Annexure-II to purchase specification TC54014

TURBINES AND COMPRESSORS

BHEL, HYDERABAD

PRICE SCHEDULE

Enquiry ref. No: Date:

Offer ref no. Date:

Sl. No	Description	Mat Code	Qty	Unit	Unit Price (In Rupees)	Total Price (In Rupees)
01	Oil Centrifuge Assy consists of					
1.1	OIL CENTRIFUGE ASSY(T) 1600LPH, IIC IE3MOTOR	TC9754014485	10	EA		
1.2	PRESSURE GAUGES (20% (subject to minimum of 2 nos.) for each type, range, material of construction, size, rating and length of capillary); (PI at Centrifuge inlet and exhaust: 2nos each)	TC9754014620	10	SET		
1.3	TEMPERATURE GAUGES (20% (subject to minimum of 2 nos.) for each type, range, stem length and length of capillary.) (TG at Centrifuge inlet : 2nos each)	TC9754014639	10	SET		
1.4	SOLENOID VALVES 10% (subject to minimum of 2 nos.) for each type.	TC9754014736	10	SET		
1.5	PANEL MOUNTED INSTRUMENTS ; 10% (subject to minimum of 2 no.) for each type. Hooter:- 10% (subject to minimum of 2 no.) for each type Annunciators:- e) Lamps: 10% of total quantity.	TC9754014744	10	SET		
1.6	PULSATING DAMPENER, SNUBBER, SYPHON, GAUGE SAVER ETC. 20% (subject to minimum of 2 no.) for each type.	TC9754014728	5	SET		
1.7	SAFETY RELIEF VALVES: 10% (subject to minimum 1 no.) for each type	TC9754014647	5	SET		
1.8	PIPE FITTINGS, FLANGES & VALVES (5% of installed Qty or Minimum 1 No.)	TC9754014558	5	SET		
1.9	SET OF BEARINGS (NDE + DE) FOR ALL OPU MOTOR	TC9754014779	5	SET		
1.10	SET OF TERMINAL STUDS & BUSHING ASSY. FOR MOTORS	TC9754014868	5	SET		
1.11	SET OF COOLING FANS FOR ALL OPU MOTORS	TC9754014817	5	SET		
1.12	TERMINAL BLOCK (INCLUDING TERMINAL BOX COVER WITH SCREWS) FOR ALL OPU MOTORS	TC9754014825	5	SET		
1.13	SET OF COOLING FAN COVER	TC9754014833	5	SET		
1.14	SPARE FUSE OF OPU SKID	TC9754014760	3	SET		
1.15	SPARE MCB OF OPU SKID (10% of installed Qty)	TC9754014531	3	SET		
1.16	TERMINAL BLOCK FOR OPU LOCAL PANEL	TC9754014752	3	SET		

Rev. No.	Revisions	Prepared:	Reviewed:	Approved	Date
00	Issue	ANSHUL	S B Jiwtode	P D Mahulikar	23.02.2022

1.17	HOUSING INNER COVER (DE) FOR OPU MTR	TC9754014892	2	SET		
1.18	HOUSING OUTER COVER (DE) FOR MOTOR	TC9754014906	2	SET		
1.19	HOUSING INNER COVER (NDE) FOR MOTOR	TC9754014914	2	SET		
1.20	HOUSING OUTER COVER (NDE) FOR MOTOR	TC9754014922	2	SET		
1.21	CIRCLIP SETS FOR OPU MOTOR	TC9754014930	2	SET		

NOTE:
1. Sl. No 1.1 to 1.21 is to be considered for L1 price evaluation.
2. Any additional requirements, which are essential for proper functioning of Oil Centrifuge but not indicated in specification, are included in the main offer.

Vendor's Signature **Vendor's Company seal**

Annexure-II to purchase specification TC54014

TURBINES AND COMPRESSORS

BHEL, HYDERABAD

PRICE SCHEDULE

Enquiry ref. No: Date:

Offer ref no. Date:

Sl. No	Description	Mat Code	Qty	Unit	Unit Price (In Rupees)	Total Price (In Rupees)
01	Oil Centrifuge Assy consists of					
1.1	OIL CENTRIFUGE ASSY(T) 1000LPH, IIC IE3 MOTOR	TC9754014604	20	EA		
1.2	PRESSURE GAUGES (20% (subject to minimum of 2 nos.) for each type, range, material of construction, size, rating and length of capillary); (PI at Centrifuge inlet and exhaust: 2nos each)	TC9754014620	20	SET		
1.3	TEMPERATURE GAUGES (20% (subject to minimum of 2 nos.) for each type, range, stem length and length of capillary.) (TG at Centrifuge inlet : 2nos each)	TC9754014639	20	SET		
1.4	SOLENOID VALVES 10% (subject to minimum of 2 nos.) for each type.	TC9754014736	20	SET		
1.5	PANEL MOUNTED INSTRUMENTS ; 10% (subject to minimum of 2 no.) for each type. Hooter:- 10% (subject to minimum of 2 no.) for each type Annunciators:- e) Lamps: 10% of total quantity.	TC9754014744	20	SET		
1.6	PULSATING DAMPENER, SNUBBER, SYPHON, GAUGE SAVER ETC. 20% (subject to minimum of 2 no.) for each type.	TC9754014728	10	SET		
1.7	SAFETY RELIEF VALVES: 10% (subject to minimum 1 no.) for each type	TC9754014647	10	SET		
1.8	PIPE FITTINGS, FLANGES & VALVES (5% of installed Qty or Minimum 1 No.)	TC9754014558	10	SET		
1.9	SET OF BEARINGS (NDE + DE) FOR ALL OPU MOTOR	TC9754014779	10	SET		
1.10	SET OF TERMINAL STUDS & BUSHING ASSY. FOR MOTORS	TC9754014868	10	SET		
1.11	SET OF COOLING FANS FOR ALL OPU MOTORS	TC9754014817	10	SET		
1.12	TERMINAL BLOCK (INCLUDING TERMINAL BOX COVER WITH SCREWS) FOR ALL OPU MOTORS	TC9754014825	10	SET		
1.13	SET OF COOLING FAN COVER	TC9754014833	10	SET		
1.14	SPARE FUSE OF OPU SKID	TC9754014760	5	SET		
1.15	SPARE MCB OF OPU SKID (10% of installed Qty)	TC9754014531	5	SET		
1.16	TERMINAL BLOCK FOR OPU LOCAL PANEL	TC9754014752	5	SET		
1.17	HOUSING INNER COVER (DE) FOR OPU MTR	TC9754014892	5	SET		

Rev. No.	Revisions	Prepared:	Reviewed:	Approved	Date
00	Issue	ANSHUL	S B Jiwtode	P D Mahulikar	23.02.2022

1.18	HOUSING OUTER COVER (DE) FOR MOTOR	TC9754014906	5	SET		
1.19	HOUSING INNER COVER (NDE) FOR MOTOR	TC9754014914	5	SET		
1.20	HOUSING OUTER COVER (NDE) FOR MOTOR	TC9754014922	5	SET		
1.21	CIRCLIP SETS FOR OPU MOTOR	TC9754014930	5	SET		

NOTE:
1. Sl. No 1.1 to 1.21 is to be considered for L1 price evaluation.
2. Any additional requirements, which are essential for proper functioning of Oil Centrifuge but not indicated in specification, are included in the main offer.

Vendor's Signature **Vendor's Company seal**

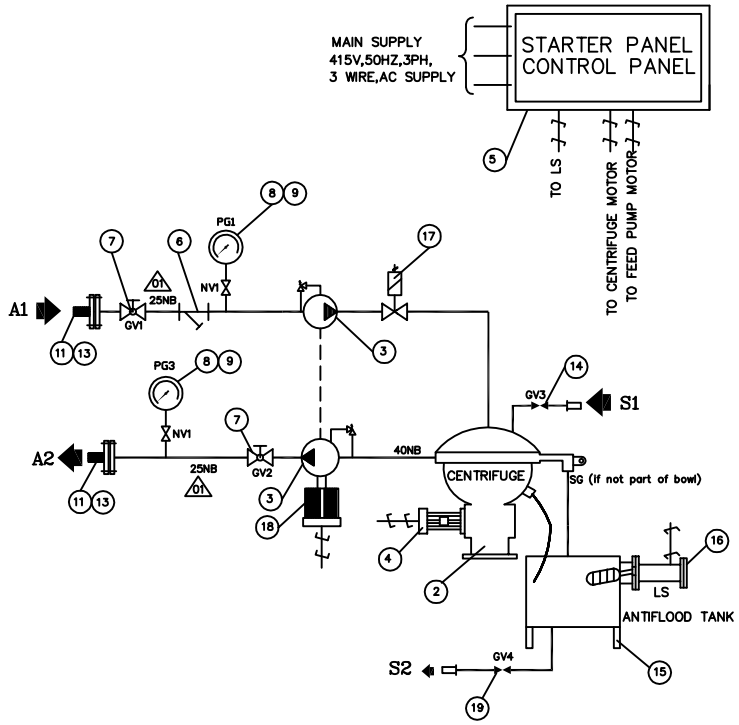
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 2-308-00-00030 SHT.1 OF 1

COMPUTER FILE NAME 2308000030-300-R00.DWG | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261



S.No	QTY	DESCRIPTION	MATL.	TAG NO.
19	2	DRAIN VALVE	CS	FG1-2
18	1	AC ELECTRIC MOTOR FOR FEED PUMP	CS	–
17	5	SOLENOID VALVE	–	PI 1-5
16	3	LEVEL SWITCH	–	TI 1-3
15	2	ANTO FLOOD TANK	–	TS2-3
14	1	WATER ADMIXXING DEVICE	–	DPS
13	1	INLET AND OUTLET FLANGE as per ANSI	–	DPG
12	1	ARMOURED CABLE 6mm2x3 core witrh Plug and socket of 20M length.	CS FAB. –	– LS1-2
11	1	Flexible SS bradded hose with inlet & outlet 1 1/2"300#	SS	SV
9		PRESSURE GAUGE 0 TO 6 KG/CM2 OF Ø150 (SS)		
8	1	VALVE FOR GAUGE ISOLATION VALVE 15NB. Needle valve	–	–
7	1	ISOLATING VALVE 25NB	TP304 TUBES	–
6		STRAINER 25NB SS. Screen Mesh		
5	1	STARTER WITH PLUG AND SOCKET	–	–
4	1	MOTOR (FLAME PROOF) FOR CENTRIFUGE B5, 1500RPM(SYN), 3 PHASE ,415V±10%,50HZ±5%COMBINED VOLTAGE & FREQ. ±10%, AC SUPPLY, IP 55, AMBIENT TEMP.50°C, INSULATION CL'F' WITH TEMP.RISE LIMITED TO CL 'B'.	–	–
3	1	FEED & DISCHARGE PUMP – BUILT ON	–	–
2	1	CENTRIFUGE WITH SS BOWL	–	–
1	1	BASE FRAME / TROLLEY TYPE (AS PER ENQUIRY)	CS FAB.	–

NOTES:

1. Integral feed & discharge pump & centrifuge are driven by common motor
2. Counter flanges with nuts,bolts & gaskets shall be provided for oil inlet & outlet by vendor
3. Flanges shall be as per ASA 150RF,B16.5 std., Material : S.S 316
4. Inter connecting pipes material shall be stainless stee: SS316l
5. Valve material–with S.S 316 Complete body.
6. All drains will have hose nipple and caps.
7. Painting – Epoxy – IS:5 – shade 631 light grey
8. System capacity – 1000 LPH of turbine lube oil of Servoprime 46
9. Booster Pump shall have a capacity 1000 LPH and 3kg/sq.cm.g. at clean oil outlet
10. 20m length of power cable will be provided with suitable Plug and socket.
11. 1" NB, SS WIRE BRADED FLEXIBLE HOSE WITH ANSI 150# AT BOTH ENDS LENGTH LENGTH OF 10M (Qty– 2 Nos.) with Gasket, Nuts, BNolts and washer.
12. All motor shall confirm to requirment of Exd, II C, IE3, T3 Class.

CONNECTIONS: –

A1 – Oil inlet(Dirty) – 25NB hose connection.
A2 – System filling conn. – 25NB hose connection.
A4 – Oil outlet(Clean) – 25NB hose connection.
A10 – Feed for liquid seal – 10NB hose connection.

W – Heater water inlet – 20NB hose connection.
WD – Heater water drain & overflow – 20NB hose connection.
HD – Heater oil drain – 20NB hose connection.
SD1 – Anti flood tank drain – 20NB hose connection.
SD2 – Anti flood tank drain – 20NB hose connection.
S1 – Sampling conn. – 15NB hose connection.
S2 – Sampling conn. – 15NB hose connection.
S3 – Sampling conn. – 15NB hose connection.

REV.	DATE	ALTERED	CHD/APPD
01	27.06.22	ALTERED ANSHUL	CHD/APPD SUNIL

ZONE: PIPE CHANGE TO 25NB FROM 40 NB
SOLENOID VALVE ADDED.
MOTOR REQUIRMENT ADDED.
PIPE CHANGE TO 25NB FROM 40 NB

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: TROLLEY TYPE FLAME PROOF–1000 LPH

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	SUNIL B J	-Sd/-	15.07.19	
CHD.	SUNIL B J	-Sd/-	15.07.19	NA
APPD.	P S V S K	-Sd/-	15.07.19	

DEPT. CODE	UNTOL. DIMS.	SCALE	WEIGHT(KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
TCBG 415	GR. F/M/F	N.T.S	N.A	NA	NA	NA

TITLE: FLOW DIAGRAM FOR OIL PURIFICATION UNIT (TROLLEY TYPE–CAPACITY 1000 LPH.)

CARD CODE: NA

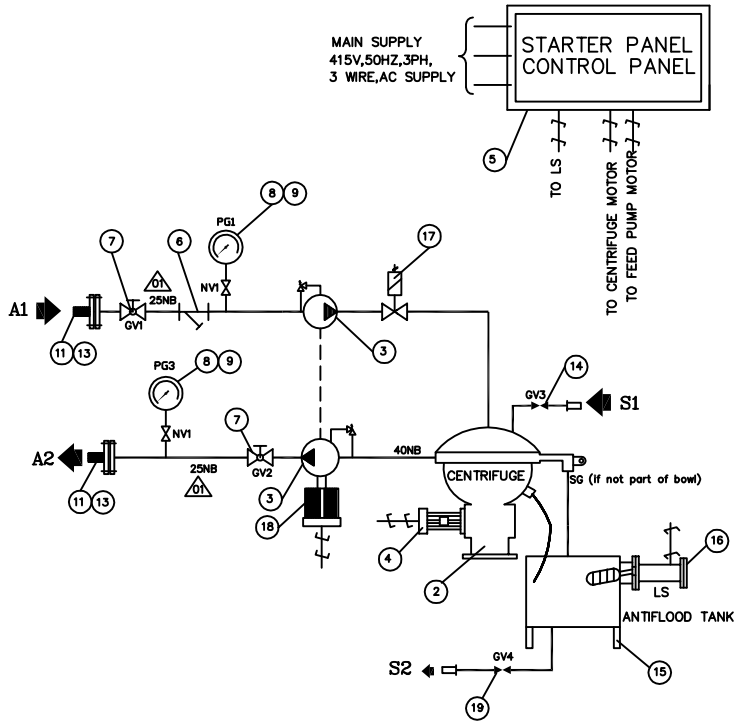
DRAWING NO. 2-308-00-00050 REV. 01

SHT. No. 1 NO. OF SHT. 1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 2-308-00-00030 SHT.1 OF 1



S.No	QTY	DESCRIPTION	MATL.	TAG NO.
19	2	DRAIN VALVE	CS	FG1-2
18	1	AC ELECTRIC MOTOR FOR FEED PUMP	CS	–
17	5	SOLENOID VALVE	–	PI 1-5
16	3	LEVEL SWITCH	–	TI 1-3
15	2	ANTO FLOOD TANK	–	TS2-3
14	1	WATER ADMIXXING DEVICE	–	DPS
13	1	INLET AND OUTLET FLANGE as per ANSI	–	DPG
12	1	ARMOURED CABLE 6mm2x3 core witrh Plug and socket of 20M length.	CS FAB. –	– LS1-2
11	1	Flexible SS bradded hose with inlet & outlet 1 1/2"300#	SS	SV
9		PRESSURE GAUGE 0 TO 6 KG/CM2 OF Ø150 (SS)		
8	1	VALVE FOR GAUGE ISOLATION VALVE 15NB. Needle valve	–	–
7	1	ISOLATING VALVE 25NB	TP304 TUBES	–
6		STRAINER 25NB SS. Screen Mesh		
5	1	STARTER WITH PLUG AND SOCKET	–	–
4	1	MOTOR (FLAME PROOF) FOR CENTRIFUGE B5, 1500RPM(SYN), 3 PHASE ,415V±10%,50HZ±5%COMBINED VOLTAGE & FREQ. ±10%, AC SUPPLY, IP 55, AMBIENT TEMP.50°C, INSULATION CL'F' WITH TEMP.RISE LIMITED TO CL 'B'.	–	–
3	1	FEED & DISCHARGE PUMP – BUILT ON	–	–
2	1	CENTRIFUGE WITH SS BOWL	–	–
1	1	BASE FRAME / TROLLEY TYPE (AS PER ENQUIRY)	CS FAB.	–

NOTES:

1. Integral feed & discharge pump & centrifuge are driven by common motor
2. Counter flanges with nuts,bolts & gaskets shall be provided for oil inlet & outlet by vendor
3. Flanges shall be as per ASA 150RF,B16.5 std., Material : S.S 316
4. Inter connecting pipes material shall be stainless stee: SS316l
5. Valve material–with S.S 316 Complete body.
6. All drains will have hose nipple and caps.
7. Painting – Epoxy – IS:5 – shade 631 light grey
8. System capacity – 1000 LPH of turbine lube oil of Servoprime 46
9. Booster Pump shall have a capacity 1000 LPH and 3kg/sq.cm.g. at clean oil outlet
10. 20m length of power cable will be provided with suitable Plug and socket.
11. 1" NB, SS WIRE BRADED FLEXIBLE HOSE WITH ANSI 150# AT BOTH ENDS LENGTH LENGTH OF 10M (Qty– 2 Nos.) with Gasket, Nuts, BNolts and washer.
12. All motor shall confirm to requirment of Exd, II C, IE3, T3 Class.

CONNECTIONS: –

A1 – Oil inlet(Dirty) – 25NB hose connection.
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SD1 – Anti flood tank drain – 20NB hose connection.
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S1 – Sampling conn. – 15NB hose connection.
S2 – Sampling conn. – 15NB hose connection.
S3 – Sampling conn. – 15NB hose connection.

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

COMPUTER FILE NAME 2308000030-300-R00.DWG | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

REV.	DATE	ALTERED	CHD/APPD
01	27.06.22	ALTERED ANSHUL	CHD/APPD SUNIL

ZONE: PIPE CHANGE TO 25NB FROM 40 NB SOLENOID VALVE ADDED. MOTOR REQUIRMENT ADDED. PIPE CHANGE TO 25NB FROM 40 NB

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: TROLLEY TYPE FLAME PROOF–1600 LPH

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	SUNIL B J	-Sd/-	15.07.19	
CHD.	SUNIL B J	-Sd/-	15.07.19	NA
APPD.	P S V S K	-Sd/-	15.07.19	

DEPT. CODE: TCBG 415 | UNTOL. DIMS. GR.: F/M/F | SCALE: N.T.S | WEIGHT(KG): N.A | REF. TO ASSY. DRG.: NA | ITEM NO.: NA | NO.OF ITEMS: NA

TITLE: FLOW DIAGRAM FOR OIL PURIFICATION UNIT (TROLLEY TYPE–CAPACITY 1600 LPH.)

CARD CODE: NA

DRAWING NO. 2-308-00-00050 REV. 01

SHT. No. 1 NO. OF SHT. 1

1.0 In case of any conflict between BHEL spec TC 54014 Rev 10 and other enquiry documents, the following preferential order shall govern.

1.1 BHEL Specification TC54014 Rev 10

1.2 Annexures to purchase specification TC54014 Rev 10, TC54373 Rev 04 & TC54197 Rev 11

1.3 International standards/codes/recommended practices as applicable.

2.0 The following are to be considered by vendor before offer:

2.1 Compliance with this specification shall not relieve the vendor of the responsibility of furnishing equipment and auxiliaries of proper design, materials and workmanship to meet the specified operating conditions considering the above specification / data sheets.

2.2 All the Equipment's shall be packed for an outdoor storage period of 12 Months.

2.3 Customer drawing, Spare part and document numbers will be informed after placement of order.

2.4 All brought out material shall be procured from approved vendor list (Refer Annex-III).

2.5 All SS and Alloy Steel Material shall be PMI tested.

2.6 Vendor shall submit the valid PESO/CCOE certificate for the applicable instruments.

2.8. All solenoid valves shall be intrinsic safe type and certified for use in specified hazardous area. Solenoid Valves shall be SIL-3 certified as minimum.
Solenoid valves shall be universal type and shall be continuous rated type with class H coil insulation. Solenoid valve shall be of SS body with SS 316 trim, as a minimum.
Positioners with inbuilt Solenoid valves shall not be considered.
Atmospheric vents shall be fitted with SS/Brass bug screens, to prevent blockage of port because of bugs and to save the port from dust.
Solenoid valve shall be explosion proof with area of classification ZONE 1 GAS GR IIC, T3 type and shall be as per IEC 60085/IS1271. Vendor shall submit the CCOE & PESO certificate for the same.

2.2 Electrical Area classification: Zone 2, Gas Group IIC, Temp class T3

2.3 Instrumentation Area classification: Zone 1, Gas Group IIA/IIB, Temp class T3; Junction Boxes shall be flameproof with Ex'd' certification

1.4 The make of all the items including instruments & solenoid valve shall be as per Project supplier list as per Annex-III.

2.7 **PLC shall be SIL-3 certified.**

2.8 Noise level of the complete package shall be restricted within 85 dBA at any point located 1 m away from the equipment. If the noise level exceeds the specified value, necessary modifications to meet the noise level criteria, shall be provided by the vendor without any cost/time implications.

2.9 Vendor to provide trolley mounted Centrifuge with flame proof motors and their flameproof starters (complete with all protection, controls and indication etc.) suitable for use in Zone-2, Gas group IIC, Temp class T3, with 30 meters of armored copper conductor trailing cable.

2.10 Electrics for each portable trolley mounted motors, vendor shall supply following

- 415V, 16A TPN receptacles with plug (flameproof) and socket.
- Motor starter (flameproof)

Rev. No.	Revisions	Prepared:	Reviewed:	Approved	Date
00	Issue	S B Jiwtode	S B Jiwtode	P D Mahulikar	19.05.2021

2.11 The trolley mounted pumps shall be complete with integral starters; connection between motor & starter shall be through armored copper conductor cable and shall have motor protections, other hardware such as switch, fuse, contactor and BMR etc.

2.12 MV motors with starter and associated flexible cabling between FLP 415V, 16A TPN receptacle, motor starter and motor for trolley mounted pumps shall be provided.

2.13 For motors and heaters etc. controls shall be provided in the Local Control Panel (LCP)/ individual local control station (LCS), as applicable.

2.14 Following facilities shall be provided as a minimum on LCP/LCS:
i) Start/Stop push buttons for all motors/heaters
ii) Ammeters for all motors rated above 5.5 kW.
iii) L-O-R (Local-Off-Remote) Selector switches as required.
iv) Speed raise/lower for VFD fed motor
v) Motor running indication

2.15 Vendor shall supply cable glands (Double compression type nickel-plated brass flameproof) and tinned Cu (Cable size up to 16 mm2) /Al (Cable size greater than 16 $mm_{2)}$ crimping type lugs for equipment supplied by them.

2.16 All nuts and bolts shall be of SS304.

2.17 All electrical equipment for use in hazardous areas shall be certified by CIMFR, PTB, Baseefa, UL, FM or equivalent independent testing agency for the service and the area in which it can be used and shall be approved by PESO/CCOE. Copies of Hazardous area test certificates & PESO/CCOE approval shall be furnished.

2.18 All cable glands/adapters/blocking plugs for hazardous area equipment shall meet the requirement of IS/IEC: 60079-0.

2.19 All motors shall be provided with GI canopy.

2.20 The preliminary Power cable size is 2.5 mm2 (CU), Final cable sizes of power Cable shall be finalized during detailed engineering.

2.21 Provisions, as required in motor/Motor terminal box for termination of the final cable size (higher than 2.5 mm2 (CU) shall be made accordingly without any cost & time implications.

2.22 The Motors shall be Ex (d), Zone 2, Gas group IIC Temp class T3, IE3 class efficiency.

2.23 PMI for Centrifuge and AC Motor shall be considered/carried out as per project PMI Specification attached.

2.24 Fans for motor shall be of an anti-static non sparking material and shall not be with plastic material.

2.25 Equipment earthing shall be done at 2 points and both earth connections shall be brought to skid inbuilt earth plate by means of 10mm (3/8") dia G.I wire rope, the same shall be supplied along with motor.

2.26 Vendor to provide suitable flameproof motor starter used in Zone 2, Gas group IIC, Temp class T3 with 20 metres of armoured copper conductor trailing cable with plug.

2.27 **Hose storage wheel shall be provided.**

2.28 **Unit shall be supplied with Plug and socket suitable for specified area of classification.**

Material shall be guaranteed for Material, Quality and Workmanship for a period of 18 months from the data of commissioning of plant or 24 months from the date of last dispatch whichever is earlier.

Therefore, the above clause is applicable in place of clause 8.2.0 of TC64514.

2.0 Scope of supply:

Please refer Annexure-IV for price schedule

3.0 Requirement of services from vendor during functional testing and commissioning activity at Site.

3.1 Two-day stay at Site including to and fro charges & accommodation (If required)

3.2 Charges for additional stay per day at Site other than above (If required)

4.0 Enclosures:

4.1 BHEL Specification TC54014 Rev 10

4.2 BHEL Specification TC54373 and TC54197.

4.3 Annexures to purchase specification TC54014 Rev 10, TC54370 Rev 04 & TC54197 Rev 11

4.4 SQP for Purification skid

4.5 PQC-TC54033

4.6 Annex-II-Price schedule

4.7 Annex-III-Applicable vendor list for sub-vendor items.

1.1 PUMP

	2.118 PUMP - ROTARY GEAR API 676		
1		ALLWEILER INDIA PRIVATE LIMITED	INDIA
2		DEL PD PUMPS & GEARS PVT LTD	INDIA
3		FLOWSERVE CORPORATION	USA
4		MAAG PUMPS SYSTEMS AG	SWITZERLAND
5		SHIMADZU CORPORATION	JAPAN
6		VIKING PUMP INC	USA

1.2 MOTOR

	5.112 MOTOR - INDUCTION MV (ZONE 2 TYPE E & N, FLP/PRESSURIZED)		
1		ABB INDIA LTD	INDIA
2		BHARAT BIJLEE LTD	INDIA
3		CG POWER & INDUSTRIAL SOLUTIONS LTD	INDIA
4		KIRLOSKAR ELECTRIC CO LTD	INDIA
5		LAXMI HYDRAULICS PVT LTD	INDIA
6		MARATHON ELECTRIC MOTOR INDIA LTD	INDIA
7		TMEIC INDUSTRIAL SYSTEMS INDIA PVT LTD	INDIA
8		WEG INDUSTRIES INDIA PVT LTD	INDIA

1.3 CONTROL PANEL/ STATION

	5.120 CONTROL STATIONS - FLAME PROOF		
1		BALIGA LIGHTING EQUIPMENTS PVT LTD	INDIA
2		FCG FLAMPROOF CONTROL GEARS PVT LTD	INDIA
3		FCG POWER INDUSTRIES PVT LTD	INDIA
4		FLAMEPROOF EQUIPMENTS PVT.LTD	INDIA
5		FLEXPRO ELECTRICALS PVT LTD	INDIA
6		KAYSONS TECHNO EQUIPMENTS PVT LTD	INDIA
7		SUDHIR SWITCH GEARS PVT LTD	INDIA

1.4 PLUG / SOCKET & HANDLAMPS

	5.127 PLUGS/ SOCKETS/ HANDLAMPS (FLAME PROOF)		
1		BALIGA LIGHTING EQUIPMENTS PVT LTD	INDIA
2		FCG FLAMPROOF CONTROL GEARS PVT LTD	INDIA
3		FCG POWER INDUSTRIES PVT LTD	INDIA
4		FLAMEPROOF EQUIPMENTS PVT LTD	INDIA
5		FLEXPRO ELECTRICALS PVT LTD	INDIA
6		KAYSONS TECHNO EQUIPMENT PVT LTD	INDIA
7		SUDHIR SWITCHGEARS PVT LTD	INDIA
8		R.STAHL PVT LTD	INDIA

1.5 POWER CABLES-

	5.130 MEDIUM VOLTAGE POWER CABLES - XLPE & PVC FRLS		
1		ASSOCIATED FLEXIBLES & WIRES PVT LTD	INDIA
2		CORDS CABLE INDUSTRIES LTD	INDIA
3		FINOLEX CABLES LTD	INDIA
4		GEMSCAB INDUSTRIES LTD	INDIA
5		HAVELLS INDIA LTD	INDIA
6		KEC INTERNATIONAL LTD	INDIA
7		KEI INDUSTRIES LIMITED	INDIA
8		POLYCAB WIRES LTD (FORMERELY POLYCAB WIRES PVT LTD)	INDIA
9		RALLISON ELECTRICALS PVT LTD	INDIA
10		RAVIN CABLES PVT LTD	INDIA
11		SRIRAM CABLES PVT LTD	INDIA
12		TORRENT CABLES LTD	INDIA
13		UNIVERSAL CABLES LTD	INDIA

1.6 CONTROL CABLE

	5.132 CONTROL CABLES - XLPE & PVC FRLS		
1		ASSOCIATED CABLES PVT LTD	INDIA
2		ASSOSCIATED FLEXIBLES & WIRES PVT LTD	INDIA
3		CMI LIMITED	INDIA
4		CORDS CABLE INDUSTRIES LTD	INDIA
5		ELKAY TELELINKS LTD	INDIA
6		FINOLEX CABLES LTD	INDIA
7		GEMSCAB INDUSTRIES LTD	INDIA
8		HAVELLS INDIA LTD	INDIA
9		ICON CABLE LTD	INDIA
10		KEC INTERNATIONAL LTD	INDIA
11		KEI INDUSTRIES LIMITED	INDIA
12		NORTH EASTERN CABLES PVT LTD	INDIA
13		POLYCAB WIRES LTD (FORMERELY POLYCAB WIRES PVT LTD)	INDIA
14		RALLISON ELECTRICALS PVT LTD	INDIA
15		RAVIN CABLES PVT LTD	INDIA
16		SRIRAM CABLES PVT LTD	INDIA
17		SUYOG ELECTRICALS LTD	INDIA
18		THERMO CABLES LTD	INDIA
19		TORRENT POWER LIMITED (CABLES UNIT)	INDIA

SL No	Category	Vendor Name	Country
20		UNIVERSAL CABLES LTD	INDIA
21		SHRIRAM TELELINK	INDIA
22		DELTON CABLES	INDIA

1.7 CABLE GLANDS

	5.135 CABLE GLANDS (FOR HAZARDOUS AREA)		
1		BALIGA LIGHTING EQUIPMENTS PVT LTD	INDIA
2		COMET BRASS PRODUCTS	INDIA
3		FCG FLAMPROOF CONTROL GEARS PVT LTD	INDIA
4		FCG POWER INDUSTRIES PVT LTD	INDIA
5		FLAMEPROOF EQUIPMENTS PVT LTD	INDIA
6		FLEXPRO ELECTRICALS PVT LTD	INDIA
7		KAYSONS TECHNO EQUIPMENTS PVT LTD	INDIA
8		STANDARD METAL INDUSTRIES	INDIA
9		R.STAHL PVT LTD	INDIA
10		SUDHIR SWITCH GEARS PVT LTD	INDIA

1.8 MCB/MCCB/FUSES

	5.137 MCB		
1		ABB INDIA LTD	INDIA

MASTER SUPPLIER LIST

Numaligarh Refinery Expansion Project

SL No	Category	Vendor Name	Country
2		C & S ELECTRIC LTD	INDIA
3		LARSEN & TOUBRO LTD	INDIA
4		LEGRAND INDIA PVT LTD	INDIA
5		NOVATEUR ELECTRICAL & DIGITAL SYSTEMS PVT LTD	INDIA
6		SCHNEIDER ELECTRIC INDIA PVT LTD	INDIA
7		SIEMENS LIMITED	INDIA
8		STANDARD ELECTRICALS LTD	INDIA
	5.138 MCCB		
1		ABB INDIA LTD	INDIA
2		GE T&D INDIA LIMITED	INDIA
3		LARSEN & TOUBRO LTD	INDIA
4		SCHNEIDER ELECTRIC INDIA PVT LTD	INDIA
5		SIEMENS LIMITED	INDIA
	5.139 FUSES		
1		COOPER BUSSMAN INDIA PVT LTD	INDIA
2		GE T&D INDIA LIMITED	INDIA
3		LARSEN & TOUBRO LTD	INDIA
4		NOVATEUR ELECTRICAL & DIGITAL SYSTEMS PVT LTD	INDIA
5		SCHNEIDER ELECTRIC INDIA PVT LTD	INDIA
6		SIEMENS LIMITED	INDIA

1.9 LEVEL SWITCH

	6.117 MAGNETIC LEVEL INSTRUMENTS		
1		ABB INDIA LTD	INDIA
2		BLISS ANAND PVT LTD	INDIA
3		CESARE BONNETTI INDIA PVT LTD	INDIA
4		CHEMTROLS SAMIL (INDIA) PVT LTD	INDIA
5		GAUGES BOURDON (I) PVT LTD	INDIA
6		LEVCON INSTRUMENT PVT LTD	INDIA
7		PRATOLINA INSTRUMENTS PVT LTD	INDIA
8		SHRIDHAN AUTOMATION PVT LTD	INDIA
9		TECHNOMATIC INDIA PVT LTD	INDIA

SL No	Category	Vendor Name	Country
10		PUNE TECHTROL PVT LTD	INDIA

1.10 CONTROL PANEL, CABINET & ACCESORIES

	6.205 CONTROL PANEL, CABINET & ACCESSORIES (RELAYS, SWITCH, LAMP, FAN, TERMINALS, PSU, PUSHBUTTON, MCB, METERS, TEMP.CONVERTER)		
1		ABB INDIA LTD (MCB)	INDIA
2		HAVELLS INDIA LTD (MCB)	INDIA
3		JYOTI LIMITED (RELAY)	INDIA
4		LARSEN & TOUBRO LTD (MCB)	INDIA
5		LARSEN & TOUBRO LTD.(CONTROL&AUTOMATION (LAMP, PUSH BUTTON)	INDIA
6		OMRON CORPORATION (RELAY)	INDIA
7		PEPPERL + FUCHS (SWITCH & RELAY)	INDIA
8		PHOENIX CONTACT INDIA PVT LTD (TERMINALS & POWER SUPPLY UNIT-QUINT MODEL)	INDIA
9		PYROTECH ELECTRONICS PVT LTD	INDIA

SL No	Category	Vendor Name	Country
10		RADHA KRISHNA CONTROLS	INDIA
11		RITTAL	INDIA
12		ROCKWELL AUTOMATION INDIA LTD (RELAYS)	INDIA
13		SCHNEIDER ELECTRIC INDIA PVT LTD (MCB)	INDIA
14		SIEMENS LIMITED (MCB)	INDIA

1.11 PRESSURE GAUGE

	6.128 PRESSURE GAUGE		
1		AN INSTRUMENTS PVT LTD	INDIA
2		BAUMER TECHNOLOGIES INDIA PVT LTD	INDIA
3		THERMAL INSTRUMENT INDIA PVT LTD	INDIA
4		GOA INSTRUMENTS INDUSTRIES PVT LTD	INDIA
5		H.GURU INSTRUMENTS (SOUTH INDIA) PVT LTD	INDIA
6		MANOMETER (INDIA) PVT LTD	INDIA
7		PRECISION MASS PRODUCTS PVT LTD	INDIA
8		WIKA INSTRUMENTS INDIA PVT LTD	INDIA
9		GOA THERMOSTATIC INSTRUMENTS PVT LTD	INDIA
10		WALCHANDNAGAR INDUSTRIES LTD	INDIA
11		GAUGES BOURDON (I) PVT LTD	INDIA

1.12 TEMP GAUGE

	6.131 TEMPERATURE GAUGES (BI METALLIC, FILLED SYSTEM)		
1		AN INSTRUMENTS PVT LTD	INDIA
2		BAUMER TECHNOLOGIES INDIA PVT LTD	INDIA
3		THERMAL INSTRUMENT INDIA PVT LTD	INDIA
4		GOA INSTRUMENTS INDUSTRIES PVT LTD	INDIA
5		H.GURU INSTRUMENTS (SOUTH INDIA) PVT LTD	INDIA
6		PRECISION MASS PRODUCTS PVT LTD	INDIA
7		WIKA INSTRUMENTS INDIA PVT LTD	INDIA
8		PYRO ELECTRIC INSTRUMENTS GOA PVT LTD	INDIA
9		GAUGES BOURDON (I) PVT LTD	INDIA

1.13 SOLENOID VALVE

	6.140 SOLENOID VALVES		
1		ASCO NUMATICS INDIA PVT LIMITED	INDIA
2		AVCON CONTROLS PVT LTD	INDIA

SL No	Category	Vendor Name	Country
3		IMI CRITICAL ENGINEERING (HERION WERKE)	INDIA
4		ROTEX AUTOMATION LTD	INDIA
5		SCHRADER DUNCAN LIMITED	INDIA

1.14 PRESSURE RELIEF VALVE

	6.141 PRESSURE RELIEF VALVE		
1		ANDERSON GREENWOOD CROSBY SANMAR LTD	INDIA
2		BHARAT HEAVY ELECTRICALS LTD (TRICHY)	INDIA
3		DARLING MUESCO INDIA PVT LTD	INDIA
4		FAINGER LESER VALVES PVT LTD	INDIA
5		GE OIL & GAS INDIA PVT LTD	INDIA
6		TRILLIUM FLOW TECHNOLOGIES PVT LTD (FORMERLY WEIR BDK VALVES)	INDIA
7		UNI KLINGER LTD	INDIA
8		BLISS ANAND PVT LTD	INDIA

1.15 SS HOSES

	4.107 HOSE METALLIC FLEXIBLE - SS		
1		BENGAL INDUSTRIES PVT LTD	INDIA
2		DEWAS HYDROQUIP PVT LTD	INDIA
3		GAYTRI INDUSTRIAL CORPORATION	INDIA
4		HELIFLEX HYDRAULICS & ENGG CO	INDIA
5		INDIA FLEX INDUSTRIES PVT LTD	INDIA
6		INSAP ENGINEERS PVT LTD	INDIA
7		QUALITY FOILS (INDIA) PVT LTD	INDIA
8		RM APPLIED ENGINEERS	INDIA

SL No	Category	Vendor Name	Country
9		SENIOR INDIA PVT LTD	INDIA

1.16 STRAINER

	4.113 STRAINERS (FAB/CAST/FORGED)		
1		BOMBAY CHEMICAL EQUIPMENTS	INDIA
2		ESCO STEAMCON PVT LTD	INDIA
3		FORBES MARSHALL STEAM SYSTEMS PVT LTD	INDIA
4		GRAND PRIX ENGINEERING PVT LTD	INDIA
5		GUJRAT OTO FILT	INDIA
6		LEADER VALVES LTD	INDIA
7		MULTITEX FILTRATION ENGINEERS PVT LTD	INDIA
8		PENNANT ENGINEERING PVT LTD	INDIA
9		SUNGOV ENGINEERING PVT LTD	INDIA

1.17 CHECK VALVE FORGED

	4.121 VALVE CHECK FORGED		
1		ASSOCIATED TOOLINGS INDIA PVT LTD	INDIA
2		AUTOCAP INDUSTRIES	INDIA
3		AV VALVES LIMITED	INDIA
4		CESARE BONETI INTERNATIONAL PVT LTD	INDIA
5		FLUIDLINE VALVES CO PVT LTD	INDIA
6		GM ENGINEERING PVT LTD	INDIA
7		HAWA ENGINEERS LTD	INDIA
8		INTERVALVE POONAWALLA LTD	INDIA
9		KSB PUMPS LTD (COIMBATORE)	INDIA
10		L & T VALVES LIMITED	INDIA
11		LEADER VALVES LTD	INDIA
12		MICON ENGINEERS (HUBLI) PVT LTD	INDIA
13		NITON VALVE INDUSTRIES PRIVATE LTD	INDIA
14		NSSL LTD (NECO SCHUBERT & SALZER LTD)	INDIA
15		OSWAL INDUSTRIES LTD	INDIA
16		PANCHVATI VALVES & FLANGES PVT LTD	INDIA
17		PEE INDUSTRIAL VALVES PVT LTD	INDIA
18		SHALIMAR VALVES PVT LTD	INDIA
19		STEEL STRONG VALVES INDIA PVT LTD	INDIA
20		TRILLIUM FLOW TECHNOLOGIES PVT LTD (FORMERLY WEIR BDK VALVES)	INDIA
21		VELAN VALVES INDIA PVT LTD	INDIA

1.18 GLOBE VALVE FORGED

SL No	Category	Vendor Name	Country
	4.122 VALVE GLOBE FORGED		
1		ASSOCIATED TOOLINGS INDIA PVT LTD	INDIA
2		AUTOCAP INDUSTRIES	INDIA
3		AV VALVES LIMITED	INDIA
4		CESARE BONETI INTERNATIONAL PVT LTD	INDIA
5		FLUIDLINE VALVES CO PVT LTD	INDIA
6		GM ENGINEERING PVT LTD	INDIA
7		HAWA ENGINEERS LTD	INDIA
8		INTERVALVE POONAWALLA LTD	INDIA
9		KSB PUMPS LTD (COIMBATORE)	INDIA
10		L & T VALVES LIMITED	INDIA
11		LEADER VALVES LTD	INDIA
12		MICON ENGINEERS (HUBLI) PVT LTD	INDIA
13		NITON VALVE INDUSTRIES PRIVATE LTD	INDIA
14		OSWAL INDUSTRIES LTD	INDIA
15		PANCHAVATI VALVES & FLANGES PVT LTD	INDIA
16		PEE INDUSTRIAL VALVES PVT LTD	INDIA
17		SHALIMAR VALVES PVT LTD	INDIA
18		STEEL STRONG VALVE INDIA PVT LTD	INDIA
19		TRILLIUM FLOW TECHNOLOGIES PVT LTD (FORMERLY WEIR BDK VALVES)	INDIA
20		VELAN VALVES INDIA PVT LTD	INDIA
	4.123 VALVE GATE FORGED		
1		ASSOCIATED TOOLINGS INDIA PVT LTD	INDIA

1.19 BALL VALVE

	4.133 VALVE BALL NON FIRE SAFE (CAST STAINLESS STEEL)		
1		AMPO VALVES INDIA PVT LTD	INDIA
2		ANAND TEKNOW AIDS ENGINEERING INDIA LTD	INDIA
3		BELGAUM AQUA VALVES PVT LTD	INDIA
4		BRAY CONTROLS INDIA PVT LTD	INDIA
5		DELVAL FLOW CONTROLS PVT LTD	INDIA
6		DEMBLA VALVES LTD	INDIA
7		EMERSON PROCESS MANAGEMENT (INDIA) PVT LTD	INDIA
8		FLOWCHEM INDUSTRIES	INDIA
9		GM ENGINEERING PVT LTD	INDIA
10		HAWA ENGINEERS LTD	INDIA
11		INTERVALVE POONAWALLA LTD	INDIA
12		L & T VALVES LIMITED	INDIA
13		LEADER VALVES LTD	INDIA
14		MEVADA ENGINEERING WORKS PVT LTD	INDIA
15		MICON ENGINEERS (HUBLI) PVT LTD	INDIA
16		MICROFINISH VALVES PVT LTD	INDIA
17		NELES INDIA PVT LTD (FORMERLY ROTEX MANUFACTURERS & ENGINEERS PVT LTD)	INDIA
18		NITON VALVE INDUSTRIES PVT LTD	INDIA
19		NSSL LTD (NECO SCHUBERT & SALZER LTD)	INDIA
20		OSWAL INDUSTRIES LTD	INDIA

SL No	Category	Vendor Name	Country
21		PETRO VALVES PVT LTD	INDIA
22		REYNOLD VALVES LTD	INDIA

1.20 PIPE

	4.181 PIPE/TUBE - SS (SEAMLESS & WELDED) TO ASTM STANDARDS		
1		APEX TUBES PVT LTD	INDIA
2		ARVIND PIPES & FITTINGS IND PVT LTD	INDIA
3		ASR MET TECH PVT LTD	INDIA
4		BHANDARI FOILS AND TUBES LTD	INDIA
5		CHANDAN STEEL LTD	INDIA
6		DIVINE TUBES PVT LTD	INDIA
7		HEAVY METAL & TUBES LTD	INDIA
8		HELLIOS TUBE ALLOYS PVT LTD	INDIA
9		JINDAL QUALITY TUBULAR LTD	INDIA
10		JINDAL SAW LTD	INDIA
11		KRYSTAL STEEL MFG PVT LTD	INDIA
12		MAXIM TUBES COMPANY PVT LTD	INDIA

SL No	Category	Vendor Name	Country
13		MBM TUBES PVT LTD	INDIA
14		PARAS BHAVANI STEEL PVT LTD	INDIA
15		PATELS AIRFLOW LTD	INDIA
16		PRAKASH STEELAGE LTD	INDIA
17		RATNADEEP METAL TUBES LTD	INDIA
18		RATNAMANI METALS AND TUBES LTD	INDIA
19		REMI EDELSTAHL TUBULARS LTD	INDIA
20		SANDVIK ASIA PVT LTD (AHMEDABAD)	INDIA
21		SCODA TUBES LTD	INDIA
22		SCORODITE STAINLESS PVT LTD	INDIA
23		SHALCO INDUSTRIES PVT LTD	INDIA
24		SHUBHLAXMI METALS AND TUBES PVT LTD	INDIA
25		SLS TUBES PVT LTD	INDIA
26		STEAMLINE INDUSTRIES LTD	INDIA
27		SURAJ LIMITED	INDIA

1.21 FLANGE

	4.173 FLANGE - STAINLESS STEEL		
1		ANANDMAYEE FORGINGS PVT LTD	INDIA
2		BHARAT FORGE LTD	INDIA
3		BRITEX ENGINEERING WORKS	INDIA
4		CD INDUSTRIES (PROP KISAAN ENGINEERING WORKS PVT LTD)	INDIA
5		CHANDAN STEEL LTD	INDIA
6		CHW FORGE PVT LTD (FORMERLY CHAUDHRY HAMMER)	INDIA
7		ECHJAY INDUSTRIES PVT LTD (RAJKOT)	INDIA
8		FIVEBROS FORGINGS PVT LTD	INDIA
9		GOOD LUCK ENGINEERING CO	INDIA
10		HILTON METAL FORGING LTD	INDIA
11		JAV FORGINGS & ENGINEERINGS PVT LTD	INDIA
12		JAV FORGINGS PVT LTD	INDIA

SL No	Category	Vendor Name	Country
13		KISAAN DIETECH PVT LTD	INDIA
14		KISAAN STEEL PVT LTD	INDIA
15		KUNJ FORGINGS PVT LTD	INDIA
16		LAL METAL FORGE LTD	INDIA
17		MAASS FLANGE INDIA PVT LTD	INDIA
18		METAL FORGINGS PVT LTD	INDIA
19		P K TUBES & FITTINGS PVT LTD	INDIA
20		PARAMOUNT FORGE	INDIA
21		PRADEEP METAL LTD	INDIA
22		R D FORGE	INDIA
23		SANGHVI FORGINGS & ENGINEERING LTD	INDIA
24		UTSAH ENGINEERING PVT LTD (A CD ENGG COMPANY)	INDIA
25		VIRAJ PROFILES LTD	INDIA

1.22 PIPE & TUBE FITTINGS

	4.196 FITTINGS FROM SEAMLESS PIPE – STAINLESS STEEL		
1		CSA FITTINGS	INDIA
2		DEE DEVELOPMENT ENGINEERS LTD	INDIA
3		FITTECH INDUSTRIES PVT LTD	INDIA
4		GAYATRI FORGE PVT LTD	INDIA
5		INTERTECH FITTINGS INDIA PVT LTD	INDIA
6		K.S PIPE FITTINGS PVT LTD	INDIA
7		M.S. FITTINGS MFG CO PVT LTD	INDIA
8		MAXELL FORGE INDUSTRIES	INDIA
9		P.K.TUBES & FITTINGS PVT LTD	INDIA
10		PETRO CHEM INDUSTRIES	INDIA
11		SAWAN ENGINEERS PVT LTD	INDIA
12		SIDDHARTH & GAUTAM ENGINEERS PVT LTD	INDIA
13		TEEKAY TUBES PVT LTD	INDIA
14		TOPAZ PIPING INDUSTRIES	INDIA
15		TUBE BEND (CALCUTTA) PVT LTD	INDIA
16		TUBE TURN (INDIA) PVT LTD	INDIA

BHARAT HEAVY ELECTRICALS LIMITED **R.C.PURAM, HYDERABAD**	**STANDARD QUALITY PLAN FOR VENDOR ITEMS** **ITEM:** OIL PURIFICATION UNIT **BHEL SPEC:** TC54014, TC54017, TC54216, TC54217, TC54367	**QP. NO:** HYQA/STD QP/TC/1213/07 **Rev. No. :** 03 **DATE:** 16.03.2021 **VALID UPTO:** 15.03.23	**PAGE 1 OF 6**

Sl No	Component & Operations	Characteristics	Class	Type Of Check	Quantum Of Check	Ref Document	Acceptance Norms	Format Of Record	* D	Agency P	Agency W	Agency V	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
1.01	Base Plate/ Frmae	Chemical Mechanical	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
1.02	Centrifuge Bowl	Material Conformity	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC/COC	√	2		1	
	Bowl Balancing	Balancing Test	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC/COC	√	2		1	
	Bowl Spindle	UT	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC/COC	√	2		1	
1.03	Control Wiring & Power Cables	Make, Size, Material, Functional	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
1.04	Polishing Filter	Make, Size, Material, Functional	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
1.05	Piping, Fitting Flanges	Mechanical Chemical properties	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
1.06	Indirect type oil heater	Make, Size, Material, Functional	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
1.07	Instruments (Level Switch, Solenoid Valve, Pressure gauge, Pressure Switch thermometer, thermostat, Differential Pressure indicator, Switch, flow meter etc.)	Calibration Performance	Major	Measurement	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	

LEGEND:
P: - PERFORM, W: - WITNESS , V: - VERFICATION,
INDICATING 1: - BHEL / BHEL NOMMNATED INSPECTION AGENCY, 2: - VENDOR / SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTICS UNDER THE COLUMNS P, W & V.
* D: RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.

PREPARED BY	REVIEWED BY	APPROVED BY
Sachin Katiyar Sr. Engineer / QA	B. Ashok Kumar AGM/QA	B. Ashok Kumar AGM/QA

Sl No	Component & Operations	Characteristics	Class	Type Of Check	Quantum Of Check	Ref Document	Acceptance Norms	Format Of Record	* D	Agency P	Agency W	Agency V	Remarks
1.08	Strainer	Make, Size, Material, Leak Tightness Functional	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
1.09	Valves	Make, Size, Material, Leak Tightness Functional	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
1.10	Flexible hose	Make, Size, Material, Leak Tightness	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
1.11	Anti-Flood Tank	Make, Size, Material, Leak Tightness	Major	Review	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
1.12	Pumps with AC Motor	Routine test	Major	Mechanical	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
		Type test	Minor	Elect. test	Sample			TC	√	2		1	
		Statutory requirement of Flame proof / Explosion proof for the motor & Starter	Major	Type test certificates with respect to area classification.	Type test			Type test certificates (certified by approving authorities)	√	2		1	
1.13	Drive Motor	Routine test	Major	Elect. test	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
		Type test	Minor	Elect. test	Sample			TC	√	2		1	
		Energy Efficiency	Major	Type Tests	Sample			TC	√	2		1	
		Statutory requirement of Flame proof / Explosion proof for the motor & Starter	Major	Type test certificates with respect to area classification.	Type test			Type test certificates (certified by approving authorities)	√	2		1	

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PREPARED BY	REVIEWED BY	APPROVED BY
Sachin Katiyar Sr. Engineer / QA	B. Ashok Kumar AGM/QA	B. Ashok Kumar AGM/QA

BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD	STANDARD QUALITY PLAN FOR VENDOR ITEMS **ITEM:** OIL PURIFICATION UNIT **BHEL SPEC:** TC54014, TC54017, TC54216, TC54217, TC54367	**QP. NO:** HYQA/STD QP/TC/1213/07 **Rev. No. :** 03 **DATE:** 16.03.2021 **VALID UPTO:** 15.03.23 **PAGE 3 OF 6**

Sl No	Component & Operations	Characteristics	Class	Type Of Check	Quantum Of Check	Ref Document	Acceptance Norms	Format Of Record	* D	Agency P	Agency W	Agency V	Remarks
2.0	**IN PROCESS CONTROL / INSPECTION**												
2.1	Fabrication / Welding	WPS, PQR review	Major	Verification	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
		DP Test	Major	NDT	100%			TC	√	2		1	
2.2	Assembly	Dimensions	Major	Measurement	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
		Completeness	Major	Visual	100%			TC	√	2		1	
2.3	Piping	Butt weld / Fillet weld	Major	RT / DT	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
		Hydro Test	Major	Mechanical	100%			TC	√	2		1	
2.4	PMI	PMI on SS & AS material	Major	PMI	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
2.5	IGC Test	IGC Test on SS material	Major	IGC Test	100%	BHEL Spec/ Approved Drawing / Data Sheet		TC	√	2		1	
2.6	Controls & Panel	Dimension	Minor	Measurement	100%	BHEL Spec/ Approved Drawing / Data Sheet		IR	√	2		1	
		Interlock & sequential operation	Major	Simualtion	100%			IR	√	2		1	
		Insulation resistance before & after HV	Major	Megger test	100%			IR	√	2		1	
		HV test	Major	HV test	100%			IR	√	2		1	
		Bill of Material	Minor	Visual	100%			IR		2		1	
		Flame proof-ness	Major	Electrical test	Type test			TC	√	2		1	
3.0	**FINAL ASSEMBLY, INSPECTION & TESTING**												
3.1	Dimension and general layout of system	Dimension & layout Completeness Lifting Arrangement	Minor	Measurement & visual check	100%	BHEL Spec/ Approved Drawing / Data Sheet		I.R	√	2	1		
3.2	Assembly	Hydro test (without centrifuge)	Criti-cal	Pressure Test	100%	Approved Test Procedure / Appd Drg & BHEL Spec		IR	√	2	1		

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P: - PERFORM, W: - WITNESS , V: - VERFICATION,
INDICATING 1: - BHEL / BHEL NOMMNATED INSPECTION AGENCY, 2: - VENDOR / SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTICS UNDER THE COLUMNS P, W & V.
* D: RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.

PREPARED BY	REVIEWED BY	APPROVED BY
Sachin Katiyar Sr. Engineer / QA	B. Ashok Kumar AGM/QA	B. Ashok Kumar AGM/QA

BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD	STANDARD QUALITY PLAN FOR VENDOR ITEMS **ITEM:** OIL PURIFICATION UNIT **BHEL SPEC:** TC54014, TC54017, TC54216, TC54217, TC54367	**QP. NO:** HYQA/STD QP/TC/1213/07 **Rev. No. :** 03 **DATE:** 16.03.2021 **VALID UPTO:** 15.03.23 **PAGE 4 OF 6**

Sl No	Component & Operations	Characteristics	Class	Type Of Check	Quantum Of Check	Ref Document	Acceptance Norms	Format Of Record	* D	Agency P	Agency W	Agency V	Remarks
3.3	System interlocks and alarms & DOL Starter Function.	Functioning of instruments	Major	Simulation	100%	BHEL Spec/ Approved Drawing / Data Sheet		I.R	√	2	1		
3.4	Mechanical run test	Cleanliness, Minimum temperature rise through heater, Capacity, Vibration, leakages, Noise level.	Criti-cal	Measurement	100%	BHEL Spec/ Approved Drawing / Data Sheet		I.R	√	2	1		
3.5	Performance & Acceptance	Moisture content in oil before & after separation (sample to be collected in the presence of TPI)	Criti-cal	Lab report on samples collected	100%	BHEL Spec/ Approved Drawing / Data Sheet / ISO:4406		I.R	√	2	1		
3.6	Oil Purity	Particle Size of Oil Inlet & Outlet	Criti-cal	Visual	Sample	BHEL Spec/ Approved Drawing / Data Sheet / ISO:4406		I.R	√	2	1		Type Test Report to be verified by BHEL TPI.
3.7	Completeness Check	Bill of material	Major	Visual	100%	BHEL Spec/ Approved Drawing / Data Sheet		I.R	√	2	1		
4.0	**SURFACE PREPARATION & PAINTING**												
4.1	Painting	Paint shade & finish	Major	Visual	100%	BHEL Spec/ Approved Drawing / Data Sheet		IR	√	2		1	
4.2	Marking	Name Plate & Rating	Minor	Visual	100%	BHEL Spec/ Approved Drawing / Data Sheet		Conformance Certificate	√	2		1	
4.3	Packing		Minor	Visual	100%	BHEL Spec/ Approved Drawing / Data Sheet			√	2		1	

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Sl No	Component & Operations	Characteristics	Class	Type Of Check	Quantum Of Check	Ref Document	Acceptance Norms	Format Of Record	* D	Agency P	Agency W	Agency V	Remarks

THIS QUALITY PLAN DESCRIBES TYPICAL STANDARD TEST REQUIREMENTS OF OIL PURIFICATION UNIT. VENDOR MAY BE REQUIRED TO PREPARE & SUBMIT QUALITY PLAN SPECIFIC TO ENQUIRY WITH ADDITIONAL REQUIREMENTS AS PER APPROVED ENGINEERING DOCUMENTS (DRAWING / DATA SHEET).

ABBREVIATIONS:		
MTC – MILL TEST CERTIFICATE	MPI - MAGENTIC PARTICLE INSPECTION	TC – TEST CERTIFICATE, TR – TEST REPORT
HT – HEAT TREATMENT	UT - ULTRASONIC TEST	TPIA - THIRD PARTY INSPECTION AGENCY APPOINTED BY BHEL.
IR - INSPECTION REPORT	RT – RADIOGRAPHY TEST	COC – CERTIFICATE OF CONFORMITY
MEASRT - MEASUREMENT	WPS – WELDING PROCEDURE SPECIFICATION	PQR – WELDING PROCESS QUALIFICATION RECORD
WQR – WELDER QUALIFICATION RECORDS	PO – PURCHASE ORDER	LPI – LIQUID PENETRANT INSPECTION

NOTE:

1. ALL MATERIAL OF CONSTRUCTION (MOC) SHALL BE AS PER APPROVED DATA SHEET / BOM / DRG AND BOUGHT OUT ITEMS (BOIs) SHALL BE PROCURED FROM BHEL AGREED SOURCES / APPROVED DATA SHEET / BOM / DRG.
2. SPARES PROCURED ALONG WITH MAIN EQUIPMENT/ITEM SHALL BE INSPECTED FOR RELEVANT / APPLICABLE CHECKS AS INDICATED IN THE SQP.
3. ANY OTHER TESTS/ CHECKS INDICATED IN SPECIFICATION, P.O., OR DRAWING & ANY ADDITIONAL CHECKS ENVISAGED BY BHEL/TPI TO ENSURE WORKMANSHIP, FINISH, AESTHETICS, ETC. SHALL ALSO BE CONDUCTED AND WITNESSED/VERIFIED BY BHEL /TPI / CUSTOMER AS REQUIRED.
4. ANY PROJECT / CUSTOMER SPECIFIC REQUIREMENT, LIKE QP APPROVAL & CUSTOMER/CONSULTANT INSPECTION, WHICH SHALL BE NOTIFIED HAVE TO BE FULFILLED BY THE VENDOR AT THE TIME OF EXECUTION OF ORDER.

Refer Annexure-I for Notes.

Sl No	Component & Operations	Characteristics	Class	Type Of Check	Quantum Of Check	Ref Document	Acceptance Norms	Format Of Record	* D	Agency P	Agency W	Agency V	Remarks

Annexure – I

Notes:

1. PRE-DESPATCH INSPECTION PHOTOGRAPHS OF THE EQUIPMENT/ITEM SHALL BE INCLUDED IN QUALITY DOCUMENTATION.
2. LATEST VERSION OF STANDARDS/DRAWINGS /TOLERANCES ETC TO BE MENTIONED IN QUALITY PLAN/DRAWING. THIS QP SHOULD BE READ ALONG WITH BHEL SPEC, BHEL DRAWINGS / APPROVED DRAWINGS, DATA SHEET, BOM AND PO.
3. DRAWING / DATA SHEET/ SPECIFICATION SHALL PREVAIL OVER QUALITY PLAN IN CASE OF ANY CONTRADICTION.
4. BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST, IF REQUIRED.
5. BHEL APPROVED INSPECTION ENGINEERS TO BE DEPLOYED FOR INSPECTION.
6. ONLY LEVEL II & ABOVE QUALIFIED PERSON IN RESPECTIVE NDE TO VERIFY OR WITNESS THE NDT TEST REPORT/RESULTS.
7. INSPECTION TO BE OFFERED ONLY AFTER ENSURING THAT ALL DOCUMENTS (QUALITY PLAN, DRAWINGS, DATA SHEET, PURCHASE SPECIFICATIONS, ETC) ARE AVAILABLE AS PER PURCHASE ORDER.
8. VENDOR TO OFFER ORIGINAL TEST CERTIFICATES ISSUED BY THIRD PARTY LABORATORIES OR SUPPLIERS.
9. VENDOR TO ENSURE WITH TPIA THAT A NOTE ‘COMPARED WITH ORIGINAL TEST CERTIFICATE. REVIEWED, VERIFIED AND FOUND IN ORDER’ SHALL CONTAIN WITH EVERY INSPECTION REPORT.
10. ONLY VALID AND CALIBRATED MEASURING INSTRUMENTS AND EQUIPMENT SHALL BE USED – TPIA TO VERIFY.
11. VENDOR TO ENSURE WITH TPIA THAT MATERIAL TEST CERTIFICTAE & TRACEABILITY RECORDS ARE AVAILABLE FOR USE OF CORRECT MATERIAL.
12. QUALIFICATION OF EQUIPMENT, PROCESS & PERSONNEL FOR SPECIAL PROCESSES LIKE WELDING, BRAZING, PAINTING & METAL COATING ETC. (AS APPLICABLE AS PER PO) SHALL BE ENSURED.
13. VENDOR TO ENSURE THAT ALL CERTIFICATES ARE ENDORSED BY TPIA WITH COMMENTS (WITNESSED OR VERIFIED) AS PER QUALITY PLAN.
14. VENDOR SHALL OFFER LOG SHEETS CONTAINING ACTUAL MEASURED VALUES INSTEAD OF SAYING OK/NOT OK TO TPIA.
15. VENDOR SHALL SUBMIT COMPLETE INSPECTION AND TEST DOCUMENTATION WHICHEVER IS IDENTIFIED WITH (√) UNDER COLUMN ‘D’ OF APPROVED QULAITY PLAN SHALL BE ENCLOSED WITH THE INSPECTION REPORT.
16. VENDOR SHALL SUBMIT ORIGINAL COPIES OF ALL INSPECTION AND TEST DOCUMENTS AUTHENTICATED BY TPIA.

LEGEND: P: - PERFORM, W: - WITNESS , V: - VERFICATION, INDICATING 1: - BHEL / BHEL NOMMNATED INSPECTION AGENCY, 2: - VENDOR / SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTICS UNDER THE COLUMNS P, W & V. * D: RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.	PREPARED BY Sachin Katiyar Sachin Katiyar Sr. Engineer / QA	REVIEWED BY B. Ashok Kumar AGM/QA	APPROVED BY B. Ashok Kumar AGM/QA

OIL PURIFICATION UNIT
(TROLLEY TYPE)

1.0.0 **SCOPE :**

This standard specifies the requirements of Oil centrifuge / conditioner driven by Explosion proof A.C Electrical motor (Exd) of Gas Group IIC along with explosion proof starter mounted on a trolley. This unit is used in Refinery / petroleum plant.

2.1.0 **DESIGN PHILOSOPHY/CRITERIA-GENERAL:**

Selection of rotating equipment shall be based upon the following consideration

1. The design shall be purely based on Centrifuging process with high speed motor drive
2. Suitability for the specified duty conditions.
3. Standard models under vendor's regular range of manufacture.
4. Proven track record in similar service.
5. Optimum operating and maintenance costs.
6. Maximum interchangeability of parts.
7. Ease of operation and maintenance.

2.2.0 **THE ORDER OF PRECEDENCE IS TO BE FOLLOWED.**

Applicable codes, standards

For design aspects not specifically covered by data sheets, specifications, codes and standards or regulations, the design shall be based on good engineering practices.

3.0.0 **TECHNICAL REQUIREMENTS:**

3.1.0 **APPLICATION**:

The lube oil purification unit is used for removal of sludge and moisture from the lube oil, used for lubrication and shaft sealing. The oil purification unit comprises of feed pump, Oil centrifuge, discharge pump, drive motor, integral piping, electrical starter and Instrumentation.

3.2.0	Capacity of centrifuge	: ---- LPH, as per variant table
3.3.0	Motor requirement	: Explosion proof (Ex'd)). The motor shall be as per purchase specification TC54197 (Exd, IIC, Zone1, T3) & Energy Efficient IE-3 as per TC54373
3.4.0	**PROPERTIES OF OIL**	
3.4.1	Fluid handled	: Turbine oil type ISO VG 46
3.4.2	Kinematics Viscosity of oil	: 18 mm^2 /s (CST) at 65°C (operating) 46 mm^2 /s (CST) at 40°C (during starting)

3.4.3	Specific gravity	: 0.88
3.4.4	Viscosity Index	: 96

Note: Actual throughput for the above oil parameters and best separation results should be indicated in the offer.

3.5.0 Guaranteed size of solids in the oil at the outlet of the centrifuge at rated capacity shall be 5 microns.

3.6.0 Maximum water content allowed is 300 to 500 PPM free water (from an initial level of 15000 ppm)

3.7.0	Type	: Centrifuge (No other system is allowed)
3.8.0	Suction lift of feed pump	: 4 MWC
3.9.0	Discharge pressure of discharge pump	: 15 MWC

3.10.0 Centrifuge shall be supplied as purifier assembly.

3.11.0 Conversion spare kit from purifier to clarifier is part of the equipment and shall supply along with Centrifuge equipment.

3.12.0 Centrifuge unit should be free from copper and copper alloys.

3.13.0 **OIL CENTRIFUGE:**

A suitable vertical centrifuge shall carry out primary separation of impurities in the lubricating oil. The centrifuge bowl shall be of separator type having ample size to give the required optimum performance. Heavier phase discharge from the centrifuge (Mainly water) shall go to anti-flood tank through a hose connection. Level switch is to be provided by the vendor to trip the centrifuge and feed pump motor incase flooding of anti-flood tank. 7

The rotating assembly of the centrifuge unit shall be carefully balanced to minimize unbalanced and shaft vibrations while operating at the rated speed. The centrifuge bearings shall be designed for at least 10000 hours of continuous operation. All lubricating oil contact parts of the purifier shall be of stainless steel material.

The bowl shall be assembled and dispatched. Sufficient care has to be taken to avoid any transit damage to the bowl assembly.

3.14.0 Centrifuge shall be assembled as a single unit and shall be ready to use.

3.15.0 **MATERIALS:**

3.15.1	Centrifuge bowl body	: Stainless steel – AISI 316
3.15.2	Bowl unit	: Stainless steel – AISI 316
3.15.3	Disc stack & gravity disc	: Stainless steel – AISI 316
3.15.4	Distributor, top discharge	: Stainless steel – AISI 316
3.15.5	Inlet piping, fittings & valves	: Stainless steel – AISI 316

CENTRIFUGE MOTOR:

The Explosion proof (Ex "d") shall be as per purchase specification TC54197 & TC54373.

The specific customer / Consultant data sheet will be sent along with enquiry & the same is to be forwarded duly filled by vendor after placement of PO.

3.16.1	Type	: 3-phase squirrel cage induction motor
3.16.2	Voltage	: 415 V
3.16.3	Voltage Variation	: ± 10%
3.16.4	Frequency	: 50 HZ ± 3%
3.16.5	Combined variation on voltage and frequency	: ± 10%
3.16.6	Ambient temperature Min / Max in ºC	: 1 / 50
3.16.7	Insulation	: F with temperature rise limited to class B
3.16.8	Design	: IS 325, IS12615, IEC60034-30
3.16.9	Type of enclosure	: IP 55, TEFC
3.16.10	Type of starting	: DOL
3.16.11	Motor rating	: Vendor to inform
3.16.12	Motor speed	: 1500 RPM
3.16.13	Direction of rotation	: Bi-directional

3.16.14 **Acceptable vendors:**

- M/s ABB, India
- M/s Siemens India
- M/s CGL
- M/s BBL
- M/s LHP

3.17.0 **STARTER:**

Flame proof DOL starter suitable for gas group IIC, Ex'D & Zone1 area of classification and conforming to IS: 2148.

The starter consisting of the following:

- Main ON / OFF switch (L&T make)
- HRC fuses (English electric)
- ON / OFF Indicating lamp (BCH)
- Start / stop push button (BCH / Siemens / L&T)
- Contractor (L&T / Siemens)
- Over load relay (Siemens)
- Terminals (GE)
- Flameproof double compression type brass nickel-plated cable gland suitable gas group IIC.
- The starter housing shall be in Al – Alloy LM 6 construction.

- All electrical equipment for use in hazardous areas shall be certified by CIMFR, PTB, Baseefa, UL, FM or equivalent independent testing agency for the service and the area in which it can be used and shall be approved by PESO/CCOE. Copies of Hazardous area test certificates & PESO/CCOE approval shall be furnished.

4.0.0 **PAINTING:**

Unit should be painted with Epoxy, anti-rust, anti-corrosive type paint.
Final shade shall be 692 as per IS: 5
Approval shall be obtained for mechanical cleaning and painting procedure from BHEL prior to starting manufacturing.

5.0.0 **SCOPE OF SUPPLY:**

5.1.0 Trolley mounted centrifuge with water admixing device, Anti-flood tank with level switch, Explosion proof Motor (Ex "d", Gas group IIC) Explosion proof / Flame proof DOL starter, control panel and Instrumentation with Gas group IIC.

5.2.0 Common fabricated base plate mounted on a trolley with SS integral piping, fittings and valves for the complete unit.

5.3.0 Standard tools and commissioning spares. (List shall be submitted).
The commissioning spares are properly identified with tags.

5.4.0 2 Numbers of 10 meters' length of flexible SS braided hoses with inlet & outlet rotating flanged connections 1" ANSI 300# RF or final sizes will be informed during detailed engineering stage. 7

5.5.0 20 Meters length of Armored power cable in 2.5 MM^2, 3 core with flame proof plug socket for connection to Explosion proof starter

6.0.0 **SPARE PARTS:**

The offer shall accompany with the quotation for recommended spare parts for 2-year normal operation for complete unit with separate price bid. The same unpriced bid shall be submitted along with technical bid.

7.0.0 **TEST AND GUARANTEE CERTIFICATE:**

7.1.0 **TEST CERTIFICATE:**

1 hard copy of Inspection and test certificates shall be supplied for each item of the consignment quoting BHEL STD Number, Purchase Order No. and manufacturer's identification serial number.

7.2.0 **GUARANTEE CERTIFICATE:**

7.2.1 A guarantee certificate for 18 months of trouble free performance from the date of shipment or 12 months from the date of commissioning whichever is earlier shall be supplied.

7.2.2 If any mal performance or defects occur during the guarantee period, the vendor shall make all necessary alteration, repairs, or replacement free of charge.

8.0.0 **DOCUMENTATION:**

8.1.0 **DOCUMENT TO BE SUBMITTED ALONG WITH OFFER.**

The following documents shall be supplied along with offer

8.1.1 The descriptive leaflets and catalogues giving full sectional details of the equipment.

8.1.2 Flow diagram with bill of material and sub-suppliers name.

8.1.3 Electrical schematic and electrical connection diagram.

8.1.4 Overall dimensional drawing of the unit with weight.

8.1.5 Quality assurance plan.

8.1.6 Mechanical cleaning and painting procedure.

8.1.7 The motor documents shall be as per clause 29.1 of our purchase specification TC54197.

8.1.8 Vendor to submit the duly signed and stamped annexure-1 to TC54014 along with offer

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8.2.0 **DOCUMENT TO BE SUBMITTED AFTER PLACEMENT OF ORDER**

The following documents shall be supplied after placement of order

8.2.1 Flow diagram with bill of material and sub-suppliers name

8.2.2 Electrical schematic and electrical connection diagram.

8.2.3 Overall dimensional drawing showing complete details of the equipment

8.2.4 Quality assurance plan

8.3.0 **DOCUMENT TO BE SUBMITTED AFTER APPROVAL .**

8.3.1 Overall dimensional drawing showing complete details of the equipment

8.3.2 Flow diagram with bill of material and sub-suppliers name

8.3.3 Electrical schematic and electrical connection diagram.

8.3.4 O & M Manuals

8.3.5 All test reports, Inspection reports, Material certificates, performance test certificates, Guarantee certificates etc.

8.3.6 The motor documents shall be as per clause 29.3 of our purchase specification TC54197

8.4.0 **DOCUMENT ALONG WITH CONSIGNMENT**

8.4.1 All test reports, Inspection reports, Material certificates & performance test certificates etc.

8.4.2 O & M Manuals (2 Copies along with consignment).

8.4.3 Test & Guarantee certificates.

8.4.4 The motor documents shall be as per clause 29.4 of our purchase specification TC54197.

9.0.0 **SPECIAL NOTES:**

9.1.0 Final documents as per clause 5.2.1 & 5.2.2 shall also be furnished in in soft copy format

9.2.0 O & M manuals shall be furnished in soft copy for both centrifuge & motor.

9.3.0 Motor dimensional and cross sectional drawings shall also be furnished in PDF

9.4.0 Refer Project specific Annexures (If applicable) sent along with Inquiry

9.5.0 Vendor to submit the filled in Annex –III & Annex-IV while submitting the offer

10.0.0 **PACKING:**

The equipment shall be properly packed to withstand mechanical damage and rust during transit.

11.0.0 **MARKING:**

11.1.0 The manufacturer's serial number and year of manufacture shall be marked at suitable locations viz. Name plate.

11.2.0 A tag bearing the relevant 12-digit material code shall be attached for each item.

11.3.0 The name plate of the centrifuge shall contain the following information

11.3.1 Manufacturer's name or trade mark and serial number.

11.3.2 Centrifuge model number.

11.3.3 Capacity of the centrifuge.

11.3.4 Pump discharge pressure.

11.3.5 Performance guarantees figures of moisture content and solid particles.

12.0.0 **SCHEDULE OF QUALITY CHECKS FOR OIL CENTRIFUGE.**

12.1.0 Inspection &Testing: As per manufacturer's standard

12.2.0	Checks	**C**	**B**	**S**
12.2.1	Material compliance certificates of critical parts	2	2	3
12.2.2	Visual Inspection	1	1	3
12.2.3	Centrifuge rotor balancing	1	1	3
12.2.4	Hydrostatic test of pressure parts	2	2	3
12.2.5	Capacity check and performance test - Capacity of centrifuge. - Moisture content in oil before and after purification	1	1	3
12.2.6	Explosion proof certification for DOL starter from CMRS	2	2	3

12.2.7 The Inspection & testing for motor shall be followed as per our purchase specifications TC54197 & TC54373.

AGENCY:

C	: **Consultant/Customer**
B	: **B H E L**.
S	: **SUPPLIER.**

TYPE OF INSPECTION :

1.	: Witnessed
2.	: Review of certificates.
3.	: Certificate check by manufacturer

14.0.0 **INSPECTION AND TESTING :**

14.1.0 All the materials used for the manufacture of the equipment cover under this specification shall be of tested quality. Relevant test certificates shall be made available to the purchaser before the final shop inspection. In case the relevant correlating test certificates are not available, the supplier shall arrange to carry out necessary tests as required by the code at his own cost.

14.2.0 The pressure vessels shall be hydrostatically tested at not less than one and half times design pressure, prior to painting and lining. The pressure vessels shall be kept pressurized for at least 30 minutes at this test pressure and shall be demonstrated to be free from visible leaks.

14.3.0 All electrical equipment for use in hazardous areas shall be certified by CIMFR, PTB, Baseefa, UL, FM or equivalent independent testing agency for the service and the area in which it can be used and shall be approved by PESO/CCOE. Copies of Hazardous area test certificates & PESO/CCOE approval shall be furnished.

14.4.0 **NOTES :** △7

14.4.1 The centrifuge and feed pump motor shall be interlocked with the level switch on the anti-flood tank. In the event of the flooding of the centrifuge the interlock shall operate to trip the motor of the pumping unit and centrifuge.

14.4.2 Flooding of the centrifuge may be caused by any one of the following malfunctions.

14.4.3 Loss of water seal of centrifuge causing over flow of oil to the anti-flood tank.

14.4.4 Presence of excessive water in the oil, which may cause insufficient separation of oil. This can be sensed by a rise in water level in the anti-flood tank.

14.4.5 Clogging of the heavy phase drain pipe and possible over flow of water to the light Phase section. This can also be sensed from a raise in anti-flood tank water level.

14.4.6 **In addition to the Instrumentation shown above any either Instrument / protections required for automatic / safe operation shall be provided. The same shall be indicated in the offer**.

14.4.7 **If any solenoid valve is applicable in vendor‘s system for proper functioning of system, the same shall be provided as per Annexure-I.** ---- Rev08

Sl. No.	Qty.	Description	Remarks
01	1	Base Frame (Trolley Type)	
02	1	Oil Centrifuge with S.S Bowl	
03	1	Feed and discharge pump	
04	1	A.C Ex. Proof (Ex"d" of Gas group IIC) Electrical motor	
05	1	Starter of Explosion proof type as per IS: 2418 Gr IIC, Temp. class T3	
06	1	Strainer 25 NB S.S screen mesh	
07	2	Isolating valve 25 NB	
08	3	Valve for Gauge Isolation 15 NB, needle valve	
09 ⚠7	3	Pressure Gauge 0 to 5 Kg/cm^2 of Ø10 mm (Stainless steel)	Refer project specific requirement in Annexure – I for this specification.
10 ⚠7	1	Thermometer 0 to 100 ºC of Ø100 mm (Stainless steel)	Refer project specific requirement in Annexure – I for this specification.
11	2	Flexible S.S braided hoses with inlet & outlet connections, 1" ANSI 300# RF of 15 M length each	
12	1	Armored cable 2.5 mm^2 x 3 core with plug socket of 30 M length	
13	2	Inlet & outlet flanges as per ANSI standard	
14	1	Water admixing device	
15 ⚠7	1	Anti-Flood Tank	
16 ⚠7	1	Level switch	
17 ⚠7	1	Flow glass	
18 ⚠7	1	A.C Ex. Proof (E Ex "Refer Annexure-I" of Gas group IIC) Electrical motor for FEED pump.	
19 ⚠7	1	Drain valve	
20	1	Set of Plug & Socket	
21	1	Cable Glands and Lugs	
22	1	Storage Wheels for Hose and Hanger for cable	

Var No	Description	Material code
01	OIL PURIFICATION UNIT (TROLLEY TYPE) CAP.: 1000 LPH. Motor voltage: 415V	**TC9754014 019**
02	OIL PURIFICATION UNIT (TROLLEY TYPE) CAP.: 1000 LPH. Motor voltage: 400V	**TC9754014024**
03	OIL PURIFICATION UNIT (TROLLEY TYPE) CAP.: 2400 LPH. Motor voltage: 415V	**TC9754014035**
04	Commissioning spares for Oil Centrifuge 50 Lpm	**TC9754014043**
05	Spare Pipe & Fittings (1/2" to 36") of 1000 LPH OPU (2% of installed quantity)	**TC9754014051**
06	Spare Valve (1/2" to 36") of 1000 LPH OPU (2% of installed quantity)	**TC9754014060**
07	Spare Pressure Gauge & Differential Pressure Gauge of 1000 LPH OPU (20% subject to minimum of one) of each Type, Range & MOC	**TC9754014078**
08	Spare Temperature Gauge of 1000 LPH OPU (20% subject to minimum of one) of each Type, Range & MOC	**TC9754014086**

Var No	Description	Material code
09	Spare Level Gauge of 1000 LPH OPU (20% subject to minimum of one) of each Type, Range & MOC	**TC9754014094**
10	Spare 3-Way & 5-Way Manifolds & Hookups of 1000 LPH OPU (10% subject to minimum of one) of each Type, Size & MOC	**TC9754014108**
11	Spare variable area flow meter (Rotameter) of 1000 LPH OPU (20% or minimum of one- complete set) of each Type, Size, Rating & MOC	**TC9754014116**
12	Spare SS Tubes for instruments of 1000 LPH OPU (10% of installed quantity) of each size	**TC9754014124**
13	Spare instruments signal cable (Pair /triad and Multi Pair/Triad) of 1000 LPH OPU (10% of installed quantity) of each type & size	**TC9754014132**
14	Spare Control Cable and Power Cable of 1000 LPH OPU (10% of installed quantity) of each type & size	**TC9754014140**
15	Spare Terminal Block of 1000 LPH OPU (10% of installed quantity) of each size	**TC9754014159**
16	Spare Fittings/Nipples/Sockets/Blinds/Unions of 1000 LPH OPU (10% of installed quantity) of each type & size	**TC9754014167**
17	Spare 1/2", ¾" & 1" valve used for instruments(Ball, Needle, Gate, Globe) of 1000 LPH OPU (10% of installed quantity) of each type & size	**TC9754014175**
18	Spare Junction Box of 1000 LPH OPU (10% of installed quantity or minimum one) of each type & size	**TC9754014183**
19	Spare Safety Relief Valve of 1000 LPH OPU (10% of installed quantity or minimum one) of each type & size	**TC9754014191**
20	Spare Solenoid Valve of 1000 LPH OPU (20% of installed quantity or minimum one) of each type & size	**TC9754014205**
21	Spare panel mounted Instruments and Annunciators of 1000 LPH OPU (10% of installed quantity or minimum one) of each type & size	**TC9754014213**
22	Spare Pressure Gauge & Differential Pressure Gauge of 2400 LPH OPU (20% subject to minimum of one) of each Type, Range & MOC	**TC9754014221**
23	Spare Temperature Gauge of 2400 LPH OPU (20% subject to minimum of one) of each Type, Range & MOC	**TC9754014230**
24	Spare Level Gauge of 2400 LPH OPU (20% subject to minimum of one) of each Type, Range & MOC	**TC9754014248**
25	Spare 3-Way & 5-Way Manifolds & Hookups of 2400 LPH OPU (10% subject to minimum of one) of each Type, Size & MOC	**TC9754014256**
26	Spare SS Tubes for instruments of 2400 LPH OPU (10% of installed quantity) of each size	**TC9754014264**
27	Spare instruments signal cable (Pair /triad and Multi Pair/Triad) of 2400 LPH OPU (10% of installed quantity) of each type & size	**TC9754014272**
28	Spare Control Cable and Power Cable of 2400 LPH OPU (10% of installed quantity) of each type & size	**TC9754014280**
29	Spare Terminal Block of 2400 LPH OPU (10% of installed quantity) of each size	**TC9754014299**
30	Spare Fittings/Nipples/Sockets/Blinds/Unions of 2400 LPH OPU (10% of installed quantity) of each type & size	**TC9754014302**
31	Spare 1/2", ¾" & 1" valve used for instruments(Ball, Needle, Gate, Globe) of 2400 LPH OPU (10% of installed quantity) of each type & size	**TC9754014310**
32	Spare Safety Relief Valve of 2400 LPH OPU (10% of installed quantity or minimum one) of each type & size	**TC9754014329**
33	Spare panel mounted Instruments and Annunciators of 2400 LPH OPU (10% of installed quantity or minimum one) of each type & size	**TC9754014337**
34	Spare Pipe & Fittings (1/2" to 36") of 2400 LPH OPU (2% of installed quantity)	**TC9754014345**
35	Spare Valve (1/2" to 36") of 2400 LPH OPU (2% of installed quantity)	**TC9754014353**
36	Spare Pressure Gauge & Differential Pressure Gauge of 2400 LPH OPU (20% subject to minimum of one) of each Type, Range & MOC	**TC9754014361**
37	Spare Temperature Gauge of 2400 LPH OPU (20% subject to minimum of one) of each Type, Range & MOC	**TC9754014370**
38	Spare variable area flow meter (Rotameter) of 2400 LPH OPU (20% or minimum of one- complete set) of each Type, Size, Rating & MOC	**TC9754014388**
39	Spare SS Tubes for instruments of 2400 LPH OPU (10% of installed quantity) of each size	**TC9754014396**

Var No	Description	Material code
40	Spare instruments signal cable (Pair /triad and Multi Pair/Triad) of 2400 LPH OPU (10% of installed quantity) of each type & size	**TC9754014400**
41	Spare Control Cable and Power Cable of 2400 LPH OPU (10% of installed quantity) of each type & size	**TC9754014418**
42	Spare Terminal Block of 2400 LPH OPU (10% of installed quantity) of each size	**TC9754014426**
43	Spare Fittings/Nipples/Sockets/Blinds/Unions of 2400 LPH OPU (10% of installed quantity) of each type & size	**TC9754014434**
44	Spare 1/2", ¾" & 1" valve used for instruments(Ball, Needle, Gate, Globe) of 2400 LPH OPU (10% of installed quantity) of each type & size	**TC9754014442**
45	Spare Safety Relief Valve of 2400 LPH OPU (10% of installed quantity or minimum one) of each type & size	**TC9754014450**
46	Spare Solenoid Valve of 2400 LPH OPU (20% of installed quantity or minimum one) of each type & size	**TC9754014469**
47	Spare panel mounted Instruments and Annunciators of 2400 LPH OPU (10% of installed quantity or minimum one) of each type & size	**TC9754014477**
48	OPU ASSLY(TROLLEY Mounted)1600 LPH, MTR IIC	TC9754014485
49	SP.PG & DPG -1600 LPH OPU(20%INST or)	TC9754014493
50	SP.TG -1600LPH OPU (20% OF INSTALLED)	TC9754014507
51	SP.SOL.VALVE -1600 LPH OPU(20%QTY/MIN 1)	TC9754014515
52	SP FOR LOCAL PANEL (10% QTY/MIN 2)	TC9754014523
53	SP.1/2",¾"&1"INST.V/V-(10%QTY EA TYPE)	TC9754014531
54	SPARE COMPOUND PG FOR 1000 LPH OPU	TC9754014540
55	SPARE SS TUBE OF INSTRUMENT-1600 LPH OPU	TC9754014558
56	SP INSTRUMENT SIGNAL CABLE 1600 LPH OPU	TC9754014566
57	SP TERMINAL BLOCK 1600 LPH OPU	TC9754014574
58	SP PANEL MOUNTED INSTRUMENTS-1600 LPH	TC9754014582
59	Spares for 1600LPH OPU as per Annexure-VI	TC9754014590
60	OPU ASSY(T) 1000LPH IIC MOTOR,IE3	TC9754014604
61	OPU ASSY(T) 1000LPH EXD IIC MOTOR,IE2	TC9754014612
62	SP.OF OPU 1000LPH-PG(20%OFINSTLD/MIN 2)	TC9754014620
63	SP.OF OPU 1000LPH-TG(20%OFINSTLD/MIN 2)	TC9754014639
64	SP.OF OPU 1000LPH-SRV (10%/MIN 1)	TC9754014647
65	SP.OF OPU 1000LPH-FLOWMETER(20% /MIN 1)	TC9754014655
66	SPOFOPU 1000LPH-V/V MANIFOLD(10%/MIN 1)	TC9754014663
67	SPOFOPU 1000LPH-SS TUBE(10%OF INSTALED)	TC9754014671
68	SP OF OPU 1000LPH-TUBE FITTING(10%)	TC9754014680
69	SPOF OPU 1000LPH-INST.SIGNAL CABLE(10%)	TC9754014698
70	SP OF OPU 1000LPH-FITTING,LUGS,ETC(10%)	TC9754014701
71	SP OF OPU 1000LPH-INSTRUMENT VALVE(10%)	TC9754014710
72	SPOF OPU 1000LPH-DAMPENER,SAVER,ETC(10%	TC9754014728
73	SP.OF OPU-SOL.VALVE 24VDCSIL3(20%/MIN2)	TC9754014736
74	SPOF OPU 1000LPH-PANEL MONTEDINSTR.(10%	TC9754014744
75	SPOF OPU 1000LPH-HOOTER(10% OR MIN 1)	TC9754014752
76	SPOF OPU 1000LPH-LAMPS(10% OR MIN 1)	TC9754014760
77	SP.OF OPU-SET OF BEARING OF MOTOR<1KW	TC9754014779

Var No	Description	Material code
78	TERM.BLOCK+COVER+SCREW OF MOTOR>1KW	TC9754014787
79	SP.OF OPU-SETOF COOLING FAN OFMOTOR<1KW	TC9754014795

RECORD OF REVISIONS

Rev. No	Date	Revision Details	Revised	Approved
00.	17.04.09	FIRST ISSUE	-	-
01	11.02.10	Variant 02 added	M S Kumar	S K Dash
02	11.07.13	Generally Revised	M S Kumar	M V S Raju
03	05.11.13	Generally Revised	M S Kumar	M V S Raju
04	21.08.15	Clauses 3.16.14 & 5.5.0 modified	M S Kumar	M V S Raju
05	09.09.15	Clause 9.5.0 Added	M S Kumar	M V S Raju
06	21.12.15	Variant 04 Added	M S Kumar	M V S Raju
07	26.03.17	Variants 05 to 21 Added	Sunil B J	P S V S K
08	24.04.17	Variants 22 to 47 Added & Generally Revised	M S Kumar	Sunil/ PSVS K
09	20.01.18	Variants 54 added	Kotta Bharath	Sunil B J
10	29.03.18	Variants 55 to 58 Added	Kotta Bharath	Sunil B J

PRE-QUALIFICATION CRITERIA

Enquiry Items of Lube Oil System

S.No.		BHEL Requirement	Vendor's Confirmation	Deviation, if any	**Remarks**
1		All the suppliers need to submit this document i.e. titled pre-qualification criteria and furnish required information along with offer.			
2	a)	Name, address, e-mail id, contact no.etc. of manufacturer of enquiry item			
	b)	Name, address, e-mail id, contact no.etc. of authourised agency / trading house quoting on behalf of manufacturer In case offer is received from authourised agency / trading house, the following requirements shall be full filled. i) Valid letter of authorisation and copy of agreement to be enclosed with offer. ii) The offer shall be either from the authorised agency or from the manufacturer directly. In case of BHEL receiving offer from both, then offer from manufaturer will only be considered. Offer from an unauthorised agency / entity on behalf of any vendor shall be summarily rejected. iii) Name, address, e-mail id, contact no.etc. of entity on whom order to be released in case of L1 shall be clearly indicated.			
3		Supplier to confirm/provide the following criteria/documents for evaluation of offer.			
		(a) The supplier should have the proven experience in manufacturing and supply of offered model as per enquiry requirement.			
	i	Application: Lube Oil System			
	ii)	Proven track Record of equipment: Enquiry item shall be identical and similar in terms of flow, Operating pressure, Mechanical Design, Materials etc as compared to at least TWO unit of the proposed model designed, engineered, manufactured, tested and supplied from the proposed manufacturing plant in the last **TEN** years and the reference unit shall have completed **ONE** year of satisfactory operation at site as on bid due date.			
	iii)	All the facilities reqired for manufacturing and testing of Enquiry Item as per applicable standards shall be available with manufacturer.			
	iv)	Vendor shall furnish the details of Service after Sale facilities available in India with references of executed project. Spare shall be readily available at propretary suppliers/ distributors in India.			
		All the above criteria 3(a) (i) to 3(a) (iv) must be combinedly met by the vendor against a single supply reference.			
		(b) The supplier meeting all the above criteria as per clause 3 (a), shall furnish details of such supplies in the annexure II (Proven Track Record). Suppliers shall furnish up to 03 numbers of latest customer reference details. **Note : Details furnished in any other format shall not be considered.** All the documents shall be furnished only in English. Documents furnished in other langauges will not be considered for further evaluation.			
		(c) BHEL reserves the right to cross verify with the above such customers including overseas customers with a copy to the supplier and satisfy itself with reference to the claims of the supplier. If the information furnished by the supplier is not found satisfactory, the offer will be technically rejected.			
		(d) 1. vendor details, i.e. name, address, BHEL/EIL/IOCL/Consulatnt/ Customer enlistment letter. 2. One PTR of compressor to be provided by BHEL indicating that the items have been procured from proposed vendors and supply has been completed. PTR shall include the following minimum: - Approved GAD and BOM indicating item details and vendor details. - Unpriced PO copy issued by BHEL to the vendors for the listed items.			
4		The vendors should furnish the detailed process of manufacturing and testing procedures along with the offer.			
5		List of BHEL qualified bidders shall be forwarded to BHEL's End Customer for their review and approval. The list finalized by BHEL's End Customer shall be final and binding.			
6		BHEL team may carry out vendor evaluation/assesment(incase of a new vendor)by a visit to vendor works for qualifying /rejecting the technical bid based on the findings of the visit.			
7		Vendors to submit their bid in 2 - part system i.e. Part-I shall consists of Pre-Qualification Criteria along with the required documents and Techno-Commercial Bid.Vendor shall submit duly filled supplier questionarie. Part-II shall consists of Price Bid. Offers failing to meet prequalification part will not be considered for further evaluation.			

Vendor's Signature with Seal

EXPLOSION PROOF SQ. CAGE INDUCTION A.C MOTORS
TYPE: E. Ex. d-IIC, T3

1.0.0 DESIGN PHILOSOPHY / CRITERIA – GENERAL:

Selection of rotating equipment shall be based upon the following consideration.
Suitability of the specified duty conditions
Standard models under vendor's regular range of manufacture.
Proven track record in similar service.
Optimum operating and maintenance costs.
Maximum interchangeability of parts.
Ease of operation and maintenance.

2.0.0 THE ORDER OF PRECEDENCE IS TO BE FOLLOWED:

Customer standard specification.
Project specific motor data sheet
BHEL Specification TC54370/TC54373 (Latest)(Based on energy efficiency class)
Engineering design basis.
Applicable codes, standards
For design aspects not specifically covered by data sheets, specifications, codes and standards or regulations, the design shall be based on good engineering practices.

Vendor shall make all possible efforts to comply strictly with the requirements of this design basis. In case deviation is considered essential by the vendor (after exhausting all possible efforts), these shall be clearly brought out and consolidated under technical exception chapter at offer stage. However vendor specific deviation (if any) to applicable codes / specifications shall be subject to Consultant/Customer's approval during detail engineering.
The motors shall be energy efficient type

3.0.0	Reference Codes	:	As per relevant national and international standards, IS - 2148, IS - 5571, IS – 325, IEC 60034.
4.0.0	Particular Requirement	:	Motor shall comply with Customer motor specification enclosed along with Enquiry & Project specific motor data sheet for the requirements not covered in this specification. For efficiency class of motor, refer BHEL Specification TC54370/TC54373 (latest) attached as applicable. -- **(R10)**

5.0.0	Area of classification	:	Zone 1, Gas group IIC, Temperature class T3 according to IEC 79 / IS 6381.
6.0.0	Type of motor	:	Squirrel cage induction. Continuous duty (S1)
7.0.0	KW Rating	:	As per enquiry.
8.0.0	Speed	:	As per enquiry.
9.0.0	Construction shape	:	As per enquiry.
10.0.0	Voltage	:	415 V ±10% AC Fault level 35 MVA (50KA) for 415 V system and the fault duration shall be taken as 0.25 seconds for motors rated 55KW & above. For motors below 55KW, the fault energy to be considered shall depend upon the back-up fuse rating.
11.0.0	Frequency	:	50 Hz ± 5%
12.0.0	Combined Voltage and Frequency variation	:	±10%
13.0.0	No of phases / connections / No of terminals.	:	3 / delta / 6
14.0.0	Type of starting	:	Direct on line
15.0.0	Enclosure and execution	:	IP 55, TEFC,(Explosion proof)EEx de IIC T3.
16.0.0	Terminal box inlet type	:	Flame proof double compression cable glands shall be supplied along with motor
17.0.0	Direction of rotation	:	Bi – directional
18.0.0	Space heater	:	Suitable to 240V, Single phase AC (For more than 22 KW Rating)

21.0 **INSPECTION & TESTING** : According to relevant IS Codes.
M/s Lloyds is the approved Inspection agency, if the item is procuring from imported organization. The Inspection charges shall be included in main equipment price.

22.0 **MOTOR MAIN TERMINAL BOX:**

a) Fault level rating for at least 0.25 Seconds. : See clause 10 of this specification

b) Protection : IP 55 Explosion proof E Ex-de IIC T3

c) Cable connection(Cable gland size) : As per project specific datasheet or the value will be provided during detailed engineering. Vendor to provide the same.

23.0 **OTHER REQUIREMENTS** :

a) All hardware like nuts, screws shall be zinc plated / electro galvanized.
b) Locked rotor withstand time (Hot) is not less than 8 seconds. Locked rotor Withstand time (Cold) is not less than 10 seconds.
c) Facility terminate fourth core of cable in motor Terminal box to be provided
d) Supplier shall include in the offer the spare parts for commissioning & shall be Quote separately the spare parts for two years operation.
e) Starting time of motor shall be less than its locked rotor withstand time (Hot)
f) Dimensional drawings and shaft end details shall accompany the offer.
g) Vendor to furnish type test certificate and flame proof / Explosion proof requirement for the motor and terminal box from approving authorities (**CMRS, BASEEFA, PTB, UL**) complying also to the requirement of **IIC** (**H_2** gas group)
h) Vendor is to furnished quality plan along with offer.

26.0 **LIST OF ENCLOSURES** : 1.Customer standard specification
2.Project specific motor data sheet &
3. BHEL Specification TC54175 (Latest)
4.Refer project specific Annexures to Specification(If applicable)

27.0 **SPECIAL NOTES** :

1. Motor dimensional and cross sectional drawings shall also be furnished in C.D compatible for using in Acad
2. O & M Manuals shall also be furnished in C.D compatible for using in MS-WORD
3.Vendor to submit the filled in Annex-I(TDS) &Annex-II(Price format, while quoting offer

28.0 **OPTIONAL REQUIREMENTS:**

The following spares shall be offered in separate price bid along with offer.

- Spare set of bearings (DE & NDE)
- Spare cooling fan

29.0 DOCUMENTATION :

29.1 **ALONG WITH OFFER : (2 Sets of documents)**

- Overall dimensional drawing and wiring diagrams
- Completely filled Vendor's motor data sheet (As per Customer project oriented motor data sheet.)
- Terminal box detail drawings.
- Torque Vs Speed curves.
- Starting curve Vs Time curve including thermal limit curve
- Factory inspection & test form.
- Type test certificates with respect to area classification.
- Quality plan as followed in vendor's works

29.2 **AFTER PLACEMENT OF ORDER: (3Sets of documents)**

- Overall dimensional drawing and wiring diagrams for approval
- Cross sectional drawing of the motor showing recommended spare parts.
- Completely filled Vendor's motor data sheet (As per Customer project oriented motor data sheet.)for approval
- Terminal box detail drawings.
- Torque Vs Speed curves.
- Starting curve Vs Time curve including thermal limit curve
- Type test certificates with respect to area classification.
- Quality plan as followed in vendor's works
- Operation, Instruction and Maintenance manuals

29.3 **DOCUMENT TO BE SEND AFTER APPROVAL:**

The following documents are to be supplied in 2 hard copies & 1 soft copy
Final Overall dimensional drawing of the motor
- Final Cross-sectional drawing of the motor
- Final completely filled Vendor's motor data sheet (As per Customer project oriented motor data sheet - Final Motor characteristic curves
- Operation, Instruction and Maintenance manuals

29.4 **ALONG WITH CONSIGNMENT:**

- Operation, Instruction and Maintenance manuals (2 Hard copies & 1 Soft Copy)
- Test and Guarantee certificates (6 Copies)

72	37	1450	SPARE COOLING FAN 37 KW AC MOTOR	B3	**TC9754197725**
71	18.5	1450	TER.STUD/BUSHING ASSY 18.5KW ACMOTOR	B3	**TC9754197717**
70	18.5	1450	SP.COOLING FAN 18.5 KW AC MOTOR	B3	**TC9754197709**
69	18.5	1450	SET OF BEARING(DE+NDE)18.5KW ACMOTOR	B3	**TC9754197695**
Var.	**KW**	**RPM**	**Description**	**Co. shape**	**Material code**

68	30	2900	SPARE SET OF SPACE HEATER (OF EACH RATING & TYPE) FOR 30KW MOTOR	B3	**TC9754197687**
67	30	2900	SP.SET OF JUNCTION BOX & CABLE GALNDS FOR 30KW MOTOR (10% SUBJECT TO MIINIMUM 10 No. OF EACH TYPE)	B3	**TC9754197679**
66	30	2900	SPARE SET OF INNER AND OUTER COVERS FOR DE+NDE BEARING (OF EACH RATING & TYPE) FOR 30KW MOTOR	B3	**TC9754197660**
65	30	2900	SPARE SET OF GREASE,NIPPLE AND PLUG (OF EACH RATING AND TYPE) FOR 30KW MOTOR	B3	**TC9754197652**
64	30	2900	SPARE SET OF COOLING FAN (OF EACH RATING AND TYPE) FOR 30KW MOTOR	B3	**TC9754197644**
63	30	2900	SPARE SET OF BEARING ACCESSORY OF EACH RATING AND TYPE FOR 30KW MOTOR	B3	**TC9754197636**
62	30	1450	SET OF TERMINAL BLOCK (OF EACH RATING AND TYPE) & STUDS FOR 30KW MOTOR	B3	**TC9754197628**
61	30	1450	SET OF TER.STUD/BLOCK FOR 30KW AC MOTOR	B3	**TC9754197610**
60	22	2950	SP.SET-JUNCT. BOX&CABLE GLANDS OF22KW M	B3	**TC9754197601**
59	22	2950	SP.SET OF COOLING FAN FOR 22KW MOTOR	B3	**TC9754197598**
58	22	2950	SP.INNER&OUTER COVER OF DE+NDE BEARING	B3	**TC9754197580**
57	22	2950	SP.SETOF GREASE, NIPPLE & PLUG FOR22KW MOTOR.	B3	**TC9754197571**
56	22	2950	SETOF BEARING(DE+NDE)ACCESSORIES OF22KW	B3	**TC9754197563**
55	37	1450	Sp set of Terminal /Bushing (Terminal Box Cover with Screws & Terminal Block) for LOP motor 37KW & 415V	B3	**TC9754197555**
54	37	1450	Sp set of brgs (NDE+DE) for LOP motor 37KW & 415V	B3	**TC9754197547**
53	37	2900	Horizontal Foot mounted Explosion proof (E.Ex(d), Zone-2 Gas group: IIC) sq. cage AC induction motor, 37KW, 415V	B3	**TC9754197539**
52	30	2900	Sp set of Terminal /Bushing (Terminal Box Cover with Screws & Terminal Block) for LOP motor 30KW & 415V	B3	**TC9754197520**
51	30	2900	Sp set of brgs (NDE+DE) for LOP motor 30KW & 415V	B3	**TC9754197512**
50	30	2900	Horizontal Foot mounted Explosion proof (E.Ex(d), Zone-2 Gas group: IIC) sq. cage AC induction motor, 30KW, 415V	B3	**TC9754197504**
49	22	1450	Sp set of Terminal /Bushing for LOP motor 22KW & 415V	B3	**TC9754197490**
48	22	1450	Sp set of brgs (NDE+DE) for LOP motor 22KW & 415V	B3	**TC9754197482**
47	7.5	2900	Vertical Flange Mounted Explosion Proof (Ex"d", Gas group IIC) sq. cage A.C Induction Motor,415 V	V1	**TC9754197474**
46	11	1450	Vertical Flange Mounted Explosion Proof (Ex"d", Gas group IIC) sq. cage A.C Induction Motor,415 V	V1	**TC9754197466**
45	22	1450	Horizontal Foot mounted Explosion proof (E. Ex(d), Gas group: IIC) sq. cage AC induction motor. Voltage 415V. The motor cable gland & terminal box is to be designed to suit the existing cable size of 3CX120A2FY. The motor frame size 180 is to be offered by vendor as much as possible. Vendor shall comply wih M/s Jacobs datasheet No: TCEG-MCN1003-LOPDM-DS as enclosed in Enquiry	B3	**TC9754197458**
Var.	**KW**	**RPM**	**Description**	**Co. shape**	**Material code**

44	7.5	2900	Horizontal Foot mounted Explosion proof (EEx(d), Gas group:IIC) sq. cage AC induction motor. Voltage:400V	B3	**TC9754197440**
43	0.75	1450		B3	**TC9754197431**
42	0.75	1450		B5	**TC9754197423**
41	1.1	1450		B3	**TC9754197415**
40	11	2900	Sp set of brgs (NDE+DE) for CEP motor,415V	V1	**TC9754197407**
39	5.5	2900	Sp cooling fan for EOP motor,415V	B3	**TC9754197393**
38	5.5	2900	Sp set of brgs (NDE+DE) for EOP motor,415V	B3	**TC9754197385**
37	18.5	1450	Sp set of brgs (NDE+DE) for LOP motor,415V	B3	**TC9754197377**
36	22	2900	Horizontal Foot mounted Explosion proof (EEx(de), Gas group:IIC) sq. cage AC induction motor,415V	B3	**TC9754197369**
35	18.5	2900		B3	**TC9754197350**
34	15	2900		B3	**TC9754197342**
33	11	2900		B3	**TC9754197334**
32	7.5	2900		B3	**TC9754197326**
31	5.5	2900		B3	**TC9754197318**
30	3.7	2900		B3	**TC9754197300**
29	110	1450		B3	**TC9754197296**
28	100	1450		B3	**TC9754197288**
27	90	1450		B3	**TC9754197270**
26	75	1450		B3	**TC9754197261**
25	55	1450		B3	**TC9754197253**
24	45	1450		B3	**TC9754197245**
23	37	1450		B3	**TC9754197237**
22	30	1450		B3	**TC9754197229**
21	22	1450		B3	**TC9754197210**
20	18.5	1450		B3	**TC9754197202**
19	15	1450		B3	**TC9754197199**
18	11.0	1450		B3	**TC9754197180**
17	7.5	1450		B3	**TC9754197172**
16	5.5	1450		B3	**TC9754197164**
15	3.7	1450		B3	**TC9754197156**
14	1.1	1450		B3	**TC9754197148**
13	0.75	1450		B3	**TC9754197130**
12	0.37	1450		B3	**TC9754197121**
11	0.75	1450	Hor. Foot/flg mounted Ex. proof (EEx (d), Gas group:IIC) sq. cage AC motor,415V	B5	**TC9754197113**
10	90	2900	Vertical Flange mounted Explosion proof (Ex(d), Gas group:IIC) sq. cage A.C induction motor,415V.	V1	**TC9754197105**
09	75	2900		V1	**TC9754197091**
08	55	2900		V1	**TC9754197083**
07	45	2900		V1	**TC9754197075**
06	37	2900		V1	**TC9754197067**
05	30	2900		V1	**TC9754197059**
04	22	2900		V1	**TC9754197040**
03	15	2900		V1	**TC9754197032**
02	18.5	2900		V1	**TC9754197024**
01	11	2900		V1	**TC9754197016**
Var.	**KW**	**RPM**	**Description**	**Co. shape**	**Material code**

RECORD OF REVISIONS

Rev. No	Date	Revision Details	Revised	Approved
00.	18.02.08	FIRST ISSUE	-	-
01	19.04.08	Var. nos. added in variant table	MVS Raju	KK Rao
02	11.02.10	Var. nos. added upto 39	MVS Raju	RA Krishnan
03	13.05.10	Var. nos. added upto 43	MVS Raju	RA Krishnan
04	15.12.10	Var. no. 44 added.	MVS Raju	RA Krishnan
05	15.03.12	Var. no. 45 added.	M.S. Kumar	MVS Raju
06	27.08.15	Clause 26 point 4 Addedd	M S KUMAR	M V S RAJU
07	07.09.15	Variant 46 Added	M.S.KUMAR	M.V.S.RAJU
08	09.09.15	Clause 22.0 & 27.0 Added	M S Kumar	M V S Raju
09	29.10.15	Variant 47 Added	M S Kumar	M V S Raju
10	28.05.18	Marked as R10 & Variants added upto 62	Shekhar	K BHARATH
11	28.06.18 27.12.18	Variants added from 63 to 67 Variant nos. added upto 72	Sunil B Jiwtode	P S V S K

SQUIRREL CAGE INDUCTION MOTORS IE-3 (Premium Efficiency Class)

(For BFP Drive Turbine)

1. SCOPE:

This standard specifies the requirements of the 3-phase medium voltage squirrel cage Induction motors used for driving Centrifugal / Screw / Gear pumps of lube oil systems of Industrial Turbo sets and BFP drives.

2. TECHNICAL REQUIREMENTS:

2.1 General:

The squirrel cage induction motors shall be of horizontal foot mounted (B3) type or Vertical flange mounted (V1) type construction as per enquiry suitable for bi-directional rotation. Unless otherwise specified the motors are of type IP55 enclosure (as per IS: 4691 & IEC60034-05) with class 'B' insulation and continuous duty (S1). Class 'F' insulation is also accepted with temperature rise limited to class 'B'. The motors shall be suitable for 100% humid (at 40 deg C), salty tropical conditions and highly polluted environment.

2.2 Design Standards:

The motors shall conform to relevant latest amendments of National and International Codes and standards, especially the Indian Statutory Regulations.

- Performance : IS 325 & IS 8789 & IEC:60034
- Dimensions : IS 1231 / IS 2223
- Enclosure and protection : IS 4691 / IEC:60034-05
- Tropicalizing treatment : IS 3202
- Energy Efficient motors : IS 12615 / IEC:60034-30
- Method of Cooling : IS 6362 / (Equivalent IEC: 60034 Std.)

2.3 Design and Constructional Features:

2.3.1 Motors shall work satisfactorily for following supply conditions:

Variation of supply voltage from rated voltage : ± 10%
Variation of supply frequency from rated frequency : + 3% to - 5%
Combined voltage and frequency variation : ± 10%

2.3.2 The Voltage level of motors shall be as follows: (unless otherwise specified)
Up to 200 kW: 3 Phase 415V AC

2.3.3 Rated frequency: 50 Hz

2.3.4 The ambient temperature is 50°C and an altitude not exceeding 1000 meters above mean sea level shall be taken into consideration unless otherwise specified.

2.3.5 TEMPERATURE RISE 70°C by resistance method for both thermal class 130(B) & 155(F) insulation.

2.3.6 Continuous duty LT motors up to 160 KW Output rating (at 50°C ambient temperatures), shall be Energy Efficient motors, Efficiency class of Premium efficiency (IE3) as per IEC: 60034-30 unless otherwise specified.

2.3.7 Winding and Insulation shall be Non-hygroscopic, oil resistant, and flame resistant.

2.3.8 Motor body shall have two earthing points on opposite sides.

2.3.9 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.

2.3.10 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.

2.3.11 The starting time of the motor shall be less than 3 secs.

2.312 The motor shall be totally enclosed fan cooled (TEFC) unless otherwise specified.

2.4 Performance:

2.4.1 Motor shall be suitable for DOL starting.

2.4.2 The motor shall be capable of start & operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminal.

2.4.3 Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. Starting torque should not be less than 120% of FLT. The pullout torque at the rated voltage shall be not less than 205% of the full load torque with no negative tolerance. Unless otherwise agreed, the pullout torque shall not exceed 300% of the rated load torque.

2.4.4 Fault capacity of the system to which motor is connected is about 45 kA RMS 1 second.

2.4.5 Noise level for all the motors shall be limited to 85dB (A) at distance of 1 m as per IS12065 (latest) /IEC60034.

2.4.6 Vibration shall be limited within the limits prescribed in IS: 12075 / IEC 60034-14. Motors shall withstand vibrations produced by driven equipment.

2.4.7 The spacing between gland plate & center of terminal stud shall be as per Table-1.

2.4.8 For motors with starting time up to 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.

2.4.9 The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance)

a) Below 110 kW: 10.0

(b) From 110 kW & up to 200 kW: 9.0

2.4.10 Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below

(a) Fuel oil area: Group - IIB

2.4.11 The starting voltage requirement shall be 85% for motors below 110KW rating and 80% from 110KW to 200KW.

2.5 ACCESSORIES:

Terminals and Terminal box:

2.5.1 All the six terminals should be brought out on the terminal block, which shall be provided with connecting strips and shall amply be rated.

2.5.2 The terminal box shall be capable of being turned through 360 degrees in steps of 90 degrees and location is to be midway on right hand side when viewed from coupling end.

2.5.3 The terminals shall be clearly marked R.Y.B.

2.5.4 The terminal box shall be furnished completely with nickel coated brass double compression glands for termination.

2.5.5 Grounding pads shall be as per relevant standards.

2.5.6 The degree of protection shall be IP55 as per IS4601 & IEC60034-05

2.6 Suitable single phase AC (240 V) space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Space heaters shall be wired up to separate terminal box complete with removable gland plate and suitable terminals & glands for connections of cable & temperature detectors, bearing temperature indicators and moisture detectors terminals, Neutral CT terminals shall also be provided.

2.7 Lower capacity motors (less than 30kW) where separate Anti condensation heaters are not provided, two phases of the winding will be subjected to 240V AC, 50HZ supply continuously whenever the motor is switched off to avoid any ingress of moisture. The supplier in the offer in this regard shall bring out any limitations. For LV Motors: Two point five (2.5) mm2, two (2) core copper conductor PVC insulated, armoured & FRLS PVC sheathed heavy duty 650/1100 V grade cable to IS: 1554 Part-I).

2.8 RATING PLATES

A rating plate of non-corrosive material upon which shall be engraved Manufacturer's name, Motor type, Motor model, Serial no. of motor, Rating, Voltage, Speed in RPM, Type of duty, Full load current in Amps, type of protection and efficiency class (IE3 / IE4).

These rating plates shall be of White non-hygroscopic material with engraved black lettering.

Stainless steel name plate as per IS 325 (Latest) /IEC 60034 (latest).

2.9 PROTECTION AND PRESERVATIVE COATING REQUIREMENTS:

2.9.1 All coated surfaces shall be protected against abrasion impact, discoloration any other damages. All exposed threaded portions shall be suitably protected with either metallic or a nonmetallic protection device. The shaft ends of motor shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted due to exposure to whether, should also be properly treated and protected in a suitable manner. All primers / paints / coatings shall take into account the hot humid, corrosive & alkaline, subsoil or over ground environment as the case may be.

2.9.2 Preservative shop coating:

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces that will not be easily accessible after the shop assembly shall be treated before-hand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and pre heated in the shop. The surfaces that are to be finish painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer.

All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of Customer / BHEL.

2.10 PAINT AND FINISH

Motor external parts shall be finished and painted to produce a neat and durable surface, which would prevent rusting, and corrosion. The equipment shall be thoroughly degreased, all rust, sharp edges and scale removed and treated with one coat of primer and finished with two coats of RAL 5012 blue paint unless otherwise specified.

Material shall be properly packed to withstand mechanical damage and rust during transit.

2.11 The motor winding shall be tropicalized. The windings shall preferably be vacuum impregnated. Alternately the winding shall be suitably varnished, baked and treated with epoxy gel for operating satisfactorily in humid and corrosive atmospheres.

2.12 Cooling fan hub shall be threaded for withdrawing.

2.13 Drain plug shall be provided at the bottom of the starter frame.

2.14 The following **cable sizes** shall be considered for selecting suitable cable glands, unless otherwise specified.

Up to 3.7 KW - 3C x 2.5 mm^2 multi stand cu. conductor armored cable.

Above 3.7 KW up to 11KW - 3C x 10 mm^2 Multi stand Al. conductor, Armored cable

Above 11 KW up to 26KW - 3C x 25 mm^2 Multi stand Al. conductor, Armored cable.

Above 26 KW up to 37KW - 3Cx50 mm^2 Multi stand Al. conductor, Armored cable.

Above 37 KW up to 55KW - 3Cx95 mm^2 Multi stand Al. conductor, Armored cable.

Above 55 KW up to 75KW - 3Cx150 mm^2 Multi stand Al. conductor, Armored cable.

Above 75 KW up to 150KW -2x 3Cx185 mm^2 Multi stand Al. conductor, Armored cable.

Three (3) core cables .....Stranded aluminium conductor, XLPE insulated, colour coded, laid up, FRLS PVC type ST2 sheathed, GI wire /strip armoured, FRLS PVC type-ST2 jacketed overall, 650 / 1100V grade, heavy-duty cable as per IS:1554 Part-I).

For space heater 2Cx6 mm^2 Aluminum conductor, Armored cable

Special sizes if any will be as per our enquiry.

- For NTPC:

  90 kW AC motor: 1x3C x 150sq mm

2.15 Bearing & Lubrication:

Motors shall have greased lubricated ball or roller bearings. In all cases, the bearings shall be chosen to provide a minimum life of 5 Years (40000 hours) at rated operating conditions. Unless otherwise specified the bearings shall be adequate to absorb axial thrust produced by the motor itself or due to shaft expansion. Vertical motors shall be provided with thrust bearings suitable for the load imposed by the driven equipment. In cases such as pumps for hot liquids where the driven machine operates at high temperatures, a shaft-mounted fan shall cool bearings. This shall ensure efficient ventilation of the bearing and disperse the heat transmitted from the driven object by conduction or convection. For motors operating in hazardous areas fans shall be of an anti-static non-sparking material.

Bearings shall be capable of grease injection from outside without removal of covers with motors in the running conditions. The bearing boxes shall be provided with necessary features to prevent loss of grease or entry of dust or moisture e.g. labyrinth seal. Where grease nipples are provided, these shall be associated, where necessary with appropriately located relief devices, which ensure passage of grease through the bearing. Pre-lubricated sealed bearings may be considered provided full guarantee is given for 4 to 5 years of trouble free service without the necessity of re-lubrication.

2.16 Cooling system:

All motors shall be self-ventilated, fan cooled (TEFC). Fans shall be corrosion resistant or appropriately protected. They shall be suitable for motor rotation in either direction without affecting the performance of the motor. If this is not possible for large outputs, it shall be possible to reserve the fan without effecting the balancing of the motor.

Motor shall be capable of 5 equal spaced cold starts per hour under normal conditions, 3 starts in quick succession from cold condition and two hot start in succession with motor initially at normal running condition.

2.17 **ROTOR:**

The rotor shall be of squirrel cage type, dynamically balanced to provide a low vibration level and long service life of the bearings. The accepted values of peak-to-peak vibration amplitudes for a motor at rated voltage and speed on a machined surface bedplate with the motor leveled and with a half-key or coupling fitted shall not exceed those given in IS-12075 (latest).

2.18 Grounding

General- Two (2) grounding terminals one (1) on either side at the bottom suitable for connecting mild steel/GI flat/GI wire grounding conductor, size of grounding conductor shall be decided during detailed engineering.

LV Motors-At each earthing point, two (2) drilled and tapped holes with hexagonal head bolts, plain washers, spring washers and tinned lugs (for motors upto 5.5 KW) for size of conductor specified shall be provided.

3. TESTS CERTIFICATE:

3 copies of performance test certificate of motor shall be supplied for each item of the consignment quoting BHEL Standard number, purchase order number and manufacturer's identification serial number.

4. GUARANTEE CERTIFICATE:

4.1 A guarantee certificate for 24 months of trouble free performance from the date of shipment or 18 months from the date of commissioning whichever is earlier shall be supplied.

4.2 If any mal-performance or defects occur during the guarantee period, the vendor shall make all necessary alteration, repairs and replacement free of charge.

5. SCOPE OF SUPPLY:

5.1 Main Supply

5.1.1 Motor with suitable double compression cable glands, lugs and along with shaft keys.

5.1.2 Space heater & RTD for motors with separate terminal box of rating 30 KW and above.

5.2 1 Set of commissioning spares (DE &NDE Bearings) items- Separate Purchase Requisitions is raised if required.

5.3 3 years Normal Operational spares (optional price shall be quoted for validity of 2 years) - Separate Purchase Requisitions will be raised as and when required.

5.3.1 Terminal Box.

5.3.2 Cooling Fan with End shield Cover

5.3.3 DE and NDE side Bearings

6. TESTS:

6.1 Each motor shall be Routine tested in accordance with IEC 60034-2 latest in presence of purchaser's representative.

Type test of similar frame size motor to be produced at the time of inspection. Tests on completely assembled motor shall be carried out in the presence of BHEL / Customer representative. The results shall be tabulated and signed by both vendor and BHEL / Customer representatives. **Though the motors shall be accepted on the basis of the satisfactory result of the tests at the vendor's works, it shall not absolve the vendor from liability regarding the proper functioning of motor coupled to the driven equipment at BHEL works or at sites.**

6.2 LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last eight (8) years.

6.3 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. However if the contractor is not able to submit report of the type test(s) conducted within last eight (8) years from the date of ordering, 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 owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

1. Type tests

i. No load saturation and loss curves up to approximately 115% of rated voltage.
ii. Momentary overload test.
iii. Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., core temp., coolant flow and its temperature 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.iv. Surge withstand test on the sample coil after placing it in stator core at (4U + 5 KV) and with at least five impulse of 1.2/50 micro sec. wave, for HV motors only,where U is the line to line voltage in kV.

v. Surge-withstand test with 0.3/3 micro sec. wave on each type of 6.6/11 kV motor coils with at least five such impulses, followed by one minute power frequency high voltage test on turn to turn insulation, after cutting the coil and bringing out the turns suitably. The power frequency test voltage shall be decided during detailed engineering.
vi. Dimensions (for motors covered by IS 1231:1974 and IS 2223:1983 only).
vii. Measurement of resistance of windings of stator and wound rotor.
viii. Reduced voltage running up test at no load (for squirrel cage motors up to 37kw

only).

ix. Full load test to determine efficiency, power factor and slip.

x. Insulation resistance test.

xi. Test for vibration severity of motor.

xii. Test for noise levels of motor.

xiii. Test for degree of protection by enclosure.

xiv. Temperature rise test at limiting values of voltage and frequency variations.

xv. Over speed test.

2. Routine Tests

The following shall constitute the routine tests.

i. Insulation resistance test

ii. Measurement of resistance of windings of stator and wound rotor.

iii. No load test

iv. Locked rotor readings of voltage, current and power input at a suitable reduced voltage

v. Reduced voltage running up test (for squirrel cage motor) vi. Open circuit voltage ratio of stator and rotor windings (for slip ring motors);rotor;

vii. High voltage test

7. DOCUMENTATION:

7.1 All the drawings/ documents submitted by the vendor during detailed engineering stage shall be stamped “For Approval” or For Information” prior to submission. After the approval of the drawing, further work by the vendor shall be in strict accordance with these approved drawings and no deviations shall be permitted without the written approval of customer.

7.2 All manufacturing, fabrication and execution of work in connection with the equipment prior to the approval shall be at the vendor’s risk. The vendor is expected not to make any changes in the design of the approval of the drawings equipment, once they are approved by customer. However, if some changes are necessitated in the design of equipment at a later date, the vendor may do so, but such changes shall promptly be brought to the notice of customer indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the technical specification.

7.3 LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED

- All the motors shall be tested in accordance of IEC 60034-2
- The following type test reports shall be submitted for each type and rating of

LT motor of above 50 KW only

1. Measurement of resistance of windings of stator and wound rotor.
2. No load test at rated voltage to determine input current power and speed
3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)
4. Full load test to determine efficiency power factor and slip.
5. Temperature rise test.
6. Momentary excess torque test.
7. High voltage test.
8. Test for vibration severity of motor.
9. Test for noise levels of motor (Shall be limited to 85 dB (A) until otherwise specified)
10. Test for degree of protection
11. Over - speed test.
12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1.

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 basic price.

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.

7.4 NUMBER OF DOCUMENTS TO BE SUBMITTED:-

- Drawings, Data sheets, Curves for Information /approval .....3 prints (1 soft copy).
- Final Drawings, Data sheets, Curves for Information / approval .... 3 Prints.
- Performance and functional guarantee test reports .... 3 prints
- O&M manual with project drawings, data sheets, performance and functional guarantee test reports ..... 10 Prints & 1 CD

8. DRAWINGS, DATA TO BE FURNISHED

8.1 Documents to be sent along with offer (2 copies)

(Without following data, offers will not be considered)

8.1.1 The descriptive leaflets / catalogues giving full sectional details of the item.

8.1.2 Motor Overall dimensional drawing along with terminal box details.

8.1.3 Motor cross-sectional drawing showing spare part details.

8.1.4 Filled in motor data sheets as per NTPC format (Page 12 to 15)

8.1.5 Characteristics curve of motor.

8.1.6 Speed torque characteristic curve of motor along with GD^2 Value.

8.1.7 Quality plan

8.1.8 Type test Certificates of similar frame size

8.2 DOCUMENTS TO BE SENT AFTER PLACEMENT OF ORDER FOR APPROVAL
(3 Hard Copies + 1 Soft copy)

8.2.1 Motor Overall dimensional drawing along with terminal box details.
8.2.2 Motor cross-sectional drawing showing spare part details.
8.2.3 Filled in motor data sheets as per NTPC format (Page 12 to 15)
8.2.4 Characteristics curve of motor
8.2.5 Speed torque characteristic curve of motor along with GD^2 value
8.2.6 Quality plan
8.2.7 Type test Certificates of similar frame size

8.3 DOCUMENT TO BE SUBMITTED AFTER FINAL APPROVAL

8.3.1 Material test certificates.
8.3.2 Guarantee certificates
8.3.3 Motor Overall dimensional drawing.
8.3.4 Filled in motor data sheets.
8.3.4 Quality plan.
8.3.7 Type test report

8.4 DOCUMENT TO BE SUBMITTED ALONG WITH CONSIGNMENT

8.3.1 Material test certificates.
8.3.2 Performance test certificates & Performance curve.
8.3.3 Guarantee certificates
8.3.4 Motor Overall dimensional drawing.
8.3.5 Filled in motor data sheets.
8.3.6 Quality plan.
8.3.7 Type test reports
8.3.8 O&M Manual

9. SPECIAL NOTES:

9.1 Final documents shall be furnished in CD for using in MS – word, AutoCAD & PDF.
9.2 Before forwarding the drawings and documents, vendor shall ensure that the following information is properly entered in each drawing.
9.2.1 Name of the equipment
9.2.2 Equipment tag number
9.2.3 Name of the project
9.2.4 Client / Customer
9.2.5 Drawing / Document title
9.2.6 Drawing / Document number.
9.2.7 Revision and date.
9.2.8 The manufacturer's serial no. shall be marked at suitable location.
9.2.9 A tag number bearing the relevant 12 digit material code shall be attached for each item.

10. **REFERENCE**

- IS 325: THREE-PHASE INDUCTION MOTORS
- IS 8789: Values of performance characteristics for three-phase induction motors(up to 37 kw)
- IEC:60034: Rotating electrical machines
- IS 1231: Dimensions of Three-phase Foot-mounted Induction Motors
- IS 2223: Dimensions of flange mounted ac induction motors
- IS 4691: Degrees of protection provided by enclosure for rotating electrical machinery
- IS 3202: Code of practice for climate proofing of electrical equipment
- IS 12615, Energy Efficient Induction Motors - Three Phase Squirrel Cage
- IEC:60034-30: Rotating electrical machines - Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)
- IS 6362: Designation of methods of cooling of rotating electrical machines

11. **TABLE 1:**

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS:

S.N.	Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm
1	UP to 3 KW	As per manufacturer's 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	203

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

S.N.	Motor MCR in KW	Clearance
1	UP to 110 KW	10mm
2	Above 110 KW and up to 150 KW	12.5mm
3	Above 150 KW	19mm

12. DATA SHEET (NTPC FORMAT):

DE-1	LT MOTORS	

A.	**GENERAL**	
1.	Manufacturer & Country of origin.	
2.	Equipment driven by motor	
3.	Motor type	
4.	Quantity	
B.	**DESIGN AND PERFORMANCE DATA**	
1.	Frame size	
2.	Type of duty	S1
3.	Type of enclosure /Method of cooling/ Degree of protection	
4.	Applicable standard to which motor generally conforms	
5.	Efficiency class as per IS 12615 (latest) / IEC 60034-30 (latest)	IE3 (default)
6.	(a)Whether motor is flame proof	Yes/No
	(b)If yes, the gas group to which it conforms as per IS:2148	
7.	Type of mounting	
8.	Direction of rotation as viewed from DE END	Bi-directional
9.	Standard continuous rating at 40 deg. C ambient temperature as per Indian Standard (KW)	
10.	Deaerated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
11.	Maximum continuous load demand of driven equipment in KW	
12.	Rated Voltage (volts)	415
13.	Permissible variation of :	
	a. Voltage (Volts)	±10
	b. Frequency (Hz)	±5
	c. Combined voltage and frequency	±10
14.	Rated speed at rated voltage and frequency(RPM)	
15.	At rated Voltage and frequency:	
	a. Full load current	
	b. No load current	
16.	Power Factor at	
	a. 100% load	
	b. NO load	
	c. Starting.	
17.	Efficiency at rated voltage and frequency,	
	a.100% load	
	b. 75% load	

	c. 50% load	
18.	Starting current (amps) at	
	a. 100 % voltage	
	b. 85% voltage	
	c. 80% voltage	
19.	Minimum permissible starting Voltage (Volts)	
20.	Starting time with minimum permissible voltage	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
21.	Safe stall time with 100% and 110% of rated voltage	
	a. From hot condition	
	b. From cold condition	
22.	Torques :	
	a. Starting torque at min. permissible voltage (kg-mtr.)	
	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg-m) available at lowest permissible starting voltage	
	e. Rated torque (kg-m)	
23.	Stator winding resistance per phase (ohms at 20 Deg.C.)	
24.	GD^2 value of motors	
25.	No of permissible successive starts when motor is in hot	
26.	Locked Rotor KVA Input	
27.	Locked Rotor KVA/KW	
28.	Vibration limit :Velocity (mm/s)	
29.	Noise level limit (dBA)	
C.	**CONSTRUCTIONAL FEATURES**	
1.	Stator winding insulation	
	a. Class & Type	

	b. Winding Insulation Process	
	c. Tropicalised (Yes/No)	Yes
	d. Temperature rise over specified maximum ambient temperature of 50 deg C	
	e. Method of temperature measurement	
	f. Stator winding connection	
2.	Main Terminal Box	
	a. Type	
	b. Location(viewed from NDE side)	
	c. Entry of cables(bottom/side)	
	d. Recommended cable size (To be matched with cable size envisaged by owner)	
	e. Fault level (MVA),Fault level duration(sec)	50kA RMS for 0.25 sec
	f. Cable glands & lugs details (shall be suitable for power cable)	
3.	Type of DE/NDE Bearing	
4.	Motor Paint shade	RAL5012(Blue)
5.	Weight of	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	
D.	**List of accessories.**	
1.	Space Heaters (Nos./Power in watts/supply voltage)	
2.	Terminal Box for Space Heater (Yes/No)	yes
3.	Speed switch (Yes/No) No of contacts and contact ratings of speed switch	
4.	Insulation of bearing (Yes/No)	
5.	Noise reducer(Yes/No)	
6.	Grounding pads	
	i) No and size on motor body	
	ii) Nos on terminal Box	
7.	Any other fitments	

E.	List of curves.	
1.	Torque speed characteristic of the motor	
2.	Thermal withstand characteristic	
3.	Starting. current Vs. Time	
4.	Starting. current Vs speed	
5.	P.F. and Effi. Vs Load	

13. **VARIANT TABLE:**

Var. No.	Description	Material code
01	TEFC SQ. CAGE HOR FOOT MOUNTED (B3) A.C IND. MOTOR FOR L.O.P. RATING: 90 KW, 415 VAC, 1450 RPM EFFICENCY AS PER IE3 IEC60034-30, SCOPE AS PER CLAUSE 5.1, NTPC Project	**TC9754373019**
02	SPARE SET OF BEARINGS (DE+NDE) FOR 90 KW A.C MOTOR- COMMISSIONING SPARE	**TC9754373027**
03	SPARE COOLING FAN FOR 90 KW A.C.MOTOR	**TC9754373035**
04	TERMINAL PLATE FOR IE3 90KW MOTOR	**TC9754373043**
05	SPACE HEATER FOR 90KW IE3 MOTOR	**TC9754373051**
06	TEFC SQ. CAGE HOR FOOT MOUNTED (B3) A.C IND. MOTOR FOR L.O.P. RATING: 110 KW, 415 VAC, 2900 RPM EFFICENCY AS PER IE3 IEC60034-30, SCOPE AS PER CLAUSE 5.1	**TC9754373060**
07	IE3 TEFC(B3)AC IND MTR,90KW,415VAC,2900	**TC9754373078**
08	IE3 TEFC(B3)AC IND MTR,75KW,415VAC,1450	**TC9754373086**

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised By	Approved By
00	01.07.14	First Issue		
01	20.06.16	First revision	Anshul	M.V.S.Raju
02	19.05.17	Second revision	Anshul	Sunil Jiwtode
03	16.12.17	Third revision , Var 08 added	Anshul	Sunil Jiwtode
