SPECIFICATION

FOR

ELECTRIC ACTUATORS

(OPEN/CLOSE TYPE)

WITH INTEGRAL STARTERS & PROFIBUS COMPATIBILITY

REV NO	DATE	DESCRIPTION	PREPARED	REVIEWED	APPROVED
00	02.08.2019	INITIAL RELEASE	P SRITARUN	A K PALANISAMY	M JEYAMURUGANAND
01	24.08.2020	Clauses:G.1, C2.1,G2.7,C2.2,8.4.0 are revised. Clause A.8 is added.	P SRITARUN	A K PALANISAMY	M JEYAMURUGANAND

1.0.0 SCOPE OF SUPPLY:

The Electrical Actuator for Gate/Damper shall be supplied complete with all fittings and accessories as detailed in this specification and the drawing referred in purchase enquiry/order.

2.0.0 PROJECT INFORMATION

2.1.0 AMBIENT CONDITIONS:

2.1.1 Ambient temperature : -20°C to +50° C

2.1.2 Humidity : 100% RH

2.1.3 Location : Outdoor, Dusty area.

3.0.0 The vendor shall furnish quotation details clearly for each of the items listed out in the specification without any ambiguity.

4.0.0 GENERAL

G.1 SIL CERTIFICATION

Actuator shall be certified for SIL 2 or better for Actuators if required as per tender .

G.2 PROFIBUS COMPATIBILITY

Actuators interface with the control system shall be through Profibus network.

G.2.1 All actuators shall be Profibus DP compatible complying with IEC 61158. The actuator shall have two (redundant) Profibus DP ports for connecting the redundant Profibus DP cables. That is if one profibus cable is cut or not working/ not available, then complete actuator functionality shall be available through the second redundant cable without any manual intervention.

G.2.2 Open/ close commands, open/ close feedback status, disturbance signal etc. shall be available to the Control System through the Profibus network along with diagnostics.

G.2.3 Open/close command termination logic shall be suitably built inside actuator.

G.2.4 Suitable terminals/ connectors, integral to actuator, for terminating profibus cables and power cables shall be provided. Necessary glands for power cables and profibus cables shall be provided.

G.2.5 The vendor shall provide all necessary configuration files/application like GSD (General Station description), EDD (Electronic Device Description), DTM (Device Type Manager) DTM and any other file for interface of actuator with DDCMIS.

G.2.6 The vendor has to furnish Profibus Certification of the offered product from accredited Profibus User Organization (PI) Test Lab (PITL).

G.2.7 Vendor to provide On-site training per unit to BHEL/End User's engineers from their certified personnels covering all aspects of the Profibus based actuator being offered/supplied. Tentatively 10-15 Engineers will participate in this training. Training shall necessarily include Technical details of Installation, Maintenance, troubleshooting ,diagnosis, fault handling and testing , as minimum requirement.

G.3 ENCLOSURE

G.3.1 Actuator shall be of a totally enclosed, weatherproof and dust proof construction with minimum IP 68 enclosure and shall be suitable for outdoor application.

G.3.2 Actuator shall be suitable for operation in damp, dusty polluted atmospheres of 95% relative humidity and ambient temperatures varying from -20°C to +50° C

G.3.3 The actuators shall be non-intrusive type electrical actuator. All setting of actuator including torque, limit should be possible without opening actuator cover & LCD indication shall be available integral to actuator body.

G.4 VOLTAGE

G.4.1 The unit shall be suitable for operation on a 415 V, 3 phase 50Hz A.C.

G.5 CONSTRUCTION

G.5.1 The actuators are open/close duty, direct shaft mounting type.

G.5.3 The exact mounting arrangement with dimensions shall be clearly furnished along with the offer.

G.5.4 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 operation.

G.5.5 Actuators offered shall be with self-locking worm.

G.5.6 Actuator should consist of basic actuator and secondary gear box and should be supplied in Toto (properly coupled).

G.5.7 Suitable double compression type cable glands (brass nickel plated) for control cables and for power cable shall be provided in the actuators. The exact cable size will be informed during drawing approval.

G.5.8 Actuator shall be clockwise to close.

G.5.9 All RH mounted actuator shall be clockwise to close. Clockwise rotation of manual hand wheel shall always result closing of actuators.

G.5.10 Key way length shall be for total length of bore.

G.5.11 The bore and key way tolerance are given below.

DESCRIPTION	MAIN DIMENSION	TOLERANCE ALLOWED
Bore Diameter	All	+0.05mm to -0.00mm
Key way width	<=16mm	-0.06 to -0.02mm
Key way width	>16mm	-0.07 to -0.02mm
Key way depth	<=3.8mm	0.1mm to -0.00
Key way depth	>3.8mm	0.2mm to -0.00

G.5.12 All actuator shall have removable output bush.

G.5.13 No part of actuator shall protrude beyond secondary gear box flange.

G.5.14 Separate name plate shall be provided in the actuator.

G.5.15 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.5.16 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.5.17 Sizing calculation to be furnished along with the offer for new models which are not supplied to BAP Ranipet earlier.

G.6 TORQUE

G.6.1 The actuators shall be capable of giving the required torque at the output shaft. (Required torque values are given in the data sheet).

G.6.2 Indicate the adjustable range of run torque and starting torque of actuator in KGM for each actuator offered. The actuator shall be designed to operate at the running torque for a period of 15 min or 3 successive open-close operations whichever is longer.

G.6.3 Starting torque of the actuator (Basic actuator + Secondary gearbox) shall be greater than the damper starting torque.

G.6.4 The actuator (Basic actuator+sec.GB) run torque (6 min or 15 min) shall be greater than the damper run torque (6 min or 15min).

G.6.5 The stall torque of the actuator (Basic actuator + sec. Gear box) shall be lesser than the damper shall torque.

G.6.6 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.6.7 The run torque range of the actuator (Basic actuator + sec. Gear box) shall cover the required run torque mentioned in the data sheet.

G.7 REVOLUTIONS

G.7.1 Each actuator shall be capable of giving total operating turns as indicated in the data sheet. Please furnish actual number of turns available for each actuator offered.

G.8 SPEED

G.8.1 Desired output speeds are indicated in the data sheet. Actual speeds of actuator offered shall be clearly indicated.

G.9 WEIGHT

G.9.1 Furnish weight of actuators including all accessories.

G.10 LUBRICANT

G.10.1 The gearbox of the actuator shall preferably be oil failed. 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.11 DIMENSIONAL CATALOGUES

G.11.1 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 dimensions of the actuators and other details called for in the specification.

G.11.2 Five Nos configuration / diagnostic tool (if applicable) for all field bus compatible actuators shall be provided.

G.12 O&M INSTRCTION MANUALS

G.12.1 25 copies of operating and maintenance instruction manual shall accompany each actuator ordered.

5.0 ACCESSORIES

A.1 TORQUE SWITCHES

A.1.1 Two numbers adjustable 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 in Kg-m (for whole actuator including secondary gear box) 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 (Fiber gears are not acceptable).

A.2 LIMIT SWITCHES

A.2.1 Two numbers of position limit switches, rotary drum type capable of being set at any position (one for open and one for close) each with 2 NO & 2NC potential free contacts.

A.2. Two auxiliary limit switches rotary drum type capable of being set at any position (one for open and one for close) each with 2NO & 2 NC potential free contacts.

A.2.3 Gear train shall be made of metal (Fiber gears are not acceptable).

A.3 MICRO SWITCHES

A.3. Limit switch & torque switches shall be enclosed in weatherproof compartment suitably for damp atmospheres and shall not cause any trouble during commissioning and operation.

A.3.2 Limit switch compartment shall be weatherproof and spacious enough for easy setting.

A3.3 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% of travel. Positional unit measurement shall be done using absolute encoders.

A.5 ELECTROMAGNETIC BRAKES

A.5.1 In case electromagnetic brakes are provided in the actuators,the same shall have IP-68 weatherproof enclosures.

A.6 SPACE HEATER

A.6.1 Each actuator shall have a space heater of adequate rating in the limit switch compartment suitable for 240V AC,50 C/S single phase supply.

A.7 REMOTE POSITION TRANSMITTER

A.7.1 Each open/close actuator shall have one number of remote position transmitter of LVDT type for remote indication.

A.8 If the offered actuators are provided with absolute encoder which performs the function of limit & torque switches & position transmitter, mechanical limit switches/torque switches may not be provided separately.

6.0 MOTORS

M.1 POWER SUPPLY

M.1.1 Motor shall be suitable for operation on a 415V,3phase 3 wire ungrounded supply system.

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

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 varies simultaneously and the sum of the absolute percentage values in variation does not exceed 10 %.

M.2 CONSTRUCTIONS

M.2.1 Motor shall be squirrel cage induction type. The enclosure shall be totally enclosed, self ventilated with minimum IP 68 degree of protection.

M.2.2 Motor shall be conforming to BS 2613-70. IS 325 or any other equivalent international standard for all requirements unless otherwise specified herein.

M.2.3 Motor shall be painted with corrosion proof epoxy -resin paint.

M.2.4 Motor shall be provided with inbuilt thermostat connected in series (one thermostat in each phase) & wired to limit switch compartment.

M.2.5 Motors shall have double shielded, grease lubricated anti friction bearings.

M.3 INSULATION

M.3.1 Motor shall have class F insulation with troplicalisation suitable for polluted dusty and corrosion atmosphere of relative humidity 90%. If higher insulation is provided, the temperature rise shall be limited to class F insulation. Motor shall be designed for ambient temperatures varying between -20degree C to +50degree C. Motor shall withstand temperature rise of 70degree C, over 50degree C ambient.

M.4 RATING

M.4.1 For open/close actuator motor shall be short time rated for S2-15 minutes duty or 3 successive open-close operations whichever is longer.

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 rated current.

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 terminals shall be provided on the body of the motor.

M.7 MOTOR DATA

M.7.1 Motor data sheets for each type of actuators ordered shall be furnished. Internal wiring and limit switch contact development diagram for the actuators ordered shall be furnished.

M.8 WEIGHT

M.8.1 Weight of the motor shall be furnished with the offer.

M.9 TESTS

M.9.1 Tests are to be conducted as per relevant Indian standards and international standards as given below. Required copies of the test certificates are to be furnished for the tests.

7.0 CONTROLS

C.1 INTERNAL WIRING

C.1.1 Internal wiring diagram shall be neatly pasted on the cover of terminal box.

C.2 TERMINAL BOX

C.2.1 All terminals of position limit switches, torque limit switches, space heaters and position transmitters shall be brought to a common terminal board if applicable. The terminals shall be of screw-type with sufficient insulation between 2 adjacent terminals.

C.2.2 Minimum 5 number of terminals shall be available in the terminal board as spare terminals if terminal board is applicable.

C.2.3 Terminal box of actuator shall be weatherproof and have enough space for connecting cable glands/plug and sockets. Insulation Voltage for power terminals block & control terminal block is 650V grade.

C.2.4 Terminal box of motor shall be weatherproof 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 terminals boxes shall be fitted with a removal front cover-plate.

C.2.6 Internal wiring shall be done with 650V ,1.5 sq.mm PVC insulated standard copper wires. Ferrules should be provided on the wires for easy identification.

S.1 SPARES

Vendor shall specify a list of recommended spares for 2/5 years of trouble free operation.

P.1 PAINT & FINISH

All external parts shall be finished and painted/powder coated to produce a neat and durable surface, which would prevent rusting & corrosion. The equipment shall be thoroughly degreased and sharp edges and scales removed and treated with one coat of Epoxy primer and two coats of Epoxy enamel paint. Refer enquiry for paint shade. The consolidated thickness (one coat of Epoxy primer and two coats of Epoxy enamel)of the paint coats shall be minimum of 100 microns.

P.1.2 All fasteners used in the construction of the equipment shall be either of corrosion resistant material or high cadmium plated. Current carrying fasteners shall be either of stainless steel or High Tensile Brass or Copper.

8.0 ELECTRONIC INTEGRAL STARTER

8.1.0 GENERAL

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

8.2.0 INTEGRAL STARTER FEATURES

8.2.1 The integral starter shall be provided in a weather proof Enclosures with protection class IP 68.

8.2.2 The control logic of integral starter shall be through Electronic logic control. Hardwire control logic is not acceptable. The electronics should be capable of operating in a temperature range of -20degree C to +50degree C. Entire integral starter unit along with basic actuator shall conform to IP68 Enclosure standards.

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

8.2.4 INTEGRAL STARTER COMPONENTS:

8.2.4.1 Electrically and mechanically interlocked contactor shall be provided for forward and revers operation. Contactor rating shall be sufficient to withstand the extreme Conditions like valve jamming and instantaneous reversal of motor.

A Local LCD display shall be provided to display details of alarm, status and position indications as a minimum.

8.2.4.2 Key lockable selector switch for LOCAL-OFF REMOTE selection shall be provided.

8.2.4.3 OPEN –STOP –CLOSE push buttons (for local operation) shall be provided. Lockable local/ remote selection shall be provided in the actuator.

8.2.4.4 Thermal overload relay shall be provided in addition to thermostats embedded in motor winding. Overload relay and thermostats shall be connected in control circuit to trip actuator in case of overload. OLR set value shall be mentioned in wiring diagram.

8.2.4.5 Automatic phase correction facility, wrong phase sequence protection and single phasing prevention shall be available.

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

8.2.4.7 Open /Close command termination logic with position and torque limit switches shall be suitably built in the PCB inside the actuator.

8.2.4.8 Necessary fuses shall be provided.

8.2.4.9 For torque closing valves, open torque switch shall be bypassed initially for 3 secs or 5% of the valve travel.

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

8.2.4.11 It should also be possible to reverse the direction of travel for inching valves (in LOCAL and REMOTE) without giving stop command.

8.2.4.12 Provision shall exist in electronic control for bypassing the torque switch during initial 5% opening of dampers. Details for this must be indicated in the wiring diagram.

8.3.0 **INPUT COMMANDS:**

8.3.1 Open command

8.3.2 close command

8.4.0 **OUTPUTS FOR CUSTOMERS USE**

8.4.1 The following signals 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).

8.4.2 Local stop PB operated

8.4.3 Actuator opened.

8.4.4 Actuator closed.

8.4.5 Open torque switch acted.

8.4.6 Closed torque switch acted.

8.4.7 L/R switch local.

8.4.8 L/R switch off.

8.4.9 L/R switch remote.

8.5.0 The following status annunciation shall be made available locally in the actuator.

a. Actuator open

b. Actuator close

c. Actuator running

d. Internal 24V dc control voltage healthy.

Note: Alternatively a diagnostic tool shall also be provided at free of cost.

8.6.0 The following individual faulty annunciation shall be made available locally in the actuator for easy trouble shooting.

a. Torque switch open

b. Torque switch close

c. Thermostat trip

d. Thermal overload relay trip

e. Motor single phasing

Note: Alternatively a diagnostic tool shall also be provided at free of cost.

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

a. Open command from remote control system

b. close command from remote control system

c. open feedback from actuator to remote control system

d. close feedback from actuator to remote control system.

8.8.0 Actuator shall be suitable for remote operation for open / close and stop. The necessary 24V DC power shall be derived internally.

8.9.0 Space heater supply shall be derived internally.

8.10.0 Documents to be submitted along with offer:

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

b. Actuator GA & cross sectional drawing.

"ELECTRICAL ACTUATOR DATA SHEET"

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

ABSENCE OF ANY DETAIL WILL BE CONSTRUED AS NON REPONSIVE 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.				
1.1	Profibus type & specification.				
1.2	SIL level				
	MOTOR:				
2.0	Type & frame size.				
2.1	Rating (voltage/KW)				
2.2	Starting Current. (A)				
2.3	Current at run torque (15 Min. torque for louver & 6 min. torque for gate).				
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 B. Run Torque. C. Class of Insulation. D. Stator winding Star or (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 degree c (-20deg C to + 50deg C) E. Duty time (S2-15min.) F. Full load power factor. G. Full load efficiency.				

	H. OLR set value				
	GEAR BOX:				
3.0	A. Primary Gear Box Ratio. B. Primary Gear Box efficiency.				
3.1	Primary GB maximum output torque(KGM)				
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 momentary torque capacity(KGM) B. secondary GB momentary torque capacity(KGM)				
5.0	Actuator + Secondary GB output RPM				
5.1	A. Actuator + Secondary GB output torque (KGM)(15 min. torque for louver & 6 min. for gate.) B. Secondary GB lead angle less than or equal to 6 degrees. 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).				
5.5	Approximate Weight of actuator + Secondary GB.				
5.6	Lubrication: A. Recommended interval of checking/filling. B. Type of lubricant. C. Indian equivalent mark. 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	Wiring Diagram				