

- (c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.
- (d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate pasts. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing.
- (e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.

27.7.2 Welded Joints

- (a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.

27.7.3 Flanged Joints

- (a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.
- (b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.
- (c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.

27.8.00 Bends/elbows/mitre bends/Tees/Reducers & other fittings

27.8.1 Unless otherwise specified elbows shall be of long radius type.



- 27.8.2 For pipe sizes up to 65 Nb, long radius forged elbows or seamless pipe bends shall be used. Pipe bends, if used, shall be cold bent to a radius measured to the centre line of pipe of 3 to 5 times the pipe diameter.
- 27.8.3 For steel pipes 80 Nb and above, seamless long radius forged elbows shall be used. For pipe size 250 Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. Bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.
- 27.8.4 Mitre bends are not acceptable in case of rubber lined mild steel pipes.
- 27.8.5 For pipe fittings such as reducers and tees, the material shall be to ASTM-A-234 gr. WPB up to 300 NB. For pipe reducers and tees above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fittings shall conform to the dimensional standard of ANSI B-16.9.
- However, for pipes upto 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.
- For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.
- 27.8.6 Stainless steel fittings shall conform to either ASTM-A-182, Gr. 304 (316 for Sea water application, if any) or ASTM-A-403, Gr. WP 304 (316 for Sea Water application, if any) Class-S, for sizes upto and including 50 mm NB, i.e. the fitting shall be of seamless construction.
- However, for stainless steel fittings above 50mm NB, the same shall conform to ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any), Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.
- 27.8.7 In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.

27.9.00 Flanges

- 27.9.1 Flanges shall be slip on type. Welding of flanges in tension is not permitted.
- 27.9.2 All flanges and flanged drilling shall be to ANSI B 16.5/BS EN-1092 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 (316 for Sea water application, if any) or equivalent.

27.10.00 Specific technical requirement of laying buried pipe with anti corrosive treatment

The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.

27.10.1 Trenching

- (a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822 or any international standard.
- (b) Free access shall be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained.
- (c) The free working space shall conform to IS: 5822. The trench shall be excavated so as to provide minimum cover of 1000 mm between the top of the pipe and finished grade.
- (d) Prior to lowering and laying pipe in any trench, the bidder shall backfill and compact the bottom of the trench or excavation in accordance with IS: 5822 to provide an acceptable bed for placing the pipe.
- (e) Coating and Wrapping shall be done as under.

27.10.2 Preparation and cleaning of piping

- (a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Kerosene will not be permitted for cleaning. This cleaning operation shall be immediately followed by priming with the mechanical priming machine.
- (b) Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.
- (c) On the internal surface for pipes 1000 NB and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.
- (d) The cleaning and priming operation shall be carried out at site. The entire pipe length shall be cleaned but the ends of the pipes shall be left without coating for a distance of 230 mm for joints, which shall be coating manually at site after laying, welding and testing the pipe.

27.10.3 Coating and wrapping/ Anti corrosive Protection Coal tar tape

- a. Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are:

- (1) Coating primer (coal tar primer)
- (2) Coating enamel (coal tar enamel)
- (3) Wrapping materials.

All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable.

Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat.

Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of Coats and wraps shall be decided based on soil corrosivity/resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available.

Total thickness of completed coating and wrapping shall not be less than 4.0 mm.

- b. Alternatively, the anti-corrosive protection for buried pipes can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to IS 15337 or equivalent. These-tapes shall be applied hot over the cold coal tar primer in steps of 2 mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total thickness of the finished protective coating shall be 4.0 mm min.

27.10.4 Trench bed preparation and back filling

Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.

27.10.5 Laying of galvanized steel (GI) pipes

All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joints shall be applied with Zinc silicate paste.

All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and "anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.

27.11.00 Cleaning and Flushing

- 27.11.1 All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.
- 27.11.2 Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done in such a manner that the coating on MS pipe is not affected.
- 27.11.3 After erection, all water lines shall be hydro tested at 1.5 times the design pressure.
- 27.11.4 All compressed air pipe work shall be cleaned by blowing compressed air.

27.12.00 Painting of Pipes**27.12.1 Buried Piping****Internal surfaces**

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Tests to be carried out after application : Bond/ Adhesion test, Holiday test

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Coal tar primer compatible with coal tar enamel grade. The number of coats shall be two with a DFT of 35 microns each.
- (iii) Coal tar enamel shall be applied. A single spiral inner wrap of glass fibre tissues shall be applied overlapping at least 25 mm ensuring impregnation of glass fibre tissues in the first coat. The second coat of enamel and second outer wrap of glass fibre felt, Type – I to IS: 7193-1974 will be applied in the same way confirming to Table – 10 of IS – 10221 – 1982.

The total thickness of the coating will not be less than 4.0 mm

- (iv) Alternatively Wrapping with coal tar based anticorrosion tape conforming to IS 15337: 2003 is also acceptable in lieu of s.no. (iii) above. Wrapping thickness shall be 4.0 mm.

NOTE : CW piping shall be encased in 500 mm thk RCC.

Tests to be carried out after application : Bond/ Adhesion test, Holiday test

27.12.2 Overground Piping

Internal surfaces

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 140 microns (min).

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 140 microns (min).

27.12.3 Other requirements

- (a) Paint manufacturers instructions shall be followed in method of application, handling, drying time etc.
- (b) The color of the finish paint shall be as per approved color-coding.
- (c) If finish paint was applied in shop, one coat of finish paint shall be applied at site.
- (d) The dry film thickness of paint shall not be less than 0.15 mm.

27.12.4 Color code for identification

The pipes shall be color painted/banded for identification as per the approved color-coding scheme and shall be generally as per IS-9404.

27.13.00 Specification for hangers and supports

27.13.1 All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.

27.13.2 While designing supports for rubber lined pipes special consideration should be given. Any kind of welding on these pipes is not allowed after rubber lining.

- 27.13.3 Hanger for piping 65 mm Nb and larger and all spring support assemblies regardless of size shall be completely engineered in conformance with the provisions of power piping code ANSI B 31.1.
- 27.13.4 Hangers, saddles, supports etc. shall be fabricated from plates/pipes sections conforming to ASTM A 53/IS: 2062/IS:226/ or equivalent. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. The structural steel work shall be as per IS: 800/BS:4360. Insulation protection saddles shall be used at support point of all insulated piping.
- 27.13.5 The support shall be so interspaced as to minimize sagging of the pipes and to keep them within permissible limits where pipes are full with the conveying media.
- 27.13.6 The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.
- 27.13.7 All pipe supports shall be designed to provide an absolute minimum head room of 2.5 m from floor in passages/walkways.
- 27.13.8 At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.
- 27.13.9 All components of hangers/support shall be provided with two coats of primer (red oxide paint) at shop before dispatch to site. After erection they shall be given finish coat of Long Oil Synthetic enamel to IS: 2932 of total DFT 100 to 140 microns. CLH & VLH will be primed with Epoxy Zinc rich primer of 50 micron followed by finish painting of Aliphatic Acrylic Polyurethane or equivalent of DFT 65 microns.

27.14.00 Design/Construction/Material Particulars of Gate/Globe/Check Valves/Globe Stop Valve/Butterfly Valve

27.14.1 GENERAL

- (a) All valves shall be suitable for the service conditions i.e. flow, temperature and pressure, at which they are required to operate.
- (b) General requirement of valves are as indicated below:
 - (1) The valves as well as all accessories shall be designed for easy disassembly and maintenance.
 - (2) Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.
 - (3) All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be of outside screw and yoke type.
 - (4) All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced.

- (5) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined.
 - (6) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. For valves of size 350 mm and above either bevel or spur gearing shall be provided to facilitate manual operation.
 - (7) The valves coming in vacuum lines shall be of extended gland type and / or water sealed.
- (c) The actuator-operated valves shall be designed on the basis of the following:
- (1) The internal parts shall be suitable to support the pressure caused by the actuators.
 - (2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
 - (3) All actuator-operated valves shall be provided with hand operated gearing mechanism also.
 - (4) All actuators operated valves shall open/close fully within time required by the process.
- (d) Valves coming under the purview of IBR shall meet IBR requirements.
- (e) Gate/sluice valves shall be used for isolation of flow. Gate valves shall be provided with the following accessories in addition to other standard items:
- (1) Hand wheel
 - (2) Position indicator (for above 50 mm NB valve size)
 - (3) Draining arrangement wherever required.
- (f) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction.
- (g) Check valves shall be used for non-return service. They shall be swing check type or double door (Dual plate) check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening/closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600 mm NB.
- (h) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing.

- (i) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.
- (j) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.
- (k) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer.
- (l) All valves except those with rising stems shall be provided with continuous mechanical position indicator; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.
- (m) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS-1538 for fitting shall be applicable.

27.14.2 VALVE BODY MATERIAL

Valve body material for various services shall be as follows:

Valve body material for water application like circulating water, Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) & drinking water shall be cast iron for sizes 65 NB and above; gun-metal for sizes 50 NB and below.

For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.

DM water: SS body and disc alongwith SS internals.

Condensate: Cast Carbon Steel/Forged Carbon Steel.

- 27.14.2.1 The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes and the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.

Standards and Codes

AWWA-C-504

Rubber seated butterfly valves



1 x 660 MW - Panki Thermal Power Station

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BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.
IS-778	Gun-metal gate, globe and check valves for general purpose.
BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.
IS-780	Sluice valves for water works purpose (50-300 mm size)
IS-2906	Sluice valves for water works purpose (350-1200 mm size)
IS-5150	Cast iron wedge and double disc gate for general purpose.
BS-5152	Specification for cast iron globe valves
BS-5153	Cast iron check valves for general purpose.
IS-5312	Swing check type reflux (non-return) valves
ANSI B 16.34	Standard for valves
API-594	Standard for Dual-check valves
API-600	Steel gate valves
ANSI-B-16.10	Valves face to face and other relevant dimension
API-598	Valves inspection test

27.14.2.2 End Connections

The end connections, shall comply with the following:

Socket welding (SW) – ANSI B 16.11

Butt Welding (BW) – ANSI B 16.25

Threaded (SC) – ANSI B 2.1

Flanged (FL) – ANSI B 16.5 & AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges)

27.14.2.3 All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).

27.14.2.4 All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.

- 27.14.2.5 All gun metal body valves shall have screwed ends.
- 27.14.2.6 All flanged end valves/specialties shall be furnished alongwith matching counter flanges, fasteners, gaskets etc. as required to complete the joints

27.15.00 Check Valves

- 27.15.1 Check valves shall comply with the following characteristics:
- (a) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);
 - (b) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.
 - (c) In the case of swing check valves, the body seat shall be inclined at such an angle from the vertical as will facilitate closing and prevent chatter.
- 27.15.2 Drilling on flanges of flanged valves must correspond to the drilling on flanges of the piping system on which the valves are to be installed.
- 27.15.3 All flanged valves intended for installation in steel piping systems shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class.
- 27.15.4 Counter flanges to be installed on air pipes shall be screwed-on type irrespective of size.

27.16.00 Globe Valves

- 27.16.1 The globe valves shall have the following characteristics;
- Straight conveyed flow
- Right angle
- Preferably, the valves shall be of the vertical stem type.
- 27.16.2 Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.
- 27.16.3 The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.
- 27.16.4 For the regulating valves, valves with regulating plug & parabolic outline disc type is preferred.

- 27.16.5 All motorized globe valves with regulating plug for which indication of percentage (%) opening are required in the control room shall be provided with necessary position transmitter.

27.17.00 Gate valves

All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate.

Gate valves shall be of the solid/elastic or articulated wedge disc and rising stem type.

27.18.00 Air Release Valve

- (a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.
- (b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.
- (c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS:210 Gr. FG 260 and spindle shall conform to high tensile brass.
- (d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/butterfly valve.

125# ASA cast iron body, double ball construction air release valve with flanged ends to ASA B 16.10; and bolted cover to release the air. Construction materials shall be as below:

Body, cover	:	Cast iron to IS:210 Gr.FG 260
Bolts	:	Light weight leather/wooden balls
Seats	:	Bronze to ASTM-B-62
Cover packing	:	Braided asbestos
Float	:	Wood/rubber

27.19.00 Butterfly Valves**27.19.1 Design/Construction**

- (a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm nb diameter. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition.
- (1) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable.
 - (2) The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.
 - (3) For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.
 - (4) The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.
 - (5) The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration.
 - (6) The operating mechanism shall be mounted directly on or supported from the valve body.
 - (7) All valves shall be complete with:
 - Position indicator (located in a visible place)
 - Arrow indicating the flow direction;

Adjustable mechanical stop limiting devices to prevent over

Travel of valve disc in open/close position.

All valves shall be "tight shut off"

(8) Hand operated valves shall have the following

Local hand controls

The hand controls shall close the valve with clockwise rotation.

The hand controls shall be dimensioned to guarantee an easy maneuver under most severe conditions.

The hand controls shall be provided with locking systems suitable to avoid the disc assuming a non-desirable position during the operation.

Hand wheel shall be made of malleable iron with arms and rims of adequate strength. The hand wheel of diameters 300 mm or less shall be provided with handles for ease of operation. The pulling force required on the hand wheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure.

Valves-350 Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.

Valves-350 Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque. It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.

Limit and torque switches (if applicable) shall be enclosed in water tight enclosures alongwith suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.

27.19.2 Material of Construction (Butterfly Valves)

Materials and other design details shall be as indicated below:

(a) Cast Iron Butterfly valves

Body & Disc	ASTM A48, Gr. 40 with 2% Ni/ IS: 210. Gr. FG-260, with 2% Ni and epoxy coated
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Shaft BS 970 431 S: 291/EN 57, or
AISI-410 or AWWA-permitted shaft material
equivalent to EN-57/AISI-410 or better.

Seat ring 18-8 Stainless steel
Seal Nitrile Rubber

(b) Stainless Steel Butterfly Valves

Body & Disc ASTM A 351, Gr. CF8M/ASTM-A-182-Gr. 304

Shaft ASTM A 182, Gr. 316/ASTM-A-479 Gr.
316/Equivalent

Disc & Seat Rings EPT/BUNA-N/Neoprene

(c) Carbon Steel Butterfly Valves

Body & Disc ASTM A 216, Gr. WCB
Shaft ASTM A 182, Gr. 304/ASTM-A-479 Gr.
304/Equivalent

Disc & Seat Rings EPT/BUNA-N/Neoprene

27.19.3 Proof of Design Test (Type Test) for Butterfly Valves

Proof of Design (POD) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual POD test shall be conducted by the bidder in the presence of Employer's representative.

All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of POD test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the POD test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of POD test of AWWA-C-504.

27.20.00 MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)

(a) The materials shall generally comply with the following:

(1) Cast Steel Valves

Body & bonnet ASTM A 216 Gr. WCB/
ASTM A 105

Disc for non-return Valves ASTM A 216 Gr. WCB/
ASTM A 105

Trim. ASTM A 182 Gr. F6 or Equivalent

(2) Stainless Steel Valves

Body & Bonnet ASTM A 351 Gr. CF 8M/



ASTM A 182 Gr. 304

Disc -do-

Trim. ASTM 182 Gr. F. 316
/ASTM-A-479 Gr. 316 or Integral
with body**(3) Cast Iron Valves**

Body & bonnet BS 1452 Gr. 14/IS-210 Gr. FG 260

Seating surfaces and rings 13% chromium steel/13% Chrome
overlay

Disc for non-return valves BS 1452 Gr. 14/IS-210 Gr FG 260

Hinge pin for non-return valves AISI 316

Stem for gate globe valves 13% chromium steel or Equivalent

Back Seat 13% chromium steel / 13%
Chrome overlay**(4) Gun Metal Valves**

Body and bonnet IS 318 Gr. 2/Equivalent Standard

Trim -do-

- (b) Cast iron body valves shall have high alloy steel stem and seat.
- (c) Material for counter flanges shall be the same as for the piping.

27.21.00 Float Operated Valves

- (a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.
- (b) **DESIGN AND CONSTRUCTION FEATURES**
The following design and construction feature of the valve shall be the minimum acceptable.
- (c) Valves shall be right-angled or globe pattern.
- (d) Valves shall be balance piston type with float ball.
- (e) Leather liner shall not be provided.
- (f) The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or Is: 210 Grade 200 or equivalent, and float shall be of copper with epoxy painting of two (2) coats.
- (g) Valves shall be suitable for flow velocities of 2 to 2.5m/sec.
- (h) The valves shall have flanged connections.

27.22.00 PAINTING OF VALVES:

Two (2) coats of primer followed by three (3) coats of epoxy of approved color code/shade (usually same as that of connected piping) shall be applied to all exposed surfaces except stainless steel surface, Galvanized steel surface and gun metal surface at shop as required to prevent corrosion, before dispatch. The use of grease/oil other than light grade mineral oil, for corrosion protection is prohibited. The total DFT of painting shall be 150 micron (minimum). If during transport, unloading/unpacking or erection at site any part of the painted surface gets damaged, the same shall be made good by the contractor by repainting with compatible painting primer and enamel to the satisfaction of the project manager.

27.23.00 RUBBER EXPANSION JOINTS

- 27.23.1 All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.
- 27.23.2 The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.
- 27.23.3 The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.
- 27.23.4 The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.
- 27.23.5 Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.
- 27.23.6 Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipelines.
- 27.23.7 The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the 'duck' shall be either a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.
- 27.23.8 The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.
- 27.23.9 All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr. B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.

- 27.23.10 The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges.
- 27.23.11 All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.
- 27.23.12 Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.
- 27.23.13 Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.
- 27.23.14 Bidder to note that any metallic part which comes in contact with DM / Corrosive water shall be of stainless steel material.

27.24.00 STRAINERS**27.24.1 Simplex type**

The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition fitted with a removable plug. The material of construction of various parts shall be as follows:

- | | | |
|-----|------------------|---|
| (a) | Body | IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent) |
| (b) | Strainer Element | Stainless steel (AISI 316) |
| (c) | End connection | Screwed upto 50 mm Nb, and flanged above 50 mm Nb |

27.24.2 Duplex type

- (a) The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow.
- (b) Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.

- | | |
|------|---|
| Body | IS: 318, Gr. 2
Up to 50 mm Nb, and IS:210, |
|------|---|

Gr. FG 260 of ASTM-A-515 Gr. 75/IS-2062
Gr. B and internally epoxy-painted above 50 mm NB.

Strainer element Stainless steel (AISI 316)

End connection Screwed up to 50 mm Nb, and
Flanged above 50 mm Nb.
Gasket shall be of full face type

- (c) The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data.
- (d) The size of the strainer and the flow direction will be indicated on the strainer body casting.
- (e) Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.

27.24.3 Three shop coats of paint preceded by two coats of primer shall be applied to all exposed surfaces as required to prevent corrosion. All parts shall be adequately protected for rust prevention. The use of grease or oil other than light grade mineral oils for corrosion protection is prohibited

PART OF SPECIFICATION PE-TS-426-160-A001

ANNEXURE-I**SPECIFICATION FOR DUCTILE IRON (DI) PIPES, FITTINGS & SPECIALS****1.00.00 GENERAL**

This specification covers the specific requirement of design, material, manufacture / fabrication, constructional features, inspection & testing, transportation, handling, laying, site testing and annual maintenance contract of Ductile Iron (DI) Pipes, Joints, fittings and specials.

2.00.00 CODES AND STANDARDS

The material, design, manufacture, dimensions, tolerances, mechanical properties, internal cement mortar lining, external zinc coating along with bituminous finished layer, inspection and testing of DI water pipes shall comply with the latest Indian Standard, "IS 8329 (Centrifugally cast (spun) ductile iron pressure pipes for water, gas and sewage – specification)" or equivalent international standard unless otherwise specified elsewhere in this Technical Specification.

Sl. No.	Code No.	Code Title
1	IS 8329	Centrifugally cast (spun) ductile iron pressure for water, gas and sewage - specification
2	IS 9523	Ductile iron fittings for pressure pipes for water, gas and sewage - specification
3	IS 5382	Rubber sealing rings for gas mains, water mains and sewers
4	IS 638	Specification for Sheet Rubber Jointing and Rubber Insertion Jointing
5	IS 12288	Code of practice for use and laying of Ductile Iron pipes
6	IS 11606	Methods of sampling of Cast Iron pipes and fittings
7	IS 455	Portland slag cement
8	IS 12330	Sulphate resisting Portland cement
9	IS 6452	Specification for high alumina cement for structural use
10	IS 6909	Specification for supersulphated cement
11	IS 8112	43 grade ordinary Portland cement
12	IS 1387	General requirements for supply of metallurgical materials
13	IS 1500	Methods for Brinell hardness test for metallic materials
14	IS 1608	Mechanical testing of metals – tensile testing
15	ISO 2531	Ductile iron pipes, fittings, accessories and their joints for water applications
16	ISO 4179	Ductile iron pipes and fittings for pressure and non-pressure pipelines – Cement mortar lining
17	ISO 4633	Rubber seals – Joint rings for water supply, drainage and sewerage pipelines – Specification for materials

18	ISO 8179	Ductile iron pipes – External zinc-based coating – Part 1: Metallic zinc with finishing layer
19	ISO 8179	Ductile iron pipes – External zinc coating – Part 2: Zinc rich paint with finishing layer
20	ISO 8180	Ductile iron pipelines – Polyethylene sleeving for site application
21	ISO 10802	Ductile iron pipelines – Hydrostatic testing after installation
22	ISO 10803	Design method for ductile iron pipes
23	ISO 16132	Ductile iron pipe and fittings – seal coats for cement mortar linings
24	AWWA M 41	Ductile iron pipe and fittings (guideline code for design, manufacturing, testing, jointing, laying & installation etc.)
25	BS EN 545	Ductile iron pipes, fittings, accessories and their joints for water pipelines – Requirements and test methods

3.00.0 DUCTILE IRON (DI) PRESSURE PIPES:

3.01.01 DESIGN REQUIREMENTS

Pipeline shall be sized considering C value as 140 and velocity 2-3m/sec.

3.01.01 Classification:

The class of DI pipes to be provided shall be as specified in the data sheet attached with this sub-section. The external diameter and wall thickness of socket and spigot pipes for the specified Class shall be as per IS 8329 or equivalent international standard.

3.02.00 Joints:

3.02.01 Generally push-on flexible joints shall be provided for pipe to pipe connection as per IS 8329 or equivalent international standard. However mechanical joints, flange joints and restrained joints can also be used.

3.02.02 Rubber gaskets

Rubber gasket used with push-on flexible joints shall conform to the requirements of IS: 5382 or equivalent international standard. Rubber gaskets for use with flanged joints shall conform to IS 638 or approved equivalent international standard.

4.00.00 DI FITTINGS & SPECIALS

4.01.0 Design Requirements

4.01.01 Classification

The DI fittings shall be as per IS 9523 or equivalent international standard.

4.02.00 External layer:

The DI fittings supplied shall be provided with external protection of metallic zinc coating or zinc rich paint coating with finishing layer of bituminous paint as per IS 9523 or equivalent international standard.

4.03.00 Internal lining:

The fittings shall be provided with suitable cement mortar internal lining as per IS 9523 or equivalent international standard.

4.04.00 Joints between pipe and fittings:

4.04.01 Generally , Push-on flexible joints shall be provided for pipe to fitting connection as per IS 9523 or equivalent international standard. Flange joints, wherever required, shall conform to the requirements of IS 9523 or equivalent international standard.

4.04.02 Rubber gaskets

All the DI fittings shall be provided with rubber gaskets for each socket. Rubber gasket used with push-on flexible joints shall conform to the requirements of IS: 5382/ IS 9523 or equivalent international standard.

Rubber gaskets for use with flanged joints shall conform to IS 638 or equivalent international standard.

5.00.00 TYPE TESTS

5.01.00 The contractor / manufacturer shall carry out the type tests as listed in this specification on the pipes to be supplied under this contract.

5.02.00 The type tests shall be carried out in presence of the Employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.

5.03.00 In case the contractor / manufacturer has already conducted such specified type test(s), he may submit the type test reports to the Employer during detailed engineering for consideration of waiver of conductance of such type test(s) or otherwise as deemed fit by Employer. Such test(s) should have been either conducted at an independent laboratory or duly approved by accredited third party agency. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract.

5.04.00 The type test shall be performed whenever a significant change is made in the design, material or process of manufacture or a new size or size range of the product is being supplied by the manufacturer.

5.05.00 THE FOLLOWING TYPE TESTS SHALL BE CARRIED OUT:

5.05.01 Joint Leak Tightness Test:

- a) Tests for joints (push-on flexible joints) shall be conducted as per the guidelines of ISO 2531 to establish adequate joint performance with respect to internal pressure, external pressure and vacuum pressure under both normal alignment of joints and deflected alignment of joints as dictated in ISO 2531.
- b) Tests for Leak tightness and mechanical resistance of flanged joints shall be conducted as per ISO 2531.

5.05.02 Cement Lining Smoothness Type Test:

The contractor / manufacturer should have carried out Cement Lining Smoothness test to establish C value (Hazen & William's constant) of the offered DI pipe as 140. Necessary certificate for the same shall be furnished to the employer.

In case the contractor / manufacturer has not carried out the test, the same shall be carried out by the contractor / manufacturer within the scope of this contract.

5.05.03 Ring bend test:

Ring bend test for 3% deflection with respect to external diameter of DI pipe offered shall be conducted by contractor / manufacturer to prove that internal cement mortar lining does not come off the substrate surface of Ductile Iron on random basis for each manufacturing lot.

If the contractor / manufacturer of pipes do not have the facility for this type test at his own works, the same can be arranged by him to conduct and demonstrate the test.

6.00.00 LAYING AND JOINTING OF DI PIPES:

6.01.00 Laying, erection and jointing of DI pipelines at field / site shall be under the direct supervision of Manufacturer (Supplier) from whom pipe is sourced / procured.

For underground laying, Special provisions in trench shall be made for accommodating socket (Bell) of each pipe, as applicable so that barrel is uniformly rested on even trench bed surface, which is well compacted as recommended in codes / standards.

6.02.00 Pipeline anchorage

Pipeline shall be securely anchored at dead ends, tees, bends, tapers and valves to resist thrust arising from internal pressure. Suitable thrust blocks made of concrete shall be designed and cast-in-situ.

7.00.00HYDRAULIC TESTING OF PIPELINES

After laying and jointing, the pipeline shall be tested for soundness and leak tightness of pipes, fittings and joints, and soundness of any construction work. The pipeline may be tested in sections.

Water and other facilities as required for such hydro testing shall be arranged by the Contractor.

7.01.00 Hydraulic Testing of Sections

The section under test shall be filled with water, taking care that all the air is displaced either through vents at the high points or by using a pig or a sphere. After filling, the pipeline shall be slightly pressurized for a period of time to achieve stable conditions.

The pipeline is then pressurized up to the full test pressure as per the relevant standard. The test pressure shall be maintained for a period of not less than 10 minutes to reveal any defects in the pipes, joints or anchorages. The test pressure shall be measured such as to ensure that the required test pressure is not exceeded at any point in the entire pipeline.

If the test is not satisfactory, the fault shall be found and rectified. Methods employed for finding faults shall be as per IS 12288.

7.02.00 Hydraulic Testing of Complete Pipeline

After all the sections have been joined together on completion of section testing, a test on the complete pipeline shall be carried out. This test shall be carried out at a pressure as specified in the data sheet attached with this sub-section. During the test, the pressure at any point in the pipeline shall not exceed the pressure as specified in the data sheet attached with this subsection.

8.00.00 DATA SHEET FOR DI PIPES, FITTINGS & SPECIALS

Sl.No.	Description	Units	Parameters
1	Pipe Material		Ductile Iron (DI) pipe internally cement mortar lined and externally coated with metallic zinc & finishing layer of bituminous paint.
2	Applicable standards		IS/ISO/AWWA/BS as listed in technical specification
3	Hazen & William's Constant		140
4	Pipe class		K7/K9 as per IS 8329 or equivalent international standard. Compatible with system pressure requirement.
5	Pipe Joint type		Push-on flexible joints as per IS 8329 / Flanged/ Restraint

6	Pipe Joint type at valves, pumps and other piping		Flange Joints as per IS 8329 & IS 9523
7	Welded-on Flange (as applicable) pressure class		Compatible with system pressure requirement.
8	DI fittings class		Compatible with system pressure requirement.
9	DI fittings flange (as applicable) class		PN 25
10	Restrain mechanism at bends, specials etc.		Thrust Blocks
11	Maximum field hydrostatic test pressure	N/mm ²	Shut-off pressure or (operating pressure+surge pressure) whichever is higher for not less than 10 minutes
	At each section (not exceeding 1000m)		
	Complete pipeline		As per IS: 12288 Table-1
12	Other requirements		As per technical specification

Section - M9 : Mill Reject Handling System**1.0 PNEUMATIC CONVEYING SYSTEM****1.1 PIPING, VALVES, STRAINERS AND FITTINGS**

- a) All pipes and fittings shall be tested as per applicable code.
- b) All valves shall be hydraulically tested for body, seat and back seat (if applicable) as per relevant Standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure. Valves shall be offered in unpainted condition only.
- c) Functional checks of the valves for smooth opening and closing shall also be done.
- d) Strainer body shall be hydraulically tested. One of each type and size of Strainer shall be tested for Pressure drop v/s flow rate, if not tested earlier.

1.2 PRESSURE AND STORAGE VESSELS:

- (a) Atmospheric Tank
 - i) All weld joints shall be DP tested and complete tanks shall be water fill tested.
 - ii) All atmospheric storage tanks fabricated and erected at site shall be subjected to all tests (Hydro, NDT and Vacuum) according to design code as applicable.
- (b) Pressure Vessel
 - (1) NDT on weld joint shall be as per respective code requirements or the minimum as specified as below:
 - i) 100% DPT on root run of butt weld, nozzle welds and finished fillet welds.
 - ii) 10% DPT on all finished butt welds
 - iii) 10% RT (covering all 'T'/cross joints) of butt welds
 - (2) Butt Welds of dished ends shall be stress relieved and subjected to 100% RT.
 - (3) Each finished vessels shall be hydraulically tested to 150% of the design pressure for duration of 30 minutes.

1.3 PACKAGE AIR COMPRESSOR

In addition to Hydraulic tests of pressure parts, performance test of the compressor shall be done for FAD, pressure, power consumption, as per relevant code. Noise and vibration shall also be measure.

1.4 BAG FILTERS

- 1.4.1 Leakage test shall be carried out for casing and other pressure parts



1.4.2 Pulsing and sequential test on bag filter cages shall be done.

1.5 MONO RAIL HOIST/CHAIN PULLEY BLOCKS

1.5.1 Chain pulley blocks shall be tested as per IS:3832

1.5.2 UT & MPI/DPT shall be done on gear blank, pinion shaft, axles.

1.5.3 Proof Load Test on hooks shall be carried out followed by DPT.

1.5.4 100% Radiography on weld joints under tension and 25% radiography on compression butt joints followed by 100% DPT shall be done for rope drum, girder, end carriage etc.

1.5.5 Complete hoists shall be tested for load and overload test as per IS:3177

PART OF SPECIFICATION PE-TS-426-160-A001





**1X660 MW PANKI EXTN
TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION No: PE-TS-426-160-A001

**PACKAGE: MILL REJECT SYSTEM
(PNEUMATIC TYPE)**

SECTION-I

REV. 00

DATE: JUNE 2019

ANNEXURES

Annexure	Title
A	Equipment Design / Selection Criteria
B	Quality Assurance
C	Sub-vendor List
D	Mandatory Spares
E	Maintenance Tools and Tackles
F	Drawings/documents to be submitted after award of contract
G	Performance guarantees requirement, trial run, commissioning requirement, operation & erection manual, third party inspection, FQP requirement
H	P&ID for Mill Reject System
I	Reference drawings - General Arrangement drawing of mill - Foundation plan of mill - Plot plan - Compressor room layout

PART OF SPECIFICATION PE-TS-426-160-A001



1X660 MW PANKI EXTN

TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)

SPECIFICATION No: PE-TS-426-160-A001

PACKAGE: MILL REJECT SYSTEM
(PNEUMATIC TYPE)

SECTION-I

SUB-SECTION-IA

REV. 00

DATE: JUNE 2019

ANNEXURE A

EQUIPMENT DESIGN/SELECTION CRITERIA

Mill Data		
	No. of mills (working & standby) at 100% BMCR with worst coal firing	8 mills (8 working + 0 standby)
	Type of Mills	HP 1103 WITH DYNAMIC CLASSIFIER (PLANETARY GEAR BOX)
	Elevation of Mill Reject Spout (Tramp iron spout)	2.400m from EL. 0.0m
	Mill Arrangement	Side mill layout
Reject Data		
	Reject Temperature (Normal/Design) (deg. C)	Around 180 deg. C / 200 deg. C
	Normal size	(-) 25 mm (about 80% of total reject)
	Maximum size to be handled pneumatically	40 mm (about 10% of total reject)
	Maximum size rejected by mill	50 mm (about 10% of total reject)
	Bulk Density for	
	a) Volumetric calculation	1600 Kg/m ³
	b) Load calculation	2400 Kg/m ³
System Data		
	Type of mill reject system	Pneumatic conveying system
	System capacity / reject generation	1.75 TPH per mill
Equipment Data		
1.	Pyrite Hopper	
	No of Pyrite Hopper	One (1) no. per mill
	Number of outlet	Three (3) nos.
	Capacity	2-3 times Transporter Vessel capacity
	Pyrite Hopper Accessories	
	Temperature switch	Requisite nos
	RF type level probes	Requisite sets for Pyrite Hopper High / Permissive
	Water Spray quenching system with solenoid operated spray nozzle	One (1) no. per hopper
	Rupture disc	One (1) no. per hopper
	Flexible joint	One (1) no. per hopper
	Oversize reject chute	One (1) no. per hopper
	Bypass Chute	One (1) no. per hopper
	Material of construction	
	Pyrite hopper body	MS as per IS 2062 Gr A/B, 10 mm THK
	Grid	One (1) no. per hopper of MS 2062 bars and flats (requisite size) grid opening size)

PART OF SPECIFICATION PE-TS-426-160-A001



1X660 MW PANKI EXTN

TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)

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	Supports, Platform	MS as per IS 2062 Gr A/B
	Provision of inspection/poking doors in pyrite hopper	Yes
	Pressure Gauge at each service water and instrument air line to pyrite hopper	One (1) no.
2.	Knife Gate Valve (Metal to metal seated)	
	Type & Quantity	Cylinder operated
	Knife gate valve at Mill outlet – (KGV-1)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Knife gate valve at Over size discharge chute of Pyrite Hopper (KGV-2)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Knife gate valve at By Pass Chute of Pyrite Hopper (KGV-3)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Knife gate valve at Pyrite Hopper outlet (KGV-4)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Material of construction	
	Body	Cast Iron 225 BHN (IS 210 Gr. FG 260)
	Knife Gate	10 mm thick SS (ASTM A 240 type 304) (Edge hardened to 350-400 BHN)
	Seat	Replaceable type alloy CI or SS smooth finished with 250 BHN hardness
	Deflection cone	Provided before the pyrite hopper inlet knife gate valve
	Method of operation	Solenoid valve with manual override facility (for pneumatic knife gate valve) and manual (for manual knife gate valve)
	Each knife gate valve (KGV-1 to KGV-3) shall be provided with open and close limit switch for interlock and control purpose with indication in OWS of DDCMIS based control system and local control panel/pneumatic panel.	
3.	Transporter Vessel	
	No. of transporter vessel envisaged	One (1) no. per hopper
	Capacity of transporter vessel	To suit the conveying rate with 85% filling for 0.85 T/hr/mill
	Material of construction	
	Transporter vessel	Mild Steel IS – 2062, Gr. A/B as per ASME code for unfired vessels or as per IS 2825
	Inlet Valve	MOC of inlet valve shall be as per proven design of MRS system supplier suitable for intended application as per IS/BS/International Codes
	Type & material of construction of valve	Dome/plate/butterfly/swing type cylinder operated as per supplier's proven practice

PART OF SPECIFICATION PE-TS-426-160-A001



1X660 MW PANKI EXTN

TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)

SPECIFICATION No: PE-TS-426-160-A001

PACKAGE: MILL REJECT SYSTEM
(PNEUMATIC TYPE)

SECTION-I

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		Material of construction: Body: Cast Iron (IS:210 Gr. FG 260) hardness as 180-2202 BHN) Shaft: SS 304 Disc: SS 304/Alloy CI
	Dedicated pneumatic panel with minimum features as mentioned. (One (1) no. per stack up assembly)	• One "Power On" indication • Push button for Probe override operation • Push button for Purge operation (Purge or equivalent system as per vendor's proven practice shall be decided during detail engineering) • Local indication of limit switches of pneumatically operated KGV's and vessel inlet valve.
	Outlet bend (ACI 400BHN)	One (1) no. per transporter vessel
	Type of joint in pipe line	Flanged
	Conveying velocity	Less than 6m/sec
	Number of cycle per hour	Not more than 6 per hour
4.	Reject conveying pipe	
	Reject conveying pipe size	As per system requirement (to be decided by system supplier)
	Quantity	As per layout requirement
	Material of pipe line	MS ERW IS 1239(Heavy grade) (≤150Nb) / 3589 (>150 Nb) (Heavy grade)
	Type of joint in pipe line	Flanged
	Distance over which material is to be conveyed and the lift	As per layout requirement
	Conveying pipe bends	
	Material of conveying pipe bends	Alloy CI (400BHN) Radius of bends shall not be less than 5D.
	Quantity	One (1) lot
5.	Bunker & Its Accessories	
	Number required	One (1) no. per bay
	Effective Capacity	168 T per bunker (effective storage capacity of twenty four (24) hours considering each mill in the bay rejecting @ 2.0% of mill capacity corresponding to unit operation at 100% BMCR with worst coal firing.)

PART OF SPECIFICATION PE-TS-426-160-A001



1X660 MW PANKI EXTN

TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)

SPECIFICATION No: PE-TS-426-160-A001

PACKAGE: MILL REJECT SYSTEM
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	Number of outlet	One (1) no. per bunker
	Minimum free board in mm	500
	Angle of repose	30 deg minimum
	Material of Construction and Thickness	
	Bunker Plates	10mm thick, MS plates as per IS 2062 Gr A/B
	Liners	3 mm THK. SS plate in complete bunker (for Straight & conical portion)
	Discharge gate	Twin Sector gates(Motor operated undercut gate of double pivoted sector type) MS to IS 2062 with TISCRA/SAIL HARD Liner
	Pressure Relief Valve	One (1) no. per bunker
	Level Transmitter	Two (2) nos. per bunker
	Terminal Boxes with Up stand on bunker top for terminating the reject instrument airs	One (1) set per bunker as per IS 2062 Gr. A/B (requirement as per layout). Impacting surface shall be provided with SAIL HARD/TISCRA liner.
	Clear access/headroom underneath MRS bunker for a road tanker/truck	5.5 m
	Accessories	i) Access staircase from ground level to silo top. ii) Hand rails and toe plate iii) Monorail with electric hoist to be handle equipment from silo top to ground. iv) Adequately sized bag filter to vent the transport air to atmosphere, terminal boxes, level probe and pressure relief valve shall be provided over top of storage bunker
6.	Bag Filter on Bunker top with associated instruments	
	Type & Number	Reverse pulse jet type / One per bunker
	Material of filter cloth	Polyester needle felt of antistatic type
	Air to cloth ratio (at maximum air flow)	1.0-1.5 with isolation of 10% bags
	Bag cage	MS, IS 2062, Gr. A, 3mm thick, galvanized
	Outlet air quality (SMP level) at bag filter discharge;	Less than 30 mg/NM3
	Differential Pressure Gauge and Differential Pressure Switch	One (1) no. each per bag filter
	Electric hoist over bag filter	- No. of Electric hoist – 1 no. - Service condition – Class II

PART OF SPECIFICATION PE-TS-426-160-A001



1X660 MW PANKI EXTN

TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)

SPECIFICATION No: PE-TS-426-160-A001

PACKAGE: MILL REJECT SYSTEM
(PNEUMATIC TYPE)

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		outdoor Capacity of Electric Hoist (minimum 1T) shall be selected considering a minimum margin of 25% over the maximum weight of the heaviest equipment/ component to be handled as per IS 3938
7.	Compressors with drive motor and all other accessories	
	No. and type of compressors	Two (2) Nos. (1 working + 1 standby) Oil free rotary type screw air compressors
	Location	Housed in Main Plant Air Compressor House
	Pressure	As per supplier's proven practice
	Service	Conveying air
	Type of Drive	Electric Motor
	Design ambient for drive	50 deg. C
	Compressor selection criteria	75% RH with 45 deg. C. - At least 50% margin shall be provided on compressor capacity over and above the maximum flow requirement. - Noise level- Shall be limited to 85dBA at a distance of 1.0 m in horizontal direction from the nearest surface of the machine and at a height of 1.5 m from the floor level in elevation. Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with calibrated integrating sound level meter meeting the requirement of IEC 651 or BS: 5969 or IS 9779.
	Materials of construction	As per attached customer specification
	Instrumentation	As per manufacturer's standard practice with redundancy requirement as per attached C & I specification.
	All instruments as shown in P&ID.	
	Note: Conveying air compressor system shall be designed to supply the air to operate each dense phase pneumatic conveying system of both units simultaneously.	

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MILL REJECT SYSTEM (PNEUMATIC TYPE)

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8.	Air receiver with isolation valves, instruments & accessories	
	Quantity	Two number (One (1) no. per bay)
	Design Code	ASME Section-VIII / IS: 2825 / IS 7938 A corrosion allowance of 3mm (minimum) shall be provided. It shall be designed for 1.5 times the compressor discharge pressure.
	Capacity	Each air receiver capacity shall be selected to convey one complete cycle with a minimum margin of 25% provided over and above the calculated air capacity. (minimum 10 M3 capacity each).
	Shell/ Body	MS: IS 2062 Gr A/B; thickness as per design calculation
	Safety relief valve, fusible plugs, pressure gauges, pressure switch, temperature gauge, flanged pipe connections, inspection manholes with automatic drain traps	One (1) no. per air receiver Pressure gauges shall be provided at each air inlet line to air receiver in addition to pressure gauge on air receiver
	Auto drain & Y type Strainer	One (1) no. per air receiver
	Structural platform for maintenance of safety relief valves and instruments	To be provided by supplier.
9.	Pipe work for Conveying Air, Instrument Air, Cooling Water for Inlet Valve top plate of Transporter Vessel (if applicable), Cooling water for Quenching in Pyrite Hopper, Cooling water for air compressor	
	Quantity	One (1) lot
	Material of construction	Service Water pipelines : Carbon Steel, ERW conforming to IS1239 (Heavy Grade($\leq 150\text{NB}$) Carbon Steel IS 2062 Gr. B Plates rolled and welded as per IS:3589 ($>150\text{NB}$) DM Water pipelines : SS and welded as per IS:3589 ($>150\text{NB}$) Instrument Air: ASTM A-53 type E Gr. B galvanized /IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to SI-4736 or equivalent. Conveying air pipelines : MS ERW pipes as per IS-1239($\leq 150\text{NB}$) (heavy grade)/ 3589 ($>150\text{NB}$)

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SPECIFICATION No: PE-TS-426-160-A001

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	Pressure Transmitter	One (1) no. each at service water tapping and at instrument air tapping. (refer P&ID of mill reject system for instruments)
10.	Impulse tubing	Shall be of SS 304 type
11.	Control System	DDCMIS based control system (BHEL scope)
12.	Lines for various services Valves for Air & Water Lines Fittings, Flanges, Fasteners & Gaskets Velocities	As per Low Pressure Piping Specification

ELECTRIC WIRE ROPE HOISTS

A SIZING

Electrically operated wire rope hoists of suitable capacity (min 1T), lift, wherever required as per feasibility, maintenance requirement & as per the layout arrangement. The hoist capacity shall be selected considering 25% margin over the weight of single heaviest component /equipment to be handled during maintenance. The hoist parameters are subject to changes, to suit the final layout of the area in which it is intended to be installed.

B CODES AND STANDARDS

Design and duty of main hoist & cross travel machinery shall be in accordance with IS: 3938 (latest edition).

C DESIGN REQUIREMENTS

- Equipment offered shall be suitable for outdoor duty conforming to Class II of IS: 3938.
- Electric hoists shall be pendent operated.
- Both hoisting and trolley movement shall be motor driven.
- All motions control shall be thru' VVVF drives to achieve creep speed of 10% of main speed.
- Wheels shall be single flanged type.
- Hook shall be swiveling type and fitted with a safety latch.
- Control panel shall be hoist mounted.
- Power feeding to the electric hoists shall be thru' flexible trailing cable
- Brakes shall be fail to safety, electro- magnetic type.
- Load/overload testing of the hoists shall be carried out as per IS: 3938.
- Water proof pendent shall be provided
- Canopy for motors, panels etc. shall be provided

D Technical Data Sheet

Sl. No.	DESCRIPTION	TECHNICAL PARTICULARS
1.0	Type	Steel wire electric hoist with electrically operated

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		trolley.
2.0	Scope (Qty., Capacity, lift, travel length)	Capacity: minimum 1T, lift and travel length: as per requirement Quantity: 1 number per bunker.
3.0	Type of service	outdoor
4.0	Overload test	125% of SWL
5.0	Design ambient temperature	50 Deg C
6.0	General design	As per IS: 3938 / 1983 or latest, Class-II duty
7.0	Operating speed	
7.1	Hoisting speed/ creep speed (thru' VVVF drive)	3.5 to 5 M/min Creep speed- 10% of main speed.
7.2	Trolley speed/ creep speed (thru' VVVF drive)	5 to 10 M/min Creep speed- 10% of main speed.
8.0	Type of transmission	Through electric motor and gear box
9.0	Wire rope	
9.1	Construction/ core	6x36 construction, fiber core
9.2	Code	IS: 2266
9.3	Number of falls	Min. 4
9.4	Factor of safety	Not less than 5.
10.0	Load hook and block	Normalized hook only.
10.1	Type of load hook	Shank type swiveling with safety latch
10.2	Load hook code	IS: 15560
10.3	Load hook material	Forged steel
10.4	Hook suspension	Thrust bearing
10.5	Material of block suspension	Fabricated from steel plate, Material: IS: 2062
11.0	Gearing	
11.1	Type	Spur/ Helical
11.2	Gear material	Gear: EN 9/ 55C8 Pinion: EN19/EN24
11.3	Lubrication	Oil splash/ grease lubricated
11.4	Bearing type	Antifriction ball/ roller
12.0	Trolley drive	-
12.1	Wheel	Single flanged taper thread
12.2	Wheel confirm to (Std./ Code)	IS: 3938
12.3	Wheel material	Forged steel.
12.4	Bearing type	Antifriction ball/ roller
12.5	Hardness	MAX HARDNESS 200 BHN
13.0	SHEAVE	
13.1	Material	Fabricated from cast steel/ steel plate IS: 2062 GR A/B or B/ CS GR 280-520 IS: 1030.

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13.2	Bearing type	Antifriction ball/ roller	
14.0	BRAKE (HOIST)		
14.1	Type	DCEM brakes disc/ shoe type (fail to safety).	
14.2	Capacity	As per IS: 3938.	
14.3	Number	One number for each motor.	
15.0	BRAKE (TROLLEY)		
15.1	Type	DCEM brakes disc/ shoe type (fail to safety).	
15.2	Capacity	As per IS: 3938.	
15.3	Number	One number for each motor.	
16.0	ROPE DRUM		
16.1	Material	Fabricated from carbon steel as per IS: 2062, GR B and stress relieved/ seamless pipe as per ASTM A106/ 53 GR A/B.	
16.2	Flange/ Flangeless	Flanged	
17.0	TYPE OF DSL		
17.1	CT travel	Shrouded bus bar GI conductor type DSL	
18.0	MOTORS		
18.1	Type	Sq. cage induction, TEFC, S4 duty, 40% CDF.	
18.2	Number of start	150 starts/hr.	
18.3	Voltage, phase and frequency	415V +/- 10%, 3 phase, 50 Hz, 4 wire.	
18.4	Class of insulation	Class "F" and temperature rise limited to class B.	
18.5	Type of enclosure	TEFC	
18.6	Degree of protection provided for enclosure	IP-55	
19.0	LIMIT SWITCHS (automatic reset type)	Hoisting	Trolley
19.1	Type	Rotary geared + gravity type	Lever
19.2	Degree of protection	IP-55	
19.3	Material of contacts	Limit switch shall be provided with 2 NO & 2 NC contacts. Material of contact shall be high grade silver cadmium plated with high conductivity and non-corrosive type.	
19.4	Confirm to code	All limit switch shall confirm to IEC-60947-5-1	
20.0	Pendent push button	Up /down / forward / Reverse push buttons along with Start/stop and emergency push button shall be provided on the pendent. Indicative marking for easy operation shall be provided.	
21.0	Speed control	Thru' VVVF with at least with 1024 pulse incard, droop control for synchronization and crane software. The rating of VVF shall be decided considering 250% of full load current of	

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		respective drive motor based on in panel rating with derated at 50 Deg C ambient temperature.
21.1	Starting torque of VVVF drive	Up to 200% typical
21.2	Starting current	Less than 150% of rated torque
21.3	Temperature	Capable of withstanding up to 50 Deg C without derating.
21.4	Additional feature	In-built electrical overload protection for drive
22.0	Isolating switch	One No. isolating switch panel shall be provided for each electric hoist. Location of isolating switch panel shall be at respective operating floor of the area.
23.0	Control transfer	One no. (1x100%)
24.0	Control panel	
24.1	Material & size	A 14 SWG thick corrosion resistant sheet steel weather proof, water shedding, dust and vermin proof control panel/cabinet conforming to degree of protection IP55 with 16 SWG thick sheet steel water tight hinged and padlocked doors, fully wired, shall be provided for terminating all wiring for control, protection and alarm circuits of each transformer. Suitable stiffeners shall be provided wherever required.
24.2	DOP	IP-55
24.3	Type	Local relay based control system
24.4	Location	Mounted with respective hoists.
25.0	Power cables	XLPE insulated power cables shall be of copper conductor for current rating of up to 10 A. For higher current rating, conductor can be aluminium/copper. Minimum size of copper conductor shall be 1.5 sq.mm
26.0	Control cable	Control cable shall be multi core, minimum 1.5 sq.mm cross section, stranded copper conductor, PVC insulated, inner PVC sheathed / galvanized steel wire armored and outer sheath made of FRLS PVC compound.
27.0	Control voltage	110 V

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		PACKAGE: MILL REJECT SYSTEM (PNEUMATIC TYPE)	
		SECTION-I	SUB-SECTION-IA
		REV. 00	DATE: JUNE 2019

ANNEXURE-B **QUALITY ASSURANCE**

QUALITY PLANS, INSPECTION & TESTING PROCEDURE

The following Quality plans/ Check lists of mechanical items are attached for ready reference of supplier.

- a) Local Panel
- b) Transport Vessel
- c) Pyrite Hopper
- d) Terminal Box
- e) Bunker Discharge Gate
- f) Pressure Relief Valve
- g) Air Receiver
- h) Rupture Disc
- i) Electric hoist
- j) Bag Filter
- k) Pipes
- l) ACI Bends
- m) Knife Gate Valves
- n) Expansion bellow
- o) Plates & Structures

The inspection requirements indicated in the above QP's / CL's shall be adhered to as a minimum. Inspection requirement of some of the items are also elaborated in the technical specification under Sec-IIA. The QP's for above items as well as other items not listed above but required, as part of the system shall be prepared by the successful bidder in project specific format to be finalised with the successful bidder after award of contract.

Standard Quality Plans of few instruments & motors are enclosed elsewhere in the specification, for compliance by the bidder.

All QP's/CL's shall be submitted by the bidder for Customer/Consultant's review and approval. All comments made by customer / consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

		S/Contractor :- Mfr:- Works:-			Manufacturing Quality Plan Item :-Local Panels QAP No. LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- Consultant :-				
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9	10	11		
								TYPE	M	C	N	
1	Materials CRCA Sheet	Visual	Major	Visual	100%	Appr. Drg / IS: 513	Appr. Drg / IS: 513	IR	-	P	-	
		Chem. & Physical.	Major	Chem. & Physical.	100%	Do	Do	TC	✓	V	V	
		Thickness	Major	Measurement	100%	App. Drawing	App. Drawing	IR/TC	✓	V	V	
2	Bought outs. Verification of type, size & Make of FLV unit, PG, PS, SV	Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Approved Drawing / Data Sheet	IR/TC	✓	V	V	
3	Painting Pre Treatment 7 tank process	Physical	Major	DFT / Shade / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR/TC	✓	V	V	
4	Final Inspection	Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	✓	P	W	V
		Dimension	Major	Measurement	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	✓	P	W	V
		Check for Pneumatic Circuit	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	✓	P	W	V
		Check for Wiring / Mountings / Terminations	Major	Visual / Continuity	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	✓	P	W	V
		Functional Check for Solenoid Valve	Major	Functional	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	✓	P	W	V
5	QA Documents	Review	Major	verification	100%	-	-	-	-	-	-	
		LEGENDS:- Records identified by ✓ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N ->CLIENT P->Perform, V-> Verification, W-> Witness			For Client Use:-		Document. No.:-					
Manufacturer / Sub Vendor		Contractor		Name & Signature of Approving Authority with Seal								
SIGNATURES												

S/Contractor :-			Manufacturing Quality Plan				Project:- Package :- Mill Rejects System Client :-					
Mfr:- Works:-			Item :- Transport vessel QAP No. LOI Nos:-				Contractor :- M/s BHEL					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9	10			11
Consultant :-												
TYPE												
1	Raw Materials											
1.1	Dome & dome Valve Body	Dimensions Surface Defects Physical Check	Major	Measurement Visual TS & Hardness	100% 100% 1/Heat	App. Drg. / Data Sheet / Standard	App. Drg. / Data Sheet / Standard	- - TC	- - P/V	P P V	- - V	- - V
1.2	Plates for Vessel	Chemical Check	Major	Chemical Comp.	1/Heat			TC	✓	P/V	V	V
		Dimensions		Measurement	100%	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	-	-	P	-	-
		Surface Defects		Visual	100%			TC	✓	P/V	V	V
		Physical Check		TS & Elongation	1/Heat			TC	✓	P/V	V	V
		Chemical Check		Chemical Comp.	1/Heat			TC	✓	P/V	V	V
1.3	Insert Seal	Surface Defects	Major	Visual	100%	Mfr's Drg. / Std	Mfr's Drg. / Std	-	-	P	-	-
1.4	Shaft	Hardness	Major	Measurement	1/Lot			IR	✓	P/V	V	V
2		Physical Check	Major	TS & Elongation	1/Heat	App. Drg./ IS Std.	App. Drg./ IS Std.	TC	✓	P/V	V	V
2.1	In - Process Insp.											
2.1	Welders & Welding	WPS / PQR / WPQ	Major	Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	WPS / PQR	✓	P/V	V	V
2.2		Welding Defects	Major	DPT on Root run	100%	ASTM E-165	ASTM E-165	IR	✓	P/V	V	V
2.3	Machining of Dome & dome Valve	Visual & Dimension	Minor	DPT on Final run	100%	ASTM E-165	ASTM E-165	IR	✓	P/V	V	V
2.4	Hydrotest of Vessel	Soundness / Leakage	Major	Visual, Measurement	100%	Mfr's Drg / Standard	Mfr's Drg / Standard	-	-	P	-	-
3				Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	✓	P/V	W	W
3.1	Final Assy	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	✓	P/V	W	W
3.2	Run Test / Performance	Operation of Dome Valve	Minor	Visual, 5 times Cycle operation	100%	Mfr's Standard	Mfr's Standard	IR	✓	P/V	W	W
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	✓	P/V	W	W
4	QA Documentation											
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	V
LEGENDS:-						Document No.						
Records identified by ✓ shall be essentially included in QA documentation. TC-Test Certificate, IR - Insp. Report						For Client Use:-						
M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT												
Manufacturer / Sub Vendor						Name & Signature of Approving Authority with Seal						
SIGNATURES												

S/Contractor :-			Manufacturing Quality Plan				Project:- Package :- Mill Rejects System Client :-						
Mfr:- Works:-			Item :- Pyrite Hopper QAP No. LOI Nos				Contractor :- M/s BHEL						
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking			Remarks	
1	2	3	4	5	6	7	8	9	10			11	
								TYPE	D	M	C	N	
1	1.1	Plates for Body	Major	Measurement	100%	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	-	-	P	-	-	
				Visual	100%			-	-	P	-	-	
				TS & Elongation	1/Heat			✓	P/V	V	V		
1	1.2	Spray Nozzle	Major	Chemical Comp.	1/Heat			MTC	✓	P/V	V	V	
				Visual	100%	Mfr's Drg. / IS Standard	Mfr's Drg. / IS Standard	-	-	P	-	-	
				Chemical Comp.	1/Lot			✓	P/V	V	V		
2	2.1	Welders & Welding	Major	Measurement	100%			MTC	✓	P	V	V	
				Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	✓	P/V	V	V		
				WPS / PQR / WPQ	100%			WPS / PQR	✓	P/V	V	Welders to be approved by BHEL	
2	2.2	Fabrication	Minor	DPT on Root run	100%	ASTM E-165	ASTM E-165	IR	✓	P/V	W	W	
				DPT on Final run	100%	ASTM E-165	ASTM E-165	IR	✓	P/V	W	W	
				Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	3.1	Final Assy	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	✓	P/V	W*	W*	
				Completeness & Dimension	100%								* -> Witness 10%
				Finish / DFT	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting shall be Heat Resistance
4	4.1	TC & IR	Major	Visual, Measurement	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	V	
				Verification & approval	100%								
				LEGENDS:-				Document No.:-					
				Records identified by ✓ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report				For Client Use:-					
Manufacturer / Sub Vendor				Contractor									
SIGNATURES				P->Perform, V-> Verification, W-> Witness				Name & Signature of Approving Authority with Seal					

S/Contractor :-				Manufacturing Quality Plan				Project:- Package :- Mill Rejects System Client :-				
Mfr:-				Item :- Terminal Box QAP No. :- LOI Nos:-				Consultant :-				
Contractor :- M/s BHEL				Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking			Remarks	
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check								
1	2	3	4	5	6	7	8	9	10		11	
								TYPE	D	M	C	K
1	Raw Materials											
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - ✓ ✓	P P P/V P/V	- - V V	- - V V
2	In - Process Insp.											
2.1	Welders Qualification & Welding	WPS / PQR / WPQ Welding Defects	Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	✓ ✓ ✓	P/V P/V P/V	V V W	V V V
2.2	Flange Machining and Drilling	Dimensions	Major	Measurement	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	-	P	-	-
2.3	Connection -pipe to flange, pipe to body	Fit up	Major	Joint set up, PCD, Orientation	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	-	P	-	-
2.4	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-
3	Final Inspection											
3.1	Final Assy	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	✓	P/V	W	W
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-
4	QA Documentation											
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	V
				LEGENDS:-				For Client Use:-				Document No.:-
				Records identified by ✓ shall be essentially included in QA documentation. TC-Test Certificate, IR - Insp. Report								
Manufacturer / Sub Vendor				Contractor								
SIGNATURES				P->Perform, V-> Verification, W-> Witness				Name & Signature of Approving Authority with Seal				

S/Contractor :-		Manufacturing Quality Plan					Project:- Package :- Mill Rejects System Client :-					
Mfgr:- Works:-		Item :- Bunker Discharge Gate QAP No. :- LOI Nos:-					Contractor :- M/s BHEL					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9	10	11		
Consultant :-												
TYPE												
1	Raw Materials											
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC	- - PV PV	- - V V		
1.2	Shaft	Physical Check Chemical Check	Major	TS & Elongation Chemical Comp. Internal defect Visual	1/Heat 1/Heat 100% 100%	do do do	do	TC TC IR Mfr's TC	PV PV PV V	V V V V		
1.3	Cylinder / Actuator	UT If Dia > 50 mm Visual / Specification	Major			do	do					
2	In - Process Insp.											
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	PV PV PV	V V V	Welders to be approved by BHEL / CLIENT	
3	Final Inspection											
3.1	Final Assy	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	PV	W		
3.2	Operation with job / shop actuator	Opening & Closing of Gate	Major	Visual	100%	Proper Working	Smooth Operation	IR	PV	W		
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	W	Painting before disp.	
4	QA Documentation											
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	PV	V		
LEGENDS:-								Document No.:-				
Records identified by ✓ shall be essentially included in QA documentation. TC -Test Certificate, IR - Insp. Report								For Client Use:-				
M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N-> CLIENT												
P->Perform, V-> Verification, W-> Witness								Name & Signature of Approving Authority with Seal				
Manufacturer / Sub Vendor		Contractor		SIGNATURES								

		S/Contractor :- Mfr:- Works:-			Manufacturing Quality Plan Item :- Pressure Relief Valve QAP No. : LOI Nos:-			Project:- Package :- Mill Rejects System Client :-		
					Contractor :- M/s BHEL			Consultant :-		
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records Agency for Checking Remarks		
1	2	3	4	5	6	7	8	9	10	11
1	Raw Materials									
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - P/V P/V	- - V V
2	In - Process Insp.									
2.1	Welders & Welding	WPS / PQR / WPQ	Major	Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	WPS / PQR	P/V V	Welders to be approved by BHEL / NTPC
2.2	Fabrication	Welding Defects Fit up, Marking, Cutting, Grinding	Major Major Major Minor	DPT on Root run DPT on Final run Visual, Measurement	100% 10% 100%	ASTM E-165 ASTM E-165 Mfr's Standard	ASTM E-165 ASTM E-165 Mfr's Standard	IR IR -	P/V P/V P	V V -
3	Final Inspection									
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	P/V W	W
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	P/V W	- Painting before disp.
4	QA Documentation									
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	P/V V	V
		LEGENDS:- Records identified by ✓ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness			For Client Use:-			Document No.:-		
Manufacturer / Sub Vendor		Contractor			Name & Signature of Approving Authority with Seal					
SIGNATURES										

S/Contractor :-		Manufacturing Quality Plan			Project:- Package :- Mill Rejects System Client :-			
Mfr:- Works:-		Item :- Air Receiver QAP No. :- LOI Nos:-			Contractor :- M/s BHEL			
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Consultant :-
1	2	3	4	5	6	7	8	9
								Format of Records
								Agency for Checking
								Remarks
								10
								11
1	Raw Materials							
1.1	Plates for Shell, Dish End & Flange	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC
1.2	Formed Dish End	Dimensions Thickness/Thinning DPT of Knuckle	Major	Measurement Measurement DP Test	100% 100% 100%	App. Drg. / Data Sheet ASTM E-165	App. Drg. / Data Sheet ASTM E-165	IR IR TC
2	In - Process Insp.							
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects do do	Major Major Major Critical	Procedure / Qualification DPT on Root run DPT on Final run Radiography Test on all C/S & L/S including T & X Visual, Measurement (Ovality, off set orientation)	100% 100% 10% 100%	ASME sec - IX ASTM E-165 ASTM E-165 IS 2825 Class-II / ASME Sec VIII	ASME sec - IX ASTM E-165 ASTM E-165 IS 2825 Class II / ASME Sec VIII	WPS / PQR IR IR RT Film / Report
2.2	Fabrication	Marking, Cutting, Rolling, Edge Preparation, Joint & Nozzle set up	Major	Visual, Measurement (Ovality, off set orientation)	100%	Mfr's Standard / Approved Drg.	Mfr's Standard / Approved Drg.	IR
3	Final Inspection							
3.1	Final Assy	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR
3.2	Hydrotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR
4	QA Documentation							
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-
				LEGENDS:-				Document No.:-
				Records identified by ✓ shall be essentially included in QA documentation. TC -> Test Certificate, IR - Inspection Report				
Manufacturer / Sub Vendor				M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N-> CLIENT				
SIGNATURES				P-> Perform, V-> Verification, W-> Witness				
				Name & Signature of Approving Authority with Seal				

		S/Contractor :- Manufacturer :-		Manufacturing Quality Plan Item :- Rupture Disc QAP No. :- LOI Nos:-				Project:- Package :- Mill Rejects System Client :-				
				Contractor :- M/s BHEL				Consultant :-				
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9	10			11
								TYPE	D	M	C	K
1	Materials -> Rupture Disc Material	Physical & Chemical Properties	Major	Chemical Analysis, YTS & UTS	1 per Heat	ASTM A240 Type - 304 / Approved Data Sheet / Drg.	ASTM A240 Type - 304 / Approved Data Sheet	MTC	✓	V	V	V
	Final Inspection Dimension Burst Test of Rupture Disc	Measurement Functional	Major Major	Measurement Burst Test @ 200 Degree Centigrade	100% 1 per lot offered	App. Drawing Approved drawing / Datasheet	App. Drawing Min 0.4 bar (g) @ 200 degree C Max 0.6 bar (g) @ 200 degree C / App. Data Sheet	IR IR / Burst Test Certificate	✓ ✓	P P	W W	W W
		LEGENDS:- Records identified by ✓ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & K -> Client P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
Manufacturer / Sub Vendor		Contractor										
SIGNATURES		Name & Signature of Approving Authority with Seal										

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT: 1X660 MW PANKI TPS				
		ITEM: ELECTRIC HOIST		REV	Rev 00	PACKAGE: Mill reject handling system				
		CAPACITY: -		DATE	Page 2 of 5	BHEL DOC. NO:				
				PAGE	Page 2 of 5	CONTRACTOR:				
S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency	Remark
1	2	3	4	5	6	7	8	9	10	11
1.8	Limit switch, SFU, Relays, MCB, Fuses, Push buttons etc, DSL Control transformer	Make/Type/Rating Functional /continuity Make , type, rating, input/output	Major	Review of TC	100%	Appd drg./DS/Scheme /Manu.Std		QCR Routine TC/CO C of mfrgr	V V V	
2	INPROCESS- INSPECTION									
2.1	WPS,PQR & WPQ	Verification of approval				WPS,PQR & WPQ			P V V	IN CASE OF NTPC/ LLOYDS / EIL / TPL QUALIFIED WELDERS AVAILABLE, REQUALIFICATION OF WELDER IS NOT REQUIRED.
2.2	Assembled gear box	No load run test backlash & contact pattern, noise, vibration & oil temp rise (for oil lubricid)	Major	Performance	100%	Apprvd drg./DS/Mfg std Noise 85dba max, vibration 75 mi-crons max, oil temp rise – 30 °C above ambient max			P V V	
2.3	Trolley , rope drum (if fabricated) etc.,	DPT of Welds(all) RT of Butt weld	Major	LPI RT	100% on butt&10% on fillet 100%/10%	ASTM E165 or Eq. / No crack or linear indication ASME Sec.VIII,Div 1, UW 51/52		I.R. RT film & report	P V V	@RT-100%, for Butt weld in tension & 25% in compression. 100% RT on butt weld for fabricated rope drum
2.4	Hook	Dimension Proof Load NDT after proof load	Major	Measurement Load Test MPI/LPI	100%	Mfr's drg / Related Std. As per appd. Drg./data sheet/ IS: 15560 IS: 15560		QCR QCR I.R.	P V V	
2.5	Gears, pinions, shafts, axles & wheels (#)	Hardness Surface Defect (after machining)	Major	DPT	100%	Approved Drg/ Data sheet ASTM E-165 No linear indication		MTC	P V V	
3	FINAL INSPECTION									
3.1	Overall dimensions	Dimensions (span) level, alignment	Critical	Measurement	100%	Appd GA drg & IS: IS:3938		I.R.	P W V	

LEGEND: CLASS A: Critical, B: Major, C: Minor ** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "p" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Record		DOC. NO.:
MANUFACTURER NAME & SIGNATURE		NAME & SIGN OF APPROVING AUTHORITY & SEAL

MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT: 1X660 MW PANKI TPS					
		ITEM: ELECTRIC HOIST		REV	Rev 00	PACKAGE: Mill reject handling system					
		CAPACITY: -		DATE		BHEL DOC. NO:					
				PAGE	Page 3 of 5	CONTRACTOR:					
S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency	Remark	
1	2	3	4	5	6	7	8	9	10	11	
3.2a	Assembled EH along with individual control panel & pendant station	Current & speed for Cross Travel & Hoisting, interlocking sequencing, inching operation, Limit switch operation	Critical	Measure /Verify	100%	Appd GA drg & IS: 3938/ Appd data sheet		I.R.	✓		
3.2b	Overload test at 125% of SWL	Holding capacity of brakes		Lifting from mid Air	100%	Appd GA drg & IS:3938/ Appd data sheet		I.R.	✓		
3.3	Control Panel & Pendant station	1. Make/type/rating of BOIs. 2.IR-HV functional &interlocks 3.DOP by paper insertion for panel	Major	Visual, Operational & Functional Measurement do	100%	Approved drawing / Data sheet		I.R.			
3.4	Painting	Examination – shade	Minor	Visual & measurement	100%	Paper should not go easily.					
		Dry Film Thickness	Major	Measurement	Sample	Customer's / Approved Painting Procedure					

NOTE1:*** When back wall echo is set to 100% in sound area then,
a) defect echo shall not exceed 20%
b) Back echo shall be minimum 80% in any area

Note 2:- Less than 30 KW. Acceptance of motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows : It is hereby confirmed that the above mentioned motor/motors was/were manufactured taking care of customer specific requirement regarding ambient temp, voltage & frequency variation, hot start, pull out torque, startin KVA/KW, temp rise, distance between center of stud and gland plate and tested in accordance with approved drawing/data sheet.

				DOC. NO.:	
		LEGEND: CLASS A: Critical, B: Major, C: Minor ** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "p" PERFORMS, "w" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control			
MANUFACTURER	CONTRACTOR				
NAME & SIGNATURE		NAME & SIGN OF APPROVING AUTHORITY & SEAL			

बी एच ई एल BHEL		S/Contractor :- Manufacturer :-		Manufacturing Quality Plan Item :- Bag Filter (Without Enclosure) QAP No. :- LOI Nos:-				Project:- Package :- Mill Rejects System Client :-				
Components / Operations		Characteristics	Classification	Type of Check	Contractor :- M/s BHEL		Consultant :-					
Sl. No.					Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9	10			11
								TYPE	D	M	C	K
1	Materials											
1.1	Manifold Body / Casings (MS Plate / Sheet / Pipe)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / Data Sheet / IS:2062 Gr. A / IS:1079 Gr. 0 / IS: 1239 Class Med.	App. Drawing / Data Sheet / IS:2062 Gr. A / IS:1079 Gr. 0 / IS : 1239 Class Med.	MTC	✓	V	V	V
1.2	Bag Cages (Inserts)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	MTC	✓	V	V	V
1.3	Solenoid Valves	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	✓	P	V	V
1.4	Sequence Controller	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	✓	P	V	V
1.5	Filter Bags (Make :- Charminar / Supreme)	Physical	Major	Visual / Measurement	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	✓	P	V	V
2	In Process											
2.1	Manifold	Dimensional & Visual	Minor	Dimensional & Visual	100%	As per Mfr's Drg.	As per Mfr's Drg.	IR	✓	P	V	** -> DPT & Hydro -Test of Manifold to be witnessed by vendor
2.2		Welding	Major	DPT on Final Weld	100%	ASTM E-165	No Defect	IR	✓	P	V**	V
2.3		Hydro Test for 30 Minutes	Major	Leakage	100%	Appr. Data sheet	No Leakage	IR	✓	P	V**	V

Document No.:-

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking	Remarks
1	2	3	4	5	6	7	8	9	10	11
								TYPE	M C K	
3	Final Inspection									
3.1	Assembly \$-> Pneumatic Test at 1.1 times W/Pressure	Dimensional Pne. test \$of Manifold in Assly.	Major Major	Measurement Leakage by soap solution	100% 100%	Appr. Drawing Appr. Data Sheet	Appr. Drawing No Leakage	IR IR	P W	V V
		Functional Test of Pulsing System	Major	Pulse Sequence	100%	Appr. Data sheet / Testing Procedure	Appr. Data sheet / Testing Procedure	IR	P	V
4	Painting	Measurement & Visual	Major	DFT / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR	P	-
TESTING PROCEDURE TO BAG FILTER										
1-> Functional test through compressed air , Sequential pulsing through valves and sequential controller on No - Load Condition to be conducted. 2-> The Soenoid valve shall be connected to the sequential timer and suitable electric supply shall be provided. Air header to be connected to supply of compressed air. The Timer is set to 20 sec and Sequential operation of Solenoid operated valve is observed.										
Page 261 of 531						LEGENDS:-		Document No.:-		
Manufacturer / Sub Vendor						Records identified by ✓ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT		For Client Use:-		
SIGNATURES						P->Perform, V-> Verification, W-> Witness		Name & Signature of Approving Authority with Seal		

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

● Test on bag filter casing: In case bag filter is assembled in casing at site, smoke/ bubble test shall be carried out on the bag filter casing to ensure that the casing is free of welding defect. However, if assembly of bag filter & casing is done at shop, relevant NDT shall be carried out as per approved MQP for checking the soundness of weld.

		S/Contractor :- Manufacturer :-			Manufacturing Quality Plan Item :- MS GI ERW Pipes (IS:1239/IS3589) QAP No. :- LOI Nos:-			Project:- Package :- Mill Rejects System Client :-		
					Contractor :- M/s BHEL			Consultant :-		
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking	Remarks
1	2	3	4	5	6	7	8	9	10	11
1	Final Inspection of Finished Pipes	Physical Dimensional Mechanical Properties Chemical Hydro Test	Major Major Major Major Major	Visual Measurement Tensile, elongation, Bend or Flattening Chemical Analysis Pressure Testing	100% 100% IS: 4711 1 per heat 100%	IS:1239 / IS:3589 / Approved Data Sheet	IS:1239 / IS:3589 / Approved Data Sheet	IR / TC	P W* P W* P / V V P W* K	* -> Random 5% of offered lot irrespective of size
2	Galvanising (For GI Pipes)	Uniformity & mass of Zinc Coating, Adhesion test, Free bore test	Major	As per IS:4736	As per IS:4736	As per IS:4736 / Approved Data Sheet	As per IS:4736 / Approved Data Sheet	IR	P	# one sample for each size
3	Identification	Verification of Batch No. / Mfg stamp / Heat No.	Major	Visual	100%	Mfgr Practise / IS 1239 / IS 3589	Mfgr Practise / IS 1239 / IS 3589	IR	P	
4	Review of QA Documents					As per QAP	As per QAP		V	
NOTES :- For SAIL Pipes verification of reports for the tests mentioned in Sl. No. 1 & 2 by BHEL & NTPC For GI Pipes, Galvanising Check as per relevant standard shall be done. All material shall be as per approved data sheet in case of ambiguity in QAP, material as data sheet shall be final.										
		LEGENDS:- Records identified by ✓ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness			For Client Use:-		Document No.:-			
Manufacturer / Sub Vendor		Contractor			Name & Signature of Approving Authority with Seal					
SIGNATURES										
Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final										

		S/Contractor :- Manufacturer :-		Manufacturing Quality Plan Item :- ACI Bends QAP No. :- LOI Nos:-		Project:- Package :- Mill Rejects System Client :-					
				Contractor :- M/s BHEL		Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking	Remarks	
1	2	3	4	5	6	7	8	9	10	11	
								TYPE	M	C	K
1	Raw Material										
1.1	Scrap Receipt	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	P	-	-
1.2	Ferro Alloys	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	P	-	-
2	Final Inspection										
2.1	Product Analysis	Chemical Analysis	Major	Chemical	1 / heat	Mfg's Standard	Mfg's Standard	MTC	P	V**	V
2.2	Leakage	Hydro Test	Major	Pressure Test	100%	Approved Drg / Data Sheet	No Leakage	IR	P	W*	W* * 10% by Vendor / BHEL / CLIENT
2.3	Dimension	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	P	W*	W*
2.4	Hardness	Hardness	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR/TC	P	W*	W*
						LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness		Document No.:-			
Manufacturer / Sub Vendor		Contractor		Name & Signature of Approving Authority with Seal							
SIGNATURES											

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contractor :- Manufacturer :-		Manufacturing Quality Plan Item :- Knife Gate Valve [Manual / Pneumatic] QAP No. : LOI Nos:-			Project:- Package :- Mill Rejects System Client :-					
Contractor :- M/s BHEL				Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking	Remarks		
1	2	3	4	5	6	7	8	9	10	11		
1		Raw Material / Bought Out's						TYPE	D	M	C	K
1.1	Body	Chemical & Mechanical	Major	Foundary TC	1 per Heat	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	✓	P/V	V	V
1.2	Gate	do	Major	Lab Analysis	1 per lot	do	do	Mill / Lab TC	✓	P/V	V	V
1.3	Stem (For Manual Valve)	do	Major	Lab Analysis	1 per batch	do	do	do	✓	P/V	V	V
1.4	Pneumatic Cylinder (For Pneu. Valve)	Visual & Functional	Major	Mfr's TC Review	100%	Smooth Operation	Smooth Operation	Mfr's TC	✓	P/V	V	V
2		In - Process Inspection										# -> Test Pressure as per Data Sheet
2.1	Body, Gate	Dimensional	Major	Measurement	100%	Mfr's Drawing	In-Process Insp. Record	-		P	V	V
2.2	Body Shell Test	Leak Tightness	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	No Leakage	IR	✓	P	V	V
3		Final Inspection										BHEL / Vendor/CLIENT to Witness 10 % of Quantity.
3.1	Assembled Valve	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	✓	P	W	W
3.2	do	Function	Major	Operation	100%	Smooth Operation	Smooth Operation	IR	✓	P	W	W
3.3	do	Seat Leakage	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	✓	P	W	W
				LEGENDS:-			For Client Use:-			Document No.:-		
				Records identified by ✓ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report								
Manufacturer / Sub Vendor				M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT								
SIGNATURES				P->Perform, V-> Verification, W-> Witness								
				Name & Signature of Approving Authority with Seal								

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

S/Contractor :- Manufacturer :-			Manufacturing Quality Plan Item :-EXPANSION BELOW QAP No. :- LOI Nos:-				Project:- Package :- Mill Rejects System Client :-						
Contractor :- M/s BHEL							Consultant :-						
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking			Remarks	
1	2	3	4	5	6	7	8	9	D	M	C	K	11
1	<u>Raw Material</u>							TYPE					
1.1	Bellows	physical & Chemical	Major	Lab Analysis	1 per Heat	AS204 TP304/ Approved Drg.	AS204 TP304/ Approved Drg.	MTC	✓	V	V	V	
1.2	Flanges/ End Pipe	physical & Chemical	Major	Lab Analysis	1 per lot	IS 2062 / Approved Drg.	IS 2062 / Approved Drg.	MTC	✓	V	V	V	
2	<u>In - Process Inspection</u>												
2.1	Bellows & Pipe ** For Bellows	Dimension Soundness Of Weld of L-Seam	Major major	Measurement DPT **(Before & After Forming)	100% 100%	Approved Drg. ASTM E- 165	Approved Drg. No Cracks/ Linear Indication	IR IR	✓ ✓	P P	V V	V V	
3	<u>Final Inspection</u>												
3.1	Assembly	DP Test of Fillet Weld of Bellows to Pipe & Pipe to Flange	Major	visual	100%	ASTM E-165	No Crack / Linear Indication	IR	✓	P	W	V	
3.2	Testing	Dimensions pressure	Major Critical	Measurement Hydraulic	100% 100%	Approved Drg EJMA D.3.2.1/ Data sheet	Approved Drg EJMA D.3.2.1/ Approved Drg.	IR IR	✓ ✓	P P	W W	W W	
		Spring Rate Test (Axial)	Critical	Stiffness Test	100%	EJMA / Data Sheet	EJMA / Data Sheet	IR	✓	P	W	W	
		Deflection	Critical	Deflection Test	100%	EJMA / Data Sheet	EJMA/Data Sheet	IR	✓	p	W	W	
3.30	Painting	Visual/ Measurement	Major	DFT	100%	Approved Painting Schedule	Approved Painting Schedule	IR	✓	p	-	-	
							For Client Use:-		Document No.:-				
							Records identified by ✓ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report						
Manufacturer / Sub Vendor			Contractor				M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT						
SIGNATURES							P->Perform, V-> Verification, W-> Witness						
							Name & Signature of Approving Authority with Seal						

Note :- In case of any difference in parameters specified in Drawing PABT/01/2017/001, value specified in PABT/01/2017/001 Drg / Data Sheet shall be Final

Manufacturer's Name & Address :			MANUFACTURING QUALITY PLAN										Project :	
			Item : MS Plates & Structures		QP No. :		BHEL Ref. :		Contract No.:		SUB-CONTRACTOR-			
			Sub-System :		Rev. No. : 0		Date :		Contractor : BHEL					
			Page No.: 11 of 1											
Sl. No.	Components & Operations	Characteristic/Item	Class	Type/method of check	Extent of Check	Reference Document	Acceptance	Format of Record		Agency		Remarks		
1	2	3	4	5	6	7	8	9	D	P	W	V		
RAW MATERIAL														
1	Steel Plates	Chemical composition and Mechanical test	Major	Review of correlated MTC	One/heat	IS:2062	IS:2062	Mfgr. TC	✓	3		2,1		
2		Visual and dimensional Check	Major	Visual and measurement	100%	Mfgr. TC	Mfgr. TC	Mfgr. TC	✓	3	2,1			
3		Identification / Marking	Major	Co-relation establish	100%	AS per manufacturing practice	AS per manufacturing practice IS 2062	Mfgr. TC	✓	3	2	1		
LEGEND : 1 - BHEL / CUSTOMER 2 - VENDOR 3 - Manufacturer CR - Critical Characteristics MA - Major Characteristics MI - Minor Characteristics														
MANUFACTURER/ SUBCONTRACTOR SIGNATURE			CONTRACTOR			P - Agency Performing the Test W - Agency Witnessing the Test V - Agency Verifying the Test			REVIEWED BY NAME & SIGNATURE OF APPROVING AUTHORITY					
						BHEL Doc. No. _____ Rev. 0								

Notes:

- 1 In case material is despatched directly from SAIL/TISCO plant/stockyard or procured from dealer against co-related TC's witnessing by BHEL is waived off and material will be accepted based on MTC of SAIL/TISCO.
- 2 In case material is procured from dealer and co-related TC's are not available, check on 100% quantity of plates will be performed on sample drawn from each plate at NABL certified/ approved laboratory or any govt approved laboratory for chemical & physical properties, However dimensional check shall be witnessed by BHEL.
- 3 There will not be any inspection by CUSTOMER.



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ANNEXURE C: SUB VENDOR LIST

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
I	SELF MFG ITEMS			
1.	PYRITE HOPPER	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	IN CASE BID HAS BEEN SUBMITTED ON COLLABORATION ROUTE, ITEMS IDENTIFIED UNDER SELF-MANUFACTURED ITEMS SHALL BE SOURCED FROM COLLABORATOR/ PRINCIPAL/ APPROVED AND PROVEN SOURCES OF PRINCIPAL IN CASE BID HAS BEEN SUBMITTED ON COLLABORATION ROUTE, ITEMS IDENTIFIED UNDER SELF-MANUFACTURED ITEMS SHALL BE SOURCED FROM COLLABORATOR/ PRINCIPAL/ APPROVED AND PROVEN SOURCES OF PRINCIPAL
2.	DENSEVEYOR	SUPPLIERS/SUB-VENDORS		
3.	BUNKER DISCHARGE GATE (SECTOR GATE)	SUPPLIERS/SUB-VENDORS		
4.	TERMINAL BOX	SUPPLIERS/SUB-VENDORS		
5.	PRESSURE RELIEF VALVE	SUPPLIERS/SUB-VENDORS		
6.	PNEUMATIC PANEL	SUPPLIERS/SUB-VENDORS		
7.	PYRITE HOPPER	SUPPLIERS/SUB-VENDORS		
II	BOUGHT OUT ITEMS			
A	MECHANICAL			
1.	BAG FILTER	ORIENT FAN (FORMER ACCO)	KOLKATA	
		THERMAX	PUNE	
		BATLIBOI	SURAT	

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		FLAKT	MUMBAI	
2.	DRAIN TRAPS	SPIRAX MARSHAL	MUMBAI	MAIN CONTRACTOR COC ALONG WITH MANUFACTURER STD. TC TO BE SUBMITTED.
		GREAVES COTTON	MUMBAI	
3.	GATE. GLOBE. CHECK VALVES- C.I	LEADER	JULLANDH AR	
		KBL	KONDAPUR I	
		BANKIM	HOWRAH	
		H.SARKAR	HOWRAH	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHA R	
		FLUIDLINE VALVES COMPANY PVT.LTD.	MUMBAI	
		G.M. DALUI AND SONS PVT.LTD.	HOWRAH	
		A.V. VALVES LTD	AGRA	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
		LEADER	JULLANDH AR	
		KBL	KONDAPUR I	
		BANKIM	HOWRAH	
		H.SARKAR	HOWRAH	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
4.	GATE. GLOBE. CHECK VALVES- G.M	LEADER	JULLANDH AR	MAIN CONTRACTOR COC ALONG WITH MANUFACTURER STD. TC TO BE SUBMITTED.
		SANT VALVES	JULLANDH AR	
		A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	MUMBAI	
		VALTECH INDUSTRIES		
5.	GATE. GLOBE.	KSB	COIMBOITO	

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	CHECK VALVES- C.S / F.S		RE	
		WEIR BDK	HUBLI	
		FOURESS	MUMBAI	
		LEADER	JULLANDH AR	
		AUDCO (L&T)	CHENNAI	
6.	BALL VALVES	MICRO FINISH	HUBLI	MAIN CONTRACTOR COC ALONGWITH MANUFACTURER STD. TC TO BE SUBMITTED.
		WEIR BDK	HUBLI	
		PRECISION ENGG.	MUMBAI	
		WEIR BDK ENGG INDUSTRIES	NEW DELHI	
		FLOW CHEM. INDUSTRIES	AHEMDABA D	UPTO 50 NB 800 CLASS: 350NB 150 CLASS
		AUDCO	CHENNAI	
		AKAY INDIA	HUBLI	UPTO 50NB 800 CLASS
		A V VALVES	AGRA	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS LTD.	CHENNAI	
		ATAM VALVES	JALANDHA R	(1) BALL VALVES: FCS/FSS - 1/2" TO 2" #800 & CCS/CSS - 2.1/2" TO 4" # 150 (2) BALL VALVES: GUN METAL VALVES SIZE 15 NB TO 80 NB - UPTO PN16.0
		GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	SIZE UP TO 2" & #800 WITH MOC AS FCS & FSS AND FOR SIZE FROM 65 NB TO 150 NB & #150 WITH MOC AS CCS AND CSS.
		INTERVALVE (INDIA) LTD.	PUNE	STEEL BALL VALVES UPTO 50NB, #800 AND 65NB TO 150NB. #150

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		NILON VALVES PRIVATE LIMITED	AHMEDABA D	
		LEADER VALVES LTD.	JALANDHA R	CAST STEEL UPTO 200 MM, CLASS 150/300.
		DEMBLA VALVES LTD.	THANE	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	FOR CARBON STEEL/STAINLESS STEEL UPTO SIZE 200NB.
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	FORGED CARBON & ALLOY STEEL BALL VALVES, SCREWED TYPE BALL VALVES RATING 800, SIZES UPTO 50 & CC& ALLOY STEEL BALL VALVES RATING 150, SIZES 65 TO 200 FLANGED TYPE.
		VAAS AUTOMATION	NEW DELHI	
		BELGAUM AQUA VALVE	BELGAUM	
7.	SAFETY RELIEF VALVES	LEADER	JULLUNDH AR	
		BHEL	TRICHY	
		KEYSTONE (TYCO FLOW CONTROL)	HALOL	
8.	MS G.I / ERW PIPES	JINDAL	GHAZIABA D/HISS AR	UPTO 350 NB ERW PIPES AS PER IS 1239/3589
		SURYA ROSHNI	BAHADURG ARH	UPTO 400 NB
		SAIL	ROURKELA	
		TATA TUBE	JAMSHEDP UR	UPTO 150 NB ERW PIPES AS PER IS 1239
		PSL	CHENNAI/V IZAG/K UTCH/DAM AN	SPIRAL WELD SAW AS PER IS 3589
		LALIT PROFILE	THANE	SPIRAL WELD SAW AS PER IS 3589
		SAMSHI PIPES	VADODARA	SPIRAL WELD SAW AS

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	INDUSTRIES		PER IS 3589
	MUKUT PIPES	RAJPURA	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
	INDUS TUBES	G B NAGAR	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
	MANN IND	INDORE	SPIRAL WELD SAW AS PER IS 3589
	SURENDRA ENGG	RAJPURA	SPIRAL WELD SAW AS PER IS 3589
	PRATIBHA PIPES & STRUCTURE PVT LTD	THANE	SPIRAL WELD SAW AS PER IS 3589
	JCO GAS PIPE	CHINDWAR A	SPIRAL WELD SAW AS PER IS 3589
	NUKAT TANKS AND VESSELS	TARAPUR	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
	DADU PIPES	SIKRANDR ABAD	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
	GOOD LUCK TUBES	SIKANDRA BAD	
	ADVANCE STEEL TUBES	SAHIBABA D	
	BIHAR TUBES	SIKANDRA BAD	
	HI TECH PIPES	SIKANDRA BAD	
	RATNAMANI	KUTCH/AH MEDAB AD/CHHAT RAL	UPTO 400 NB ERW PIPES AS PER IS 3589 AND SAW AS PER IS 3589
	MAHARASHTRA SEAMLESS	RAIGAD	200-500 NB ERW PIPES AS PER IS 3589
	WELSPUN	ANJAR/BHA RUCH	UPTO 400 NB ERW PIPES AS PER IS 1239/3589 AND SAW AS PER IS 3589
	JINDAL	GHAZIABA D/HISS AR	UPTO 150 NB
	SURYA ROSHNI	BAHADURG ARH	UPTO 350 NB ERW PIPES AS PER IS 1239/3589
	SAIL	ROURKELA	UPTO 400 NB
9.	ACI BENDS	CRAWLEY & RAY	HOWRAH

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		MENON METALLICS	PUNE	
		PARAMOUNT	NAGPUR	
		NORTHERN ALLOY	BHAV NAGAR	
10.	PLATE VALVE/KNIFE GATE VALVE (H/W OPTD & CYLINDER OPTD)	VAAS INDUSTRIES	CHENNAI	
		ORBINOX	COIMBATORE	
		FOURESS	BANGALORE	
		DEZURIKK	CHENNAI	
		JAASH	INDORE	
		VAAS INDUSTRIES	CHENNAI	
		ORBINOX	COIMBATORE	
11.	METTALIC EXPANSION BELLOWS	MB METTALIC BELLOWS	CHENNAI	
		SUR INDUSTRIES	KOLKATA	
		LONE STAR	CHENNAI	
12.	RUPTURE DISC	BS & B SAFETY SYSTEM	CHENNAI	
13.	CHAIN PULLEY BLOCK	Universal Hoist-O-Fabrik	MUMBAI	MAIN CONTRACTOR COC ALONGWITH MANUFACTURER STD. TC TO BE SUBMITTED.
		CENTURY CRANE ENGINEERS PVT. LTD.	PALWAL, HARYANA	
		BAKELITE ELECTRICAL MFG. CO. PVT. LTD.	MUMBAI	
		TRACTEL TIRFOR INDIA PVT. LTD.	PALWAL, HARYANA	
		BRADY & MORRIS ENGINEERING CO. LTD.	AHMEDABAD	
		TECHNO INDUSTRIES	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	HOWRAH	
14.	CONVEYING COMPRESSOR (RECIPROCATING)	KIRLOSKAR PNEUMATICS	PUNE	
		INGERSOLL RAND	AHEMDABAD	
	CONVEYING COMPRESSOR (SCREW TYPE)	ELGI	COIMBOITORE	
		ATLAS COPCO	BELGIUM. ASSEMBLY AND TESTING AT	

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			PUNE	
		KIRLOSKER PNEUMATIC PUNE	PUNE	
15.	ELECRIC HOIST	GRIP ENGINEERS PVT. LTD.,	FARIDABAD	
		MANGLA HOISTS PVT LTD	GREATER NOIDA	
		TECHNO INDUSTRIES	AHMEDABAD	
		TRACTEL TIRFOR INDIA PVT. LTD.	PALWAL	
		BRADY & MORRIS ENGINEERING CO. LTD.	AHMEDABAD	
		ALPHA SERVICES	BHIWADI	
		UNIVERSAL HOIST-O-FABRIK	MUMBAI	
		CENTURY CRANE ENGINEERS PVT. LTD.	PALWAL	
		REVA INDUSTRIES LTD.	FARIDABAD	
		CONSOLIDATED HOISTS PVT LTD	PUNE	
		EDDY CRANES PVT. LTD.	MUMBAI	
16.	PNEUMATIC ACTUATOR/ CYLINDER (UP TO 12")	SCHARDER	PUNE	
		NUCON	HYDERABAD	
		VASS	CHENNAI	
		ROTEX	MUMBAI	
17.	MS PLATES / STRUCTURES & SS LINERS (REFER NOTE - 3)	SAIL		
		ISPAT INDUSTRIES		
		ESSAR STEEL		
		IISCO		
		JSW		
		RINL		
		LLOYD STEEL INDUSTRIES LTD.		
		TISCO		
		JSPL		
18.	GRATING	INDIANA	PUNE	
19.	TOOLS AND TACKLES	BRANDED		

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20.	AIR RECEIVER	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	SELF-MANUFACTURING
		PARKAIRE	NEW DELHI	
		TEMASME VESELLEX	NOIDA	
		UNITED ENGG WORKS	NASIK	
		INTIGRATED ENGINEERS	PUNE	
		DIAMOND FABRICATOR	PUNE	
		SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	
		PARKAIRE	NEW DELHI	
		TEMASME VESELLEX	NOIDA	
21.	STRAINERS (Y-TYPE & BASKET TYPE)	MULTITEX FILTRATION ENGINEERS LIMITED,	NOIDA	
		SAROJINI ENTERPRISES	KOLKATA	
		OTOKLIN FILTERS	MUMBAI	
		BHATIA ENGINEERING CO.	DELHI	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		FILTRATION ENGINEERS (I) PVT. LTD.	MUMBAI	
		OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NOIDA	
		SAROJINI ENTERPRISES	KOLKATA	
		OTOKLIN FILTERS	MUMBAI	
		BHATIA ENGINEERING	DELHI	

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		CO.		
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
22.	DRAIN PUMP (SUBMERSIBLE)	SU MOTORS	MUMBAI	MAIN CONTRACTOR COC ALONGWITH MANUFACTURER STD. TC TO BE SUBMITTED.
23.	HORIZONTAL/V ERTICAL CENTRIFUGAL PUMP	KBL	KIROLSKAR WADI	
		M&P	PUNE	
		FLOWMORE	GHAZIABA D	
		SULZER PUMPS INDIA LTD.	NAVI MUMBAI	
		WORTHINGTON	GHAZIABA D	
		BHARAT PUMPS & COMPRESSORS LTD	ALLAHABA D	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATO RE	
		JYOTI LTD.	VADODARA	
	VERTICAL CENTRIFUGAL PUMP	KISHORE PUMP	PUNE	
		SAM TURBO	COIMBATO RE	
		KSB	PUNE	
		BEST AND CROMPTON	CHENNAI	
		VOLTAS	MUMBAI	
		V-FLO PUMPS & SYSTEMS CO. LTD.,	BEIJING, CHINA	
24.	FITTINGS	M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABA D	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABA D	
		EBY	MUMBAI	
25.	S.S. PIPES	REMI	MUMBAI	

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	(FOR SMALL QUANTITY -500 M)	RATMANI	AHMEDABAD	
		APEX TUBES	BEHROR	
		CHOKSI	AHMEDABAD	
26.	STEEL PLATE, STRUCTURAL STEEL AND SECTION FOR FIRE WATER STORAGE TANK	SAIL	ANY PLANT	FOR SMALL QUANTITY: AUTHORISED STOCKIST/ DEALER OF APPROVED LISTED MAKES FOR WHICH TCS/IRS WILL BE FURNISHED
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		
		LLOYD		
		ISPAT		
		INDIAN IRON & STEEL CO. LTD		
27.	GEARED MOTOR	PBL	ANAND - V.V NAGAR	
		PREMIUM	PUNE	
		BONFIGLIOLI	CHENNAI	
		SEW	GERMANY	
		IC	AURANGABAD	
28.	ELECTRIC HOIST	ARMSEL MHE PVT. LTD	BANGALORE	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD	
		GLOBAL TECHNOLOGIES	HYDRABAD	
		HERCULES HOISTS LTD.	KHALAPUR	UPTO 25.0 T CAPACITY.
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	DELHI	

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		MEEKA MACHINERY PVT. LTD.	AHEMDAB AD	UPTO 15 TONNES.
		REVA INDUSTRIES LTD.	FARIDABAD	
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADUR GARH	
		SAFEX ENERGY PVT. LTD.	AHEMDAB AD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	
		TECHNO INDUSTRIES	AHEMDAB AD	
29.	MRHS - SILO	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS/ SITE	
30.	FQP RECEIPT, STORAGE & ERECTION	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	
B	ELECTRICAL & INSTRUMENTATION			
1.	MOTORS	SIEMENS	MUMBAI	FOR HT AND LT MOTOR
		NGEF	BANGALORE	UP TO 15KW
		KEC	BANGALORE/HUBLI	HUBLI UP TO 90KW
		CGL	AHEMAD NAGAR	
		ABB	FARIDABAD/BANGALORE	FARIDABAD UP TO 55KW, BANGALORE ABOVE 55KW & UP TO 200KW
		MARATHON	KOLKATA	FOR HT AND LT MOTOR
		CROMPTON GREEVES	AHMEDABAD	FOR HT AND LT MOTOR
		JYOTI	VADODARA	FOR LT MOTOR ONLY
		LHP	SOLAPUR	UP TO 120 KW
		BHEL	BHOPAL	FOR HT MOTOR ONLY

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		BHARAT ELECTRIC (BHEL)		FOR LT MOTOR ONLY
		BHARAT BIJLEE LTD.	MUMBAI	UP TO 160KW (LT MOTOR ONLY)
		GE-POWER		LV MOTORS (NON FLAME PROOF)
		RAJINDRA ELECT INDUSTRIES		LV MOTORS (NON FLAME PROOF)
2.	AIR FILTER / LUBRICATOR / REGULATOR	PLACKA	CHENNAI	
		SHAVONORGAN	MUMBAI / BANGALORE	
3.	LEVEL SWITCHES (RF) / CAPACITANCE TYPE	EIP ENVIRO LEVEL CONTROL	NOIDA	
		NIVO CONTROL	INDORE	
		FLOW STAR	FARIDABAD	
		E&H	GERMANY /AURANGABAD (INDIA)	ONLY CAPACITANCE TYPE
		SAPCON	INDORE	
		LEVCON	KOLKATA	
		DREXEL BROOK	USA	
4.	ANNUNCIATORS	IIC	MUMBAI	
		PECON	AHEMDABAD	
		PROCON	CHENNAI	
5.	SOLENOID VALVES	NUCON	HYDERABAD,	
		HERION	GERMANY	
		ASCO	CHENNAI	
		ROTEX	BARODA/ VV NAGAR	
		SMC	NOIDA	
		AVCON	MUMBAI	
6.	PRESSURE SWITCHES, DP SWITCHES / TEMPERATURE SWITCHES	BARTON INST. SYSTEM	USA	
		SWITZER	CHENNAI	UPTO 40KG/CM2 & 200DEG EXCEPT 900SERIES, NOT FOR COMPOUND PRESSURE

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				SWITCH
		GAUGES BOURDON (FOR PRESSURE SWITCH)	PANVEL	UPTO 40KG/CM2 & 200DEG EXCEPT COMPOUND PRESSURE SWITCH
		ASHCROFT	GANDHIN AGAR	
		INDFOS IND.	GAZIABAD	UPTO 40KG/CM2 & 200DEG EXCEPT COMPOUND PRESSURE SWITCH
		DRESSER	USA	
		TRAFAG	RANIPET/ GURGAON	
7.	PRESSURE GAUGES && DP GAUGES	AUXITROL	UK	MAIN CONTRACTOR COC ALONGWITH MANUFACTURER STD. TC TO BE SUBMITTED.
		BUDENBURG	UK	
		GAUGE BOURDEN	PANVEL	
		GOA THERMOSTATIC MANOMETER INDIA	GOA	
		SWITZER (DP GAUGE)	MUMBAI	
		FORBE MARSHALL	CHENNAI	
			HYDRABAD	
		GUCK INDIA	MUMBAI	
		AN INSTRUMENTS	KOLKATA	
		H GURU SOUTH INDIA	BANGALORE	
		GENERAL INST	MUMBAI/ GOA	
		WIKA	PUNE	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI- MAHARASHTRA	
		ASHCROFT INDIA PVT LTD.	KALOL- GUJARAT	
8.	TEMPERTURE GAUGES	AN INSTRUMENTS	KOLKATA	MAIN CONTRACTOR COC ALONGWITH MANUFACTURER STD. TC

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				TO BE SUBMITTED.
		WIKI	PUNE	
		GAUGES BOURDON	PANVEL	
		H. GURU SOUTH INDIA	BANGALORE	
		FORBE MARSHALL	HYDRABAD	
		BUDENBURG	UK	
		GENERAL INST	MUMBAI/GOA	
		GOA THERMOSTATIC	GOA	
		ASHCROFT INDIA PVT LTD.	KALOL-GUJARAT	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI-MAHARASHTRA	
9.	PULSE VALVE	ASCO	CHENNAI	
		MANIK	PUNE	
10.	CABLE GLANDS	SUNIL & CO.	KOLKATA	
		ARUP ENGG & FOUNDRY WORKS	KOLKATA	
		QUALITY PRECISION	KOLKATA	
		COMMET BRASS PRODUCTS	MUMBAI	
		ALLIED TRADERS & EXPORTERS		
		BALIGA LIGHTING EQPT.PVT.LTD.		
		DOWELLS		
		ELECTROMAC INDUSTRIES		
		INCAB		
11.	CABLE LUGS	DOWELLS	MUMBAI	
		BILLET (3D)	VALSAD	
		WAGO	INDIA	
		COMET	MUMBAI	
		CHETNA	NASHIK	
		UNIVERSAL MACHINES LTD.		

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12.	CABLE TRAYS & ACCESSORIES	MJ ENGG	DELHI / BHIWADI	
		JAMUNA METALS	DELHI / SONEPAT	
		INDUSTRIAL PERFORATION	KOLKATT A	
13.		INDIANA GRATINGS PVT. LTD.	MUMBAI	GALVANISATION TO BE DONE FROM BHEL-PEM APPROVED GALVANIZERS.
		INAR PROFILES	ANAKAPALLI	GALVANIZATION AT VISAKHA-ANAKAPALLY
		EROS METAL WORKS (P) LTD.	NAGPUR	GALVANISATION TO BE DONE AT M/S EROS INFRASTRUCTURE PVT. LTD. OR FROM BHEL-PEM APPROVED GALVANIZERS.
		INDIA ELECTRICALS SYNDICATE	KOLKATA	REGISTERED AS PER 27TH MISCC-ELECTRICAL AND C&I MEETING DTD. 13.03.2014.
		INDMARK FORMTECH PVT. LTD.	PUNE	GALVANIZING UNIT LOCATED AT PHAS-3, E-11/1, MIDC, PUNE ,
		MAHESHWARI ELECTRICAL	NOIDA	GALVANIZING TO BE DONE
		MFRS. PVT. LTD.,		FROM BHEL-PEM APPROVED GALVANIZERS.
		NAMDHARI INDUSTRIAL TRADERS PVT. LTD	LUDHIANA	GALVANISING CAN BE DONE FROM THEIR OWN GALVANISING PLANT OR PEM APPROVED GALVANISING UNITS
		PREMIER POWER PRODUCTS (CAL) PVT. LTD.	KOLKATA	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS.
		PATNY SYSTEMS (P) LTD	SEUNDRA	

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	BAD	
PARMAR METALS PVT.LTD.	RAJKOT	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS.
PASSIVE INFRA PROJECTS PVT. LTD.	DELHI	
PENTAX FERRO INCORPORATE	MUMBAI	IT'S GALVANIZATION PLANT M/S GALBRO ISPAT GALVANIZERS PVT. LTD.
RUKMANI ELECTRICAL & COMPONENTS PVT LTD	KOLKATA	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED ADDITIONAL WORKS AT RAIPUR INCLUDING GALVANIZING PLANT.
RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	KOLKATA	MSED-MICRO; GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS. REMARKS CHANGED W.E.F. 03.07.2014; , ADDITIONAL WORKS AT "SANKRAIL INDUSTRIAL PARK, BHAGABATIPUR MAUJA, DHULAGARH, HOWRAH-711302" APPROVED W.E.F. 08.12.2014 ,
RABI ENGINEERING WORKS PVT. LTD.	KOLKATA	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS. LATEST LIST

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				WILL BE PROVIDED AT THE TIME OF TENDERING; REMARKS ADDED W.E.F. 03.07.2014
		SARAL INDUSTRIES	RAE BAREILI	APPROVED IN PERMANENT CATEGORY FOR FABRICATION OF CABLE TRAYS & ACC. ONLY. GALVANIZING TO BE DONE FROM BHEL APPROVED GALVANIZERS.
		UNITECH FABRICATORS AND ENGINEERS PVT LTD	KOLKATA	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS. LATEST LIST WILL BE PROVIDED AT THE TIME OF TENDERING; REMARKS CHANGED W.E.F. 03.07.2014
		VINFAB ENGINEERS INDIA PVT. LTD.	MUMBAI	
14.	LOCAL PANEL / LPBS	PYROTECH	UDAIPUR	LOCAL PANEL: CAT- I & LPBS: CAT- III*
		C & S	NOIDA	
		INDUST CONTROLS AND APPLIANCE	MUMBAI	
		POSITRONICS	BARODA	
		SWITCHING CIRCUITS	KOLKATT A	
15.	JUNCTION BOXES	AJMERA INDUSTRIAL & ENGINEERING WORKS	MUMBAI	GALVANIZED AND FRP JUNCTION BOXES
		KEMROCK	VADODAR A	FRP JUNCTION BOXES
		TRINITY TOUCH	PALWAL	FRP JUNCTION BOXES

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		FLEXPRO ELECTRICALS PVT. LTD.	GIDC, KABILPOR E, NAVSARI GUJARAT	METAL TYPE JUNCTION BOX ONLY
		K.S.INSTRUMENTS PVT.LTD.	INDUSTRI AL SUBURB, YESHWAN THPUR BANGALO RE- KARNATA KA	
		SUCHITRA INDUSTRIES	REJAMAH ALVILAS EXTN 2ND STG BANGALO RE	
		SHRENIK & COMPANY,	PANCHRA TNA INDUSTRI AL ESTATE, SARKHEJ- BAVLA ROAD AHMEDAB AD- GUJARAT	FRP JBS AND METAL JBS.
		HOFFMAN	BANGALO RE	
		RITTAL	BANGALO RE	
16.	CONTROL CABLES	PARAMOUNT CABLE	ALWAR	FOR QUANTITY LESS
		DELTON	FARIDABA D	THAN 500 METERS / SIZE,
		NICCO	KOLKATT A	MANUFACTURER'S COC ALONG WITH TYPE TEST CLEARANCE SHALL BE

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		HVPL	FARIDABAD	REVIEWED.
		POLYCAB	DAMAN	
		KEI	BHIWADI	
		RADIANT	HYDRABAD	
		ICL	RAJPURA	
		CORDS CABLE	BHIWADI	
17.	SIGNAL CABLES	PARAMOUNT CABLE	ALWAR	IF A VENDOR IS
		RELIANCE ENGR.	BANGALORE	APPROVED IN PAST AND
		NICCO	KOLKATA	FOR 5 YEARS VENDOR
		DELTON	FARIDABAD	HAVE NOT SUPPLIED
		UNIVERSAL	SATNA	ITEMS TO BHEL THEN
		CORDS CABLE	BHIWADI	DETAILS TO BE
		KEI	BHIWAF	FURNISHED.
		THERMOCABLES	HYDRABAD	
		ELAKAY TELELINKS	FARIDABAD	
		POLYCAB	DAMAN	
18.	EARTHING MATERIALS	INDIANA	PUNE	
		JAMUNA METALS	DELHI	
		MJ ENGG	DELHI	
19.	LEVEL INDICATOR / GAUGES [FLOAT & BOARD TYPE / FLOAT & DISPALCER TYPE / TRANSPARARENT & REFLEX TYPE]	SBEM PVT. LTD.	PUNE	
		PUNE TECHTROL	PUNE	
		LEVCON	KOLKATA	
		SIGMA	MUMBAI	
		DK INSTRUMENTS	KOLKATA	
		GAUGE BOURDEN	PANVEL	
20.	TRANSMITTERS	ABB LIMITED	FARIDABAD DHARYAN A	PRESSURE TRANSMITTER, DP TRANSMITTER AND TEMP TRANSMITTER

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		ENDRESS + HAUSER (INDIA) PVT. LTD.,	NEW DELHI	FOR TEMPERATURE TRANSMITTER ONLY.
		MOORE INDUSTRIES INTERNATIONAL INC.	CALIFORNIA-USA	INDIAN REPRESENTATIVE: CHEMTROL INDUSTRIES LTD.
		NIVO CONTROLS PVT. LTD.	INDORE- M.P	FOR CAPACITANCE TYPE ONLY
		PUNE TECHTROL PVT. LTD.	PUNE- MAHARAS HTRA	ONLY FOR CAPACITANCE TYPE LEVEL TRANSMITTER
		EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	MUMBAI- MAHARAS HTRA	
		SIEMENS LIMITED	MAHARAS HTRA	
		SMART INSTRUMENTS LTD, BRAZIL	MUMBAI- MAHARAS HTRA	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.
		SBEM PVT. LTD.	PUNE- MAHARAS HTRA	FOR CAPACITANCE TYPE.
		HONEYWELL AUTOMATION INDIA LIMITED	NEW DELHI- DELHI- INDIA	
		TOSHNIWAL INDUSTRIES PVT. LTD.,	AJMER,- RAJASTHA N,	
		V. AUTOMAT & INTRUMENTS (P) LTD.	NEW DELHI-	A) DISPLACEMENT TYPE TRANSMITTERS. B)PRESSURE AND DP TRANSMITTERS
		YOKOGAWA INDIA LIMITED,	BANGALO REKARNA TAKA	
21.	MICRO- PROCESSOR / MICRO- CONTROLLER MICRO-	ALLEN BRADLY	BANGALO RE	
		SIEMENS	BANGALO RE	
		GE	BANGALO	

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	PROCESSOR / MICRO-CONTROLLER		RE	
		SCHENIDER	BANGALORE	
22.	Battery	EXIDE	KOLKATA	
		HBL POWER SYSTEM	HYDERABAD	
		AMAR RAJA	TIRUPATI	
		AMCO SAFT	BANGALORE	
		HBL POWER SYSTEM	HYDERABAD	
		SAFT	FRANCE/SWEDEN	
23.	DC Lead Acid / Ni-Cd Batteries	AMCO SAFT INDIA LTD	BANGALOREKARNATAKA	
		EXIDE INDUSTRIES LTD	NEW DELHI	
		HBL POWER SYSTEMS LTD	HYDERABAD-AP	
		HOPPECKE BATTERIEN GMBH & CO.KG,	BRILON HOPPECKE-GERMANY	
24.	DC BATTERY CHARGER	AMARA RAJA POWER SYSTEMS LIMITED	TRIPUTI-TAMIL NADU	
		CHHABI ELECTRICALS PVT.LTD.	JALGAON-MAHARASHTRA	
		CHLORIDE POWER SYSTEMS & SOLUTIONS LIMITED	KOLKATA-WEST BENGAL	
		DUBAS ENGG PVT LTD	BANGALORE	
		HBL POWER SYSTEMS LTD	HYDERABAD-AP	
		JEMA ENERGY	LASARTE-ORIASPAIN	

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		MASS-TECH CONTROLS PVT.LTD.	MUMBAI	
		STATCON POWER CONTROLS LTD	NOIDA-UTTAR PRADESH	
25.	INSTRUMENT FITTINGS	AURA INCORPORATED	DELHI	
		ASTEC VALVES & FITTINGS PVT. LTD.,	MUMBAI	
		ARYA CRAFTS & ENGINEERING PVT. LTD.	MUMBAI	
		COMFIT & VALVE PVT. LTD.	NANDASAN	
		FLUIDFIT ENGINEERS PVT. LTD.	MUMBAI	
		FLUID CONTROLS PVT. LTD.	MUMBAI	
		HP VALVES & FITTINGS INDIA PVT. LTD.	CHENNAI	
		PRECISION ENGINEERING INDUSTRIES	MUMBAI	
		PANAM ENGINEERS,	MUMBAI	
		PERFECT INSTRUMENTATION CONTROL (INDIA) PVT. LTD.	MUMBAI	
		VIKAS INDUSTRIAL PRODUCTS	NOIDA	
26.	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	AM-TECH ENGG.SERVICES	PUNE	
		INDUSTRIAL PERFORATION (I) PVT.LTD.	KOLKATA	
		INDMARK FORMTECH PVT. LTD.	PUNE	WORKS ADDRESSES ARE APPLICABLE FOR MANUFACTURING AND GALVANISING.
		PREMIER POWER PRODUCTS (CAL) PVT. LTD.	KOLKATA	

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27.	CABLE TRAY SUPPORT SYSTEM- WELDED(GALV) CABLE TRAY SUPPORT SYSTEM- WELDED(GALV)	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	KOLKATA	GALVANIZING UNIT LOCATED AT PHAS-3, E-11/1, MIDC, PUNE
		STEELITE ENGINEERING LTD.	MUMBAI	
		ASSOCIATED POWER STRUCTURES PVT. LTD.	VADODAR AGUJARA T	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS.
		INDUSTRIAL PERFORATION (I) PVT.LTD.	KOLKATA -WEST BENGAL	
		INDMARK FORMTECH PVT. LTD.	PUNE- MAHARAS HTRA	
		JAMNA METAL COMPANY	NARLA INDL. AREA DELHI	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS.
		PREMIER POWER PRODUCTS (CAL) PVT. LTD.	KOLKATA, -WEST BENGAL	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS. ADDITIONAL WORKS AT "SANKRAIL INDUSTRIAL PARK, BHAGABATIPUR MAUJA, DHULAGARH, HOWRAH- 711302" APPROVED
		PATNY SYSTEMS (P) LTD	SECUNDR ABAD	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS.
		PASSIVE INFRA PROJECTS PVT. LTD.	PITAMPUR A DELHI	REGISTERED IN PERMANENT CATEGORY ALONG WITH GALVANIZER M/S SARAL



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				PROJECTS AND PROCESSORS , ,
		RUKMANI ELECTRICAL & COMPONENTS PVT LTD	KOLKATA -WEST BENGAL	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS.
		RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	KOLKATA -WEST BENGAL	
		RABI ENGINEERING WORKS PVT. LTD.	KOLKATA -WEST BENGAL	
		SARAL INDUSTRIES	RAE BARELI-UTTAR PRADESH	
		UNITECH FABRICATORS AND ENGINEERS PVT LTD	KOLKATA -WEST BENGAL	HEAT SHRINKABLE TYPE ONLY.
28.	CABLE TRAY SUPPORT SYSTEM-WELDED(UNGA LV)	RASHTRIYA ISPAT NIGAM LIMITED	AMBAWA DI AHEMDAB AD	
		STEEL AUTHORITY OF INDIA LTD.	ISPAT BHAWAN LODI ROAD NEW DELHI	
29.	CABLE TERM.& JOINT KITS	3M ELECTRO AND COMMUNICATION INDIA P.LTD	RAJENDR A PLACE, DELHI	CABLE TERM.& JOINT KITS
		HARI CONSOLIDATED PVT.LTD.,NEW DELHI	JHANDEW ALAN, NEW DELHI-DELHI	
		RAYCHEM RPG PRIVATE LIMITED	JANAKPU RI NEW DELHI	

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		YAMUNA CABLE ACCESSORIES PVT. LTD.	AMBALA ROAD, JAGADHRI YAMUNA NAGARHA RYANA	
30.	MICRO- PROCESSOR / MICRO- CONTROLLER	ALLEN BRADLY	BANGALO RE	
		SIEMENS	BANGALO RE	
		GE	BANGALO RE	
		SCHENIDER	BANGALO RE	
31.	ACTUATOR FOR MOTORISED VALVE	AUMA	BANGALO RE	
		LIMITORQUE	FARIDABA D	
32.	PAINT	ASIAN PAINTS (I) LTD.	ANY PLANT	
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		

**FOR MAKES OF OTHER CONTROL AND INSTRUMENTATION-REFER
ANNEXURE C1**

NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO
BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING

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STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.

BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

2. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY.
3. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER, THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.



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Annexure-D
LIST OF MANDATORY SPARES

SL. NO.	DESCRIPTION	TOTAL QUANTITY FOR THE PROJECT
	Mill Reject Handling System	
	Pneumatic Conveying System	
1	Conveying System Spares	
(i)	Pneumatic main valves	4 sets of each type
(ii)	Pneumatic/Solenoid Two/ Three position control valve	4 sets of each type
(iii)	Plate/Dome valve(including seals) with Actuators (pneumatic/hydraulic)	6 no's
(iv)	Plate/Dome valve seals	6 sets
2	Mill reject Compressor	
(i)	Compressor	1 no.
(ii)	Compressor motor	1 no.
3	Indicators, Recorders, Electrical Metering and Skid Mounted Instruments	
(i)	For skid mounted instruments	10% of total number of instruments for each Type and model or a minimum of one number for each model and type, whichever is more
(ii)	Panel and Wall mounted Indicators	10% of total number of instruments or a minimum of one number for each type, model, range etc. whichever is more
4	Temperature Elements and Thermowells	
(i)	Thermocouple/RTD elements	15% of flue gas temp, coal air mixture temp, boiler/TG metal temp thermocouples and 5% for other applications of total duplex thermocouple element assemblies and duplex RTD assemblies (with head assembly, terminal block and nipple) of each type and length whichever is more. The element assembly shall be suitable for direct replacement in the corresponding thermowell.
(ii)	Thermowells	10% for each type of temperature sensors or a minimum of one for each type & size, whichever is more
5	Temperature Transmitters and Electronic Transmitters of all type, range and model no. (For Pressure, DP, Temp, Flow, Level), Process Transmitters, Radar type level transmitter, 3D type level Transmitter with local display, Magnetic/Electromagnetic flow meter with local display, mass flow meter with	10% of total number of instruments/transducers offered for each model and type, rating or a minimum of one number for each model, rating and type , whichever is more.

PART OF SPECIFICATION PE-TS-426-160-A001



1X660 MW PANKI EXTN

TECHNICAL SPECIFICATION FOR MILL REJECT SYSTEM (PNEUMATIC TYPE)

SPECIFICATION No: PE-TS-426-160-A001

PACKAGE: MILL REJECT SYSTEM
(PNEUMATIC TYPE)

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	local display., Process meters, Junction Box, Position Transmitter, Transducer or any other instrument etc.	
6	Process actuated switch Devices- As applicable for each package as per following:	
	1. Temperature Switches	5% of total nos. or 1 no. of each make, model, range and type whichever is more
	2. Differential pressure Switches	5% of total nos. or 1 no. of each make, model, range and type whichever is more
	3. Pressure switches	5% of total nos. or 1 no. of each make, model, range and type whichever is more
	4. Level Switches	5% of total nos. or 1 no. of each make, model, range and type whichever is more
7	Local Gauges like temperature gauges, pressure gauges, differential Pressure gauges, flow gauges, flow meters with local display etc.	10% of total number of instruments/transducers offered for each model and type, rating or a minimum of one number for each model, rating and type , whichever is more.
8	All type of Rotameters & Sight Flow Indicator.	1 no. of each range and type
9	Any other instruments not indicated in the tender P&ID but required for control, monitoring and operation of the equipment/plant/systems	10% or 2 nos. of each type whichever is more
10	Complete Electronic card/PCB assembly and Power supply card assembly.	10% of Electronic card/PCB assembly for each type, model & rating or a minimum of one number for each model, rating and type, whichever is more for each type of Transmitter, switch & Flow Meters.
11	415 V Motors	
i	Terminal plates	10 Nos. each for small motors upto 30 kW & 4 Nos. each for more than 30 kW
ii	Heaters	2 sets
iii	Greasing arrangements	4 sets each type of motor
iv	Motor of each type and rating	10% of the installed quantity or minimum 1 number whichever be higher (Excluding compressor motor)
v	Bearings (DE and NDE) for each type and rating of motors.	4 sets
vi	Stator winding coils for all type of LT motors	One (1) set
vii	Dust seals and gaskets for each type of motors	Three (3) sets
12	LP piping- Valves [Complete valve along with Actuators (pneumatic / hydraulic) and all other accessories which are the part of original supply shall be supplied]	5% of the total population (minimum 2 Nos) for each type, material, size and class, whichever is more

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TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)

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Notes:

1. Percentage shall be calculated based on total quantity installed in power plant for Mill Reject system.
2. One (1) set means 100% requirement in one equipment of each type/size/range.
3. Set for the particular equipment, would include all components required to replace the item, for example a set of bearing shall include all hardware normally required while replacing the bearings. It is further, intended that the assembly / sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly / sub-assembly, these shall be considered as different types of assembly/sub-assembly.
4. Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed.
5. Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity
6. Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number
7. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed as per the list
8. Any item which is quoted as “not applicable” in the above list and is found to be “applicable” at a later date shall be supplied by the Bidder without any commercial implications. The Bidder shall note that if there in any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the mandatory spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.
9. Mandatory spares shall not be dispatched before dispatch of corresponding main equipment. The spares shall be treated and packed for a long storage under the climatic condition prevailing at site.
10. All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. These spares should include all mounted accessories like components, boards, add or items, fitting, connectors etc. and be complete in all respects so that the replacement of the main items by these spares does not require any additional item. The vendors must conform the pair to pair compatibility of each electrical spares modules with the modules should be supplied in the original package. All electronic modules should be pre-set and/or pre-programmed for ready use at site. Alternatively, suitable instruction sheet indicating the details of required PCB jumper position, BCD which is setting, EPROM/PROM listing etc should be packed along with each module. Also a caution mark sign should be put on all such module which needs pre-setting/pre-programming before putting them in to service. The spares shall be treated and packed for long storage under the climatic conditions prevailing at

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the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.

11. Each spares part shall be clearly marked or labeled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.



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ANNEXURE-E

MAINTENANCE TOOLS & TACKLES

Sl.No.	Description	Qty.	Unit
1	Spur geared chain pulley block of 2.0 tonnes capacity , 3 mtr.	1	Nos.
2	2 lbs ball pen hammers	2	Nos.
3	Cold Chisel 8"	2	Nos.
4	6" outside and inside callipers	2	Nos.
5	Double end spanners and ring spanners upto one inch size	2	Sets
6	6 feet long measuring tape	1	Nos.
7	a Hacksaw frames 1/2" x 12	4	Nos.
	b HSS blade 12 x 1/2"	6	Nos.
	c Hacksaw blades	6	Nos.
8	Allen keys set	2	Sets
9	Pipe wrenches 18"	2	Nos.
10	10" right angle	1	Nos.
11	12" aluminium spirit levels	2	Nos.
12	Filler Gauges - 8" & 12"	2	Sets
13	10" slide wrenches	2	Nos.
14	6",8",10",12" screw drivers	1	Set
15	Insulated Pliers 8"	1	No.
16	Tommy Bars 6"	2	Nos.
17	a) Cotton Hand Gloves	2	Pairs
	b) Lather Hand Gloves	2	Pairs
18	Lifting wire rope slings 8 ft with eye at each end 1/2 " size and 5/8" size	2	Pair each
19	Ratchet and sockets set for hexagonal head screws & bolts size M-6 to M-24	1	Set
20	Flaring tools with disc	1	Set
21	Grease Gun	1	No
22	Oil Gun	1	No
23	Screw Pitch Gauge	1	No
24	a) JK Flat file 12" smooth	2	Nos.
	b) JK Half round file 12" rough	2	Nos.
	c) JK Half round file 12 " fine	2	Nos.
	d) Square file 12"	2	Nos.
	e) Round File 12"	2	Nos.
25	Line Tester no: 814	2	Nos.
26	a) Cutting Pliers 8"	2	Nos.
	b) Nose Pliers 6"	2	Nos.
27	Soldering iron with flux	1	No.
28	Vice 4" & 12"	1	No. each
29	Taps and Dies	1	No.
30	Steel Scale 12" & 24"	2	each
31	Hand Lamps	2	Nos.
32	Torch with Battery (2 sizes)	2	Nos.

PART OF SPECIFICATION PE-TS-426-160-A001

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ANNEXURE-F

A. DRAWINGS/ DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

S.No.	BHEL DRGNO	DRG TITLE	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF LOI	CATEGORY
1	PE-V0-426-160-A002	GA OF WATER AND AIR LINE VALVES	12	A-CUST
2	PE-V0-426-160-A003	G.A., TECHNICAL DATA SHEET OF AIRCOMPRESSOR MOTOR	10	A-CUST
3	PE-V0-426-160-A004	DESIGN PHILOSOPHY AND SYSTEM SIZING CALCULATION OF MILL REJECT SYSTEM	4	A-CUST
4	PE-V0-426-160-A005	INSTRUMENT SCHEDULE	10	I-CUST
5	PE-V0-426-160-A006	P & I DIAGRAM OF MILL REJECT HANDLING SYSTEM	4	A-CUST
6	PE-V0-426-160-A007	DETAILED BOM	20	I-BHEL
7	PE-V0-426-160-A008	GA & DS OF SELF MFG. ITEMS (DENSVEYOR, HOPPER, BNKR DIS. GATE, PRV, ACI BEND, PNEU. PANEL, AIR RECVR, TER. BOX, ETC.)	6	I-CUST
8	PE-V0-426-160-A009	P G TEST PROCEDURE	20	A-CUST
9	PE-V0-426-160-A010	P & I DIAGRAM OF MRS COMPRESSOR	10	A-CUST
10	PE-V0-426-160-A011	SUB VENDOR LIST WITH INSPECTION CATEGORY	4	A-CUST
11	PE-V0-426-160-A012	WELDING PROCEDURE SPECIFICATION	6	A-CUST
12	PE-V0-426-160-A013	EQPT AND PIPING LAYOUT OF MILL REJECT SYSTEM AND PIPING LAYOUT FROM COMPRESSOR HOUSE	8	A-CUST
13	PE-V0-426-160-A014	LAYOUT OF COMPRESSOR HOUSE	10	A-CUST
14	PE-V0-426-160-A015	QAP OF MS STRUCTURAL STEEL/ PLATES	6	A-CUST
15	PE-V0-426-160-A016	CABLE TRAY, EARTHING LAYOUT	10	A-CUST
16	PE-V0-426-160-A017	QAP OF SELF MANUFACTURED- CONVEYING VESSEL , PYRITE HOPPER, BUNKER DISCHARGE GATE, PRESSURE RELIEF VALVE, TERMINAL BOX , ACI BEND, AIR RECEIVER , PNEUMATIC PANEL	8	A-CUST
17	PE-V0-426-160-A019	G.A OF MRS BUNKER	6	A-CUST
18	PE-V0-426-160-A020	QAP OF MS ERW PIPE	10	A-CUST
19	PE-V0-426-160-A021	QP FOR COMPRESSOR	10	A-CUST
20	PE-V0-426-160-A022	TRENCH AND INSERT DETAIL OF MRS	8	A-CUST
21	PE-V0-426-160-A023	QP FOR KNIFE GATE/PLATE VALVE	10	A-CUST



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22	PE-V0-426-160-A024	DESIGN CALCULATION AND STRUCTURAL ARRANGEMENT OF BUNKER AND LOAD DATA OF BUNKER	10	A-CUST
23	PE-V0-426-160-A025	GA OF KNIFE GATE/PLATE VALVE	8	I-CUST
24	PE-V0-426-160-A026	QP FOR BAG FILTER	10	A-CUST
25	PE-V0-426-160-A027	G.A OF BAG FILTER	8	I-CUST
26	PE-V0-426-160-A028	QP FOR METALLIC EXPANSION BELLOW	10	A-CUST
27	PE-V0-426-160-A030	QP FOR RUPTURE DISC	10	A-CUST
28	PE-V0-426-160-A031	QP FOR ELECTRIC HOIST	10	A-CUST
29	PE-V0-426-160-A032	QP FOR WATER AND AIR LINE VALVES	10	A-CUST
30	PE-V0-426-160-A033	QP FOR COMPRESSOR MOTOR	10	A-CUST
31	PE-V0-426-160-A034	G.A OF METALLIC EXPANSION BELLOW	8	I-CUST
32	PE-V0-426-160-A035	G.A. OF RUPTURE DISC.	8	I-CUST
33	PE-V0-426-160-A036	QAP of INSTRUMENTS (PG/PS/PT/TS/TG/SV)	12	A-CUST
34	PE-V0-426-160-A037	GA AND SCHEMATIC DETAIL OF ELECTRIC HOIST	8	I-CUST
35	PE-V0-426-160-A040	TYPE TEST CERTIFICATE/PROCEDURE FOR MOTORS	10	A-CUST
36	PE-V0-426-160-A043	G.A., TECHNICAL DATA SHEET AND FOUNDATION DETAILS OF AIRCOMPRESSOR, GA AND WIRING DIAGRAM FOR LOCAL PANEL OF CONVEYING AIR COMPRESSOR	10	A-CUST
37	PE-V0-426-160-A044	QP FOR SUMP PUMP WITH MOTOR	12	A-CUST
38	PE-V0-426-160-A045	GA, TECHNICAL DATA SHEET AND WIRING DIAGRAM OF SUMP PUMP	10	I-CUST
39	PE-V0-426-160-A046	ELECTRICAL LOAD LIST	6	I-G-P
40	PE-V0-426-160-A047	TECHNICAL DATA SHEET OF TEMPERATURE SWITCH, TEMPERATURE GAUGE, PRESSURE SWITCH, PRESSURE GAUGE, SOLENOID VALVE, LEVEL SWITCH, AIR FILTER REGULATOR	10	I-CUST
41	PE-V0-426-160-A048	CONTROL WRITE-UP & INTERLOCK & PNEUMATIC CIRCUIT OF CONVEYING VESSEL, BLOCK LOGIC DIAGRAM/CONTROL SCHEME WITH HMI SCREEN & I/O List	10	A-CUST
42	PE-V0-426-160-A051	CABLE INTERCONNECTION DIAGRAM	14	I-CUST
43	PE-V0-426-160-A052	PAINTING SCHEDULE	8	I-CUST
44	PE-V0-426-160-A053	PIPING AND VALVE SCHEDULE	8	I-CUST
45	PE-V0-426-160-A054	CABLESCHEDULE -SIGNAL AND CONTROL	12	I-CUST
46	PE-V0-426-160-A055	OPERATION AND MAINTENANCE MANUAL	24	I-CUST

Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.

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2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
4. Bidder to note that all values/dimensions/elevations etc. without supporting back up data adopted/assumed by the successful bidder (during contract stage) in the design calculation/drawings shall be taken by the customer/owner to be correct unless they are stipulated in the specification. Any problem arising later in this regard shall be made good by the successful bidder at his cost and no extension of time shall be granted for the same.
5. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:-
 - a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
 - b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
 - c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
 - d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
 - e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3etc.
 - f) Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.
 - g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.
 - h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No.
 - i) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
 - j) Bidder to follow the following the drawing submission schedule:
 - i. 1st submission of drawings from date of LOI as per the submission schedule.
 - ii. Every revised submission incorporating comments – within 7 days.
 - k) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

**1X660 MW PANKI EXTN****TECHNICAL SPECIFICATION
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(PNEUMATIC TYPE)****SECTION-I****SUB-SECTION-IA****REV. 00****DATE: JUNE 2019****LIST OF BASIC DRAWINGS**

S. No.	BHEL DRGNO	DRG TITLE
1	PE-V0-426-160-A002	GA OF WATER AND AIR LINE VALVES
2	PE-V0-426-160-A003	G.A., TECHNICAL DATA SHEET OF AIRCOMPRESSOR MOTOR
3	PE-V0-426-160-A004	DESIGN PHILOSOPHY AND SYSTEM SIZING CALCULATION OF MILL REJECT SYSTEM
4	PE-V0-426-160-A006	P & I DIAGRAM OF MILL REJECT HANDLING SYSTEM
5	PE-V0-426-160-A008	GA & DS OF SELF MFG. ITEMS (DENSVEYOR, HOPPER, BNKR DIS. GATE, PRV, ACI BEND, PNEU. PANEL, AIR RECVR, TER. BOX, ETC.)
6	PE-V0-426-160-A011	SUB VENDOR LIST WITH INSPECTION CATEGORY
7	PE-V0-426-160-A013	EQPT AND PIPING LAYOUT OF MILL REJECT SYSTEM AND PIPING LAYOUT FROM COMPRESSOR HOUSE
8	PE-V0-426-160-A014	LAYOUT OF COMPRESSOR HOUSE
9	PE-V0-426-160-A017	QAP OF SELF MANUFACTURED-CONVEYING VESSEL, PYRITE HOPPER, BUNKER DISCHARGE GATE, PRESSURE RELIEF VALVE, TERMINAL BOX, ACI BEND, AIR RECEIVER, PNEUMATIC PANEL
10	PE-V0-426-160-A019	G.A OF MRS BUNKER
11	PE-V0-426-160-A022	TRENCH AND INSERT DETAIL OF MRS
12	PE-V0-426-160-A024	DESIGN CALCULATION AND STRUCTURAL ARRANGEMENT OF BUNKER AND LOAD DATA OF BUNKER
13	PE-V0-426-160-A043	G.A., TECHNICAL DATA SHEET AND FOUNDATION DETAILS OF AIRCOMPRESSOR, GA AND WIRING DIAGRAM FOR LOCAL PANEL OF CONVEYING AIR COMPRESSOR
14	PE-V0-426-160-A048	CONTROL WRITE-UP & INTERLOCK & PNEUMATIC CIRCUIT OF CONVEYING VESSEL, BLOCK LOGIC DIAGRAM/CONTROL SCHEME WITH HMI SCREEN & I/O List

Note:

Drawings listed above have been identified as basic drawings. During contract engineering stage, approval of these drawings from BHEL/Customer shall be treated as clearance to milestone payment for completion of design & engineering.

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B. DOCUMENT MANAGEMENT SYSTEM:

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per dwg/ document distribution schedule. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized after award of contract.

Bidder to ensure following at their end

Internet explorer version – Minimum Internet Explorer 7

Internet speed 2 mbps (Minimum preferred)

Pop ups from our external DMS IP (124.124.36.198) should not be blocked

Vendor's Internal proxy setting should not block DMS application's link

(<http://124.124.36.198/wrenchwebaccess/login.aspx>)”

DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.

For quick access bidder may refer the link

<http://bhelpem.com/DMSManuals/DMSManuals.html>

C. DOCUMENT DISTRIBUTION SCHEDULE

DOCUMENTS DISTRIBUTION SCHEDULE

S.No.	Description of Document	DESEIN				UPRVUNL			
		HO		SITE		HO		SITE	
		HC	CC	HC	CC	HC	CC	HC	CC
1.	Drawings, Data Sheets, Calculation, all equipment / Instrument Schedule, BOM etc. a) For Approval b) Resubmission c) For Information	6*	1	-	-	2	1	-	-
2.	Final Approved Documents	2	1 + 1 CD	1	1	1	1 + 2 CD	4	1 + 1 CD
3.	Drawings / Documents 'As Built'	2	1 + 1 CD	1	1	2	1 + 2 CD	4	1 + 1 CD
4.	Type Test Reports (Initial)	4*	1 + 1 CD	-	-	2	1 + 2 CD	-	-
5.	Type Test Report (Final)	2	1 + 1 CD	1	1	2	1 + 2 CD	4	1 + 1 CD
6.	Piping / Equipment Analysis (Transient) etc., Model Study Report (Draft) including Input / Output date etc.	4*	1	-	-	2	1 + 1 CD	-	-
7.	Piping / equipment Analysis (Transient) etc. Model Study Report (Final Approval) including Input / Output date	2	1 + 1 CD	-	-	2	1 + 2 CD	2	1 + 1 CD
8.	Erection Manual (Draft)	3*	1CD	-	-	1	1CD	-	-

S.No.	Description of Document	DESEIN						UPRVUNL					
		HO			SITE			HO			SITE		
		HC	CC	HC	HC	CC		HC	CC	HC	HC	CC	
9.	Erection Manual 'Final'	1	1CD	1	1	-		1	1CD	2		1CD	
10.	O&M Manual 'Draft'	3*	1CD	+		-		1	1CD	-		-	
11.	O&M Manual 'Final'	1	1CD	1		-		1	1CD	2		2CD	
12.	Commissioning Procedure 'Draft'	3*	1CD	-		-		1	1CD	-		-	
13.	Commissioning Procedure 'Final'	1	1CC	1		-		1	1CD	2		1CD	
14.	PG Test Procedure "Draft"	3*	1	-		-		1	1	-		-	
15.	PG Test Procedure 'Final'	1	1 + 1 CD	1		-		2	1 + 1 CD	2		1 + 1CD	
16.	Progress Report	3	1CD	1		-		2	1CD	1		1CD	
17.	PG Test Report for Approval	4*	1	-		-		2	1 + 1 CD	-		-	
18.	Approved PG Test Report	1	1 + 1 CD	1		-		2	1 + 1 CD	4		1 CD	
19.	Project Completion Report	1	1 + 1 CD	1		-		1	1CD	1		1CD	
20.	Vendor Details in respect of proposed vendors including Contractor's evaluation Report	1	1CD	-		-		1	1CD	-		-	
21.	Monthly Vendor / QP Approval Status	1	1	-		-		2	1	1		1	
22.	Manufacturing QPs, Field QPs for review / comments	6*	1	-		-		2	1CD	-		-	
23.	Manufacturing QPs, Field QP, Final	1	1CD	1		-		2	1CD	2		1CD	
24.	QA documents Package for equipment / field activities etc.	1	1CD	1		-		1	1CD	1		1CD	

* -	Consultant will return one (1) commented document to Vendor and CE (UPRVUNL), Lucknow
HC -	Hard Copy
CC -	Soft Copy thru e-mail
CD -	CD ROM
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1X660 MW PANKI EXTN

SPECIFICATION No: PE-TS-426-160-A001

TECHNICAL SPECIFICATION
FOR

MILL REJECT SYSTEM (PNEUMATIC TYPE)

PACKAGE: MILL REJECT SYSTEM
(PNEUMATIC TYPE)

SECTION-I

SUB-SECTION-IA

REV. 00

DATE: JUNE 2019

ANNEXURE G:

**PERFORMANCE GUARANTEES REQUIREMENT, TRAIL RUN, COMMISSIONING
REQUIREMENT, OPERATION & ERECTION MANUAL, THIRD PARTY INSPECTION, FQP
REQUIREMENT**

• PERFORMANCE GAUARNTTEE & LIQUIDATED DAMAGES

Performance Guarantee test shall comprise of

**Guarantee Under Category – I (Liquidated damages are applicable for following
guarantees)**

- i) Guaranteed auxiliary power consumption for each conveying air compressor at its rated duty point (refer schedule- Sec III)

If the contractor is not able to demonstrate the guarantees, UPRVUNL/ BHEL will have the right to reject the equipment / system / plant and recover the payments already made or accept the equipment / system after levying liquidated damages.

Guarantee Under Category – III

The parameters/capabilities to be demonstrated for various systems/ equipment shall include but not be limited to the following:

- i) Continuous effective discharge and conveying at the rated capacity of the mill rejects without spillage or blockage in the system.
- ii) Following shall be demonstrated at site for compressor
 - Capacity and discharge pressure of each air compressor
 - Power consumption of each air compressor at its rated duty point with its own motor.
- iii) Particulate emission rate from bag filters less than 30 mg/nm³ of air shall be demonstrated at site
- iv) Vibration and noise level of each compressor and any other rotating equipment shall be demonstrated at site.

All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency.

Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779.

Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment / machine and at height of 1.5m above the floor level in elevation.

The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any

PART OF SPECIFICATION PE-TS-426-160-A001

	1X660 MW PANKI EXTN TECHNICAL SPECIFICATION FOR MILL REJECT SYSTEM (PNEUMATIC TYPE)	SPECIFICATION No: PE-TS-426-160-A001	
		PACKAGE: MILL REJECT SYSTEM (PNEUMATIC TYPE)	
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equipment/machine, furnished & installed under these specification, expressed in decibels to a reference of .0002 microbar shall not exceed 85 dba except for-

- Safety valves & associated vent pipes for which it shall not exceed 105 dba.
- Regulating drain valves in which it shall be limited to 90 dba.

A minimum of 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on the A – weighting scale. The average of A-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar, shall not exceed the guaranteed value. Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.

In case during test it is found that the equipment/system has failed to meet the guarantees, the contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer. However, if the contractor is not able to demonstrate the guarantees, even after the above modifications/replacements within a reasonable period allowed by UPRVUNL/ BHEL, after the tests have been completed, UPRVUNL/ BHEL will have the right to Reject the equipment / system / plant and recover the payments already made or accept the equipment / system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by UPRVUNL/ BHEL

The contractor shall make every effort to practicable to correct the deficiencies. In case the Contractor fails to meet the guarantees, the equipment / system shall be replaced with the one that shall meet the guaranteed values without any time and cost implication to the Owner.



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TECHNICAL SPECIFICATION
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MILL REJECT SYSTEM (PNEUMATIC
TYPE)**

SPECIFICATION No: PE-TS-426-160-A001

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(PNEUMATIC TYPE)**

SECTION-I

SUB-SECTION-IA

REV. 00

DATE: JUNE 2019

#

ANNEXURE H
P&ID FOR MILL REJECT SYSTEM

PART OF SPECIFICATION PE-TS-426-160-A001



1X660 MW PANKI EXTN

TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)

SPECIFICATION No: PE-TS-426-160-A001

PACKAGE: MILL REJECT SYSTEM
(PNEUMATIC TYPE)

SECTION-I

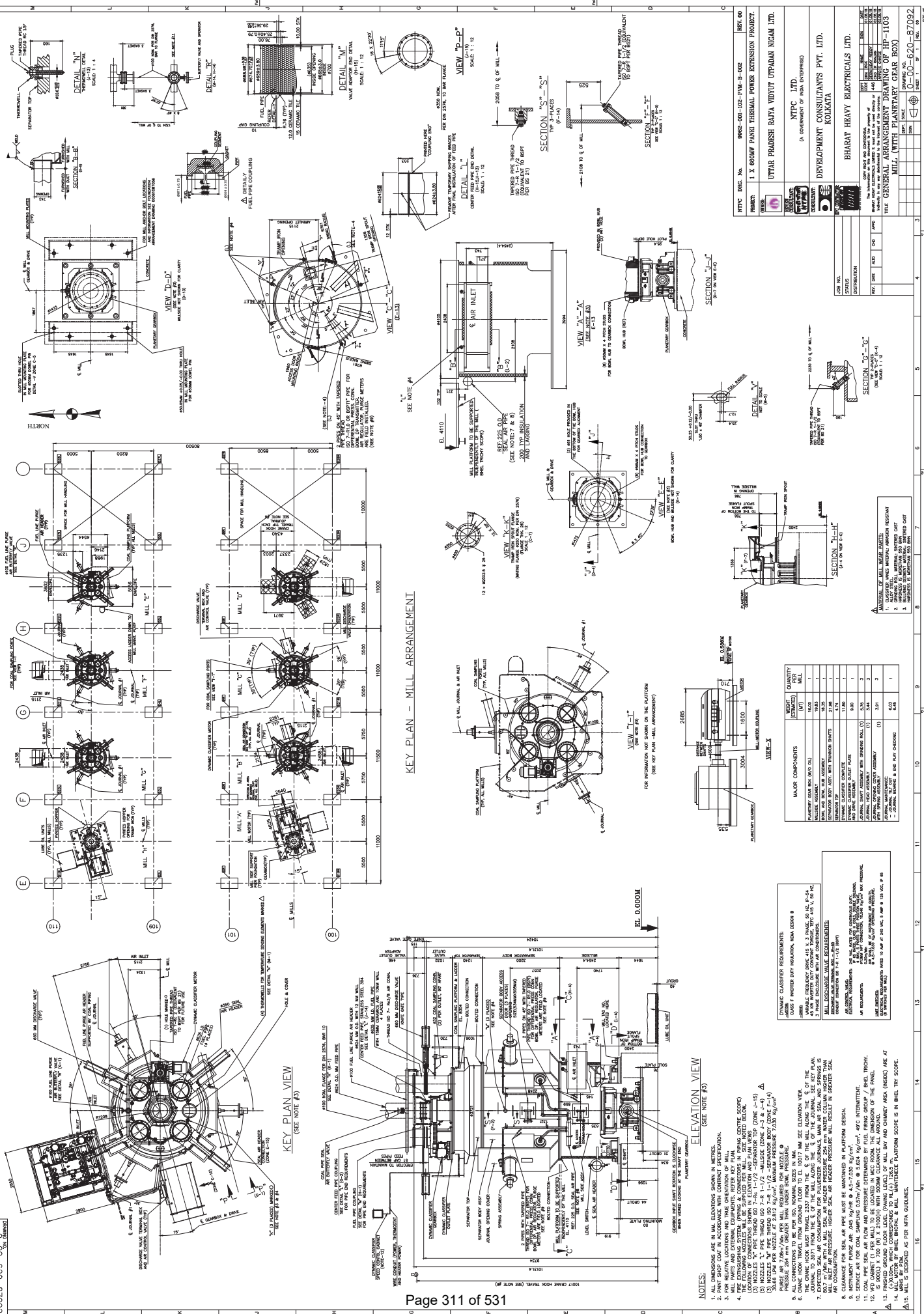
SUB-SECTION-IA

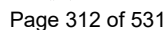
REV. 00

DATE: JUNE 2019

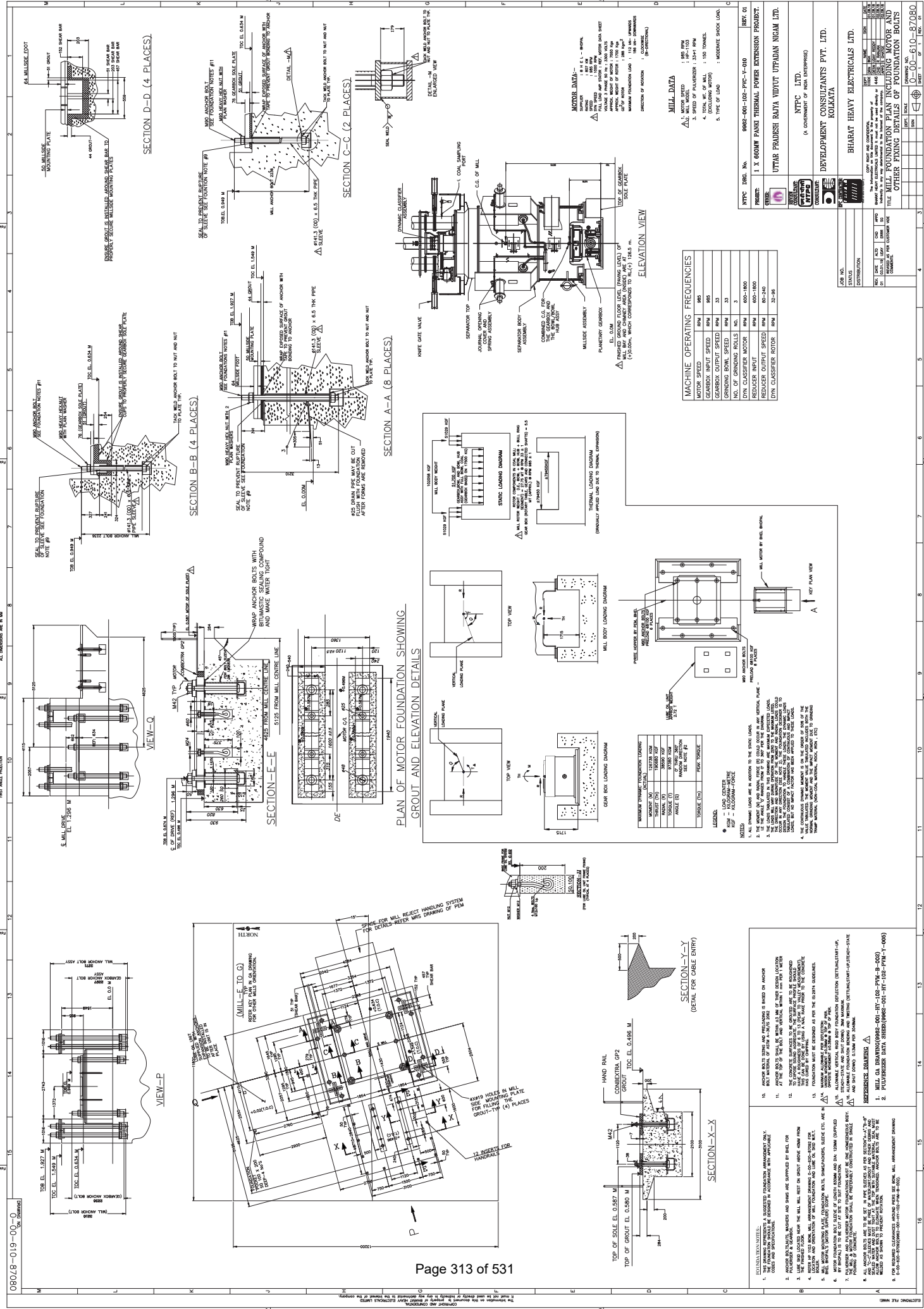
ANNEXURE I
REFERENCE DRAWINGS

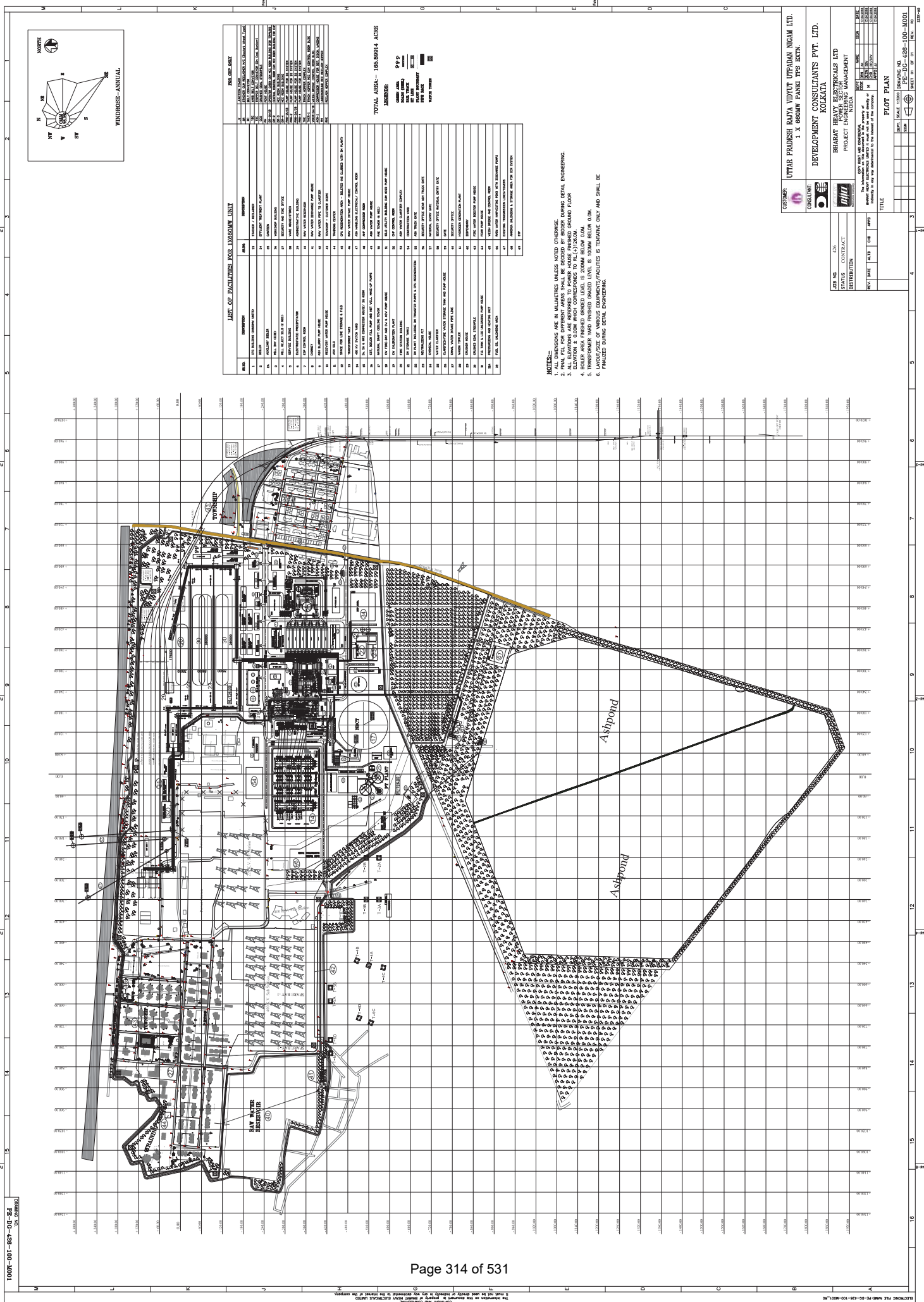
PART OF SPECIFICATION PE-TS-426-160-A001





DRAWING TITLE:
PLAN AND ELEVATION VIEW OF MILL







S.No.	DISCRPTION	QTY.	WEIGHT.(APPROX)
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MOTOR WEIGHT: 3500 Kg. (APPROX)

S.No.	DISCRPTION	QTY.	WT. PER UNIT (A
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1) ALL ELEVATIONS ARE MARKED WRT TG HALL FFL WHICH CORRESPONDS TO RL (+)126.5M.

- (2) ALL DIMENSIONS ARE IN MM.
- (3) CAPACITY OF DOUBLE ENDER EOT CRANE IS 8.0 T.
- (4) DIMENSION FOR EOP, LOCATED IN COMPRESSOR HOUSE HAVE BEEN CONSIDERED MAXIMUM W.R.T. ALL PROSPECTIVE SUPPLIERS AND SHALL NOT CHANGE BUILDING DIMENSION (49.0Mx6.0M) AT LATER DATE.
- (5) EQUIPMENT DETAILS, VALVES & INSTRUMENTS SHALL BE INCORPORATED AFTER FINALISATION OF CAS SUPPLIER.
- (6) FOR E-DG SET, HEAVIEST PART TO BE LIFTED SHALL BE ENGINE WEIGHING 6000 KG (APPROX.)

BHARAT HEAVY ELECTRICALS LTD

	ADDRESS	CITY	STATE	ZIP
PROJECT ENGINEERING MANAGEMENT				
NINDA				
M				
CDISC				
SPIN	K&AN	-		
LEJN	K&AN	-		
HARDY	-			
CHD	-			
MSK	-			

								SIGN	 PE-V0-426-SG SHEET 1 OF 1 REV