



BHARAT HEAVY ELECTRICALS LIMITED
BOILER AUXILIARIES PLANT
ELECTRICAL CONTROLS AND INSTRUMENTATION
RANIPET - 632 406

TECI:STD (NON-
NTPC):ELECT:REGU:
ACT:REV:01
SHEET 1 OF 15

SPECIFICATION
FOR
ELECTRIC DAMPER ACTUATORS
WITH INTEGRAL STARTERS
(REGULATING/INCHING TYPE)
(FOR NON-NTPC)

REV. NO.	DATE	DESCRIPTION	PREPARED	REVIEWED	APPROVED
00	12.06.2009	INITIAL RELEASE	P.Muthukumar	S.Rangarajan	S.Rangarajan
01	27.05.2014	Cl.No.G.3.14 to G.3.19 & G.4.4 to G.4.7 are added.	K.Priyadharshini <i>Priyadharshini</i>	S.Rangarajan <i>[Signature]</i>	S.Rangarajan <i>[Signature]</i>



ENGINEERING DIVISION

BHARAT HEAVY ELECTRICALS LIMITED/RANIPET-632 406.

The vendor shall furnish clearly along with quotation details for each of the items listed out in the specification with out ambiguity.

GENERAL

G.1 ENCLOSURE

- G.1.1 Actuator (basic Actuator+SY.Gear box) as a whole shall be of a totally enclosed weatherproof and dust proof construction with IP 65 enclosure and shall be suitable for outdoor applications.
- G.1.2 Actuator shall be suitable for operation in damp, dusty polluted atmospheres of 100 % relative humidity and ambient temperatures varying from -20° C TO +50° C.

G.2 VOLTAGE

- G.2.1 The unit shall be suitable for operation on a 415V 3 phase , 3 wire, 50Hz. A.C. supply.
- G.2.2. Actuator + SY.Gear box can operate at specified run torque for the following conditions:
A. voltage variation of $\pm 10\%$
B. frequency variation of $\pm 5\%$ and
C. A combined variation of voltage + frequency $\pm 10\%$ absolute.
- G.2.3. Actuator+ SY.Gear box can start at 80% rated volts and run at 75%voltage for 5 min under loaded condition.

G.3 CONSTRUCTION

- G.3.1 Damper actuators shall be of regulating/inching duty, Foot mounting (lever operated) type/Flange mounting.
- G.3.2 The exact mounting arrangement with dimensions shall be clearly furnished along with the offer. In case of foot mounting, the connecting 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 automatically when the power supply to the motor is restored. The hand wheel engaging lever shall give trouble-free performance under repeated operations.



- G.3.4 Every Actuators, especially SY.Gear box shall be self-locking worm Gears.
- G.3.5. Actuator+SY.Gear box shall met all the conditions mentioned in "Actuator Data Sheet".
- G.3.6. Necessary number of fasteners (or) mounting bolts nuts shall be furnished with every actuator. Mounting & overall arrangement drawings shall be submitted In 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 +SY.Gear box shall be properly coupled and shall be dispatched as a single unit.
- G.3.10. Secondary Gear Box continuous capacity shall be greater than or equal to starting torque of Actuator.
- G.3.11. Counter clockwise rotation looking actuator-driving end shall result in close. Also refer "Actuator data sheet".
- G.3.12. Actuator+SY.Gearbox should be capable of meeting total turns indicated in the "Actuator data sheet" and limit switches set accordingly.
- G.3.13. The operating time of actuator shall be as per enquiry/data sheet from open to close or vice versa
- G.3.14. Key way length shall be for total length of bore.
- G.3.15 The Bore and key way tolerance are given below.

Description	Main Dimension	Tolerance allowed
Bore Diameter	All	+0.05mm to -0.00 mm
Key way width	≤ 16 mm	-0.06 to -0.02 mm
Key way width	> 16 mm	-0.07 to -0.02 mm
Key way depth	≤ 3.8 mm	0.1 mm to -0.00
Key way depth	> 3.8 mm	0.2 mm to -0.00

- G.3.16 No part of actuator shall protrude beyond secondary gear box flange.
- G.3.17 All the basic actuators and the gear boxes should have undergone endurance testing. Reference standards are EN15714 for basic actuator and AWWA standard for Gear box.
- G.3.18 Supplier shall confirm self locking is provided in their design. Further to self Locking, the supplier shall confirm over travel will not be there in their design i.e., when power is switched off, gear box should not rotate and gate should not come down on its own. Supplier shall give specific confirmation to this point.



G.3.19 Sizing calculation to be furnished along with the offer for new models which are not supplied to BAP Ranipet earlier.

G.4 **TORQUE**

G.4.1 The actuators shall be capable of giving the required torque at the output shaft. (Required torques are given in the data sheet).

G.4.2 Indicate the adjustable range of torque and starting 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 meet specified continuous run torque at the duty specified in Cl.No.M.4.1.

G.4.4 Starting torque of the actuator (Basic actuator + Sec.Gearbox) shall be greater than the damper starting torque.

G.4.5 The actuator (Basic actuator+sec.GB) Run Torque (6 min or 15 min) shall be greater than the Damper Run torque (6 min or 15 min).

G.4.6 The stall torque of the actuator (Basic actuator + sec. Gear box) shall be lesser than the damper stall torque.

G.4.7 The momentary torque capacity, continuous torque capacity and maximum torque capacity of the secondary Gear box shall be greater than the starting torque of the actuator (Basic actuator + sec. Gear box) .

G.4.8 The run torque range of the actuator (Basic actuator + sec. Gear box) shall cover the required run torque mentioned in the data sheet.

G.5 **REVOLUTIONS**

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

G.6 **SPEED**

G.6.1 Desired output shaft 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. Direction of rotation for closing of load(Damper/Vane).
- E. Secondary Gear Box type.
- F. Torque capacities 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 constructional details shall be sent along with the offer. The catalogues shall also provide over all dimension of the actuators, maximum spindle acceptance diameter and other details called for in the specification. Description of the code numbers representing various actuators shall be submitted.

G.11 O & M INSTRUCTION MANUALS

- G.11.1 Fifteen (15) copy of operating and maintenance instruction 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 2 NC potential free contacts.
- A.1.2 It is required to have calibration for the torque switches so that the switches could be easily set to any value desired, within 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 calibration shall be provided with torque value in KGM.

A.2 LIMIT SWITCHES

- A.2.1 Two numbers of self latching type position limit switches (one for open and one for close) each with 2 NO & 2 NC potential free contacts.
- A.2.2 Two auxiliary limit switches (one for open and one for close) each with 2 NO and 2 NC potential 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 operation.

A.3.2 Limit switch compartment shall be weather-proof and spacious enough for easy setting.

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

A.4 **LOCAL POSITION INDICATORS**

A.4.1 Each actuator shall have a local position indicator to indicate 0 to 100% adjustable with in 360⁰ rotation.

A.4.2. Position indicator provided with adjustable Gear sets & Charts.

A.5 **ELECTROMAGNETIC BRAKES**

A.5.1 In case electromagnetic brakes are provided in the actuators the same shall have IP 65 weather-proof enclosures.

A.6 **SPACE HEATER**

A.6.1 Each actuator shall have a space-heater in the limit switch compartment suitable for 240V AC, 50 Hz single phase supply.

A.7 **REMOTE POSITION TRANSMITTER**

A.7.1 Each regulating type actuator and inching duty (manual regulating type) actuator shall be provided with 2 wire, 4-20mA DC, non-contacting type (LVDT) electronic position transmitter. This shall be capable of driving minimum 500 ohms control circuits of the purchaser, in addition to electronic positioner supplied by the vendor. 24V,DC power supply required for position transmitter shall be fed internally.

A.8 **ACTUATOR DATA**

A.8.1 Actuator data sheets for each type of actuators offered, shall be furnished along with offer (Refer sheet 11/15 to 15/15).

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 operation on a 415V, 3 phase 3 wire ungrounded supply system.
- M.1.2 Motor shall operate without any trouble under the following conditions.
- a. If the voltage varies within $\pm 10\%$ of the rated value of 415 V.
 - b. If the frequency of the power source varies within $\pm 5\%$ of 50 C/S.
 - c. If the voltage and frequency of the source vary simultaneously and the sum of the absolute percentage values in variation does not exceed 10%.
- M.1.3 Motor winding connection brought to common terminals.

M.2 CONSTRUCTIONS

- M.2.1 Motor shall be squirrel cage induction type. The enclosure shall be totally enclosed, self ventilated with IP 65 degree of protection.
- M.2.2 Motor shall be of totally enclosed (TEFC/TENV) construction with IP 65 weather proof enclosure and shall be suitable for out-door installation without canopy. Cooling fan, if provided shall be suitable for both directions of rotation.
- M.2.3 Motor shall be conforming to BS 2613-70, IS 325 or any other equivalent international 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 limit switch compartment.
- M.2.6 Motors shall have double shielded, grease lubricated anti-friction bearings.

M.3 INSULATION

- M.3.1 Motor shall have class F insulation with tropicalisation suitable for polluted dusty and corrosion atmosphere of relative humidity 90% with temperature rise limited to class-B insulation. Motor shall be designed for ambient temperatures varying between -20°C or $+50^{\circ}\text{C}$.

M.4 RATING

- M.4.1 In the case of regulating 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 starting.
- M.5.2 Starting current shall be limited to 6 times the full load current exclusive of tolerance.
- M.5.3 Motor shall be capable of
1. Starting at 85% of rated voltage.
 2. Running at 80% of rated 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, routine tests, acceptance test, 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 shall be as per our drawing No. 3-00-114-36123. enclosed. The terminal marking also shall be according to the enclosed wiring diagram 3-00-114-36123 & limit switch contact development shall be as per BHEL Drg. 3-00-114-36123 enclosed. 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 2 x 2.5 Sq.mm wire.
- C.2.2. All terminals of position limit switches, torque limit switches, space heaters and positions transmitters 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 weatherproof and have enough space for connecting cable glands/ plug and sockets as indicated in internal wiring diagram No. 3-00-114-36123. Insulation voltage for power terminal block & control terminal block is 650V grade.



C.2.4 Terminal box of motor shall be weather-proof and have enough space for connecting 1 number Power cable which will be indicated before placement of order. Motor terminals 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. Termination shall be done with crimping type insulated annealed tinned copper lugs.

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

C.3 ELECTRONIC POSITIONER

C.3.1 Each regulating type actuator shall be provided with an electronic positioner which can accept 4-20mA position command signal for damper actuation.

C.3.2 Electronic positioner shall use 4-20mA position feed back signal, from the actuator for controller.

C.3.3. Electronic positioner shall provide 4-20mA signal feed back for customer.

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

C.3.5 Electronic positioner shall be provided with necessary.

- A. **solid state reversers** (Thyristors switching devices).No contactor type is accepted.
- B. Overload relay.
- C. Lock in last position.
- D. Auto/manual 2 position selector switch.
- E. Open-Stop-Close 3 position selector switch.

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

C.3.7 The electronic positioner shall derive its power supply from 415V, 3 phase, 50Hz supply.

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

a. SPAN

To calibrate the position feedback signal to align the full travel of the actuator with full 0-100% range of position demand signal.



- b. **ZERO**
To calibrate position feedback signal to align the appropriate end of travel position of the actuator to correspond with minimum 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 $\pm 0.5\%$ to $\pm 1.0\%$.
- 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 brake to achieve this.

C.3.8. If customer provides 24 V DC or 48V DC it shall be suitable and giving output of 4 to 20 mA.

C.3.9 Upon loss of command signal, the actuator shall lock itself in the position called for by the last valid position demand signal. (ie) the actuator shall have STAYPUT characteristic.

C.3.10. Detailed wiring diagram for regulating type actuator shall be sent along with the offer showing solid-state reverser Local/remote selector switch, open/close/stop PBs etc.

C.3.11. Provided with NEON indication to indicate forward (open) direction or (close) reverse direction triggered.

C.3.12. Shall have IP 67 protection and thus suitable for outdoor mounting of damp dusty polluted atmosphere of 100% relative humidity and ambient temperature range of -20°C to $+50^{\circ}\text{C}$.

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

As an aid to calibration and trouble shooting, the solid-state reverser is to be equipped with two neon type indicating lights to provide a visual indication of which circuit (thus direction of motor rotation) of the solid state starter has been triggered.

S.1. **SPARES**

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

P.1 **PAINT & FINISH**

P.1.1. All external Parts shall be finished and painted to produce a neat and durable surface which would prevent Corrosion & Rusting. The equipment shall be



thoroughly degreased, sharp edges/scales removed, treated with one coat of epoxy primer and two coats of epoxy enamel paint shade as per the requirement for outdoor motor. Motor fans shall also be painted to withstand Corrosion, if provided.

P.1:2 All fasteners used in the construction 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.

" ELECTRICAL ACTUATOR DATA SHEET "

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

ABSENCE OF ANY DETAIL WILL BE CONSTRUED AS NON RESPONSIVE OFFER AND LIABLE FOR REJECTION.

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

SL.NO	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO			
		001	002	003	004
1.0	Actuator type chosen. <u>MOTOR:</u>				
2.0	Type & frame size.				
2.1	Rating (Voltage / KW)				
2.2	Starting current. (A)				
2.3	Current at continuous run torque(A)				
2.4	Full load current (at 100% Torque setting)				
2.5	Current at dynamic stall (Locked rotor)				
2.6	Permissible locked rotor withstand time.				
2.7	A. Starting Torque				

VENDOR SIGNATURE :



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SL.NO	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO			
		001	002	003	004
	B. Run Torque.				
	C. Class of Insulation.				
	D. Stator winding Star or Delta. (Delta Preferable)				
2.8	Full load torque (100 % Torque setting).				
2.9	A. No. Of starts per Hr at no load condition. 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.				
	<u>GEAR BOX :</u>				
3.0	A. Primary Gear Box Ratio. B. Primary Gear Box Efficiency.				
3.1	Primary GB maximum output torque (kgm)				

VENDOR SIGNATURE :



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SL.NO.	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO.			
		001	002	003	004
4.0	A. Secondary GB type & make. B. Secondary GB Ratio. C. Secondary GB efficiency.				
4.1	Secondary GB maximum torque (kgm))				
4.2	A. Secondary GB continuous torque capacity B. Secondary GB momentary torque capacity.				
5.0	Actuator + Secondary GB output RPM .				
5.1	A. Actuator + Secondary GB continuous torque range (kgm)) B. Secondary GB lead angle less than or equal to 6° . C. Worm & worm wheel material.				
5.2	Actuator + Secondary GB starting 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.				

VENDOR SIGNATURE:



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SL.NO.	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO.			
		001	002	003	004
5.6	Lubrication : A. Recommended interval of checking/ filling. B. Type of lubricant. C. Indian equivalent make. D. Qty. in Litres / kg .				
5.7	Type and make of Limit switches and Torque switches.				
5.8	Actuator + Secondary GB paint. A. Colour. B. Paint thickness.				
5.9	Cable Glands. A. Type B. Numbers				

VENDOR SIGNATURE :



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Sl.No.	Specification requirement	Actuator Sl.No.			
		001	002	003	004
6.0	Remote Position Transmitter				
	A. Type				
	B. Numbers				
	C. Output/Rating				
7.0.	Electronic Positioner				
	A. Type				
	B. Numbers				
	C. Output/rating				
	D. Power supply required.				

VENDOR SIGNATURE :