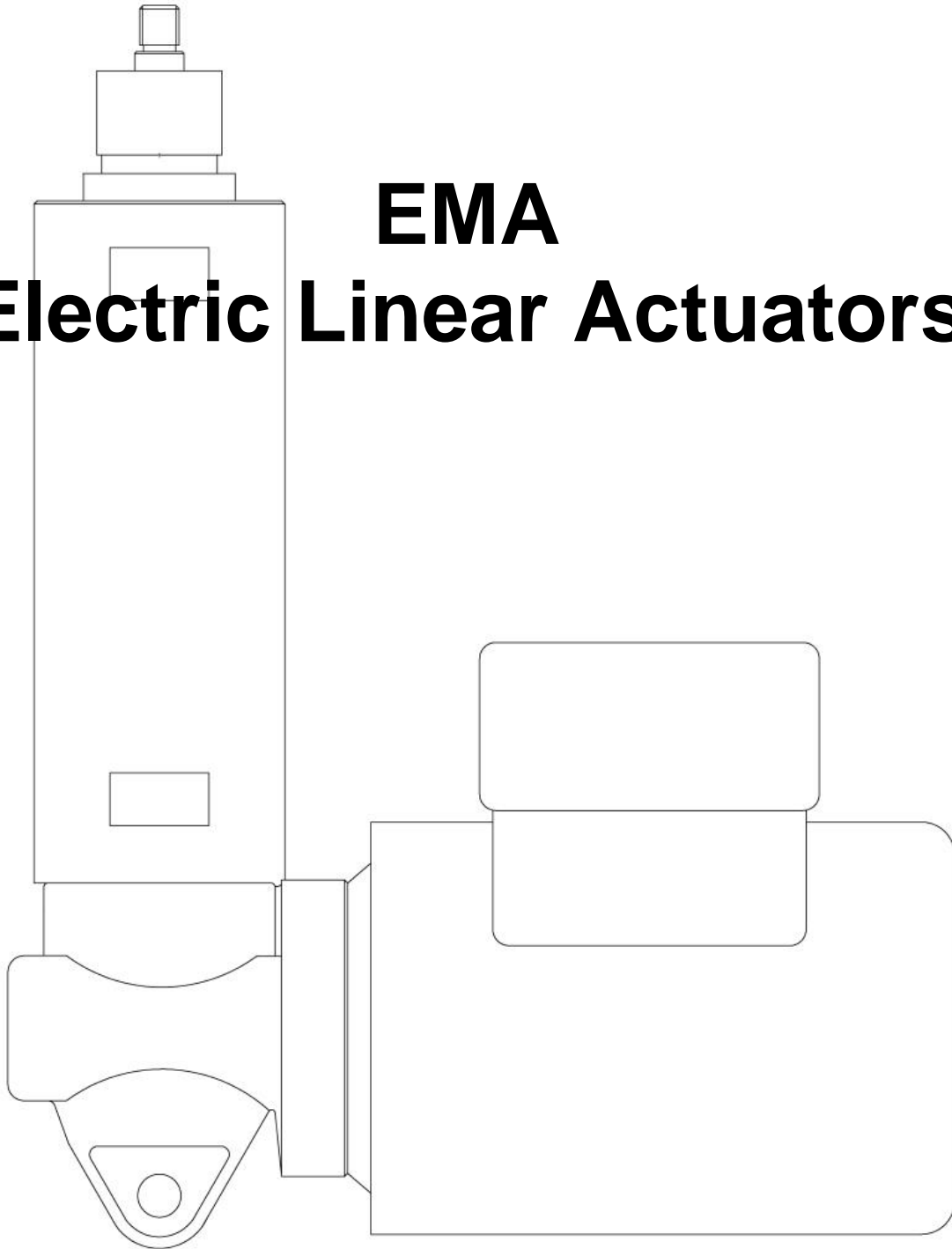


**EMA
Electric Linear Actuators**



Contents

1. SAFETY AUTHORISED USE.....	3
1.1 RESIDUAL RISK AND HAZARDS.....	3
1.2 OPERATING PERSONNEL	3
1.3 COMMISSIONING	4
1.4 MODIFICATIONS AND ALTERATIONS TO THE UNIT	4
2. DESCRIPTION.....	5
3. TECHNICAL DATA	6
3.1 MODEL I - INTERMITTENT (LESS THAN 10 STARTS/DAY, 10 HOURS/DAY)	6
3.2 MODEL C - CONTINUOUS (MORE THAN 10 STARTS/DAY)	6
3.3 MODEL H - HIGH SPEED CONTINUOUS	6
4. MOUNTING A SINGLE ACTUATOR	7
4.1 UNPACKING AND INSTALLATION	7
4.2 MOUNTING	7
4.3 MOUNTING OPTIONS	8
5. ADJUSTING THE LIMIT SWITCHES	9
6. ADJUSTING THE CLUTCH	10
6.1 EMA CLUTCH GENERAL ASSEMBLY	11
6.2 EMA CLUTCH SETTINGS	11
7. ELECTRICAL INSTALLATION.....	12
7.1 LIMIT SWITCH – ELECTRO-MECHANICAL TYPE	12
7.2 MOUNTING THE DRIVE MOTOR	12
7.3 STANDARD MOTOR TERMINAL BOX POSITION	13
7.4 OPTIONS.....	13
7.5 MOTOR CONNECTION.....	13
7.5.1 Three Phase Motor Connections	13
7.5.2 Single Phase Motor Connections	14
7.5.3 DC Motor.....	14
8. MAINTENANCE AND LUBRICATION	14
9. PARTS LIST - GENERAL.....	15
9.1 EMA ELECTRIC LINEAR ACTUATOR (GENERAL ASSEMBLY)	16

1. Safety Authorised use

EMA electric linear actuators are exclusively designed for carrying out lifting, lowering and feeding movements with the lifting forces up to 10 kN. Any other application other than specified or one going beyond the above mentioned capacity is unauthorised. The manufacturer is not liable for damages resulting from such applications. The user alone has to bear the risk.

Since the actuators can be applied in various areas, the user is responsible for the specific application of use.

In compliance with the regulations concerning the electromagnetic compatibility of machines, the EMA linear actuators may only be used in industrial areas according to the definition EN 50 081-2.

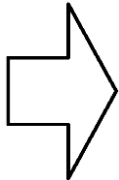
Safety instructions in the operating manual



This symbol indicates potential dangers to people. Comply with the instructions in order to avoid injury.



This symbol indicates potential dangers to the unit. Comply with the instructions in order to avoid damage to the unit.



This symbol indicates special information on:

- the best possible use of the unit
- how to facilitate operation of the unit

1.1 Residual risk and hazards

Should a risk of damage to material or injury to persons remain despite the structural safety of the EMA actuators, the user must employ other safety measures and draw attention to such hazards by means of suitable warning notices and written instructions indicating safety precautions.

1.2 Operating personnel

The EMA electric linear actuators are designed according to state-of-the-art technology and are in line with applicable safety regulations.

However, the general risks of personal injury or damage to property connected with the use of such machinery cannot be completely eliminated. Therefore the units may only be assembled and operated by competent and qualified personnel and only be used for the authorised application. Therefore a careful study of this operating manual should be made before attempting to use or service the unit and particular attention should be paid to the safety instructions.

Work to be performed on electrical parts, such as:

- installation of limit switches
- mounting of the drive
- Checking of the direction of rotation may only be carried out by qualified electricians.

The linear actuators and the installation should be inspected by the operating and supervising personnel for externally visible damage and defects at least once every shift. Any changes (including the operational conditions) which may affect the safety are to be reported immediately.

1.3 Commissioning

The EMA electric linear actuators must not be put into service before the machinery into which it is to be incorporated fulfils all provisions of the EC directive relating to machinery.

1.4 Modifications and alterations to the unit

It is not permitted to make any alterations to the safety features or design of the EMA electric linear actuators without our written consent. Power Jacks declines any responsibility in the event of such alterations. Worn and spare parts may only be replaced after consultation with our service technicians or by them personally. It is not permitted to disassemble or disconnect any safety or protection device. When using special accessories the assembly instructions of the manufacturer must be observed!

The following regulations must be complied with:

- the relevant regulations for the prevention of accidents
- generally recognised safety regulations
- EC guidelines and
- National regulations

To comply with the regulations concerning the electromagnetic compatibility of machines, the units must be connected according to EC rules & regulations. Therefore the norms EN 50 081-2 and EN 50 082-2 should be observed, to avoid electromagnetic interference.

2. Description

EMA electric linear actuators are mainly used whenever precisely controlled lifting, lowering or feeding movements are required. The actuators consist of either a trapezoidal or ball lead screw, driven by an electric motor through spiroid gearing. The screw converts the rotary motion into linear movement. As the screw rotates, the nut extends and retracts the ram, which is attached to the load.

There are 3 standard EMA models, all available in a right-angle drive configuration.

- Intermittent model, incorporating a trapezoidal screw.
- Continuous model, incorporating a ball screw
- High Speed Continuous model, incorporating a ball screw.

Where the standard range does not meet the application specification, special actuators can be designed to meet customers' specific requirements.

As standard, the units are available with 240V / 415VAC 3phase or 240VAC 1 phase or 24VDC motors, with or without a brake. The type of motors required is dependent on the customer's application. The motors are mounted to the actuator on an IEC 63C Face Flange Mounting.

3. Technical Data

3.1 Model I - Intermittent (less than 10 starts/day, 10 hours/day)

Dynamic Load Capacity (kN)	Linear Speed (mm/min)	Motor (kW) Frame Size	Motor Frame Size	Motor Poles	Max. Stroke (mm) (in compression)
10	135	0.18	D63	6	750
5	200	0.18	D63	4	750
5	270	0.18	D63	6	750
5	410	0.18	D63	2	750
2.5	820	0.18	D63	2	750

3.2 Model C - Continuous (more than 10 starts/day)

Dynamic Load Capacity (kN)	Linear Speed (mm/min)	Motor (kW) Frame Size	Motor Frame Size	Motor Poles	Max. Stroke (mm) (in compression)
10	225	0.18	D63	6	900
10	335	0.18	D63	4	900
10	685	0.18	D63	2	900
5	1370	0.18	D63	2	1250
2.5	2740	0.18	D63	2	1500

3.3 Model H - High Speed Continuous

Dynamic Load Capacity (kN)	Linear Speed (mm/min)	Motor (kW) Frame Size	Motor Frame Size	Motor Poles	Max. Stroke (mm) (in compression)
10	900	0.25	D71	6	900
10	1375	0.37	D71	2	900
10	2755	0.55	D71	2	900
5	1805	0.18	D71	6	1250
5	5510	0.37	D71	2	1250

4. Mounting a single actuator

4.1 Unpacking and Installation

Remove the EMA electric linear actuator from its container. Dispose of the packaging material and the desiccant in an environmentally friendly way. If it is necessary and in order to avoid damages, please use soft straps to transport or mount the actuator.



In order to avoid damage; do not attach the straps to the inner tube but to the outer housing of the drive or to the gearbox.

4.2 Mounting

There are two possible ways of mounting the EMA actuator at the gearbox end:

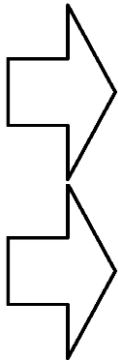
By means of bearing journals for trunnion mounting or clevis mount.

Rear Clevis

- Mount the actuator by attaching the desired bracket and pin to the clevis end. Refer to section 4.2.1 for ram mounting options.
- Verify that the ram attachment is aligned throughout the actuator stroke before connecting the ram. The ram attachment will either be pinned or bolted in place depending on chosen model.

Trunnion Mount

- Mount the actuator by attaching the desired bearings (or mounting feet) to the trunnion pins. Refer to section 4.2.1 for ram mounting options.
- Verify that the ram attachment is aligned throughout the actuator stroke before connecting the ram. The ram attachment will either be pinned or bolted in place depending on chosen model.

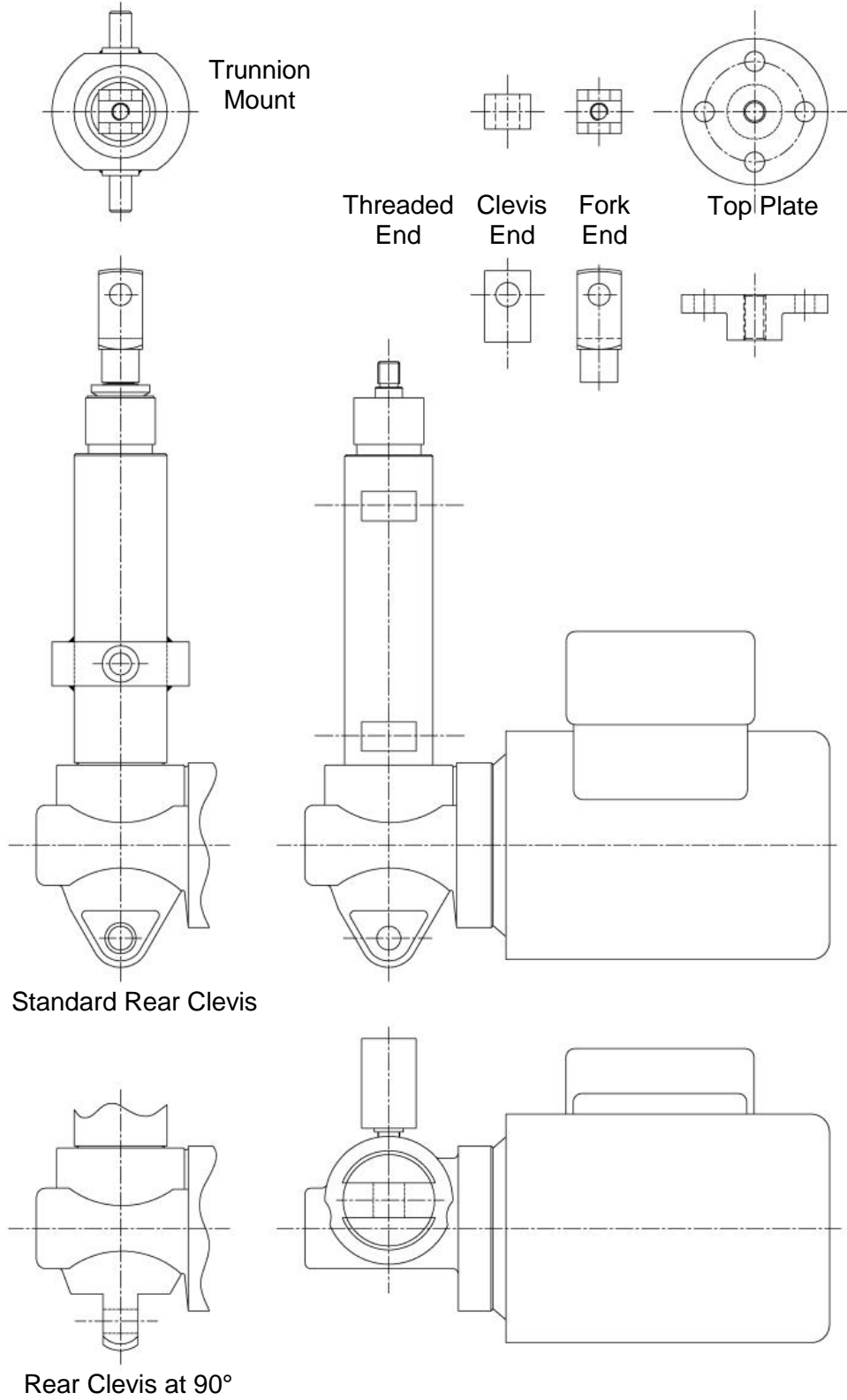


Always ensure that clevis holes align correctly and that they allow for the correct angle of pivoting for the application before operating the actuator.

Side loads on the actuator ram should be avoided by ensuring that the load is guided. The load guide mechanism should resist the torque developed at the ram by the screw mechanism. A guided ram can be supplied on request, which utilises a keyway in the inner ram, eliminates the need for torsional restraint and therefore allows flexibility in the choice of end fitting.

The desired mounting orientation will be determined when placing the order; this orientation must be maintained at installation.

4.3 Mounting Options



5. Adjusting the limit switches



Electrical connections may only be performed by licensed electricians.

Standard mechanical limit switches are used to cut off the electrical drive before the final position is reached. The limit switch is triggered by a cam on the lifting nut assembly. The positions of these limit switches are fixed and are not adjustable. The position is determined by the length of stroke specified by order and cannot be changed at a later date. The mounting of a position-measuring system is possible as an option.



Suitably rated mechanical safety limit switches must be used if the non-disconnection of the electrical drive constitutes a potential danger to people.

Adjusting the best possible sensing distance:

1. Position the cam on the lifting nut assembly to cover the opening of the switch.
2. Screw the switch into the housing until the unit switches over.
3. Lock the switch in place with the lock nut.
4. Check the correct function of the switches by moving the lifting-nut assembly manually.
5. If the switch works correctly then repeat the procedure for the next switch. Otherwise repeat procedure for this switch.
6. Once all the limit switches are set ensure that the cam on the lifting nut is resting in a position in between both end of travel limit switches.



The drive must not be put into service before all limit switches have been mounted and correctly adjusted.

6. Adjusting the Clutch

The clutch is a device mounted on the actuator inner tube (ram) which will slip when the torque to drive the load exceeds the limit set. (refer 6.1)

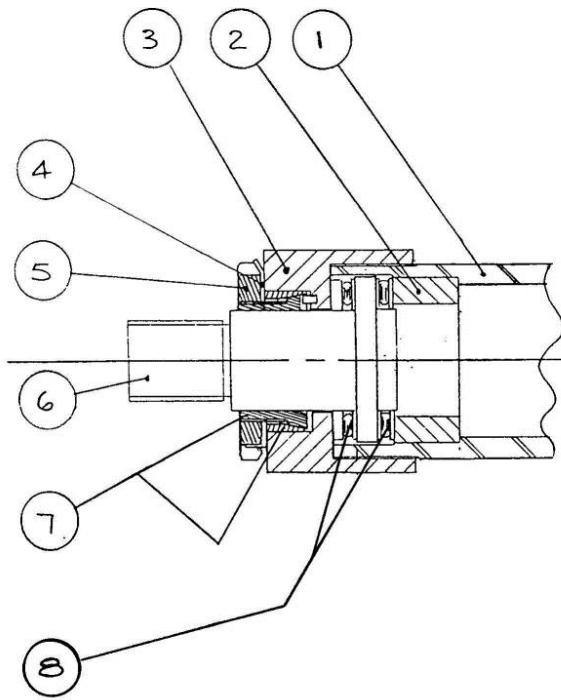
The clutch spindle, (6) that is attached to the load via an end fitting, is supported on bearings (8) and clamped from rotating by interlocking conical rings (7). The clamping load is applied by a locknut (5) with keyways to engage a tab washer (4). The clutch housing (3) is attached to the inner tube (1) and the clamping effort of the conical rings (7) carries the residual torque of lifting to the clutch spindle (6).

If the load is axially locked or if a torque greater than the clutch setting is required to move the load, the conical rings will rotate within each other, disengaging the spindle to inner tube drive and preventing the motor from overloading the actuator components or the load guides etc.

Under normal operation and with no overload experienced the clutch requires no regular maintenance or adjustment. If however the clutch slips regularly in operation the setting of the clutch will reduce to a point where the normal operating torque will overcome the clutch and the load will not move. Under these circumstances the clutch can be adjusted as follows:

1. Remove the actuator from the installation.
2. Extend the inner tube (1) and clamp in soft jaws in a vice.
3. Bend out the tab of the washer (4) from the keyway of locknut (5).
4. With a suitable fitting screwed on to the clutch spindle (6) tighten the locknut until a torque is indicated in table 1 (refer 6.2) is measured, e.g. Clutch lever forces in table are for a 254mm (10in) lever inserted through clevis.
5. When the torque has been set, bend a tab of the washer into an adjacent keyway in the locknut. The actuator is ready to reinstall.
6. The clutch is selected from either of the following:
 - a) Ringspan Cone Clamping Element TLK 250:-
 - i) 4202015.001 - 27Nm max.
 - ii) 4202025.001 - 74Nm max.
7. When assembling the clutch a small quantity of oil (3 in 1) should be applied to the cone (7) surfaces.

6.1 EMA Clutch General Assembly



Item Number	Description
1	Inner Tube (ram)
2	Distance Piece
3	Clutch Housing
4	Tab Washer
5	Lock Nut
6	Clutch Spindle
7	Conical Rings
8	Thrust Bearing

6.2 EMA Clutch Settings

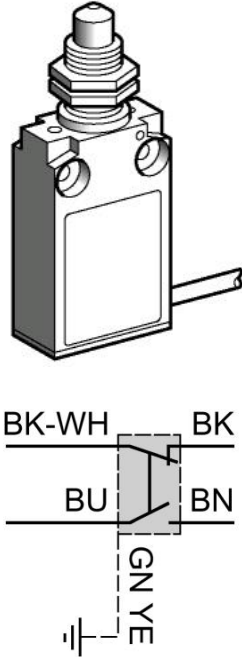
Actuator Rating	Lead	Type	Torque	Clutch Lever Force	
				lbs	kg
(kg)	(mm)	-	(Nm)		
250	3	T	7.8	7	3
250	5	B	4.9	4	2
250	6	T	15.6	14	6
250	10	B	9.8	9	4
250	12	T	31.2	28	13
250	20	B	19.5	17	8
250	25	B	24.4	22	10
500	3	T	15.6	14	6
500	5	B	9.8	9	4
500	6	T	31.2	28	13
500	10	B	19.5	17	8
500	12	T	62.4	55	25
500	20	B	39	35	16
500	25	B	48.8	43	20
1000	5	B	19.5	17	8

Type:

- T - Trapezoidal
- B - Ball Screw

7. Electrical Installation

7.1 Limit Switch – Electro-Mechanical Type



Item	Description
Housing	Metal, compact housing, totally enclosed and sealed.
Pre-Cabled	2m PVC cable 5x0.75mm ² (other cable lengths available on request).
Switch type	Single-pole, 1 change-over, snap action.
Switch Actuation	End of plunger (metal).
Max actuation speed	0.5 m/s
Mechanical durability	10 million operating cycles.
Ambient temperature	
Operation	-25°C → +70°C
Storage	-40°C → +70°C
Product conformity	IEC947-5-1
Enclosure	IP67
Operating characteristics	AC-15; B300 (Ue=240V, Ie=1.5A) DC-13; R300 (Ue=250V, Ie=0.1A)
Insulation voltage	Ui=300V

7.2 Mounting the drive motor



The electrical installations and the checking of the direction of rotation may only be carried out by a licensed electrician.

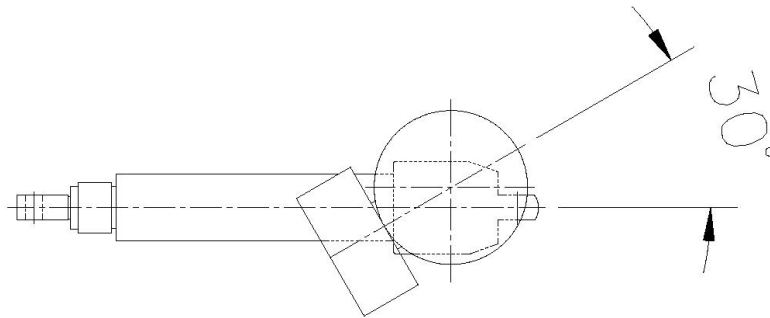


Connect the motor in compliance with the electro-technical regulation

Before mounting the motor, check the direction of rotation / linear travel of the EMA actuator and the operation of the limit switches (if fitted). In order to do this:

1. Place the motor at the mounting position near the gearbox input.
2. Switch on the motor and check the direction of rotation.
3. Check the direction of rotation / linear travel by manually turning the gearbox input shaft. Change the direction of the motor rotation if necessary by changing motor connections.
4. Where necessary, attach coupling halves to motor shaft.
5. Mount motor onto gearbox input flange using screws provided.

7.3 Standard Motor Terminal Box Position



7.4 Options

- Delivery with mounted brake motor (DC or AC brake).
- Delivery with non-standard motor types e.g. servo motor, 48VDC motor.
- Special request, motor being supplied by the customer.

7.5 Motor Connection

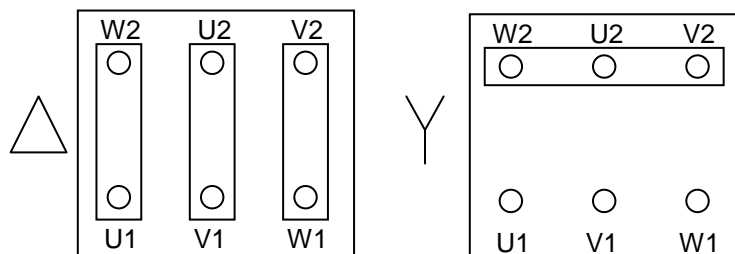
The electrical connections for the standard three-phase, single-phase or DC-permanent-magnet motor are within the terminal box. Appropriate rated and insulated cables require to be selected in accordance with the rated power. If motors are supplied with flying leads please consult Power Jacks.



All electrical connections are to be carried out by a qualified electrician.

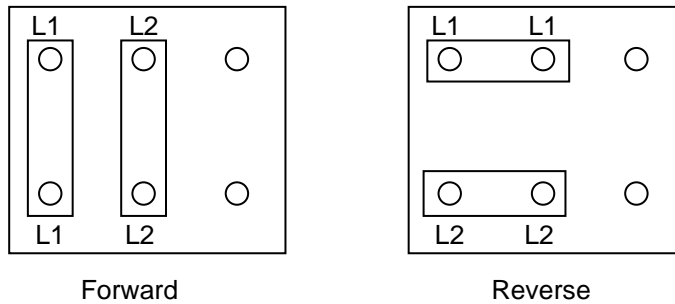
7.5.1 Three Phase Motor Connections

Star and Delta connections for dual wound motors

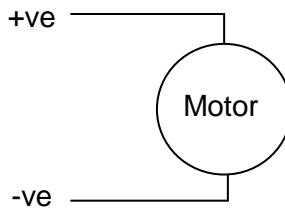


7.5.2 Single Phase Motor Connections

This diagram is typical for motors with on board capacitors connected to the motor for the correct start and run characteristics. For motors with loose capacitors consult Power Jacks or the motor manufacturer.



7.5.3 DC Motor



8. Maintenance and Lubrication

Unless otherwise specified the actuators are shipped with their full requirement of grease for normal operation. The actuators should not need a lubrication refill within their standard life provided they have been installed and used correctly. Should the unit require lubrication then use one of the following extreme pressure greases or their equivalent:

Shell	Alvania WR2
BP	Energrease LC2
Castrol	Spheerol L-EP2
Mobil	Mobilux EP2

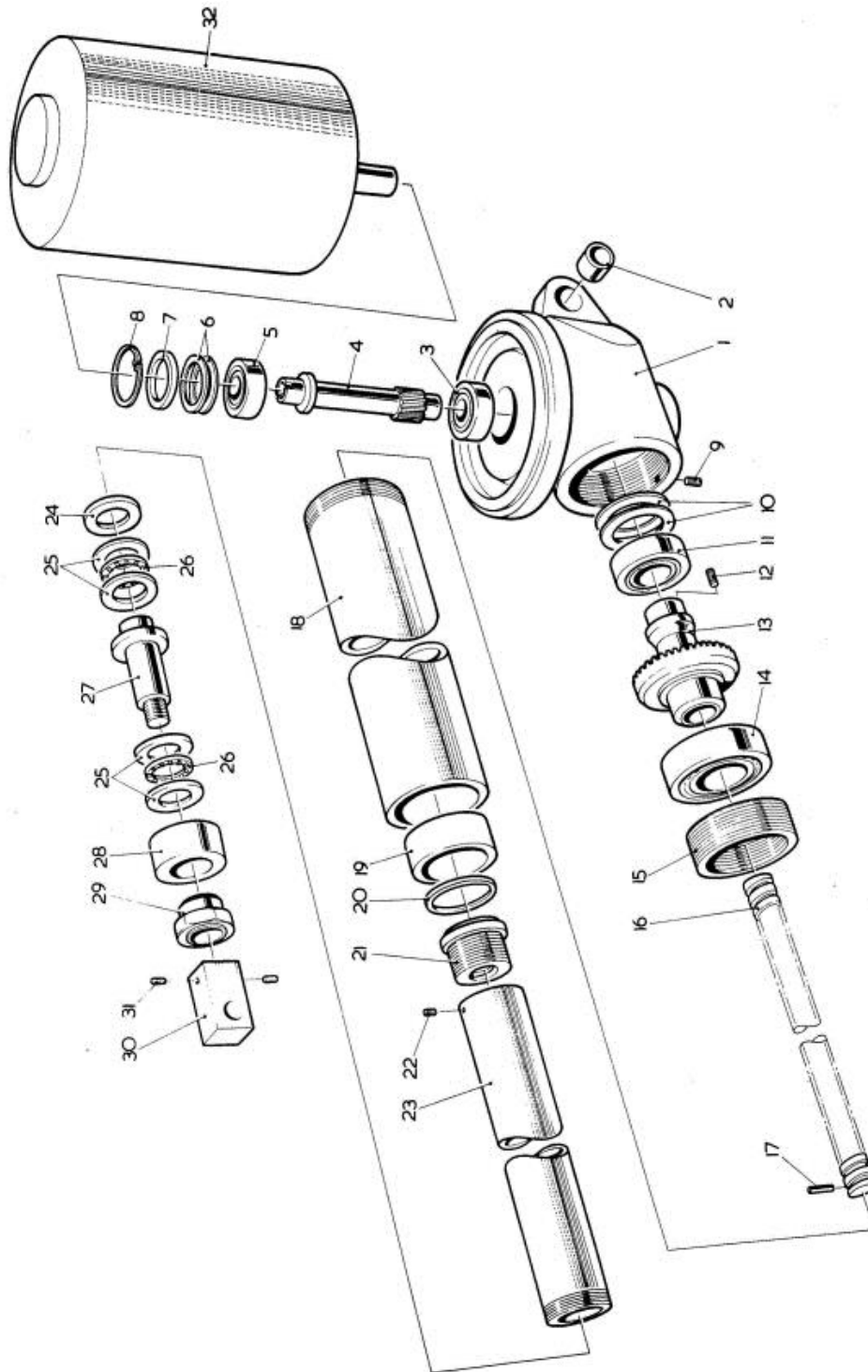
If ambient temperatures exceed 50°C (122°F) consult Power Jacks.

9. Parts List - General

(refer to section 9.1 for EMA Electric Linear Actuator general assembly diagram)

Item	Description
1.	Gearbox housing
2.	Rear clevis guide bush.
3.	Pinion bearing
4.	Pinion
5.	Pinion bearing
6.	Shims
7.	Thrust ring
8.	Circlip
9.	Grub screw for locking bearing cap.
10.	Shims
11.	Rear bearing for gear
12.	Grub screw for locking gear to lifting screw.
13.	Gear
14.	Front bearing for gear.
15.	Bearing end cap
16.	Lead screw (trapezoidal or ball screw).
17.	Emergency end stop pin
18.	Outer tube
19.	Guide bush for ram
20.	Seal/wiper unit for ram
21.	Lifting nut
22.	Grub screw for locking ram to lifting nut.
23.	Inner tube (ram)
24.	Clutch - Distance piece
25.	Clutch - Bearing washer (raceway)
26.	Clutch - Bearing cage assembly
27.	Clutch - Spindle
28.	Clutch - Housing
29.	Clutch - Ring Assembly (Lock nut, tab washer, conical ring)
30.	Ram end (clevis, fork end or top plate)
31.	Grub screw for locking ram end.
32.	Electric motor
33.	Trunnion Ring - Not shown on diagram (welded to outer tube at customer specified point)

9.1 EMA Electric Linear Actuator (General Assembly)



**Power Jacks Ltd
Balmacassie Commercial Park
Ellon AB41 8BX
Scotland**

**Tel: +44 (0) 1358 285100
Email: sales@powerjacks.com
www.powerjacks.com**

MM-LA-EMA-04-b