



**TITLE:**  
**TECHNICAL SPECIFICATION FOR  
COAL HANDLING PLANT  
RUN-OFF WATER TREATMENT SYSTEM  
3X800 MW PATRATU STPP EXT.PH-I**

BHEL DOCUMENTS NO.: PE-TS-434-157-A001

VOLUME-II-B

SECTION-C1

REV. NO. 00

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**DATASHEET-A**  
**(COAL HANDLING PLANT RUN-OFF WATER TREATMENT SYSTEM)**



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**DATA SHEET – A**

1.	<b>TRANSFER PUMPS TREATMENT PLANT</b>	
1.1		<b>Clarifier feed Pumps (CSSP Area)</b>
1.2	Number	4X25%
1.3	Service	-----Intermittent----- ---
1.4	Capacity (Each)-Minimum	To suit net Clarifiers output of 4800 cum/hr and Head to meet the system requirement. i.e each pump capacity shall be 1200 cum/hr+ water loss due to sludge.
1.5	Operating Speed (Maximum)	----- 1500 rpm -----
1.6	Pumps & Drives to be designed for	-----Outdoor Duty -----
1.7	Service of duty	-----Continuous -----
1.8	Type of pump	Vertical Turbine (wet pit) Type and non-pull out type.
1.9	Type of Working Fluid	Decanted water
1.10	Maximum water temperature	36 deg C
1.11	Minimum water temperature	25 deg C
1.12	Type of Discharge	-----Above Floor discharge -----
1.13	Type of impeller	-----Closed / Semi-open -----
1.14	Type of lubrication	-----Self water or grease -----
1.15	Suction condition	-----Submerged -----
1.16	Minimum Water level	----- By Bidder -----
1.17	Maximum Water level	-----Local Finished Grade Level (FGL) -----
1.18	Sump Invert level	----- As per design -----
1.19	Operating floor level	-----Minimum 500 mm above FGL -----
1.20	Type of shaft coupling	-----Flexible / Rigid -----
1.21	<b>Material of Construction</b>	
(I).	Suction Bell	2.5%NiCl; IS: 210Gr FG 260; S-0.1% & P-0.15% max.
(II).	Casing / Bowl	2.5%NiCl;IS:210Gr FG 260;S-0.1% & P-0.15% max.
(III).	Impeller	ASTM A351 CF8M
(IV).	Wearing rings (if applicable)	-----As per manufacturer's Std -----
(V).	Impeller Shaft, Pump & line shaft	-----SS ASTM A 276 Gr. 410. -----
(VI).	Shaft coupling	----- SS ASTM A 276 Gr. 410 -----
(VII).	Shaft sleeves	-----SS - ASTM –A 276 – 410 -----
(VIII).	Shaft bearings	Cutless rubber with bronze retainer for bearings below minimum water level and Thordon type bearing for bearings above minimum water level
(IX).	Column pipe	Fabricated steel as per IS: 2062 (minimum thickness shall not be less than 8 mm) with 2 coats of epoxy coating inside & outside.



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(X).	Shaft enclosing tube	----- Not Applicable -----
(XI).	Discharge Head	Fabricated steel as per IS:2062 (minimum thickness shall not be less than 8 mm) or Cast Iron with 2 coats of epoxy coating inside and outside.
(XII).	Distance piece (if applicable)	Fabricated steel as per IS:2062(minimum thickness shall not be less than 10 mm) with 2 coats of epoxy coating inside.
(XIII).	Matching flanges	Fabricated steel as per IS:2062
(XIV).	Stuffing box	2.5% NI-CI to IS:210 FG-260
(XV).	Gland	2.5% NI-CI to IS:210 FG-260
(XVI).	Gland packing	Impregnated TEFLON
(XVII).	Gaskets	Wire reinforced rubber gasket / Neoprene rubber / Compressed Asbestos Fiber
(XVIII).	Bolts & nuts	Stainless steel AISI type 304/316 for those coming in contact with water and for others, material shall be high tension carbon steel.
(XIX).	Base plate and Soleplate	Fabricated steel as per IS : 2062
(XX).	Accessories to be provided with each pump	a. Companion flanges with nuts, bolts and gaskets, Positioning dowels, Eye bolts, lifting etc b. Internal piping with valves filters & Instruments for sealing/ cooling/ lubrication system upto and including isolating valve etc as per requirement. c. Non –reverse ratchet shall be provided as per manufacturer's standard practice.
1.22	Other Technical	Refer sub-section titled "General Technical Requirement of Pumps" in Sec-D of Technical Specification
2.	<b>INLET VALVES</b>	
2.1	Inlet valves to Stilling Chamber	One (1) number motorized butterfly valve (Inching Type) located at inlet to stilling chamber along with one (1) number Manual butterfly valve.
2.2	Inlet valves size	Suitable to cater to total flow i.e. Same as that of Pipe Size
2.3	Control	Under " Auto" mode of flow control valve, valve shall automatically maintain the level of water in the Distribution Chamber, i.e valve shall automatically close when reservoir level becomes high.
3.	<b>STILLING CHAMBER</b>	
3.1	No.	One (1) Number
3.2	Purpose	To dampen out any turbulence of the incoming water.
3.3	Type Of Construction	Circular/Rectangular
3.4	Capacity(Design flow)	(4800 + 3% for sludge) Cum/hr.
3.5	Material of construction	RCC
3.6	Drain arrangement	Suitable draining arrangement shall be provided for the stilling chamber and drain lines shall be connected to sludge sump.
4.	<b>PARSHALL FLUME</b>	
4.1	No.	Two (2) number
4.2	Purpose	To measure flow.
4.3	Material of construction	RCC
5.	<b>INLET CHAMBER</b>	



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5.1	Nos.	Two (2) numbers , One for each clarifier.
5.2	Material Of Construction	RCC
5.3	Capacity (Design flow) min.	(2400 + 3% for sludge) Cum/hr (each).
6.	<b>HRSCC (HIGH RECOVERY SOLID CONTACT CLARIFIER)</b>	
6.1	Number	Two (2)
6.2	Design Capacity (Net output)	2400 Cum/hr (each).
6.3	Type	High Rate Solids Contact Reactor Type Clarifier (HRSC).
6.4	Material Of Construction	RCC
6.5	MOC of pipe from inlet channel to clarifier	Carbon Steel pipe encased with concrete for buried portion and externally epoxy painted inside the clarifiers.
6.6	Sludge Blow Off to sludge sump	By gravity through telescopic stand-pipe for continuous discharge and through motor operated blow-off valve for intermittent. (Suitable manhole arrangement shall be provided in sludge lines)
6.7	Sludge Blow Off- Pipe Material	CI class A as per IS: 1536)
6.8	Reaction Turbine	With variable frequency drive as per Manufacturer's Standard
6.9	Flushing Connection	Required.
7.	<b>CLARIFIER SCRAPPERS</b>	
7.1	Number required	One (1) assembly per clarifier.
7.2	Material	Mild steel (MS) with rubber inserts (With bitumastic paint protective coating)
7.3	Drive	Slow speed motor driven through reduction gear unit or Variable frequency Drive as per manufacturer's std.
8.	<b>OVERFLOW WEIR/NOTCH</b>	
8.1	Location	To be fixed in the radial launders of Clarifier
8.2	Material	Mild steel/RCC
9.	<b>SUITABLE ACCESSORIES</b>	
9.1	Access ladder, platform, staircase, hand railings etc.	Shall be provided of structural steel.
9.2	Walkway	Shall be provided with hand railings around launder periphery of width 1000 mm.
10.	<b>Distribution Chamber (Above ground)</b>	
10.1	Number of Basin	One(1) number in twin sections
10.2	Material of Construction	RCC
10.3	Capacity of each section	500 Cum (minimum)
11.	<b>SLUDGE PIT</b>	
11.1	Number	One (1) (Under Ground) in twin section
11.2	Capacity (effective)	1 hrs of storage in each section.
11.3	Dimension	Suitable
11.4	Material	RCC with epoxy paint.
11.5	Location	Shall be finalized during Detailed Engineering (DDE).
11.6	Special arrangement	Agitation/ recirculation line shall be provided in sludge transfer pit.
12.	<b>AIR BLOWER FOR SLUDGE PIT</b>	



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12.1	Number	Two (1W+1S)
12.2	Type	Centrifugal /Twin Lobe Type
12.3	Duty	Intermittent
12.4	Capacity & Head	As required
12.5	MOC of casing and lobes	CI as per IS 210 FG 260
12.6	MOC of shaft	Carbon steel BS-970 En-8/ANSI-I045
12.7	Accessories Required	Acoustic Enclosure, Suction Filter, Silencer, relief Valve etc
12.8	Location	Outdoor
13.1	<b>FILTER PRESS</b>	
I.	Number	2 Nos
II.	Type	Automatic Chamber filter press with automatic filter cake removal and VFD driven
III.	Flow rate	Each filter press shall be designed for the handling of total sludge generated while the other filter press will be under backwash/cleaning operation ensuring continuous desludging of the sludge generated.
IV.	Sludge consistency required at outlet	20% to 25%
V.	No of cycle per filter press	As per supplier recommendation
VI.	Cycle time (hour)	As per supplier recommendation
VII.	Number of Recessed Plates and chambers	As per supplier recommendation
VIII.	Recessed Plate shifting	Automatic
IX.	<b>Material of Construction:</b>	
X.	Chassis Structure	MS with Epoxy coated
XI.	Filter / End Plates	Polypropylene
XII.	Wetted part (any)	MS with Epoxy coated suitable for intended application
XIII.	Type of Element	Recessed with Centre Feeding/ Polypropylene Membrane & Recessed with Centre Feeding
XIV.	Location	Filter press shall be located in the vicinity of clarifier at elevated RCC structure with platform for maintenance & operation with Solid cake removal from bottom. The clear water shall be routed to clarifiers through Pumping. Suitable collection & disposal arrangement (i.e. sump, Pumps (2x100%) along with associated pipping, instruments , valves etc ) to be provided by bidder.
XV.	Cleaning system for filter press, plate & Filter clothe etc.	Suitable arrangement to be provided.
13.2	<b>Coagulant aid Dosing Tanks</b>	
a)	Number	Two (2)
b)	Type	Vertical cylindrical with dished end bottom & with cover at the top.
c)	Capacity (Total)-	To hold coagulant for 24 hours requirement of all the Filter Press operating at design capacity and a design dosage rate of 2 ppm minimum, Whichever is maximum.
d)	Material of Construction	Carbon Steel internally rubber lined and externaly painted with epoxy painting
e)	Agitator & Number	Motor driven with reduction gear unit One(1) per tank
f)	Agitator Shaft material	SS316
g)	Agitator Impeller material	SS316



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13.3	<b>Pumps- Metering Pumps</b>					
a)	Number	Two (2x100%)				
b)	Min Capacity (Each) cum/hr	As per system requirements.				
c)	Head	As per system requirements.				
d)	Type	Simplex hydraulically operated Diaphragm type				
e)	Liquid to handled and concentration	PE Solution				
f)	Capacity control	10 --100% of capacity manually by micrometer dial				
g)	Pump stroke speed per minute	Maximum 100				
h)	<b>Material of Construction:</b>					
I.	Liquid end (pump head valve, valve housing, etc) ,valve spring	AISI -316				
II.	Diaphragm	PTFE				
III.	Packing	PTFE				
IV.	Shaft	Hardened steel EN8-BS-970)/ AISI-316				
V.	Accessories	Pressure Dampeners, Safety Relief valves etc. required				
13.	<b>CHEMICAL DOSING CUM STORAGE AREA</b>					
14.1	Number	One (1)				
14.2	Type	Shed.				
14.3	Area dimensions	Shall be finalized during Detailed Engineering (DDE).				
14.4	Purpose	Location of all chemical dosing tanks including dosing facility of Coal slurry settling ponds, pumps & Storage of chemical required for Alum, Lime, coagulant aid and flocculants dosing for 15 days storage capacity.				
14.	<b>WEIGHING SCALE FOR CHEMICAL</b>					
15.1	Type	Platform & dial type./electronic type				
15.2	Number	Two (2) [ One (1) Range 0-500 Kg & One (1) Range 0-2000 Kg]				
15.	<b>HOIST</b>					
16.1	Type	Electric operated				
16.2	Number	One (1).				
16.3	Capacity	1 Ton				
16.4	Design Standard	IS:3938 Class 2				
16.	<b>CHEMICAL DOSING SYSTEM</b>					
17.1	<b>Chemical tanks</b>					
<b>S.No</b>	<b>Designation</b>	<b>Lime Slaking Tanks</b>	<b>Lime Dosing Tanks</b>	<b>Alum Dosing Tanks</b>	<b>Synthetic Flocculants Dosing tanks</b>	<b>Coagulant aid Dosing Tanks</b>
I.	Number	Three (3)	Three (3)	Four (4)	Three (3)	Two (2)
II.	Type	-	-	-	Vertical cylindrical with dished end bottom & with	Vertical cylindrical with dished end



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					cover at the top.	bottom & with cover at the top.
III.	Capacity (Total)-	To hold lime slurry (of about 10% W/V concentration from Quick lime of purity of 75% CaO) for 24 hours requirement of all the clarifiers operating at design capacity and a design dosage rate of 30 ppm minimum, Whichever is maximum.	To hold lime solution (of about 6% W/V concentration) for 24 hours requirement of all the clarifiers operating at its design capacity and a design dosage rate of 30 ppm minimum, Whichever is maximum	To store alum solution (of about 10% W/V concentration) for 24 hrs req. of all clarifier operating at its design capacity and a dosing rate of 70 ppm min, Whichever is maximum.	To hold coagulant for 24 hours requirement of all the clarifiers operating at design capacity and a design dosage rate of 2 ppm minimum, Whichever is maximum.	To hold coagulant for 24 hours requirement of all the clarifiers operating at design capacity and a design dosage rate of 2 ppm minimum, Whichever is maximum.
IV.	Material of Construction	RCC (With 2 Coats of Bitumastic Paint over 2 coats of Primer)	RCC (With Acid/Alkali resistant Tiles)	Carbon Steel internally rubber lined and externally painted with epoxy painting		
V.	Agitator & Number	Motor driven with reduction gear unit One(1) per tank				
VI.	Disolving Chamber For Each Tank	Required (Stainless steel Material)			Not Applicable	
VII.	Agitator Shaft material	SS316				
VIII.	Agitator Impeller material	SS316				
<b>17.2</b>	<b>Pumps- Metering Pumps</b>					
<b>S.No</b>	<b>Designation</b>	<b>Alum Dosing Pumps</b>	<b>Synthetic Flocculants Dosing Pumps</b>	<b>Coagulant aid Dosing Pumps</b>		
I.	Number	Two (2x100%)	Two (2x100%)	Two (2x100%)		
II.	Min Capacity (Each) cum/hr	As per system requirements.				
III.	Head	As per system requirements.				
IV.	Type	Simplex hydraulically operated Diaphragm type				
V.	Liquid to handled and concentration	Alum solution 10% W/V	-	-		
VI.	Capacity control	10 --100% of capacity manually by micrometer dial				
VII.	Pump stroke speed per minute	Maximum 100				
VIII.	<b>Material of Construction:</b>					
a.	Liquid end (pump head valve, valve housing, etc) ,valve	AISI -316				



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	spring					
b.	Diaphragm	PTFE				
c.	Packing	PTFE				
d.	Shaft	Hardened steel EN8-BS-970)/ AISI-316				
e.	Accessories	Pressure Dampeners, Safety Relief valves etc. required				
17.	<b>Pumps- Horizontal Centrifugal Pumps</b>					
<b>S.No</b>	<b>Designation</b>	<b>Flushing/Cleaning Pump for Filter Press</b>	<b>Lubrication Pumps for Clarifier Pumps</b>	<b>Supernatant Transfer Pumps</b>	<b>Lime Slurry Transfer Pumps</b>	<b>Lime Dosing Pumps</b>
18.1	Number	Three (3) (2W+1S)	Two (2) (1W+1S)	Two (2) (1W+1S)	Two (2) (1W+1S)	Two (2) (1W+1S)
18.2	Min Capacity (Each) cum/hr	To Suit Requirement of one (1) Filter Press.	To Suit Requirement of All Pumps Four (4) Feed Pumps	325 cum/hr	As per System Req.	As per System Req.
18.3	Operating Speed	-----1500 rpm (max)-----				
18.4	Pumps & Drives To be Designed for	-----Outdoor Duty-----				
18.5	Service of Duty	-----Continuous-----				
18.6	Type of Pump casing	-----Radially Split Type-----				
18.7	Type of Working Fluid	-----Service Water-----	Supernatant	Lime Solution (10% v/v)	Lime Solution (6% v/v)	
18.8	Max. Water Temperature	45 Deg.C	45 Deg.C	45 Deg.C	80 Deg.C	80 Deg.C
18.9	Min. Water Temperature	33 Deg.C	33 Deg.C	33 Deg.C	40 Deg.C	40 Deg.C
18.10	Type of Lubrication	-----Grease-----				
18.11	Suction Condition	-----Flooded-----				
18.12	<b>Material of Construction</b>					
I.	Casing	ASTM A351 CF8M	ASTM A351 CF8M	ASTM A351 CF8M	2.5% Ni Cl IS210 Gr FG 260	2.5% Ni Cl IS210 Gr FG 260
II.	Impeller	ASTM A351 CF8M	ASTM A351 CF8M	ASTM A351 CF8M	ASTM A351 CF8M	ASTM A351 CF8M
III.	Wearing rings (If applicable)	-----SS316-----				
IV.	Shaft	-----SS410-----				
V.	Shaft Sleeves	-----SS410-----				
VI.	Stuffing Box	-----2.5% Ni Cl IS210 Gr FG 260-----				
VII.	Gland	-----2.5% Ni Cl IS210 Gr FG 260-----				
VIII.	Bolts & Nuts	Stainless steel for those coming in contact with water and for others, material shall be high tension carbon steel.				
IX.	Base Plates	-----Carbon Steel-----				



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18.13	Accessories to be provided with each pump	a. Companion flanges with nuts, bolts and gaskets, Internal piping with valves filters & Instruments for sealing/ cooling/ lubrication system up to and including isolating valve etc, b. Positioning dowels, drain plugs, vent valve etc c. Coupling guards, Eye bolts, lifting etc.
18.14	Other Technical	Refer sub-section titled "General Technical Requirement of Pumps" in Sec-D of Technical Specification
18.	<b>Pumps- Vertical Sump Pumps</b>	
<b>S.No</b>	<b>Designation</b>	<b>Sludge Transfer Pumps      Centrate Transfer Pump</b>
19.1	Number	Three (3x50%)      Two (2x100%)
19.2	Min Capacity (Each) cum/hr	As Per System Req.
19.3	Operating Speed	1500 rpm (Maximum)
19.4	Pumps & Drives To be Designed for	Outdoor Duty
19.5	Service of Duty	Continuous
19.6	Type of Pump	Vertical, non-clog, Sump pumps
19.7	Type of Working Fluid	Sludge
19.8	Type of Discharge	Above Floor Discharge
19.9	Type of impeller	----- open -----
19.10	Type of lubrication	-----grease -----
19.11	Suction condition	-----Submerged -----
19.12	Minimum Water level	----- By Bidder -----
19.13	Maximum Water level	-----Local Finished Grade Level (FGL) -----
19.14	Operating floor level	-----Minimum 500 mm above FGL -----
19.15	Type of shaft coupling	-----Flexible / Rigid -----
19.16	<b>Material of Construction</b>	
I.	Suction Bell/casing	2.5%NiCl; IS: 210Gr FG 260; S-0.1% max. & P-0.15% max.
II.	Impeller	ASTM A351 CF8M
III.	Shaft	SS410
IV.	Shaft coupling	SS410
V.	Shaft sleeves	SS410
VI.	Column pipe & Discharge Pipe	CS as per IS2062 or Eq.
VII.	Shaft enclosing tube (If Applicable)	CS as per IS2062 or Eq.
VIII.	Stuffing box	2.5% NI-Cl to IS:210 FG-260
IX.	Gland	2.5% NI-Cl to IS:210 FG-260
X.	Gland packing	TIWA
XI.	Gaskets	Neoprene rubber
XII.	Bolts & nuts	Stainless steel for those coming in contact with water and for others, material shall be high tension carbon steel.
XIII.	Base plate and Soleplate	Carbon Steel (Min.10 mm Thick)
19.17	Accessories to be provided with each	d. Companion flanges with nuts, bolts and gaskets, Positioning dowels, Eye bolts, lifting etc



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	pump	e. Non –reverse ratchet shall be provided as per manufacturer’s standard practice.
19.18	Other Technical	Refer sub-section titled “General Technical Requirement of Pumps” in Sec-D of Technical Specification
19.	<p><b>VALVES</b>  All the valves shall generally be conforming to the requirements specified in the Chapter titled “General Technical Requirement Of Low Pressure Piping” considering the following aspects as minimum requirement:</p>	
20.1	Coagulant (Alum) and Coagulant aid Services	<p><b>i. Type of Valves</b>  <u>For Isolation</u>  a) Saunder’s Patented Diaphragm Valves  b) Ball Valves in CPVC pipes  <u>For non-return / Check</u>  Swing Check type /Dual Plate type</p> <p><b>ii. Material of Construction Valves</b>  <u>Diaphragm Valves</u>  a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40 ; BS: 1452 Gr.220/Equivalent. OR Cast Steel to ASTM. A 216GR. WCB and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene  b) Diaphragm shall be shall be of reinforced rubber /Hypalon/ approved equivalent  c) Stem, Compressor &amp; Bush shall be Stainless steel Construction  <u>Ball Valves in CPVC Pipe lines</u>  a) Body , Ball &amp; stem shall be of CPVC  b) Seat ring &amp; Packing shall be EPDM / or equivalent  <u>Check Valves</u>  a) Body &amp; Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt and <u>shall be lined with natural Rubber, PTFE or Viton</u> or Stainless Steel – 316  b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and <u>shall be coated with PVDF, or suitable elastomer</u> or Stainless Steel – 316  c) Disc facing ring and Body Seat rings shall be Stainless Steel  d) Bearing bushes shall be SS – 316  e) Material of construction of spring in dual type valve shall be of INCONEL or better</p>
20.2	Lime slurry/Solution/ Suspensions	<p><b>i. Type of Valves</b>  <u>For Isolation</u>  Non-lubricated Plug Valves  <u>For non-return / Check</u>  Swing Check type /Dual Plate type</p> <p><b>ii. Material of Construction Valves</b>  <u>Plug Valves</u>  a) Body shall be Cast Iron to IS: 210 Gr FG 260 / ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt  b) Plug shall be Stainless steel to AISI 316  c) Body Sleeve &amp; Seat shall be PTFE  d) Gland &amp; Gland nut shall be SS 304/316  e) Cover shall be of Cast Steel to ASTM A 216 Gr WCB  <u>Check Valves</u>  a) Body &amp; Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260 / ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt and <u>shall be lined with natural Rubber, PTFE or Viton</u> or Stainless Steel – 316  b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and <u>shall be coated with PVDF, or suitable elastomer</u> or Stainless Steel – 316  c) Disc facing ring and Body Seat rings shall be Stainless Steel  d) Bearing bushes shall be SS-316  e) Material of construction of spring in dual type valve shall be of</p>



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20.3	Sludge	<p>INCONEL or better</p> <p><b>i. Type of Valves</b>  <u>For Isolation</u>  Gate or Sluice or Knife edge type Slide Valves  <u>For non-return / Check</u>  Swing Check type /Dual Plate type</p> <p><b>ii. Material of Construction</b>  <u>Gate / Sluice / Knife Edge Slide Valve</u>  a) Body,Disc : Cast Iron  b) Stem : Stainless Steel AISI 420  d) Packing : PTFE  e) Gland &amp; Gland nut : AISI 420  f) Hand wheel : Cast Iron  <u>Check Valves</u>  a) Body &amp; Cover, Hinge Disk/Door shall be Cast Iron BS:1452 Gr.220 or Eqvt  b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB / High tensile Brass or BS: 2872 equivalent.  c) Disc facing ring and Body Seat rings shall be Stainless Steel.  d) Bearing bushes shall be Leaded tin Bronze.  e) Material of construction of spring in dual type valve shall be of INCONEL or better</p>
20.4		<p><b>Other Requirements:</b></p> <ol style="list-style-type: none"> <li>1) Butterfly valves shall conform to design standard latest revision of AWWA C-504/EN 593/equivalent standard of required class/rating.</li> <li>2) Plug valves shall be designed as per BS: 5353 Cl.150 or equivalent.</li> <li>3) Valves for alum solution shall be Saunders's patented Diaphragm type designed as per BS: 5156 or approved equivalent standard.</li> <li>4) Sluice/Gate Valves shall conform to BS: 5150 (BS: 5163 PN 16) PN16, IS:14846 of rating PN 1.6 (min.). Stem, seat ring and wedge facing ring shall be of stainless steel construction. Other parts shall be as per IS: 14846 /BS:5163). Flanges shall be designed as per ANSI B 16.5 Cl. 150 (min.) to meet with the piping flanges. Valves shall be of outside screw and rising stem type. Gate valves for sizes below 50 NB and below shall conforms to IS:778 Class-2/ANSI B16.34 straight, rising stem; without side screw.</li> <li>5) Sluice/Gate valves shall be provided with the following accessories in addition to the standard items: <ol style="list-style-type: none"> <li>a. Hand wheel</li> <li>b. Manual Gear reduction unit operator for valves 200 NB and above</li> <li>c. Bypass valve for valve of sizes 350 NB and above.</li> <li>d. Draining arrangement wherever required.</li> <li>e. Arrow indicating flow direction.</li> <li>f. Position indicator.</li> <li>g. Sluice/Gate Valves shall be provided with back seating bush to</li> <li>h. facilitate gland renewal during full open condition.</li> </ol> </li> <li>6) Design standard for Gates shall be IS: 3042 or Equivalent.</li> </ol> <p><b>Material of Construction</b></p> <ol style="list-style-type: none"> <li>a. Frame and Door : Cast Iron IS:210 Gr.260</li> <li>b. Spindles, bolts &amp; nuts: M.S. to IS:2062</li> <li>c. Face &amp; seat rings : Gun metal (as per IS: 3042).</li> </ol> <ol style="list-style-type: none"> <li>7) All the parts of gates shall be applied with the coats of heavy duty bitumastic paint. Each of the gates shall be provided with hand wheel and a position indicator.</li> <li>8) Sluice valve/knife edge type slide valves shall design by IS 14846. Plug valves shall be used for the application of lime slurry/lime solutions conforming to BS: 5353 Class 150 or Equivalent.</li> <li>9) Valves will be used to start/stop or control flow. Gates will be primarily used for isolation of flow in open channels although these should be capable of throttling the flow too. However, contractor can provide either isolation gates or butterfly valves in various RCC tanks/pits/sumps such as sludge pit, distribution chamber etc. Sample valves will be used in sample collection lines. Unless otherwise specified all the valves shall be supplied with counter flanges by the Contractor.</li> <li>10) All valves shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required to operate. All the valves shall be of standard pressure rating of the relevant design standard. Nonstandard pressure rating shall not be accepted. The pressure and temperature</li> </ol>



**TITLE:**  
**TECHNICAL SPECIFICATION FOR**  
**COAL HANDLING PLANT**  
**RUN-OFF WATER TREATMENT SYSTEM**  
**3X800 MW PATRATU STPP EXT.PH-I**

BHEL DOCUMENTS NO.: PE-TS-434-157-A001

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SECTION-C1

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	rating of the valve shall not be less than the maximum expected pressure and temperature plus 5% additional margin of the system in which valves are proposed to be installed. The pressure rating of individual piping system component such as valves, flanges etc. shall however be not less than that specified.	
20.	<b>PIPING</b> All the piping shall generally be conforming to the requirements specified in the Chapter titled "General Technical Requirement Of Low Pressure Piping" considering the following aspects as minimum requirement:	
21.1	Decanted & Supernatant water	Carbon Steel: IS: 1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 /IS: 3589 - Grade 410; / IS-2062 Gr.-B (for fabricated from plates) / Equivalent
21.2	Coagulant (Alum )	Rubber lined Steel/CPVC Schedule 80
21.3	Lime slurry/Solution/ Suspensions	CPVC as per ASTM F441 CPVC 4120 Sch. 80
21.4	Coagulant aid Solution	Rubber lined Steel/CPVC as per ASTM F441 CPVC 4120, Schedule80/equivalent.
21.5	Sludge	1) GRP as per ASTM D3517/ AWWA C950-88/AWWA M45 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS:4984 or Equivalent for buried portion
21.6	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.



**TITLE:**  
**TECHNICAL SPECIFICATION FOR  
COAL HANDLING PLANT  
RUN-OFF WATER TREATMENT SYSTEM  
3X800 MW PATRATU STPP EXT.PH-I**

BHEL DOCUMENTS NO.: PE-TS-434-157-A001

VOLUME-II-B

SECTION-C2

REV. NO. 00

DATE:

**SECTION-C2  
(SPECIFIC TECHNICAL REQUIREMENT-ELECTRICAL)**



TITLE :  
**ELECTRICAL EQUIPMENT SPECIFICATION FOR**  
**CHPWTP**  
**3 X 800 MW PATRATU STPP EXT PH-I**

SPECIFICATION NO.  
VOLUME NO. : **II-B**  
SECTION : **C**  
REV NO. : **00** DATE :  
SHEET : 1 OF 3

**TECHNICAL SPECIFICATION**

**FOR**

**DM PLANT/ CW TREATMENT/ PRE  
TREATMENT PLANT/EFFLUENT TREATMENT  
PLANT/ GAS CHLORINATION PLANT/SEWAGE  
TREATMENT PLANT / **CHPWTP****

**(ELECTRICAL PORTION)**



TITLE :  
**ELECTRICAL EQUIPMENT SPECIFICATION FOR**  
**CHPWTP**  
**3 X 800 MW PATRATU STPP EXT PH-I**

SPECIFICATION NO.  
VOLUME NO. : **II-B**  
SECTION : **C**  
REV NO. : **00** DATE :  
SHEET : 2 OF 3

**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/ CW TREATMENT/ PRE TREATMENT PLANT/EFFLUENT TREATMENT PLANT/ GAS CHLORINATION PLANT/SEWAGE TREATMENT PLANT.**
- 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.


**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 two signed and stamped copies of the following shall be furnished by the bidder as technical offer:

- a) A copy of this sheet “Electrical equipment Specification for **DM PLANT/ CW TREATMENT/ PRE TREATMENT PLANT/EFFLUENT TREATMENT PLANT/ GAS CHLORINATION PLANT/SEWAGE TREATMENT PLANT.**” and “Electrical Scope between BHEL and Vendor” with bidder’s signature and company stamp.
- b) Electrical load requirement

	<b>TITLE :</b> <b>ELECTRICAL EQUIPMENT SPECIFICATION FOR</b> <b>CHPWTP</b> <b>3 X 800 MW PATRATU STPP EXT PH-I</b>	SPECIFICATION NO.
		VOLUME NO. : <b>II-B</b>
		SECTION : <b>C</b>
		REV NO. : <b>00</b> DATE :
		SHEET : 3 OF 3

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.
- c) Datasheets & quality plan for motors.
- d) Provenness & Technical specification for control cables
- e) Datasheets & quality plan for control cables
- f) Technical specification for Screened control cables
- g) Datasheets & quality plan for Screened control cables
- h) Electrical Load data format (Annexure –II)
- i) BHEL cable listing format (Annexure –III)
- j) Electrical mandatory spares (Annexure IV)

## ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES : VENTILATION / AC / MRS/ DM/ PTP/ CHLORINATION/ ETP/ CPU/ CWT/PT/STP  
 SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT  
 PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) 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. OR (DE to select the choice applicable for their project)) 415 V AC, 3 phase, 3 wire 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, optical fibre 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

Shweta Gaba  
09/03/15

Ravi Kant  
09/03/15

## ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES : VENTILATION / AC / MRS/ DM/ PTP/ CHLORINATION/ETP/ CPU/ CWT/STP  
SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT  
PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	control cables. 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 (including electronic earthing) & 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.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (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 and electronic earthing cable 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.

**ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**

**PACKAGES : VENTILATION / AC / MRS/DM/ PTP/ CHLORINATION/ ETP/ CPU/ CWTP/STP  
 SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT  
 PROJECT:**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
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.

*Shweta Gabe*  
 09/03/15

*(Signature)*  
 09/03/2015



# SUB-SECTION – B-07

## **MOTORS**

**EPC PACKAGE FOR  
PATRATU SUPER THERMAL POWER STATION EXPANSION  
PHASE –I ( 3X 800MW)**

**TECHNICAL SPECIFICATION  
SECTION – VI, PART-B  
BID DOC NO. : CS-9585-001-2**

CLAUSE NO.	TECHNICAL REQUIREMENTS																	
<b>MOTORS</b>																		
<b>1.00.00</b>	<b>GENERAL REQUIREMENTS</b>																	
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.																	
1.02.00	All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.																	
1.03.00	Contractor shall provide fully compatible electrical system, equipment, accessories and services.																	
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.																	
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.																	
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.																	
1.07.00	<p>Degree of Protection</p> <p>Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-</p> <table border="0" data-bbox="407 1178 1468 1377"> <tr> <td>i) Indoor motors</td> <td>-</td> <td>IP 54</td> </tr> <tr> <td>ii) Outdoor motors</td> <td>-</td> <td>IP 55</td> </tr> <tr> <td>iii) Cable box-indoor area</td> <td>-</td> <td>IP 54</td> </tr> <tr> <td>iv) Cable box-Outdoor area</td> <td>-</td> <td>IP 55</td> </tr> </table>			i) Indoor motors	-	IP 54	ii) Outdoor motors	-	IP 55	iii) Cable box-indoor area	-	IP 54	iv) Cable box-Outdoor area	-	IP 55			
i) Indoor motors	-	IP 54																
ii) Outdoor motors	-	IP 55																
iii) Cable box-indoor area	-	IP 54																
iv) Cable box-Outdoor area	-	IP 55																
<b>2.00.00</b>	<b>CODES AND STANDARDS</b> <table border="0" data-bbox="407 1472 1468 1766"> <tr> <td>1) Three phase induction motors</td> <td>:</td> <td>IS/IEC:60034</td> </tr> <tr> <td>2) Single phase AC motors</td> <td>:</td> <td>IS/IEC:60034</td> </tr> <tr> <td>3) Crane duty motors</td> <td>:</td> <td>IS:3177, IS/IEC:60034</td> </tr> <tr> <td>4) DC motors/generators</td> <td>:</td> <td>IS/IEC:60034</td> </tr> <tr> <td>5) Energy Efficient motors</td> <td>:</td> <td>IS 12615, IEC: 60034-30</td> </tr> </table>			1) Three phase induction motors	:	IS/IEC:60034	2) Single phase AC motors	:	IS/IEC:60034	3) Crane duty motors	:	IS:3177, IS/IEC:60034	4) DC motors/generators	:	IS/IEC:60034	5) Energy Efficient motors	:	IS 12615, IEC: 60034-30
1) Three phase induction motors	:	IS/IEC:60034																
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<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b>	<b>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2</b>	<b>SUB-SECTION-B-07 MOTORS</b>	<b>PAGE 1 OF 10</b>															

CLAUSE NO.	TECHNICAL REQUIREMENTS		
<b>3.00.00</b>	<b>TYPE</b>		
3.01.00	<b>AC Motors:</b> <ul style="list-style-type: none"> <li>a) Squirrel cage induction motor suitable for direct-on-line starting.</li> <li>b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30.</li> <li>c) Crane duty motors shall be squirrel cage Induction motor as per the requirement.</li> <li>d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.</li> </ul>		
3.02.00	DC Motors	Shunt wound	
<b>4.00.00</b>	<b>RATING</b>		
<b>5.00.00</b>	<b>TEMPERATURE RISE</b>  <b>Air cooled motors</b>  70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.  <b>Water cooled</b>  80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2	SUB-SECTION-B-07 MOTORS	PAGE 2 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS				
<p><b>6.00.00</b></p> <p>6.01.00</p> <p>6.01.01</p> <p>6.01.02</p> <p>6.01.03</p> <p>6.01.04</p> <p>6.02.00</p> <p>6.02.01</p> <p>6.02.02</p> <p>6.03.00</p>	<p>41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor.</p> <p><b>OPERATIONAL REQUIREMENTS</b></p> <p><b>Starting Time</b></p> <p>For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.</p> <p>For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.</p> <p>For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.</p> <p>Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.</p> <p><b>Torque Requirements</b></p> <p>Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.</p> <p>Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.</p> <p><b>Starting voltage requirement</b></p> <p>(a) Up to 85% of rated voltage for ratings below 110 KW</p> <p>(b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW</p> <p>(c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW</p> <p>(d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW</p> <p>(e) Up to 75 % of rated voltage for ratings above 4000KW</p> <p>Except AOP &amp; JOP motors running on D.G emergency supply, starting voltage shall be 80%.</p>	<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2</p>	<p>SUB-SECTION-B-07 MOTORS</p>	<p>PAGE 3 OF 10</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
<p><b>7.00.00</b></p> <p>7.01.00</p> <p>7.02.00</p> <p>7.03.00</p> <p>7.04.00</p>	<p><b>DESIGN AND CONSTRUCTIONAL FEATURES</b></p> <p>Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters &amp; RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.</p> <p>All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACCA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below</p> <p>(a) Fuel oil area : Group – IIB</p> <p>(b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA / IEC60034)</p> <p>Winding and Insulation</p> <p>(a) Type : Non-hygroscopic, oil resistant, flame resistant</p> <p>(b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature.</p> <p>(c) 11kV &amp; 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse &amp; intertern insulation surge withstand level shall be as per IEC-60034 part-15.</p> <p>However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better.</p> <p>(d) 240VAC, 415V AC &amp; 220V DC motors : Thermal Class ( B ) or better</p> <p>Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.</p>		
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2</p>	<p>SUB-SECTION-B-07 MOTORS</p>	<p>PAGE 4 OF 10</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.		
7.06.00	Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.		
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.		
7.08.00	Motor body shall have two earthing points on opposite sides.		
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.		
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material for single core cables) shall be provided.		
7.11.00	The spacing between gland plate & center of terminal stud shall be as per Table-I.		
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.		
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.		
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.		
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.		
<p align="center"><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b></p>	<p align="center"><b>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2</b></p>	<p align="center"><b>SUB-SECTION-B-07 MOTORS</b></p>	<p align="center"><b>PAGE 5 OF 10</b></p>

CLAUSE NO.	TECHNICAL REQUIREMENTS																	
8.00.00	<p>The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.</p> <table border="0" data-bbox="423 304 1136 598"> <tr> <td>(a) Below 110KW</td> <td>:</td> <td>11.0</td> </tr> <tr> <td>(b) From 110 KW &amp; upto 200 KW</td> <td>:</td> <td>9.0</td> </tr> <tr> <td>(c) Above 200 KW &amp; upto 1000KW</td> <td>:</td> <td>10.0</td> </tr> <tr> <td>(d) From 1001KW &amp; upto 4000KW</td> <td>:</td> <td>9.0</td> </tr> <tr> <td>(e) Above 4000KW</td> <td>:</td> <td>6 to 6.5</td> </tr> </table>			(a) Below 110KW	:	11.0	(b) From 110 KW & upto 200 KW	:	9.0	(c) Above 200 KW & upto 1000KW	:	10.0	(d) From 1001KW & upto 4000KW	:	9.0	(e) Above 4000KW	:	6 to 6.5
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(d) From 1001KW & upto 4000KW	:	9.0																
(e) Above 4000KW	:	6 to 6.5																
9.00.00	CW motor shall be designed with minimum power factor of 0.8 at design duty point.																	
<b>10.00.00</b>	<b>TYPE TEST</b>																	
10.01.00	<b>HT MOTORS</b>																	
10.01.01	<p>The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.</p>																	
10.01.02	<p>The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.</p>																	
10.01.03	<p>In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.</p>																	
10.01.04	<p>Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED "and carried out within last ten years from the date of bid opening. These reports should be for</p>																	
<p align="center"><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW</b></p>		<p align="center"><b>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2</b></p>	<p align="center"><b>SUB-SECTION-B-07 MOTORS</b></p>	<p align="center"><b>PAGE 6 OF 10</b></p>														

CLAUSE NO.	TECHNICAL REQUIREMENTS		
10.01.05	<p>the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.</p> <p><b>LIST OF TYPE TESTS TO BE CONDUCTED</b></p> <p><b>The following type tests shall be conducted on each type and rating of HT motor</b></p> <ul style="list-style-type: none"> <li>(a) No load saturation and loss curves upto approximately 115% of rated voltage</li> <li>(b) Measurement of noise at no load.</li> <li>(c) Momentary excess torque test (subject to test bed constraint).</li> <li>(d) Full load test (subject to test bed constraint)</li> <li>(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.</li> </ul>		
10.01.06	<p><b>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</b></p> <p><b>The following type test reports shall be submitted for each type and rating of HT motor</b></p> <ul style="list-style-type: none"> <li>(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.</li> <li>(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.</li> <li>(c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15</li> <li>(d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15</li> </ul>		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2	SUB-SECTION-B-07 MOTORS	PAGE 7 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS		
10.02.00	<b>LT Motors</b>		
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.		
10.02.02	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.		
10.02.03	<p><b>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</b></p> <p><b>The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only</b></p> <ol style="list-style-type: none"> <li>1. Measurement of resistance of windings of stator and wound rotor.</li> <li>2. No load test at rated voltage to determine input current power and speed</li> <li>3. Open circuit voltage ratio of wound rotor motors ( in case of Slip ring motors)</li> <li>4. Full load test to determine efficiency power factor and slip.</li> <li>5. Temperature rise test.</li> <li>6. Momentary excess torque test.</li> <li>7. High voltage test.</li> <li>8. Test for vibration severity of motor.</li> <li>9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)</li> <li>10. Test for degree of protection and</li> <li>11. Over speed test.</li> </ol>		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2	SUB-SECTION-B-07 MOTORS	PAGE 8 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS																				
<p>10.03.00</p> <p>10.04.00</p>	<p>12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1</p> <p>All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.</p> <p>The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.</p> <p style="text-align: center;"><b>TABLE - I</b></p> <p style="text-align: center;"><b>DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS</b></p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;"><b>Motor MCR in KW</b></th> <th style="text-align: right;"><b>Minimum distance between centre of stud and gland plate in mm</b></th> </tr> </thead> <tbody> <tr> <td><b>UP to 3 KW</b></td> <td style="text-align: right;"><b>As per manufacturer's practice.</b></td> </tr> <tr> <td>Above 3 KW - upto 7 KW</td> <td style="text-align: right;">85</td> </tr> <tr> <td>Above 7 KW - upto 13 KW</td> <td style="text-align: right;">115</td> </tr> <tr> <td>Above 13 KW - upto 24 KW</td> <td style="text-align: right;">167</td> </tr> <tr> <td>Above 24 KW - upto 37 KW</td> <td style="text-align: right;">196</td> </tr> <tr> <td>Above 37 KW - upto 55 KW</td> <td style="text-align: right;">249</td> </tr> <tr> <td>Above 55 KW - upto 90 KW</td> <td style="text-align: right;">277</td> </tr> <tr> <td>Above 90 KW - upto 125 KW</td> <td style="text-align: right;">331</td> </tr> <tr> <td>Above 125 KW-upto 200 KW</td> <td style="text-align: right;">203</td> </tr> </tbody> </table> <p>For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.</p> <p><b>PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:</b></p> <p>NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:</p>	<b>Motor MCR in KW</b>	<b>Minimum distance between centre of stud and gland plate in mm</b>	<b>UP to 3 KW</b>	<b>As per manufacturer's practice.</b>	Above 3 KW - upto 7 KW	85	Above 7 KW - upto 13 KW	115	Above 13 KW - upto 24 KW	167	Above 24 KW - upto 37 KW	196	Above 37 KW - upto 55 KW	249	Above 55 KW - upto 90 KW	277	Above 90 KW - upto 125 KW	331	Above 125 KW-upto 200 KW	203
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<b>Motor MCR in KW</b>	<b>Clearance</b>	
	UP to 110 KW	10mm	
	Above 110 KW and upto 150 KW	12.5mm	
	Above 150 KW	19mm	
<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b>	<b>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2</b>	<b>SUB-SECTION-B-07 MOTORS</b>	<b>PAGE 10 OF 10</b>

**MOTOR**

TESTS/CHECKS  TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y
Shaft	Y	Y	Y	Y	Y	Y			Y
Magnetic Material	Y	Y	Y	Y			Y		
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y
Stator copper	Y	Y	Y	Y			Y		Y
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y
Insulating Material	Y		Y	Y			Y		
Tubes, for Cooler	Y	Y	Y	Y	Y				Y
Sleeve Bearing	Y	Y	Y	Y	Y				Y
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y	
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y	
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y
Wound stator	Y	Y					Y	Y	
Wound Exciter	Y	Y					Y	Y	
Rotor complete	Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y		
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y						
Complete Motor	Y	Y	Y						
<p><b>Note:</b></p> <ol style="list-style-type: none"> <li>1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices &amp; Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.</li> <li>2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard</li> <li>3. Makes of major bought out items for HT motors will be subject to NTPC approval.</li> </ol> <p>Y1 = for HT Motor / Machines only.</p>									

**MOTOR**

TESTS/CHECKS  ITEMS/ COMPONENTS	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC60034/IEC 60079-1	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.										
Shaft										
Magnetic Material	Y		Y							
Rotor Copper/Aluminium										
Stator copper			Y							
SC Ring										
Insulating Material			Y							
Tubes for Cooler		Y								
Sleeve Bearing		Y								
Stator/Rotor, Exciter Coils										
Castings, stator frame, terminal box and bearing housing etc.										
Fabrication & machining of stator, rotor, terminal box										
Wound stator										
Wound Exciter										
Rotor complete				Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly										
Accessories, RTD, BTD,CT, , Space heater, antifriction bearing, gaskets etc.										
Complete Motor						Y	Y	Y	Y1	Y
<p><b>Note:</b> 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices &amp; Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.</p> <p>2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard</p> <p>3. Makes of major bought out items for HT motors will be subject to NTPC approval. Y1 = for HT Motor / Machines only.</p>										

<b>TITLE :</b> <b>GENERAL TECHNICAL REQUIREMENTs</b>  <b>FOR</b>  <b>LV MOTORS</b>	SPECIFICATION NO. PE-SS-999-506-E101
	VOLUME NO. : <b>II-B</b>
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**GENERAL TECHNICAL REQUIREMENTS**

**FOR**

**LV MOTORS**

**SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00**

<b>TITLE :</b> <b>GENERAL TECHNICAL REQUIREMENTS</b>  <b>FOR</b>  <b>LV MOTORS</b>	<b>SPECIFICATION NO.</b> PE-SS-999-506-E101
	<b>VOLUME NO. : II-B</b>
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### 1.0 INTENT OF SPECIFICATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

### 2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement of rotating electrical machines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

### 3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information  
 Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

#### 3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

#### 3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

#### 3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

#### 4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

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- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.  
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7. **Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.  
  
Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 Unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or V W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

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**4.9 General**

- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
- 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
- 4.9.6 Name plate with all particulars as per IS: 325 shall be provided
- 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

**5.0 INSPECTION AND TESTING**

- 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.
- 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.
- 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.
- 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

**6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:  
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).
  - i) Current vs. time at rated voltage and minimum starting voltage.
  - ii) Speed vs. time at rated voltage and minimum starting voltage.
  - iii) Torque vs. speed at rated voltage and minimum voltage.  
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
  - iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

TITLE  <b>LV MOTORS</b>  <b><u>DATA SHEET-A</u></b>	SPECIFICATION NO.	
	VOLUME	II B
	SECTION	D
	REV NO. 00	DATE 01/10/2012
	SHEET 1	OF 1

- |      |  |   |   |
|------|--|---|---|
| 1.0  | Design ambient temperature                                       | : | 50 °C   |
| 2.0  | Maximum acceptable kW rating of LV motor                         | : | ≤200KW  |
| 3.0  | Installation (Indoors/ Outdoors)                                 | : | As required   |
| 4.0  | Degree Of Protection (Indoor/Outdoor)                            | : | IP54/IP55   |
| 5.0  | Type of Cooling  | : | TEFC/CACA/TETV  |
| 6.0  | Details of supply system   |   |   |
|      | a) Rated voltage (with variation)                                | : | 415V ± 10%  |
|      | b) Rated frequency (with variation)                              | : | 50 Hz (Variation: +3% TO –5%)   |
|      | c) Combined voltage & freq. variation                            | : | 10%   |
|      | d) System fault level at rated voltage                           | : | 50 kA for 1 sec   |
|      | e) Short time rating for terminal boxes                          | : |   |
|      | o 110kW & Above<br>(Breaker controlled)                          | : | 50 kA for 1 sec   |
|      | o Below 110kW (SFU+<br>Contactor controlled)                     | : | 50 KA for 0.20 sec.   |
|      | f) LV System grounding   | : | Solidly   |
| 7.0  | Class of insulation  | : | Class 'F', with temp rise limited to class B.<br>(Refer clause 5.00.00 of Motors) |
| 8.0  | Minimum voltage for starting<br>(As percentage of rated voltage) | : | As per Customer Motor Spec (enclosed)   |
| 9.0  | Power cables data  | : | Shall be given during Detailed engg.  |
| 10.0 | Earth Conductor Size & Material                                  | : | Shall be given during Detailed engg.  |
| 11.0 | Space heater supply  | : | 240 V, 1Φ , 50 Hz   |
| 12.0 | Rating up to which Single phase motor                            | : | Acceptable below 0.20 kW  |
| 13.0 | Tests  | : | As per Customer motor spec. (enclosed)  |
| 14.0 | Energy efficient/ Flame proof motor                              | : | As per Customer spec. requirement   |

- **Also detail Customer spec. for Motors to be referred as enclosed with spec.**
- **The requirements mentioned in Customer Motor Spec for Motors shall prevail in case of conflict between the same and the corresponding requirements mentioned in the Section C/ Section D/ Datasheet A**

<b>TITLE</b>  <b>MOTOR</b>  <b>DATA SHEET - C</b>	<b>SPECIFICATION NO.</b>
	<b>VOLUME II B</b>
	<b>SECTION D</b>
	<b>REV NO. 00 DATE 28.07.14</b>
	<b>SHEET 1 OF 2</b>

S. No.	Description	Data to be filled by successful bidder
<b>A.</b>	<b>General</b>	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
<b>B.</b>	<b>Design and Performance Data</b>	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a) Voltage	
6	b) Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB)	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	


NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			


<b>MOTOR DATA SHEET - C</b>	TITLE	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 28.07.14
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
<b>C.</b>	<b>Constructional Features</b>	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level ( kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
<b>D.</b>	<b>Characteristic curves/ drawings</b> (To be enclosed for motors of rating $\geq 55KW$ )	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

		QUALITY PLAN			CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
		SHEET 1 OF 9			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	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			11	
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	HEAT NO. SHALL BE VERIFIED	
		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 :				PROJECT			SPECIFICATION :		
					BIDDER/ VENDOR :				TITLE				NUMBER :	
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	P	W	V	11		
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	FOR DIA OF 55 MM & ABOVE		
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			CUSTOMER :			PROJECT			SPECIFICATION :		
					BIDDER/ VENDOR			TITLE			NUMBER :		
SHEET 3 OF 9		SYSTEM			NUMBER PED-506-00-Q-007, REV-03			QUALITY PLAN			SPECIFICATION :		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III			TITLE		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			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		CUSTOMER :			PROJECT			SPECIFICATION :				
		BIDDER/ VENDOR :			TITLE			NUMBER :				
SHEET 4 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	P	W	V	11
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	
1.11	SLIP RING (WHEREVER APPLICABLE)	3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
		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	
1.12	OIL SEALS & GASKETS	4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
		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	-	-	
<b>BHEL</b>			<b>PARTICULARS</b>			<b>BIDDER/VENDOR</b>						
			<b>NAME</b>									
			<b>SIGNATURE</b>									
			<b>DATE</b>						<b>BIDDER'S/VENDORS COMPANY SEAL</b>			



**QUALITY PLAN**

SHEET 5 OF 9

CUSTOMER :

PROJECT  
TITLE

SPECIFICATION :  
NUMBER :

BIDDER/  
VENDOR

QUALITY PLAN  
NUMBER PED-506-00-Q-007, REV-03

SPECIFICATION :  
TITLE

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
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR )	1.WORKMANSHIP & CLEANNESS	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-	RELEVENT SPEC./ ASTM-E165	MANUFR'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	-	-	
<b>BHEL</b>			<b>PARTICULARS</b>			<b>BIDDER/VENDOR</b>						
			<b>NAME</b>									
			<b>SIGNATURE</b>									
			<b>DATE</b>						<b>BIDDER'S/VENDORS COMPANY SEAL</b>			



QUALITY PLAN		CUSTOMER :			PROJECT TITLE			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		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	
									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	-	-		
		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		FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-		
		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	THREE DIPS TO BE GIVEN	
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE					BIDDER'S/VENDORS COMPANY SEAL					



**QUALITY PLAN**

SHEET 7 OF 9

CUSTOMER :

PROJECT  
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
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION 1.COMPACTNESS & CLEANLINESS	MA	-DO- VISUAL	-DO- 100%	-DO- -DO-	-DO- -DO-	Log Book Log Book	2	-	1	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS 2.SOUNDNESS	CR	-DO- MALLETT TEST & UT	-DO- -DO-	-DO- -DO-	-DO- -DO-	Log Book Log Book	2	-	-	
2.9	COMPLETE ROTOR ASSEMBLY	3.HV 1.RESIDUAL UNBALANCE	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT 2.WORKMANSHIP 3.AXIAL PLAY 4.DIMENSIONS 5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE 6. RTD, BTD & SPACE HEATER MOUNTING.	MA	MEAS. VISUAL MEAS. -DO- VISUAL	-DO- -DO- -DO- -DO- 100%	-DO- -DO- -DO- MFG.DRG./ MFG SPEC. MFG SPEC. RELEVANT IS	-DO- -DO- -DO- MFG. DRG/ RELEVANT IS MFG SPEC. RELEVANT IS	Log Book Log Book Log Book Log Book Log Book	2	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN			CUSTOMER :				PROJECT			SPECIFICATION :		
					BIDDER/ VENDOR :				TITLE			NUMBER :		
SHEET 8 OF 9		SYSTEM				NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION :					
SL. NO.		COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION			VOLUME III	
1		2	3	4	5	6	7	8	9	10			11	
P		W	V	REMARKS										
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1		
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 <sup>s</sup>	1	<sup>s</sup> NOTE - 2		
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 <sup>s</sup>	1	<sup>s</sup> NOTE - 2		
		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	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3		
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 <sup>s</sup>	1	<sup>s</sup> NOTE - 2		
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 <sup>s</sup>	1	<sup>s</sup> NOTE - 2		
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 <sup>s</sup>	1	<sup>s</sup> NOTE - 2		
		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	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3		
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 <sup>s</sup>	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY <sup>s</sup> NOTE - 2		
BHEL			PARTICULARS			BIDDER/VENDOR								
			NAME											
			SIGNATURE											
			DATE						BIDDER'S/VENDORS COMPANY SEAL					



**QUALITY PLAN**

SHEET 9 OF 9

CUSTOMER :

PROJECT  
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
									P	W	V	
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.
- 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

- P. PERFORM  
W. WITNESS  
V. VERIFY

<b>BHEL</b>	<b>PARTICULARS</b>	<b>BIDDER/VENDOR</b>	
	<b>NAME</b>		
	<b>SIGNATURE</b>		
	<b>DATE</b>		<b>BIDDER'S/VENDORS COMPANY SEAL</b>

		QUALITY PLAN	CUSTOMER :			PROJECT			SPECIFICATION :			
			BIDDER/ VENDOR :			TITLE			NUMBER :			
			SYSTEM			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
SHEET 1 OF 2					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
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
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	-	NOTE -1 & NOTE-3
		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									