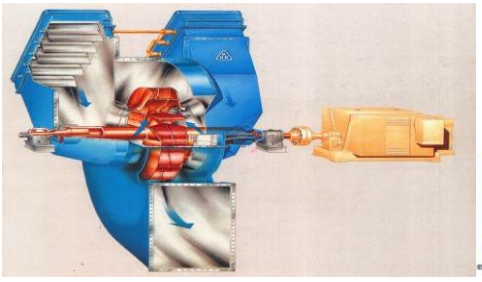
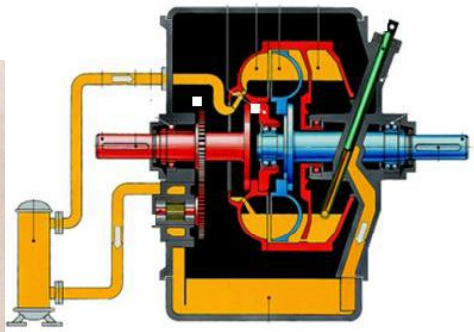
BHARAT HEAVY ELECTRICALS LIMITED
BOILER AUXILARY PLANT
RANIPET-632 406

FANS ENGINEERING DEPARTMENT

SPECIFICATION FOR HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS

[Applicable Annexure -Annexure 1 to Annexure 9]





02	D.SARASWATHI	P.NATARAJAN	PRASANTA SAHA	R.M.CHHIPA	REVIEW & UPDATED ON 11/09/2013
01	V.SIVANATHAN	R.S.G.K	M.SATYAMOORTHY		ANNEXURE UPDATED
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REV. NO.	K.J.K PREPARED	G.V.R CHECKED	K.A.R APPROVED	B.S.RAO SIG.OF.QA	REMARKS WITH DATE

ONLY LATEST REVISION SHALL BE REFERRED FOR ALL THE STANDARDS SPECIFIED.

DESCRIPTION	SPECIFICATION NUMBER	REV.NO	DATE :
HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	TFN:348	02	11/09/2013
			PAGE 01 OF 67

CONTENTS

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN. NO TFN: 348 REV.NO.02

A Project/ applica on details

Refer **Annexure-1**

B Selec on & construc on requirement

1. Selec on of hydraulic coupling shall be made for the maximum power consump on at input coupling sh (P max) and speed of the drive motor referred in fan torque vs. speed curve (T-S curve) indicated in **Annexure -1** The coupling selec on chart with Kw & speed marked shall be submitted as part of offer for review by BHEL.

2. The coupling size/model offered for this enquiry shall be considered for evaluation only if the vendor has Supplied same or bigger size coupling (both wheel diameter & torque transferred will be the basis of Comparison) for at least one similar application of "regulating type duty for fans" and the equipment is in service for a minimum period of one year in the date of opening of the tender. The supplier shall produce necessary data to this effect viz. detail of the size/model number/customer/project where the coupling is in opera on, duty condi ons like applica on/drive KW/maximum speed / maximum torque/ wheel diameter transferred and date of supply/commissioning.

3. The vendor shall indicate the expected power consump on at the input sha of the hydraulic coupling for the different load/speed conditions of the fan listed in **Annexure -1**(taking the indicated fan power consump on). This addi onal power shall include the slip losses, mechanical losses and any addi onal electrical drives employed by the coupling supplier (like external motor driven pump.) every effort shall be made to keep this extra power (difference of power at input of coupling over fan power) as minimum of possible.

4. At the me of price comparison, for the guaranteed load condi on (as listed in Annexure -1), equipment price offered by the respective suppliers will be loaded for every additional kW over and above the lowest offered kW at that load. The loading cost per kW is also listed in **Annexure -1.**

5. The hydraulic coupling shall be self-supported type (no transfer of axial or radial load to drive or fan sh Permi ed) and shall have infinitely variable speed variation (through remote control) and minimum regula on range (turn down ra o) of 5:1.

6. The coupling external shell/enclosure shall be ruggedly designed-free from resonance/vibra on-and the runners shall be aluminum alloy/steel. The bearings used in assembly shall be of reputed make (SKF/FAG) and shall be designed for a minimum life of one lakh opera ng hours.

7. The rotors shall be dynamically balanced to a grade of Q 6.3 (for maximum speed of fan opera on up to 900 rpm) and Q2.5 (if the maximum speed of fan opera on is ≥900 rpm).

8. Speed regula on of the driven equipment (fan) shall be based on the demand signal received from the system controller through a 4 – 20mA signal. This signal is to be processed through a posi oned (suitable i/p converter is to be employed in case pneuma c control actuator is used). A posi on feedback transmi er (4 - 20mA) shall be used to give feedback to the controller on the percentage regula on of the coupling and to generate the "error signal" for control.

9. The quan ty of oil in the working circuit of the coupling may be varied (for regul ng the speed) by any one of the means like – scoop tube/flow control valve of pump etc. A write-up explaining the feature employed for speed regulation and working principle shall be submitted with the offer.

10. The regula on of the speed shall be calibrated (0 to 100%) in line with 4 20mA signals and a suitable local display scale to be provided to note the running regula on status.

11. The pump employed for providing working fluid to the runners shall be preferably shaft driven driven by set of gear connected to the primary sha .

12. In case the pump is located external to the shell and driven by electrical motor, the same shall be 2x100% (1 working + 1 stand by) mounted on the sump por on of the coupling shell. The drive motor of the external pump(S) shall be suitable for 415V, AC, 3Ø , 50HZ opera on and shell meet the requirements of LT motor specification defined in **Annexure – 2** and suitable for Direct On – line star ng(DOL).

13. The coupling shall be provided with a "fusible plug" for protection of coupling. Suitable provision in the coupling is to be made and two nos. of spare plug shall be fitted in this provision as part of original supply – for any emergency use.

14. The lubrica on of the coupling bearings may be done by por on of the oil tapped from the pump –tapping taken after the heat exchanger and routed to the bearings through a duplex filter(2x100%).

15. The heat exchanger shall be of reputed make. The heat exchangers shall be 2x100% capacity and shall be of shell (oil flow) & tube (water flow) type. Oil pressure considered for operation of heat exchanger is to be more than the cooling water indicated in **Annexure – 1.** Details on selec on of heat exchanger shall be submitted with the offer.

The cooling water line connections to the heat exchanger shall be flange connection and blind counter flanges shall be supplied for field termination of water lines. Material test certificate for the cooler tube bundles and pressure test certificate of cooler tubes & shell (to be pressure tested to minimum 1.5 times the maximum opera ng pressure) shall be part of inspec on report.

16. The typical process & Instrumenta on diagram (PID) for the coupling is a ached in Annexure 3. The vendor shall submit PID as provided by them – generally confirming to the minimum requirements indicated in **Annexure 3.**

17. All display instruments / switches / transmi ers / speed indicator (linked to a non - contact type output speed measuring device) offered in line with the PID shall be mounted in a panel (with suitable cut-outs for the instruments) fitted to the coupling shell except instruments required to be mounted in the field.

18. Necessary impulse piping for the various switches / transmi ers shall be properly done at factory. Instruments required to be fitted in the field requiring impulse piping work at site shall be clearly mentioned in the PID. pipes / fittings required for any field installation shall be included in the scope of the vendor.

19. All instruments as figuring in the PID shall have IP 55 protection or better. Those requiring electrical power input in the field shall have potential free micro switch contacts (no relay contacts are permi ed) and shall be suitable for 230V AC, 1Ø , 50HZ. Specification for major instruments are placed in Annexure – 6. The offer shall indicate the list of instruments offered in BHEL format covering the make, model number etc. The offer shall contain catalogue copies of instruments offered- with the model number marked.

20. The actuator (electrical or pneumatic as specified in **Annexure 1**), if used for scoop tube opera on, shall conform to the specification placed in **Annexure - 4.** The actuator shall be factory mounted with the coupling over a sturdy bracket a ached to the coupling shell.

21. The end limits of regula on viz. 4 & 20mA shall be identified by means of two limit switches each double pole double throw (DPDT) poten al free contacts in case of scoop tube regula on and by other suitable means in case of other types of controls So that they are used for fan start - stop interlock / logic. Typical interlock / logic required to be considered for start – stop is placed in **Annexure – 5.** The vendor shall submit detailed start – stop logic as applicable to the offered coupling.

22 All instruments shall be neatly wired through suitable cable conduits to a junc on box (with minimum 20% extra terminals) mounted in the coupling shell. In case electrical motors are used, the terminals of the

motor shall be wired to a power junc on box (with minimum 20% extra terminals). Instrument & power junc on boxes shall be separate.

23. The connec ng couplings required at motor sha hydraulic coupling sha interface (input end) and hydraulic coupling sha fan shaft(output end) shall be flexible disc couplings (with spring elements) with spacers. The fan / motor sha end details, distance between sha ends (DBSE) at input & output end and the more details are furnished in the drawings listed in **Annexure 1.**

24. The connec ng coupling halves hub mounted on motor sha in case of input coupling and hub mounted on fan sha in case of output coupling – shall be supplied with a "key phaser slot of 25 mm length x 15 mm width x 3mm depth and shall be identified by paint marking. These slots will be used by end user for phase measurement by non contact probes as part of vibra on monitoring.

25. The connecting couplings shall be dynamically balanced to the same grade as specified in clause 2.0 (f) for the hydraulic coupling rotor.

26. Only seamless pipes / elbows etc shall be supplied for all field piping. ERW / flexible pipes not acceptable. The minimum straight length of pipe shall not be less than 2 meters. Necessary elbows & fittings (with minimum 20% reserve or 1 additional no. whichever is more) for field termination shall be included in the scope of the vendor.

27. Necessary coupling guards (at inlet & outlet), leveling packers & founda on bolts required for fixing the coupling and heat exchangers to concrete founda on shall be included in the scope of supply.

28. The vendor shall offer set of commissioning spares – generally requires for commissioning viz. applicable seals, instruments and spares for actuator. The vendor shall indicate the items, recommended quan ty and unit price against each item. BHEL will finalize the list and quantity at the time of ordering.

29. The vendor shall also indicate the list and unit price of recommended spares for 5 years opera on.

30. The vendor shall offer one set of **"special tools"** required for maintenance of the equipment. The special tools shall generally cover heat exchanger related cleaning tools & any other tailor made tools for dismantling / assembly of the components of equipment during maintenance.

31. Language of communica on / details contained in drawings & documenta on / O&M manuals required to be submi ed subsequently shall only by English.

32. Only metric units shall be used in transac on & supplies.
33. The equipment shall perform on commissioning mee ng the vibra on levels norms in **Annexure 1.**
34. The noise levels measured at 1 meter from the surface & 1.5 meter from the base of the equipment shall be limited to 85 dBA.
35. The offered hydraulic coupling along with the connecting spacer coupling shall fit into the dimension specified in the GA drawings in **Annexure 1.** The vendor can suitably alter the DBSE at input/output to meet this requirement.
36. The center line height of the coupling (from its foot to shaft center line) shall be as specified in the drawing. If the offered coupling center line is less, suitable interface base frame shall be offered by the vendor.
37. The bottom face of the base frame shall have fixing holes matching with that specified in GA drawing and the top face shall be suitably adjusted to suit the hydraulic coupling foot print.
38. In case base frame is offered, the connecting fasteners between base frame to foundation and base frame to coupling shall be in the scope of vendor.

C Scope of supply

1. Hydraulic coupling with the respec ve half couplings (with key phaser slots) mounted on the input / output sha of the hydraulic coupling and with one no. internal sha drive pump or external 2 x 100% electrical motor driven pumps (as applicable)
2. Matching connec ng coupling halves with spacers – as required to be mounted on motor / fan sha .
3. Associated instruments (as mounted in the display panel), duplex filter, scoop tube actuator mounted on the suppor ng bracket, i/p converter (if applicable), associated posi oner, posi on feedback transmi er
4. 2x100% heat exchanger with blind counter flanges for field oil piping.
5. Seamless pipes, elbows, fittings as applicable for field oil piping.
6. Instruments required to be mounted in the field

7. Material (copper tube & fittings)for impulse piping from the point of measurement to the instrument on the display panel.

8. Leveling packers, founda on bolts & nuts for fixing coupling for foundation

9. Leveling packers, Foundation bolts& nuts for fixing heat exchangers

10. Coupling guards for connec ng couplings on both sides

11. Commissioning spares list as finalized at the time of ordering

12. Opera onal spares – list as finalized at the time of ordering.

13. Special tools – list as finalized at the time of ordering.

D Scope of services

In case of any discrepancy in quantity of items supplied as noticed at the time of field erection and any damage / malfunc oning of any instrument / component no ced during erec on commissioning, the vendor shall depute their representative to site immediately to study the discrepancy and arrange for rectification / replacement.

E Inspec on requirements

1. The hydraulic coupling & sub-components will be inspected by BHEL / authorized representa ves as per the approved quality plan. The vendor shall give minimum 2 weeks advance informa on

   The coupling (100%) shall be subjected to no-load run test at vendor's works and will be witnessed by BHEL / authorized representa ves. Wherever possible, one number of each size of coupling covered under the purchase order shall be subjected to load test within the limita on of the test facility

   Complete set of opera onal parameters like input / output speed (as measured by the deliverable speed indicator), working oil temperature, bearing temperature, cooling water / oil temperature (in and out) of heat exchanger, pressure drop across filter etc will be recorded during the no-load / load test.

2. Verification of in-house inspection reports of hydraulic coupling covering material test certificates, NDT records, dimensional reports, balancing reports of runner etc.
3. Verification of dynamic balancing & key phaser slot provision in connec ng couplings.
4. Verification of pressure test certificate & material test certificate of cooler tubes / shell

5. Verification of electrical input / output of each of the electrical instruments as part of **E (2)** above or otherwise separately.
6. Verification of inspection records of all bought-out item like coupling, filter etc.
7. All the inspec on records / test reports should be submi ed to BHEL – within one week of comple ng the inspec on.

F **Special contract requirement**

Any other special requirement (over & above specified in various **Annexure 1 to 6**) exclusive to the project viz. requirement of transmi ers in place of switches special pain ng / end user inspec on etc are detailed in **Annexure – 7.** In case of no other additional requirement, "NIL" will be declared in **Annexure – 7.**

G **Informa on / details to be submitted with offer**

1. Clause by clause confirmation / observation / deviation for the requirements specified in **clause B**. Any observa on / devia on shall be explained explicitly. If no observa on / devia on is listed, it will be deemed that the vendor is fully abiding by the specification requirement,
2. Equipment selection details meeting the requirements specified in clause **B (1) –** with opera ng data clearly marked on the vendor's equipment selection chart
3. Reference list to substantiate the qualification specified in clause **B (2)** as per **Annexure - 8**
4. Power consumed at the input sha of the hydraulic coupling for each duty condition as called for in **B (3)**
5. Write-up on principle of speed regula on employed and the linkage to control signal – as called for in clause **B (7)**
6. General assembly drawing of the coupling with overall dimensions, weight, iner a of primary / secondary parts, turn down ratio offered, material of the runners, balancing grade followed, bearing type & sizes used etc.
7. Field installa on drawing showing the DBSE with motor & fan, layout of the heat exchanger, field piping and arrangement of founda on pocket / loads for coupling & heat exchanger.
8. Details of actuator, i/p converter, posi oner & posi on feedback transmitter offered with catalogues with model numbers marked **B (8,9 & 20)**

9. Filled-up LT motor data sheet in case of external motor driven pump **B 12**
10. Details of heat exchanger offered with drawing – **B (15)**
11. PID clearly indicating the instrument offered B (16)
12. Details of panel mounted / field mounted instruments with make & model numbers filled-up list **B (17 &18)**
13. Catalogue of instruments offered-model numbers marked **B (19 & 22)** as per **Annexure – 9)**
14. Start / stop logics for the coupling & fan B(21)
15. Make & drawings of connecting couplings offered showing balancing grade & key phaser slot – **B (23 to 25)**
16. Typical quality plan followed for manufacture of coupling indicates stages / quantum of checks involved for review.
17. Bill of material of loose items offered – other than hydraulic coupling including field mounted coupling halves, instruments, pipe lines, founda on bolts, coupling guards etc.
18. List of commissioning spares offered – quan ty & unit price **B (28)**
19. List of recommended opera onal spares – **B(29)**
20. List of special tools offered quan ty & unit price **B (30)**
21. Cooling water requirement for one working heat exchanger with expected temperature rise & pressure drop
22. Permissible pressure drop across filter under normal operating conditions.
23. Input power supply (phase / volts / frequency) requirements for various equipment viz. pumps (if applicable) & other instruments. Maximum load demand (current drawn) of each equipment to be indicated
24. Recommended oil specification (ISO VG grade & brand name / manufacturer) with total quan ty of oil required separately for (a) flushing and (b) first fill – considering maximum level oil in coupling, oil to be filled in heat exchanger & field pipelines.

25. Maximum kW / speed to which the offered coupling can be load tested at supplier's works.

26. Typical test produce & test report for no load & load test as planned at supplier's works with details of parameters to be monitored / sample calcula ons.

27. Requirement of base frame if any and detailed drawing showing interface of base frame to founda on and base frame to hydraulic coupling – **B (36, 37 & 38).**

H Details to be furnished – 3 weeks from the date of order

1. Complete GA drawing of the coupling – with final details of connecting coupling, heat exchangers, actuator, external motor driven pumps etc.

2. Installation drawing of heat exchangers & field piping.

3. Finalized PID and start / stop logics.

4. List of panel mounted & field mounted instruments data sheet & catalogues.

5. BOM of typical dispatch hydraulic coupling & other loose items – with weight details.

6. Quality plan for the subject order for approval.

7. Test procedure for no-load / maximum load test as planned at supplier's works for the ordered coupling along with sample calcula ons.

I Details to be furnished 12 weeks from order or 4 weeks ahead of dispatch (whichever is earlier)

1. O & M manual shall contain – as built drawings of all equipment including the list of instrumenta on.
2. The O & M manual shall contain complete drawings / informa on & catalogues (with marked-up model numbers) of other peripheral items like connec ng couplings, heat exchangers, filters, actuators etc.

3. The O & M manual shall be submi ed in so from (1CD) and 5 hard copies for each of the size of coupling involved in the order.

ANNEXURE – 1

PROJECT DETAILS

[2 PAGE]

Note: Also refer Annexure – 8 for special contract requirement

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

Project / applica on details

1.0 Project :

2.0 Site condi ons

2.1	Ambient temperature	:	XX° C
2.2	Cooling water type	:	clarified / potable / sea water
2.3	Cooling water temperature	:	XX° C
2.4	Cooling water pressure	:	XX bar

3.0 Applica on for hydraulic coupling : Speed regula on of FD / ID PA fan

4.0 Opera ng requirement : Out door, con nuous [24x7]exposed to sun, rain and dust

5.0 Drive : Induc on motor

6.0 Sha axis : Horizontal

7.0 Moun ng : Directly on concrete

8.0 Vibra on isolators used between concrete deck & ground : Yes / No

9.0 Applicable vibra ons limits part 3 : Group G / Group T as per ISO 10816

10.0 Maximum Duty condi on : Refer a ached T – S curve **4-00-xxx-xxxxx**

11.0 Power consump on

Load point	Maximum	Guarantee point	Opera ng point[1]	opera ng point[2]
Power [KW] at fan shaft [to be filled by BHEL]				
Fan Speed [rpm]				
Power [KW] at coupling input shaft [to be filled by vendor]. This shall include power consump on by working external pumps, if any.				

Guarantee point power will be considered for loading **[as per B3]**

12.0	General assembly of fan – motor (For DBSE, sha end details & heat exchanger loca on)	:	Refer a ached drawings **0-00-xxx-xxxxx(Refer indent)** **1-00-xxx-xxxxx(Refer indent)**
13.0	Maximum permissible pressure drop across filter temperature	:	0.5 bar
	rise across heat exchanger	:	4° C

ANNEXURE – 2

TECHNICAL SPECIFICATION FOR LT MOTORS [AC]

TFN: LTM – REV 06

(Specification : 07 pages & data sheet : 5 pages)

Note: Vendor to submit filled up data sheets with offer

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

TITLE SPECIFICATION FOR LT MOTORS(AC)

TFN: LTM **PAGE: 01 OF 07**

EFFECTIVED DATE: 03/11/2012

08		
07		
06	03.11.2012	At Point no.05 Note added for export contract Requirement
05	24.04.2003	SL.44,55 in datasheet, CI 32,37 in Specn. Amended
04	13.03.2002	SL.53 54 & 56 added in datasheet
03	27.01.2000	SL.24,43, added in Specn. and sl. 28 added in datasheet
02	10.03.1997	SL.27 and 51 amended in datasheet
01	15.10.1996	SL.23(h) corrected
00	15/10/1996	PREPARED BASED ON TFN332 & TCI 140 REV. 4 FRESH ISSUE
REV NO.	DATE	RECORD OF REVISION

Rev. No.& Date	Prepared by	Checked by	Approved by
06 of 03/11/2012	**P.MOHAN**	**K.S.S.MANIAN & P NATARAJAN**	**S.RANGARAJAN**

D.Saraswathi	**P.Natarajan**	**Prasanta Saha**	**R.M.CHHIPA**	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 16/67

NOTE TO VENDORS: FILL UP THE VENDOR'S "CONFIRMATION COLUMN", TAKE XEROX AND SEND COPIES WITH THE OFFER.

SL.NO.	Requirements	Vendor's confirmation YES / NO
01.	Motor suitable to operate to 1000 meter Al tude.	:
02.	Motor suitable for Ambient temperature 50 Deg C and R.H 100%.	:
03.	Motor suitable to operate in dusty, humid, Salty and highly corrosive atmosphere	:
04.	Motor confirms to IS325, IS 4691 or equivalent Interna onal standards.	:
05.	Motor suitable for 415V +/- 10% 3 Ph. 50 Hz +/-5%, 3 Wire(ungrounded) supply and combined Varia on In voltage & frequency of 10%(abt. Sum).	:

NOTE : REFER ENQUIRY/SCHEME DRG.FOR MOTOR VOLTAGE REQUIREMENT FOR EXPORT CONTRACT

06.	Con nuous duty (S I)	:
07.	Method of star ng to be D.O.L	:
08.	IP 55 protec on as per IS 4691	:
09.	a). Totally enclosed fan cooled type b). Horizontal foot mounted type	:
10.	Motor insulation class "F" with temperature Rise Limited to class "B" limit	:
11.	Star ng current limited to SIX mes full load Current excluding tolerance as per IS 325	:
12.	Motor suitable for star ng at 80% of rated Voltage RV(including allowed varia on in voltage)	:

NOTE TO VENDORS: FILL UP THE VENDOR'S "CONFIRMATION COLUMN", TAKE XEROX AND SEND COPIES WITH THE OFFER.

SL.NO.	Requirements	Vendor's confirmation YES/NO
13.	Motor suitable to run sa sfactorily at a) 75% RV 5 minutes : b) 70% RV for 1 Sec. : (Including allowed varia on in voltage)	
14.	Cooling fans suitable for both direc on of rota on. : Material to be Cast Iron or Aluminum or Mild Steel. Cooling air flow from NDE to DE. Specified DOR to be Marked by an arrow block on NDE.	
15.	a)Motor shall withstand 120% of rated speed without any mechanical damage for a period of two minutes. : b)Provision to measure motor speed in NDE.	
16.	High speed bus transfer withstand capability shall be 150% of RV. :	
17.	Dynamic balancing for rotor as per ISO:1940 quality Grade 2.5 for>950 RPM and for<650 RPM quality Grade 6.3. :	
18.	Motor winding insula on shall be given tropical and Fungicidal treatment & suitable to operate in hot, Humid & tropical climate. :	
19.	Motor temperature rise shall not exceed 60 deg C by Thermometer & 70 deg C by resistance method Over an ambient temperature of 50 deg C. :	
20.	Maximum torque shall not be below 205% of FLT :	
21.	Motor suitable at RV for : a) Two successive starts from cold condi on at Rated load opera on temperature. b) Three equally spread starts per hour c) One hot restart from hot condi on	

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SL.NO.	Requirements	Vendor's confirmation YES / NO

22. Locked rotor withstand me at 110% RV under hot Condi on shall be at least 3 sec. more than the star ng Time(at 80% RV)for motors with star ng me at 80%RV Of 20 sec. and below. If this value is above 20 sec. the Above difference to be 5 sec. If this value is not met, Speed switch to be provided with all accessories. :

23. Motor terminal box shall be
    a) Weather proof IP 55 as per IS 4691. :
    b) Double compression type, brass cable gland & Lugs to suit cable size to be told later. :
    c) Cable entry both top & bo om :
    d) Rota on in steps of 90 degrees :
    e) Terminals shall be stud type with plain/spring Washer & check nuts. :
    f) Suitable to withstand short circuit level of 50KA for 1 sec. :

24. Both the ends of each winding of motor shall be Brought out to TB shall be provided to gives DELTA Connec on. Each TB shall have sample room for Termina ng PVC insulated, Aluminum conductor. Armored cables and shall have removable cover With an oil resis ng water ght gasket. Each terminal/ Adapter box shall have a removable gland plate. :
25. Motor peak amplitude of vibra on within IS 12075 limits. :
26. Noise level to comply with IS 12065 & limited to 85dB A at 1 meter horizontal distances. :
27. Motor bearings & lubrica on shall be
    a) Greased ball or roller type and effectively scaled against Ingress of dust. :
    b) Loss of grease to be minimum

NOTE TO VENDORS: FILL UP THE VENDOR'S "CONFIRMATION COLUMN", TAKE XEROX AND SEND COPIES WITH THE OFFER.

SL.NO.	Requirements	Vendor's confirmation YES / NO

c) Seepage of grease inside rotor along the sha : to be avoided.
d) Online greasing with grease relief arrangement : for motors>22Kw. Dimension Drg. To show this
e) Minimum bearing life to be 40,000 hours, :

28. Two Earth bolts are provided one on either side : of the motor and another Earth bolt inside the TB to suit following conductor size.
a) Motors up to 1 kw-8 SWG wire :
b) 1kw to 30kw-25 x 3 mm GI flat :
c) 30 kw to 60 kw-25 x 6 mm GI flat :
d) 60kw & above-30 x 6 mm GI flat :

29. Eye bolts or lugs are provided for safe li ing :
30. Key slo ed bare sha extension with key at DE to be : provided.
31. Possibility to drill holes ver cally through motor feet : for dowel pin installa on a er erec on.

32. 6 Nos.PTC Thermistors in stator winding for motors : above 37 kw. These terminals shall be brought out to separate T.B.

33. Motor name plate provided as per IS 325 with the : following addi onal informa on.
a) Type of bearing & recommended lubricant :
b) Allowable Temperature rise at 50 deg C ambient

34. Motor winding suitable for 24V, 1Ph. AC hea ng to : avoid condensa on when the motor is idle.

NOTE TO VENDORS: FILL UP THE VENDOR'S "CONFIRMATION COLUMN", TAKE XEROX AND SEND COPIES WITH THE OFFER.

SL.NO.	Requirements	Vendor's confirmation YES/NO
35.	Motor above 30 KW to have space heaters suitable For 240V, AC, 1Ph, AC hea ng to avoid condensa on when the motor is idle.	:
36.	One No. drain hole with plug to be provided at the b om most point of the motor.	:
37.	FINAL Dimensional drawing of the motor enclosed along with the offer	:
38.	Filled up data sheets of the motor enclosed along with the offer as per proforma enclosed.	:
39.	Vendor shall submit on receipt of P.O	
	A. Characteris c curves.	
	a) Speed Vs torque curve at RV	:
	b) Current Vs me curve	:
	c) Current Vs slip curve	:
	d) Thermal withstand characteris cs under Hot & Cold condi on	:
	e) Efficiency and P.F curve	:
	f) Thermistor characteris cs curve	:
	B. O & M manual (6SETS)	:
40.	Motor & Cooling fan painted with one coat of primer And 2 coats of Epoxy based paint-50 microns thickness (Minimum)	:
41.	Vendor to submit along with the offer T-S curves of the Motor superimposed with the fan T-S curve & show That the offered motor is suitable to start & Accelerate the load to rated RPM at	:
	a) DOL start at 100% RV	:
	b) DOL start at 80% RV	:
	c) Star Delta start at 100% RV *	:
	d) Star Delta start at 80% RV *	:
	For Star – Delta start motors only	
42.	Inspec on as per our standard PR: QA: 501 (latest)	:

NOTE TO VENDORS: FILL UP THE VENDOR'S "CONFIRMATION COLUMN", TAKE XEROX AND SEND COPIES WITH THE OFFER.

SL.NO.	Requirements	Vendor's confirmation YES / NO

43. Vendor to submit characteris cs of Thermistors for : Selec on of Thermistors protec on relay

44. Motor to confirm to fan load curve enclosed :

45. Vendor shall submit calcula on sheets, duly ;indica ng the formula used and values subs tuted for star ng me and thermal withstand me in support of values furnished in datasheet. This calcula on sheet shall be submi ed with the datasheet and specification confirmation along with the offer.

ENCLOSED - YES/NO

46. TWO SETS OF MOTOR O & M manual shall be submi ed along with data sheets a er PO placement. Vendor to note that data sheets will be approved only on receipt of O & M manuals. 4 sets of O & M manuals shall be sent along with motor during dispatch.

VENDOR'S SIGNATURE & SEAL

Date:

Enquiry no.

ABBREVIATION

R.V. = Rated Voltage
DE = Drive End
NDE = Non Drive End
DOR = Direc on of Rota on
T.B. = Terminal Box
P.F = Power factor
DOL = Direct on line

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

DATA SHEET
LT MOTORS(AC)

P.O. No. PROJECT
ENQUIRY NO.
REF.SPECN :: TFN LTM REV05

DATA SHEET FOR TFN:LTM REV: 06 SHEET: 01 OF 05

1. Applica on	:	
2. Type	:	
3. Frame size	:	
4. Manufacturer	:	
5. Rated output in KW	:	
6. Duty cycle	:	Con nuous, SI
7. Rated Voltage, no. of phases and frequency	:	415V, 3 PH, 50Hz
8. Allowed voltage varia on	:	±10%
9. Allowed frequency varia on	:	±5%
10. Combined Voltage and frequency varia on	:	10%(Absolute sum)
11. At rated voltage and frequency	:	
a) Full load current (Amps)	:	
b) Rated speed (RPM)	:	
c) Full load efficiency	:	
d) Full load power factor	:	
e) Star ng current in % of FLC(excluding tolerance)	:	
f) Star ng torque in % of FLT	:	
12. Method of star ng	:	Direct on line
13. Degree of protec on	:	IP 55
14. Method of ven la on	:	TEFC
15. Class of insula on	:	"F"
16. Stator winding connec on(for con nuous run)	:	DELTA/STAR

D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 23/67

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

P.O. No. PROJECT

ENQUIRY NO.

REF.SPECN :: TFN LTM REV05

DATA SHEET FOR TFN:LTM REV: 06 SHEET: 02 OF 05

17. Full load torque(Rated) :
18. Breakdown torque in % of FLT :
19. Pull up torque in % of FLT :
20. Locked rotor current(excluding IS tolerance) : AMPS
21. No load star ng me
    a) At rated voltage : SEC
    b) At 80% rated voltage : SEC
    c) At 110% rated voltage : SEC

22. Motor efficiency and P.F.
    a) At 100% full load :
    b) At 50% full load :
    c) At 25% full load :
    d) At No load :

23. Locked rotor withstands me under hot/cold condi on : HOT COLD

    a) At 80% voltage : Sec Sec
    b) At 100% voltage : Sec Sec
    5c) At 110% voltage : Sec Sec

24. Stator thermal me constant : MINUTES

25. Maximum permissible star ng me of motor : Sec

26. No load current (INDICATIVSE) : Amps

27. Star ng me in Seconds with driven : DOL STAR - DELTA

Equipment coupled *** : HOT/COLD MEDIUM HOT/COLD MEDIUM

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HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

P.O. No. PROJECT
ENQUIRY NO.
REF.SPECN :: TFN LTM REV:06

DATA SHEET FOR TFN:LTM REV: 06 SHEET: 03 OF 05

a) At rated voltage :
b) At 80% voltage :
c) At 110% voltage :

28. STAR TO DELTA change over me at rated :
Voltage (for STAR DELTA star ng)

29. Actual temperature rise over an ambient of 50 :
deg C when motor is delivering rated output
a) By thermometer method : deg C.
b) By resistance method : deg C.

30. Number of successive starts with driven :
Equipment. Coupled and motor ini ally at
Rated load temperature.

31. Minimum voltage required y the motor to :
Bring the driven equipment to rated speed.

32. Permissible running me with full load at :
Minimum allowable voltage i.e. 70% RV.

33. Resistance per phase in ohms at 20 deg. C : ohms
(INDICATIVE)

HOT/COLD STARTING TIME VALUES ARE APPLICABLE ONLY INCASES WHERE THE MEDIUM HANDLED IS HOT AIR AND THE HOT AIR FAN MAY HAVE TO BE STARTED WITH COLD AIR AS MEDIUM AT TIMES OR DURING COMMISSIONING.

34. Space heater: Qty : No.
Capacity : Wa s
Voltage : Volts, AC/DC

35. Direc on of rota on viewed from driving end : CW/An CW/Bi-direc onal

36. Make, type and size of bearing(SKF/FAG ONLY) :
a) At drives end :
b) At Non drive end :

D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 25/67

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

P.O. No. PROJECT
ENQUIRY NO.
REF.SPECN :: TFN LTM REV 06

DATA SHEET FOR TFN:LTM REV: 06 SHEET: 04 OF 05

37. An cipated bearing life in hours(minimum) : Hours

38. Lubricant quan ty, grads and recommended : interval of lubrica on.

39. Type of moun ng and sha orienta on :

40. Method of connec on to driven equipment : (Refer fan load curve)

41. Loca on of terminal box viewed from Motor : Drive end and Angle of rota on.

42. Limi ng rotor temperature for determining : deg. C Safe stall me.

43. Type and number of terminals brought out :

44. Type and size of cable gland(Double : Compression, Brass).
- a) Stator T.B :
- b) Space heater T.B :
- c) Thermistor TB :

45. Cable entry (Top/Bo om) :
46. Insula on material :
47. Tropical & fungicidal treatment :
48. GD^2 of the motor : Kg.M

49. Weight of the motor : Kgs

50. Weight of the motor : Kgs

D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 26/67

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

P.O. No. PROJECT

ENQUIRY NO.

REF.SPECN :: TFN LTM REV06

DATA SHEET FOR TFN:LTM REV: 06 SHEET: 05 OF 05

51. Weight of the rotor : Kgs

52. Fan curve referred :

53. Motor Dynamic load Kilo Newton's
    a) UP ward :
    b) Downward :

54. Motor Static load Kilo Newton's
    a) UP ward :
    b) Downward :

55. Motor bearings RTD's(DE & NDE) set value : ALARM C
    (IF APPLICABLE) TRIP C

56. Applicable only for motors with VSD star ng
    Equivalent circuit parameters : OHMS/PHASE

    a) RS = Stator resistance :
    b) XLS= Stator leakage reactance :
    c) XM= Magne zing reactance :
    d) RR'= Rotor resistance referred to stator :
    e) XLR'= Rotor resistance referred to stator :
    (The above are required to decide the VSD parameters by VSD supplier).

REF SPECN: 1. TFN LTM REV 06

VENDOR'S SIGNATURE
WITH SEAL & DATE

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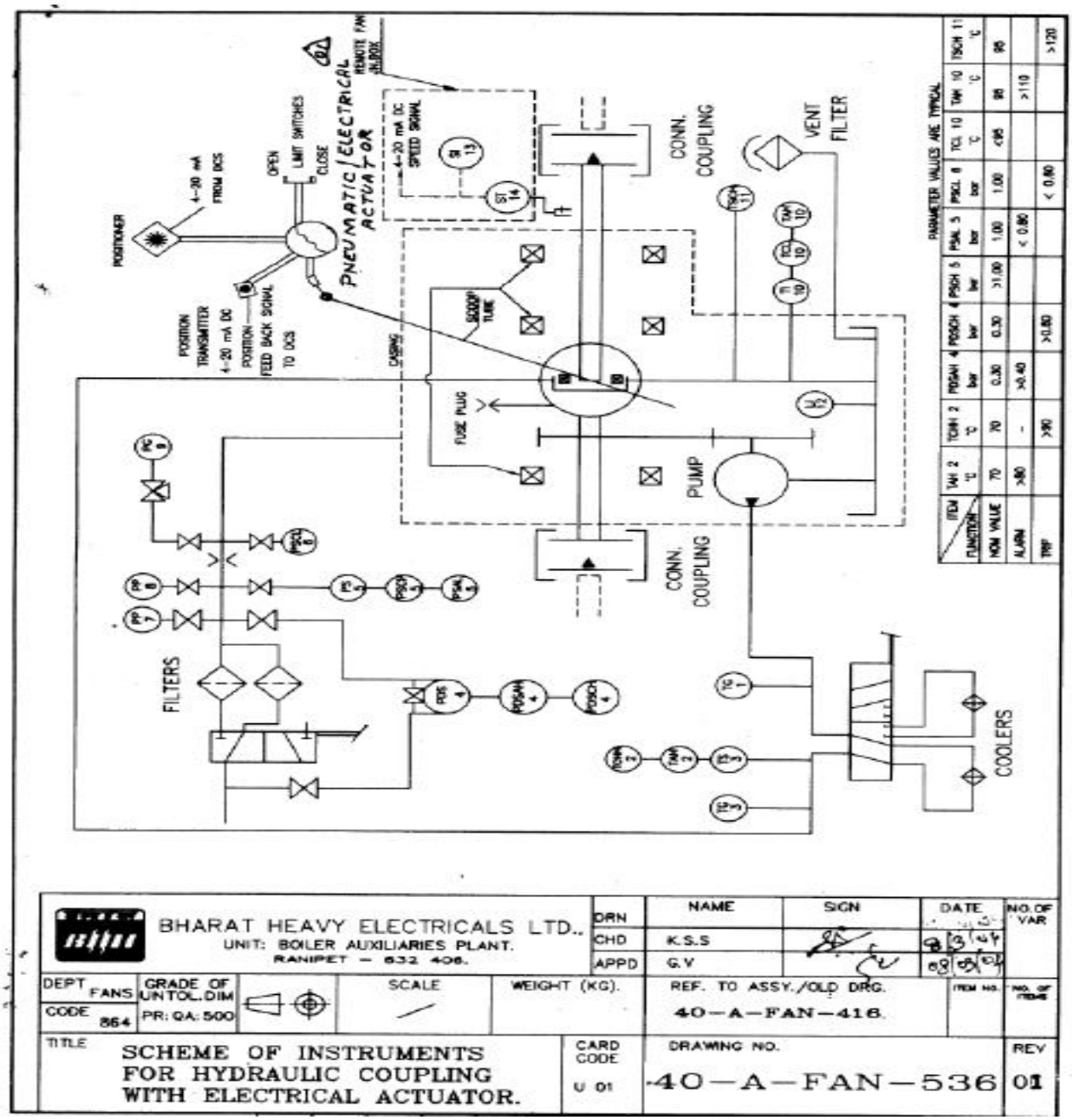
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 27/67

ANNEXURE – 3

TYPICAL P & I DIAGRAM FOR HYDRAULIC COUPLING

DRG. NO. 40-A-FAN-536 (2 pages)

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02



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PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 29/67

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

LIST OF INSTRUMNETS FOR HYDRAULIC COUPLING WITH ELECTRICAL ACTULATOR

SL.NO	TAG DETAILS	DESCRIPTION
1.	TG - 1	THERMOMETER AT PUMP OUTLET.
2.	TS 2 TAH – 2 TCHH – 2	TEMPERATURE SWITCH WITH 2 SET POINTS AT COOLER OUTLET. (1XSPDT CINTACT FOR EACH SET POINT).
3.	TG – 3	THERMOMETER AT COOLER OUTLET.
4.	PDS – 4 PDSAH 4 PDSCH – 4	DIFFERENTIAL PRESSURE SWITCH WITH 2 SET POINT ACROSS FILLET.(1XSPDT CONTACT FOR EACH SET POINT).
5.	PS 5 PSAL - 5 PSCH – 5	PRESSURE SWITCH WITH 2 SET POINTS IN THE LUBE OIL LINE (1XSPDT CONTACT FOR EACH SET POINT).
6.	PSCL – 6	PRESSURE SWITCH WITH ONE SET POINTS IN THE LUBE OIL LINE (1XSPDT CONTACT)
7.	PP 7 PP – 8	PRESSURE TEST POCKETS IN LUBE OIL LINE.
8.	PG – 9	PRESSURE GAUGE IN LUB OIL LINE.
9.	TI – 10 TCL-10 TAH-10	TEMPERATURE INDICATOR WITH 2 SET POINTS AT SCOOP LUBE OUTLET (1XSPDT CONTACT FOR EACH SET POINT).
10.	TSCH – 11	TEMPERATURE SWITCH WITH ONE SET POINT AT SCOOP TUBE OUTLET (1XSPDT CONTACT)
11.	LI – 12	LEVEL INDICATOR ON TANK.
12.	SI – 13	SPEED INDICATOR
13.	ST – 14	SPEED TRANSMITTER

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: BOILER AUXILIARIES PLANT.
RANIPET – 632 406.

	NAME	SIGN	DATE	NO. OF VAR
DRN				
CHD	K.S.S		8/3/04	
APPD	G.V		08/03/04	

DEPT	GRADE OF UNTOL. DIM		SCALE	WEIGHT (KG).	REF. TO ASSY./OLD DRG.	ITEM NO.	NO. OF ITEMS
FANS					40-A-FAN-416.		
CODE 864	PR: QA: 500						

TITLE	CARD CODE	DRAWING NO.	REV
SCHEME OF INSTRUMENTS FOR HYDRAULIC COUPLING WITH ELECTRICAL ACTUATOR.	U 01	40-A-FAN-536	01

D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 30/67

ANNEXURE – 4

SPECIFICATION FOR PNEUMATIC / ELECTRIC ACTUATOR

PNEUMATIC ACTUATOR + IP CONVERTOR----------05 PAGES + 03 PAGES

ELECTRIC ACTUATOR + DATA SHEETS ----------18 PAGES

Note: Vendor to submit applicable filled up data sheet with offer.

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

Bharat Heavy Electricals Limited

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPPALLI 620 014

TECHNICAL DELIVERY CONDITIONS
FOR SUB – DELIVERY COMPONENTS OF
CONTROLS AND INSTRUMENTATION

POWER CYLINDERS – REGULATING TYPE

Rev. No.	DATE	DESCRIPTIPN	PREPARED	REVIEWED	APPROVED ENGG	APPROVED QAC
01,	------	General Revisions	sd/-	sd/-	sd	sd/-
02	09.07.93	Page Number added & QP included	sd/-	sd/-	sd/-	
03	16.06.97		sd/-	sd/-	sd/-	
04	17.02.99	General Revision			sd/-	sd/-
05		Spec. Revised as part of special improvement projects				

D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 32/67

CL.NO	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note:2)
1.0	SITE CONDITIONS		
1.1	Al tude above man seal level	550 m	
1.2	Ambient temperature condi on	50° C	
1.3	Rela ve humidity	100%	
1.4	Atmosphere	Tropical, Dusty, salty, corrosive and highly polluted.	
2.0	POWER CYLINDER		
2.1	Applica on	For regula on of vanes / dampers	
2.2	Air supply		
2.2.1	Power air	Minimum 3 kg/sq.cm (g); Maximum 7 kg/sq.cm(g) (cylinder to be sized for minimum air pressure)0.2	
2.2.2	Signal air	1.0 Kg/sq.cm (g)	
2.3	Power cylinder type	Double ac ng piston, modula ng type	
2.4	Duty cycle	Con nuous	
2.5	Loca on	Outdoor	
2.6	Moun ng	Foot mounted, weather proof confirming to IP 55 with output lever having an angular movement. Required quan ty of cadmium coated founda on bolts & fasteners shall also be supplied (Refer to Note 3)	
2.7	Air connec on	1/4'' NPT or 3/8" NPT (with suitable adopter for accepting ¼" OD copper tubing)	
2.8	Min. opera on me for open-close or close-open.	Refer to Power Cylinder Data Sheet	
2.9	Air filter regulator with output gauge	Required. Calibra on shall be 1 – 10 Kg / sq.cm(g)	
2.10	Lubricator	Required, if applicable	
2.11	Ac on of power cylinder on Power Air Supply failure.	Stay put	
2.12	Type stay put device	Self reset	
2.13	Posi on indicator	1.No. local mechanical posi on indicator required	
2.14	Movement of piston	Piston moves outward & opens the vane/Damper on increase of signal.	

CL.NO	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note:2)
2.15	Provision for reversal of ac on	Required	
3.0	MATERIAL		
3.1	Piston rod	Head chrome plated high strength steel	
3.2	Cylinder barrel	Honed and hard chrome plated	
3.3	Piston & cylinder seals	Viton	
4.0	ACCESSORIES		
4.1	LIMIT SWITCHES		
4.1.1	Quan ty	One for open and one for close	
4.1.2	Number of contacts	2 NO + 2 NC	
4.1.3	Type	Snap ac on	
4.1.4	Contact Ra ng	5A at 240 V AC / 0.5A at 220 V DC	
4.1.5	Reset	Self reset	
4.2	POSITIONER		
4.2.1	Posi oner by pass for local	Required (with power air)	
4.2.2	manual opera on Moun ng	Integrity mounted suitable for both direct and reverse loading. Changing over from direct to reverse loading shall not pose any problem. Details for the same are to be furnished by the vendor. Each posi oner shall be provided with 3 pressure gauges. One for Control Air and one each on either side of cylinder for power air supply suitably mounted. Posi oner shall be suitable for working air pressure of 7 kg/sq.cm(g) (maximum)	
4.2.3	Cam characteris cs	One linear cam to be fitted. 1 No. equal percentage, 1.No. square root and one blank cam to be supplied extra along with posi oner in a separate pack. (Refer to Note – 3)	

CL.NO	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note:2)
4.3	Air Fi er cum Regulator		
4.3.1	Supply air pressure	7 Kg/sq.cm(g)	
4.3.2	Type	Diaphragm	
4.3.3	Pressure ra ng	15 kg / sq.cm(g)	
4.3.4	Material		
	a. Body	Die-cast aluminum	
	b. Inner valve and sea ng	Stainless steel	
	c. Spring	Stainless steel	
4.3.5	Output pressure	0 7 kg/ /sq.cm(g)	
4.3.6	Filter quan ty	To suit power cylinder requirement (Minimum 25 microns)	
4.3.7	Output gauge		
	a. Dial	50 mm Diameter	
	b. Type	Bourdon	
	c. Material	Phosphor bronze (Bourdon)	
	d. Range	0 – 10 kg / sq.cm (g)	
	e. Accuracy	(+ or -)5%	
4.3.8	Air connec on inlet	¼" NPT with suitable adopter to receive ¼" OD copper tube	
4.3.9	Air connec on outlet		
4.3.10	Type Of moun ng	To suit power cylinder requirement To be mounted on the power cylinder.	
4.4	Posi on Transmi er		
	a. Type	Electronic, Non-contact type, one number, 2 wire 4 – 20mA DC output	
	b. Output		
	c. Power supply	24 V DC	
	d. Enclosure	Die-cast aluminum, weatherproof	
	e. Linearity	±1% of span or be er.	
4.5	Hand Wheel / Lever	To be provided along with power cylinder.	
4.6	Pain ng	Corrosion resistant, Epoxy based resin.	

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

CL.NO	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note:2)
5.0	CHARACTERISTICS (Power Cylinder with posi oner)		
5.1	Sensi vity	(+ or -) 0.5 % of input span under no load.	
5.2	Repeatability	(+ or-)3% of output span under no load.	
5.3	Accuracy	(+ or -) 35 of output span under no load.	
5.4	Hysterisis	(+ or -) 1% of output span under no load.	
5.5	Dead band	(+ or -) 1.8% of input span under no load.	
6.0	INSPECTION & TESTING	As per quality plan CI: QAC:STD:QP:42	
7.0	DOCUMENTS	1. Dimensional Drawing of assembled power cylinder.	
7.1	Along with Technical offer:	2. Air consump on of PC in scfm. 3. Weight of power cylinder in kg. with all accessories mounted. 4. Offer for I Commissioning spares ii Maintenance spares for two years opera on 5. Torque at various Pressures. 6. Material of construc on of each part. 7. Data sheet	
7.2	A er placement of order:	1. Instruc on manual(25 sets) 2. Test certificates 3. Method of calibra on recommended by vendor.	
8.0	PACKING	As per Packing procedure no.CI: QAC : PR :03	

NOTE:

1. Refer current valid list for revision status of quality plan, Drawing No & Packing Procedure.
2. In Vendor Compliance column – vendor to indicate 'YES' 'NO' or 'NOT APPLICABLE'
3. Foundation bolts, fasteners & positioner cams shall be identified separately in shipping list / delivery chalan

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

CONTROLS & INSTRRUMENTATION / PE (BOILERS)

TECHNICAL DELIVERY DONDITION FOR SUB-DELIVERY COMPONENTS

SPECIFICATION FOR I/P CONVERTER.

1.0 SITE CONDITION.

1.1	Al tude above mean sea level	:	550 M.
1.2	Design ambient opera ng temperature	:	-20°C to +70°C
1.3	Rela ve Humidity	:	100% condensa on Permissible.
1.4	Design ambient Transport Temperature	:	-40° C... +80°C
1.5	Atmosphere dusty and corrosive.	:	Heavily polluted,

2.0 INPUT

2.1	Input current	:	4-20mA DC.
2.2	Input resistance	:	Less than 250 ohms.

3.0 Output

3.1	Output Resistance	:	3 – 15 psi
3.2	Output air capacity	:	4.5 scfm at 1.4 KG/CM^2 supply pressure.
3.3	Air consump on	:	0.2 scfm at 1.4 kg/cm^2 supply pressure.

4.0 CHARACTERISTICS

4.1	Ac on	:	Air to close, Air to open Field reversible.

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

4.2	Zero adjustability	:	150% of output span.
4.3	Repeatability	:	0.2% of span
4.4	Response me	:	5 seconds
4.5	Ambient Temperature	:	1 % of span from -20° to +60°
4.6	Calibra on accuracy	:	± 0.5% of span
4.7	Opera ng temperature	:	40° F – 180° F
4.8	Air Supply Pressure	:	1.2 – 1 .6 kg/cm^2(1.4 kg/SQ.cm typical)
4.9	Volume Booster	:	Required if output Capacity is less than 5 scfm.
4.10	Pneumatic Connections	:	1/4 " NPT " (F)
4.11	Electrical Connections	:	3/4 " NPT " (F)
4.12	Air filter Regulator	:	Required
5.0	MOUNTING	:	Pipe or well (out door)
6.0	HOUSING		
6.1	Housing Material	:	Die-cast Aluminum
6.2	Protec on Type	:	IP 65
7.0	ACCESSORIES	:	Moun ng Brackets if required
8.0	TEST REQUIREMENTS		
8.1	Rou ne Test	:	i) Calibra on test including accuracy. ii) Linearity iii) Hystersis

iv) Repeatability

v) H.V Test at 500v for one Minute.

vi) Ambient Temperature effect test.

8.2 Type test : i) Enclosure protec on Test.

ii) Vibra on Test as per IS2840

iii) Thermal Stability test ISA:RP 8.L

iv) Transporta on Test.

v) Contact Ra ng Test.

9.0 INSPECTION : The vendor shall submit Q.P and the materials are subject to BHEL/customer inspec on. A Minimum 15 days me shall be given.

10.0 Documents to be supplied along with instrument : i) Test Certificate in Triplicate

ii) O & M Manual in English.

iii) Complete circuit Diagram

11.0 PACKING : i) To be packed in polythene cover along with moisture absorber.

ii) Wrapped with sponge material.

iii) Individually packed in a plywood box

iv) The packing shall take care of transport vibra on & storage condi ons

SPECIFICATION FOR ELECTRIC ACTUATORS

WITH INTEGRAL STARTERS

(REGULATING/INCHING TYPE)

REV. NO.	DATE	DESCRIPTION	PREPARED	REVIEWED	APPROVED
00	03.12.09	INITIAL RELEASE	P.Muthukumar	S.Rangarajan	S.Rangarajan

The vendor shall furnish clearly along with quota on details for each of the items listed out in the specification without ambiguity. Vendor shall comply customer specific requirements if any.

GENERAL

G.1 ENCLOSURE

G.1.1 Actuator (basic Actuator + SY. Gear box) as a whole shall be of a totally enclosed weather proof and dust proof construc on with IP 65 enclosure and shall be suitable for outdoor applica ons.

G.1.2 Actuator shall be suitable for opera on in damp, dusty polluted atmospheres of 100% rela ve humidity and ambient temperatures Varying from -20 ° To +50° C.

G.2 VOLTAGE

G2.1 The unit shall be suitable for opera on on 415V 3 phase, 3 wire, 50 HZ. A.C. supply.

G2.2 Actuator + SY.Gear box can operate at specified run torque for the following conditions.

A. voltage Varia on of ± 10%
B. frequency varia on of ± 5% and
C. a combine varia on of volt + frequency ± 10% absolute.

G2.3 Actuator + SY.Gear box can start at 80% rated volts and run at 75% volt for 5 min under loaded condi on

G.3 CONSTRUCTION

G.3.1 Damper actuators shall be regula ng/inching duty, Foot moun ng (lever operated) type/Flange moun ng.

G.3.2 The exact mounting arrangement with dimensions shall be clearly furnished along with the offer. In case of foot moun ng, the connec ng lever shall also be supplied along with the actuator. For lever details refer Drg.No.3-00-114-34386.

G.3.3 Each actuator shall have a hand wheel fitted on it for emergency operation. The hand wheel shall be designed such that it is declutched automa cally when the power supply to the motor is restored. The hand wheel engaging lever shall give trouble – free performance under repeated opera ons.

G.3.4 Every actuator, especially SY.Gear box shall be self-locking worm Gears.

G.3.5 Actuator + X.Y Gearbox shall met all the conditions mentioned in "Actuator Data Sheet"

G.3.6 Necessary number of fasteners (or) moun ng bolts nuts shall be furnished with every actuator. Mounting & overall arrangement drawing shall be submitted ith the offer. Output shall have removable spline bush.

G.3.7 Every Actuator shall be supplied with 3 Nos. of PG 29 and one No. of PG 21 cable glands.

G.3.8 Conforming to the mounting/coupling details as per detailed out in "Actuator data sheet".

G.3.9 Actuator + S.Y Gear box shall be properly coupled and shall be dispatched as a single unit.

G.3.10 Secondary Gear Box con nuous capacity shall be greater than or equal to star ng torque of Actuator.

G.3.11 Counter clockwise rota on looking actuator – driving end shall result in close. Also refer "Actuator data sheet"

G.3.12 Actuator+SY. Gearbox capable of meeting total turns indicated in "Actuator data sheet" and limit switches set accordingly.

G.3.13 The opera ng me of actuator me of actuator shall be as per enquiry/data sheet from open to close or vice versa

G.4 **TORQUE**

G.4.1 The actuator shell be capable of giving the star ng torque at the output sha . (Required torques are given in the data sheet).

G.4.2 Indicate the adjustable range of torque and star ng torque of actuator in kgm for each actuator offered. The maximum thrust capability of the actuators shall also be furnished. The actuators shall be designed to take the full thrust.

G.4.3 Actuator will specified continuous run torque at the duty specified in CI.NO.M.4.1

G.5 **REVOLUTIONS**

G.5.1 Each actuator shall be capable of giving total opera ng turns as indicated in the enquiry/data sheet if Applicable. Please furnish actual number of turns available for each actuator offered.

G.6.0 **SPEED**

G.6.1 Desired output sha speeds are enclosed in enquiry/data sheet for various cases. Actual speeds of actuators offered shall be clearly indicated.

G.7 **WEIGHT**

G.7.1 Furnish weight of actuators including all accessories.

G.8 **NAME PLATE DETAILS:**

G.8.1 Actuator name plate shall have the minimum of following:

A. Standard Motor details
B. Current proportional to continuous run torque specified.
C. Tag. No. as specified by BHEL.
D. Direc on of rota on for closing of load (Damper/Vane).
E. Secondary Gear Box type.
F. Torque capaci es of whole actuator.

G.9 **LUBRICANT**

G.9.1 The gear box of the actuator shall preferably be oil filled. The actuator shall have proper seals to prevent leakage of oil into the limit switch compartments, terminal box and motor. Actuator shall be designed for mounting in any position without lubricant leakage or other operational difficulty.

G.10 **DIMENSIONAL CATALOGUES**

G.10.1 Three copies of catalogues of the actuators in English language describing the construc onal details shall be sent along with the offer. The catalogues shall also provide over all dimension of the actuators, minimum spindle acceptance diameter and other details called for in the specification. Description of the code numbers represen ng various actuators shall be submi ed.

G.11 **O & M INSTRUCTION MANUAL**

G.11.1 Fi een (15) copy of opera ng and maintenance instruc on manual shall accompany for each project.

ACCESSORIES.

A.1 **TORQUE SWITCHES**

A.1.1 Two numbers adjustable, self latching type torque switches (one for open and one for close), each with 2 NO and 2NC poten al free contacts.

A.1.2 It is required to have calibra on for the torque switches so that the switches could be easily set to any value desired, with in the range specified for each actuator.

A.1.3 Gear train shall be made of metal (Fibre gears are not acceptable).

A.1.4 Name plate for torque switch calibra on shall be provided with torque value in KGM.

A.2 **LIMIT SWITCHES**

A.2.1 Two numbers of self latching type posi on limit switches (one for open and one for close) each with 2 NO & 2 NC poten al free contacts.

A.2.2 Two auxiliary limit switches (one for open and one for close) each with 2 NO and 2NC poten al free contacts.

A.2.3 The limit switches shall be independently adjustable type.

A.2.4 Gear train shall be made of metal (Fibre gears are not acceptable).

A.3 **MICRO SWITCHES**

A.3.1 Limit switches & torque switches shall be enclosed in weather proof compartment to suit for damp atmospheres and shall not cause any trouble during commissioning and opera on.

A.3.2 Limit switch compartment weather-proof and spacious enough for easy se ng.

A.3.3 The switches shall be suitable for 5A at 240V AC; 0.5A(Induc ve) at 220V DC.

A.4 **LOCAL POSITION INDICATORS**.

A.4.1 Each actuator shall have a local posi on indicator to indicate 0 to 100% adjustable with in 360° rota on

A.4.2 Posi on indicator provided with adjustable Gear sets & Charts.

A.5 **ELECTROMAGNETIC BRAKES**

A.5.1 In case electromagne c brakes are provided in the actuator the same shall have IP 65 weather-proof enclosures.

A.6 **SPACE HEATER**

A.6.1 Heat actuator space-heater in the limit switch component suitable for 240V AC,50 Hz single phase supply.

A.7 **REMOTE POSITION TRANSMITTER**

A.7.1 Each regula ng type actuator and inching duty (manual regula ng type)**actuator shall be provided with 2 wire, 4-20mA DC, electronic posi on transmi er.** This shall be capable of driving minimum 500 ohms control circuits of the purchaser. Type of the posi on transmi er shall be either induc ve (non contac-LVDT) type of poten o metric (contact) type. The type shall be referred in enquiry. Vendor shall supply the item as per the specification against each project and specific clarification by the vendor to this effect to be given in the offer itself.

A.8 **ACTUATOR DATA**

A.8.1 Actuator data sheets for each type of actuators offered, shell be furnished along with offer (Refer sheet 14/17 to 17/17)

A.9 **WEIGHT**

A.9.1 Weight of the actuator shall be furnished with the offer.

MOTORS

M.1 **POWER SUPPLY**

M.1.1 Motor shall be suitable for opera on on a 415V, 3Phase 3Wire ungrounded supply system.

M.1.2 Motor shall operate without any trouble under the following condi ons.

a. If the voltage varies within ±10% of the rated value of 415V.

b. If the frequency of the power source varies within ±5% of 50 C/S.

c. If the voltage and frequency of the source vary simultaneously and the sum of the absolute percentage values in varia on does not exceed 10%.

M.1.3 Motor winding connec on brought to common terminals.

M.2 **CONSTRUTIONS**

M2.1 Motor shall be squirrel cage induc on type. The enclosure shall be totally enclosed, self ven lated with IP 65 Degree of protec on.

M.2.2 Motor shall be of totally enclosed (TEFC/TENV) construc on with IP 65 weather proof enclosure and shall be suitable for out-door installa on without canopy. Cooling fan, if provided shall be suitable for both direc on of rota on.

M.2.3 Motor shall be confirming to BS 2613-70, IS 325 or any other equivalent interna onal standard for all requirements unless otherwise specified herein.

M.2.4 Motor shall be painted with corrosion proof epoxy-resin paint.

M.2.5 Motor shall be provided with in – built thermostat & wired to limits switch compartment.

M.2.6 Motor shall have double shielded, grease lubricated -fric on bearings.

M.3 **INSULATION**

M.3.1 Motor shall have class F insula on with tropicalisa on suitable for polluted dusty and corrosion atmosphere of rela ve humidity 90 % with temperature rise limited to class-B insula on. Motor shall be designed ambient temperatures varying between -20 °C or +50° C

M.4 **RATING**

M.4.1 In the case of regula ng type actuator the motor shall be S4 duty with CDF of 60% and suitable for 1200 cycles/hour as per IS 12824. For inching type actuator the starts per hour shall be 150 minimum.

M.5 **STARTING**

M.5.1 Motor shall be suitable for direct on-line star ng.

M.5.2 Starting current shall be limited to 6 times the fill load current exclusive of tolerance.

M.5.3 Motor shall be capable of

1. Staring at 85% of rated voltage.
2. Running at 80% of rate voltage for a period of 5 minutes

M.6 **EARTHING TERMINALS**

M.6.1 2 Nos. Earthing terminal shall be provided on the body of the motor.

M.7 **TESTS**

M.7.1 Tests are to be conducted as per relevant Indian Standard and required copies of the test certificates are to be furnished for the tests.

M.7.2 All type tests, rou ne tests, acceptance tests, etc, shall be as per vendor quality plan approved by BHEL/Customer.

CONTROLS

C.1 INTERNAL WIRING

C.1.1 Internal wiring of the actuators, terminal marking and limit switch contact development shall be as per our drawing enclosed with the enquiry. Internal wiring shall be suitable for 650V, stranded copper wire, and the cables are of ISI make only.

C.1.2 Internal wiring diagram shall be neatly pasted on the cover of terminal box.

C.2 TERMINAL BOX

C.2.1 Actuator provided with common terminals and each terminal suitable for 2x2.5 sq.mm wire.

C.2.2 All terminals of posi on limit switches, torque limit switches, space heaters and posi ons transmi ers shall be brought to a common terminal board. The terminals shall be of screw-type with sufficient insulation between 2 adjacent terminals.

C.2.3 Terminal box of actuator shall be weather proof and have enough space for connec ng cable glands/ plug and sockets as indicated in internal wiring diagram (please refer enquiry). Insula on voltage for power terminal block & control terminal block is 650 V grade.

C.2.4 Terminal box of motor shall be weather-proof and have enough space for connec ng 1 number power cable which will be indicated before placement of order. Motor terminal shall be stud-type.

C.2.5 The terminal box shall be fitted with a removal front cover-plate.

C.2.6 Internal wiring shall be done with 1.5 sq.mm PVC insulated copper wires. Ferrules should be provided on the wires for easy identification.

C.2.7 Termina on shall be done with crimping type insulated annealed nned copper lugs.

C.2.8 For all outgoing cables, double compression type nickel plated, brass cable glands shall be provided. Annealed nned copper lugs shall also be provided for all outgoing cables.

C.3 ELECTRONIC POSITIONER

C.3.1 Each regula ng type actuator shall be provided with an Electronic Posi oner which can accept 4-20mA posi on command signal for damper actua on.

C.3.2 Electronic posi oner shall use 4-20mA posi on feedback signal, from the actuator for controller.

C.3.3 Electronic Pos oner shall provide 4-20mA signal feedback for customer.

C.3.4 Output (feedback) signals shall be galvanically isolated.

C.3.5 Electronic Posi oner shall be provided with necessary.

A. Contactors (or) solid state reversers (Thyristors switching devices).Please refer enquiry for exact requirement. Vendor shall supply the item as per the respective enquiry specification against each project and specific clarification by the vendor to this effect to be given in the offer itself.
B. Overload relay
C. Lock in last posi on.
D. Auto/manual 2 posi on selector switch.
E. Open-Stop-Close 3 posi on selector switch.

C.3.6 The electronic posi oner shall be mounted along with actuator, as an integral part.

C.3.7 The Electronic posi oner shall derive is power supply from 415V. 3Phase 50HZ supply.

C.3.8 The electronic Posi oner shall have following standard, adjustable control features.

a. **SPAN:**
To calibrate the posi on feedback signal to align the full travel of the actuator with full 0-100% range of posi on demand signal.

b. **ZERO:**
To calibrate posi on feedback signal to align the appropriate end of travel posi on of the actuator to correspond with input signal

c. **DEAD BAND:**
To determine the magnitude of error signal that must be developed before the actuator-motor begins to rotate. Dead-band range shall be adjustable between ±0.5% to ±1.0%.

d. **RATE(SPEED):**
To decide the speed at which set-point is reached.

e. **GAIN:**

Cause actuator to approach set point more slowly, to prevent overshoot on high speed units or short circuit break to achieve this.

C.3.9 If customer provides 24 V DC or 48 V DC it shall be suitable and giving output of 4 to 20mA.

C.3.10 Upon loss of command signal the actuator shall lock itself in the posi on called for by the last valid posi on demand signal. (ie) the actuator shall have STAYPUT characteris c.

C.3.11 Detailed wiring diagram for regulating type actuator shall be send along with the offer showing solid-state reverser Local/remote select the switch, open/close/stop PBs etc.

C.3.12 Provided with NEON/LED indica on to indicate forward (open) direc on or (close) reverse direc on trigged.

C.3.13 Shall have IP 67 protec on and thus suitable for outdoor moun ng of damp dusty polluted atmosphere of 100% rela ve humidity and ambient temperature range of -20°C to +50°C.

C.4.0 **AID TO CALIBRATION & TROUBLE SHOOTING**

As an aid to calibra on and trouble shoo ng, the solid-state reverser is to be equipped with two neon type indica ng lights to provide a visual indica on of which circuit(thus direc on of motor rota on) of the solid state has been triggered.

S.1 **SPARES**

S.1.1 Supplier may specify a list of recommended spares for 2/5 years of trouble free opera on.

P.1 **PAINT & FINISH**

P.1.1 All external Parts shall be finished and painted/Powder coated to produce a neat and durable surface which would prevent Corrosion & Rus ng. The equipment shall be thoroughly degreased, sharp edges/scales removed, treated with one coat of epoxy enamel paint shade as per the requirement for outdoor motor. Motor fans shall also painted to withstand Corrosion if provided. Paint shade will be confirmed during drg./data sheet approval. The thickness of paint shade shall be min. 100 microns.

P.1.2 All fasteners used in the construc on of the equipment shall be either of corrosion resistant material or heavy cadmium plated. Current carrying fasteners shall be either of stainless steel or high tensile brass or copper.

PUCHASE SPECIFICATION FOR ELECTRONIC INTEGERAL STARTER

1.0 **GENERAL**

Vendors shall furnish point wise confirmation /deviation to each clause of this specification explicitly.

2.0 **INTEGRAL STARTE FEATURES:**

2.1 The integral starter shall be provided in a weather proof enclosure with protec on class IP67/IP67.

2.2 The control logic of integral starter shall be through Electronic logic control. Hardwire control logic is not acceptable. The electronics should be capable of opera ng in a temperature range.

2.3 Control supply voltage of the starter shall be 24V DC or 110V AC. If 110V AC is used, then the same shall be derived with step down transformer of 415V/110V. Necessary primary and secondary fuses shall be provided Opto isola on circuit shall be provided with suitable coupling relays for 24V DC commands from external control system.

2.4 **INTEGRAL STARTER COMPONENTS:**

2.4.1 Electricity and mechanically interlocked contactors shall be provided for forward and reverse opera on. Contactor rating shall be sufficient to withstand the extreme conditions like valve jamming and instantaneous reversal of motor. In case of solid state reverser thyristor switching shall be used for forward and reverse operation. Vendor shall mention in the offer itself.

2.4.2 Key lockable Selector switch for LOCAL-OFF-REMOTE selec on shall be provided.

2.4.3 OPEN-STOP-CLOSE push bu ons (for local operation) shall be provided.

2.4.4 Thermal overload relay shall be provided in addi on to thermostats

2.4.5 Automa c phase correc on facility and single phasing preven on shall be available.

2.4.6 Interposing relays provided (with coil burden <=2.5VA, one for open and one for close) to ini ate opening and closing by 24V DC signal from the external control system.

2.4.7 Open/Close command termina on logic with posi on and torque limit switches shall be suitably built in the PCB inside the actuator.

2.4.8 Necessary fuses shall be provided.

2.4.9 For torque closing valves, open torque switch shall be bypassed ini ally for 3 sec or 5% of the valve travel.

2.4.10 Space heater for switch compartment shall be provided with internally derived power supply.

2.4.11 It should also be possible to reverse the direc on of travel for inching values (in LOCAL and REMOTE) without giving stop command.

2.4.12 Provision shall exit in electronic control for bypassing the torque switch during ini al 5% opening of dampers. Details for this must be indicated in the wiring diagram.

3.0 **INPUT COMMANDS:**

3.1 Open command (24V DC)

3.2 Close command (24V DC)

4.0 **OUTPUT CONTACTS FOR CUSTOMER USE:**

4.1 A common poten al free contact (monitoring relay) shall be available to annunciate the following faults.

a. Thermostat trip
b. OLR trip
c. Actuator jammed in mid-travel.
d. Motor single phasing.
e. Control supply failure
f. Local stop
g. L/R selector switch not in remote
h. Torque switch trip (In case tripping by close torque switch is chosen, the same should not be considered as a fault signal).

4.2 Local stop PB operated

4.3 Actuator opened.

4.4 Actuator closed.

4.5 Open torque switch acted.

4.6 Close torque switch acted.

4.7 L/R switch local.

4.8 L/R switch OFF.

4.9 L/R switch remote.

4.10 Actuator power supply healthy/faulty.

5.0 The following status annuncia on shall be made available locally in the actuator .

a. Actuator OPEN.

b. Actuator CLOSE.

c. Actuator running.

d. Internal 24 V DC control voltage healthy.

6.0 The following individual fault annuncia on shall be made available locally in the actuator for easy trouble shoo ng.

a. Torque switch OPEN.
b. Torque switch CLOSE.
c. Thermostat trip.
d. Thermal overload relay trip.
e. Motor single phasing.

In case the local annunciation is not available in vendor's design provision of one number of diagnostic tool shall be provided at free of cost covering all above requirements of C I Nos.5.0 and 6.0.

7.0 **The actuator shall be suitable for the following signals interfacing with remote control system.**

a. Open command from remote control system (poten al free contact)
b. Close command from remote control system (poten al free contact)
c. Open feedback from actuator to remote control system (poten al free contact)
d. Close feedback from actuator to remote control system (poten al free contact)

8.0 Actuator shall also suitable for remote opera on by poten al free contacts for open close and stop, the necessary 24V DC power supply shall e derived internally.

9.0 Space heater supply shall be derived internally.

10.0 Documents to be submitted along with offer.

a. Bill of material and control circuit diagram incorpora ng all standard starter components

b. Actuator GA & cross sec onal drawing.

"ELECTRONIC ACTUATOR DATA SHEET"

(VENDOR TO COMPLETELY FULL UP AND FURNISH COPIES ALONG WITH OFFER)

ABSENCE OF ANY DETIAL WILL BE CONSTRUCTED AS NON RESPONSIVE OFFER AND LIABLE FOR REJECTION.

SPECIFY TOLERANCE WHEREVER APPLICABLE- (REAUIRED TO BE CHECKED DURING TESTING INSPECTION)

SL.NO	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO			
		001	002	003	004
1.0	Actuator chosen				
	MOTOR:				
2.0	Type & frame size				
2.1	Ra ng (voltage/KW)				
2.2	Star ng current (A)				
2.3	Current at con nuous run torque(A)				
2.4	Full load current (at 100% Torque se ng)				
2.5	Current at dynamic stall (Locked rotor)				
2.6	Permissible locked rotor with stand me				

VENDOR SIGNATURE:

D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013

SL.NO	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO			
		001	002	003	004
2.7	A. Star ng Torque.				
	B. Run Torque.				
	C. Class of insula on.				
	D. Stator winding Star or Delta (Delta Preferable)				
2.8	Full load torque (100% Torque se ng.)				
2.9	A. No. Of starts per Hr at no load condi on.				
	B. No. of starts per Hr with load at specified run torque.				
	C. Full load RPM.				
	D. Ambient temp . in °C (-20°C to +50°C)				
	E. Duty.				
	F. Full load power factor				
	G. Full load efficiency .				
	GEAR BOX:				
3.0	A. Primary Gear box Ra o.				
	B. Primary Gear Box Efficiency.				
3.1	Primary GB maximum output torque (kgm)				
4.0	A. Secondary GB type & make				
	B. Secondary GB Ra o.				
	C. Secondary GB efficiency.				

VENDOR SIGNATURE:

PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 55/67

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS

SPECN . NO
TFN: 348
REV.NO.02

SL.NO	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO			
		001	002	003	004
4.1	Secondary GB maximum torque (kgm)				
4.2	A. Secondary GB con nuous torque Capacity in kgm.				
	B. Secondary GB momentary torque Capacity in kgm				
5.0	Actuator + secondary GB output RPM.				
5.1	A. Actuator +Secondary GB con nuous torque range (kgm)				
	B. Secondary GB lead angle less than or equal to 6°				
	C. Worm & worm wheel material				
5.2	Actuator + Secondary GB star ng torque (kgm)				
5.3	Actuator + Secondary GB dynamic stall torque (kgm).				
5.4	Bore Dia X length of secondary GB (mm)> If applicable. Otherwise furnish relevant Output dimensional details of GB				
5.5	Approximate Weight of actuator +Secondary GB.				
5.6	Lubrica on:				
	A. Recommended interval of checking/filling				
	B. Type of lubricant.				
	C. Indian equivalent make.				
	d. Qty.in litres/kg.				

VENDOR SIGNATURE:

D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 56/67

SL.NO	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO			
		001	002	003	004
5.7	Type and make of limit switches and Torques switches.				
5.8	Actuator + Secondary GB paint.				
	A. Colour				
	B. Paint thickness				
5.9	Cable Glands				
	A. Type				
	B. Numbers				
6.0	Remote Posi on Transmi er				
	A. Type				
	B. Numbers				
	C. Output/Ra ng				
7.0	ELECTRONIC POWER POSITIONER				
	A. Type				
	B. Numbers				
	C. Output/Ra ng				
	D. Power supply required				

VENDOR SIGNATURE:

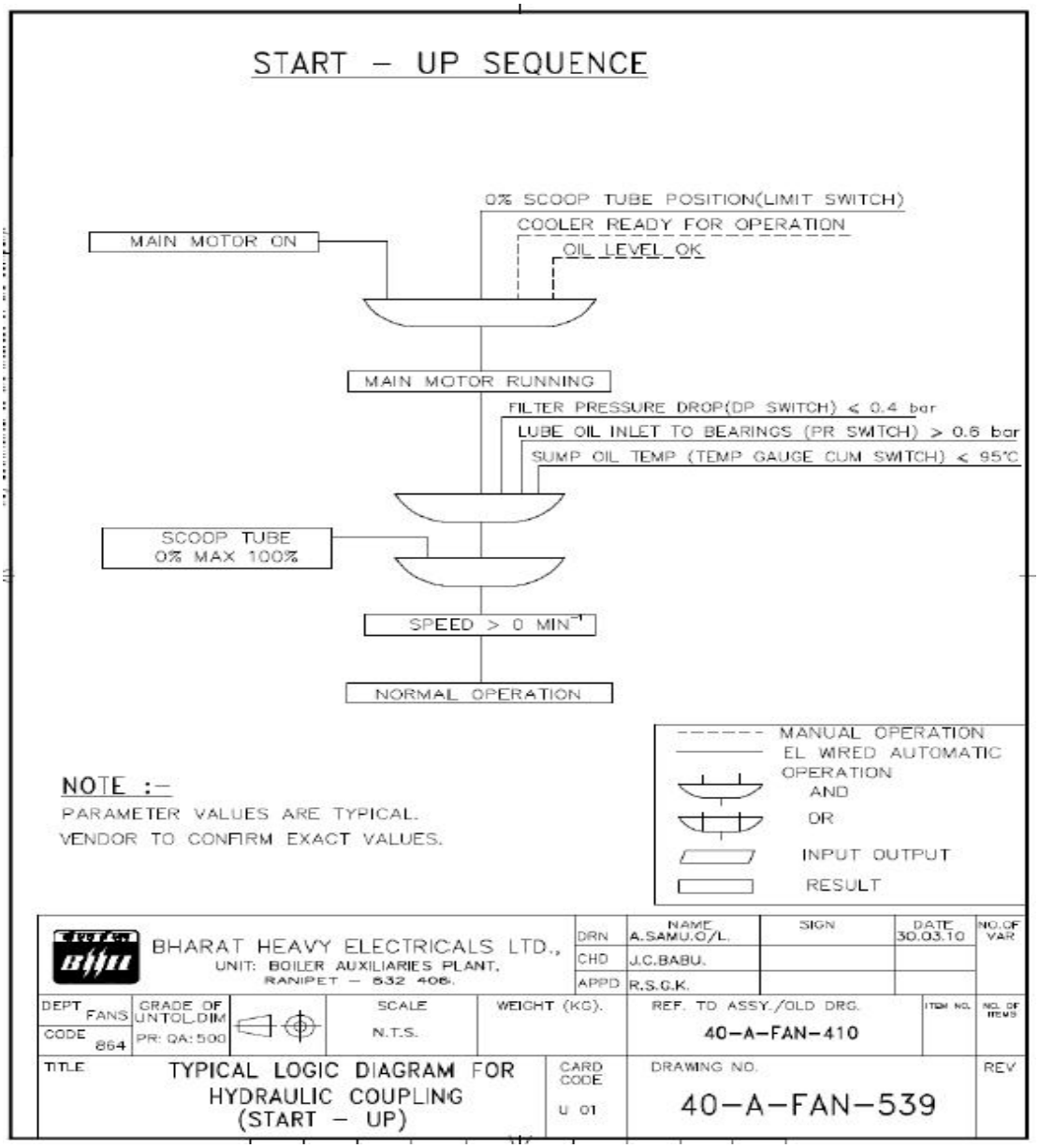
D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 57/67

ANNEXURE – 5

TYPICAL & INTERLOCK-S FOR HYDRAULIC COUPLING

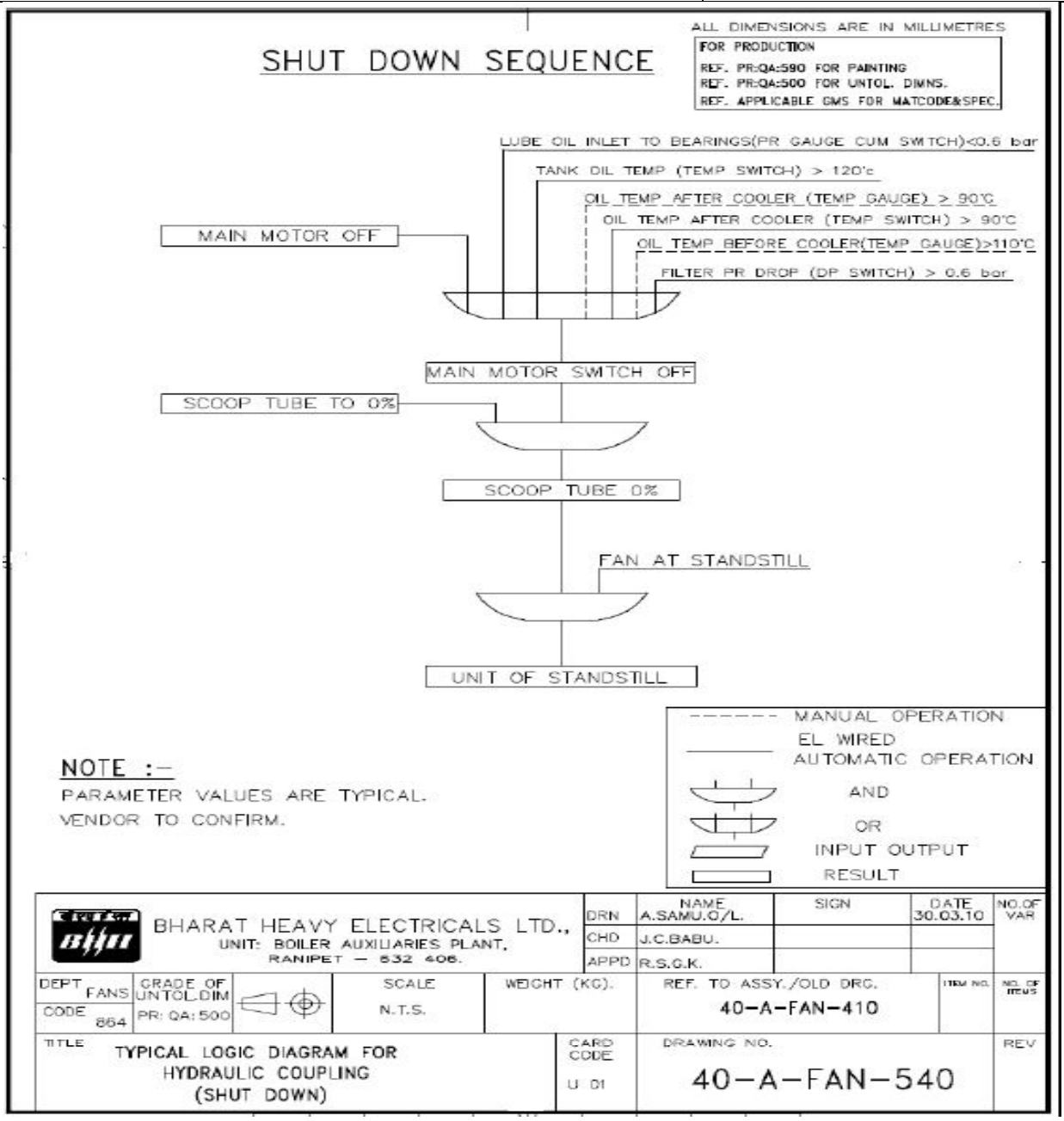
DRG.NO. 40-A-FAN-539 & 40-A-FAN-540

(2 PAGES)



D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 59/67

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02



D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO. 60/67

ANNEXURE - 6

INSTRUMENT SPECIFICATION

(1 PAGE)

HYDRAULIC COUPLING FOR SPEED REGULATION OF FANS	SPECN . NO TFN: 348 REV.NO.02

Instrument Specification

Specification given below governors only the minimum requirements. Other specific requirements like range / resolu on / set point adjustably etc should be selected to sui the opera ng parameters / interlock requirements of the offered hydraulic coupling.

1.0 Temperature gauge (with or without contacts) & Temperature switches

Construc on	: Weather proof, water proof and dust proof.
Enclosure	: NEMA 4/IP 55
Accuracy	: ±2% FSD
Temp compensa on	: Required
Material of compensa on	: Stainless steel
dial size	: 150mm
Scale	: Linear graduated in °C
Se point	: Con nuously adjustable throughout the range with calibrated scale
Contacts (as applicable)	: Poten al free, micro switch type, auto- reset (230 V Ac/1 Ø / 50HZ)
Connec on for control cables	: Plug-in type connector

2.0 Pressure gauge

Construc on	: Weather proof
Enclosure	: NEMA 4
Accuracy	: 2 % FSD
Material of construc on	: Stainless steel
Dial size	: 150 mm
Scale	: Linear – Graduated in bar OR Kg / Sq cm

3.0 Pressure switch / Differential pressure switch.

Type of construc ons	: weather proof, water proof and dust proof.
Type of moun ng/enclosure	: NEMA 4 / ip55
Accuracy	: ±2% FSD
Repeatability	: ± 1%
Material of construc on	: Stainless steel
Set point	: Con nuously adjustable through out the range with calibrate scale
Connec on for control cables	: Plug-in type connector

D.Saraswathi	P.Natarajan	Prasanta Saha	R.M.CHHIPA	REVIEWED AND UPDATED ON 11/09/2013	
PREPARED	CHECKED	APPROVED	SIGN. OF QA	REMARKS WITH DATE	PAGE NO.62/67

ANNNEXURE – 7

SPECIAL CONTRACT EQUIPMENT

Note: In case of no additional requirement, "NIL" will be declared against this annexure.

ANNEXURE – 8

DATA SHEET ON INSTRUMENTS SUPPLIED

(1 PAGE)

Note: **Vendor to submit filled up datasheet & attach catalogue (with model nos. marked for each instrument) with offer.**

S.NO	Location	Medium	Qty per coupling	Process Connection	Electrical connection	Designation	Range	Rated Values	Nominal Value at Operation	Make	Remarks
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											
9.											

ANNEXURE – 9

DATA SHEET ON QUALIFICATION REQUIREMENT

(1 PAGE)

Note: Vendor to submit filled up datasheet & attach copies of "un priced P.O." for the quoted reference

Reference list of coupling meeting Qualification Requirement B(2)

S.NO	Name of customer/ address Contact Phone/Mail Id	Operating Site	Application (Regulating type only)	Motor (Kw)/ Speed (rpm)	Model.no supplied	Maximum Torque kg-m	Wheel Dia.(m)	Month & year of supply	Month & year of commissioning	Remarks
1										
2										
3										

Offered Coupling for the current enquiry

Motor Kw/rpm :.

Maximum torque (Kg-m) :.

Model No Offered :.

Wheel dia (m) :.