Annexure-D to purchase specification TC54216 R11

TURBINES AND COMPRESSORS

BHEL, HYDERABAD

PRICE SCHEDULE

Enquiry ref. No: Date:
Offer ref no. Date:

Sl.No	Description	Qty	Price (In Figures and Words)
01	Oil Purification Unit, FXD,1000LPH,415V AC, Without Heater & Polishing Filter, as per attached Drg 23080000044-S00-R00 (HYDG-3-31101-25021-S00-R01) Mat Code: TC9754216177	10 No's	
02	Spare set of Gasket for each pump of 1000 lph Centrifuge; Mat Code: TC9754216304	10 SET	

Notes:

1) All Items in **Sl.No.01 & Sl.No.02.** are to be considered for price evaluation
2) Service PR will be generated for service requirements and this Purchase Order will be applicable whenever requirement arises before commissioning.
3) Validity of Service PR will be 18 months after dispatch of consignment.

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

Rev. No.	Revisions	Prepared:	Reviewed:	Approved	Date
00	Issue	Kotta Bharath	Sunil B Jiwtode	Sunil B Jiwtode	19.02.2021

Annexure-D to purchase specification TC54216 R11

TURBINES AND COMPRESSORS

BHEL, HYDERABAD

PRICE SCHEDULE

Enquiry ref. No: Date:
Offer ref no. Date:

Sl.No	Description	Qty	Price (In Figures and Words)
01	Oil Purification Unit, FXD,2400LPH,415V AC, Without Heater & Polishing Filter, as per attached Drg 23080000044-S00-R00 (HYDG-3-31101-25021-S00-R01) Mat Code: TC9754216193	4 No's	
02	Spare set of Gasket for each pump of 1000 lph Centrifuge; Mat Code: TC9754216304	4 SET	

Notes:

1) All Items in **Sl.No.01 & Sl.No.02.** are to be considered for price evaluation
2) Service PR will be generated for service requirements and this Purchase Order will be applicable whenever requirement arises before commissioning.
3) Validity of Service PR will be 18 months after dispatch of consignment.

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

Rev. No.	Revisions	Prepared:	Reviewed:	Approved	Date
00	Issue	Kotta Bharath	Sunil B Jiwtode	Sunil B Jiwtode	19.02.2021

Annexure-D to purchase specification TC54216 R11

TURBINES AND COMPRESSORS

BHEL, HYDERABAD

PRICE SCHEDULE

Enquiry ref. No: Date:
Offer ref no. Date:

Sl.No	Description	Qty	Price (In Figures and Words)
01	Oil Purification Unit, FXD,1600LPH,415V AC, Without Heater & Polishing Filter, as per attached Drg 23080000044-S00-R00 (HYDG-3-31101-25021-S00-R01) Mat Code: TC9754216266	4 No's	
02	Spare set of Gasket for each pump of 1000 lph Centrifuge; Mat Code: TC9754216304	4 SET	

Notes:

1) All Items in **Sl.No.01 & Sl.No.02.** are to be considered for price evaluation
2) Service PR will be generated for service requirements and this Purchase Order will be applicable whenever requirement arises before commissioning.
3) Validity of Service PR will be 18 months after dispatch of consignment.

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

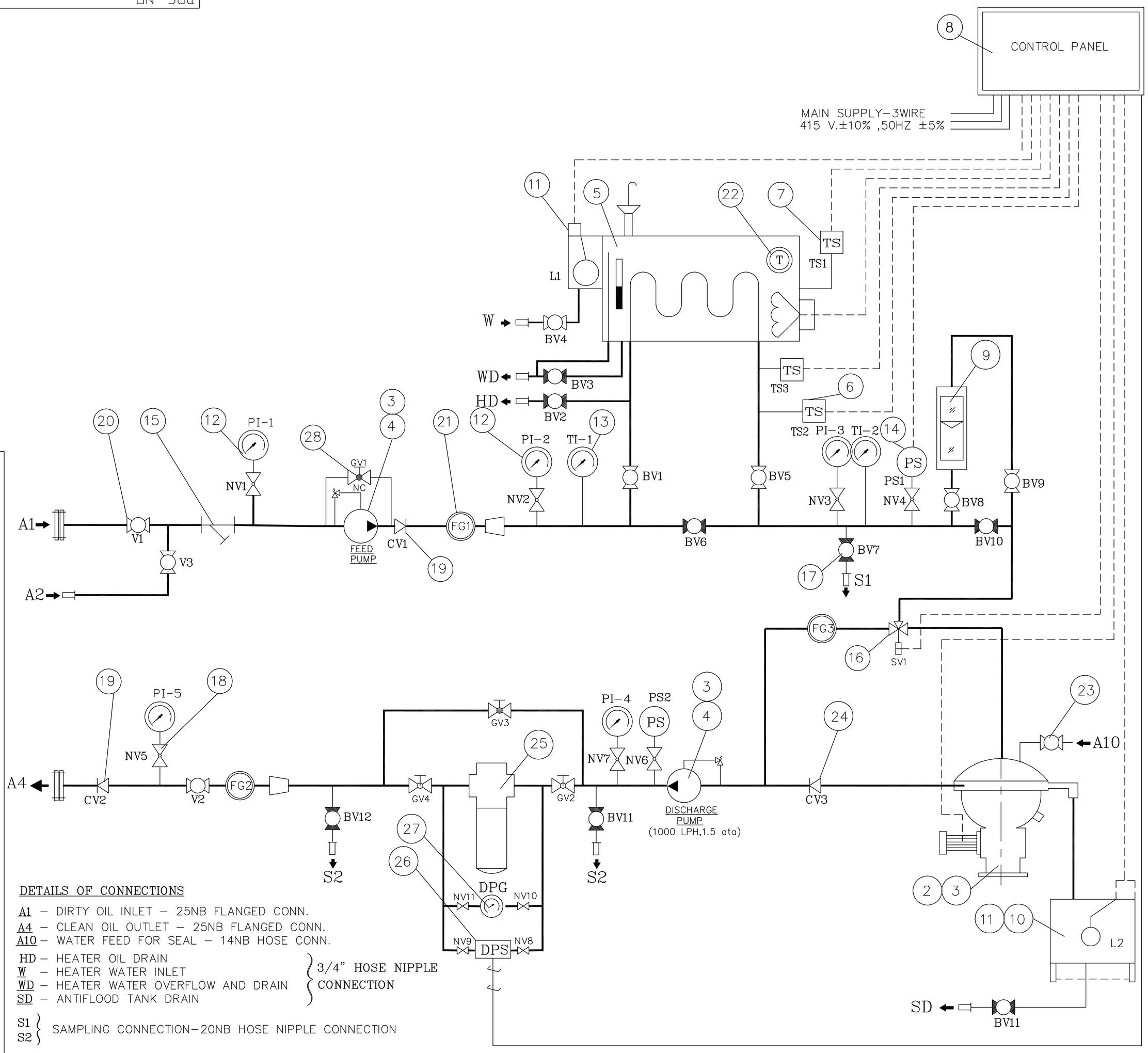
Rev. No.	Revisions	Prepared:	Reviewed:	Approved	Date
00	Issue	Kotta Bharath	Sunil B Jiwtode	Sunil B Jiwtode	19.02.2021

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 2-308-00-00043

SHT. 1 OF 1



28.	4.	GLOBE VALVE	CS	GV1-4
27.	1.	DIFF.PR.GAUGE – DIAL ø150, 0-4 KG/CM2(GLYCERIN FILLED)	–	DPG
26.	1.	DIFFERENTIAL PRESSURE SWITCH	–	DPS
25.	1.	POLISHING FILTER	–	–
24.	1.	CHECK VALVE 20 NB S.W	STEEL	CV3
23.	1.	WATER ADMIXING DEVICE (LOOSE SUPPLY)	–	–
22.	1.	THERMOMETER 0-100°C, DIAL ø100 mm		T
21.	2.	FLOW GLASS 1" BSP	C.ST	FG1-3
20.	2	BALL VALVE 25 NB. S.W.	C.ST	V1-3
19.	2	CHECKVALVE 25 NB. S.W	STEEL	CV1-2
18.	5	NEEDLE VALVE 1/2" BSP	C.ST	NV1-7
17.	14	BALL VALVE 20 NB. S.W.	F.ST.	BV1-12
16.	1	3/2 WAY SOLENOID VALVE 1" BSP	F.ST.	
15.	1	STRAINER Y TYPE 1" BSP WITH SS SCREEN (MESH12)	–	
14.	1	PRESSURE SWITCH-20NB.(FOR LOW SET)	–	PS1-2
13.	2	THERMOMETER 0-120°C, DIAL ø100mm.	–	TI 1-2
12.	4	PRESSURE GAUGE DIAL DIA.100mm-1 TO 7kg/cm^2	–	PI 1-5
11.	2	FLOAT LEVEL SWITCH.	–	L1-2
10.	1	ANTI FLOOD TANK	MS	
9.	1	FLOW METER LPH	–	
8.	1	CONTROL PANEL SUPPLY 3PH.415V,50HZ.	–	
7.	1	THERMOSTAT FOR WATER SET AT 90°C		TS1
6.	2	THERMOSTAT FOR OIL SET AT 60 & 70 °C		TS2.3
5.	1	HEATER INDIRECT TYPE.24KW(12+12)SUPPLY 3PH,415V,50HZ,AC	TP304 TUBES	
4.	1,1	FEED & DISCHARGE PUMP GEAR TYPE	–	
3.	1	MOTOR FOR CENTRIFUGE,B5,1HP,1500RPM(SYN),50HZ±5% 415V±10%, COMB.V. AND F±10%, AMB.TEMP.50°C, IP55, INSULATION CL'F' WITH TEMP. RISE LIMITED TO CL'B'	IE3	
2.	1	CENTRIFUGE 1000 LPH WITH S.S BOWL.	–	
1.	1	BASE FRAME / TROLLEY TYPE	MS	
S.NO	QTY	DESCRIPTION	MATERIAL	TAG NO.

NOTES :

1. INTEGRAL FEED & DISCHARGE PUMP & CENTRIFUGE ARE DRIVEN BY COMMON MOTOR.
2. COUNTER FLANGES WITH BOLT NUT & GASKET SHALL BE PROVIDED FOR OIL INLET & OUTLET BY VENDOR
3. FLANGES AS PER ASA 150 B 16.5 STD SS FLANGES.
4. PIPE MATERIAL AS PER TP304 SEAMLESS.
5. PIPE SIZE – 25NB UP TO FEED PUMP AND 20 NB THEN ONWARDS.
6. VALVE MATERIAL – ~~CARBON STEEL WITH S.S INTERNAL~~ / AS PER PROJECT SPEC REQUIREMENT
7. ALL DRAINS WILL HAVE HOSE NIPPLE AND CAPS.
8. PAINTING-EPOXY-IS: 5 – SHADE-631 LIGHT GREY., UNLESS OTHERWISE SPECIFIED.
9. CAPACITY – 1000 LPH, 3.0 KG/SQ.CM.G OF TURBINE LUBE OIL OF GRADE VG46
10. SEAL WATER 5 LPM, AT 1.5 KG/SQ.CM OR TAP WATER.

DETAILS OF CONNECTIONS

A1 – DIRTY OIL INLET – 25NB FLANGED CONN.
A4 – CLEAN OIL OUTLET – 25NB FLANGED CONN.
A10 – WATER FEED FOR SEAL – 14NB HOSE CONN.

HD – HEATER OIL DRAIN
W – HEATER WATER INLET
WD – HEATER WATER OVERFLOW AND DRAIN
SD – ANTIFLOOD TANK DRAIN
} 3/4" HOSE NIPPLE CONNECTION

S1, S2 } SAMPLING CONNECTION–20NB HOSE NIPPLE CONNECTION

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPAY

COMPUTER FILE NAME | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

REV.	DATE	ALTERED	CHD/APPD	ZONE

TYPE OF PRODUCT
OR
NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	K.BHARATH		12.12.12	
CHD.	M.ASIM		12.12.12	
APPD.	M.V.S.RAJU		12.12.12	NA

DEPT.	UNTOL. DIMS. GR.	SCALE	WEIGHT(KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
TCEG		N.T.S	1200	NA	NA	NA
CODE 415	C/M/F					

TITLE FLOW DIAGRAM FOR OIL PURIFICATION UNIT (CAPACITY : 1000 LPH)

CARD CODE NA

DRAWING NO. 2-308-00-00043 REV. 01

SHT. No. 1 NO. OF SHT. 1

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

TURBINE OIL PURIFICATION PLANT

(FIXED TYPE)

1.00.00 This specification is intended to cover the design, manufacture, fabrication, assembly & testing at manufacturers works & delivery, properly packed (For transport, erection, testing & commissioning) including guarantee tests of one (1) no. Turbine oil purification a plant with all necessary accessories complete in all respects for efficient & trouble free continuous operation at site. The flow diagram for oil purification unit shall be as per BHEL schematic drawing specified in variant table

2.00.00 **GENERAL INFORMATION:**

10

2.01.00 The system shall remove moisture from the oil from an initial level of 1.5% so that the oil at the outlet of purifying system does not contain moisture more than 0.05% by volume. All suspended particles shall be removed down to maintain the impurities within permissible limits. Purified oil with no free moisture & max particle size confirming to code 15/12 as per IS:4406. This shall be demonstrated with inlet oil quality confirming to code 21/18 as per ISO:4406 when oil temp is 65°C. The oil purification unit shall handle turbine oil (Servo prime 46 of IOC make) The capacity of the centrifuge shall be suitable for the operating temperature of 65°C The oil purifier shall be located on the ground floor below the oil level in the Turbine oil tank.

The design, manufacture & testing of the equipment shall confirm to latest edition of all standards & codes as applicable & required.All the pressure piping shall be designed & constructed in accordance with ANSI standard B 31.1 for Pressure piping. All materials issued shall be new and of tested quality and first class in all respects.

The oil centrifuge shall be constructed from high grade stainless steel. Carbon steel antiflood tank for each purifier. Positive displacement feed & discharge pumps, each having capacity 10% higher than purifying unit. Necessary interlocks for preventing centrifuge operation in case these feed & discharge pumps are not operating shall be provided. Indirect electric oil heater to heat oil to temperature not more than 65˚C with possibility to cut heater elements in steps. Entire purification equipment to be mounted upon a substantial metal base having a raised lip around the outside with a drain connection. The name plate shall be S.S with minimum 2 mm thickness. Copper & copper alloys shall not be used. The overall weight shall be indicated in equipment GA drawing

2.02.00 The purification process shall operate on a by-pass system, handling only a portion of the turbine oil & will be working continuously while the turbine is running. A dirty oil pump shall draw the lubricating oil from the Turbine oil tank & send it to the centrifuge through the oil heater. Similarly one clean oil pump shall deliver the purified oil back to the turbine oil tank through the polishing filter. Make up oil shall be filled manually in the Turbine Oil tank as and when necessary.

3.00.00 **EQUIPMENT, MATERIAL & SERVICES TO BE FURNISHED BY THE CONTRACTOR:**

3.01.00 The equipment covered by this specification shall comprise of the following:

3.01.01 One (1) centrifuge oil purifier with drive.

3.01.02 One (1) dirty & one (1) clean oil pump with drive.

3.01.03 Indirect type oil heater.

3.01.04 10 Polishing filter along with one additional spare element.(If applicable as per variant

3.01.05 table & scheme enclosed)

3.01.06 All controls, instruments, control wiring, power cables inside the plant including the control panel.

Common fabricated base plate for entire plant with anchor bolts, sleeves, parts to be embedded in concrete. However, the owner as per the requirement of the contractor shall furnish equipment foundation.

3.01.07 Suitable lifting and handling arrangement for the centrifuge, filter, tank, pumps etc.

3.01.08 10 One set of commissioning spares, special erection & maintenance tools.

3.01.09 List of loose supply items which are supplied along with purification unit.

3.01.10 Spare parts of two year normal operation (Separate price is to be furnished)

4.00.00 **DESIGN & CONSTRUCTION:**

4.01.00 **General**:

4.00.01 The design, manufacture & testing of the equipment shall conform to latest edition of all standards & codes, as applicable & required.

4.01.02 All the pressure piping shall be designed & constructed in accordance with ANSI standard B 31.1 for Pressure piping. Each line size is to be specified in schematic diagram provided by vendor. Line size calculations shall be furnished for our review.

4.01.03 All materials issued shall be new & of tested quality & first class in all respects.

4.02.00 **CENTRIFUGE:**

4.02.01 A suitable vertical centrifuge shall carry out primary separation of the impurities in the lubrication oil. The centrifuge bowl shall be of separator type having ample size to give the required optimum performance. It shall be vapour tight type construction to prevent oil fumes of vapours from escaping into turbine room. Heavier phase discharge from the centrifuge (Mainly water) shall go to waste through a small tank, level of which may be utilized for signalising flooding of centrifuge due to loss of water seal or due to clogging in the heavy phase drain pipe or in the event of excessive water in the oil.

The rotating assembly of the centrifuge unit shall be carefully balanced to minimise unbalance and shaft vibration while operating at the rated speed. The centrifuge bearings shall be designed for at least 25000 Hrs of continuous operation. All influent lubricating oil contact parts of the purifier shall be made of stainless steel. The bowl shall be assembled and dispatched. Sufficient care to be taken to avoid any transit damage to the bowl assembly.

4.02.02 Centrifuge shall be assembled as a single unit and shall be ready to use. The inlet & outlet connection with counter flanges shall be as per ANSI B16.5 and the size is inline with the schematic diagram provided by BHEL along with enquiry.

4.03.00 **OIL HEATER:**

4.03.01 Turbine oil shall be heated up to the necessary centrifuging temperature by passing it through an electric heater located immediately upstream of the centrifuge. The heater shall be indirect type, in which the electric immersion heater elements are used to heat a batch of water, which in turn heats the oil passing through the coils immersed in this bath. 11

10 The minimum temperature rise of oil through heater in one pass shall be 30 deg C(at minimum ambient temperatures of 10-20 deg C).

The heating elements shall be readily accessible for inspection and easily removable for maintenance or replacement.

4.04.00 **DIRTY AND CLEAN OIL PUMPS:**

4.04.01 The pumps shall be of positive displacement type complete with necessarily relief valves at the discharge. Ratings of these pumps shall match the requirement of purifier. The pumps shall be designed with a margin of 10%. The motor shall be sized of 1.25 times of shaft BKW of the pump & centrifuge and the motor rating shall be considered as per IS 325

4.05.00 **POLISHING FILTER:**

4.05.01 The purified oil coming out of the centrifuge shall pass through a polishing filter capable of handling the required output before returning it to the turbine oil tank. This filter shall eliminate all suspended solids down to maintain the impurities within permissible limits conforming to grade 15/12 as per ISO 4406 when oil temperature is 65°C vapour cloud in the cloud in the oil by stripping action. It shall not however remove any rust inhibitor or oxidation inhibitor in the process.

One spare filter element shall be provided along with oil purification unit.

The filter vessel shall be designed for the maximum working pressure and fabricated in accordance with the ASME code for unfiltered pressure vessel. It shall be provided with a small relief valve to protect from over pressure due to thermal expansion etc.

4.06.00 **DRIVE MOTOR:**

4.06.01 General specification for the Electrical drive motor shall be as per BHEL specification **TC 5 4370 or as per specification** mentioned in enquiry.

4.07.00 **MATERIALS**

4.07.01	Centrifuge bowl	: 12% Chrome steel
4.07.02	Heater element	: Nichrome
4.07.03	Heater sheeting	: 12 % Chrome steel
4.07.03	Heater bath	: Carbon steel with silver heat resistant paint.

4.07.04	Cast iron components	: IS 210 Grade 20 or equivalent
4.07.05	Insulation	: Glass wool
4.07.06	Tanks	: Mild steel as per IS 2062 or equivalent
4.07.07	Heater tubes in tank	: Stainless steel AISI 304

5.00.00 **INSTRUMENTATION , CONTROLS AND PANELS:**

5.01.00 The oil purification plant shall be complete with all the instruments and controls, for efficient operation of the plant. The various instruments, control lamps, enunciators etc shall be brought to a control panel on a common skid mounting. The panel shall be complete with all wiring tubing and the various instruments and switches shall be displaced on it in a neat manner. The make of the instruments shall be as per Customer/ BHEL "A" class approved vendor directory. Vendor shall select the sub-vendors strictly as per clause 13.00 of this specification. However, project specific vendor list is final. Also Necessary provision shall be provided in control panel to enable on-off control of Oil purification unit, common alarm & separator motor feedback through DCS/control room.

11 The arrangement of control panel (internal layout) shall be identical for all the machines of one project and shall be as per drawing of control panel - electrical wiring diagram.

5.02.00 The following interlocking arrangement shall be provided.

5.02.01 10 The 3/2-way solenoid valve shall be provided and valve shall be interlocked with a level switch on the anti-flood tank. In the event of the flooding of the centrifuge the interlock shall operate the solenoid valve automatically and bypass the flow from centrifuge and the same time to trip the motor of the centrifuge. The same solenoid valve shall be used to bypass the flow from centrifuge incase the oil temperature is below necessary centrifuge temperature.
Flooding of the centrifuge may be caused by any one of the following malfunctions.
Loss of water seal of centrifuge causing over flow of oil to the anti flood tank.

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.

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.

5.02.02 Incase the centrifuge drive V - belt operated, a belt failure limit switch will be provided which will initiate closing of the inlet solenoid valve and tripping of the centrifuge and pump motors in the event of belt failure.

5.02.03 The heating element of the heater shall be switched off in the event of low water level in the heater.

5.02.04 Two numbers of thermostats are to be mounted on the oil piping downstream of each electric heater. The thermostats shall operate in its differential temperature for suitable for best separation. Dirty and clean oil pump trip due to over load and flooding of centrifuge shall also be provided. Necessary Interlock

5.03.01 The system of annunciating the loss of water seal, plugging of polishing filter, over load trip of centrifuge drive and over load trip of electric heaters shall be provided with a visual alarm as well.

The following interlocks are provided in the panel

- Liquid seal breakage alarm / trip
- High oil & eater temperature alarm / heater trip
- Centrifuge and booster pump motor over load trip
- Low oil temperature alarm
- Low heater water level alarm / heater trip
- Polishing filter choke-up alarm trip

-Necessary Interlock for preventing centrifuge operation in case of feed and discharge pumps non operation.

6.00.00 INSPECTION AND TESTING AT MANUFACTURER'S SHOP:

6.01.00 All materials used for manufacture of the equipment covered 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 correlating test certificates are not available, the supplier shall arrange to carry out necessary tests as required by the code at his own cost.

6.02.00 The pressure vessels shall be hydro statically tested at not less than 1 ½ times design pressure prior to painting and lining. The pressure vessels shall be kept pressurized for at least 30 min. at this test pressure and shall be demonstrated to be free from visible leaks.

6.03.00 The performance of the complete assembly oil purifier unit shall be tested at the manufacturer's works in the presence of purchaser's representative. The performance test procedure shall be reviewed by customer & approved by purchaser.

6.04.00 The capacity of oil purification unit to be shown during inspection at 65° C

6.05.00 The Inspection shall be carried out as per the BHEL / Customer approved vendor quality plan

6.06.00 10 Minimum temperature rise through heater at Minimum Ambient temperature shall be checked.

7.00.00 PROTECTION AND PRESERVATIVE COATING REQUIREMENTS:

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. All ends of all valves and piping and conduit equipment connections 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.

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.
All piping shall be cleaned after shop assembly by shot blasting or other means approved by the customer / BHEL. Lube oil piping shall be pickled

8.00.00 RATING PLATES

Each item of Oil purification unit shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service/conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required. The nameplates or labels shall be white non-hygroscopic material with engraved black lettering.

9.00.00 DOCUMENTATION:

The list of engineering data would be a comprehensive one including all engineering data / drawings / information for all brought out items and manufacturing items

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 with out the written approval of customer.

All manufacturing, fabrication and execution of work in connection with the equipment / system. Prior to the approval of the drawings. Shall be at the vendor's risk. The vendor is expected not to make any changes in the design of the equipment / system, once they are approved by customer. However, if some changes are necessitated in the design of equipment / system 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.

The no of copies / prints/CD/manuals to be furnished as follows:

- Drawings, Data sheets, Design calculations for Information / approval ….. 3 prints & 1 CD
- Final Drawings, Data sheets, Design calculations for Information / approval …. 5 prints & 1 CD
- Performance and functional guarantee test reports …. 8 prints & 1 CD

O&M manual with project drawings, data sheets, performance and functional guarantee test reports. 10 Prints & 1 CD

10.00.00 **DRAWINGS, DATA TO BE FURNISHED:**

10.01.00 Following drawings & data are to be submitted with proposal:
The offer cannot be considered with out submission of these documents. Vendor has to categorically state that his offer is confirming compliances to this specification in Toto.

10.01.01 Preliminary outline drawing indicating principal dimensions and weights of the equipment offered & location of pipe connections.

10.01.02 Preliminary foundation drawing indicating loading data.

10.01.03 Flow diagram

10.01.04 Cross sectional drawings showing the construction of centrifuge, pump, filters etc.

10.01.05 Schematic diagram of the electrical connections.

10.01.06 Complete descriptive illustrated literature including manufacturer's name, size & description of the various equipments bought out sub deliveries.

10.01.07 Logic diagrams, Electric schematic instrumentation list with bill of materials & probable sub vendors shall also be submitted.

10.01.08 Vendor has to submit the oil purification system data sheet as per clause 12.00.00 of this specification.

10.01.09 Quality plan

10.01.10 Cleaning and painting procedure adopted by vendor.

10.02.00 Drawings and data to be furnished after receipt of order for approval by purchaser within two weeks of letter of intent.

10.02.02 Certified foundation drawings indicating loading data (Static & dynamic) for the assembly in order to enable the purchaser to design the concrete foundation as per manufacturer's requirements.

10.02.03	Vendor has to submit the oil purification system data sheet as per clause 12.00.00 of this specification.
10.02.04	Motor data sheets, Speed torque characteristic curve of motor and performance curve of motor.
10.02.05	Cleaning and painting procedure for entire oil purification system. The painting shall be RAL 9002 (Grey)
10.02.06	Detailed drawings of all components.
10.02.07	Before dispatch clearance is requested all test reports, Inspection reports, material certificates, performance test reports etc., to be furnished.
10.02.08	5 Copies of Instruction manual covering all items including instruments in this specification.
11.00.00	**SCOPE OF SUPPLY:**
11.00.01	The scope shall be as per schematic diagram provided by BHEL along with offer.
11.00.02	One set of special erection & maintenance tools
11.00.03	Foundation items for fixing the purification unit. (Anchor bolts, sleeves etc.)
11.00.04	One set of gaskets & “O” rings as required during erection & commissioning
11.00.05	One spare filter element for polishing filter.
11.01.00	**SPARE PARTS:**
11.01.01	Complete list of spare parts recommended by the manufacturer for two years operation with itemized list and quantity shall be submitted with the proposal for the total system. List of spare parts along with their drawing and catalogues and procedure for ordering spares shall be listed in O& M manuals.
12.00.00	**DATA SHEET:**
	The following data sheet of Oil purification plant to be filled and sent along with offer
12.01.00	**GUARANTEED PERFORMANCE DATA:**
12.01.01	Unit oil purification plant :
12.01.02	Rated capacity in LPH :

12.01.03	Guaranteed size of solids in the oil purified oil at the outlet of the polishing filter at rated capacity in microns. Specify also the maximum water content in %
12.01.04	Guaranteed size of solids in the oil purified oil at the outlet of centrifuge but ahead of the polishing filter at rated capacity in microns. Specify also the maximum water content in %
12.01.05	Guaranteed % of oil drained through heavy phase drain
12.01.06	Maximum permissible delivery pressure at the outlet of the polishing filter in Kg/cm2(g)
12.01.07	Centrifuge temperature in Deg Cent
12.02.00	**OIL PUMPS:**
12.02.01	Number of pumps
12.02.02	Capacity in LPM
12.02.03	Total head in Kg/cm2(g)
12.02.04	Maximum permissible suction lift at rated capacity in MLC
12.02.05	Pump speed in RPM
12.02.06	Power required at the rated operating conditions in KW
12.02.07	Efficiency of the pumps at the operating conditions
12.03.00	**TECHNICAL PARTICULARS:**
12.03.01	**Centrifuge:**
12.03.01.1	Manufacturer
12.03.01.2	Type and model number
12.03.01.3	Codes / Standards followed for design and manufacture of the unit
12.03.01.4	Bowl capacity in Lts
12.03.01.5	Bowl diameter in mm
12.03.01.6	Speed of Centrifuge in RPM
12.03.01.7	Vapour tight assembly
12.03.01.8	Type of transmission from drive motor to centrifuge
12.03.01.9	Bearings

12.03.01.9.1	Type and number	
12.03.01.9.2	Type of lubrication needed	
12.03.01.9.3	Make and model number	
12.03.01.10	Method of balancing and its standard	
12.03.01.11	Heavy phase drain through anti-flood tank	
12.03.01.12	Method of signaling loss of water seal in centrifuge and/or excessive water in oil and/or chocking of heavy phase drain pipe	
12.03.01.13	Weight of the rotating assembly in Kgs.	
12.03.01.14	Power required at the rated operating condition in KW	
12.04.00	**OIL HEATER:**	
12.04.01	Manufacturer	
12.04.02	Type & model number	
12.04.03	Rated capacity in LPH.	
12.04.04	**WATER BATH:**	
12.04.04.01	Dimensions in mm	
12.04.04.02	Water content in Liters	
12.04.04.03	Provision of Gauge glass	
12.04.04.04	Type of insulation and its standard	
12.04.05	**Heating elements:**	
12.04.05.01	Number of elements and KW rating per each element	
12.04.05.02	Material and type of construction of the heating elements	
12.04.05.03	Power supply, Voltage, Phase & Frequency	
12.04.05.04	Provision of metallic sheeting	
12.04.05.05	Provision of Ceramic terminal blocks	

12.04.05.06	Number of Thermostats and out “in” and out “out” temperature of each thermostat	
12.04.05.07	Cutting in and cutting out contacts of thermostat rated at	
12.04.05.08	Type and number of parallel paths of oil heating coil	
12.04.05.09	Total heating surface area in Sq. M of oil heating coil	
12.05.00	**OIL PUMPS:**	
12.05.01	Manufacturer	
12.05.02	Type & model number	
12.05.03	Size of suction in mm	
12.05.04	Size of discharge in mm	
12.05.05	Relief valve (At pump discharge) set pressure in $Kg/cm^2(g)$	
12.05.06	Type of transmission between motor shaft and pump shaft	
12.06.00	**POLISHING FILTER:**	
12.06.01	Manufacturer	
12.06.02	Type & model number	
12.06.03	Rated capacity in LPH	
12.06.04	Normal pressure drop at rated capacity in Kg/cm2(g)	
12.06.05	Maximum pressure drop at rated capacity in Kg/cm2(g)	
12.06.06	Filter surface area in M2	
12.06.07	**Filtering elements:**	
12.06.07.01	Type	
12.06.07.02	Material	
12.06.07.03	Reusable after cleaning	

12.06.08	**Filter vessel:**	
12.06.08.01	Outer diameter in mm	
12.06.08.02	Height in mm	
12.06.08.03	Plate thickness in mm	
12.06.08.04	Provision of relief valve	
12.06.08.05	Design pressure in Kg/cm2(g)	
12.07.00	**Drive motors:** The motor data sheet to be filled & submitted as specified in motor specification	
12.07.01	Manufacturer	
12.07.02	Nameplate rating	
12.07.03	Speed in RPM	
12.07.04	Insulation class	
12.07.05	Enclosure (IP)	
12.08.00	Material of construction (Specify Grade / Code / Std etc.	
12.08.01	Centrifuge bowl and internals	
12.08.02	Centrifuge frame and cover	
12.08.03	Centrifuge shaft	
12.08.04	Heating element	
12.08.05	Element sheathing	
12.08.06	Heater bath	
12.08.07	Oil heating coil	
12.08.08	Oil tanks	
12.09.00	**Weights and dimensions:**	

12.09.01	Weight of the complete oil purification plant in Kgs	
12.09.02	Weight of the polishing filter in Kgs	
12.09.03	Weight of the centrifuge unit in Kgs	
12.09.04	Weight of empty oil heater in Kgs	
12.09.05	Weight of flooded oil heater in Kgs	
12.09.06	Dimensions of the complete unit oil purification plant	
12.09.06.01	Length in mm	
12.09.06.02	Width in mm	
12.09.06.03	Height in mm	
12.10.00	Instruments, controls & panels furnished as required	
12.11.00	Piping, hangers, supports, valves, fittings, specialties etc furnished as required	
12.12.00	Insulation furnished as required	
12.13.00	Cleaning & painting will be done as required	
13.00	**LIST OF ACCEPTABLE SUB-VENDORS:** (However, project specific vendor list is final)	
13.01	Centrifuge	Centrifuge vendor
13.02	Centrifuge Base frame	Centrifuge vendor
13.03	Motor for centrifuge & Feed pump	CGL, BBL, KEC, Siemens, ABB, Alstom or As per Annexure.
13.04	Control panel	Centrifuge approved vendor
13.05	Heater, Indirect type	Centrifuge approved vendor

13.06	Temperature Sensor	Detrive Instruments, Mumbai Minco, USA Honeywell, USA Heraeaus, Germany Degussa, Germany Pyroelectric, Goa Leads & Nothup, USA GIC, Mumbai
13.07	Pump Screw type	Tushaco pumps Allweiler, Germany IMO, Sweeden/USA Lestritz, Germany
13.08	Polishing filter	Fairey arlon, holland Pall India pvt.Ltd EPE, Germany
13.09	Solenoid valve	ASCO or equivalent
13.10	Auto float level switch – Sealed bulb type	Levcon Instruments, Kolkatta
13.11	Antiflood tank	Centrifuge approved vendor
13.12	Differential pressure gauge	Switzer, Chennai Asheroft, USA ITTBARTON BUDENBURG, USA/UK AN Instrumrnts, Kolkatta
13.13	Differential pressure switch	ITTBARTON,USA Herion, Germany SOR, USA Dresser, USA KDG, UK Delta, UK Switzer, Chennai Vasutech, Rewadi Indfoss, Ghaziabad AN Instruments, Chennai
13.14	Thermostat	Switzer, Chennai Indfoss, Ghaziabad
13.15	Thermometer	Forbsons Engineers, secunderabad H.Guru, Bangalore GIC, Chennai
13.16	Pressure gauges	Neivafima, Italy Bells Controls, Kolkatta GIC, MUMBAI Budenburg, U.K Alecandria Wika, Germany Dreser Aschcroft, USA AN Instruments, Kolkatta

13.17	Strainer Y-type	JNM, Skilt
13.18	Flow Glass	Sigma, Technoflow
13.19	Check valve	Flowline, Expert
13.20	Regulating globe valve	BDK or equvalent
13.21	Needle valve	ASCO or equivalent
13.22	Globe valve	Centrifuge approved vendor
13.23	Flow meter	Centrifuge approved vendor
13.24	Ball valve	BDK, Audco
13.13	Flow Glass	Sigma Technoflow

14.00.00 **TEST & GUARANTEE CERTIFICATES:**

14.01.00 **TEST CERTIFICATES:**

3 Copies of the manufacturers test certificates for performance of oil purification unit shall be supplied for each item of the consignment quoting BHEL standard number, purchase order number and manufacturer's identification serial number

14.02.00 **GUARANTEE CERTIFICATES:**

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

15.00.00 **PACKING:**

The entire unit shall be properly packed to withstand mechanical damage and rust during transit. The packing shall be seaworthy packing.

16.00.00 **MARKING:**

The manufacturer's serial number and year of manufacture shall be marked at suitable locations viz Name plate
A tag bearing the relevant 12 digit material code shall be attached for each item.
The name plate of the oil purification unit shall contain the following information
- Manufacturer's name or trade mark & serial number
- Capacity of the centrifuge
- Pump discharge pressure
- Performance guarantee figures of moisture content and solid particles

Similar name plate to be provided for other items like Electric heater, polishing filter, oil pumps, electrical motors, Anti flood tank etc.
All the Instruments are to be properly tagged for easy identification

VARIANT TABLE

Variant No.	Flow diagram Drawing No.	Description	Code No.
01	2-308-00-00040	Oil Purification Unit, FXD,1000LPH,415V,W/O PF	TC9754216010
03	2-308-00-00041	Oil Purification Unit, FXD,2400LPH,415V, W/O PF	TC9754216037
05	2-308-00-00040	Oil Purification Unit, FXD,1000LPH,380V	TC9754216053
06	2-308-00-00040	Oil Purification Unit, FXD,1000LPH,400V	TC9754216061
07		1.1KW & 0.75KW AC Motors of Centrifuge	TC9754216070
08		Oil Purification Unit, Trolley,2400LPH,W/O Heater,415V	TC9754216088
09		Oil Purification Unit, Trolley,1000LPH,W/O Heater,415V	TC9754216096
10	2-308-00-00043	Oil Purification Unit, FXD,1000LPH, 415V,with Polishing Filter	TC9754216100
11	2-308-00-00041	Oil Purification Unit, FXD,2400LPH, 400V,W/O Polishing Filter	TC9754216118
12		SPARE SET - SEAL,O RING,GASKET-FRO 1000LPH OPU	TC9754216126
13		SPARE SET - FRICTION PAD & SCREW FOR 1000LPH OPU	TC9754216134
14		SPARE BOWL DISC FOR 1000LPH OPU	TC9754216142
15		SPARE SET OF SHEAR COUPLING FOR 1000LPH OPU	TC9754216150
16		SOLENOID VALVES COIL WITH PLUNGER FOR 1000LPH OPU	TC9754216169
17		Oil Purification Unit, FXD,1000LPH,415V AC, Without Heater & PF	TC9754216177
18		Oil Purification Unit, FXD,2400LPH,415V AC, Without Heater & PF	TC9754216185
19	2-308-00-00041	OIL PURUNT,FXD2400LPH,DRG3080000041IE3	TC9754216193
20	2-308-00-00044	OIL PUR FXD1600LPH,DRG23080000044 IE2	TC9754216207

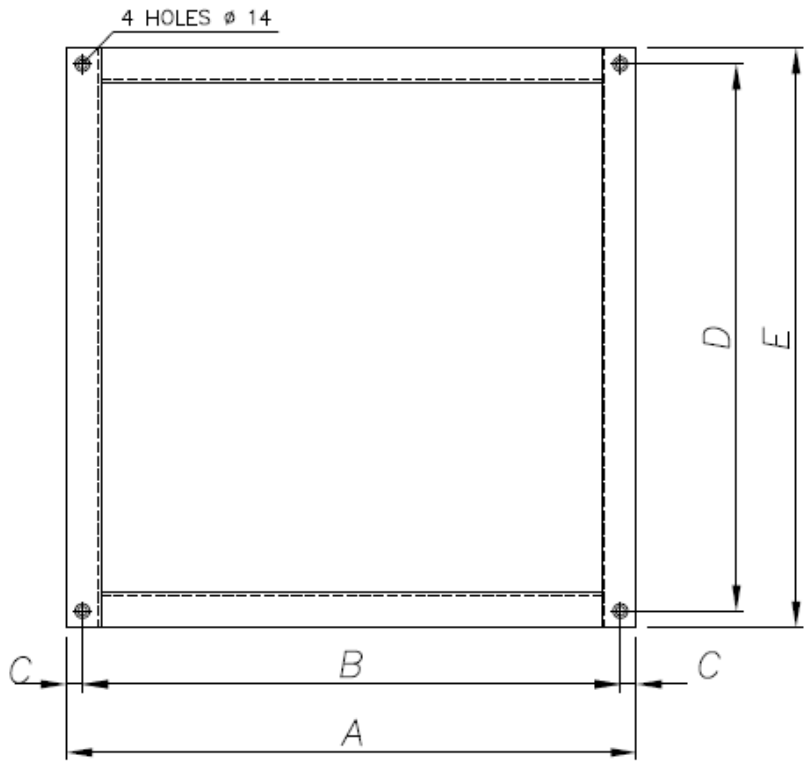
Sl. No.	**Spare item description for MMB305 (ALFA LAVAL)**	**Quantity**
01	Insert (544012-02)	2 set
02	O-Ring (74067)	1 number
03	O-Ring (223406-35)	2 set
04	O-Ring (223404-20)	2 set
05	O-Ring (223406-30)	2 set
06	Parting Chamber Cover (545797-05)	1 set
07	Inlet Tube (54888-85)	1 set
08	Distributor (545657-90)	1 set
09	Top Disc (545715-05)	1 set

Table1

Foundation details

S.No.	MATERIAL CODE	A	B	C	D	E
1	TC9754216010	1300	1270	15	900	1400
2	TC9754216037 TC9754216193	1500	1470	15	1150	1650
3	TC9754216053 TC9754216061	1300	1270	15	900	1400
8	TC9754216100	1500	1470	15	1150	1650
9	TC9754216118	1500	1470	15	1150	1650
10	TC9754216177 TC9754216207	800	770	15	600	900
11	TC9754216185	1300	1270	15	900	1400

OIL CONSOLE FOR BARRING GEAR FOUNDATION DETAILS



RECORD OF REVISIONS

Rev. No	Date	Revision Details	*Revised*	Approved
00	22.02.05	First issue.	----	----
01	01.10.07	Variant 05 added & generally revised	*MVS RAJU*	*KK RAO*
02	01.06.12	Generally revised	*MVS RAJU*	*VV subramanyam*
03	28.05.13	Variants 06 added	*M S Kumar*	*M V S Raju*
04	13.12.13	Variants 11 added	*M S Kumar*	*M V S Raju*
05	01.11.14	Variants 12,13,14,15,16 & 17 added	*Sunil B Jiwtode*	*M V S Raju*
06	30.01.15	Variant 18 added & clause 4.06.01 modified	*M S Kumar*	*M V S Raju*
07	30.04.15	Variant 18 capacity modified, Foundation details added	*M S Kumar*	*M V S Raju*
08	14.01.16	Variant 19 and its foundation details added	*K bharath*	M V S Raju
09	20.01.16	Variant 20 and its foundation details added	*K bharath*	M V S Raju
10	19.04.17	Revised as indicated 10	*K bharath*	Sunil B Jiwtode
11	12.03.20	1. Minimum temperature rise of oil through heater in one pass shall be 30 deg C. 2. Clause 5.01.00 revised. 11	*K bharath*	Sunil B Jiwtode

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. <u>Type tests</u>

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

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	

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* 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

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

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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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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.

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

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