

BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI - 620 014

FUEL SYSTEMS / PE/ FOSSIL BOILERS

TITLE SHEET


***SPECIFICATION FOR
TORQUE LIMITING TYPE
ELECTRIC ROTARY ACTUATOR***

SPECIFICATION NUMBER: GF-331

REVISION No. : 03

03	03/04/2014	Clause 19.4 added. Note-3 included in drawing (sht.9/15)	Rajmohan K & Aruna Kumar JVV
02	19/10/04	Clauses 1.2, 1.3 altered Annexure II added.	KRM
01	16/09/04	Updated	DVK
Rev.No.	Rev. Date	Description	Chd. & Appd.

	Name	Signature	Date
Prepared	S.Manivannan	-sd-	10/03/01
Checked	J.V.V.Arunkumar	-sd-	10/03/01
Approved	D.Vijayakumar	-sd-	10/03/01

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MATERIAL CODE : **COAL VALVE** : 36" size
QTY / RAW COAL GATE : 1 **PGMA** : 67-27x

1.0 Scope:

- 1.1 This specification covers the **standard** requirements of design, manufacture, testing inspection (at vendor's works) and supply of Torque limiting type rotary actuator and it's necessary accessories like position indicators, torque limit switches, travel limit switches, space heaters etc.
- 1.2 **Special Contractual** requirements are specified in Annexure-II. In case of any difference between the standard requirement in this specification and special requirement in Annexure-II, the requirement of Annexure II shall be final.
- 1.3 The extent of supply stated above is not necessarily exhaustive and shall not relieve the vendor from his responsibility to provide goods and services necessary to satisfy the performance criteria and guarantees specified.

2.0 Final control element:

- 2.1 Plate type coal gate operated by rack and pinion arrangement.

3.0 Actuator type:


- 3.1 Actuator shall be of non-rising stem type.
- 3.2 The Starters are required as per Annexure-I. (Inching operation is required)
- 3.3 Thrust load if any should not be transferred from the actuator to driven equipment.

4.0 Motor:

- 4.1 Shall conform to IS: 325 of S2-15 duty 'B' class insulation.
- 4.2 1440 rpm – 415V, 3PH – 50HZ.
- 4.3 Motor rating shall be selected suitably for this application.

5.0 Actuator output shaft (termed as shaft hereunder):

- 5.1 Actuator output shaft speed 12 rpm.
- 5.2 No off revolutions of actuator output shaft for full travel from open to close vice versa 13.5 Revolutions.
- 5.3 Tripping torque to be set at factory 22Kgm - for 36" coal valve at the actuator output shaft.
- 5.4 Tripping torque range required on the torque switch 12 To 31 Kgm. (Setting procedure required to reset in the field if required should be furnished by supplier).

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5.5 Output shaft shall be designed with bore and slot for feather key (Ref. Sketch-2 shown in sheet 10 of 15)

5.6 Direction of rotation and orientation of shaft shall be as shown in sketch-1 (refer sheet 09 of 15)

6.0 Type of mounting:

6.1 Direct - Horizontal.

7.0 Manual operation:

7.1 Chain wheel to be provided instead of hand wheel for manual operation with declutch lever and chain guide.

7.2 Chain wheel shall declutch automatically upon energising actuator motor.

7.3 Chain wheel should be suitable for chain pitch 36mm - $\varnothing 6$ - $t=18$.

7.4 The direction of rotation for gate open/close shall be clearly indicated (should be visible to a distance of 8m) on the chain wheel.

8.0 Electrical local position indicator:

8.1 2 nos, 100 Ω potentiometric types (required for 0 to 100% position)

9.0 Torque limit switches:

9.1 Quantity shall be 2 nos.

9.2 Shall be Rated for 240V - AC 5Amps/ 220V DC-0.5Amps (inductive) and each switch shall have 2NO+2NC independent contacts.

9.3 Name plate for torque limit switch calibration shall be provided with torque value IN Kgm *.

- * 1. Torque value set at shop Kgm #
- 2. Torque value reset at field Kgm ##

To be filled by actuator supplier

to be filled by person setting the value in the field

9.4 The gear train used for limit switches shall be metal. Fibre gears are not acceptable.

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10.0 Travel limit switches:

- 10.1 Quantity shall be 4 Nos.
- 10.2 Shall be rated for 240V-AC 5Amps, 220V-DC 0.5Amps (inductive) and each switch shall have 2NO+2NC independent contacts.
- 10.3 The gear train used for limit switches shall be metal, Fibre gears are not acceptable.
- 10.4 The position limit switches shall be of rotary drum type and shall be capable of being set at any position.

11.0 Terminal strip requirement:


- 11.1 66 (Refer sketch –4 shown in sheet 12 of 15)

12.0 wiring:

- 12.1 Internal wiring shall be done as per BHEL diagram (refer sheet 11 & 12).
- 12.2 Complete wiring diagram of actuator with integral starter shall be submitted along with offer meeting Annexure-I requirements.

13.0 Terminal Box:

- 13.1 All terminals of position limit switches, torque limit switches, space heaters and position transmitters shall be brought to a common terminal board. The terminals shall be of cage clamp type with sufficient insulation between two adjacent terminals.
- 13.2 Minimum 5 numbers of terminals shall be available in the terminal board as spare terminals.
- 13.3 Terminal box of actuator shall be weather proof. Insulation voltage for power terminal block & control terminal block is 600V.
- 13.4 9 pin plug & socket for control shall be provided as per sl.no.11.00 of Annexure-I.
- 13.5 Terminal box of actuator shall be weather proof and have enough space for connecting 1 no. Power cable as mentioned below. Motor terminals shall be stud type.
- 13.5.1 Cable sizes to select 1 no. power cable gland with blanking washers.
 - a) Upto 3kW - 3c x 2.5 sq.mm. (Al) unarmoured: 14 ± 2 mm OD.
 - b) >3kW & upto 7kW - 3C x6 sq.mm (Al) UNARMOURED: 17 ± 2 mm OD.
 - c) >7kW & upto 13kW - 3C x 16 sq.mm. (Al) unarmoured: 20 ± 2 mm OD.
 - d) >13kW & upto 24kW - 3C x 35 sq.mm. (Al) PVC insulated: 25 ± 2 mm OD.

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13.6 The terminal box shall be fitted with a removal front cover plate.

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

14.0 Space heater:

14.1 Actuator shall be provided with space heater (approx. 25 watts) suitable for 240V AC single-phase 50Hz in limit switch compartment. The supply for the same shall be derived internally.

15.0 Documents:

15.1 The following documents / details shall be furnished along with the offer.

- i) Filled in data sheet as per the sheet 07& 08.
- ii) Total cross sectional assembly drawing with BOM.
- iii) Unit weight of Actuator assembly
- iv) Commissioning spares, if required
- v) List of spares for 2 years trouble free operation
- vi) Suppliers' catalogues for Actuators

15.2 The following documents shall be furnished after placement of purchase order.

- i) Filled in data sheet as per the sheet 07& 08 (for approval)
- ii) General Arrangement and Cross Sectional Drawing (for approval)
- iii) Quality plan (for approval)
- iv) Lubrication details
- v) Graph showing the relation between torque switch setting and unit output torque (Kgm)
- vi) Load Vs Efficiency curve
- vii) Load Vs Power factory curve
- viii) Test certificate for each actuator.


15.3 The documents to be supplied along with the main supply shall include the following.

- i) 25 sets (Minimum) of Operation and instruction manuals
- ii) 6 sets of test certificates for each actuator
- iii) Packing and shipping details

16.0 O & M manuals:

16.1 Manuals shall be in printed form.

16.2 The manuals shall be made of correct A4 size sheets with drawings in A3 size. Larger size drawings (greater than A3 size) should be reduced to A3 size and inserted.

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16.3 Drawings shall be of printed or laser printed only.

16.4 Spiral or comb bound copies should be totally avoided.

16.5 If manuals are supplied in folders, the folder shall have 3 hole punching system.

16.6 O & M manuals, shall be submitted to BHEL/ Tiruchirapalli prior to despatch of the equipment

16.7 Manuals, generally should contain the following:

- i) Data sheet
- ii) Brief description
- iii) Operation
- iv) Maintenance (including lubrication, where necessary) and service, recommended spares for 2/3 years trouble free service.
- v) Trouble shooting
- vi) Assembly drawings with part list, dimensional drawings & other applicable drawings
- vii) Manuals should pertain only to the type or model supplied for a particular order. Copies shall be sent to BHEL / Tiruchirappalli

17.0 Working condition:

17.1 Actuator should be suitable to operate in damp, dusty, polluted atmospheres of 100% relative humidity at an ambient temperature of -20⁰ C to + 70⁰ C.

18.0 Packing:

18.1 The Actuator shall be packed in such a way that it does not get damaged during transport. It shall be properly covered with thick tear proof polythene sheet and dispatched in suitable moisture proof wooden crates.

19.0 General:


19.1 Colour of the actuator shall be smoke grey shade 692 of IS: 5. However the colour may be altered to the requirement of customer.

19.2 The gear boxes supplied shall be guaranteed for operation even under worst condition like dynamic stall torque.

19.3 Vendor shall highlight the deviations from the specification (if any) or special features of the Actuators, which are not covered in the specification during the offer stage itself.

19.4 Stainless steel name plate with following information, as a minimum, shall be firmly fixed to actuator body

- Make & Model No
- Actuator type & Sl. No
- **BHEL material code**

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DATA SHEET

Supplier shall fill up this information and furnish along with offer in the following format only. Absence of any detail result in incomplete offer and will not be considered.

Actuator model:			
Project:			
P.O No.			
Sl. No.	DESCRIPTION	UNITS	DATA
	Actuator Manufacturer		
1.	Torque Range & speed	Kgm & rpm	
2.	Starting Torque (approx.)	Kgm	
3.	Stall Torque (min.)	Kgm	
4.	Duty Cycle		
5.	Enclosure (Type & Protection)		
6.	Admissible Ambient Temperature	Deg C	
7.	Cable Gland : (Double Compression) a. Size for power cable -1 No b. Size for control cable - 3 Nos.		
8.	Position Limit Switches (Nos.)		
9.	Torque Switches (Nos.)		
10.	Ratings of Switches		
11.	Position Transmitter		
12.	Space Heater		
13.	Thermostat (Nos.)		
14.	Internal Wiring		
15.	Terminal Plan		
16.	Contact Development Diagram		
17.	Painting		
18.	Weight	Kgs	



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Motor:

Sl. No.	DESCRIPTION	UNITS	DATA
1.	Nominal Output	KW	
2.	Rated Voltage	V	
3.	Rated Frequency	Hz	
4.	No. Of Phases		
5.	Admissible Voltage Fluctuation	%	
6.	Admissible Frequency Fluctuation	%	
7.	Admissible Voltage & Frequency Fluctuation	%	
8.	Full load torque	Kgm	
9.	Starting torque	Kgm	
10.	Run torque	Kgm	
11.	Nominal Current	A	
12.	Starting Current	A	
13.	Stall Current	A	
14.	Full Load Speed	rpm	
15.	Insulation Class (B / F)		
16.	Power Factor	%	
17.	Full Load Efficiency		
18.	Temperature rise over ambient temperature 40° C	Deg C	
19.	Type of Starter		
20.	Motor Type & Ref. Standard		
21.	OLR Value		

Gear Box:

1	Primary gear box type		
2	Gearbox ratio.		
3	Gear box efficiency	%	
4	Max. Operating torque.	Kgm	
5	Gearbox lubrication.		

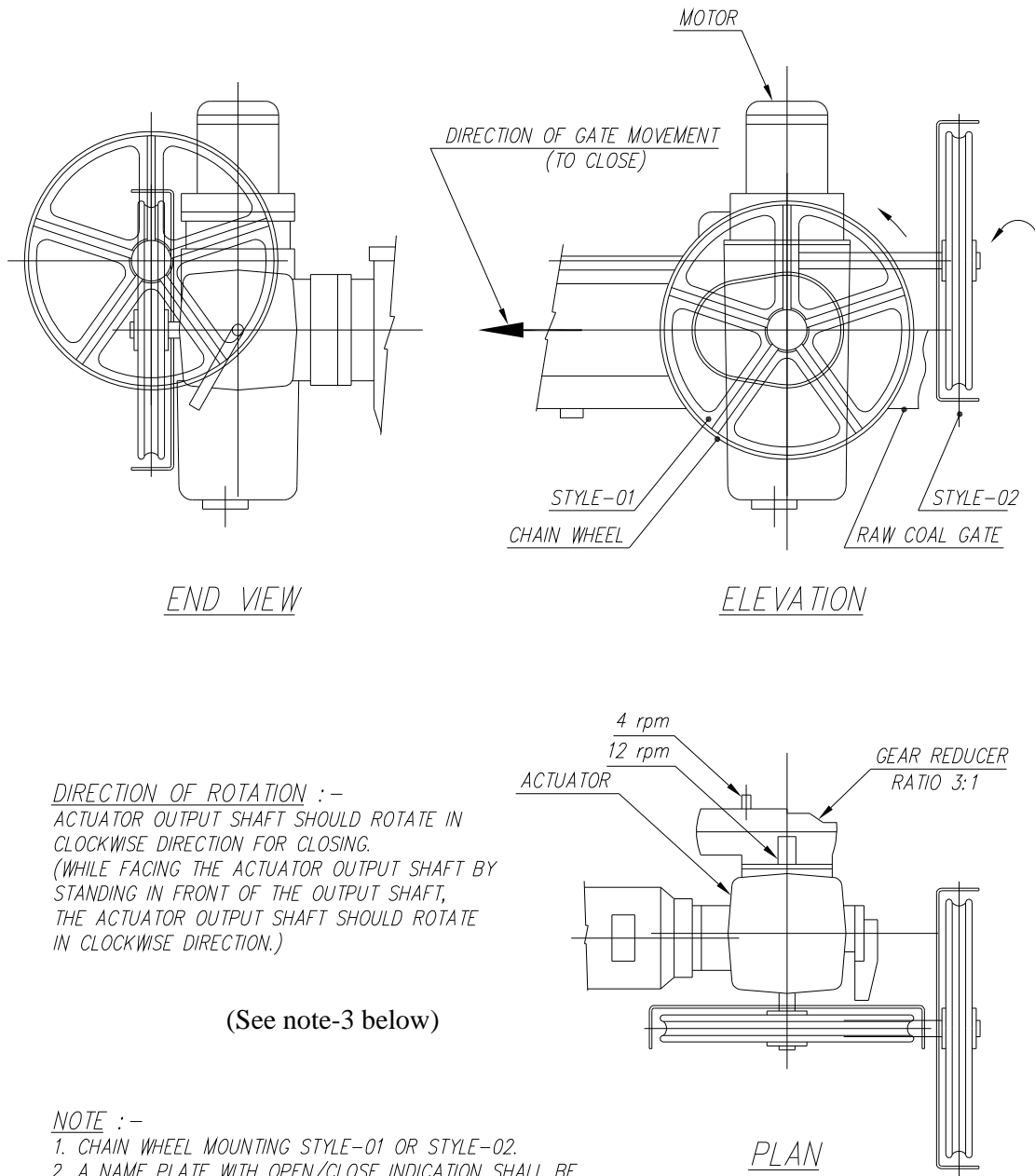
Supplier Signature With Stamp



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3. BHEL material code shall be indicated in the actuator name plate. (Refer to clause 19.4)

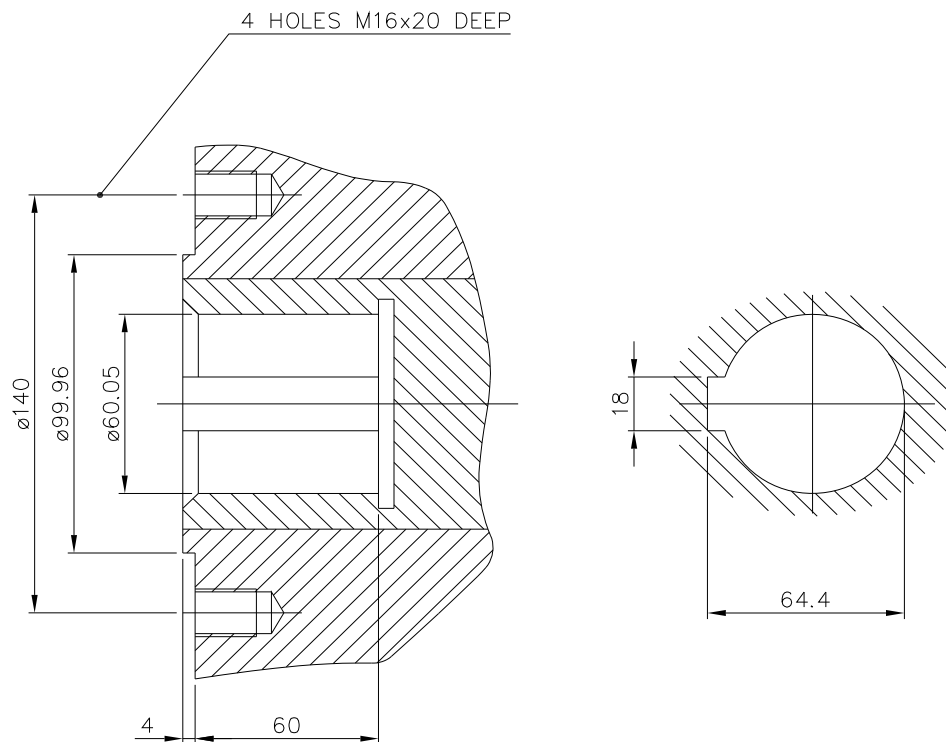
SKETCH-1



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MOUNTING & OUTPUT SHAFT
DETAILS

SKETCH-2

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		POSITION OF GATE			
	LIMIT SWITCH CONTACT TERMINAL No.	FULL OPEN	INTERMEDIATE	FULL CLOSE	
OLS-1 & OLS-2	17 – 18 & 33-34	–	X	X	THESE LIMIT SWITCH CONTACTS ACT ON VALVE REACHING RESPECTIVE POSITION
	19– 20 & 35-36	X	–	–	
	21-22 & 37-38	-	X	X	
	23-24 & 39-40	X	-	-	
CLS-1 & CLS-2	25-26 & 41-42	X	X	–	
	27 –28 & 43 –44	–	–	X	
	29-30 & 45-46	X	X	-	
	31-32 & 47-48	-	-	X	
OTS	1 – 2& 5 – 6	–	X	X	THESE LIMIT SWITCH CONTACTS ACT ON THE TORQUE SET BEING REACHED
	3– 4& 7– 8	X	–	–	
CTS	9 –10 & 13– 14	X	X	–	
	11 – 12& 15 – 16	–	–	X	
“X” INDICATES CONTACT CLOSED			“-” INDICATES CONTACT OPEN		

REFER WIRING DIAGRAM PAGE-12 OF 15


CTS – TORQUE SWITCH FOR C.W.ROTATION (CLOSE)

OTS – TORQUE SWITCH FOR C.C.ROTATION (OPEN)

OLS –1 & OLS-2 – LIMIT SWITCHES FOR POSITION OPEN

CLS –1 & CLS-2 – LIMIT SWITCHES FOR POSITION CLOSE

SKETCH-3

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ANNEXURE - I TO SPECIFICATION GF-331
(SPECIFICATION FOR VALVE ACTUATORS WITH INTEGRAL STARTER)

1.00 TYPE:

The actuators shall have integral starters along with over load relays with built-in SPP (Single Phasing Preventor). A 415V, 3phase 3-wire power supply shall be given to the actuator from BHEL switchboard through a switch fuse unit. Control voltage of the motor starter shall be 24V DC, derived suitably from 415V power supply.

In case supplier's standard control voltage for Open / Close Contactors is 110V AC, the same is acceptable if suitable Opto Isolation circuit is provided with coupling relays for 24V DC command inputs.


2.00 INTER FACES

Open / Close command termination logic with position & torque Limit Switches, positioner circuit shall be suitably built in the PCB inside the actuator.

FOR BINARY DRIVE: Open / Close command & status thereof and disturbance monitoring signal (common contact for Overload, Thermostat, control supply failure, L/R selector switch in local & other protections operated) shall be provided. Interface with the control system shall be through hardware signal only. Inter posing relays provided (with coil burden 2.5 VA) in the actuator shall be energized to initiate opening and closing, by 24V DC signal from the external control system.

3.00 RATING:

- a) Supply Voltage & frequency: 415 +/- 10%, 3 Phase, 3 Wire 50Hz +/- 5%.
- b) Sizing: Open / Close at rated speed against designed differential pressure at 90% of rated voltage. For isolating service three successive open-close operations or 15 mins. Whichever is higher? For regulating service, 150 starts per hour or required cycles, whichever is higher?

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4.00 CONSTRUCTION:

- a) ENCLOSURE: Totally enclosed weatherproof minimum I5 degree of protection.
- b) GEAR TRAIN: Metal (Fibre gears are not acceptable) self-locking to prevent drift under torque switch (where ever applicable) spring pressure when motor is de-energized.
- c) MANUAL HAND WHEEL: Shall disengage automatically during motor operation.

5.00 MOTOR:

- a) TYPE: Squirrel cage induction motor. Direct on line starting with starting current limited to six times the rated current.
- b) ENCLOSURE: Totally enclosed, self-ventilated, IP-55 degree of protection.
- b) INSULATION: Class B or better. Temperatures raise 70 deg C. over 50 deg Cambient.
- d) BEARINGS: Double shielded, grease lubricated antifriction.
- e) EARTH TERMINALS: Two
- f) PROTECTION: Single Phasing Protection, Over heating protection through Thermostat and wrong phase sequence protection shall be provided over and above other protection features standard to bidders design. Suitable means shall be provided to diagnose the type of fault locally.

6.00 POSITION / TORQUE SWITCHES:


Four nos. (2 each in open and close position) position limit switches & two nos. (one each in open and close direction) torque switches each having two nos. NO and two nos. NC contacts, shall be provided.

All contacts of limit switches at each position shall be actuated by a single shaft.

7.00 LOCAL OPERATION:

It shall be possible to operate the actuator locally also.

Lockable local/ remote selection shall be provided on the actuator.

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8.00 POSITION INDICATOR:

To be provided for 0 to 100% travel.

9.00 TERMINAL BOX:

To terminate command and position feed back signals with external control systems, 9 pin plug and socket (1 no. Per actuator to suit 4 pair 0.5 sq.mm.copper over all shielded (16mm OD), instrumentation cable shall be mounted in the starter box itself. For actuators with 4-20 mA position transmitters (regulating and inching duty) additional one number 5 pin plug and socket (to suit 2 pair 0.5 sq.mm copper (13 mm OD) individual and overall shielded instrumentation cable shall be mounted in the starter box itself. Necessary cable glands for power cable shall be provided.

10.00 TERMINAL BLOCK:

650 V grade for power cables.

11.00 SPACE HEATER:

Space heater of suitable rating. The supply shall be derived from the main power supply available in the actuator.
