SPECIFICATION FOR
TECHNICAL DELIVERY CONDITIONS FOR SCANNER AIR FANS

1. SCOPE

This technical delivery conditions specify the design, construction and testing requirements of centrifugal fans.

2. APPLICABLE STANDARDS:

BS 848 part-I: Methods of testing performance ; IS 4894 : Specification for centrifugal fans ; ISO 1940 : Balance quality of rotating rigid bodies. In case of any information not specified in this technical delivery conditions, the above standards will be binding.

3. DESIGN AND CONSTRUCTIONAL REQUIREMENTS:

a) Type:

Radial, backward curved blade type; directly coupled to the motor and mounted on a common frame; designed for continuous duty. Fan will be mounted on ground or on structural floor as indicated in the vendor enquiry data sheet.

b) Fan suction:

Fan suction shall be side axial with transition piece.

c) Fan Discharge:

Fan discharge shall be vertically upwards with transition piece.

d) The transition pieces shall be less than 300 mm length. The taper angle shall not exceed 15 degrees to give smooth transition. The fan to transition piece shall be flanged. The suction and discharge ends shall be provided with flanges and counter flanges to match with the pipe sizes specified.

d) Fan regulation:

Flow and pressure are regulated by inlet and outlet dampers arranged by purchaser, if necessary.

f) Motor Capacity :

Motor capacity shall be 20% more than the BHP required by the fan. Motor shall be of reputed make and conform to the attached LT motor specification.

- The starting current of the motor shall not exceed the value indicated in the LT motor specification when started with fan inlet and outlet dampers fully open.

- The starting time for the fan assy.,to reach the full load current shall not exceed the value indicated on LT motor specns., when input/output dampers are open.

g) Fan Impeller :

The fan impeller shall be directly mounted on the shaft with the impeller hub keyed to the shaft and axially bolted to motor shaft to prevent axial movement of impeller. The thickness of impeller shroud shall not be less than 3mm. Material of construction shall be IS 2062 or better. The shaft shall be fully enclosed in the impeller hub. RPM shall be as indicated in the fan data sheet (TOS:NTPC:1811).

h) Casing :

Casing shall be of single construction suitably stiffened for minimum vibration. Inspection door and drain plug shall be provided. Efficient clearance shall be given between impeller and suction mouth. A stainless steel flow direction arrow plate shall be fixed permanently on the casing; casing thickness shall be 5 mm (min).

i) The static and dynamic balancing tests shall be done as per ISO 1940. The residual up balance shall be limited to the group C 6.3 of ISO-1940. The ωe shall be less than 6.3 mm/e, where e = permissible residual unbalance and ω is the angular velocity. The above testing shall be made with all the vibration pads mounted under the frame.

j) Necessary damping (vibration) pads with bolts shall be provided in case of fans to be mounted on steel structure. In case of ground mounted fans necessary foundation bolts, nuts and washers shall be provided.

k) Bearings shall be provided with the facility for greasing.

4.0 INSPECTION AND TESTING:

All fans are to be inspected by the purchaser at the manufacturer's works for its constructional and dimensional details.

The following tests are to be done by the manufacturers witnessed by purchaser:

a) Performance test on one fan in each type as per BS 848 part I or IS 4894/1968. However the tolerance on pressure, capacity and power absorbed shall be as per BS 848 part I class C only.

The following is the variations permitted when tested at rated pressure:

Inlet volume of flow : - 7.5%

Power input : ± 15%

b) Vibration measurement, when mounted on vibration isolation pads.

c) Continuous running test for 8 Hrs. (Temperature rise on bearings)

d) Starting current when started with no inlet and outlet dampers or the inlet and outlet dampers completely open.

e) Starting time.

f) MPI / LPI shaft < 2.5" & UT for ≥ 2.5"

5.0 The following documents shall be supplied in triplicate :

a) Filled in technical data sheet (TOS:NTPC:1811)
b) Fan operating characteristics.
c) Assy. Drg. of motor and fan with transition piece, foundation details and material specifications.
d) Test certificates as mentioned under section 4.
e) Erection, operating and instruction manuals with trouble shooting guide & spares identification drawings.
f) Material test certificates for impeller and shaft.
g) Test certificates and characteristics as called for under LT motor specification.

6.0 GUARANTEE:

The equipment shall be guaranteed against manufacturing defects. The performance guarantee shall be for a period of 12 months from the date of commissioning or 18 months from the date of delivery of equipment, whichever is earlier.

7.0 PAINTING :

a) Surface Preparation & Surface Profiles: SSPC-SP3/Power tool cleaning.

b) Primer coat: No. of coats=2

Paint: Red oxide zinc phosphate Primer (Alkyd base) to IS 12744;

DFT=30µm per coat.

c) Finish coat: No. of coats=1

Paint: Syn. Enamel paint (Long oil Alkyd) to IS2932; DFT=20µm per coat.

Shade: Smoke Grey Shade No. 692 of IS5.

e) Total DFT = 80µm (minimum).

f) Bearings, shaft, parts with running clearances are coated with rust preventive.

8.0 PACKING:

a) The fan and motor shall be packed in assembled condition. All components shall be identifiable with packing lists with BHEL material codes mentioned.

b) All opening shall be covered with blanks/caps and the total assembly is to be covered with rain proof sheet to avoid water entry into motor winding and fan. The total assembly shall be packed firmly in wooden box.

ANNEXURE – A

TECHNICAL DATA SHEET OF SCANNER AIR FAN

(To be furnished by fan supplier to the motor supplier for selection of Motor)

01.	Fan Type	:	Radial backward curved blade
02.	Power consumption in KW	:	
03.	Rated fan speed in rpm	:	
04.	Direction of fan rotation	:	
05.	Moment of inertia (GD^2) in kg-m^2	:	
06.	Starting torque in kg-m	:	
07.	Full load torque in kg-m	:	
08.	Permissible starting time :		
	a) When inlet & outlet dampers are opened	:	
	b) When inlet &outlet dampers are closed	:	
09.	Recommended motor rating	:	
10.	Fan characteristic curves	:	

ANNEXURE – B

TECHNICAL DATA SHEET OF SCANNER AIR FAN DRIVE MOTOR

(To be obtained by fan supplier from the motor supplier for furnishing to BHEL)

01. Motor rating, type and frame size :

02. Rated voltage, phase and frequency :

03. Rated motor speed in rpm :

04. Moment of inertia (GD^2) in kg-m^2 :

05. Starting torque in kg-m :

06. Full load torque in kg-m :

07. Starting time at minimum permissible starting voltage :

08. Max. permissible starting time :

09. Method of starting :

10. Recommended starter scheme :

11*. Calculation of starting resistances in case of recommendation for reduced voltage starting for DC motors.

* ***Relevant documents shall be enclosed with this data sheet.***

PREPARED	CHECKED	APPROVED	DATE

TECHNICAL DATA SHEET FOR SCANNER AIR FAN

BHEL MATERIAL CODE: L428114320001001-008 ENQUIRY No.

1.TYPE :		RADIAL, BACKWARD CURVED BLADE, SINGLE SUCTION	
2.MAKE & MODEL No.			
3.MOUNTING		ON STRUCTURAL STEEL FLOOR	
4.MEDIUM TO BE HANDLED		DUST LADEN AIR	
5.Max. DUST CONCENTRATION		300 mg/m^3	
6.AMBIENT CONDITION		760mm Hg ; 50^{0}C	DENSITY: 1.09 kg/m^3
7.OPERATING CONDITIONS		NORMAL	TEST BLOCK
7.1 CAPACITY :	Cum/ Hr	10600	
7.2 PRESSURE DEVELOPED :	mmwc	250	
7.3 AIR TEMPERATURE :	^{0}C	50	
7.4 SUCTION PRESSURE :	mmwc	0 to 360	
7.5 POWER CONSUMPTION :	kw		
7.6 FAN SPEED :	Rpm	1500 rpm	
7.7 DIRECTION OF ROTATION :		CLOCKWISE (SEEN FROM DRIVE END)	
7.8 FAN MOVEMENT OF INERTIA (GD^2) :	Kgm^2		
7.9 FAN STARTING TORQUE :	Kgm		
7.10 FAN FULL LOAD TORQUE :	Kgm		
7.11 EFFICIENCY OF FAN :	%		
7.12 MOTOR RATING :		KW, 415VOLTS, 50 Hz AC;	KW, 220 V DC
7.13 MAKE / FRAME SIZE:			
7.14 MOTOR DATA SHEET No.			
7.15 FAN STARTING TIME:			
7.16 FIRST CRITICAL SPEED :		> 150% OF NORMAL SPEED	
7.17 VIBRATION LEVEL AT CASING:			
7.18 NOISE LEVEL :	dB	< 85 AT 1 M DISTANCE	
8.0 CONSTRUCTIONAL DETAILS :		MATERIAL	SIZE
8.1 SPIRAL CASING SIDE WALL ;			
8.2 SPIRAL CASING PERIPHERAL WALL ;			
8.3 IMPELLER BLADE :			
8.4 IMPELLER BACK PLATE:			
8.5 IMPELLER COVER PLATE:			
8.6 IMPELLER HUB :			
8.7 SHAFT :			
8.8 BEARING MAKE & TYPE No. :			
8.9 SEAL TYPE :			
8.10 VIBRATION PADS PROVIDED :		YES	No. OFF / ASSY. :
8.11 BALANCING :		STATIC & DYNAMIC BALANCED TO C 6.3 OF ISO : 1940	
8.12 BASE FRAME PROVIDED :		YES	
8.13 WEIGHT PER ASSY. :	Kg		
8.14 SUPPLIERS DRG No.:			
9.0 LUBRICANT TO BE USED :			
9.1 FREQUENCY OF LUB. & QTY. :			
10.0 O & M MANAUL REFERENCE:			
FAN INLET TRANSITION PIECE TO MATCH THE PIPE		OD x T : 508 x 6.08 mm	
FAN OUTLET TRANSITION PIECE TO MATCH THE PIPE		OD x T : 508 x 6.08 mm	

PREPARED	CHECKED	APPROVED	DATE

TECHNICAL DATA SHEET FOR SCANNER AIR FAN

BHEL MATERIAL CODE: L428114320001001-008 ENQUIRY No.

SPECIAL CONTRACT REQUIREMENT, IF ANY	
BHEL REQUIREMENT	**VENDOR CONFIRMATION**
1) Rotor components i.e shaft and hub shall be subjected to ultrasonic test at mill and magnetic particle examination after rough machining. 2) 10% of butt and fillet welds both in rotor and static components of the fan shall be subjected to MPI/DPT after stress relieving. 3) Fan impeller shall be balanced dynamically to quality grade 2.5 of ISO 1940. (USE AN ANNEXURE IF THIS SPACE IS INADEQUATE)	

PREPARED	CHECKED	APPROVED	DATE

SPECIFICATION FOR SCANNER AIR FANS

(To be read with TOS:NTPC:1811/ Rev 01)

1. Intent :

To design manufacture, test and supply of scanner air fans.

2. Scope :

The scanner air fan shall be supplied with the drive motor as per the LT motor specification enclosed.

3. Functional and Terminal condition :

To supply required air for scanner purging and cooling.

4. Constructional Features and Special requirements :

a) Refer enclosed fan data sheet (TOS:NTPC:1811 / Rev 01)
b) The motor shall be as per the approved L.T motor specification.

5. Applicable drawing :

Manufacturer's drawing.

6. Inspection and Testing :

The scanner air fan with the drive shall be inspected and tested as the approved NTPC quality plan.

All tests as per the NTPC approved QP for centrifugal fans should be done and inspection calls shall be made 15 days in advance for NTPC/BHEL to witness tests envisaged as customer hold points in the QP shall be given. No further operation by vendor shall proceed till necessary written clearance is provided by NTPC for the hold points.

Exhaustive test certificates as with QP shall be furnished by vendor to NTPC/BHEL for review and clearance prior to despatch.

7. Packing :

Fan and motor assembled completely and packed in a weather proof box with the required supports to avoid and transit damages.

8. Information to be furnished :

a) QP shall be furnished in NTPC format.
b) 3 sets of catalogue and drawing showing the overall dimensions and cross sectional view of the fan and with the foundation detail.
c) Test certificates of materials used.
d) Performance test of fan with motor as per the approved NTPC QP.
e) In the event of order, provide 6 sets of above documents.

NTPC CUSTOMER NUMBER 4281

Controls & Instrumentation/Fossil Boilers
Project Specific Transmittal for LT AC motors and DC motors

Transmittal Ref.: TR: LT AC-DC MOTOR

The project specific transmittal has to be referred along with the technical specification of the motor.

a) Efficiency Class of LT motor and Cable Entry Details of LT AC Motor and DC Motor

Energy efficient level: IE3 as per IS 12615 – 2018 (For LT AC Motors).

Table - 1, Power cable size for LT AC motors: -

Vendor to provide the cable entry and supply cable-glands, lugs as per the technical specification requirement and suitable for the power cable sizes as indicated below. The cable sizes indicated below are tentative. The actual power cable size based on the run length will be intimated during technical evaluation stage, before placement of purchase order.

Sl. No.	From (KW)	To (KW)	Power Cable size in sq. mm. (#)
1.	2.2	3.7	3C-2.5mm^2(CU)/ 3C-10mm^2 (AL)
2.	3.71	5.5	3C-10mm^2(AL)
3.	5.51	7.5	3C-10mm^2(AL)/ 3C-16mm^2 (AL)
4.	7.51	11	3C-10mm^2(AL)/ 3C-25mm^2 (AL)
5.	11.1	18.5	3C-25mm^2(AL)/3C-50mm^2 (AL)
6.	18.51	30	3C-50mm^2 (AL)
7.	30.1	45	3C-95mm^2 (AL)
8.	45.1	90	3C-150 mm^2(AL)
9.	90.1	110	3C-240mm^2(AL)

b) Relevant sheets of the contract specification.

The contract specification will supersede the respective clauses of the technical specification, if the requirements are spelt in both technical specification and contract specification.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	MOTORS
1.00.00	**GENERAL REQUIREMENTS**
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.
1.02.00	All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.
1.03.00	Contractor shall provide fully compatible electrical system, equipment, accessories and services.
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.
1.07.00	Degree of Protection Degree of protection for various enclosures as per IEC60034-05 shall be as follows:- i) Indoor motors - IP 54 ii) Outdoor motors - IP 55 iii) Cable box-indoor area - IP 54 iv) Cable box-Outdoor area - IP 55
2.00.00	**CODES AND STANDARDS** 1) Three phase induction motors : IS/IEC:60034 2) Single phase AC motors : IS/IEC:60034 3) Crane duty motors : IS:3177, IS/IEC:60034 4) DC motors/generators : IS/IEC:60034 5) Energy Efficient motors : IS 12615, IEC: 60034-30

CLAUSE NO.	TECHNICAL REQUIREMENTS
3.00.00	**TYPE**
3.01.00	**AC Motors:**
	a) Squirrel cage induction motor suitable for direct-on-line starting.
	b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30.
	c) ~~Crane duty motors shall be squirrel cage Induction motor as per the requirement.~~
	d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.
3.02.00	DC Motors Shunt wound
4.00.00	**RATING**
	(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.
	Applicable only if enquiry calls for supply of motor along with load.
	(b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.
	(c) ~~For BFP motors, starting MVA shall be restricted to meet requirements indicated in B-0.~~
	(d) The starting current for the DC motors shall be restricted to 3 times of the full load current.
5.00.00	**TEMPERATURE RISE**
	Air cooled motors
	70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.
	~~**Water cooled**~~
	80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor.
6.00.00	**OPERATIONAL REQUIREMENTS**
6.01.00	**Starting Time**
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
6.02.00	**Torque Requirements**
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
6.03.00	**Starting voltage requirement** (a) Up to 85% of rated voltage for ratings below 110 KW (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.

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

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

CLAUSE NO.	TECHNICAL REQUIREMENTS
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor. (a) Below 110KW : 11.0 (b) From 110 KW & upto 200 KW : 9.0 (c) Above 200 KW & upto 1000KW : 10.0 (d) From 1001KW & upto 4000KW : 9.0 (e) Above 4000KW : 6 to 6.5
9.00.00	~~CW motor shall be designed with minimum power factor of 0.8 at design duty point~~.
10.00.00	**TYPE TEST**
10.01.00	**HT MOTORS**
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII-(BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.
10.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
10.01.03	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the employer for waival of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.
10.01.04	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED "and carried out within last ten years from the date of bid opening. These reports should be for

CLAUSE NO.	TECHNICAL REQUIREMENTS
	the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.
10.01.05	**LIST OF TYPE TESTS TO BE CONDUCTED** **The following type tests shall be conducted on each type and rating of HT motor** (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test (subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.
10.01.06	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** **The following type test reports shall be submitted for each type and rating of HT motor** (a) Degree of protection test for the enclosure followed by IR, HV and no load run test. (b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15

CLAUSE NO.	TECHNICAL REQUIREMENTS
10.02.00	**LT Motors**
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed in this specification and carried out within last *ten* years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
10.02.02	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.
10.02.03	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** **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 as per clause no 7.06.00 of this section) 10. Test for degree of protection and 11. Over speed test.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1
10.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
10.04.00	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.

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW	**Minimum distance between centre of stud and gland plate in mm**
UP to 3 KW	**As per manufacturer's practice.**
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

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:

CLAUSE NO.	TECHNICAL REQUIREMENTS

Motor MCR in KW	**Clearance**
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

BHARAT HEAVY ELECTRICALS LIMITED

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPALLI-620 014

CONTROLS & INSTRUMENTATION/FB

TECHNICAL SPECIFICATION FOR LT MOTORS (NON FLAME PROOF)

SPECIFICATION NUMBER – TCI: 140

Revision History

Rev. No.	Date	Description	Prepared	Reviewed	Approved	
					ENGG.	QA
01 to 09		Earlier Revisions	-Sd-	-Sd-	-Sd-	-Sd-
10	21-02-17	General revisit				

Sl. No.	Characteristics	Requirement	Vendor's Compliance
1	Site Conditions :-		
	Altitude above MSL	550metre	
	Ambient temperature	50°C	
	Relative Humidity	100 %	
	Atmosphere	Tropical, dusty, salty, corrosive and highly polluted	
2	General Description	Squirrel cage induction motor suitable for direct on line starting through any type of breaker. Maximum continuous rating (MCR) shall have at least 10 % margin over maximum load demand including voltage and frequency variation, temperature rise and other variations unless otherwise specified in the mechanical sub-divisions of purchase enquiry	
3	Applicable Standards	IS-325, IS-1231, IS-6362, IS-2253, IS-12065, IS-12075, IS-12615, IS-60529 & IEC-60034 (All standards shall be as per latest versions)	
4	Type of Motor	Totally Enclosed Fan cooled (TEFC), IP-55 as per IS-60529	
5	Application	Scanner Air Fan Motor	
6	Duty Cycle	Continuous, S1	
7	Energy Efficiency Class	IE-2 as per IS-12615	
8	Rated Voltage & Tolerance	415 V, AC, 3 Phase, ± 10 %	
9	Rated Frequency & Tolerance	50 Hz ± 5 %	
10	Combined voltage & frequency tolerance	10 %	
11	High speed bus transfer withstand capability	Suitable to withstand 150 % rated voltage	
12	Type of balancing of rotor	Dynamic balancing	
13	Method of cooling	TEFC, As per IC-0411	

Sl. No.	Characteristics	Requirement	Vendor's Compliance
14	Direction of cooling air flow	NDE side to DE Side	
15	General Requirements	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% of motor full load torque. Pull Out torque at rated voltage shall not be less than 205% of full load torque All motors shall be so designed that maximum inrush currents, locked rotor and pull out torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.	
16	Class of Insulation	Class F insulation with temperature rise limited to Class B. Temperature rise of the motor shall be limited to 70 deg. C (by resistance method) over an ambient temperature of 50 deg. C	
17	Winding Treatment	Winding Insulation shall be given tropical and fungicidal treatment for operation of motor in hot, humid & tropical climate. Windings shall be non-hygroscopic, oil resistant and flame resistant	
18	Starting Current	The starting current (% of FLC) shall be limited to a suitable value, as per the IS	
19	Locked Rotor Condition	The ratio of Locked Rotor KVA at rated voltage to rated KW shall not exceed as indicated below (without any tolerance) For Motors of rating <110KW : 11.0	
20	Shaft extension	Motor shall be provided with key slotted bare shaft extension with key at the drive end	
21	Terminal box	Weather proof, IP 55 as per IS-60529, capable of being turned through 360° in steps of 90°	

Sl. No.	Characteristics	Requirement	Vendor's Compliance
22	Size of Terminal box	Size of Terminal box shall have adequate space which shall be suitable to terminate the Power cable applicable to the motor by using the suitable crimping lugs. Also refer to Data sheet	
23	Terminals	Separate Terminals for Windings and Space heaters. Suitable connecting links shall also be supplied	
24	Cable Glands & Lugs	Cable entries, Cable glands and Lugs shall be provided suitable for the power cable sizes as indicated in the project specific requirement. Double Compression type, brass with nickel plated flame proof cable glands shall be supplied. Tinned Copper Lugs shall be provided.	
25	Earthing terminals	1 Number External and 1 Number inside the terminal box	
26	Space heater for ratings 30 KW & above	Separate space heater suitable for 240 V AC, Single Phase supply	
27	RTD for winding/bearing	For motor rated 160KW and above only, unless specifically called for in the enquiry. If applicable, two per phase for winding and bearing shall be provided. The same shall be terminated suitably, in a separate Junction box.	
28	Noise level	Noise level shall be limited to 85dB(A) at 1metre distance as per IS 12065	
29	Vibration level	The peak amplitude of vibration shall be as per IS 12075 (Limits of Severity - Normal grade shall be followed)	
30	Lifting device	Eye bolt	
31	Name Plates	Motor shall have name plates as per relevant IS and in addition the following data shall be provided	

Sl. No.	Characteristics	Requirement	Vendor's Compliance
		a) Manufacture's name, frame size and number, Energy Efficiency class b) Insulation class designation, ambient temperature and temperature rise in °C over ambient temperature at rated output c) Connection diagram shall be marked inside the terminal box	
32	Inspection & Testing	**For NON NTPC Projects** Motors up to 20KW- Inspection by Vendor as per relevant standards as applicable. Routine & type test reports shall be submitted for review and acceptance by BHEL For Motors > 20 KW, Inspection by BHEL/TPI as per BHEL Standard Quality Plan QA:CI:STD:QP:24. Routine & type test reports shall be submitted for review and acceptance by BHEL **For NTPC Projects** Motors up to 30KW- Inspection by Vendor as per relevant standards as applicable. Routine & type test reports shall be submitted for review and acceptance by BHEL&NTPC For Motors >30 KW and < 50 KW, Inspection by BHEL/TPI as per NTPC approved VQP/RQP. Routine & type test reports shall be submitted for review and acceptance by BHEL&NTPC For Motors > 50 KW, Inspection by BHEL/TPI &NTPC as per NTPC approved VQP/RQP. Routine & type test reports shall be submitted for review and acceptance by BHEL&NTPC For all the above cases, the type test reports submitted shall not be earlier than 5 years from the date of Purchase Enquiry	
33	Documents (along with offer)	a. Taking care of all the requirements indicated in the technical specification & in annexure, Vendor has to submit No-deviation format. In the document, Vendor to specify the reference details of the specification/documents/drawings	

Sl. No.	Characteristics	Requirement	Vendor's Compliance
		and should indicate as "No – Deviation". b. Filled in technical data sheet, with complete details for all the clauses, as per the format given by BHEL c. Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions	
34	Documents for approval by BHEL/Customer (after placement of purchase order)	3 Sets of the following :- • Final technical Data sheet as per BHEL's format. • Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions • Motor Characteristics curves (Torque vs. Speed, Current vs. Speed, Speed vs. time, Current vs. time, Efficiency and PF vs. load, Thermal withstand characteristic) • O & M manuals	
35	Packing	The packing shall be as per manufacturer's standard meeting the Transport, environment and Storage hazards	

Note :-

Vendor to indicate "Yes" or "Confirmed" in the Vendor's Compliance column for all the clauses and submit along with the offer.

BHARAT HEAVY ELECTRICALS LIMITED

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPALLI-620 014

CONTROLS & INSTRUMENTATION/FB

TECHNICAL SPECIFICATION FOR DC MOTORS (NON FLAME PROOF)

SPECIFICATION NUMBER – TCI:223

Revision History

Rev. No.	Date	Description	Prepared	Reviewed	Approved	
					ENGG.	QA
01 to 03		Earlier Revisions	-Sd-	-Sd-	-Sd-	-Sd-
04	21-02-17	General Revisit				

Sl. No.	Characteristics	Requirement	Vendor's Compliance
1	Site Conditions :-		
	Altitude above MSL	550metre	
	Ambient temperature	50°C	
	Relative Humidity	100 %	
	Atmosphere	Tropical, dusty, salty, corrosive and highly polluted	
2	General Description	DC Shunt Motor suitable for 3 step Resistance starting. Maximum continuous rating (MCR) shall have atleast 10 % margin over maximum load demand including voltage variation, temperature rise and other variations unless otherwise specified in the mechanical sub-divisions	
3	Applicable Standards	IS-6362, IS-2253, IS-12065, IS-12075, IS/IEC-60034 & IS-60529 (All standards shall be as per latest versions)	
4	Application	Scanner Air fan	
5	Constructional Features	Poles and armature shall preferably have fully laminated construction with low loss silicon steel sheet. Yoke shall be made of cast steel or thick rolled steel plates and shaft shall be forged from special high tensile steel (Solid Yoke).	
6	Brushes	a) The brushes shall be of electric graphite of high quality and the pressure on the brush shall be adjustable, if necessary b) The brush holder shall be of non-ferrous material and so constructed to maintain constant brush pressure regardless of brush wear and tear and to ensure sparkless commutation at top speeds and over load. c) Provision shall be made available for maintenance of brushes.	

Sl. No.	Characteristics	Requirement	Vendor's Compliance
		d) Motor shall have double shaft extension for mounting brakes and tachometers on the non- driving end.	
7	Duty Cycle	Continuous, S1	
8	Rated Voltage & Tolerance	220V DC/110V DC (As per requirement) -15% to +10%	
9	Method of motor starting	Resistance method in 4 steps (3 Resistances)	
10	Capacity to restart	3 starts spread over an hour and 2 consecutive hot starts	
11	Over speed	a) 20% above rated maximum field working speed in both direction of rotation without any mechanical damage to the rotor. b) Provision shall be available for measuring the speed of motor, while the motor is running.	
12	Type of balancing of rotor	Dynamic balancing	
13	Method of cooling	As per IC-0411	
14	Direction of cooling air	NDE side to DE Side	
15	Winding Treatment	Winding Insulation shall be given tropical and fungicidal treatment for operation of motor in hot, humid & tropical climate. Windings shall be non-hygroscopic, oil resistant and flame resistant	
16	Starting Current	200% of Full Load Current	
17	Shaft extension	Motor shall be provided with key slotted bare shaft extension with key at the drive end	
18	Terminal box	Weather proof IP 55 as per IS-60529, capable of being turned through 360° in steps of 90°	
19	Size of Terminal box	Size of Terminal box shall have adequate space which shall be suitable to terminate the Power cable applicable to the motor by using the suitable crimping lugs. Also refer to Data sheet	

Sl. No.	Characteristics	Requirement	Vendor's Compliance
20	Terminals	Separate Terminals for Windings and Space heaters. Stud type terminals with plain washers, spring washers & check nuts Solder type/Crimping type Crimping lugs shall also be supplied for connecting the power cable and cable for space heaters, if applicable.	
21	Earthing terminals	1 Number External and 1 Number inside the terminal box	
22	Lifting device	Eye bolt	
23	Name Plates	Motor shall have name plates as per relevant IS and in addition the following data shall be provided a) Manufacture's name, frame size and number b) Insulation class designation, ambient temperature and temperature rise in °C over ambient temperature at rated output c) Connection diagram shall be marked inside the terminal box	
24	Painting	Epoxy based paint finish	
25	Inspection & Testing	Vendor to submit Test Certificates for BHEL's review	
26	Documents (along with offer)	a. Point-wise confirmation to this technical specification b. Filled in technical data sheet, with complete details for all the clauses, as per the format given by BHEL c. Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions	

Sl. No.	Characteristics	Requirement	Vendor's Compliance
27	Documents for approval by BHEL/Customer (after placement of purchase order)	6 Sets of the following :- a. Final technical Data sheet as per BHEL's format. b. Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions c. Motor Characteristics curves (Performance curve, Speed Vs Torque curve and Thermal withstand characteristics) at maximum, minimum and rated voltages d. Guarantee certificate e. O & M manuals	
28	Packing	The packing shall be as per manufacturers standard meeting the Transport, environment and Storage hazards	

Note :-

Vendor to indicate "Yes" or "Confirmed" in the Vendor's Compliance columnfor all the clauses and submit along with the offer.

BHEL	MANUFACTURER'S NAME AND ADDRESS: BHEL TIRUCHIRAPPALLI & NTPC APPROVED SUB-SUPPLIERS	REFERENCE QUALITY PLAN			NTPC	TO BE FILLED IN BY NTPC	
		ITEM : SCANNER AIR FANS WITH ACCESSORIES SUB-SYSTEM : Steam Generator and Auxiliaries	CQP NO.: 2678 REV. NO.: 02 DATE : PAGE: 1 OF 3	SIGN. OF MFRR. R. Venkanna (VENKANNA RUPANI)	QP NO.: 0000-999-QVM -P-164 REV. NO.: 02 DATE: 12.07.2016 PAGE: 1 OF 3 VALID UPTO: 11.07.2019	REVIEWED BY:	APPROVED BY: Approved

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			Dt. REMARKS
										M	C	N	
1	2	3	4	5	6	7	8	9	D*	**10			11
1.0	**RAW MATERIALS**												
1.1	Raw material sheets / Plates for casing & Impeller	Chemical, Mech. Properties surface defect.	B	Chem.Analysis, Mech. test, Visual	Sample/Heat test 100%	BHEL Apprd. Drg	BHEL Apprd. Drg	MTC		P	V	V	See Note-1
1.2	Hub	Chemical, Mech. Properties	B	Chem.Analysis, Mech. Test	Sample/Heat test	BHEL Apprd. Drg	BHEL Apprd. Drg.	MTC	√	P	V	V	See Note-2
		Internal soundness	B	UT*	100%	ASME V / ASTM A388 Freq. 2-4MHz	See Note-3		√	P	V	V	*For dia. More than 40mm
1.3	AC motor / DC motor	MAKE/TYPE/ RATING	B	Review	100%	BHEL Apprd Drg/Datasheet	NTPC Apprd Data Sheet	QCR	√	P	V	V	
		Routine test	A	Measurement	See note-4	IS: 325-1996/ IS: 4722-2001	IS: 325-1996/ IS: 4722-2001	QCR	√	V*	V	V	*See Note-9 & 10
2.0	**INPROCESS CONTROLS**												
2.1	Welding Qualifications	Procedure Qualification	B	Review of Documents	100%	ASME Sec IX / AWS D 1.1		WPS & PQR	√	P	V	V	See Note-5
		Personnel Qualification	B					WQR	√	P	V	V	
2.2	Casing Fabrication Welding	Dimensional conformity	B	Measurement	100%	BHEL Apprd. Drg.		Log		P	-	-	
		Surface defects	B	Visual	100%	No defects	See note-6	Log		P	-	-	
		NDT	B	LPI	20%	ASME-E-165	No defects*	IR	√	P	V	V	*See Note-6
2.3	Impeller Fabrication Welding	Dimensional conformity	B	Measurement	100%	Mfg. Drg.		Log		P	-	-	
		Surface defects	B	Visual	100%	No defects	See note-6	Log		P	V	V	
		NDT	B	LPI	20%	ASME-E-165	No defects*	IR	√	P	W	W	*See Note-6
	Machining of HUB	Dimensional	B	Measurement	100%	Mfg. Drg.		Log		P	-	-	
2.4	Static & Dynamic balancing of impeller	Amount of unbalancing	A	Balancing	100%	ISO: 1940-1	ISO: 1940 Balancing GR.6.3	IR	√	P	W	W	
2.5	Assembly	Completeness dimensional	B	Visual Measurement	100%	BHEL Apprd. Drg.		IR	√	P	V	V	

LEGEND: * **RECORDS**, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
** M: MANUFACTURER/SUB-SUPPLIER, **C:** MAIN SUPPLIER//NOMINATED INSPECTION AGENCY, **N:** NTPC; **P:** PERFORM **W:** WITNESS AND **V:** VERIFICATION. AS APPROPRIATE; **CHP:** NTPC SHALL IDENTIFY IN COLUMN AS 'W'; MTC- MILL / MANUFACTURER'S TEST CERTIFICATE, D : RECORD OF DATA FOLDER, QCR- QUALITY CONTROL RECORD, HC- HISTORY CARD; **LEGEND : CI : Class (A: Critical, B:Major, C:Minor); IR: Inspection Report**

Note:# NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of Inspection

बी एच ई एल BHEL	MANUFACTURER'S NAME AND ADDRESS: BHEL TIRUCHIRAPPALLI & NTPC APPROVED SUB-SUPPLIERS	**REFERENCE QUALITY PLAN** ITEM : SCANNER AIR FANS WITH ACCESSORIES SUB-SYSTEM : Steam Generator and Auxiliaries	CQP NO.: 2678 REV. NO.: 02 DATE : PAGE: 2 OF 3	SIGN. OF MFRR. [signature] (VENKANNA RUPANI)
NTPC	TO BE FILLED IN BY NTPC	QP NO.: 0000-999-QVM -P-164 REV. NO.: 02 DATE: 12.07.2016 PAGE: 2 OF 3 VALID UPTO: 11.07.2019	REVIEWED BY: [signatures]	APPROVED BY: [stamp: Quality Assurance, N.T.P.C., Noida — अनुमोदित Approved]

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	AGENCY M	AGENCY C	AGENCY N	REMARKS
1	2	3	4	5	6	7	8	9	D*	**10			11
3.0	**Final Inspection:**												
3.1	Fan Assembly*	1. Performance test 2. Capacity, S.P., 3. Power consumption, 4. Speed, 5. Efficiency, 6. Bearing temp rise (For 4 hr. or till establishing the bearing temp.)	A	Performance Test for each size & type of fan (See note-7) (See note-8)	1 unit of each size / type	BHEL Apprd. Drg. IS: 4894-1987 NTPC Appd. Data sheet	BHEL Apprd. Drg. & Tolerance as per IS: 4894. NTPC Appd. Data sheet	Performance test result with curve.	√	P	W	W	*See Note 11
		7. Run test a) Vibration b) Noise & c) Current Drawn	B	Routine test	100%		a) 60 Microns (Max) b) 85 dBA (Max) at 1.0 Mtr. Dist. c) NTPC Appd. Data sheet	IR	√	P	W	W	
3.2	Other Accessories like transition pieces, anti-vibration pads, foundation/ fixing bolts, vibration isolators, etc.	Visual & Dimensional	B	Verification / Measurement	100%	BHEL Approved. Drg.		IR	√	P	W	W	
3.3	Document Review	Verification	B	Review	As noted in Column "D"			-		P	V	V	
3.4	Surface Preparation & Protection	Cleaning & Painting	B	Visual & Measurement	100%	NTPC Technical Specification/Datasheet/ BHEL Specification. See Note-12		IR	√	P	V	-	
3.5	Marking	Name Plate	B	Visual	100%	BHEL Approved. Drg.				P	V	-	
3.6	Packing	Tightness & Stability	B	Visual	100%	BHEL Specn.		Packing Slip		P	V	-	

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
** M: MANUFACTURER/SUB-SUPPLIER, C: MAIN SUPPLIER//NOMINATED INSPECTION AGENCY, N: NTPC; P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE; CHP: NTPC SHALL IDENTIFY IN COLUMN AS 'W'; MTC- MILL / MANUFACTURER'S TEST CERTIFICATE, D : RECORD OF DATA FOLDER, QCR- QUALITY CONTROL RECORD, HC- HISTORY CARD; LEGEND : Cl : Class (A: Critical, B:Major, C:Minor); IR: Inspection Report

Note:# NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of Inspection

बी एच ई एल BHEL	MANUFACTURER'S NAME AND ADDRESS: BHEL TIRUCHIRAPPALLI & NTPC APPROVED SUB-SUPPLIERS	REFERENCE QUALITY PLAN			एनटीपीसी NTPC	TO BE FILLED IN BY NTPC	
		ITEM : SCANNER AIR FANS WITH ACCESSORIES SUB-SYSTEM : Steam Generator and Auxiliaries	CQP NO.: 2678 REV. NO.: 02 DATE : PAGE: 3 OF 3	SIGN. OF MFRR. R Venkanna (VENKANNA RUPANI)	QP NO.: 0000-999-QVM -P-164 REV. NO.: 02 DATE: 12.07.2016 PAGE: 3 OF 3 *VALID UPTO:* 11.07.2019	REVIEWED BY:	APPROVED BY: Certified Approved

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
										M	C	N	
1	2	3	4	5	6	7	8	9	D*	**10			11

Notes:

1) For Plates/ Sheets, in case Mfr's TC is not available, one sample from plate of each heat shall be tested at approved lab by Vendor & TC shall be submitted to NTPC for review.
2) For Hub, in absence of correlated TC, one sample from each bar shall be tested by Vendor & TC shall be submitted to NTPC for review.
3) The defect echo height more than 20% of FSH when back wall echo initially set to 100% (FSH) in sound area of material shall be unacceptable. Also, fall in back wall echo to less than 80% of FSH when back wall echo initially set to 100% (FSH) shall not be acceptable. For other defects which are acceptable as scanned above.: Total number of defects permissible are five in one meter long & distance between two defects shall not be less than 3 times the dia. of probe.
4) Type test certificate for similar motor rating of more than 50 KW & frame size from same manufacturer is to be submitted to NTPC for verification.
5) Only qualified welders as per ASME Section IX/AWS D1.1 are engaged and approved consumables are to be used. Records to be shown for verification. WPS shall be approved by BHEL.
6) No defects like pin hole, under cut, linear indication.
7) "AC Motor FAN" shall be tested with actual job motor.
8) "DC Motor FAN" shall be tested with equivalent AC motor.
9) **Motors to be procured from NTPC approved sources.**
10) **Motors:**
    a) **For motors less than 30KW:** Acceptance of motor less than 30KW is based on COC of the manufacturer and the contractor confirming as follows:
    "It is hereby confirmed that the above mentioned motor(s) was /were manufactured taking care of NTPC specific requirements regarding ambient temperature, voltage and frequency variation , hot start, pull out torque, starting KVA / KW, temperature rise, distance between centre of the stud and gland plate, space heater and tested in accordance with approved drawing / data sheet".

    b) **For motors of 30KW and above:** Acceptance of motor rating between 30KW and 50KW is based on NTPC review of routine test inspections. Report as per IS 325 witnessed by main contractor along with COC of the manufacturer and the contractor confirming as follows:
    "It is hereby confirmed that the above mentioned motor(s) was /were manufactured taking care of NTPC specific requirements regarding ambient temperature, voltage and frequency variation , hot start, pull out torque, starting KVA / KW, temperature rise, distance between centre of the stud and gland plate, space heater and tested in accordance with approved drawing / data sheet".

11) **Scanner Air Fans to be procured from NTPC Approved vendors.**
12) In absence of specific NTPC requirement/Datasheet requirement, BHEL spec. maybe followed.

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
** M: MANUFACTURER/SUB-SUPPLIER, C: MAIN SUPPLIER//NOMINATED INSPECTION AGENCY, N: NTPC; P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE; CHP: NTPC SHALL IDENTIFY IN COLUMN AS 'W'; MTC- MILL / MANUFACTURER'S TEST CERTIFICATE, D : RECORD OF DATA FOLDER, QCR- QUALITY CONTROL RECORD, HC- HISTORY CARD; LEGEND : Cl : Class (A: Critical, B:Major, C:Minor); IR: Inspection Report

Note:# NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of Inspection

Technical Pre-Qualification Requirement for Scanner Air Fan & Motor assembly.

1. The vendor shall be an established Centrifugal fan (radial backward curved) supplier having adequate Engineering, Manufacturing, testing and servicing facilities for fan and shall furnish technical backup documents in proof of the above requirements.
2. The vendor shall have experience of having supplied Centrifugal Fan of radial backward curved type with AC/DC motor assembly & shall be capable of handling the dust-laden air, designed for developing head and capacity as per the technical specification for boiler/refinery or application of similar severity. The supplied fan & motor shall be in operation for at least one year as on the date of enquiry.
3. The Scanner Air Fan & Motor assembly offered shall be from the existing regular manufacturing range of the supplier.
4. As proof of pre-qualifying requirement, vendor should also submit :
   a. Minimum ONE end user certificate for the satisfactory operational performance of their supplied Scanner Air Fan & Motor assembly meeting the minimum pre-qualifying requirements stated above.

      OR

      Minimum Two past purchase orders of similar Scanner Air Fan & Motor assembly meeting the minimum pre-qualifying requirements stated above.
   b. Vendor to attach the corresponding data sheets/ technical documents of the Scanner Air Fan & Motor assembly supplied as per P.O / End user certificate (submitted vide point 4.b) for our review.
5. In case of ordering, the Vendor shall have the responsibility for the following and same to be confirmed point wise.
   i) Vendor should have the component replacement responsibility in case of defect / failure.
   ii) Experts from Vendor's side shall assist in commissioning activities at site, if required.
   iii) Vendor should ensure the product performance during erection & commissioning.

6. DOCUMENT SUBMISSION CHECKLIST FOR THE VENDOR TO MEET PQR

Clause	Documents acceptable	Check list
1	i) ISO or Other third Party certification about the engineering, manufacturing, testing and servicing facilities in the name of supplier/OEM as applicable. The certificate shall be specific for the product quoted by the vendor. (OR) ii) List of manufacturing, testing and servicing facilities available (like machinery/equipment) in the letterhead of supplier/OEM as applicable.	☐
2	Supply reference list with details of PO, PO date, customer name, application severity/type in the form of a table	☐
3	Product Catalogue in the name of supplier/OEM as applicable	☐
4	Min. one end user certificate (or) Two POs in the name of supplier/OEM as applicable	☐
5	Signed copy of this technical PQR document	☐

Vendor signature and seal with Date

BHARAT HEAVY ELECTRICALS LIMITED

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPALLI-620 014

CONTROLS & INSTRUMENTATION/FB

TECHNICAL SPECIFICATION OF

LT AC MOTORS (SAFE AREA)

SPECIFICATION REFERENCE – TCI : 140, Rev. 13

Revision History

Rev. No.	Date	Description	Prepared & Reviewed	Approved
01 -12		Earlier Revisions	-Sd-	-Sd-
13	05-03-22	General Revisit	M. Muruga Jothi	D. Kavitha 8/3/2022

Sl. No.	Description	Requirement
1	Site Conditions :-	
	Altitude above MSL	500 meters
	Ambient temperature	50° C
	Relative Humidity	100 %
	Atmosphere	Tropical, dusty, salty, corrosive and highly polluted environment.
2	Motor type	Squirrel cage type induction motor suitable for direct on line starting through any type of breaker.
3	Applicable Standards	IS-325, IS 12615, IS/IEC-60034, IS-12065, IS-12075, IS 15999, IS/IEC-60529, IS 4029, IS-1231, IS-6362, IS-2253. (Latest version of relevant standards shall be referred).
4	Type of Enclosure and degree of protection	Totally Enclosed Fan Cooled (TEFC), IP-55 as per IS/IEC-60529
5	Duty Cycle	Continuous, S1
6	Energy Efficiency Class	IE2/IE-3 as per IS-12615/IEC 60034-30. Refer project specific transmittal furnished along with enquiry for applicable energy efficiency class.
7	Rated Voltage & Tolerance	415 V AC, 3 Phase, ± 10 %.
8	Rated Frequency & Tolerance	50 Hz, ± 5 %
9	Combined voltage & frequency tolerance	10 % (absolute sum)
10	General Requirements	a. All motors shall be so designed that maximum inrush currents, locked rotor and pull out torque, developed at the extreme voltage and frequency variations do not endanger the motor and driven equipment. b. Motor shall be designed to keep the torsional and rotational natural frequencies of vibration, at least 25 percent above the motor rated speed ranges to avoid resonant vibration over the operating speed range of the motor and driven equipment.

Sl. No.	Description	Requirement
		c. Maximum continuous rating (MCR) of the motor shall have at least 15 % margin over the maximum load demand of the driven equipment including voltage and frequency variation. (Applicable only if vendor supplies motor along with the driven equipment or load).
11	Torque requirements	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% of motor full load torque. Pull Out torque at rated voltage shall not be less than 205 % of full load torque.
12	Requirements during Starting & Running	• Motor shall start with rated load and accelerate to full speed with 80 % rated voltage at motor terminals • The motor shall be capable of withstanding the stresses imposed if started at 110 % rated voltage. • The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75 % rated voltage at motor terminals.
13	Momentary Overload withstanding capability	The motor shall be designed to withstand momentary over-load of 60% of full load torque for 15 seconds without any damage.
14	Momentary Over speed Withstanding capability	The motor shall be designed to withstand 120 % of rated speed for 2 minutes without any mechanical damage.
15	Hot thermal withstand curve	Margin of at least 10% over the full load current
16	Class of Insulation	Class-F insulation with temperature rise limited to Class-B. Temperature rise of the motor shall be limited to 70° C (by resistance method) over an ambient temperature of 50° C.
17	Stress withstanding capability during Bus Transfer	The motor may be subjected to sudden application of 150 % rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.
18	Capacity to restart for rated voltage	a. Two successive starts from cold condition. b. Three equally spread starts per hour. c. Two hot starts in succession, with motor initially running at normal temperature.

Sl. No.	Description	Requirement
19	Starting Current	The starting current (% of FLC) shall be limited as per the standard IS-12615.
20	Locked Rotor Condition	The ratio of Locked Rotor KVA at rated voltage to rated KW shall not exceed as indicated below (without any further tolerance) For Motor rating from 50 KW and up to 110 KW: 11
21	Locked Rotor with-stand time	For motor with starting time up to 20 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 seconds more than starting time.
		For motor with starting time more than 20 seconds but not exceeding 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 seconds more than the starting time.
		For motor with starting time more than 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be 10% more than the starting time
		Vendor to provide Speed switches mounted on the motor shaft in case the above requirement is not met with.
22	Type of balancing of rotor	Dynamic balancing
23	Method of cooling	IC-0411 as per IS-6362
24	Direction of cooling air flow	NDE side to DE Side
25	Winding wire	Enameled Copper Wire, Grade-2, as per IS-13730, Part-3. Windings shall be non-hygroscopic, oil resistant and flame resistant.
26	Treatment on Winding Insulation	Winding Insulation shall be given tropical and fungicidal treatment for operation of motor in hot, humid & tropical climate.

Sl. No.	Description	Requirement
27	Bearing	Deep Groove Ball Bearing or Roller bearing as per the motor design, properly sealed to protect against the ingress of dust and water. Lubrication : Grease.
28	Noise level	Noise level shall be limited to 85 dB at 1 meter distance.
29	Vibration level	The peak amplitude of vibration shall be as per IS-12075 (Limits of Severity-Normal grade shall be followed).
30	Shaft extension	Motor shall be provided with key slotted bare shaft extension, with key at the drive end.
31	Terminal box	Weather proof terminal box shall be provided. The terminal box shall be capable of being turned through 360° in steps of 180° or 90°. Shall meet IP 55 protection class requirements as per IS 60529. Minimum Distance between center of the terminal stud & the gland plate and Minimum inter-phase/phase-earth air clearance shall be provided as per IS/IEC standards. Refer Project Specific transmittal for project specific requirements of dimensions. Terminal box shall have adequate space to terminate the Power cable applicable to the motor by using suitable lugs. Connection diagram shall be marked inside the terminal box. The terminal box shall be capable of withstanding a fault level of 50 kA rms for 1 second (Voltage : 415 V) at the terminals.
32	Cable Entries, Cable Glands & Lugs	Cable entries, Cable glands and Lugs shall be provided suitable for the power cable size, which will be indicated after PO placement during datasheet approval. Tentative sizes are indicated in the project specific transmittal. Double Compression type, brass with nickel plated, weather proof cable glands shall be provided – Quantity to be matched with the number of entries. 6 Nos. of Tinned Copper Lugs shall be provided.
33	Terminals	Separate Terminals for Space heaters and Windings with suitable connecting links shall be supplied.

Sl. No.	Description	Requirement
34	Earthing provisions	Earthing provisions shall be provided on motor body (2 nos. at opposite locations) and in terminal boxes as per the standard.
35	Space heater for motors rated 30 KW and above	Separate space heater suitable for 240 V AC, Single Phase supply shall be provided.
36	Lifting device	Eye bolt.
37	Project specific requirements	Vendor to take care of the project specific requirements indicated in the annexure - “Project specific transmittal”.
38	Name Plates	Motor shall have name plate as per relevant IS and in addition, Manufacture’s name, frame size, Energy Efficiency class, Insulation class, Bearing details, year of manufacture shall also be indicated.
39	Type test reports	Type test reports shall be produced for the following tests as per the requirements spelt in the standards, • Measurement of resistance of windings of stator. • No load test at rated voltage to determine input current power and speed • Full load test to determine efficiency, power factor and slip. • Temperature rise test. • Momentary excess torque test. • High voltage test. • Test for vibration severity of motor. • Test for noise levels of motor. • Test for degree of protection. • Over speed test. • Energy Efficiency test. In case the vendor is not able to submit report of the type test(s) conducted within last 5 years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the vendor shall conduct all such tests either in an independent laboratory or at manufacturer’s works in presence of Owner’s representative under this contract, free of cost to the Owner and submit the reports for approval.

Sl. No.	Description	Requirement
40	Confirmation and Documents to be submitted by the vendor, during Purchase Enquiry.	Vendor to indicate the references of the technical specification, project specific annexure and indicate "No Deviation" in the Sub-Delivery Enquiry deviation form. Any deviation shall only be indicated in the Sub-Delivery Enquiry deviation form. Deviations indicated elsewhere in the offer will not be considered.
41	Documents to be submitted by the vendor for approval by BHEL/Customer, after placement of purchase order.	3 Sets of the following: - a. Final technical Data sheet as per the format submitted by BHEL. b. Motor GA drawing indicating details of foundation, shaft dimensions and terminal box arrangement with complete dimensions. c. Motor Characteristic curves (Torque Vs. Speed, Current Vs. Speed, Speed Vs. time, Current Vs. time, Efficiency and PF Vs. load, Thermal withstand characteristic) d. O & M manuals.
42	Packing	The packing shall be suitable for safe transport, safe delivery at site and shall avoid damages due to environmental conditions during storage at site.
43	Painting	Paint shade shall be as per the purchase enquiry. The finish shall be corrosion resistant, epoxy based paint.

Taking care of the above indicated technical requirements in full, vendor to submit Sub-delivery enquiry deviation (SDED) format sent along with the purchase enquiry, without any deviations. Any deviation/clarification in the technical requirements has to be indicated only in the SDED format. Other than the SDED format, hidden deviations indicated elsewhere in the offer will not be considered.

BHARAT HEAVY ELECTRICALS LIMITED

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPALLI-620 014

CONTROLS & INSTRUMENTATION/FB

TECHNICAL SPECIFICATION FOR DC MOTORS (NON FLAME PROOF)

SPECIFICATION REFERENCE – TDC: 223/DC MOTOR

Revision History

Rev. No.	Date	Description	Prepared	Reviewed	Approved
00 - 05	12-06-2019	Initial Revisions	-sd-	-sd-	-sd-
06	16-02-2022	Standards reference, Details of Terminal box updated	M. Murugesan	M. Murugesan	D. Kavitha 08/3/2022

Sl. No.	Characteristics	Requirement
1	Site Conditions :-	
	Altitude above MSL	550 metre
	Ambient temperature	50° C
	Relative Humidity	100 %
	Atmosphere	Tropical, dusty, salty, corrosive and highly polluted
2	General Description	DC Shunt Motor. Maximum continuous rating (MCR) shall have at least 10 % margin over maximum load demand including voltage variation, temperature rise and other variations.
3	Applicable Standards	IS/IEC-60034, IS-12065, IS-12075, IS/IEC-60529, IS-6362, IS-2253, IS 13730. (Latest version of relevant standards shall be referred).
4	Application	Scanner Air fan
5	Constructional Features	Poles and armature shall have fully laminated construction with low loss silicon steel sheet. Yoke shall be made of cast steel or thick rolled steel plates and shaft shall be forged from special high tensile steel (Solid Yoke).
6	Brushes	a) The brushes shall be of graphite of high quality and the pressure on the brush shall be adjustable, if necessary. b) The brush holder shall be of non-ferrous material and constructed to maintain constant pressure, regardless of wear and tear and to ensure sparkless commutation at top speeds and during over load. c) Provision shall be made available for maintenance of brushes. d) Motor shall have double shaft extension for mounting brakes and tachometers on the non- driving end.
7	Duty Cycle	Continuous, S1
8	Rated Voltage & Tolerance	220V DC (-15% to +10%)
9	Method of motor starting	3 step resistance cutting method is adopted for motor starting. The external resistors are placed in series to the armature resistance and are cut off in steps through control circuit. Starter Box will be supplied by BHEL. As per the fan starting time and motor characteristics, vendor to calculate the starting resistance values and shall furnish to BHEL.
10	Capacity to restart	3 starts spread over an hour and 2 consecutive hot starts

Sl. No.	Characteristics	Requirement
11	Type of balancing of rotor	Dynamic balancing
12	Enclosure protection & Method of cooling	IP 55 as per IS 60529 and IC-0411 as per IS-6362
13	Direction of cooling air	NDE side to DE Side
14	Winding wire	Enameled Copper Wire, Grade-2, as per IS-13730, Part-3. Windings shall be non-hygroscopic, oil resistant and flame resistant.
15	Winding Treatment	Winding Insulation shall be given tropical and fungicidal treatment for operation of motor in hot, humid & tropical climate.
16	Class of Insulation	Class-F insulation with temperature rise limited to Class-B. Temperature rise of the motor shall be limited to 70° C (by resistance method) over an ambient temperature.
17	Starting Current	200 – 250 % of Full Load Current.
18	Shaft extension	Motor shall be provided with key slotted, bare shaft extension with key at the drive end
19	Terminal box	Weather proof IP 55 as per IS-60529, capable of being turned through 360° in steps of 90°.
20	Terminals	• Stud type terminals with plain washers, spring washers & check nuts • Size of Terminal box shall have adequate space which shall be suitable to terminate the Power cable
21	Cable Entries, Cable Glands & Lugs	Cable entries, Cable glands and Lugs shall be provided suitable for the power cable size, which will be indicated after PO placement during datasheet approval. Tentative sizes are indicated in the project specific transmittal. Double Compression type, brass with nickel plated, weather proof cable glands shall be provided – Quantity to be matched with the number of entries. 6 Nos. of Tinned Copper Lugs shall be provided.
22	Earthing terminals	Earthing provisions shall be provided on motor body (2 nos. at opposite locations) and in terminal boxes as per the standard.
23	Lifting device	Eye bolt
24	Noise level	Noise level shall be limited to 85 dB at 1 metre distance.
25	Vibration level	The peak amplitude of vibration shall be as per IS-12075 (Limits of Severity-Normal grade shall be followed).

Sl. No.	Characteristics	Requirement
26	Over speed	a) 20% above rated maximum field working speed in both direction of rotation without any mechanical damage to the rotor. b) Provision shall be available in the motor for measuring the speed of motor, while the motor is running.
27	Painting	Paint shade shall be as per the purchase enquiry. The finish shall be corrosion resistant, epoxy based paint.
28	Inspection & Testing	Motors up to 30 KW- Inspection by Vendor meeting IEC standard requirements, as applicable. Routine & type test reports shall be submitted for review and acceptance by BHEL. In case the vendor is not able to submit report of the type test(s) conducted within last 5 years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the vendor shall conduct all such tests either in an independent laboratory or at manufacturer's works in presence of Owner's representative under this contract free of cost to the Owner and submit the reports for approval.
29	Documents (along with offer)	a. Vendor to indicate the references of technical specification and project specific annexure and indicate "No Deviation" in the Sub-Delivery Enquiry deviation form. Any deviation shall only be indicated in the Sub-Delivery Enquiry deviation form. Deviations indicated elsewhere in the offer shall not considered. b. Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions.
30	Documents for approval by BHEL/Customer (after placement of purchase order)	a. Final technical Data sheet as per the format submitted by BHEL. b. Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions. c. Motor Characteristic curves (Torque Vs. Speed, Current Vs. Speed, Speed Vs. time, Current Vs. time, Efficiency and PF Vs. load, Thermal withstand characteristic) d. O & M manuals
31	Packing	The packing shall be as per manufacturers standard meeting the Transport, environment and Storage hazards

Taking care of the above indicated technical requirements in full, vendor to submit Sub-delivery enquiry deviation (SDED) format sent along with the purchase enquiry without any deviations. Any deviation/clarification in the technical requirements has to be indicated only in the SDED format. Other than the SDED format, hidden deviations indicated elsewhere in the offer will not be considered.