



TECHNICAL MANUAL
FOR

emtork[®]

**ELECTRIC
ACTUATORS**

THREE PHASE ROTARY, QUARTER
TURN & LINEAR MODELS IN
STANDARD & FLAMEPROOF
V E R S I O N S

(Emtork is the Registered Trade Mark of MARSH)

MARSH MAKE EMTORK ELECTRIC ACTUATORS AND SUPPLEMENTARY GEAR BOXES

1. **APPLICATION :**

The "Emtork" Electric Actuators are electromechanical units used for operating the final control elements like valves or dampers to control the flow of fluids flowing thru the pipes or ducts. The specific advantages of using these units are :

- Ease of operation
- Remote control facility
- Proportional action of final control element in close loop system.
- Attaining & holding the desired preset position of the valve/damper.
- Various indications & alarms are available on the remote control panel & also on the unit.
- Emergency manual operation possible in case of power failure.
- Works on most convenient & easily available source of energy i.e. electricity.
- Models available to cover wide range of valves & dampers.

2. **DESIGN FEATURES :**

The Emtork actuators are specially designed and manufactured to suit the Indian operating conditions. Maximum durability, operational reliance and complete safety is assured when the valves are equipped with 'EMTORK' Actuators.

2.1 ***Basic Design :***

The Emtork actuator is basically a worm gear type reduction gear box. A single stage grease bath worm gear gives quietness and reliability in operation. The valve can be full opened, full closed or adjusted to any intermediary position. The reactionary force on the Worm shaft, which is a "Floating one", is directly proportional to the output torque and is absorbed by a set of disc Springs. The lateral movement of the worm shaft under load, trip closes the torque switch. The driving motor is a TEFC squirrel cage class F IP65 enclosure motor combining low inertia with a high starting and stalling torque. The output sleeve is provided with suitable coupling arrangement and fixing holes as per DIN 3210 for connection to the valve body. Actuators with IP 67/68 class of protection are available on demand.

2.2. ***Torque and Travel dependent switches :***

While closing the valve, the first and foremost requirement is that there should not be any leakage on the delivery side when the valve is closed. At the same time, it is also necessary that the valve seat lining does not get damaged due to over tightening of the wedge. This difficult operation is made possible by the Emtork Valve actuator. The torque limit switches can be preset, within its operating range, to limit the output torque. When the required torque is developed by the actuator, the limit switch, set for the x torque limit, trips off motor.

The torque limit switch provided in the valve opening direction works as a back up protection, in case the travel dependent switch in opening direction fails or the valve gets stuck due to some obstruction, thereby increasing the actuator output torque beyond the preset value.

Thus the torque limit switches in either direction stop the valve movement in case the preset torque is exceeded, thereby avoiding costly damages the valve.

The travel dependent switching is adopted to cut-off the actuator supply at the end of the preset travel of the valve in either direction. During valve closing operation, the travel dependent switch works as a backup protection. The closing operation of the valve can also be achieved by adjusting the travel limit to the desired position in which case the torque switch will act as a back-up protection.

Additional travel switches can be supplied for interlock purpose of part opening / closing operation of valves.

2.3 Emergency Manual Operation-Motor over-riding mechanism :

Emtork actuator is provided with a Hand wheel for manual operation. The selector fork lever when put into "Hand position", disconnects the motor drive and couples the output spindle to the hand wheel.

When the motor is switched on, the hand wheel engagement to the output spindle is disconnected automatically and coupled to the motor drive, thus giving the motor - over riding feature.

A locking arrangement can be provided for keeping the "Hand / Motor" selector lever in motor position, so that unauthorised tampering with the valve actuator can be avoided.

2.4 Hammer Blow Effect :

Sometimes it is necessary to provide a considerably higher starting torque to open the jammed, sticky valves. This is achieved by providing a "Hammer blow" effect through "lost-motion" principle, which is an inherent feature of the Emtork actuator, provided specially with output shaft, types A and C. The hammer blow is developed by allowing the drive motor to attain its speed and momentum before the drive is transmitted to the valve spindle. During the process, an additional force, which is substantially more than the normal requirement, is imparted to the valve spindle, unseating the sticky and jammed valves. The hammer blow effect is also achieved by providing High starting torque motor.

2.5 Local Position Indicator :

Emtork valve actuator is provided with a continuous type mechanical position indicator. The drive to the indicator pointer shaft is given from the output shaft, through a gear train. Thus the angular movement of the indicator shaft is directly proportional of the rotation of the output shaft.

The position indicator may have to be adjusted at site, after mounting the actuator on the valve body.

2.6 Out Shaft designs :

The Emtork valve actuators can be supplied in following output shaft designs as per DIN3210.

Shaft design 'A' - With threaded bush for rising stem.

Shaft design 'C' - With claw coupling for rising / nonrising stem.

Shaft design 'E' - With bore and key for nonrising stem.

Shaft design 'D' - With shaft extension for nonrising stem.

The overall output shaft coupling dimensions for models MO, M1 and M2 are given in the following pages.

2.7 Accessories :

The following accessories can be supplied on request.

A) BRAKE UNIT FOR MOTOR :

A suitable A.C. electromagnetic brake unit can be supplied to prevent the over travel of the actuator output shaft. An Electronic braking unit in control panel is also available.

B) CONTROL PANELS : THREE PHASEACTUATORS

All the three phase electrical actuator do need a control panel to operate and control the movement of the final control element.

For On / Off or Regulating duty operations of the final control element the control panel is provided with the following equipment :

- ◆ Main switch
- ◆ MCB on fuses for power & control circuits
- ◆ Push buttons for open / stop / close commands
- ◆ Indicating lamps for various indications such as power on, opened, closed, fault operation etc.
- ◆ Remote position indicator
- ◆ Selector switch for Auto / Manual operations
- ◆ Centralis
- ◆ Over load relay cum single phase preventor
- ◆ Phase sequence protector
- ◆ Current transformer
- ◆ Space heater
- ◆ Electronic braking unit for motor
- ◆ Electronic Positioner
- ◆ Relays for non - self locking actuators
- ◆ D.C. supply source for two wire transmitter
- ◆ Relays for DCS compatibility
- ◆ Connectors etc.

The above mentioned items are selected as per the customers specific requirements and are wired accordingly and are housed in sheet metal or Aluminium housing. The indicative wiring diagrams for guidance purposes are given in the further sections of this manual.

The control panels can be provided for local operation, remote operation or for a local and remote parallel operations as per the customer's requirements.

C) REMOTE POSITION INDICATOR :

An electrical remote position indicator can be supplied which is to be mounted on the control panel unit. The remote indicator can either be digital or analogue type. This will indicate 0 to 100% opening of the valve in control room.

D) ANTI CONDENSATION SPACE HEATER :

A 20 W, 220 VAC space heater, for operating the actuator in damp conditions, can be supplied, both in actuator control compartment & control panel.

E) ADDITIONAL TRAVEL SWITCHES :

Additional travel switches (max upto 4 nos. of 1 No + 1 NC type) if required for process control, can be supplied for operation in either directions.

F) MODULATING DUTYACTUATORS :

The actuators could be supplied with motors which can withstand the modulating duty operations, upto 1200 cycles / hr.

G) THERMAL CUT OUT :

The actuators could be provided with the thermal cut outs to monitor the motor winding temperatures. These will be embedded in motor windings.

H) Travel and torque limit switches, with 2 No and 2 NC contacts, can be supplied.

I) TAILOR MADE ACCESSORIES :

Any other tailor made accessories and suitable valve fitting arrangements can be designed and supplied as per the customer's specific requirements.

J) MOTORISATION OF VALVES :

We give a special service to convert manually operated valves to electrical operations at site. - Retrofitting jobs.

3. ACTUATOR SPECIFICATIONS :

The Emtork actuators are available in three basic models viz. M0, M1 & M2 with different output speeds. The following table gives the complete information on model, speed, torque ratings and with electric drive.

DETAILS OF BASIC ACTUATOR MODELS - MULTI TURN

Type	Output Speed RPM	Self Locking OR Non-self Locking	Torque		Drive	
			Rated Mkg	Adjustable Range Mkg	KW/HP	Speed RPM
M0	10	SL	8	2-8	0.75/1	1500
	15				0.75/1	1500
	20				0.75/1	1500
	30				0.75/1	1500
	40				0.75/1	1500
	60				0.75/1	1500
	70				0.75/1	1500
	80				2.2/3	3000
	120				2.2/3	3000
	140				2.2/3	3000

M0	190 240 270 365 426	NSL	8	2.8	2.2/3	3000 3000 3000 3000 3000
M1	10 15 20 30	SL	20	6-20	0.75/1	1500 1500 1500 1500
M1	40 60 80 90 120	NSL	20	6-20	1.5/2 1.5/2 2.2/3 2.2/3 2.2/3	1500 1500 3000 3000 3000
M2	10 15 20 30 40 65 90	SL	30	8-30	0.75/1 0.75/1 1.5/2 1.5/2 2.2/3 2.2/3 2.2/3	1500 1500 1500 1500 3000 3000 3000
M2	120	NSL	30	8-30	2.2/3	3000

Notes :

1) Emtork actuators type M0 - from speeds 10 to 140 RPM are self - locking and above 140 RPM are non self locking. Actuator type M1 - with speeds upto 30 RPM are self locking and above 30 RPM non self locking. For M2 models speed upto 90 RPM are self locking and above 90 RPM are non elf locking.

2) Only when the actuator is equipped with a type A (Threaded bush for rising stem) and mounted on to the valve, the axial thrust is transferred to the actuator. In all other versions of output shaft designs, the axial thrust is sustained by valve.

Maximum Axial Thrust Capacity : For 'A' type coupling units

M0 - 4000 Kgs.

M1 - 6000 Kgs

M2 - 12000 Kgs

3) All the models of Emtork actuators can be supplied with any of the four output shaft designs as per DIN 3210. viz. A, C, D, E.

4) Suitable Spur Gear (SG) and Worm Gear (WG) reduction gear boxes can be supplied for higher output torque requirements.

Depending on the reduction ratios of the spur and worm gear boxes, the output torque multiplies with the proportional reduction in the output speeds.

The worm gear reduction boxes are specially developed for coupling with butterfly valves, dampers etc., with adjustable mechanical stoppers.

The reduction ratios offered are as follows :

GEAR REDUCTION RATIO			DESIGNATION	TYPE OF GEAR BOX	OUTPUT SHAFT TYPE
2.5:1			SG02	SPUR GEAR ↓	A/C/D/E ↓
4:1			SG04		
6:1			SG06		
8:1			SG08		
12:1			SG12		
WORM	SPUR	TOTAL		WORM GEAR ↓	E ↓
30:1	-	30:1	WG030		
50:1	-	50:1	WG050		
75:1	-	75:1	WG075		
100:1	-	100:1	WG100		
75:1	2.5:1	190:1	WG200		
100:1	2.5:1	250:1	WG250		
100:1	4:1	400:1	WG400		
100:1	6:1	600:1	WG700		
100:1	8:1	800:1	WG1000		
100:1	12:1	1200:1	WG1500		

DATA ON ACTUATOR MOTORS - TYPICAL

Sr. No.	Description	Motor Output - KW/HP		
		0.75/1	1.5/2	2.2/3
1.	Rated Speed - RPM	1405	1415	2850
2.	Frame Size	80	90	90
3.	Rotor Class	KL 16	KL 16	KL 16
4.	Rated current at 415 V - Amps.	1.8	3.3	4.55
5.	Rated torque - mkg.	0.52	1.03	0.752
6.	Power factor cos φ at full load	0.78	0.8	0.83
7.	Efficiency % at full load	76	78.5	81
8.	Ratio of current to rated current	4.5	4.8	6.2
9.	Ratio of starting torque to rated torque	3.0	2.5	3.3
10.	Ratio of pull out torque to rated torque	3.25	3.0	3.5
11.	Ratio GD ² - Kgm ²	0.0072	0.016	0.0093
12.	approx weight - Kgs.	11	23	23
13.	Time allowed at locked rotor - secs.	5	5	5
14.	Stator winding	STAR	STAR	STAR
15.	Acceleration time with full load connected (Secs.)	3	3	3
16.	Over load capacity for 15 secs.	60%	60%	60%
17.	Bearings Nos. (Deep Groove Ball Bearings)	6004	6004	6205
18.	Life of Bearings - Hrs.	20,000	20,000	20,000
19.	Terminal connections (Stud type) Nos.	3	3	3
20.	Earthing terminals	2	2	2

All above motors will have the following Electrical Specifications in commen.

1. Supply Conditions:

- a) 1) Rated voltage - 415 VAC \pm 10%
- 2) Rated Frequency - 50 Hz \pm 5%
- 3) Combined variation - \pm 10%
- 4) No. of Phases - 3 Phase (4 wire)

b) **Reference Standards** - I. S. 325, IEC34, VDE 0530, BS 2613.

- 2. **Type of motor** - TEFC (Totally Enclosed Fan Cooled, Squirrel cage, induction.) / TESC (Totally Enclosed Surface Cooled) for IP 67/68
- 3. **Protection** - IP 65 as per IS 13947 Part I 1993.
- 4. **Class of Insulation** - Class 'F' with temperature rise restricted to class 'B'.
- 5. **Duty cycle** - As per IS 325 - S1 continuous (S4 - Modulating as a special case) OR (S2 - 15 / 30 min as a special case.)
- 6. **Method of starting** - DOL - Direct on line.
- 7. **Reference ambient temp** - 50 $^{\circ}$ c
- 8. Motor painted with corrosion proof epoxy resin paint.
- 9. Standard continuous duty (S1 Duty) motor suitable for:
 - a) 3 Nos. of consecutive starts in hot condition.
 - b) 8 Nos. of starts distributed over 15 minutes.
- 10. Thermostat for motor protection can be provided as a special accessory.
- 11. Space heater can be provided as a special accessory.
- 12. Flame / Explosion proof motors duly approved for Gas groups I, II A, II B & II C as per IS - 2148 are supplied with Flame / Explosion proof actuators, as per requirements.

SPECIFICATION OF TORQUE AND TRAVEL SWITCHES

Description	Contract Details		Make / Type
	Type	Rating	
Travel Switches (MSO /MSE)	1 NO + 1 NC (change over) Micro Switch	10 Amp at 250 VAC	Honeywell / Cherry / equivalent
Torque Switches (LSO/LSC)	1 NO + 1NC Snap Action Open execution - Limit Switch	10 Amp at 550 VAC	Siemens / JB / Bohmen / Equivalent
Travel / Torque Switches	2 NO + 2 NC Snap Action	10 Amp at 250 VAC	Marsh / JB / BCH

SELECTION GUIDE FOR EMTORK ACTUATORS

The steps for selecting the Emtork valve actuator, are as follows:

1. Calculate stem thrust / stem torque necessary for operating the valve
2. With information on the stem pitch / lead, total number of revolutions required to full open / close the valve and the total operational time, determine the proper speed of the actuator.
3. Depending on the valve - stem design, select suitable output shaft design of the actuator viz. Type A / C / D / E.
4. Select the suitable accessories as per the requirements.

CALCULATION OF THRUST & TORQUE :

As these factors are governed by the specifications of the fluid handled and material of construction of the valve parts," CALCULATIONS SHOULD BE BASED ON THE VALVE MANUFACTURER'S ACTUAL PERFORMANCE DATA."

A rough calculation method, for a general case, is given below : (To be used as a guideline)

1.1 Lead screw operated valve (Gate, Globe, Sluice valve etc.)

Thrust $F = A \cdot P.C. + E$ Kgs (1)

Torque $T = K \cdot F \cdot 1.5$ or 2.2 mkg (2)

1.5 - when thrust bearing is provided either in valve or in actuator

2.2 - when thrust collar is provided in the valve.

Where

A = Cross sectional area of valve port

$\sim \frac{\pi}{4} \times (\text{Valve port dia.})^2$ cm²

P = Max. differential pressure kg/cm²

..... Generally maximum at fully closed position.

..... Minimum 2 Kgs / cm²

C = Valve factor Tabel 1.

E = Gland friction allowance - Kgs Table 2.

K = Stem factor Table 3.

Table 1 Valve Factor (C)

Valve Type	Valve Factor (C)			
	Liquid		Gas	
	Below 400 °C	Above 400 °C	Below 400 °C	Above 400 °C
Parallel Side	0.25	0.30	0.35	0.45
Wedge Gate	0.35	0.40	0.40	0.50
Globe	1.20	1.20	1.20	1.20

Table 2 Gland Friction Allowance (E)

Valve stem diameter	Gland friction allowance (E)
Below 25 mm	400 kgs.
26 mm - 50 mm	700 kgs
51 mm - and above	1100 kgs.

Table 3
Stem Factor (K)

Stem Dia. mm	Lead of Screw mm		Factor (K)						
	3	5	6	7	8.5	10	12.5	17	25
19	.0018	.0021	.0023	.0026	.0028				
25	.0022	.0025	.0027	.0028	.0030	.0032	.0036		
32	.0025	.0027	.0030	.0032	.0034	.0036	.0040		
38			.0034	.0036	.0038	.0041	.0045	.0049	
44			.0038	.0041	.0043	.0046	.0049	.0055	
51			.0043	.0046	.0048	.0050	.0053	.0058	.0070
57			.0047	.0051	.0052	.0055	.0058	.0061	.0074
64			.0052	.0055	.0056	.0059	.0062	.0066	.0078
70			.0057	.0059	.0061	.0064	.0067	.0070	.0082
76			.0061	.0063	.0065	.0068	.0071	.0075	.0086
83			.0065	.0068	.0070	.0073	.0075	.0079	.0090
89			.0070	.0072	.0075	.0077	.0080	.0084	.0094
94			.0075	.0077	.0079	.0082	.0085	.0088	.0098
102			.0080	.0082	.0084	.0086	.0087	.0093	.0103
108			.0084	.0086	.0088	.0090	.0094	.0097	.0107
114			.0088	.0090	.0092	.0095	.0099	.0102	.0112
121			.0092	.0094	.0096	.0100	.0104	.0106	.0117
127			.0097	.0099	.0100	.0104	.0108	.0110	.0122

Example of Calculation.

Select a suitable Emtork actuator for the following conditions.

300 mm wedge gate, non - rising stem valve, stem dia. 44 mm. 8.5 mm pitch, to operate in approx.

1 minute, on 14 kgs / cm² differential pressure. (Fluid inside, water at normal temperature.) Thrust bearing provided in the valve.

Total revolutions required for full opening / closing of valve = 40.

1. **Thrust F** = (A. Δ P.C.) + E
 = (706.5 x 14 x 0.35) + 700
 = 4162 kgs.
2. **Torque T** = F x K
 = 4162 x 0.0043 x 1.5
 = 26.1 mkg - Hence M1 actuator with SG02
 (gear ratio 2.5 : 1) will be required.
3. Total revolution required to full open / close valve = 40
 Hence the actuator output rev. required = 40 x 2.5 = 100 to operate the valve in 1 minute.
4. Therefore, the recommended Emtork model - M1 / 090 / SG02 / WG000 / E (effective operating time will be 1.1 min.)

1.2 Butterfly Valve :

In this case the thrust is generally sustained by the valve itself. For the torque requirement of the actuator, rough calculation method is given below :

The torque required at fully closed -

- Valve position $T_c = T_s + T_f$

The torque required at intermediate -

-- Openings $T_i = T_u + T_f$

Where T_c = Torque required at fully closed valve position.

T_s = Seating torque required for closing the valve. Since the sealing mechanism differs from one manufacturer to other, the value of T_c is not uniform.

It is therefore recommended that the seating torque requirement be supplied by the valve manufacturers.

T_f = Friction torque required.

T_i = Torque required at intermediate valve openings.

T_u = Unbalanced torque due to fluid flow.

$$T_f = \frac{1}{100} \times t_c \times b_c \times D^2 \times \frac{d}{2} \times p \text{ mkg}$$

Where t_c = Thrust coefficient - refer table 4

b_c = bearing coefficient

= For ball bearing $b_c = 0.001$

= For plain bushing $b_c = 0.4$

D = Valve Bore (cm)

d = Stem diameter (cm)

ΔP = Differential pressure (kg / cm²)

$$T_u = \frac{1}{100} \times c_t \times d^3 \times \Delta P \text{ mkg}$$

Table 4

Torque and Thrust Coefficients										
Angle of rotation	Full close									Full Open
	0	10	20	30	40	50	60	70	80	90
Torque Coefficient (Ct)	0	0.005	0.015	0.020	0.040	0.080	0.130	0.230	0.300	0.80
Thrust Coefficient Tc	0.78	0.80	0.62	0.85	0.90	0.95	0.90	0.70	0.30	--



Example of Calculations :

Select a suitable "Emtork" valve actuator for the following conditions :

A tight seat Butterfly valve size 500 mm diameter, stem diameter 60 mm, differential pressure at full closed position 3 kg / cm² at 80° opening.

Calculations :

Ts = 30 mkg (Assumed for a particular valve manufacturer)

$$\begin{aligned} \text{Tf at full closed position} &= \frac{1}{100} \times t_c \times b_c \times D^2 \times \frac{d}{2} \times p \text{ mkg} \\ &= \frac{1}{100} \times 0.78 \times 0.4 \times 50^2 \times \frac{6}{2} \times 3 \text{ mkg} \\ &= 70 \text{ mkg} \end{aligned}$$

$$\begin{aligned} \text{Tf at } 80^\circ \text{ opening} &= \frac{1}{100} \times 0.3 \times 0.4 \times 50^2 \times \frac{6}{2} \times 0.2 \text{ mkg} \\ &= 1.8 \text{ mkg} \end{aligned}$$

$$\begin{aligned} \text{Tu at } 80^\circ \text{ opening} &= \frac{1}{10} \times 0.3 \times 50^3 \times 0.2 \text{ mkg} \\ &= 75 \text{ mkg} \end{aligned}$$

Therefore,

The total torque required at full close is,

$$\begin{aligned} T_c &= T_s + T_f \\ &= 30 + 70 = 100 \text{ mkg} \end{aligned}$$

The total torque required at 80° opening is,

$$\begin{aligned} T_i &= T_u + T_f \\ T_i &= 75 + 1.8 \\ &= 76.8 \end{aligned}$$

Hence a suitable actuator have to be selected for 100 mkg output torque.

Therefore, the recommended 'Emtork' model : M1/010/SG00/WG030/E

(Operating time for 90° travel - 45 Secs.)

Conversion Table - 1

mkgs	ft-lbs	mkgs	ft-lbs	mkgs	ft-lbs
1	7.233	15	108.495	65	470.145
2	14.466	20	144.660	70	506.310
3	21.699	25	180.825	75	542.475
4	28.932	30	216.990	80	578.640
5	36.165	35	253.135	85	614.805
6	43.398	40	289.320	90	650.970
7	50.631	45	325.485	95	687.135
8	57.864	50	361.650	100	723.300
9	65.097	55	397.815		
10	72.330	60	433.980		

Conversion Table - 2

ft-lbs	mkg	ft-lbs	mkg
1	0.138	175	24.15
2	0.276	200	27.60
3	0.414	225	31.05
4	0.552	250	34.50
5	0.690	275	37.95
6	0.828	300	41.40
7	0.966	350	48.30
8	1.104	400	55.20
9	1.242	450	62.10
10	1.38	500	69.00
20	2.76	550	75.90
30	4.14	600	82.80
40	5.52	650	89.70
50	6.90	700	96.60
60	8.28	750	103.50
70	9.66	800	110.40
80	11.04	850	117.30
90	12.42	900	124.00
100	13.80	950	131.10
125	17.25	1000	138.00
150	20.70		

Conversion Table - 3

lbs / sq. in.	kgs / cm ²	lbs / sq. in.	kgs / cm ²
1	0.0703	60	4.219
2	0.1406	70	4.922
3	0.2109	80	5.625
4	0.2812	90	6.329
5	0.3516	100	7.032
6	0.4219	125	8.790
7	0.4922	150	10.548
8	0.5625	175	12.306
9	0.6329	200	14.064
10	0.7032	225	15.822
15	1.0548	250	17.580
20	1.4064	275	19.338
25	1.7580	300	21.097
30	2.1097	350	24.613
35	2.4613	400	28.129
40	2.8129	450	31.645
45	3.1645	500	35.161
50	3.5161		

FORMULAE TO REMEMBER

1 kg / cm² = 14.22 lbs / sq. in.

1 atmosphere = 14.7 lbs. / sq. in.

1 Bar = 1 atmosphere

1 HP = 0.746 kw

1 Mkg = 7.233 ft. lbs.

1 Mkg = 9.65 NM

Water head in Feet = Pressure in PSI x 2.31

Water Head in Meter = Pressure in Kg / cm² x 10

$$HP = \frac{T \times N}{716}$$

HP : Horse Power.

T : Torque in Kgm.

N : Speed in RPM.

SUPPLEMENTARY GEAR BOXES

1. SPUR GEAR BOXES - For Multi turn applications

Application -

These are developed to multiply the output torque of the electrical actuator models M0, M1 & M2 for remote control operation of the bigger valves. The spur gear units, depending upon the ratio, multiply the output torque with correspondingly reduced output speeds. The gear boxes also admit a bigger diameter of the valve spindle. An actuator, with a spur gear box unit, is a less expensive solution for operating the large valves - than providing large size actuator unit.

Design -

SIX models of the spur gear unit are available having torque rating ranging between 30 mkg to 300 mkg. A spur gear train is housed in cast iron housings and the gears are so arranged that the actuator output shaft and the gear box output shaft rotate in the same direction. The spur gear box and the actuator are coupled by means of a coupling flange. The gear box unit can be coupled to valve stem by means of any one of the output shaft designs A, C, D, & E.

Salient Features -

1. The gear box casings are made from graded cast iron.
2. The spur gears are manufactured from good quality carbon steel by generation method.
3. The protection class for the gear box is in accordance with IP65 or better.
4. The gears are grease lubricated.
5. It can be adopted for rising & nonrising spindle valves.

2. WORM GEAR BOXES - For Quarter turn application

Application -

The worm gear supplementary gear boxes are useful when the valve actuator is required for the operation of Dampers, Butterfly valves, plug valves, ball valves etc. i.e. for 90° operation. Worm gear boxes, with or without spur gear reduction unit, have a large speed reduction and high output torque. This helps to operate the large butterfly valves at a correspondingly low speed.

Design -

The worm gear reduction boxes are basically of two types i.e. one with a single worm reduction unit and other with a small supplementary spur reduction unit in addition to the worm unit.

The output torque of the combined actuator gear box unit, ranges between 80 to 8100 mkg at travel speeds between approximately 2 sec. to 300 sec. for 90° operation, depending upon the model selected.

The worm gear boxes are housed in a graded cast iron housing and provided with mounting flanges to mount the actuator at input end and the whole assembly on the valve from output end. The output coupling is generally type 'E'.

The worm wheel is a sector type and rotates in the same direction as that of actuator output shaft. The unit is provided with mechanical stoppers to prevent accidental over - travel. The gear box is also provided with local position to indicate the valve position.

Salient Features -

1. The worm shaft is manufactured from good quality carbon steel.
The worm is made from alloy steel and is precisely cut to match the worm wheel. It is supported on two bush bearings.
2. The worm wheel, which is of sector type, is made from Ph. Bronze/ S. G. Iron and is precisely hobbled to give maximum efficiency.
3. The protection class for the gear box is in accordance with IP65 or better.
4. The gears are lubricated with grease while assembling.
5. The gear box is provided with thrust bearings to take end thrust during operation.

NOTES :

1. The auxiliary gear boxes are basically used to increase the output torque, which is necessary while operating bigger/ high pressure valves. By coupling the auxiliary gear box to the actuator, the effective output speed reduces due to which the operation time for valve closing / opening increases.
2. By coupling the spur gear box to the actuator the output motion of the combined unit remains rotary only : whereas by coupling the actuator to the worm gear boxes, the output motion gets restricted only to quarter turn (90°). Hence, the spur gear box combination is suitable only for those valves which require rotary motion for closing / opening (e.g. gate, sluice valves etc.) and the worm gear box combination is suitable only those valves which require 90° (quarter turn) opening / closing (e.g. Butterfly valves, dampers etc.)
3. The output speeds and torques of the possible combined units are given in the following tables.
4. It may be noted that both the spur and worm gear boxes cannot be coupled to the actuator at one time, except the ones recommended by us.
5. If the output speed of the combined unit does not match with the standard output speeds mentioned in the catalogue and if lower output speed of the actuator is required you may please refer back to us as we may be able to offer different output speeds by changing the gear ratios in the actuator, if possible.
6. It is possible to offer different output shaft designs viz. A / C / D / E of the combined unit of actuator and spur gear box, depending on the valve requirements.
7. When the actuator is coupled to the worm gear box, the combined unit is suitable only for butterfly valves or dampers where shaft design type 'E' is suitable.
8. When actuator is to be coupled to any type of auxiliary gear boxes (spur or worm) the output shaft design "of the actuator" has been standardised of type 'E' only.
9. For selecting the output shaft design of the bare actuator and spur gear combination, the following points have to be taken into consideration :
 - a) For rising stem valves, only output shaft design A & C will be suitable as the rising stem of the valve will pass through the body of the actuator / gear box. The diameter of the stem of the valve has to be maximum upto 28 mm while using M0 model and 36 mm while using M1 model and 52 for M2, as the stem has to clearly pass through the holes give in the actuator body as shown in the catalogue. If the actuator is coupled with the spur gear box the maximum stem dia will be as specified in the gear - box selection chart.
 - b) Most commonly used output shaft design is type 'E' where male part of the valve stem is fixed by means of key to the actuator.

'EMTORK'

Flameproof / Explosion proof Actuators

APPLICATION : 'Emtork' - actuators are the high output torque at high speed units and designed for the remote control and regulation of valves in the hazardous locations.

These actuators can be used to operate gate valves, globe valves, butterfly valves, sluice valves and such similar equipment. The actuator is designed to ensure that in a hazardous location any accidental internal explosion is contained in the flameproof enclosure without damage to itself and without communicating the flammation (or explosion) to the external hazardous atmosphere.

CERTIFICATION : 'Emtork' flameproof actuator has been tested and certified by Central Mining Research Station (CMRS, Dhanbad) for Group I, IIA and IIB, locations as per IS:2148 - 1981. The actuators have also been approved by the Directorate General, Factory Advice Service and Labour Institute, Bombay.

CONSTRUCTION : The basic actuators follow the design of M0 and M1 models and have the features specified in our catalogue. The CMRS certification covers Actuators Type M0 and M1 with SG (Spur Gear) and WG (Worm Gear) type Auxiliary Gear Boxes. The actuators are coupled with Flame proof motors.

'EMTORK'

Linear Actuator - Model LMO / 75 & LM1 / 100

DESCRIPTION : This linear model is built around 'EMTORK' Rotary actuator, model M0 with a rated output torque of 8 mkg. & M1 with 20 mkg.

The Linear actuator Model LM0 / 75 gives a max. Thrust of 3500 kgs. (rated thrust 3000 kgs.) and a stroke of 75 mm. LM1 / 100 gives max Thrust of 4500 kgs. (rated thrust 4000 kgs.) and a stroke of 100 mm. Variety of linear speeds are available, depending upon the basic M0 & M1 actuator chosen.

TECHNICAL DATA :

	LM0	LM1
Max. stroke	75 mm	100 mm
Rated thrust	3000 kgs.	4000 kgs.
Max. thrust	3500 kgs.	4500 kgs.
Degree of Protection	IP 65	IP 65
Weight	78 kgs.	88 kgs.
Stroke Adjustment	10 to 75 mm	10 to 100 mm
Linear Speed	- As per the enclosed chart	
Motor Data	- As per our Catalogue	

SPECIFICATIONS OF LINEAR ACTUATORS - MODELS : LM0/75 & LM1/100

MODEL								
S.N.	LM0/75				LM1/100			
	Act. Speed RPM	Linear Speed mm/sec	Motor		Act. Speed RPM	Linear Speed mm/sec	Motor	
			KW	RPM			KW	RPM
01.	10	1	0.75	1395	10	1	0.75	1395
02.	15	1.5	0.75	1395	15	1.5	0.75	1395
03.	20	2	0.75	1395	20	2	0.75	1395
04.	30	3	0.75	1395	30	3	0.75	1395
05.	40	4	0.75	1395	40	4	1.5	1395
06.	60	6	0.75	1395	60	6	1.5	1395
07.	80	8	2.2	2850	90	9	2.2	2850
08.	120	12	2.2	2850	120	12	2.2	2850
09.	190	19	2.2	2850	--	--	--	--
10.	270	27	2.2	2850	--	--	--	--
11.	360	36	2.2	2850	--	--	--	--

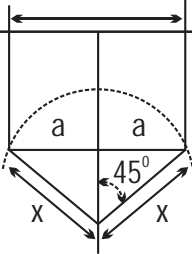
Emtork Damper Actuators - TM Services

Applications :

1. These are units basically a combination of Emtork actuator with supplementary worm gear box duly mounted on mounting brackets and coupled with a suitable linkages to convert quarter turn (90°) movement into a linear one for the operation of dampers, flaps, gates etc.
2. These actuators are selected considering following factors.
 - a) Total thrust required in kgs.
 - b) Length of the stroke in mm.
 - c) Speed of operation mm/sec.
 (Refer Diagrams TM1 - 01 R1, Tm1 - 02 and tables TM1 - 03, TM1 - 04 and TM1 - 05 for details)

Table TM1 - 03

LENGTH OF ARM (for 90° travel of arm corresponding to various stroke length) - Series TM

Sr. no.	Length of stroke mm	Length of arm mm	Stroke
1	150	106	 <p> $x = \frac{a}{\sin 45^\circ}$ $a = \frac{1}{2} \text{ stroke}$ $x = \text{Length of Arm.}$ $\sin 45^\circ = 0.707$ </p>
2	200	141	
3	300	212	
4	400	283	
5	500	354	
6	600	424	
7	700	495	
8	800	566	
9	900	636	
10	1000	707	

The thrust is calculated as follows :
$$\text{Thrust} = \frac{\text{Torque in mkg}}{\text{Length of arm in meters}}$$

Table TM1 - 4

DETAILS OF THRUST AND STROKE VALUES OF LINEAR ACTUATOR - Series TM

Sr. No.	Stroke Length mm	Model		Model		Model	
		TM0 / - / WG030	TM1 / - / WG030	TM1 / - / WG050	TM1 / - / WG075	TM1 / - / WG100	Model
1.	150	135 to 540	540 to 1800	900 to 3000	1350 to 4500	1800 to 6000	
2.	200	100 to 400	400 to 1400	700 to 2300	1050 to 3500	1400 to 4650	
3.	300	67 to 270	270 to 900	450 to 1500	675 to 2250	900 to 3000	
4.	400	50 to 200	200 to 700	350 to 1150	525 to 1750	700 to 2325	
5.	500	40 to 160	160 to 550	270 to 900	400 to 1375	540 to 1800	
6.	600	34 to 135	135 to 450	225 to 750	340 to 1125	450 to 1500	
7.	700	30 to 120	120 to 400	200 to 650	300 to 1000	400 to 1300	
8.	800	25 to 100	100 to 350	170 to 575	260 to 875	340 to 1165	
9.	900	22 to 90	90 to 300	150 to 500	225 to 750	300 to 1000	
10.	1000	20 to 80	80 to 275	135 to 450	200 to 680	270 to 900	

DETAILS OF OUTPUT SPEED FOR LINEAR ACTUATOR - Series TM

Linear output speeds mm / sec. (approx.)

Sr. No.	Actuator Models	Basic Actuator Speeds RPM	Linear output speeds mm / sec. (approx.)									
			10	15	20	30	40	60	80	90	120	180
1.	TM0 / - / WG030	3	5	7	10	14	20	25	--	38	60	88
2.	TM1 / - / WG030	3	5	7	10	14	20	--	30	--	--	--
3.	TM1 / - / WG050	2	3	4	6	8	12	--	19	--	--	--
4.	TM1 / - / WG075	1.3	2	3	4	5	8	--	12	--	--	--
5.	TM1 / - / WG100	1	1.5	2	3	4	6	--	9	--	--	--

GENERAL SELECTION CHART FOR ACTUATORS

S. No. 1.	Type of Valves/Damper 2.	Main Selection Criteria 3.	Actuator Models Recommended 4.	Remarks 5.
I) 1.	MULTITURN VALVES : Gate valves with Rising spindle	Torque, Speed, Spindle-diameter	M0 / M1 / M2 M0/SG, M1/SG, M2/SG	With output Coupling type 'A' or 'C'
2.	Globe valves - with rising & rotary spindle (Threaded spindle)	Torque, Speed	M0/M1, M0/SG, M1/SG M2/SG	(With output Coupling type 'A' (Special valve spindle extension to be provided by valve manufacturer)
3.	Sluice valve - with non-rising spindle	Torque, Speed	M0/M1 M0/SG M1/SG M2/SG	With output coupling 'C' 'D' 'E'
II) 1.	QUARTER TURN VALVES : Butterfly valves Ball valves Plug valves	Torque, Speed	QT QM0 QM1 M0/WG M1/WG M2/WG	With output coupling type 'E'
III) 1.	LINEAR VALVES : Globe valves with reciprocating rising spindle (unthreaded)	Thrust, Linear speed	ST - 5102 ST - 5103 LM0/LM1	
IV) 1.	QUARTER TURN DAMPERS : Single or Multi Louvers	Thrust, Linear Speed	ST - 5102 - D ST - 5103 - D TM0/TM1	with output linkages.

(I) SELECTION OF ACTUATORS FOR MULTITURN VALVES

S. No. 1.	Actuator Model 2.	Output Torque kgm. 3.	Output Speed of basic Actuator 4.	Effective output speed R.P.M. 5.	* Max acceptable Valve spindle Dia mm. 6.
1.	M0	8	10 15 20 30 40	N.A.	28

1.	2.	3.	4.	5.	6.
			60 70 80 120 140 190 240 270 365 426	N.A.	28
2.	M1	20	10 15 20 30 40 60 80 90 120	N.A.	36
3.	M2	30	10 15 20 30 40 65 90 120	N.A.	52
4.	M0/SG02 (2:5:1)	16	10 15 ↓ 360	4 6 ↓ 144	52
5.	M1/SG02 (2:5:1)	40	10 15 ↓ 120	4 6 ↓ 48	52
6.	M1/SG04 (4:1)	65	10 15 ↓ 120	2.5 3.75 ↓ 30	55

1.	2.	3.	4.	5.	6.
7.	M1/SG06 (6:1)	100	10 15 ↓ 120	1.7 2.5 ↓ 20	60
8.	M1/SG08 (8:1)	130	10 15 ↓ 120	1.25 1.9 ↓ 15	80
9.	M1/SG12 (12:1)	200	10 15 ↓ 120	0.8 1.25 ↓ 10	90
10.	M2/SG12 (12:1)	300	10 ↓ 120	0.8 ↓ 10	100

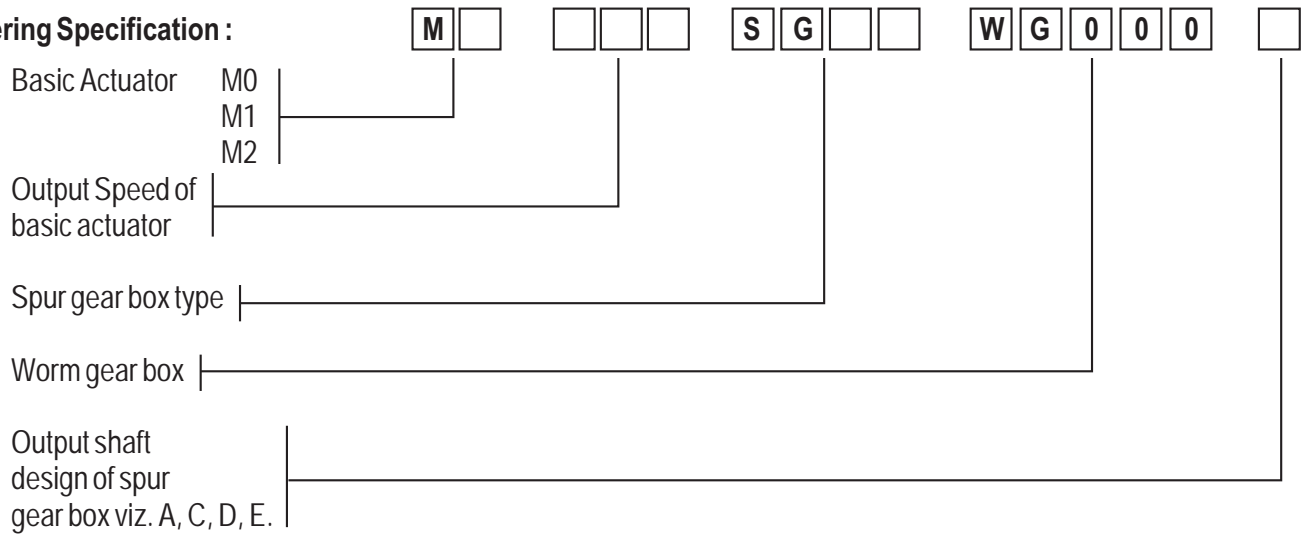
Note :

1) * Max. acceptable valve spindle diameter applicable only for rising spindle valves Actuator output shaft design 'A' or 'C'

2)

$$\text{Effective output speed} = \frac{\text{Output speed of basic actuator}}{\text{Gear Reduction Ratio}}$$

3. Ordering Specification :



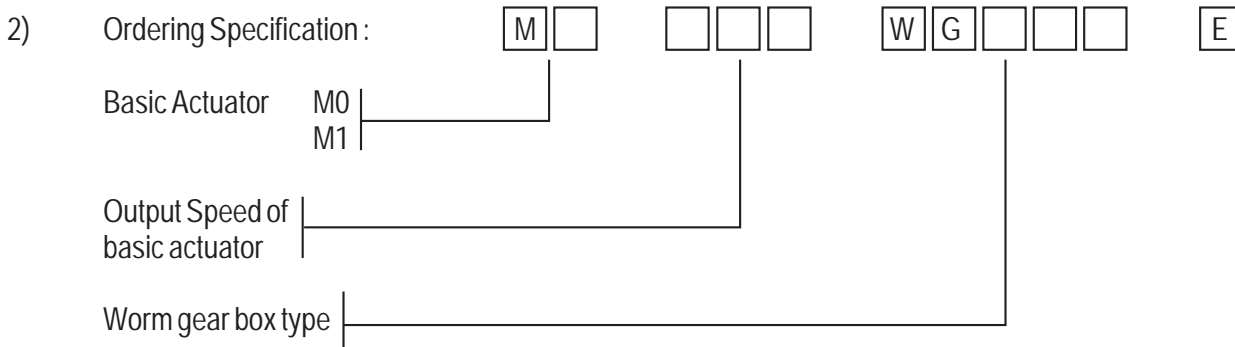
(II) SELECTION OF ACTUATORS FOR QUARTER TURN VALVE

S. No.	Actuator Model	Output Torque kgm.	Output Speed of basic Actuator	Effective output speed R.P.M.	Time of operation Sec/90°	Remark
1.	2.	3.	4.	5.	6.	7.
1	QT-3	3	0.8	N.A.	18	
2	QT-5	5	0.8	N.A.	18	Supply 220 V.A.C. 1 Ph.
3	QT-10	10	0.75	N.A.	20	
4.	QT-20	20	0.75	N.A.	20	Supply 220 V.A.C. 1 Ph.
5.	QT-30	30	0.6	N.A.	26	
6.	QT-40	40	0.6	N.A.	26	
7.	QT-50	50	0.6	N.A.	26	
8.	QM0	20	4.3 ↓ 0.6	N.A.	3.5 ↓ 24	Supply 440 V.A.C. 3Ph.
9.	QM/1	35	1.4 ↓ 0.2	N.A.	11 ↓ 75	Supply 440 V.A.C. 3Ph.
10.	M0/WG030 (30:1)	80	10 15 ↓ 270	0.33 0.5 ↓ 9.0	45 30 ↓ 1.7	Supply 440 V.A.C. 3Ph.
11.	M1/WG030 (30:1)	200	10 15 ↓ 90	0.33 0.5 ↓ 3.0	45 30 ↓ 5	Supply 440 V.A.C. 3Ph.
12.	M1/WG050 (50:1)	350	10 15 ↓ 90	0.2 0.3 ↓ 1.8	75 50 ↓ 8.3	Supply 440 V.A.C. 3Ph.
13.	M1/WG075 (75:1)	500	10 15 ↓ 90	0.13 0.2 ↓ 1.2	115 75 ↓ 12.5	Supply 440 V.A.C. 3Ph.
14.	M1/WG100 (100:1)	660	10 15 ↓ 90	0.1 0.15 ↓ 0.9	150 100 ↓ 16.7	Supply 440 V.A.C 3Ph.

1.	2.	3.	4.	5.	6.	7.
15.	M1/WG200 (190:1)	1050	10 15 ↓ 90	0.05 0.08 ↓ 0.47	300 187 ↓ 31.90	Supply 440 V.A.C. 3Ph.
16.	M1/WG250 (250:1)	1400	10 15 ↓ 90	0.04 0.06 ↓ 0.36	375 250 ↓ 41.7	Supply 440 V.A.C. 3Ph.
17.	M1/WG400 (400:1)	2400	10 15 ↓ 90	0.025 0.037 ↓ 0.225	600 405 ↓ 66.7	Supply 440 V.A.C. 3Ph.
18.	M1/WG1000 (800:1)	5400	10 15 ↓ 90	0.010 0.016 ↓ 0.094	1500 937 ↓ 159.6	Supply 440 V.A.C. 3Ph.
19.	M1/WG1500 (1440:1)	8100	10 15 ↓ 90	0.007 0.01 ↓ 0.062	2143 1500 ↓ 242	Supply 440 V.A.C. 3 Ph.

Note:

1)
$$\text{Effective output speed} = \frac{\text{Output speed of basic actuator}}{\text{Reduction Ratio of Gear Box}}$$



(III) SELECTION OF ACTUATORS FOR LINEAR VALVES

S.No.	Actuator Model	Output Thrust kgs.	Output Speed of basic Actuator R.P.M.	Linear output speed mm/sec.	Max. Stroke Length mm	Remarks
1.	2.	3.	4.	5.	6.	7.
1	ST-5102	200	N.A.	0.26	43	Supply 220 V.A.C. 1Ph.
2	ST-5103	600	N.A.	0.45	60	Supply 220 V.A.C. 1Ph.
3	LM0	3000	10	1	75	Supply 440 V.A.C. 3Ph.
			15	1.5		
			↓	↓		
			360	36		
4	LM1	4000	10	1	100	Supply 440 V.A.C. 3Ph.
			15	1.5		
			↓	↓		
			120	12		

NOTE :

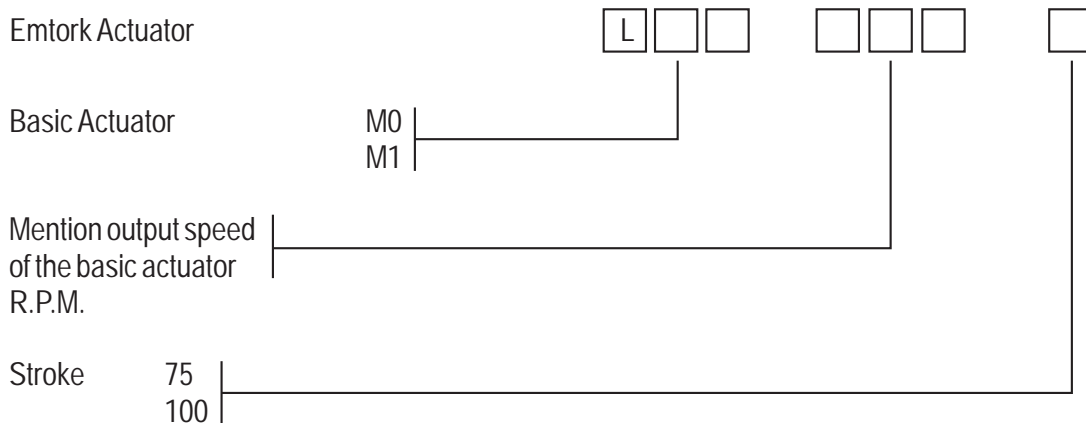
1) In case of LM0 actuator the output spindle moves by 6 mm per revolution. Hence Linear output speed

$$\text{mm/sec.} = \frac{\text{Output R.P.M.} \times 6}{60}$$

2) Ordering Specifications :

i) Regeltek Actuators : ST - 5102
 ST - 5103

ii) Emtork Actuator



IV) SELECTION OF ACTUATORS FOR QUARTER TURN DAMPERS

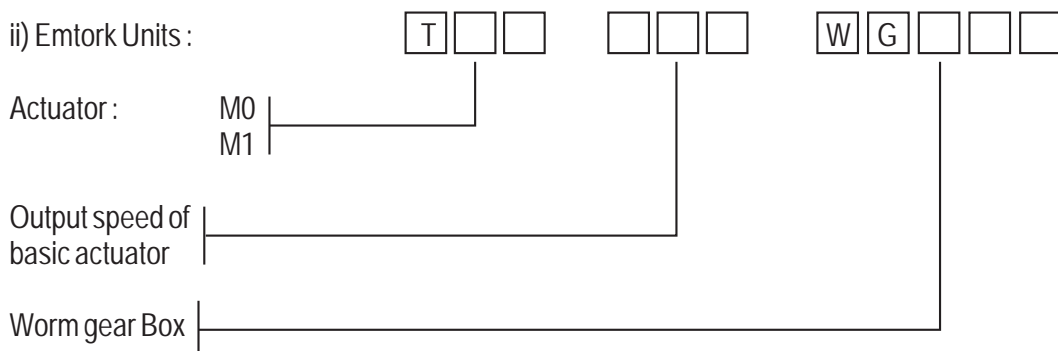
S. No.	Actuator Model	Output Thrust kg. (Rated)	Length of Stroke mm	Output Speed of basic Actuator R.P.M.	Effective Linear Output speed mm/sec.
1.	2.	3.	4.	5.	6.
1.	ST-5102-D	40	180	N.A.	1.3
2.	ST-5103-D	85	400	N.A.	3.2
3.	TM0/WG030	540	150	10	3
		200	200	15	5
		↓	↓	↓	↓
		80	1000	270	88
4.	TM1/WG030	1800	150	10	3
		1400	200	15	5
		↓	↓	↓	↓
		275	1000	90	30
5.	TM1/WG050	3000	150	2	10
		2300	200	3	15
		↓	↓	↓	↓
		450	1000	19	90
6.	TM1/WG075	4500	150	1.3	10
		3500	200	2	15
		↓	↓	↓	↓
		680	1000	12	90
7.	TM1/WG100	6000	150	1	10
		4650	200	1.5	15
		↓	↓	↓	↓
		900	1000	9	90

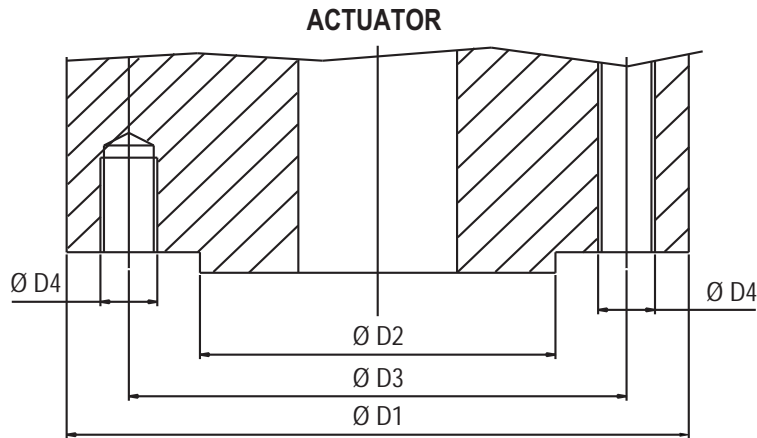
NOTE :

Ordering Specifications :

i) Regeltek Units : ST-5102-D
ST-5103-D

ii) Emtork Units :





FLANGE TYPE	Ø D1	Ø D2	Ø D3	Ø D4	NUMBER OF STUDS OR BOLTS
F 07	90	55	70	M8	4
F 10	125	70	102	M10	4
F 14	175	100	140	M16	4
F 16	210	130	165	M20	4
F 25	300	200	254	M16	8
F 30	350	230	298	M20	8
F 35	415	260	356	M30	8
F 40	475	300	406	M36	8

Note1- The method of attachment may be by means of studs or through bolting. When the latter method is used, the diameter of the clearance holes shall permit the use of bolts of a size given by the corresponding D4 dimensions.

Note 2 - The holes for the studs/bolts shall be located off-centre and shall be equispaced.

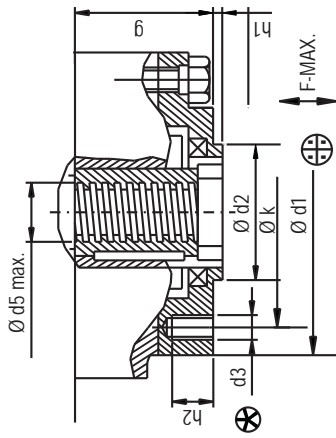
Note 3 - The recess in the mounting surface corresponding to diameter, D2, is mandatory; the spigot on the actuator is optional.

Note 4 - The dimension, D1, has been based on sufficient landing for the nuts and bolts heads, where applicable. Such landing is defined as a radius from the bolt hole centre with the dimension $(D1-D3)/D2$, and shall be considered as a minimum. The shape of the flange of both valve and actuator outside of these areas of landing is left to the option of the manufacturer.

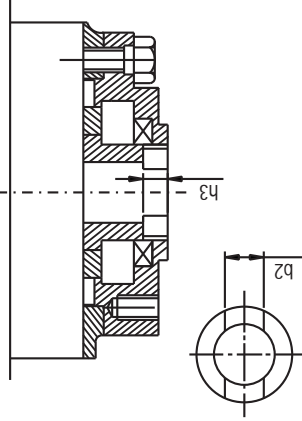
		MARSH ENGINEERS	
SCALE	NTS	TITLE- MOUNTING FLANGE DIMENSIONS	DRG.NO. GEN 704
			SHEET 1 OF 1

OUTPUT SHAFT DESIGNS (AS PER DIN 3210) EMTORK ELECTRIC ACTUATORS MODEL M0, M1 & M2

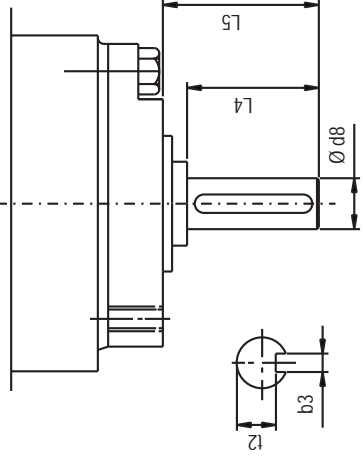
TYPE-A With threaded bush for rising stem



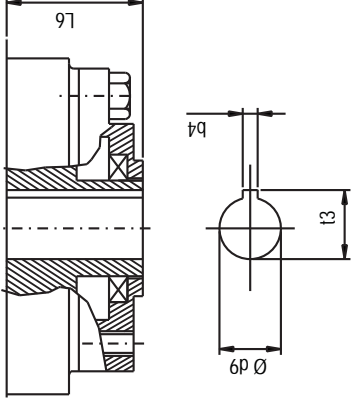
TYPE-C With claw coupling for rising / nonrising stem



TYPE-D With shaft extension for nonrising stem



TYPE-E With bore & key for nonrising stem



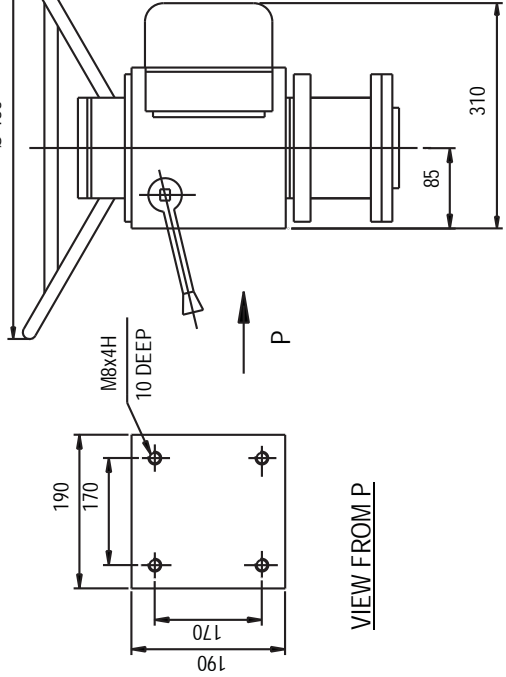
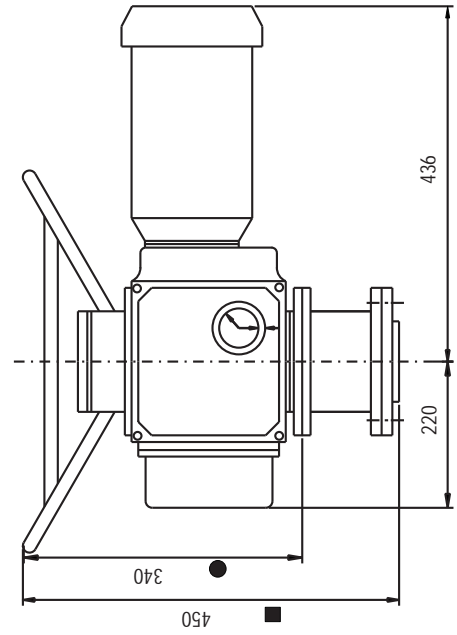
⊗ -4 Holes-Off centre.


⊕ F-Max-Maximum Axial Thrust.

DIMENSIONS

TYPE	b2 H11	b3 P9	b4 H9	Ø d1	Ø d2 f8	d3	Ø d5 max.	Ø d8 g6	Ø d9 H8	F max. kg.	g	h1	h2	h3	Ø k PCD	L4	L5	L6	l3	App. Weight Kg.	Mounting
M0	14	6	6	125	70	M10	28	20	20	4K	40	3	15	10	102	50	55	16.5	22.8	52	F10
M1	20	8	8	175	100	M16	36	30	30	6K	55	4	22	12	140	70	76	26	33.3	70	F14
M2	20	8	8	175	100	M16	52	30	30	12K	55	4	22	12	140	70	76	26	33.3	75	F14

OVERALL DIMENSIONS OF EMTORK ACTUATORS MODELS M0 & M1-AS PER IS 9334-1986





MARSH ENGINEERS

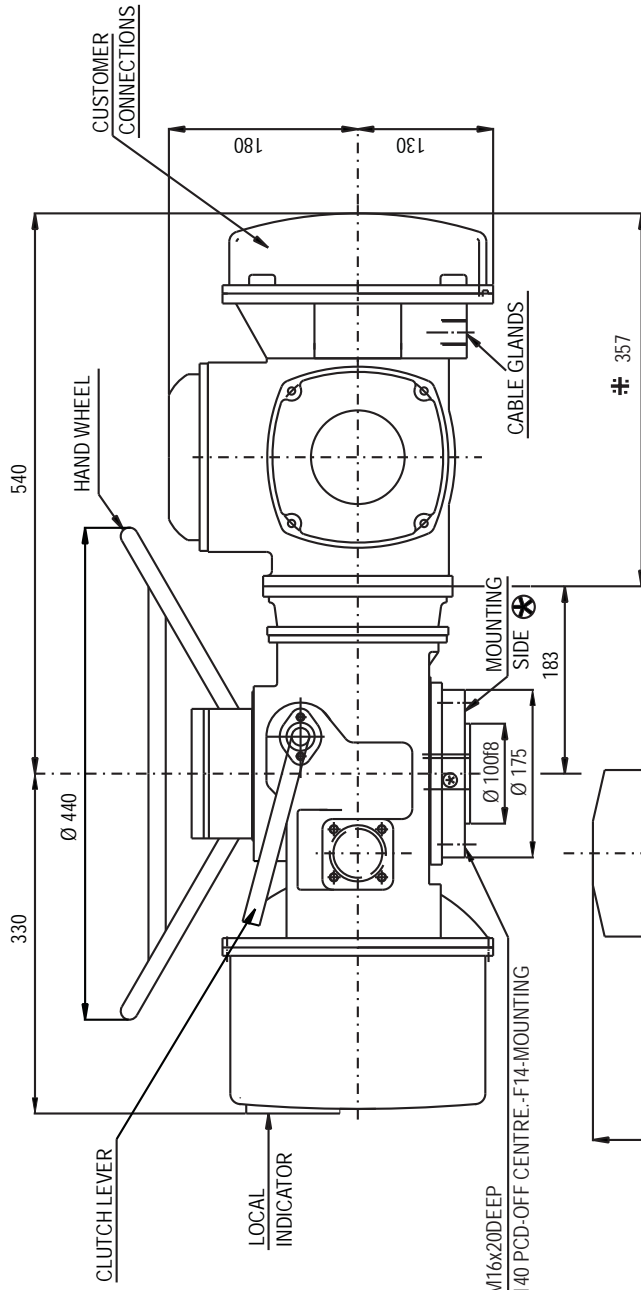
TITLE-
**OVERALL DIMENSIONS
FOR EMTORK ACTUATORS**

DRG.NO.
GEN 756

SHEET 1 OF 1

● Only for M0

■ Only for M1

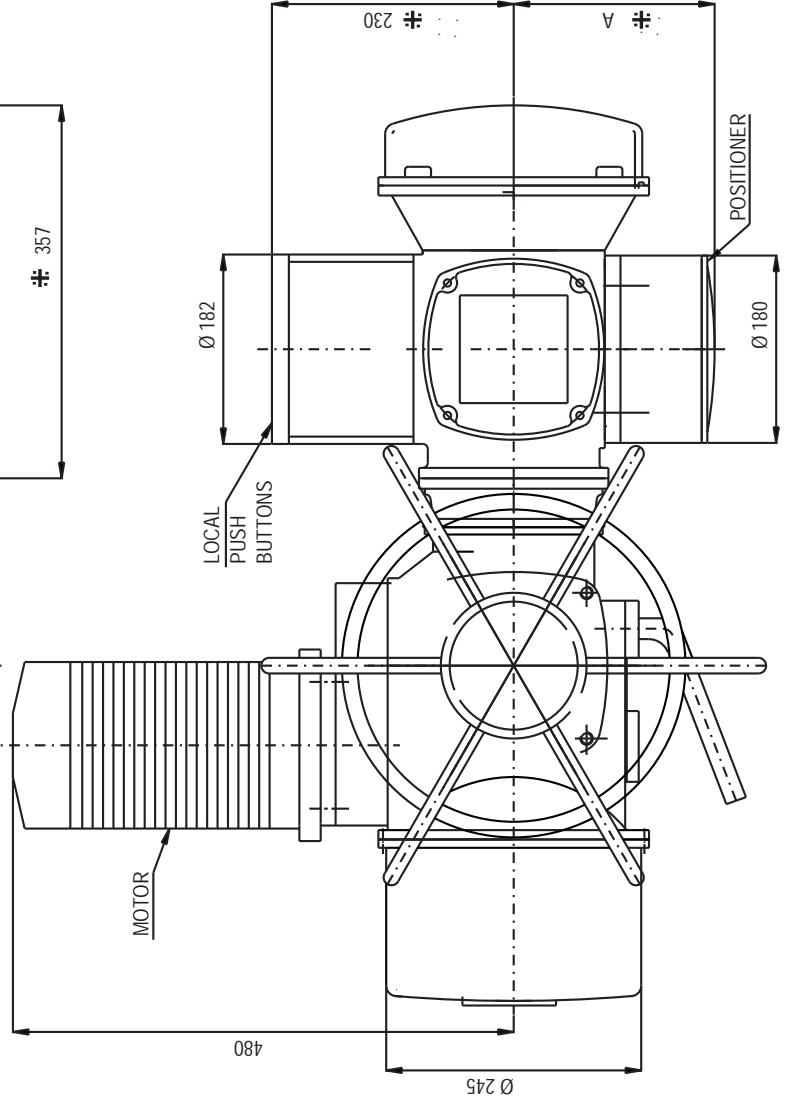


⊗ Ø 30Hx75 DEEP WITH KEYWAY
8Wx3.3 DEEP - TYPE E COUPLING.

APPLICABLE ONLY IN CASE OF UNIT WITH INTEGRAL STARTER & POSITIONER.

A : 205mm WITH POSITIONER UNIT.
: 120mm WITHOUT POSITIONER UNIT.

4H M16x20DEEP
AT 140 PCD-OFF CENTRE:-F14-MOUNTING



MARSH ENGINEERS

TITLE-

GA DRAWING
EMTORK ACTUATOR
MODEL M2 COUPLED
WITH INTEGRAL
STARTER & POSITIONER

DRG.NO.

GEN 755

SHEET 1 OF 1

PART LIST

SR. NO.	DRG. NO.	DESCRIPTION	QTY.
1	101	MAIN HOUSING	1
2	102	HOUSING	1
3	103	FLANGE	1
4	104	OUTER FLANGE	1
5	105	HAND WHEEL FLANGE	1
6	109	TRAVEL BRACKET	1
7	111	RING GEAR	1
8	112	CAP SPINDLE COVER	1
9	113	WORM WHEEL	1
10	114	TOP COVER	1
11	117	TORQUE BRACKET	1
12	118	TORQUE LEVER	2
13	126	DRIVE SHAFT	1
14	128	DRIVING SLEEVE	1
15	130	OUT PUT SLEEVE	1
16	131	HAND WHEEL SLEEVE	1
17	134	PNION (GEAR) - 17 TEETH	2
18	135	GEAR - 17 TEETH	1
19	136	GEAR - 22 TEETH	2
20	137	WORM	1
21	138	HAND WHEEL	1
22	142	FIN	2
23	143	NUT	1
24	145	TORQUE SHAFT	1
25	146	TORQUE LEVER PLATE	1
26	147	FIN FOR TORQUE LEVER	1
27	148	SHAFT FOR TRAVEL BRACKET	1
28	157	FIN FOR PNION	2
29	159	HAND WHEEL SPRING	1
30	161	TORQUE SPRING	1
31	169	LOCK NUT	1
32	195	CAM	2
33	225	SPACER	6
34	227	NUT	2
35	237	GEAR - 72 TEETH	1
36	238	GEAR - 26 TEETH	1
37	243	BRACKET FOR POT	1
38	246	INDICATOR PLATE (A & B)	1

MARSH

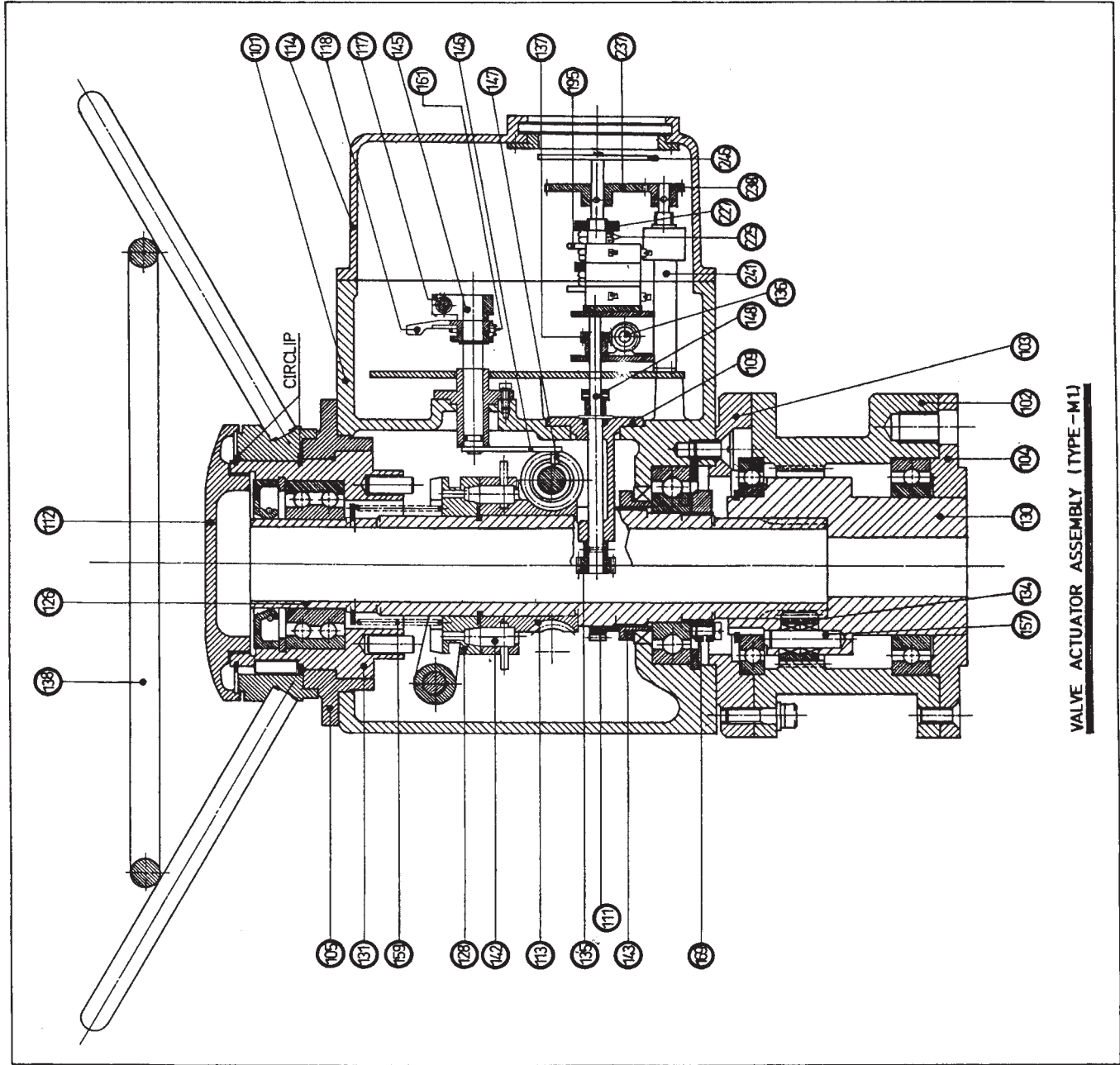
DRG. NO. **100R1**
SHEET 1 OF 2

TITLE - **VALVE ACTUATOR - ASSEMBLY (TYPE - M1)**

DATE **19.12.58**

SCALE

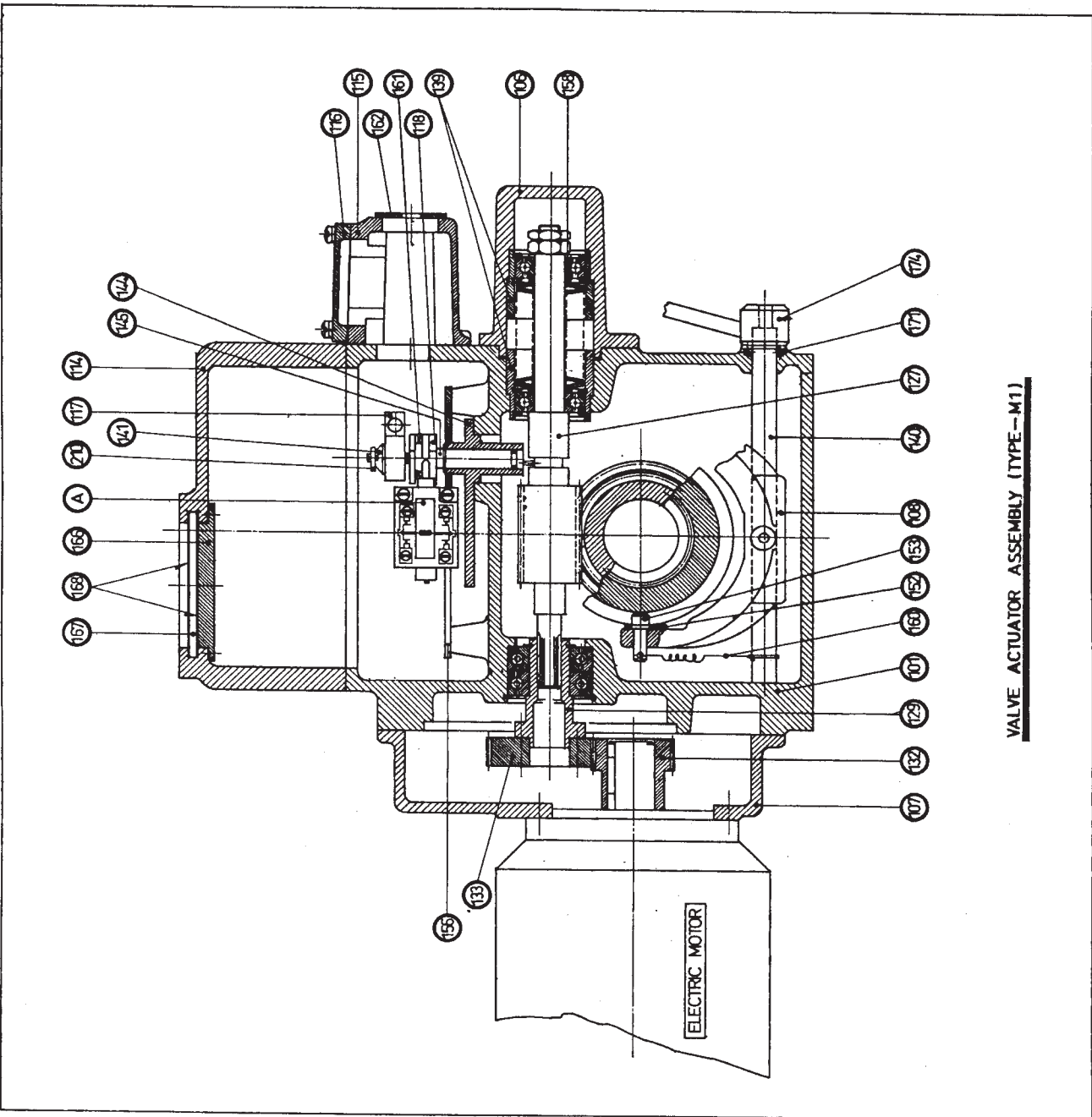
100 R1A, 100 R1B, 100 R1C, 100 R1D, 100 R1E, 100 R1F, 100 R1G, 100 R1H, 100 R1I, 100 R1J, 100 R1K, 100 R1L, 100 R1M, 100 R1N, 100 R1O, 100 R1P, 100 R1Q, 100 R1R, 100 R1S, 100 R1T, 100 R1U, 100 R1V, 100 R1W, 100 R1X, 100 R1Y, 100 R1Z




VALVE ACTUATOR ASSEMBLY (TYPE - M1)

PART LIST

SERIAL NO.	DRG. NO.	DESCRIPTION	QTY.	REMARKS
1	101	MAIN HOUSING	1	
2	106	SPRING COVER	1	
3	107	MOTOR FLANGE	1	
4	108	FORK	1	
5	114	TOP COVER	1	
6	115	ELECTRIC BOX	1	
7	116	ELECTRIC BOX COVER	1	
8	117	TORQUE BRACKET	1	
9	118	TORQUE LEVER	2	
10	127	WORM SHAFT	1	
11	129	SPLINED BUSH	1	
12	132	DRIVE GEAR	2	
13	133	DRIVEN GEAR	1	
14	139	SPRING BUSH	2	
15	140	FORK SHAFT	1	
16	141	ECCENTRIC PIN	1	
17	144 & 145	TORQUE BUSH & TORQUE SHAFT (1 each)	2	
18	152	FLAPPER PIN	2	
19	153	FLAPPER PIN	2	
20	156	PLATE	1	
21	158	SPRING	1	
22	160	FORK SPRING	2	
23	161	TORQUE SPRING	1	
24	162	PLATE (IN ELECTRIC BOX)	1	
25	166	DIAL COVER PLATE	1	
26	167	GLASS	1	
27	168	GASKET	2	
28	171	WASHER	1	
29	174	HANDLE	1	
30	210	PLATE FOR TORQUE BRACKET	1	
31	A	LSD & LSC (SWITCHES)	2	



VALVE ACTUATOR ASSEMBLY (TYPE-M1)



MARSH

DRG. NO. - 100 B1

SHEET 12 OF 22

VALVE ACTUATOR - ASSEMBLY (TYPE-M1)

DRAWN: [blank]

CHECKED: [blank]

APPROVED: [blank]

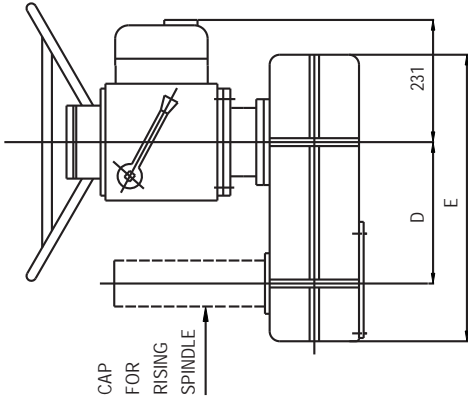
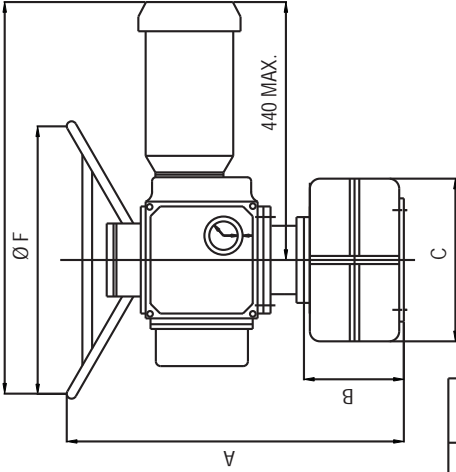
DATE: 19.12.58

SCALE: [blank]

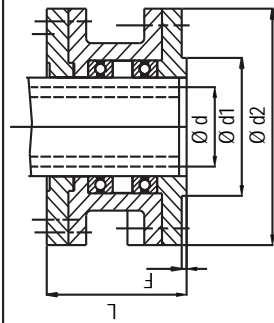
DRG. NO. - 100 B1

SHEET 12 OF 22

685 MAX.

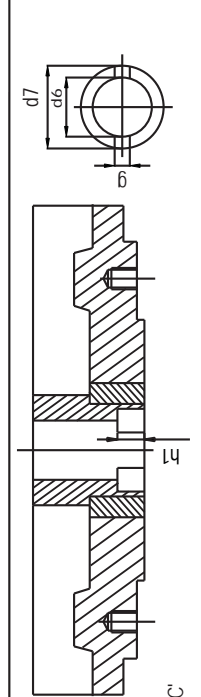


TYPE	Ø d	Ø d1	Ø d2	L	F	MOUNTING HOLES OFF-CENTRE
SG 02	52	140	230	150	5	4xM20x190PCD
SG 04	55	165	250	185	5	4xM20x210PCD
SG 06	60	230	330	255	5	4xM20x210PCD
SG 08	80	230	330	255	5	8xM16x280PCD
SG 12						ON DEMAND



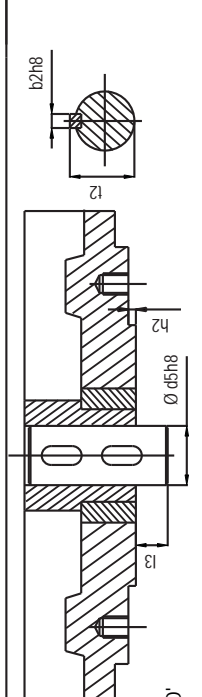
TYPE-'A'

TYPE	Ø d6	Ø d7	g	h
SG 02	64	100	30	16
SG 04	64	100	30	16
SG 06	64	100	30	16
SG 08	64	100	30	16
SG 12	75	120	40	18



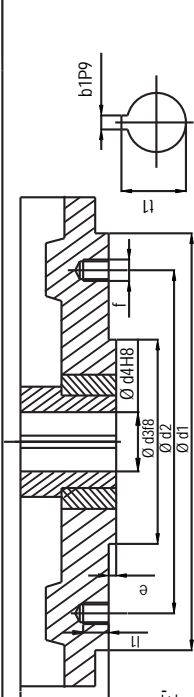
TYPE-'C'

TYPE	Ø d5	h2	b2
SG 02	40	5	43
SG 04	40	5	43
SG 06	50	6	53.5
SG 08	50	6	53.5
SG 12	60	6	64



TYPE-'D'

TYPE	Ø d1	Ø d2	Ø d3	d4	e	l1	l2	l1	b1
SG 02	210	165	130	40	5	25	100	43.3	12
SG 04	210	165	130	40	5	25	100	43.3	12
SG 06	210	165	130	50	6	20	120	53.8	14
SG 08	210	165	130	50	6	20	120	53.8	14
SG 12	300	254	160	60	6	25	130	64.4	18



TYPE-'E'

TYPE	f off-centre
SG 02	4H-M20x25L
SG 04	4H-M20x25L
SG 06	8H-M16x20L
SG 08	8H-M16x20L
SG 12	8H-M20x25L

SR. NO.	SIZE	A		B	C	D	E
		M0	M1				
1	SG 02	560	670	142	258	180	500
2	SG 04	560	670	142	258	210	530
3	SG 06	580	695	165	380	190	610
4	SG 08	580	695	165	380	183	604
5	SG 12	615	725	200	490	244	720

ØF — [—] Ø485 FOR NORMAL APPLICATION.
Ø330 FOR EXTRA LONG RISING STEM!



MARSH ENGINEERS

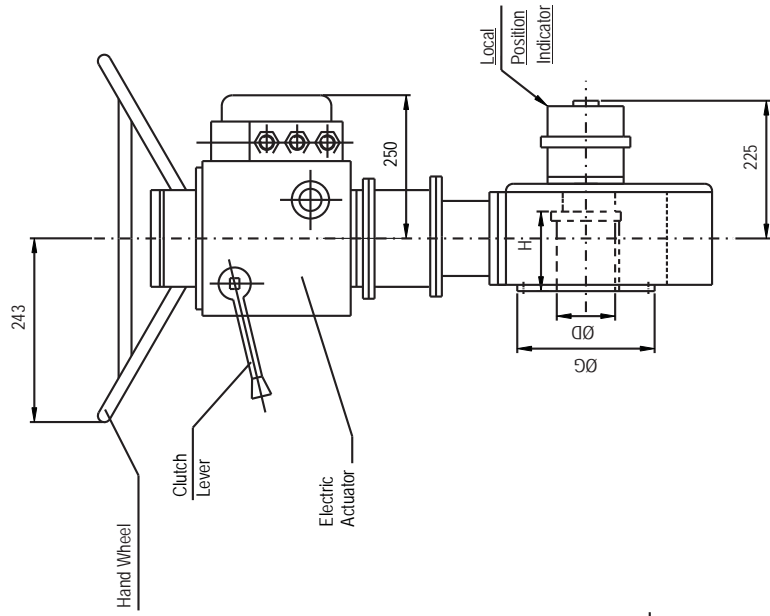
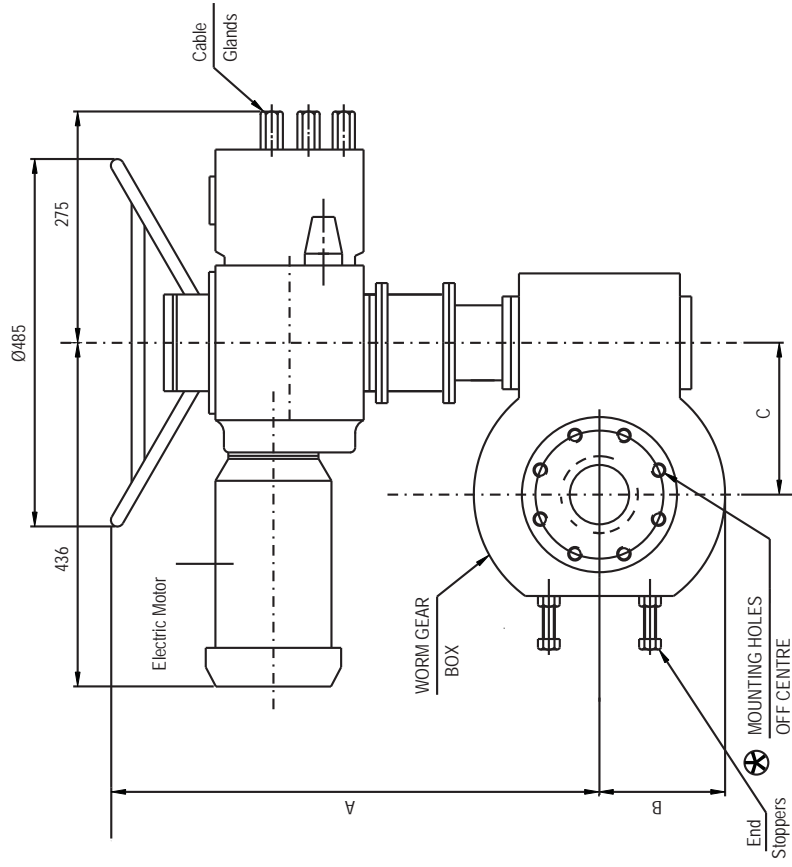
TITLE-

EMTORK VALVE ACTUATOR WITH SPUR GEAR(SG) BOXES

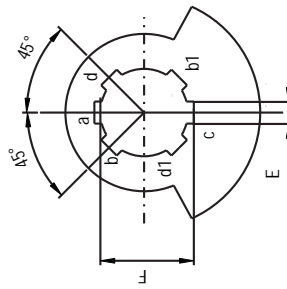
DRG.NO.

GEN 719

SHEET 1 OF 1



SECTOR WORM WHEEL



KEYWAY POSITION 'C'
(AT CENTRE OF SECTOR)

STANDARD SUPPLY
OTHER POSITIONS
ON DEMAND

MODEL	A		B	C	ØD H9	E	F	ØG	H	⊗ Mounting Holes Off Centre
	MO	M1								
MO/M1/WG30	585	685	125	100	45	14	48.8	150	65	4 NOS. M12x15 deep ON 125 PCD
MO/M1/WG50	573	673	165	160	80	22	85.9	200	125	4 NOS. M16x20 deep ON 165 PCD
MO/M1/WG75	650	750	240	225	100	28	106.4	300	140	8 NOS. M16x20 deep ON 260 PCD
MO/M1/WG100	650	750	300	300	127	32	134.4	400	160	12 NOS. M24x30 deep ON 300 PCD

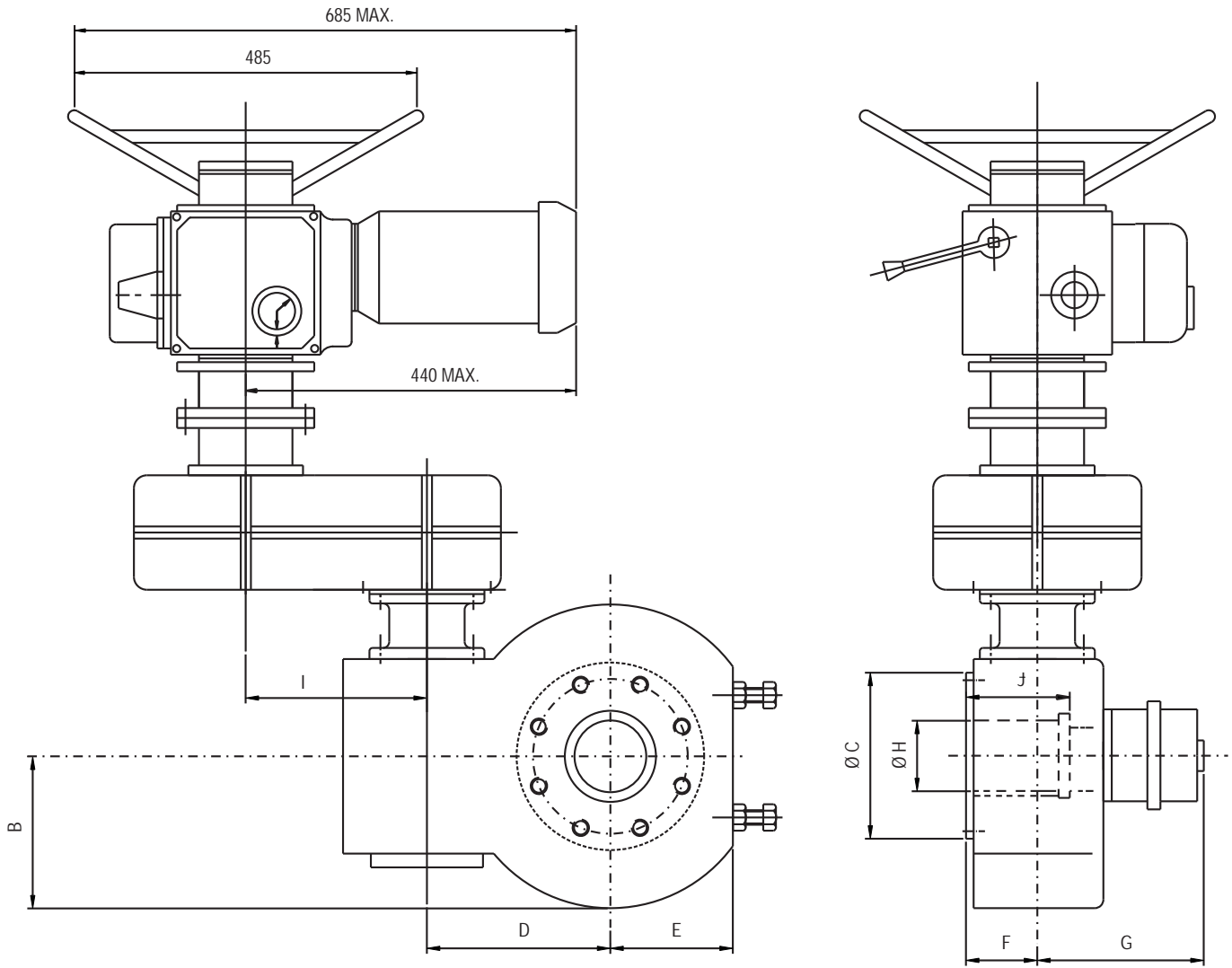


MARSH ENGINEERS

TITLE:-
**EMTORK ELECTRIC
ACTUATOR
WITH WORM GEAR BOX
MODELS:MO-M1/WG30/
WG50/WG75/WG100
EXECUTION I**

DRG.NO.
GEN 691

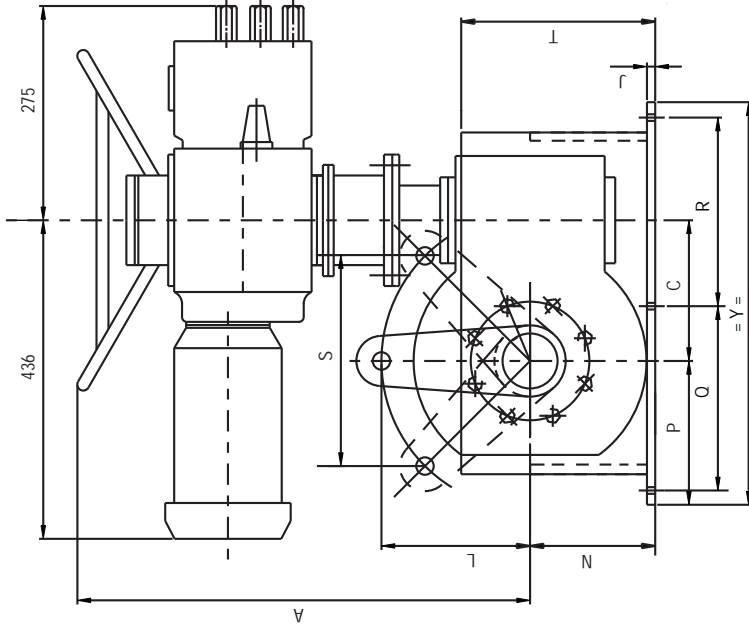
SHEET 1 OF 1



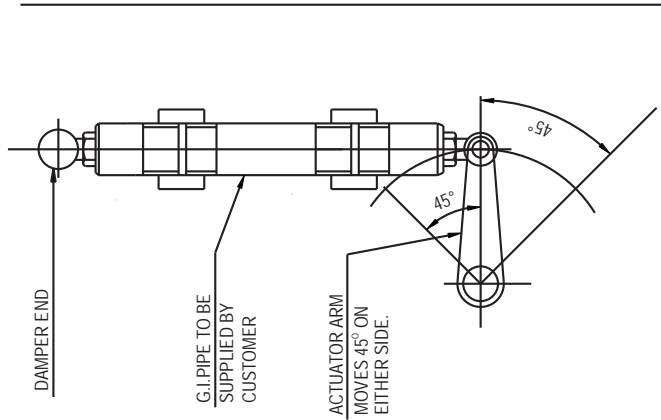
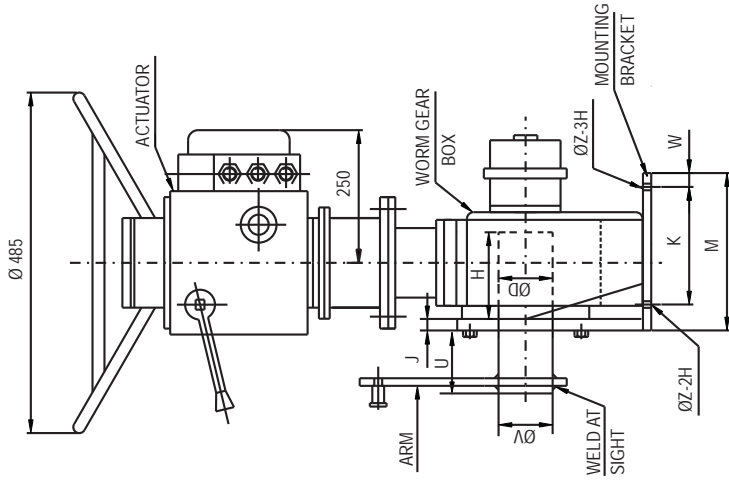
SR. NO.	MODEL	A	B	C	D	E	F	G	ØH	I	J	MOUNTING DETAILS
1	WG200	935	240	300	222.5	165	80	220	100	180	140	8NOS-M16 ON 260 PCD
2	WG250	960	295	400	297.5	210	95	225	127	180	160	12NOS-M24 ON 300 PCD
3	WG400	960	295	400	297.5	210	95	225	127	210	160	12NOS-M24 ON 300 PCD
4	WG1000	1130	425	480	420	268	115	275	180	183	200	12NOS-M24 ON 400 PCD
5	WG1500	1145	425	480	420	268	115	275	200	244	200	12NOS-M24 ON 400 PCD

MARSH ENGINEERS

TITLE- <p style="text-align: center;">EMTORK VALVE ACTUATOR WITH WORM GEAR BOXS</p>	DRG.NO. <p style="text-align: center;">GEN 758</p>
SHEET 1 OF 1	



1000	707
900	636
800	566
700	495
600	424
500	354
400	283
300	212
200	141
150	106
LG OF STROKE 'S' IN MM	LG OF ARM 'L' IN MM.



CENTRE POSITION OF ARM TAKEN AS- HORIZONTAL/VERTICAL

L/S: TO SUIT OPERATIONAL NEEDS.

MODEL	A		Ø D	H	C	H9	D	H	J	K	M	N	P	Q	R	T	U	Ø V	W	Y	Ø Z
	MO	MT																			
TM0/TM1/WG30	585	685	45	65	100	45	15	150	220	145	165	180	180	180	225	65	45	25	400	18	
TM0/TM1/WG50	573	673	80	125	160	80	20	180	250	195	205	240	240	295	150	80	25	520	18		
TM0/TM1/WG75	650	750	100	140	225	100	25	180	270	275	275	312.5	312.5	440	145	80	30	685	22		
TM0/TM1/WG100	650	750	127	160	300	127	25	210	300	335	330	380	380	525	145	90	30	820	22		



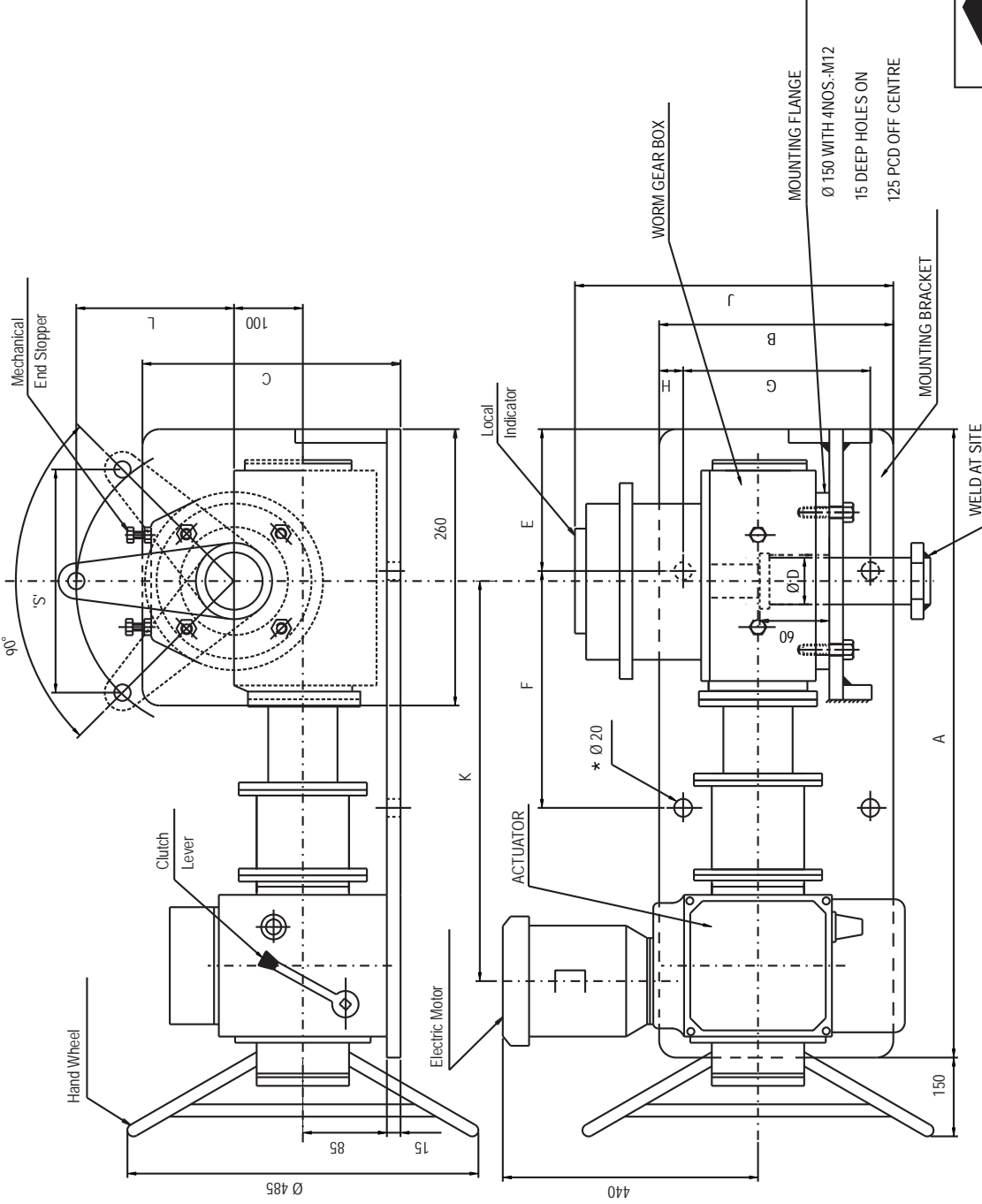
MARSH ENGINEERS

TITLE-
EMTORK ELECTRIC ACTUATOR WITH WORM GEAR BOX WITH MOUNTING BRACKET & LINKAGE-EXECUTION-II

DRG.NO.

GEN 721

SHEET 1 OF 1



Values of L & S to be selected as per customer's requirements.

1000	707
900	636
800	566
700	495
600	424
500	354
400	283
300	212
200	141
150	106
L.G.OF STROKE 'S' IN MM	L.G.OF ARM 'L' IN MM



MARSH ENGINEERS

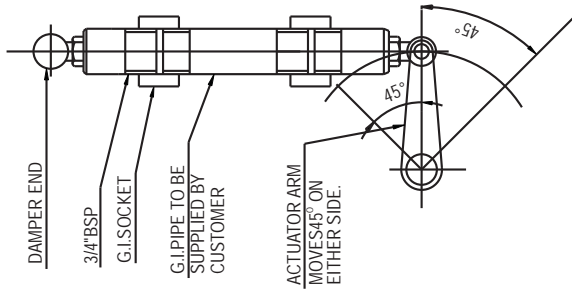
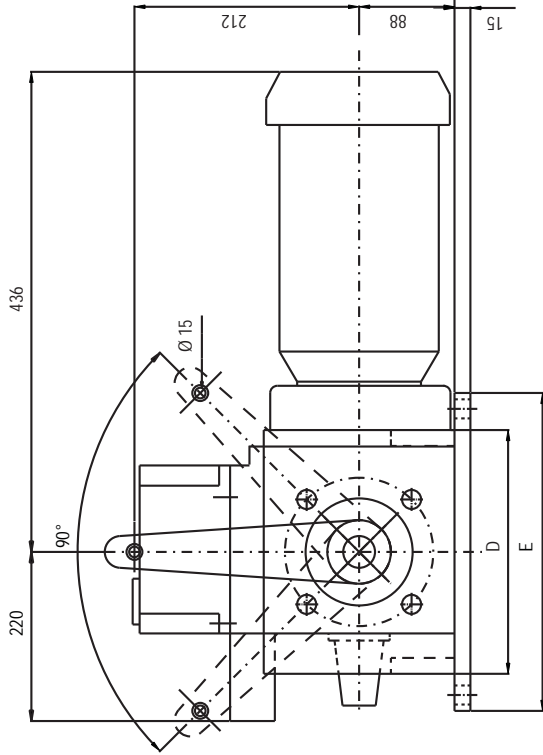
TITLE-
EMTORK ELECTRIC ACTUATOR WITH WORM GEAR BOX
MODEL:MO/M1/WG30
HORIZONTAL MOUNTING

DRG.NO.
 GEN 763

SHEET 1 OF 1

MODEL	A	B	C	Ø D	E	F	G	H	J	K
TMO/WG30	570	250	290	45	130	220	200	25	330	345
TM1/WG30	670	250	290	45	130	220	200	25	330	638

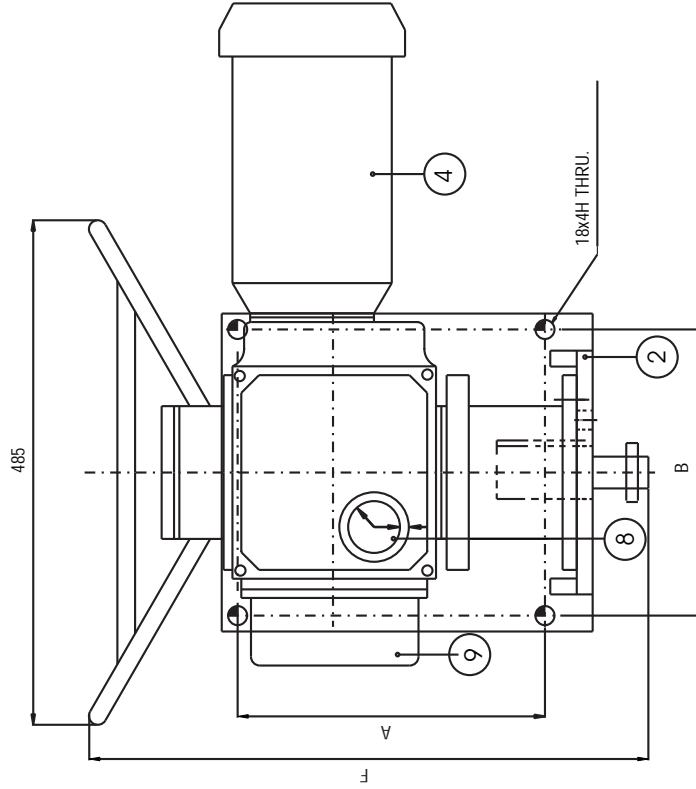
* Ø 20x4HOLES FOR MOUNTING IN THE BASE PLATE.



CENTRE POSITION
OF ARM TAKEN AS-
HORIZONTAL/VERTICAL

MODEL	A	B	C	D	E	F
TOMO	200	250	260	230	280	450
TOM1	290	270	350	230	300	550

S. NO.	QTY	DESCRIPTION	MATERIAL	REMARK
9	1	TERMINAL BOX	AL	
8	1	LOCAL INDICATOR	GLASS	
7	1	CLUTCH LEVER	M.S.	
6	1	LEVER	M.S.	
5	1	HAND WHEEL	M.S.	
4	1	MOTOR	AL, CI, CU	
3	4	FIXING BOLTS	M.S.	
2	1	MOUNTING BRACKET	M.S.	
1	1	ACTUATOR	CI, CS, AL	

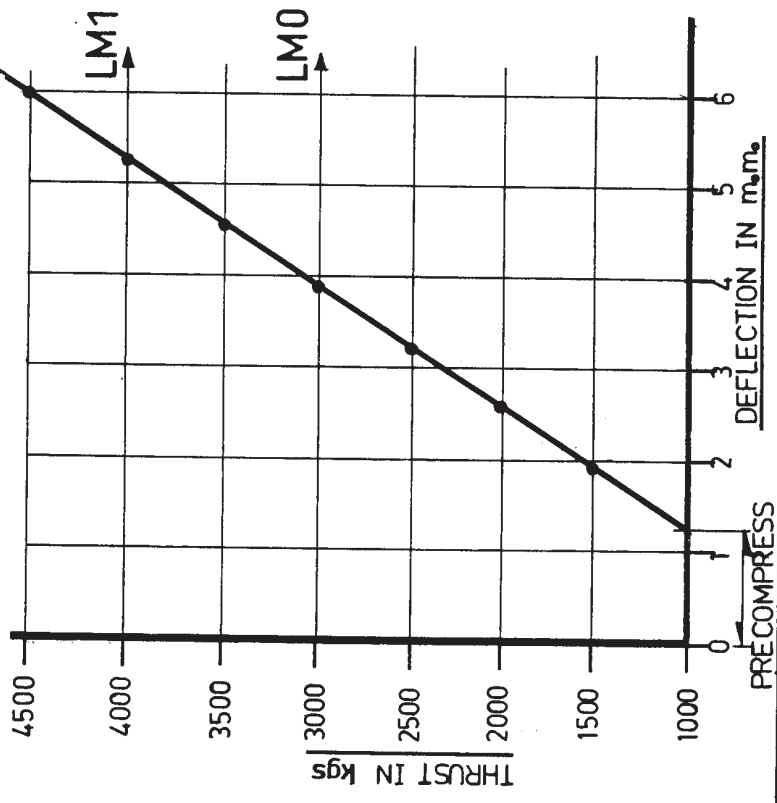
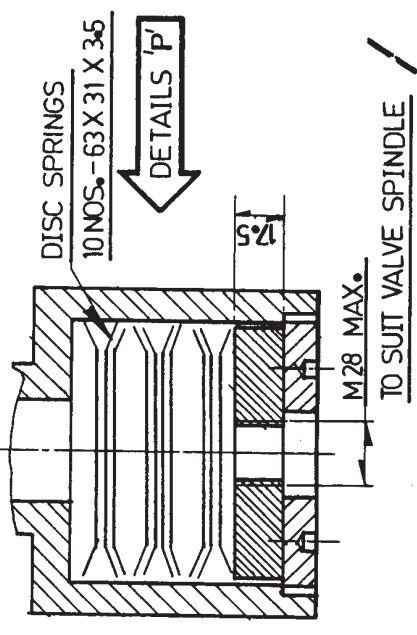
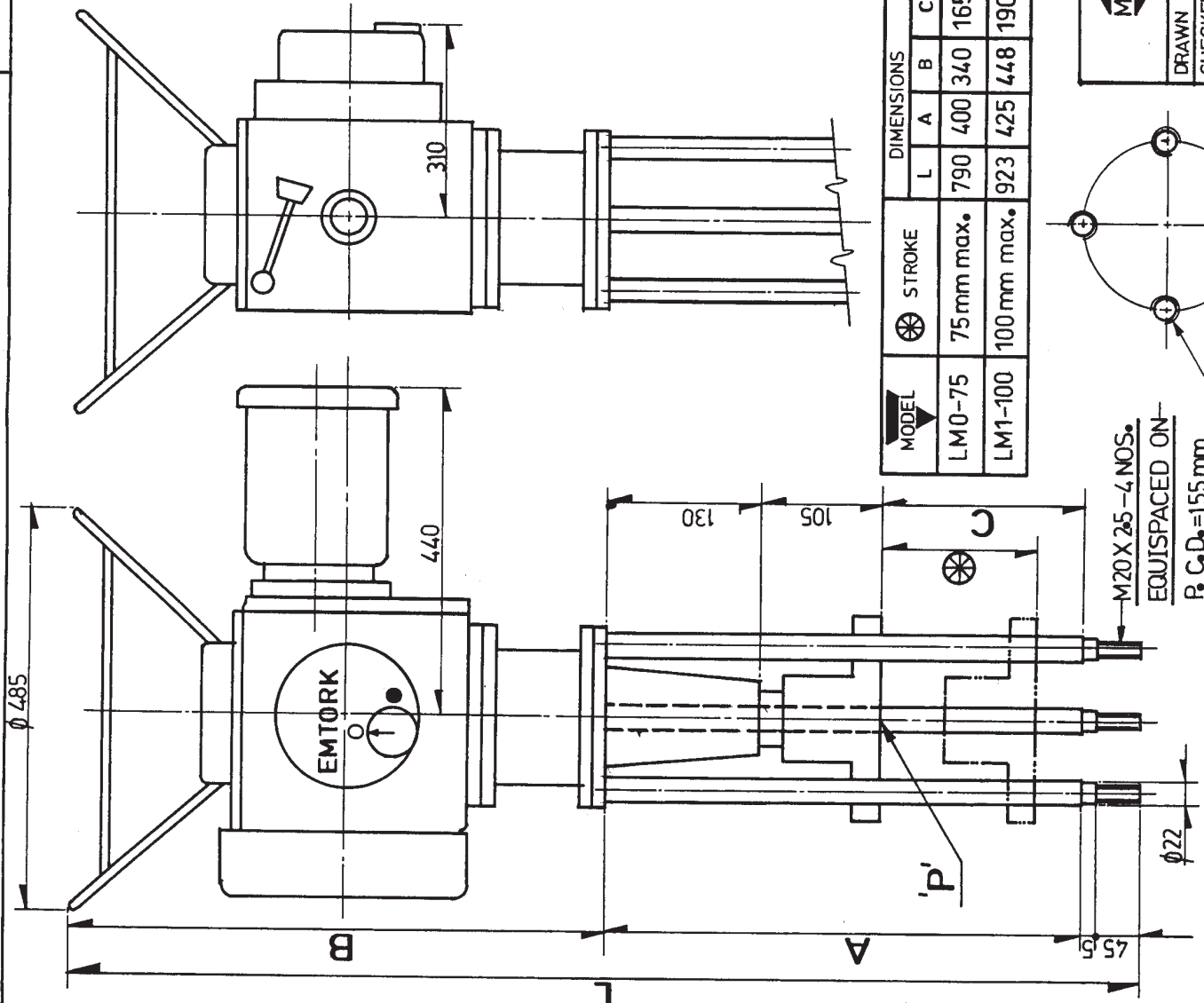


MARSH ENGINEERS

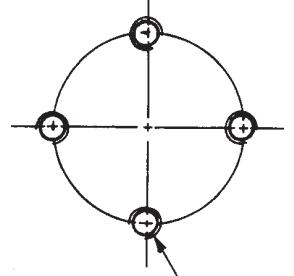
TITLE-
**ASSEMBLY DRAWING OF
EMTORK ACTUATOR
(TQM1 & TQM0) WITH
MOUNTING BKT.& LINKAGE**

DRG.NO.
STD 002

SHEET 1 OF 1



MODEL	STROKE	DIMENSIONS			
		L	A	B	C
LM0-75	75 mm max.	790	400	340	165
LM1-100	100 mm max.	923	425	448	190



M20 X 25 - 4 NOS.
EQUISPACED ON -
P.C.D. = 155 mm
FOR MOUNTING



MARSH ENGINEERS

DRAWN	REHANDAR
CHECKED	
APPROVED	<i>RM</i>
DATE	25.11.98
SCALE	

TITLE--

LINE/AR /ACTUATOR

(MODEL : LM0-75 & LM1-100)

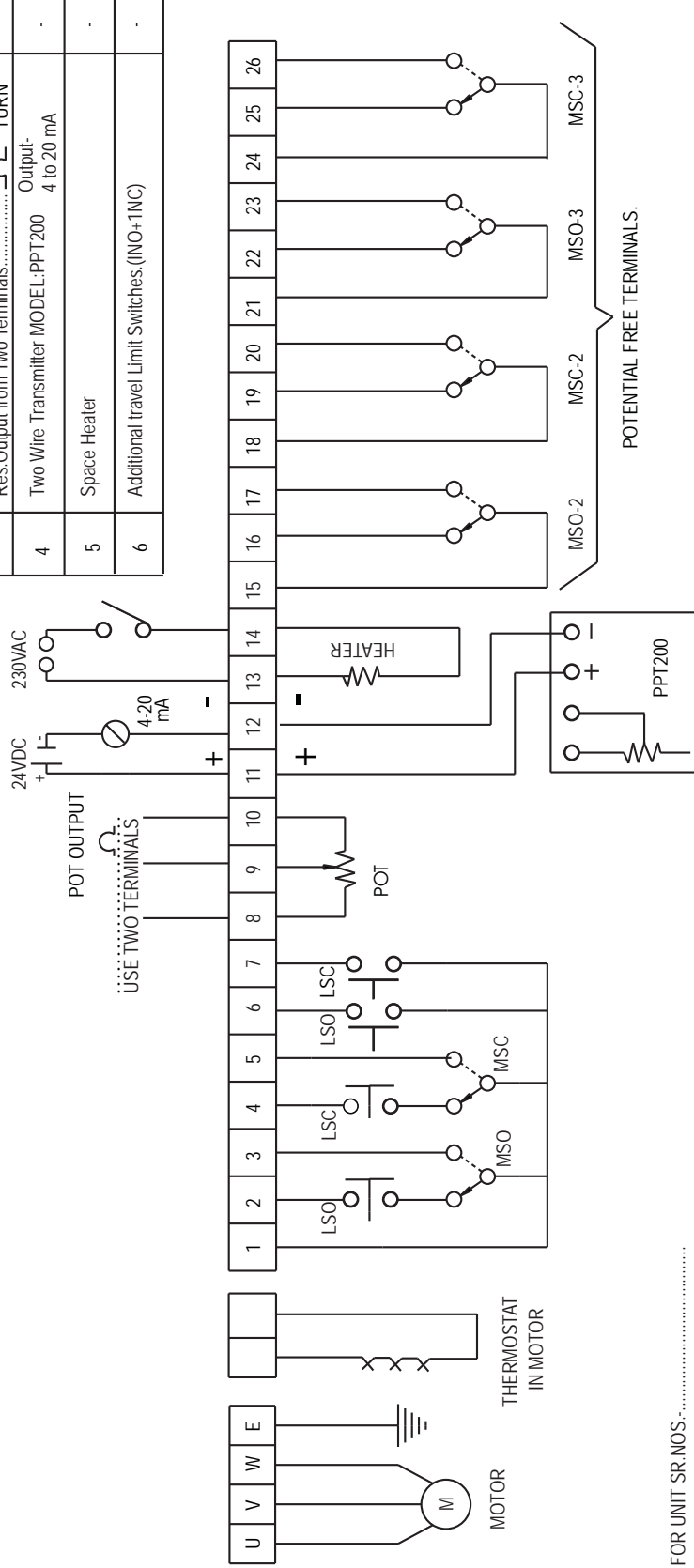
DRG. NO.

LM0-75 / LM1-100R1



ACTUATOR SUPPLIED WITH FOLLOWING ACCESSORIES

Sr. No.	Description	Qty.
1	Travel Limit Switches MSO & MSC (1NO+1NC)	2
2	Torque Limit Switches LSO & LSC (1NO+1NC)	2
3	Feed Back Potentiometer-Value: 250 SINGLE TURN Res.Output from Two Terminals:.....	1
4	Two Wire Transmitter MODEL:PPT200 Output- 4 to 20 mA	-
5	Space Heater	-
6	Additional travel Limit Switches, (1NO+1NC)	-



USER SCOPE →

ACTUATOR TERMINALS (SUPPLIER SCOPE) →

- NOTE - 1) FOR UNIT SR.NOS.....
 2) TERMINAL NOS.....ARE NOT APPLICABLE.
 3) SUPPLY TO THE MOTOR TO BE GIVEN THRU REVERSIBLE CONTROL PANEL WITH SWITCHES INTERLOCKED.



MARSH ENGINEERS


TITLE-

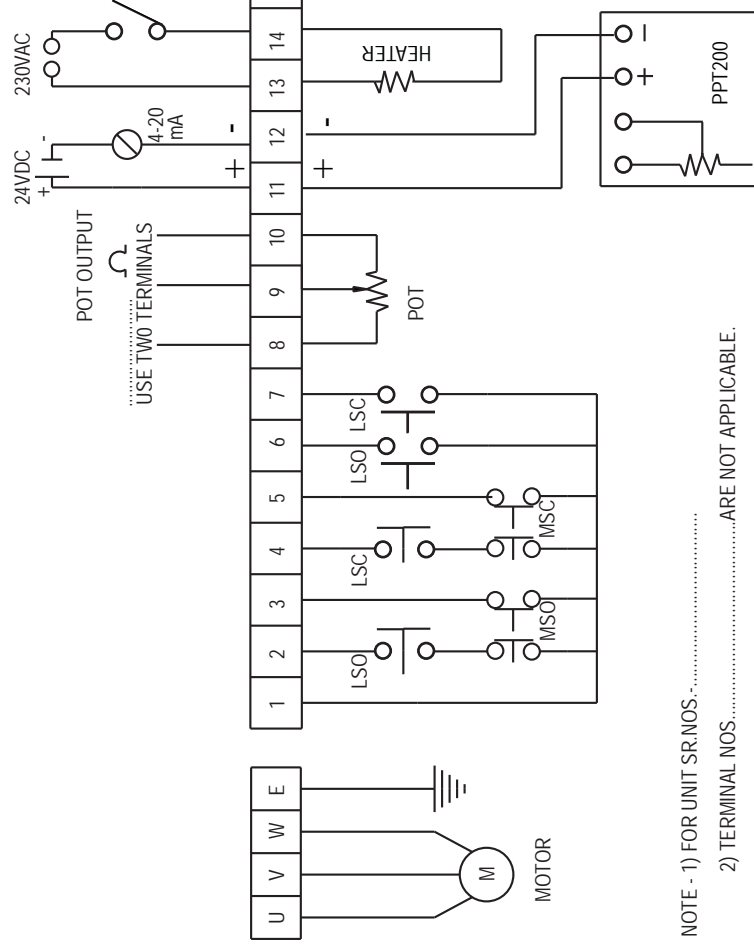
**EMTORK-3 PHASE ACTUATOR
 TERMINAL DIAGRAM (WITH OPTIONAL FOUR
 EXTRA TRAVEL LIMIT SWITCHES)
 SELF & NONSELF LOCKING MODELS**

DRG.NO.
N 001

SHEET 1 OF 1

ACTUATOR SUPPLIED WITH FOLLOWING ACCESSORIES

Sr. No.	Description	Qty.
1	Travel Limit Switches MSO & MSC (2NO+2NC)	
2	Torque Limit Switches LSO & LSC (2NO+2NC)	
3	Feed Back Potentiometer-Value: Res. Output from Two Terminals:.....  Output- 4 to 20 mA	
4	Two Wire Transmitter MODEL:PPT200	
5	Space Heater	




USER SCOPE

ACTUATOR TERMINALS (SUPPLIER SCOPE)

NOTE - 1) FOR UNIT SR.NOS.

2) TERMINAL NOS. ARE NOT APPLICABLE.

3) SUPPLY TO THE MOTOR TO BE GIVEN THRU REVERSIBLE CONTROL PANEL WITH SWITCHES INTERLOCKED.

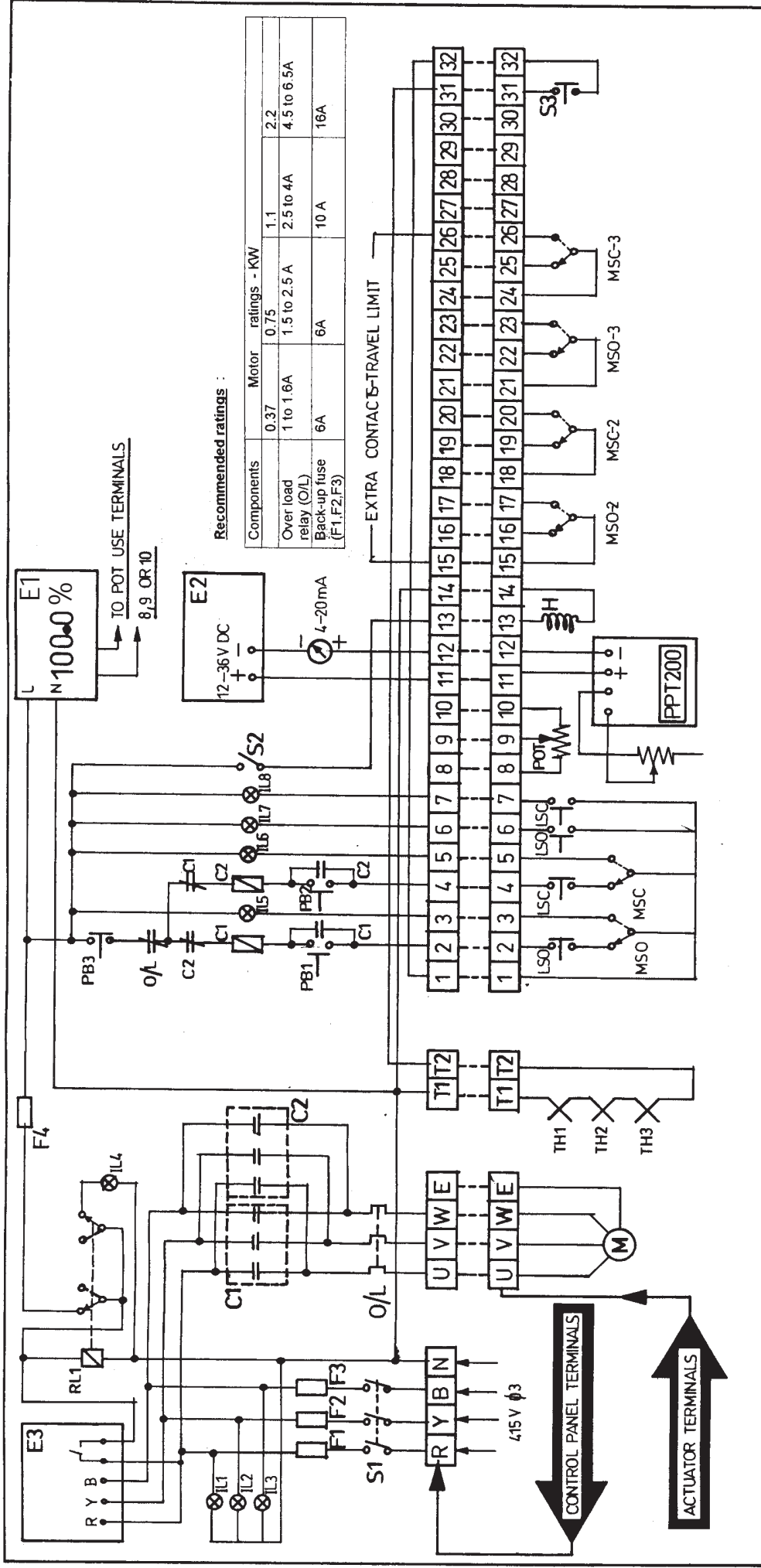


MARSH ENGINEERS

TITLE- **EMTORK TERMINAL DIAGRAM (WITH 2NO+2NC- TRAVEL & TORQUE LIMIT SWITCHES) SELF & NONSELF LOCKING MODELS**

DRG.NO. **N 002**

SHEET **1 OF 1**



COMPONENT DETAILS :-

S.N.	Ref.	Description	Specification	Qty.
1	S1	Isolator	415 V, 16 A	1
2	F1, F2, F3	HRC Fuses	Refer chart	3
3	IL1, IL2, IL3	Supply on Ind. Lamps	230 VAC	3
4	E3	Phase sequence protector	415 VAC 3 Phase	1
5	RL1	Relay	Plug-in type 230 VAC 2 c/o	1
6	F4	HRC Fuse	2A	1
7	IL4	Phase fault ind. Lamp	230 VAC	1
8	C1, C2	Contactors	No. 3 12 Amp + Aux. -2NO+2NC Coil 230 VAC	2
9	O/L	Over load relay cum 1 ph. preventor	Ref. chart	1
10	TH1, TH2, TH3	Thermostat	110°C	3
11	PB1, PB2	Push buttons Open/Close	230 VAC	2
12	PB3	Push button - stop	230 VAC Mushroom type	1
13	IL5, IL6, IL7, IL8	Valve opened, closed, fault ind. lamps		
14	S2	Switch for heater		
15	E1	Valve Position Indicator		
16	E2	D.C. Supply source	230 VAC	4
17	LSO, LSC	Torque Limit switches	SPST 230 VAC	1
18	MSO, MSC	Travel limit switches	5 Amp	
19	Pot	1 or 10 turn potentiometer	Digital 0-100%	1
20	PPT 200	Two wire transmitter	12 - 36 VDC 10 A at 500 VAC 10 A at 250 VAC output 100-230 Ohms (Normally) thru two wires Input : 100-230 Ohms Output : 4-20 mA (Normally)	1
21	H	Space heater	20 W - 230 VAC	1
22	MSO2, MSC2, MSO3, MSC3	Spare travel limit switches	10 A at 250 VAC	4
23	S3	Hand lever switch	10 A at 500 VAC	1

MARSH ENGINEERS

TITLE:-

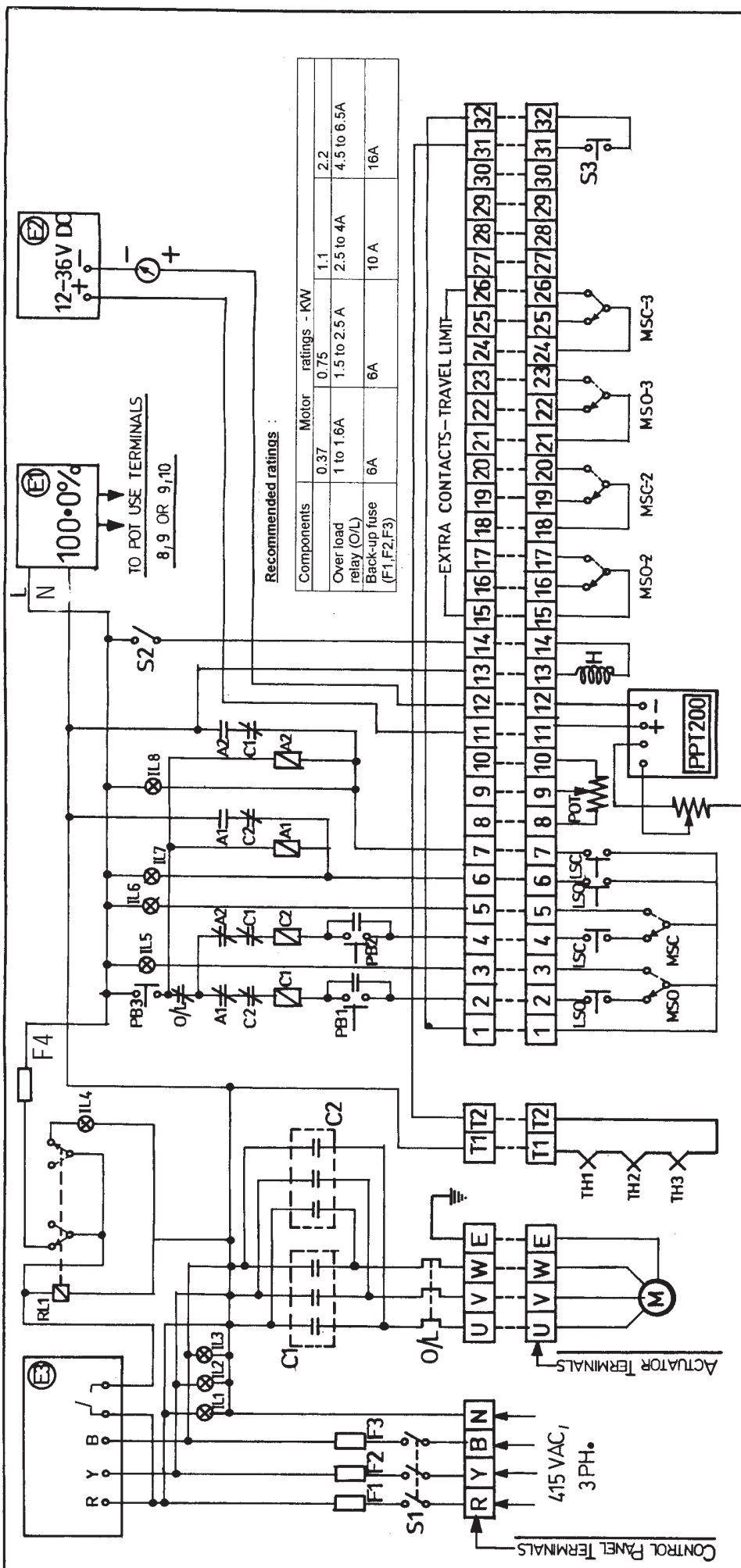
RECOMMENDED WIRING -

DIAGRAM FOR SELF-LOCKING

ACTUATOR FOR ON-OFF

APPLICATION

DRG. NO. **N011**



COMPONENT DETAILS :

S.N.	Ref.	Description	Specification	Qty.
1	S1	Isolator	415 V, 16 A	1
2	F1, F2, F3	HRC Fuses	Refer chart	3
3	IL1, IL2, IL3	Supply on Ind. Lamps	230 VAC	3
4	E3	Phase sequence protector	415 VAC 3 Phase	1
5	RL1	Relay	Plug-in type 230 VAC 2 c/o	1
6	F4	HRC Fuse	2A	1
7	IL4	Phase fault Ind. Lamp	230 VAC	1
8	C1, C2	Contactors	No. 3 12 Amp + Aux-2NO+2NC Coil 230 VAC	2
9	O/L	Over load relay cum 1 ph. preventor	Ref. chart	1
10	TH1, TH2, TH3	Thermostat	110°C	3
11	PB1, PB2	Push buttons Open/Close	230 VAC	2
12	PB3	Push button - stop	Self illuminating 230 VAC	1
			Mushroom type	
13	IL5, IL6 IL7, IL8	Valve opened, closed, fault ind. lamps	230 VAC	4
14	S2	Switch for heater	SPST 230 VAC 5 Amp	1
15	E1	Valve Position Indicator	Digital 0-100%	1
16	E2	D.C. Supply source	12 - 36 VDC	1
17	LSO, LSC	Torque Limit switches	10 A at 500 VAC	2
18	MSO, MSC	Travel limit switches	10 A at 250 VAC	2
19	Pot	1 or 10 turn potentiometer	output 100-230 Ohms (Normally) thru two wires Input : 100-230 Ohms Output : 4-20 mA (Normally)	1
20	PPT 200	Two wire transmitter		1
21	H	Space heater	20 W - 230 VAC	1
22	MSO2, MSC2, MSO3, MSC3	Spare travel limit switches	10 A at 250 VAC	4
23	S3	Hand lever switch	10 A at 500 VAC	1
24	A1, A2	Relays	2 c/o Coil 230 VAC	2

MARSH ENGINEERS

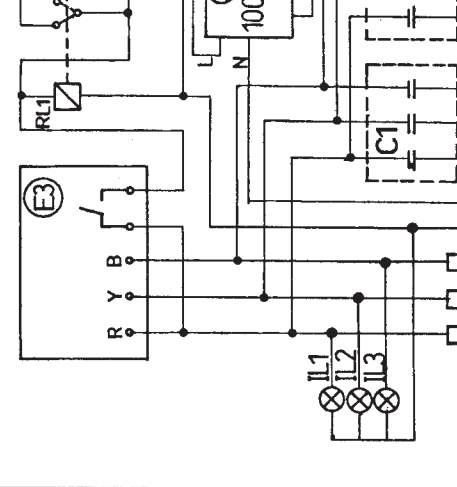
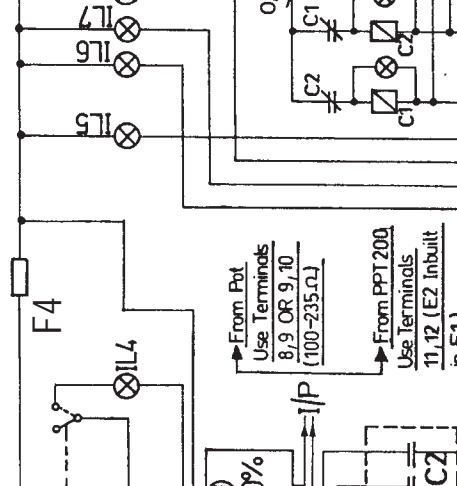
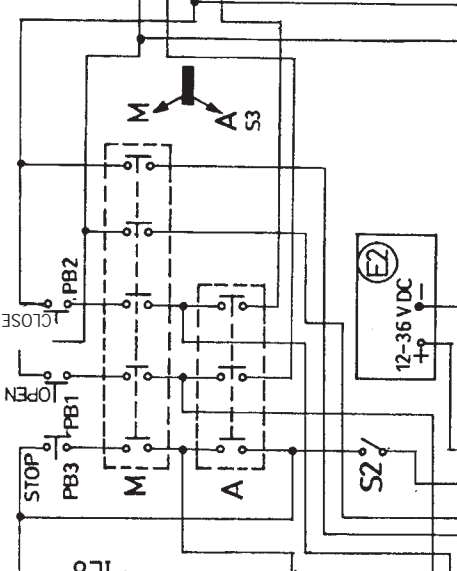
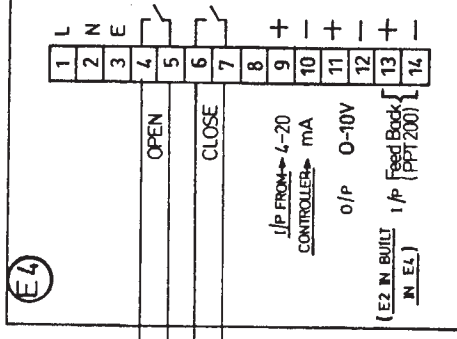
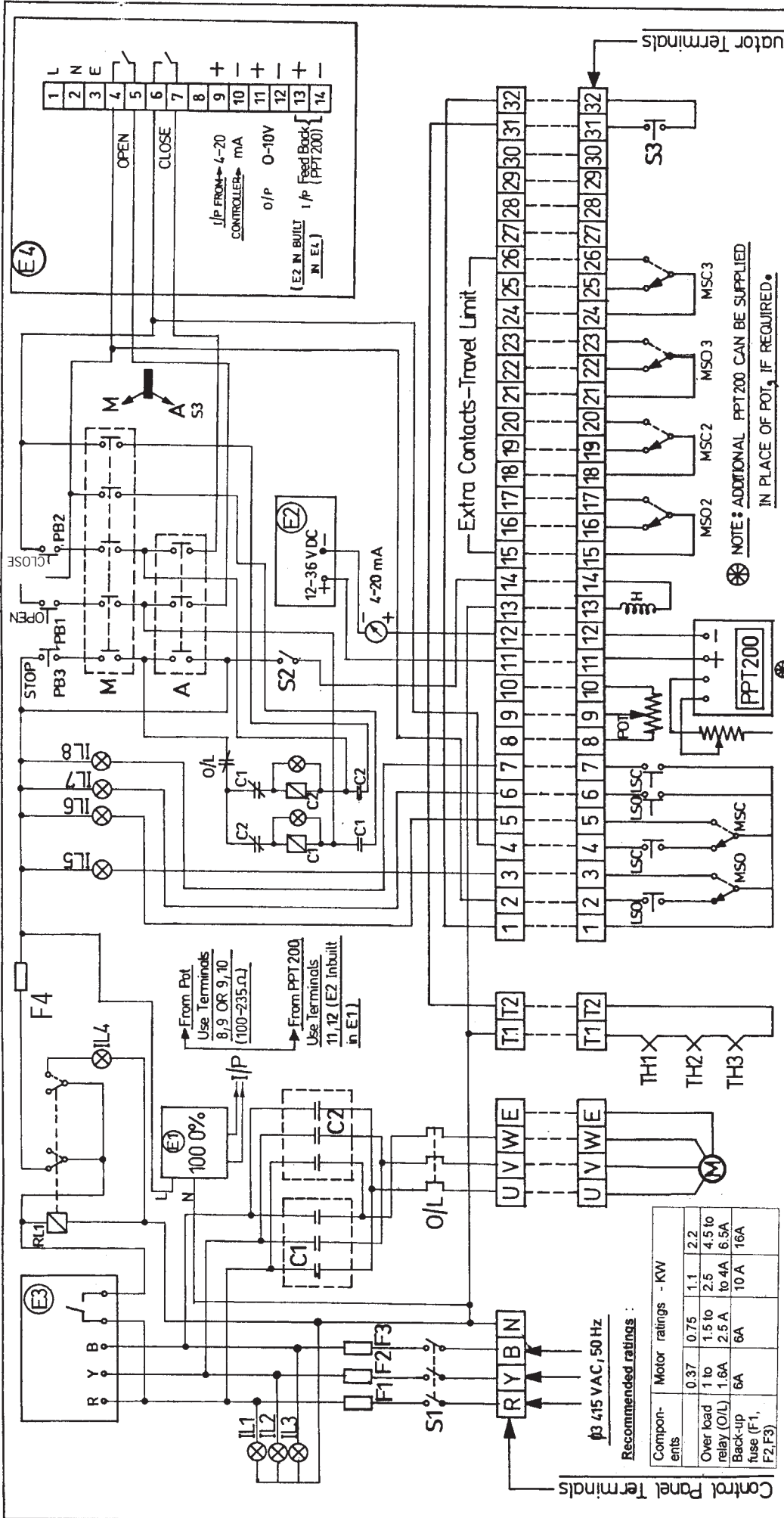
TITLE -

RECOMMENDED WIRING DIAGRAM

FOR NON-SELF LOCKING ACTUATOR

FOR ON-OFF APPLICATION

DRG. NO. N 012



Recommended ratings :

Component	Motor ratings - KW
Over load relay (O/L)	0.37 to 1.1
Back-up fuse (F1, F2, F3)	1.5 to 2.5 to 4A 6.5A to 10 A 16A

COMPONENT DETAILS :

Sr. No	Description	Specification
1	S1 Isolator	415 V, 16 A
2	F1, F2, F3 HRC Fuses	Refer chart
3	IL1, IL2, IL3 Supply on Ind. Lamps	230 VAC
4	E3 Phase sequence protector	415 VAC 3 Phase
5	RL1 Relay	Plug-in type 230 VAC 2 c/o
6	F4 HRC Fuse	2A
7	IL4 Phase fault Ind. Lamp	230 VAC
8	C1, C2 Contactors	3 NO 12 Amp + Aux. -2NO+2NC Coil 230 VAC
9	O/L Over load relay	cur 1 ph. preventor

19	Pot	1 or 10 turn potentiometer	1
20	PPT 200	Two wire transmitter	1
21	H	Space heater	20 W - 230 VAC
22	MSO2, MSO3, MSC3	Spare travel limit switches	10 A at 250 VAC
23	S3	Hand lever switch	10 A at 500 VAC
24	E4	Valve Positioner	Marsh Model No.
Note : E2 is not required if E4 is having internal D.C. Supply for current loop power of PPT200, 2 wire transmitter			
25	S3	3 Position selector switch	MAN-OFF-AUTO

10	TH1, TH2, TH3	Thermostat	110°C	3
11	PB1, PB2	Push buttons Open/Close	230 VAC	2
12	PB3	Push button - stop	Self Illuminating 230 VAC	1
13	IL5, IL6, IL7, IL8	Valve opened, closed, fault ind. lamps	Mushroom type 230 VAC	4
14	S2	Switch for heater, power ON/OFF	SPST 230 VAC 5 Amp	1
15	E1	Valve Position Indicator	Digital 0-100%	1
16	E2	Torque Limit switches	12 - 36 VDC	1
17	LSO, LSC	Travel limit switches	10 A at 500 VAC	2
18	MSC, MSC	Travel limit switches	10 A at 250 VAC	2

MARSH ENGINEERS

Recommended Wiring Diagram

For Self Locking Actuator

(Modulating Duty)

DRG. NO. N 013

28-07-2000

Sr. No	Description	Specification
1	S1 Isolator	415 V, 16 A
2	F1, F2, F3 HRC Fuses	Refer chart
3	IL1, IL2, IL3 Supply on Ind. Lamps	230 VAC
4	E3 Phase sequence protector	415 VAC 3 Phase
5	RL1 Relay	Plug-in type 230 VAC 2 c/o
6	F4 HRC Fuse	2A
7	IL4 Phase fault Ind. Lamp	230 VAC
8	C1, C2 Contactors	3 NO 12 Amp + Aux. -2NO+2NC Coil 230 VAC
9	O/L Over load relay	cur 1 ph. preventor