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6.5 <u>DUCT WORKS</u> This specification is intended to cover the fabrication, delivery at site, testing and commissioning of complete ductwork along with its accessories and auxiliaries pertaining to ventilation system for areas given in the Specification. 6.5.1 Scope of Work The scope of work covered by this specification shall include the following: (a) The contractor shall have to submit detailed drawings showing fabrication details, hangers, location of dampers etc for approval of Owner before commencement of erection. (b) Supply of materials at erection site (c) Fabrication and sub assembly of ducting and other components. Transportation to erection site. (d) Taking over the foundation, building and structure. (e) Assembly, erection, alignment etc of ducting as detailed. (f) Painting and any other associated work needed for completion of the job except grouting. (g) Testing, commissioning and balancing. (h) Supply and application of insulations and jacketing. (i) The Contractor shall alter the openings in the wall with written permission from the Owner, if required. The Contractor shall not be allowed to remove any material from the erection site without the consent of the Owner. 6.5.2 Supply & Erection The supply and erection of plant for ventilation system covered under this		

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specification includes the following items. (It shall be noted that the list is indicative and not exhaustive.) 6.5.2.1 Supply _ (a) Grilles, registers, dampers, canvas cloth expansion joints and fire dampers as required. (b) Insulating material for ducts as required. (c) Supply of GI sheets and any other material required. (d) Nuts, bolts, rivets, adhesives, felt, anchor fasteners/clinch anchors etc. required for ducting and duct supports. (e) Supply of hangers/supports, duct flanges & bracings. (f) Fan supporting structure. (g) Any other material required for completion of work including commissioning thereof. 6.5.2.2 Erection (a) All the items mentioned as above. (b) Ducting along with hangers, supports as per ducting layout drawings. (c) The insulation of duct as given elsewhere in the specification 6.5.3 Standards and Codes The design, fabrication, inspection and testing, erection and commissioning of the material included in the specification shall comply with the latest editions of the standards unless otherwise stated.		

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6.5.4 Operating Condition

As given elsewhere in this specification.

6.5.5 Duct Work

The actual quantity of duct work shall be governed by construction drawings. All duct work shall be fabricated of Galvanized Steel Sheets properly reinforced to prevent sagging, buckling or vibration. The interior of all ducts shall be smooth and free from obstruction.

All duct sections shall be cross-broken. The air velocity inside the duct shall be limited to 12 m/sec.

6.5.5.1 Duct Thickness

The ducting system envisaged is a low-pressure system. The thickness of the G.I. sheets to be used for fabrication of ducts shall be as follows:

Sr. No.	Dimension of larger Side (in mm)	Thickness of Sheet (in mm)	Gauge Number	Galvanise Class as per IS: 277
(a)	Rectangular Low Pressure Duct:			
(i)	0-300	0.63	24 G	IV
(ii)	325-1350	0.80	22 G	IV
(iii)	1375-2100	1.00	20 G	IV
(iv)	Above 2100	1.25	18 G	IV
(b)	Circular Duct – Low Pressure			
(i)	150-500 dia	0.63	24 G	
(ii)	501-1000 dia	0.80	22 G	
(iii)	1001-1250 dia	1.00	20 G	
(iv)	Above 1250 dia	1.25	18 G	

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All the G.I. Sheets procured shall be of lock forming quality.

6.5.5.2 Joints

All longitudinal joints shall be Pittsburgh lock seam. The other type of joints shall be accepted at the discretion of Owner.

For rectangular ducts, all transverse joints shall be continuous. Around the four sides, corner closures are required. The type of transverse joints shall be as under:

Sr. No.	Large side (mm)		Type of Transverse Joint
(a)	Upto 300	:	25 mm wide pocket, drive or S-slip
(b)	301-750	:	25 mm wide, bar slip or pocket slip
(c)	751-1500	:	Bar slip or pocket slip reinforced with 35 mm x 35 mm x 5 mm galvanized angle.
(d)	1501-2250	:	40 mm x 40 mm x 6 mm galvanized angle connection.
(e)	Above 2250	:	50 mm x 50 mm x 6 mm galvanized angle connection

External edges and corners formed from cleaved joints shall be neatly dressed down and joints made airtight.

6.5.5.3 Bracing

Intermediate transverse bracing continuous around the duct sides shall be provided between the joints as follows :

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Sr. No.	Dimensions of Larger Side		Bracing details
(a)	0-450 mm	:	None
(b)	451-1500 mm	:	35 x35 x5 mm angles, 1200 mm joints
(c)	1500 & above	:	35 x35 x5 mm angles, 600 mm joints

All flat surfaces between bracing or joints for duct of above 900 mm but below 1500 mm wide shall be reinforced by a longitudinal internal standing seam located in the centre of the duct width.

All flat surfaces over 1500 mm wide shall be reinforced by two longitudinal internal standing seams located approximately one third of duct width away from duct wall.

6.5.5.4 Riveting, Sealing & Brazing

All joints, slips and seams shall be made secure by riveting on centers not exceeding 150 mm. All transverse stiffeners and all reinforced bars slip joints shall be riveted on centers not exceeding 200 mm. All angle iron joints shall be riveted to duct on 75 mm centers and shall be bolted together on centers not exceeding 75 mm.

All construction joints and seams shall be machine formed. Hand made joints are not considered acceptable unless unavoidable. However, final decision shall be taken by Owner.

All exhaust ducts shall be made air tight by an approved Pittsburgh Lock Seam Joint and 3 m high velocity duty sealant.

An adhesive shall be applied on all the contacting surfaces before making up the joints.

6.5.5.5 Access Doors

All main duct work shall be accessible throughout using tight fitted hinged access doors. Access doors are generally to be provided where fittings like

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dampers, controls, etc. are located. The actual locations for these doors shall be designed by the Contractor with due approval from the Owner. Doors shall have cemented sponge rubber gaskets. Approved heavy duty latches shall be provided such that an air tight closure is ensured, despite frequent operation. The Contractor shall supply all necessary accessories i.e. latches, handles etc for this work. 6.5.5.6 Grilles And Registers Grilles and registers shall be provided as per requirement. G.I. sections/sheets shall be used for the manufacture of grilles and registers for ventilated areas. All grilles and registers shall be true to shape and shall be checked with a level gauge before being secured in position. No distortion or wrapping is permitted. All duct mounted registers shall be complete with rubber gaskets and flanged holding frames of suitable design for the intended installation. They shall be mounted on collar extending from the duct as detailed in the drawing. No part of register shall project into the main duct. (a) Type A Grilles These are supplying Grilles (side throw type) having two sets of adjustable louvers and with opposed blade damper. The front of louvers shall be vertical to provide horizontal deflections and the rear back of horizontal louvers shall adjust vertical deflection. The damper shall have horizontal opposed blades regulated by an operating lever in the frame. (b) Type B Grilles These are exhaust transfer registers having single deflection louvers with opposed blade dampers.		

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(c) Type C Grilles These are supply diffusers suitable for mounting on false ceiling. These grilles are fitted at the bottom portion of horizontal ducts, which are square or rectangular in shape. (d) Type-D Grilles These are exhaust diffusers suitable for mounting on false ceiling, ducting in horizontal position and are square/rectangular in shape respectively. (e) Type-E Grilles These are circular supply diffusers suitable for mounting on false ceiling. (f) Type-F Grilles These are circular exhaust diffusers suitable for mounting on false ceiling. Type-C to F grilles shall be fitted with opposed blade dampers and built in vane and louver arrangement as per manufacturer's standard design subject to approval of the owner. The grilles shall have 1, 2, 3 or 4 way discharge patterns. 2-way discharge pattern means discharge of air from two opposite side of grille. Grille schedule shall give type of grille along with discharge pattern, e.g. C2 means C type grille with 2-way discharge pattern. Return air grill (if required) shall be without damper 6.5.5.7 Hangers And Supports All duct work shall be provided with adequate supporting arrangement to ensure rigid support and to prevent vibration. Hangers and supports types and locations have been decided by the Owner and shall be marked on the drawings to be released for construction. The type of support to be adopted for each location shall also be marked on the drawing. A total of four types of supports shall be used (Types A, B, C & D). Fabrication details of each support including size of members shall be decided by Contractor.		

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Support may be welded directly to the embedded / anchored plates in slabs / beam / floors, which have been provided for this purpose. 6.5.5.8 Dampers, Deflectors, Vanes Dampers and deflectors shall be installed as per requirement. Manually operated dampers in duct runs shall be provided with indicating and locking devices consisting of a quadrant with large thumb screws and shall be installed with the quadrant parallel to the blade of the damper so that the position of the damper within the duct shall be clearly indicated from the outside of the duct. Damper blades shall be made of 16 gauge Galvanized sheet with maximum width of 250 mm. The damper frame shall be fabricated from channel (Min. ISMC-75) and shall be finished with suitable rust proofing paints. Edges of the blades of the dampers shall be fitted with neoprene edging material for tight shut-off. The deflectors and turning vanes shall have aerofoil construction which shall be provided in the duct to have streamlined flow. They shall be of heavy gauge construction galvanized and free from vibration. Internal bend radius of the ducts shall be at least equal to the width of the duct. Where this is not practicable, square elbow with turning vanes shall be provided. Take offs from the main ducts shall be provided of conical shape. Duct size right angle take off shall not be permitted. Fire dampers as required shall be provided and installed. They shall be of fuse link type operated by thermal sensors. 6.5.6 Insulation Duct shall be insulated, wherever required. Expanded Polystyrene Type SE slabs shall be used for insulation purpose.		

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Surface to be insulated shall be cleaned and dried thoroughly. A coat of Hot Bitumen, Grade 85/25 as per IS: 702 shall be applied at 15 kg/m² on the cleaned and dried surface and inside surfaces and edges of insulation slab. Gaps between joints shall be filled with insulation granules mixed with hot bitumen. A thick vapour seal of hot bitumen at 2.5 kg/m² shall be applied uniformly on the outer surface of the insulation and allowed to dry. Insulation shall be reinforced by wire netting (12.5 mm x 0.71 mm hexagonal galvanized chicken wire netting), the ends of which shall be stitched with soft annealed 0.884 mm diameter lacing wire passing through wire netting. Insulation protection saddles made out of 0.8 mm thick GI sheets shall be provided at each duct support. The insulation shall be wrapped with Aluminium sheet of 32 G thick. Special care shall be taken to provide satisfactory insulation for damper, access door etc to facilitate maintenance and inspection. 6.5.7 Provision for Air Flow Rate Measurement Air flow rates are to be measured in main and branch ducts during commissioning of the system. The Contractor shall arrange for all instruments required to establish the airflow rates. The Contractor shall also provide test holes at suitable locations for this purpose. The test hole shall preferably be provided on straight duct and as far as possible away from bends, dampers or other obstruction that could cause uneven or spiral flow. Location of test hole shall also be easily accessible for mounting measuring device such as pitot tube. 6.5.8 Flexible Connections in the Duct Flexible connections shall be provided in the ducts at locations, where the duct is passing from one building to another. The flexible connections shall		

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be of same size as that of duct and shall be made out of plastic impregnated canvas cloth with MS flanges. The flexible connection piece shall be designed to provide following relative displacement between two ends of the connection pieces in an erected position, occurring simultaneously, without causing any wear and tear to the flexible connection as well as duct. (a) 12 mm in longitudinal direction (compression or expansion) (b) 12 mm in lateral direction. Flexible connections shall be provided as per requirement. 6.5.9 Painting All mild steel members shall be thoroughly wire-brushed, cleaned and given two coats of red oxide zinc phosphate primer coating. Adequate protective painting shall have to be provided by the Contractor where galvanized portion of the duct work is damaged. Duct carrying exhaust from battery rooms shall be painted with epoxy paint externally as well as internally along with the supporting structure. 6.6 MOTORISED FIRE DAMPER This part of specification is intended to cover the design, manufacture, assembly, testing, painting, delivery at site properly packed for transportation and protected from weather, erection and commissioning and guarantee of Motorised fire damper to be used in Ventilation system. The scope of supply shall include but not limited to the following: (a) Dampers complete with accessories like bearing, spindle sleeves, linkages etc. (b) Motorised : type operator to operate the spindle of the damper. (c) Two (2) Limit switches along with linkages mounted on actuator to indicate open and close position of damper.		

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(e) Nuts, Bolts, Gaskets, etc. (f) Cleaning, Protection, Painting as specified. 6.6.1 General Description Depending on the purposes to be served, the dampers specified herein have been divided into three categories: Type – A, B & C. (a) Type – A Dampers These Dampers shall be installed in supply/return duct of ventilation system and are required to shut off within the duct to cut off the supply/return air to/from the ventilated space where fire took place. (b) Type – B Dampers These Dampers shall be installed on the supply air duct of Battery rooms. These are required to shut off to prevent over pressurization of Battery rooms in case of failure of axial flow exhaust fans and to shut off supply air connection in case of a fire. (c) Type – C Dampers These Dampers shall be installed at the inlet of DG rooms exhaust fans and are required to shut – off on detection of fire. The above dampers shall get actuated by smoke detectors to be provided in ventilated space. There shall be provision for indication lamps to show open/close position of damper. 6.6.2 Performance Required The fire dampers shall possess 1.5 hour standard fire protection rating in accordance with “Standard for Fire Damper UL – 555”. The fire damper		

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shall be smoke tight type. All Dampers shall remain tightly closed upon the operation of sensing device. 6.6.3 General Design Requirement The equipments to be supplied shall be suitably constructed for safe and proper operation under all conditions described or supplied in this specification without undue vibration, strain, corrosion or other difficulties. Contractor's scope of work with respect to design and procurement of control and procurement of control and instrumentation is specified elsewhere in this specification. For each damper, following instrumentation shall be provided. (a) Local control panel complete with solenoid valve, PRV (if needed), terminal blocks and any other instrument required. Minimum Ten (10) spare terminals shall also be provided for Owner's future use. Solenoid valve shall be wired to the terminal block. Solenoid valve shall get de-energised on receiving signal from smoke detector or any other control logic to close the damper. (b) Limit switches mounted on damper actuator shall be suitably wired to the terminal block in the control panel. (c) Copper tubes of suitable size shall be laid from solenoid valve, installed in control panel to the actuator. All parts subject to substantial temperature changes shall be designed and supported so as to permit free expansion or contraction without resulting in leakage, distortion and excessive strains in the equipment. Parts subject to wear, corrosion or other deterioration or requiring adjustment, inspection or repairs shall be accessible and have reasonable convenience for removal, replacement and repair. All such parts shall be of suitable material or suitably lined for keeping maintenance to a minimum.		

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6.6.3.1 Operator

The Operator shall be piston and cylinder type, installed on the duct. The movement of the piston from one end to the other shall be used, through linkage, to open or close the damper blades. The operator shall be actuated by instrument air to be supplied at 7.0 kg/cm² (g) pressure, after using a suitable PRV, lubricator if needed. The energized condition of the solenoid valve shall open the dampers, which shall close on de-energised condition of the solenoids. The pneumatic tubing shall be of copper.

The dampers shall be provided with manual local operation.

6.6.3.2 Solenoid Valves

- (a) The solenoid valve shall be 4-way type, the solenoid being operated by 48 V DC supply. The valve body shall be forged brass confirming to ASTM-B124 and the seat shall be of soft material like nylon or neoprene for tight shut-off. The end connections shall be threaded female NPT.
- (b) The valve shall be suitable for a design pressure of 10.0 kg/cm² (g) and body hydrotest pressure of 15.0 kg/cm² (g). The solenoid valve shall be as per specification enclosed elsewhere.

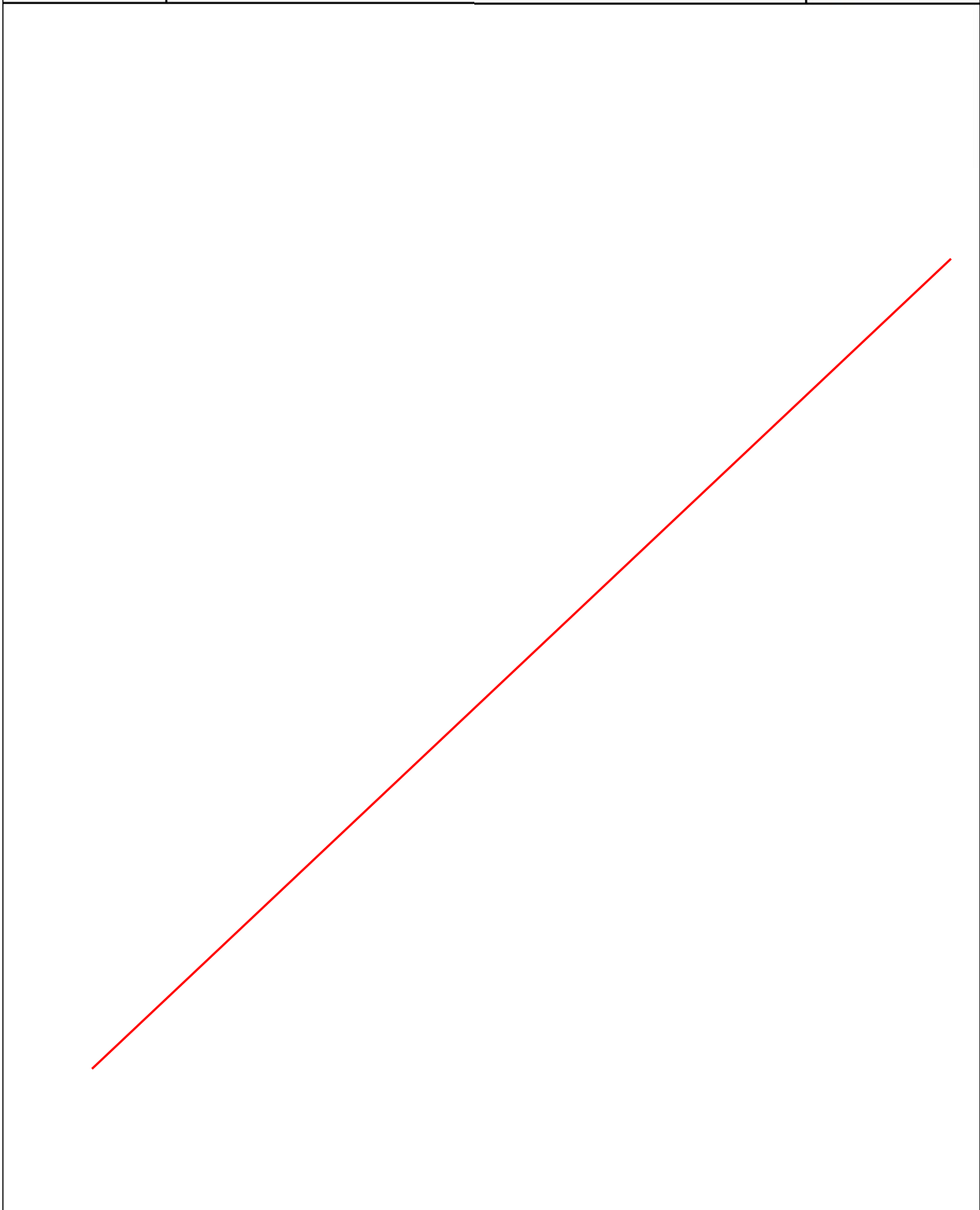
6.6.3.3 Dampers

- (a) All dampers shall be multi-blade type.
- (b) Materials of construction for damper shall be suitable for 1.5 hr Standard fire protection.
- (c) The frames shall be fabricated from channel (min ISMC-75) and shall be finished with rust proofing paints after application of primer.
- (d) The blades shall be maximum 250 mm wide. The blades shall be stiffened by formed edge. The edges shall be fitted with neoprene edging material for tight shut-off. An indicating device shall be provided outside to denote open/close position of the damper. The dampers shall be suitable for mounting inside the ducts, complete

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with rubber gaskets and flanged holding frame. 6.6.3.4 Performance Guarantee The Contractor shall guarantee that upon completion of the satisfactory commissioning and acceptance of the equipment by Contractor, all the portions thereof, shall be in accordance with requirement of the contract and shall be perfect as to design, materials, workmanship etc. If stipulated requirements are not fulfilled, the contractor shall make good the deficiency in every case by altering and/or replacing the part or whole equipment free of charge to Owner immediately. All replaced parts/equipments shall be removed from site at Contractor's expenses. 6.6.4 Special Cleaning, Protection and Paintings Internal surfaces of all parts shall be cleaned to remove loose scale and dirt. All sharp edges shall also be removed. Weld rod stubs and other foreign objects shall be removed prior to final assembly. All M.S. parts shall be painted with two coats of red oxide/zinc chromate primer and one coat of aluminium paint before despatch of material. All parts provided with zinc spray shall be coated with aluminium paint. 7.0 <u>GUARANTEED PERFORMANCE TESTING</u> All equipment shall be guaranteed by the Bidder for workmanship, materials and satisfactory performance. The guarantee for performance shall cover individual items and systems including electrical for their ratings/outputs as well as for the integrated operation of the equipment and its auxiliaries as a whole. 7.1 On completion of satisfactory commissioning, the Bidder shall conduct performance/acceptance tests on the equipment and system as a whole for demonstrating the guaranteed performance parameters specified. All instruments, gauges installed for the normal operation of equipment shall be made use of during the acceptance test as far as practicable. If additional instruments are required for the tests, these shall be brought by bidder free of cost and shall be taken back after performance test.		

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7.2	The guarantee tests shall cover but not be limited to the following rated parameters for smooth operation of ventilation system. (a) Vibration and noise level (b) Temperature inside ventilated area	
8.0	<u>SPECIAL CLEANING, PROTECTION AND PAINTING</u>	
8.1	Internal surfaces of all parts shall be cleaned to remove loose scale and dirt. The external surface of the motor and cover shall be sand blasted to remove all rust, scale etc. All sharp edges shall also be removed. Weld rod stubs and other foreign objects shall be removed prior to final assembly. Excess oil and grease shall be removed by wiping.	
8.2	All parts shall be painted with two coats of red or zinc-chromate primer and one coat of aluminium paint before dispatch.	
9.0	<u>DRAWING, DATA AND INFORMATION REQUIRED</u>	
9.1	For Drawing, Data and Information required along with BID, please refer Volume VIII.	

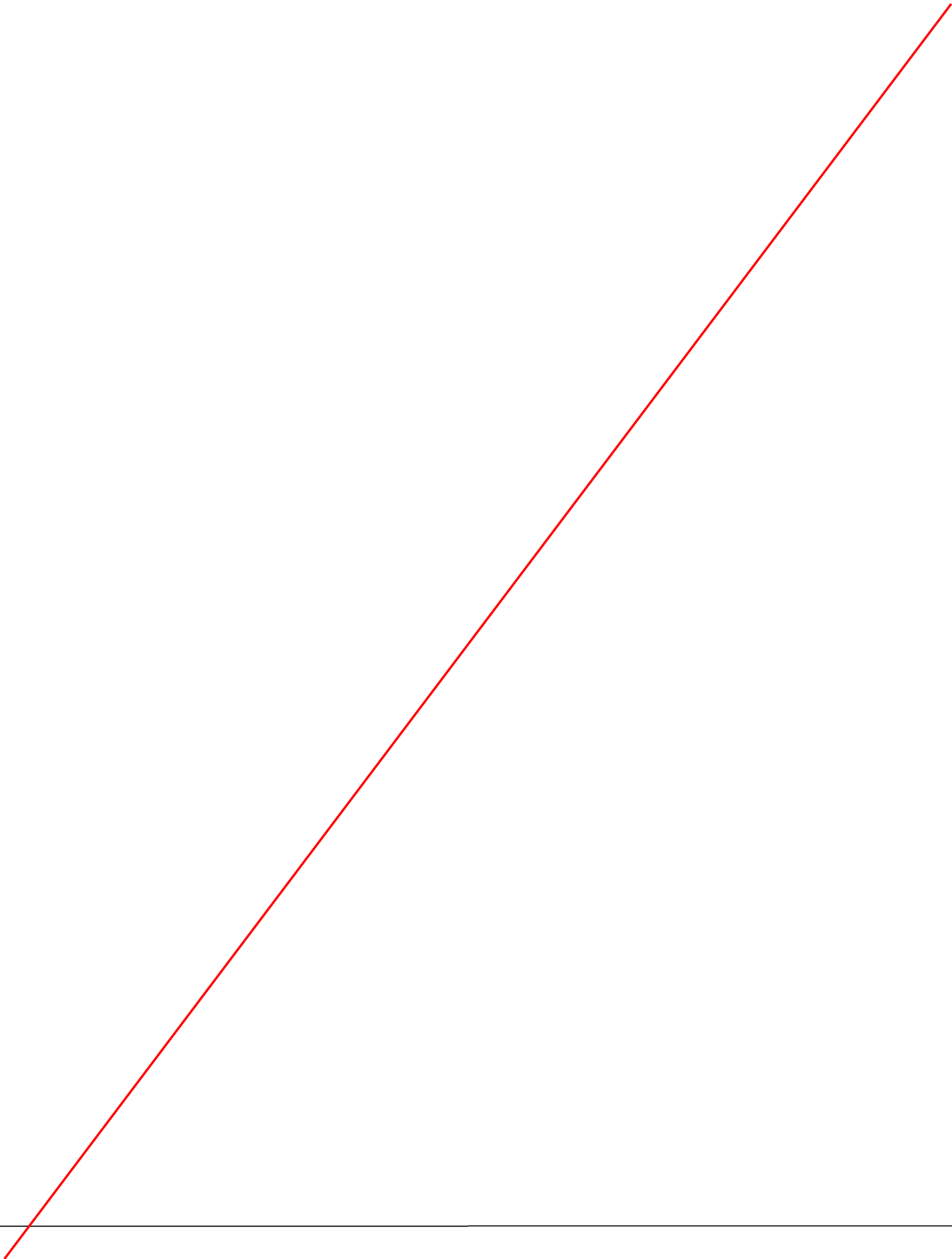
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ANNEXURE A MINIMUM TESTING AND INSPECTION REQUIREMENTS		

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1.0 <u>GENERAL:</u> 1.1 The testing and inspections listed herein are the minimum requirements as perceived by the Owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments/systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration and relevant codes and standards. The comprehensive list of tests considered for each of the equipment/systems shall be furnished as part of the bid. 1.2 <u>FANS</u> 1.2.1 20% DPT of welding on fan hub, blades, casing and impeller as applicable shall be carried out. 1.2.2 DPT of fan shafts shall be carried out after machining. 1.2.3 UT of fan shafts (dia greater than or equal to 50mm) shall be carried out. 1.2.4 Rotating components of all fans shall be statically and dynamically balanced to ISO-1940 Gr. 6.3. 1.2.5 All Centrifugal Fans shall be subjected to run test for 4 hrs. or till temperature stabilization is reached. Vibration, Noise level, Temp. rise and current drawn shall be measured during the run test. 1.2.6 One fan of each type and size will be performance tested as per corresponding IS code for Airflow, Static Pressure, Total Pressure, Speed, Efficiency, Power Consumption, Noise, Vibration and Temp. Rise. 1.3 <u>CENTRIFUGAL PUMP</u> 1.3.1 UT on pump shaft (dia. greater than or equal to 50mm), MPI/DPT on pump shaft and impeller after machining shall be carried out. 1.3.2 All rotating components of the pumps shall be statically and dynamically balanced to ISO-1940 Gr. 6.3.		

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1.3.3 1.3.4	A standard hydrostatic test shall be conducted on the pump casing with water at 1.5 times the shut off pressure or twice the rated pressure whichever is higher, for a minimum duration of 30 minutes. Standard Running Test (a) All pumps shall be tested in the manufacturer's works preferably with contract motor for capacity, efficiency, head and brake horsepower. Pump shall be given running test over the entire operating range covering from the shut-off head to the maximum flow. The duration of test shall be minimum one (1) hr. A minimum of five readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pumps shall be in accordance with stipulations of Hydraulic Institute Standard (HIS) and/or as per applicable Indian Standard or equivalent. Acceptance shall be as per approved datasheet & HIS standard only. (b) Noise and vibration shall be measured at shop for reference purpose only. (c) Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and/or excessive vibration are observed during the shop test. (d) NPSH test shall be conducted with water as the medium, if required as per approved data sheets. 1.4 <u>LOW PRESSURE AIR DISTRIBUTION SYSTEM</u> 1.4.1 Functional test for fire damper along with solenoid shall be done. 1.4.2 Prototype tests for fire resistance rating as per UL-555 of each type and size of damper shall be carried out. In case prototype tests have already been done, the bidder shall submit the test report for verification and approval. 1.4.3 SITE TEST: - After completion, all ducting system shall be checked/tested for air leakages/tightness (smoke test) at site.	

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1.5	<u>INSULATION</u> 1.5.1 Insulation material shall be tested for all mandatory tests only as per relevant code/standard. 1.5.2 Thermal conductivity tests (for thermal insulation only) shall be done once in six months for insulation material manufactured during six months period for the same density, outer diameter and thickness of material as applicable as per IS: 3346 or equivalent standard. 1.6 <u>AIR FILTERS</u> 1.6.1 Pre/Fine filters shall be tested for initial and final pressure drop Vs flow and average synthetic dust weight arrestance as per the requirement of BS 6540/ASHARE-52-76/EN779. 1.7 <u>PIPES & FITTINGS</u> 1.7.1 Dye penetration test of welds of pipes/fittings (including welds of rolled and welded pipes, if any) shall be carried out. 1.7.2 All pipes and fittings shall be tested as per applicable codes/standards at manufacturer's works. Piping shall be tested at site hydraulically/ pneumatically as per application requirement. 1.8 <u>VALVES & SPECIALTIES</u> 1.8.1 Visual and dimensional check of valves as per relevant code/approved drawing. 1.8.2 All the water line valves shall be hydraulically tested for body, seat and back seat (wherever provided) as per the relevant standard to which these valves are supplied irrespective of the working pressure for which these valves are selected. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure. 1.8.3 All valves shall be offered for hydro test in unpainted condition. 1.8.4 Functional check of the valves for smooth opening and closing shall be done	

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DATASHEET - A

DESIGN CRITERIA FOR VENTILATION SYSTEM

Building/Area	Ambient Air Temperature (°C)	Indoor Temperature		Humidity Control (% RH)	Minimum Design Ventilation Rate (ac/h)	Filtration Efficiency (%)	Pressurisation	Redundancy	Noise Criteria
		Maximum °C	Minimum °C						
Steam Turbine Area									
Below operating floor	Extreme	Evaporative Cooling Less than ambient Temp	-	None	8	90% down To 10 °	Slightly pressurised	Multiplicity	Background
Above operating floor	Extreme	Evaporative Cooling Less than ambient Temp	-	None		Do	Do	Multiplicity	Background

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Building/Area	Ambient Air Temperature (°C)	Indoor Temperature		Humidity Control (% RH)	Minimum Design Ventilation Rate (ac/h)	Filtration Efficiency (%)	Pressurisation	Redundancy	Noise Criteria
		Maximum °C	Minimum °C						
Valve stations, miscellaneous	Extreme	Ambient temp. plus 5	-	None	20 or as per heat load whichever is higher	None	None	None	85 dB (A)
Elevator machine rooms	Normal	Ambient temp. plus 3	-	None	As per heat load	90 % down to 10 micron	Positive	None	85 dB (A)
Electrical Equipment									
Critical equipment (including supply fans and circulating fans for Air Washer / Unitary Air Filtration Systems	Extreme	Ambient temp Plus 3	-	None	30 or as per heat load whichever is higher.	Dependin g upon the internal equipment	None	2 x 100%	85 dB (A)

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Building/Area	Ambient Air Temperature (°C)	Indoor Temperature		Humidity Control (% RH)	Minimum Design Ventilation Rate (ac/h)	Filtration Efficiency (%)	Pressurisation	Redundancy	Noise Criteria
		Maximum °C	Minimum °C						
CW-ACW and F.O heating & Pressurizing Pump Houses	Normal	Ambient temp plus 3	-	None	20	None	None	None	85 dB (A)
Coal Conveyor Tripper floor	Normal	Ambient temp plus 3	-	None	30	None	None	None	85 dB (A)
Locker rooms and toilets	Extreme	Ambient temp plus 5	Ambient	None	20	None	None	Multiplicity	Background und
Mechanical Equipment									
Pumps, Compressors etc	Extreme	Ambient temp. Plus 3	-	None	20 or as per heat load whichever is higher	None	None	Multiplicity	Background und

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Building/Area	Ambient Air Temperature (°C)	Indoor Temperature		Humidity Control (% RH)	Minimum Design Ventilation Rate (ac/h)	Filtration Efficiency (%)	Pressurisation	Redundancy	Noise Criteria		
		Maximum °C	Minimum °C								
Enclosed Switchgear equipment areas	Extreme	Ambient temp plus 3	-	Not exceeding 60%	15 or as per heat load whichever is higher	90 % down to 10 micron	Positive	Multiplicity	85 dB (A)		
Critical equipment	Extreme	Ambient temp Plus 3	-	None	15 or as per heat load whichever is higher.	Depending upon the internal equipment	None	2 x 100%	85 dB (A)		
Diesel generator area	Extreme	Ambient temp plus 3	-	None	8 or as per heat load whichever is higher	None	None	None	Background		
Electrical Equipment											
Water Treatment Plant	Normal	Ambient temp plus 3	-	None	30	None	Negative	Multiplicity	85 dB (A)		

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Building/Area	Ambient Air Temperature (°C)	Indoor Temperature		Humidity Control (% RH)	Minimum Design Ventilation Rate (ac/h)	Filtration Efficiency (%)	Pressurisation	Redundancy	Noise Criteria
		Maximum °C	Minimum °C						
Ozonisation Room	Normal	Ambient temp plus 3	-	None	30	None	Negative	Multiplicity	85 dB (A)
Battery Rooms	Extreme	Ambient temp plus 3	-	None	30 or as required for hydrogen dilution	None	Negative	2 x 100%	85 dB (A)
Switchgear Room	Extreme	-Do-	-	None	15	90%	Pressurised	2 x 50%	-Do-

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VOLUME II
SECTION – 4
GENERAL TECHNICAL REQUIREMENTS

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1.0 <u>CODES AND STANDARDS</u> 1.1 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the Annexure to this Section and mentioned in detailed Specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible, had there been a Standard Specification. 1.2 Where the Bidder proposes alternative codes or standards, he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification. 1.3 Wherever specified or required, the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Electricity Rules, Indian Explosives Act, Factories Act etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Bidder. 1.4 In the event of any conflict between the codes and standards referred above and the requirements of this specification, the requirements, which are more stringent, shall govern. 1.5 In case of any change of code, standards and regulations between the date of purchase order and the date the Contractor proceeds with manufacturing, the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Contractor to advise Owner of the resulting effect. 1.6 Successful Bidder shall furnish two (2) sets of latest of national/international codes and standards to owner.		

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2.0 <u>RESPONSIBILITY FOR DESIGN</u> 2.1 The Bidder shall assume full responsibility for the design of the whole and every part of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Contractor was directly involved in the design work. 2.2 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar or more arduous conditions elsewhere, at least for continuous two (2) years in two different power stations. 2.3 The successful bidder shall have to carry out surge analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice. 2.4 The Bid shall include a detailed discussion on the development status of and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants. 2.5 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feed back etc are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions etc shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation. 3.0 <u>NAME PLATES (RATING PLATES)</u> 3.1 Instruction plates, nameplates or labels shall be permanently attached to each main and auxiliary item of Plant in a conspicuous position. These plates shall		

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	be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of Plant has been designed to operate.	
3.2	Items such as valves etc which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.	
3.3	All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.	
3.4	The size and location of nameplates shall be subject to Approval of the Engineer.	
4.0	<u>SAFETY AND SECURITY</u>	
4.1	The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.	
4.2	Ready and safe access with clear head room shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.	
4.3	Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The plant layout shall be designed to localize and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA and TAC etc as necessary shall be followed in all respects.	
4.4	The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall	

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minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.		
5.0	<u>GUARDS</u>	
5.1	Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.	
5.2	Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.	
5.3	All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.	
5.4	Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.	
5.5	Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.	
6.0	<u>LOCATION AND LAYOUT REQUIREMENTS</u>	
The majority of plant and equipment shall all be of indoor installation. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment / components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria		

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given under the various equipment and system specifications as well as those stipulated in Annexure-B attached to this section. Enclosed General Layout and other tender layout drawings show the location of major installations and auxiliary buildings. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the powerhouse as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered. Bidder may give as an alternative his own preferred layout clearly indicating the advantages and other implications, if any. Such alternative will not be considered for evaluating the bid, but may be considered with the successful Bidder if Owner / Engineer find the proposal more attractive in terms of techno-economic consideration. 6.1 While developing the layout of buildings the following criteria shall be given effect: 6.1.1 The minimum width of clear access corridors around equipment shall be one (1) meter. 6.1.2 Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as specified. 6.1.3 The plinth level with respect to the existing grade level shall be as indicated elsewhere in this specification. Finished Grade Level (FGL) above Mean Sea Level (MSL) for the plant area, CHP area and for PWS area inside plant to be developed. Mean sea level for the plant is 210 m. 6.1.4 The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of two (2) meters shall be maintained between the floor and any overhead piping/cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.		

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6.1.5	There shall be at least two (2) main access doors, one on either side of each building, of which one shall be minimum three (3) meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.	
6.1.6	All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified elsewhere in this specification shall be complied with.	
6.1.7	All rail/road crossings for pipe/cable racks shall be done with minimum Seven (7) meters headroom from top of rail/road to bottom of rack. Similarly, top cover over underground pipes/cables shall be minimum one (1) meter.	
6.1.8	Cubicle for operating personnel shall be located at safe place near the equipment.	
6.1.9	Cable racks / pipe racks shall have hand railings in walkways on both sides at appropriate heights.	
6.1.10	Concept of various mechanical and electrical equipment location and building dimensions (including column-row spacing) as shown in Plot Plan/Floor Plan drawing are to be adhered as far as possible. Any departure from this suggestive layout is primarily not recommended.	
6.2	The following requirements for equipment layout shall be complied with:	
6.2.1	The regular basement floor is not acceptable in Boiler & Mill Bunker bay building. Further, local pits/trenches shall be avoided as far as possible.	
6.2.2	Mills shall be located by the side of Boiler. The width of Mill/Bunker building shall be 12.5 M and the length of the same shall be 10.5 M per Mill. A clear walkway of 1200 mm (min) shall be ensured between the mills/ its foundation/ mill reject vessel edge and inner face of mill bay column. Raw coal bunker shall be circular in shape unless otherwise approved.	

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6.2.3	Interconnecting walkways (minimum 2 m width) between main plant building and boiler (on either side of boiler) at Ground, Mezzanine, Operating, PRDS and Deaerator floor levels shall be provided. Also inter-connecting platform between Boiler and Coal Tripper floor level and roof of Mill maintenance floor level, Feeder floor level, Bunker Building at Mill bay shall be provided. Number of interconnecting platforms between Boiler and Coal Bunker building for each level / floor specified above shall be two (2) on each side of Boiler i.e. four (4)/floor.	
6.2.4	Two of the landing levels of the Goods Elevator shall preferably coincide with the feeder and tripper floor elevations. In case of difference in levels, electric hoists to shift goods from elevator floors to feeder/ tripper floors shall be provided.	
6.2.5	Fuel Oil (F.O.) piping shall be routed over trestles. The headroom for F.O. trestle in Boiler/ESP/ID fan/Chimney area shall be 8.0 M till the road behind chimney and 7.0 M in CD bay area. The headroom for F.O. trestle in outlying area shall be 3.0 M except at rail/road crossing where the headroom shall be 8.0 M.	
6.2.6	Clear walkways along A-row & B-row of TG building shall be provided as indicated below: (a) 1.5 m at all levels of AB Bay. (b) 3.5 m along B-row at operating floor level for interconnection with service Building & in front of control room.	
6.2.7	The layout of the steam turbine unit shall permit sufficient lay down area for all the parts/components to enable carrying out maintenance and overhauling operations.	
6.2.8	Steam turbine and generator (except stator) and other equipments located in the turbine hall shall be accessible by the EOT cranes for their handling during erection and maintenance. For all other equipment/components, suitable handling arrangement for erection and maintenance shall be provided.	

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6.2.9	In TG bay at crane rail level, walkway with handrails is envisaged for entire column sectional depth for full length of the building. In addition, it shall be ensured that on A-row and B-row columns, through walkway (without hindrance) of minimum 600 mm clear width is available from the face of the column to the handrail of the platform.	
6.2.10	Layout of facilities and equipment shall allow removal of Generator Stator, Generator transformers, Station & Unit transformers without disturbing equipments, piping, cabling, duct routed in the area.	
6.2.11	Adequate space and handling arrangement shall be provided for handling/removal of pumps, heaters, heat-exchanger, fans, mills during maintenance.	
6.2.12	Valves shall be located in accessible positions and operating/maintenance platforms shall be provided along with approach ladders & handrails for the same.	
6.2.13	While developing the layout, all fresh air ventilation louvers shall be considered 1000 mm from floor level and directed downwards at an angle. Ventilation fans on AB bay roof shall be kept staggered and shall not be near the centerline of turbo generator set.	
6.2.14	Each equipment room shall be provided with alternate exits in case of fire/accidents as per requirements of factory Act and Statuary bodies/Insurance companies.	
6.2.15	All other safety requirements as per the factories Act, Rules/regulations made under Electricity Act, 2003 and applicable codes/standards shall be observed while developing the layout.	
7.0	<u>OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS</u>	
7.1	Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.	

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7.2	Ample space for ease of operation and maintenance including equipment removal, tube bundle / cartridge / rotor pulling etc shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.	
7.3	Motorised lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part. Suitable beams, hooks etc. for this purpose shall be provided in the Buildings.	
7.4	Lifting devices like lifting tackles, slings etc. to be connected to hook of the hoist/crane shall be provided by the Bidder for lifting the equipment, accessories covered under this specification.	
7.5	All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where ever feasible, common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.	
8.0	<u>MATERIALS</u>	
8.1	In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/ fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal. All materials shall be new, and shall be of the quality most suited to the proposed application.	
8.2	In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or International codes of practice. Where such standards or codes of practice are not available, sufficient information shall be provided to allow the Engineer to assess the suitability of the material for the particular application.	

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	All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.	
8.3	All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.	
9.0	<u>LUBRICATION</u>	
9.1	Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.	
9.2	Non ferrous capillary tubing shall be used throughout.	
9.3	Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.	
9.4	All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.	
9.5	All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.	
9.6	The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.	
10.0	<u>LUBRICANTS AND CONTROL FLUIDS</u>	
10.1	The Contractor shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Contractor for initial commissioning, first fill and till COD of unit.	

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10.2	The Contractor shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Contractor shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognized standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.	
10.3	No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.	
11.0	<u>OPERATION AND MAINTENANCE</u>	
11.1	The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimized. The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.	
11.2	Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.	
11.3	All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further, identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.	
11.4	All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.	

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11.5

On completion of commissioning, a complete set of tools for the maintenance of the entire plant shall be provided by the Contractor. This shall include all necessary spanners, special wrenches, extraction equipment and any special tools reasonably required by the Engineer. Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.

11.6

All equipment and major valves should be provided with adequate maintenance approach and facility.

12.0

PLANT LIFE AND MODE OF OPERATION

The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended.

The critical components of the major equipments like Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations.

The unit would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand. The units shall also be suitable for two shift operation, if required.

The expected start-ups should be considered as minimum
(Based on HPT metal temperature)

(a)	Cold start-up (>50 hrs. shutdown)	:	20 per year
(b)	Warm start-up (between 10 to 50 hrs. of shutdown)	:	40 per year
(c)	Hot start-up (Less than 10 hrs. shutdown)	:	180 per year

The allowable stresses shall be so selected so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall

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discuss this aspect in his technical proposal.

13.0 **PACKAGING & MARKING**

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of railway wagon sizes in India shall be taken into account. Bidder shall consider the details of various wagons normally available with Indian Railways for transportation of heavy equipment. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below:

- (a) Width of the Package (from centre-line of rails-1.6 : 3.2 Meters
metres on both sides)
- (b) Height of the package from rail top : 4.47 Meters

The above indicates the dimensions, which can be normally transported on the wagons without infringement of the "moving gauge". This is however not indicative of the consignment which can be carried out with infringement of "moving gauge" duly authorised and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge" and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder shall consider unloading of material delivered through rail transportation, at near by railway station/ site unloading siding. The subsequent transportation up to project work place shall be considered by

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road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services of the Bidder. Bidder may consider entire material delivered up to site through rail transportation only.

The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition, the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

Specification of Packaging and Marking has been described in detail in Volume I: General Condition of Contract of the Specification.

14.0 PROTECTION

Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.

Electrical equipment controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors.

All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs. Female threaded

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openings shall be closed with forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped. Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.		
15.0	<u>PAINTING</u>	
15.1	<u>GENERAL</u>	
All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner. All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner. All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects. All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat. Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in		

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windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment. Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use. Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel. The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished. The Contractor shall select shop primer for steel and iron surfaces, which will have a continuous operating temperature below 35°C, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C. The Owner/Engineer shall submit the colour scheme during execution of contract for approval.		
15.2	<u>PREPARATION</u> Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying. Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed. The priming coat shall be applied without delay.	
15.3	<u>DAMAGED PAINTWORK</u> Any damaged paintwork shall be made good as follows:	

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15.3.1	The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.	
15.3.2	A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.	
15.3.3	The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming	
15.4	<u>PAINTING SYSTEMS</u>	
	The requirements for the Dry Film Thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.	
15.4.1	Surfaces subject to Weathering	
	All surfaces shall have a minimum of four coats of paint made up as follows:	
	(a) Primer coat	: 35 micron DFT
	(b) Tie coat	: 35 micron DFT
	(c) Finishing coat (Two Nos.)	: 35 micron DFT per coat
	(d) The total minimum DFT	: 140 micron
15.4.2	Surfaces Inside Buildings	
	All surfaces shall have a minimum of three coats of paint made up as follows:	
	(a) Primer coat	: 35 micron DFT
	(b) Tie coat	: 35 micron DFT
	(c) Finishing coat (Two Nos.)	: 25 micron DFT per coat
	(d) The total minimum DFT	: 120 micron

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The Contractor shall select the type and colour of primer & finish coat after approval by the Owner.

For detail painting on building & structural steel elements, please refer **Volume VI / A & B** of this specification.

16.0 COLOUR CO-ORDINATION & FINISH

16.1 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.

16.2 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification.

16.3 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned.

16.4 Final colours and finishes shall be to the Approval of the Engineer.

17.0 ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT

17.1 ENVIRONMENT PROTECTION

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and Stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

In case the Ministry of Environment & Forest stipulates any other conditions not specified hereunder while clearing the project, same shall be complied with by the Contractor.

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17.1.1 For Liquid Effluent (a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI: General Standards for discharge of Environmental pollutants Part-A: Effects of Environmental (Protection) Rules 1986, as amended till date. (b) Any specific requirement of State Pollution Authorities over and above the above stipulation 17.1.2 For Air Emission (a) Suspended Particulate Matter i.e. dust burden at Chimney outlet - Maximum 50 mg/Nm³ (with worst coal and one field out). (b) NO_x : 365 ppm (maximum) or 750 mg/Nm³ (Equivalent NO₂). (c) SO₂ : As per prevailing Indian/ World Bank standards The Bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated. 17.2 <u>NOISE LEVEL REQUIREMENT</u> The plant shall be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations. 17.2.1 Maximum noise level shall not exceed 85 dB (A) when measured at 1.0 M away from the noise emission source. 17.2.2 Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, 'Ambient Air Quality Standards' in respect of noise. 17.2.3 Any statutory changes in stipulations regarding noise limitation that may occur in future according to Maharashtra Pollution Control Board or Central Pollution Control Board or Ministry of Environment & Forest regulation		

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during tenure of the contract, the Contractor shall comply with the requirement. An exception will be made for the plant at startup operations and other big pressure reducing devices operating during emergency periods and for the safety valves.		
18.0	<u>INSPECTION AND TESTING</u>	
18.1	<u>GENERAL:</u>	
18.1.1	An indicative list of Inspection and testing requirements for each package has been given for equipments across various volumes of this specification. Bidder shall note that these testing and inspections listed herein are the minimum requirements as perceived by the Owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments / systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration. The comprehensive list of tests considered for each of the equipment/ systems shall be furnished as part of the bid.	
18.2	<u>INSPECTION AND TESTS DURING MANUFACTURE</u>	
18.2.1	The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.	
18.2.2	The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this Specification.	
18.2.3	Before any item of plant or equipment leaves its place of manufacture, the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.	
18.2.4	Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in	

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writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results. The Contractor shall forthwith forward to the engineer duly certified six (6) copies of the Test Certificates. Distribution of six (6) copies of Test Certificates for approval will be two (2) copies to Owner and four (4) copies to Consultant. These four (4) copies will be further distributed by Consultant after approval to Owner, site and bidder. One copy will be retained with the Consultant for record purpose. Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to Owner, Three (3) copies to site, Two (2) copies to Consultant, Two (2) copies to Owner's library / record. 18.2.5 Under no circumstances any repair or welding of castings shall be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer. 18.2.6 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works. Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to despatch from place of manufacture. 18.2.7 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Owner. The certificates shall include tests for mechanical properties and chemical analysis of representative material. 18.2.8 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one		

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hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour. 18.2.9 All necessary non-destructive examinations shall be performed to meet the applicable code requirements. 18.2.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR, as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination, magnuflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed. 18.2.11 Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR Maharashtra Jurisdiction) shall also be made by the Bidder. In such case, Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval. 18.3 <u>PERFORMANCE TESTS AT SITE</u> 18.3.1 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected system shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the system under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks etc. 18.3.2 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site. 18.3.3 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection,		

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pre-commissioning to tests on completion and commissioning of the complete system/equipment.

18.4 For details of specific tests required on individual equipment, refer to respective section of this specification.

19.0 **TRAINING OF OWNER'S PERSONNEL**

The Contractor shall extend all possible assistance and co-operation to the Owner regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.

Number of man-days of training as mentioned below shall be included in Tender.

19.1 **TRAINING AT CONTRACTOR'S PREMISES**

The Contractor shall conduct training of Thirty (30) engineers of the Owner on engineering, operation and maintenance of the Plant at the Contractor's or Associates or Sub-contractor's premises where adequate training facilities are available during the design and manufacturing stage of the Contract.

The total man-months for training of engineers shall be maximum Thirty (30), having following indicative break-up:

	Discipline	Number of Engineers	Number of Man-month
(a)	Operation	10 heads	10
(b)	Maintenance (Boiler & Turbine)	10 heads	10
(c)	Electrical Maintenance	4 heads	4
(d)	Control & Instrumentation	4 heads	4
(e)	Maintenance Planning	2 heads	2
		30 heads	30

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However, the details of the training programme will be discussed and finalised with the successful Bidder.

The training may also be arranged by the Contractor in any Plant where the equipment manufactured by the Contractor or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Contractor. All expenses inherently related to the training shall be borne by the Contractor and shall include but not limited to travel expenses (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.

The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the area of engineering, operation and maintenance and as trainers for in-house technology transfer programme of the Owner.

The Contractor shall be responsible for the development of the Training Module and Programme Schedule, which shall be submitted to the Owner for approval.

The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee.

Three (3) sets of the materials included in the training modules shall be handed over to the Owner upon completion of the training. An evaluation shall be jointly undertaken by the Contractor and the Owner's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.

The content of the training programme shall include but not be limited to:

- (a) Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.

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(b) Plant operation and systems training for operators including simulator training as applicable. (c) Maintenance training programme covering electrical, mechanical and instrumentation and control. Said training programme shall be submitted to the Owner for approval. The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant. The Contractor shall provide qualified English speaking instructors and training coordinator (s) during the tenure of the training programme. 19.2 <u>OPERATION AND MAINTENANCE TRAINING AT SITE</u> The Contractor shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting of the Contractor's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the Unit. The following instructors shall be at the Site continuously during the training: (a) One (1) for Steam Generator and Auxiliaries ; (b) One (1) for Turbine Generator and Auxiliaries ; (c) One (1) for Electrical Works ; (d) One (1) for Instrumentation and Control (Boiler and Auxiliaries) ; (e) One (1) for Instrumentation and Control (Turbine and Auxiliaries). Instructors shall also be available for Coal handling Plant, Ash Handling Plant, Water Treatment Plant and other specific areas as per requirement.		

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19.3 ON-THE-JOB TRAINING

During the period of pre-commissioning, commissioning and trial operation, the Owner shall provide operation and maintenance personnel to assist the Contractor in the operation and maintenance of his supply and work under the direction of the Contractor for the purpose of on-the-job training.

The Owner shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The Contractor shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.

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LIST OF STANDARDS FOR REFERENCE

ANNEXURE – A

- 1.0 International Standards Organisation (ISO)
- 2.0 International Electro-technical Commission (IEC)
- 3.0 American Society of Mechanical Engineers (ASME)
- 4.0 American National Standards Institute (ANSI)
- 5.0 American Society for Testing and Materials (ASTM)
- 6.0 American Institute of Steel Construction (AISC)
- 7.0 American Welding Society (AWS)
- 8.0 Architecture Institute of Japan (AIJ)
- 9.0 National Fire Protection Association (NFPA)
- 10.0 National Electrical Manufacturer's Association (NEMA)
- 11.0 Japanese Electro-technical Committee (JEC)
- 12.0 Institute of Electrical and Electronics Engineers (IEEE)
- 13.0 Federal Occupational Safety and Health Regulations (OSHA)
- 14.0 Instrument Society of America (ISA)
- 15.0 National Electric Code (NEC)
- 16.0 Heat Exchanger Institute (HEI)
- 17.0 Tubular Exchanger Manufacturer's Association (TEMA)

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18.0	Hydraulic Institute (HIS)	
19.0	International Electro-Technical Commission (IEC) Publications	
20.0	Power Test Code for Steam Turbines (PTC)	
21.0	Applicable German Standards (DIN)	
22.0	Applicable British Standards (BS)	
23.0	Applicable Japanese Standards (JIS)	
24.0	Electric Power Research Institute (EPRI)	
25.0	Standards of Manufacturer's Standardization Society (MSS)	
26.0	Bureau of Indian Standards (BIS)	
27.0	Indian Electricity Rules	
28.0	Indian Boiler Regulations (IBR)	
29.0	Indian Explosives Act	
30.0	Indian Factories Act	
31.0	Tariff Advisory Committee (TAC) rules	
32.0	Emission regulation of Central Pollution Control Board (CPCB)	
33.0	Pollution Control regulations of Dept. of Environment, Govt. of India	
34.0	Central Board of Irrigation and Power (CBIP) Publications	
35.0	The Air Prevention and Control of Pollution Act	
36.0	The Environmental Protection Act	
37.0	The Public Liability Insurance Act	

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38.0 The Forest Conservation Act 39.0 The Wildlife protection Act 40.0 The EIA Notification, 1994 41.0 IS: 14665-Specification for Electric Traction Lift 42.0 Any other statutory Codes/Standards/Regulation		

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CRITERIA FOR LAYOUT

ANNEXURE – B

<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
1.0	<u>SITE CONDITIONS TO BE CONSIDERED</u>	
1.1	Prevalent wind direction during summer (for deciding cooling tower orientation)	See wind-rose in plot plan.
1.2	Prevalent wind direction (s) during dry seasons (for deciding the location of coal stock pile and ash dump/unloading areas, minimising the pollution effect due to dust)	See wind-rose in plot plan.
1.3	Location of	
1.3.1	Raw Water intake point	As shown in Plot Plan
1.3.2	Plant drainage outfall point (s)	In Existing Drainage/Effluent treatment Plant
1.3.3	Railway entries & exits	As shown in Plot Plan
1.3.4	Road entries & exits	As shown in Plot Plan
1.3.5	Electrical power transmission grid system	As shown in Plot Plan
1.3.6	Preferred / selected ash dump area	Velhala nearly 10 Km from the site
1.3.7	Nearest residential area	Existing Colony

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<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
2.0	<u>LAYOUT REQUIREMENTS</u>	
2.1	<u>MAXIMUM PERMISSIBLE SLOPE IN</u>	
2.1.1	Rail track	1 in 400
2.1.2	Road	1 in 30
2.1.3	Sides of unpaved embankment	1 in 2
2.2	<u>REQUIRED ROAD WIDTH</u>	
2.2.1	Main roads	14.00 Metres with 1.0 m wide shoulders on either side for outer roads on western and eastern side and 7 meters with 1.5 m wide shoulders for other two sides of power block.
2.2.2	Auxiliary interconnections	Minimum 4 Metres without shoulders on either side and shall vary upto 7 m subject to availability of space. For carriage way, 5 Metre wide with 0.5 Metre shoulders and 7.0 Mtre wide with 1.5 Metre shoulders.
2.2.3	Road to the power house unloading bay	
(a)	Only for entry to the unloading bay	Yes
(b)	To pass through the unloading bay	No

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<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
2.3	Required minimum horizontal distance between the nearest points of	
2.3.1	Plant boundary and the boundary of residential area	(Local municipality/factory rule)
2.3.2	Electrical transformer and any other	As per the Tariff Advisory Committee Rules
2.3.3	Fire water supply installation and any building / facility subject to fire risk.	As per the Tariff Advisory Committee Rules
2.3.4	Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities	Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code
2.4	Required minimum vertical clearance	
2.4.1	Under pipes/cable racks at road crossings	8.0 Metres
2.4.2	Soil coverage over underground pipes	1.0 Metre (minimum)
2.4.3	Pipe/Cable trench	Not Acceptable
2.5	Railway Wagon clearance	Rules of the Indian Railways
2.6	Minimum Clearance between any road edge and building/ structure / any fixed installation	3 Metres
2.7	Required level, above the local developed grade level, of	

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2.7.1	Top of all roads	150 mm	
2.7.2	All outdoor paved areas	150 mm	
2.8	Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes	
2.9	Green belt around power plant area	As per environmental guidelines of MOEF, Govt. of India.	

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BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS

ANNEXURE – C

<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
1.0	Minimum clear space required at all working and walking areas for operating & maintenance personnel	
1.1	<u>HORIZONTAL, IN ALL DIRECTIONS</u>	
1.1.1	Adjacent to any electrical equipment, electrical cables, running (rotating / reciprocating) equipment, safety valve or vent / drain pipe outlet, pipe / equipment of surface temperature exceeding 60°C.	1200 mm
1.1.2	Adjacent to any other plant facilities (including walls / structures)	1000 mm
1.2	<u>VERTICAL</u> (head-room clearance)	
1.2.1	Under any pipe / equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items.	2.0 Metre
1.2.2	Under any other plant facilities (including structures, pipes etc.)	2.0 Metre

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<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
1.3	For all areas where any equipment (including trucks, trolleys and other material handling equipment) move or manoeuvre.	Minimum 500 mm clear in all direction from the outer edges of the equipment
1.4	Minimum clear hand space required for	
1.4.1	The application of thermal insulation	100 mm
1.4.2	Welding work	150 mm
1.4.3	Bolt tightening	150 mm
2.0	<u>FLOORS, PLATFORMS, STAIRCASE, LADDERS, WALLS, DOORS & WINDOWS</u>	
2.1	Statutory Requirement	As per the regulations of Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.
2.2	<u>OPERATION & MAINTENANCE REQUIREMENT</u>	
2.2.1	Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ Maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required.	Yes

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<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
2.2.2	Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.	Yes
2.3	Minimum access opening required (with rolling shutter) transportation,	3.5 M wide x 4 M high or wherever entry of truck, for material depending upon the envisaged equipment size to be handled.
2.4	Plinth level of all buildings, above the local developed for power house building.	300 mm
3.0	<u>OTHER MAINTENANCE REQUIREMENT</u>	
3.1	Generator stator handling In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking / lowering assembly, dismantling of building end walls / structures etc. shall be kept.	Yes

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<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
3.2	Maintenance of the internals / impellers of all important equipment, like Boiler Feed Pumps, Feed Water Heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, Cooling Water Pumps, Coal Mills, Air Compressors, Blowers, Heat Exchangers, Fuel Oil Pumps, Filters etc.	Shall be possible without disconnecting or dismantling any piping/ducting.
3.3	Overhauling and handling of the casings for the above items	Shall be possible without disturbing / dismantling any piping / ducting not directly connected to them.
3.4	Crane Approach Wherever required, the unobstructed approach of the crane hook / other hoisting equipment hook to various plant & equipment shall be possible.	Yes
4.0	<u>CENTRAL CONTROL ROOM</u> All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room.	Yes

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<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
5.0	The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.	
5.1	However, as a guide line, following features are given:	
5.1.1	False ceiling and false flooring shall be provided.	
5.1.2	Uniform height, colouring schemes for cabinets etc. shall be available.	
5.1.3	The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.	
5.1.4	No opening shall be provided from Boiler side.	
5.1.5	Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.	
5.1.6	Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided.	

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<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>	
5.1.7	The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.		
5.1.8	Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.		
5.1.9	Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.		
6.0	Toilet and drinking water facility	Required in all buildings and on all floors wherever operating personnel are to be deployed.	

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SPECIFIC LAYOUT CONSIDERATIONS

ANNEXURE-D

While developing the layouts, the following major layout parameters shall be ensured, as a minimum:

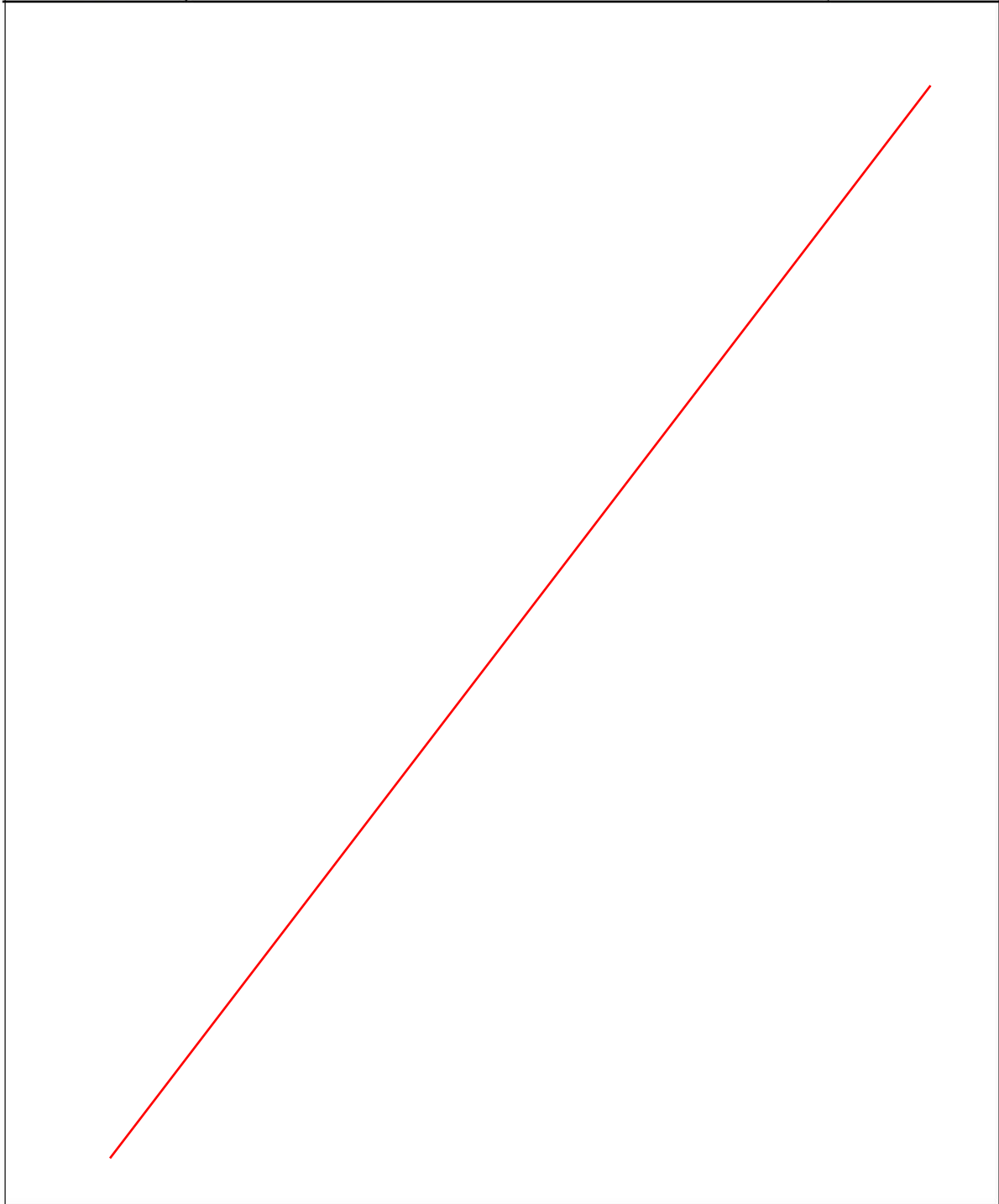
<u>SR.NO.</u>	<u>PARAMETER</u>	<u>REQUIREMENTS</u>
1.0	AB bay, BC & CD bay widths	36.0 M, 12.0 M & 12.0M
2.0	Arrangement of TG set	Longitudinal
3.0	Floor levels in AB bay	0.0 M, 9.0 M, 17.0 M
4.0	Floor levels in B-C bay	0.0 M, 9.0 M, 17.0 M 24.0M, 28.0 M 32.8 M, 38.0 M
5.0	Level of operating floor	17.0 M
6.0	Level of mezzanine floor	9.0 M
7.0	HT/LT Switchgear and MCC location	HT Switchgear at 3.5 M and LT Switchgear & MCC at 12.0 M in AB bay
8.0	Area of unloading bays	750 sq. M
9.0	Lay down Area (Minimum on operating floor) with EOT Crane approach	750 sq. M.
10.0	Minimum clear working space around the equipment	1200 mm
11.0	Location of Deaerator	In BC bay at EL. 38.0 M

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<u>SR.NO.</u>	<u>PARAMETER</u>	<u>REQUIREMENTS</u>
12.0	Location of Heaters	HP Heaters/LP Heaters at Operating Floor/ Mezzanine Floor respectively in B-C Bay.
13.0	Location of BFP	TDBFP at Operating Floor and MDBFP at Ground Floor in AB Bay.
14.0	Location of Boiler MCC	At 28.0 M in BC bay
15.0	Clear Head room within Main plant Building for pipes, structures & cable trays, ducts etc.	2.5 M
16.0	Number of Fire Escape staircases in the main plant with fire doors at each landing	Minimum Four (4)
17.0	Minimum width of all staircases landings	1500 mm
18.0	Passenger Elevators	One (min)
19.0	Clear approach width in front and rear of ESP	10 M (Height = 8 M)
20.0	Head Room for pipe/cables trestles at rail, road crossing	8.0 M
21.0	Minimum straight length in Flue gas duct at ESP outlet for Opacity meters.	As required for accurate dust measurement within the battery limits.
22.0	Elevation of ID Ducts entering Chimney	12.75 M (Min.) (Bottom of steel)

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1.0	PROJECT MANAGEMENT SERVICES
2.0	SITE SERVICES
3.0	PROTECTION AND CARE