



**BHARAT HEAVY ELECTRICALS LIMITED,**  
**THIRUCHIRAPALLI-620 014**

**CONTROLS & INSTRUMENTATION/FOSSIL BOILERS**

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Technical specification for Electrical Actuator  
(Open/Close duty & Inching duty applications)

**Specification Number: - TCI: 318/Rev. 01**

Revision History

Rev. No.	Date	Description	Prepared	Reviewed	Approved
00	09-12-2013	Initial release	-sd-	-sd-	-sd-
01	08-02-2019	Revision after revisit	H. Hingf jond	H. Hingf jond	V. Mahalingam



Sl. No.	Details	Requirements		
1	Site Conditions	Ambient Temperature: -20° C to +50° C Relative Humidity : 95% Atmosphere : Tropical, dusty, salty, corrosive and highly polluted		
2	Actuator Application	Open/Close, inching duty, suitable for Valve/Gate applications.		
3	Actuator type	Type 1	Type 2	Type 3
		Electrical Actuator without integral starter.	Electrical Actuator with integral starter. The Starter shall be as per technical specification.	Electrical Actuator with integral starter and 9 pin plug & socket arrangement. The Starter shall be as per technical specification.
4	Actuator Construction	Actuator shall be of totally enclosed weatherproof construction. Protection Class: - IP 65		
5	Gearing	Suitable gearboxes shall be coupled (if required) to achieve the torque requirements of the load. All the gears available in the actuator shall be of suitable metal. Actuator shall have self-locking facility.		
6	Manual operation through Hand-wheel	Shall have a de-clutch lever and a hand wheel mechanism for manual operation. The hand wheel mechanism shall be designed such that it is declutched automatically when the power supply to the motor, is restored.		
7	Torque requirement	Shall be designed to meet with the required torque at the output shaft as per the load requirement.		
8	Operating time	The operating time of the actuator required for the complete travel has to match with the load requirement.		
9	Supply voltage	415 V, 3 phase AC supply, 50Hz.		



Sl. No.	Details	Requirements
10	Power supply variation	The actuator shall operate without any trouble under power supply voltage variation of $\pm 10\%$ of the rated value, power supply frequency variation of $\pm 5\%$ of the rated value, combined voltage and frequency variation of 10% of the rated value.
11	Motor construction	Shall be of Totally Enclosed, Self-Ventilated construction. Shall have double shielded, grease lubricated anti-friction bearings.
12	Motor Insulation	Motor winding shall be tropicalized, suitable for the site conditions as indicated above.  Shall have class F insulation with temperature rise of the motor winding limited to Class B. Temperature rise over ambient temperature of 50° C shall be 70° C.
13	Motor duty cycle	The duty cycle of the motor shall be short time S2 duty cycle rated for the period of operation of 15 minutes or rated for 3 successive open-close operations whichever is longer.  For inching duty, the motor shall be suitable for 150 starts/hour.
14	Standards	Actuator shall be conforming to the standard EN15714 - 2 for all requirements.
15	Motor Thermostat	Motor winding shall be provided with inbuilt thermostat connected in series (one thermostat in each phase) and shall be wired to terminal box.
16	Space heater for Motor	Shall have a space-heater with suitable rating and the power supply shall be derived internally from the main power supply.
17	Earth terminals	2 Nos. of earth terminals shall be provided on the body of the motor.



Sl. No.	Details	Requirements
18	Torque & position limit switches	<p>2 numbers of adjustable torque limit switches (one for open and one for close), each with 2 NO and 2 NC potential free contacts. The torque limit switches shall have calibration in Kg-m (for whole actuator including gear box if supplied), so that the switches could be easily set to any desired value, within the range specified for each actuator.</p> <p>Torque switches shall be bypassed in both the end positions using the position Limit switches available at the other end of the travel.</p> <p>Actuators shall have provision for bypassing the torque switch, initially for 3 seconds or during initial 5% opening of the valve.</p> <p>4 numbers of position limit switches, rotary drum type capable of being set at any position (2 nos. for open and 2 nos. for close) each with 2 NO &amp; 2 NC potential free contacts.</p> <p>Contacts of limit and torque switches shall be Silver plated having high conductivity and non -corrosive type.</p> <p>Contact rating of all the above limit switches shall be 2A at 240 V AC and 0.2 A at 220 V DC.</p>
19	Local position indicator	Shall be provided to indicate 0 to 100% travel.
20	Position Feedback transmitter	For inching duty applications, position feedback transmitter has to be supplied. Shall be 2 wire, non-contact type (LVDT) electronic position feedback transmitter with an output of 4-20 mA DC and shall be loop powered from external power supply. The output shall also be capable of driving minimum 500 ohms load in the control circuits.
21	Internal wiring	<p>Shall be done with 1.5 sq.mm PVC insulated, stranded copper wire of 650V grade for control signals. For Power circuits, internal wiring shall be done by using suitable size of stranded copper conductor cables, taking care of the motor current rating.</p> <p>Ferrules should be used for easy identification. Internal wiring and the terminal block drawing shall be neatly pasted on the internal side of the terminal box.</p>



Sl. No.	Details	Requirements
22	Terminal box	<p>Motor terminals shall be of stud type. All terminals of the position limit switches, torque limit switches, space heaters shall be terminated in the terminal box. The terminals shall be of plug in cage clamp type, suitable for the cables of size 2.5 sq.mm.</p> <p>Minimum 6 numbers of spare terminals shall be made available in the terminal board.</p> <p>Terminal box of actuator shall be weatherproof, conforming to IP 65 and shall have enough space for connecting cable glands/plug and sockets. Terminal box shall be fitted with a removable front cover-plate.</p>
23	Cable Termination philosophy	<p>Vendor to refer the respective terminal block drawing (Type 1/Type 2/Type 3) furnished by BHEL along with the enquiry and shall follow the same.</p> <p>Power Cable :- (Common to Type1/Type 2/Type 3)) Double compression type, Brass with Nickel plated, weather proof cable glands shall be provided for the termination of power cable. Cable gland along with blanking washers shall be selected suitable for the power cable sizes as indicated below.</p> <p>a) Upto 3 kW – 3C x 2.5 sq.mm. Copper, OD – 17 mm <math>\pm</math> 2 mm. b) &gt; 3 kW &amp; upto 7 kW - 3C x 6 sq.mm, Aluminium, OD – 19 mm <math>\pm</math> 2 mm.</p> <p>Termination of Control Cable (Type 1 &amp; Type 2) :- For Type 1 and Type 2 actuators, 3 Nos. of Double Compression type, Brass with Nickel plated, weather proof cable glands have to be supplied for the termination of the control/instrumentation cables suitable for a cable OD of 18mm.</p> <p>Termination of Control Cable (Type 3) :- For Type 3 actuator, 9 Pin plug &amp; sockets (2 Nos. wired + 1 No. spare as loose supply) shall be provided to suit 4 pair 0.5 sq.mm. Copper overall shielded (16 mm OD), instrumentation cable.</p>
24	Paint & finish	<p>All external Parts shall be finished and painted to produce a neat and durable surface which would prevent Corrosion &amp; Rusting. All fasteners used in the equipment shall be of a corrosion resistant material.</p>



Sl. No.	Details	Requirements
25	Lubricant	The gear box of the actuator shall be either oil filled or grease filled.
26	Inspection & Testing	For the purpose of inspection & testing of the electrical actuator, Quality Plan Ref. QA:CI: STD: QP:13 has to be referred.

**Technical Specification for Electronic Integral Starter (Applicability as per the project requirement)**

Sl. No.	Details	Requirements
1.	Integral starter	<p>Control logic of the starter shall be designed by using suitable electronic control circuit. The starter shall have the following minimum features:</p> <ul style="list-style-type: none"><li>• Power supply isolation switch &amp; fuses of suitable rating.</li><li>• Thermal Over load relay.</li><li>• Lockable Local- Off -Remote selector switch.</li><li>• Push buttons for Local Operation (OPEN, CLOSE, STOP)</li><li>• Indication lamps (OPEN, CLOSE, TRIP)</li><li>• Remote Signal interface</li><li>• Output Contacts</li><li>• Status indication</li><li>• Fault annunciation</li></ul>
2.	Open/Close Command	<p>Interposing relays of coil burden <math>\leq 2.5\text{VA}</math> shall be provided to initiate opening and closing using 24V DC command from the external control system, respectively.</p> <p>Actuator shall also be suitable for remote operation by potential free contacts for Open &amp; Close, the necessary 24V DC power supply shall be derived internally.</p> <p>Contactors shall be provided for forward and reverse operation and the same shall be suitably rated and interlocked in the control circuit.</p>
3.	Protection Features in Starter	<p>Shall have various protection features such as Single Phasing prevention, Wrong phase sequence protection, Automatic phase correction, Over heating protection through thermostat, Short Circuit protection, Overload, Supply Under Voltage, over and above other standard protection features as per manufacturer's design.</p>
4.	Control Supply	<p>Control supply voltage of the starter shall be 24V DC and the same shall be derived internally by the manufacturer. If control voltage rating other than 24 V DC is used, then necessary primary and secondary fuses shall be provided. Also, Opto isolation circuits shall be provided with suitable coupling relays for 24V DC commands from external control system.</p>



Sl. No.	Details	Requirements
5.	Local Operation	Provision shall be available to operate the actuator locally. Lockable local/off/remote selection shall be provided on the front panel of the actuator.
6.	Status indication	<p>The following status indication signals shall be provided in the actuator over and above the standard signals available in the actuator as per the manufacturer's standard</p> <ul style="list-style-type: none"><li>• Actuator Open</li><li>• Actuator Close</li><li>• Actuator in travel</li></ul>
7.	Group Fault/Output Contacts	<p>A Common potential free contact for collective fault annunciation of following faults such as Thermal Overload trip, Motor Thermostat trip, Control supply failure, Power Supply Failure/Single Phasing, Local/Remote switch in LOCAL/OFF, Torque Switch acted along with Other protections acted shall be provided for customer's use.</p> <p>Potential free output contacts shall be provided for Local/Remote/Off positions of the selector switch.</p>
8.	Fault Annunciation	<p>The following fault annunciation signals shall be provided in the actuator over and above the standard signals available in the actuator as per the manufacturer's standard,</p> <ul style="list-style-type: none"><li>• Open Torque Switch/Close Torque Switch acted</li><li>• Motor thermostat trip</li><li>• Motor Overload relay acted</li></ul> <p>Actuator shall have necessary provision for diagnosing the fault locally.</p>
9.	Details to be furnished	The ratings of the various components of the starter, various signal exchanges to/from the starter and the wiring interconnections shall be clearly indicated in the wiring drawing of the actuator.