

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

<u>SR. NO.</u>	<u>DESCRIPTION</u>	
(b)	Backwash Velocity	To be specified by the Bidder.
22.2.14	Material of construction	
(a)	Shell	Carbon steel as per IS 2062 or ASTM A 516 Gr. 60/70 or better.
(b)	Dished Ends	Carbon steel as per IS 2062 or ASTM A 516 Gr. 60/70 or better.
22.2.15	Protection	
(a)	Internal	
	(i) Primer	One Coat of High build Epoxy Zinc Phosphate primer. DFT per coat – 100 microns.
	(ii) Finish paint	One Coat of High build Epoxy finish paint. DFT per coat – 200 microns.
(b)	External	
	(i) Primer	Two coats of chlorinated zinc phosphate primer. DFT per coat – 50 microns.
	(ii) Finish paint	Three coats of chlorinated rubber paint. DFT per coat – 100 microns.
	(iii) Shade	As approved by Purchaser
22.2.16	Influent Distributor Material	SS-316
22.2.17	Manhole	Two (2) minimum each of Davit type and 500 mm dia.
22.2.18	Sight windows	One (1) in Backwash Space.

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22.2.19	Hand hole	One (1) no. of 150 mm dia. for removal of Activated Carbon.
22.2.20	Instruments, alarm and Interlock	To be provided as per the Tender Specification and Tender P&ID.
23.0	<u>ALKALINE BRINE SOLUTION PREPARATION TANK</u>	
23.1	Numbers To be provided	One (1)
23.2	Description for each Tank	
23.2.1	Type	Vertical cylindrical with flat bottom.
23.2.2	Location	Indoor
23.2.3	Type of fluid to be handled	Alkaline Brine Solution.
23.2.4	Effective capacity, in m ³	Suitable to meet the requirements for five (5) bed volumes of resin in one no. Anion Exchanger plus 20% margin.
23.2.5	Minimum Free Board, in mm	300 in addition to above margin
23.2.6	Size	Bidder to indicate.
23.2.7	Design Pressure, kg/cm ² .(g)	As per Tender Specification.
23.2.8	Design Temperature, °C	60
23.2.9	Design Code	As indicated elsewhere in the Specification
23.2.10	Material of Construction	
(a)	Shell	Carbon steel as per IS 2062 or ASTM A 516 Gr.70.
(b)	Ends	Carbon steel as per IS 2062 or ASTM A 516 Gr.70.

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23.2.11	Thickness, in mm	Not less than 6.
23.2.12	Protection	
(a)	Internal	
	(i) Material	Natural rubber [shore hardness 60 ⁰ – 70 ⁰ A], suitable to withstand the design temperature.
	(ii) Thickness	4.5 mm in three (3) layers.
(b)	External	
	(i) Primer	Two coats of chlorinated zinc phosphate primer. DFT per coat – 50 microns.
	(ii) Finish paint	Three coats of chlorinated rubber paint. DFT per coat – 100 microns.
23.2.13	Provided with accessories as follows:	
(a)	Inlet	To be provided.
(b)	Outlet	To be provided.
(c)	Drain	To be provided.
(d)	Overflow	To be provided.
(e)	Vent	To be provided complete with Breather.
(f)	Agitator along with drive motor and other accessories	To be provided. All wetted parts of the Agitator – Hastelloy C or SS-316 L.
(g)	Sample Collection Point	To be provided.

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(h)	Special accessories	Solution Preparation Basket of SS-316 Construction needs to be provided.
23.2.14	Instruments, alarm and Interlock	To be provided as per the Tender Specification and Tender P&ID.
24.0	<u>DILUTION WATER HEATER FOR ALKALI</u>	
24.1	Number	One (1)
24.2	Description for each unit	
24.2.1	Type	Vessel - vertical cylindrical with dished ends. Heater – Immersion Coil or Nichrome type.
24.2.2	Location	Indoor.
24.2.3	Type of fluid to be handled	Treated water from Anion Exchanger.
24.2.4	Effective Capacity in m ³	Suitable to meet the motive water requirement for regeneration of one (1) bed volume of Anion Exchanger at 40°C + 20% margin.
24.2.5	Design Temperature in °C	60.
24.2.6	Design Pressure in kg/cm ² (g).	Same as Anion Exchanger
24.2.7	Design Code	ASME SEC-VIII DIV-I
24.2.8	Material of construction	
(a)	Shell	SS-316.
(b)	Dished ends	SS-316.
24.2.9	Protection	

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(a)	Internal	
	(i) Material	Not required.
	(ii) Thickness	Not required.
(b)	External	
	(i) Primer	Not required.
	(ii) Finish paint	Not required.
	(iii) Shade	Not required.
24.2.10	Manhole	Two (2) minimum each of Davit type and 500 mm dia.
24.2.11	Instruments, alarm and Interlock	To be provided as per the Tender Specification and Tender P&ID.
25.0	<u>HEATER DATA</u>	
25.1	Type	Immersion Coil type with Thermostat
25.2	Number OF Heating element	As required to get the desired heating, minimum two (2)
25.2.1	Heater kW Rating	Suitable heat load calculations to be furnished for approval
25.2.2	Insulation Material	MGO fused powder or equivalent refractory block
25.2.3	Heating Time in hrs.	Maximum 4-6
25.2.4	Instruments	
25.2.5	Pressure Relief Valve	To be provided
25.2.6	Temperature Indicator	Local as well as panel mounted

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25.2.7	Temperature indicator controller	One (1) panel mounted to control the water temperature. Controller shall have auto and manual selection mode.
25.2.8	Control Valves	
(a)	Number and Location	Two (2) at the inlet line of the Heat Exchanger
(b)	Material	Stem, Plug and Seat: SS-316 Body: Cast Iron
(c)	Actuators	Pneumatic with local hand wheel. Valve shall be modulating type.
26.0	<u>RESIN TRANSFER VESSEL</u>	
26.1	Number	One (1)
26.2	Description for each unit	
26.2.1	Type	Vertical cylindrical with dished ends.
26.2.2	Location	Indoor.
26.2.3	Capacity	Adequate to hold the complete resin transferred from one cation or one anion or one mixed bed units whichever is highest.
26.2.4	Backwash	At least 60% backwash space to be provided.
26.2.5	Regeneration/ Degreasing/ Befouling	Suitable regeneration of resins from any of the cation, anion or mixed bed unit by acid/alkali. Arrangement shall also be provided for degreasing/befouling of cationic or anionic resins.

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26.2.6	Design Temperature in °C	60 (for Mechanical Design) Temperature for Regeneration and Backwash are mentioned elsewhere in Specification.
26.2.7	Design Code	ASME SEC-VIII-DIV-I
26.2.8	Material of construction	
(a)	Shell	Carbon steel as per IS 2062 or ASTM A 516 Gr.60/70 or better.
(b)	Dished ends	Carbon steel as per IS 2002 or ASTM A 516 Gr.60/70 or better.
26.2.9	Resin Traps	One (1) at service outlet and other at backwash & drain line.
26.2.10	Cleats for Internal Support	SS-316
26.2.11	<u>UNDER DRAIN SYSTEM</u>	
(a)	Type	Header Lateral or Strainer on plate, designed to avoid any non-uniformity of flow.
(b)	Material of construction	For Header Lateral, Header: MSRL-RC and Lateral: PP (double decker replaceable type) For Strainer on plate, Plate: MSRL and Strainer: PP (double decker replaceable type).
(c)	Special feature	For Strainer on plate system, an additional manhole shall be provided to give access below the bed plate.
26.2.12	Provided with accessories as follows:	

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(a)	Inlet	To be provided.
(b)	Outlet	To be provided.
(c)	Drain	To be provided.
(d)	Overflow	To be provided.
(e)	Vent	To be provided complete with Breather.
(f)	Relief Valve	Suitable heat load calculations to be furnished for approval
(g)	Sample Collection Point	To be provided.
(h)	Separate platform and/or staircase with handrails required for operation	To be provided for access from ground floor to top of Tank
(i)	Manhole	Two (2) minimum each of Davit type and 500 mm dia.
(j)	Sight windows	Two (2) nos. One at top level and other at bottom level.
(k)	Hand hole	One (1) no. of 150 mm dia. for removal of Ion Exchange Resins.
26.2.13	Instruments, alarm and Interlock	To be provided as per the Tender Specification and Tender P&ID.
27.0	<u>REGENERATION WATER TRANSFER PUMPS</u>	
27.1	Number	Two (2) (1W + 1S)
27.2	Description for each Pump	
27.2.1	Location	Indoor.

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27.2.2	Fluid to be handled	DM Water
27.2.3	Duty	Continuous and to be suitable for parallel operation.
27.2.4	Type of Pump	Horizontal Centrifugal Non Clog type
27.2.5	Type of Impeller	Closed
27.2.6	Design standard	As per IS-5659 & IS-5120.
27.2.7	Service temperature, in °C	60
27.2.8	Rated Capacity, in m ³ /hr	Suitable to meet the system requirements.
27.2.9	Permissible tolerance in rated capacity, in %	As per IS-5659 & IS-5120.
27.2.10	Range of operation	20 % - 120 %.
27.2.11	Suction Condition	Flooded.
27.2.12	Head to be developed at rated capacity	By bidder.
27.2.13	Shut Off Head	To be suitable for stable operation at rated duty point.
27.2.14	Permissible tolerance in efficiency at rated capacity, in %	As per IS-5659 & IS-5120.
27.2.15	Material of construction	
(a)	Casing	AISI-316.
(b)	Impeller	AISI-316.
(c)	Shaft	AISI-316.
(d)	Mechanical Seal	AISI-316.

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(e)	Common Base plate	Fabricated Steel as per IS 2062.
(f)	Nuts and bolts	AISI-316.
27.2.16	Type of drive	Electrical Motor
27.2.17	Rated speed (RPM)	1500 (Sync.) maximum.
27.2.18	Instruments, alarm and Interlock	To be provided as per the Tender Specification and Tender P&ID.
27.2.19	Start and stop facility provided both at local and panel	To be provided in conjunction with Auto Start Facility.
27.2.20	Trip interlock	To be provided.
28.0	<u>AIR RECEIVER</u>	
28.1	Numbers required	One (1)
28.2	<u>DESCRIPTION FOR EACH AIR RECEIVER</u>	
28.2.1	Installation	Indoor
28.2.2	Type	Vertical cylindrical with torispherical dished ends.
28.2.3	Design pressure	10 kg/cm ² (g)
28.2.4	Hydraulic test Pressure	15 kg/cm ² (g)
28.2.5	Design code	IS-2825/IS-7938/ Approved equal
28.2.6	Capacity of each air receiver	Bidder to compute in accordance with the system requirement. However the water filled volume shall not be less than 2 m ³ under any circumstances.
28.2.7	Material of construction	

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(a)	Shell	IS-2002
(b)	Dished ends	IS-2002
(c)	Flanges	IS-2002
28.2.8	Supply of Accessories & Services	
(a)	Flanges with nuts, bolts and gaskets	Yes
(b)	Pressure gauge with snubber	Yes
(c)	Pressure switch	Yes
28.2.9	Temperature indicator	Yes
28.2.10	Relief valve	Yes, set pressure shall be at least 10% above working pressure.
28.2.11	Trap station	Yes
28.2.12	Level gauge	Yes
28.2.13	Vent valve/plug	Yes
28.2.14	Supporting stand with necessary foundation bolts, nuts, sleeves, etc	Yes
28.2.15	Eye bolts, lifting tackle etc.	Yes
28.2.16	Painting	
(a)	External	Two coats of red-oxide primer and two finish coats of synthetic enamel paints.
(b)	Internal	Shop painted as per manufacturer's standard.

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28.2.17	Inspection and Testing	
(a)	Material testing and identification	Yes
(b)	Bend test as per BS-5169	Yes
(c)	Spot radiography of circumferential and longitudinal butt welds	Yes
(d)	Field performance test	Yes
(e)	D.P. test where radiography cannot be done	Yes
(f)	Hydraulic Test	Yes
(g)	Other specific tests as specified in this specification	Yes
29.0	<u>NEUTRALIZATION PIT</u>	
29.1	Numbers To be provided	One (1) with two compartments.
29.2	Description for each Tank	
29.2.1	Location	Outdoor.
29.2.2	Type	Underground and rectangular in cross-section.
29.2.3	Type of fluid to be handled	Regeneration Waste Water.
29.2.4	Effective capacity of each compartment, in m ³	Suitable to hold waste effluent generated from regeneration of one (1) complete DM chains + 20% overall margin.

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29.2.5	Size	Bidder to indicate.
29.2.6	Liquid depth in m	2.5 (maximum)
29.2.7	Free board in mm	500 (minimum)
29.2.8	Design Temperature, °C	60
29.2.9	Design Code	As indicated elsewhere in the Specification.
29.2.10	Code for Tests and Inspections	As indicated elsewhere in the Specification.
29.2.11	Material of Construction	RCC.
29.2.12	Thickness, in mm	As indicated elsewhere in the Specification
29.2.13	Protection	
(a)	Internal	
	(i) Material	PPGRP (poly propylene glass reinforced plastic)
	(ii) Thickness	3 mm
29.2.14	Provided with accessories as follows:	
(a)	Inlet	To be provided.
(b)	Outlet	To be provided.
(c)	Drain	To be provided.
(d)	Platform complete with handrails for operation	To be provided.

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(e)	Staircase	To be provided
(f)	Special accessories	To be provided
	(i) Baffles	Suitable for mixing of waste for neutralization
	(ii) Air Grid Arrangement	Required in each chamber for air agitation to achieve better mixing and economy in chemical consumption.
	(iii) Inlet Gate	Separate Inlet Gate to be provided for each Compartment.
29.2.15	Instruments, alarm and Interlock	To be provided as per the Tender Specification and Tender P&ID.
30.0	<u>NEUTRALIZED EFFLUENT DISPOSAL PUMPS</u>	
30.1	Number	Two (2) [One (1) to be under operation and the One (1) as standby].
30.2	Description for each Pump	
30.2.1	Location	Outdoor.
30.2.2	Fluid to be handled	Regeneration waste.
30.2.3	Service	Recirculation of regeneration waste and disposal of neutralized regeneration waste.
30.2.4	Duty	Continuous and to be suitable for parallel operation.
30.2.5	Type of Pump	Vertical Centrifugal Type
30.2.6	Type of Impeller	Semi Open
30.2.7	Design standard	As per IS-5120 & IS-5659.

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30.2.8	Service temperature, in °C	60 maximum.
30.2.9	Rated Capacity, in m ³ /hr	Not less than 100.
30.2.10	Permissible tolerance in rated capacity, in %	As per IS-5120 & IS-5659.
30.2.11	Range of operation	20 % - 120 %.
30.2.12	Suction Condition	Suction Lift required.
30.2.13	Head to be developed at rated capacity	Suitable to meet the system requirements.
30.2.14	Shut Off Head	To be suitable for stable operation at rated duty point.
30.2.15	Permissible tolerance in efficiency at rated capacity, in %	As per IS-5120 & IS-5659.
30.2.16	Material of construction	
(a)	Casing	AISI-316.
(b)	Impeller	AISI-316.
(c)	Shaft	AISI-316.
(d)	Mechanical Seal	AISI-316.
(e)	Common Base plate	Fabricated Steel as per IS 2062.
(f)	Nuts and bolts	AISI-316.
30.2.17	Type of drive	Electrical Motor
30.2.18	Rated speed (RPM)	1500 (Sync.) maximum.
30.2.19	Painting for complete set of Pump & Motor	To be provided.

Note: "To be provided" shall be read as "To be provided by bidder".

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PART-C

1.0	DMF, ACF AND UF BACKWASHED WATER PIT	
1.1	Number	One (Twin sections) with a common sump
1.2	Material of construction	R.C.C.
1.3	Effective capacity each sections	Each compartment with 2 Hrs UF reject/backwash water + 1 ACF backwash water+1 DMF backwash water +20% margin
2.0	DMF, ACF and UF Backwashed Water Transfer Pumps	
2.1	Total Number of Pumps	2 (1W+1S)
2.2	Guaranteed Flow of each pump	Capacity to evacuate the each section in 2 hrs.
2.3	Total head	As reqd.
2.4	Type of pump	Vertical, non-clog, Sump pumps
2.5	Type of Working Fluid	Drains with particle size up to 40 mm
2.7	Type of impeller	Open
2.8	Suction Bell /Casing	ASTM A 351 CF8M, SS– 316
2.9	Impeller , Shaft, Sleeves	ASTM A 351 CF8M, SS– 316
2.10	Column pipe & Discharge Pipe	SS– 316
2.11	Shaft enclosing tube (if applicable)	SS– 316
3.0	UF FEED WATER STORAGE TANK	
3.1	Type	Vertical cylindrical atmospheric
3.2	Design Standard (for diameter,length & thickness)	As per BS: 2594. However, dished ends shall be of Torispherical type
3.3	Number of units per DM stream	One (1)
3.4	Useful (Effective) Capacity (minimum)	1 Hr storage Capacity of one UF stream to match with net output (Post UF) + Water required for backwashing of UF membrane Chemical preparation requirements Plus 5% margin over the above total requirements.
3.5	MOC	MSRL (4.5 mm RL).
4.0	UF FEED PUMPS	
4.1	Numbers Required.	Two (2) (1 working + 1 stand-by).
4.2	Type	Horizontal centrifugal.
4.3	Capacity (each)	As per system requirement.
4.4	Head	As Required.
4.5	Suction Condition	Flooded
4.6	Material of construction	
4.7	Casing	SS 316
4.8	Impeller	SS 316
4.9	Shaft	SS-410
4.10	Shaft sleeve	SS-410
4.11	Type of Shaft Sealing	Mechanical Seal
4.12	Location	Near UF Feed water storage tank.
5.0	BASKET STRAINER	
5.1	Number	2 (1W+1S) for each stream
5.2	MOC	SS 316

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5.3	Size	100 microns
5.4	Filtration capacity	Strainer shall be sized for 100 % of rated flow of each UF Feed water pump
6.0	UF SKIDS	
6.1	Streams	2 Nos. (2x100%)
6.2	Feed temperature	20-36 Deg.C
6.3	Each Capacity (net) in cu.m/hr	To Suit the net DM Plant output (Post UF) per stream of 100 cum/hr
6.4	Type Of Operation	Automatic Back wash
6.5	UF membrane	MWCO not greater than 10000 Daltons.
6.6	Type of membrane mounting	Horizontal/Vertical
6.7	Colloidal silica removal efficiency	99.8%
6.8	UF recovery	Not less Than 95%
6.9	Make	KOCH/MEMCOR/NORRIT/DOW/TEAM.
7.0	UF BACKWASH / FEED FLUSH PUMPS	
7.1	Quantity	2 Nos. (1W+1S)
7.2	Location	Indoor.
7.3	Fluid to be handled	Demineralized water from DM water storage tank
7.4	Service	Backwashing and CEB of UF system
7.5	Duty	Continuous and to be suitable for parallel operation.
7.6	Type of Pump	Horizontal Centrifugal with VFD
7.7	Design Capacity & Head	As per UF system requirement
7.8	Material of construction	
(i).	Casing	2.5 % Ni Cl IS 210 Gr FG 260
(ii).	Impeller	ASTM A CF 8M
(iii).	Wearing Rings (if applicable)	SS 316
(iv).	Shaft	SS 420/SS 316
(v).	Shaft Sleeves	SS 420/SS 316
8.0	UF CIP TANK	
8.1	Quantity	1 Nos.
8.2	Type	Vertical Cylindrical with top cover hinged & dished bottom. The tank shall be fitted with vent, drain, overflow, etc.
8.3	Location	Outdoor
8.4	Useful capacity (for each tank)	Cleaning requirement of 1 UF system stream plus 20% margin
8.5	Pressure Rating	Atmospheric
8.6	Material of construction	FRP with suitable internal protection
8.7	Free board	300mm
8.8	Agitator with motor & reduction gears	As per chemical preparation requirement
8.9	Accessories for each tank	Manhole, handhold, approach ladder & charging platform etc
9.0	UF CLEANING PUMPS	
9.1	Quantity	2 Nos. (1W+1S)
9.2	Location	Indoor.
9.3	Service	Chemical cleaning of UF system
9.4	Duty	Continuous and to be suitable for parallel operation.

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9.5	Type of Pump	Horizontal Centrifugal		
9.6	Design Capacity & Head	As per UF system requirement		
9.7	Material of construction			
(i).	Casing	2.5 % Ni CI IS 210 Gr FG 260		
(ii).	Impeller	ASTM A CF 8M		
(iii).	Wearing Rings (if applicable)	SS 316		
(iv).	Shaft	SS 420/SS 316		
(v).	Shaft Sleeves	SS 420/SS 316		
10.0	UF CEB DOSING SYSTEMS	Common for All UF system		
	Chemical cleaning system description	Dosing system 1 (if applicable)	Dosing system 2 (if applicable)	Dosing system 3 (if applicable)
A	DOSING TANK			
i)	Quantity	1 No.	1 No.	1 No.
ii)	Type	Vertical Cylindrical with top cover hinged & dished bottom. The tank shall be fitted with vent, drain, fume absorber, overflow seal pots etc.		
iii)	Location	Indoor		
iv)	Useful capacity (for each tank)	Cleaning requirement of 1 UF system stream plus 25% margin		
v)	Pressure Rating	Atmospheric		
vi)	Material of construction	FRP with suitable internal protection		
vii)	Free board	300 mm		
viii)	Dissolving basket	As per chemical preparation requirement		
ix)	Agitator with motor & reduction gears	As per chemical preparation requirement		
x)	Accessories for each tank	Handhole, approach ladder & charging platform etc		
B	DOSING PUMPS			
i)	Quantity	2Nos. (1W+1S)	2Nos. (1W+1S)	2Nos. (1W+1S)
ii)	Type	Simplex positive displacement hydraulically operated diaphragm type		
iii)	Suction strainers	Required		
iv)	Pressure dampener	Required		
v)	External safety relief valve (in addition to inbuilt safety valve)	CPVC		
vi)	Maximum pump stroke per minute	100 - 200		
vii)	Motor rating	Minimum 15 % margin over BkW at rated duty point		
viii)	Material of construction			
ix)	Liquid end (pump, head, valves, valve housing, valve spring, etc)	PP for all wetted parts		
x)	Diaphragm	PTFE		
xi)	Packing	PTFE		
xii)	Frame	MS fabricated, epoxy painted		
11.0	SAFETY EQUIPMENTS	Six sets of safety equipment comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided. A personnel water drench safety shower with eye bath (2 Nos) shall be provided near acid alkali unloading/handling area.		

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
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12.0	PIPING	
12.1	Filtered water	Stainless Steel: Stainless Steel ASTM A 312 Gr. 304 Sch. 40 /Equivalent Seamless for Sizes 50 and above and welded for sizes 65 mm NB and above.
12.2	Demineralized water including UF	Stainless Steel: Stainless steel to ASTM A312, Gr. 304 Sch.40s seamless for sizes 50mm and below and welded for sizes 65 mm NB and above.
12.3	Decationised & Deanionised water and N-pit waste and ACF and UF backwashed water.	Rubber lined Carbon Steel: IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 – Grade 410;/ ASTM A-36/ASTM - 53 Type- E, Grade B/ Equivalent and Galvanized to IS: 4736 or Equivalent internally lined with 3 mm thick Rubber of shore hardness 65 ± 5°A) Note: The inside surface of pipes shall be completely de-beaded and made suitable for rubber lining
12.4	Concentrated Hydrochloric Acid (5-30% Conc.)	1) PP lined Carbon Steel: IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B /ASTM A 36 / IS:3589 - Grade 410;/ Equivalent and Galvanized to IS: 4736 or Equivalent internally lined with 3 mm thick Polypropylene) 2) CPVC as per ASTM F441 CPVC 4120
12.5	Dilute Hydrochloric Acid(Less than 5% Conc.)	1) Rubber lined Carbon Steel: IS:1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 / IS:3589 - Grade 410;/ Equivalent internally lined with 3 mm thick Rubber of shore hardness 65 ± 5°A) 2) Chlorinated Polyvinyl chloride (CPVC) as per ASTM F441 CPVC 4120
12.6	Alkali (Sodium Hydroxide) a) Strong (5% and above) b) Dilute (below 5%)	a) Stainless Steel SS-316L b) Polypropylene lined steel/CPVC as per ASTM F441 CPVC 4120 Schedule 80
12.7	Lime slurry/Solution/ Suspensions	CPVC as per ASTM F441 CPVC 4120 Sch. 80
12.8	Cleaning Solution Line	SS316 Sch. 40 /CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.
12.9	Chemical Waste from vessels and tanks	1) Rubber lined Steel (as referred above) 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS: 4984 or Equivalent for buried portion.
12.10	Instrument air	CS Galvanized as per IS 1239 Gr.B Galvanized
12.11	UF frontal	CPVC, Sch-80.
13.0	VALVES	

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
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13.1	Raw water/filter water	Either Butterfly type or gate valves shall be used for isolation purpose. Ball valves or globe valves may also be provided for this application for sizes 40 Nb and below. <u>Butterfly</u> Butterfly valves shall be of double flanged confirming to AWWA-C-504 class 150 (min.) or BS:5155 PN 10 (min.) Body: cast Iron IS:210 Gr. FG 260 Disc: cast Iron IS:210 Gr. FG 260 Shaft:ASTM.A296 Gr. CF8M Seat rings: Nitrilerubber, EPDM, Hypalon All the butterfly valves shall be provided with Hand wheel or lever as per the requirements. All the butterfly valves shall be provided with an indicator to show the position of the disc. Flanges shall conform to ANSI B 16.5 Cl.150 (min.) <u>GATE VALVE</u> Type :Outside screw and rising stem type Stem, seat ring and wedge facing ring: SS, Rating: PN 10 (min). Other parts of the valve: As per IS:14846. <u>BALL VALVE</u> Type :Full bore Rating: PN 10 (min). Body: cast Iron/carbon steel Ball: stainless steel Seat ring: PTFE Stem: Stainless steel Seat: Nitrile rubber, PTFE <u>GLOBE</u> Type: Double flanged or wafer type Rating: PN 10 (min). Body: Cast iron: IS 210 Gr FG260 Stem: Stainless steel Disc: Cast iron.
13.2	Decationised, Deanionised and Demineralised and UF water application	Butterfly valves or Diaphragm valves shall be used for this application. <u>Diaphragm Valve</u> The Diaphragm shall conform to following requirement i) Design standard: BS:5156 or equivalent of required rating/class. (minimum rating of valves shall be PN 10). ii) Type: Flanged and lined body ends, sealed bonnet, weir pattern, tight shut off type iii) Material of Construction - Body , Bonnet: Cast iron IS 210 Gr. FG 260 or equivalent or Cast steel ASTM A-216 Gr. WCB - Body lining : Soft natural rubber, ebonite , Polypropylene - Handwheel : Cast Iron - Compressor : Stainless Steel - Stem and Bush : Stainless Steel <u>Butterfly Valve</u> The butterfly valves shall conform to CL No. 13.1 above except for the following requirements: - Body shall be lined (minimum 3 mm) with natural rubber, ebonite, polypropylene or PVDF. - Disc shall be lined with PVDF, Polypropylene or natural rubber. - Seat rings shall be of Nitrile rubber or Hypalon.
13.3	Acid and alkali service	Valves shall be of Diaphragm type. These valves shall conform to above (sl no. 13.1 and 13.2) except that the diaphragm shall be of reinforced Teflon, EPDM/Black Butyl/ approved equivalent for acid services and reinforced neoprene/Hypalon/approved equivalent for alkali services.

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13.4	Non return valve	These valves shall be swing check type or dual plate type Swing check type (non corrosive application) Body and disc : Cast iron Hinge pin and door/disc pin: Cast steel ASTM A216 Gr.WCB Disc facing ring: stainless steel Body Seat ring: Stainless steel For application of lime, corrosive water (DM water, decaionised /deanionised water), and air,the body,cover and disc shall be lined with natural rubber,PTFE or Viton. Bolting shall be stainless steel. For acid services, the valves shall be of lined construction as specified above and body/disc facingring shall be of resilient materials such as natural rubber, PTFE or Viton. For alkali service, the complete valve shall be stainless steel construction.
13.5	Isolation Gates For DMF, ACF and UF Sump	i. Four numbers gate shall be provided by the Bidder. ii. Design standard for each gate shall be IS:3042 or Eqv. iii. The gates shall be rectangular or square sluice, rising spindle type conforming to class-1 of IS:3042. iv. Material of Construction of each gate: • Frame and Door: Cast Iron IS:210 Gr. 20 • Spindles, bolts & nuts : M.S. to IS:2062 • Face & seat rings: Gun metal (as per IS:3042). • All the parts of each gates shall be applied with the coats of heavy duty bitumastic paint. • Each of the gates shall be provided by the Bidder with hand wheel, and a position indicator. • Each gate shall be FRP coated on both sides.
13.6	Isolation Gates For Neutralisation pit	i. Four numbers gate shall be provided by the Bidder. ii. Design standard for each gate shall be IS:3042 or Eqv. iii. The gates shall be rectangular or square sluice, rising spindle type conforming to class-1 of IS:3042. iv. Material of Construction of each gate: • Frame and Door: Cast Iron IS:210 Gr. 20 • Spindles, bolts & nuts : M.S. to IS:2062 • Face & seat rings: Gun metal (as per IS:3042). • All the parts of each gates shall be applied with the coats of heavy duty bitumastic paint. • Each of the gates shall be provided by the Bidder with hand wheel, and a position indicator. • Each gate shall be FRP coated on both sides.

PUMPS AND PIPE SELECTION CRITERIA.

Pump and Pipeline carrying water and chemicals etc. shall generally be sized on the following velocities. However wherever minimum pipe sizes are defined in the drawing/datasheets, the selected size shall not be less than the specified size.

	VELOCITY IN m/sec.		
	BELOW 100 MM.	100-200 MM	200 MM AND ABOVE
Pump Suction for water	1.0		
Pump discharge/distribution for water	1.8	2.2	2.5
Gravity flows	1.0 (maximum).		

Note 1- All piping system shall be capable of withstanding the maximum pressure in the corresponding line.

Note 2- TDH of all pumps shall be decided by the supplier assuming the following 'C' values in Hazen & Williams equation for calculation of friction loss.

- a) Carbon steel pipes – 100, C. I pipes –100, Rubber lined steel pipe – 120 and PVC/HDPE pipes – 140
10% margin shall be taken over the pipe friction losses for calculating the pump head.

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QUALITY PLAN



TITLE:

**TECHNICAL SPECIFICATION FOR DM PLANT.
1X660MW BHUSAWAL TPS-UNIT:6**

SPECIFICATION NO.: PE-TS-415-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

Tests/Check Items / Components	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Std/ Appd. Data Sheets	Other Tests	Remarks
1. Horizontal Centrifugal Pumps				Y	Y			Y ¹	Y		LEGENDS: Y Applicable Y ^a One per Heat/Heat Treatment batch./Lot Y ^b On machined surfaces only. Also 100% on Butt Welds & 10% on Fillet Welds. Y ^c UT shall be done for shafts with Dia 50 mm or above & Plates of Thickness 20 mm or above. Y ^d Dynamic Balancing per ISO: 1940, Grade 6.3 minimum. Y ¹ As per HIS, USA. Y ² 10% RT to be conducted on butt welds for Thk ≥10 mm. Y ³ Seat Leakage Test for actuator operated valves shall be done by closing the valve with job actuator. Y ⁴ Tests on Rubber Diaphragms per batch of Rubber mix such as Tensile, Elongation, Hardness, Thickness, Bleed Resistance, Flex Test for 1500 cycles etc. shall be conducted. In addition, Type Test for 50,000 cycles for each type of diaphragm shall also be conducted, if not carried out earlier. Y ⁵ Seat Leakage Test is required to be done in both directions. Disc strength test as per relevant code shall be carried out. Y ⁶ Blue Matching, Wear Travel for Gate Valves, reduced pressure test for check valves shall be conducted per relevant standards.
1.1. Casing	Y ^a		Y ^b				Y				
1.2. Impeller	Y ^a		Y ^b							Y ^d	
1.3. Shaft	Y ^a		Y						Y ^c		
2. Vertical Pumps				Y	Y			Y ¹	Y		
2.1. Casing	Y ^a		Y ^b				Y				
2.2. Impeller	Y ^a		Y ^b							Y ^d	
2.3. Shaft	Y ^a		Y						Y ^c		
2.4. Fabricated Parts	Y ^a	Y	Y ^b			Y ²	Y				
3. Dosing/ Metering Pumps	Y ^a						Y	Y ¹	Y		
4. Gate/ Globe/ Check Valves	Y ^a		Y ^b		Y		Y	Y	Y	Y ⁶	
5. Dual Plate Check Valves	Y ^a		Y ^b		Y		Y	Y	Y	Y ¹²	
6 Diaphragm Valves	Y ^a				Y		Y ³		Y	Y ⁴	
6. Butterfly Valves (Low Pr.)				Y	Y		Y ³	Y		Y ⁵	
7.1 Body (Cast)	Y ^a		Y ^b								
7.2 Disc (Cast)	Y ^a		Y ^b								
7.3 Shaft	Y ^a		Y ^b							Y ^c	
8. Plug/ Ball Valves (Low Pr.)	Y ^a		Y ^b	Y	Y		Y	Y	Y		
9. Blowers	Y ^a		Y ^b	Y	Y		Y	Y	Y	Y ^{dc}	
10. Atmospheric Storage Tanks/ Pressure Vessels	Y ^a	Y	Y ^b	Y	Y	Y ⁸	Y		Y ^c	Y ⁷	



TITLE:
TECHNICAL SPECIFICATION FOR DM PLANT.
1X660MW BHUSAWAL TPS-UNIT:6

SPECIFICATION NO.: PE-TS-415-163-A001
VOLUME II-B
SECTION –C1
REV. NO. 00

Tests/Check Items / Components	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Std/ Appd. Data Sheets	Other Tests	Remarks
11. Rubber lining	Y ^a				Y				Y	Y ^g	Y⁷ Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Welded dished ends shall be stress relieved. Dished ends manufactured by cold working shall be stress relieved as per the requirement of code. Y⁸ RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT. Y⁹ Rubber Lining Mix shall be subjected to Bleed Resistance Test on mould sample. Adhesion Test, Spark Test and Hardness Test for the Rubber lined jobs shall also be conducted. Y¹⁰ Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted. Y¹¹ One Fan of each type & size shall be routine performance tested as per corresponding code fir air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured. Y¹² Blue Matching, reduced pressure test for check valves shall be conducted per relevant standards. Dry cycle test on valve spring for 1, 00,000 cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring.
12. Resins / Activated Carbon Filter	Y ^a	Y	Y ^b	Y	Y				Y	Y ¹⁰	
13. Hoists & Cranes	Y ^a	Y	Y ^b	Y	Y	Y ⁸		Y	Y		
14. Agitators /Flash Mixer/ Flocculator	Y ^a	Y	Y ^b	Y	Y			Y		Y ¹⁰	
15. Pipes	Y ^a	Y		Y	Y		Y		Y		
16. Ventilation/Exhaust Fan	Y ^a		Y ^b	Y	Y			Y ¹¹	Y	Y ^{10c}	
After erection, the complete Piping system along with valves & fittings shall be hydraulically tested at 1.5 times design pressure or 2 times working pressure whichever is higher.											

Note:1) The above mentioned requirement are bare minimum. However any additional comments provided by BHEL / Customer shall be adhered by successful bidder without any commercial and delivery implication to BHEL/Customer.

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PERFORMANCE AND GUARANTEE TEST

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAVAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

- (a) ~~Calibration tests for Weigh Machine/Load Indicator~~
- (i) ~~Determination of the following parameters of Filter Media of Dual Media Pressure Filter and Activated Carbon Filter :~~
 - a. ~~Bulk density~~
 - b. ~~Sieve Analysis, Uniformity Coefficient, Effective Size, Ash Content, Surface Area, Silica Content, Ignition Residue etc.~~
- (ii) ~~The resins shall be tested as per the standard procedures.~~

3.2 TESTS BEFORE TRIAL RUN

~~For Tests before trial run refer Clause 2.2 of Annexure II.~~

3.3 PERFORMANCE GUARANTEE TEST PROCEDURE FOR DM PLANT

- (a) Necessary pumps shall be started and flow shall be established through all the streams. Valves shall be adjusted so as to have equal and rated distribution of flow through all the streams.
- (b) One (1) stream shall be running at a time. Samples of water shall be drawn every hour from the outlet of Activated Carbon Filter, Cation Exchanger, Degasified Water Storage Tank, Anion Exchanger & Mixed Bed Exchanger and then tested in the laboratory. The results shall be compared against the required parameters stipulated elsewhere under this specification.
- (c) Exhaustion of each Unit shall be indicated by the features described under Cl. No. 5.5 in Section III of this volume – Operation and Control Philosophy for Demineralization Plant. Units shall then be backwashed/regenerated at the specified regeneration level. Total amount of chemicals required for regeneration and the duration of chemical injection/regeneration of each Ion Exchange Unit shall be noted against the guaranteed figures.

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DM PLANT
1X660MW BHUSAVAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

- (d) The regenerated stream shall be again put into service and tests in item shall be continued. At the end of run (as determined in above, total amount of water treated shall be noted from the flow integrators).
- (e) Inlet water analysis is determined by making arithmetic average of all hourly readings of Filtered water taken during the test.
- (f) Based on this inlet water analysis, regeneration level employed, resin volume provided and characteristic curves of the resins employed, the capacity of each stream in terms of total volume of treated water (m^3) between two (2) successive regenerations shall be calculated. Resin volume shall not include the buffer and inert layers provided. The calculation shall be approved by the Purchaser / Engineer.
- (g) Quantity of treated water as determined by tests as in above shall be checked against calculated quantity of treated water during regeneration as in above and must be equal to or more than the calculated amount.
- (h) All the above mentioned tests shall be separately done for each of the Two (2) Streams of the complete DM Plant.

**3.4 PERFORMANCE GUARANTEE PARAMETERS FOR
DEMINERALIZATION PLANT**

- (a) Each pump shall be guaranteed for capacity, total dynamic head and power consumption.
- (b) All blowers shall be guaranteed for head and power consumption.
- (c) Activated Carbon Filter

Each Activated Carbon Filter shall have a rated continuous treated water output net capacity over and above the quantity of treated water required for backwash/ regeneration/ rinse of itself and other units of the same stream or chain it belongs to. It shall be backwashed once after every 20 hours of continuous service run.

TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.

(d) Ion Exchange Units

- (i) Each Ion Exchange Unit shall have a rated continuous treated water output net capacity over and above the quantity of treated water required for backwash/regeneration/rinse of itself and other units of the same stream or chain it belongs to. Except Mixed Bed Units, each Ion Exchange Unit shall be regenerated once after every 20 hours of continuous service run. Each Mixed Bed Unit shall be regenerated once every after 140 hours of continuous service run.
- (ii) Net output from each of cation units and anions unit between two regeneration shall be not less than (operating hours x net output cap in m³/hr) m³ of treated water and that for each of mixed bed units shall be not less than (operating hours x net output cap in m³/hr) m³ of treated water for the design water analysis as exhibited in Annexure-I. In case water analysis is different from the design values, guaranteed quantity shall be calculated as indicated elsewhere in this Specification and guarantee shall be applicable on this calculated quantity.
- (iii) Chemical consumption of the ion exchange units as indicated by the Bidder shall be guaranteed against the regeneration level employed and resin volume provided without any tolerance.

The guaranteed values of chemical consumption shall hold good for chemicals conforming to following specification:

- a. Hydrochloric Acid IS – 265
(Tech Grade)
 - b. Sodium Hydroxide IS – 252
(Rayon grade available in Flakes)
- (iv) The total time for complete regeneration of a stream or chain of Demineralization Plant Stream and backwash operation for (Dual Media Pressure Filter - Activated Carbon Filter - Cation

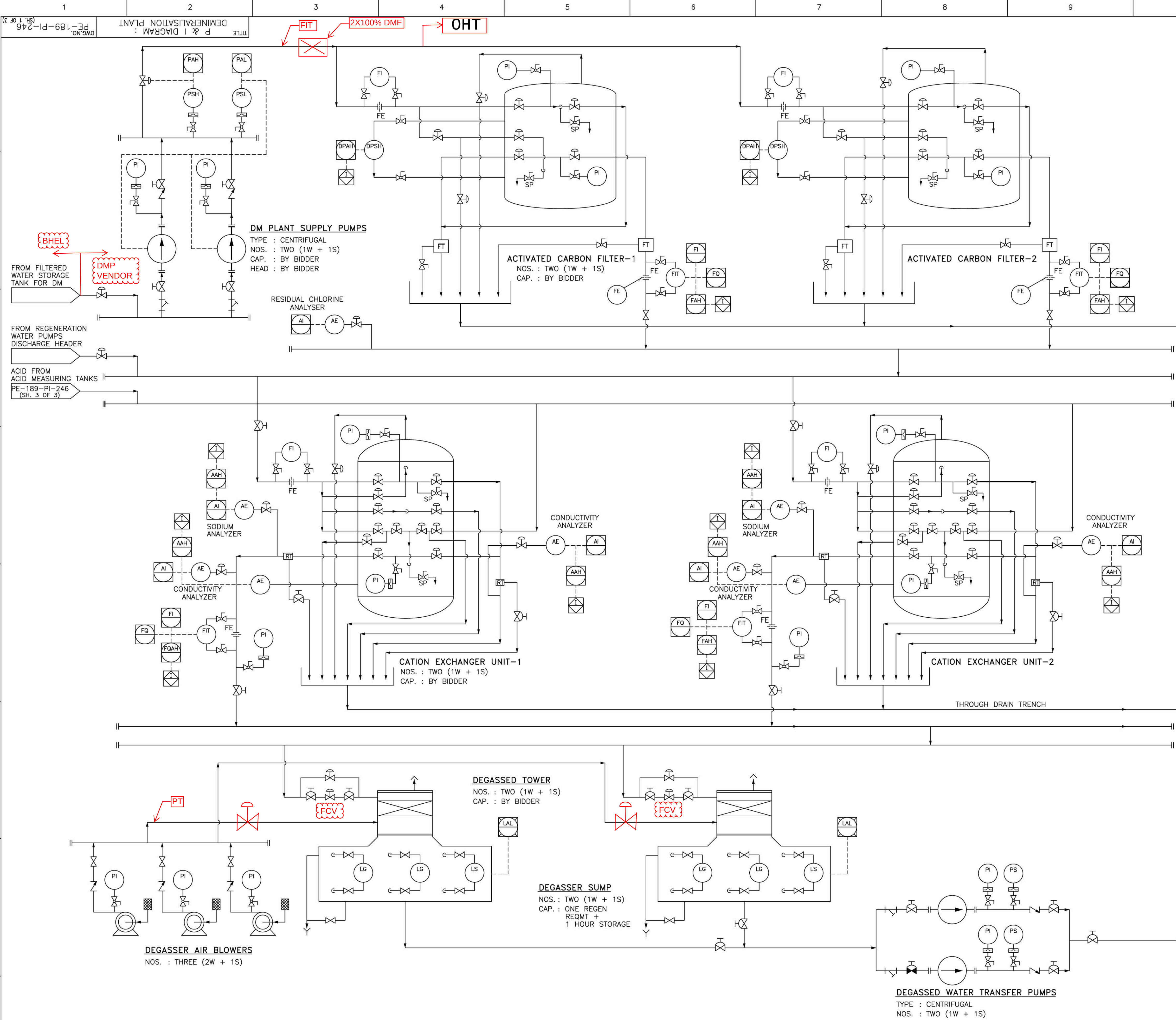
**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

Exchanger - Anion Exchanger - Mixed Bed Exchanger) shall not exceed 5 hours.

Note-1: For PG test please refer sl no-9, Section-C1 also.
Note-2: For UF the PG test procedure shall be decided during detailed engineering subject to BHEL/Customer approval.

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Note:
1) LCP shall be read as DCS.
2) All switch like DPS, PS, LS, FS shall be replaced by DPT, PT, LT, FT.
3) DPT shall be provided across Resin Trap and Media Trap and Strainer at pump suction.
4) In place of Gate valve Butterfly valve or Diaphragm Valve also acceptable.
5) 2X100% Dual Media Filter (DMF) shall be provided before ACF.
6) the configuration and connection of DMF, Instrument and valves for DMF shall be inline with ACF.
7) 2X100% Blower shall be provided and the instrument and valves for blower shall be inline with blower for MB.
8) One RCC overhead tank (OHT) shall be provided for DMF backwash.
9) Media Trap shall be provided in each DMF backwash line with DPT across each media trap.
10) DMF, ACF and UF backwash pit shall be with two compartment and arrangement, Isolation gate and Instrument shall be inline with N-Pit.

Note:
Primary sensor redundancy for Control/measurement shall be decided as per following general criteria:
Critical controls and respective measurements- Triple redundant.
Non-critical but important control & measurements- Dual redundant.
Only measurement- No redundancy.

(Transfer by pumping)
TO CMB

LEGEND:
REFER LEGEND DRAWING : PE-189-PI-200

NOTES:
1. BIDDER TO NOTE THAT THE SCHEME SHOWN CAPTURES THE BROAD CONTOURS OF THE SYSTEM TITLED HERE AS CONCEIVED BY OWNER/ OWNER'S CONSULTANT AND SHALL BE READ IN CONJUNCTION WITH THE RELEVANT SECTION OF THE SPECIFICATION. BIDDER SHALL DEVELOP DETAILED P&IDS MEETING THE OVERALL INTENT OF THE SCOPE AND PERFORMANCE AND FURNISH AS PART OF THE PROPOSAL.

ENGINEERING REFERENCE DRAWINGS:

- 1. P & I DIAGRAM : DEMINERALISATION PLANT PE-189-PI-246 (SH. 2 OF 3)
- 2. P & I DIAGRAM : DEMINERALISATION PLANT PE-189-PI-246 (SH. 3 OF 3)

BHEL DOC NO. PE-TS-415-163-A001

FOR BID PURPOSE ONLY

DO NOT SCALE

MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

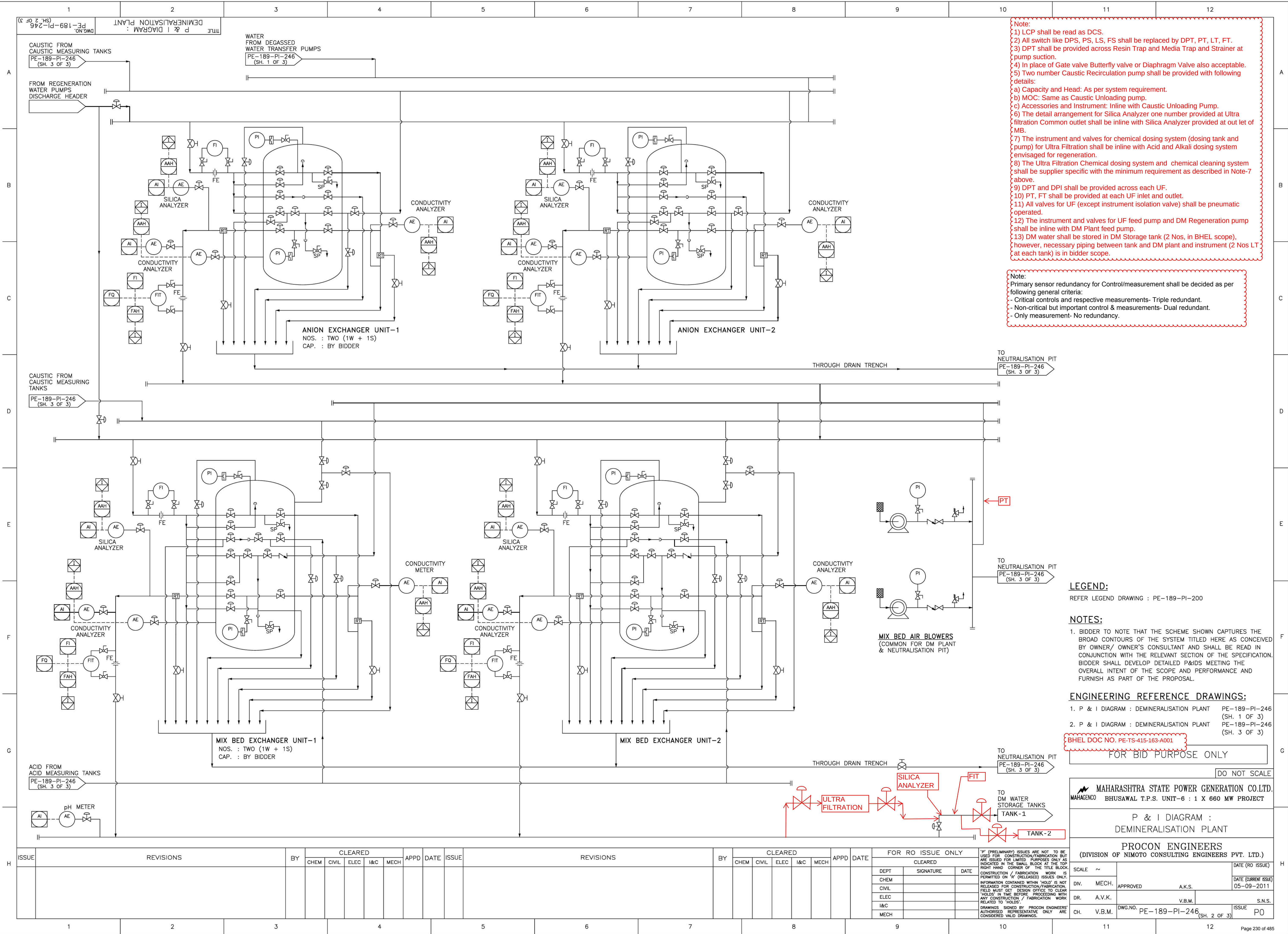
P & I DIAGRAM :
DEMINERALISATION PLANT

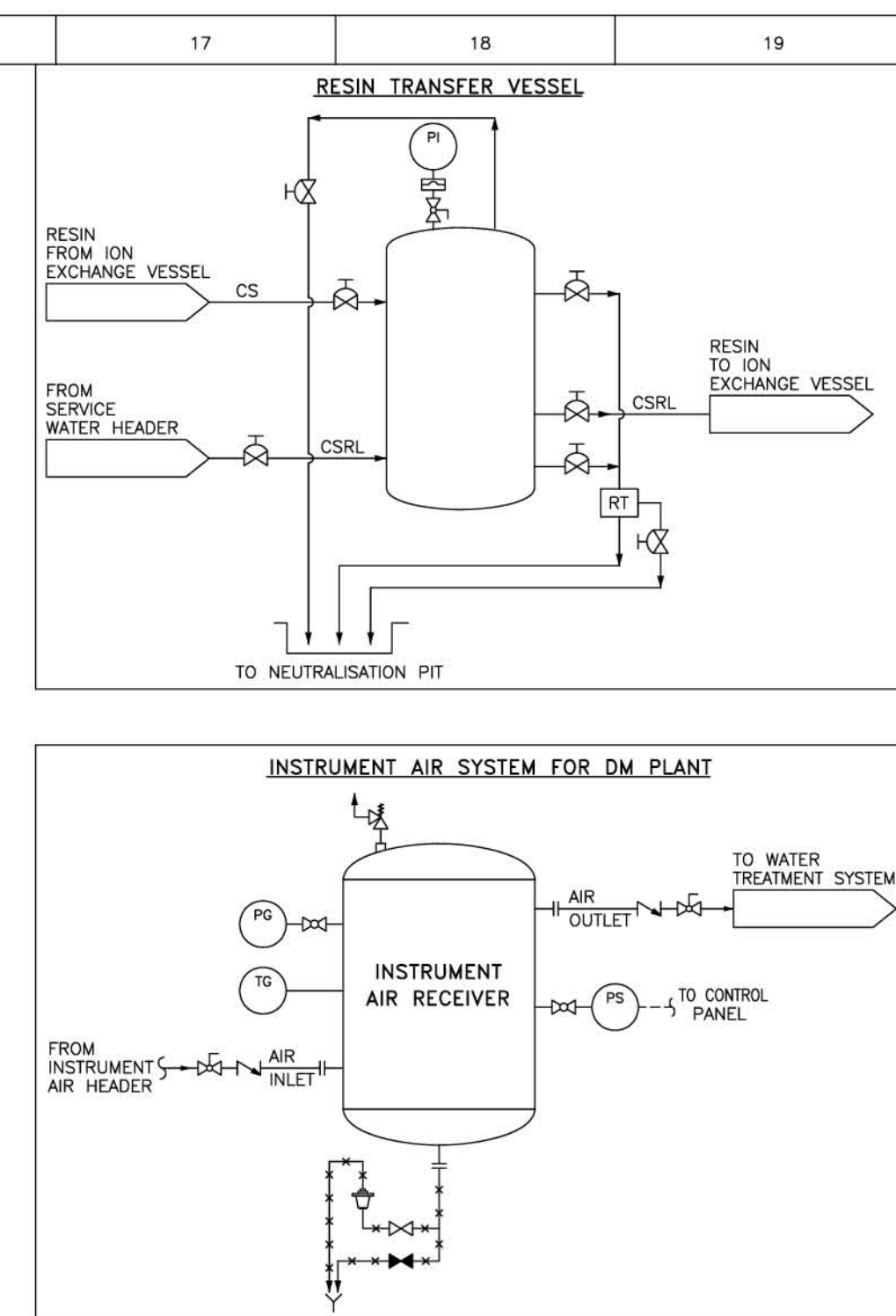
PROCON ENGINEERS
(DIVISION OF NIMOTO CONSULTING ENGINEERS PVT. LTD.)

SCALE	~	DATE (NO ISSUE)
DIV. MECH.	APPROVED	DATE (CURRENT ISSUE) 05-09-2011
DR. A.V.K.	V.B.M.	S.N.S.
CH. V.B.M.	DWG.NO. PE-189-PI-246 (SH. 1 OF 3)	ISSUE P0

ISSUE	REVISIONS					BY	CLEARED					APPD	DATE	ISSUE	REVISIONS					BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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'P' (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION/FABRICATION BUT ARE ISSUED FOR LIMITED PURPOSES ONLY AS INDICATED IN THE SMALL BLOCK AT THE TOP RIGHT HAND CORNER OF THE TITLE BLOCK. CONSTRUCTION / FABRICATION WORK IS PERMITTED ON 'R' (RELEASED) ISSUES ONLY. INFORMATION CONTAINED WITHIN 'HOLD' IS NOT RELEASED FOR CONSTRUCTION/FABRICATION. FIELD MUST GET DESIGN OFFICE TO CLEAR 'HOLD' IN TIME BEFORE PROCEEDING WITH ANY CONSTRUCTION / FABRICATION WORK RELATED TO 'HOLD'.
DRAWINGS SIGNED BY 'PROCON ENGINEERS' AUTHORISED REPRESENTATIVE ONLY ARE CONSIDERED VALID DRAWINGS.





Note:
Primary sensor redundancy for Control/measurement shall be decided as per following general criteria:

- Critical controls and respective measurements- Triple redundant.
- Non-critical but important control & measurements- Dual redundant.
- Only measurement- No redundancy.

NOTES:

1. BIDDER TO NOTE THAT THE SCHEME SHOWN CAPTURES THE BROAD CONTOURS OF THE SYSTEM TITLED HERE AS CONCEIVED BY OWNER/ OWNER'S CONSULTANT AND SHALL BE READ IN CONJUNCTION WITH THE RELEVANT SECTION OF THE SPECIFICATION. BIDDER SHALL DEVELOP DETAILED P&IDs MEETING THE OVERALL INTENT OF THE SCOPE AND PERFORMANCE AND FURNISH AS PART OF THE PROPOSAL.

(SH. 2 OF 3)

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FOR BID PURPOSE ONLY

P & I DIAGRAM :
DEMINERALISATION PLANT

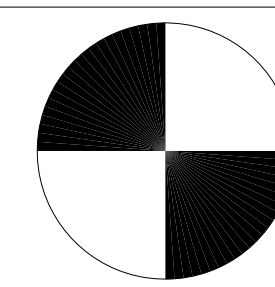
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T. (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR ANY OTHER PURPOSES THAN THAT FOR WHICH THEY ARE ISSUED FOR LIMITED PERIODS. REVISED ONLY AS REQUIRED IN THE SMALL BLOCKS AT THE TOP RIGHT HAND CORNER OF THE TITLE BLOCK.		(DIVISION OF NIMOTO CONSULTING ENGINEERS PVT. LTD.)			
DATE	SCALE	~	CONSTRUCTION / FABRICATION WORK PERMITTED ON (Y) (RELEASED) ISSUES ONLY. INFORMATION CONCERNING WHEN THESE ISSUES ARE TO BE USED MUST BE OBTAINED FROM THE FIELD. MUST GET DESIGN OFFICE TO CLEAR ANY CONSTRUCTION / FABRICATION WORK RELATED TO ISSUES?	DATE (CURRENT SS)	05-09-2011
	DR. MECH.	APPROVED	A.K.S.		
	DR. S.D.A.		V.B.M.	S.N.S.	
DRAWINGS SIGNED BY PROCEEDS ENGINEERS AUTHORIZED - REPRESENTATIVE ONLY ARE CONSIDERED VALID FOR DESIGN PURPOSES.			DWG.NO.	PE-189-p-246	ISSUE OF 485P0
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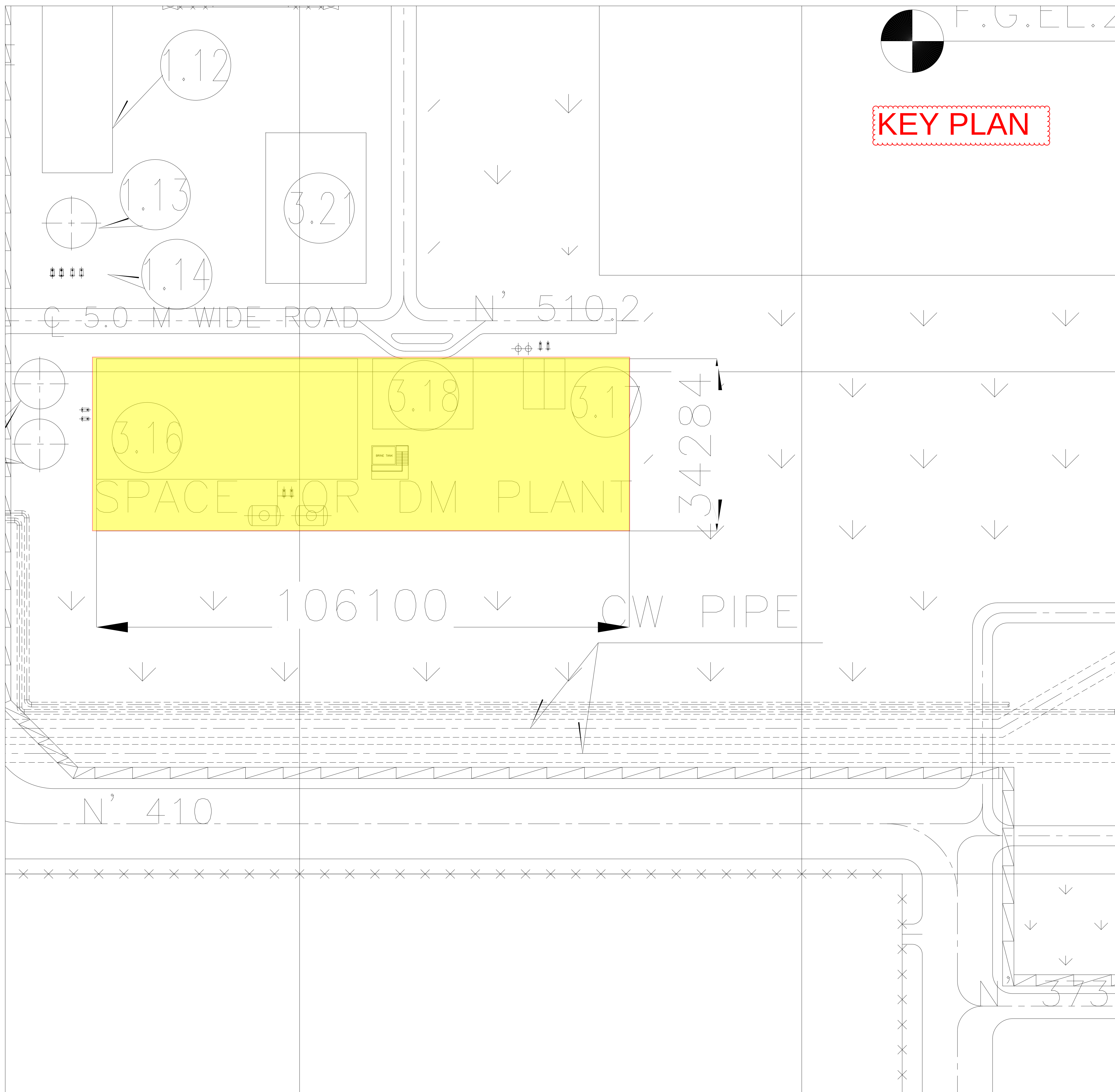
	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
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KEY PLAN



F.G.E.L.4

KEY PLAN



	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
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SECTION – C2

(SPECIFIC TECHNICAL REQUIREMENTS FOR ELECTRICAL)

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ELECTRICAL EQUIPMENT SPECIFICATION

	TITLE: ELECTRICAL EQUIPMENT SPECIFICATION FOR DM PLANT	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION: C
		REV NO. : 00 DATE: 02/07/2019
		SHEET: 1 OF 1

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for DM PLANT SYSTEM.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL.
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc. shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “both end equipment in vendor’s scope” shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this, the bidder shall furnish two signed and stamped copies of the following:

- a) A copy of this sheet “Electrical Equipment Specification for PT Plant Package and sheet Electrical scope between BHEL and Vendor” with bidder’s signature and company stamp.
- b) Electrical load requirement in the load data format.

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc. is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures:

- a) Electrical scope between BHEL & vendor (~~Annexure – I~~)
- b) Technical specification for motors ~~DC/BSL U-6/2011/T-1~~
- c) Datasheets ~~along with Annexure I~~
- d) Conduit & Pipes specification & constructional details of cables.
- e) Quality plan for motors.
- f) Electrical Load data format (~~Annexure – II~~)
- g) BHEL cable listing format (~~Annexure – III~~)

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ELECTRICAL LOAD FORMAT

[illegible]

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)



JOB NO.	415	ORIGINATING AGENCY		PEM (ELECTRICAL)	
PROJECT TITLE	1X660MW BHUSAWAL TPS	NAME		DATA FILLED UP ON	
SYSTEM / S	DM PLANT	SIGN.		DATA ENTERED ON	
DEPTT. / SECTION	ELECTRICAL	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	Page 289 of 485

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ELECTRICAL SCOPE FOR VENDOR AND BHEL

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGE: DM PLANT****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 1 X 660MW BHUSAWAL TPP**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	1. 415 V AC (3 Phase, 4 Wire) /240 V AC supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGE: DM PLANT****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 1 X 660MW BHUSAWAL TPP**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable (excluding power cables) in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

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SECTION – C3
(SPECIFIC TECHNICAL REQUIREMENTS FOR C&I)

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
Specific Technical Requirements (C&I): 1) The control of DM Plant shall be through DCS based control system (in BHEL scope). The operation and control philosophy of CPU has been elaborated in separate section in the specification. The DCS panel along with OWS, EWS, printers (in BHEL scope) shall be located in DM Plant Control Room. 2) All electrical actuators shall be integral type. 3) The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with. 4) The solenoid valves shall have limit switches for open/close feedback. 5) Interface of MCC, HT SWGR, Actuators, solenoid drives, control valves etc. with DCS based control system shall be as per Drive Control Philosophy attached in the specification. 6) All the instruments/drives shall be terminated on JBs/Panels in field. JBs/Panels shall be in Bidder's scope. RTD's shall be of duplex type. 7) Primary sensor redundancy for Control/measurement shall be decided as per following general criteria: - Critical controls and respective measurements- Triple redundant. - Non-critical but important control & measurements- Dual redundant. - Only measurement- No redundancy. 8) Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification. Any cable in Bidder's scope shall be as per specification. 9) Redundant 230 VAC UPS feeders shall be provided by BHEL at a single point. Further distribution to various instruments/analyzers/local panel etc. shall be in Bidder's scope. Bidder to include necessary power distribution board (ACDB) (as per details attached elsewhere in this specification) in his scope. Any power supply other than the above, if required by any instrument/device, has to be derived by the Bidder from the above supply and all necessary hardware for the same shall be in bidder's scope. Bidder to furnish UPS power requirement along with the bid.		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
10) Bidder to comply with codes and standards as mentioned in the specification. 11) All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. All transmitters shall be HART compatible. 12) Bidder to delegate /depute their persons/experts as per owner/consultants' requirement. 13) Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system. 14) The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL. 15) Any part/module of the C&I system which are not listed under recommended spares shall be deemed as having life expectancy not less than the expected life of the plant i.e. 30 years. 16) Instrument ranges shall be selected to have the normal reading ,preferably between 50% and 70% of full scale for linear parameters and 70% to 80% for flow measurements. Deviation indicators shall have the null position at mid scale. The normal operating parameter shall be identified with a clear green mark.		

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SECTION-D
(GENERAL TECHNICAL REQUIREMENT)

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		SECTION: D	
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SECTION-D1

(GENERAL TECHNICAL REQUIREMENT FOR MECHANICAL)

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

1.0 SYSTEM DESCRIPTION

The schematic arrangement of the DM Plant has been detailed in P&I Diagram enclosed with this document.

- 1.1 The DM Plant capacity shall be arrived at based on bidder's basic engineering. However, a minimum net capacity of 2 x 100 m³/hr shall be provided. Under normal condition, one stream is envisaged to be kept in operation.

Layered bed Technology shall be used for DM Plant.

All regeneration wastes and other drainages from Ion Exchange Units of DM Plant are led to Neutralization Pit, each compartment of which shall be capable to hold regeneration effluent generated from one (1) complete chain plus 20% margin.

1.2 ION EXCHANGE RESINS FOR CATION, ANION & MB

RESINS shall be of reputed make and must have been in use in demineralising plants capable of producing water as specified or better for a period of not less than five (5) years.

- (a) The cation resins shall be high capacity premium grade sulphonated strong acidic cation resin in sodium form, microporous polystyrene bead type suitable for counter current regeneration.

The attrition loss of the cation resins shall be guaranteed not to exceed three (3) percent per year for the five (5) years of operation.

Resin quantity for cation exchanger shall be supplied to ensure minimum cation leak and regeneration level shall be selected so as keep sodium slip less than 0.5 ppm as Na in the effluent.

- (b) The anion resin shall be high capacity strong base, quaternary ammonium type-1 anion resin in chloride form, macroporous or isoporous, resistant to organic fouling suitable for counter – current

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

regeneration. Anion resin should be able to withstand a temperature of 60° C.

The attrition loss of the anion resins shall be guaranteed not to exceed five (5) percent per year for the first five (5) years of operation. Resin quantity for anion exchanger shall be supplied to ensure minimum anion leak and regeneration level shall be selected so as to keep silica slip less than 0.1 ppm as SiO₂ in the effluent.

- (c) The mixed bed cation & anion resins shall be as described above suitable for co-current regeneration.
- (d) Effective bed depth for each exchanger shall be 1.0m minimum.
- (e) Quantity of 100mm bed depth inert resin provided in cation & anion exchanger shall be indicated separately.
- (f) Quantity of resins in each exchanger shall be adequate so as to require not more than one (1) regeneration per day at design capacity.
- (g) At least 100% free-board shall be provided over resin bed for expansion during backwashing or addition of some extra resins if required.
- (h) Regeneration effluent generated from cation and anion exchangers and also acidic and alkaline effluents from mixed bed shall be self neutralizing to each other.

Complete performance characteristics of the selected offered resins along with regenerant/neutralizing chemical consumption calculations shall be furnished.

- (i) The resin shall be unaffected by acids, alkalis or common solvents. The resin shall be able to withstand a temperature of 60°C (minimum) continuously.

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

- (j) All Resins shall be supplied in manufacture's own sealed containers. No broken drum/containers or loose packing for resins will be accepted.
- (k) The bidder should consider 10% (minimum) deration over the corrected exchange capacity, obtained from the manufacturer's published resin literature.
- (l) The uniformity co-efficient of resins shall be less than 1.2 & Simultaneous semi-auto regeneration facility for one (1) stream shall be provided.
- (m) For the regeneration of cation exchanger units, powder water used shall be degassed water.
- (n) For the regeneration of anion/mixed bed exchanger units, powder water used shall be deionised water.

All header pipes shall be sized considering simultaneous operations of all streams at rated conditions. Regeneration system shall be sized for regeneration of one (1) stream at a time.

2.0 SCOPE OF SUPPLY AND SERVICES

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

- 2.1 Two (2) DM Plant Feed Pumps, each complete with electrical drive motor and all other accessories as required and located near Filtered Water Pump house for DM.
- 2.2 Two (2) Activated Carbon Filter Units, each complete with internals, integral pipe works, valves and all other accessories as required.

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

- 2.3 Two (2) Cation Exchanger layered bed weak/strong resin units with separation plates each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.4 Two (2) forced draft Degasser Towers [One (1) on each Degassed Water Storage Tank], each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.5 Two (2) Degasser Blowers [One (1) working and one (1) standby on each Degasser Towers], each complete with electrical drive motor and all other accessories as required.
- 2.6 Two (2) Degassed Water Storage Tanks, complete with integral pipe works, valves and all other accessories as required.
- 2.7 Two (2) Degassed Water Transfer Pumps [One (1) working and one (1) standby for each Degasser Water Storage Tanks] each complete with electrical drive motor and all other accessories as required.
- 2.8 Two (2) Anion Exchanger layered bed weak/strong resin units with separation plates each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.9 Two (2) Mixed Bed Exchanger Units, each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.10 Two (2) Air Blowers (One (1) working and one (1) standby common for Two (2) Mixed Bed Exchanger Units and Neutralization Pit), each complete with electrical drive motor, suction filters, suction and discharge silencers, relief valve and all other accessories as required.
- 2.11 One (1) Resin Transfer Vessel & resin cleaning vessel tank with dosing pumps and all other accessories as required.
- 2.12 Two (2) hose stations for unloading Hydrochloric Acid. The hose station shall have two (2) 80 NB rubber hose connection.
- 2.13 Two (2) Hydrochloric Acid Transfer Pumps, each complete with electrical drive motor and all other accessories as required.

**TECHNICAL SPECIFICATION FOR
DM PLANT
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MAHARASHTRA, INDIA.**

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| 2.14 | Two (2) Hydrochloric Acid Bulk Storage Tanks, each complete with integral pipe works, valves and all other accessories as required. |
| 2.15 | Two (2) Hydrochloric Acid Measuring Tanks for Cation Exchangers, each complete with integral pipe works, valves and all other accessories as required. |
| 2.16 | Two (2) Hydrochloric Acid Measuring Tanks for Mixed Bed Exchangers, complete with integral pipe works, valves and all other accessories as required. |
| 2.17 | Two (2) hose stations for unloading Caustic. The hose station shall have two (2) 80 NB rubber hose connections. |
| 2.18 | Two (2) Caustic Transfer Pumps, each complete with electrical drive motor and all other accessories as required. |
| 2.19 | One (1) Activated Carbon Filters Unit for caustic, complete with internals, integral pipe works, valves and all other accessories as required. |
| 2.20 | Two (2) Caustic Bulk Storage Tanks, each complete with integral pipe works, valves and all other accessories as required. |
| 2.21 | Two (2) Caustic Measuring Tanks for Anion Exchangers, complete with integral pipe works, valves and all other accessories, as required. |
| 2.22 | Two (2) Caustic Measuring Tanks for Mixed Bed Exchangers, complete with integral pipe works, valves and all other accessories, as required. |
| 2.23 | One (1) Brine Preparation Tank, complete with integral pipe works, valves and all other accessories as required. |
| 2.24 | One (1) Regeneration Water Heater for regeneration of anion resins, complete with integral pipe works, valves and all other accessories as required. |
| 2.25 | Two (2) (common for Two (2) DM streams) Regeneration Water Pumps, each complete with electrical drive motor and all other accessories as required. |

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- 2.26 One (1) Acid Measuring Tank for neutralization, complete with integral pipe works, valves and all other accessories as required.
- 2.27 One (1) Caustic Measuring Tank for neutralization, complete with integral pipe works, valves and all other accessories as required.
- 2.28 One (1) Neutralization Pit (with two compartments), complete with integral pipe works, valves and all other accessories as required.
- 2.29 Two (2) [One (1) working and one (1) standby for each N-Pit compartments] Neutralized Effluent Disposal Pumps, each complete with electrical drive motor and all other accessories as required.
- 2.30 Two (2) safety showers.
- 2.31 One (1) of Air Receiver and all other accessories as required.
- 2.32 Centralized sampling rack for DM stream.
- 2.33 First fill of filter media, resin, and Degasser tower packings complete with make-up filter media, resin and packings for first three years of operation. Quantity of make-up resins shall be calculated on the basis of 3% and 5% attrition loss per annum for cation and anion resin respectively. For filter make-up, a loss of 10% per annum shall be considered.
- 2.34 All integral and interconnected pipe works, valves, sump, gates, all types of pipe supports, pipe and cable racks, pipe and cable bridges, etc. for the entire Demineralization Plant.
- 2.35 For electrical scope of work, bidder may please refer ~~Volume IV - A & B~~ of this specification.
- 2.36 Complete Instrumentation and Control for the entire Plant. The nature and extent of Instrumentation and Control required as a minimum, have been outlined in the P & I Diagrams enclosed with this Specification. However, bidder shall provide all the required instrumentation for the control & monitoring functionality of the system. The basic philosophy and other details of instrumentation and control have been furnished in ~~Volume V~~ of this Specification.

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- 2.37 ~~Provide design calculation documents, detailed drawings and bill of quantities including getting the same approved by the consultant pertaining to all civil and architectural works. For details of civil and architectural works, bidder may please refer Volume-VI of this specification.~~
- 2.38 Supply and application of shop painting and final painting at manufacturer's works and at site for the entire Plant as specified elsewhere in this specification.
- 2.39 ~~Supply of first charge of lubricating oil, inhibitor for oil and also adequate quantity of the same consumables for topping up for first six (6) months of initial operation after successful commissioning.~~
- 2.40 Supply of Mandatory Spares for the entire Plant.
- 2.41 Spares required for erection and commissioning of complete Plant.
- 2.42 One new set of special tools and tackles, fixtures etc., as required for regular operation and maintenance of the equipment offered. Adequate means shall be provided for lifting and handling of each item of plant and equipment. The scope shall also include supply of mandatory spares as per list enclosed elsewhere.
- 2.43 All erection tools plant like cranes, hoists, welding sets, gas electrodes, compressed air, sump pumps, paints, putty, and all consumable stores required for erection, testing and commissioning purpose except for chemicals.

SERVICES INCLUDED UNDER THIS SPECIFICATION

The services as addressed below need also to be considered as included with reference to Demineralization Plant under the scope of Specification:

- 2.44 Arrangement for the different specified stage inspection/testing at manufacturer's works by Purchaser's/Engineer's representatives.
- 2.45 Arrangement for dispatch of all the materials by road to sites.

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| 2.46 | Project engineering and management till handing over the complete DM Plant. |
| 2.47 | Receiving and unloading of all equipment and materials at site, checking with consignment note and reporting for missing or damaged items. |
| 2.48 | Proper stacking, storing under Bidder's custody and security, providing proper maintenance of stored items and keeping proper records of materials at store for convenience and proper scheduling of erection work and for quick identification and when required. |
| 2.49 | Issue of materials from stores and maintaining detail on account of the same as required & Transportation/shifting of materials from stores to erection site. |
| 2.50 | Submission of a phased time schedule for various stages of completion of work, which shall be the essence of the contract and guaranteed. |
| 2.51 | Arrangement for availability of all erection tools plant like cranes, hoists, welding sets, gas electrodes, compressed air, sump pumps, paints, putty, and all consumable stores required for erection, testing and commissioning purpose except for chemicals. |
| 2.52 | Pre-assembly at site after proper checking/overhauling, as required. |
| 2.53 | Erection and subsequent cleaning/flushing as required. |
| 2.54 | Pre-start check of the installation to ensure correctness of the erection. |
| 2.55 | Installation, testing and commissioning of all equipment, piping, instrumentation and control, etc. supplied under this package and as specified. This shall include necessary cleaning, reliability run and performance guarantee & acceptance test of the individual equipment as well as the entire Plant as a whole as given in the specification elsewhere. |
| 2.56 | Arrangement for construction and drinking water at site. |
| 2.57 | Deployment of all skilled, semi-skilled/unskilled workmen/labor, supervisory staff, inspectors, erection and commissioning engineer, clerical |

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staff, watch and ward staff, store-keeper, draw etc. as required for all services till handing over of the plant.

2.58 Submission of all drawings, data, test certificates, etc. as necessary.

2.59 Compilation and Submission of different manufacturer's operating and instruction manuals in a comprehensive manner, proposed for use by operating and/or maintenance personnel.

2.60 Submission of complete "AS-BUILT" drawings for the system/sub-system /equipment/material as erected and installed at site incorporating change or modifications in the executed works.

3.0 SALIENT DESIGN FEATURES

3.1 The Filtered water analysis to be adopted for the design of DM Plant has been furnished in Annexure-I enclosed along with this document.

3.2 Design qualities of treated water from various Units of DM Plant shall be furnished.

3.3 Cation resin of DM Plant shall be regenerated by hydrochloric acid (30-33% w/v) and anion resins by sodium hydroxide available in lye (40-48% w/v) form. All chemicals shall be as per the requirements of technical grade as per relevant IS.

3.4 The total time of regeneration of a complete DM Stream (Dual Media Filter, Activated Carbon Filter, Cation Exchanger, Anion Exchanger and Mixed Bed Exchanger Unit) shall not exceed four (4) hours.

3.5 Counter-current regeneration for Cation Exchanger Units and Anion Exchanger Units shall be adopted. For MB units, regeneration shall be co-current.

3.6 Regeneration level in CE and AE in DM system to be so adopted that the resultant effluent become self neutralizing. Moreover, the regeneration effluent from MB Unit shall individually be self neutralizing in nature.

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- 3.7 A minimum of 300 mm freeboard shall be provided for all the atmospheric tanks.
- 3.8 Under drain system shall be either header lateral or strainer on plate type. In case of header lateral system, no subfill shall be used which may come in contact with water. In case of strainer on plate type design, an additional manhole shall be provided to give access below the bed plate.
- 3.9 For calculations of anion exchange capacity and silica leakage, the temperature of alkali for regeneration should be taken as 25⁰ C for regeneration of Anion Exchanger Unit only.
- 3.10 The regeneration level, resin quantity, treated water quality and chemical consumption for the AE Units shall be designed, selected and guaranteed based on regeneration of the same at ambient temperature i.e. 25⁰ C.
- However, all ion- exchange units, degasifying tower and filters shall be designed for inlet water temperature of 10⁰ C. Backwash system shall be designed for maximum water temperature, as per site data furnished in Vol II of this specification.
- 3.11 For calculation of actual Exchange Capacity of all type of resins, 10% deration need to be considered on design Exchange Capacity.
- 3.12 Uniformity coefficient for both cation and anion exchange resin shall be less than 1.2.
- 3.13 **RESIN TRANSFER VESSEL AND PIPING SYSTEM**
- For storage and transfer of ion exchange resins, one (1) resin transfer vessel shall be provided.
- The vessel shall be vertical cylindrical type with dished ends and of mild steel rubber lined construction. The vessel shall be fitted with necessary connections for hydro-pneumatic transfer, resin inlet, resin outlet, vent, drain etc.
- A main resin transfer line along the length of the building shall be permanently laid for transferring and taking back the Ion exchange resins

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from Ion exchanger units to the resin transfer vessel and vice versa. However, connection of respective Ion exchanger unit with the main resin transfer line shall be achieved through reinforced flexible piping fitted with quick fixing (bayonet type) coupling. All Ion exchange units shall be provided with necessary permanent valve arrangement for the removal of charging of Ion exchange resins to/from the resin transfer vessel with necessary arrangement for fixing the flexible resin transfer piping.

The resin from the various ion exchange units shall be transferred to the resin transfer vessel hydro-pneumatically to minimize loss of water. The suggested mode of transfer of resin is shown in flow diagram. However, the bidder may propose any alternative mode for the same, if felt more appropriate by him. Resins after treatment shall also be taken back to the respective ion exchange units, from the resin transfer vessel hydro-pneumatically. The bidder may offer any alternative method considered more suitable by him.

All resin transfer piping shall be mild steel rubber lined construction. Proper velocity in the pipeline shall be adopted such that an attrition loss of the resins and blockage in the pipeline does not occur.

~~3.14~~ **PIPING**

~~3.14.1 For Material of Construction of pipes under various services, Bidder may please refer to Volume III - F.~~

~~3.14.2 For Pipelines carrying water, chemicals, air etc. & its velocities, Bidder may please refer Volume III - F.~~

~~3.15~~ **VALVES**

~~For valve design and testing standard, Bidder may please refer Volume III -F.~~

4.0 OPERATION AND CONTROL PHILOSOPHY

DCS BASED

~~4.1 The control concept of DM plant shall be so designed that the Plant can be controlled and monitored from TFT monitor based Operator's Station located in Control Room inside Demineralization Plant Building.~~

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		SECTION: D	
		REV NO: 0	DATE:

SECTION-D2

(GENERAL TECHNICAL REQUIREMENT FOR ELECTRICAL)

GENERAL TECHNICAL REQUIREMENT FOR ELECTRICAL

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1.0 SCOPE

- 1.1 This section covers the general requirements of the drive motors for power station auxiliary equipment.
- 1.2 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 1.3 In case of any discrepancy, the driven equipment specification shall govern etc.

2.0 STANDARDS

- 2.1 All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification.
- 2.2 Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed
 - (a) IS-325
 - (b) IS-12615
 - (c) IEC-34

3.0 SERVICE CONDITIONS

- 3.1 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash canopy to be provided to all outdoor install motors.
- 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.

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3.3 For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature

4.0 TYPE AND RATING

4.1 A.C. MOTORS

4.1.1 Motors shall be general purpose, constant speed, squirrel cage, three phase, induction type.

4.1.2 All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.

4.1.3 The motor name-plate rating at 50°C shall have at least 10% margin over the input power requirement of the driven HT equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.

4.1.4 The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.

4.1.5 All LT motors used in this project are proposed to be energy efficient type suitable for EFF1 efficiency rating.

4.1.6 The motor name plate rating shall have at least 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point.

4.1.7 Motors located in hazardous area shall be flame proof type.

4.2 D.C. MOTORS

4.2.1 D.C. Motor provided for emergency service shall be shunt/compound wound type.

4.2.2 Motor shall be sized for operation with fixed resistance starter for maximum reliability.

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4.2.3 Starter panel complete with all accessories shall be included in the scope of supply.

4.3 For equipment installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in determining the design ambient temperature.

5.0 PERFORMANCE

5.1 RUNNING REQUIREMENTS

5.1.1 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure.

5.1.2 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.

5.1.3 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

5.1.4 Motor shall not be stalled if the supply voltage drops to 70% of the rated voltage for 2 seconds duration.

5.2 STARTING REQUIREMENTS

Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries except boiler feed pump where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above for HT motors

5.2.1 The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage

5.2.2 Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal except BFP motor. In case of BFP motor, it shall

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be 75% rated voltage. Minimum starting requirement for mill motor (double cage) shall be 85% rated voltage at motor terminals.

- 5.2.3 Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition.

Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day.

Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction.

- 5.2.4 HT pump motors shall be suitable to start with forward rotation.

- 5.2.5 The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage

5.3 STRESS DURING BUS TRANSFER.

- 5.3.1 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.

- 5.3.2 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.

5.4 LOCKED ROTOR WITHSTAND TIME

- 5.4.1 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.

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5.4.2 Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.

5.4.3 Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilizing motor rated capacity

6.0 SPECIFIC REQUIREMENTS

6.1 ENCLOSURE

6.1.1 All indoor motor enclosures shall conform to the degree of protection IP-55 unless otherwise specified and outdoor motor enclosure shall confirm to degree of IPW-55. Motor for outdoor or semi-outdoor service shall be of weather-proof construction.

6.1.2 For hazardous area approved type of increased safety enclosure shall be furnished.

6.2 COOLING

6.2.1 The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air- cooled (CACA).

6.2.2 In case water cooling is required for very large motors, prior approval of the customer is to be obtained before proceeding ahead with design & manufacture.

6.3 WINDING AND INSULATION

6.3.1 All insulated winding shall be of copper.

6.3.2 All motors shall have class F insulation but limited to class B temperature rise.

6.3.3 Windings shall be impregnated to make them non-hygroscopic and oil resistant.

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6.4 TROPICAL PROTECTION

6.4.1 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

6.4.2 All fittings and hardwares shall be corrosion resistant.

6.5 BEARINGS

6.5.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.

6.5.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

6.5.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.

6.5.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.

6.5.5 Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.

6.5.6 Oiled bearing shall have an integral self cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.

6.5.7 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.

6.5.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.

6.5.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

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6.6 NOISE & VIBRATION

6.6.1 The noise level shall be as per statutory acceptance (IS/IEC).

6.6.2 The peak amplitude of the vibration shall be within IS/IEC specified limits.

6.7 MOTOR TERMINAL BOX

6.7.1 Motor terminal box shall be phase segregated (PSTB) type and located in accordance with Indian Standards clearing the motor base- plate/ foundation.

6.7.2 Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. For HT motors and 90 Deg. for LT motors unless otherwise approved.

6.7.3 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.

6.7.4 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.

6.7.5 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.

6.7.6 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.

6.7.7 The terminal box shall be capable of withstanding maximum system fault current for duration of 0.25 sec.

6.7.8 For 11kV and 3.3kV motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.

6.7.9 Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.

6.7.10 The gland plate for single core cable shall be non-magnetic type.

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- 6.7.11 Due to any reason, if the terminal box is found to be not suitable for the approved cable size for either HT/LT motors, then the bidder shall arrange necessary adopter box to facilitate the termination of cables. The adopter box shall be of the same short circuit rating and specifications as the main terminal box. The adopter box shall be located as near as possible to the main terminal box. The interconnecting cabling between adopter box and main terminal box along with providing suitable cable glands and termination kits as applicable shall also be done by the bidder.

6.8 GROUNDING

- 6.8.1 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GS bolts and washer

- 6.8.2 The grounding connection shall be suitable for accommodation of ground conductors as follows :

Motor above 90 kW : 75 x 10 mm GS Flat

Motor above 30 kW up to 90 kW : 50 x 6 mm GS Flat

Motor above 5 kW up to 30 kW : 25 x 6 mm GS Flat

Motor up to 5 kW : 8 SWG GS Wire

- 6.8.3 The cable terminal box shall have a separate grounding pad

6.9 RATING PLATE

In addition to the minimum information required by IS, the following information shall be shown on motor rating plate:

- (a) Temperature rise in Deg.C under rated condition and method of measurement.
- (b) Degree of protection.

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(c) Bearing identification no. and recommended lubricant.

(d) Location of insulated bearings.

6.10 CONSTRUCTION

6.10.1 Stator Core

The Stator Core Lamination shall be made of high-grade silicon/magnetic steel sheet varnished on both sides and pressed to form rigid core.

6.10.2 Rotor

The rotor construction shall be such that in case of dislodging of the rotor bar from the end ring, it should not come out and hit the stator core/stator winding and damage.

7.0 ACCESSORIES

7.1 GENERAL

Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application

7.2 SPACE HEATER

7.2.1 Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement.

7.2.2 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle.

7.3 TEMPERATURE DETECTORS

7.3.1 All 11kV and 3.3kV motors shall be provided with twelve (12) nos. Simplex type winding temperature detectors, four (4) nos. per phase.

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- 7.3.2 11kV and 3.3kV motor bearing shall be provided with duplex type temperature detectors.
- 7.3.3 The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.
- 7.3.4 Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.
- 7.3.5 Five numbers of Temperature detectors / thermistors shall be provided for L.T. Motors above 90 kW (3 nos. Winding temperatures & 2 nos. bearing temperatures).
- 7.4 INDICATOR/SWITCH
- 7.4.1 Dial type local indicator with alarm contacts shall be provided for the following :
- (a) 11kV and 3.3kV motor bearing temperature
 - (b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor
- 7.4.2 Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.
- 7.4.3 Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 5A at 240V A.C.
- 7.5 CURRENT TRANSFORMER FOR DIFFERENTIAL PROTECTION
- 7.5.1 Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 nos. CT for mounting on switchgear side shall be in bidder's scope.

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7.5.2 The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.

7.6 ACCESSORY TERMINAL BOX

7.6.1 All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.

7.6.2 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.

7.7 DRAIN PLUG

Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

7.8 LIFTING PROVISIONS

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

7.9 DOWEL PINS

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

7.10 PAINTING

Motor including fan shall be painted with corrosion proof paints of colour shade (RAL-7032).

8.0 TESTS

8.1 ROUTINE AND TYPE TEST:

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Tests are to be conducted for HT and LT motors 60kW and above in presence of Mahagenco representative and contractor as per IS: 325 and required copies of test certificates are to be furnished for approval and despatch clearance. In addition, following tests shall have to be carried out on the motors in presence of MAHAGENCO representative & contractor on LT & HT motors. For Motors below 60kW type and routine test conducted as per IS325 shall be witnessed by contractor and test certificate shall be submitted for review of Mahagenco & Dispatch clearance

8.1.1 FOR HT MOTORS:

- (a) Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-671/IS 14422,1995 test voltages as under

Voltage rating of motor	Impulse Test Voltage
3.3 kV	: 18 kV peak
11 kV	: 49 kV peak

- (b) Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test
- (c) Polarization Index Test as per IS:7816 as routine test
- (d) Tan delta measurement on coils
- (e) Surge withstand test for inter turn insulation.
- (f) Test to diagnose rotor bar failure during manufacture.

Tests indicated at (d), (e), (f) shall be carried out during manufacture of the coils and shall be furnished for verification .

8.1.2 FOR HT & LT MOTORS:

- (a) Test for suitability of IP55/ IPW- 55 as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test,

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provided the test motor is identical to motor being supplied. Second numeral test shall be carried out on one motor of each type and rating.

- (b) Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box within last three years.
- (c) Test for noise level as routine test.
- (d) Test for vibration as routine test.
- (e) Overspeed test as type test.

8.2 TEST WITNESS:

Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

AC & DC MOTOR

SR. NO.	ITEM	UNIT	
1.0	<u>AUXILIARY POWER SUPPLY</u>		
1.1	<u>H.T. SUPPLY</u>		
	11kV, 3Ø, 3W, 50 Hz non-effectively earthed		Motors rated 1000 kW and above
	Fault level 44 kA symm		
	3.3kV, 3Ø, 3W, 50 Hz, non-effectively earthed		Motors above 160 kW and below 1000kW
	Fault level 40 kA symm		
1.2	<u>L.T. SUPPLY</u>		
	415V, 3Ø, 3W, 50 Hz effectively earthed		Motors below and including 160kW
	Fault level 50 kA symm		
	240V, 1Ø, 2W, 50 Hz effectively earthed		Lighting, space heating, A.C. control & protective devices
1.3	<u>D.C. SUPPLY</u>		
	220V, 2W, unearthed		D.C. alarm, control & protective devices
	Fault level 25* kA.		
	Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation		
2.0	<u>RANGE OF VARIATION</u>		

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

SR. NO.	ITEM	UNIT	
2.1	<u>A.C. SUPPLY:</u>		
	Voltage		± 10%
	Frequency		± 5%
	Combined Voltage & frequency		± 10% (absolute sum)
	During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance		
2.2	<u>D.C. SUPPLY</u>		
	Voltage		198 to 240 Volt

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

DATA SHEET A – MOTORS



TITLE

LV MOTORS DATA SHEET-A

1X660 MW BHUSAWAL TPP

SPECIFICATION NO.

VOLUME II B

SECTION

D

REV NO. 00

DATE 02.07.2019

SHEET 1

OF 1

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : 160KW
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
 - a) Rated voltage (with variation) : 415V $\pm$ 10%
 - b) Rated frequency (with variation) : 50 Hz (+5% and -5%)
 - c) Combined voltage & freq. variation : 10% (sum of absolute values)
 - d) System fault level at rated voltage : 50 kA for 1 sec
 - e) Short time rating for terminal boxes
 - o 90 kW and upto 160kW : 50 KA for 1 sec.
(Breaker controlled)
 - o Below 90 kW : 50 KA protected by fuse for 0.2 sec
(SFU + Contactor controlled)
 - f) LV System grounding : Effectively grounded
- 5.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 6.0 Minimum voltage for starting : 80% of rated voltage
(As percentage of rated voltage)
- 7.0 Power cables data : Shall be given during Detailed engg
- 8.0 Earth Conductor Size & Material : Shall be given during Detailed engg
- 9.0 Space heater supply : 240 V, 1 ϕ , 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.20 kW
- 11.0 Additional tests : As per QP and customer motor spec
- 12.0 Flame-proof motor
 - a) Enclosure suitable (As per IS:2148) : As per requirement
 - b) Classification of Hazardous area : As per requirement
(As per IS: 5572 part-I)
- 13.0 Makes : As per ANNEXURE-I
- 14.0 Paint shade : RAL 7032
- 15.0 Degree of Protection of enclosure (motors):

INDOOR	IP-55
OUTDOOR	IPW-55
- 16.0 Energy efficiency : IE3 as per IS:12615: 2011

❖ Also detail Customer spec. for Motors to be referred as enclosed with spec.

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

DATA SHEET C– MOTORS

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 DATE 08/09/2010	
		SHEET	1 OF 7

LT MOTORS

A. GENERAL

1. Manufacturer & Country of origin.
(Shall be as per approved QA make)
2. Equipment driven by motor
3. Motor type
4. Quantity

B. DESIGN AND PERFORMANCE DATA

1. Frame size
2. Type of duty
3. Type of enclosure /Method of cooling/Degree of protection
4. Applicable standard to which motor generally conforms
5. Efficiency class as per IS 12615
6. (a) Whether motor is flame proof Yes/No
(b) If yes, the gas group to which it conforms as per IS:2148
7. Type of mounting
8. Direction of rotation as viewed from DE END__
9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)
10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)
11. Maximum continuous load demand of driven equipment in KW
12. Rated Voltage (volts)
13. Permissible variation of :

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.		
		VOLUME		II B
		SECTION D		
		REV NO. 00 DATE 08/09/2010		
		SHEET	2	OF 7

- a. Voltage (Volts)
 - b. Frequency (Hz)
 - c. Combined voltage and frequency
14. Rated speed at rated voltage and frequency(RPM)
15. At rated Voltage and frequency:
- a. Full load current
 - b. No load current
16. Power Factor at
- a. 100% load
 - b. NO load
 - c. Starting.
17. Efficiency at rated voltage and frequency,
- a. 100% load
 - b. 75% load
 - c. 50% load
18. Starting current (amps) at
- a. 100 % voltage
 - b. 85% voltage
 - c. 80% voltage
19. Minimum permissible starting Voltage (Volts)
20. Starting time with minimum permissible voltage
- a. Without driven equipment coupled
 - b. With driven equipment coupled

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.		
		VOLUME		II B
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		SHEET	3	OF

21. Safe stall time with 100% and 110% of rated voltage
 - a. From hot condition
 - b. From cold condition
22. Torques :
 - a. Starting torque at min. permissible voltage(kg-mtr.)
 - b. Pull up torque at rated voltage.
 - c. Pull out torque
 - d. Min accelerating torque (kg.m) available
 - e. Rated torque (kg.m)
23. Stator winding resistance per phase (ohms at 20 Deg.C.)
24. GD^2 value of motors
25. No of permissible successive starts when motor is in hot condition
26. Locked Rotor KVA Input
27. Locked Rotor KVA/KW
28. Vibration limit :Velocity (mm/s)
29. Noise level limit (dBA)

C. CONSTRUCTIONAL FEATURES

1. Stator winding insulation
 - a. Class & Type
 - b. Winding Insulation Process
 - c. Tropicalised (Yes/No)

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
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		SHEET	4 OF 7

- d. Temperature rise over specified maximum ambient temperature of 50 deg C
 - e. Method of temperature measurement
 - f. Stator winding connection
2. Main Terminal Box
 - a. Type
 - b. Location (viewed from NDE side)
 - c. Entry of cables(bottom/side)
 - d. Recommended cable size (To be matched with cable size envisaged by owner)
 - e. Fault level (MVA), Fault level duration (sec)
 - f. Cable glands & lugs details (shall be suitable for power cable)
3. Type of DE/NDE Bearing
4. Motor Paint shade
5. Weight of
 - a. Motor stator (KG)
 - b. Motor Rotor (KG)
 - c. Total weight (KG)

D. List of accessories.

1. Space Heaters (Applicable for 30 KW & above motor)
(Nos./Power in watts/supply voltage)
2. Terminal Box for Space Heater (Yes/No)
3. Speed switch (Yes/No)
No of contacts and contact ratings of speed switch

NAME OF VENDOR			SEAL	REV.	
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	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
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		SHEET	5 OF 7

4. Insulation of bearing (Yes/No)

5. Noise reducer(Yes/No)

6. Grounding pads

i) No and size on motor body

ii) Nos on terminal Box

7. Vibration pads

i) Nos and size

ii) Location

8. Any other fitments

E. List of curves.

1. Torque speed characteristic of the motor

2. Thermal withstand characteristic

3. Starting. current Vs. Time

4. Starting. current Vs speed

5. P.F. and Effi. Vs Load

F. Additional Data to be filled for each rating of DC Motor

1. Rated armature voltage (Volt)

2. Rated field excitation (Amp)

3. Permissible % variation in voltage

4. Minimum Permissible Starting voltage (volt)

5. At rated voltage

i) Full load Armature current.(Amp)

ii) Full load Field current (Amp)

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	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
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- iii) No load Armature current (Amp)
6. Full load Field current (Amp)
7. No load Armature current (Amp)
8. Minimum permissible field current(Amp) to avoid overspeeding at
 - i) Maximum permissible voltage
 - ii) Rated voltage
 - iii) Minimum Permissible Voltage
9. Resistance (indicative Values) in ohm
 - i) Armature winding (Arm + IP + Series) at 25 deg.C
 - ii) Field Winding at 25 deg. C
10. Inductance (indicative values)
 - i) Armature winding
 - ii) Field winding
11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at
 - i) 220 V DC
 - ii) 250 V DC
 - iii) 187 V DC
12. Value of the external resistance (ohm) required to be connected in series with armature during starting only
13. Technical data sheet for external resistance box
14. GA drawing of motor
15. Starting time calculation

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	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.
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16. Starter resistance design calculation
17. Electrical connection diagram of motor

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	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

QUALITY PLAN (MOTOR)

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION TITLE				
				SHEET 1 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		TITLE QUALITY PLAN		SPECIFICATION : TITLE :				
				SHEET 2 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 1 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	
											PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR	
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2	
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
		SHEET 2 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 3 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA MA	VISUAL TEST	100% SAMPLE	- MANUF'S SPEC.	NO VISUAL DEFECTS MANUF'S SPEC.	INSPT. REPORT LOG BOOK AND OR SUPPLIER'S TC	3 3	- -	2 2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2.DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA MA MA	VISUAL MEASUREMENT ELECT. & MECH TESTS	100% SAMPLE -DO-	- MANUFR'S DRG. . MANUF'S SPEC./ RELEVANT IS	NO VISUAL DEFECTS (FREE FROM BURS) MANUFR'S DRG. RELEVANT IS	LOG BOOK -DO- SUPPLIER'S TC	3 3 3	- - -	- 2 2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
1.9	CONDUCTORS	1. SURFACE FINISH 2.ELECT. PROP. & MECH. PROP	MA MA	VISUAL ELECT. & MECH.TEST	100% SAMPLES	- RELEVANT IS/ BS OR OTHER STANDARDS	FREE FROM VISUAL DEFECTS RELEVANT IS/ BS OR OTHER STANDARDS	LOG BOOK SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3* 3	- -	2* 2	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 4 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :					
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE					
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	11	12	13	
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2		
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2		
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2		
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2		
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-		
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-		
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2		
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2		
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-		
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-		
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-		
BHEL			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										
			DATE										
												BIDDER'S/VENDORS COMPANY SEAL	

		QUALITY PLAN SHEET 5 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION : VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNES	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC./BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SHEET 6 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION AGENCY		VOLUME III REMARKS
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	FOR MV MOTOR
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	THREE DIPS TO BE GIVEN
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 7 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	VERIFICATION FOR MV MOTOR ONLY
2.8	BRAZING/COMPRESSION JOINT	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.10	ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
												BIDDER'S/VENDORS COMPANY SEAL

		QUALITY PLAN SHEET 8 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P W V			REMARKS
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC CLAUSE 8.1.2	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1	1	\$ NOTE - 2 \$ NOTE - 2 \$ NOTE - 2 * REFER NOTE-3 \$ NOTE - 2 \$ NOTE - 2 \$ NOTE - 2 TC FROM AN INDEPENDENT LABORATORY ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR. SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 ^{\$}	1	
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	1*	1	
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 ^{\$}	1	
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^{\$}	1	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			



		QUALITY PLAN SHEET 9 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE			
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P W V		REMARKS
1	2	3	4	5	6	7	8	9	10	11	
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED FOR FIRST NUMERAL OF IP-XX. SECOND NUMERAL TEST SHALL BE CARRIED OUT ON ONE MOTOR OF EACH TYPE & RATING. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY											
BHEL			PARTICULARS			BIDDER/VENDOR					
			NAME								
			SIGNATURE								
			DATE								
									BIDDER'S/VENDORS COMPANY SEAL		

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

CABLE SCHEDULE FORMAT

ANNEXURE III

[illegible]