



365-147/B
31.08.16

BHEL – Tiruchirappalli – 620014,
India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:AC:001** Rev: **07**

Effective Date: **20/08/2020**

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Product: Specification for Electrical Actuator

Revision Record:

Rev. No	Date	Details of Revision
04	01 January 2005	Specification updated for Rate contract
05	21 December 2005	High torque actuator requirement included
06	01 November 2013	Specification updated for Rate contract. Std. wiring diagrams added
07	20 August 2020	Specification format changed. Updated to take care Spring loaded type actuator.

IMPORTANT INSTRUCTIONS:

- Vendor shall furnish point-to-point confirmation / deviation to each clause of this specification explicitly.**
- The offer shall be submitted along with all the documents required in this specification. Offer without all supporting documents requested in this specification will not be considered.**

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.0	GENERAL	
G.1.0	ENCLOSURE:	
G.1.1	Actuators shall be of totally enclosed weather proof and dust proof construction with min. IP 68 enclosure and shall be suitable for outdoor applications. The actuator should be capable of operating in ambient temperature of -20 deg.C to +70 deg.C.	
G.2.0	VOLTAGE:	
G.2.1	The unit shall be suitable for operation on a 415V, 3 phases, 50Hz. -3 wire system for actuator with integral starters. -4 wire system for actuator without integral starters.	
G.3.0	CONSTRUCTION:	
G.3.1	Actuators shall have provision to accommodate raising spindle of the valve and the hole shall be properly covered with a removable lid. The actuator shall be supplied with stem protection tube to accommodate larger spindle travel as indicated elsewhere in this specification. All the above parts, i.e. The threaded portion of actuator, removable lids and stem protection tubes shall be able to withstand the prolonged outdoor storage without getting rusted or damaged.	
G.3.2	The actuator shall be suitable for mounting directly on the valve. The actuator shall be capable of giving the required torque, rpm and thrust. The actuator shall be suitable for mounting in any position. Indicate the adjustable range of torque and starting torque of actuator in kgm/Nm 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. All Gears used shall be metallic. Fiber gears are not acceptable. Metallic gear trains used shall be self-locking to prevent drift under torque switch (wherever applicable) spring pressure when motor is de energised.	



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Clause No	Specification requirement	Vendor confirmation / comments / deviation
G.3.3	Actuator shall have thrust base with blank removable adaptor bush of aluminum bronze, which can be threaded to accommodate raising spindles of valve. NI-Resist material shall be supplied as optional if required.	
G.3.4	The exact mounting arrangement with dimensions shall be clearly furnished in the enclosed drawing. The flange dimension shall be as per DIN/ISO standard. For high torque actuator mounting dimensions shall be as per the BHEL approved dimensions.	
G.3.5	The dimension drawing of the blank adaptor bush shall be furnished in the enclosed drawing.	
G.3.6	Each actuator shall have a hand wheel fitted on it for manual operation in case of power failure. It shall be possible to fully open /close the valve with the hand wheel. The hand wheel shall be designed such that its engaging lever declutches automatically when the power supply to the motor is restored. The material of the hand wheel shall be either malleable iron or steel. The hand wheel-engaging lever shall give trouble free performance under repeated operations. Side mounted hand wheel with gear can be offered as optional. The hand wheel construction shall be strong enough to withstand the impacts of normal handling and storage of actuator without any damage. The hand wheel shall be able support the weight of the actuator, without any damage to actuator or hand wheel, when actuator is rested on the hand wheel.	
G.3.7	Actuators offered shall be with self-locking worm.	
G.3.8	Actuators shall have provision to set the Torque value from 40% of the maximum Torque mentioned in the below Table 1 .	
G.4.0	SPRING LOADED / THRUST COMPENSATOR ASSEMBLY OUTPUT DRIVE	
G.4.1	Spring loaded (or) thrust compensator drive assembly shall be provided wherever “ AF ” indicated in the actuator requirement Ref (Table 2). This drive assembly is required to take care of high dynamic thrust, which will be developed during multistage reduction process.	
G.5.0	REVOLUTIONS:	
G.5.1	Desired output shaft speeds are given below for different torque ranges. Actual speeds of actuators offered shall be clearly indicated.	
G.6.0	WEIGHT:	
G.6.1	Furnish weight of actuator including all accessories.	
G.7.0	LUBRICANT:	
G.7.1	Oil plugs shall be provided for filling and draining.	



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G.7.2	The gearbox of the actuator shall be oil filled or grease filled. The oil/grease must be suitable for operation for 80 Deg. above ambient temperature. Furnish detail of lubricant used with Indian oil Company's BPCL, IOCL & HPCL's equivalent. The actuator shall have proper seals to prevent leakage of oil at all installation positions. The actuator construction shall be such that the oil/grease does not leak to other compartments or outside. In case of any complaint of such leakage, the complaint shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	

TABLE 1

Sl.No	Maximum Torque (Kg-M)	RPM (Approx)	Out put flange details (LD x PCD x Bolt Details.)	Stem Protection Cover in mm (unless other wise specified)
1	3.5	18	60 x 102 x 4Nos M10*	100
2	6	24	60 x 102 x 4Nos M10*	100
3	15	36	60 x 102 x 4Nos M10*	150
4	30	36	100 x 140 x 4Nos M16*	250
5	50	36	127 x 165 x 4Nos M20*	300
6	60	96	100 x 140 x 4Nos M16*	400
7	80	36	152 x 254 x 8Nos M16*	400
8	100	96	127 x 165 x 4Nos M16*	500
9	200	32	177.8x298.5-8Nos M20*	300
10	400	32	215.9x355.6-8 Nos M24*	400
11	800	22	228.6x406.4-8NOS M30*	450
12	1100	22	228.6x406.4-8NOS M30*	450
13	1600	22	228.6x406.4-8NOS M30*	500

TABLE 2

Sl.No	Max.Torque (Kg-M)	RPM (Approx)	Out put flange details in mm (LD x PCD x Bolt Details.)	Stem Protection Cover in mm	Output drive type
1	15	36	F14 (100 x 140 x 4Nos M16)*	250	Spring loaded/ Thrust compensator assembly
2	25	36	F14 (100 x 140 x 4Nos M16)*	300	

***-Vendor has to adhere this BHEL's specific requirement**



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Clause No	Specification requirement	Vendor confirmation / comments / deviation
G.8.0	DIMENSIONAL CATALOGUES (In English language)	
G.8.1	Three copies of catalogues of the actuators describing the constructional details, over all dimensions of the actuators, maximum spindle acceptance diameters and other details called for in the specification.	
G.9.0	O & M INSTRUCTION MANUALS: (In English language)	
G.9.1	O&M manual should have the procedure for safe disposal of items of failed actuator components along with O & M instruction. i) One Hard copy of Operating and Maintenance Instruction Manual along with wiring diagram shall accompany each actuator ordered. ii) One set soft copy O&M along with wiring diagram should be submitted before actuator dispatch.	
A.0	ACCESSORIES	
A.1.0	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. The type of torque switch like rotary/cam shall be mentioned in the data sheet.	
A.1.2	The torque switches shall have accuracy of plus or minus 5% of set value.	
A.1.3	A scale shall be provided for each torque switch to set required torque. Each division shall indicate actual value of torque. The scale-setting knob shall have locking screw to avoid any setting disturbance at site due to line vibration.	
A.1.4	Actuators shall have provision for bypassing the torque switch during initial 5% opening of valves. Details for this must be indicated in the wiring diagram.	
A.1.5	The wiring diagram shall include details of changes to be done for making the actuator suitable for torque seating or position seating valves.	
A.2.0	LIMIT SWITCHES:	
A.2.1	Two numbers of position limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts. The type of limit switch like rotary/drum/cam type shall be mentioned in the data sheet.	
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	Each limit switch shall be capable of being set to trip at any position independently between fully open and fully closed position.	
A.2.4	Limit switches and torque switches shall be weather proof suitable for damp atmospheres, and shall not cause any trouble during commissioning and operation. Further the operating mechanism of the switches (like shafts, gears, cams, metallic parts etc) shall be able with stand exposure to damp atmosphere for long time without getting rusting or damaged. If any such damage is reported it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	
A.2.5	The torque and position limit switches shall be suitable for the following ratings, both 240 volts, AC, 5 amps and 220 volts DC, 0.5 amps. The insulation level between each set of contacts shall be minimum of 1.2KV for 1min.	



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Clause No	Specification requirement	Vendor confirmation / comments / deviation
A.3.0	LOCAL POSITION INDICATORS:	
A.3.1	Each actuator shall have a local position indicator to indicate 0 to 100% of valve travel.	
A.3.2	The actuator shall be suitable for operating different valve size with varying lifts. The actuators shall have adjustable gear for the local position indicator so that accurate indication of valve position can be obtained for all valve lifts by adjusting the gears. The gears selection chart for setting of local position indicator and mechanical transmitter for different valve lifts (output shaft revolutions) shall be furnished. Also one set of change gears shall be supplied along with each actuator, alternately the change gears/spacers shall be supplied in sufficient quantities whenever required.	
A.4.0	ANTI-CONDENSATION HEATER (SPACE HEATER):	
A.4.1	Each actuator shall have an anti-condensation heater in the limit switch compartment. In case of integral starter actuator the space heater supply shall be derived internally, if integral starter is not available it shall be suitable for 240V AC 50 Hz single phase supply. The wattage of the heater shall be specified in the data sheet and wiring diagram.	
A.5.0	REMOTE POSITION TRANSMITTER:	
A.5.1	Open/Close actuator shall have two Nos. of resistance type position transmitter for remote indication. Rating of position transmitter 100ohms, 50 Volts, AC/DC. A suitable fixed dropping resistor must be put in series for limiting the power consumption.	
A.5.2	For regulating and inching duty applications, actuators shall have one electronic position transmitter (EPT), suitable for 24V DC with an output of 4-20mA and 2 wire. LVDT type transmitter shall be supplied wherever indicated.	
M.0	MOTORS	
M.1.0	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 plus or minus 10% of the rated value of 415 Volts. b. If the frequency of the power source varies within plus or minus 5% of 50 Hz. 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.2.0	CONSTRUCTION:	
M.2.1	Motor shall be totally enclosed with min IP68 weatherproof enclosure and shall be suitable for outdoor installation without canopy. In case of any water leakage due to enclosure failure it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	
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.	



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M.2.3	Motor shall be painted with corrosion proof & weather proof paint. Painting colour scheme shall be as per BHEL's requirement, which will be informed after placement of order.	
M.3.0	INSULATION:	
M.3.1	Motor shall have class F non-hygroscopic insulation with tropicalisation suitable for polluted dusty and corrosion atmospheres of relative humidity 100%. Motor shall be designed for the design ambient temp. However, the temperature rise of the motor winding shall be limited to the maximum temperature allowed for class 'B' insulation. It shall also be possible to rewind the motor in case the windings and insulation get burnt out.	
M.4.0	RATING:	
M.4.1	Motors shall be S2-15 min. rating. This shall not be less than the highest of the following: 1) Fifteen minutes. 2) As required for three successive open/close operations. 3) As required for the service. The motor shall be suitable for min 60 starts/hr. for on/off and 150 starts/hr. for inching duty application. 600 and 1200 starts/hour shall be given as optional.	
M.5.0	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.	
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, at 1/3 load. 3. The torque at reduced supply voltage shall be mentioned for 75% voltage, 80% voltage, 85% voltage & 90% voltage.	
M.6.0	BEARINGS:	
M.6.1	Bearing shall be of double shielded, grease lubricated antifriction type. The anticipated bearing life shall be indicated for all models.	
M.7.0	EARTHING TERMINALS:	
M.7.1	Two earthing terminals shall be provided on either side of the motor.	
M.8.0	MOTORS:	
M.8.1	Motors shall be provided with three numbers of Thermostats, one in each winding, for over load protection.	
M.9.0	MOTOR DATA:	
M.9.1	One set of hard and soft copies of motor data sheets for each type of actuators ordered shall be furnished as per format furnished.	
M.10.0	WEIGHT	
M.10.1	Weight of the actuator with and without starter shall be furnished separately along with the offer.	
M.11.0	TESTS:	
M.11.1	Tests shall be carried out as per approved QP.	



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Clause No	Specification requirement	Vendor confirmation / comments / deviation
C.0	CONTROLS	
C.1.0	INTERNAL WIRING:	
C.1.1	Internal wiring diagram shall be neatly pasted on cover of terminal box.	
C.1.2	Internal wiring shall be done with 1.5 sq.mm PVC insulated copper wires. Ferrules should be provided on both ends of the wire for easy identification.	
C.2.0	FEATURES APPLICABLE TO INTEGRAL STARTER	
C.2.1	Control supply shall be derived with step down transformer from 415V, 3 PH, 50Hz incoming supply (For AC actuator only). Necessary primary and secondary fuses shall be provided. All the PCBs shall be protected against moisture by suitable coating and treatment - in case of failure of PCBs due to moisture entry it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	
C.2.2	Automatic phase correction facility and single phasing prevention shall be available.	
C.2.3	Pad lockable Selector switch for LOCAL-OFF-REMOTE selection with OPEN-STOP-CLOSE push buttons (for local operation) shall be provided.	
C.2.4	It should also be possible to reverse the direction of travel for inching valves (in LOCAL and REMOTE) without giving stop command.	
C.2.5	In addition to mechanical dial position indicator, lamp indication for full open, full close and in-travel positions shall be provided.	
C.2.6	Electrically and mechanically interlocked contactors shall be provided for forward and reverse operation. Contactor rating shall be sufficient to withstand the extreme conditions like valve jamming and instantaneous reversal of motor.	
C.2.7	Potential free contacts for LOCAL-OFF-REMOTE positions shall be wired to terminals and available for customer connections.	
C.2.8	Open/Close command termination logic with position and torque limit switches shall be suitably built in the PCB inside the actuator.	
C.2.9	The selection of the following mode shall be available locally on actuator through suitable switch programming. It shall also be clearly described in wiring diagram. a) Valve seating by torque switch (close) or limit switch (close) shall be available. b) Inching (non self-retaining) or non-inching (self-retaining) for remote command and local mode shall be field configurable.	
C.2.10	Provision shall be there for bypassing the torque switch during initial 5% opening and closing of valves. Details for this must be indicated in the wiring diagram. This shall be done through electronic circuit or through one 'NC' contact of 'limit switch'.	
C.2.11	A minimum of '1NO+1NC' contact of Main limit switches and torque switches shall be available for customer use. All the contacts of aux. Limit switches shall also be available for customer use.	



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C.2.12	Actuator shall be suitable for remote operation by potential free contacts for open / close and stop, the necessary 24V DC power supply shall be derived internally. Also It shall be possible to energize the interposing relays provided (with coil burden $\leq 2.5\text{VA}$, one for open and one for close) to initiate opening and closing by 24V DC signal from the external control system.	
C.2.13	24V Power supply for EPT shall be derived internally.	
C.2.14	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 / Data sheets .	
C.2.15	A common potential free contact (monitoring relay) shall be available to annunciate the following faults. a) Thermostat trip b) OLR trip c) Valve jammed in mid-travel. d) Motor single phasing. e) Power failure. f) Local stop or local/remote selector switch in local mode.	
C.2.16	The following status annunciation shall be made available locally (integral to actuator) a) Actuator running in OPEN b) Actuator running in CLOSE c) Internal 24V DC Control voltage healthy d) 24V DC availability for customers use healthy.	
C.2.17	The following individual fault annunciation shall be made available locally (integral to 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	
C.2.18	BLINKER RELAY: Blinker relay contact for remote indication of 'actuator running' is to be provided as a standard part of integral starter actuator.	
C.3.0	TERMINAL BOX:	
C.3.1	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 clip-on type/screw type with sufficient insulation between 2 adjacent terminals. All terminals must be suitable for 2 nos. of 2.5 sq.mm wires.	
C.3.2	Minimum 10 numbers of terminals shall be available in the terminal board as spare terminals.	



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C.3.3	Terminal box of actuator shall be weather proof and have enough space for connecting three numbers of PVC insulated unarmoured copper conductor control cable 19-pair / 1.5 sq.mm. One Number PVC insulated unarmoured copper / aluminium conductor power cable with sizes as indicated in clause C.3.1. Motor terminals shall be of stud type, screw type and press fit type depending on the power rating. Terminal box shall be fitted with a removable front cover plate.	
C.3.4	DEFAULT SETTING OF TORQUE SWICTH, DIAL INDICATOR ON AND TORQUE/LIMIT CLOSING. The requirement of the default setting of torque switch, dial indicator and torque closing/limit closing selections are already provided by BHEL for all models. The same has to be followed. The list of default setting to be included in the documents.	
C.4.0	CABLE GLAND:	
C.4.1	Actuators are to be provided as a standard with one cable gland for power and minimum 3 cable gland for control (or) two plug & sockets for control to be provided (In case of flameproof actuator 3 cable glands for control to be provided). The cable gland details along with the cable OD that can be accommodated is indicated below. If any other cable size is envisaged this will be informed during order stage. However for actuators with plug and socket, minimum necessary cable glands shall be provided. All the cable glands shall be of double compression type. Power cable size is given below. The cable entries shall be closed with metallic gland plug with suitable sealing (like 'o' ring) to ensure IP68 protection.	
C.4.2	Preferably all the cable glands shall be provided on one direction (face) only. Wherever this is not technically feasible, the cable gland on the second side shall be provided with necessary elbows, so that all glands will be facing at one side.	

KW	DESC	OD
UPTO 3 KW	3 Core x 2.5Sq.mm Copper unarmored PVC insulated	14±2mm
Above 3 to 7 KW	3 Core x 6Sq.mm Aluminum unarmored PVC insulated	17±2mm
Above 7 to 13 KW	3 Core x 16Sq.mm Aluminum unarmored PVC insulated	20±2mm
Above 13 to 24 KW	3 Core x 35Sq.mm Aluminum unarmored PVC insulated	25±2mm
Above 24 to 37 KW	3 Core x 70Sq.mm Aluminum unarmored PVC insulated	31±2mm



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C.5.0	FEATURES APPLICABLE TO FLAME PROOF ACTUATORS	
C.5.1	STANDARDS	
C.5.1.1	Actuators meant for hazardous area shall meet the requirements of latest IS 2148/IEC60079, IEC – 79 or equivalent International Standards.	
C.5.1.2	Indigenous equipment shall be certified by CIMFR and approved by PESO and DGFASLI and shall carry the BIS License Marking. All the certification shall be valid at the time of delivery.	
C.5.1.3	Imported equipment shall be tested and certified by an independent certifying agency of country of equipment origin.	
C.5.2	ENVIRONMENT:	
C.5.2.1	Area Classification: Class 1, Division 1, Zone 1	
C.5.2.2	Gas Group: IIA & IIB. - IIC if specified	
C.5.2.3	Temperature Class (As per IEC-79): T3 (200 Deg. C) T4 if specified	
C.5.2.4	Construction: Flame Proof Ex (d) as per IS 2148/IEC60079	
C.5.3	CABLE GLANDS: Flame proof, double compression Nickel plated brass cable glands shall be provided for conduit entries. Unused entries shall be plugged with flame proof plugs.	
D.0	DOCUMENTATION REQUIREMENTS	
D.1.0	The following documents are to be furnished along with offer and after ordering	
	a. GA drawings for all models including dismantling clearances.	
	b. The dimension drawing of the blank adopter bush	
	c. Data sheet for all models. Along with weight of the actuator	
	d. Dimensional catalogue with maximum spindle acceptance details	
	e. Wiring diagram for all models.	
	f. Gear selection chart for setting of local position indicator	
	g. Outline dimension of assembled motor.	
	h. Outline dimension of actuator.	
	i. Dimensional drawing of terminal showing the method of terminating incoming cables.	
	j. CIMFR Test Certificates for Flame proof Actuator	
	k. Approvals of PESO and DGFASLI for Flame proof Actuator	
	l. BIS License for Flame proof Actuator	
	m. General arrangement drawing of actuator consisting following as minimum.	



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	i) Identification of critical component with its material composition.	
	ii) Mounting flange dimension	
	iii) Hand wheel dimensions	
	iv) Actuator cover removal clearances	
	v) Weight of actuator with and without integral starter	
	vi) Stem protection cover length, thread size and type	
	vii) Double compression cable gland	
	viii) Separate drawing for details of cable gland cross section, min/ max.	
	ix) Cable OD that can be accommodated, critical dimension etc.	
	n. Quality plan.	
	o. Type test certificates	
	p. Default settings of torque, dial indicator and torque/limit closing for all models.	
Q.0	QUALITY REQUIREMENTS	
Q.1.0	INSPECTION AND TEST REQUIREMENTS	
Q.1.1	All equipments shall be subject to inspection by BHEL/ Client and/or their nominated inspecting authority. Vendor shall make all provisions in his shop/sub-vendors shops for complete inspection and test of actuator as per BHEL approved vendor's QP.	
Q.2.0	TESTS& INSPECTION:	
Q.2.1	During fabrication/testing, the actuator shall be subject to inspection by BHEL/CUTOMER or by any agency authorized by them. Manufacturer shall furnish all necessary information concerning the supply to BHEL/CUTOMER inspectors.	
Q.2.2	All routine tests as specified by the applicable standards shall be conducted.	
Q.2.3	Shop tests shall be witnessed by an inspector of BHEL/CUTOMER or of an agency authorized by customer.	
Q.2.4	Quality plan for the actuator to be followed.	
Q.3.0	PAINTING,PROTECTION,PACKING,SUPPLY & IDENTIFICATION:	
Q.3.1	SURFACE PREPARATION: Weld slag & spatter shall be removed and the surfaces to be coated shall be free from contamination. Surface defects shall be removed by suitable methods. Sharp edges shall be smoothened by grinding. Prior to surface preparation oil, grease, drilling emulsions, cutting emulsions and preservative agents shall be carefully removed by suitable solvents. The surface shall be carefully dried with clean cloths to prevent the dissolved impurities from spreading over the entire surface. The surface shall be cleaned by wire brush and shot blasting if required. Proper adhesiveness of paint to the surface shall be ensured.	



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Q.4.0	PAINT SHADE	
Q.4.1	The enclosures shall be treated and prepared for painting with suitable painting system for withstanding 500Hrs of salt spray as per ASTM B-117/ ISO9227 standard. Paint shade shall 'shade 692 of IS 5 (Smoke Grey)'. For NTPC projects the paint shade shall be as per the NTPC approved shade.	
Q.5.0	PACKING & TRANSPORT:	
Q.5.1	The actuator shall be supplied to site packed in wooden crates / Carton boxes. They shall be wrapped with polythene sheets. They shall have skid bottoms for handling. All spares shall be packed separately in boxes marked SPARE Special precaution notations such as Fragile. This side up, centre of gravity, weight, Owner's particulars. Purchase number etc. shall be clearly marked on the package together with other details as per purchase order. The equipment may be stored in a covered shed for long periods before installation. The packing should be suitable for such storage.	
S.0	SPARES	
S.0.1	Supplier shall specify a list of recommended spares for 2/5 years trouble free operation. An exploded view of the actuator shall be furnished with part numbers for identifying the spares.	
T.0	TEST REQUIREMENTS FOR ACTUATORS	
T.1.0	ROUTINE TEST:	
T.1.1	Dimensions: Overall and mounting	
T.1.2	Details of painting as per specification and vendor practice: Anti-corrosiveness Epoxy.	
	i. Shade.	
	ii. Finish	
	iii. Paint thickness	
T.1.3	Manual operation through hand wheel.	
T.1.4	Testing of position and torque limit switches for accuracy and repeatability.	
T.1.5	Hand-Auto switching function.	
T.1.6	For motors, all routine tests as called in IS: 325 / BS 4999 from motor manufacturer.	
T.1.7	Output shaft speed and torque of actuator and corresponding current.	
T.1.8	Stall current and stall torque for the actuator assembly.	
T.1.9	a. Position indicator and transmitter: Calibration check for accuracy, linearity and repeatability.	
	b. Functional test for electronic position transmitter.	
T.1.10	Leakage test for gear case (visual).	
T.1.11	HV test at 1.6 KV (80% of 2 KV) for the assembled actuator.	
T.1.12	Operation of actuator under variation in supply voltage (plus or minus 10%) for verifying rated torque and speed.	



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Clause. No	Specification requirement	Vendor confirmation / comments / deviation
T.1.13	Checking of wiring as per approved wiring diagram (Typical WD for actuators without starters is attached).	
T.1.14	The following tests are applicable for integral starter actuators	
	a. Functional test for local / remote / off selection	
	b. Open/close/stop operation in local and remote mode.	
	c. OLR tripping	
	d. Functional test, temperature raise test and burn-in test on PCB	
T.2.0	TYPE TEST certificates shall be provided for the following tests.	
T.2.1	Type test for motor as per IS:325/BS 4999 part 60.	
T.2.2	Noise and vibration test for total assembly IS: 4729/BS 4999.	
T.2.3	Temperature rise test during:	
	a. Operation of actuator at 90% voltage.	
	b. Operation of actuator at 50 degree C ambient.	
T.2.4	Operation with variation in frequency (plus or minus 5%) for verifying rated torque and speed.	
T.2.5	Enclosure protection for the total assembly.	
T.2.6	Endurance test for actuator.	
T.2.7	Endurance test for limit switches.	
T.2.8	Damp heat cycle test as per IS:9000/IEC 68-30.	
T.2.9	Following test are applicable for integral starter actuators	
	a. Type test on bare PCB	
	b. Life cycle test	
N.0	NOTES:	
N.0.1	These quality plans shall be approved by BHEL.	
N.0.2	All testing facilities shall be arranged by the vendor, at his works before calling BHEL representative for inspection.	
N.0.3	Approved drgs., PO specification and relevant standards if any shall be made available during testing / inspection.	
N.0.4	All measuring and testing instruments shall be periodically calibrated from National test house and certificates made available during inspection.	
N.0.5	All relevant GA drawings, data sheets & wiring diagrams shall be submitted as controlled copy and approval shall be obtained from BHEL. All supply shall be as per these documents.	

Applicable terminal plans for actuator with integral starter (3-V-MISC-24227),

Actuator without integral starter ((4-V-MISC-90271) and

For NTPC projects integral starter with Plug Socket (3-V-MISC-24283) enclosed



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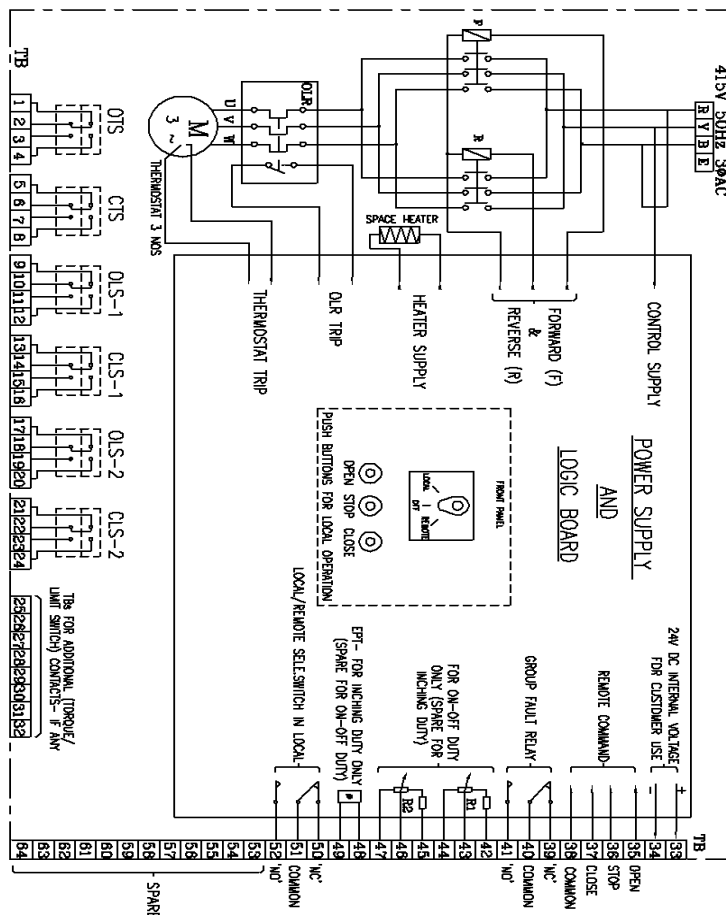
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L2747-CSIM-V-3
ON DRAWING

ALL DIMENSIONS ARE IN MILLIMETRES FOR TOLERANCES OF UNBALANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP



NOTE:-

1. ALL TORQUE AND LIMIT SWITCHES (OTS, CTS, OLS-1&2, CLS-1&2) ARE WITH 2NO+2NC CONTACTS
1NO+1NC IS TERMINATED IN TBS 1-24. REMAINING CONTACTS ARE FOR INTERNAL USE.
ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
2. CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
3. OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
4. OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
5. CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
6. EPT - ELECTRONIC POSITION TRANSMITTER
(POTENTIOMETER TYPE, FOR INCHING DUTY)
7. RT-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC
OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
9. M - MOTOR 3A 415V 50 Hz AC SUPPLY

SWITCH TERMINALS FOR CUSTOMER USE

REVY DATE
CHD & APPD

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

TYPE OF PRODUCT		ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS	
OR NAME OF CUSTOMER/PROJECT		(DRAWN FOR INTERMEDIATE POSITION OF VALVES)	
BHARAT HEAVY ELECTRICALS LTD.		BHARAT HEAVY ELECTRICALS LTD.	
UNIT: HIGH PRESSURE BOLTER PLANT		UNIT: HIGH PRESSURE BOLTER PLANT	
PROJECT NO: 365-171		PROJECT NO: 365-171	
SCALE		SCALE	
WEIGHT (KG)		WEIGHT (KG)	
DRAWING NO		DRAWING NO	
3-V-MISC-24227		3-V-MISC-24227	
REV		REV	
0		0	

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH			
VALVES	OPEN		CLOSE
	MAIN	BACK UP	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OTS	OTS *	CLS
ALL OTHER GATE & GLOBE VALVES	OTS	OTS *	CLS
# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT			
* - BYPASS OTS FOR INTNL 5% OF TRAVEL (FOR GATE VALVES ONLY)			

CONTACT DEVELOPMENT DIAGRAM			
OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL	
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL	
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL	
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL	
OLS-1	9-10	OPEN AT OVER TORQUE DURING OPENING TRAVEL	
	11-12	CLOSE AT OVER TORQUE DURING OPENING TRAVEL	
OLS-1	13-14	OPEN AT OVER TORQUE DURING CLOSING TRAVEL	
	15-16	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL	
OLS-2	17-18	OPEN AT OVER TORQUE DURING OPENING TRAVEL	
	19-20	CLOSE AT OVER TORQUE DURING OPENING TRAVEL	
CLS-2	21-22	OPEN AT OVER TORQUE DURING CLOSING TRAVEL	
	23-24	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL	
SWITCH	TERMINAL NO.	VALVE POSITION	TRIP NO.
	0	INTERMEDIATE	5
	1	OPEN	6
	2	CLOSE	7



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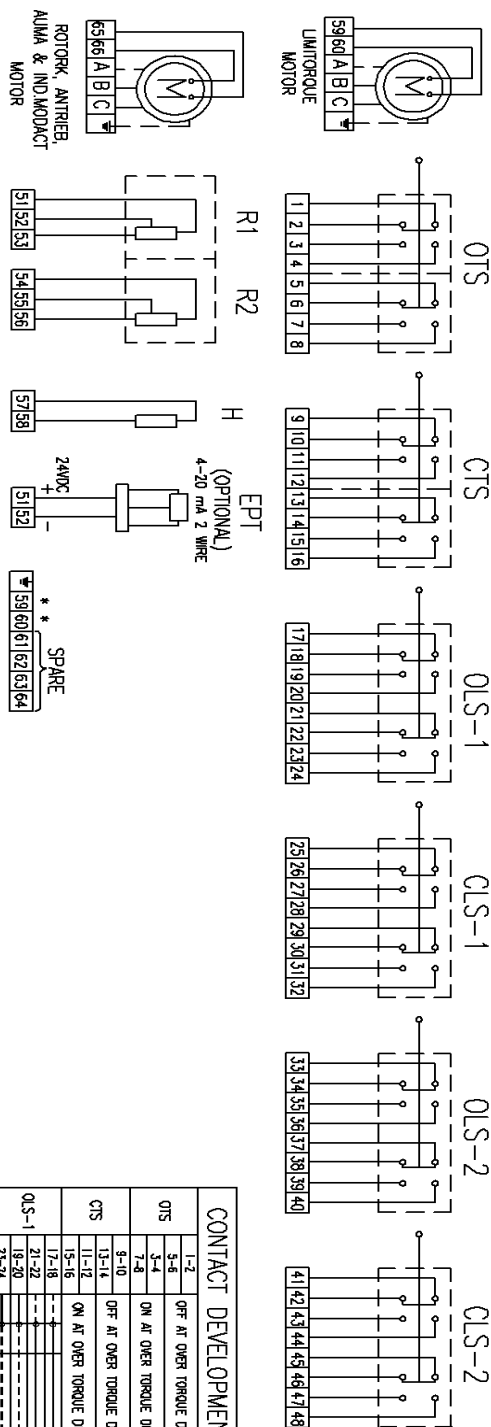
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* - SPARE FOR ROTORK, AUMA, ANTIREB & INDMODACT
SWITCHES - ALL ARE POTENTIAL FREE AND TWO PAIR OF CONTACTS CAN BE USED FOR DIFFERENT SUPPLY
THERMOSTAT - 65-66 (ROTORK, AUMA, ANTIREB & INDMODACT), 59-60 (LIMTORQUE),
EPT - ELECTRONIC POSITION TRANSMITTER (POTENTIOMETRIC TYPE, FOR INCHING DUTY)
THERMOSTAT TERMINALS - TERMINATED IN MOTOR TB IN ANTIREB & INDMODACT AND IN MAIN TB IN OTHER MACHES
CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE) - 2 NO+2 NC
OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN) - 2 NO+2 NC
OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN - 2 NO+2 NC
CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE - 2 NO+2 NC
OTS, CTS - TWO INDEPENDENT SWITCHES IN ANTIREB & LIMTORQUE
OLS-2 & CLS-2 - CAM DISC IN ROTORK & ANTIREB
R1-R2 - POTENTIOMETER 2 x 100 OHMS
H - SPACE HEATER 1ø 240V AC SUPPLY
M - MOTOR 3ø 415V 50 Hz AC SUPPLY

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH				
VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF 100 mm AND ABOVE	CLS	OTS	CLS	CTS
IN 1500 CL AND ABOVE RAININS				
ALL OTHER GATE & GLOBE VALVES	CLS	OTS	CTS	Ø

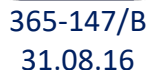
Ø - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT
NOTE:
1. BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)
2. CONNECT THERMOSTAT WITHOUT FAL IN THE STARTER CIRCUIT

CONTACT DEVELOPMENT DIAGRAM									
CONTACT	NO.	SWITCH	TERMINAL	FULL OPEN	INTERMEDIATE	FULL CLOSE	VALUE POSITION	INDICATES CONTACT CLOSED	INDICATES CONTACT OPEN
OTS	1-2		21-22						
OTS	3-4		18-20						
OTS	7-8		23-24						
OTS	9-10		25-26						
OTS	11-12		27-28						
OTS	13-14		29-30						
OTS	15-16		31-32						
OTS	17-18		33-34						
OTS	19-20		35-36						
OTS	21-22		37-38						
OTS	23-24		39-40						
OTS	25-26		41-42						
OTS	27-28		43-44						
OTS	29-30		45-46						
OTS	31-32		47-48						
OTS	33-34		49-50						
OTS	35-36		51-52						
OTS	37-38		53-54						
OTS	39-40		55-56						
OTS	41-42		57-58						
OTS	43-44		59-60						
OTS	45-46		61-62						
OTS	47-48		63-64						

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

BHARAT HEAVY ELECTRICALS LTD.				BHARAT HEAVY ELECTRICALS LTD.			
UNIT: HIGH PRESSURE BOILER PLANT, TIRUCHIRAPPALLI 620014.				UNIT: HIGH PRESSURE BOILER PLANT, TIRUCHIRAPPALLI 620014.			
365-139				365-139			
N.P.ESWAR				N.P.ESWAR			
DRAWN				DRAWN			
KARUNACHALAM				KARUNACHALAM			
CHECKED				CHECKED			
PILCOMATHAN				PILCOMATHAN			
APPROVED				APPROVED			
DATE				DATE			
09.09.2000				09.09.2000			
CONTACT DEV. RECORDED.				CONTACT DEV. RECORDED.			
REV				REV			
DATE				DATE			
09.09.2000				09.09.2000			
4-V-MISC-90271				4-V-MISC-90271			
REV				REV			
11				11			

RETRACED WITH REVISION 11



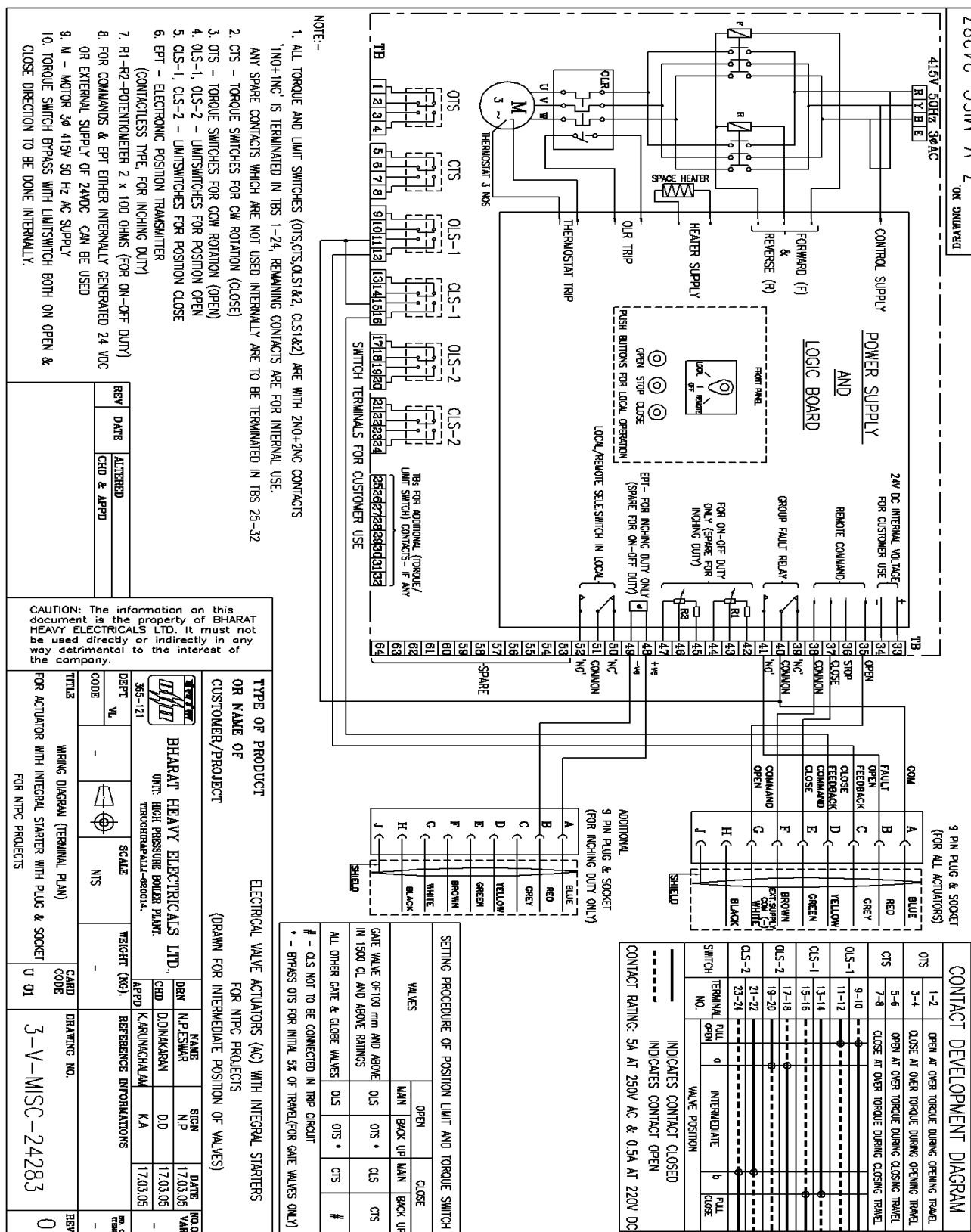
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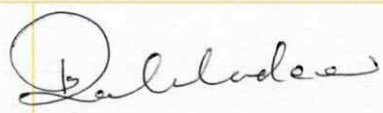
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Signature			
Name	S.MADHURAM	K.JAJALUDEEN	D.KAVITHA
Designation	DY.ENG	DM	DGM
Date	20 August 2020	20 August 2020	20 August 2020
Action	Prepared By	Checked & Reviewed By	Approved By