95%. The motors will be suitable for operation in a highly polluted environment.
- (c) AC Motors will be of constant speed, squirrel cage, three/ single phase, induction type. Motors will be rated for continuous duty. They will also be suitable for long period of inactivity.
- (d) DC motors provided for emergency service will be shunt / compound wound type. Motor will be sized for operation with fixed resistance starter for maximum reliability.
- (e) All motors will be designed to withstand 120% of rated speed without any mechanical damage for two (2) minutes.
- (f) Maximum continuous motor ratings will be at least 15% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.
- (g) Motors will be capable of developing the rated full load torque even if the supply voltage drops to 70% of the rated voltage. Pull out torque at rated voltage will not be less than 205% of full load torque. It will be 275% for crane duty motors.
- (h) The motors will be suitable for bus transfer schemes provided on the 6.6KV, and 415V systems without any injurious effect on its life. If motors are connected to an automatic bus transfer system, they may be subjected to 150% of the nominal voltage during changeover of buses due to the phase difference between the incoming voltage and motor residual voltage. In such cases, Motors will be capable of restarting under full load after momentary loss of voltage.
- (i) Motors will be of energy efficient of type IE2 as per IS: 12615/equivalent IEC/ International Standards.

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ISSUE
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SPECIFICATION NO TCE.7742B-C-540-001	TATA CONSULTING ENGINEERS LIMITED	SECTION : C7
	1X 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR STEAM TURBINE GENERATOR AND AUXILIARIES ELECTRICAL DESIGN REQUIREMENTS	SHEET 93 OF 126

- (j) Motor will be designed to keep torsional and rotational natural frequencies of vibration of the motor and driven equipment atleast 25% above the motor operating speed range.
- (k) The motor rating will be at least 10% over the maximum input power requirement of the driven equipment at rated point. Continuously operating motors will be of high efficiency type.
- (l) The voltage rating for AC motors will be as follows :
 - (i) Below 0.18 kW : 240V, single phase
 - (ii) From 0.18 kW up to including 200kW : 415V, 3 phase
 - (iii) Above 200 kW : 6.6kV, 3 phase
- (m) Squirrel cage induction motors will be designed for direct on line starting unless specified otherwise in datasheet-A. The locked rotor current / starting current of the motors will not exceed the following values which are inclusive of 20% tolerance.
 - (i) 600% of full load current for motors upto and including 1500 kW.
 - (ii) 450% of full load current for motors above 1500 kW
- (n) The starting current for DC motors will be limited to 200% of full load current. DC Motors will be suitable for operation with fixed resistance starter for maximum reliability.
- (o) The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between incoming voltage and motor residual voltage.
- (p) Motor enclosures will conform to the degree of protection IP-54 (indoor) and IPW-55 (outdoors). For hazardous areas, approved type of flameproof and increased safety enclosure will be provided.
- (q) For HT motors, the locked rotor withstand time under hot conditions at 110% rated voltage will be more than the starting time at minimum permissible voltage by at least three seconds or 15% of the accelerating time whichever is greater. Provision of speed switch will be avoided to the extent possible. In case the speed switch is required, it will be indicated out by the CONTRACTOR in his offer.
- (r) Pump motor subject to reverse rotation will be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 50% rated speed in reverse direction.

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ISSUE
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SPECIFICATION NO TCE.7742B-C-540-001	TATA CONSULTING ENGINEERS LIMITED	SECTION : C7
	1X 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR STEAM TURBINE GENERATOR AND AUXILIARIES ELECTRICAL DESIGN REQUIREMENTS	SHEET 94 OF 126

- (s) The motors will generally be of self-ventilated type totally enclosed fan cooled (TEFC). Alternatively for large motors, closed air circuit air cooled (CACA) / closed air circuit water cooled (CACW) / totally enclosed tube ventilated (TETV) type cooling arrangement will be adopted.
- (t) All motors will have class F insulation with temperature rise limited to class B.
- (u) All HT motors will be provided with six (6) no. simplex type winding temperature detectors, two (2) nos. per phase and two (2) no. duplex type bearing temperature detectors, each at driving and non-driving end. These temperature detectors will be resistance type, 3 wire, platinum wound, 100 ohms at 0°C.
- (v) RTD based temperature measurements with alarm contacts will be provided for the followings :
- (i) HT motor bearing temperature
 - (ii) Hot and cold air temperatures of the closed air circuit for CACA and CACW motors
- (w) Motors of rating 30 kW and above will be provided with space heaters, rated for 240 V, single phase, 50 Hz.
- (x) Motor terminal boxes will be detachable type. For HT motors, the terminal box will be phase segregated type and neutral leads will be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection. All accessory equipment such as space heater, temperature detector, current Transformer etc., will be wired and terminated in enclosure, separate from motor (power) terminal box. The degree of protection for accessory terminal box will be same as that of motor.
- (y) In HT motors, at least six platinum resistance type temperature detectors will be provided in stator winding. Each bearing will be provided with dial type thermometer with adjustable alarm contact and resistance type temperature detector.
- (z) Two grounding terminals one on diagonally opposite points on either side at the bottom suitable for connecting GI flats/wires will be provided. At each earthing point, two drilled and tapped holes with hexagonal head bolts and washers will be provided.
- (aa) HT motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable boxes. In case elastimould terminations are offered,

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SPECIFICATION NO

TATA CONSULTING ENGINEERS LIMITED

SECTION : C7

TCE.7742B-C-540-001

1X 40 MW CAPTIVE POWER PLANT FOR CDQ
10&11

TATA STEEL LIMITED, JAMSHEDPUR
STEAM TURBINE GENERATOR AND AUXILIARIES
ELECTRICAL DESIGN REQUIREMENTS

SHEET 95 OF 126

then protective cover and trifurcating sleeves will also be provided. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) will be provided in case of cable boxes.

(bb) Noise level and vibration will be limited within the limits prescribed in IEC/IEEE respectively. Motors will withstand vibrations produced by driven equipment.

(cc) Motors when started with the driven equipment coupled will be capable of withstanding at least two successive starts from cold conditions & one start from hot condition without injurious heating of windings. The motors will also be suitable for three equally spread starts per hour under the specified supply conditions.

(dd) Temperature Rise

Air cooled motors:

70 deg. C by resistance method for both class B&F insulation.

Water cooled:

80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both class B&F insulation.

(ee) Degree of Protection Degree of protection for various enclosures as per IEC will be as follows:

Indoor motors	-	IP 54
Outdoor motors	-	IPW 55
Cable box - indoor area	-	IP 54
Cable box - outdoor area	-	IPW 55

7.13.1.2 ACTUATOR

(a) Actuators will have totally enclosed weather & dust proof construction with IP-65 enclosure and will be suitable for outdoor application without the necessity of a canopy.

(b) The actuator will be suitable for mounting directly on the valve / damper. Each actuator will have a hand wheel fitted on it for emergency operation. It will be provided with required number of position limit switches / torque switches of adjustable type.

ISSUE
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SPECIFICATION NO TCE.7742B-C-540-001	TATA CONSULTING ENGINEERS LIMITED	SECTION : C7
	1X 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR STEAM TURBINE GENERATOR AND AUXILIARIES ELECTRICAL DESIGN REQUIREMENTS	SHEET 96 OF 126

- (c) Each electrical actuator will have a space heater in the limit switch compartment suitable for 240 V, 50 Hz, single-phase supply.
- (d) All motorised actuator will be provided with non-integral starter.
- (e) The drive motor will be three phase, squirrel cage, induction type with class B insulation and IPW-55 enclosure, designed for high torque and reversing service. The motor will be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.
- (f) Each actuator will have one (1) no. built-in local position indicator for 0 -100% travel and one (1)no. transducer for remote position indicator for 0 -100% travel

7.13.2 TESTS

7.13.2.1 Reports of Type test already carried out on identical / similar equipment will be furnished during detail engineering. Such type tests should have been carried out within last five years as on date of bid opening. In absence of such type test reports or in case such reports are found not to meet the design specification requirement, all type tests will be conducted free of cost and will be submitted to the owner for approval.. Valid type test report will be submitted in conformity with the latest international standard, IEC or equivalent.

7.13.2.2 All routine tests will be performed as per latest amendments of IS / IEC.

7.14 220V DC SYSTEM

7.14.1 Two (2) x 100% rated 220V Lead acid plante type battery with associated 2 x 100% float cum boost charger and One (1) no. DC switchboard with two bus sections and a bus coupler will be provided for catering to the power plant DC loads.

7.14.2 All required DC cables and other accessories will be in CONTRACTOR'S scope.

7.14.3 The DC system will include DC loads of three (3) numbers of 33kV GIS circuit breakers, associated control, metering & protection panel and emergency lighting system supplied by others.

7.14.4 DESIGN CRITERIA

7.14.4.1 LEAD ACID PLANTE BATTERY

- (a) The procedure for sizing the battery will be as detailed in IEEE 485. A design margin of 10% to be considered.

ISSUE R1

ISSUE NO. R0	SPEC.NO.	TATA CONSULTING ENGINEERS LIMITED		SECTION: D05
	TCE.7742B-C-540-001	DATA SHEET-A1 LOW VOLTAGE INDUCTION MOTORS		SHEET 1 OF 3
SL.NO.	DESCRIPTION	UNIT	TECHNICAL PARTICULARS	
1.0	General		BY CONTRACTOR	
1.1	Application		BY CONTRACTOR	
1.2	Numbers required		BY CONTRACTOR	
1.3	Type of motor		Squirrel cage	
1.4	Supply system fault level	KA	50	
1.5	Type of earthing of supply system neutral		Effectively earthed	
2.0	Rating			
2.1	Rated output :	KW	CONTRACTOR to furnish	
2.2	Rated voltage :	V	415	
2.3	Number of phases & frequency		3 phase 50Hz	
2.4	Supply condition			
2.5	Synchronous speed	RPM	BY CONTRACTOR	
3.0	Duty			
3.1	Type of duty		S1 as per IEC 60034	
3.2	Power required by load	KW	BY CONTRACTOR	
3.3	Energy efficiency class		IE2	
4.0	Method of starting		D.O.L./star delta/ soft start/VFD	
5.0	Insulation			
5.1	Class of insulation		Class F	
5.2	Ref. Ambient temperature	deg.C	Refer: Section-B	
5.3	Temperature rise of winding by wdg resistance method	deg.C	Corresponding to Class B Insulation	
6.0	Installation			
6.1	Location		Indoor/outdoor – as per requirement	
6.2	Hazardous area division		– As per requirement	
6.3	Atmosphere		INDUSTRIAL CONDUCTIVE/ DUSTY	
7.0	Enclosure			
7.1	Type of cooling		TEFC	
7.2	Designation for degree of protection		IP 54 for indoor installation IPW 55 for outdoor installation	
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DATE		CHD. BY:		
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ISSUE NO. R0	SPEC.NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION: D05
	TCE.7742B-C-540-001	DATA SHEET-A1 LOW VOLTAGE INDUCTION MOTORS	SHEET 2 OF 3

SL.NO.	DESCRIPTION	UNIT	TECHNICAL PARTICULARS
8.0	Main terminal box		
8.1	Location as seen from non- drive end:		BY CONTRACTOR
	RATINGS		
8.2	(a) Short time		
	i. Current :	kA(RMS)	50
	ii. Duration :	SECS.	0.25
	(b) Dynamic :	kA (PEAK)	127
8.3	External cable details		
8.3.1	Type		BY CONTRACTOR
8.3.2	Size & no of cores		BY CONTRACTOR
8.4	Earthing conductors		
8.4.1	Material		BY CONTRACTOR
8.4.2	Size	MMxMM	BY CONTRACTOR
9.0	Miscellaneous requirements		<u>TO BE FILLED IF MOTORS ARE BOUGHT SEPERATELY</u>
9.1	Shaft orientation		BY CONTRACTOR
9.2	Mounting symbol (IS:2253 OR EQUIVALENT)		BY CONTRACTOR
9.3	Rotation as seen from non-drive end		BY CONTRACTOR
9.4	Type of bearing		BY CONTRACTOR
9.4.1	Drive end		BY CONTRACTOR
9.4.2	Non drive end		BY CONTRACTOR
9.5	Whether bed plate required		Yes
9.6	Motor shall match the following torque requirements of the driven equipment:		
	a) Starting torue		
	b) Full load (rated) torque		
	c) Pull out torque		
	d) Pull up torque		

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ISSUE. NO. R0	SPEC.NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION: D05
	TCE.7742B-C-540-001	DATA SHEET-A1 LOW VOLTAGE INDUCTION MOTORS	SHEET 3 OF 3

SL.NO.	DESCRIPTION	UNIT	TECHNICAL PARTICULARS
9.7	Coupling by motor supplier		BY CONTRACTOR
9.8	If yes, type of coupling		
10.0	Colour shades of paint		
11	Whether vibration pads required		BY CONTRACTOR
12	Temperature detectors/indicators		
12.1	Embedded temperature detectors for winding required		Yes (for motors rated 50kW and above)
12.2	Embedded temperature detectors for bearings required		BY CONTRACTOR
12.3	Bearing thermometers for driving end & non driving ends required		BY CONTRACTOR
13	Space heaters for motors required		Space heater shall be provided for motors greater than 30 kW

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ISSUE NO. R0	SPEC. NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION: D05
	TCE.7742B-C-540-001	DATA SHEET-A2 LOW VOLTAGE INDUCTION MOTORS	SHEET 1 OF 3

SL.NO.	BRIEF TITLE	REFERENCE NUMBER OF STANDARDS		
1.	THREE PHASE INDUCTION MOTORS	<input type="checkbox"/> IS-325	<input type="checkbox"/> BS-4999	<input type="checkbox"/> IEC-34
2.	ROTATING ELECTRICAL MACHINES	<input type="checkbox"/> IS-4722	<input type="checkbox"/> BSEN60034-	<input type="checkbox"/> IEC-34-1
3.				
4.	SINGLE PHASE INDUCTION MOTORS	<input type="checkbox"/> IS-996	<input type="checkbox"/> BS	<input type="checkbox"/> IEC
5.	CODE OF PRACTICE FOR CLIMATE PROOFING	<input type="checkbox"/> IS	<input type="checkbox"/> BS-6751	<input type="checkbox"/> IEC
6.	DESIGNATIONS FOR TYPES OF CONSTRUCTION AND MOUNTING ARRANGEMENT OF ROTATING ELECTRICAL MACHINES	<input type="checkbox"/> IS-2253	<input type="checkbox"/> BSEN60034-	<input type="checkbox"/> IEC-34-7
7.	TERMINAL MARKING & DIRECTION OF ROTATION FOR ROTATING ELECTRICAL MACHINERY	<input type="checkbox"/> IS-4728	<input type="checkbox"/> BS-4999-108	<input type="checkbox"/> IEC-34-8
8.	DESIGNATION OF METHODS OF COOLING FOR ROTATING ELECTRICAL MACHINES	<input type="checkbox"/> IS-6362	<input type="checkbox"/> BSEN 60034-6-1994	<input type="checkbox"/> IEC-34-6
9.				
10.	DEGREES OF PROTECTION PROVIDED BY ENCLOSURE FOR ROTATING ELECTRICAL MACHINERY	<input type="checkbox"/> IS-4691	<input type="checkbox"/> BS-EN60529	<input type="checkbox"/> IEC-529
11.	GUIDE FOR TESTING THREE PHASE	<input type="checkbox"/> IS-4029	<input type="checkbox"/> BSEN60034-	<input type="checkbox"/> IEC-34-2

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ISSUE NO. R0	SPEC. NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION: D05
	TCE.7742B-C-540-001	DATA SHEET-A2 LOW VOLTAGE INDUCTION MOTORS	SHEET 2 OF 3

SL.NO.	BRIEF TITLE	REFERENCE NUMBER OF STANDARDS		
	INDUCTION MOTORS	<input type="checkbox"/> IS-12075	<input type="checkbox"/> BS-4999142	<input type="checkbox"/> IEC-34-14
	MEASUREMENT AND EVALUATION OF VIBRATION OF ROTATING ELECTRICAL MACHINES	<input type="checkbox"/> IS-5572	<input type="checkbox"/> BS	<input type="checkbox"/> IEC-79
	CLASSIFICATION OF HAZARDOUS AREAS FOR ELECTRICAL INSTALLATION			
12.	DIMENSIONS OF SLIDE RAILS FOR ELECTRIC MOTORS	<input type="checkbox"/> IS-2968	<input type="checkbox"/> BS-4999-141	<input type="checkbox"/> IEC
13.	PERMISSIBLE LIMITS OF NOISE LEVEL FOR ROTATING ELECTRICAL MACHINES	<input type="checkbox"/> IS-12065	<input type="checkbox"/> BSEN 60034-9-1994	<input type="checkbox"/> IEC
14.	GUIDE FOR TESTING INSULATION RESISTANCE OF ROTATING MACHINES	<input type="checkbox"/> IS-7816	<input type="checkbox"/> BS	<input type="checkbox"/> IEC
15.	INDUCTION MOTORS- ENERGY EFFICIENT THREE PHASE SQUIRREL CAGE- SPECIFICATION	<input type="checkbox"/> IS-12615		<input type="checkbox"/> IEC-60034-3
16.				
17.	FLAME PROOF A C MOTORS FOR USE IN MINES.	<input type="checkbox"/> IS- 3682		
18.				
19.	FLAME PROOF ENCLOSURES OF ELECTRICAL APPARATUS	<input type="checkbox"/> IS-2148		
	STARTING PERFORMANCE OF SINGLE SPEED THREE	<input type="checkbox"/> IS-8789	<input type="checkbox"/> BSEN-	<input type="checkbox"/> IEC-34-12

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ISSUE NO. R0	SPEC. NO.		TATA CONSULTING ENGINEERS LIMITED		SECTION : D05
	TCE.7742B-C-540-001		DATA SHEET - B LOW VOLTAGE INDUCTION MOTORS		SHEET 1 OF 3
	ENQUIRY / SPECIFICATION NO.				
SR.NO.	ITEM 1	CONTRACTOR R→	UNIT	GUARANTEED PARTICULARS	
1.0	Application				
2.0	Manufacturer				
3.0	Country of Origin				
4.0	Applicable Standards				
5.0	Efficiency Category(For Energy Efficient Motors only)				
6.0	Rated				
	(a) Output		kW		
	(b) Speed		RPM		
	(c) Frame size				
7.0	Type of Duty				
8.0	(a) Supply Conditions				
	i) Rated Voltage		V		
	ii) No. of Phases		No(s).		
	iii) Frequency		Hz		
	(b) Allowable Variations in				
	i) Voltage		%		
	ii) Frequency		%		
	iii) Combined		%		
9.0	Current				
	(a) Full Load Amps				
	(b) Starting		% FL		
10.0	Method of Starting				
11.0	Insulation				
NOTE TO CONTRACTOR				SIGNATURE OF CONTRACTOR	
1. ITEMS WHICH DEVIATE FROM THE SPECIFICATION SHOULD BE MARKED WITHIN ASTERISK(*) (DETAILS TO BE GIVEN IN SCHEDULE OF DEVIATIONS).				DATE	
2. THIS DATA SHEET SHALL BE FILLED UP COMPLETELY AND A COPY SHALL BE ENCLOSED WITH EACH COPY OF THE BID.					

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ISSUE NO. R0	SPEC. NO.	TATA CONSULTING ENGINEERS LIMITED		SECTION : D05
	TCE.7742B-C-540-001	DATA SHEET - B LOW VOLTAGE INDUCTION MOTORS		SHEET 2 OF 3
	ENQUIRY / SPECIFICATION NO.			
SR.NO.	ITEM	CONTRACTOR R→	UNIT	GUARANTEED PARTICULARS
11.1	Class of Insulation			
11.2	Whether Tropicalised		Yes/No	
12.0	(a) Ref. Ambient Temp.		deg.C	
	(b) Temp. rise of windings by Res. Method			
	i) Stator		deg.C	
	ii) Rotor		deg.C	
	(c) Temp. rise of bearings		deg.C	
13.0	Degree of Protection			
14.0	Suitable for Outdoor Operation		Yes/No	
15.0	Normal winding connection		Star/Delt a	
	(i) Stator			
	(ii) Rotor			
16.0	Space heater Rating Terminal box		Watts	
	(i) Type & No. of Terminals brought Out			
	(ii) Fault withstand capacity at rated voltage & duration			
	(iii) Maximum size of Aluminium armoured cable that can be Terminated		cores X Sq mm	
17.0	Dimensional Dwg. Enclosed		Yes/No	
18.0	Torque			
	a) Full load torque		kg-m	
	b) Starting torque		% FLT	
	c) Pull out Torque		% FLT	
	d) Pull up Torque		% FLT	
19.0	Efficiency (%)			
NOTE TO CONTRACTOR			SIGNATURE OF CONTRACTOR	
1. ITEMS WHICH DEVIATE FROM THE SPECIFICATION SHOULD BE MARKED WITHIN ASTERISK(*) (DETAILS TO BE GIVEN IN SCHEDULE OF DEVIATIONS)			DATE	
2. THIS DATA SHEET SHALL BE FILLED UP COMPLETELY AND A COPY SHALL BE ENCLOSED WITH EACH COPY OF THE BID.				

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ISSUE NO. R0	SPEC. NO.		TATA CONSULTING ENGINEERS LIMITED		SECTION : D05
	TCE.7742B-C-540-001		DATA SHEET - B LOW VOLTAGE INDUCTION MOTORS		SHEET 3 OF 3
	ENQUIRY / SPECIFICATION NO.				
SR.NO.	ITEM ↴	CONTRACTOR R→	UNIT	GUARANTEED PARTICULARS	
	a) Full Load Efficiency b) 75% Load Efficiency c) 50% Load Efficiency d) 25% Load Efficiency				
20	Lubrication arrangement				
NOTE TO CONTRACTOR				SIGNATURE OF CONTRACTOR	
1. ITEMS WHICH DEVIATE FROM THE SPECIFICATION SHOULD BE MARKED WITHIN ASTERISK(*) (DETAILS TO BE GIVEN IN SCHEDULE OF DEVIATIONS) 2. THIS DATA SHEET SHALL BE FILLED UP COMPLETELY AND A COPY SHALL BE ENCLOSED WITH EACH COPY OF THE BID.				DATE	

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SPEC. NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION: D05
TCE.7742B-C-540-001	DATA SHEET-C LOW VOLTAGE INDUCTION MOTORS	SHEET 1 OF 3

**INFORMATION TO BE SUBMITTED BY THE VENDOR
AFTER AWARD OF CONTRACT**

- 1.0 Technical particulars as per data sheet B of tender specification. (Based on motor manufacturer)
- 2.0 Type and frame size:
- 3.0 Starting time (Secs)
 - 3.1 With 100% voltage at terminals
 - 3.2 With minimum voltage at terminals (at ____ % Rated voltage)
 - 3.3 With 110% voltage at terminals
- 4.0 Safe stall time at 100/110% rated voltage under hot/cold condition.
- 5.0 Type and size of cable for which gland is provided in the terminal box :
- 6.0 Type of bearings and expected life.
- 7.0 Total weight of motor (kg)
 - 7.1 Weight of Stator (kg)
 - 7.2 Weight of Rotor (kg)
- 8.0 Motor GD²:
- 9.0 Efficiency (%)
 - 9.1 Full Load Efficiency
 - 9.2 75% Load Efficiency
 - 9.3 50% Load Efficiency
 - 9.4 25% Load Efficiency
- 10.0 Power Factor
 - 10.1 Full Load Power Factor
 - 10.2 75% Load Power Factor

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SPEC. NO.	TATA CONSULTING ENGINEERS LIMITED		SECTION: D05
TCE.7742B-C-540-001	DATA SHEET-C LOW VOLTAGE INDUCTION MOTORS		SHEET 2 OF 3
10.3	50% Load Power Factor		
10.4	25% Load Power Factor		
11.0	Torque (% FLT)		
11.1	Starting		
11.2	Maximum (Pullout torque)		
11.3	Pull up torque		
12.0	Type of Enclosure		
13.0	Cooling designation		
14.0	Space heaters		
14.1	Rated voltage/number		
14.2	Rating total		
14.3	Separate terminal box provided		
15.0	Motor reactances (Pu)		
15.1	Sub transient reactance		
15.2	Transient reactance		
15.3	Steady state reactance		
16.0	Guaranteed losses (kW)		
16.1	Iron loss		
16.2	Copper loss		
16.3	Friction, Windage & Stray losses.		
17.0	Motor outline dimension drawing (Number of copies as per distribution schedule)		
18.0	Type test certificates (Number of copies as per distribution schedule)		
19.0	Speed torque curve at rated & minimum starting voltage with Speed/Torque curve of the driven equipment superimposed.		

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SPEC. NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION: D05
TCE.7742B-C-540-001	DATA SHEET-C LOW VOLTAGE INDUCTION MOTORS	SHEET 3 OF 3
20.0	Current - speed curve.	
21.0	Current - time curve.	
22.0	Efficiency, power factor, slip, current against output curve.	
23.0	Thermal withstand characteristic for motors of 100 kW & above - Hot & Cold.	
24.0	Negative sequence current Vs time curve for motor of 100 kW & above.	
25.0	Rotor voltage/Rotor current (for wound motors).	
		ISSUE R0

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TCE. 7742A-ME-900-DC-001	TATA CONSULTING ENGINEERS LIMITED	SECTION: WRITE UP
	PIPING MATERIALS SPECIFICATION	SHEET 9 OF 49

PIPE CLASS : 150CS4

RATING : 150#

BASE MATERIAL : CARBON STEEL

CORROSION ALLOWANCE : 1.5 mm

TEMPERATURE (Deg. C) AND PRESSURE (kg/cm² g) RATINGS

TEMP	-29	38	50	100	150	200	250	300	325	350
PRESS	19.37	19.37	18.66	16.01	14.48	13.46	12.34	10.40	9.48	8.57

SERVICE : RAW WATER, INDUSTRIAL WATER, CLARIFIED WATER, COOLING WATER, MAKE UP WATER, TREATED WATER, FIRE WATER (UPTO INLET OF DELUGE VALVE), CHILLED WATER, CONDENSATE

SERVICE CONDITIONS :

MAXIMUM WORKING PRESSURE : 16 kg/cm² (g)

MAXIMUM TEMP : 60°C

MINIMUM WORKING PRESSURE : ATM.

MINIMUM TEMP : 5°C

NOTES

1. THICKNESSES OF FITTINGS SHALL BE MATCHED WITH CONNECTED PIPES.

SPECIAL NOTES

ITEM	SIZE	DESCRIPTION
MAINTAINENCE JOINTS	ALL	FLANGED, TO BE KEPT MINIMUM
PIPE JOINTS	DN 40 & BELOW	SW COUPLING
	DN 50 & ABOVE	BUTTWELDED
VALVES	DN 40 & BELOW	SW COUPLING
	DN 50 & ABOVE	FLANGED
EQUIPMENT LOCATION	ALL	FLANGED
TEMP.CONN	DN 40	FLANGED SET-ON NOZZLE
PRESS.CONN	DN 20	SW HALF COUPLING NIPPLE SCH 80 WITH GATE VALVE
DRAINS	ON LINES <= DN 40	AS PER P&ID OR PIPING DESIGN BASIS
	ON LINES >= DN 50	AS PER P&ID OR PIPING DESIGN BASIS
VENTS	ON LINES <= DN 40	AS PER P&ID OR PIPING DESIGN BASIS
	ON LINES >= DN 50	AS PER P&ID OR PIPING DESIGN BASIS

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INPUT ID.	ITEM TYPE	LOWER SIZE (DN)	UPPER SIZE (DN)	SCH/ THK	DESIGN / DIM. STD.	MATERIAL	DESCRIPTION
PIPE							
PIP	PIPE	15	40	MED	IS 1239 (PART-I)	IS 1239 (BLACK)	CARBON STEEL, PE, ERW
PIP	PIPE	50	150	MED	IS 1239 (PART-I)	IS 1239 (BLACK)	CARBON STEEL, BE, ERW
PIP	PIPE	200	250	6.3	IS 3589	IS 3589 GR. Fe 410	CARBON STEEL, BE, ERW
PIP	PIPE	300	300	7.1	IS 3589	IS 3589 GR.410	CARBON STEEL, BE, ERW
PIP	PIPE	350	350	8.0	IS 3589	IS 3589 GR.410	CARBON STEEL, BE, ERW
PIP	PIPE	400	500	8.0	IS 3589	IS 3589 GR. Fe 410	CARBON STEEL, BE, SWP
PIP	PIPE	550	600	10.0	IS 3589	IS 3589 GR. Fe 410	CARBON STEEL, BE, SWP
PIP	PIPE	650	1200	10.0	IS 3589	IS 3589 GR. Fe 410	CARBON STEEL, BE, SWP
NIP	NIPPLE	15	40	HVY	IS 1239 (PART-I)	IS 1239 (BLACK)	PBE, WELDED
FITTINGS							
ELB90	ELBOW 90	15	40		ASME B16.11	ASTM A105	SW 3000
ELB90	ELBOW 90	50	200		ASME B 16.9	ASTM A234 GR.WPB	BW, R=1.5D,150
ELB90	ELBOW 90	250	1200		IPSS 1-06-020	SAME AS PARENT PIPE	FABRICATED MITRE BENDS FROM PIPE / PLATE (RADIUS AS PER IPSS)
ELB45	ELBOW 45	15	40		ASME B16.11	ASTM A105	SW, 3000
ELB45	ELBOW 45	50	200		ASME B16.9	ASTM A234 GR.WPB	BW, R=1.5D,150
ELB45	ELBOW 45	250	1200		IPSS 1-06-020	SAME AS PARENT PIPE	FABRICATED MITRE BENDS FROM PIPE / PLATE (RADIUS AS PER IPSS)
TEQ	TEE EQUAL	15	40		ASME B16.11	ASTM A105	SW, 3000
TEQ	TEE EQUAL	50	200		ASME B16.9	ASTM A234 GR.WPB	BW, 150
TEQ	TEE EQUAL	250	1200		IPSS 1-06-020	SAME AS PARENT PIPE	FABRICATED TEE FROM PIPE / PLATE
TRED	TEE REDUCING	15	40		ASME B16.11	ASTM A105	SW, 3000
TRED	TEE REDUCING	50	200		ASME B16.9	ASTM A 234 GR.WPB	BW,150
TRED	TEE REDUCING	250	1200		IPSS 1-06-020	SAME AS PARENT PIPE	FABRICATED TEE FROM PIPE / PLATE

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	PIPING MATERIALS SPECIFICATION	SHEET 12 OF 49

SWGC	SWAGE CONCENTRIC REDUCER	15	40		BS 3799	ASTM A105	PBE
REDC	REDUCER CONCENTRIC	50	200		ASME B16.9	ASTM A234 GR.WPB	BW,150
REDC	REDUCER CONCENTRIC	250	1200		IPSS 1-06-020	SAME AS PARENT PIPE	FABRICATED REDUCER FROM PIPE / PLATE
SWGE	SWAGE ECCENTRIC	15	40		BS 3799	ASTM A105	PBE
REDE	REDUCER ECCENTRIC	50	200		ASME B16.9	ASTM A234 GR.WPB	BW,150
REDE	REDUCER ECCENTRIC	250	1200		IPSS 1-06-020	SAME AS PARENT PIPE	FABRICATED REDUCER FROM PIPE / PLATE
CAP	CAP	15	40		ASME B16.11	ASTM A105	SW, 3000
CAP	CAP	50	1200		ASME B16.9	ASTM A234 GR.WPB	BW, CAP
CPLF	COUPLING FULL	15	40		ASME B16.11	ASTM A105	SW, 3000
CPLH	COUPLING HALF	15	40		ASME B16.11	ASTM A105	SW, 3000
CPLL	COUPLING LH	15	40		ASME B16.11	ASTM A105	SW, 3000
CPLR	COUPLING RED	15	40		ASME B16.11	ASTM A105	SW, 3000
UNN	UNION	15	40		BS 3799	ASTM A105	SW, 3000
FLANGE							
FLGSVW	FLANGE SOCKET WELD	15	40		ASME B16.5	ASTM A105	SW, RF, 150, SERRATED FINISH, 125AARH
FLGPL	FLANGE PLATE	65	500		IS 6392 TABLE-17	IS 2062 GR.B	RF, SERRATED FINISH, 125AARH
FLGSO	FLANGE SLIP ON	600	600		ASME B16.5, CLASS 150#	ASTM A105	SORF, SERRATED FINISH, 125AARH
FLGSO	FLANGE SLIP ON	65	600		ASME B16.5, CLASS 150#	ASTM A105	SOFF, SERRATED FINISH, 125AARH
FLGSO	FLANGE PLATE	650	1200		AWWA C207 CLASS D	IS 2062 GR.B	HUB TYPE, FF, SERRATED FINISH, 125AARH
FLGBL	FLANGE BLIND	15	40		ASME B16.5	ASTM A105	RF, 150, SERRATED FINISH, 125AARH
FLB	FLANGE BLIND	50	600		ASME B16.5	ASTM A 105	RF, 150, SERRATED FINISH, 125AARH
FLB	FLANGE BLIND	650	1200		AWWA C207 CLASS D	IS 2062 GR.B	FF, SERRATED FINISH, 125AARH
VALVE							

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GAV	VALVE GATE	15	40		API 602/ BS EN ISO 15761	BODY: ASTM A105, TRIM: STELLITED, STEM: 13%CR. STEEL	SW, 800, 3000, ASME B16.11
GAV	VALVE GATE	50	300		API 600 / ISO 10434	BODY: ASTM A216, GR. WCB, TRIM: 13% CR. STEEL	FLGD, RF, 150, B16.5, SERRATED FINISH, 125AARH
GAV	VALVE GATE	350	600		IS 14846	BODY: IS 210 GR. FG 200, TRIM: 13% CR. STEEL	FLGD, 150, B16.5, FF, SERRATED FINISH, 125AARH
GAV	VALVE GATE	650	1200		MNF. STD.	BODY, BONNET, DISC & YOKE MATERIAL OF STEM AND GLAND: CARBON STEEL, IS 2062 GR B, STEM: SS; GLAND: IS 2062 GR B, BODY SEAT: SS (17% CR STEEL), DISC SEAT: SS	FABRICATED, DOUBLE DISC, MOVABLE SPINDLE (STEM) GATE VALVE WITH COMPANION FLANGE
GLV	VALVE GLOBE	15	40		BS EN ISO 15761	BODY: ASTM A 105, TRIM: STELLITED, STEM: 13% CR STEEL	SW, 3000, B16.11
GLV	VALVE GLOBE	50	200		BS 1873	BODY: ASTM A 216, GR.WCB, TRIM: 13% CR STEEL	FLGD, 150, B16.5, SERRATED FINISH 125AARH
GLV	VALVE GLOBE	250	400		IS 9338	BODY: IS 210 GR. FG 200, DISC: IS 210 GR. FG 200, STEM: 13% CR	FLGD, 150, B16.5, FF, SERRATED FINISH, 125AARH
BFV	VALVE BUTTERFLY	65	200		BS EN 593 / API 609	BODY: ASTM A 216 GR.WCB, TRIM: 13% CR. STEEL	WAF, 150, B16.5
BFV	VALVE BUTTERFLY	450	600		BS EN 593 / API 609	BODY: CI; TRIM: 13% CR. STEEL	FLGD, 150, B16.5, FF, SERRATED FINISH, 125AARH
BFV	VALVE BUTTERFLY	650	1200		AWWA C504	BODY: ASTM A216, GR. WCB, TRIM: 13% CR. STEEL	FLGD, AWWA C207 CLASS D, FF, SERRATED FINISH, 125AARH
CHV	VALVE CHECK	15	40		API 602 / BS EN ISO 15761	BODY: ASTM A105, TRIM: 13% CR. STEEL	CHECK VALVE, LIFT TYPE, SW, 3000
CHV	VALVE CHECK	50	150		BS 1868	BODY: ASTM A216 GR.WCB, TRIM: 13% CR. STEEL	FLGD, 150, B16.5, RF, SERRATED FINISH, 125AARH

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	PIPING MATERIALS SPECIFICATION	SHEET 14 OF 49

CHV	VALVE CHECK	200	600		IS 5312 PART 1	BODY: CI, IS 210 GR. FG 200, TRIM: 13% CR. STEEL	FLGD, AWWA C207 CLASS D, FF, SERRATED FINISH, 125AARH
CHV	VALVE CHECK	650	1200		IS 5312 PART 2	BODY: CS, IS 1030 GR.B	FLGD, AWWA C207 CLASS D, FF, SERRATED FINISH, 125AARH
PLV	VALVE PLUG	15	25		BS 5158	BODY: CI, IS210 GR. FG 200	SCREWED AND LUBRICATED, TAPERED PLUG VALVE
BLV	VALVE BALL	15	50		BS EN ISO 17292	BODY: ASTM A216 GR. WCB, TRIM: 13% CR. STEEL	SW, 3000, B16.11
ARV	VALVE AIR RELEASE CUM VACUUM	50	200		AWWA C512	BODY: CI, ASTM A126 Class B TRIM: SS316	FLGD, 125, B16.5

GASKET							
GSK	GASKET	15	50		ASME B16.21, DRILLING AS PER ASME B16.5, CLASS 150	NON-ASBESTOS BS 7531 GR X	COMPRESSED COMPOSITE, NON-ASBESTOS FIBRE, SELF-CENTERING TYPE, 150, 2 MM THK
GSK	GASKET	65	500		ASME B16.21, DRILLING AS PER IS 6392 TABLE-17	NON-ASBESTOS BS 7531 GR X	COMPRESSED COMPOSITE, NON-ASBESTOS FIBRE, SELF-CENTERING TYPE, 150, DN 65 - 2 MM THK, DN 80 AND ABOVE - 3 MM THK.
GSK	GASKET	600	600		ASME B16.21, DRILLING AS PER ASME B16.5, CLASS 150	NON-ASBESTOS BS 7531 GR X	COMPRESSED COMPOSITE, NON-ASBESTOS FIBRE, SELF-CENTERING TYPE, 150, 3 MM THK
GSK	GASKET	200	600		ASME B16.21, DRILLING AS PER ASME B16.5, CLASS 150	NON-ASBESTOS BS 7531 GR X	COMPRESSED COMPOSITE, NON-ASBESTOS FIBRE, FULL FACED, 150, 3 MM
GSK	GASKET	650	1200		ASME B16.21, DRILLING AS PER AWWA C207 CLASS D	NON-ASBESTOS BS 7531 GR X	COMPRESSED COMPOSITE, NON-ASBESTOS FIBRE, SELF-CENTERING TYPE 150, 3 MM
FASTENER							


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TCE. 7742A-ME-900-DC-001	TATA CONSULTING ENGINEERS LIMITED	SECTION: WRITE UP
	PIPING MATERIALS SPECIFICATION	SHEET 15 OF 49

BOS.	BOLT STUD	15	600		ASME B18.2	BOLT: ASTM A193 GR.B7, NUT: ASTM A194 GR.2H	
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SPECIFICATION NO. TCE.M4-681-006		TATA CONSULTING ENGINEERS LIMITED		SECTION: D		
ENQUIRY NO. TCE.7742B- C-540-001		DATA SHEET A6 GATE VALVE		SHEET 1 OF 9		
FOR PRESSURE RATING		SIZE RANGE : NB 65 & ABOVE/NB 50 & BELOW				
SERVICE						
ANSI 900 CLASS AND ABOVE						
CONSTRUCTION FEATURES	TYPE	RISING STEM OUTSIDE SCREW AND YOKE				
	ENDS	BUTT WELDED TO ANSI B 16.25 / SW TO ANSI B 16.11				
	BONNET	PRESSURE SEALED / INTEGRAL				
	DISC	FLEXIBLE WEDGE / PARALLEL SLIDE				
	BODY SEAT	INTEGRAL				
	DISC SEAT	INTEGRAL				
	BACK SEAT	INTEGRAL				
	OPERATOR	AS PER FLOW DIAGRAM				
	SPECIAL REQUIREMENTS					
	1.	IBR APPROVAL AS REQUIRED				
FLUID		*				
BODY		NB 50 & BELOW				
BONNET		ASTM A182 GR. F11/22/91 (FOR TEMP. RANGE 400-510°C/510-550°C/>550°C)				
DISC		ASTM A105 FOR TEMP. <400°C				
		FOR NB 65 & ABOVE				
		CAST CHROME MOLY STEEL TO ASTM A-217 GR. WC6/WC9/WC12A (FOR TEMP. RANGE 400-510°C/510-550°C/>550°C)				
		CAST CARBON STEEL TO ASTM A-216 GR. WCB (FOR TEMP. BELOW 400°C)				
		FOR BOILER FEED DISCHARGE ASTM A-216 GR. WCC				
SPINDLE		FORGED ALLOY STEEL TO ASTM A-182 GR. F6a.				
BODY SEAT		STELLITED				
DISC SEAT		STELLITED				
BACK SEAT		STELLITED				
REV. NO.	R0	R1		JOB NO.	CLIENT: TATA STEEL LIMITED	
PPD. BY	PC	PC/SG		TCE.774 .2B		
CHD. BY	RM	RM			PROJECT: 1x 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11	
DATE	APR-2015	DEC-2015			TATA STEEL LIMITED JAMSHEDPUR	
					ISSUE R1	

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SPECIFICATION NO. TCE.M4-681-006	TATA CONSULTING ENGINEERS LIMITED	SECTION: D
ENQUIRY NO. TCE.7742B- C-540-001	DATA SHEET A6 GATE VALVE	SHEET 2 OF 9

	BONNET GASKET	IN-GOT IRON SILVER PLATED/GRAPHOIL	
	GLAND PACKING	LUBRICATED REINFORCED ASBESTOS	
	BOLTS & STUDS	ASTM A-193 GR. B.16/ ASTM A-193 GR. B.7	
	NUTS	ASTM A-194 GR. 3/ ASTM A-194 GR. 2H	
	HAND WHEEL	MALLEABLE IRON ASTM A-47 GR. 32510	
TESTING	SHELL HYDROSTATIC TEST PR.	AS PER CL. 7.1 OF ANSI 16.34	
	SEAT & BACK SEAT HYDROSTATIC PRESSURE.	CL. 7.2, 7.2.1 & 7.2.2 OF ANSI 16.34	
	SEAT AIR TEST PR.	6 BAR(G)	
NOTES			
1.	END TO END DIMENSIONS OF THESE VALVES CONFORM TO ANSI B 16.10		
2.	MINIMUM HARDNESS OF SEAT : 350 HB		
*	CONTRACTOR TO INDICATE BASED ON FLOW DIAGRAM.		
	FOR PRESSURE RATING	SIZE RANGE : NB 65 & ABOVE/NB 50 & BELOW	
SERVICE	ANSI 600 CLASS AND BELOW		
CONSTRUCTION FEATURES	TYPE	RISING STEM OUTSIDE SCREW AND YOKE	
	ENDS	BUTT WELDED TO ANSI B 16.25 / SW TO ANSI B 16.11	
	BONNET	BOLTED FOR NB 65 & ABOVE / INTEGRAL FOR NB 50 AND BELOW.	
	DISC	FLEXIBLE WEDGE / PARALLEL SLIDE	
	BODY SEAT	INTEGRAL	
	DISC SEAT	INTEGRAL	
	BACK SEAT	INTEGRAL	
	OPERATOR	AS PER FLOW DIAGRAM	
	SPECIAL REQUIREMENTS		
	1.	IBR APPROVAL AS REQUIRED	

REV. NO.	R0	R1			JOB NO.	CLIENT: TATA STEEL LIMITED	
PPD. BY	PC	PC/SG			TCE.774 2B		
CHD. BY	RM	RM				PROJECT: 1x 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11	ISSUE R1
DATE	APR-2015	DEC-2015				TATA STEEL LIMITED JAMSHEDPUR	

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SPECIFICATION NO. TCE.M4-681-006	TATA CONSULTING ENGINEERS LIMITED	SECTION: D
ENQUIRY NO. TCE.7742B- C-540-001	DATA SHEET A6 GATE VALVE	SHEET 3 OF 9

MATERIALS	FLUID	*
		CAST CHROME MOLY STEEL TO ASTM A-217 GR. WC6/WC9/WC12A (FOR TEMP.RANGE 400-510°C/510-550°C/>550°C)
	BODY	(NB 65 & ABOVE)
	BONNET	ASTM A182 GR. F 11/22/91 (FOR TEMP.RANGE 400-510°C/510-550°C/>550°C (NB 50 & BELOW)
	DISC	CAST CARBON STEEL TO ASTM A-216 GR. WCB/WCC FOR TEMP UPTO 400°C (NB 65 & ABOVE) OR A105 UPTO 400°C FOR NB 50 & BELOW
	SPINDLE	STAINLESS STEEL TO ASTM A-182 GR. F6a
	BODY SEAT	STELLITED
	DISC SEAT	STELLITED
	BACK SEAT	STELLITED
	BONNET GASKET	INGOT IRON SILVER PLATED
	GLAND PACKING	GRAFITED ASBESTOS
	BOLTS & STUDS	ASTM A-193 GR. B.7
	NUTS	ASTM A-194 GR. 2H
	HAND WHEEL	MALLEABLE IRON ASTM A-47 GR. 32510
TESTING	SHELL HYDROSTATIC TEST PR.	AS PER CL. 7.1 OF ANSI 16.34
	SEAT & BACK SEAT HYDROSTATIC PRESSURE.	CL. 7.2,7.2.1 & 7.2.2 OF ANSI 16.34
	SEAT AIR TEST PR.	6 BAR(G)
NOTES	1. END TO END DIMENSIONS OF THESE VALVES CONFORM TO ANSI B 16.10	
	2. MINIMUM HARDNESS OF SEAT : 350 HB	
	* CONTRACTOR TO INDICATE BASED ON FLOW DIAGRAM	

REV. NO.	R0	R1		JOB NO.	CLIENT: TATA STEEL LIMITED	
PPD. BY	PC	PC/SG		TCE.774 2B		
CHD. BY	RM	RM			PROJECT: 1x 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11	ISSUE R1
DATE	APR-2015	DEC-2015			TATA STEEL LIMITED JAMSHEDPUR	

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SPECIFICATION NO. TCE.M4-681-006	TATA CONSULTING ENGINEERS LIMITED	SECTION: D
ENQUIRY NO. TCE.7742B-C-540-001	DATA SHEET A6 GLOBE VALVE	SHEET 4 OF

	FOR PRESSURE RATING	SIZE RANGE : NB 65 & ABOVE / NB 50 & BELOW
SERVICE		
	ANSI 900 CLASS AND ABOVE	
CONSTRUCTION FEATURES	TYPE	RISING STEM OUTSIDE SCREW AND YOKE
	ENDS	BUTT WELDED TO ANSI B 16.25 / SW TO ANSI B 16.11
	BONNET	PRESSURE SEALED / INTEGRAL
	DISC	PLUG SUITABLE FOR CONTROLLING
	BODY SEAT	INTEGRAL
	DISC SEAT	INTEGRAL
	BACK SEAT	INTEGRAL
	OPERATOR	AS PER FLOW DIAGRAM
	SPECIAL REQUIREMENTS	
1.	IBR APPROVAL AS REQUIRED	
	FLUID	*
MATERIALS	BODY	CAST CHROME MOLY STEEL TO ASTM A-217 GR. WC6/WC9/WC12A (FOR TEMP RANGE 400-510°C/510-550°C/>550°C) (NB 65 & ABOVE)
	BONNET	
	DISC	CAST CARBON STEEL TO ASTM A-216 GR. WCB FOR TEMP UPTO 400°C (NB 65 & ABOVE) OR A105 UPTO 400°C FOR NB 50 & BELOW FOR BOILER FEED DISCHARGE ASTM A 216 WCC (FOR NB 65 & ABOVE)
	SPINDLE	STAINLESS STEEL TO ASTM A-182 GR. F6a
	BODY SEAT	STELLITED
	DISC SEAT	STELLITED
	BACK SEAT	STELLITED
	BONNET GASKET	INGOT IRON SILVER PLATED

REV. NO.	R0	R1		JOB NO.	CLIENT: TATA STEEL LIMITED	
PPD. BY	PC	PC/SG		TCE.774 2B		
CHD. BY	RM	RM			PROJECT: 1x 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11	ISSUE R1
DATE	APR-2015	DEC-2015			TATA STEEL LIMITED JAMSHEDPUR	

SPECIFICATION NO. TCE.M4-681-006	TATA CONSULTING ENGINEERS LIMITED	SECTION: D
ENQUIRY NO. TCE.7742B-C-540-001	DATA SHEET A6 GLOBE VALVE	SHEET 5 OF 9

	GLAND PACKING	LUBRICATED REINFORCED ASBESTOS
	BOLTS & STUDS	ASTM A-193 GR. B.16/ASTM A-193 GR. B.7
	NUTS	ASTM A-194 GR. 3/ASTM A-194 GR. 2H
	HAND WHEEL	MALLEABLE IRON ASTM A-47 GR. 32510
TESTING	SHELL HYDROSTATIC TEST PR.	AS PER CL. 7.1 OF ANSI 16.34
	SEAT & BACK SEAT HYDROSTATIC PR.	CL. 7.2,7.2.1 & 7.2.2 OF ANSI 16.34
	SEAT AIR TEST PR.	6 BAR(G)
NOTES		
1.	END TO END DIMENSIONS OF THESE VALVES CONFORM TO ANSI B 16.10	
2.	MINIMUM HARDNESS OF SEAT : 350 HB	
*	CONTRACTOR TO INDICATE BASED ON FLOW DIAGRAM	
	FOR PRESSURE RATING	SIZE RANGE : NB 65 & ABOVE / NB 50 & BELOW
SERVICE	ANSI 600 CLASS AND BELOW	
CONSTRUCTION FEATURES	TYPE	RIISING STEM OUTSIDE SCREW AND YOKE
	ENDS	BUTT WELDED TO ANSI B 16.25
	BONNET	BOLTED
	DISC	TAPERED PLUG SUITABLE FOR CONTROLLING
	BODY SEAT	INTEGRAL
	DISC SEAT	INTEGRAL
	BACK SEAT	INTEGRAL
	OPERATOR	AS PER FLOW DIAGRAM
	SPECIAL REQUIREMENTS	
1.	IBR APPROVAL AS REQUIRED	
FLUID	*	

REV. NO.	R0	R1			JOB NO.	CLIENT: TATA STEEL LIMITED	
PPD. BY	PC	PC/SG			TCE.774 2B		
CHD. BY	RM	RM				PROJECT: 1x 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11	ISSUE R1
DATE	APR-2015	DEC-2015				TATA STEEL LIMITED JAMSHEDPUR	

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SPECIFICATION NO. TCE.M4-681-006	TATA CONSULTING ENGINEERS LIMITED	SECTION: D
ENQUIRY NO. TCE.7742B-C-540-001	DATA SHEET A6 GLOBE VALVE	SHEET 6 OF

MATERIALS	BODY	} CAST CHROME MOLY STEEL TO ASTM A-217 GR. WC6/WC9/WC12A (FOR TEMP.RANGE 400-510°C/510-550°C/>550°C)
	BONNET	
	DISC	ASTM A182 GR. F 11/22/91 (FOR TEMP.RANGE 400-510°C/510-550°C/>550°C (NB 50 & BELOW) CAST CARBON STEEL TO ASTM A-216 GR. WCB (FOR TEMP. BELOW 400°C) FOR BOILER FEED DISCHARGE ASTM A-216 GR. WCC (NB 65 & ABOVE) ASTM A105 FOR TEMP. <400°C (NB 50 & BELOW)
	SPINDLE	STAINLESS STEEL TO ASTM A-182 GR. F6a
	BODY SEAT	STELLITED
	DISC SEAT	STELLITED
	BACK SEAT	STELLITED
	BONNET GASKET	SOFT IRON
	GLAND PACKING	GRAFITED ASBESTOS.
	BOLTS & STUDS	ASTM A-193 GR. B. 7
	NUTS	ASTM A-194 GR. 2H
	HAND WHEEL	MALLEABLE IRON TO ASTM A-47 GR. 32510
TESTING	SHELL HYDROSTATIC TEST PR.	AS PER CL. 7.1 OF ANSI 16.34
	SEAT & BACK SEAT HYDROSTATIC PR.	} CL. 7.2, 7.2.1 & 7.2.2 OF ANSI 16.34
	SEAT AIR TEST PR.	
NOTES		
1.	END TO END DIMENSIONS OF THESE VALVES CONFORM TO ANSI B 16.10	
2.	MINIMUM HARDNESS OF SEAT : 350 HB	
*	CONTRACTOR TO INDICATE BASED ON FLOW DIAGRAM	

REV. NO.	R0	R1			JOB NO. TCE.774 2B	CLIENT: TATA STEEL LIMITED	
PPD. BY	PC	PC/SG				PROJECT: 1x 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED JAMSHEDPUR	ISSUE R1
CHD. BY	RM	RM					
DATE	APR-2015	DEC-2015					

SPECIFICATION NO. TCE.M4-681-006	TATA CONSULTING ENGINEERS LIMITED	SECTION: D
ENQUIRY NO. TCE.7742B-C-540-001	DATA SHEET A6 CHECK VALVE	SHEET 7 OF 9

	FOR PRESSURE RATING	SIZE RANGE : NB 65 & ABOVE / NB 50 & BELOW	
SERVICE			
	ANSI 900 CLASS AND ABOVE		
CONSTRUCTION FEATURES	TYPE	SWING DISC.	
	ENDS	BUTT WELDED TO ANSI B 16.25 / SW TO ANSI B 16.11	
	CAP	PRESSURE SEALED / INTEGRAL	
	BODY SEAT	INTEGRAL	
	DISC SEAT	INTEGRAL	
	SPECIAL REQUIREMENTS		
	1.	IBR APPROVAL AS REQUIRED	
MATERIALS	FLUID	*	
	BODY	NB 50 & BELOW	
	CAP		
	DISC		
		ASTM A182 GR. F 11/22/91 (FOR TEMP. RANGE 400-510°C/510-550°C/>550°C)	
		ASTM A105 FOR TEMP. <400°C	
		FOR NB 65 & ABOVE	
		CAST CHROME MOLY STEEL TO ASTM A-217 GR. WC6/WC9/WC12A (FOR TEMP. RANGE 400-510°C/510-550°C/>550°C) CAST CARBON STEEL TO ASTM A-216 GR. WCB (FOR TEMP. BELOW 400°C) FOR BOILER FEED DISCHARGE ASTM A-216 GR. WCC	
	BODY SEAT	STELLITED	
	DISC SEAT	STELLITED	
CAP GASKET	INGOT IRON SILVER PLATED		
BOLTS & STUDS	ASTM A-193 GR. B. 7		
NUTS	ASTM A-194 GR. 2H		
TESTING	SHELL HYDROSTATIC TEST PR.	} AS PER CL. 7.1 OF ANSI 16.34 CL. 7.2, 7.2.1 & 7.2.2 OF ANSI 16.34	
	SEAT HYDROSTATIC PRESSURE		

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PPD. BY	PC	PC/SG			TCE.774 2B		
CHD. BY	RM	RM				PROJECT: 1x 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED JAMSHEDPUR	ISSUE R1
DATE	APR-2015	DEC-2015					

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SPECIFICATION NO. TCE.M4-681-006	TATA CONSULTING ENGINEERS LIMITED	SECTION: D
ENQUIRY NO. TCE.7742B-C-540-001	DATA SHEET A6 CHECK VALVE	SHEET 8 OF 9

	SEAT AIR TEST PRESSURE	6 BAR(G)	
NOTES			
1.	END TO END DIMENSIONS OF THESE VALVES CONFORM TO ANSI B 16.10		
2.	MINIMUM HARDNESS OF SEAT : 350 HB		
3.	SEAT TEST TO BE CONDUCTED ALSO AT 25% OF THE SEAT HYDROSTATIC TEST PRESSURE SPECIFIED		
*	CONTRACTOR TO INDICATE BASED ON FLOW DIAGRAM		
	FOR PRESSURE RATING	SIZE RANGE : NB 65 & ABOVE / NB 50 & BELOW	
SERVICE			
	ANSI 600 CLASS AND BELOW		
CONSTRUCTION FEATURES	TYPE	SWING DISC.	
	ENDS	BUTT WELDED TO ANSI B 16.25 FOR NB 65 & ABOVE / SW TO ANSI B 16.11 FOR NB.50 & BELOW	
	CAP	BOLTED / INTEGRAL	
	BODY SEAT	INTEGRAL	
	DISC SEAT	INTEGRAL	
	SPECIAL REQUIREMENTS		
	1.	IBR APPROVAL AS REQUIRED	
	FLUID	*	
MATERIALS	BODY	NB 50 & BELOW	
	CAP		
		ASTM A182 GR. F 11/22/91 (FOR TEMP.RANGE 400-510°C/510-550°C/>550°C A 105 FOR TEMP.< 400°C FOR NB 65 & ABOVE	
	DISC	CAST CHROME MOLY STEEL TO ASTM A-217 GR. WC6/WC9/WC12A (FOR TEMP.RANGE 400-510°C/510-550°C/>550°C) CAST CARBON STEEL TO ASTM A-216 GR. WCB (FOR TEMP. BELOW 400°C) FOR BOILER FEED DISCHARGE ASTM A-216 GR. WCC	
	BODY SEAT	STELLITED	

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	DISC SEAT	STELLITED
	CAP GASKET	SOFT IRON / SWG SS-304
	BOLTS & STUDS	ASTM A-193 GR. B. 7
	NUTS	ASTM A-194 GR. 2H
TESTING	SHELL HYDROSTATIC TEST PR.	AS PER CL. 7.1 OF ANSI 16.34
	SEAT HYDROSTATIC PRESSURE	CL. 7.2,7.2.1 & 7.2.2 OF ANSI 16.34
	SEAT AIR TEST PRESSURE	6 BAR(G)
NOTES		
1.	END TO END DIMENSIONS OF THESE VALVES CONFORM TO ANSI B 16.10	
2.	MINIMUM HARDNESS OF SEAT : 350 HB	
3.	SEAT TEST TO BE CONDUCTED ALSO AT 25% OF THE SEAT HYDROSTATIC TEST PRESSURE SPECIFIED	
*	CONTRACTOR TO INDICATE BASED ON FLOW DIAGRAM	
4.	DATA SHEET FOR ANY OTHER TYPE OF VALVES EXCEPTING GATE, GLOBE & CHECK VALVE WILL BE FURNISHED DURING DETAIL ENGINEERING STAGE.	

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CHD. BY	RM	RM				PROJECT: 1x 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11	ISSUE R1
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TCE.7742B-C-540-001	1 X 40MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 TATA STEEL LIMITED, JAMSHEDPUR STEAM TURBINE GENERATOR AND AUXILIARIES SPECIFIC PIPING REQUIREMENTS	SHEET 1 OF 9

21.0 SPECIFIC PIPING REQUIREMENTS

21.1 Design Requirements

21.1.1 The following clauses describe in detail BIDDEER'S scope with regard to the design and engineering of the piping systems covered under this contract, as indicated in previous sections.

21.1.2 Unless otherwise stated specifically, the CONTRACTOR will be completely responsible for the entire design and engineering of all the piping systems supplied by him.

21.2 Line Sizing

Sizes of pipelines will be selected such that the velocity of fluid in pipes does not exceed the following limits under conditions of maximum possible volumetric flow:

Steam

Superheated steam	75 m/s
Saturated steam	40 m/s
Wet steam/Exhaust steam	30 m/s
Process steam	75 m/s

Water

Pump suction	1.5 m/s
Pump delivery	3.0 m/s
Boiler feed pump discharge	6.0 m/s
Service/Potable water	1.5 m/s

Oil

LDO	2 m/s
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Air

Compressed air	15 m/s
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21.2.1 Lower values of velocities than those stated above will be used to determine line size if dictated by considerations of pressure drop, NPSH, surges, water hammer, etc.

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21.2.2 The design flows considered in line sizing will not be less than the rated capacities of equipment to which the piping is connected such as pumps, blowers, compressors etc., or the system heat and/or mass balance diagrams.

21.2.3 Sizes of CEP pump suction piping will be selected to meet the NPSH requirements of the pumps under both normal and transient conditions prevailing on loss. Similarly for all pumps, NPSH requirements will be satisfied in line sizing.

21.3 **Piping Layout**

21.3.1 It is the CONTRACTOR's responsibility to plan and finalise all piping layouts in accordance with the flow diagrams and general arrangement drawings. CONTRACTOR will prepare fabrication and isometric drawings as well as composite piping drawings. The CONTRACTOR will plan the layout of pipelines in such a way as to avoid interference with other pipes and their hangers and supports, structures, equipment, electrical conduits, cable trays, ventilation ducts, etc. If any interference occur during erection of piping at site, the CONTRACTOR will modify the piping suitably to clear the same at no extra cost to the PURCHASER. The pipe routing will also take into account the availability of structures/structural members for providing suitable supports and hangers.

21.3.2 In case of pipes at working temperature above the ambient, the CONTRACTOR will ensure that the layout finalised has adequate flexibility to absorb thermal expansion without causing undue stress in the pipelines. Further CONTRACTOR will carry out exhaustive stress analysis studies for piping which has temperature more than ambient as per internationally accepted procedure and present the results to the ENGINEER for approval. CONTRACTOR will also furnish a write-up furnishing all details regarding methodology adopted for analysis, computer programs employed alongwith input/ output list.

21.3.3 Piping will generally be routed above ground but where specifically indicated or approved by the ENGINEER, such pipe work may be arranged in trenches or buried with adequate corrosion protection.

21.3.4 Drains will be provided at all low points and vents at all high points as per actual layout regardless of whether the same have been shown in the flow diagrams or not. Pipelines will be sloped towards the drain points. Drains on all steam lines will be provided with suitable trap assemblies. Each trap assembly will be provided with isolating, bypass valves. Drains will be provided also at appropriate points to enable on line instruments, control valves, etc., to be removed from the line for repairs or replacement. Any additional requirement of drains/vents indicated by the ENGINEER while reviewing CONTRACTOR's piping drawings will be provided by the CONTRACTOR without any additional cost.

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21.3.5 All equipment/piping drains will be piped upto the nearest flash boxes/floor drains, as required, by the CONTRACTOR. Similarly, all vents will be piped outside the buildings or flash tanks, as required, by the CONTRACTOR.

21.4 Hangers and Supports

21.4.1 Design and engineering of hangers, pipe supports, clamps, insert plate restraints, anchors for all piping systems supplied by the CONTRACTOR is the responsibility of the CONTRACTOR. Maximum use of the plant steel/concrete structures will be made for taking pipe support. All auxiliary structural steel as required for the provision of hangers, supports, restraints, anchors, etc., on CONTRACTOR's piping system will be designed, engineered and supplied by the CONTRACTOR.

21.4.2 The location of the hangers and supports will be so chosen as to avoid interference with other piping and their supports, cable trays and conduits, ventilation ducts, structural members, equipment, etc. However, the spacing between successive hangers/supports will not exceed the maximum recommended spans indicated in codes.

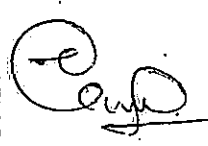
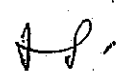
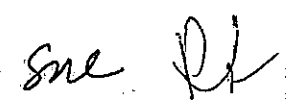
21.4.3 CONTRACTOR will provide anchor at all the terminal points (for hot pipes) and the anchor design will be by CONTRACTOR. Load transferred due to PURCHASER piping would be furnished to the successful CONTRACTOR for design of anchor.

21.4.4 If as per the recommendations of the CONTRACTOR the safety valves are to be located close to the headers, the headers will be designed for accepting full compliment of reaction force due to safety valve discharge at rated capacity.

21.5 Thermal Insulation

21.5.1 CONTRACTOR will submit with a schedule of insulation thickness proposed by him along with sample calculations. The calculations will be based on maximum thermal conductivity values as per relevant Indian standards. No credit would be given to the superior values of thermal resistivity claimed by insulation manufacturer. PURCHASER reserves the right to ask for calculations of any specific case other than sample calculations if PURCHASER / ENGINEER so desires.

21.5.2 CONTRACTOR will demonstrate to the PURCHASER/ENGINEER the surface temperature of the insulation at site. For indoor piping the temperature will be measured at the middle of one segment of piping run at different points. These temperatures will be taken as representative temperature for that length of piping. If the temperature measured is higher than the guaranteed, the whole length will be replaced or additional thickness added to meet the surface temperature. Two measurements will be taken at the measuring points

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21.6 General

- 21.6.1 All structure in the area will be designed to take care of loads due to piping systems provided by the PURCHASER. The details of the above would be furnished to the CONTRACTOR after completion of engineering by CONSULTANT during detailed engineering stage.
- 21.6.2 All Pipes, fittings and valves will comply with attached PMS (TCE. 7742A-ME-900-DC-001)
- 21.6.3 The CONTRACTOR will furnish schedule of terminal point in a format prescribed by PURCHASER.

21.7 Layout and Maintenance Requirements

21.7.1 Layout of all piping will ensure that all valves including motor operated valves are located so as to be accessible conveniently. Valves which require frequent operation and maintenance will have a clear 1.0m approach space. In case where two root valves are provided, one root valve will be near the tap off and the second root valve at an accessible location. The equipment & piping layout will be made to ensure proper access of all equipments & valves with the existing floor. If any of the valves are not accessible, suitable access platform will be provided by the CONTRACTOR. This will be clearly identified in the corresponding piping drawings and design/supply of the platform (if any) will be by the CONTRACTOR.

21.7.2 The layout of piping will ensure that all valves are located so as to be conveniently accessible. The overhead piping will have a minimum working clearance as specified below unless otherwise approved by the ENGINEER. All valves, 100 NB and above will have a clear approach space of 1m to facilitate its operation and maintenance.

All accessible areas will be provided with minimum clear headroom as follows, unless otherwise specified:

Finished floors to ceiling (buildings)	:	3000 mm
Doors, Walkways, Platforms, Stairs etc.	:	2100 mm
False ceiling of office areas	:	2400 mm
Walkway above false ceiling	:	1000 mm
Safety cage for ladders	:	2500 mm
Access for forklift trucks	:	2800 mm
Main roads/Railway crossings & crane access	:	9000 mm
Other plant roads and truck access	:	6000 mm
Cable & Pipe rack	:	3000 mm
(Except Road/Rail crossings)		

21.7.3 All piping will be arranged to provide clearance for the removal of equipment requiring maintenance and for easy access to valves and other piping accessories

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required for operation and maintenance. The orientation of valves/handles/hand wheels/actuators will be such that they can be operated freely in it's full range with free access to operator. Layout drawings will indicate valve orientations and availability of access to valves and specialities.

21.8 BOP PIPING, VALVES & FITTINGS

21.8.1 System Description

All the piping systems will be designed to operate without replacement and with normal maintenance for an estimated plant service life of 30 years and will withstand the cyclic fluctuations in the operating parameters which can be normally expected during the service life.

This section of contract covers all low pressure piping handling fluids like Service water, Potable water, Cooling water, DM water, Compressed air etc.

21.8.2 Design Basis

Pipe lines carrying water, chemicals, air etc. will be sized generally for the following range of velocities.

Service	Below 50 mm	50-150 mm	200 mm & above
Pump suction	-	1.2 - 1.5	1.2 - 1.5
Pump discharge	0.8 - 1.0	1.2 - 1.8	1.5 - 2.5
Header	-	1.2 - 1.8	1.5 - 2.5
Compressed air below 2 Kg/cm2(g)	10 - 15	10 - 20	10 - 25
Compressed air 2 Kg/cm2(g) & above	10 - 20	10 - 25	15 - 25

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Pipe line under gravity flow will be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow will be sized for a maximum flow velocity of 0.6 m/sec.

The following " C" Value will be used in HAZEN WILLIAM's formula for calculating the friction loss in piping systems.

- i) Carbon Steel pipe - 100
- ii) C.I Pipe / Ductile Iron - 100
- iii) Rubber lined steel pipe - 120
- iv) PVC / HDPE pipes - 140
- v) GRP pipes - 150

For calculating the pump head, at least 10% margin will be provided over the pipe friction losses.

21.8.3 Design and Construction

Pipes, valves and fittings

Material of construction for pipes carrying various fluids will be generally as below for detail please refer the PMS no. TCE. 7742A-ME-900-DC-001:

Service	Recommended Material
CW, ACW water	CS with epoxy coating with corrosion allowance. Outside Epoxy for over ground. Wrapping & coating for buried pipes.
Clarified water	CS with epoxy coating with corrosion allowance. Outside Epoxy for over ground. Wrapping & coating for buried pipes.
Acidic Water	Rubber lined Steel/316L SS (Upto 80NB- SS 316L and beyond 80 NB - CSRL)
Demineralised Water	SS 304
Acid (hydrochloric)	SS 304
Alkali (Sodium Hydroxide)	SS 304
Alum Solution	SS 304
Lime Solution/Suspensions	Galvanised Steel/ SS 304

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Service	Recommended Material
Coagulant aid Solution	SS 304
Sludge.	Cast Iron/ Ductile Iron- Cement mortar lined pipes / GRP
Instrument Air	Galvanised Steel

21.8.4 Piping Materials and Sizes

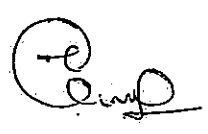
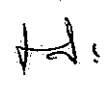
All piping system will be capable of withstanding the maximum pressure and temperature in the corresponding line. The pressure rating of individual piping system component such as valves, flanges etc will however be not less than that specified.

Fittings

- a) Fittings to be used for all types of piping will conform to relevant IS/BS ANSI Standards and in conformity with the parent pipe standard as indicated in PMS no. TCE. 7742A-ME-900-DC-001.
- b) Inside surface of all the fittings used for the rubber lined application will be debaded and made suitable for rubber lining.
- c) Galvanised pipe application- Fittings will be galvanised as per IS:4736.

Following items will be included for piping under this package:

- Pipes, bends, elbows, tees, branches laterals, crosses, reducing unions, couplings, cap, expansion joints, flanges, blank flanges, saddles, shoes, sampling connections etc. necessary for making a reliable piping system.
- Valve, gates, dampers, etc.
- Strainers and filters.
- Instrument tapping connection, stubs and thermo-wells, root valves.
- Matching flanges, pipe spools and matching pipes to connect to equipment, instruments, etc. as necessary.
- Gaskets, ring joint, bracing rings, jointing material etc. as required.


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- Bolts, nuts, fasteners as required for interconnecting piping, valves and fitting as well as for terminal points.
- Pipe supports like pedestals, Anchor blocks (for buried / overground piping), brackets, hangers, clamps, trestles, etc.
- Secondary steel for pipe supports and embedded steel. Also pipe supports and necessary embedment required to be embedded in concrete for under ground/above ground pipes.
- Painting, anti-corrosive coatings, wrapping and coating, thermal insulation, etc. inside and outside of pipes as necessary.

End connections

End connections will be as described in the PMS TCE. 7742A-ME-900-DC-001.

Piping Layout

Pipes will be generally routed above ground but where specifically indicated/specified, the pipe may be laid in trenches or buried. Buried piping will be generally installed so that the top of pipe is 1.5 metre below the ground level unless otherwise specifically mentioned. At the road crossings, the underground pipes will be laid minimum 1.5 metre below the ground level with concrete encasement. Full length of buried piping will be provided with 100 mm thick sand bed.

Complete supporting system for the pipe line will be designed, fabricated and supplied by the CONTRACTOR. Inside the building, the overhead portion of the pipe line may be supported from the building structures. No support will be taken from the brick wall. Outdoor, pipes other than buried pipes will run on steel trestles. Crossing of the road on a pipe bridge will be with a clear height of at least 8 metres (minimum) over the road surface. All the steel structure for the pipe bridge, and the supporting posts/trestles along with all necessary hangers, clamps, connecting steel, fixing bolts, nuts etc. will be supplied and

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erected by the CONTRACTOR. All pipe rack will be provided with 750 mm (Minimum) clear width walkways.

Hangers and supports will be capable of carrying the sum of all concurrently acting loads. They will be designed to provide the required supporting strength and allow pipe line movements as necessary. All guides, anchors, braces, dampener, expansion joint and structural steel to be attached to the building/structure, trenches etc. will be provided.

Mitre bends will not be accepted for steel pipes of 250 NB and below. For sizes 300 NB and above, the mitre bends will conform to BS:534.

Valves

All valves, will be suitable for service conditions i.e. flow, temperature and pressure under which they are required to operate. The valves will be of standard pressure rating as per the relevant code/ standard:

Manually operated valves will be provided with reduction gear unit for valves of size 250 NB and above. Valve provided with motorised or pneumatic actuator will be provided with a hand wheel for manual operation.

All the valves will be equipped with adjustable mechanical stop-limiting devices to prevent over travel of the valve disc in the open and closed positions. The valve operators (Handwheel or Gear reduction unit or Motor actuator etc.) will be designed as per relevant International Standard. Valve details will be as described in the PMS no. TCE. 7742A-ME-900-DC-001.

21.9 3-D Modeling

Purchaser proposes to carry out detailed engineering in 3D environment utilising Autodesk Plant 3D software. CONTRACTOR will model the equipment covered in the package(s) and accessories and also associated integral/external piping system using 3D software (The exact version and other modalities will be discussed with the successful CONTRACTOR during detail engineering stage) to enable OWNER to carry out 3D modelling of equipment and their location in the power plant. The archival of 3D model will be furnished to the OWNER in phased manner at mutually agreed schedule so that the same can be integrated with the model developed by the OWNER / ENGINEER.

CONTRACTOR will follow PDMS to make 3D modeling. All 3D model files to be shared by CONTRACTOR to Owner for model integration.

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TCE.7742B-C-540-001	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR STEAM TURBINE GENERATOR AND AUXILIARIES ERECTION, COMMISSIONING AND TESTING	SHEET 1 OF 6

22.0 ERECTION, COMMISSIONING AND TESTING REQUIREMENTS

General Requirements

- 22.1 The CONTRACTOR will erect all equipment/systems covered in this specification.
- 22.2 Transferring levels and coordinates from the master bench marks provided by the PURCHASER is the responsibility of the CONTRACTOR.
- 22.3 The erection work will include grouting of foundation bolts; base plates, etc. touch up and finish painting. Only open space for storage will be provided by the PURCHASER inside the plant boundary. CONTRACTOR will make all arrangements for proper storage of equipment.
- 22.4 Calibration and commissioning of all instruments and control equipment supplied under this contract will be executed by the CONTRACTOR. Hardware's required for erection of all instruments and control equipment covered under this contract will be supplied by the CONTRACTOR.
- 22.5 The entire works will be carried out with necessary precautions to meet the rules of local statutory authorities to have the utmost protection to men and material. A full fledged safety engineer will be provided by the CONTRACTOR to be in charge of the supervision of safety requirements at site. It is the CONTRACTOR's responsibility to provide safety to his personnel and equipment.
- 22.6 Grouting the bases of all equipment and structural steel members erected by the CONTRACTOR is covered in his scope and supply of all grouting materials in the CONTRACTOR's responsibility. Concrete/ cement mortar cubes/briquettes, etc., will be tested for their strength by the CONTRACTOR at his cost. Grouting permits will have to be cleared by the PURCHASER only after which the CONTRACTOR will undertake grouting work.
- 22.7 Works such as machining and bedding of packers, minor rectification of foundation bolts, reaming of holes, drilling for dowels, making new dowel pins, etc., if required are also covered in the CONTRACTOR's scope.
- 22.8 Pre-commissioning checks, individual loop checks, power initialisation, verification of system functioning, trouble shooting final solutions to application and/or instrument problems etc., is SUPPLIERS responsibility. All the required software and hardware changes will be incorporated as required for successful commissioning to Purchaser's satisfaction.

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- 22.9 CONTRACTOR will submit a detailed PERT network for all activities. This master network will be comprehensive and detailed in all aspects. After review and approval of this network by the PURCHASER, this approved network will be the basis for all erection work. Based on this master network, the CONTRACTOR will develop sub-networks and bar charts for all activities. The 'START' and 'COMPLETION' dates of all construction activities and milestone activities will be closely adhered to.
- 22.10 The CONTRACTOR will abide by general safety and security rules formulated by the PURCHASER. CONTRACTOR will furnish the detailed safety manual for erection & commissioning of the steam turbine generator and auxiliaries.
- 22.11 The CONTRACTOR will maintain records of all non-consumable items such as tools, tackles, Machineriers etc. with all the incoming and outgoing gate passes corresponding to each items/equipments belonging to him to facilitate easy identification and take-over while closing the site office.
- 22.12 Supply and erect metallic tags on the equipment/valves/instruments and accessories supplied by the CONTRACTOR. The tags and connecting wires will be of stainless steel and the size of the tags will be adequate to accommodate tag number.
- 22.13 Construction water and construction power will be made available by the PURCHASER at one point in the plant on chargeable basis. Further connections required from this point onwards will be included by the SUPPLIER in his scope.

Specific Requirements

- 22.14 Supply of adequate quantity of consumables required for the job, viz., drill bits, tapes, scaffolding, , oil, kerosene, grease, lubricants, cotton waste, chemicals etc., required for erection, commissioning and testing till handing over is covered under this contract. Welding electrodes and gas for field erection will have to be arranged by the CONTRACTOR.
- 22.15 DM water required during commissioning will be made available at the battery limit and further distribution will be carried out by the CONTRACTOR. All temporary piping and accessories will be in CONTRACTOR's scope.
- 22.16 The CONTRACTOR will prepare isometric drawings for installation and routing of impulse pipes from the tapping point location to each instrument and device supplied by him. The CONTRACTOR will furnish an installed drawing to the PURCHASER.

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TCE.7742B-C-540-001	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR STEAM TURBINE GENERATOR AND AUXILIARIES ERECTION, COMMISSIONING AND TESTING	SHEET 3 OF 6

22.17 During erection, commissioning and testing activities like hydro test, acid cleaning etc., all the effluents will be made available up to the treatment facility provided by OTHERS. Acid cleaning if required for the reasons attributable to the SUPPLIER and will be done by the SUPPLIER without extra price.

22.18 During steam blowing operation CONTRACTOR will make provision for silencers to attenuate the noise level within the acceptable limits.

22.19 Installation Requirements

(a) The installation details given in the specification are the guide lines and the installation will be done as per the standards. The exact routing of impulse pipes/ tubes will be decided at site during erection by the CONTRACTOR depending upon the location of tap points. PURCHASER/ ENGINEER reserves the right to approve the suitable location of field mounted junction boxes.

(b) The CONTRACTOR will prepare isometric drawing for installation and routing of impulse pipes from the tapping point location to each instrument and device supplied by him. The CONTRACTOR will furnish as installed drawing to the PURCHASER/ENGINEER.

(c) The actual location of junction boxes and other instruments will be decided by the CONTRACTOR depending on the site conditions considering the layout and maintenance aspects.

(d) The CONTRACTOR will get prior approval of the PURCHASER/ ENGINEER before any installation work starts. If any work is carried out by the CONTRACTOR before prior approval from PURCHASER/ ENGINEER and modification is sought by PURCHASER/ENGINEER later, then the work will be redone by the CONTRACTOR without any cost/material implications to the PURCHASER/ ENGINEER.

(e) Impulse/sample piping, air supply and pneumatic tubings and equipment will be supported rigid enough to prevent vibration and anchored sufficiently to prevent strains on equipment installed. Supporting clamps will be provided atleast at every one metre distance for better rigidity. Impulse/sampling piping will be provided with adequate slope. (preferably 1:6). Hanger and supports will be so installed as not to interfere with free expansion and contraction of the piping and tubing between anchors. Suitable vibration dampeners etc., will be provided wherever necessary. In addition, care should be taken that the arrangement of impulse/sampling piping, air supply and pneumatic tubing and supports will provide for safety under working stress and will protect the impulse/sample piping, air supply and pneumatic tubing from detrimental sagging, mechanical injury, abuse due to unusual service conditions from sources other than those due to pressure, temperature and vibrations. All impulse line of joints will be welded type unless otherwise specified.

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- (f) All the, cabinets supplied by the CONTRACTOR will be welded or bolted to the floor channel.
- (g) The CONTRACTOR will also carryout the following works.
- (i) Mounting of all thermowells, thermometers, thermocouples and RTD and Seal welding of the thermowells wherever required.
 - (ii) Erection of drain pipes and associated fittings of the field mounted instruments to the floor drains.
 - (iii) Supply of local supports/mounting bracket with necessary fixtures for all the equipment supplied.
 - (iv) Welding for high pressure piping/tubing as per IBR requirements.
- (h) If in the opinion of PURCHASER/ENGINEER, the tools and tackles etc. provided by CONTRACTOR are not adequate, the CONTRACTOR will suitably augment the same as directed by PURCHASER/ENGINEER. In the event of non compliance by the CONTRACTOR, the owner reserves the right to augment such facilities and back charge the CONTRACTOR all expenses incurred in this connection including the PURCHASER's overheads.

22.20 Testing Requirements

- (a) The CONTRACTOR will set up his own instrument laboratory. The calibration equipment will cover complete range and will have the desired accuracy of not less than 0.1%. All the calibration equipment will have the certification from National Physical Laboratory (NPL) or 'IDEMI' for the duration of the Contract period.
- (b) The CONTRACTOR will follow the standard procedures for calibration of various instruments and as set by the manufacturer of instruments and as instructed by the PURCHASER including any requirements of field calibration. First, the calibration will be carried out independently by the CONTRACTOR and later in presence of PURCHASER and get certified. Proper documentation in this regard will be maintained and handed over to the PURCHASER.
- (c) All the instruments will be calibrated for the entire range of the instrument for which it is designed. Calibration will include test for repeatability. After first commissioning, the instruments will be tested for calibration again to check whether the instrument maintains its zero and maximum of the range.
- (d) All switches will be tested for the actuation of both normally open and normally closed contacts at the desired set points and also for the fixed differential settings.

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- (e) All the float operated level switches will be tested for the movement of the float and linkages to make or break the switch contacts by filling up with water before installation. For such tests necessary testing set up required will be arranged by the CONTRACTOR. All the conductivity type probes and switches will be tested for performance before installation.
- (f) All control valve/control damper positioners supplied by the CONTRACTOR and connected to the control system (loops) supplied by OTHERS will be calibrated based on the input data furnished by PURCHASER.
- (g) For all electrical actuators of the valves, functioning, setting and performance of limit switches/torque switches at various positions will be checked before and after installation of the actuators. The positioner will be calibrated.
- (h) Pneumatic actuators will be calibrated at site.
- (i) All valves/Dampers/Actuators/Control valves/Pipes & fittings are to be properly cleaned, serviced, manually operated before being erected in position.

22.21 Commissioning Requirements

- (a) All the items supplied by the CONTRACTOR will be commissioned.
- (b) Prior to taking the instruments in service, all impulse lines, sampling lines and air supply lines will be blown as many times as required with the establishment of adequate line pressure and temperature conditions to keep the lines thoroughly clean to the satisfaction of PURCHASER.
- (c) Blow out of these lines and commissioning of the instruments may have to be repeated many times till the unit takes full-load and in continuous operation. The CONTRACTOR will meet these requirements as instructed by PURCHASER/ENGINEER.
- (d) Once the instrument is taken in service, the CONTRACTOR will physically inspect the various joints and pipes for leakages and report to PURCHASER and take up the repair work to rectify the faults.
- (e) On-line [ie. without removing control valves from the pipe] calibration of the positioners and stroking of control Valves/control dampers will be carried out as required by PURCHASER during control system tuning.
- (f) Manufacturer's instructions will be thoroughly understood and followed before commissioning each instrument.
- (g) After delivery of the equipment, the CONTRACTOR will locate all the equipment including electronic cards in its final position, check all the

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power wiring, grounding and interconnection cables, all in accordance with manufacturer's recommendations. The CONTRACTOR will perform initialisation of system power, and system functionality to verify conformance with manufacturer's instructions and specifications, implementation of any configuration changes as required and providing general trouble shooting and final solutions to application and/or instrument problems.

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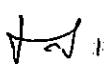
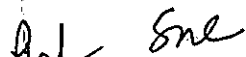
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ANNEXURE - 12

SPECIFICATION NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION: C23
TCE.7742B-C-540-001	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR STEAM TURBINE GENERATOR & AUXILIARIES STARTUP, ESSENTIAL & RECOMMENDED SPARES	SHEET 1 OF 2
<p>23.0 STARTUP, ESSENTIAL AND RECOMMENDED SPARES</p> <p>Spares</p> <p>23.1 The spares supplied will be strictly interchangeable with parts for which they are intended for replacement.</p> <p>23.2 The spares will be treated and packed for long storage (minimum 5 years) under the climatic conditions prevailing at the site.</p> <p>23.3 The start-up spares will be delivered at the site well in time before the start-up and commissioning of the plant.</p> <p>Start-Up Spares</p> <p>23.4 The start-up spares are those spares which will be required during start-up and commissioning of the equipment/systems, and until performance testing. It is the responsibility of the SUPPLIER to supply all the necessary spares as required until the equipment/systems are handed over to the PURCHASER. An adequate stock of start-up spares will be available at the site such that the start-up and commissioning of the equipment/systems, performance testing and handling over the equipment/systems to the PURCHASER will be carried out without hindrance and delay. All start-up spares which remain unused after the taking over the plant will remain the property of the PURCHASER. The list of startup spares considered for each unit is furnished in the Section-F6, Schedule of Start-up Spares.</p> <p>Essential Spares</p> <p>23.5 Essential spares are those considered necessary by the PURCHASER for first three (3) years of normal plant operation. A list of such spares has been listed in the Data Sheet-A19 and the same will be included in SUPPLIER's scope. When a particular item of spares is indicated as 'percentage', it will be considered as percentage of total number of that item of spares in the single equipment/system, unless specified otherwise and the fraction will be rounded-off to the next higher whole number. Whenever the item of spares has been indicated as 'set' the same will mean the supply for a single equipment/system. One set of spares for the particular equipment will mean the total quantities of that particular spares for a single equipment e.g., 'set' of bearings for a pump will include the total number of bearings in a pump. The 'set' will however include all components required to replace that item of spares. Whatever essential spares are ordered by PURCHASER, will be in the scope of CONTRACTOR/ SUPPLIER.</p> <p>23.6 In case during start-up and commissioning certain essential spares are used up, the same will be replaced within one (1) month without any commercial implications.</p>		
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23.7 CONTRACTOR will furnish details/dimensional sketch for all essential spares.

Recommended Spares

23.8 In addition to the spares mentioned above, the CONTRACTOR will also furnish a list of recommended spares with unit prices. The PURCHASER reserves the right to buy any of the recommended spare parts as considered necessary by him. The prices of recommended spares will be consistent with those of start-up / essential spares. This recommended spares are not part of this contract. Purchase of these spare parts will be covered by a separate order or an amendment to the contract. Whatever recommended spares are ordered by PURCHASER, will be in the scope of CONTRACTOR/SUPPLIER.




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SPEC.NO. TCE.7742B-C- 540-001	TATA STEEL LIMITED CONSULTANT: TATA CONSULTING ENGINEERS LIMITED 1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11	SECTION: D19
	WELDING SPECIFICATION FOR POWER PLANT PIPING SYSTEMS	SHEET 1 OF 17
1.0	<u>SCOPE</u>	
1.1	This CONTRACT will apply to all welded pipe joints of carbon and alloy steels including stainless steels for power plant piping systems. This CONTRACT is applicable to shop fabrication, site fabrication and field erection. The welded joints are hereby defined as including:	
1.1.1	All the line joints of the longitudinal and circumferential butt welded and socket welded type.	
1.1.2	The attachment of castings, forgings and flanges to pipe.	
1.1.3	Welded manifold headers and all other sub-assemblies.	
1.1.4	Welded branch connections with or without saddles and reinforcement rings.	
1.1.5	Fabrication of built-up fittings.	
1.1.6	The attachment of smaller connections for drips, drains instruments, branch lines, weldolets, sockolets, thermowells, couplings, etc.	
1.1.7	Any other similar joints not specified above but encountered during fabrication and/or erection stage. It is imperative that the CONTRACTOR makes every effort to secure the same high degree of competent supervision and workmanship during field erection as is intended for shop fabrication in view of the adverse field conditions of weather, piping location etc.	
1.2	Material specifications generally covered are as follows :	
1.2.1	<u>Alloy Steel Piping</u>	
	Ferritic alloy steel pipes to SA 335 grades P11, P12, P22, P-91 or equivalent; austentic alloy steel pipes to SA 312 Grade TP 304, 316, etc. or equivalent and corresponding materials for fittings, flanges valves etc.	
1.2.2	<u>Carbon Steel Piping</u>	
	Carbon steel pipes to SA106 grade A,B,C or SA 53 Grade A,B; SA 672 Gr B60 Cl.12, IS-1239, IS-1978, API-5L grade B, etc. or equivalent and corresponding materials for fittings, flanges, valves, etc.	
2.0	<u>CODES AND STANDARDS</u>	
	The welding of fusion welded system will comply with all currently applicable statutes, regulations and safety codes in the locality where it will be installed. It	
		 

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	CONSULTANT: TATA CONSULTING ENGINEERS LIMITED 1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 WELDING SPECIFICATION FOR POWER PLANT PIPING SYSTEMS	




will also conform to the latest applicable standards. Nothing in this CONTRACT will be construed to relieve the CONTRACTOR of this responsibility. In particular, the welding and fabrication will conform to the latest editions of the following codes and standards:

- 2.1 ASME code for power piping (ASME B31.1)
- 2.2 Indian Boiler Regulations (IBR)
- 2.3 ASME Boiler and Pressure Vessel Codes:
 - Section II, Part A "Ferrous Material Specifications"
 - Section II, Part C "Specifications for Welding Rods, Electrodes and Filler Metals"
 - Section V "Non Destructive Examination"
 - Section VIII "Rules for Construction of Pressure Vessels"
 - Section IX "Welding and Brazing Qualifications".
- 2.4 Standards of Pipe Fabrication Institute, USA.
- 2.5 BS 2633 "Specification for Class 1 Arc Welding of Ferritic Steel Pipe Work for Carrying Fluids".
- 2.6 Any other codes/ standards specified in Section C
- 2.7 The above mentioned codes and standards form an integral part of this CONTRACT. In the event of conflict between this CONTRACT and the codes and standards listed above, the stricter requirement of the two will govern.
- 3.0 **WELDING PROCESSES**
- 3.1 The welding processes that are used in the fabrication and welding are restricted to shielded metal arc welding (SMAW) and gas tungsten arc welding (GTAW) or a combination of the two.
- 3.2 GTAW root pass will be employed for all alloy steel piping and carbon steel piping. Subsequent welding after root pass can be carried out by SMAW with coated electrodes. Exceptions are as follows :





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<p>(a) For pipes of thickness less than 6mm, the entire welding will be carried out by GTAW only. When using GTAW welding process, welding without the addition of filler metal will not be done.</p> <p>(b) For LP piping systems such as water and air piping systems entire welding including root pass may be carried out by SMAW.</p> <p>3.3 Where special welding techniques are recommended by equipment manufacturer for piping connecting to equipment, appropriate qualification tests and welding techniques will be followed. The specific and detailed instructions of equipment manufacturer regarding welding, preheating, stress relieving etc. will be strictly adhered to by the CONTRACTOR at no extra cost to the Purchaser.</p> <p>4.0 <u>PROCEDURE AND PERFORMANCE QUALIFICATIONS</u></p> <p>4.1 No production welding will be undertaken until the procedure qualification tests which are to be used have been established as per ASME Boiler and Pressure Vessel Code- Section IX and/or IBR. Test results and specimens from qualification tests of the welding process and welding operators will be made available to the PURCHASER/ ENGINEER, for approval, where results of existing procedure qualifications and of welders, performance tests are acceptable to the PURCHASER/ ENGINEER, such results will be kept on file and be subject to review regularly. Where doubt exists regarding the acceptability of any qualification test, a retest will be made. All such qualifications tests and specimen testing will be conducted in the presence of the PURCHASER/ENGINEER.</p> <p>4.2 The costs of all procedure qualification and tests will be borne by the CONTRACTOR.</p> <p>4.3 The CONTRACTOR will prepare a written specification containing the information detailed in section IX of ASME Boiler and Pressure Vessel Code. Form QW-482, - "Welding Procedure Specification" (WPS) and the qualification test data and other information detailed in Form QW-483.- "Procedure Qualification Record" (PQR). These documents will be provided to the PURCHASER/ENGINEER for review and approval. The CONTRACTOR will prepare certificate of Welder/Welding operator Performance Qualification Test (WPO) containing the information detailed in Form QW-484 : "Manufacturer's Record of Welding or Welding Operator Qualification Test" of ASME Section IX. These will be kept on field and made available to the PURCHASER/ ENGINEER upon request.</p> <p style="text-align: center;">    </p>		

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<p>5.0 <u>WELDERS AND SUPERVISORS</u></p> <p>5.1 Unless otherwise agreed, the CONTRACTOR will advise the PURCHASER/ENGINEER, in writing at least three (3) weeks before any welder is employed on the work, the names and qualifications of the proposed welders and welding supervisors. It will be the CONTRACTOR's responsibility to ensure that all welders employed by him or his SUB-CONTRACTORS on any part of the Contract either in the CONTRACTOR'S /his SUB-CONTRACTOR's works or at site are fully qualified as required by the code. Each welder will qualify for all types of welds and materials he may be called upon to weld.</p> <p>5.2 Should the PURCHASER/ENGINEER require test or retest of any welder, the CONTRACTOR will arrange for the same at no extra cost to The PURCHASER/ENGINEER.</p> <p>5.3 Welding supervisors will have qualifications such as Engineering Degree/Diploma in welding technology with adequate knowledge of non-destructive testing and a minimum of 5 years experience in supervising welding of pipe joints.</p> <p>5.4 All welding including tack welding will be carried out by approved welders only. Any weld made by other than an approved welder will be cut out and rewelded.</p> <p>5.5 For purposes of identification and to enable tracing full history of each joint, each welder employed on the work will be given a designation. The welder's designation and the date on which the joint was made will be stamped on the relevant piping and marked on the relevant drawings also. Copies of the drawings so marked will be furnished to the PURCHASER/ENGINEER for record purposes. Alternatively, record charts may be used.</p> <p>5.6 For each welder, a record will be maintained showing the procedures for which he is qualified. The details of production welds, the date of welding the type of defects occurred and their frequency. The record will be available for review by the PURCHASER/ENGINEER and those welders whose work required a disproportionate amount of repair will be disqualified from welding. Requalification of welders disqualified will be entirely at the discretion of the PURCHASER/ENGINEER.</p> <p>6.0 <u>PREPARATION OF WELD ENDS</u></p> <p>6.1 Surfaces to be welded will be smooth, uniform and free from fins, tears and other defects which would adversely affect the quality of the weld. All</p> <div style="display: flex; justify-content: space-between; align-items: flex-end; margin-top: 20px;"> <div> </div> <div> </div> <div> </div> <div style="border: 1px solid black; padding: 2px;"> ISSUE R5 </div> </div>		

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	CONSULTANT: TATA CONSULTING ENGINEERS LIMITED 1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 WELDING SPECIFICATION FOR POWER PLANT PIPING SYSTEMS	

welding faces and adjoining surfaces, for a distance of atleast 150 mm from the edge of the welding groove or 12mm from the toe of the fillet in the case of socket welded or fillet welded joints will be thoroughly cleaned of rust, scale, paint, oil or grease both inside and outside prior to welding.

6.2 Unless otherwise specified, joints for pipes 50mm NB and smaller, will be socket welding type and for pipes 65mm NB and larger, will be of the butt-welding type. All butt welds will be full penetration welds.

6.3 BUTT JOINTS

6.3.1 Butt joints will be prepared as per ASME B 16.25 and/or IBR unless otherwise specified.

6.3.2 While meeting the alignment requirements of piping joints as per Cl. 127.3.1 C of ASME B31.1, care will be exercised that the trimming depth in case of excess mis-alignment does not interfere with Radiography/Ultrasonic Test (RT/UT) interpretations. In such cases the trimming width from the tip of the edge preparation along the pipe will be large enough that it is well away from the weld face.

6.3.3 Unless noted otherwise, all butt welds will be made without using backing rings.

6.4 T. CORNER AND LAP JOINTS

These will be prepared as follows :

- a) Fillet welds will have a throat dimension equal to the nominal thickness of either of the joint members.
- b) Weld edges of full penetration groove welds for T joints will be prepared with a minimum included angle of 45 deg.




6.5 The ends will be prepared by machining, grinding or flame cutting. Where flame cutting is used, the effect on the mechanical and metallurgical properties of the base metal will be taken into consideration. Flame cutting of alloy steel pipes is not allowed. However, flame cutting of carbon steel pipes is permitted. Wherever practicable, flame cutting will be carried out by machine. Machine flame cut edges will be substantially as smooth and regular as those produced by edge planing and will be cleaned free of slag. Manual flame cutting will be permitted only where machine flame cutting is not practicable and with the approval of the PURCHASER/ENGINEER, and such surfaces will be ground or dressed to a smooth finish as required by the specification and to the satisfaction of the PURCHASER/ENGINEER. Slag,

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	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 WELDING SPECIFICATION FOR POWER PLANT PIPING SYSTEMS	SHEET 6 OF 17
<p>scale or oxides will be removed by grinding to bright metal atleast 2mm beyond the burnt area.</p> <p>6.6 Thermal cutting of carbon steel piping will be performed under the same conditions of preheat and post heat as for the welding of carbon steel material. However, post weld heat treatment is not required when :</p> <p>a) The heat affected zone produced by thermal cutting is removed by mechanical means immediately after cutting. However, in any case, all remaining slag scale or oxides will be removed by grinding to bright metal at least 2mm beyond the burnt area, or</p> <p>b) Thermal cutting is part of fabrication, manufacturing or erection sequence leading to a weld end preparation where welding immediately follows.</p> <p>6.7 For the piping systems that are supplied by the PURCHASER/ ENGINEER but being erected by the CONTRACTOR, bevelling of pipes for butt welds will be carried out as indicated on the respective piping fabrication drawings, where required. For systems which the CONTRACTOR supplies and erects, the pipe ends will be bevelled to conform to applicable codes/standards. At connections to equipment, the bevelling of piping will conform to the requirements of the equipment connections.</p> <p>6.8 Any change in the joint configuration will be done after the approval from the PURCHASER/ENGINEER.</p> <p>6.9 All weld joint fit-up will comply with the tolerances specified on the design drawings or applicable codes and standards.</p> <p>6.10 If the CONTRACTOR uses a header arrangement with central location of oxygen and acetylene for cutting and edge preparation operations, the arrangement will be in accordance with best safety practices and standards and will be approved by the PURCHASER/ENGINEER.</p> <p>6.11 Before fitting up the weld joint, the profile and dimensions of the weld end preparation will be checked by the PURCHASER/ENGINEER. If the specified tolerances are exceeded, this will be corrected (with prior approval) by grinding, machining or any other method acceptable to the PURCHASER/ENGINEER.</p> <p>6.12 All fit-ups will be examined by the PURCHASER/ENGINEER prior to welding the root pass.</p> <p>7.0 <u>WELDING OF PIPES</u></p>		
 		
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- 7.1 All vertical welding will be carried out in the uphill direction unless otherwise approved by the PURCHASER/ENGINEER.
- 7.2 No single run in SMAW will exceed 8 mm in size.
- 7.3 Each leg of the fillet weld will have a length of atleast 1.25 times the nominal wall thickness of the pipe. Socket and fillet welds will have a minimum of two weld layers.
- 7.4 All tack welds will be made using a qualified procedure and qualified welders. Any preheat requirements specified on the welding procedure will also apply to tack welds.
- 7.5 All tack welds will be examined visually for defects, and if found defective will be completely removed.
- 7.6 As the welding proceeds, tack welds will be either removed completely or will be properly prepared by grinding or filling their stopping and starting ends so that they may be satisfactorily incorporated in the final weld.
- 7.7 The maximum weaving of any SMAW or GTAW run will be of 3 times the electrode dia.
- 7.8 Welded-on branches for all piping systems will be full penetration type connection.
- 7.9 Preheating prior to tack welding and welding as called for in clause 8.0 will be employed as a means of crack prevention and improving general weld reliability. At no time during welding will the temperature of the joint be allowed to fall below the minimum preheat temperature. Excessive preheating will be avoided.
- 7.10 Irrespective of the class of steel, root runs will be made without interruption except for changing the electrodes or to allow the welder to reposition himself. Root runs made in the shop may afterwards be allowed to cool by taking suitable precautions to ensure slow cooling e.g. by wrapping in a dry asbestos blanket. Welds made at site will not be allowed to cool until the thickness of weld metal deposited exceeds one third of the final weld thickness or 10 mm, whichever is greater.
- 7.11 When welding alloy steels, it is strongly recommended that interruption of welding will be avoided. Where such interruption is unavoidable, either the preheat will be maintained during interruption or the joint will be wrapped



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in dry asbestos blankets to ensure slow cooling . Before recommencing welding preheat will be applied again.

- 7.12 No welding will be done if there is impingement of rain, snow, sleet or high wind on the weld area.
- 7.13 Welded-on bridge pieces and temporary attachments should prefer-ably be avoided. Where approved by the PURCHASER/ ENGINEER. they may be used .Material of these will be compatible with parent material. All these pieces will be removed carefully without damaging the parent material after welding of pipe joints and the weld area ground flush and subjected to magnetic particle examination before applying any postweld heat treatment, which will embrace the area occupied by the bridge pieces also. These pieces will be welded by qualified welders and with electrodes compatible with the parent material. The preheating requirements will be applied and maintained during the welding of pieces.
- 7.14 The arc will be struck only on those parts of parent metal where weld metal is to be deposited. In the event of any inadvertent arc strikes the defects will be removed by grinding and the area examined by liquid penetration or magnetic particle testing method.
- 7.15 (a) Oxides will not be permitted to form during welding or heat treatment or both, on the internal surfaces of pipes which will not be subsequently cleaned. Inert gas purging will be an acceptable method to prevent such oxidation. All joints in materials which contain greater or equal to 5% chromium will be purged to assure that less than 1% of oxygen is present on the joint underside before initiation of the welding. The purging operation will be maintained for two passes. Refer Cl. 7.15 (b) for flow rate during purging .The CONTRACTOR may submit examples of any other procedures for consideration of the PURCHASER/ENGINEER.
- (b) Argon gas used in GTAW process for shielding and purging will be of minimum 99.95%. purity. Purging will be carried out at a flow rate depending on diameter of pipe until 6 times the volume between dams is displaced. In no case will the initial purging period be less than 10 minutes. After initial purging, the flow of the backing gas will be reduced to a point where only a slight positive pressure prevails. Any dams used in purging will be fully identified and removed after welding and accounted for in order to avoid leaving them in the system.
- 7.16 Thorough check will be exercised to ensure that the required inter pass temperature is maintained.

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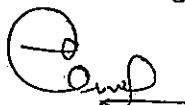
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SPEC.NO. TCE.7742B-C- 540-001	TATA STEEL LIMITED	SECTION: D19 SHEET 9 OF 17
	CONSULTANT: TATA CONSULTING ENGINEERS LIMITED 1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 WELDING SPECIFICATION FOR POWER PLANT PIPING SYSTEMS	

- 7.17 All equipment necessary to carry out the welding for supporting of the work, for the preheating and post weld heating including thermal insulation for retaining the heat and for the protection of the welder will be provided by the CONTRACTOR.
- 7.18 After deposition, each layer of weld metal will be cleaned with a wire brush to remove all slag, scale and defects, to prepare for the proper deposition of the next layer. The material of the wire brush will be compatible with pipe material. Special care will be taken to secure complete and thorough penetration of the fusion zone into the bottom of the weld. It is recommended that the root run be checked by liquid penetrant or magnetic particle procedures.
- 7.19 The cleaning of the root from the second side of butt welds is to be carried out wherever feasible by gouging, grinding, chipping, machining or other approved methods. The gouged surface must be cleaned to remove any carbon or oxidised metal before commencing the welding. The welding groove will be examined by dye penetrant or magnetic particle method to ensure that the root is free from defects.
- 7.20 Repair of weld metal defects will meet CL 127.4.11 of ASME B31.1.
- 7.21 Upon completion of welding, the joints will be wrapped in dry asbestos blankets to ensure slow cooling, unless post-weld heat treatment is applied immediately.
- 7.22 No welding or welded parts will be painted, plated, galvanised or heat treated until inspected and approved by the PURCHASER/ ENGINEER. Welds will be prepared/ground in such a way that weld surfaces merge smoothly into the base metal surface.
- 7.23 Except where necessary to grind flush for non-destructive examination purpose, the centre of reinforcement for butt welds will be as indicated below:

Component Thickness (mm)	Max Reinforcement (mm)
Upto 12	1.6
Over 12 to 25	2.4
Over 25 to 50	3.2
Over 50	4.0

The reinforcement will be crowned at the centre and tapered on each side of the joined members. The exposed surface of the weld will be ground where required to present a workman like appearance and will be free from depressions below the surface of the joined members. The exposed surface





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	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 WELDING SPECIFICATION FOR POWER PLANT PIPING SYSTEMS	SHEET 10 OF 17

of the butt welds will be free from undercuts greater than 0.8 mm in depth, overlaps or abrupt ridges or valleys and will merge smoothly into the pipe surface at the weld toe. However, undercuts will not encroach on the minimum section thickness.

- 7.24 Any weld repair will be subject to the approval of the PURCHASER/ENGINEER.
- 7.25 The same area on the weld will not be repaired more than twice. The joint will be remade in case of more than 2 repairs.
- 7.26 Postweld heat treatment will be carried out as per Cl. 132 of ASME B31.1.

7.27 IDENTIFICATION OF WELDS

Wherever code symbol stamps are required on carbon steel and ferritic alloy steel piping they will be applied directly to the pipe with low stress dotted design metal die stamps or to a small stainless steel plate especially provided for such marks. These plates will be lightly tack welded to the pipe using electrodes (of diameter 3 mm or less) of the type specified for the material. Before making the required tack weld, the pipe material in the immediate surrounding area will be preheated, as required, by electric means or propane or natural gas burners. Cooling will take place under asbestos insulation in a draft free area. Stress relieving of these welds is not required. Steel stamping directly on the surface of alloy steel piping with other than low stress die stamps will not be permitted. Use of oxy acetylene gas for pre-heating is not allowed.

7.28 SEAL WELDS

- 7.28.1 Seal welding will be done by qualified welders and in accordance with approved drawings
- 7.28.2 Threaded joints that are to be seal welded will be made without the use of thread lubricating compound.

8.0 PREHEATING

Preheating prior to cutting, tack welding and welding will be employed as a means of crack prevention and improving general weld reliability. The general requirements listed in para 9.0 "Stress Relieving" will be applied for preheating. Preheating when performed will be in accordance with Cl. 131 of ASME B31.1 Preheating requirement for thermal cutting will be the same as applicable to welding.

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SPEC.NO. TCE.7742B-C- 540-001	TATA STEEL LIMITED	SECTION: D19 SHEET 11 OF 17
	CONSULTANT: TATA CONSULTING ENGINEERS LIMITED 1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 WELDING SPECIFICATION FOR POWER PLANT PIPING SYSTEMS	

8.1 CARBON STEEL /ALLOY STEEL

8.1.1 At no time during the welding operation will the temperature of the weld area be allowed to fall below the specified temperatures. Before performing any tack welding which may be required in preparing alloy/carbon steel pipe for welding or other fabrication, or before attaching thermocouples, the pipe area to which the tack weld is to be made will be evenly heated to these temperatures preferably by resistance heating or induction coils. Propane or natural gas torches or preferably burner rings will be employed where it is impossible to use electric heating. The use of oxy-acetylene is prohibited. The metal temperatures in this procedure will be determined by the use of thermocouples and potentiometers except that temperature sensitive crayons may be used as temperature indicators in tack welding thermocouples.

8.1.2 Welded joints for piping NB 100mm and larger will be heated by means of induction coil or resistance heating. Welded joints in smaller pipe will be heated by means of electrical resistance coils or suitable propane or natural gas torches.

8.2 AUSTENITIC STAINLESS STEEL

Welded joints in austenitic stainless steel piping need not be preheated except where the ambient temperature is below 0°C. For this condition, the joint will be heated to 40°C by propane, natural gas or electrical means before any welding is performed.

9.0 POSTWELD HEAT TREATMENT

Postweld heat treatment of piping welds is required when so specified in code clause 132 of ASME B31.1 and will be performed as described below. However for carbon limitation on carbon steel material of all piping refer Cl. 9.2.1.

9.1 GENERAL REQUIREMENTS




9.1.1 A complete automatic temperature recording will be used during preheating and stress relieving operations. Where propane gas burners or electrical resistance coils are employed, a complete temperature record of the preheating and stress relieving operation will be made by means of a box type potentiometer. Other means of recording temperatures are permissible subject to the PURCHASER/ENGINEER'S approval.

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	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 WELDING SPECIFICATION FOR POWER PLANT PIPING SYSTEMS	SHEET 12 OF 17
9.1.2	Stress relief may be local or full furnace. Local stress relief will be performed with electric induction or electric resistance coils. Suitable gas burning equipment using natural gas or propane may be employed.	
9.1.3	During stress relieving / preheating cycle, no water or liquid cooling medium will be employed.	
9.1.4	Where members being joined are unequal in thickness, the dimension of the heavier section will govern the selection of width of the heated band and the duration of the holding period.	
9.1.5	When local stress relief is performed, the area of the welded joint and the adjacent material to be postweld heat treated, will be as called for in para 132.7 of ASME B31.1	
9.1.6	For local stress relief using electrical methods, a minimum of two thermocouples tack-welded to the surface and potentiometers, will be used on the pipe under at least 4 layers of asbestos paper. The hot junctions of the thermocouples will be located on either side of the joint atleast 12mm from the edge of the joint, but no farther away than 100mm. When employing induction heating, at least six turns of induction cable will be wrapped on top of the asbestos paper protecting the thermocouples with the first turn approximately 150mm from the centre of the weld.	
9.1.7	Local stress relief using natural gas torches or ring burners may be employed. However, the procedure will be limited to pipes below 100mm NB and must be approved by the PURCHASER/ENGINEER.	
9.1.8	The stress relieving temperature will be maintained for a period of time proportioned on the basis of one hour per 25 mm of wall thickness of the thickest section at the joint, but in no case less than one hour.	
9.1.9	For tubing joints and socket welded joints, pads, bosses and couplings, one thermocouple will be positioned at a minimum distance of two pipe wall thickness from the weld.	
9.1.10	For welds used for attachment of base brackets, two thermocouples will be used for determinations of preheating and stress relieving temperatures. They will be tack welded directly to the header and located 180 deg apart on the circumference of the header and midway between adjacent legs.	
9.1.11	Piping on both sides of any joint will be adequately supported throughout the preheating, welding and stress relieving operations to prevent distortion. When a butt welded joint is to be post-weld heat treated and the piping is	
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SPEC.NO. TCE.7742B-C- 540-001	<p style="text-align: center;">TATA STEEL LIMITED</p> <p style="text-align: center;">CONSULTANT: TATA CONSULTING ENGINEERS LIMITED</p> <p style="text-align: center;">1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11</p> <p style="text-align: center;">WELDING SPECIFICATION FOR POWER PLANT PIPING SYSTEMS</p>	SECTION: D19 SHEET 13 OF 17
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cold sprung, the forces required to position the pipes will be maintained by external means until the completion of the heat treatment procedure.

9.1.12 All heating and cooling must be performed in still air

9.2 CARBON STEEL

9.2.1 Welded joints of carbon steel piping where the nominal pipe wall thickness of the heaviest material being joined is greater than 19mm or the carbon content more than 0.25% for piping system under IBR, and 0.3% for non-IBR piping systems will be stress relieved upon completion of welding operation.

9.2.2 When the height of a boss above the OD of the pipe is 19 mm or greater the weld will be stress relieved

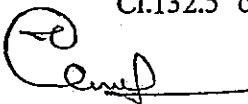
9.2.3 When the wall thickness of a coupling or a pad is greater than 19 mm the weld will be stress relieved

9.2.4 When local stress relief is employed, the welded joint will be heated to a temperature of not less than 600°C. This temperature level will be maintained within the limits of 600 °C to 650 °C for one hour per 25mm of wall thickness, but in no case less than 1 hour. The weld area will then be allowed to cool undisturbed in still air to a temperature not exceeding 315 °C.

All welded joints which are locally stress relieved in pipes 100mm NB and larger will be heated by means of electric induction coils or resistance heating. Welded joints in pipes smaller than 100mm NB will be stress relieved by means electric resistance coils or suitable propane or natural gas torches only.

9.2.5 Heating and Cooling

Carbon steels after having reached their specific stress relief temperatures, may be cooled in the furnace or under wraps, i.e leaving the induction coils or resistance heaters and insulation in place. This means that at the stress relief temperatures, the power to the furnace or heating coils may be shut off and cooling is allowed to take place in the furnace or with all insulation and coils remaining on the pipe. For furnace stress relief, the doors of the furnace may be opened after the power is shut off, at 315 deg C. The thermocouples controlling the temperatures will remain during the cooling cycle so that excessive cooling, if it occurs, can be observed and immediately corrected. The rate of heating and cooling will conform to Cl.132.5 of ASME/B31.1. The stress relieving coils and insulation will be





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removed only after the piping has cooled to below 315 deg C, or if stress relieved in a furnace, the pipe may be removed from the furnace and permitted to cool in still air, when this pipe has cooled below 315 °C.

9.3 ALLOY STEEL

9.3.1 All welds in alloy steel piping will be stress relieved after the welding operation in accordance with C1.132 of ASME B31.1. Immediately after welding the material will be wrapped in asbestos and allowed to cool.

9.3.2 Local Stress Relief

All welded joints in pipes 100 mm NB size and larger will be locally stress relieved by means of electric induction coils or resistance heating. Welded joints in smaller pipe sizes will be stress relieved by means of electric resistance coils or propane or natural gas torches only.

9.3.3 For full furnace stress relief of a welded assembly the entire fabricated section will be heated uniformly to the temperature specified. The temperature will be maintained for a period of time proportioned on the basis of one hour per 25 mm wall thickness of the piece having the greatest wall thickness in the furnace charge, but in no case less than one hour.

9.3.4 Heating and Cooling

The rate of heating and cooling will conform to Cl. 132.5 ASME of B31.1

9.4 AUSTENITIC STAINLESS STEEL

Joints in austenitic stainless steel piping need not be stress relieved after welding.

10.0 ELECTRODES

10.1 (a) The specification and size of the electrodes, voltages and amperages, thickness of beads and number of passes will be as specified in the approved welding procedure or otherwise agreed in writing Only basic coated electrodes will be used, which will deposit weld metal having the same or higher physical properties and similar chemical composition to the members being joined. For each batch of approved brand, certificate showing compliance with the specification will be secured and will be submitted to PURCHASER/ENGINEER for review before being released for use on project piping. All electrodes will be purchased in sealed containers and stored properly to prevent

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deterioration. All low hydrogen electrodes will be baked at 350 deg. C for 1 hour and stored in ovens kept at 80-100 deg C before being used. Recommendations of the electrode manufacturer will be followed.

- (b) For welding of all grades of steel and alloys by the GTAW process, a 2% thoriated tungsten electrode conforming to SFA-5.12 EWTH-2 (AWS-A5.12, EWTH-2) classification will be used.

10.2 CARBON & ALLOY STEEL

All electrodes to be used on alloy and carbon steel will conform to ASME Boiler and Pressure Vessel Code Sec 2 Part C or any other equivalent code.

- 10.3 As welding electrodes deteriorate under adverse conditions of storage leading to dampness in the electrode coating, they should normally be stored in air conditioned rooms or in hot boxes or ovens in their original sealed containers whose temperatures will be maintained within specific limits. The condition of electrodes will be frequently inspected. Electrodes with damage to coating will not be used. Electrodes will remain identified until consumed.

- 10.4 The type of electrodes used should be only those recommended by the manufacturer for the use in the position in which the welds are to be made. Electrodes which have the areas of flux covering broken away or damaged will not be used.

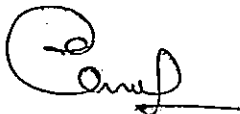
11.0 INSPECTION AND TESTING

- 11.1 The PURCHASER/ENGINEER will have accessibility to inspect the welding or any other related operations at any time and at any stage of fabrication.

- 11.2 The PURCHASER/ENGINEER may require non-destructive testing of any weld for reasons other than those given in the specification. The responsibility for the cost of such testing will be mutually decided between the PURCHASER/ENGINEER and the CONTRACTOR.

- 11.3 The CONTRACTOR will inform the PURCHASER/ENGINEER when the weld preparation and setting up for welding of various members selected by the PURCHASER/ENGINEER is in progress so that the PURCHASER/ENGINEER can inspect the assembly before welding starts.

- 11.4 The responsibilities of the PURCHASER/ENGINEER's representative will in no way reduce the CONTRACTOR's responsibilities to ensure that the work is carried out in accordance with the specification.





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11.5 Non-Destructive Test (NDT) will be carried out at appropriate time as below. Radiographic Testing (RT) on welds will be carried out after final heat treatment except for welds on PI Group material for which (Refer ASME Sec. IX) RT can be performed either before or after final heat treatment.

11.6 All requirements specified in TCE.M4-185-28 and TCE.M4-185-38 will be strictly followed.

11.7 EXAMINATION METHODS OF WELDS

11.7.1 Non destructive examinations of welds will be carried out in accordance with TCE. M4-185-28 and TCE.M4-185-38.

11.7.2 Penalty Clause

Where radiography specified is less than 100%, the penalty will be as follows:

- (a) For every weld found defective two additional penalty joints on either side of the joint will be marked for RT.
- (b) If any of the penalty joints is found defective, entire weld joints represented by the defective joint will be radiographed.
- (c) If the penalty joints referred under point (a) above are found acceptable, the original defective weld will be repaired to the required standard and re-radiographed.

11.7.3 In addition, at the discretion of the PURCHASER/ENGINEER and the INSPECTORS, and where requested by them, the CONTRACTOR will perform radiography and other tests of the joints of any other piping. Refer 11.2 on cost of such testing.

11.7.4 (a) Where access holes for radiography have been provided in the piping, the CONTRACTOR will employ single wall thickness radiography. The access holes will be plugged and seal welded only after the radiograph is found acceptable

(b) Where no access holes for radiography are provided in the piping, the CONTRACTOR will employ double wall radiography, with elliptical projection technique.

(c) The CONTRACTOR will ensure that isotopes of sufficient strength and quality are used in order that the radiographs taken are of proper density, contrast and visibility.





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(d) Access hole plug welding will be examined by magnetic particle or liquid penetrant methods.

12.0 QUALIFICATIONS AND CERTIFICATION OF NON-DESTRUCTIVE EXAMINATION PERSONNEL

Organisations performing code required, non-destructive examinations will use personnel competent and knowledgeable to the degree specified by ASME.

13.0 ACCEPTANCE STANDARDS

The acceptance standards for radiographic, ultrasonic, magnetic particle, liquid penetrant and visual examinations etc. will conform to ASME B31.1.

14.0 REPAIR WELDING

14.1 All defects in welds requiring repair will be removed by flame or arc gouging, grinding, chipping or machining. The major repairs may involve.

- (a) Cutting through the weld -
- (b) Cutting out a length of pipe containing the weld, or
- (c) Removing the weld metal down to the root depending upon the magnitude of the defects.

14.2 After removing the defect, the welds will be examined by the same non-destructive testing methods as specified for the original weld and the same acceptance criteria will hold good.

14.3 All the repair welds will be made using same or other specified welding procedures as those used in making the original welds including preheating and stress relieving as originally required.

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SPEC NO. TCE.7742B- C-540-001	TATA STEEL LIMITED CONSULTANT: TATA CONSULTING ENGINEERS LIMITED	SECTION : D30
	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 MINIMUM INSPECTION REQUIREMENTS FOR DOSING PUMPS	SHEET 1 OF 2

			INSPN CATEGORY
1.	Raw Materials	a) Material Test Certificate Review	C
		b) Ultrasonic test if diameter > 50 mm	C
2.	IN PROCESS INSPECTION		
	A) Casings	a) PT on machined area	100% C
		b) Hydro test	C
	B) Piston	PT on machined area	100% C
	C) Crank Shaft	PT after machining	100% C
	D) Motors	Routine Test	C
3.	FINAL INSPECTION		
		a) Performance test	A
		b) Noise level check	A
		c) Vibrations check	A
		d) Dimensional check	A

NOTES:

(A) INSPN CATEGORY:

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

ISSUE R2

SPEC NO.	TATA STEEL LIMITED CONSULTANT: TATA CONSULTING ENGINEERS LIMITED	SECTION : D30
TCE.7742B- C-540-001	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 &11 MINIMUM INSPECTION REQUIREMENTS FOR DOSING PUMPS	SHEET 2 OF 2

(B) ACCEPTANCE NORMS:

- (1) MATERIALS : As per applicable material specifications
- (2) WELDING : As per ASME Section-IX
- (3) NON DESTRUCTIVE TESTING : As per ASME Section-V requirements
- (4) NOISE LEVEL : Max 85 dB at 1.0 m distance
- (5) VIBRATION LEVEL : VDI 2056 - Good Zone

(C) PT - LIQUID PENETRANT TESTING

MT - MAGNETIC PARTICLE TESTING

UT - ULTRASONIC TESTING

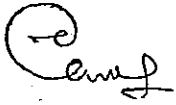

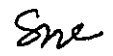
RT - RADIOGRAPHIC TESTING

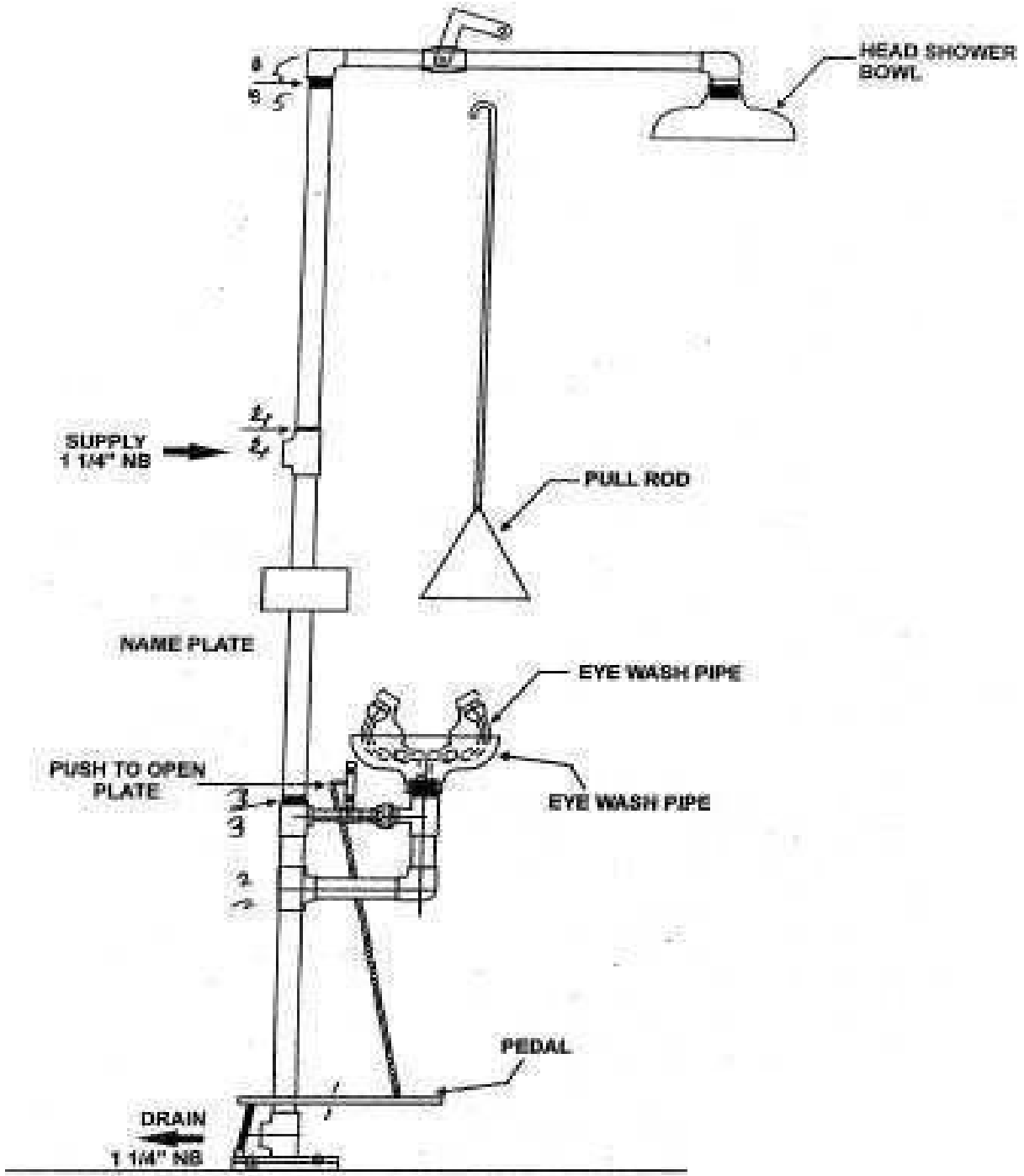
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ISSUE R2

SPEC NO.	TATA STEEL LIMITED CONSULTANT: TATA CONSULTING ENGINEERS LIMITED		SECTION : D34	
TCE.7742B- C-540-001	1 X 40 MW CAPTIVE POWER PLANT FOR CDQ 10 & 11 MINIMUM INSPECTION REQUIREMENTS FOR STRAINERS & FILTERS		SHEET 1 OF 1	
			<u>INSPN CATEGORY</u>	
1.0	RAW MATERIAL			
	A) COVER, BODY & SUPPORTS	1) Visual Inspection 2) Review of MTC	C C	
2.0	WELDING (COVER, BODY, SUPPORTS)		C C	
3.0	ASSEMBLY		A A A A A	
<u>NOTES:</u>				
(A) INSPN CATEGORY:				
A - WITNESSED BY TCE/PURCHASER				
B - WITNESSED BY TCE/PURCHASER'S DISCRETION				
C - CERTIFICATES REVIEW BY TCE/PURCHASER				
(B) ACCEPTANCE NORMS:				
(1) MATERIALS : As per applicable material specifications				
(2) WELDING : As per ASME Section-IX				
(3) NON DESTRUCTIVE TESTING : As per ASME Section-V / Section-VIII Div. 1 requirements				
(C) PT - LIQUID PENETRANT TESTING				
MT - MAGNETIC PARTICLE TESTING				
UT - ULTRASONIC TESTING				
RT - RADIOGRAPHIC TESTING				
  			<table border="1"> <tr> <td>ISSUE R2</td> </tr> </table>	ISSUE R2
ISSUE R2				



EYE WASH AND SAFETY SHOWER

INVENTORY NO. SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME 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

PY-SC-4-M085-9301-01

DRG. NO.

SH. 01 OF 07

ANNEXURE - 17

DRIVE CONTROL PHILOSOPHY

REV.	DATE	ALTERED
		CHD/APPD

ZONE

REV.	DATE	ALTERED
		CHD/APPD

ZONE

REV.	DATE	ALTERED
		CHD/APPD

ZONE

CONSULTANT:		TATA CONSULTING ENGINEERS LIMITED MUMBAI				TATA STEEL LTD JAMSHEDPUR				
BHARAT HEAVY ELECTRICALS LTD., HYDERABAD		DRN.	VINEET		04.06.16	NO.OF VAR.	DEPT	40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT	CODE	
		CHD.	SUJATHA		06.06.16	N.A.	AREA	JAMSHEDPUR	CODE	
		APPD.	SUJATHA		06.06.16		SUBJECT	DRIVE CONTROL PHILOSOPHY	CODE	
DEPT. PE&SD CODE 450	UNTOL. DIMS. GR. ø/M/Y		SCALE NTS	WEIGHT (KG) -N.A.-	REF. TO ASSY. DRG. -N.A.-	ITEM NO. -N.A.-	TATA DRG. NO.		REV	
TITLE DRIVE CONTROL PHILOSOPHY		CARD CODE	BHEL DRAWING NO. PY-SC-4-M085-9301-01		REV. 00				01	
		SHT. No	01	NO. OF SHT.		07				

NOTES & LEGENDS

NOTES

- 1) RTS feedback shall be generated in MCC / ACTUATOR when following conditions are met:
 - a) Stop PB in MCC / ACTUATOR is not pressed
 - b) MCC / ACTUATOR Control supply is healthy.
 - c) Thermal overload relay not operated.
 - d) Local/Remote switch located in MCC / Actuator is in REMOTE
- 2) Local control stations (LCS) shall be provided for all LT drives. LCS shall have Emergency Stop [EPB push button and shall be hard wired directly to MCC. (Emergency Stop - 'NC' Contact). The EPB (stay put type) will be provided with press to lock and turn to release type, keyless mechanism.
- 3) Remote operation shall be done from DCS Operator work station [OWS] based on receipt of Ready To Start [RTS] feedback from MCC / ACTUATOR. Accordingly suitable provision shall be made in DCS.
- 4) ON/OFF Indicating lamps and ammeters will be provided on Local control stations (LCS) for motors rated 30kW and above.

LEGENDS

- ZT - Position Transmitter
- DCS - Distributed Control System
- MCC - Motor Control Center
- L/R Switch - Local / Remote switch
- OWS - Operating Work Station
- IPR - Interposing Relay
- LCS - Local Control Station
- E/P - E/P Positioner

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COMPUTER FILE NAME

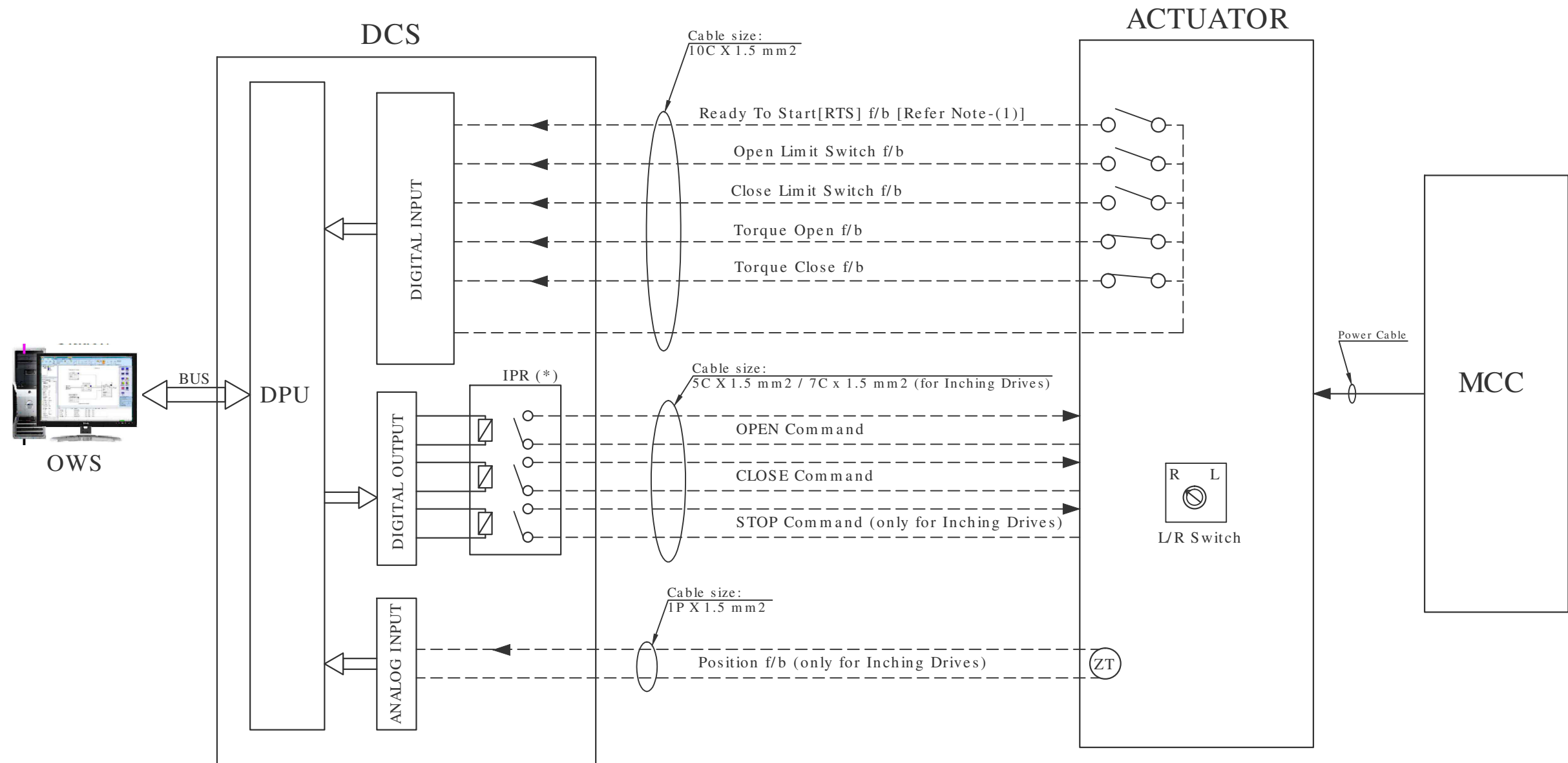
REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED MUMBAI						TATA STEEL LTD JAMSHEDPUR				
BHARAT HEAVY ELECTRICALS LTD., HYDERABAD						DEPT	40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT		CODE	
						AREA	JAMSHEDPUR		CODE	
DEPT. PE&SD CODE 450						UNTOL. DIMS. GR. Ø/M/P		SCALE NTS		WEIGHT (KG) -N.A.-
TITLE DRIVE CONTROL PHILOSOPHY						REF. TO ASSY. DRG.	-N.A.-		ITEM NO.	-N.A.-
CARD CODE						BHEL DRAWING NO.	PY-SC-4-M085-9301-01		REV.	00
SHT. No 02						NO. OF SHT. 07		TATA DRG. NO.		REV 05

DCS Interface for BI-DIRECTIONAL DRIVE

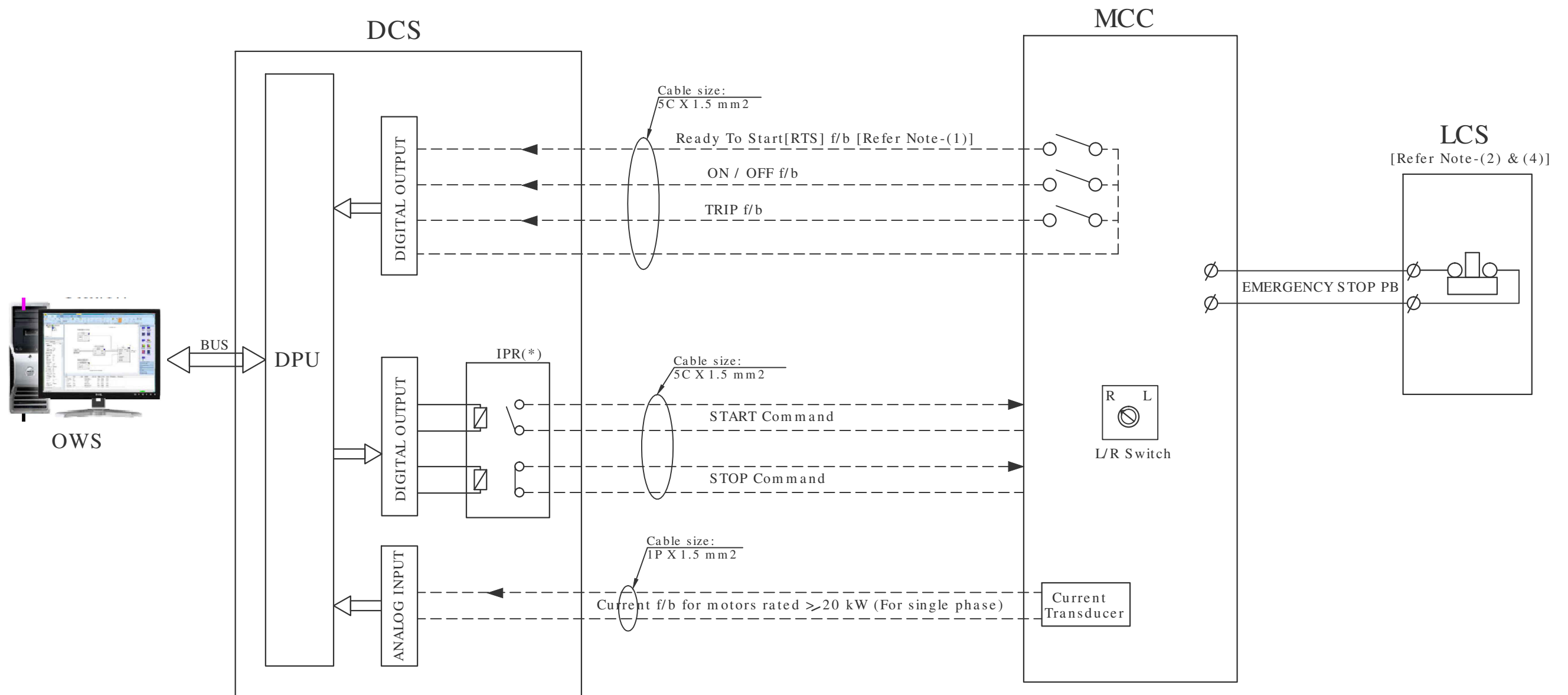


(*) -> Interrogation voltage for commands & feedbacks shall be 24V DC and same shall be powered from DCS and ACTUATOR respectively.

INVENTORY NO. SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME 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

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED MUMBAI						TATA STEEL LTD JAMSHEDPUR				
DEPT. PE&SD CODE 450						NAME VINEET SIGN. <i>[Signature]</i> DATE 04.06.16		DEPT 40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT		CODE
UNTO. DIMS. GR. 2/M/7						CHD. SUJATHA APPD. SUJATHA		AREA JAMSHEDPUR		CODE
SCALE NTS						REF. TO ASSY. DRG. -N.A.-		SUBJECT DRIVE CONTROL PHILOSOPHY		CODE
WEIGHT (KG) -N.A.-						ITEM NO. -N.A.-		TATA DRG. NO.		REV
TITLE DRIVE CONTROL PHILOSOPHY						BHCL DRAWING NO. PY-SC-4-M085-9301-01		REV. 00		05
CARD CODE						SHT. No 03		NO. OF SHT. 07		

DCS Interface for UNI-DIRECTIONAL LT DRIVE (Contactor operated)

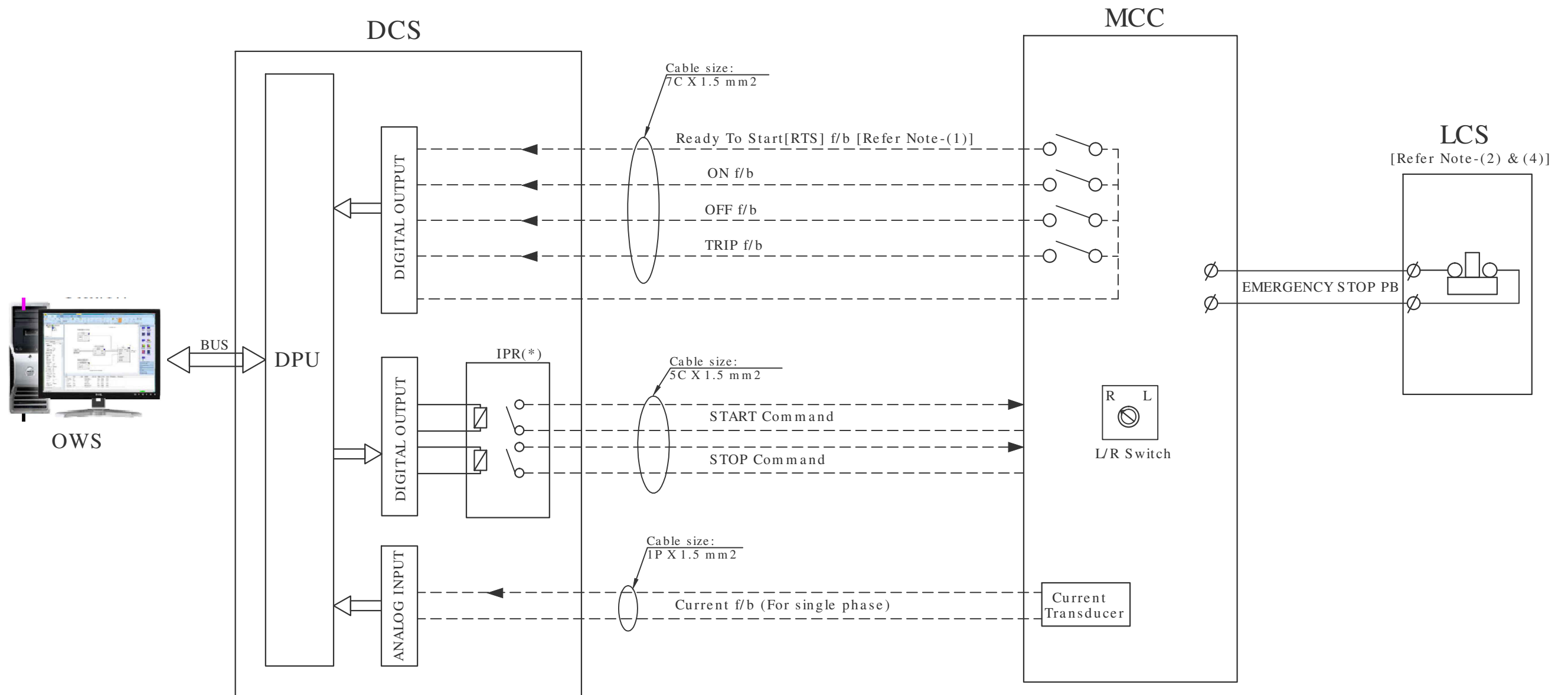


(*) -> Interrogation voltage for commands shall be 110V AC and same shall be powered from MCC.

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CONSULTANT: TATA CONSULTING ENGINEERS LIMITED MUMBAI						TATA STEEL LTD JAMSHEDPUR					
BHEL BHARAT HEAVY ELECTRICALS LTD., HYDERABAD						DEPT	40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT		CODE		
DEPT. PE&SD CODE 450	UNTOL. DIMS. GR. Ø/M/P	SCALE NTS	WEIGHT (KG) -N.A.-	REF. TO ASSY. DRG. -N.A.-	ITEM NO. -N.A.-	NO.OF VAR.	AREA	JAMSHEDPUR		CODE	
DRN. VINEET CHD. SUJATHA APPD. SUJATHA						NO.OF ITEMS	SUBJECT	DRIVE CONTROL PHILOSOPHY		CODE	
TITLE DRIVE CONTROL PHILOSOPHY						NO.OF ITEMS	TATA DRG. NO.		REV		
CARD CODE SHT. No 04 NO. OF SHT. 07						REV.	00		06		

DCS Interface for UNI-DIRECTIONAL LT & HT DRIVE (Breaker operated)

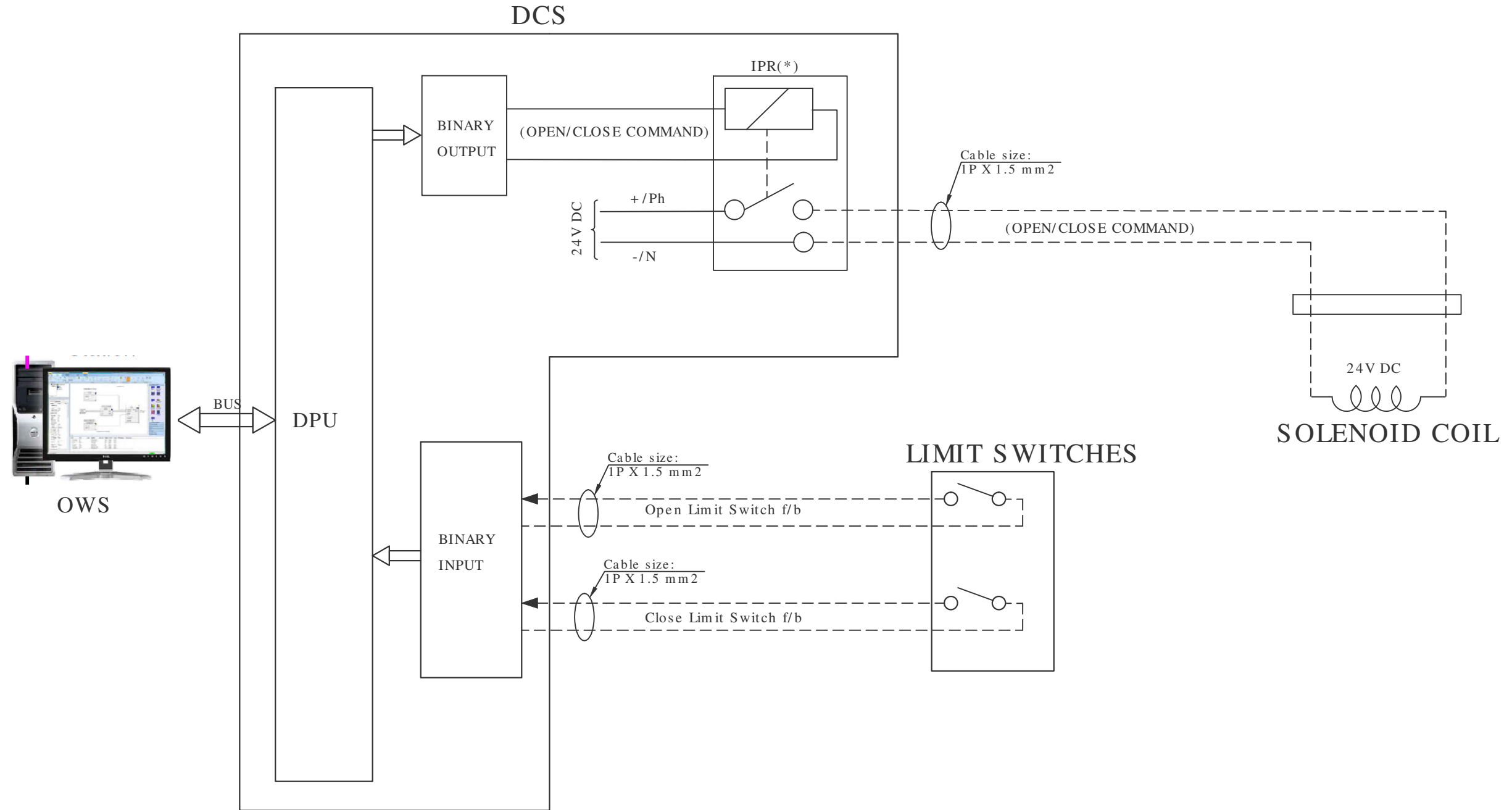


(*) -> Interrogation voltage for commands shall be 220V DC and same shall be powered from MCC.

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CONSULTANT: TATA CONSULTING ENGINEERS LIMITED MUMBAI						TATA STEEL LTD JAMSHEDPUR				
BHEL BHARAT HEAVY ELECTRICALS LTD., HYDERABAD						DEPT	40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT		CODE	
DEPT. PE&SD CODE 450 UNTOL. DIMS. GR. 0/M/7 SCALE NTS WEIGHT (KG) -N.A.- REF. TO ASSY. DRG. -N.A.- ITEM NO. -N.A.- NO.OF ITEMS -N.A.-						AREA	JAMSHEDPUR		CODE	
TITLE: DRIVE CONTROL PHILOSOPHY CARD CODE:						SUBJECT	DRIVE CONTROL PHILOSOPHY		CODE	
TATA DRG. NO.						TATA DRG. NO.		REV	06	
SHT. No 05 NO. OF SHT. 07										

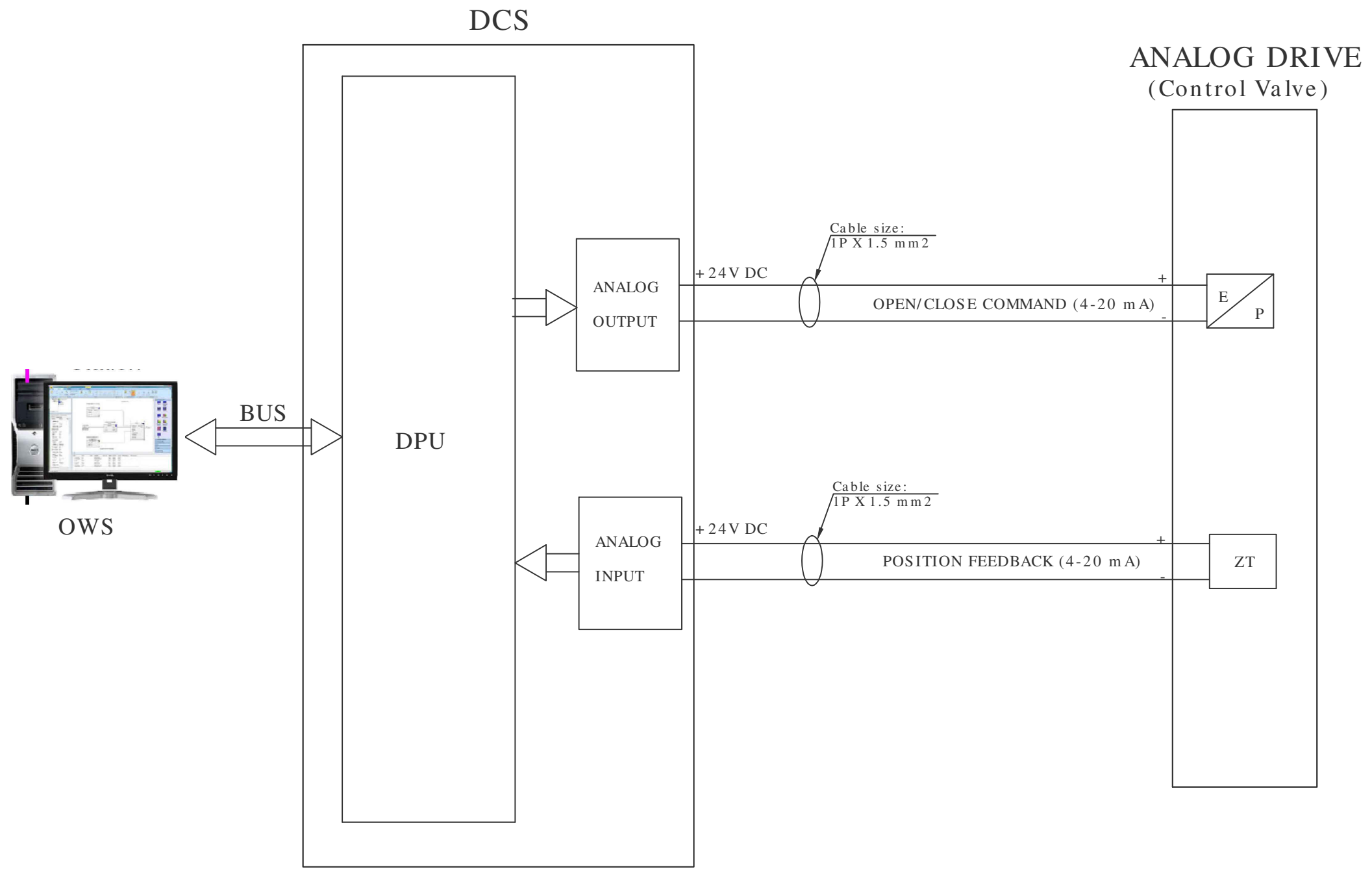
DCS Interface for Solenoid (24V DC) operated ON-OFF valve



INVENTORY NO. SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME 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

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED MUMBAI						TATA STEEL LTD JAMSHEDPUR				
BHEL BHARAT HEAVY ELECTRICALS LTD., HYDERABAD						DEPT	40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT		CODE	
DEPT. PE&SD CODE 450 UNTOL. DIMS. GR. 0/M/Y SCALE NTS WEIGHT (KG) -N.A.- REF. TO ASSY. DRG. -N.A.- ITEM NO. -N.A.- NO.OF ITEMS -N.A.-						AREA	JAMSHEDPUR		CODE	
TITLE: DRIVE CONTROL PHILOSOPHY CARD CODE: PY-SC-4-M085-9301-01 SHT. No 06 NO. OF SHT. 07						SUBJECT	DRIVE CONTROL PHILOSOPHY		CODE	
						TATA DRG. NO.				
						REV 09				

DCS Interface for ANALOG DRIVE



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COMPUTER FILE NAME

REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED MUMBAI						TATA STEEL LTD JAMSHEDPUR											
DEPT. PE&SD CODE 450						NAME DRN. VINEET		SIGN. 		DATE 04.06.16		NO.OF VAR. N.A.		DEPT 40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT		CODE	
UNTO. DIMS. GR. 2/M/7						CHD. SUJATHA		SIGN. 		DATE 06.06.16		AREA JAMSHEDPUR		CODE			
SCALE NTS						APPD. SUJATHA		SIGN. 		DATE 06.06.16		SUBJECT DRIVE CONTROL PHILOSOPHY		CODE			
WEIGHT (KG) -N.A.-						REF. TO ASSY. DRG. -N.A.-		ITEM NO. -N.A.-		NO.OF ITEMS -N.A.-		TATA DRG. NO.					
TITLE DRIVE CONTROL PHILOSOPHY						CARD CODE		BHEL DRAWING NO. PY-SC-4-M085-9301-01		REV. 00		REV					
SHT. No 07						NO. OF SHT. 07						10					



PRODUCT STANDARD
PROJECT ENGINEERING & SYSTEMS DIVISION
HYDERABAD

Data sheet No:PTD-TSL-DS-01
 REV. 00

Diaphragm seal - Pressure Transmitter (PTD) Technical Data Sheet

GENERAL	1	Range & Qty.	Skid vendor to decide	ACCESSORIES	30	Mounting Bracket	For 2" pipe mounting, SS304
	2	Type	Electronic Smart (2 wire), HART, Intrinsic safe		31	U Clamp+Fastner	Reqd, SS 304
	3	Principle of Sensor	Vendor Std.,		32	Cable Glands	SS Double Compression+Flameproof
	4	Ambient Temp Limit	- 40 to 80°C		33	Cable entry Plugs	Reqd, SS 304
	5	Process Temp. Limit	- 40 to 120°C		34	Vent/Drain Plugs	Reqd, SS 304
SENSOR	6	Accuracy	For a rangeability of 1:10 a) Equal or Above 500 mmWC: ±0.25 % b) Less than 500 mmWC: ±0.5 %	35	Tag Plate	Reqd, SS 304	
	7	Response Time	As per OEM recommendation	36	Spacer Ring & plug	Required, SS	
	8	Stability	As per OEM recommendation	37	Diaphragm Assembly	SS316L, Flush flange type (Refer fig.1)	
TRANSMITTER	9	Turn Down Ratio	As per OEM recommendation	38	Armoured Capillary	Reqd. 3 Mts, SS316L with PVC Coat	
	10	Process Connection	Raise flanged, 1½" , class 150	39	Stud Nuts+Bolts	Reqd. A194Gr2H+A193GrB7 (Min 120mm long)	
	11	Instrument Connection	1/2" NPT (F)	40			
	12	Electrical Connection	2 Nos of 1/2" NPT (F)	41	Gasket	Reqd. Spiral Wound, SS	
	13	Power Supply	24V DC, Loop Powered	42	5-Point Calibration	100% Review	
	14	Over Range Protection	> 130% of range.	43	Hydro test	100% Review	
	15	Protection	IP 65	44	Material compliance	100% Review	
	16	Zero & Span adjustment	Required.	45	Functional Test	100% Review	
	17	Display	Integral LCD Digital (in Engg Units & in %)	46	Performance Test	100% Review	
	18	Impulse Entry	As per OEM recommendation	47	Ingress Prot. Test	100% Review	
MATERIAL	19	Load Resistance	600Ω @ 24 VDC	48	Intrinsic Safety Test	100% Review	
	20	Output	4-20mA + HART	49	Conformity Test	100% Review	
	21	Diagnostic Features	Required.	50	Internal tests (like IR etc.)	100% Review	
	22						
	23	Hazardous area class	Safe area				
	24	Body	SS316	PROJECT SPECIFIC	51	Certification	As per OEM recommendation
	25	Element	SS316	52	Compartments	As per OEM recommendation	
26	Sensor O-Ring	Glass-filled PTFE/Teflon	53	Manifold Type	Non-Coplanar, Inegral 2 Way, SS		
27	Electronic Housing	Die-cast Aluminum	54	Statutory Approvals	For Transmitters+Glands+Plugs		
28	Sensor fill fluid	Silicon Oil	55	Sensor Type	Non-Inductive type.		
29	Humidity	0 - 100% RH	56	Corrosive Protection	Reqd.		
				56	Terminal Block type	Integral, Non-fly leads	

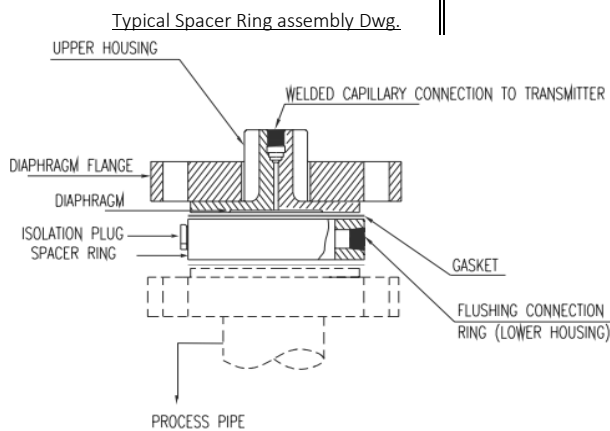


FIGURE - 1



PRODUCT STANDARD
PROJECT ENGINEERING & SYSTEMS DIVISION
HYDERABAD

Data sheet No:DPT-TSL-DS-01
 REV. 00

Differential Pressure Transmitter (DPT) Technical Data Sheet

GENERAL			ACCESSORIES					
1	Range & Qty.	Skid vendor to decide	28	Mounting Bracket	Suitable for Rack mounting			
2	Type	Electronic Smart (2 wire), HART, Weather Proof	29	U Clamp+Fastner	Reqd, SS 304			
3	Principle of Sensor	Vendor Std.,	30	Cable Glands	SS Double Compression+Flameproof			
4	Ambient Temp Limit	- 40 to 80°C	31	Cable entry Plugs	Reqd, SS 304			
5	Process Temp. Limit	- 40 to 120°C	32	Vent/Drain Plugs	Reqd, SS 304			
SENSOR 6 Accuracy For a rangeability of 1:10 a) Equal or Above 760 mmWC: ± 0.075 % b) Less than 760 mmWC: ± 0.15 % 7 Response Time As per OEM recommendation 8 Stability As per OEM recommendation			33	Tag Plate	Reqd, SS 304			
			34	Bolts + Nuts	Reqd. A193GrB7 + A194Gr2H			
			35					
TRANSMITTER 9 Turn Down Ratio As per OEM recommendation 10 Process Connection 1/2" NPT (F) 11 Electrical Connection 2 Nos of 1/2" NPT (F) 12 Power Supply 24V DC, Loop Powered 13 Over Range Protection > 130% of range. 14 Protection IP 65 15 Zero & Span adjustment Required. 16 Display Integral LCD Digital (in Engg Units & in %). 17 Impulse Entry As per OEM recommendation 18 Load Resistance 600Ω @ 24 VDC 19 Output 4-20mA + HART 20 Diagnostic Features Required.			TEST REPORT/CERTIFICATE 36 5-Point Calibration 100% Review 37 Hydro test 100% Review 38 Material compliance 100% Review 39 Functional Test 100% Review 40 Performance Test 100% Review 41 Ingress Prot. Test 100% Review 42 Intrinsic Safety Test 100% Review 43 Conformity Test 100% Review 44 Internal tests (like IR etc.) 100% Review					
			MATERIAL 21 Hazardous area class Safe area 22 Body SS316 23 Element SS316 24 Sensor O-Ring Glass-filled PTFE/Teflon 25 Electronic Housing Die-cast Aluminum 26 Sensor fill fluid Silicon Oil 27 Humidity 0 - 100% RH			PROJECT SPECIFIC 45 Certification As per OEM recommendation 46 Compartments As per OEM recommendation 47 Manifold Type Non-Coplanner, Inegral 3-Valve, SS 48 Statutory Approvals Not applicable 49 Sensor Type Non-Inductive type. 50 Corrosive Protection Required 51 Terminal Block type Integral, Non-fly leads		

NOTES:

- 1 All integral parts of the transmitter shall be suitable for the differential over-range in either direction equal to the full rated pressure of the body with the opposite side vented to atmosphere without permanent distortion or calibration error. For vacuum service, the element shall have under-range protection to full vacuum.
- 2 The square root extraction for the differential pressure based flow measurement shall be carried out in DCS. Transmitter shall indicate both DP & flow values.



**PRODUCT STANDARD
PROJECT ENGINEERING & SYSTEMS DIVISION
HYDERABAD**

Data sheet No:PG-TSL-DS-01
REV. 00

Pressure Gauge (PG) Technical Data Sheet

GENERAL	1	Range & Qty.	Skid vendor to decide	MATERIAL	20	Hazardous area class	Safe Area	
	2	Type	Surface mount /Local Gauge		21	Case Material	SS304	
	3	Ambient Temp Limit	0 to 65°C		22	Element Material	SS316	
			23		Window Glass	Shatter Proof.		
GAUGE SPECIFICATION	4	Sensor Type	Bourdon Tube		24	Pointer	Alluminium.	
	5	Dial Size	150MM (6")		25	Blow out Disc	SS 304	
	6	Accuracy	±0.5% of Span		26	Tag Plate	Reqd, SS 304	
	7	Process Connection	1/2" NPT (M), Bottom entry.		27	Bezel ring	SS 304	
	8	Blow out Disc	Required.		28	Movement	SS 304	
	9	Solid Front Case	Required for > 60Kg/Cm2.		29	Socket Material	SS 304	
	10	Over Range Protection	> 130% of full scale.		CERTIFICATE	30	Calibration	100% Review
	11	Protection	IP 65			31	Vibration test	100% Review
	12	Zero & Span adjustment	External Required.	32		Material compliance	100% Review	
	13	Anti-corrosive Dial	Non-Rusting Plastic, White with black figure	33		Ingress prot. Test	100% Review	
	14	Micro meter Adjustment	Required for pointers.	TEST				
	15	Scale type	Concentric, Graduated units		34	Calibration	10% or min. 2 of each range	
	16	Pointer-270° Deflection	Yes, Metal with Black Finish		35	Over Protection Test for 30 min.	10% or min. 2 of each range	
	17	Pointer Stop	Required at both end		36	Accuracy Test	10% or min. 2 of each range	
	18	Bezel ring	Bayonet Lock Type					
	19	Movement	Geared / Cam-roller type					

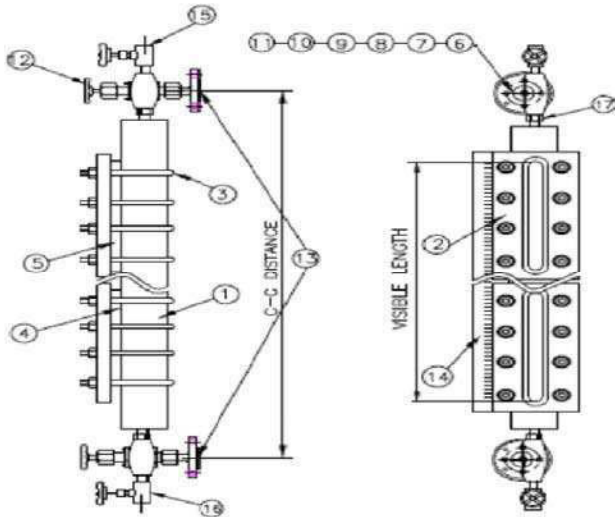
NOTES:

1 The elastic element material shall be as follows:

- a) For range ≤ 60 Kg/cm²- AISI-316 seamless drawn stainless steel tube, argon arc welded at AISI-316 forged or wrought stain less steel tube anchorage and tube end piece.
- b) For range > 60 Kg/cm² - AISI-316 bored stainless steel.

Level Gauge Side Mounted Technical Data Sheet

(1)	GENERAL	Range & Qty.	: Skid vendor to decide
(2)		Type	: Field mounted, Weather proof
(3)		Ambient Temp Limit	: 0 to 50°C and 95% RH max; suitable for tropical climate, ambient of Ammonia & Sulphur; Copper and copper alloys shall be avoided for all the parts exposed to atmosphere.
(4)	LEVEL GAUGE	Type	: Reflex type
(5)		Body material	: SS 316
(6)		Cover plate	: Carbon steel
(7)		Glass	: Toughened Borosilicate (Klinger/Moxos/Bont)
(8)		Gauge Valves	: Required at top & bottom of gauge with auto shutoff ball check arrangement
(9)		Minimum Visible length	: Shall be intimated after P.O. placement.
(10)		Hydraulic test pressure	: For services rated ANSI #300 : 77 kg/cm2(g) at room temp For services rated ANSI #600 : 150 kg/cm2(g) at room temp For services rated ANSI #1500 : 370 kg/cm2(g) at room temp
(11)	ACCESSORIES	Vent & Drain needle valve	: 2 No's; MOC: SS316; Size : ½" NPT(F)
(12)		Tag Plate	: Required, SS 316
(13)		Bolts + Nuts	: Required. A193GrB7 + A194Gr2H
(14)	Inspection & Testing	Bill of Material (model, dim., Tag no's)	: 100% Witness
(15)		Spares (BOM, part no's)	: 100% Witness (if ordered)
(16)		Material compliance certificate	: 100% Review
(17)		Hydraulic test	: 100% Review
(18)		Radiography for weld joints	: 100% Review
(19)		IBR in Form III C	: 100% Review
(20)		Ingress Protection Test	: 100% Review



BILL OF MATERIAL		
S. No.	DESCRIPTION	MATERIAL
1	CHAMBER	SS 316
2	COVER PLATE	C.S.
3	'U' BOLTS/NUTS	A 193 Gr. B7/A 194 Gr.2H
4	GASKET: TEMP UP TO 150 Deg C	NON ASBESTOS
	GASKET: TEMP ABOVE 150 Deg C	GRAFOIL
5	GLASS	TOUGHENED BOROSILICATE
6	VALVE BODY	SS 316
7	VALVE BONNET	SS 316
8	SPINDLE	SS 316
9	RENEWABLE SEAT	SS 316
10	BALL CHECK	SS 316
11	VALVE PACKING	GRAFOIL
12	HAND WHEEL	C.S.
13	PROCESS FLANGE (1" 300RF)	SS 316
14	SCALE	SS 304
15	VENT NEEDLE VALVE [1/2" NPT(F)]	SS 316
16	DRAIN NEEDLE VALVE [1/2" NPT(F)]	SS 316
17	UNION NIPPLE	SS 316

FIGURE-4 : LEVEL GAUGE (REFLEX TYPE)

Remote seal - Differential Pressure Transmitter (DPT-2D) Technical Data Sheet

GENERAL	SENSOR	TRANSMITTER	MATERIAL	ACCESSORIES	TEST REPORT/CERTIFICATE	PROJECT SPECIFIC
1	Range & Qty.	Skid vendor to decide		30	Mounting Bracket	For 2" pipe mounting, SS304
2	Type	Electronic Smart (2 wire), HART, Intrinsic safe		31	U Clamp+Fastner	Reqd, SS 304
3	Principle of Sensor	Vendor Std.,		32	Cable Glands	SS Double Compression+Flameproof
4	Ambient Temp Limit	- 40 to 80°C		33	Cable entry Plugs	Reqd, SS 304
5	Process Temp. Limit	- 40 to 120°C		34	Vent/Drain Plugs	Reqd, SS 304
6	Accuracy	For a rangeability of 1:10 a) Equal or Above 500 mmWC: ±0.25 % b) Less than 500 mmWC: ±0.5 %		35	Tag Plate	Reqd, SS 304
7	Response Time	As per OEM recommendation		36	Spacer Ring & plug	Required, SS
8	Stability	As per OEM recommendation		37	Diaphragm Assembly	SS316L, Flush flange type (Refer fig.1)
				38	Armoured Capillary	Reqd. 3 Mts, SS316L with PVC Coat
				39	Stud Nuts+Bolts	Reqd. A194Gr2H+A193GrB7 (Min 120mm long)
				40		
				41	Gasket	Reqd. Spirral Wound, SS
9	Turn Down Ratio	As per OEM recommendation		42	5-Point Calibration	100% Review
10	Process Connection	Raise flanged, 3" , class 300		43	Hydro test	100% Review
11	Instrument Connection	1/2" NPT (F)		44	Material compliance	100% Review
12	Electrical Connection	2 Nos of 1/2" NPT (F)		45	Functional Test	100% Review
13	Power Supply	24V DC, Loop Powered		46	Performance Test	100% Review
14	Over Range Protection	> 130% of range.		47	Ingress Prot. Test	100% Review
15	Protection	IP 65		48	Intrinsic Safety Test	100% Review
16	Zero & Span adjustment	Required.		49	Conformity Test	100% Review
17	Display	Integral LCD Digital (in Engg Units & in %).		50	Internal tests (like IR etc.)	100% Review
18	Impulse Entry	As per OEM recommendation				
19	Load Resistance	600Ω @ 24 VDC				
20	Output	4-20mA + HART				
21	Diagnostic Features	Required.				
22	Remote Seal Assembly	Diaphragm on HP side & capillary on LP side				
23	Hazardous area class	Safe area		51	Certification	As per OEM recommendation
24	Body	SS316		52	Compartments	As per OEM recommendation
25	Element	SS316		53	Manifold Type	Not applicable
26	Sensor O-Ring	Glass-filled PTFE/Teflon		54	Statutory Approvals	For Transmitters+Glands+Plugs
27	Electronic Housing	Die-cast Aluminum		55	Sensor Type	Non-Inductive type.
28	Sensor fill fluid	Silicon Oil		56	Corrosive Protection	Reqd.
29	Humidity	0 - 100% RH		57	Terminal Block type	Integral, Non-fly leads

NOTES:

- 1 All integral parts of the transmitter shall be suitable for the differential over-range in either direction equal to the full rated pressure of the body with the opposite side vented to atmosphere without permanent distortion or calibration error. For vacuum service, the element shall have under-range protection to full vacuum.
- 2 The square root extraction for the differential pressure based flow measurement shall be carried out in DCS. Transmitter shall indicate both DP & flow values.

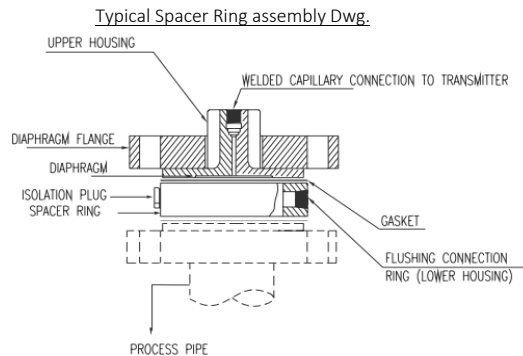


FIGURE - I

Diaphragm seal - Differential Pressure Transmitter (DPT-1D) Technical Data Sheet

GENERAL	1	Range & Qty.	Skid vendor to decide	ACCESSORIES	30	Mounting Bracket	For 2" pipe mounting, SS304
	2	Type	Electronic Smart (2 wire), HART, Intrinsic safe		31	U Clamp+Fastner	Reqd, SS 304
	3	Principle of Sensor	Vendor Std.,		32	Cable Glands	SS Double Compression+Flameproof
	4	Ambient Temp Limit	- 40 to 80°C		33	Cable entry Plugs	Reqd, SS 304
	5	Process Temp. Limit	- 40 to 120°C		34	Vent/Drain Plugs	Reqd, SS 304
SENSOR	6	Accuracy	For a rangeability of 1:10 a) Equal or Above 500 mmWC: ±0.25 % b) Less than 500 mmWC: ±0.5 %	35	Tag Plate	Reqd, SS 304	
	7	Response Time	As per OEM recommendation	36	Spacer Ring & plug	Required, SS	
	8	Stability	As per OEM recommendation	37	Diaphragm Assembly	SS316L, Flush flange type (Refer fig.1)	
TRANSMITTER	9	Turn Down Ratio	As per OEM recommendation	38	Armoured Capillary	As per OEM recommendation	
	10	Process Connection	Raise flanged, 3" , class 300	39	Stud Nuts+Bolts	Reqd. A194Gr2H+A193GrB7 (Min 120mm long)	
	11	Instrument Connection	1/2" NPT (F)	40			
	12	Electrical Connection	2 Nos of 1/2" NPT (F)	41	Gasket	Reqd. Spirral Wound, SS	
	13	Power Supply	24V DC, Loop Powered	42	5-Point Calibration	100% Review	
	14	Over Range Protection	> 130% of range.	43	Hydro test	100% Review	
	15	Protection	IP 65	44	Material compliance	100% Review	
	16	Zero & Span adjustment	Required.	45	Functional Test	100% Review	
	17	Display	Integral LCD Digital (in Engg Units & in %).	46	Performance Test	100% Review	
	18	Impulse Entry	As per OEM recommendation	47	Ingress Prot. Test	100% Review	
	19	Load Resistance	600Ω @ 24 VDC	48	Intrinsic Safety Test	100% Review	
	20	Output	4-20mA + HART	49	Conformity Test	100% Review	
21	Diagnostic Features	Required.	50	Internal tests (like IR etc.)	100% Review		
22	Remote Seal Assembly	Diaphragm on HP side					
MATERIAL	23	Hazardous area class	Safe area	TEST REPORT/CERTIFICATE			
	24	Body	SS316				
	25	Element	SS316				
	26	Sensor O-Ring	Glass-filled PTFE/Teflon				
	27	Electronic Housing	Die-cast Aluminum				
	28	Sensor fill fluid	Silicon Oil				
	29	Humidity	0 - 100% RH				
				PROJECT SPECIFIC	51	Certification	As per OEM recommendation
					52	Compartments	As per OEM recommendation
					53	Manifold Type	Not applicable
					54	Statutory Approvals	For Transmitters+Glands+Plugs
					55	Sensor Type	Non-Inductive type.
					56	Corrosive Protection	Reqd.
					57	Terminal Block type	Integral, Non-fly leads

NOTES:

- 1 All integral parts of the transmitter shall be suitable for the differential over-range in either direction equal to the full rated pressure of the body with the opposite side vented to atmosphere without permanent distortion or calibration error. For vacuum service, the element shall have under-range protection to full vacuum.
- 2 The square root extraction for the differential pressure based flow measurement shall be carried out in DCS. Transmitter shall indicate both DP & flow values.

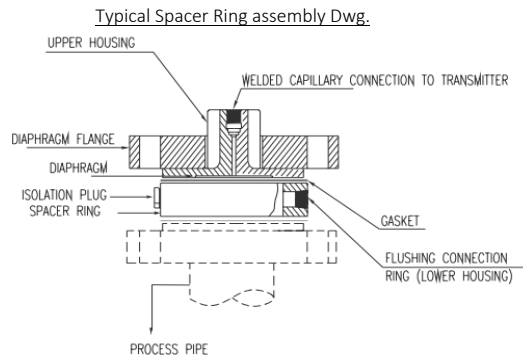
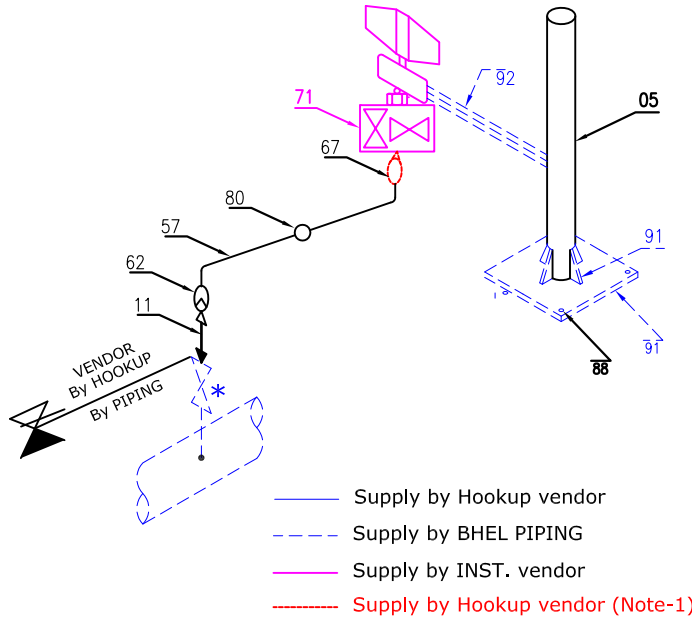


FIGURE - I

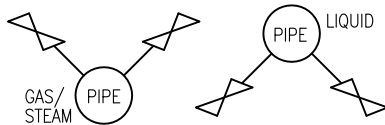
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GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261



* -> Double isolation valves shall be provided for High pressure applications.

Tapping Orientations



BOM for Material Code : PY9756132400; [SCHEME : PT/PS-TUBE-L/G without SWAGELOK]

Pos. No.	DESCRIPTION	QTY/SET	UNITS	IBR in IIIC	Swagelok/ Parker Make
11	NIPPLE SS 316L 1/2" PL x NPT(M), SCH 80S	1	No's	Required	NO
62	FEMALE CONNECTOR SS 316 1/2" NPT(F) x 1/2" OD TUBE, CL6000	1	No's	Not required	NO
57	TUBE (SMLS) SS 316L 1/2" OD X 2.1 mm	12	Mtrs	Not required	NO
80	TUBE UNION SS 316 1/2" OD, CL3000	1	No's	Not required	NO
05	PIPE (SMLS) SA 106 Gr. B 2" SCH 40	1.5	Mtrs	Not required	NO
86	U-BOLT GALVZD IS 226 1/2"	4	No's	Not required	NO
88	ANCHOR BOLT Chro coated MS M10x160mm	4	No's	Not required	NO
67	MALE CONNECTOR SS 316 1/2" NPT(M) x 1/2" OD TUBE, CL6000	1	No's	Not required	NO
73	2 WAY MANIFOLD [NOTE-1] SS 316 1/2" NPT(F), CL6000	1	No's	Not required	NO
91	STR STEEL MS ANGLE(50x50x6) (BY BHEL PIPING)	2.7012	KG's	Not required	NO
92	STR STEEL 6 mm PLATE (BY BHEL PIPING)	23.55	KG's	Not required	NO

BOM for Material Code : PY9756132418; [SCHEME : PT/PS-TUBE-L/G + SWAGELOK]

Pos. No.	DESCRIPTION	QTY/SET	UNITS	IBR in IIIC	Swagelok/ Parker Make
11	NIPPLE SS 316L 1/2" PL x NPT(M), SCH 80S	1	No's	Required	NO
62	FEMALE CONNECTOR SS 316 1/2" NPT(F) x 1/2" OD TUBE, CL6000	1	No's	Not required	YES
57	TUBE (SMLS) SS 316L 1/2" OD X 2.1 mm	12	Mtrs	Not required	NO
80	TUBE UNION SS 316 1/2" OD, CL3000	1	No's	Not required	YES
05	PIPE (SMLS) SA 106 Gr. B 2" SCH 40	1.5	Mtrs	Not required	NO
86	U-BOLT GALVZD IS 226 1/2"	4	No's	Not required	NO
88	ANCHOR BOLT Chro coated MS M10x160mm	4	No's	Not required	NO
67	MALE CONNECTOR SS 316 1/2" NPT(M) x 1/2" OD TUBE, CL6000	1	No's	Not required	YES
73	2 WAY MANIFOLD [NOTE-1] SS 316 1/2" NPT(F), CL6000	1	No's	Not required	YES
91	STR STEEL MS ANGLE(50x50x6) (BY BHEL PIPING)	2.7012	KG's	Not required	NO
92	STR STEEL 6 mm PLATE (BY BHEL PIPING)	23.55	KG's	Not required	NO

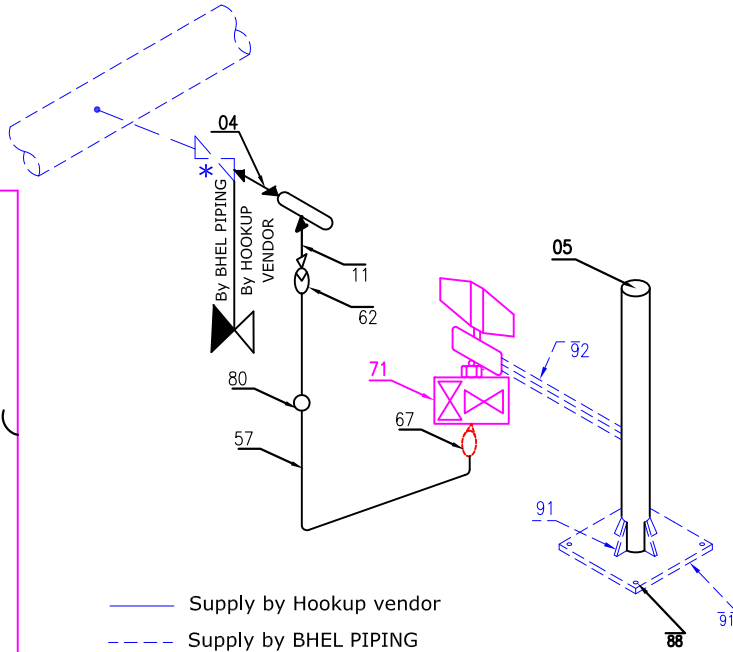
NOTES ::

- Manifold requirement is project specific. Requirement of these items shall be separately mentioned in enquiry with separate material code. Site to check the same in supplies and erect as per above scheme.
- All the hookup items shall be supplied in loose condition.
- Welding shall be done at site.
- BOM listed above shall be packed each material code wise in ONE packing box except pipe/tubes.
- Packing of pipes / tubes shall be as per vendor practice.

INVENTORY NO	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	BHARAT HEAVY ELECTRICALS LTD. HYDERABAD	NAME	SIGN.	DATE	NO. OF VAR.
	ZONE		CHD/APPD	ZONE		CHD/APPD	ZONE		CHD/APPD		DRN.	SUNIL	<i>[Signature]</i>	03.08.15
										DEPT.	PL&SD			
										UNTL. DIMS. GR.	450			
										SCALE	NTS			
										WEIGHT (KG)	N.A			
										REF. TO ASSY. DRG.	-N.A.-			
										TITLE	DRAWING NO.			REV.
										INSTALLATION DRAWING for PS / PT (Tube fittings)	PT/PS-TUBE-L/G			00
										CARD CODE	N.A			
										SHT. No	01			NO. OF SHT. 01

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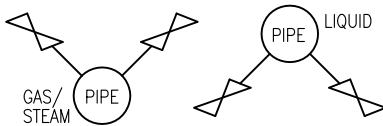
GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261



- Supply by Hookup vendor
- - - Supply by BHEL PIPING
- Supply by INST. vendor
- - - Supply by Hookup vendor (Note-1)

* -> Double isolation valves shall be provided for High pressure applications.

Tapping Orientations



BOM for Material Code : PY9756132957; [SCHEME : PT/PS-TUBE-S without SWAGELOK]

Pos. No.	DESCRIPTION	QTY/SET	UNITS	IBR in IIIC	Swagelok/Parker Make
04	PIPE (SMLS) SA 335 Gr. P91 1/2" SCH 80	3	Mtrs	Required	NO
48	CONDENSATE POT with Leak-proof Plugs SA 335 Gr. P91 CL 6000, As per fabrication drawing	1	No's	Required	NO
11	NIPPLE SS 316L 1/2" PL x NPT(M), SCH 80S	1	No's	Required	NO
62	FEMALE CONNECTOR SS 316 1/2" NPT(F) x 1/2" OD TUBE, CL6000	1	No's	Not required	NO
57	TUBE (SMLS) SS 316L 1/2" OD X 2.1 mm	12	Mtrs	Not required	NO
80	TUBE UNION SS 316 1/2" OD, CL3000	1	No's	Not required	NO
05	PIPE (SMLS) SA 106 Gr. B 2" SCH 40	1.5	Mtrs	Not required	NO
86	U-BOLT GALVZD IS 226 1/2"	4	No's	Not required	NO
88	ANCHOR BOLT Chro coated MS M10x160mm	4	No's	Not required	NO
67	MALE CONNECTOR SS 316 1/2" NPT(M) x 1/2" OD TUBE, CL6000	1	No's	Not required	NO
73	2 WAY MANIFOLD [NOTE-1] SS 316 1/2" NPT(F), CL6000	1	No's	Not required	NO
91	STR STEEL MS ANGLE(50x50x6) (BY BHEL PIPING)	2.7012	KG's	Not required	NO
92	STR STEEL 6 mm PLATE (BY BHEL PIPING)	23.55	KG's	Not required	NO

BOM for Material Code : PY9756132965; [SCHEME : PT/PS-TUBE-S + SWAGELOK]

Pos. No.	DESCRIPTION	QTY/SET	UNITS	IBR in IIIC	Swagelok/Parker Make
04	PIPE (SMLS) SA 335 Gr. P91 1/2" SCH 80	3	Mtrs	Required	NO
48	CONDENSATE POT with Leak-proof Plugs SA 335 Gr. P91 CL 6000, As per fabrication drawing	1	No's	Required	NO
11	NIPPLE SS 316L 1/2" PL x NPT(M), SCH 80S	1	No's	Required	NO
62	FEMALE CONNECTOR SS 316 1/2" NPT(F) x 1/2" OD TUBE, CL6000	1	No's	Not required	YES
57	TUBE (SMLS) SS 316L 1/2" OD X 2.1 mm	12	Mtrs	Not required	NO
80	TUBE UNION SS 316 1/2" OD, CL3000	1	No's	Not required	YES
05	PIPE (SMLS) SA 106 Gr. B 2" SCH 40	1.5	Mtrs	Not required	NO
86	U-BOLT GALVZD IS 226 1/2"	4	No's	Not required	NO
88	ANCHOR BOLT Chro coated MS M10x160mm	4	No's	Not required	NO
67	MALE CONNECTOR SS 316 1/2" NPT(M) x 1/2" OD TUBE, CL6000	1	No's	Not required	YES
73	2 WAY MANIFOLD [NOTE-1] SS 316 1/2" NPT(F), CL6000	1	No's	Not required	YES
91	STR STEEL MS ANGLE(50x50x6) (BY BHEL PIPING)	2.7012	KG's	Not required	NO
92	STR STEEL 6 mm PLATE (BY BHEL PIPING)	23.55	KG's	Not required	NO

NOTES ::

- (1) Manifold requirement is project specific. Requirement of these items shall be separately mentioned in enquiry with separate material code. Site to check the same in supplies and erect as per above scheme.
- (2) All the hookup items shall be supplied in loose condition.
- (3) Welding shall be done at site.
- (4) BOM listed above shall be packed each material code wise in ONE packing box except pipe/tubes.
- (5) Packing of pipes / tubes shall be as per vendor practice.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE		

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD		NAME: SUNIL DRN. SUJATHA APPD. KAMAL	SIGN. [Signature] DATE: 03.08.15 03.08.15 03.08.15	NO. OF VAR. -N.A.- NO. OF ITEMS -N.A.-
DEPT. PE&SD CODE 450	UNTO. DIMS. GR. GAUGE	SCALE NTS WEIGHT (KG) N.A.	REF. TO ASSY. DRG. -N.A.-	ITEM NO. -N.A.-
TITLE: INSTALLATION DRAWING for PS / PT (Tube fittings)		CARD CODE N.A.	DRAWING NO. PT/PS-TUBE-L/G	REV. 00
		SHT. No 07	NO. OF SHT.	

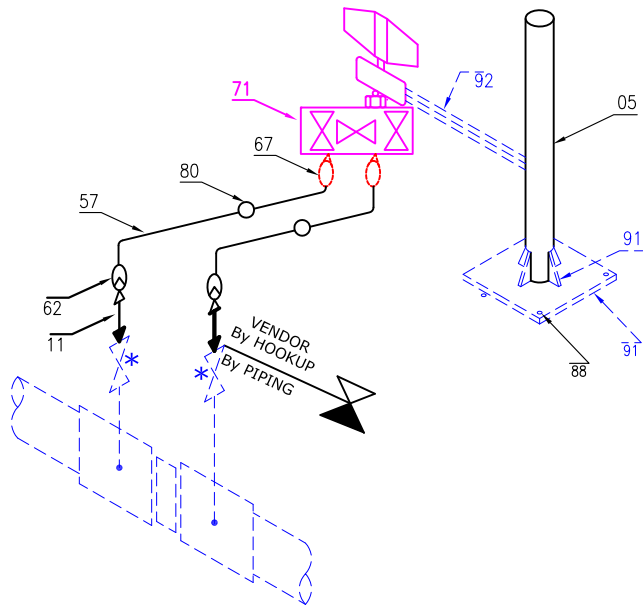
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INVENTORY NO

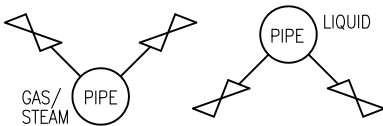
GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261



- Supply by Hookup vendor
- - - Supply by BHEL PIPING
- Supply by INST. vendor
- - - Supply by Hookup vendor (Note-1)

* -> Double isolation valves shall be provided for High pressure applications.

Tapping Orientations



BOM for Material Code : PY9756132744; [SCHEME : FT/DPT-TUBE-L/G without SWAGELOK]

Pos. No.	DESCRIPTION			QTY/SET	UNITS	IBR in IIIC	Swagelok/ Parker Make
11	NIPPLE	SS 316L	1/2" PL x NPT(M), SCH 80S	2	No's	Required	NO
62	FEMALE CONNECTOR	SS 316	1/2" NPT(F) x 1/2" OD TUBE, CL6000	2	No's	Not required	NO
57	TUBE (SMLS)	SS 316L	1/2" OD X 2.1 mm	24	Mtrs	Not required	NO
80	TUBE UNION	SS 316	1/2" OD, CL3000	2	No's	Not required	NO
05	PIPE (SMLS)	SA 1CG Gr. B	2" SCH 40	1.5	Mtrs	Not required	NO
86	U-BOLT GALVZD	IS 226	1/2"	4	No's	Not required	NO
88	ANCHOR BOLT	Chro coated MS	M10x160mm	4	No's	Not required	NO
67	MALE CONNECTOR	SS 316	1/2" NPT(M) x 1/2" OD TUBE, CL6000	2	No's	Not required	NO
71	3 WAY MANIFOLD [NOTE-1]	SS 316	1/2" NPT(F), CL6000	1	No's	Not required	NO
91	STR STEEL MS ANGLE(50x50x6) (BY BHEL PIPING)			2.7012	KG's	Not required	NO
92	STR STEEL 6 mm PLATE (BY BHEL PIPING)			23.55	KG's	Not required	NO

BOM for Material Code : PY9756132752; [SCHEME : FT/DPT-TUBE-L/G + SWAGELOK]

Pos. No.	DESCRIPTION			QTY/SET	UNITS	IBR in IIIC	Swagelok/ Parker Make
11	NIPPLE	SS 316L	1/2" PL x NPT(M), SCH 80S	2	No's	Required	NO
62	FEMALE CONNECTOR	SS 316	1/2" NPT(F) x 1/2" OD TUBE, CL6000	2	No's	Not required	YES
57	TUBE (SMLS)	SS 316L	1/2" OD X 2.1 mm	24	Mtrs	Not required	NO
80	TUBE UNION	SS 316	1/2" OD, CL3000	2	No's	Not required	YES
05	PIPE (SMLS)	SA 106 Gr. B	2" SCH 40	1.5	Mtrs	Not required	NO
86	U-BOLT GALVZD	IS 226	1/2"	4	No's	Not required	NO
88	ANCHOR BOLT	Chro coated MS	M10x160mm	4	No's	Not required	NO
67	MALE CONNECTOR	SS 316	1/2" NPT(M) x 1/2" OD TUBE, CL6000	2	No's	Not required	YES
71	3 WAY MANIFOLD [NOTE-1]	SS 316	1/2" NPT(F), CL6000	1	No's	Not required	YES
91	STR STEEL MS ANGLE(50x50x6) (BY BHEL PIPING)			2.7012	KG's	Not required	NO
92	STR STEEL 6 mm PLATE (BY BHEL PIPING)			23.55	KG's	Not required	NO

NOTES ::

- (1) Manifold requirement is project specific.
Requirement of these items shall be separately mentioned in enquiry with separate material code. Site to check the same in supplies and erect as per above scheme.
- (2) All the hookup items shall be supplied in loose condition.
- (3) Welding shall be done at site.
- (4) BOM listed above shall be packed each material code wise in ONE packing box except pipe/tubes.
- (5) Packing of pipes / tubes shall be as per vendor practice.

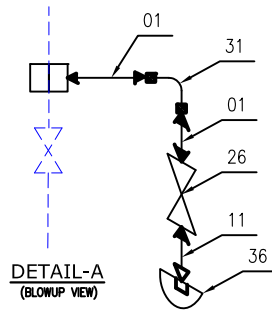
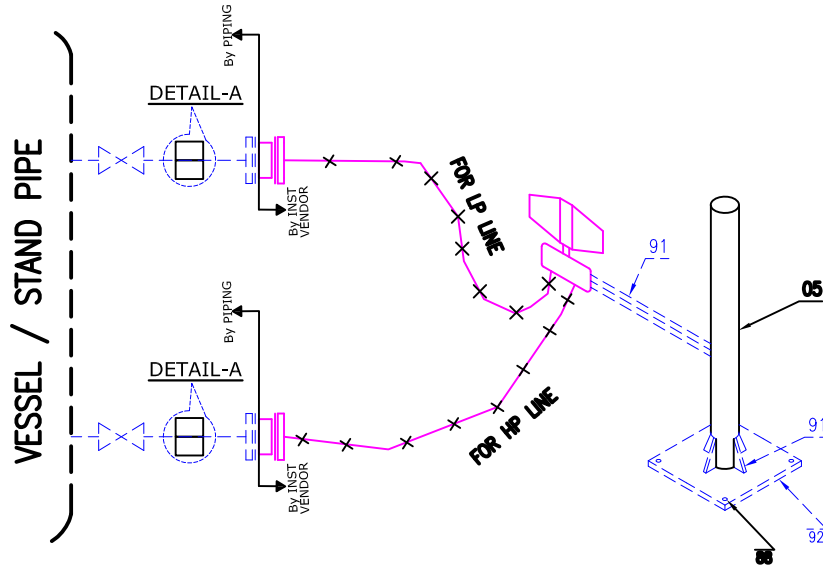
REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE		

		NAME	SUNIL	SIGN.	[Signature]	DATE	03.08.15	NO. OF VAR.
DRN.	CHD.	SUJATHA	[Signature]	03.08.15				-N.A.-
APPD.	KAMAL	[Signature]		03.08.15				-N.A.-
DEPT. CODE	UNTO. DMS. OR. GR. GA/AF	SCALE	NTS	WEIGHT (KG)	N.A.	REF. TO ASSY. DRG.	-N.A.-	ITEM NO. OF ITEMS
450								-N.A.-
TITLE	INSTALLATION DRAWING for DPG / DPT/ DPS (Tube fittings)		CARD CODE	N.A.	DRAWING NO.	FT/DPT-TUBE	REV.	00
			SHT. No	01			NO. OF SHT.	01

INVENTORY NO. SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME

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GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261



- Supply by Hookup vendor
- Supply by BHEL PIPING
- Supply by INST. vendor

BOM for Material Code : PY9756132809 ; [SCHEME : LT-2D-600#-L(CS) W/O SWAGELOK]

Pos. No.	DESCRIPTION	QTY/SET [A]	UNITS	IBR in IIIC	Swagelok/Parker Make
01	PIPE (SMLS) SA 106 Gr. B 1/2" SCH 80	6	Mtrs	Not required	NO
11	NIPPLE SA 106 Gr. B 1/2" PL x NPT(M), SCH 80	2	No's	Not required	NO
31	ELBOW A 105 1/2" SW, CL 3000	2	No's	Not required	NO
26	GATE VALVE A 105 1/2" SW, CL 800	2	No's	Not required	NO
36	CAP A 105 1/2" NPT(F), CL 3000	2	No's	Not required	NO
05	PIPE (SMLS) SA 106 Gr. B 2" SCH 40	1.5	Mtrs	Not required	NO
86	U-BOLT GALVZD IS 226 1/2"	4	No's	Not required	NO
88	ANCHOR BOLT Chro coated MS M10x160mm	4	No's	Not required	NO
91	STR STEEL MS ANGLE(50x50x6) (BY BHEL PIPING)	2.7012	KG's	Not required	NO
92	STR STEEL 6 mm PLATE (BY BHEL PIPING)	23.55	KG's	Not required	NO

BOM for Material Code : PY9756132817 ; [SCHEME : LT-2D-600#-L(SS) W/O SWAGELOK]

Pos. No.	DESCRIPTION	QTY/SET [A]	UNITS	IBR in IIIC	Swagelok/Parker Make
01	PIPE (SMLS) SS 316L 1/2" S CH 80S	6	Mtrs	Not required	NO
11	NIPPLE SS 316L 1/2" PL x NPT (M), S CH 80S	2	No's	Not required	NO
31	ELBOW SS 316 1/2" S W, CL 3000	2	No's	Not required	NO
26	GATE VALVE SS 316 1/2" S W, CL 800	2	No's	Not required	NO
36	CAP SS 316 1/2" NPT (F), CL 3000	2	No's	Not required	NO
05	PIPE (SMLS) SA 106 Gr. B 2" S CH 40	1.5	Mtrs	Not required	NO
86	U-BOLT GALVZD IS 226 1/2"	4	No's	Not required	NO
88	ANCHOR BOLT Chro coated MS M10x160mm	4	No's	Not required	NO
91	STR STEEL MS ANGLE(50x50x6) (BY BHEL PIPING)	2.7012	KG's	Not required	NO
92	STR STEEL 6 mm PLATE (BY BHEL PIPING)	23.55	KG's	Not required	NO

NOTES ::

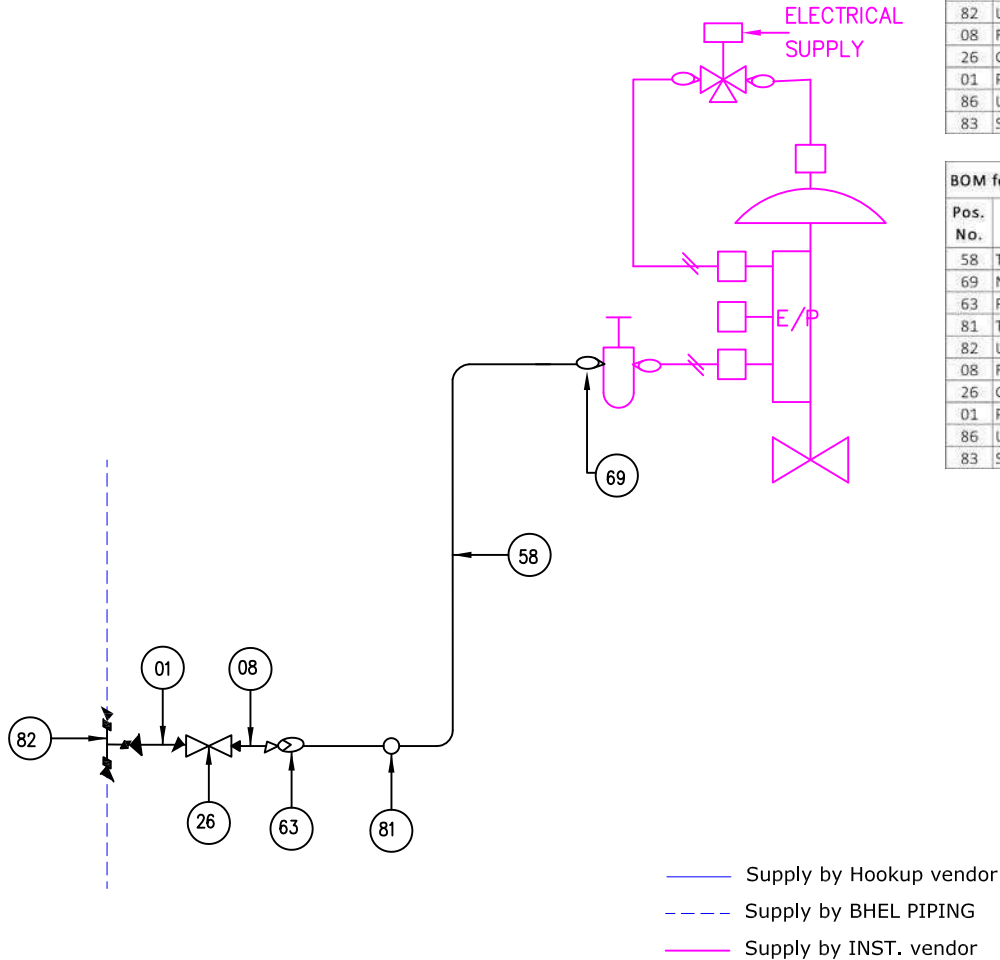
- (1) Materials shown in "DETAIL-A" are required only if drip ring is not supplied along with instrument. Requirement of these item shall be separately mentioned in enquiry with separate material code.
- (2) All the hookup items shall be supplied in loose condition.
- (3) Welding shall be done at site.
- (4) BOM listed above shall be packed each material code wise in ONE packing box except pipe/tubes.
- (5) Packing of pipes / tubes shall be as per vendor practice.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE		

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD		NAME: SUNIL DRN. SUJATHA APPD. KAMAL	SIGN. [Signature] DATE: 03.08.15 DATE: 03.08.15 DATE: 03.08.15	NO. OF VAR. [Blank] NO. OF ITEMS [Blank] REV. 01
DEPT. PE&SD CODE 450	UNTO. DIMS. GR. GAUGE	SCALE NTS WEIGHT (KG) N.A.	REF. TO ASSY. DRG. -N.A.- ITEM NO. -N.A.-	NO. OF SHT. 01
TITLE INSTALLATION DRAWING for LEVEL TRANSMITTER (DIA-SEALED)		CARD CODE N.A.	DRAWING NO. LT-2D-600#-L	REV. 01

SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME 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

GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261



BOM for Material Code : PY9756132850 ; [SCHEME : CV-600#(SS)+SWAGELOK]

Pos. No.	DESCRIPTION		QTY/SET [A]	UNITS	IBR in IIIC	Swagelok/ Parker Make
58	TUBE (SMLS)	SS 316L 6 x 1mm	12	Mtrs	Not required	NO
69	MALE CONNECTOR	SS 316 1/4" NPT(F) x 6mm OD TUBE, CL6000	1	No's	Not required	YES
63	FEMALE CONNECTOR	SS 316 1/4" NPT(F) x 6mm OD TUBE, CL6000	1	No's	Not required	YES
81	TUBE UNION	SS 316 6mmOD, CL3000	1	No's	Not required	YES
82	UNEQUAL TEE	SS 316 1" x 1" x 1/2" SW, CL 3000	1	No's	Not required	NO
08	REDUCER	SS 316 1/2" SW x 1/4" NPT(M), SCH 80S	1	No's	Not required	NO
26	GATE VALVE	SS 316 1/2" SW, CL 800	1	No's	Not required	NO
01	PIPE (SMLS)	SS 316L 1/2" SCH 80S	3	Mtrs	Not required	NO
86	U-BOLT GALVZD	IS 226 1/2"	2	No's	Not required	NO
83	SHELL TYPE PIPE CLAMP	MS 1/4"	4	No's	Not required	NO

BOM for Material Code : PY9756132841 ; [SCHEME : CV-600#(SS) without SWAGELOK]

Pos. No.	DESCRIPTION		QTY/SET [A]	UNITS	IBR in IIIC	Swagelok/ Parker Make
58	TUBE (SMLS)	SS 316L 6 x 1mm	12	Mtrs	Not required	NO
69	MALE CONNECTOR	SS 316 1/4" NPT(F) x 6mm OD TUBE, CL6000	1	No's	Not required	NO
63	FEMALE CONNECTOR	SS 316 1/4" NPT(F) x 6mm OD TUBE, CL6000	1	No's	Not required	NO
81	TUBE UNION	SS 316 6mmOD, CL3000	1	No's	Not required	NO
82	UNEQUAL TEE	SS 316 1" x 1" x 1/2" SW, CL 3000	1	No's	Not required	NO
08	REDUCER	SS 316 1/2" SW x 1/4" NPT(M), SCH 80S	1	No's	Not required	NO
26	GATE VALVE	SS 316 1/2" SW, CL 800	1	No's	Not required	NO
01	PIPE (SMLS)	SS 316L 1/2" SCH 80S	3	Mtrs	Not required	NO
86	U-BOLT GALVZD	IS 226 1/2"	2	No's	Not required	NO
83	SHELL TYPE PIPE CLAMP	MS 1/4"	4	No's	Not required	NO

NOTES ::

- (1) All the hookup items shall be supplied in loose condition.
- (2) Welding shall be done at site.
- (3) BOM listed above shall be packed each material code wise in ONE packing box except pipe/tubes.
- (4) Packing of pipes / tubes shall be as per vendor practice.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE		

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD		NAME: SUNIL SIGN: [Signature] DATE: 03.08.15 NO. OF VAR.:
DEPT. PE&SD CODE: 450	UNTO. DIMS. GR. GAUFE	SCALE: NTS WEIGHT (KG): N.A. REF. TO ASSY. DRG.: -N.A.- ITEM NO. OF ITEMS: -N.A.-
TITLE: INSTALLATION DRAWING for CONTROL VALVE		DRAWING NO.: CV-600# (SS) REV.: 01 SHT. No 01 NO. OF SHT. 01

SPECIFICATION. NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION : C 19
TCE.7742B-C-540-001	1X 30 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR STEAM TURBINE GENERATOR & AUXILIARIES PAINTING	SHEET 1 OF 15

19.0 PAINTING SCHEME FOR POWER PLANT

1.0 SCOPE

The purpose of this tender document is to describe the surface preparation methods, application procedures and type of protective coatings required. This section covers the painting requirements for the power plant equipment, structures, piping etc. and any other surface required to be painted. The painting system should ensure optimal protection of the installation with minimum need for maintenance, environmental friendly & easy to apply.

2.0 CODES AND STANDARDS

Painting of equipment shall be carried out as per the tender specification indicated below and shall conform to the relevant IS contract for the material and workmanship.

The following Standards may be referred to for carrying out the painting

IS: 5	:	Colours for ready mixed paints and enamels
IS: 101	:	All Parts and Sections for paint testing
IS: 1303	:	Glossary of terms relating to paints
IS: 2379	:	Colour code for identification of pipelines
IS: 1477	:	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS: 2524	:	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS: 6278	:	Code of practice for white washing and colour Washing
IS: 13183	:	Aluminium Paint, heat Resistant Contract document
IS: 158	:	Ready mixed paint, brushing, bituminous, black, Lead free, acid, alkali, water and heat resisting
IS: 2074	:	Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS: 104	:	Ready mixed paint, brushing, Zinc Chrome, priming
IS: 2932	:	Enamel, synthetic, exterior (a) undercoating (b) finishing.
IS: 2629	:	Recommended Practice for Hot Dip Galvanising
BS EN ISO 14713	:	Code of practice for protection of iron & steel structure against corrosion
ISO 8501	:	Preparation of steel substrates before application of paint & related Products.

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ISO 8502	:	Assessment of dust on steel surface prepared for painting (Pressure sensitive tape method)
ISO 12944	:	Paints and Varnishes-Corrosion protection of steel structures by protective paint systems
SSPC	:	US Contract documents of Steel Structures Painting Council, SSPC Volumes I and II
SSPC-SP-08	:	Surface preparation by Pickling
NORSOK M-501	:	Surface preparation & Protective coating
ISO 20340	:	Pre-Qualification test
ASTM	:	American standard test method for paints and coatings
AWWA	:	American Water Works Association

Statutory and Local regulations shall be strictly followed in selection and application of paint.

3.0 GENERAL

This tender document covers the surface preparation, method of application and material to be used for all coating of equipment, steel structures and piping. Steel material subjected to surface preparation on shop/site shall have minimum requirements in accordance with Rust Grade B (SSPC/SSPM Volume-2).

Coating materials according to SSPC, EN ISO, ASTM, BIS or DIN standards, shall be used. The paint shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work. The materials shall be matched with each other so that they are compatible. Coatings deviating this tender specification document shall be subject to approval. Standards of surface preparation and painting shall give a time to first maintenance of 10 years.

3.1 Approved Paint Manufacturers

- | | |
|--|-----------------------------------|
| i) Asian Paints (I) Ltd. | vi) Shalimar Paints Ltd. |
| ii) Berger Paints India Ltd | vii) Addison Paints Ltd. |
| iii) Goodlass Nerolac | viii) Grand Polycoat |
| iv) Jenson & Nicholson (I) Ltd | ix) Bombay Paints |
| v) CDC carboline (I) Ltd. | x) Sigma Coatings |
| xi) Premier Products | xii) Coromandel Paints & Chemical |
| xii) Anupam enterprises | xiii) VCM Polyurethane Paints |
| xiv) International Protective Coatings | xv) Ameron, USA |
| xvi) Jotun | xvii) Cipy Polyurethane |
| xviii) M S Corrocoat | |

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3.2 Coating materials

The selected coating materials shall be suitable for the intended use and shall be selected after an evaluation of all relevant aspects such as

- Corrosion protective properties
- Requirements to health, safety and environment
- Properties related to application conditions, equipment and personnel
- Experience with the coating materials and coating system.

Performance standard as listed below shall be established by paint manufacturer, the records shall be submitted for review.

- Adhesion test (pull off test)
- Flexibility test
- Salt spray test (min 1000 Hrs)
- Water absorption test
- UV resistance test (external coating)
- Cathodic disbonding test (internal coating)
- Abrasion test (internal coating)
- Impact resistance test
- Sea water immersion test (structures in tidal, splash zone and conveying sea water)

Each product shall have a batch number showing year and month of manufacture and giving full traceability of production. Shelf life shall be included in the technical data sheet. All coating materials and solvents shall be stored in the original container bearing the manufacturer's label and instructions.

The paint manufacturers shall provide coating system data sheet for each coating system to be used containing the following information

1. Surface preparations
2. Film thickness(min and max)
3. Min and max recoating intervals at relevant temperatures
4. Mixing ratio, thinner details and coating repair systems

The composition of the paint shall be at the discretion of the manufacturer, provided that the finished product meets the requirements of, State or Local regulatory bodies for the products. All vehicle components for use in the manufacture of paints and enamels shall meet the ASTM/ ISO Contract document except as otherwise stated. Coating systems shall be selected as per corrosivity category. Coating systems are tabulated in ANNEXURE and shall be pre-qualified in accordance with Contract document. Coating systems/ alternative coating systems may be re-subjected to pre-qualification, at the discretion of OWNER/ ENGINEER. The specified coating systems,

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the number of coats and the coating film thicknesses given in Annexure are minimum requirements Top coat colors should be in accordance with Annexure.

The paint to be applied shall be approved by Customer / Engineer.

4.0 Painting System Procedure

All paints & paint material used shall be procured from approved manufacturers. Paint shall be supplied in manufacturers original containers with the description of content, Contract document No., colour, ref no, date of manufacture, shelf life expiry date & pot life.

All coating materials and solvents shall be protected from ignition sources and shall remain within storage temperatures and storage conditions recommended by the coating manufacturer. All coating materials and solvents shall be stored in the original container bearing the manufacturer's label and instructions.

The sample for testing the paint being used may be taken by the customer at any time. In general Shop manufactured equipment / component will be delivered to the site coated with a shop applied system or the manufacturer's standard finish in accordance with the requirements of this Contract document. The bidder shall state the extent of shop coating and field coating for the equipments supplied.

For equipment that has received shop prime coat, touch-up prime coat and additional coats shall be applied in accordance with the coating schedule. It is responsibility of the Bidder to ensure compatibility between shop and field applied paint systems.

Necessary Protection shall be provided to the surfaces of all the other equipment, structures, during surface preparation and painting. Damage to other surfaces or equipment shall be repaired by the Bidder.

The Bidder shall submit the following for review and approval by the Customer:

1. Manufacturer's recommended paint scheme for the project
2. Latest published product & instructions for application data,
3. Procedures for surface preparation and application of recommended painting scheme.
4. Pre qualification for equipments and blasting materials, product, procedure and personnel qualifications for the paint and painting systems.
5. Painting repair procedures

The supply of all necessary equipments, weather protection, and scaffolding for painting to ensure work is carried out in accordance with the Contract document and agreed programme.

Maintenance of the paint work until completion of the contract, this shall include repair of any damaged areas caused by third party.

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Disposal of painting waste resulting from painting, shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work and coating materials.

It is a mandatory requirement that all operatives working to this procedure take full cognizance and implement necessary safety precautions.

5.0 PREPARATION OF SURFACES

All surfaces to be painted shall be thoroughly cleaned of all grease, oil, loose mill scale, dust, rust, weld spatters, sharp edges and any other foreign matter. Removal of grease and oil contamination shall be in accordance with SSPC-SP1 prior to cleaning process described below.

Mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out, hand scrapping may be permitted with steel wire brushes and/or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the Engineer.

The blast cleaned surface shall be checked for signs of salt contamination as per ISO 8502-6 &9. The maximum allowable level of contamination shall be 20 mg/m². Surfaces that do not meet these criteria shall be reprocessed.

Mechanical Cleaning:

Manual/power tool cleaning shall be done as per grade St-2 or St-3, of ISO 8504-3. This method to be used for repair painting or on already painted surface and in case of usage on new construction painting prior approval may be obtained from purchaser/engineer.

	Condition of surface	ISO 8504-3	SIS 055900	SSPC
Hand tool cleaning	Rusted	C St2	C St2	SP2
	Rusted and pitted	D St2	D St2	SP2
Power tool cleaning	Rusted	C St3	C St3	SP3
	Rusted and pitted	D St3	D St3	SP3

i) Grade St-2: Thorough scraping and wire brushing, machine brushing, grinding etc. This grade of preparation shall remove loose mill scale, rust and foreign matter. Finally the surface is to be cleaned with a vacuum cleaner or with clean compressed air or with clean brush. After preparation, the surface should have a faint metallic sheen. The appearance shall correspond to the prints designated St-2.

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ii) Grade St-3: very thorough scraping and wire brushing, machine brushing, grinding etc. After preparing the surface, it should have a pronounced metallic sheen and correspond to the prints designated St-3.

Blast cleaning:

Compressors: Compressed air supply for blast cleaning shall be free of water and oil. Air compressors shall not be allowed to deliver air at 110deg C. The blasting activity shall be performed at ambient temperatures above 5°C and relative humidity less than 85%. Steel temperature shall be 3°C above dew point. Necessary safety precautions for equipment and operator shall be adhered to.

Abrasives: Abrasives used for blast cleaning carbon steel and alloy steel shall be as per ISO 8504-2 and SSPC painting manual. Suggested abrasives may be chilled iron grit or shot steel and malleable iron grit and shots non metallic abrasive (aluminium oxide, copper slag, garnet etc.).

Removal of mill scale and rust using abrasives such as grit or shot under high pressure. The grade of blasting performed in line with the approved painting scheme.

Surfaces to be coated shall be free of all grease, oil, loose rust, and loose mill scale. Rust, mill scale, weld spatter, flux, shall be removed by the methods indicated in the Coating Schedule. Oil and grease shall be removed by solvent cleaning method as outlined in SSPC - SP – 1 prior to blasting.

The quality and grain size of abrasives and the parameter of their use are to be chosen to obtain the surface profile depth and cleanliness. Abrasives shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertaining to the work.

Profile measurements for abrasive blast cleaned surface shall be made with a Profile comparator and permanent record shall be maintained with Testex Press-O-Film.

Surfaces prepared for coating shall be coated the same day and before any visible rusting occurs (the time elapsed between blast cleaning and commencement of painting shall under no circumstances exceed 4 hours, but in any case must commence before signs of degradation occur).

After blasting cleaning, depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 25 µm may be used.

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The grades of surface finish:

	ISO 8501-1	SIS 055900	SSPC	NACE
White metal	Sa3	Sa3	SP5	1
Near White metal	Sa 2½	Sa 2½	SP10	2
Commercial blast	Sa2	Sa2	SP6	3
Brush off blast	Sa1	Sa1	SP7	4

PAINT APPLICATION

GENERAL:

Paints and other coating materials shall be applied in accordance with the paint manufacturer's instructions. The surface preparation and painting system shall be as described in ANNEXURE with the following exceptions:

Nameplates, code stampings and push buttons

Concrete brickwork, tile, and glass unless specified by the Purchaser / Engineer

Non-ferrous materials

Austenitic stainless steel

Plastic and / or plastic coated materials

Insulated surface of equipment and pipes except colour coating wherever required

Any surface specified by the Purchaser / Engineer not to be painted.

Painting records shall contain:

- Equipment/components/location painted
- Date of painting
- Paint details such as Contract document No, colour, date of manufacture, shelf life, expiry date
- Application equipments
- Ambient conditions at the time of painting
- Surface temperature
- Drying time between coating, DFT and number of coatings
- Appropriate work plan for painting.

PAINT APPLICATION REQUIREMENTS

The paint shall be applied in accordance with the paint manufacturer's product data sheet, which shall include the mix ratio, the method of application, and the use of thinners and over coating times.

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Paint application shall be by brush, roller or spray gun. Local regulations regarding spray and roller coating shall be observed. A smooth uniform film shall be applied to the surfaces to be coated.

Painting shall be performed when the temperature of the surface is greater than 3°C above the dew point of the surrounding air and relative humidity of the air is less than 85% unless local conditions dictate otherwise and the Customer is in agreement. Guidance on the estimation of the probability of condensation can be found in ISO 8502-4. The measurement of these conditions is the responsibility of the Bidder.

In addition, paints shall not be applied under the following conditions:

- When the surface temperature is greater than 60 °C (unless a higher temperature is agreed by the paint manufacturer)
- When the air temperature is less than approximately 5°C, (depending on local conditions)
- When there is the likelihood of an unfavourable change in weather conditions within two hours after painting
- When there is a deposition of moisture in the form of rain, condensation, frost, etc., on the surface.
- When the available light is less than 500 lux.

Paints shall not be applied within 50 mm of edges which will later have to be welded. Such weld areas shall be taped/one coat of weldable primer for distance of 50 mm either side of the weld line.

When zinc rich primers are used, care shall be taken to mask to avoid any possibility of over spraying onto duplex, austenitic stainless steels; nickel alloys or 9% nickel steel components.

Two pack coatings like Air drying epoxy, Polyurethane coatings etc shall be mixed in the ratio recommended by manufacturer to ensure proper and complete curing of the coatings. The base and hardener are to be separately mixed first to obtain a homogenous mixture. The hardener is to be added to the base slowly, with continuous mixing / agitation and not the reverse. Power agitation is preferred over hand mixing.

Any addition of thinner to achieve the application viscosity should be made only after the components are thoroughly mixed. Excess thinner is not recommended, as increase in volume, leads to lower DFT, sagging, longer curing time, etc.

Coating containing heavy or metallic pigments that have a tendency to settle shall be kept in suspension by continuous use of a mechanical agitator whilst being applied, to ensure uniformity over the surface area (e.g., zinc MIO's pigmented materials).

Transport and erection of painted structures shall be carried out only after the drying time specified by the paint manufacturer has elapsed. Handling & packing of painted

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material shall be appropriate to avoid damage to painting, such as the use of non-metallic slings, etc for handling and by minimising handling after painting.

All steel equipment shall be provided with priming or coating system to protect the steel surface during transport, storage, installation and construction.

Spray application:

Airless or pneumatic spray applications are preferred methods of application. Spraying shall be carried out keeping the spray gun at the minimum suitable distance from the work piece and consistently at 90° to the surface being painted.

Approval of Purchaser / Engineer shall be obtained during spray painting which may cause interference to other works. If spray painting is to be carried out, the following shall be taken into account:

The correct spray tips, air pressures, etc, as recommended by the equipment supplier, shall be used.

Conventional air spray equipment is used, the correct combination of air volume, air pressure and fluid flow to give good atomisation to be ensured to get a defect free painted surface. The major disadvantage of conventional air spray is that high build coatings can generally not be applied by this method as most paints have to be thinned to a suitable viscosity for satisfactory atomisation, and so lose their high build properties. Bidder shall follow manufacture's instruction.

Air spray (pressure pot) is recommended in cases where large quantities of paint are to be applied as paint in the tank can be prevented from settling, reduces application time and also enables the gun to be turned to any angle to coat objects effectively without spilling paint.

Airless spray is recommended as high build coatings can be applied without thinning, very rapid application is possible, giving an economic advantage, compared to conventional spray, overspray and bounce-back are reduced, leading to reduced losses of material and less dust and fume hazards.

Each coat shall be applied uniformly and completely over the entire surface. All runs and sags shall be brushed out immediately or the paint shall be removed and the surface re-sprayed.

Very complex structures should be painted by brush instead of spray gun to avoid overspray, dry spray and unacceptable paint losses.

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Brush application:

Brush application may be used under the following circumstances:

- When areas cannot be properly coated by spraying for reasons such as material or environmental considerations
- For the initial coat of paint to corners, edges, crevices, holes, welds or irregular surface prior to spray application
- For "touch up" or repairs to localize damaged paint or areas of incorrectly applied paint
- Where the paint manufacturer considers the coating material suitable for brush application.

Brushes shall be of a style and quality that will permit the proper application of paint. Brush applications should be done in two passes that are perpendicular to each other 'wet on wet" so that a smooth coat, as near uniform in thickness as possible, is obtained there by avoiding running and droplets. There should be no deep or detrimental brush marks. Paint shall be worked into all crevices and corners. Runs and sags shall be brushed out.

During the application of each coat, all areas such as corners, edges, welds, small brackets, bolts, nuts and interstices shall receive additional paint to ensure that these areas have at least the minimum specified dry film thickness and to ensure continuity of coating.

Roller application:

Roller application shall only be used on relatively large surface areas and only if spraying is not an option. Roller application shall only be used if the first or priming coat of paint has been applied by brush. Roller application shall be in accordance with the paint Manufacturer's instructions.

Galvanising:

Gratings and step threads

- i) Surface preparation
Gratings and step threads shall be cleaned by acid pickling as per SSPC-SP-08.
- ii) Hot dip galvanising
The hot dip galvanising shall be done as per IS 2629 .The average mass of coating shall be 610 gms/m².
- iii) Post galvanising treatment
Immediately after galvanising, post treatment such as chromating shall be applied to retard white rust attack.

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- iv) Touch up mechanical damages
The repair of damages coatings shall be done as per the recommended practice ASTM A 780.

CORROSIVITY OF ENVIRONMENTS

Corrosivity category	
C2	Low
C3	Medium
C4	High
C5	Very High Industrial & marine
IM 1	Immersion in Fresh Water
IM 2	Immersion in Sea or brackish water
IM 3	Buried in Soil

Tests required for evaluation of acceptance of coating materials:

TABLE -1
PERFORMANCE TEST OF PAINT

SL. No.	TEST	ASTM TEST METHOD
	Abrasion Resistance: (topcoat only)	ASTM D4060
	Adhesion:	ASTM D4541
	Dry Heat Resistance:	ASTM D2485
	Flexibility: (topcoat only)	ASTM D522, 180° bend
	Pencil Hardness: (topcoat only)	ASTM D3363
	Salt Fog Resistance:	ASTM B117, 1000 hours
	Weather Resistance:	ASTMG23 Type D
	Test	ASTM Test Method
	Density	D 1475
	Dipping properties	D 823
	Drying time	D 1640
	Flexibility	D 1737/D 522
	Hardness	D 3363
	Adhesion (pull off test)	D 4541
	Abrasion resistance	D 968/D 4060
	DFT/Coat	As per SSPC Guidelines

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	Storage Stability	D 1849
	Resistance to	
	i) Humidity for 2000 hrs.	D 2247
	ii) Salt Spray for 2000 hrs.	B 117
	iii) Accelerated Weathering	D 822

INSPECTION:

Inspection will be performed by an inspector authorised by Purchaser / Engineer if applicable in MQP & FQP. Paint materials including primers and thinners brought to site by Bidder for application shall be procured directly from manufactures as per Contract document and shall be accompanied by manufacturer's test certificates.

The painting work shall be subjected to inspection by purchaser / engineer at all times. The Bidder shall offer following stage of inspection:

- Surface preparation
- Primer application
- Subsequent coats
- Paint qualification test

Bidder shall provide the expert technical services of the paint manufactures as and when required by purchaser / engineer to ensure both the surface preparation and applications are carried out as per their recommendations. This service shall be provided without any obligation to purchaser.

The following coating inspection & test shall be carried out:

1. Ambient and steel temperature, relative humidity and dew point min twice in a shift.
2. Surface finish & profile check each component or once per 10 m² after surface preparation.
3. Salt contamination test - Free from salt contamination.
4. Dry Film Thickness as per ISO 2808 No.6.
5. Holiday Test as per ASTM D 5162/ NACE RP 0188.
6. Adhesion Test as per ISO 2409 for cross-cut test, or a pull-off test as per ISO 4624/ ASTM D 4541.

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6.0 SUGGESTED COLOUR CODES FOR PAINTING:

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
1.0	Structures, platforms, ladders and handrails	Dark Admiralty Grey	632	-	-
2.0	Boiler casing, ESP and ducting	Nut Brown	413	-	-
3.0	Fans, pumps, motors,	Light Grey	631	-	-
4.0	Tanks (without insulation and cladding)				
4.1	Outdoor	Aluminium	-	-	-
4.2	Indoor	Light grey	631	-	-
5.0	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
6.0	Switchgear	Light grey	631	-	-
7.0	Control & relay panels	Light grey	631/70 78 of IS 1650	-	-
8.0	Turbine	Golden Yellow	356	-	-
9.0	Generator & exciter	Light grey	631	--	-
10.0	Transformers	Aluminium	-	-	-
11.0	Machinery guards	Signal red	537	-	-
12.0	Piping (without insulation and cladding)				
12.1	Water System				
	Boiler feed	Sea green	217	-	-
	Condensate	Sea green	217	Light brown	410
	Bearing cooling water	Sea green	217	French blue	166

Notes:

1. This colour code basically refers to IS: 2379 for piping with necessary modifications.
2. Where band colour is specified, same shall be provided at 30 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.

Note: Bidder will follow their painting standard for steam turbine & generator and will provide fibre epoxy painting for condenser.

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ANNEXURE

A. Painting scheme for C2 and C3 environment

Sl no	Description	Surface Preparation	Primer		Intermediate paint		Finish coat		Total DFT			
			paint	no of coats	DFT	paint	no of coats	DFT	paint	no of coats	Min	
1	Boiler Structure, uninsulated ducts, suspensions, hangers temperature < 120 °C	Sa 2 ½	In organic Zn silicate	2	80 µ	HB MIO epoxy	1	120µ	poly urethane	2	60µ	260µ
2	Indoor Structure	Sa 2 ½	HB Zn Phosphate	2	80 µ	HB MIO epoxy	1	120µ	-	-	-	200µ
3	Insulated parts exposed to temp > 120 °C	Sa 2 ½	In organic Zn silicate	2	60 µ							60 µ
4	Work Shop	Sa 2 ½	HB Zn Phosphate	2	80 µ	HB MIO epoxy	1	120µ	-	-	-	200µ
5	Water Treatment Plant (external)	Sa 2 ½	Zn rich epoxy	2	80µ	HB MIO epoxy	2	200µ	Aliphatic poly urethane	2	80µ	360µ
6	Coal Handling Plant	Sa 2 ½	In organic Zn silicate	2	80 µ	HB MIO epoxy	1	120µ	poly urethane	2	60µ	260µ
7	Fuel pipings	Sa 2	Ethny Zn silicate	1	40µ				HR aluminium paint	2	40µ	80 µ
8	Un insulated silencer, steel stacks > 120 °C	Sa 2 ½	Ethny Zn silicate	1	40µ				HR silicone aluminium paint	2	40µ	80 µ
9	Above Ground piping	Sa 2 ½	In organic Zn silicate	2	80 µ	HB MIO epoxy	1	120µ	poly urethane	2	60µ	260µ
10	Burried Piping (External)	Sa 2 ½	Coal tar primer, coal tar enamel, inner wrap of fibre glass, final outer wrap of enamel impregnated fibre									4.0 mm
11	Burried Piping (internal)	Sa 2 ½										500µ
12	storage Tanks External	Sa 2 ½	In organic Zn silicate	2	80 µ	HB MIO epoxy	1	120µ	poly urethane	2	60µ	260µ
13	storage tanks Internal	Sa 2 ½				3 coats of amine adducts						400µ
14	DM water piping internal	Sa 2 ½				hard rubber lining min 4 mm thickness						4.0 mm
15	DM water tank internal	Sa 2 ½	In organic Zn silicate	2	80 µ	HB coal tar epoxy	1	150µ	HB coal tar epoxy	1	150µ	380µ
16	Fuel Oil Tanks Internal	Sa 2 ½	In organic Zn silicate	2	80 µ	HB coal tar epoxy	1	150µ	HB coal tar epoxy	1	150µ	380µ
17	Insulated parts continuously exposed to condensing water	Sa 2 ½	In organic Zn silicate	2	75 µ							75 µ
18	For insulated piping < 125 °C	Sa 2 ½	Polyamide cured epoxy coating	2	250 µ							250 µ
19	Electrical parts, control panels, valves, pumps & motors (indoor)*	Sa 2 ½	Zn phosphate epoxy	2	80 µ				Chlorinated rubber	2	80µ	160µ
20	Electrical parts, control panels, valves, pumps & motors (outdoor)*	Sa 2 ½	Zn phosphate epoxy	2	80 µ				Chlorinated rubber	2	100µ	180µ
21	Switch Yard, floor grills, walk ways	Sa 2 ½				hot dip galvanising 80 µ						80µ

* Note: Manufacturer to specify details of painting system capable of withstanding environmental conditions for a period of 10 years before first maintenance

ISSUE
R0

SPECIFICATION. NO.	TATA CONSULTING ENGINEERS LIMITED	SECTION : C 19
TCE.7742B-C-540-001	1X 30 MW CAPTIVE POWER PLANT FOR CDQ 10&11 TATA STEEL LIMITED, JAMSHEDPUR STEAM TURBINE GENERATOR & AUXILIARIES PAINTING	SHEET 15 OF 15

ANNEXURE

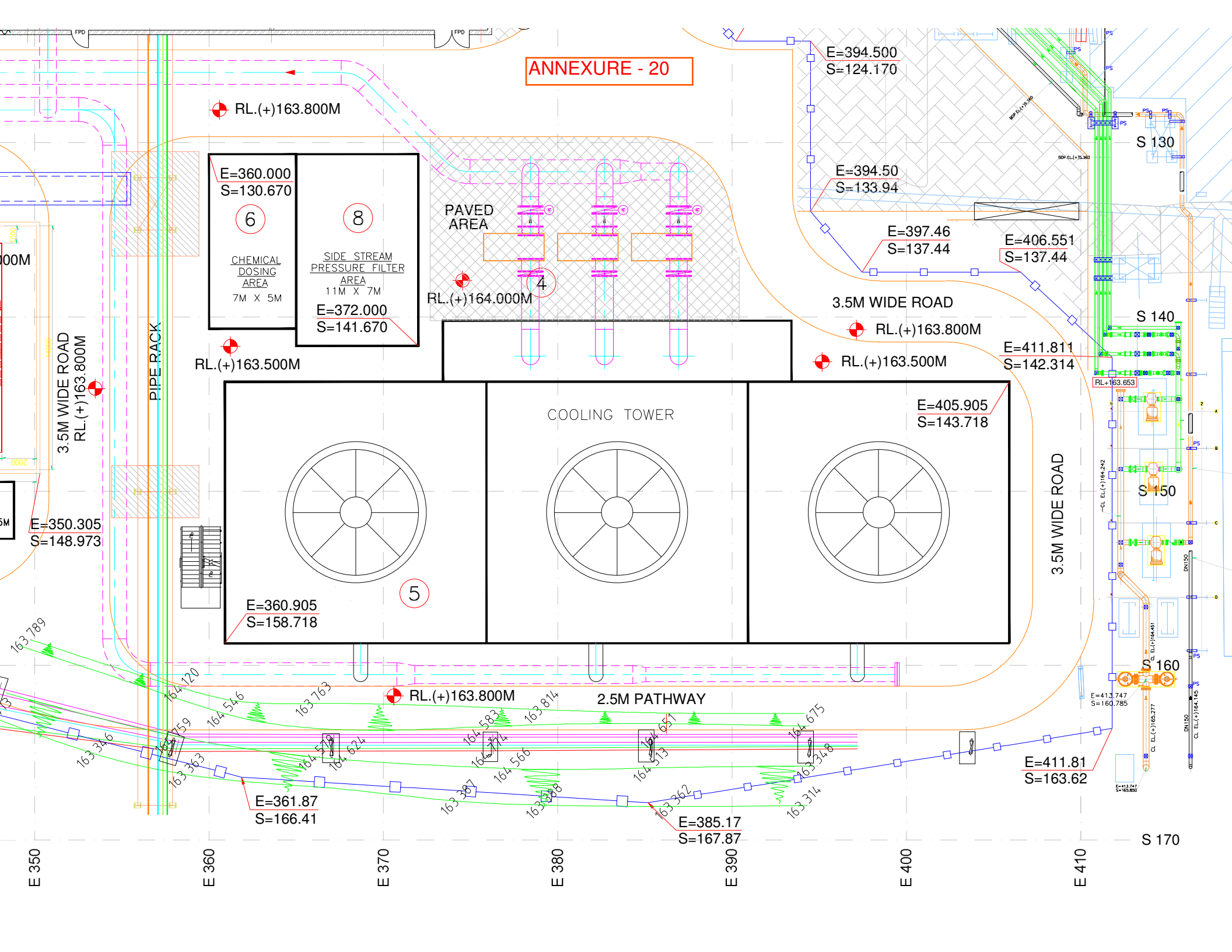
A. Painting scheme for C4 and C5 environment

Sl no	Description	Surface Preparation	Primer		Intermediate paint		Finish coat		Total DFT	
			paint	no of coats	paint	no of coats	paint	no of coats		
1	Boiler Structure, uninsulated ducts, suspensions, hangers temperature < 120 °C	Sa 2 1/2	HB Zn Phosphate	2	80 µ	HB MIO epoxy	2	200µ	80µ	360µ
2	Indoor Structure	Sa 2 1/2	HB Zn Phosphate	2	80 µ	HB MIO epoxy	1	120µ	60µ	260µ
3	Insulated parts exposed to temp > 120 ° C	Sa 2 1/2	In organicZn silicate	2	60 µ					60 µ
4	Work Shop	Sa 2 1/2	HB Zn Phosphate	2	80 µ	HB MIO epoxy	1	120µ	60µ	260µ
5	Water Treatment Plant (external)	Sa 2 1/2	Zn rich epoxy	2	80µ	HB MIO epoxy	2	200µ	80µ	360µ
6	Coal Handling Plant	Sa 2 1/2	HB Zn Phosphate	2	80 µ	HB MIO epoxy	2	200µ	60µ	340µ
7	Coal Fuel pipings	Sa 2	Ehthy Zn silicate	1	40µ				40µ	80 µ
8	Un insulated silencer, steel stacks > 120 °C	Sa 2 1/2	Ehthy Zn silicate	1	40µ				40µ	80 µ
9	Above Ground piping	Sa 2 1/2	In organicZn silicate	2	80 µ	HB MIO epoxy	1	120µ	60µ	260µ
10	Burried Piping (External)	Sa 2 1/2	Coal tar primer, coal tar enamel, inner wrap of fibre glass, final outer wrap of enamel							4.0mm
11	Burried Piping (internal)	Sa 2 1/2								500µ
12	storage Tanks External	Sa 2 1/2	In organicZn silicate	2	80 µ	HB MIO epoxy	2	200µ	60µ	340µ
13	storage tanks Internal	Sa 2 1/2				3 coats of amine adducts				400µ
14	DM water piping internal	Sa 2 1/2				hard rubber lining min 4 mm thickness				4.0 mm
15	DM water tank internal	Sa 2 1/2	In organicZn silicate	2	80 µ	HB coal tar epoxy	1	150µ	150µ	380µ
16	Fuel Oil Tanks Internal	Sa 2 1/2	In organicZn silicate	2	80 µ	HB coal tar epoxy	1	150µ	150µ	380µ
17	Insulated parts continuously exposed to condensing water	Sa 2 1/2	In organicZn silicate	2	75 µ					75 µ
18	For insulated piping < 125 °C	Sa 2 1/2	Polyamide cured epoxy coating	2	250 µ					250 µ
19	Electrical parts, control panels, valves, pumps & motors (indoor)*	Sa 2 1/2	Zn phosphate epoxy	2	80 µ					160µ
20	Electrical parts, control panels, valves, pumps & motors (outdoor)*	Sa 2 1/2	Zn phosphate epoxy	2	80 µ					180µ
21	Switch Yard, floor grills, walk ways	Sa 2 1/2				hot dip galvanising coating Wt.610 gms/M ² (coating thickness of 80 µ)				80µ

* Note: Manufacturer to specify details of painting system capable of withstanding environmental conditions for a period of 10 years before first maintenance

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ANNEXURE - 20



RL.(+)163.800M

E=360.000
S=130.670

6

CHEMICAL
DOSING
AREA
7M X 5M

8

SIDE STREAM
PRESSURE FILTER
AREA
11M X 7M
E=372.000
S=141.670

PAVED
AREA

RL.(+)164.000M

4

E=394.500
S=124.170

E=394.50
S=133.94

E=397.46
S=137.44

E=406.551
S=137.44

3.5M WIDE ROAD

RL.(+)163.800M

RL.(+)163.500M

E=411.811
S=142.314

RL(+163.653)

E=405.905
S=143.718

COOLING TOWER

E=360.905
S=158.718

5

3.5M WIDE ROAD
RL.(+)163.800M

E=350.305
S=148.973

3.5M WIDE ROAD

RL.(+)163.800M

2.5M PATHWAY

E=361.87
S=166.41

E=385.17
S=167.87

E=411.81
S=163.62

E 350

E 360

E 370

E 380

E 390

E 400

E 410

S 170

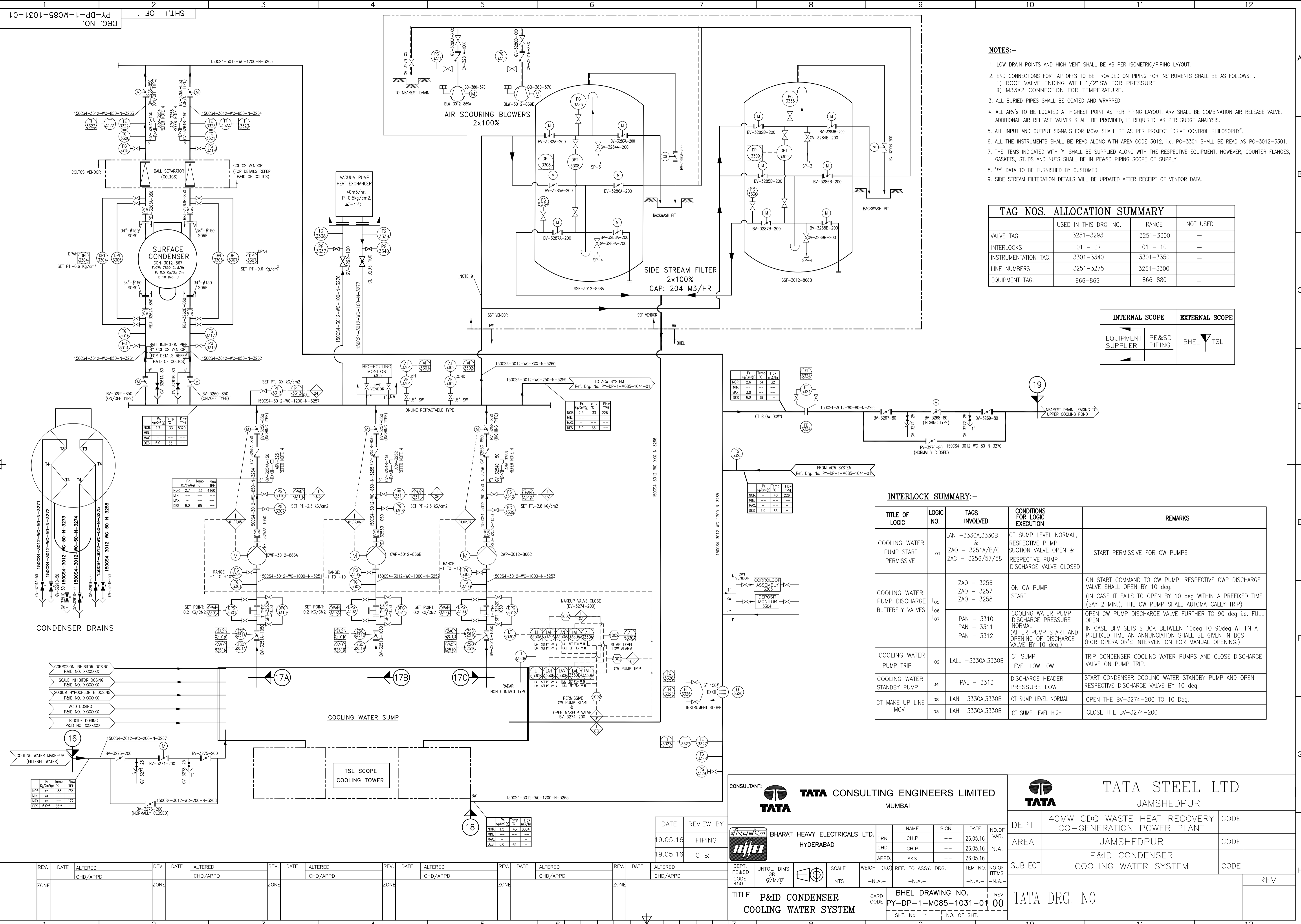
S 130

S 140

S 150

S 160

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- NOTES:-**
- LOW DRAIN POINTS AND HIGH VENT SHALL BE AS PER ISOMETRIC/PIPING LAYOUT.
 - END CONNECTIONS FOR TAP OFFS TO BE PROVIDED ON PIPING FOR INSTRUMENTS SHALL BE AS FOLLOWS:
 - ROOT VALVE ENDING WITH 1/2" SW FOR PRESSURE
 - M3X2 CONNECTION FOR TEMPERATURE.
 - ALL BURIED PIPES SHALL BE COATED AND WRAPPED.
 - ALL ARV'S TO BE LOCATED AT HIGHEST POINT AS PER PIPING LAYOUT. ARV SHALL BE COMBINATION AIR RELEASE VALVE. ADDITIONAL AIR RELEASE VALVES SHALL BE PROVIDED, IF REQUIRED, AS PER SURGE ANALYSIS.
 - ALL INPUT AND OUTPUT SIGNALS FOR MOVs SHALL BE AS PER PROJECT "DRIVE CONTROL PHILOSOPHY".
 - ALL THE INSTRUMENTS SHALL BE READ ALONG WITH AREA CODE 3012, i.e. PG-3301 SHALL BE READ AS PG-3012-3301.
 - THE ITEMS INDICATED WITH "*" SHALL BE SUPPLIED ALONG WITH THE RESPECTIVE EQUIPMENT. HOWEVER, COUNTER FLANGES, GASKETS, STUDS AND NUTS SHALL BE IN PE&SD PIPING SCOPE OF SUPPLY.
 - "**" DATA TO BE FURNISHED BY CUSTOMER.
 - SIDE STREAM FILTRATION DETAILS WILL BE UPDATED AFTER RECEIPT OF VENDOR DATA.

TAG NOS. ALLOCATION SUMMARY			
	USED IN THIS DRG. NO.	RANGE	NOT USED
VALVE TAG.	3251-3293	3251-3300	-
INTERLOCKS	01 - 07	01 - 10	-
INSTRUMENTATION TAG.	3301-3340	3301-3350	-
LINE NUMBERS	3251-3275	3251-3300	-
EQUIPMENT TAG.	866-869	866-880	-

INTERNAL SCOPE		EXTERNAL SCOPE	
EQUIPMENT SUPPLIER	PE&SD PIPING	BHEL	TSL

INTERLOCK SUMMARY:-

TITLE OF LOGIC	LOGIC NO.	TAGS INVOLVED	CONDITIONS FOR LOGIC EXECUTION	REMARKS
COOLING WATER PUMP START PERMISSIVE	101	LAN - 3330A, 3330B & ZAO - 3251A/B/C ZAC - 3256/57/58	CT SUMP LEVEL NORMAL, RESPECTIVE PUMP SUCTION VALVE OPEN & RESPECTIVE PUMP DISCHARGE VALVE CLOSED	START PERMISSIVE FOR CW PUMPS
COOLING WATER PUMP DISCHARGE BUTTERFLY VALVES	105, 106, 107	ZAO - 3256, ZAO - 3257, ZAO - 3258, PAN - 3310, PAN - 3311, PAN - 3312	ON CW PUMP START, COOLING WATER PUMP DISCHARGE PRESSURE NORMAL (AFTER PUMP START AND OPENING OF DISCHARGE VALVE BY 10 deg.)	ON START COMMAND TO CW PUMP, RESPECTIVE CWP DISCHARGE VALVE SHALL OPEN BY 10 deg. (IN CASE IT FAILS TO OPEN BY 10 deg WITHIN A PREFIXED TIME (SAY 2 MIN.), THE CW PUMP SHALL AUTOMATICALLY TRIP)
COOLING WATER PUMP TRIP	102	LALL - 3330A, 3330B	CT SUMP LEVEL LOW LOW	TRIP CONDENSER COOLING WATER PUMPS AND CLOSE DISCHARGE VALVE ON PUMP TRIP.
COOLING WATER STANDBY PUMP	104	PAL - 3313	DISCHARGE HEADER PRESSURE LOW	START CONDENSER COOLING WATER STANDBY PUMP AND OPEN RESPECTIVE DISCHARGE VALVE BY 10 deg.
CT MAKE UP LINE MOV	108, 103	LAN - 3330A, 3330B, LAH - 3330A, 3330B	CT SUMP LEVEL NORMAL, CT SUMP LEVEL HIGH	OPEN THE BV-3274-200 TO 10 Deg. CLOSE THE BV-3274-200

CONSULTANT: **TATA CONSULTING ENGINEERS LIMITED** MUMBAI

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

DATE: 19.05.16 REVIEW BY: PIPING C & I

DEPT. CODE: 450 UNTOOL DIMS. GR. 0/M/F SCALE: NTS WEIGHT (KGS) REF. TO ASSY. DRG. ITEM NO. NO. OF ITEMS

TITLE: **P&ID CONDENSER COOLING WATER SYSTEM**

BHEL DRAWING NO. PY-DP-1-M085-1031-01

TATA STEEL LTD JAMSHEDPUR

DEPT: 40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT CODE

AREA: JAMSHEDPUR CODE

SUBJECT: P&ID CONDENSER COOLING WATER SYSTEM CODE

TATA DRG. NO.

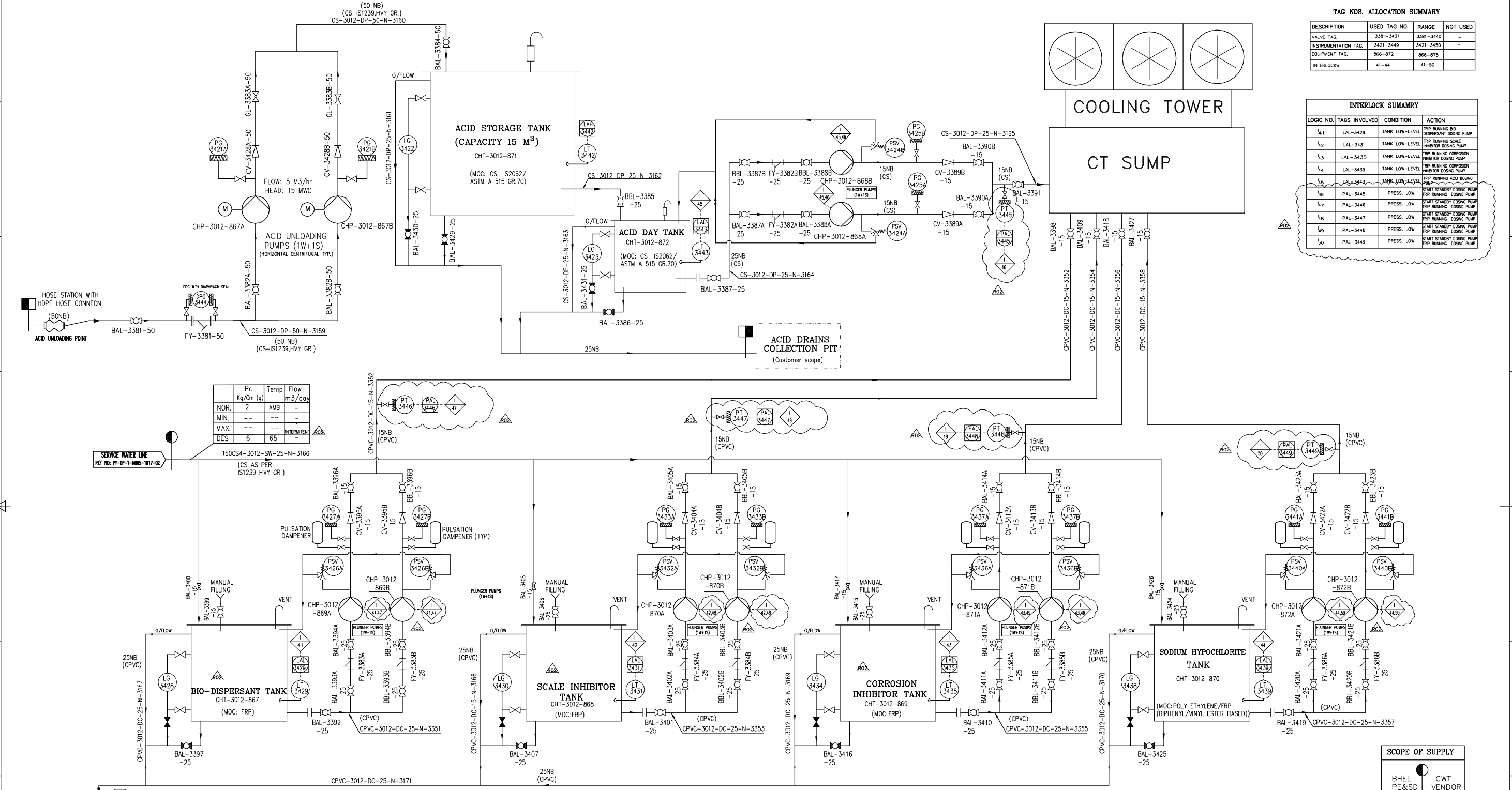
REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED

TAG NOS. ALLOCATION SUMMARY

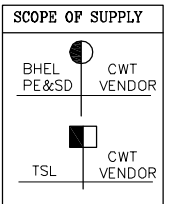
DESCRIPTION	USED TAG NO.	RANGE	NOT USED
VALVE TAG	3381-3431	3381-3440	-
INSTRUMENTATION TAG	3421-3449	3421-3450	-
EQUIPMENT TAG	866-872	866-875	-
INTERLOCKS	41-44	41-50	-

INTERLOCK SUMMARY

LOGIC NO.	TAGS INVOLVED	CONDITION	ACTION
41	LAL-3429	TANK LOW-LEVEL	TRIP RUNNING BIO-DISPERSANT DOSING PUMP
42	LAL-3431	TANK LOW-LEVEL	TRIP RUNNING SCALE INHIBITOR DOSING PUMP
43	LAL-3435	TANK LOW-LEVEL	TRIP RUNNING CORROSION INHIBITOR DOSING PUMP
44	LAL-3439	TANK LOW-LEVEL	TRIP RUNNING ACID DOSING PUMP
45	LAL-3443	TANK LOW-LEVEL	TRIP RUNNING ACID DOSING PUMP
46	PAL-3445	PRESS. LOW	START STANDBY DOSING PUMP
47	PAL-3446	PRESS. LOW	TRIP RUNNING DOSING PUMP
48	PAL-3447	PRESS. LOW	START STANDBY DOSING PUMP
49	PAL-3448	PRESS. LOW	TRIP RUNNING DOSING PUMP
50	PAL-3449	PRESS. LOW	START STANDBY DOSING PUMP



- NOTES:**
1. TANK CAPACITIES, PIPE SIZES AND DOSING PUMP SHALL BE FINALIZED BASED ON SUB-VENDOR DATA.
 2. A SAFETY SHOWER AND EYE WASH SHALL BE PROVIDED NEAR THE PACKAGE.
 3. BULK ACID STORAGE TANK SHALL BE PROVIDED WITH DYKE AREA OF ACID RESISTANT TILES, WHICH SHALL BE IN CUSTOMER'S SCOPE.
 4. a) PIPES FOR SULPHURIC ACID & SERVICE WATER LINES SHOULD BE AS PER IS 1239 HEAVY GRADE.
b) PIPES FOR CHEMICAL LINES SHALL BE CPVC.



REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
01	15.07.16	CHD/APPD	02	30.06.16	CHD/APPD	03	30.06.16	CHD/APPD	04	30.06.16	CHD/APPD	05	30.06.16	CHD/APPD	06	30.06.16	CHD/APPD

CONSULTANT: **TATA CONSULTING ENGINEERS LIMITED**
MUMBAI

TATA STEEL LTD
JAMSHEDPUR

DEPT.	UNTO. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
PE&SD	g/m ³	NTS	-N.A.-	-N.A.-	-N.A.-	-N.A.-

PROJECT	40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT	CODE	
AREA	JAMSHEDPUR	CODE	
SUBJECT	P&ID OF COOLING WATER TREATMENT SYSTEM	CODE	

TATA DRG. NO. 02

INVENTORY NO. SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME

ANNEXURE - 23



Approved Supplier List - Mechanical Items



Mechanical Segment Steering Committee

Published in January 2014

Tata Steel Limited, Jamshedpur

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4	Pollution Control Equipment	8
5	Mobile Equipment & Accessories	9
6	Bearings	11
7	Pump	12
8	Valves	14
9	Weld & gas Cutting Equipment	16
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12	Hydraulic System	19
13	Lubrication System	21
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16	Steel Wire Ropes & Accessories	26
17	Fasteners	27
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19	Pipe & Pipe Fittings	29
20	Tools & Tackles	30

Sl. No.	Commodity	Page No.
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24	Mechanical – Measuring and Testing Equipment	34
25	Material Handling Equipment	35
26	Loco and Accessories	36
27	Refrigeration Equipment & Accessories	37
28	Turbines and Accessories	38
29	Turbo Blower	39
30	Water Systems	40
31	Springs	41
32	Boiler Spares and Accessories	42
33	Blower, Booster, Fans	43
34	Chain and Sprocket	44
35	Combustion Systems	45
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40	List of top 30 dealers with their Original Equipment/Component Manufacturer	50

Methodology used for formulating the “Approved Supplier List”

- The commodities covered under all the CCTs have been selected for supplier panel identification.
- The supplier panel for each of the commodities is made based upon last three years (FY 10-12) of spend data and past experiences.
- Within each Commodity (Basic Generic Group), the sub – commodity (Generic Group) contributing to 80% of the total spend were selected for identification of the supplier panel.
- Within each Commodity (Basic Generic Group), the number of suppliers/suppliers contributing to 80% of the total spend have been mentioned.
- Suppliers who supply items on proprietary basis have not been considered for the supplier panel list e.g. SMS Siemag, Paul Wurth Italy etc.
- Suppliers, with whom one of transactions has taken place for high value items, have also not been considered for the supplier panel list.
- Wherever possible, the name of the Channel Partners has been replaced with that of the OEMs or OCMs.
- The sub-commodities for which the CCT has already evaluated and modified the supplier panel have been kept as per final CCT decision.
- This supplier panel is as per the “As-Is” data. All changes are to be made as per “Trial Policy” and approval of CCT / COMM.

List of Abbreviations:

BGG	Basic Generic Group (Commodity Type)
GG	Generic Group (Sub – Commodity Type)
CCT	Commodity Competence Team

Note: The information contained in this booklet is confidential and for internal circulation only. The information can be shared with turnkey project executors with appropriate control mechanism.

Commodity 7: Pump

BGG	Description	Major Sub-Category (GG)	Spend of 3 yrs. (FY 10-12) [INR Cr]	No. of Suppliers (80% spend)	CCT Name	CCT Leader	CCT Altn. Leader
284	Pump	4	47.18	17	Pumps & Valves	Biswanath Roy, M&U (MM)	GRP Singh, MEG

Sub-category (GG)	Description	Supplier Panel					
		Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5	Supplier 6
0496	Horizontal centrifugal pumps	Kirloskar Brothers Ltd.	Mather & Platt	KSB Pumps Limited	Voltas Ltd / Suzler	Goulds	Pumpsense (for developmental items)
		Flowserve Limited	Grundfoss	Flowmore			
	Horizontal centrifugal pumps (small)	B.E. Pumps	Flowdyne	Varat	Becon Weir Limited		
	Vertical centrifugal pumps	Kirloskar Brothers Ltd.	Worthington Pump India Ltd.	Flowmore	Grundfoss		
	Submersible drainage / sewage pumps	KSB Pumps Limited	Grundfoss	SU Pumps	Darling	SUM Turbo	
	Diaphragm pumps	HDO Pumps	TriveniEngg.	Yamai			
	Slurry / Sludge pumps	Warman	Denver	Akay	Wilfrey	Metso	Becon Weir Limited

Commodity 7: Pump (contd.)

Sub-category (GG)	Description	Supplier Panel					
		Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5	Supplier 6
0496 (Contd.)	Chemical (Centrifugal) Pumps	Akay	Khimline / Suzler	KSB Pumps Limited	Kirloskar Brothers Ltd.	Prominent	Shoptools
	Dosing Pumps	Asia-LMI	Milton Ray				
	Vacuum Pumps	Kirloskar Brothers Ltd.	Wilfrey	BHEL			
	Engines For Pumps	Kirloskar Brothers Ltd.	Cummins	Greaves	Komatsu	TIL	
	Alkali Pumps	Kirloskar Brothers Ltd.	CNP	KSB Pumps	Sam Turbo	Johnson	WPIL
		Jyoti Pumps					

Commodity 8: Valves

BGG	Description	Major Sub-Category (GG)	Spend of 3 yrs. (FY 10-12) [INR Cr]	No. of Suppliers (80% spend)	CCT Name	CCT Leader	CCT Altn. Leader
298	Valves	7	61.99	20	Pumps & Valves	Biswanath Roy, M&U (MM)	GRP Singh, MEG

Sub-category (GG)	Description	Supplier Panel						
		Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5	Supplier 6	Supplier 7
0705	Gate Valve (Water, Air, Gas)	Kirloskar	KSB	VAG	Intervalve	Orbinox	Crane	Kitz Corporation (Trial)
		Fouress (Aurangabad Plant)	BDK (Trial)*	Audco (Trial)*	Virgo (Stafford)	Tyco		
	GATE VALVE (Steam)	Kirloskar	KSB	Klinger	Crane	Audco	Virgo (Stafford)	
	Knife Edge Gate Valve	Dezurik	Orbinox	Vaas	Fouress	VAG		
0820	Butterfly Valve	Kirloskar	VAG	Deltech	Intervalve	Dembla	Crane	HAWA
		Fouress (Aurangabad Plant)	Xomox	Kitz Corporation (Trial)	BDK (Trial)*	Audco (Trial)*	Virgo (Stafford)	Tyco
0116	Ball Valve	BDK	Xomox	Deltech	Microfinish	Hawa	Virgo (Stafford)	Alto
		VTM	Kitz Corporation	Dembla	AUDCO (Trial)*			
0710	Control Valve	TYCO (India)	Fisher	Dembla	Forbes Marshall	IL Palghat		

0701	Non Return Valve	Kirloskar	VAG	Orbinox	KSB	Normex	Velan	Kitz Corporation (Trial)*
		BDK (Trial)*	Audco (Trial)*					
0702 / 0932	Globe / Piston Valve	Fouress (Aurangabad Plant)	BHEL	KSB	Hydrotech	Klinger	Armstrong	Audco (Trial)*
0704	Plug Valve	Flowserve Sanmar Limited	Xomox	BDK	Chemtrol	Audco (Trial)*		
0923	Diaphragm Valve	Saunders	BDK					

Vendor Panel for Special Application of Valves

Sub-category (GG)	Description	Supplier Panel			
		Supplier 1	Supplier 2	Supplier 3	Supplier 4
0705	Gate Valve	Fluid Control Equipment	Warman	BHEL	VTM
0820	Butterfly Valve	Keystone / TYCO	Fisher	Tomoe	
0706	Safety Valve	Zimmerman			
0701	Non Return Valves	Adams			

Vendor Panel for Valve Refurbishment

Application Area	Supplier Panel		
	Supplier 1	Supplier 2	Supplier 3
Waterline /Gas / Air	Chemtech	Deltech	VAG
Steamline	IFCO		

* - Trial orders can be given for non-critical areas only.
1. L&T is to be evaluated as a new vendor for trial.

Commodity 17: Fasteners

BGG	Description	Major Sub-Category (GG)	Spend of 3 yrs. (FY 10-12) [INR Cr]	No. of Suppliers (80% spend)	CCT Name	CCT Leader	CCT Altn. Leader
243	Fastener	6	16.27	7	Mechanical Misc.	Sanjay Kedia, Iron Making (MM)	Kalyan Prasad, Steel Making (MM)

Sub-category (GG)	Description	Supplier Panel				
		Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5
0101	Hexagon Head High Tensile Bolt (Cold Forged<=M24)	Laxmi Precision Screw (LPS)	Deepak Fasteners Ltd (Brand-UNBRAKO)	Sunderam Fasteners	Caparo Fasteners	Precision Fasteners Ltd. (<M20)
	Hexagon Head High Tensile Bolt (Hot Forged >M24)	Laxmi Precision Screw (LPS)	Deepak Fasteners Ltd			
0090	Black Bolt/Black Bolt With Nut	India Bolts Nuts & Rivets	Mehta Enterprises (Trader)	S.S.S. Industries	NAV Bharat Supply Stores (trader)	Krishna Hardware Mart. (Trader)
0096	Nut For High Tensile Bolt	Laxmi Precision Screw (LPS)	Deepak Fasteners Ltd.	Sunderam Fasteners	Caparo Fasteners	
0100	Socket Head High Tensile Screw	Caparo Fasteners	Sunderam Fasteners	Deepak Fasteners Ltd	Precision Fasteners Ltd.	Laxmi Precision Screw (LPS)
1053	Hook Bolt With Nut	Shree Sandeep Industries &	A. Lakshmi Press & Forge Works			
0918	Stud	NAV Bharat Supply Stores (trader)	Mehta Enterprises (Trader)	Rajesh Enterprises		
0103	HT Washer	Laxmi Precision Screw (LPS)	Deepak Fasteners Ltd.			

Commodity 19: Pipe & Pipe Fittings

BGG	Description	Major Sub-Category (GG)	Spend of 3 yrs. (FY 10-12) [INR Cr]	No. of Suppliers (80% spend)	CCT Name	CCT Leader	CCT Altn. Leader
281	Pipe & Pipe Fittings	5	45.11	15	Mechanical Misc.	Sanjay Kedia, Iron Making (MM)	Kalyan Prasad, Steel Making (MM)

Sub-category (GG)	Description	Supplier Panel					
		Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5	Supplier 6
0164	Seamless Tube	Maharashtra Seamless	Indian Seamless Metal Tubes Limited	Chinese Source (with IBR Test Certificate for Steam or Boiler application)			Lal Baba Seamless (Trial)
				Jayesh Industrial Suppliers Pvt Ltd. (Trader)	SKRK Enterprises Pvt Ltd (Trader)	Ferrum International Co. Ltd.	
0186	M.S.Steel Pipe	Ami Enterprises Pvt. Ltd. (Lance Pipe)	The Bengal Hardware Mart (Trader)	SKRK Enterprises Pvt Ltd. (Trader)	Jayesh Industrial Suppliers Pvt. Ltd. (Trader)		
1118	Expansion Joint	Lonestar Industries	Sur Industries Pvt.Ltd.	Flexican Bellows & Hoses Pvt. Ltd.	KELD ELLETOFT INDIA (P) LTD.	MB Metallic Bellows Pvt Ltd	EagleburgmanKe. Pvt. Ltd.
0179	Pipe S.S.	Sandvik Asia Ltd.	Jayesh Industrial Suppliers Pvt Ltd (Trader)	Gandhi Tubes	SKRK Enterprises Pvt Ltd. (Trader)	Sainest Tubes Ltd.	
	ERW Pipes	Tubes Division					
	Flanged Pipes	Tubes Division					

Commodity 30: Water Systems

BGG	Description	Major Sub-Category (GG)	3 yrs. Spend (FY 10-12) [INR Cr]	No. of Suppliers (80% spend)	CCT Name	CCT Leader	CCT Altn. Leader
299	WATER SYSTEMS	3	24	14			

Sub-category (GG)	Description	Supplier Panel					
		Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5	Supplier 6
1057	NOZZLE	LECHLER (I) PVT. LTD.	NEOGIE ENGINEERING WORKS PVT. LTD.	SPRAYING SYSTEMS (INDIA) PVT.LTD.			
1575	FILTER/SPARES/ ACCESSORIES	HYDAC (INDIA) PVT. LTD.	AMIAD FILTRATION SYSTEMS INDIA LTD.	DINSHAW	DHRUV ENTERPRISES (importer)	CALCUTTA PETRO CHEMICALS	PUREX SYSTEMS AND TECHNOLOGY
1100	ROTARY COUPLING FOR COOLING ROTATING PART	DEUBLIN COMPANY					

Approved vendor list for Instrumentation

Category 'A' Vendors are for (i) Critical Control Applications and (ii) Capital Projects buy

Category 'B' Vendors are for non-critical applications

Note : If vendor category is not mentioned in the Purchase Requisition, RFQ shall be sent to both Category A & B Vendors.

S.No	Item	Category 'A' Vendors	Category 'B' Vendors
1	THERMOCOUPLE, RTD & OXYGEN PROBES		
1.1	THERMOCOUPLE ASSEMBLIES	Tempsens/ Pyro Electric Instruments Goa/ Emerson/ Yamari (Japan)	Rajput Instrumentation/ Industrial Instrumentation/ Eureka
1.2	MI THERMOCOUPLE	Tempsens/ Pyro Electric Instruments Goa/ Emerson.	Rajput Instrumentation/ Industrial Instrumentation/ Eureka/ GIC
1.3	THERMOCOUPLE ELEMENTS / WIRES	Arora Mathy (Pt wires only)	-
1.4	RTD	Tempsens/ Pyro Electric Instruments Goa/ Emerson.	Industrial Instrumentation/ Eureka/ Marc/ GIC
1.5	EXPENDABLE THERMOCOUPLE TIPS	Electro-Nite / Ardee Business/ Allied	-
1.6	MOLTEN STEEL TEMP. SYSTEMS	Electro-Nite / Ardee Business	Rungta Pyro Instruments
1.7	MOLTEN STEEL OXYGEN SYSTEMS	Electro-Nite / Ardee Business	Rungta Pyro Instruments
1.8	EXPENDABLE OXYGEN PROBES	Electro-Nite / Ardee Business	-
1.9	PYROMETERS	Land/ Raytek/ Ircon	Mikron/ Impac/ Keller
2	INSTRUMENTATION CABLES		
2.1	NON MINERAL INSULATED COMPENSATING CABLES FOR LANCE AND TRAILING CABLES	Cords Cable Industries/ Udey Pyrocables Mumbai/ Tempsens	Rajput Instrumentation/ Pyroelectric Instruments Goa
2.2	LANCE CABLES MINERAL INSULATED	Ardee / Tempsens/ Pyroelectric Instruments Goa	Rungta Pyro Instruments
2.3	INST. CONTROL / SIGNAL CABLES	Cords Cable/ Udey Pyrocables/ Special Cables	Thermocables
2.4	PROFIBUS AND FIELDBUS CABLES	Lapp/ Cords Cable	
3	GAUGES		
3.1	PRESSURE GAUGES	Wika/ Waaree/ Forbes Marshall/ Hydac / Rexroth	GE Gauges/ Oyster Entrepreneurs/ Pyroelectric Instruments Goa/ GIC / Sree
3.2	TEST PRESSURE GAUGES	Burdenberg/ Odin/ Wika/ Scandura	Waree
3.3	TEMPERATURE GAUGES	Wika/ Waaree/ Forbes Marshall/ Pyroelectric Instruments Goa	GE Gauges/ Oyster Entrepreneurs/ GIC
4	PRESSURE & TEMPERATURE SWITCHES		



S.No	Item	Category 'A' Vendors	Category 'B' Vendors
4.1	BLIND TYPE	Indfoss/ Switzer/ Wika/ Kromschroder/ Honeywell	Orion
4.2	INDICATING TYPE-Pressure Switches Analogue / Digital	Wika/ Waaree / IFM	GE Gauges/ Oyster Entrepreneurs
4.3	D.P. SWITCHES/ GAUGES	Indfoss/ Switzer/ Wika	Orion/ Waree
4.4	FLOW SWITCHES	Switzer/ Indfoss/ Levcon/ Endress &Hauser / IFM	Waree/ D K Enterprises
5	LEVEL GAUGES / SWITCH / TRANSMITTERS		
5.1	GENERAL SWITCHES	Switzer/ Levcon/ Nivo Controls/ Magnetrol	D K Enterprises/ V Automat/ Kobold
5.2	DP LEVEL TRANSMITTERS	Emerson Rosemount/ Yokogawa/ Honeywell/ ABB	
5.3	ULTRASONIC / RADAR / NON CONTACT TYPE	Endress + Hauser(European Origin)/ Siemens Millitronics/ Emerson (SAAB) Nivalco/ Burket (Germany)/ APM3D	Krohne
6	TRANSMITTERS FOR PRESSURE, FLOW AND TEMPERATURE APPLICATION		
6.1	PRESSURE TRANSMITTER (PT) & DIFFERENTIAL PT	Emerson Rosemount/ Yokogawa	Honeywell/ ABB
6.2	TEMPERATURE TRANSMITTERS	Emerson Rosemount/ Yokogawa	Honeywell/ ABB
6.3	PT & DPT (Foundation FieldBus &Profibus)	Endress & Hauser(European Origin)/ Yokogawa	-
6.4	TEMPERATURE TRANSMITTERS (Foundation Fieldbus & Profibus)	Endress & Hauser (European Origin)	-
6.5	WIRELESS TEMPERATURE TRANSMITTER	Yokogawa/ Emerson	-
7	VIBRATION SENSOR & MONITOR	Bentley Nevada/ Schenk Avery/ Sherman/ Chemtrol	Shinkawa(Forbes Marshall)
8	FLOW METERS AND FLOW ELEMENTS		
8.1	MAGNETIC FLOW METERS	Yokogawa/ Endress &Hauser/ ABB/ Emerson Rosemount	Krohne/ Burket (Germany)
8.2	VORTEX FLOW METERS	Yokogawa/ Endress &Hauser/ ABB/ Emerson Rosemount	Krohne
8.3	CORIOLLIS MASS FLOW METERS	Emerson Rosemount/ Krohne	-
8.4	ULTRASONIC FLOW METERS	Emerson Rosemount/ Yokogawa/ Endress & Hauser	Krohne
8.5	ROTAMETERS	Krohne/ Emerson(Brooks)	Eureka / Placka
8.6	ORIFICE PLATES/ NOZZLES/ VENTURIES	Engineering Specialities/ Mechanical Engineers/ Emerson/ GIC	Oyster Entrepreneurs/ Marc/ Unicontrols
8.7	ANNUBAR	Mechanical Engineers/ Engineering Specialities/ Emerson	Unicontrols/ Switzer
9	PANEL INSTRUMENTS		
9.1	SINGLE LOOP PID/ ON-OFF CONTROLLERS	Invensys (Foxboro)/ Honeywell/ Eurotherm/ ABB/ Moore(Forbes Marshall)/ Yokogawa	Masibus

S.No	Item	Category 'A' Vendors	Category 'B' Vendors
9.2	RECODERS CHARTLESS	Yokogawa / Eurotherm	-
9.3	BAR GRAPHIC INDICATORS	Yokogawa / Masibus/ Eurotherm	-
9.4	DIGITAL INDICATORS	Yokogawa/ Masibus/ Eurotherm	-
9.5	TOTALISERS	ABB / Yokogawa/ Masibus	-
9.6	SCANNERS	Masibus	-
9.7	POWER SUPPLY (24 VDC)	Phoenix/ Masibus/ Siemens	MTL Instrumentation Ltd.
9.8	SIGNAL ISOLATORS	MTL Instruments Ltd./ Yokogawa/ Masibus/ Pepperl&Fuchs	-
9.9	ANNUNCIATOR	IIC/ Digicont/ Minilec/ Procon	-
10	TEST INSTRUMENTS	Fluke/ Scandura/ Druck(Chennai)/ Yokogawa	Masibus/ Waaree /SKF- for vibration analyser only
11	SMART HART CONFIGURATOR (UNIVERSAL)	Rosemount/ Yokogawa/ ABB	-
12	FLAME DETECTOR	Honeywell / Durag/ Fire eye/ Krom Schroder	Industrial Research Associates/ COEN
13	ANALYSERS		
13.1	GAS ANALYSERS	ABB Analytical/ Siemens/ Emerson Rosemount/ Yokogawa/ Invensys-Foxboro(Humidity)/ Servomex	Forbes Marshall (In-situ O2 analyser)/ Endress + Hauser (Moisture)/ Honeywell (Teledyne)/ Testo(CO/ O2/ Humidity and Misc)
13.2	CV ANALYSERS	Union/ Reinecke/ Yokogawa	-
13.3	GAS ANALYSERS (SAFETY) - CO & O2 MONITORING	Dragger/ MSA/ BW Technologies/ Oldham	Endee/ Technovation
13.4	LIQUID ANALYSERS	Emerson Rosemount/ ABB Analytical/ Yokogawa/ Honeywell/ Hach (USA)/ Burket (Germany)	-
13.5	CALIBRATION GAS FOR GAS ANALYSERS	Inox Air Products/ Bhorukha Gases Limited/ BOC/ Praxair	-
14	CONTROL VALVES AND ACCESSORIES		
14.1	GENERAL SERVICE CONTROL VALVES WITH DIAPHRAM ACTUATORS	Neles-Jamesbury / Instrumentation Limited/ Fisher Xomox/ Arca Controls/ Flowserve/ Valtek/ Adam/ Metso (Neles&Jamesbury)/ Dresser Masonelien	Samson/ Fouress Engineering/ Deltech/ Koso/ Dembla Valves/ Copes Vulcan
14.2	OXYGEN SERVICE	Severn Glucon/ Arca (Germany)/ Metso(Neles Jamesbury)/ Valtek(Flowserve)	Bailey/ Masoneilan
14.3	CONTROL VALVE WITH QUARTER TURN ACTUATOR	Virgo/ Fisher Xomox/ Deletch/ L&T	Kenetrol/ Keystone
14.4	QUARTER TURN ACTUATOR	Elomatic/ Hytork	-

S.No	Item	Category 'A' Vendors	Category 'B' Vendors
14.5	PRESSURE RELIEF VALVE	Instrumentation Limited/ Forbes Marshall (SPIRAX)	-
14.6	SELF ACTUATED PRESSURE CONTROL VALVE	Arca(Forbes Marshall)/ Fisher Xomox/ Daniel Industries (USA)/ Dresser Product Industries (France)	-
14.7	POWER CYLINDERS	Instrumentation Ltd./ Schrader/ Norgren/ Rotex	OM Controls / KAT Instrumentation
14.8	ELECTRICAL ACTUATORS	Limitorque (I) Ltd./ Auma India Limited/ Beacon Rotork	Marsh
14.9	I/P CONVERTERS	Emerson Rosemount/ Yokogawa/ ABB/ Watson Smith/ Moore	MTL Instrumentation Ltd.
14.10	SOLENOID VALVES	Asco/ Schradder/ Norgren/ Rotex/ Burket (Germany)	Festo/ Avcon Controls
14.11	VALVE POSITIONERS	Youngtech Company/ Instrumentation Limited/ Forbes Marshall/ Sipart (Siemens) / Fisher / ABB / Samson	-
14.12	POSITION FEEDBACK UNIT OF VALVES	Instrumentation Limited/ Fisher Xomox	-
14.13	BUTTERFLY VALVES	Instrumentation Limited / Metso/ Fisher Xomox/ Virgo(Stafford)/ Intervolve/ Masoneilan	L&T/ BDK/ Deltech/ Dembla/ Keystone
14.14	BALL VALVES	Audco/ KSB/ Virgo/ BDK	-
14.15	GLOBE / PISTON VALVES	Audco/ Fisher Xomox/ Klinger	Forbes Marshall/ KSB
14.16	AIR FILTER REGULATOR	Norgren/ Placka/ ABB/ Schrader	-
14.17	ELECTRO HYDRAULIC ACTUATOR	REXA	
15	ERECTION HARDWARE	Swaglock/ Festo/ Waaree/ Flotek / Hydair	Tata Steel Approved Hardware Dealers/ Shivam Electrical Co/ CECO/ Quality Enterprises/ Sagar Engineering / Industrial Control Systems
16	SCADA/ DCS SYSTEMS	Honeywell/ ABB Systems/ Yokogawa/ Emerson/ Siemens	-
17	CONTROL PANELS	Pyrotech/ Power Control/ Techno Commerce/ Power Electronics/ Rittal	-
18	MOISTURE MEASUREMENT		
18.1	COKE MOISTURE GAUGE	Chemtrol (TN Technologies)/ Concord Intl (Berthold)	-
18.2	NEUTRON MOISTURE GAUGE	Concord/ Emerson/ ECIL/ Endress&Hauser(European Origin) / Shaw	-
18.3	NON NUCLEONIC MOISTURE SCANNER	Calidan	-
19	NUCLEONIC LEVEL GAUGE	Concord/ FIRL/ ECIL/ Chemtrol/ Endress&Hauser(European Origin)	-
20	ELECTRONIC WEIGHING SYSTEM	ABB/ SJN/ Sartorius/ Mechatronics/ Transweigh/ IPA/ SAL/ Philips-Global Weighing/ Avery-Amstel	-
21	MASS SPECTROMETER	ABB Analytical/ Chemtrol	-

Vendor list for Additional items:

S.No.	Item	Vendor List
1.	FLANGES	PRESHZINGER ENGINEERING
	(Chinese make is not acceptable)	THE PUNJAB STEEL WORKS,
		METAL FORGINGS P. LTD.
		TUBE PRODUCTS INCORPORATE
		PIPEFIT ENGINEERS PVT. LTD.
		C.D. INDUSTRIES,
		CHW FORGE PRIVATE LIMITED
		KISAAN STEELS (PVT) LTD.,
		C.D.ENGINEERING CO.
		KUNJ FORGINGS PVT. LTD.
2.	GASKETS	JYOTHI INDUSTRIES,
		STARFLEX SEALING INDIA
		JAMES WALKER INMARCO INDS PVT LTD.
		UNIQUE INDUSTRIAL PACKINGS PVT LTD,
		UNI KLINGER LTD.
		TEEKAY FLOWFLEX PVT. LTD.
		I G P ENGINEERS LIMITED.
		MADRAS INDUSTRIAL PRODUCTS
		GOODRICH GASKET PVT. LTD.
3.	BOLTING MATERIAL	LAXMI PRECISION SCREW
		DEEPAK FASTENERS LTD (BRAND-UNBRAKO)
		SUNDERAM FASTENERS
		CAPARO FASTENERS
		PRECISION FASTENERS LTD
		ATLAS FASTENERS
		MULTI FASTNERS PVT. LTD.
		BOLTMASER (INDIA)PVT.LTD.
		PRESIDENT ENGINEERING WORKS
		MEGA ENGINEERING PVT. LTD.
		PIONEER NUTS AND BOLTS PVT.LTD
		MORNING STAR INDUSTRIES,
		UDEHRA FASTENERS LIMITED
		SREE PAVITHRA INDUSTRIES,
4.	PIPES (CS)	JR SEAMLESS PRIVATE LIMITED
		PATELS AIRFLOW LIMITED
		EVERGREEN SEAMLESS PIPES & TUBES
		MAHARASHTRA SEAMLESS LTD.,
		JINDAL SAW LIMITED,
		HEAVY METAL & TUBES LIMITED,
		ISMT LIMITED.,
		MOKSHI INDUSTRIES PVT. LTD.
		AMARDEEP STEEL CENTRE
		POONAM ENTERPRISE
		NAGARDAS KANJI SHAH
		TUBES INDIA
		SCORODITE STAINLESS
		TUBOS REUNIDOS,S.A,

5.	Pipe fittings (SW)	S.S.PIPE FITTINGS & FORGINGS
		UNIQUE ENGINEERING ENTPS. P. LTD.
		PRESHZINGER ENGINEERING
		FLASH FORGE PVT LTD
		CARLO DYNATECH INDUSTRIES,
		U I PIPE FITTINGS PVT. LTD.
		PIPEFIT ENGINEERS PVT. LTD.
		TRUE FORGE PVT.LTD.,
		P.K. TUBES & FITTINGS PVT. LTD.
		K. S. PIPE FITTINGS PVT. LTD.
		SKY FORGE PRIVATE LIMITED
		PRECISION ENGINEERING INDS.,
		FITTECH INDUSTRIES PVT. LTD.
		LEADER VALVES LIMITED
		M.S. FITTINGS MANUFACTURING CO. PVT
		N L HAZRA AND SON
6.	Y- TYPE STRAINER	GUJARAT OTOFILT,
		TRIVENI EQUIPMENTS PVT LTD
		GRAND PRIX ENGINEERING PVT. LTD
		SCIENTIFIC DEVICES (BOMBAY) PVT. LT
		JAY-EESH ENGINEERING COMPANY
		FILTRATION ENGINEERS INDIA PVT LTD
		SKILT FABRICATORS PVT.LTD,
		SPIRAX MARSHALL LIMITED
		NISAN SCIENTIFIC PROCESS
		ASIAN INDUSTRIAL VALVES AND
		SUNGOV ENGINEERING PVT LTD,
7.	PRESSURE RELIEF VALVES	INSTRUMENTATION LIMITED
		FORBES MARSHALL (SPIRAX)
	Note: In addition to the above vendors, PRV/PSVs of dosing pump vendor make are also acceptable. However, PTR documents for the same are to be furnished for acceptance of the same.	
8.	L.T MOTORS	SEIMENS
		CROMPTON GREAVES LTD.
		KIRLOSKAR ELEC.CO.LTD
		MARATHAN
		BHEL
		ABB

It shall be mandatory for the successful bidder to follow this sub-vendor list. However, Items for which sub-vendors are not mentioned, all sub-vendors having valid statutory authority approval (which is recognized in India, like BIS/BS/API/ASME/etc.) are acceptable. Bidder may highlight the items which have not been covered in our sub-vendor list.

ANNEXURE - 24

DOCUMENT TRANSMITAL FOR CW TREATMENT SYSTEM - TATA STEEL 40 MW STG PROJECT			
S.No.	Drg./ Doc. Name	Scheduled date	Remarks
MECHANICAL			
M.01	P&ID for CW Treatment System	One week from PO	
M.02	Sizing Calculation (including all tank sizings) and System write up for CW Treatment System	One week from PO	
M.03	Equipment Layout for CW Treatment System	Two week from PO	
M.04	Piping Layout for CW Treatment System	3 weeks from PO	
M.05	GAD of Bulk acid Tank	Two week from PO	
M.06	GAD of Acid dosing Tank	Two week from PO	
M.07	GAD OF Chemical dosing Tank	Two week from PO	
M.08	GAD of Dosing Pump (Acid, Biocide, Corrosion Inhibitor& NaOCl)	Two week from PO	
M.09	GAD of Acid Unloading Pump	3 weeks from PO	
M.10	Data sheet of Dosing Pumps (Acid, Biocide, Corrosion Inhibitor, Scale Inhibitor, NaOCl & Acid Unloading)	Two week from PO	
M.11	Data sheet for Corrosion Rack	3 weeks from PO	
M.12	Datasheet for Bio Probe	3 weeks from PO	
M.13	Datasheet for Deposit monitor	3 weeks from PO	
CIVIL			
C.01	Civil input/foundation drawings for Drain pit	Two week from PO	
C.02	Civil input/foundation drawings for All tanks and pumps	Two week from PO	
ELECTRICAL/INSTRUMENTATION			
I.01	Electrical Load List	One week from PO	
I.02	Key SLD	One week from PO	
I.03	Datasheet of Pressure Gauge	Two week from PO	
I.04	Datasheet of Pressure Transmitter	Two week from PO	
I.05	Datasheet of Pressure Safety Valve	Two week from PO	
I.06	Datasheet for Level Switch	Two week from PO	
I.07	Datasheet of Level Indicator	Two week from PO	
I.08	GA and wiring diagram of Local MCC	Two week from PO	
I.09	Cable schedule	3 weeks from PO	
I.10	Cable tray / trench layout	3 weeks from PO	
I.11	Bill of Material of Local MCC, Cables & accessories	3 weeks from PO	
GENERAL			

G.01	Billing Break-up	Two week from PO	
G.02	Bill of Quantity and Subvendor List	3 weeks from PO	
G.03	O&M Manuals	1 month from PO	
G.04	As Built Drawings		
G.05	Recommended Spares List for 2Years	1 month from PO	
G.06	PG Test Procedure	1 month from PO	

HYDERABAD

CHECK LIST FOR CHEMICAL DOSING SKID OFFER

Note: Bidder to note that Check List shall be completely filled and the data required in-line with Check List shall be submitted along with their Offer to enable Purchaser to evaluate the offer submitted.

<u>S.No.</u>	<u>Description</u>	Enclosed or [Yes/No]	Remarks /Comments By Bidder
1	Bidder to confirm compliance with PEMC-06167 and its annexure (Including P&IDs for CW Treatment system) without any deviations.		
2	Bidder has already raised pre-bid queries (if any) on Purchase specification.		
3	Bidder to Confirm Compliance with scope, terminal points and exclusions of Purchase Specification.		
4	Bidder Shall submit completely filled following Annexures enclosed with Technical Purchase Specification PY 51084, along with their offer		
4.1	Annexure-I: Key Information		
4.2	Annexure-II: List of Recommended Spare Parts		
4.3	Annexure-III: Special Tools and Tackles		
4.4	Annexure-IV: Deviation from specification (All other requirements except for the deviation brought out under deviation list, have been taken into consideration.)		
5	Bidder to comply compliance with list of sub-vendor indicated in Job Specification for CW Treatment system, Doc. No. PEMC-06167.		
6	Tentative Electrical Load List is enclosed with offer.		
7	Bidder shall furnish the list of Erection and commissioning spares along with their offer.		
8	Bidder to Confirm Compliance with Typical QAP enclosed with purchase specification PEMC-06167		
9	Bidder has filled-up and submitted Unpriced Price bid format along with technical offer.		



QAP GUIDELINES & FORMAT

The QAP format and guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement.

Note :


1. Typical /Indicative /Standard QAP(s) for equipment /package attached is reference document and to use by successful bidder in future for preparation and submission of QAP for BHEL /CUSTOMER approval.
2. No deviation to reference document is acceptable.

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**GUIDELINES TO VENDORS FOR
PREPARATION OF QUALITY ASSURANCE PLAN**

1. QAP shall be made in landscape mode on A4 size paper as per the format enclosed. Font size shall be minimum 10.
2. Each page of QAP shall contain the following information.
 - a) Vendor's name & address.
 - b) Customer: BHEL, Hyderabad.
 - c) Project.
 - d) BHEL Product Standard Number/revision number as referred in P.O.
 - e) BHEL Purchase Order Number & Date.
 - f) Product as per P.O. description.
 - g) QAP Number (unique and shall not repeat)/revision number/date.
 - h) Page number and number of pages
3. QAP shall contain four parts / stages as follows.
 - a) Raw materials and bought out items.
 - b) In process Control / Inspection.
 - c) Final assembly, Inspection & Testing.
 - d) Painting, preservation & packing.
4. Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc).
5. Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.)
6. Under 'Class', indicate minor, major or critical depending on the importance of characteristic.
7. Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.)
8. Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.)
9. Under 'Reference document' and 'Acceptance norms', appropriate National & International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review & approval by our Engineering dept.
10. Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc.
11. Please refer 'Agency' in QAP format.
Under P: Perform, W: Witness, V: Verify
Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR
2: (Vendor / Sub vendor)

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE Rev No. 00 Page 3 of 3
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.	<p>Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, under Witness (W) column use 1. Under 'Verify' column, use code 1.</p> <p>12. Under 'D' please put (<input type="checkbox"/> Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification.</p> <p>13. Vendor's signature & stamp should be available on each page of QAP.</p> <p>14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification & Approved Drawings.</p> <p>15. The following operations/characteristics/check points may be included (AS APPROPRIATE)</p> <ol style="list-style-type: none"> a) Visual check b) Dimensional check c) Mechanical and Chemical properties. d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.) e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc. f) Check for correctness for all components mounted as per General arrangement Drawing, Bill Of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc. g) Verification of test certificate for protection class for the enclosures. h) Mechanical functioning of switches. i) Continuity of earthing and provision of earth points. j) Colour coding of wiring, size, tightness & dressing of wiring. k) Review of test certificates of assembled items, raw materials, internal test reports etc. l) Witness of functional checks, which may include mechanical run & electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc. m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc. n) Material identification (for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.) o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non Destructive Tests. p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating) q) All tests as per BHEL Product Standard & approved drawings including Type tests and Routine tests on individual items and on System as a whole. r) Packing and Preservation. <p>16. QAP Format enclosed.</p>		
Ref. Doc			

