Bharat Heavy Electricals Limited
Tiruchirappalli-620 014

Fuel Systems/PE(FB)

Title Sheet

Specification for

Effluent Sump Pump And Motor Assy

Specification Number: TOS:2001 **Revision No. : 01**

01	10/03/14	LDO added in Cl.3, LDO specific gravity added in Cl. 3.3 &Sl. No 1.2 of datasheet, Cooling water requirement applicability added as Sl. No. 7 in datasheet.Cl 4.6 added. Drawing in pg8 revised.	GSK
Rev. No.	**Date**	**Revision statement**	**Checked & Approved**

	Name	Signature	Date
Prepared	S.Selvaraju	-sd-	13.01.2009
Checked	S.Selvaraju	-sd-	13.01.2009
Approved	M.Thandapani	-sd-	13.01.2009

1. Intent:
To design, manufacture, test and supply of the Vertical submerged pump with motor.

2. Scope:
The complete Sump pump with drive and required accessories as per the specification furnished below.

3. Functional and technical conditions:
The pump shall be designed to handle the LDO/HFO/LSHS/HPS and work in the environment as furnished.
Performance as per VDMA standard.

3.1	Fluid handled	:	Fuel oil / Sludge
3.2	Pumping Temperature	:	50-80Deg. C
3.3	Sp.gravity	:	0.83/0.925/1.05
3.4	Capacity	:	10 Cum/Hr.
3.5	Head (Diff) @ duty Point	:	50MLC (Minimum)
3.6	R.P.M	:	1450 Clockwise (As seen from motor end)
3.7	Minimum Submergence	:	Vendor to State
3.8	Ht. below Discharge Flange	:	3000mm (Approximately)

4. Constructional features and special requirements:
The pump shall be Vertical mounted, steel body
Delivery Flange shall be drilled as per ANSI B 16.5 Class 150 lbs.
Drive motor and base frame are by the vendor and shall be as per the specification enclosed for L.T. motor.
Materials:

4.1	Pump Casing	:	C.I , 2-3% Ni with Min 180 BHN Hardness
4.2	Pump Impeller	:	C.I , 2-3% Ni with Min 180 BHN Hardness
4.3	Pump Shaft	:	EN 8
4.4	Bearing	:	Vendor to State
4.5	Fasteners in Liquid	:	M.S. Galvanised
4.6	Gaskets	:	Shall be of non-asbestos type

5. Marking:
Stainless steel nameplates with the following boldly engraved shall be firmly fixed to the body; Maker's name & production serial number, Full pump designation: Flow, Viscosity, Minimum allowable suction pressure, discharge pressure.
Each spare shall be individually tagged with part name, maker's name & spare code and BHEL material code.

6. Painting:
At interior surfaces supplied with rust preventive oil following hydraulic test & drying. At exposed surfaces degreased, derusted & epoxy coated over red oxide primer.

7. Packing:
All openings shall be firmly capped against ingress of water or dust.
Shall be seaworthy packed in wooden boxes with waterproof under cover.
Liberal packing material & struts shall be used to arrest rolling to protect from transmit damages.

8. Inward inspection:
Verify the works test certificate, marking particulars, nameplates of each accessory and the scope of supply. Watch for damages. Perform random check on all mounting dimensions, terminal connections and coupling details.

9. Applicable drawings:
GA Drg. With Overall Dimensions
Sectional Drg. With BOM

10. Inspection & testing:
Dimensional checks as per the approved drawing.
Performance test on each pump on standard oil over the entire operating range, with curves extrapolated for this specific application.
Body hydraulic tested for at 1.5 times body rating.
All tests envisaged shall be as per the approved Quality Plan.

11. Information to be furnished:

Foundation details, cross sectional drawing and the pump designation with description of designation.
Performance data sheet of the Pump/Filled in data sheet
Flow Vs Power,
Flow Vs Head,
Flow Vs Efficiency in %age
Calculation for
Pump Capacity, Power rating in Kw(motor),Hydraulic length, velocity & total pressure drop in MLC
O&M manuals in electronic form in compact discs.
Spares quotation for 3 years operation with description, Part No. etc.

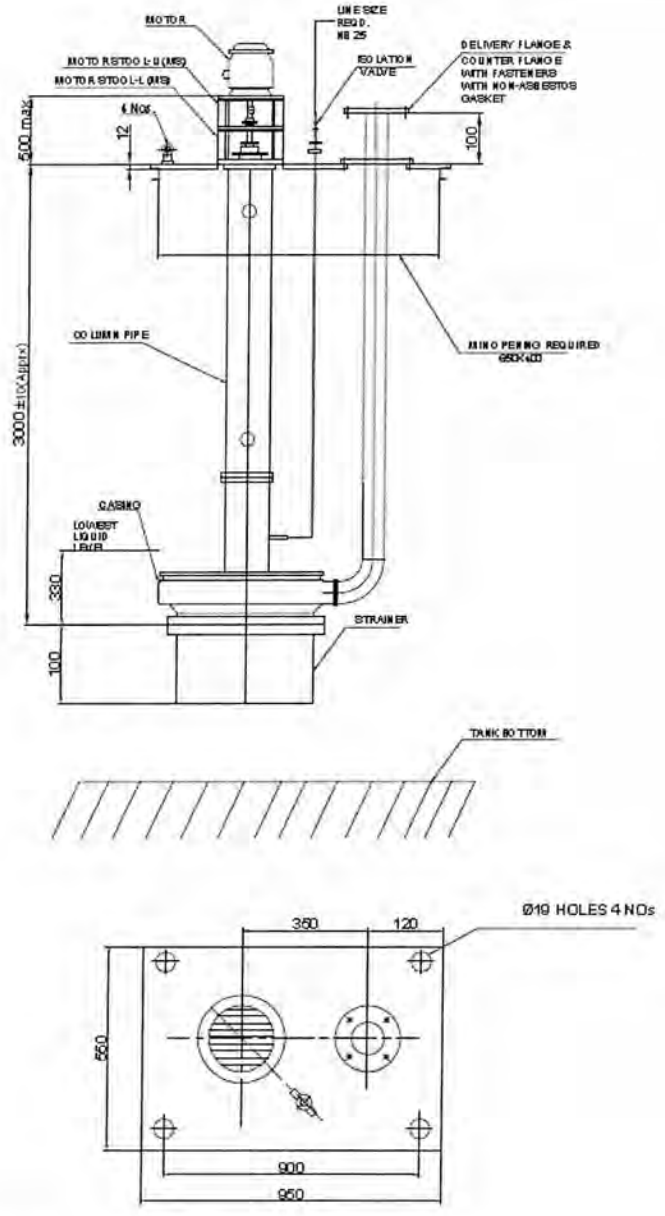
Effluent Sump Pump And Motor Assy.
Data Sheet

BHEL MATERIAL CODES: L172014220007001
ENQUIRY No.:

Sl. No.	Characteristics	Requirement	Supplier's Compliance
1.0	**Liquid Data**		
1.1	Liquid	Fuel Oil / Sludge	
1.2	Specific gravity	0.83/0.925/1.05	
1.3	Liquid Ambient temp.	50 Deg.C	
2.0	**Pump Data**		
2.1	Pump Type	Vertical Submerged	
2.2	Make & Model No.		
2.3	Quantity	Two Nos / Contract	
2.4	Height Below Discharge Flange	3000mm(Approximately)	
2.5	Flow	10Cum./Hr.	
2.6	Differential Head @ duty point	50MLC	
2.7	Minimum Safe Flow	Vendor to State	
2.8	Minimum Submergence	Vendor to State	
2.9	Delivery Flange Drilling Std	ANSI B 16.5 Class 150	
2.10	Pump Efficiency	Vendor to State	

Sl. No.	Characteristics	Requirement	Supplier's Compliance
2.11	Power BKw @ duty point	Vendor to Furnish	
2.12	Recommended Motor rating	Vendor to Furnish	
2.13	Motor Speed	1450rpm	
2.14	Impeller type	Closed	
2.15	Shaft Sealing	Gland Packing	
2.16	Motor Coupling	Rubber Spider	
3.0	**Material of Construction**		
3.1	Casing	CI +Ni 2-3% with Min. 180BHN	
3.2	Casing Wear Ring	CI +Ni 2-3% with Min. 180BHN	
3.3	Impeller (Closed)	CI +Ni 2-3% with Min. 180BHN	
3.4	Impeller (Wear Ring)	CI +Ni 2-3% with Min. 180BHN	
3.5	Shaft	En8	
3.6	Imp.Sleeve	AISI-410	
3.7	Int.Sleeve	AISI-410	
3.8	G.B.Bush	CA-15 Hardened	
3.9	Head Sleeve	AISI-410	
3.10	Column Pipe-L	M.S.ERW CL-C Galvanised	

Sl No	Characteristics	Requirement	Supplier's Compliance
3.11	Del.Pipe (DP)	M.S.ERW CL-C Galvanised	
3.12	Discharge Elbow	M.S.ERW CL-C Galvanised	
3.13	Rect.Sup.Plate (RSP)	Mild Steel	
3.14	Rsp Mounting Bolts	M.S.Galvanised	
3.15	SB Gland Packing	Vendor to Furnish	
3.16	Bearing	Vendor to Furnish	
3.17	Fasteners in Liquid	M.S.Galvanised	
4.0	**Accessories**		
4.1	Flexible Coupling	Cast Steel	
4.2	Strainer (STR)	AISI-316	
4.3	Delivery Flange & Counter Flange	M.S.Galvanised	
5.0	**Testing and Inspection**	**As per approved QP**	
6.0	**Motor Data**	**As per TDC:TCI:141: Rev.:Latest**	
7.0	**Cooling Water**		
7.1	Cooling Water requirement	**Yes/No**	
7.2	If yes, water flow reqd.		
7.3	Water parameters reqd. (Temp, pressure)		
7.4	Line size required (To be terminated with isolation valve)(TP details to be indicated in GA drawing)	NB 25	



NOTE:

DIMENSIONS SHOWN ARE SUGGESTIVE ONLY.
VARIATIONS IN DIMENSIONS ARE ACCEPTABLE
SUBJECT TO APPROVAL

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	Name	Signature	Date
Prepared	**S.Selvaraju**	**-sd-**	**13.01.2009**
Checked	**S.Selvaraju**	**-sd-**	**13.01.2009**
Approved	**M.Thandapani**	**-sd-**	**13.01.2009**

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To design, manufacture, test and supply of the Vertical submerged pump with motor.

2. Scope:

The complete Sump pump with drive and required accessories as per the specification furnished below.

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Performance as per VDMA standard.

3.1	Fluid handled	:	Fuel oil / Sludge
3.2	Pumping Temperature	:	50-80Deg. C
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3.4	Capacity	:	10 Cum/Hr.
3.5	Head (Diff) @ duty Point	:	50MLC (Minimum)
3.6	R.P.M	:	1450 Clockwise (As seen from motor end)
3.7	Minimum Submergence	:	Vendor to State
3.8	Ht. below Discharge Flange	:	3000mm (Approximately)

4. Constructional features and special requirements:

The pump shall be Vertical mounted, steel body

Delivery Flange shall be drilled as per ANSI B 16.5 Class 150 lbs.

Drive motor and base frame are by the vendor and shall be as per the specification enclosed for L.T. motor.

Materials:

4.1	Pump Casing	:	C.I , 2-3% Ni with Min 180 BHN Hardness
4.2	Pump Impeller	:	C.I , 2-3% Ni with Min 180 BHN Hardness
4.3	Pump Shaft	:	EN 8
4.4	Bearing	:	Vendor to State
4.5	Fasteners in Liquid	:	M.S. Galvanised
4.6	Gaskets	:	Shall be of non-asbestos type

5. Marking:

Stainless steel nameplates with the following boldly engraved shall be firmly fixed to the body; Maker's name & production serial number, Full pump designation: Flow, Viscosity, Minimum allowable suction pressure, discharge pressure.

Each spare shall be individually tagged with part name, maker's name & spare code and BHEL material code.

6. Painting:

At interior surfaces supplied with rust preventive oil following hydraulic test & drying. At exposed surfaces degreased, derusted & epoxy coated over red oxide primer.

7. Packing:

All openings shall be firmly capped against ingress of water or dust.

Shall be seaworthy packed in wooden boxes with waterproof under cover.

Liberal packing material & struts shall be used to arrest rolling to protect from transmit damages.

8. Inward inspection:

Verify the works test certificate, marking particulars, nameplates of each accessory and the scope of supply. Watch for damages. Perform random check on all mounting dimensions, terminal connections and coupling details.

9. Applicable drawings:

GA Drg. With Overall Dimensions

Sectional Drg. With BOM

10. Inspection & testing:

Dimensional checks as per the approved drawing.

Performance test on each pump on standard oil over the entire operating range, with curves extrapolated for this specific application.

Body hydraulic tested for at 1.5 times body rating.

All tests envisaged shall be as per the approved Quality Plan.

11. Information to be furnished:

Foundation details, cross sectional drawing and the pump designation with description of designation.
Performance data sheet of the Pump/Filled in data sheet
Flow Vs Power,
Flow Vs Head,
Flow Vs Efficiency in %age
Calculation for
Pump Capacity, Power rating in Kw(motor),Hydraulic length, velocity & total pressure drop in MLC
O&M manuals in electronic form in compact discs.
Spares quotation for 3 years operation with description, Part No. etc.

Effluent Sump Pump And Motor Assy.
Data Sheet

BHEL MATERIAL CODES: L180414220007001
ENQUIRY No.:

Sl. No.	Characteristics	Requirement	Supplier's Compliance
1.0	**Liquid Data**		
1.1	Liquid	Fuel Oil / Sludge	
1.2	Specific gravity	0.83/0.925/1.05	
1.3	Liquid Ambient temp.	50 Deg.C	
2.0	**Pump Data**		
2.1	Pump Type	Vertical Submerged	
2.2	Make & Model No.		
2.3	Quantity	Two Nos / Contract	
2.4	Height Below Discharge Flange	3000mm(Approximately)	
2.5	Flow	10Cum./Hr.	
2.6	Differential Head @ duty point	50MLC	
2.7	Minimum Safe Flow	Vendor to State	
2.8	Minimum Submergence	Vendor to State	
2.9	Delivery Flange Drilling Std	ANSI B 16.5 Class 150	
2.10	Pump Efficiency	Vendor to State	

Sl. No.	Characteristics	Requirement	Supplier's Compliance
2.11	Power BKw @ duty point	Vendor to Furnish	
2.12	Recommended Motor rating	Vendor to Furnish	
2.13	Motor Speed	1450rpm	
2.14	Impeller type	Closed	
2.15	Shaft Sealing	Gland Packing	
2.16	Motor Coupling	Rubber Spider	
3.0	**Material of Construction**		
3.1	Casing	CI +Ni 2-3% with Min. 180BHN	
3.2	Casing Wear Ring	CI +Ni 2-3% with Min. 180BHN	
3.3	Impeller (Closed)	CI +Ni 2-3% with Min. 180BHN	
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3.6	Imp.Sleeve	AISI-410	
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3.14	Rsp Mounting Bolts	M.S.Galvanised	
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4.1	Flexible Coupling	Cast Steel	
4.2	Strainer (STR)	AISI-316	
4.3	Delivery Flange & Counter Flange	M.S.Galvanised	
5.0	**Testing and Inspection**	**As per approved QP**	
6.0	**Motor Data**	**As per TDC:TCI:141: Rev.:Latest**	
7.0	**Cooling Water**		
7.1	Cooling Water requirement	**Yes/No**	
7.2	If yes, water flow reqd.		
7.3	Water parameters reqd. (Temp, pressure)		
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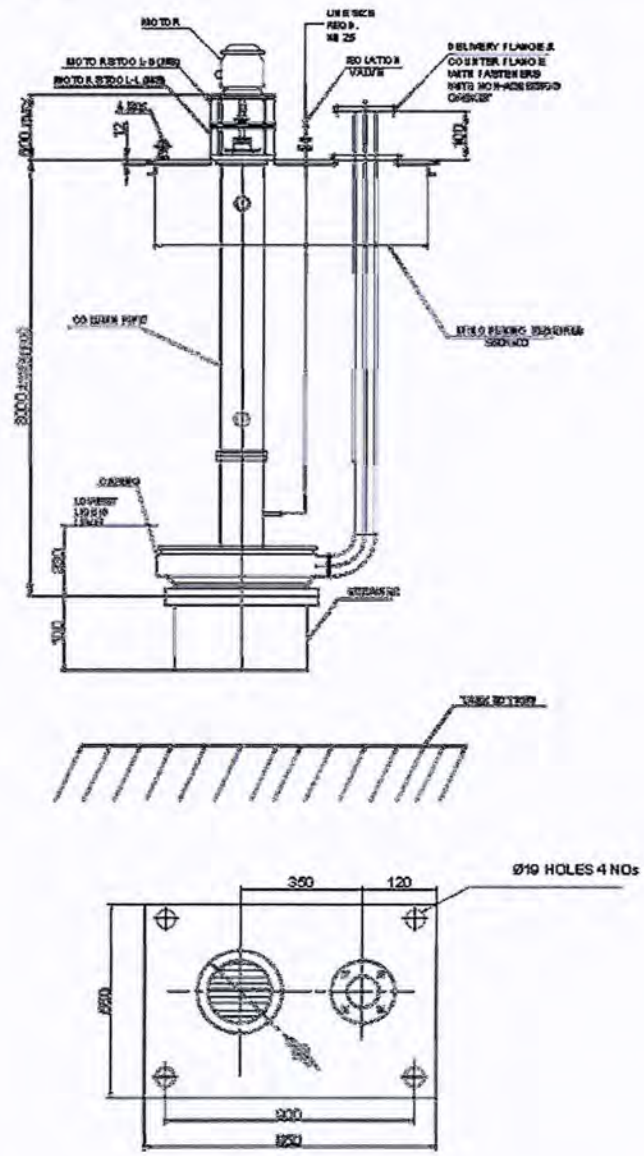

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ANNEXURE - 1
PROJECT SPECIFIC REQUIREMENTS

Reference: TCI: 141/10 (Flame Proof), TCI: 140/09 (Non – Flame Proof)

Project : **North Karanpura STPP, 3 x 660 MW**

Cust. Nos. : **1720 - 1722**

Item Description : **LT AC motors of Flame Proof & Non- Flame proof applications**

Specification details :

The project specific requirement has to be taken care of as against the clause no. of the technical specification

Spec. Clause No.	Description	Description/Value/Standard
Cl no. 8 of TCI : 141/10 Cl no. 7 of TCI : 140/09	Level of Energy Efficient Motors up to 160 KW at 50° C ambient temperature	Energy Efficiency – Premium Efficiency Class IE3 as per IS 12615 : 2011
Clause no. 6 of TCI : 141/10	Motors located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as indicated against (a) or (b).	(a) Fuel oil area : Group – IIB**(SUMP PUMP MOTOR SHALL CONFORM TO GROUP-IIB TYPE)** (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)

Cable Entry Details

Vendor to provide the cable entry in the motor suitable for the power cable sizes indicated below.

Sl. No.	Motor rating in KW	Power Cable size in sq. mm. (#)
1.	1.1-3.0	3CX2.5
2.	3.1-7.0	3CX6
3.	7.1-13.0	3CX16
4.	13.1-24.0	3CX35
5.	24.1-37.0	3CX70

6.	37.1-55.0	3CX120
7.	55.1-90.0	3CX150
8.	90.1-100.0	3C X 240 (2 nos. of cable entries shall be provided for 4 pole motors, with higher motor frame sizes.)
9.	100.1-200.0	3C X 240 (2 nos. of cable entries shall be provided for 4 pole motors, with higher motor frame sizes.)

Notes :

i) The cables of size below 150 sq. mm. shall be PVC insulated and those of size 150 sq. mm. and above shall be XLPE insulated.

ii) All cables shall be of Aluminum conductor except for 2.5 sq. mm. size which shall be Copper conductor.

Dimensions of Terminal Boxes

Sl. No.	Motor MCR in KW	Minimum Distance between centre of stud and the gland plate (in mm)
1	Up to 3 KW	As per manufacturers' practice
2	Above 3 KW – Up to 7 KW	85
3	Above 7 KW – Up to 13 KW	115
4	Above 13 KW – Up to 24 KW	167
5	Above 24 KW – Up to 37 KW	196
6	Above 37 KW – Up to 55 KW	249
7	Above 55 KW – Up to 90 KW	277
8	Above 90 KW – Up to 125 KW	331
9	Above 125 KW – Up to 200 KW	403

Phase to Phase/Phase to earth air clearance

Minimum inter-phase and phase-earth air clearance for LT motors with lugs installed shall be as follow

Sl. No.	Motor MCR in KW	Clearance (in mm)
1	Up to 110 KW	10
2	Above 110 KW – Up to 150 KW	12.5
3	Above 150 KW	19

ANNEXURE

Rev. 00

PROJECT SPECIFIC REQUIREMENTS

Applicable for LT AC Motors

Reference: TCI: 141/10, TCI: 140/09

Project : DARLIPALLI STPP, 2 x 800 MW

Cust. Nos. : 1806 - 1807

Item Description : LT Motors – LFO Pump, Drain Oil Pump and Scanner Air fan AC motor

Sl. No.	Description	Description/Value/Standard
1	Energy Efficiency Class – For Motors up to 160 KW @ 50° C ambient temperature	Energy Efficiency Class - IE2 as per IEC 60034-30

Cable Entry Details

Vendor to provide the cable entry in the motor suitable for the power cable sizes indicated below.

Sl. No.	Motor rating in KW	Power Cable size in sq. mm. (#)
1.	1.1-3.0	3CX2.5
2.	3.1-7.0	3CX6
3.	7.1-13.0	3CX16
4.	13.1-24.0	3CX35
5.	24.1-37.0	3CX70
6.	37.1-55.0	3CX120
7.	55.1-90.0	3CX150
8.	90.1-100.0	2 X 3C X 240
9.	100.1-200.0	2 X 3C X 240

Notes :

i) The cables of size below 150 sq. mm. shall be PVC insulated and those of size 150 sq. mm. and above shall be XLPE insulated.

ii) All cables shall be of Aluminum conductor except for 2.5 sq. mm. size which shall be Copper conductor.

Dimensions of Terminal Boxes

Sl. No.	Motor MCR in KW	Minimum Distance between centre of stud and the gland plate (in mm)
1	Up to 3 KW	As per manufacturers' practice
2	Above 3 KW – Up to 7 KW	85
3	Above 7 KW – Up to 13 KW	115
4	Above 13 KW – Up to 24 KW	167
5	Above 24 KW – Up to 37 KW	196
6	Above 37 KW – Up to 55 KW	249
7	Above 55 KW – Up to 90 KW	277
8	Above 90 KW – Up to 125 KW	331
9	Above 125 KW – Up to 200 KW	403

Phase to Phase/Phase to earth air clearance

Minimum inter-phase and phase-earth air clearance for LT motors with lugs installed shall be as follow

Sl. No.	Motor MCR in KW	Clearance (in mm)
1	Up to 110 KW	10
2	Above 110 KW – Up to 150 KW	12.5
3	Above 150 KW	19

The Additional requirements as indicated above shall be taken care of along with Technical Specification No. TCI: 141/10, TCI: 140/09.

LT MOTOR DATA SHEET (Flame proof)

Name of the Project	
Purchase Enquiry /Order Number & Date	
Document Reference	
Manufacturer	

Sl. No.	Characteristics	Requirement
1	Technical Specification Number	TCI:141 Rev. 10
2	Application	
3	Manufacturer	
4	Applicable Standards	IS-325, IS-1231, IS-6362, IS-2253, IS-5572, IS-12065, IS-12075, IS/IEC 60079 (IIA & IIB), IS-12615, IS/IEC-60529 & IEC-60034 (All standards shall be as per latest versions)
5	Type of Motor	
6	Frame Size	
7	Type of Enclosure	TEFC, Flame proof as per IS/IEC-60079
8	Degree of Protection	IP-55 as per IS/IEC-60529
9	Type of Mounting	Horizontal, Foot mounted
10	Energy Efficiency Class	IE2
11	Rated Output in KW	
12	Rated Speed in RPM	
13	Rated Voltage, Frequency & Tolerance	
	a. Voltage	415 V, AC, 3 Phase, ± 10 %
	b. Frequency	50 Hz ± 5 %
	c. Combined Voltage & Frequency	10 %
14	Minimum permissible Starting voltage (% of rated voltage)	

Sl. No.	Characteristics	Requirement
15	At rated voltage & frequency	
	a. Full load current	
	b. No load current	
16	Efficiency at rated Voltage & frequency	
	a. 100 % Load	
	b. 75 % Load	
	c. 50 % Load	
17	Power factor	
	a. 100 % Load	
	b. No Load	
	c. Starting	
18	Duty Cycle	S1, Continuous
19	Starting Current	
	a. 100 % Voltage	
	b. 85% Voltage	
	c. 80% Voltage	
20	Rated Torque in kgm	
21	Minimum Accelerating Torque at min. permissible starting voltage (% of Full load Torque)	
22	Starting Torque at min. permissible starting voltage (% of Full load Torque)	
23	Pull up Torque (% of Full load Torque)	
24	Pull out Torque (% of Full load Torque)	
25	No Load Starting Time (seconds)	

Sl. No.	Characteristics	Requirement
26	Locked Rotor withstand time @ Rated Voltage	
	a. Hot (seconds)	
	b. Cold (seconds)	
27	Locked Rotor withstand time @ 110 % Rated Voltage	
	a. Hot (seconds)	
	b. Cold (seconds)	
28	Locked Rotor withstand time @ Minimum Starting Voltage	
	a. Hot (seconds)	
	b. Cold (seconds)	
29	Starting time with mechanism coupled	
	@ 110 % Rated Voltage(seconds)	
	@ 100 % Rated Voltage(seconds)	
	@ Minimum Starting Voltage(seconds)	
30	Maximum permissible starting time (seconds)	
31	Locked rotor KVA input (KVA)	
32	Locked rotor KVA/Rated KW	
33	Number of permissible successive Hot starts	
34	Stator Thermal time constant (seconds)	
35	Stator Winding connection	Delta
36	Class of Insulation and Temperature rise	Class F with temperature rise limited to Class B

Sl. No.	Characteristics	Requirement
37	Temperature rise over ambient of 50° C by resistance method	70° C by resistance method
38	Resistance per phase @ 20°C (Ω)	
39	Quantity and Power consumption of space heater (For motor ratings 30KW & above)	
40	Direction of rotation	
41	Bearing type	
	@ DE Side (Make & Model number)	
	@ NDE Side (Make & Model number)	
	Lubricant Quantity for DE and NDE side, Grade and recommended interval of lubrication	
	Anticipated bearing life in hours	
42	Type of mounting and shaft orientation	
43	Terminal box	Flame proof as per IS/IEC-60079
	a. Location	
	b. Type of Cable glands	Flame proof, Double compression, Brass with Nickel plated
	c. Cable Gland size for Power cable	Suitable for 3 Core x sq.mm.
	d. Cable Gland size for Space heater cable	Suitable for 2 Core x 2.5 sq.mm.
	e. Tinned Copper Crimping Lugs, suitable for Power Cable	6 Nos., Ring type, Solder/Crimping type, suitable for sq.mm.
	f. Connecting Metal Strips	3 Nos. to make the windings in to Delta
	g. Type of terminals	Stud type with plain washers, Spring washers and Check nuts

Sl. No.	Characteristics	Requirement
	h. Number of Terminals (Number)	6
	i. Fault level (KA at 415 V for 1 second)	
44	GD^2 of Motor in kg-m^2	
45	Total weight of Motor in kg	
46	Method of coupling with load	
47	Limiting rotor temperature for determining safe stall time	
48	Grounding pads (In Motor Body & in terminal box)	
49	Noise Level as per IS-12065	
50	Vibration at Load as per IS-12075	
51	Paint Shade	

BHARAT HEAVY ELECTRICALS LIMITED

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPALLI-620 014

CONTROLS & INSTRUMENTATION/FB

TECHNICAL SPECIFICATION FOR LT MOTORS (FLAME PROOF)

SPECIFICATION NUMBER – TCI: 141

Revision History

Rev. No.	Date	Description	Prepared	Reviewed	Approved	
					ENGG.	QA
01 to 09		Earlier Revisions	-Sd-	-Sd-	-Sd-	-Sd-
10	16-12-13	General Revisit				

Sl. No.	Characteristics	Requirement
1	Site Conditions :-	
	Altitude above MSL	1000 metre
	Ambient temperature	50°C
	Relative Humidity	100 %
	Atmosphere	Tropical, dusty, salty, corrosive and highly polluted
2	General Description	Squirrel cage type, flame proof induction motor suitable for direct on line starting through any type of breaker.
3	Applicable Standards	IS-325, IS-1231, IS-6362, IS-2253, IS-5572, IS-12065, IS-12075, IS/IEC 60079 (IIA & IIB),IS-12615, IS/IEC-60529 & IEC-60034 (All standards shall be as per latest versions)
4	Application	Light Fuel Oil (LFO), Heavy Fuel Oil (HFO) & Drain Oil Pump
5	Type of enclosure	Totally Enclosed Fan Cooled (TEFC), IP 55 as per IS/IEC 60529 & Flame proof Ex-'d' as per IS/IEC 60079.
6	Area of Classification	Suitable for Hazardous Area as per IS-5572, Gas Group-IIA/IIB with suitable temperature class as per IS/IEC 60079.
7	Duty Cycle	Continuous, S1
8	Energy Efficiency Class	IE-2 as per IS-12615/IEC 60034-30
9	Rated Voltage & Tolerance	415 V, AC, 3 Phase, ± 10 %
10	Rated Frequency & Tolerance	50 Hz ± 5 %
11	Combined voltage & frequency tolerance	10 % (absolute sum)

Sl. No.	Characteristics	Requirement
12	General Requirements	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% of motor full load torque. Pull Out torque at rated voltage shall not be less than 205% of full load torque All motors shall be so designed that maximum inrush currents, locked rotor and pull out torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
13	Class of Insulation	Class F insulation with temperature rise limited to Class B. Temperature rise of the motor shall be limited to 70 deg. C (by resistance method) over an ambient temperature of 50 deg. C
14	High speed bus transfer withstand capability	Suitable to withstand 150 % of rated voltage
15	Capacity to restart for rated voltage	i. Two successive starts from cold condition ii. Three equally spread starts per hour iii. Two hot starts in succession, with motor initially at normal running temperature.
16	Locked Rotor Condition	The ratio of Locked Rotor KVA at rated voltage to rated KW shall not exceed as indicated below (without any tolerance) For Motors of rating <110KW : 10.0
17	Starting time	For motor with starting time up to 20 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 seconds more than starting time.
		For motor with starting time more than 20 seconds but not exceeding 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 seconds more than the starting time.
		For motor with starting time more than 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be 10% more than the starting time

Sl. No.	Characteristics	Requirement
		Vendor to provide Speed switches mounted on the motor shaft in case the above requirement is not met with.
18	Type of balancing of rotor	Dynamic balancing
19	Method of cooling	IC-0411
20	Direction of cooling air flow	NDE side to DE Side
21	Winding Treatment	Winding Insulation shall be given tropical and fungicidal treatment for operation of motor in hot, humid & tropical climate. Windings shall be non-hygroscopic, oil resistant and flame resistant.
22	Starting Current	The starting current (% of FLC) shall be limited to a suitable value, as per the IS
23	Noise level	Noise level shall be limited to 85dB(A) at 1metre distance as per IS 12065
24	Vibration level	The peak amplitude of vibration shall be as per IS 12075 (Limits of Severity - Normal grade shall be followed)
25	Shaft extension	Motor shall be provided with key slotted bare shaft extension, with key at the drive end
26	Terminal box	Flame proof as per IS/IEC-60079, capable of being turned through 360° in steps of 180°. Terminal box shall have adequate space to terminate the Power cable applicable to the motor by using the suitable crimping lugs. Minimum Distance between centre of the stud and the gland plate and Minimum inter-phase/phase-earth air clearance for LT motors with lugs installed shall be provided as per the details indicated in the annexure
27	Cable Glands & Lugs	Cable entries, Cable glands and Lugs shall be provided suitable for the power cable sizes as indicated in the project specific requirement. Double Compression type, brass with nickel plated flame proof cable glands shall be supplied. Tinned Copper Lugs shall be provided.

Sl. No.	Characteristics	Requirement
28	Terminals	Separate Terminals for Windings and Space heaters with suitable connecting links shall also be supplied.
29	Earthing terminals	Shall have two earthing points on opposite sides
30	Space heater for motors rated 30 KW and above	Separate space heater suitable for 240 V AC, Single Phase supply shall be provided
31	Lifting device	Eye bolt
32	Name Plates	Motor shall have name plates as per relevant IS and in addition the following data shall be provided a) Manufacture's name, frame size, Energy Efficiency class and number b) Insulation class designation, ambient temperature and temperature rise in °C over ambient temperature at rated output c) Connection diagram shall be marked inside the terminal box
33	Quality assurance, Inspection & Testing	**For NON NTPC Projects** Motors up to 20KW- Inspection by Vendor as per relevant standards as applicable. Routine & type test reports shall be submitted for review and acceptance by BHEL For Motors > 20 KW, Inspection by BHEL/TPI as per BHEL Standard Quality Plan QA:CI:STD:QP:24. Routine & type test reports shall be submitted for review and acceptance by BHEL **For NTPC Projects** Motors up to 30KW- Inspection by Vendor as per relevant standards as applicable. Routine & type test reports shall be submitted for review and acceptance by BHEL&NTPC For Motors >30 KW and < 50 KW, Inspection by BHEL/TPI as per NTPC approved VQP/RQP. Routine & type test reports shall be submitted for review and acceptance by BHEL&NTPC For Motors > 50 KW, Inspection by BHEL/TPI &NTPC as per NTPC approved VQP/RQP. Routine & type test reports shall be submitted for review and acceptance by BHEL&NTPC For all the above cases, the type test reports submitted shall not be earlier than 5 years from the date of Purchase Enquiry

Sl. No.	Characteristics	Requirement
34	Documents (along with offer)	a. Taking care of all the requirements indicated in the technical specification & in annexure, Vendor has to submit No-deviation format. In the document, Vendor to specify the reference details of the specification/documents/drawings and should indicate as "No – Deviation". b. Filled in technical data sheet, with complete details for all the clauses, as per the format given by BHEL c. Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions
35	Documents for approval by BHEL/Customer (after placement of purchase order)	3 Sets of the following :- • Final technical Data sheet as per BHEL's format. • Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions • Motor Characteristics curves (Torque vs. Speed, Current vs. Speed, Speed vs. time, Current vs. time, Efficiency and PF vs. load, Thermal withstand characteristic) • O & M manuals
36	Packing	Shall be as per Packing procedure QA: CI: STD: PR: 03 (Latest revision) or as per manufacturer's standard practice. The packing shall meet the Transport, environment and Storage hazards