RATE CONTRACT OF TOP ASSEMBLY

1. In case of any conflict between BHEL spec and other enquiry documents, the following preferential order shall govern.
   1) Annexure I to BHEL Spec TC54013
   2) BHEL Spec TC54013, TC54373 & Related Annexures of TC54013
   3) International standards/codes/recommended practices as applicable.

2. The following are to be considered by vendor before offer:

2.1 Noise level of the complete package shall be restricted within 85 dBA at any point located 1 m away from the equipment. No deviation is acceptable.

2.2 Material Code Table Summary (Refer Annexure-IV for details)

Sl. No.	MAT CODE	MAT DESCRIPTION	MOTOR TYPE
1	TC9754013012	TOP ASSY(T) 50LPM@4BAR WITH AC MOTOR	ZONE 2, T3, Ex˘d˘ IIC, IE3
2	TC9754013217	TOP ASSY (T) 50LPM@4BAR WITH Ex˘n˘IIC IE3 MOTOR	ZONE 2, T3, Ex˘n˘ IIC, IE3
3	TC9754013225	TOP ASSY 50LPM 4KG Ex 'd' IIA/IIB IE3 MOTOR	ZONE 2, T3, Ex˘d˘ IIA/IIB, IE3

2.3 Vendor to provide Trolley mounted Transfer Oil Pump Assembly with Flameproof motors and starters (complete with all protection, controls and indication etc.) suitable for use in Zone 2, IIC, T3 with 20 meters of XLPE cable along with provision for cable hanger.

2.4 Flexible SS wire braided hose pipes (15m each at suction and discharge) with inlet & outlet flange size 1 X_#300RF for connecting to lube oil reservoir nozzle along with Hose storage wheel shall be provided.

2.5 AC Motor shall be powered from a nearby 5 pin socket.

2.6 Electrics for each portable trolley mounted motors, vendor shall supply

- 415V, 63A TPN receptacles with flameproof Ex˘d˘ Plug & Socket

  FLP socket glanding and termination shall be suitable for 3CX 6sqmm 2X FY cable and Plug shall be suitable for 3CX 2.5 sq. mm cable.

- Flameproof Ex˘d˘ Motor Starter

2.7 All the equipment˘s shall be packed for an outdoor storage period of 12 Months. All the openings shall be plugged & sealed condition during dispatch.

2.8 Couplings shall be of metallic, non-lubricated, flexible element type with spacer. Minimum service factor shall be of 1.5

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00	Issue	SHEKHAR	K Bharath	Sunil B J	07.02.2023

2.9 Oil used shall be ISO VG 46, hence the viscosities to be considered as 18 CST@65éC(Normal) & 280CST @10éC(Design)

2.10 Flanges as per ASME / ANSI B16.5 shall be provided

2.11 Performance test of Pump Assembly shall be carried out with Job motor and Starter only.

2.12 AC induction motor shall suitable for 415V, 50Hz 3 Ph AC Supply.

2.13 The 1.5 KW Motor shall be suitable for operating in ZONE 2, T3, IE3 class efficiency as per IS-12615 (latest edition). Also refer clause 2.2 of this document.

2.14 All equipment shall have valid statutory approval i.e., PESO / CCOE as applicable for use in the specified hazardous area. All indigenous flame proof equipment shall have valid BIS license and marking as required by statutory authorities.

2.15 Cooling Fans shall be made of non-sparking materials such as Cast Iron (LM-6 alloy / CI)

2.16 All motors and starter panels shall be provided with FRP canopy. No deviation is acceptable.

2.17 Vendor shall supply cable glands (Rolled Al/SS Heavy Duty Type Double Compression Glands) and tinned Cu crimping type lugs for equipment supplied by them. Material of lugs must be compatible with the material of cable conductor and the connected load terminal or busbar. Bimetallic cable lugs or bimetallic strip shall be provided in case of different material i.e., Al or Cu at the point of termination. Cable glands shall be suitable for Zone 2 Area classification.

2.18 Preliminary cable size is 6 mm2 Cu, 3 core. Final sizes shall be specified during detailed Engineering stage. Vendor shall comply without any commercial and delivery implications to BHEL.

2.19 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 GI wire rope, the same shall be supplied along with motor.

2.20 Hose storage wheel shall be provided in addition to cable hanger. Deviation is NOT acceptable.

2.21 Positive Material Identification (PMI) shall be applicable for SS Parts.

2.22 All pressure welds shall be 100% radiographed. If radiography is not feasible, magnetic particle inspection shall be performed instead.

2.23 Important Points for Electrical Local Panels

a) Local control panel is housed outdoor shall be designed to meet IP-55 requirements. In addition, panel must be provided with a rain cum sun shade/ GI canopy.

b) Local control panel/panels shall be totally enclosed cubicles. Panel sizing shall be carried out based on equipment being installed keeping in view the maintenance clearances and easiness of operation. Although the panel dimensions shall be guided by the actual requirements, typical dimensions shall be 2100 mm height x 1200 mm width x 1000 mm depth. In any case, vendor shall not proceed with panel manufacturing before getting prior approval from the purchaser.

c) Local control panels located in the hazardous area shall have flame proof Ex'd' components such as lamps, push buttons, switches etc.

d) It shall be possible to switch off incoming power to panel from panel front. All such power on/off switches shall be flameproof type. In addition, all those devices and terminals, which cannot be powered off from on/off switches shall also be located inside flameproof enclosures.

e) All hinges, screws and other non-painted metallic parts shall be of stainless steel material. Door handle and its latching rod shall be stainless steel type.

f) All panels shall be supplied in pre-wired condition and shall be completely tested at manufacturer's works prior to dispatch.

g) All cable entries to the panel shall be from panel bottom only using cable glands of adequate size. Cable gland plate thickness shall be a minimum of 3 mm cold rolled cold annealed (CRCA) as a minimum. Adequate ET type with check-nut cable glands shall be provided by vendor for cable entry. All unused cable entries must be plugged.

2.24 APPROVED COUPLING SUB VENDORS:

	2.258 FLEXIBLE METALLIC COUPLINGS		
1		EAGLE BURGMANN	INTERNATIONAL
2		EMERSON	INTERNATIONAL
3		EUROFLEX	INDIA
4		GOODRICH	UK
5		JOHN CRANE	INTERNATIONAL
6		RATHI	INDIA
7		THOMAS	USA
8		UNIQUE	INDIA

2.25 APPROVED AC MOTOR SUB VENDORS:

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13JF		Description : MOTOR-INDUCTION-M.V (FLAME PROOF)		
Approved Suppliers				
1	L065	LAXMI HYDRAULICS PVT LTD	INDIA	
2	3668	CG POWER & INDUSTRIAL SOLUTIONS LTD.	INDIA	
3	M282	MARATHON ELECTRIC MOTORS (INDIA) LTD.	INDIA	
4	B048	BHARAT BIJLEE LIMITED	INDIA	

2.26 APPROVED CABLE GLANDS SUB VENDORS

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14CA		Description : CABLE GLANDS (HAZARDOUS AREA)		
Approved Suppliers				
1	3681	FCG POWER INDUSTRIES PVT LTD	INDIA	
2	27421	CMP PRODUCTS LIMITED	UNITED KINGDOM	
3	S375	STANDARD METAL INDUSTRIES	INDIA	
4	S158	SUDHIR SWITCHGEARS PVT LTD	INDIA	
5	K173	KAYSONS TECHNO EQUIPMENTS PVT. LTD.	INDIA	
6	F165	FCG FLAMPROOF CONTROL GEARS P. LTD(C-157	INDIA	
7	F036	FLAMEPROOF EQUIPMENTS PVT.LTD	INDIA	
8	F024	FLEXPRO ELECTRICALS PVT LTD	INDIA	
9	3890	AKSHAR BRASS INDUSTRIES	INDIA	
10	F141	FCG POWER INDUSTRIES PVT LTD	INDIA	
11	C205	COMET INDUSTRIES	INDIA	
12	B024	BALIGA LIGHTING EQUIPMENTS (P) LIMITED	INDIA	
13	3704	METAL CRAFT INDUSTRIES	INDIA	

2.27 APPROVED CONTROL/STARTER PANEL SUB VENDORS

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13GB		Description : CONTROL STATIONS-FLAME PROOF		
Approved Suppliers				
1	S158	SUDHIR SWITCHGEARS PVT LTD	INDIA	
2	F024	FLEXPRO ELECTRICALS PVT LTD	INDIA	
3	K173	KAYSONS TECHNO EQUIPMENTS PVT. LTD.	INDIA	
4	3681	FCG POWER INDUSTRIES PVT LTD	INDIA	
5	F036	FLAMEPROOF EQUIPMENTS PVT.LTD	INDIA	
6	F141	FCG POWER INDUSTRIES PVT LTD	INDIA	
7	G159	PEPPERL & FUCHS MANUFACTURING (INDIA) PRIVATE LIMITED	INDIA	
8	B024	BALIGA LIGHTING EQUIPMENTS (P) LIMITED	INDIA	
9	F165	FCG FLAMPROOF CONTROL GEARS P. LTD(C-157	INDIA	

2.28 APPROVED PLUG & SOCKETS SUB VENDORS

Sr No	Supplier Code	Supplier Name	Country
Item Code : 13MC		Description : PLUGS/SOCKETS/HANDLAMPS (FLAME PROOF)	
Approved Suppliers			
1	F024	FLEXPRO ELECTRICALS PVT LTD	INDIA
2	F165	FCG FLAMPROOF CONTROL GEARS P. LTD(C-157	INDIA
3	F036	FLAMEPROOF EQUIPMENTS PVT.LTD	INDIA
4	F141	FCG POWER INDUSTRIES PVT LTD	INDIA
5	K173	KAYSONS TECHNO EQUIPMENTS PVT. LTD.	INDIA
6	3681	FCG POWER INDUSTRIES PVT LTD	INDIA
7	3815	VICTORY LUMINAIRES	INDIA
8	B024	BALIGA LIGHTING EQUIPMENTS (P) LIMITED	INDIA
9	S158	SUDHIR SWITCHGEARS PVT LTD	INDIA

2.29 APPROVED POWER CABLES SUB VENDORS

Sr No	Supplier Code	Supplier Name	Country
Item Code : 13OC		Description : CABLES-MEDIUM VOLTAGE-POWER-PVC/XLPE	
Approved Suppliers			
1	3722	POLYCAB INDIA LIMITED	INDIA
2	3731	POLYCAB INDIA LIMITED	INDIA
3	H060	HAVELLS INDIA LTD	INDIA
4	G156	GEMSCAB INDUSTRIES LTD	INDIA
5	3669	KEI INDUSTRIES LIMITED	INDIA
6	K082	KEI INDUSTRIES LIMITED	INDIA
7	3602	Special Cables Pvt. Ltd.	INDIA
8	3732	POLYCAB INDIA LIMITED	INDIA
9	3781	POLYCAB INDIA LIMITED	INDIA
10	3783	POLYCAB INDIA LIMITED	INDIA
11	3647	GUPTA POWER INFRASTRUCTURE LIMITED	INDIA
12	3765	THERMO CABLES LTD.	INDIA
13	3770	CMI LIMITED	INDIA
14	3854	CHANDRESH CABLES LIMITED	INDIA
15	S304	SUYOG ELECTRICALS LTD	INDIA
16	U085	APAR INDUSTRIES LTD	INDIA
17	K190A	KEC INTERNATIONAL LIMITED	INDIA
18	A132	ASSOCIATED FLEXIBLES & WIRES [P] LTD	INDIA
19	C145	CORDS CABLE INDUSTRIES LTD	INDIA
20	T124	TCL CABLES PRIVATE LIMITED	INDIA
21	U003	UNIVERSAL CABLES LTD	INDIA

2.32 APPROVED SS BRAIDED FLEXIBLE HOSE VENDORS

Sr No	Supplier Code	Supplier Name	Country
Item Code : 02BC		Description : HOSE METALLIC FLEXIBLE SS	
Approved Suppliers			
1	3708	QUALITY FOILS (INDIA) PVT. LTD.	INDIA
2	I207	INSAP ENGINEERS PVT. LTD	INDIA
3	S773	SWAGELOK CO.	UNITED STATES
4	R204	RM APPLIED ENGINEERS	INDIA
5	B179	BENGAL INDUSTRIES PVT LTD	INDIA
6	D144	DEWAS HYDROQUIP PVT LTD	INDIA
7	G052	GAYTRI INDUSTRIAL CORPORATION	INDIA
8	I197	INDIA FLEX INDUSTRIES PVT.LTD.	INDIA

3.0 PAINTING REQUIREMENT: -

Painting scheme shall be as per vendor standard.
However, Final Shades of Pump, Motor & Control Panel shall be as per project specific requirement. Vendor shall comply without any delivery/price implication to BHEL.

4.0 SCOPE OF SUPPLY:

As per clause 4.0 of BHEL spec TC54013, Rev 7

5.0 EQUIPMENT SUPPLIER QUALIFICATION CRITERIA:

5.1 The vendor for the complete unit shall be an established manufacturer and he shall also be the Manufacturer of the proposed equipment having adequate engineering, manufacturing & testing facilities for the same.

5.2 The vendor shall have engineered, packaged, tested and supplied at least two identical or validly similar packages in terms of type of machine, driver, sealing system etc. from the proposed plant and at least ONE of these shall have successfully operated in the field for at least 8000 hrs without any major problem as on the date of tender.

5.3 The vendor besides satisfying the requirements of clause 5.1 and 5.2 above shall also be the packager of the complete system proposed and shall have the single point responsibility for the entire package. Seal Make/Model shall be from the regular manufacturing range of seal manufacturer and shall be field proven for similar services of liquid pressure and speed.

6.0 WARRANTY CLAUSE FOR NRL COMPRESSOR PROJECTS:

Warranty of complete PUMP ASSEMBLY shall be as per clause 6.2 of TC54013.

7.0 ENCLOSURE:

7.1 BHEL Spec TC54013, Rev 8 – Pump Assembly with IIC Motor
7.2 BHEL Spec TC54373, Rev 3 – AC MOTOR SPEC
7.3 BHEL Spec TC54326, Rev 5 – COUPLING SPEC
7.4 Annexure-I to TC54013 – PROJECT SPECIFIC REQUIREMENTS
7.5 Annexure-II to TC54013 – PROVEN TRACK RECORD
7.6 Annexure-III to TC54013 – TECHNICAL DEVIATION SHEET
7.7 Annexure-IV to TC54013 – PRICE SCHEDULE
7.10 Annexure-V to TC54013 – CHECK LIST
7.11 BHEL SQP of Pump Assembly
7.12 Pre-Qualification Criteria

ANEXURE II to Purchase Specification TC54013
Project: RATE CONTRCT OF LUBE OIL TRANSFER PUMP ASSEMBLY

BHEL Enquiry Ref No Date

Vendor offer Ref No Date

PROVEN TRACK RECORD FOR THE MODEL BEING OFFERED (FOR MORE THAN 8000 HOURS)

SL.NO	PLANT NAME /LOCATION	CLIENT/CONSULTANT	MODEL No. / PO Details	SUCTION / DISCHARGE PRESSURE	FLUID HANDLED CAPACITY	YEAR OF SUPPLY

Note: Vendors have to submit the reference list for similar equipment˜s models supplied in the past for similar duty conditions.

Signature and stamp of vendor

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Vendor˘s Signature

Vendor˘s Company seal

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Annexure-V to TC54013 CHECK LIST
TURBINES AND COMPRESSORS
BHEL, HYDERABAD

Project: RATE CONTRACT OF OIL TRANSFER PUMP ASSEMBLY

TO BE FILLED BY THE VENDOR AND SUBMITTED ALONG WITH THE OFFER WITH OUT WHICH OFFER WILL NOT BE CONSIDERED

Sl .No.	Description	Vendor's Confirmation (Yes/No)
1	Compliance to BHEL Specifications TC54013, TC54373 & Annexures I of TC54013	
2	Compliance to BHEL SQP for Pump Assembly.	
3	Recommended motor rating for pump shall be 1.5 KW	
4	Completely filled-in Annex II PTR of the offered model submitted along with the offer	
5	Deviations, if any, to be mentioned in Annex-III Technical Deviation Sheet along with the offer	
6	Signed copy of Annex-IV Price schedule (without prices) enclosed with technical offer.	
7	Completely filled-in Pre-Qualification Criteria (PQC) submitted along with the offer	
8	Submission of documents to be sent along with offer as per clause 7.0 of spec TC54013	
9	Sub Vendor items to be procured from Approved vendors, listed in Annexure I to TC54013. Deviation is not acceptable.	
10	Final GA Drawing shall be submitted and it shall be considered as final for proceeding with downstream engineering, further changes in any of the dimension is not acceptable during detailed engineering.	

Vendor's Signature

Vendor's Company seal

Rev. No.	Revisions	Prepared:	Reviewed:	Approved	Date
00	Issue	SHEKHAR	BHARATH	SUNIL B J	17.09.2022

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD	STANDARD QUALITY PLAN FOR VENDOR ITEMS ITEM: TRANSFER OIL PUMP (TROLLEY TYPE) BHEL SPEC: TC54013, TC54016 Rev. No. – as per PO	QP. NO: HYQA/SQP/TC/22-23/05 Rev. No.: 00 DATE: 16.09.2022 VALID UPTO: 15.09.2024 PAGE 1 OF 5

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
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
1.01	Pump Casing, End Cover	Chemical & Mechanical Properties	Major	Visual, Verification	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	
1.02	Gear & Shaft	Chemical & Mechanical Properties	Major	Visual, Verification	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	
1.03		UT on Shaft	Major	UT if Φ > 40mm	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	
1.04	Bearings, Mechanical Seals, Coupling, Coupling Guard	Make, Size, Item No, Functional properties	Minor	Visual, Verification	100%	BHEL Spec/ Approved Drg / Data Sheet		TC/COC	√	2	-	1	
1.05	Structures & Base Plate, Drip Tray	Chemical & Mechanical Properties	Major	Visual, Verification	100%	BHEL Spec/ Approved Drg / Data Sheet		TC/COC	√	2	-	1	
1.06	Suction & Discharge Isolation Valves,	Chemical & Mechanical Properties, Hydro Test, Functional Test	Major	Visual, Verification	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	
1.07	Safety Relief Valve	Chemical & Mechanical Properties, Hydro Test	Major	Visual, Verification	100%	BHEL Spec/ Approved Drg / 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

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD	STANDARD QUALITY PLAN FOR VENDOR ITEMS ITEM: TRANSFER OIL PUMP (TROLLEY TYPE) BHEL SPEC: TC54013, TC54016 Rev. No. – as per PO	QP. NO: HYQA/SQP/TC/22-23/05 Rev. No.: 00 DATE: 16.09.2022 VALID UPTO: 15.09.2024 PAGE 2 OF 5

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	Flexible Hose, Power Cable	Verification of TC	Major	Visual, Verification	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	As applicable
1.09	Flanges, Fittings	Chemical & Mechanical Properties	Major	Visual Inspection	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	
1.10	Explosion Proof Motor - as per BHEL specification.	Routine Test	Critical	Visual, Verification	100%	BHEL Spec/ Approved Drg / Data Sheet / TEFC, IP 55 / IS-12075 /IS:12065 / IS 325		TC, CCOE certificate	√	2	-	1	
		Type Test							√	2	-	1	
1.11	Explosion Proof DOL Starter	Functional & Explosion Proof	Critical	Visual, Verification	100%	BHEL Spec/ Approved Drg / Data Sheet		CMRS Certification	√	2	-	1	
2.0	**INPROCESS INSPECTION**												
2.1	Terminal Box	Workmanship finish Dimension	Major	Visual Measurement	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	
2.2	Pump Casing	Leak Tightness test for min 30 mins	Critical	Hydrostatic Test	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	
2.3	Cleanliness	Visual	Major	Visual	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	

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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: TRANSFER OIL PUMP (TROLLEY TYPE) BHEL SPEC: TC54013, TC54016 Rev. No. – as per PO	QP. NO: HYQA/SQP/TC/22-23/05 Rev. No.: 00 DATE: 16.09.2022 VALID UPTO: 15.09.2024 PAGE 3 OF 5

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
3.0	**FINAL INSPECTION & TESTING**												
3.1	Pump Assembly With **Job** Motor	Overall Dimension and Orientation	Major	Visual measurement	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	1	-	
		Performance Test* (Capacity V/s Head, Efficiency V/s Head, Power V/s Head)	Critical	Performance Test	100%	BHEL Approved Drg/Data Sheet / BHEL Spec		IR	√	2	1	-	*minimum 30 mins duration with Test Bed Lube oil of designated Viscosity
		Mechanical Run Test* (including Vibration, Noise level Test and bearing temp rise)	Critical	Visual Measure	100%	BHEL Approved Drg/Data Sheet / BHEL Spec		IR	√	2	1	-	
		Leakage	Critical	Visual	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	1	-	
		Completeness	Critical	Visual	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	1	-	
		Relief Valve Setting	Critical	Testing	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	1	-	
3.2	PMI test for AS & SS components	Alloying Elements (PMI)	Major	PMI	100%	Approved Drg/ data sheet / BHEL Spec		IR	√	2	1	-	
4.0	**PAINTING AND PACKING**												
4.1	Surface Preparation,	Workmanship, and finish	Minor	Visual Inspection	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	
4.2	Painting	DFT	Major	Visual Inspection	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	
4.3	Packing	Packing	Major	Visual Inspection	100%	BHEL Spec/ Approved Drg / Data Sheet		TC	√	2	-	1	

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Sachin Katiyar Sr. Engineer / QA	B. Ashok Kumar AGM/QA	B. Ashok Kumar AGM/QA

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										P	W	V	

Refer Annexure-I for Notes.

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

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

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.

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										P	W	V	

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.

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TRANSFER OIL PUMP ASSEMBLY
(TROLLEY TYPE)

1.0.0 **SCOPE**:

This standard specifies the requirements of gear type transfer oil pump unit driven by Explosion proof (EExd') of Gas Group IIC motor along with explosion proof starter mounted on a trolley. This unit is used in Refinery / petroleum plant where the area is hazardous.

2.0.0 **TECHNICAL REQUIREMENTS:**

2.1.0 **APPLICATION**:

The transfer oil pump unit is used for filling / emptying from the lube oil reservoir. No copper and copper alloys shall be used for any part of construction.

2.2.0 **OPERATING CONDITIONS:**

2.2.1	Fluid handled	: Turbine oil type ISO, VG 46 or Servo prime 46 of IOC
2.2.2	Kinematic Viscosity of oil	: 18 mm^2 /s (CST) at 65°C (operating) 46 mm^2 /s (CST) at 40°C (during starting)
2.2.3	Specific gravity	: 0.88
2.2.4	Viscocity Index	: 96
2.2.5	Delivery flow	: **AS PER VARIANT TABLE**
2.2.6	Pressure at inlet branch	: Flooded
2.2.7	Discharge pressure	: 4 Kg/cm^2 (g)
2.2.8	Set pressure of relief valve	: To be furnished by vendor (It shall be adjustable)
2.2.9	Speed	: 1450 RPM
2.2.10	Hydrostatic test pressure	: 1.5 times discharge pressure
2.2.11	Power absorbed by pump	: To be furnished by vendor
2.2.12	Motor rating required (1.25 times power absorbed by pump)	: To be furnished by vendor

2.3.0 **CONSTRUCTION FEATURES:**

2.3.1	Pump type	: Internal Gear
2.3.2	Pump model	: Vendor to furnish
2.3.3	Shaft sealing	: Oil Seal.
2.3.4	Pressure relief valve	: Built – in type
2.3.5	Type of coupling	: Diaphragm flexible – Unique or Lovejoy make

2.4.0 **MATERIAL OF CONSTRUCTION OF PUMP:**

2.4.1	Casing	: C.I Gr. 20 IS: 210
2.4.2	Rotor	: Alloy iron sintered
2.4.3	Shaft	: EN 8
2.4.4	Shaft seal	: Nitrile rubber
2.4.5	Base plate	: MS IS: 226 / IS: 2062
2.4.6	Mounting	: Horizontal foot
2.4.7	Type of bearing	: Bush bearing

2.5.0 SPECIFICATION OF ELECTRIC MOTOR:

The Explosion proof (E Ex" d") shall be as per purchase specification TC54197. EIL/Customer specification & EIL/Customer motor data to be followed. The specific project motor data sheet will be sent along with enquiry & the filled data sheet to be sent along with price bid by vendor.

2.5.1	Type	: 3-phase squirrel cage induction motor in Ex. proof execution to EExd', IIC, T3, IP 55 in horizontal foot mounted (B3) construction.
2.5.2	Voltage	: 415V± 10%
2.5.3	Frequency	: 50 HZ ± 3%
2.5.4	Combined variation on voltage and frequency	: ± 10%
2.5.5	Ambient temperature Min / Max in ºC	: 1 / 50
2.5.6	Insulation	: F with temperature raise limited to class B
2.5.7	Design	: IS 325
2.5.8	Type of enclosure	: IP 55, TEFC
2.5.9	Type of starting	: DOL
2.5.10	Motor rating	: 1.1 KW

(Suitability of the motor rating, type of mounting and speed shall be confirmed by the vendor)

2.5.13	Motor speed	: 1450 RPM
2.5.14	Direction of rotation	: Bi-directional

2.5.15 **Acceptable vendors:(Refer vendor list for Motors in Annex I)**

- M/s CEMP, Italy.
- M/s ABB, India
- M/s Siemens, India
- M/s CGL
- M/s LHP
- M/s BBL

2.6.0 **STARTER:**

Flame proof and weather proof DOL starter suitable for gas group IIC (Hydrogen) and conforming to IS: 2148 and shall be approved from CMRS for 1.1 KW motor

- 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.

3.0.0 **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.

4.0.0 **SCOPE OF SUPPLY:**

4.1.0 Pump with built in relief valve.
4.2.0 Explosion proof (E Ex" d") motor of Gas group IIC motor.
4.3.0 Flame proof electric starter.
4.4.0 Flexible coupling and coupling guard
4.5.0 Common base plate mounted on trolley
4.6.0 Drip tray
4.7.0 Suction & discharge Isolation valves
4.8.0 Standard tools and commissioning spares.
The commissioning spares are properly identified with tags.
4.9.0 2 Numbers of 15 meters' length of flexible SS branded hoses with inlet & outlet rotating flanged connections 1" ANSI 300# RF.
4.10.0 40 Meters length of Armored power cable in 1.5 MM^2, 3 core with flame proof plug socket for connection to Explosion proof starter

5.0.0 **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.

6.0.0 **TEST AND GUARANTEE CERTIFICATE:**

6.1.0 **TEST CERTIFICATE:**

6 copies 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.

6.2.0 **GUARANTEE CERTIFICATE:**

6.2.1 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.

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

7.0.0 **DOCUMENTATION:**

7.1.0 **DOCUMENT TO BE SUBMITTED ALONG WITH OFFER. (2 COPIES EACH)**

The following documents shall be supplied along with offer

7.1.1 The descriptive leaflets and catalogues giving full sectional details of the equipment (Pump with built-in safety relief valve, Coupling & Explosion proof starter).

7.1.2 Spare parts quotation as specified in this specification

7.1.3 Performance curves of the pump at different viscosities.

7.1.4 Overall dimensional drawing of the transfer oil pump unit mounting on a trolley including motor. (Starter should be mounted on trolley)

7.1.5 Quality assurance plan

7.1.5 Mechanical cleaning and painting procedure

7.1.6 Data sheet of the pump. (Equipment serial number and year of manufacturing also to be indicated)

7.1.7 The motor documents shall be as per clause 29.1 of our purchase specification TC54197 Rev 07.

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

(3 Copies each)

The following documents shall be supplied after placement of order

7.2.1 Cross-sectional drawing with bill of materials.

7.2.2 Final data sheet of the pump and relief valve.

7.2.4 Electrical schematic diagram of starter.

7.2.5 Overall dimensional drawing of transfer oil pump unit mounted on trolley

7.2.6 Quality assurance plan

7.2.7 Mechanical cleaning and painting procedure.

7.2.8 The motor documents shall be as per clause 29.2 of our purchase specification TC54197 Rev 07.

7.3.0 **<u>DOCUMENT TO BE SUBMITTED AFTER APPROVAL.(2 Hard Copies &1 Soft copy each)</u>**

7.3.1 Overall dimensional drawing showing complete details of transfer oil pump unit mounted on trolley

7.3.2 Final data sheet of the pump with built-in safety relief valve.

7.3.3 Electrical schematic diagram of starter.

7.3.4 O & M Manuals

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

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

7.4.0 **<u>DOCUMENT ALONGWITH CONSIGNMENT. (6 COPIES EACH)</u>**

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

7.4.2 O & M Manuals (2 Copies).

7.4.3 Test & Guarantee certificates.

7.4.4 The motor documents shall be as per clause 29.4 of our purchase specification TC54197 Rev 07

8.0 **<u>SPECIAL NOTES</u>:**

8.1.0 Final documents as per clause 5.2.1 & 5.2.2 shall also be furnished in C.D compatible for using in Autocad Rel 2007.

8.2.0 O & M manuals shall be furnished in C.D compatible for using in MS - word for both pump and motor.

8.3.0 Motor dimensional and cross sectional drawings shall also be furnished in C.D compatible for using in Acad

8.4.0 Refer Project specific Annexures(If applicable) sent along with inquiry.

8.5.0 Vendor to submit the filled in Annex-I(TDS) & Annex-II(Price format) while sending the offer.

9.0.0 **<u>PACKING</u>:**

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

10.0.0 **<u>MARKING</u>:**

10.1.0 The manufacturer's serial number and year of manufacture shall be marked at suitable locations viz. Nameplate.

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

10.3.0 The nameplate of the transfer oil pump unit shall contain the following information.

10.4.0 Manufacturer's name or trademark and serial number.

10.5.0 Transfer oil pump model number.

10.6.0 Capacity of the Transfer oil pump.

10.7.0 Pump discharge pressure.

10.8.0 Pump safety relief valve set pressure.

11.0.0 **SCHEDULE OF QUALITY CHECKS FOR TRANSFER OIL PUMP ASSY.**

11.1.0 Inspection &Testing: As per manufacturer's standard

	Checks	B	S
11.2.1	Material compliance certificates of critical parts	2	3
11.2.2	Visual Inspection	1	3
11.2.3	Dimensional check	1	3
11.2.4	Hydrostatic test of pressure parts for unit	2	3
11.2.5	Pump running / Mechanical and performance test	1	3
11.2.6	Explosion proof certification for DOL starter from CMRS	2	3
11.2.7	Safety relief valve set test	1	3

The Inspection & testing for motor shall be followed as per clause 21 of our purchase specification TC54197 Rev 07.

AGENCY:

B : **B H E L**.
S : **SUPPLIER**.

TYPE OF INSPECTION:

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

12.0.0 **REQUIREMENT OF SPARES:**

Commissioning spares are part of equipment.
2 year normal operation spares for both pump & motor shall be quoted separately along with offer. Price split of spares shall be indicated.

Var No.	Description	Material code
04	Spare Isolation Valve for TOP Assly.	**TC9754013047**
03	Transfer oil pump assy (Trolley type). 200LPM, 4 Kg/cm2(g), 1450 RPM. Motor voltage: 415V	**TC9754013039**
02	Transfer oil pump assy (Trolley type). 50LPM, 4 Kg/cm2(g), 1450 RPM. Motor voltage: 400V	**TC9754013020**
01	Transfer oil pump assy (Trolley type). 50LPM, 4 Kg/cm2(g), 1450 RPM. Motor voltage: 415 V	**TC9754013012**

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	30.05.12	Generally revised	M.V.S.Raju	V.V.Subramanyam
03	11.07.13	Generally revised	M.S.Kumar	M.V.S.Raju
04	05.11.13	Variant 03 added	M.S.Kumar	M.V.S.Raju
05	14.05.14	Motor Voltage changed to 415V	M.S.Kumar	M.V.S.Raju
06	21.08.15	Clauses 2.5.14 & 4.10.0 modified	M S Kumar	M V S Raju
07	09.09.15	Clause 2.5.0 & 8.5.0 modified	M S Kumar	M V S raju
08	11.05.16	Clause 4.10.0 Modified	M S Kumar	M V S Raju

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 22KW 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 22kW) 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.

➢ <u>For NTPC:</u>

90 kW AC motor: 1x3C x 150sq mm

2.15 **<u>Bearing & Lubrication</u>**:

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 22 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:- 3

- Drawings, Data sheets, Curves for Information /approval ….. Soft Copy
- Final Drawings, Data sheets, Curves for Information / approval …. Soft Copy
- Performance and functional guarantee test reports …. 3 prints & Soft Copy
- O&M manual with project drawings, data sheets, performance and functional guarantee test reports ….. 1 CD

8. DRAWINGS, DATA TO BE FURNISHED

8.1 Documents to be sent along with offer (1 copy)

(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

(1 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

PRODUCT STANDARD
INDUSTRIAL TURBINES & COMPRESSORS

03	16.12.17	Third Revision	Anshul	Sunil Jiwtode