TENDER DOCUMENT
NIT No.- DLI / C&E / WI-665 / 751 (R )

FOR

Tender for ‘Design, Engineering, Supply, installation, testing & commissioning of ‘PLC BASED AUTOMATION SYSTEM AND ASSOCIATED WORKS’ for the project of “Augmentation of Raw Material Receipt and Handling facilities with new OHP Part– B (Package- 061) of Bhilai Steel Plant (SAIL)”.

VOLUME- 2
TECHNICAL PART

ENGINEERING PROJECTS (INDIA) LIMITED
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TENDER DOCUMENT

NIT No. - DLI / C&E / WI-665 / 751 ( R )

FOR

Tender for ‘Design, Engineering, Supply, installation, testing & commissioning of PLC BASED AUTOMATION SYSTEM AND ASSOCIATED WORKS’ for the project of “Augmentation of Raw Material Receipt and Handling facilities with new OHP Part– B (Package-061) of Bhilai Steel Plant (SAIL)”.

VOLUME – 2A

GENERAL SPECIFICATION

ENGINEERING PROJECTS (INDIA) LIMITED
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INTRODUCTION:

Bhilai Steel Plant, in its approach note for corporate plan 2011-12, indicated that the production potential of BSP would be 7.0 MTPY of crude steel, subject to implementation of strategies to overcome the present constraints and providing certain additional facilities.

Present facilities in OHP to receive, unload & store raw material in OHP is insufficient mostly due to logistical problems in placement of rakes in yard, weighment, placement of rakes in tippler & collection of empty wagons, transportation of raw material to the yard etc. This is causing a lot of wagon detention and thereby heavy demurrages are paid to the Railway authority. Additionally logistics for stockpiling in the manner desired and reclamation also posed bottlenecks.

To overcome this problem, a scheme with one additional Wagon Tippler with all related facilities including conveyor system, interconnection of existing & proposed unloading stream, two additional beds for stockpile in the existing OHP with one Stacker, one Reclaimer, yard conveyors etc. have been envisaged as Part-A.

An immediate measure to ease the unloading of material and to avoid demurrage charges for detention of wagons, an additional Wagon Tippler in-between the existing Wagon Tippler and track-hopper of OHP with all related facilities is being separately considered in PART-A of the Augmentation of Ore Handling Plant. Thus Part-A pertains to solving the present problem posed in OHP so that raw material required at present (no increase in quantity envisaged) is handled with ease causing no delays.

“PART-A is not included in this TS. A separate package no.-060 has been prepared for PART-A (Augmentation of Existing OHP).”

PART-B of the Augmentation of OHP shall consist of all other facilities as per the scope of work and pertains to the management of the additional quantity of raw
material required to produce 7MTPY of Crude Steel. The major facilities envisaged
are a Wagon Tippler, two Track Hopper and a new OHP (OHP-II) with six numbers of
beds of stockpile, three Stackers and four Reclaimers and related conveyors to feed
new Blast Furnace BF#8 and SP-III (both modules).
The existing conveyors R101/ 102 series shall now feed the new RMP plant for new
SMS-III; however original route from existing OHP-I to Sinter Plant-III will still exist for
emergency..
GENERAL SCOPE OF WORK AND BATTERY LIMITS

(A) The broad scope of work shall be as per the following:

1. Design, engineering, manufacture, inspection, shop & primary coat of painting, supply of PLC based automation system as required for complete & trouble free operation of Raw Material Handling System in an integrated manner.

2. Submission of Basic engineering, detail engineering and reference category of drawings, operating software and documents, in requisite copies, for approval of BSP / MECON/EPI. Further, the successful bidder shall furnish final basic & detail engineering drawings as built drawings, erection drawings/ documents, operating software, operation and maintenance manuals in soft editable format etc.

3. Receipt of material, loading / unloading, storage, watch & ward, complete erection, testing, commissioning, and handing over of integrated system to BSP, demonstration of performance guarantee.

4. Deputation of representatives to site for erection, testing and commissioning.

5. Applying final finish coat of paint as per approved procedure & shades before handing over.

6. Supply of all commissioning spares and insurance spares. A list of such commissioning spares & insurance spares shall be indicated separately. Bidder shall furnish separately priced list for two years O&M spares.

7. Progress reporting as per agreed formats, providing documentary evidence of purchase orders on sub vendors with addresses of contact persons, attending progress review / engineering review meetings at BSP, Bilai or at MECON, Ranchi.

8. Arrangement of all erection equipment as required

9. Specialized training of BSP/MECON/EPI personnel for operation, maintenance, for smooth handing over the PLC based automation system. Training of plant operation and maintenance personnel shall be considered as required.

10. Testing and cold trial run of systems/ sub - systems and integrated testing shall be carried out by the successful bidder on continuous basis for complete Raw Material Handling System along with associated facilities. On successful
commissioning of the various sub-systems of the RMHS, PG test of the entire plant shall be carried out as per the procedure

11 Receiving delivery of items at site, their proper storage, and handling at site, watch and ward services etc.

12 Getting BSP/ MECON approval for the drawings prepared by the successful bidder/their sub-vender obtaining required approval from statutory authorities, providing adequate personnel, equipment, tools & tackles for timely completion of the project.

13 For detailed scope of work and design parameters on various sub-systems & facilities, technical specs and scope of work for PLC based automation system and associated works as given in the volume-2B of tender document shall be referred to.

(B) The major equipment to be installed for OHP Part B Project shall be as follows:-

• A new OHP II Yard with 3 nos. twin boom stackers (TBS 1to3) and 4 nos. bucket wheel reclaimers (BWR 1to4).
• An additional wagon-Tippler (WT B1).
• Two new track hoppers of 210m length each (TH B1)(Excluding maintenance bay, with four compartments each side).
• 4 nos. paddle feeders in the new track hoppers with all automation to discharge @1500t Ore fines/Lime stone etc. to down conveyors.
• An additional series of conveyor from OHP I to JH-20 and JH-42.
• New conveyor line for proposed Lime Dolomite plant RMP III and proposed SMS-III.
• Up gradation of capacity of existing shuttle conveyors J9BRSC1.
• Sixteen no Belt Weigh Scales on conv. Z7-C3, Z4B-C1, Z4A-C1, Z5A-C1, Z5B-C1, Z6A-C1, Z6B-C1, Z1C1, Z1C2, Z2C1, Z2C2, J9C1, L4C1, L10C1, J20C3 & J17BC1 shall be in contractor’s scope.
• Four nos. In Line magnetic separators over conv. Z2C1, Z2C2, Z1C1 & Z1C2 each shall be in bidder’s scope.
• One no. diverter gate below conveyor L4C1.
• Electric hoists, winch, mobile belt changing machine, etc. at various locations as specified.
• Provision of Weighbridges for weighment of incoming Raw materials
• 2 nos. belt feeders of rated/designed cap. 1500/1800 tph with BW 2000mm (minimum) & maximum belt speed 0.8 m/sec.

BATTERY LIMITS

An overall battery limit of the Raw Material Handling System has been described in the “Brief System Description” as enclosed with this tender document and the Flow Diagram – Drawing No. MEC/S/9101/11/17/00/00/061.B01/R3 (2 sheets) for OHP- II.

1. Battery limits for New Ore Handling Plant (OHP-II) comprises of the following:
   • New Ore Handling Plant (OHP-II) –From new Wagon Tippler WT # B1 and new track hoppers to the Ore storage bed for Stacking, reclaiming & transportation to various units, including
     ¾ Lump Ore, limestone, dolomite etc. from OHP-II to New Blast Furnace #8. (Through Junction house Z 15)
     ¾ Iron Ore fines, limestone & dolomite to both modules of Sintering Plant-III. (Through Junction house Z 11) from OHP II

2. Proposed modifications/ up-gradations are:-
   • An additional series of conveyor from OHP-I to new junction house J-20 and JH-42(Exst’g).

3. Feeding Limestone & dolomite to New Lime Dolo Plant RMP III and New Steel Melting Shop SMS III :
   This includes providing a discharge facility below belt conveyors R103A & R104A at Junction House JN#102 (With suitable modifications of Jn House #102) so as to feed new conveyor L1C1 as well as existing belt conveyors R105 & R106. Limestone/dolomite/iron ore received from existing OHP-I will be supplied to the junction house JH L6 of proposed new RMP III as well as junction house JH L10 through surge bin building JH L9 before proposed new SMS-III. The conveyor feeding raw material to RMP III from junction house JH L6 and feeding raw material to SMS III from JH L10 is not in the scope of this package. However junction houses JH L6 and JH L10 are in scope of this package.

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03.00 BRIEF SYSTEM DESCRIPTION

The turnkey package of this Contract Document comprises of the following sub-systems:

- **New Ore Handling Plant (OHP-II)** including receiving, unloading, Stacking & Reclaiming and finally transporting of Raw Material required for Blast Furnace #8, Sinter Plant-III.

- New conveyor line for New Lime Dolomite plant RMP3 and for proposed SMS-III.

- **Modifications/ up-gradations of existing equipment, including:**
  - An additional series of conveyor from OHP I to JH-20 and JH-42(Ext'g) parallel to existing route
  - Up gradation of capacity of existing shuttle conveyors J9BRSC1.

03.01 New Ore Handling Plant (OHP-II)

The raw material to be handled by the proposed system is mainly, Iron Ore Lump, Iron Ore Fines, Lime Stone (BF grade), Lime Stone (SMS grade), Dolomite (BF grade), Dolomite (SMS grade), Quartzite, Manganese ore. These raw materials are mainly required for Blast Furnace, Sinter Plant, Lime-Dolomite Plant, SMS. All the raw materials will be received at the plant boundary by rail. The type of Wagon will be BOXN, BOXNHA, BOY, BOBRN, BOST, BOBS, BOXNEL, BOYL,BOXN HS etc which will transport the raw materials depending upon the location of loading and type of raw materials.

03.01.01 Design Considerations

The Ore Handling Plant (OHP-II) has been planned based on the following assumption:

A. **Size of Raw Material**
1. Lump Iron Ore : -40 mm
2. Iron ore fines : -8 mm
3. Lime Stone (BF/SP grade) : -60 mm
4. Dolomite (BF/SP grade) : -60 mm
5. Quartzite : -50 mm
6. Lime Stone (SMS grade) : -25 mm
7. Dolomite (SMS grade) : -25 mm
8. Pellets : -18 mm
9. Manganese Ore : -25 mm
10. Coke Breeze : -25 mm

B. No of Days of Working per year: 330 days

C. Maximum material carrying capacity of each wagon shall be as per IS: 10095-1982 reaffirmed 2001. Iron-ore-lump will be received in Track-Hopper & all other material in Wagon Tipplers. Two Track Hoppers have been considered for materials received in BOBS/BOBRN wagons (mainly iron-ore), whereas wagon tippler with side arm charger has been considered for unloading the materials received in BOXN/BOST/BOXNHA/BOY/BOBS, BOXNEL, BOYL wagons.
One number Wagon tippler WT no.B1 along with a Track Hopper TH-B1 with two parallel tracks on it have been envisaged for unloading Iron ore (lump and fines), Limestone & Dolomite (both BF grade and Sinter Plant grade), Mn-ore, Quartzite etc.

The Wagon Tippler shall be of Rota-side type capable of unloading BOXN and proposed BOXNHA ,BOXNHS, BOBS, BOY wagons as per IS:10095-1982, reaffirmed 2001. The rated unloading capacity shall be rated 20 Tips/hour. Adequate system of handling sticky rakes such as vibrator/ air blaster shall be provided.

25t wagon axle load and 110t gross weight of wagons (BOX, BOXN, BOXN HA, BOXN HS, BOXN EL, BOYEL) to be considered for design of Wagon Tippler and track hopper. 2 nos. Weighbridges included in contractor's scope. The location of Weigh Bridge shall presently be considered at entry of pre hopper yard. However as the total railway track is being engineered by RITES, the location of Weigh Bridge may undergo change in detailed engineering stage. The drawings of wagon tippler/track hopper shall be subjected to approval by RITES /SECR/RDSO as applicable.

The placement of rakes shall be done by Side arm chargers capable of handling a full rake BOXN, BOXNHA, BOBS, BOY, BOXN EL, BOYEL wagons.

Two nos. of track hopper each of length 210 m excluding maintenance bay and holding capacity of 6000 t each considering material of bulk density of 1.6 t/ cu.m. shall be included in contractor's scope. The side angle of hopper with vertical shall be minimum 60 deg. Each hopper shall have four compartments. Track hopper envisaged to accommodate minimum 18 BOBS wagons. Contractor to maintain sufficient height of the track hopper superstructure to take care of OHE.
Total 4 nos. Electric hoist of 5 t capacity shall be provided for maintenance of Paddle Feeder at both ends of Track Hopper building. Two nos. double door pressurized cabin shall be provided for paddle feeder inside the track hopper tunnel. Anti-derailment device/check rail shall be provided in the track hopper subject to approval of RITES. Supply/Laying of 60 kg/m rail with continuous MS insert plate within track hopper building only are in scope of contractor.

In addition to the above, one dedicated compressor station at track hopper TH-B1 for unloading of BOBRN wagons is to be provided. Compressed air connection to BOBRN wagons to be provided at 15 mts interval. The details of requirement of compressed air, the pressure and type shall be obtained from RDSO. Other points as applicable for compressed air station shall be considered as per CS for compressed air facilities indicated elsewhere.

Provision of adequate illumination should be there on both pre & post tippler as well as on Merry Go Round circuit.

Two belt feeders below Wagon Tippler shall discharge the raw material on either of two conveyors i.e. Z1-C1 or Z1-C2 which, in turn will discharge the material at Jn House JH-Z1. From Jn House JH-Z1, conveyors Z3-C1 & Z3-C2 will carry the material and discharge at JH-Z3. There will be three incoming conveyors in Junction House JH-Z3. The tail end of two conveyors Z3-C1 & Z3-C2 will start from JH-Z1 and Belt conveyor Z3-C3 from JH-Z2. Junction house JH-Z2 shall be located in between the JH-Z1 & JH-Z3.

The track hopper with four nos. paddle feeders of 1500 tph each, two on conveyors Z2-C1 and two on conv Z2-C2 has been envisaged. From Jn. House JH- Z2, either of three conveyors Z3-C1, Z3-C2 (coming from JH-Z1) & Z3-C3 (begin from JH-Z2) shall carry the material upto Jn house JH-Z3. Reversible shuttle conveyors Z2RSC1/2 at JH-Z2 will facilitate to discharge the material on either of any three conveyors. Therefore, JH-Z2
shall be designed suitably so as to receive material from any of the conveyors coming from Track Hoppers. Non sticky liners/polymer liners are to be fixed in the track hoppers to improve flowability.

Suitable interchangeability shall be provided below Wagon Tipplers and Track Hoppers for the conveyors by providing Diverter gates.

In Jn House Z3, three nos. Reversible Shuttle conveyors no. Z3-RSC1,2&3 can feed any one of conveyor no. Z4C1, Z4C2 and Z4C3. Conveyor no. Z4C1, Z4C2 and Z4C3 shall be provided with fixed tripper at JH Z4A. In the fixed tripper at JH-Z4A, 3 nos. flap gate shall be provided to feed material either to itself or to conv Z7C1 & Z7C2 (as by pass arrangement). Conveyor no. Z4C1, Z4C2 and Z4C3 shall feed on to conveyor Z5C1, Z5C2 and Z5C3 in JH-Z4. Each of the three Conveyor Z5C1, Z5C2 and Z5C3 shall be from JH-Z4 to JH-Z6B. Conveyor Z5C1, Z5C2 and Z5C3 shall be provided with jumbo gallery (suitable for mobile trippers) from JH-Z4 to JH-Z4B and from JH-Z4B to JH-Z5B. Conv Z5C1, Z5C2 and Z5C3 are capable of feeding the stacking conv. Z4B-C1 and Z5B-C1 as well as itself through mobile trippers from JH-Z4B and JH-Z5B respectively. In JH-Z6B Conveyor Z5C1, Z5C2 and Z5-C3 shall feed stacking conveyor Z6B-C1. In JH-Z6B conveyor Z5-C1 & Z5-C2 shall have provision to feed future conveyors. Maintenance hoist of minimum 5t cap shall be provided for the trippers.

The raw material can either be transported via. JH House Z4B, Z5B or Z6B to the respective stacking conveyors Z4B-C1, Z5B-C1 & Z6B-C1 for stockpiling or can be fed directly to the reclaiming conveyors Z7-C1/ Z7-C2 (from JH-Z4A to JH-Z7) which means convey material directly from the WT/Track Hopper to:
(a) To the Blast Furnace#8 Stock House
(b) To the Fuel & Flux crushing circuit of Sinter Plant-III.

Suitable interchangeability shall be provided at Junction house Z4B, Z5B or Z6B for the conveyors by providing 2-way chutes in mobile tripper. 5T
Electric hoist each shall be provided at JH-Z5B & JH-Z6B. Whereas, JH-Z4B shall be designed only as a transfer point.

The Stacking conveyors Z4B-C1, Z5B-C1 & Z6B-C1 can form a stockpile 30m wide, 350m long and 10.5 m (maximum) high with the help of Twin boom stackers.

Suitable number of electrically operated Under-Slung Cranes, Hoists etc. shall be provided in all floors of Junction Houses and building for maintenance of equipment. Electro-Magnetic Separators, In-Line Magnetic Separators, Metal Detectors, Belt-Weigh-Scales, Air-Blasters/ Bin Vibrators shall be provided to make the system complete and the operation/maintenance smooth.

03.01.03 STORAGE AND RECLAMATION OF ORE

From the Wagon Tipplers WT-B1 and the Track Hopper TH-B1, the raw material may sometimes be fed directly to the consuming plant in case of emergency. However, this shall not happen under normal circumstances, when the three Twin-boom stackers over conveyors Z4B-C1, Z5B-C1 & Z6B-C1 store the raw material in the designated place of the yard in bed nos. 1 to 6. Flexibility shall be inbuilt in the Jn Houses Z4B, Z5B, & Z6B to ensure stacking is trouble free.

Bed blending system shall be possible with the stacker running to and fro on the length of the pile -or- on a length between two defined position in case more than one material is stored in a bed marked by travel limit switches, which through a relay sequencing circuit, with time control-reverses the traveling gear after the travel in each direction covering the desired length of the pile. After a layer of some pre-determined amount is deposited in one traveling direction of the stacker, probes fitted on the
stacker boom gives it a “raise” signal as soon as a net height of material is formed. The next layer is then formed.

Iron ore may require stockpile formation as described above for blending and uniformity. However, the emphasis on blending shall be for iron ore fines which shall be blended while stacking.

Four nos Bucket-wheel reclaimers have been envisaged for bed no. 1 to 6.

All stacking line conveyors feeders and stackers etc. shall have a rated capacity of 1500 tph & a designed capacity of 1800 tph.

All reclaim line equipment shall have a rated capacity of 1500 tph and a designed capacity of 1800 tph in the ore handling area.

Reclamation takes place by the conveyors Z4A-C1 (Bed no. 1), Z5A-C1 (Bed 2 or 3), Z6A-C1 (Bed no. 4 or 5) and Z7A-C1 (Bed no. 6) and the reclaimed material via Jn House Z4A, Z5A, Z6A and Z7A shall reach Jn House Z7. Two reclaim conveyors Z7-C1 and Z7-C2 between Z4A to Z7 will receive all the materials from yard for further transportation.

Reclamation from OHP takes place for the following circumstances:-
- Feeding of iron ore lump, dolomite, limestone, manganese, quartzite, pellet etc. to BF#8 stock house.
- Transporting Limestone/ Dolomite (SP grade) and iron-ore fines to fuel & flux crushing area for Sinter Plant-III.

Two streams of belt conveyors shall reclaim the material from new OHP-B yard to above places. Belt conveyor Z7-C1 & C2 shall carry the material and transport thru Z8-C1, C2, Z9-C1, C2, Z10-C1, C2 to Z11-C1 & C2 to Junction house JH-Z11. Junction House-Z11 can discharge the material either to existing conveyors R103/ R104 of Sinter Plant-III or proposed conveyor Z12-C1/ C2 of BF#8, with the help of reversible conveyors. To
receive the material from Z11-C1 & C2, suitable modification in existing
gallery of R103 & R104 is required. Also a junction house JH-Z11 with two
reversible conveyors & tail end of belt conveyors Z12-C1 & C2 shall be
erected above these conveyors. Further, conveyor Z12-C1 & C2 will feed
the material to conveyor Z13-C1&C2 at Junction House JH-Z13 and then
conveyor Z15-C1 &C2 shall discharge material onto conveyors (by BSP)
through diverter gates JH-Z15 and material shall move towards stock
house of BF#8.

Suitable Junction houses with RCC floors, diverter gates & galleries shall
be provided to transfer the material from one conveyor to another. The
scope of contractor shall finish at JH-Z15 with complete drive and
discharge facilities. The receiving belt conveyor below Z15-C1 & C2 shall
be in the scope of Employer i.e. BSP. However, JH-Z15 shall have a
provision (inserts/ foundation bolts) to erect outgoing conveyors to Stock
House.

03.02 OTHER ADDITIONS/ MODIFICATIONS AND UPGRADATION IN EXISTING
OHP (REF. DRG. NO. MEC/S/9101/11/00/00/061.B01/ R2)

1. **An Additional series of conveyor from OHP to J-20 and JH-42(Exst'g)**

Another proposed conveyor No J9-C1 parallel to J9-C3/J9-C4, besides
conveyors R-102, shall start from Jn. House JH-9B and shall discharge the
material to a proposed conveyor J9H-C1 in new Junction House JH-9H,
which in turn feeds to conveyor J10A-C1 in JH-9H. From JH-9H conveyor
J10A-C1 can feed proposed conveyor J11-C3, J11-RC2, J14-C2/J12-C2
(Exst'g), J15-C2. Conv J15-C2 shall feed new reversible conv. J15-RC1 in
new junction house JH-15B, which in turn can feed either existing SMS-II
which shall receive sinter from existing conv. SS-10 shall feed new
conveyor J17A-C1 in new junction house JH-15B which in turn shall
discharge onto new conv. J17B-C1 in new junction house JH-17A.
Conveyor J17B-C1 shall discharge to either of the two conveyors J20C3 or
extended J44-C5(exist) through a adjustable diverter gate in new junction	house JH-17B. Conveyor J20-C3 shall be provided with one no. belt weigh
scale and have provision of discharging onto existing sinter carrying
conveyor J27-C5 (Ext‘g) in junction house JH-20 (Ext‘g).

Necessary modification/strengthening shall be carried out in junction house
J42 to take care of additional loads by new conveyor. Suitable electrical
interlock shall be provided between the conveyors J27-C5 & J20-C3 in
junction house JH-20 to trip all the incoming conveyors in case feed rate
exceeds capacity (500tph) of the corresponding downstream conveyor J27-
C5. Similar interlock shall also be provided between J17B-C1 & extended
J44-C5(exist) in junction house JH-J17B to avoid any spillage/chute
blockage. These additional conveyors with gate will facilitate a new
additional route for BF # 7.

All above conveyor shall run adjacent to the existing conveyor/ galleries at
and JH- 17B shall be new Junction houses. For conveyor no. J11-C3,
J11-RC2, J14-C2, J15-C2, J15-RC1, J15B-C1, J17A-C1, J20-C3 & J44-C5,
the existing junction houses (JH-10, JH-11, JH-14, JH-15, JH- 17, JH-20
and JH-42) shall be suitably modified to suit proposed conveyor transfer
points/crossing over.

2. **Up gradation of Reclaiming conveyors**

The capacity up-gradation and utilization of reclaim conveyors are of
utmost importance to ensure smooth operation in the OHP.

The list of conveyors in the reclaiming circuit that shall be upgraded to 1500
tph are given in table 03.01.

<table>
<thead>
<tr>
<th>SL No</th>
<th>CONVEYOR NO</th>
<th>EXISTING</th>
<th>PROPOSED</th>
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<tr>
<td></td>
<td></td>
<td>BELT WIDTH mm</td>
<td>CAP</td>
</tr>
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*Table 03.01*
The capacity of all Belt conveyors shall be 1500tph for all raw materials viz. iron ore, limestone, dolomite with 1400mm belt width and belt speed shall be 2.0 m/s with a troughing angle of 35°. (Bulk density of raw material shall be considered as 2.2 t/m³ for power calculation/load data of structures and 1.6 t/m³ for volumetric capacity calculation of conveyor)

03.03 NEW LIME DOLO PLANT (RMP III) AND SMS III CIRCUIT

Existing conveyor R-101/R-102 shall be utilized to convey raw material required for Lime/Dolo Calcination plant RMP III and of SMS-III by tapping the conveyor from Jn house JH-N102 (With suitable modification in the Jn House) and taking a new route to the proposed Lime/Dolo calcination plant/SMSIII. Any civil work related to installation of new conveyors in existing junction house JN#102 shall be contractor's scope.

The SMS grade limestone, dolomite and iron ore in existing OHP-I shall be reclaimed via. Jn House N101, N102. Existing Belt Conveyors R101/102 coming from OHP-I shall now mostly carry Lime stone and dolomite. In JH-N102, two existing reversible conveyor R103A & R104A are having a provision for taking material to Sinter plant III as well as proposed Lime Plant. A discharge chute below R103A & R104A to feed at the tail end of proposed belt conveyor L1C1 shall be provided at Junction house J-N102. Belt conveyor L1C1 shall discharge the material on L2C1 in junction house JH-L2. Conv L2C1 discharges onto conveyor L3C1 which discharges onto L4C1 in JH L3.Conv L3C1 in turn discharge material at Junction House JH-L4 to any of the two conveyors i.e. L5C1 & L7C1 with the help of diverter Gate.

Thereafter, conveyor L7C1 will carry the material and transfer onto conveyor L9C1. Conveyor L9C1 will carry the material up to Surge Bin
building JHL9 through reversible shuttle conv. JL9RSC1. Surge bin building JHL9 shall have 3 nos. bunkers of minimum geometric capacity 190 cub m each for storing iron ore lump/limestone /bauxite. Suitable rod gate and motorized rack and pinion gates shall be fitted at the bottom of bunkers. Three (3) nos. VVF controlled vibro feeders of 420 tph capacity each shall withdraw material from bunker and discharge it onto conveyor L10C1 which shall convey up to Junction house JH L10 for onward transportation to Surge Bin Building for SMS-III (Surge bins with Vibro-feeder as shown in flow diagram at JH-L9 are in contractor’s scope.) through SMS feeding conveyor. Conveyor L10C1 complete with discharge facilities and junction house JH L10 shall be in the scope of contractor and SMS feeding conveyor shall be in the scope of employer.

The other conveyor L5C1 shall receive material from conveyor L4C1 and discharge at JH-L5 on to conv. L6C1 which shall convey up to junction house JH-L6 and discharge onto lime plant feeding conveyor for onward transport to Lime & Dolomite calcination plant RMP III. Conveyor L6C1 complete with discharge facilities and junction house JH L6 shall be in the scope of contractor. However lime plant feeding conveyor shall be in the scope of employer i.e. BSP.

Calcined lime/dolomite is received from the day bins of lime/dolo product storage building of RMP III onto conveyor L8C1. Conv. L8C1 discharges onto conv. L9C2 in JH L8 which in turn discharges onto conveyor L10C1 in Surge Bin building JH L9. This finished product of RMP III is transported to the junction house JH L10 by conveyors L10C1 which shall also carry limestone, bauxite, iron ore received directly from OHP I yard to SMS III. The scope of contractor starts from tail end on conveyor L8C1 including skirt boards.

A fixed hopper of 8 cub m capacity on conveyor L10C1 near JH L9 with VVF controlled vibro feeder of 420 tph capacity shall also be used to transport coke fines as and when required in the storage bins of the bulk material charging system of SMS III. Any other material e.g limestone/ DRI
can also be transported under emergency conditions through fixed hopper. Suitable ramp shall be provided to unload the material over hopper.

03.04 Two separate **Automatic Sampling system** complete with sample cutter, collection, sizing, crushing and grinding shall be provided for the RMHS system.

03.05 **AREA REPAIR SHOP & SUB-STORE:** Refer Chapter 04.06 & 04.07 for details.

03.06 **Welfare/ Office Building:** Refer Chapter 04.04 for details.

03.07 **Workers rest room:** Refer Chapter 04.04 for details.
GENERAL SPECIFICATION

GENERAL

The following General Specification shall be read in conjunction with General Technical Specification (GTS) of Bhilai Steel Plant, SAIL. If there are any provisions in these General Specification, which are at variance with the provisions of General Technical Specification (GTS) of Bhilai Steel Plant, SAIL, the provisions in these General Specification shall take precedence.

1.0 PROJECT SYNOPSIS

1.1 Site Conditions

1.1.1 Location

Bhilai Steel Plant (BSP), SAIL is located at Bhilai in Durg District of the state of Chhatisgarh in the central region of India. The site lies between 21.15° North latitude and 81.22° East latitude. The nearest convenient railhead is Durg which is about 12km west Bhilai. Bhilai/Durg stations are on the Howrah-Mumbai rail line of SEC Railway of the Indian railways.

The location of Bhilai is as follows:

From New Delhi, the national capital -- 1359 kms
From Kolkata -- 868 kms
From Chennai -- 1269 kms
From Mumbai -- 1100 kms

The distance from State Capital Raipur to Bhilai Steel Plant is 30km. It is well connected by the rail and road network. The nearest national highways are NH 6 & NH 43 crossing through Raipur.

1.1.2 Meteorological Data

In the absence of meteorological data at Bhilai/Durg, the data of the state capital Raipur, 30kms away, are considered. The meteorological details at Raipur are given below:

Ambient Temperature
Absolute maximum : 47.7° C
Absolute minimum : 3.9° C
Highest of mean monthly : 45.2° C

Ambient Air
Ambient air quality : Industrial

Relative Humidity
Maximum : 100%
Average altitude of the land is 300 m above MSL. Temperature inside shop premises is generally taken as 5°C above ambient, unless otherwise specified.

1.1.3 **Infrastructure Facilities Outside the Plant**

**Railway**

Bhilai Steel Plant is connected to Indian Railways network via Bhilai/Durg Stations of SEC Railway on the Howrah-Mumbai line. The track gauge of SEC Railways as well as of the plant tracks are standard broad gauge i.e 1676 mm.

**Road**

The plant is well connected to the country by road. National Highways NH6 & NH43 both pass through Raipur.

**Sea Port**

The nearest sea port is Vishakhapattnam approximately 550 km away from the site by rail.

**Air Traffic**

The nearest air port connected to the national network is Mana at Raipur, 30kms away.

1.1.4 **Infrastructure Facilities Inside the Plant**

**Railway**
The track gauge for the entire plant corresponds to the Indian Railway standard broad gauge i.e 1676mm.

Road

Main road and side of the Plant shall have roadways of 7.0m and 4.0m width respectively and the temporary roads provided during the construction stage shall be designed to cater the needs of movement of heavy construction vehicles.

2.0 GENERAL TECHNICAL REQUIREMENTS (GTR)

2.1 General Rules and Regulations

All plant units with respect to their location, layout, general arrangement and design of equipment, structural design, etc. shall be safe to the personnel and conform to the relevant statutory requirements issued by Chhatisgarh Government and the Government of India but not limited to the following.

- Chhatisgarh State Factory Rules/Acts
- Indian Electricity Rules/Acts
- Electricity Regulatory Commission Act
- Indian Petroleum Regulations/Acts
- Indian Boiler Regulations/Acts
- Indian Explosives Acts
- Gas Cylinders Rules/Acts
- Carbide of Calcium Rules/Acts
- State and mobile Pressure Vessels Codes (unifired) Rules/Acts
- Fire Protection Manual issued by Tariff Advisory Committee (India)
- Pollution Control Regulations/Acts

Pollution control measures shall be provided considering the latest norms and international standards. These should satisfy the stipulations of Central Pollution Control Board and Department of Environment and the Forest, Government of India.

2.1.1 Standard

Preferred Makes of Equipment & Supplies
To restrict/minimize stock/inventory of spares, the Purchaser considering will limit the makes of equipment & supplies to those listed in the “preferred makes of equipment and supplies” and list of approved vendors enclosed unless other-wise expressly so agreed

Unit of Measurement
All dimensions & weights shall be given in metric system.

Language

All drawings, documents etc. shall be in English language.
2.2 Safety

2.2.1 Safety Regulations
The Vendor shall comply with the, relevant Safety Rules and Regulations but not limited to the following:
- Chhatisgarh State Factory Rules/Acts
- Indian Electricity Rules/Acts
- Electricity Regulatory Commission Act
- Indian Petroleum Regulations/Acts
- Indian Boiler Regulations/Acts
- Indian Explosives Acts
- Gas Cylinders Rules/Acts
- Carbide of Calcium Rules/Acts
- State and mobile Pressure Vessels Codes (Unifired) Rules/Acts
- Fire Protection Manual issued by Tariff Advisory Committee (India)
- Pollution Control Regulations/Acts

Strict attention shall be paid to all statutory regulations and safety rules for prevention of accidents.

The safety posters/regulations for prevention of accidents shall be displayed by the Vendor at appropriate places. Notices and warning signs shall be displayed for all sources of dangers.

The Vendor is not permitted to construct any temporary road crossing on the rail tracks for the sake of their convenience at work site.

When the work is carried out at night or in the obscure day light, adequate arrangements for flood lighting in the working area shall be made by the Vendor at his own cost and got approved by the Purchaser.

All handling/transport and the rigging equipment including lifting tools and tackles shall be checked at regular intervals and kept in good and safe working condition.

A register is to be maintained regarding the results of periodical tests/checks and other particulars in respect of each and every such equipment.

The Vendor must take sufficient care in moving his construction plant and equipment from one place to another, so that those do not cause any damage to the property of the Purchaser or obstruct construction activities of other Vendors.

The Vendor shall depute a full time safety engineer who will exclusively look after all the jobs pertaining to safety at site and keep close liaison with Purchaser/Consultant. He will be responsible for maintaining safe working conditions at site, promoting safety consciousness among the workmen and reporting to concerned authorities in case of accident/dangerous occurrences.

Before execution of work in hazardous area like...
- Gas contamination
- Working at height
- Storage of inflammable materials
- Danger of electric shocks
- Explosion risks
- Excavation more than 2m deep, etc.

A protocol should be prepared in association with the agencies of the Purchaser / Consultants.

### 2.2.2 Safety while Working with Explosives

Explosives shall not be used on the work site by the Vendor without the written permission of the Purchaser and that too only in the manner and to the extent to which it has been prescribed.

Explosives shall be stored in special premises approved by Purchaser and at the cost of the Vendor who shall be liable for all damages, loss or injury to any person or property and shall be responsible for complying with all statutory obligations in these respects.

### 2.2.3 Safety Appliances

The Vendor shall provide the safety appliances conforming to the relevant Indian standards to all their workmen and supervisors engaged by them as well as by the sub-contractors.

The Vendor shall ensure that all the workmen and supervisors, are using the safety appliances regularly during work at site.

Any form of compensation in lieu of safety appliances shall not be permitted. Any violation in safety provisions of failure to maintain safe working conditions will lead to serious penalty on the Contractor and finally may lead to termination on the Contract.

The workmen of the Vendor deployed for construction and erection in hazardous areas shall be provided with personnel protective safety appliances of special nature suitable for hazardous working conditions.

### 2.2.4 Safety during Construction/Execution

The Vendor shall be responsible for the safety of his workmen and employees. The Vendor shall ensure that safety practices are followed so as to present personal injury to his workmen and also to other persons working/passing by in that area.

The Vendor shall ensure that in case of any accidents, the same are reported
without delay to the Purchaser/Statutory Authorities as per Rules. In case of any injury/accident the Vendor shall bear all the expenditure for medical treatment and shall pay the compensation in case of permanent disability or death.

The Vendor shall ensure that all personnel employed do not stray into other areas. Any injury caused due to this shall be the sole responsibility of the Contractor.

The Vendor shall ensure that skilled labours required for specific works have necessary trade certificates and adequate experience of the job. This is likely to be checked by the Purchaser. The concerned operator, mechanics, electricians, fitters, riggers, etc. must be fully conversant with the hazards associated in operation/maintenance of their relevant equipment.

2.2.5 **Safer Working Platforms**

- Vendor shall use strong and secured planks and boards of the right sizes.
- These planks shall be painted at the edges brightly to warn the workers for any misuse (usually zebra paint)
- Vendor shall make sure that scaffolds are erected by the trained scaffolders.
- Supervisors must inspect scaffolds once every week.

2.2.6 **Falling Objects and Debris**

- No loose materials which can fall down should be kept on the working platforms.
- Overhead shelters should be provided to minimize damage from falling objects.
- Strong nets to be provided to catch these objects or debris.
- Nets must envelop all sides of the building.

2.2.7 **Personal Safety Equipment**

- Workers must wear approved safety helmets and shoes.
- For those working in high places safety belts shall be provided.
- The safety belts must be attached to strong anchorage points.

2.2.8 **Operating Construction Machine**

- Vendors shall make sure that those operating the construction machinery are well trained for their jobs.
- The keys of such machinery shall be kept with the authorized persons.
- The keys shall be removed after use of the machine.

2.2.9 **Safer Electrical Installations**

- Vendor shall use approved types of electrical sockets and plugs.
- Proper insulators for all electrical wiring shall be provided.
- Wiring should not be allowed to lie on the floor or on the ground.

2.2.10 **Safety in Designing of Equipment**
All machinery and equipment must be equipped with safety devices. The safety provisions shall conform to the recognized standards, safety codes and statues.

All safety measures as required to be adopted as per statutory regulations and the safety rules of the plant shall be strictly followed by the Vendor during the execution of the Contract.

2.3 **Drawing and Documents**

2.3.1 **Drawing**

The drafting standards adopted in preparation of drawing shall be such that good clean and legible print of the drawing can be obtained.

For preparation of original drawing guidelines contained in Indian Standard specification IS: 10164-1985 (preparation of engineering drawing and diagrams) shall be followed

<table>
<thead>
<tr>
<th>Size Code</th>
<th>Working Space (mm)</th>
<th>Cut Size (mm)</th>
<th>Uncut (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0</td>
<td>811 X 1144</td>
<td>841 X 1189</td>
<td>880X 1230</td>
</tr>
<tr>
<td>A1</td>
<td>564 X 796</td>
<td>594X 841</td>
<td>625 X 880</td>
</tr>
<tr>
<td>A2</td>
<td>390 X 549</td>
<td>420 X 594</td>
<td>450 X 625</td>
</tr>
<tr>
<td>A3</td>
<td>267 X 375</td>
<td>297 X 420</td>
<td>330 X 450</td>
</tr>
<tr>
<td>A4</td>
<td>180 X 252</td>
<td>210 X 297</td>
<td>240 X 330</td>
</tr>
</tbody>
</table>

However, Vendor’s standard drawings are exempted from the above limitations. It is desirable to keep the same size of all drawings for ease of filing, reference and record keeping.

All drawings shall be oriented to match the plant layout drawings and shall have a key plan identifying the plant area to which they apply.

There shall sufficient reference notes and cross-references on the drawings to permit identification of all related drawing and documents, which are required for proper understanding.

When a drawing is revised by the Vendor/ Sub - Contractor, every change made shall be identified on the drawing by placing the revision number in a small triangle so as to be easily recognizable. In addition, a record of revisions along with the co-ordinates showing the location of revisions shall be indicated at the left hand bottom corner of the drawings as per standard practice. In case of revision of drawing, for which different number is allotted, the new drawing shall clearly indicate the number of the drawing which it supersedes.
Approval of drawings from the statutory authorities such as the Indian Boiler Inspectorate, Inspectorate of Explosives, Electrical Inspector, etc. is the responsibility of the Vendor/ Sub-Contractor.

Any additional drawings not specifically mentioned by the EPI/BSP/MECON but are required for the approval of drawings, shall be submitted by the Vendor/ Sub-Contractor.

The Title block of the drawing shall be enclosed as Annexure I.

2.3.2 **Approval of Drawings**

Approval of Vendor’s drawings will generally be accorded within four (4) weeks of receipt.

Approval of Vendor’s drawings means that these will be checked for conformity with applicable specifications and general conformity with the engineering requirement for the areas covered in the scope of work. It is understood that approval by the Purchaser’s Consultant does not include checking for drafting and other errors but only reviews of basic concepts and general principles involved.

The Vendor shall be responsible for any discrepancy, errors and omissions in the drawings have been approved by the Purchaser/Consultants or not. The Vendor shall bear all extra cost due to alterations necessitated by reasons of any discrepancies, errors or omissions in the drawings and particulars supplied by the Vendor.

Drawing furnished by the Vendor shall be certified as correct for use and shall bear the signatures of responsible persons of the Vendor.

Approval of Vendor’s drawing shall not relieve the Vendor of his responsibility to comply with the intent of the contract; manufacture/fabrication or procurement prior to approval of drawings shall be at the Vendor’s risk.

The Vendor shall submit drawing to EPI/BSP/MECON for approval by the Purchaser /Consultant as per clause 3.4 to 3.6 of GTR.

If the drawing is “Approved” then one print shall be returned back to the Vendor duly stamped “Approved” by Consultant.

If the drawing is “Not approved” or “Approved as Noted”, then one stamped print with appropriate comments shall be returned back to the Vendor for incorporation of comments and re-submission of revised drawings for approval sets with in 7 days as per clause 3.4 to 3.6 of GTR.
After approval of drawings the Vendor shall submit 12 sets of approved drawings to the EPI. The Vendor shall incorporate the following note on the drawing before “Approved by MECON vide letter no………….dtd…”

The drawing shall become a contract drawing after approval and there after the Vendor shall not deviate from them in any way whatsoever except with the written permission of the EPI/BSP/MECON.

All reference and information category drawings shall be submitted in 12 sets to EPI. These drawings shall be submitted to Purchaser before forwarding the same to erection Vendor at site for constructive/erection activities.

The information category drawings shall not be approved by the Consultant. However, information category drawings shall be stamped “For Information Only” and one set shall be returned back to the Vendor.

In case any discrepancy is observed on these drawing, same shall be informed to the Vendor by marking the comments on the drawings. The Vendor shall resubmit these drawings after incorporating the comments in 12 sets to the EPI.

After receipt of stamped “For Information Only” the Vendor shall submit 10 sets of drawings to the EPI. The Vendor shall incorporate the following note on the tracing before taking additional prints for submission to the EPI.

Stamped “For Information Only” by MECON vide their letter no…….. dtd……..

2.3.3 Submission of Drawings, CD Reproducible and Documents

The Vendor shall submit the following drawing/documents to EPI and these will be distributed to BSP/ MECON as detailed below.

<table>
<thead>
<tr>
<th>Drawings</th>
<th>MECON</th>
<th>BSP</th>
<th>EPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Approval category drawings for approval of consultants.</td>
<td>6 sets</td>
<td>2 sets</td>
<td>2 sets</td>
</tr>
<tr>
<td>2. Fabrication drawing for approval of consultants.</td>
<td>6 sets</td>
<td>--</td>
<td>4 sets</td>
</tr>
<tr>
<td>3. Drawing after approval along with list of Drawings (for distribution)</td>
<td>8 sets</td>
<td>2 sets</td>
<td>4 sets</td>
</tr>
<tr>
<td>4. Information category drawings</td>
<td>8 sets</td>
<td>2 sets</td>
<td>2 sets</td>
</tr>
<tr>
<td>5. Information category drawings after stamping “For Information Only” by consultants.</td>
<td>8 sets</td>
<td>2 sets</td>
<td>2 sets</td>
</tr>
</tbody>
</table>
6. Erection drawings          8 sets  2 sets  4 sets
7. As built drawings         --     2 sets  2 sets
8. Spare parts drawings      --     2 sets  2 sets
9. Wearing parts drawings   --     2 sets  2 sets

**Compact Disc and Reproducibles**
1. As built drawing of approval category   --     1 set  1 set
2. As built drawing of information category  --     1 set  1 set
3. Spare parts drawings             --     1 set  1 set
4. Wearing parts drawings           --     1 set  1 set
5. All manuals                       --     1 set  1 set

**Documents**
1. Erection manual               1 set  6 sets  3 sets
2. Operating and maintenance manuals 1 set  6 set  2 sets
3. Storage and reconservation manuals 1 set  6 set  2 sets
4. Safety manuals                 1 set  6 set  3 sets
5. List of consumables           1 set  6 set  3 sets
6. List of lubricants and hydraulic 1 set  6 set  3 sets
7. List of special tools and tackles 1 set  6 set  3 sets
8. Test certificates and inspection certificates  1 set  6 set  2 sets
   in bound volume

**2.3.4 Progress Report**

The Vendor shall submit a detailed PERT Network showing completion time which would indicate starting and completion dates of all activities of engineering, purchasing, procurement of materials, manufacturing, inspection, dispatch, erection, testing, and commissioning, etc. under his scope of work.

The Vendor shall submit the progress report in such details as may be required by the Purchaser so as to enable them to monitor the progress of work.
The Vendor shall submit the progress report every month in the proforma mutually discussed and agreed.

2.3.5 **Coding Scheme**

All drawings/documents/equipment/spare parts/shipments shall have a coded number which shall be finalized with the successful tenderer.

2.3.6 **Title Block of Drawing**

Separate file is attached as soft copy. Hard copy is enclosed

3.0 **PERFORMANCE GUARANTEE**

3.1 **General**

On completion of erection of the plant units along-with utilities and auxiliaries by respective package bidders as per approved drawings / documents as well as detailed drawings, the successful bidder shall undertake preliminary Acceptance Test (PAT) i.e. cold test, to prove that the unit has been supplied as per agreement and after erection the unit is fit to be started up and commissioned. The PAT shall be followed by commissioning (hot trials) to demonstrate that the unit is fit for commercial production.

3.1.1 **Preliminary Acceptance Test (PAT)**

Cold tests shall be performed on the individual sub-assemblies of the unit and shall be designed to conduct the systematic check of the components and of the functional operation thereof.

Cold tests shall comprise idle, no-load tests. Cold tests shall be conducted by the successful bidder under his sole responsibility. The employer will provide skilled operating personnel during the cold test.

A detailed programme of cold tests shall be drawn up by the successful bidder and shall be subject to the approval of the employer / consultant. Such programme may be revised and adjusted as may be required by the employer during the test run.

Results of cold tests shall be recorded jointly by the successful bidder and the employer.

On successful completion of preliminary acceptance tests, and liquidation of the defects list, preliminary acceptance certificates shall be issued by the employer.

3.1.2 **Successful Commissioning (Hot Trials)**

After issue of preliminary acceptance certificates, the successful bidder shall start-up and commission the unit in an integrated manner under his sole responsibility.
During the start-up and commissioning, the successful bidder shall perform the required adaptation, adjustment and hot run the Plant & Equipment to demonstrate its production capacity.

The employer shall, for the purpose of start-up and commissioning, provide operating personnel as may be available with him for normal operation, who shall work under the instructions and guidance of the successful bidder.

Start-up and commissioning of the unit shall be taken up only when material handling system, electrical power system, inter-plant fluid system and auxiliaries serving the unit as well as the preceding / succeeding plant units are under normal operation and / or feed material is available. The successful bidder shall rectify the defects observed during commissioning.

The quantities of starting material and facilities necessary for conducting the commissioning shall be mutually determined by the successful bidder and employer.

Commissioning of the unit shall be deemed to be successfully completed, after ten (10) days of rated material is successfully transported, for the particular circuit.

Results of start-up tests and commissioning shall be recorded jointly by the successful bidder and the employer.

On successful completion of commissioning of the unit and its commencement of commercial production as per above mentioned clause, commissioning certificate shall be issued by the employer within 15 days.

The unit shall be taken over by the employer when:

a) Commissioning certificate as per clause 08.01.02.008 has been issued by the employer.

b) The successful bidder has submitted all final documents in compliance with the provisions of this specification.

c) The successful bidder has supplied all consumables, change parts, special tools and tackles and commissioning spares.

d) The successful bidder has met, to the satisfaction of the employer, all the observation, if any, contained in the Preliminary Acceptance certificate.

3.1.3 Performance Guarantee Tests (PG)

After successful commissioning of the plant & equipment, the bidder shall offer the plant for conducting performance guarantee tests as mutually agreed upon between the employer and bidder.
The bidder shall supervise and carry out the operation under their instruction and guidance during performance guarantee tests and shall take full responsibility of the operation. The employer will make available necessary operating and maintenance personnel as per the agreed manning schedule as well as the raw materials, utilities and services etc, as specified.

The bidder shall submit the scope, general preconditions, test procedures and test evaluation methods which shall be finalised during tender discussion.

The performance tests for all plant equipment shall be carried out to satisfy all operating parameters as per the relevant clauses of the Technical specification for the equipment under consideration.

### Performance Guarantee Test

<table>
<thead>
<tr>
<th>SI No</th>
<th>Description</th>
<th>Acceptable</th>
<th>Acceptable with penalty</th>
<th>Liquidated Damages</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Wagon Tippler</td>
<td>20 tippling per hour</td>
<td>-</td>
<td>Not applicable</td>
<td>Less than 20 wagons per hour</td>
</tr>
</tbody>
</table>
| 2.0   | Yard Machines                        | As per rated capacity  
Stacker – 1500tph  
Reclaimer-1500tph | -                       | Not applicable     | Less than rated capacity                            |
| 3.0   | Conveying capacity                   | As per rated capacity | -                       | Not applicable     | Less than rated capacity                            |
| 4.0   | Environment Norms                    | As specified in TS | -                       | Not applicable     | Not achieving norms                              |

The performance guarantee test shall be performed for each sub section continuously for 10 days. Continuity of operation however, be limited by availability of raw materials for unloading and stacking and availability of storing capacity on delivering end. Wherever equipment in the sub section is of stand by nature, each such equipment shall operate for at least 10 hours on load in the period.

The performance guarantee test shall also be performed for the complete system for 5 days on round the clock basis.

In case test is disrupted due to reasons attributable to employer, the same shall
be repeated two more times attending to the reasons of the employer. If the PG test is disturbed even after this, the PG test shall be on the basis of uninterrupted operation of system for 100 hours of total system, excluding the stoppages due to fault of the bidders. However, there should not be any failure of the equipment supplied by Bidder between starts and finish of this time counting. If the operation stops due to failure of any item supplied by bidder, the operating hours prior to such failure will not be counted.

In case some equipment can not be tested within the period of testing because of failure of equipment or facility provided by others, the same will be accepted on the basis of load test result for the limited period or no-load test result where load test could not be performed at all.

The bidder shall prepare and submit a draft performance test procedure for each equipment and system within 12 months of order. The final performance test procedure will be prepared jointly by the employer / consulting engineers and the bidder based on the draft performance test prepared by the bidder and various requirement indicated in the contract specification and the order.
4.0 GENERAL SPECIFICATION ON QUALITY SYSTEM, INSPECTION & TEST OF PLANT & EQUIPMENT AT MANUFACTURER’S PREMISES

4.1 General

Inspection & testing of plant & equipment shall be carried out by BSP/MECON/EPI at the works of successful tenderer during manufacturing and/or on final product to ensure conformity of the same with the acceptable criteria of technical specifications, approved drawings, manufacturing drawings applicable national / international standards.

4.2 Quality System Requirements

The successful tenderer must recognise the importance of quality and follow defined quality programme in all stages of manufacturing and quality control activities of the product. Vendor / Contractor must define and implement the tasks and control that will provide needed assurance, in case manufacturing of product is sub-contracted either partly or fully and/ or for the procured from vendors which are duly approved by the project authority.

BSP/MECON/EPI reserve the right to verify the quality programme of tenderer & its vendors/sub- vendors to assure the effectiveness of the programme to meet the intended and specified quality of the product.

4.3 Quality Assurance Plan (QAP)

4.3.1 The successful tenderer shall furnish Quality Assurance Plan (QAP) for respective equipment after completion of detailed engineering and finalisation of billing schedule / equipment identification number for Consultant’s approval at least one month prior to start of manufacturing.

4.3.2 QAP shall be prepared & furnished by Vendor / Contractor for structural & mechanical equipment, electrical equipment and refractory materials etc., QAPs must be submitted in four (4) sets duly signed and stamped by tenderer for BSP/MECON/EPI approval.

4.3.3 The successful tenderer shall indicate procurement source and furnish to BSP/MECON/EPI, during the submission of QAP, copies of P.O., Sub-P.O., T.S., approved GA drawings/ data sheets & detailed manufacturing drawings, as backup reference materials for scrutiny & final approved by BSP/MECON/EPI. The submission & subsequent approval of QAPs shall be ensured to be restricted to one round only.

4.3.4 Inspection and test requirements shall be decided with due consideration of factors like safety, duty cycle, operating conditions, equipment life, environmental conditions, place of installation and statutory regulations, as applicable, for a particular equipment. Any, additional type or special tests or routine tests if found necessary to establish the intended quality after detailed engineering then the
same shall have to be incorporated in the QAP without any commercial implication.

4.3.5 Detailed QAP shall be prepared by the successful tenderer in consultation with their Sub-contractors / Manufacturers to avoid any complicacy later.

4.4 **Calibration of Measuring Equipment**

4.1 All the measuring equipment used for inspection & testing shall be calibrated and appropriate accuracy class of measuring equipment shall be used. Calibration standards used for calibration of measuring equipment shall be traceable to national standards of National Physical Laboratory (NPL), New Delhi with unbroken chains of comparison.

4.2 Valid calibration certificate for all measuring equipment used during inspection and testing at manufacturer’s works, with traceability to national standards of NPL/ NABL accredited laboratories shall be furnished prior to undertaking inspection by BSP/MECON/EPI.

Calibration certificate shall also indicate reference no. of calibration standards calibrated by NPL/NABL accredited laboratories and copies of such calibration certificates of calibration standards shall be included in the complied dossiers of inspection/test results.

4.5 **Test Certificates and Documents**

4.5.1 For each of the items being manufactured as per approved QAP, following test certificates and documents, as applicable for each of the equipment, in requisite copies including original, duly endorsed by the Manufacturer/successful tenderer with appropriate linkage to project, purchase order and acceptance criteria etc shall be submitted to Consultant/Purchaser.


ii) WPS, PQR & WPQ documents as per applicable code.

iii) Details of stage wise inspection & rectification records for fabricated items, castings, forgings and machined articles.

iv) Control dimension chart with records of alignment, squareness etc.

v) Manufacturer’s material and performance/ relevant test certificates for all bought-out items.

vi) Details of heat-treatment and stress relieving charts as per specification.

vii) Non-Destructive Test reports as per respective code.
viii) Static/dynamic balancing certificate for rotating components/machines.
ix) Hardness test certificate.
x) Pressure/Leakage Test Certificates.
xii) Performance Test Certificates for all characteristics.
xii) Routine / type / calibration / acceptance / special test (Type Tests etc) certificates for electrical items.
xiii) Surface preparation and painting certificates.
xiv) Certificates from competent authority for the items coming under statutory regulations.

4.5.2 Where physical and chemical test certificates of material are not available, the successful tenderer/Sub-contractor shall arrange to have specimens and test samples of the materials, tested in his own laboratory at his cost and submit the copies of test results in requisite numbers to BSP/MECON/EPI for review. Number of test samples against each heat/cast/lot or batch of materials, as applicable shall be as per relevant Indian or International Standards.

4.5.3 Where facilities for testing do not exist in the successful tenderer/Sub-contractor’s laboratories or in case of any dispute, samples and test pieces shall be drawn by the successful tenderer/Sub-contractor in presence of BSP/MECON/EPI and sealed sample shall be sent to any Govt. approved /NABL accredited laboratory for necessary tests at former’s own cost.

4.5.4 The BSP/MECON/EPI shall have the right to be present and witness all tests being carried out by the successful tenderer/Sub-contractor at their own laboratory or approved laboratories. Also, the Inspection Agency shall reserve the right to call for confirmatory test on samples, at his discretion.

4.6 Internal Inspection by Successful Tenderer/Manufacturer

4.6.1 Inspection and tests shall be carried out by Contractor/ Manufacturer in accordance with approved drawing, T.S., P.O., and approved QAP. They shall maintain records of each inspection and test carried out and signed documents shall be submitted to Purchaser/ Consultant for verification.

4.6.2 The successful tenderer shall carry out their internal inspection & obtain clearance from statutory bodies e.g. IBR, CCE, TAC, Weights & Measures, safety, IE rules etc. prior to offering any equipment for BSP/MECON/EPI’s inspection in accordance with approved QAP.

4.6.3 The successful tenderer/ Manufacturers shall identify all the inspected equipment/component/raw materials & shall maintain the record of status of
inspection viz. inspected & found acceptable, require rectification/rework, rejected etc.

4.6.4 The successful tenderer shall establish and maintain procedures to ensure that the product that does not confirm to specified requirements is prevented from inadvertent use or installation. The description of non-conformity that has been accepted subsequently by BSP/MECON/EPI by concession and/ or of repairs, shall be recorded.

Repaired and reworked product shall be offered for re-inspection to BSP/MECON/EPI along with records of corrective action taken.

4.7 Manufacturing and inspection schedule

All Vendors / contractors shall submit the schedule for manufacturing and inspection indication equipment / components, sub-assembly/ assembly. Date of approval of drawings / data sheets. Address of manufacturer with contact person and scheduled date of inspection. Such reports shall be submitted to respective Consultant Inspecting Offices with a copy to Inspection Co-ordinating Office once in a month. These monthly reports shall state the planning for next three months. Submission of first reports must commence one month prior to commencement of manufacturing activities of the product.

4.8 Method of Undertaking Inspection & Testing by Consultant / Purchaser

4.8.1 Inspection call shall be given only on readiness of the equipment/ assembly/ sub-assembly & after approval of all relevant drawings and QAP, In case equipment/ assembly/sub-assembly offered for inspection are found not ready, all the cost of visit of Consultant’s engineer shall have to be borne by the successful tenderer.

If the equipment/assembly/sub-assembly after inspection found not acceptable, require rework and involve Consultant’s re-inspection, all the cost of such re-inspections shall also have to be borne by the successful tenderer.

4.8.2 Inspection call shall be floated to BSP/MECON/EPI, in the approved duly filled in, with ten days clear margin, enclosing all documents like test Certificates, Internal Inspection Reports, P.O., Sub-P.O., T.S., Approved QAP, approved GA drawings/ data sheets and manufacturing drawings. Inspection calls without above documents shall be treated as invalid and shall be ignored. The hard copy of such documents must also accompany a CD (comprising computer readable files) containing the identical documents.

4.8.3 The successful tenderer shall offer substantial quantities for economical inspection consistent with the size of order.

4.8.4 On receipt of the Inspection call, pertaining to particular package / equipment/ item, QA & Inspection group of MECON, Ranchi (Overall co-ordinating office for Inspection activities) shall organize inspection visit or will issue Inspection assignment to other Consultant’s office (based on nearness to the vendor’s
manufacturing works / relevant job expertise). For further inspection pertaining to the same package / equipment / item, successful tenderer may forward the subsequent inspection calls to the respective Consultant’s offices (as identified per initial assignment), with a copy to QA & Inspection Section, Ranchi.

4.9 **Obligations of Successful Tenderer**

4.9.1 The successful tenderer shall provide all facilities and ensure full and free access of the Inspection Engineer of BSP/MECON/EPI to their own or their Sub-Contractor’s premises at any time, during contract period, to facilitate him to carry out inspection & testing of the product during or after or after manufacture of the same.

4.9.2 The successful tenderer shall delegate a Representative / Co-ordinator to deal with BSP/MECON/EPI on all inspection matters. Representative of successful tenderer shall be present during all inspection at Sub-Contractor’s works.

4.9.3 The successful tenderer shall comply with instructions of BSP/MECON/EPI fully and with promptitude.

4.9.4 The successful tenderer/ Sub-Contractor shall provide all instruments, tools, necessary testing & other inspection facilities to BSP/MECON/EPI free of cost for carrying out inspection.

4.9.5 The cost of testing welds by ultrasonic, radiographic and dye penetration tests etc. in the fabrication workshop shall be borne by the successful tenderer. These tests need to be witnessed by ASNT/ISNT Level-II qualified NDT personals.

4.9.6 The successful tenderer shall ensure that the equipment/ assembly/ component of the plant and equipment required to be inspected, are not dismantled or dispatched before inspection.

4.9.7 The successful tenderer shall not offer equipment for inspection in painted condition unless otherwise agreed in writing by BSP/MECON/EPI.

4.9.8 The successful tenderer shall not offer equipment and materials once rejected by the BSP/MECON/EPI, are not re-used in the manufacture of the plant and equipment. Where parts rejected during inspection have been rectified as per agreed procedures laid down in advance, such parts shall be segregated for separate inspection and approval, before being used in the work.

4.10 **Stamping and Issue of Inspection Documents**

4.10.1 **Inspection Memo:** For rejected items/items, which do not conform to Technical Specification in one or more quality characteristics requiring rectification/rework, Inspection Memo shall be issued indicating therein the details of observation & remarks. All the non-conformities with respect to specification of the product shall be indicated in the Inspection Memo for further quality control by successful tenderer.
4.10.2 **Inspection Certificate**: On satisfactory completion of final inspection & testing. All accepted plant & equipment shall be stamped suitably and Inspection Certificate shall be issued by the Consultant for the accepted items.

4.11 **General Clause**

4.11.1 Inspection & tests carried out by Consultant/Purchaser shall no absolve the responsibility of the successful tenderer/ Manufacturer to provide acceptable product as per the terms of contract nor shall it preclude subsequent rejection.

4.11.2 Purchaser/ Consultant reserve the right to inspect any product at any stage of manufacturing beyond pre-identified stages & hold points of approved QAP.

4.12 **Format**

Performa for inspection of all equipment shall be as per EPI / EPI’s clients requirement.

5.0 **PAINTING**

5.1 **General**

5.1.1 This specification covers the materials, tools, facilities and quality requirement for surface preparation and painting of steel structures, equipment, piping, ducts, chutes, wood work etc.

5.1.2 This is only a general guideline of the painting scheme to be followed by the Tenderer, However, in case a specific painting procedure is stipulated in any tendering specification, then this general guideline shall be superseded. Any special case which may arise from time to time shall be dealt with individually on the merit of each case.

5.1.3 The term “painting” referred herein covers rust preventive, fungus/insects preventive and decorative coating along with surface protection of the following area but not limited to the areas indicated below.

   i) Structural steel works
   ii) Mechanical equipment
   iii) Electrical equipment
   iv) Instrumentation and control equipment.
   v) Pipe work
   vi) Oxygen plant, etc.

5.1.4 Surfaces made of asbestos, aluminum, brass, bronze, galvanized steel, stainless steel, cast iron and other corrosion resistant alloys and rubber/synthetic polymer/fiber reinforcement plastic and buried pipe work are not required to be painted unless specified except for aesthetic purposes or for identification bands, wherever relevant.
5.1.5 The complete paint system for any item includes the following basic activities:

i) Proper surface preparation
ii) Application of primer coats
iii) Application of intermediate coats
iv) Application of finished coats

All the above coats shall be of quality paint products and of approved make. The scope of work shall also include supply of all paint materials as per specification described herein.

5.1.6 If the contractor desires to adopt alternative paint system for any specific item for an improvement or equivalent to the system specified here-in or as per recommendations of paint manufacturer, may do so subject to purchaser’s approval in advance.

5.2 Surface Preparation

5.2.1 Surface preparation required for paint application, shall be such as to clean the surface thoroughly of any material which will be conducive to premature failure of the paint substrates.

5.2.2 All surfaces shall be cleaned of loose substances, and foreign materials, such as dirt, rust, scale, oil, grease, welding flux, etc. in order that the prime coat is rigidly anchored to the virgin metal surface. The surface preparation shall confirm to pictorial representation of surface quality grade of Swedish Standards Institution SIS – 055900 or equivalent standards such as SSPC – VIS – 1.67 or DIN 55928 (Part 4) or BS 4232 or IS 1477 – 1971 (Part I).

5.2.3 The acceptable surface preparation quality /grade are described under each paint system. The procedures include solvent cleaning, Hard tool cleaning, power tool cleaning, blast cleaning, wood surface cleaning, flame cleaning and pickling. The will ensure surface quality as required by the specific primer paint. For ready reference surface preparation quality grade to be adopted in respect of SIS 055900 and DIN 55928 (Part – 4) is given in Annexure -01.

5.2.3.1 Solvent Cleaning

The surface shall be cleaned by wiping, immersion, spraying or vapour contacting of a suitable solvent or washing with an emulsion or alkaline solution to remove oil, grease, dirt, old paint, etc. Solvent cleaning shall not remove rust, scales, mill scales or weld flux. Therefore, before application of paint, solvent cleaning shall be followed by other cleaning procedures as stated in subsequent clauses.

5.2.3.2 Hand Tool Cleaning

The surface shall be cleaned manually by vigorous wire brushing as per grade St-2 quality of Swedish Standard Institution SIS 055900 and DIN 555928. This
method effectively removes loosely adherent materials, but would not affect residues of rust or mill scales that are intact are firmly adherent. Finally the surface is to be cleaned with a vacuum cleaner or with clean compressed air or with clean brush. After preparation the surface shall have a faint metallic shine. The appearance shall correspond to the prints designated St-2.

5.2.3.3 **Power Tool Cleaning**

The surface shall be cleaned by electric or pneumatic tools, such as brushes, sanding machines, disc abrasive grinder, rotary disc scaler etc, to St -3 quality. The tools shall be used carefully to prevent excessive roughening of surface and formation of ridges and burrs. This method will remove loosely adherent materials but would not affect residues of rust or mill scales that are firmly adherent and intact.

5.2.3.4 **Blast Cleaning**

The surface shall be cleaned by impingement of abrasive materials, such as graded sand at high velocity created by clean and dry compressed air blast as per the grade according to Swedish Standard Institution SIS 055900. This method will remove loosely adherent materials as well as adherent scales and mill scales. Prior to application of blast, heavy deposit of oil and grease are removed by solvent cleaning excessive surface scales are removed by hand tools or power tool cleaning. The extent of removal of adherent scales is varied, depending on the application and are defined by the surface quality grades Sa 1, Sa 2, Sa 2.5 and Sa 3 in the order of increasing cleanliness. The blast cleaning is not recommended for sheet metal work.

5.2.3.5 **Flame Cleaning**

The surface is cleaned by rapid heating by means of oxyacetylene flame to loosen the adherent scales, followed immediately by wire brushing. This method will remove loosely adherent materials as well as most of the adherent scales and mill scales. In order to minimize or prevent distortion flame cutting shall not be used on members having thickness of 6 mm and lower.

5.2.3.6 **Pickling**

In this method the surface is cleaned of mill scales, rust or rust scales by chemical reaction or electrolysis or both.

5.3 **Paint Application**

5.3.1 **Paints**

5.3.1.1 Paint shall be applied in accordance with paint manufacturer’s recommendations. The work shall generally follow IS 1477 – 1971 (Part II) for jobs carried out in India and SSPC-PA-1 or DIN 55928 of equivalent for jobs carried out outside India.
5.3.1.2 General compatibility between primer and finishing paints shall be established by the paint manufacturer supplying the paints.

5.3.1.3 In the event of conflict between this general procedure on painting and the paint manufacturer’s specification, the same shall be immediately brought to the notice of the Purchaser. Generally in cases of such conflicts, Manufacturer’s specifications / recommendations shall prevail.

5.3.1.4 Before buying the paint in bulk, it is recommended to obtain sample of paint and establish “Control Area of Painting”. On Control Area, surface preparation and painting shall be carried out.

5.3.1.5 If required, samples of paint shall be tested in laboratories to establish quality of paint with respect to:
   (i) Viscosity
   (ii) Adhesion/Bond of paint in steel surfaces.
   (iii) Adhesion/Simulated salt spray test.
   (iv) Chemical analysis (percentage of solids by weight).
   (v) Normal wear resistance as encountered during handling & erection.
   (vi) Resistance against exposure to acid fumes, etc.

5.3.1.6 Whole quantity of paint for a particular system of paint shall be obtained from the same manufacturer.

5.3.1.7 The main Contractor shall be responsible for supply of paints and this responsibility shall not be passed on to the sub-contractor.

5.3.1.8 The painting material as delivered to the Contractor, must be in the manufacturer’s original container bearing thereon manufacturer’s name brand and description. Paint/Painting material in containers without labels or with illegible labels shall be rejected, removed from the area and shall not be used.

5.3.1.9 Thinners wherever used shall be those recommended by the paint manufacturers and shall be obtained in containers with manufacturer’s name and brand name of thinner legibly printed, failing which the thinner is liable to be rejected and shall not be used.

5.3.1.10 All paint containers shall be clearly labeled to show the paint identification, date of manufacture, batch number, special instruction, shelf life etc. The container shall be opened only at the time of use.

5.3.1.11 All paints shall be stored in accordance with the requirements of laid down procedure by the paint manufacturer.

5.3.1.12 All ingredients in a paint container shall be thoroughly mixed to break-up lumps and disperse pigments before use and during application to maintain homogeneity.
5.3.1.13 The proposed make, quality and shade of the paint shall have the approval of the client.

5.3.1.14 The colour code of the finishing paint to be followed shall be intimated to the successful Tenderer after finalisation of order. The undercoat shall have different tint to distinguish the same from the finishing coat.

5.3.1.15 The Contractor shall furnish paint manufacturer’s test report or technical data sheet pertaining to the paint selected. The data sheet shall indicate among other things the relevant standards, if any, composition in weight percent of pigments, vehicles, additives, drying time, viscosity, spreading rate, flash point, method of application, quality of surface preparation required, corrosion resistance properties and colour shades available.

5.3.1.16 For details of paint materials refer Annexure -02.

5.3.2 **General**

5.3.2.1 Each coat of paint shall be continuous, free of pores and of even film thickness without thin spots.

5.3.2.2 Each coat of paint shall be sufficiently dry before application of next coat.

5.3.2.3 Paint shall be applied at manufacturer’s recommended rates. The number of coats shall be such that the minimum dry film thickness specified is achieved. The dry film thickness of painted surfaces shall be checked with ELCOMETER of measuring gauges to ensure application of specified DFT.

5.3.2.4 Zinc rich primer paints which have been exposed several months before finishing coat is applied shall be washed down thoroughly to remove soluble zinc salt deposits.

5.3.2.5 The machine finished surfaces shall be coated with white lead and tallow before shipment or before being put out into the open air.

5.3.2.6 Areas which become inaccessible after assemble shall be painted before assembly (after obtaining painting clearance from the inspecting authority) after requisite surface cleaning as specified.

5.3.2.7 Paint shall not be applied when the ambient temperature is 5 deg C and below or 45 deg C and above. Also paint shall not be applied in rain, wind, fog or at relative humidity of 80% and above unless the manufacturer’s recommendations permit. Applications of paint shall be only be spraying or brushing as per IS 486 – 1983 and IS 487 -1985.

5.3.2.8 Primer paint shall be applied not later than 2 -3 hours after preparation of surface, unless specified otherwise.
5.3.2.9 Edges, corners, crevices, depressions, joints and welds shall receive special attention to ensure that they receive painting coats of the required thickness.

5.3.2.10 Surfaces which cannot be painted but require protection shall be given a coat of rust inhibitive grease according to IS 958 – 1975 or solvent deposited compound according to IS 1153 – 1975 or IS 1674 – 1960.

5.3.2.11 Surfaces in contact during shop assembly shall not be painted. Surfaces which will be inaccessible after assembly shall receive minimum two coats of specified primer.

5.3.2.12 Surfaces to be in contact with wood, brick or other masonry shall be given one shop- coat of the specified primer.

5.3.3 Site/Field Painting

5.3.3.1 Wherever shop primer painting is scratched, abraded or damaged, the surface shall be thoroughly cleaned using emery paper and power driven wire brush wherever warranted, and touched up with corresponding primer. Touching up paint shall be matched and blended to eliminate conspicuous marks.

5.3.3.2 If more than 50% of the painted surface of an item requires repair, the entire item shall be mechanically cleaned and new primer coats shall be applied followed by intermediate and finishing coats as per painting specification.

5.3.3.3 All field welded areas on shop painted items shall be mechanically cleaned (including the weld area proper, adjacent areas contaminated by weld spatter or fumes and areas where existing primer paint is burnt). Subsequently, new primer and finishing coats of paint shall be applied as per painting specification.

5.3.3.4 The first coat of finish paint at site shall be applied preferable within three months of the shop paint.

5.3.4 Structural

5.3.4.1 All fabricated steel structure, fabricated steel pipes, etc. shall have a minimum of two coats of primer paint before dispatch to site.

5.3.4.2 Parts of steel structures embedded in concrete shall be given a protective coat of Portland cement slurry immediately after fabrication and after surfaces of this part is thoroughly cleaned from grease, rust mill scales, etc. No paint shall be applied on this part.

5.3.4.3 All structures shall receive appropriate number of primer and finishing coats in order to achieve overall DFT as per design drawings/ specification.

5.3.5 Hot Surfaces

5.3.5.1 Total DFT for heat resistant paints should no exceed 100 – 120 microns, otherwise flaking occurs (as per paint manufacturer’s recommendations).
5.3.5.2 Heat resistant paints should be applied by brush.

5.3.5.3 Primer coat should not be applied on the surfaces having temperature condition more that 120 deg C.

5.4 Painting Schemes

For a complete painting scheme of any item being printed, all types of paints are to be procured from the same manufacturer as approved by the purchaser.

5.4.1 Legend

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP</td>
<td>Surface preparation quality as per SIS standard</td>
</tr>
<tr>
<td>2P1</td>
<td>Two (2) coats of Primer paint type P1</td>
</tr>
<tr>
<td>1I1</td>
<td>One (1) coats of Intermediate paint type I1</td>
</tr>
<tr>
<td>2F1</td>
<td>Two (2) coats of Finish paint type F1</td>
</tr>
<tr>
<td>DFT</td>
<td>Dry Film Thickness in microns developed</td>
</tr>
<tr>
<td>CRT</td>
<td>Clean and Retouch</td>
</tr>
</tbody>
</table>

Type of paint products like P1 to P9, I1 to 14 and F1 to F10 have been specified under Annexure-02.

5.4.2 The painting scheme to be followed for various structure/equipment exposed to different condition is briefly given in Annexure-03 for guidance to the tenderer.

5.4.3 The colour code for different applications are indicated in Annexure-04. Wherever colour codes are not specified, the same is to be mutually agreed between the Purchaser and Contractor.

5.5 Guarantee

5.5.1 The Contractor shall guarantee that the physical and chemical properties of the paint materials conform with the specification of paint products.

5.5.2 The Contractor shall submit internal test reports from paint manufacturers regarding the quality of paint whenever asked by the BSP/MECON/EPI.

5.5.3 Guarantee period shall commence from the date of completion of finishing coat of paint. The guarantee period will be indicated depending on the type of surface preparation and system of painting. To fulfill this obligations the Contractor may obtain from the painting manufacturer, guarantee for the performance of paint/painted surfaces.
## Surface Preparation Grade

<table>
<thead>
<tr>
<th>SI No.</th>
<th>Surface Preparation</th>
<th>Swedish Std SIS 055900</th>
<th>DIN Std. Din 55928 (Part 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blast cleaning to white metal</td>
<td>Sa 3</td>
<td>Sa 3</td>
</tr>
<tr>
<td></td>
<td>Removal of all visible rusts, mill-scales, paint and foreign matters.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Blast cleaning to near white metal</td>
<td>Sa 2.5</td>
<td>Sa 2.5</td>
</tr>
<tr>
<td></td>
<td>95% of any section of surface area is free from all rusts, mill-scales and visible residues.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Blast cleaning to commercial quality</td>
<td>Sa 2</td>
<td>Sa 2</td>
</tr>
<tr>
<td></td>
<td>At least 2/3 of any section of the surface area is free from all rusts, mill-scales and visible residues.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Brush-off blast cleaning:</td>
<td>Sa 1</td>
<td>Sa 1</td>
</tr>
<tr>
<td></td>
<td>Removal of all loose mill-scales, rust and foreign matters etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Power tool cleaning:</td>
<td>St 3</td>
<td>St 3</td>
</tr>
<tr>
<td></td>
<td>Very thorough scrapping and wire brushing to remove loose mill-scale, rust and foreign matters to have pronounced metallic shine.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Hand tool cleaning:</td>
<td>St 2</td>
<td>St 2</td>
</tr>
<tr>
<td></td>
<td>Removal by hand brushing of loose mill-scale, loose rust and foreign matters.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PAINT MATERIALS

1. PRIMER PAINTS (P)

Primer paint products shall be applied only on dry and clean surfaces.

01.1 Primer Paint –P1 (Phenolic – Alkyd Based)

A single pack air drying phenolic modified alkyd composition with zinc phosphate as a primer paint conforming generally to IS : 2074.

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air drying time</td>
<td>About 60 minutes (touch dry)</td>
</tr>
<tr>
<td></td>
<td>Overnight (hard dry)</td>
</tr>
<tr>
<td>Dry film thickness (DFT)/</td>
<td>40 microns (min)</td>
</tr>
<tr>
<td>Coat Temperature resistance</td>
<td>Upto 100°C dry heat</td>
</tr>
</tbody>
</table>
01.02 **Primer Paint – P2 (Chlororubber Based)**

A single pack air drying high build chlorinated rubber based zinc phosphate primer.

- **Percent chlororubber** - 20 to 22 (% Chlorine above 65% in Chlororubber)
- **Air drying time** - About 15 minutes (touch dry)
  - Overnight (hard dry)
- **DFT/ Coat** - 50 microns (min)
- **Temperature resistance** - Up to 65°C dry heat

01.03 **Primer Paint – P3 (PVC Copolymer Alkyd Based)**

- **Polyvinyl chloride (PVC)** - Alkyd zinc phosphate – redoxide Based primer
- **Ratio** - PVC copolymer + alkyd reisn (1.1)
- **Pigments** - Zinc phosphate & Fillers
- **Air drying time** - 24 hours
- **DFT/Coat** - 80 microns
- **Temperature** - Upto 80°C dry heat

01.04 **Primer Paint – P4 (Epoxy Based)**
A two pack air drying Epoxy polyamide resin based red oxide – zinc phosphate primer.

Epoxy content (% wt.) - 15 to 18

Air drying time - About 30 minutes (touch dry)
- overnight (hard dry)

DFT/Coat - 30 microns (min)

Temperature resistance - Upto 120°C dry heat

01.5 **Primer Paint – P5 (Epoxy Based)**

A two pack air drying Epoxy polyamide with zinc dust of at least 92% zinc dust on the dry film

Epoxy content (% wt.) - 8 to 10

Air drying time - Less than 10 minutes (touch dry)
- Less than 2 hours (hard dry)

DFT/Coat - 40 microns (min)

Temperature - Upto 300°C dry heat

01.6 **Primer Paint – P6 (Poly – Vinyl Butyral Resin Based)**

A two pack air drying polyvinyl butyral resin based wash primer with rust inhibitive pigments.

Air drying time - 5 to 7 minutes (touch dry)
- 2 hours (hard dry)

DFT/Coat - 8 microns

Temperature resistance - Upto 65°C dry heat

Application for - Galvanised iron, aluminium, light alloys etc. on which the adhesion of conventional paints are poor.

01.07 **Primer Paint – P7 (Ethyl Zinc Silicate, EZS Based)**

A two pack heavy duty zinc dust rich silicate primer which protects the surface with just a single coat.

Total solids (3 wt) - 84 +/- 2
Density (g / cc) - 3.07 +/- 0.05
Air drying time - To top coat 16 hours
DFT / Coat - 60 microns
Temperature resistance - Upto 450 deg C dry heat

01.08 **Primer Paint – P8 (high Build Coal Tar Epoxy)**

A two pack cold cured H. B. epoxy coal tar coating – no primer is required.

Mixing ratio - Base: Hardener (4:1 by vol.)
Air drying time - 48 hours (hard dry)
DFT / Coat - 100 microns

01.09 **Wood Varnish – P9**

Treated oil based primer pigmented with suitable pigments:

Air drying time - 16 hours for application of top coat.
Coverage - 10 to 14 sq. m/litre

2. **INTERMEDIATE PAINTS (I)**

These paints shall be applied over primer coats as an intermediate layer to provide weather proof seal of primer coats.

02.1 **Intermediate Paint-II (Phenolic alkyd based)**

A single pack high build phenolic based paint with micaceous iron oxide (M 10).

Air Drying Time - 4 to 6 hours (touch dry)
2 days (hard dry)
DFT / Coat - 75 microns (min)
Temperature resistance - Upto 100 deg C dry heat
Compatible with - Primer P1

02.02 **Intermediate Paint -12 (Chlororubber based)**

A single pack air drying high build chloro based paint with MIO.

Air Drying Time - 15 minutes (touch dry)
- 24 hours (hard dry)
DFT/Coat - 70 microns (min)
Temperature resistance - Upto 65 deg C dry heat
Compatible with - Primer P2, P3 & P4

02.03 **Intermediate Paint -13 (PVC – Alkyd Based)**
PVC Coploymer  -  Resin 1 : 1
Pigments  -  Micaceous iron oxide (MIO)
DFT/Coat  -  80 microns
Temperature resistance  -  Upto 80 deg C dry heat
Compatible with  -  Primer P2 & P3

02.4 **Intermediate Paint -14**

A two pack air drying high build epoxy resin based paint with MIO.

Air drying time  -  6 to 8 hours (touch dry)
-  7 days (full cure)
DFT / Coat  -  100 microns
Temperature  -  Up to 180°C dry heat
Compatible with  -  Primer P4 & P5

3. **FINISH PAINTS (F)**

Finish paint costs shall be applied over primer coats and intermediate coats after proper cleaning and touch up of primed surface.

03.1 **Finish Paint – F1**

A single pack air drying high gloss phenolic alkyd modified synthetic enamel paint suitably pigmented.

Air drying time  -  3 to 4 hours (touch dry)
-  24 hours (hard dry)
DFT/Coat  -  25 microns (min)
Temperature  -  Upto 100°C dry heat
Compatible with  -  Primer P1
-  Intermediate I1
Colour  -  Generally all shades

03.02 **Finish Paint – F2**

A single pack air drying polyurethane enamel of high gloss and hard finish suitably pigmented.

Air drying time  -  2 to 2 ½ hours (touch dry)
-  6 hours (hard dry)
DFT/Coat  -  30 microns (min)
Temperature resistance  -  Upto 100°C dry heat
Compatible with - Primer P1 & P8 and Intermediate I1
Colour - Generally all shades

03.03 **Finish Paint – F3**
A two pack air drying bituminous aluminum paint.

Air drying time - 1 to 2 hours (touch dry)
- 21 hours (hard dry)

DFT/Coat - 25 microns (min)

Temperature resistance - Upto 100°C dry heat

Compatible with - Primer P1 and Intermediate I1

Colour - Bright metallic

03.04 **Finish Paint – F4**
A ready mixed oil –alkyd based synthetic enamel paint of high gloss and hard wearing properties.

Air drying time - 6 to 8 hours

Coverage - 14 to 16 Sq. m/litre

Temperature resistance - Upto 60°C dry heat

Compatible with - P8

Colour - Generally all shades

03.5 **Finish Paint – F5**
A single pack air drying plasticized chlororubber paint suitably pigmented.

Air drying time - 30 minutes (touch dry)
- 24 hours (hard dry)

DFT/Coat - 35 microns (min)

Temperature resistance - Primer 65°C dry heat

Compatible with - Primer P2 & P3, Intermediate I2 & I3

Colour - Nearly all shades except few.
03.6 **Finish Paint – F6**

A PVC - Copolymer alkyd based enamel.

Density - 1.17 ± 0.05

Total solids (1 wt) - 55 ± 2

DFT/Coat - 40 microns

Compatible with - P2 and P3

03.07 **Finish Paint – F7**

A two pack air drying epoxy polyamide enamel suitably pigmented.

Air drying time - 2 to 3 hours (touch dry)
- 7 days (full cure)

DFT/Coat - 40 microns (min)

Temperature resistance - Up to 130°C dry heat

Compatible with - Primer P4 & P5,
- Intermediate 14

Colour - Generally all shades.

03.8 **Finish Paint – F8**

A single pack synthetic rubber based aluminum paint.

Air drying time - 2 hours (touch dry)
- 24 hours (hard dry)

DFT/Coat - 25 microns (min)

Temperature resistance - Upto 200°C dry heat

Compatible with - No Primer paint except primer P6 is applicable in case of non-ferrous substrate.

Colour - Smooth aluminium.
## PAINTING SCHEME

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Painting Scheme</th>
<th>Total DFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td><strong>Steel Structures</strong> (Temp. not exceeding 80°C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>1.1</strong> Technological steel structures for plant and Equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indoor</td>
<td>SP – Sa 2.5</td>
<td>CRT 2F1</td>
</tr>
<tr>
<td></td>
<td>Outdoor</td>
<td>SP – Sa 2.5</td>
<td>CRT 2F1</td>
</tr>
<tr>
<td></td>
<td><strong>1.2</strong> Fabricated steel structures at site for rung ladders, cat-ladders, gates, rolling shutters, etc. (Springs/rubbing surfaces excluded)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Indoor / Outdoor</td>
<td>SP – St-2 and /</td>
<td>CRT 2F1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Or St-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2P1</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>1.3</strong> Walkways, stairs, platforms etc. which are of wearing surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Indoor</td>
<td>SP – St -2 and /</td>
<td>CRT 2F1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or St -3</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>2P1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Outdoor</td>
<td>SP-St2 and /</td>
<td>CRT 2F1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Or St -3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2P1</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>1.4</strong> Steel doors and windows</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Indoor / outdoor</td>
<td>SP- St-2 and /</td>
<td>CRT 2F2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or St-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2P1</td>
<td></td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Description</td>
<td>Painting Scheme</td>
<td>Total DFT</td>
</tr>
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</tr>
<tr>
<td></td>
<td></td>
<td>At Shop</td>
<td>At Site</td>
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<tr>
<td>2.0</td>
<td><strong>MECHANICAL EQUIPMENT</strong></td>
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</tr>
<tr>
<td>2.1</td>
<td>Mechanical equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Temp. not exceeding $80^\circ$C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.1</td>
<td>Static equipment like storage tanks, vessels, bins,</td>
<td>SP – Sa 2.5</td>
<td>CRT</td>
</tr>
<tr>
<td></td>
<td>bunkers, heat exchangers, coolers, Cyclones, scrubbers, etc.</td>
<td>2P2/2P3</td>
<td>2F5/2F6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>170/240</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Indoor</td>
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<td></td>
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<td></td>
<td>- Outdoor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.2</td>
<td>Rotary/moving equipment and machineries like</td>
<td>SP – Sa 2.5</td>
<td>CRT</td>
</tr>
<tr>
<td></td>
<td>crushers, mills, vibratory screens, bin activators,</td>
<td>2P3/2P4</td>
<td>2F6/2F7</td>
</tr>
<tr>
<td></td>
<td>blowers, fan, air/gas compressors, pumps, gear boxes, machine housings etc.</td>
<td>2P3+1/3 / 1/4</td>
<td>320/340</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240/140</td>
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</tr>
<tr>
<td></td>
<td>- Indoor</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>- Outdoor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td><strong>Pipe / Duct work (Overground)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Non – insulated</td>
<td>SP – St2 and</td>
<td>CRT</td>
</tr>
<tr>
<td></td>
<td>(temperature up to $80^\circ$C)</td>
<td>or St3</td>
<td>2F1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>130</td>
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</tr>
<tr>
<td></td>
<td>- Indoor</td>
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<tr>
<td></td>
<td>- Outdoor</td>
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<td></td>
<td></td>
<td>205</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insulated (hot)</td>
<td>SP – St2 and/or St3</td>
<td>Remove paint and insulate</td>
</tr>
<tr>
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<td>---------------------------------</td>
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<td>---------------------------</td>
</tr>
<tr>
<td></td>
<td>-Indoor / Outdoor</td>
<td>1P1</td>
<td></td>
</tr>
</tbody>
</table>

**4.0 Oxygen Plant**

<table>
<thead>
<tr>
<th></th>
<th>Outdoor steel Structures</th>
<th>SP – St2 and/or St3</th>
<th>CRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td></td>
<td>2P1 + 1I1</td>
<td>2F3</td>
</tr>
<tr>
<td>4.2</td>
<td>Rotary equipment like air compressors</td>
<td>Sa 2.5</td>
<td>CRT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2P4</td>
<td>2F7</td>
</tr>
</tbody>
</table>

**5.0 Others**

<table>
<thead>
<tr>
<th></th>
<th>Standard mobile equipment like chasis of trucks, dumpers, crawler cranes bulldozers, Railway rakes, chasis of slag cars, ladle cars, etc.</th>
<th>As per manufacturer’s standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2</td>
<td>Laboratory equipment like ovens, screens, magnetic stirrers, samplers, etc.</td>
<td>Stove enamelling</td>
</tr>
<tr>
<td>5.3</td>
<td>Steel structures partly immersed in water</td>
<td>SP – Sa 2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2P8</td>
</tr>
</tbody>
</table>

**Notes:-**

1. Painting scheme of all fabricated steel structures, fabricated pipe work, building structures, conveyor galleries, pipe trestles etc. is indicated in the Technical Specification of steel structures.

2. **Primer Paint**
   Primer coat shall be suitable for intended temperature applications as per manufacturer’s recommendation. The primer selection shall be generally in line with the specification laid down in Annexure -02.

3. **Finish Paint**
   In case of Aluminums cladding final painting will not be required.
6.0 LIST OF APPROVED VENDORS/MAKES:

All the items to be supplied from enclosed approved vendors/ makes list of BSP / MECON.

Please Refer :
1. Appendix - 6 (List of approved Sub-contractors / Vendors
2. Preferred makes - Chapter – 13 of GTS (GS-13)
LIST OF APPROVED SUB-CONTRACTORS / VENDORS

1.0 The following Sub-Contractors / Vendors are approved for carrying out the item of the Facilities indicated against each of them. Where more than one Sub-Contractor / Vendor is listed, the Contractor is free to choose between them, but it must notify the Employer of its choice well in advance time prior to appointing any selected Sub-Contractor / Vendor. In accordance with the Sub-Clause 19.1 of GCC, the Contractor is free to submit proposals for Sub-Contractors / Vendor for additional items from time to time. No Sub -Contractors / Vendors shall be placed with any such Sub-Contractors / Vendors for additional items until the Sub-Contractors / Vendors have been approved in writing by the Employer and their name have been added to this list of approved Sub-Contractors / Vendors.

**ELECTRICAL**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Item Description</th>
<th>Preferred Makes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>HV EQUIPMENTS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>220 KV &amp; 132 KV Power Transformers up to 160 MVA</td>
<td>BHEL, TELK, CGL, EMCO, AREVA, ABB, SIEMENS</td>
</tr>
<tr>
<td>2.</td>
<td>33 KV, 11KV, 6.6KV Oil filled / Dry type, distribution / Rectifier Transformers</td>
<td>CGL, AREVA, Transformers &amp; Rectifiers Ltd, KEC, Intra Vidyut, Kanohar, VoltAmp, Bharat Bijlee, Andrew Yule, BHEL, EMCO, ABB, SIEMENS</td>
</tr>
<tr>
<td>3.</td>
<td>33 KV, 11KV, 6.6KV Oil Filled Furnace Transformers</td>
<td>CGL, EMCO, AREVA, BHEL, ABB</td>
</tr>
<tr>
<td>4.</td>
<td>220 KV and 132 KV SF6 Circuit Breakers</td>
<td>ABB, CGL, SIEMENS, AREVA</td>
</tr>
<tr>
<td>5.</td>
<td>33 KV, 22 KV, 11 KV, 6.6 KV Vacuum Circuit Breakers</td>
<td>SIEMENS, BHEL, CGL, Schneider, AREVA, ABB, Jyoti (Jyoti -upto 11 KV only)</td>
</tr>
<tr>
<td>6.</td>
<td>6.6 KV, 11 KV Vacuum Contactors</td>
<td>BHEL, AREVA, SIEMENS, Andrew Yule, Jyoti, CGL</td>
</tr>
<tr>
<td>7.</td>
<td>220 KV and 132 KV Current Transformer (CT)</td>
<td>ABB, TELK, BHEL, CGL, AREVA</td>
</tr>
<tr>
<td>8.</td>
<td>33 KV, 22 KV, 11 KV, 6.6 KV Current Transformer (CT)</td>
<td>Pragati, Instrans, Prayog, Intravidyut, Insutech Industries, ABB</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Vendors</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>9</td>
<td>220 KV and 132 KV Voltage Transformer (PT)</td>
<td>ABB, TELK, BHEL, CGL, AREVA</td>
</tr>
<tr>
<td>10</td>
<td>33 KV, 22 KV, 11 KV, 6.6 KV Voltage Transformer (PT)</td>
<td>ABB, Pragati, Prayog, Intravidyut, Jyoti</td>
</tr>
<tr>
<td>11</td>
<td>220 KV and 132 KV Capacitance Voltage Transformer (CVT)</td>
<td>AREVA, ABB, CGL, BHEL</td>
</tr>
<tr>
<td>12</td>
<td>220 KV and 132 KV Lightning Arrestor (LA)</td>
<td>OBLUM, Elpro, AREVA, CGL</td>
</tr>
<tr>
<td>13</td>
<td>220 KV and 132 KV Isolators</td>
<td>S&amp;S Pondicherry, Elpro, WS-Insulators, ABB, AREVA, CGL</td>
</tr>
<tr>
<td>14</td>
<td>33 KV, 11KV, 6.6KV Isolator, Load Break Switch</td>
<td>A-Bond Strands, Drescher &amp; Panicker, ABB, SIEMENS, CGL</td>
</tr>
<tr>
<td>15</td>
<td>11 KV Air-Break Switch</td>
<td>Pactil &amp; Panchkari, Kayal &amp; Co.</td>
</tr>
<tr>
<td>16</td>
<td>220 KV and 132 KV Condenser Bushings</td>
<td>BHEL, CGL, AREVA, TELK. The Transformer manufacturers may give their own / any other make with QAP.</td>
</tr>
<tr>
<td>17</td>
<td>33 KV, 11KV and 6.6 KV Capacitors</td>
<td>ABB, Unistar(Universal Cables), BHEL, Meher (Bangalore)</td>
</tr>
<tr>
<td>18</td>
<td>33 KV, 11 KV and 6.6 KV Surge Suppressors</td>
<td>OBLUM, Elpro, WS-Insulators, Toshiba, SIEMENS</td>
</tr>
<tr>
<td>19</td>
<td>33 KV, 22 KV, 11 KV, 6.6KV Cable Jointing Kits (Heat Shrinkable Type)</td>
<td>Raychem, CCI, 3M, M-Seal (M-Seal for 6.6 KV)</td>
</tr>
<tr>
<td>20</td>
<td>Battery Chargers</td>
<td>Chhabi Electricals, Standard, Hi-rect, Sherene Electro Control, Amara Raja</td>
</tr>
<tr>
<td>21</td>
<td>Lead Acid Station Battery</td>
<td>Exide, AMCO, Amara Raja</td>
</tr>
<tr>
<td>22</td>
<td>Electronic Energy Meters (Trivector / KWH)</td>
<td>SEMS, L&amp;T, SATEC, CONZERVE, Dukati, ABB, SIEMENS, AREVA, Schneider</td>
</tr>
<tr>
<td>23</td>
<td>Protection and Auxiliary Relays</td>
<td>ABB, SIEMENS, L&amp;T, AREVA, Schneider</td>
</tr>
<tr>
<td>24</td>
<td>Recorders (Chartless type)</td>
<td>Chino, Yokogawa India Ltd, Okhura, Fuji, Eurotherm (Chessel), Tata Honeywell, Hioki, Fluke, ABB, Pyrotech (Udaipur).</td>
</tr>
<tr>
<td>25</td>
<td>Annunciators</td>
<td>Minilec, SPA, Procon, Yashmun,</td>
</tr>
<tr>
<td>Page</td>
<td>Description</td>
<td>Approved Vendors</td>
</tr>
<tr>
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</tr>
<tr>
<td>26</td>
<td>Panel/Indicating meters</td>
<td>IMP, AE, MECO, L&amp;T, Motwani, Conzerve</td>
</tr>
<tr>
<td>27</td>
<td>LT Air Circuit Breakers</td>
<td>L&amp;T, SIEMENS, Schneider, ABB, GE Power Control</td>
</tr>
<tr>
<td>29</td>
<td>HT HRC Fuses</td>
<td>S&amp;S, GE Power Control, Busmann, SIEMENS, ABB, Drescher Paniker</td>
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<tr>
<td>30</td>
<td>HV/LV Bus Duct</td>
<td>Best &amp; Crompton, ECC (Kolkata), Star Drive (Chennai), Enpro (Chennai), Advance Power Control (Advance Power Control only for LV Bus Duct)</td>
</tr>
</tbody>
</table>

2. LV Equipments

<table>
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<th>Page</th>
<th>Description</th>
<th>Approved Vendors</th>
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</thead>
<tbody>
<tr>
<td>31</td>
<td>Moulded Case Circuit Breaker (MCCB)</td>
<td>Schneider (CG &amp; MG), L&amp;T, Andrew Yule, ABB, SIEMENS, BCH (BIL), GE POWER CONTROL, MOELLER</td>
</tr>
<tr>
<td>32</td>
<td>Motor Protection Circuit Breakers (MPCB)</td>
<td>Schneider (TELEMECANIQUE), L&amp;T, ABB, SIEMENS, GE POWER CONTROL, MOELLER, Rockwell Automation</td>
</tr>
<tr>
<td>33</td>
<td>Miniature Circuit Breaker (MCB)</td>
<td>SIEMENS, L&amp;T, GE POWER CONTROL, SCHNEIDER (PROTEC / MG), STANDARD, INDOASIAN, HAVELLS, MDS (LEGRAND), ABB</td>
</tr>
<tr>
<td>34</td>
<td>Earth Leakage Circuit Breaker</td>
<td>GE POWER CONTROL, STANDARD, HAVELLS, ABB, SIEMENS, SCHNEIDER</td>
</tr>
</tbody>
</table>
| 35   | Switch, fuse Unit / Fuse Disconnector (Fuse Switch Unit), Air Break switch | GE POWER CONTROL, L&T, SIEMENS, BASANT PRAN & CO.  
                              HAVELLS, STANDARD, INDOASIAN, CONTROL & SWITCH GEAR, ANCHOR |
| 36   | HRC fuse for LT application | GE POWER CONTROL, L&T, SIEMENS, BHARAT LINDER, INDO ASIAN, HAVELLS, STANDARD, BUSSMAN, CONTROL & SWITCH GEAR, ABB |
| 37   | Power Contactor for Crane / Mill Duty Operation | |

List of approved vendors

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<tbody>
<tr>
<td>1. Box Type (AC/DC)</td>
</tr>
<tr>
<td>2. Vacuum Contactor</td>
</tr>
<tr>
<td>3. AC/DC Power Contactor-Clapper Type/ Bar Mounted - Mill Duty / Crane Duty</td>
</tr>
<tr>
<td>38. Power contactor for General Purpose &amp; Continuous Duty operation</td>
</tr>
<tr>
<td>39. Over Load Relays</td>
</tr>
<tr>
<td>1. Thermal (Bimetallic)</td>
</tr>
<tr>
<td>2. Electronic Over Load relays</td>
</tr>
<tr>
<td>3. Electro magnetic Over Load relay</td>
</tr>
<tr>
<td>40. Aux.Contractors / Control Relays</td>
</tr>
<tr>
<td>41. Time Delay Relay</td>
</tr>
<tr>
<td>1. Electro Pneumatic</td>
</tr>
<tr>
<td>2. Electronic Timer</td>
</tr>
<tr>
<td>3. Time switches</td>
</tr>
<tr>
<td>42. Master Controller</td>
</tr>
<tr>
<td>43. Limit Switches</td>
</tr>
<tr>
<td>1. Crane &amp; Heavy duty Application</td>
</tr>
<tr>
<td>2. Micro &amp; Other Actuating Type</td>
</tr>
<tr>
<td>44. Resistance Boxes</td>
</tr>
</tbody>
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List of approved vendors
<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
<th>List of approved vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>Electromagnetic DC Brake assembly</td>
<td>EPCC, BCH (BIL), INDUSTRIAL SYNDICATE</td>
</tr>
<tr>
<td>46</td>
<td>Thyristor Converters</td>
<td>BHEL, SIEMENS, SSD Drives, ABB, NELCO, ABIL, Converteam.</td>
</tr>
<tr>
<td></td>
<td>1. General Purpose up to 1 KA</td>
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<tr>
<td></td>
<td>2. Critical application up to 1KA</td>
<td>BHEL, Siemens, ABB.</td>
</tr>
<tr>
<td></td>
<td>3. 1 KA to 10 KA</td>
<td>BHEL, Siemens, ABB.</td>
</tr>
<tr>
<td></td>
<td>4. Main drives, more than 10 KA</td>
<td>BHEL, Siemens, ABB.</td>
</tr>
<tr>
<td>47</td>
<td>PLC</td>
<td>Rockwell Automation, L&amp;T(Quantam), Siemens, ABB, GE Fanuc, BCH, Schneider</td>
</tr>
<tr>
<td>48</td>
<td>Soft starters (LT motor)</td>
<td>ABB, Rockwell Automation, BHEL, Schneider, N. N. Planner, Siemens, Innovative Technomics</td>
</tr>
<tr>
<td>49</td>
<td>Soft starters (For HT Motors)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. With Energy saving mode</td>
<td>ABB, Rockwell Automation, BHEL, Siemens</td>
</tr>
<tr>
<td></td>
<td>2. Without Energy saving mode</td>
<td>Innovative Technomics, Trial party -SSE, China.</td>
</tr>
<tr>
<td>50</td>
<td>VVVF Drives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. General Purpose LT motors</td>
<td>ABB, ABIL, BHEL, Siemens, NELCO (Hitachi), T.B.Wood, Vacon, Schneider, SSD Drives,</td>
</tr>
<tr>
<td></td>
<td>2. Critical application for LT motors</td>
<td>Jeltron(Toshiba), L&amp;T (Yaskawa), Trial party -Danfoss</td>
</tr>
<tr>
<td></td>
<td>3. For HT Motors MV Drive/ Hi-Lo-Hi Drive</td>
<td>ABB, Rockwell Automation, BHEL, Siemens, Converteam (UK), TMEIC.</td>
</tr>
<tr>
<td>51</td>
<td>Thyristor devices</td>
<td>West Code, ABB, BHEL, EUPEC, Hind Rectifier, Rutton Shaw, Semikron rectifier.</td>
</tr>
<tr>
<td>52</td>
<td>Power Diodes</td>
<td>Rutton-Shaw, Usha Rectifier, Hind Rectifier, Insel, Semikron Rectifier, West code, EUPEC</td>
</tr>
<tr>
<td>53</td>
<td>Control Diodes</td>
<td>ECIL, BEL, Hind Rectifier, INSEL.</td>
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<tr>
<td>Page</td>
<td>Description</td>
<td>Details</td>
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<tr>
<td>54</td>
<td>Semiconductor Fuses</td>
<td>GE Power Control, Siemens, La-Ferraz, Bussman.</td>
</tr>
<tr>
<td>55</td>
<td>UPS</td>
<td>HI-REL, ILK (FUJI), Tata Libert (Emerson), Siemens, APC-MG, TVSE, DB Power Electronics (P) Ltd.</td>
</tr>
<tr>
<td>56</td>
<td>IGBT</td>
<td>West Code, FUJI, Eupec.</td>
</tr>
<tr>
<td>4.</td>
<td>MOTORS</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>LT Squirrel Cage Motors</td>
<td>ABB, BHARAT BIJLEE, CGL, KEC, LAXMI HYDRAULICS PVT LTD. (SOLAPUR), ALSTOM, SIEMENS, ELGI, JYOTI, NGEF, SEW, NORD, HINDUSTAN MOTORS, LENZE Trial Party: SIMO</td>
</tr>
<tr>
<td>58</td>
<td>LT Slipring Motors (Crane / Mill Duty)</td>
<td>CGL, ALSTOM, KEC, BHARAT BIJLEE</td>
</tr>
<tr>
<td>59</td>
<td>LT AC Roll Table Motors</td>
<td>KEC, CGL, ALSTOM, ABB, SEW, MARK ELECTRIC, Bauer, LHP</td>
</tr>
<tr>
<td>60</td>
<td>LT AC Geared Motors</td>
<td>LAXMI HYDRAULICS PVT LTD. (SOLAPUR), INTERNATIONAL COMBUSTION, RAJENDRA ELECTRICAL INDUSTRIAL LTD. (REMI), BONFIGLIOLOCOIMBATORE, SEW, NORD, Bauer, Power Build.</td>
</tr>
<tr>
<td>61</td>
<td>HT AC Motors (Squirrel cage, Slipring &amp; Synchronous Motors)</td>
<td>ALSTOM, CGL, KEC, ABB, BHEL, JYOTI, SIEMENS, WEG, TMEIC Trial Party: Simo</td>
</tr>
<tr>
<td>62</td>
<td>LT Flame Proof Squirrel Cage Motor</td>
<td>ALSTOM, BHARAT BIJLEE, CGL, KEC, LAXMI HYDRAULICS PVT LTD. (SOLAPUR)</td>
</tr>
<tr>
<td>63</td>
<td>Stall Torque Vibrator Motor</td>
<td>DEMAG, ELECTROMAG, INTERNATIONAL COMBUSTION, NORD, ELECTROMAGNETICS, BOSECO</td>
</tr>
<tr>
<td>64</td>
<td>Actuator Motors</td>
<td>AUMA, ROTORK, LIMITORQUE</td>
</tr>
<tr>
<td>65</td>
<td>DC Motors</td>
<td>KEC, BHEL, CGL, IECBANGALORE, Trial Party: TRIDENT, BAMULLER</td>
</tr>
<tr>
<td>5.</td>
<td>Electronic Components / Sensors</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Proximity Switches (Inductive, Capacitive and Magneto)</td>
<td>IFM, SIEMENS, SICK, ROCKWELL AUTOMATION, PEPPERL + FUCHS, SCHNEIDER</td>
</tr>
<tr>
<td>67</td>
<td>Encoder</td>
<td>IFM, HUBNER, HEIDENHAINE, LEONARD, DIPL.ENG.H.WENGORZ.GMBH</td>
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<tr>
<td>Page</td>
<td>Entity</td>
<td>Vendors</td>
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<tr>
<td>68</td>
<td>Zero Speed Switch</td>
<td>Schneider -SAMWA, IFM, Rockwell Automation, Siemens, Pepperl+Fuchs, Pyrotech</td>
</tr>
<tr>
<td>69</td>
<td>Sensors / Switches * Light Barriers * Distance * Level</td>
<td>IFM, SICK, ROCKWELL AUTOMATION, PEPPERL + FUCHS, SIEMENS, Schneider, Dimetix AG</td>
</tr>
<tr>
<td>70</td>
<td>Switch Mode Power Supply</td>
<td>SIEMENS, IFM, Rockwell Automation, BHEL, Schneider, Honeywell.</td>
</tr>
<tr>
<td>71</td>
<td>Electronic flow switches for oil / air / water</td>
<td>Everly, NELCO, IFM, Schneider, SIEMENS, Krone, Endress &amp; Hausser (E&amp;H)</td>
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6. Panels & Panel components (Low Voltage)

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<th>Entity</th>
<th>Vendors</th>
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<td>72</td>
<td>Panel Board ( Fire Retardent Board )</td>
<td>LAMTUF PLASTIC, Hyderabad</td>
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<tr>
<td>73</td>
<td>Panel Enclosures</td>
<td>EPCC, BCH, RITTAL, TRANSRECT, ADVANCE POWER CONTROL</td>
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<tr>
<td>74</td>
<td>Terminal blocks</td>
<td>EPCC, ELMEX, PHONIX CONTACT, CONNECT WELL, ESSEN DEINKI, WAGO</td>
</tr>
<tr>
<td>75</td>
<td>Selector Switches &amp; Control Switches</td>
<td>ABB, GE POWER CONTROL, BCH, EPCC, KAYCEE, SIEMENS, TEKNIK, L&amp;T, RECOM</td>
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<tr>
<td>76</td>
<td>Control Transformers</td>
<td>AEI, UNITECH, EPI, Power &amp; Communications, TRANSRECT, ADVANCE POWER CONTROL, EEW</td>
</tr>
<tr>
<td>77</td>
<td>Mimic Panels &amp; Annuciation Panels</td>
<td>L&amp;T, ADVANI OERLIKON, GE Power Control, BHEL, BCH, TRANSRECT, MINLEC, Tirupati Electronics, ADVANCE POWER CONTOL</td>
</tr>
<tr>
<td>78</td>
<td>M.C.C ( Draw Out Type )</td>
<td>SIEMENS, BCH, L&amp;T, ANDREW YULE, SCHNEIDER ELECTRIC/ CGL, CONTROL &amp; SWITCH GEAR, ABB, ADVANCE POWER CONTROL</td>
</tr>
<tr>
<td>79</td>
<td>M.C.C ( Non Draw Out Type )</td>
<td>SIEMENS, BCH, MAHESWARI ELECT., L&amp;T / ECC, ANDREW YULE, SCHNEIDER ELECTRIC / CGL, CONTROL &amp; SWITCH GEAR, ABB, GE POWER CONTROL, TRANSRECT, ADVANCE POWER CONTROL. TRIAL PARTIES -MEDITRON, SWITCHING CKT.</td>
</tr>
<tr>
<td>80</td>
<td>Power Distribution Boards (PDB) / Roll Table Distribution Boards</td>
<td>ABB, GE POWER CONTROL, ANDREW YULE, BCH, SCHNEIDER ELECTRIC, MAHESWARI ELECT, SIEMENS, L&amp;T, TRANSRECT, HAVELLS, STANDARD, TRICOLITE, ADVANCE POWER CONTROL</td>
</tr>
<tr>
<td>Page</td>
<td>Description</td>
<td>Vendors and Manufacturers</td>
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<td>81</td>
<td>Power Control Centre (PCC)</td>
<td>EPCC, BCH, TRANSRECT Industries, ANDREW YULE, Schneider Elect., CONTROL &amp; SWITCHGEAR, L &amp; T, SIEMENS, Maheshwari Elect, GE POWER CONTROL, ABB, NGEF, ADVANCE POWER CONTROL, TRIAL PARTIES MEDITRON, PECON, SWITCHING CKT, HANSU CONTROL, MANJUSHREE</td>
</tr>
<tr>
<td>82</td>
<td>Local Control Station (LCS) &amp; Control Desk Station</td>
<td>EPCC, BCH, TRANSRECT Industries, ANDREW YULE, Schneider Elect., CONTROL &amp; SWITCHGEAR, L &amp; T, SIEMENS, Maheshwari Elect, GE POWER CONTROL, ABB, NGEF, ADVANCE POWER CONTROL, EEW (EEW for indoor application only), TRIAL PARTIES MEDITRON, PECON, SWITCHING CKT, HANSU CONTROL, MANJUSHREE</td>
</tr>
<tr>
<td>83</td>
<td>Main Lighting Distribution Board (MLDB)</td>
<td>SIEMENS, L&amp;T / ECC, TRANSRECT, HAVELLS, STANDARD, SCHNEIDER ELECTRIC, MAHESWARI ELECT., BCH, GE POWER CONTROL, MDS, ADVANCE POWER CONTROL, EEW (EEW for indoor application and up to 200 A only), TRIAL PARTIES - MEDITRON, SWITCHING CKT., S&amp;S</td>
</tr>
<tr>
<td>84</td>
<td>Push buttons</td>
<td>GE POWER CONTROL, BCH, CONTROL &amp; SWITCHGEAR, L&amp;T, SIEMENS, TECHNIK, ESSEN, TELEMECHANIQUE, TRIAL PARTIES - VAISHNO, S&amp;S</td>
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<tr>
<td>85</td>
<td>Indicating LED LAMP assembly</td>
<td>BINOY, ESSEN DEINKI, SEIEMENS, TECHNIK, BCH, L&amp;T, ALTOS</td>
</tr>
<tr>
<td>86</td>
<td>Open Type Panels</td>
<td>EPCC, TRANSRECT, EEW</td>
</tr>
<tr>
<td>87</td>
<td>Current Transformer (LV)</td>
<td>ABB, JAYSHREE, PRAGATI, KAPPA, INTRAVISHT</td>
</tr>
<tr>
<td>88</td>
<td>Control Panel</td>
<td>SONITECH, EPCC, TIRUPATI ELECTRONICS, TRANSRECT, ADVANCE POWER CONTROL, EEW</td>
</tr>
</tbody>
</table>

7. Telecom Equipments

<table>
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<th>Page</th>
<th>Description</th>
<th>Vendors and Manufacturers</th>
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</thead>
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<td>89</td>
<td>C.C.T.V.System</td>
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<tr>
<td></td>
<td>1. CAMERA</td>
<td>PELCO, SANYO, SHARP, SONY, SAMSUNG</td>
</tr>
<tr>
<td></td>
<td>2. MONITOR</td>
<td>SHARP, HITACHI, PHILIPS, LG, SAMSUNG, SONY, SANYO</td>
</tr>
<tr>
<td>90</td>
<td>WALKIE-TALKIE SYSTEM</td>
<td></td>
</tr>
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</table>

List of approved vendors
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<tr>
<th></th>
<th>Hand Held Sets 2. Fixed Stations</th>
<th>MOTOROLA, YAESU, VERTEX STANDARD</th>
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<tbody>
<tr>
<td>91</td>
<td>Distributed Amplifier System</td>
<td>BOSCH, MEGA</td>
</tr>
<tr>
<td>92</td>
<td>Programable Loud Speaking Inter Com System (PROPAM System)</td>
<td>PHI-AUDIOCOM, BOSCH, MEGA</td>
</tr>
<tr>
<td>93</td>
<td>Conferencing System 1. Amplifiers 2. Chairman Delegate Unit 3. Speakers Note: All units should be of same make (in set).</td>
<td>BOSCH, AHUJA, MEGA, SHURE, Studio Master</td>
</tr>
<tr>
<td>94</td>
<td>Despatcher System (EPABX)/ InterCom / Hot Lines (Only Exchange)</td>
<td>SIEMENS, ERCISSION, AVAYA GLOBAL CONNECT, ALCATEL Business System, NORTEL, CORAL TELECOM</td>
</tr>
<tr>
<td>95</td>
<td>Batteries (More than 400AH) Lead Acid Batteries / Maintenance Free Batteries</td>
<td>EXIDE, Amara Raja, AMCO</td>
</tr>
<tr>
<td>96</td>
<td>Telephone Instrument</td>
<td>BEETEL, SIEMENS, PANASONIC</td>
</tr>
<tr>
<td>97</td>
<td>Yard Communication System</td>
<td>Phi-AUDIO COM, AHUJA, MEGA, BOSCH</td>
</tr>
<tr>
<td>98</td>
<td>Shop Announcement System Public Address System (PAS)</td>
<td>AHUJA, PHILIPS, BOSCH, MEGA, STUDIO MASTER, SHURE</td>
</tr>
<tr>
<td>99</td>
<td>Cable Jointing Kits</td>
<td>RAYCHEM</td>
</tr>
<tr>
<td>100</td>
<td>Optical Fibre Cable</td>
<td>MOLEX, LUCENT, FINOLEX, ERICSON, STERLITE, HFCL, OPTEL</td>
</tr>
</tbody>
</table>

**Cables**

**XLPE Cables HT**

Shriram Cables, Crystal Cables, Fort Gloster, Incab, KEI Industries, Fincab Cable, Phelps Dodge Thiland Ltd., Cable Corporation of India, Central Cables, Nagpur, LAPP Cables, Polycab Cables, RPG Cables, Sky Tone Elect., Uniflex Cables, Universal Cables, Gems Cab Industries, Delhi, Hindustan Vidyut Products Ltd., Krishna Elect. Industries.

**Rubber Cables ERP/ CSP**

List of approved vendors

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IMT Cables, Fort Gloster, Incab, Nangalwala Impex, United Cables, Fincab, Bhagwati Cables, Cable Corporation of India, Delton, Friends Cables, KEI Industries, LAPP Cables, NICCO Cables, Prestige Cables, RPG Cables, Shyam Cables, Uniflex Cables, Universal Cables, Servel Cables, KNG Plastic, Mans – Field Cables (For voltage up to 1100 V).

PVC Cables (Power & Control – Cu & Al – Armoured & Unarmoured).

Shriram Cables, Ajanta Elect., Fort Gloster, Incab, Prestige Cables, Fincab Cables, Rollex Electro Pvt. Limited, Sight Sound Electronic, Cable Corporation of India, Delton, Elkay, Finolex Cables, Friends Cables, Govind Cables, Insucon Cables, KEI Cables, LAPP Cables, Motherson Cables, NICCO Cables, Polycab Cables, RPG Cables, Reliance Engineers Limited, Shanti Cables, Shyam Cables, Sky Tone Elect., Toshniwal Cables, Uniflex Cables, Universal Cables, Servel Cables, Paramount Cables, GEMs Cab Industries, Delhi, Hindustan Vidyut Products Limited, Laxmi Power Cables, Mumbai, KNG Plastic, Rishabh Industries, Krishna Elect. Industries, Mans Field Cables (for voltage up to 1100 V), Pagoda Cables (For IS 694 and voltage up to 1100 V).

Welding Cable

IMT Cable Pvt. Limited; KNG Plastic, Nangalwala Impex.

Telephone Cables.


INSTRUMENTATION ITEM:

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<th>Sl.No.</th>
<th>Item</th>
<th>Preferred make</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>FIELD INSTRUMENTS</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Pressure instruments.</td>
<td></td>
</tr>
</tbody>
</table>
| 1.1   | Pressure/ differential pressure gauge. | 1. WIKA  
2. Ashcroft  
4. Forbes Marshall |
| 1.2   | A. Pressure/ differential pressure switches (Mech. Type) | 1. Switzer  
2. Solon  
3. Ashcroft  
4. Budenberg  
5. Forbes Marshall |
|       | B. Pressure/ differential pressure switches (Electronic type). | 1. IFM  
2. WIKA  
3. Kobold |
| 1.3   | Pressure/ Differential pressure transmitters. | 1. Emerson (Rosemount)  
2. Honeywell  
3. Yokogawa  
4. Siemens |
|   | Temperature Instrument/ Sensors | 5. E & H  
6. ABB |
|---|---------------------------------|------------------|
| 2. | Temperature gauges. | 1. WIKA  
2. Ashcroft  
3. Budenberg |
| 2.1 | Thermocouple & RTD/ thermo well. | 1. Tempsens  
2. Temptech  
3. Toshniwal Industries  
4. Detriv |
| 2.2 | Temperature Switch | 1. IFM  
2. WIKA  
3. Switzer |
| 2.3 | Temperature Transmitter. | 1. Emerson (Rosemount)  
2. Yokogawa  
3. Honeywell  
4. MTL  
5. Phoenix |
| 2.4 | Infrared radiation pyrometer/ portable. | 1. Land  
2. Raytek  
3. Iircon  
4. Impac  
5. Keller HCW |
| 3. | FLOW INSTRUMENT/ SENSORS | |
| 3.1 | Rotameters | 1. Forbes-Marshall  
2. Eureka Instruments  
3. Chemtrols  
4. Rota Instruments  
5. SMC |
| 3.2 | Orifice plate & flanges assembly/ venture, flow nozzle. | 1. Engineering Specialties  
3. Instrumentation Limited.  
4. Uni-Control |
| 3.3 | DP type flow/ level transmitters. | 1. Emerson (Rosemount)  
2. Honeywell  
3. Yokogawa  
4. Siemens  
5. E & H  
6. ABB |
| 3.4 | Flow Switch | 1. IFM  
2. Kobold  
3. Mobrey |
| 3.5 | Electromagnetic flow meter. | 1. Yokogawa  
2. Emerson (Rosemount)  
4. Endress & Hauser |

List of approved vendors
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<tr>
<th></th>
<th></th>
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</tr>
</thead>
</table>
| **3.6** Vortex Flow meter. | 1. Emerson (Rosemount)  
2. Forbes-Marshall  
3. Yokogawa  
4. Endress & Hauser |
| **3.7** Mass (coriolis) flow meter. | 1. Emerson (Rosemount)  
2. Forbes-Marshall  
3. Yokogawa  
4. Endress & Hauser |
| **4. LEVEL INSTRUMENTS** |   |   |
| **4.1** Level gauge (magnetic & reflex type) | 1. Chemtral  
2. Mobrey  
4. Solatron  
5. Hi-Tech (Levelstat) |
| **4.2** Level switch (conductivity type) | 1. Vega  
2. Endress & Hauser  
3. Pepperal & Fuchs |
| **4.3** Level switch (Capacitance/RF Type) | 1. Vega  
2. Endress & Hauser  
3. EIP Bulk  
4. Sapcon |
| **4.4** Level switch (Turning fork/rod type). | 1. Chemtral (Vega)  
2. Endress & Hauser  
3. Pepperal & Fuchs |
| **4.5** Level Switch (Float type) | 1. Emerson  
2. Forbes-Marshall  
3. Mobrey  
4. V-Automat |
| **4.6** Level Switch / Transmitter (Displacer type) | 1. Emerson  
2. Chemtrals (Eckard)  
3. Solartron  
4. Masonielan |
| **4.7** Level Switch/Transmitter (Ultrasonic type) | 1. Sick  
2. Endress & Hauser  
4. Siemens (Miltronics)  
5. Pepperal & Fuchs |
| **4.8** Level Switch/Transmitter (Radar type) | 1. Sick  
2. Endress & Hauser  
4. Solartron  
5. Pepperal & Fuchs  
6. Emerson (Rosemount) |
| **4.9** Level Switch/Transmitter (Nucleonic type) | 1. Concord International (Dr.Berthold)  
2. Emerson (Kay Ray) |

List of approved vendors

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### 5. CONTROL VALVES AND ACCESSORIES

| 5.1 | Control Valve | 1. Fisher-Xomox  
| | | 2. Instrumentation Ltd.  
| | | 3. Masonelian  
| | | 4. Valflo  
| | | 5. Samson Controls  
| 5.2 | Electrical Actuator | 1. Auma  
| | | 2. Limitorque  
| | | 3. Instrumentation Ltd. (Bernard)  
| | | 4. Beck  
| 5.3 | Pneumatic Actuator | 1. Fisher-Xomox  
| | | 2. Instrumentation Limited.  
| | | 3. Masonelian  
| | | 4. Valflo  
| | | 5. Samson Controls  
| 5.4 | Electro-Hydraulic Actuator | 1. Reineke  
| | | 2. Voith  
| 5.5 | Self-regulating pressure control valve. | 1. Samson Controls  
| | | 2. Forbes Marshall  
| | | 3. Instrumentation Limited.  
| | | 4. Fisher-Xomox  
| | | 5. Nirmal Industries.  
| 5.6 | I/P Converters | 1. Forbes Marshall (Moore products)  
| | | 2. ABB  
| | | 3. Emerson  
| | | 4. Honeywell  
| | | 5. Bells  
| 5.7 | Pneumatic Positioner. | 1. Instrumentation Limited.  
| | | 2. SMC  
| | | 3. Dresser Industries (Masonelian)  
| | | 4. Samson Controls  
| | | 5. Forbes Marshall (Arca)  
| 5.8 | Electro-pneumatic Positioner. | 1. Fisher-Xomox  
| | | 2. Siemens  
| | | 3. Masonelian  
| | | 4. Samson Controls  
| | | 5. Instrumentation Limited  
| | | 7. Yamatake  
| | | 8. ABB  
| 5.9 | Solenoid Valve | 1. Mac  
| | | 2. Herion, Rotex  

**List of approved vendors**
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<th>5.10</th>
<th>6.  CABLES</th>
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</thead>
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<td></td>
<td>Air Filter Regulator</td>
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</tr>
<tr>
<td></td>
<td>1. Shavo-Norgen</td>
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</tr>
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<td></td>
<td>2. Marsh-Bellofram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Placka</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Schrader-Schovill</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.1 Instrumentation Cables</td>
<td>1. Universal Cables</td>
</tr>
<tr>
<td></td>
<td>1. Shavo-Norgen</td>
<td>2. Delton</td>
</tr>
<tr>
<td></td>
<td>2. Marsh-Bellofram</td>
<td>3. Lapp Cables</td>
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<tr>
<td></td>
<td>3. Placka</td>
<td>4. Asian Cables</td>
</tr>
<tr>
<td></td>
<td>4. Schrader-Schovill</td>
<td>5. Brooks Cables</td>
</tr>
<tr>
<td></td>
<td>6. Belden</td>
<td>7. MEM</td>
</tr>
<tr>
<td></td>
<td>6.2 Thermocouple Compensating Cable.</td>
<td>1. Toshniwal Cables</td>
</tr>
<tr>
<td></td>
<td>1. Universal Cables</td>
<td>2. Paramount Cables</td>
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<td>2. Delton</td>
<td>3. Udey Pyro Cables</td>
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<td>3. Lapp Cables</td>
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<td>4. Asian Cables</td>
<td>5. MEM</td>
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**B. CONTROL ROOM INSTRUMENTATION**

<table>
<thead>
<tr>
<th>7.1</th>
<th>Distributed Control Systems (DCS)</th>
<th>1. YOKOGAWA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2. Honeywell</td>
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<td></td>
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<td>3. Emerson</td>
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<td></td>
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<td>4. Siemens (TELEPERM ME Plus).</td>
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<tr>
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<td>5. Toshiba, Japan</td>
</tr>
<tr>
<td>7.2</td>
<td>Programmable Logic Controllers</td>
<td>1. ABB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. GE-FANUC</td>
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<tr>
<td></td>
<td></td>
<td>3. Rockwell Automation</td>
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<tr>
<td></td>
<td></td>
<td>4. Siemens</td>
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<td></td>
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<td>5. L &amp; T (Quantum)</td>
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<td></td>
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<td>6. Schneider</td>
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<td>7.3</td>
<td>Digital Indicator</td>
<td>1. PEPL</td>
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<tr>
<td></td>
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<td>2. Yokogawa</td>
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<tr>
<td></td>
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<td>3. ABB</td>
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<td>4. Micro Controls</td>
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<td>5. Masibus</td>
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<td>6. Lectrotek</td>
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<td>7. Radix</td>
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<td>8. Honeywell</td>
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<td>7.4</td>
<td>Bar Graph Indicator</td>
<td>1. Masibus Instruments</td>
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<tr>
<td></td>
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<td>2. ABB</td>
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<td>3. Bells</td>
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<td>4. Yokogawa</td>
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<td></td>
<td></td>
<td>5. Lectrotek</td>
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<tr>
<td>7.5</td>
<td>Recorders (Chart less)</td>
<td>1. Eurotherm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Yokogawa</td>
</tr>
</tbody>
</table>

List of approved vendors
| 7.6 | Microprocessor Based Controller | 1. Yokogawa  
2. Siemens  
3. Honeywell  
4. Eurotherm  
5. MTL  
6. Forbes Marshall  
7. Toshiba |
| 7.7 | Digital Scanners | 1. Radix  
2. Micro Controls  
3. Masibus Instruments  
4. Lectrotek  
5. PEPL |
| 7.8 | DC Power Supply Unit | 1. Aplab  
2. Phoenix  
3. Schneider  
4. P&F |
| 7.9 | IS Interface/ Zenner Barrier | 1. Pepperl & Fuchs  
2. MTL  
3. Stahl |
| 7.10 | Signal Isolators | 1. Pepperl & Fuchs  
2. MTL  
3. Yokogawa  
4. Forbes Marshall (Protech)  
5. Phoenix |
| 7.11 | Annunciation System | 1. IIC  
2. Minilec  
3. Digicont  
4. MTL  
5. BETA Instruments  
6. Procon |
| 7.12 | Instrument Panels/ Control Desk | 1. Rittal  
2. Pyrotech  
3. Instrumentation Ltd. |
| 7.13 | Manual Loaders | 1. Masibus  
2. PEPL  
3. Lectrotek |
| 7.14 | Totalizer | 1. Masibus  
2. PEPL  
3. Lectrotek  
4. Bivak |
| **C.** | **ANALYTICAL/ SPECIAL INSTRUMENTS** |
| 8.1 | Gas Analysis Instruments | 1. ABB (H&B)  
2. Emerson  
3. Siemens  
4. Servomax  
5. Yokogawa |
8.2 Gas Detectors
1. Crowcon
2. MSA
3. Dragger
4. BW Technologies
5. Reiken-Keiki, Japan

8.3 Calorific Value (CV) Analysers
1. Reineke
2. Union
3. Yokogawa

8.4 Moisture Analysers (Nucleonic)
1. Concord International (Dr. Berthold)
2. Emerson (Analytical)
3. Sick

8.5 Dissolved O₂/PH/meter/Transmitter
1. Emerson (Analytical)
2. Forbes Marshall (Polymetron)
3. Yokogawa
4. ABB
5. Honeywell

8.6 IR type moisture analyzer.
1. Moistech
2. NDC (EMC)

8.7 Flame Detector
1. Honeywell
2. Durag Instruments
3. Yamatake

8.8 Vibration sensors & monitors.

a. For turbines and other high speed critical machines.
1. Bentley Nevada
2. Shinkawa (Forbes-Marshall)

b. For other applications.
1. SPM
2. Vibro Meter
3. Shindawa (Forbes-Marshall)
4. Rockwell

8.9 Opacity/ Dust concentration meter.
1. Codel (Forbes-Marshall)
2. Durag
3. Emerson
4. Land
5. GE Sensing
6. Chemtrol

8.10 Dip lance type molten metal temperature measurement system & T/C tips.
1. Ardee Busi. (Electronite)
2. Sidermes.

8.11 SPM analyzer.
1. Emerson
2. Yokogawa
3. Durag
4. ABB
5. Honeywell
6. Forbes Marshall (Codel)

8.12 SO x NO x analyzer.
1. Emerson
2. Yokogawa
3. ABB
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<thead>
<tr>
<th>9. INFORMATION &amp; AUTOMATION SYSTEMS</th>
</tr>
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<td><strong>9.1</strong> Computer (Servers)</td>
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<td>1. IBM</td>
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<td>2. HP</td>
</tr>
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<td>3. SUN</td>
</tr>
<tr>
<td><strong>9.2</strong> Computer (Work Stations/ Laptop)</td>
</tr>
<tr>
<td>1. IBM</td>
</tr>
<tr>
<td>2. COMPAQ</td>
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<td>3. LENOVO</td>
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<td>4. DELL</td>
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<td>5. HP</td>
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<tr>
<td><strong>9.3</strong> Dot Matrix Printer</td>
</tr>
<tr>
<td>1. EPSON</td>
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<td>2. TVSE</td>
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<tr>
<td><strong>9.4</strong> Laser / Inkjet Printer/ Scanners.</td>
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<tr>
<td>1. HP</td>
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<td><strong>9.5</strong> PLC</td>
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<td>1. ABB</td>
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<td>2. GE-FANUC</td>
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<td>3. ROCKWELL AUTOMATION</td>
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<td>4. SIEMENS</td>
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<td>5. L&amp;T (Quantum)</td>
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<td>6. SCHNEIDER</td>
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<th>10. NETWORK EQUIPMENT</th>
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<td><strong>10.1</strong> Active Switching &amp; Routing</td>
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<tr>
<td>1. CISCO</td>
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<td><strong>10.2</strong> Active other components.</td>
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<tr>
<td>1. Allied Telesys</td>
</tr>
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<td>2. RAD</td>
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<td>3. Xycel</td>
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<td><strong>10.3</strong> Passive Cabling components.</td>
</tr>
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<td>1. Lucent</td>
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<td>2. AMP</td>
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<td>3. Systimax</td>
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<tr>
<td>4. Molex</td>
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<td>5. R &amp; M</td>
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<tr>
<td><strong>10.4</strong> Passive Racks</td>
</tr>
<tr>
<td>1. APW President</td>
</tr>
<tr>
<td>2. Rittal</td>
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<tr>
<td>3. Krone</td>
</tr>
<tr>
<td><strong>10.5</strong> Industrial Grade Ethernet Switches.</td>
</tr>
<tr>
<td>1. Hirschmann</td>
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<td>2. Sixnet</td>
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<td><strong>10.6</strong> LCD Projector.</td>
</tr>
<tr>
<td>1. Hitachi</td>
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<tr>
<td>2. Canon</td>
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<td>3. Panasonic</td>
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<td>4. Soni</td>
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<tr>
<td>5. Sharp</td>
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<tr>
<td>6. HP</td>
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<tr>
<td><strong>10.7</strong> Computer Furniture</td>
</tr>
<tr>
<td>1. Godrej</td>
</tr>
<tr>
<td>2. Methodex</td>
</tr>
</tbody>
</table>

List of approved vendors
| 10.8 | UPS | 1. APC  
|      |     | 2. Tata Libert (Emerson) 
|      |     | 3. Fuji  
|      |     | 4. GE  

**11. WEIGH BRIDGE SYSTEMS**

| 11.1 | Static Rail Bridge | 1. M/s Pivotex OY, Finland  
|      |                   | 2. M/s Weighload Technologies, UK  
|      |                   | 3. M/s Procon Engineering Limited, UK  
|      |                   | 4. M/s Carlschenck AG, Germany  
|      |                   | 5. M/s Molen, Sweden  

| 11.2 | In-motion Rail Weighing Systems | 1. M/s Carl Schenck AG, Germany  
|      |                                 | 2. M/s AMTAB, Sweden  
|      |                                 | 3. M/s Pivotex OY, Finland  
|      |                                 | 4. M/s Weighload Technologies, UK  
|      |                                 | 5. M/s Procon Engineering Limited, UK  
|      |                                 | 6. M/s Eldigi Measurematics Pvt.Ltd., USA  

| 11.3 | Road Weigh Bridge | 1. M/s Carl Schenck AG, Germany  
|      |                   | 2. M/s AMTAB, Sweden  
|      |                   | 3. M/s Pivotex OY, Finland  
|      |                   | 4. M/s Weighload Technologies, UK  
|      |                   | 5. M/s Procon Engineering Limited, UK  
|      |                   | 6. M/s Eldigi Measurematics Pvt.Ltd., USA  
|      |                   | 7. M/s Sartorius Mechatronics, Bangalore  
|      |                   | 8. M/s Melter Teledo, UK.  

| 11.4 | Hopper Weighing System | 1. M/s Carl Schenck AG, Germany  
|      |                       | 2. M/s Molen, Sweden  
|      |                       | 3. M/s Siemens AG, Germany  
|      |                       | 4. M/s Procon Engineering Limited, UK  
|      |                       | 5. M/s Eldigi Measurematics Pvt.Ltd., USA  
|      |                       | 6. M/s Kistler-Morse Automation Ltd., USA  
|      |                       | 7. M/s Nova  

| 11.5 | Belt Weigher & Weigh Feeder | 1. M/s Carl Schenck AG, Germany  
|      |                               | 2. M/s S-E-G Instruments AB, Sweden  
|      |                               | 3. M/s Dosatec SA, Switzerland  
|      |                               | 4. M/s Procon Engineering Ltd., UK  

| 11.6 | Crane Weighing System | 1. M/s Technical Weighing Services, USA  
|      |                       | 2. M/s Eldigi Measurematics Pvt.Ltd., USA  
|      |                       | 3. M/s Eilon Engineering Ind. Weighing Systems  

List of approved vendors
| 11.7 | Load Cell | 1. M/s HBM, Germany  
2. M/s Siemens AG, Germany  
3. M/s Flintab, Germany  
4. M/s Sartorius Mechetronics, Germany  
5. M/s Tedia, Germany  
6. M/s BLH, UK  
7. M/s Molen, Sweden |
| 11.8 | Weight Transmitter | 1. M/s Sartorius Mechetronics, Bangalore  
2. M/s Flintak, UK  
3. M/s Carl Schenck AG, Germany  
4. M/s Molen, Sweden |

### SENSORS:

#### 12.1 TEMPERATURE SENSORS

| 12.1.1 Pt-Rh element | M/s Arora Matthey Ltd., Kolkata  
M/s Hindustan Platinum  
M/s Parekh Platinum ltd., Mumbai |
| 12.1.2 Contact Thermometers | M/S A.N. Instruments  
M/S Detriv Instrumentation & Electronics Pvt. Ltd., Mumbai  
M/S Waaree Instruments, Mumbai  
M/S Toshniwal Industries Pvt. Ltd., Ajmer  
M/S Wika Instruments India Pvt. Ltd., Pune |
| 12.1.3 Portable / Hand held pyrometers | M/s Tempsens Instruments (i) Pvt. Ltd., Udaipur  
M/S Toshniwal Industries Pvt. Ltd., Ajmer  
M/S Eurotherms Del India Pvt. Ltd., Kolkata  
M/S Waaree Instruments, Mumbai  
M/S Nagman Instruments & Electronics Pvt. Ltd., Chennai |

### ACWE EQUIPMENTS

#### 1. AIR WASHHING UNITS

M/s Batliboi, M/s ACCO, M/s ABB FLAKT, M/s F Harley Calcutta, M/s Mesina Bombay, M/s S K Systems Kolkata, M/s Air Technico, Kolkata. M/s Marco Blowers, Kolkata

#### 2. WINDOW AIR CONDITIONERS

M/s ACCO, M/s VOLTAS, M/s Blue Star, M/s SIEL AIRCON (USHA), M/s Carier Aircon. M/s Videocon

List of approved vendors
3. Packaged Air Conditioners (With only Open/Semi-Sealed Compressors)  
   M/s Volta, M/s Frick, M/s Batliboi, M/s Mesina, M/s Kirloskar, M/s Blue Star, M/s Sulzer Pune, M/s Lintern

4. Chilled Water Unit  
   M/s Frick India, M/s Blue Star, M/s Voltas, M/s Airtic, India (for all capacities) M/s Mesina (for Capacities up to 3 TR/5TR)

5. Air Handling Units (For A/Cs)  
   M/s Frick India, M/s Volta, M/s Batliboi, M/s Airtic India, M/s Blue Star

6. Cooling Towers  
   M/s Paharpur, M/s Frick India, M/s Mhir, M/s Mesina, M/s Anil Enterprises

7. Central A/Cs  
   M/s Volta, M/s Frick, M/s Batliboi, M/s Airtic India, M/s Blue Star* ( * with open compressors)

8. Water Coolers  
   M/s Shriram (Usha), M/s Volta, M/s Blue Star

9. Refrigerators  
   M/s Godrej, M/s Kelvinator, M/s BPL, M/s Videocon, M/s Volta, M/s Whirlpool

10. Refrigerant Compressors

   a. For Room A/Cs  
      Shriram AW1500

   b. For Water Coolers  
      Shriram AW1000, Shriram SR412.

   c. For packed A/Cs  
      Batliboi, Voltas, Kirlosker Pneumatic.

   d. Open type  
      Freeze King, KPC, Frick, ACCEL, Alphalavel.

   d. For Central A/Cs  
      Frick, Freeze King, ACCEL, Voltas, Batliboi, KPC.

11. Split A/Cs  
   M/s Volta, M/s Amtrex, M/s ACCO, M/s Shriram, M/s Blue Star, M/s Videocon.

HYDRAULICS & PNEUMATIC EQUIPMENTS

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Description</th>
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<tbody>
<tr>
<td>Shriram AW1500</td>
<td>For Room A/Cs</td>
</tr>
<tr>
<td>Shriram AW1000</td>
<td>For Water Coolers</td>
</tr>
<tr>
<td>Shriram SR412</td>
<td></td>
</tr>
<tr>
<td>Batliboi, Voltas</td>
<td>For packaed A/Cs ( Semi Hermetic)</td>
</tr>
<tr>
<td>Freeze King, KPC</td>
<td>Open type</td>
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<tr>
<td>Freeze King, ACCEL</td>
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<tr>
<td>ACCEL, Voltas,</td>
<td></td>
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<tr>
<td>Batliboi, KPC</td>
<td></td>
</tr>
<tr>
<td>M/s Volta, M/s Amtrex, M/s ACCO, M/s Shriram, M/s Blue Star, M/s Videocon</td>
<td></td>
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</tbody>
</table>
### A) Hydraulic Equipments and Spares

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Spare/ equipment.</th>
<th>Name of preferred makes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Complete Hydraulic System</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s MOOG</td>
</tr>
<tr>
<td>1.1</td>
<td>Complete Hydraulic System with servo control.</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s MOOG</td>
</tr>
<tr>
<td>1.2</td>
<td>Complete Hydraulic System with proportional and conventional controls.</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s YUKEN, M/s PARKER</td>
</tr>
<tr>
<td>2.</td>
<td>Hydraulic Pumps</td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Gear Pump</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s YUKEN, M/s PARKER</td>
</tr>
<tr>
<td>b.</td>
<td>Vane Pump</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s YUKEN, M/s PARKER</td>
</tr>
<tr>
<td>c.</td>
<td>Axial Piston Pump</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s PARKER</td>
</tr>
<tr>
<td>d.</td>
<td>Radial Piston Pump</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s YUKEN, M/s PARKER  &lt;br&gt; M/s L&amp;T, M/s HAWE</td>
</tr>
<tr>
<td>3.</td>
<td>Hydraulic Motors</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s PARKER, M/s L&amp;T, M/s HAGLUNDS  &lt;br&gt; M/s DANFOSS</td>
</tr>
<tr>
<td>4.</td>
<td>Servo Valves</td>
<td>M/s MOOG, M/S BOSCH REXROTH</td>
</tr>
<tr>
<td>5.</td>
<td>Proportional Valves</td>
<td>M/s MOOG, M/S BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s YUKEN, M/s PARKER</td>
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<tr>
<td>6.</td>
<td>Hydraulic Control Valves</td>
<td></td>
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<tr>
<td>6.1</td>
<td>Directional Control valves</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s YUKEN, M/s PARKER</td>
</tr>
<tr>
<td>6.2</td>
<td>Pressure Control Valves</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s YUKEN, M/s PARKER</td>
</tr>
<tr>
<td>6.3</td>
<td>Flow Control Valves</td>
<td>M/s BOSCH REXROTH  &lt;br&gt; M/s EATON VICKERS  &lt;br&gt; M/s YUKEN, M/s PARKER</td>
</tr>
<tr>
<td>7.</td>
<td>Hydraulic Cylinders</td>
<td></td>
</tr>
<tr>
<td>7.1</td>
<td>a) Critical Application Cylinder – As per drawing.</td>
<td>M/s Wipro, M/s Oscar, M/s USHA  &lt;br&gt; Telehoist, M/s Veljan</td>
</tr>
</tbody>
</table>

List of approved vendors
<p>| | | |</p>
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</table>
| **7.2** | a) General Application Cylinders  
– As per drawing. | M/s Wipro, M/s Oscar, M/s Veljan, M/s IPH, M/s Salzgitter, M/s USHA-Telehoist. |
|   | b) General Application Cylinders  
– As per catalogue. | M/s BOSCH Rexroth, M/s Eaton Vickers, M/s Parker |
| **8.** | Hydraulic Filters |   |
|   | 8.1 Filter for systems having servo and proportional control valves | M/s Hydac, M/s Pall, M/s Stauff |
|   | 8.2 Filter for systems having conventional control valves. | M/s Hydac, M/s Pall, M/s Stauff, M/s EPE, M/s Parker |
| **9.** | Seals. |   |
|   | 9.1 Seals for critical hydraulic cylinders (**)) | M/s Hunger, M/s Parker, M/s Busak-Shamban, M/s Merkel |
|   | 9.2 Seals for general purpose hydraulic cylinder  
Imported | M/s Hunger, M/s Parker, M/s Busak-Shamban, M/s Merkel |
|   |   | M/s Spareage, M/s Omco, M/s Vako, M/s Softex, M/s Reeco |
|   |   | Machined  
Seals | M/s Sealjet, M/s Ankseals |
| **10.** | Ball Valves | M/s Stauff, M/s Parker, M/s Hydac |
| **11.** | Accumulators | M/s Hydac, M/s EPE, M/s Fawcet - Christie |
| **12.** | Hydraulic Pipe Clamps | M/s Hyd-Air, M/s Stauff, M/s Parker, M/s Hydac |
| **13.** | Bare Hoses | Sae 100  
R1/R2/R9/R10  
/R11/R13, EN853  
1ST/1SN/2ST/2SN,  
EN856 4SP/4SH  
SAE100R1/R2,  
EN853 1ST/1SN/2ST/2SN  
| M/s Dunlop- Hiflex, M/s Aeroquip, M/s Manuli, M/s Gates  
M/s Parker – Markwel, M/s Pix, M/s Superseal |
| **14.** | Pipe fittings | M/s Hyd-Air, M/s Parker, M/s Hyloc-Hydrotechnic, M/s Stauff |
| **15.** | Quick release couplings | M/s Aeroquip, M/s Parker, M/s Stauff, M/s Sterling, M/s Holmbury |
| **16.** | Pressure gauges | M/s Wika, M/s Parker – UCC |
| **17.** | Minimess hose and couplings | M/s Parker, M/s Stauff, M/s Hydrotechnic |

(**) Critical means the items whose failure may cause more then two hours production loss.

**B) Pneumatic Equipments and Spares**

List of approved vendors

Page 22 of 22
| 1. | Air booster pumps/ intensifiers | M/s Maximator, M/s Haskel |
| 2. | a) Control valves  
b) Directional control valves  
c) Pressure control valves  
d) Flow control valves  
e) Logic control valves | M/s Parker, M/s Ross, M/s Nucon, M/s Spirax, M/s Martonair, M/s Schrader Bellow, M/s Crouzet  
M/s Telemecanique, M/s Festo |
| 3. | a) Air preparation unit  
b) Filters  
c) Regulators  
d) Lubricators  
e) Combination units  
f) Diffusers  
g) Silencers  
h) Mufflers  
i) Breathers | M/s Airmatic, M/s Parker, M/s Veljan – Hydair, M/s Schrader Bellow, M/s Nucon, M/s Festo, M/s Hydroline |
| 4. | Air driers | M/s Emsky |
| 5. | Pipe and fittings  
Various types of pipes fittings, PVC, PU and nylon turbine. | M/s Mecman. M/s Legris, M/s Parker |

**PUMPS & COOLING TOWERS**

**A. COOLING TOWERS**

- M/s Shri Ram Tower Tech. Ltd.,  
- M/s Enviro Clean System Ltd.,  
- M/s GEA Cooling Towers Chennai,  
- M/s Engg. Services & Accessories Mumbai,  
- M/s Paharpur Cooling Tower Calcutta,  
- M/s Bridge & Roof Ltd. Calcutta,  
- M/s BSBK Bilai,  
- M/s DBR Cooling Tower Calcutta.

**B. PUMPS**

- **a)** Horizontal Split Casing Centrifugal Pumps  
  Q = 500 M³/Hr. and above  
  H = upto 80 M WC, Direct coupled.  
  RPM = 1000/1440/2830  
  Construction - CI, Clear water service.  
  M/s Kirloskar,  
  M/s Jyoti,  
  M/s Mather & Platt,  
  M/s KSB,  
  M/s Beacon Weir,  
  M/s Voltas.

- **b)** Multi-Stage Centrifugal Pumps for Cold/Hot water service.  
  M/s Bharat Pumps, M/s KSB, M/s Bareja,  
  M/s Kirloskar, M/s Mather & Platt,  
  M/s Sulzer/ Khimline.
<table>
<thead>
<tr>
<th></th>
<th>Vertical Radial/ Mixed flow/ Axial flow/ Turbine Pumps for clear water service upto 300 M$^3$/Hr.</th>
<th>M/s Kirloskar, M/s Mcnally, Bangalore, M/s Kishore, M/s Jyoti, M/s KSB.</th>
</tr>
</thead>
<tbody>
<tr>
<td>d)</td>
<td>Vertical Radial/ Mixed flow axial flow/ Turbine Pumps for Clear water service more than 300 M$^3$/hr.</td>
<td>M/s Kirloskar, M/s Jyoti, M/s KSB, M/s Voltas.</td>
</tr>
<tr>
<td>e)</td>
<td>Sludge Pumps for pumping sludge from effluent treatment plant.</td>
<td>M/s HIL, M/s Warman Indore, M/s Akay Industries, M/s Beacon.</td>
</tr>
<tr>
<td>f)</td>
<td>Slurry Pumps Vertical &amp; Horizontal</td>
<td>M/s Kirloskar, M/s Mcnally, M/s KSB, M/s Kishore, M/s Beacon Weir.</td>
</tr>
<tr>
<td>g)</td>
<td>Drainage Pumps for pits, Tunnels Q= 100M$^3$/Hr., H= up to 30 M</td>
<td>M/s Kishore, M/s KSB, M/s Kirloskar, M/s Darling, M/s Sam Pumps, M/s Sehra.</td>
</tr>
<tr>
<td>h)</td>
<td>Dosing Pumps/ Metering Pumps</td>
<td>M/s Shape tool, M/s Ion Exchange, M/s Toshniwal, M/s H-Welore.</td>
</tr>
<tr>
<td>i)</td>
<td>Submersible monobloc Pumps for special drainage and Lifting Applications.</td>
<td>M/s Kirloskar, M/s Kishore, M/s Darling, M/s Calama, M/s Sehra.</td>
</tr>
</tbody>
</table>

**VALVES**

A. For all steam services, feed water to boiler, hot condensate & other critical applications for Pressure 20 Kg/ CM2 (Class 300) and above. | M/s BHEL, M/S L & T, M/s KSB, M/s Fouress Engineering Co., M/s NECO Valves (No subsidiary), M/s Leader Valves Ltd. (Up to Class 300 only) M/s Mehta Nanavati (Up to Class 300 only). M/s Fluide Line Valves Company Pvt., Ltd., Ahemedabad. M/s Chemtaech Industrial Valves. Note: These parties are eligible for categories (B) & (C) also. |
<table>
<thead>
<tr>
<th>B.</th>
<th>For compressed air, water, nitrogen and other medium pressure application (6 to 18 kg/cm²).</th>
<th>M/s Kirloskar, M/s Valve India, M/s Globe, M/s Sealmet, M/s Levcon, M/s H. Sarkar &amp; Company, M/s VIPJ Industrial Enterprises Pvt. Ltd., M/s Ronex Engineering Company, M/s SPM Engineering, M/s OSWAL Industries, Ahmadabad. Note: These parties are eligible for category (C) also.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.</td>
<td>CS Gate/ Globe Valve</td>
<td>M/s BDK Engineering Industries Ltd., Hubli, M/s BHEL, Tiruchirapalli, M/s Fouress Engg (India) Ltd., Aurangabad, M/s KSB Pumps Limited, Kolkata, M/s Larsen &amp; Toubro Ltd. (Audco), Chennai, M/s Leader Valves Ltd., Jalandhar, M/s Oswal Industries Limited, Ahmedabad.</td>
</tr>
</tbody>
</table>

| List of approved vendors |
| Sluice/ CI Gate Valves | M/s BDK Engg. Industries Ltd., Hubli  
M/s Calsens Private Ltd., Kolkata  
M/s GM Dalui & Sons, Howrah  
M/s H. Sarker & Co., Kolkata  
M/s Hawa Engineers Ltd., Ahmedabad  
M/s Kirloskar Brothers, Nagpur  
M/s Leader Valves Ltd., Jalandhar  
M/s Venus Pump & Engg. Works, Howrah  
M/s Neta Valves Pvt. Ltd., Jalandhar |
| A) For all sizes and ratings. | M/s Ronex Engg. Company, Kolkata  
M/s Upadhyaya Valve Man. Pvt. Ltd., Kolkata  
M/s Steam & Mining Industries, Kolkata  |
| B) For sizes up to NB 100 mm & PN 10 rating. | (*) Vendors appearing under ‘A’ shall be eligible for ‘B’ also. |
| Plug Valve. | M/s BDK Engg. Industries Limited, Hubli  
M/s Fisher Xomox Sanmar Ltd., Chennai  
M/s Larsen & Toubro Limited (Audco), Chennai  
M/s Habonim Vaas Automation Pvt. Ltd., Chennai  |
| Cock Valve for Gas applications. | M/s Larsen & Toubro Limited, Chennai (Audco)  |
| Check Valve / Non-return valve. | M/s Advance Valves Pvt. Ltd., Noida  
M/s BDK Engg. Industries Ltd., Hubli  
M/s Fouress Engg. (India) Ltd., Aurangabad  
M/s Inter Valves (Pvt) Limited, Pune  
M/s KSB Pumps Limited, Kolkata  
M/s Larsen & Toubro Limited (Audco), Chennai  
M/s Leader Valves Pvt. Ltd., Jalandhar  
M/s Oswal Industries Ltd., Ahmedabad  |
| Fabricated Gate Valve. | M/s Fouress Engg. (India) Ltd., Aurangabad  
M/s Larsen & Toubro Limited, Chennai (Audco)  
M/s Zimmermann & Janseen, Duren, Germany  |

List of approved vendors
M/s Spirax Marshall Limited, Nagpur. |
| --- | --- | --- |
M/s Oswal Industries Ltd., Ahmedabad.  
M/s Larsen & Toubro Limited, Chennai (Audco)  
M/s Fouress Engg. (India) Ltd., Aurangabad.  
M/s KSB Pumps Limited, Kolkata.  
M/s BHEL, Trichurapalli.  
M/s Leader Valves Pvt. Limited, Jalandhar |
| A. For all sizes and ratings. | M/s BDK Engg. Industries Limited, Hubli.  
M/s Oswal Industries Ltd., Ahmedabad.  
M/s Larsen & Toubro Limited, Chennai (Audco)  
M/s Fouress Engg. (India) Ltd., Aurangabad.  
M/s KSB Pumps Limited, Kolkata.  
M/s BHEL, Trichurapalli.  
M/s Leader Valves Pvt. Limited, Jalandhar |
| B. For sizes up to 50 mm and Class No. 150 ratings. | M/s Neta Valves Pvt Ltd., Jalandhar  
M/s Hawa Valves (India) Pvt Ltd., Mumbai  
M/s MH Valves Pvt Ltd., Ahmedabad.  
(*) Vendors appearing under ‘A’ shall be eligible for ‘B’ also. |
| N. | Knife Edge Gate Valve. | M/s Orbinox India Pvt. Limited, Coimbatore.  
M/s Fouress Engg. (India) Ltd., Aurangabad.  
M/s Energo Engg., Delhi. |
M/s Zoloto Industries, Jalandhar.  
M/s Neta Valves Pvt Ltd., Jalandhar.  
M/s Sant Valves Pvt Ltd., Jalandhar. |

• MECHANICAL EQUIPMENT :

1. Gear Box  
M/s Elecon, M/s NAW, M/s FMG  
M/s Shanthi, M/s Greaves.  

2. Geared Coupling  
M/s NAW, M/s HICLIFF, M/s Concord,  
M/s FMG, M/s Roma Mechanical Works,  
M/s Elecon, M/s David Brown, M/s Greaves.  

3. Fluid Coupling  
M/s Voith India, M/s Pembrill, M/s Fluidrive,  
M/s Fluidomat Ltd.  

4. Resilient Coupling  
M/s Wellman (Bibby).  

5. Conveyor Idler  
M/s Elecon, M/s TRF, M/s Conveyor System,  
M/s IGP Engineering, M/s Indiana,  
M/s Roll Well Conveyor Components,  
M/s Kali Handling Equipment, M/s Radiant.  
M/s Golden Engineering Industries, Bhilai.  

6. Electro Mechanical Vibro Feeder  
M/s IC/ Electromag.  

7. Vibrating Screen  
M/s IC, M/s Electromag, M/s HIL.  

List of approved vendors

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### Paint

<table>
<thead>
<tr>
<th>Category (A) – Critical Application</th>
<th>Preferred make</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Category (B) – Critical Applications for Automobiles’ Body Painting</th>
<th>Preferred make</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duco Paint (Black, White, PO Red) Dulex Paints (Black, Pale Cream, Bus Green, DA Grey, Signal Red, PO Red, White, Golden, Yellow)</td>
<td>M/s ICI Paints</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category – Non Critical Application</th>
<th>Preferred make</th>
</tr>
</thead>
</table>

### COMPRESSORS

<table>
<thead>
<tr>
<th>1. Compressors</th>
<th>Preferred make</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/s ELGI, M/s Ingersoll, M/s Consolidated Pneumatics, M/s Khosla, M/s Kirloskar, M/s Kay International (P) Ltd.*</td>
<td>(*Only for Twin Lobe)</td>
</tr>
</tbody>
</table>

### PIPES

#### SEAMLESS PIPES

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Item</th>
<th>Preferred make</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Seamless Pipes

<table>
<thead>
<tr>
<th>Manufactures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/s Maharashtra Seamless, Gurgaon</td>
</tr>
<tr>
<td>M/s BHEL, Trichi</td>
</tr>
<tr>
<td>M/s Heavy Metals &amp; Tubes, Mumbai</td>
</tr>
<tr>
<td>M/s ISMT, Kolkata</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traders:</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/s MJ Patel, Mumbai</td>
</tr>
<tr>
<td>M/s Sunil Kumar Ramesh Kumar, Jamshedpur</td>
</tr>
<tr>
<td>M/s MICCO Metal Industries, Mumbai</td>
</tr>
<tr>
<td>M/s Jayant Metals, Mumbai</td>
</tr>
<tr>
<td>M/s Asian Metals, Mumbai</td>
</tr>
</tbody>
</table>

## ERW Pipes

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Item</th>
<th>Preferred make</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ERW Pipes</td>
<td>Manufactures:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M/s Bhilai Auxiliaries, Bhilai</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M/s Precision Pipes, Kolkata</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M/s PS Steel Tubes, Bhilai</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M/s Feedback Steel Tubes, Gaziabad</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M/s Surya Roshni Limited, Haryana</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traders:</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/s MJ Patel, Mumbai</td>
</tr>
<tr>
<td>M/s Sunil Kumar Ramesh Kumar, Jamshedpur</td>
</tr>
<tr>
<td>M/s MICCO Metal Industries, Mumbai</td>
</tr>
<tr>
<td>M/s Jayant Metals, Mumbai</td>
</tr>
<tr>
<td>M/s Asian Metals, Mumbai</td>
</tr>
</tbody>
</table>

Note: For ERW pipes dia 219 and above – M/s Rourkela Steel Plant.

## Turbines & Blowers:

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Item</th>
<th>Preferred make</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Boiler</td>
<td>M/s BHEL, M/s Thermax Babcock Wilcox, M/s Alsthom</td>
</tr>
<tr>
<td>2.</td>
<td>Turbine</td>
<td>M/s BHEL, M/s Alsthom, M/s Novosky, M/s Siemens, M/s Kaluga</td>
</tr>
<tr>
<td>3.</td>
<td>Blower</td>
<td>M/s BHEL, M/s Novosky, M/s Mann Turbo, M/s Siemens, M/s Alsthom</td>
</tr>
</tbody>
</table>

## Portable Maintenance Tools

List of approved vendors
### A. Electrical equipment.

<table>
<thead>
<tr>
<th>Items</th>
<th>Preferred makes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. St.Grinder</td>
<td>M/s Ralli Wolf</td>
</tr>
<tr>
<td>2. Angle Grinders</td>
<td>M/s Bosch Power Tools</td>
</tr>
<tr>
<td>3. Drilling Machines</td>
<td>M/s Kulkarni Power Tools</td>
</tr>
<tr>
<td>4. Bench Grinders 6”</td>
<td>M/s Black &amp; Decker</td>
</tr>
<tr>
<td>5. Sanders/ Polishers</td>
<td></td>
</tr>
<tr>
<td>6. Sander</td>
<td></td>
</tr>
</tbody>
</table>

### B. Lifting / Pulling Equipments.

<table>
<thead>
<tr>
<th>Items</th>
<th>Preferred makes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pulling and lifting machines</td>
<td>M/s Tirfor, M/s Max Pul, M/s Indef</td>
</tr>
<tr>
<td>2. Hand Operated chain pulley block.</td>
<td>M/s Indef</td>
</tr>
<tr>
<td>3. Hand operated gear traveling trolleys.</td>
<td>M/s Indef</td>
</tr>
<tr>
<td>4. Hydraulic Jacks</td>
<td></td>
</tr>
<tr>
<td>a. Remote Controlled type (operating pressure + 700 bar)</td>
<td>M/s OEW, M/s Orione, M/s Enerpack</td>
</tr>
</tbody>
</table>

### C. Pneumatic Tools

<table>
<thead>
<tr>
<th>Items</th>
<th>Preferred makes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chipping Hammer</td>
<td>M/s CPT</td>
</tr>
<tr>
<td>3. Angle Grinders</td>
<td></td>
</tr>
<tr>
<td>4. Drilling Machine</td>
<td></td>
</tr>
<tr>
<td>5. Die Grinders</td>
<td></td>
</tr>
<tr>
<td>6. Impact Wrenches</td>
<td></td>
</tr>
</tbody>
</table>

### D. Miscellaneous Tools

<table>
<thead>
<tr>
<th>List of approved vendors</th>
</tr>
</thead>
</table>

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<table>
<thead>
<tr>
<th>Items</th>
<th>Preferred makes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Die less hyd. Crimping tools (6-500 sq.mm size)</td>
<td>M/s Ismal make</td>
</tr>
<tr>
<td>2. Ring Spanners of asserted sizes.</td>
<td>M/s Taparia, M/s Jhalani</td>
</tr>
<tr>
<td>3. Socket spanners.</td>
<td>M/s Evarest, M/s Mekaster</td>
</tr>
<tr>
<td>M/s Taparia, M/s Mekaster</td>
<td></td>
</tr>
</tbody>
</table>

**Bearings.**

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Category</th>
<th>Suppliers</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Category (Supercritical)(*)</td>
<td>SKF, FAG &amp; TIMKEN (Overseas manufacturers only)</td>
<td>Bearings whose country of origin is China are not acceptable.</td>
</tr>
<tr>
<td>2</td>
<td>Category II (Critical)(*)</td>
<td>SKF, FAG, TIMKEN, NSK, SNR, NTN, KOYO (Overseas/Indigenous manufacturers)</td>
<td>Bearings whose country of origin is China are not acceptable.</td>
</tr>
<tr>
<td>3</td>
<td>Category III (General) (*)</td>
<td>SKF, FAG, TIMKEN, NTN. NSK, SNR, KOYO, ZKL, GPZ, MPZ, SPZ, URB, ZWZ, INA, NBC, AEC, ABL, JMC, NRB, ARB (Overseas / Indigenous manufacturers)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Non standard Russian origin (*)</td>
<td>SPZ, MPZ, GPZ &amp; ZKL, NTN, NSK, KOYO, URB (who have already developed certain Russian bearings )</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Uncommon, Non-standard bearings of other origins: (*)</td>
<td>IKO, NACHI, ELGES, ASAHI, FAFNIR , TORRINGTON, UKF, NADELA, RBC, UNIMAC, McGill, HOFFMAN, MRC, NDH, OILITE, MATHWS, HOESCH ROTE ERDE, ROLLWAY, GAMET, POLLARD, HYATT, EICH, RHP and COOPER</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Sleeves</td>
<td>SKF, FAG, TIMKEN, NTN. NSK, SNR, KOYO, for cat-I and Cat.-II. MIDHA &amp; MIDHA, SIBCO</td>
<td>If bearing manufacturers recommend and stand guarantee for their bearings.</td>
</tr>
</tbody>
</table>
Supercritical:

Bearings whose failure can result in stoppage of either upstream or downstream process or require more than 8 hrs. for restoration of the equipment and the process of the department is stopped during this period or can result in huge consequential losses are classified as supercritical bearings. Based on this, 206 sizes are classified as supercritical bearings.

Critical:

Bearings whose failure can result into a stoppage of the process of the shop for less than 8 hours but more than 2 hours or affects downstream or upstream units to some extent are classified as critical bearings. Based on this, 595 sizes are classified as Critical bearings.

General:

Bearings whose failure can result in stoppage of process for less than 2 hours and sometimes no process stoppage is required immediately and standby or alternative arrangements can be made to maintain process continuity are classified as General purpose bearings. Based on this, 1882 sizes are classified as general purpose bearings.

Non standard Russian origin:

Bearings of supercritical / critical / general nature application supplied alongwith OEMs of Russian, CIS, or former East Block countries, whose substitutes are not available from other manufacturers are grouped under this category. 231 sizes are classified in this category.

Uncommon, Non-standard bearings of other origins:

The varieties of bearings whose consumption pattern is so low that no other manufacturer is ready to develop alternatives are classified as uncommon, non-standard of other origin. 127 sizes are classified in this category.

Sleeves:

Sleeves are to be procured from bearing manufacturers only for their bearings or from sources recommended by bearing manufacturers so that performance of bearing is guaranteed.

Chemicals / Special Material

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Type</th>
<th>Standard/ Specification</th>
<th>Preferred manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Admixtures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Plasticizer</td>
<td>IS 9103</td>
<td>FOSROC, STP, SIKA, PIDILITE, CICO, MC, BECK</td>
</tr>
</tbody>
</table>

List of approved vendors
### 2. Grouts

<table>
<thead>
<tr>
<th>Type</th>
<th>IS/ASTM</th>
<th>List of Approved Vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Cementitious, freeflow, non-shrink.</td>
<td>ASTM C 1107</td>
<td>FOSROC, STP, SIKA, PIDILITE, CICO, MC, BECK, ACC</td>
</tr>
<tr>
<td>Minimum compressive strength.</td>
<td>1 day : 250 kg/ sq.cm 28 days : 600 kg/ sq.cm</td>
<td></td>
</tr>
<tr>
<td>b. Epoxy based.</td>
<td>ASTM C 881</td>
<td>FOSROC, STP, SIKA, PIDILITE, CICO, MC, BECK, ATUL</td>
</tr>
<tr>
<td>Minimum compressive strength.</td>
<td>7 days : 150 kg/ sq.cm</td>
<td></td>
</tr>
<tr>
<td>Minimum flexural strength</td>
<td>7 days : 250 kg/ sq.cm</td>
<td></td>
</tr>
</tbody>
</table>

### 3. Floor hardeners.

<table>
<thead>
<tr>
<th>Type</th>
<th></th>
<th>List of Approved Vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Metallic</td>
<td>FOSROC, STP, PIDILITE, CICO, BECK</td>
<td>Minimum compressive strength. 28 days : 700 kg/ sq.cm.</td>
</tr>
<tr>
<td>b. Non-metallic</td>
<td>FOSROC, STP, SIKA, PIDILITE, CICO, MC, BECK</td>
<td>Minimum compressive strength. 28 days : 600 kg/ sq.cm.</td>
</tr>
</tbody>
</table>

### 4. Curing and sealing compounds.

<table>
<thead>
<tr>
<th>Type</th>
<th>IS/ASTM</th>
<th>List of Approved Vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Polymer based.</td>
<td>ASTM C 309 Type-2</td>
<td>STP, PIDILITE, CICO, MC</td>
</tr>
<tr>
<td>b. Wax based</td>
<td>ASTM C 309 Type-1</td>
<td>FOSROC, STP, SIKA, CICO, MC</td>
</tr>
</tbody>
</table>

### 5. Repair compounds.

<table>
<thead>
<tr>
<th>Type</th>
<th>IS/ASTM</th>
<th>List of Approved Vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Quick setting cementations.</td>
<td>FOSROC, STP, SIKA, PIDILITE, CICO, MC</td>
<td>Minimum compressed strength 28 days : 250 kg/ sq.mm</td>
</tr>
<tr>
<td>Initial set time.</td>
<td>2 minutes – max.</td>
<td></td>
</tr>
<tr>
<td>b. SBR Latex</td>
<td>FOSROC, STP, SIKA, PIDILITE, MC</td>
<td>List of approved vendors</td>
</tr>
</tbody>
</table>

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### List of Approved Vendors

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<table>
<thead>
<tr>
<th>Solid content</th>
<th>Not less than 42%</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH value</td>
<td>Not less than 10</td>
</tr>
<tr>
<td>Density</td>
<td>More than 1 kg/litre.</td>
</tr>
<tr>
<td>c. Epoxy bond coat</td>
<td>ASTM C 881, Type-2</td>
</tr>
<tr>
<td>d. SFMC</td>
<td>FOSROC, STP, SIKA, CICO,</td>
</tr>
<tr>
<td></td>
<td>MC, BECK, PRODORITE</td>
</tr>
<tr>
<td>Minimum compressive strength.</td>
<td>1 day: 100 kg/sq.cm</td>
</tr>
<tr>
<td></td>
<td>28 days: 500 kg/sq.cm</td>
</tr>
</tbody>
</table>

   a. Screed (*)                 
   b. Self leveling (*)          
   c. Epoxy floor coating (*)    

7. Protective and water proof coatings.
   a. Epoxy based.               
      ASTM C 881, Type-3, Gr.2   
      Class-B & C               
   b. Polymer modified cements. 
      ASTM C 309                

8. Joint sealments (Polysulphide) (*) 
   IS 12118                     

(*) Not recommended for purchase. Can be applied through contracts including supply and application of materials as per requirements and manufacturer’s specifications.

**Fire Fighting Equipment.**


**Polymer Chute Liner.**

| 1. Polymer Chute Liner. | - | M/s Jyoti Cero Rubber, Jamshedpur. |

List of approved vendors

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GENERAL SPECIFICATION
FOR
PREFERRED MAKES

(Refer enclosed volume - 4 of the tender documents for GS-13 (Preferred makes) of GTS for Bhilai Steel Plant-SAIL)