

User Guide

Hydraulic rotary actuator E1

-Double - acting-

Eckart GmbH Am Knöschen 2 36381 Schlüchtern

Ausgabe 12/2019 (Rev02)

Preface

Possessing a thorough exact knowledge of the product and adhering conscientiously to the User Guide will guarantee trouble- free operation. Start up and repairs should only be performed by experts and trained staff.

The rotary actuator is not a standalone machine in accordance with guideline 2006/42/ EC. This user guide is intended to enable manufacturers to install the rotary actuator correctly and also to help operators carry out maintenance work where necessary.

Regional safety regulations should be observed.

Machinery driven by a rotary actuator must be configured in such a manner that in case of technical faults or human error there is no danger of injury or fatal accident.

Please read the User Guide carefully before installation and start up.

Should you still encounter difficulties, contact our customer service department, who will be happy to help.

This product has been manufactured and assembled in accordance with current technical standards and is operationally reliable. The individual parts and the end product are checked continually by our quality assurance department (DIN EN ISO9001).

The manufacturer of the system in which it is integrated must assess its operational safety after integration.

We reserve the right to make technical alterations that reflect changes necessary to improve this product to the content and specifications of this User Guide.

Warranty

The information in this document can be altered without prior notice.

Unauthorized conversion or changes shall lead to the loss of the manufacturer's guarantee.

Eckart GmbH issues no guarantee of any kind with regard to this User Guide.

Eckart GmbH rejects the implied guarantee of marketability and suitability for a certain purpose.

Eckart GmbH is not liable for any direct, indirect, collateral, consequential or other damages in connection with the provision or use of this User Guide.



Used warnings and safety instructions

The following explained warnings and safety instructions are used in this user guide.



INFORMATION This icon denotes a note.

(i)

Informations can, but must not be noticed. Through non-observance, can't happen any risk.

ECKART®

Inhalt

1.	Technical data	5
2.	Identification, Type plate	5
3.	Purpose / end use	5
4.	Operation	5
5.	Warning-/ safety instructions	7
6.	Before installation	9
7.	Installation	10
8.	Start up	11
9.	Drive shaft datum	12
10.	Adjusting the drive shaft datum	12
11.	Direction of rotation	15
12.	Operating pressure	15
13.	Backlash	15
14.	Setting angle of rotation Z2 (option)	16
15.	Hydraulic fluid	18
16.	Purity of the hydraulic fluid	18
17.	Changing the hydraulic fluids	18
18.	Purging	18
19.	Pressure fluid – temperature range	19
20.	Leakage	19
21.	End position	19
22.	Torque	19
23.	Resetting forces	20
24.	Pressure supply lines	20
25.	Check rotarys	20
26.	Air bleed	20
27.	Maintenance	20
28.	End cushioning Z1 (option)	21
29.	Positioning	24
30.	Storage	24
31.	Weight	24
32.	Replacement parts, list of replacement parts	24



1. Technical data

Please take the technical data, for the rotary actuator, from the corresponding dimension sheet.

2. Identification, Type plate

Type plate for Standard-Version. In the Type field is the exact type designation. The type designation and the associated technical details please see the dimension sheet.

ECKART*	Part - No.	Serial- No.		Date	
D-36381 SCHLUECHTREN ECKART-HYDRAULICS.COM	т	P _{max.}	bar M	t max.	Nm
Туре					

Figure 1

3. Purpose / end use

The rotary actuator E1 is used for rotating or turning useful loads with limited rotation Angle. He is double-acting.

The rotary actuator may be used only for the intended purpose within the specified limits. Please note possible indications applicable on the product drawing.

One or furthermore – going use is not considered conventional. For damages resulting from this, the company Eckart GmbH is not liable.

4. Operation

As in a hydraulic cylinder the piston K (see Figure 2 on page 6) is moved in a linear motion between the two mechanical end positions E1 and E2 by means of hydraulic power.

Through the multiple helical gears the linear motion is mechanically transformed into a turning motion and transferred to the drive shaft W.

The pairs of helical gears are <u>not</u> self inhibiting. Positive lubrication and nitriding of the surfaces of the helical gears ensures long service life for the rotary actuator.



5



Section drawing



Figure 2

- A Shaft rotation anti-clockwise (by admittance of pressure in port A1)
- B Shaft rotation clockwise (by admittance of pressure in port B1)
- F Direction of view
- A1 Port A1
- B1 Port B1
- G1 Helical gear shaft piston
- G2 Straight gear matching ring piston
- E1 End stop flange
- E2 End stop bottom
- S1 Bleed port
- S2 Bleed port
- K Piston
- W Drive-shaft
- Z Cylinder cap screw



5. Warning-/ safety instructions

Death / severe injury



WARNING: By opening or closing the rotary fingers, hands, people etc., can be crushed or killed.

Make sure that no one can reach into the rotating range of the rotary actuator and no foreign parts get in access area (e. g. with satey guard).

Death, serious injury, bruising of individual body parts



WARNING: By dropping the rotary actuator individual components of the rotary actuator body parts can crush, or humans can be wounded.

Make sure that the appropriate safety measures are observed when working at e.g. be maintained during transport, assembly, disassembly, maintenance or repair, etc. Comply with the safety distance, wear safety shoes etc.



INFORMATION: Only use permitted parts when adding fittings. Observe the manufacture's guidelines for example for threaded joints, tubing, flexible sheathed cables and rotarys, etc.

Protect the rotary actuator from hydraulic and mechanical overloading, by using safety rotarys, ext. end stops, etc.

Burns of the finger/hands



WARNING: By contact with the surface during operation of the rotary actuator or individual components in repair and maintenance work burns can occur on hands and fingers.

During operation and maintenance and repair of the rotary actuator, we recommend you to wear safety gloves.

Death / severe injury



WARNING: The rotary actuator is under a hydraulic pressure of up to 100 bar (1,450 psi). The dismantling of parts of the rotary actuator, such as bottom, air bleed screw can result in death or serious injury. Splashed fluid can cause serious injury.

Before maintenance and repair of the rotary actuator, is it necessary to relieve the rotary actuator from the pressure and separated it from other energy sources.

It is recommended in place of the bleed screws S1, S2, to use bleed rotarys or messure connections, thus always an easy venting and hydraulic relaxation can be made.

Generally, the use of safety goggles is recommended to minimize injury due to liquids.



Death / severe injury



WARNING: Caution during operation with accumulators. Accumulators can still be under pressure even when pumps are turned off.

It is recommended in place of the bleed screws S1, S2, to use bleed rotarys or messure connections, thus always an easy venting and hydraulic relaxation can be made.

Death / severe injury



WARNING: When using load rotarys, even after the supply system pressure has been switched off the rotary actuator, may they still be under pressure.

It is recommended in place of the bleed screws S1, S2, to use bleed rotarys or messure connections, thus always an easy venting and hydraulic relaxation can be made.



6. Before installation



INFORMATION: Examine the rotary actuator before installation for possible transportation or other damage. Claims for damage under the guarantee cannot be accepted after installation or start up.

Check that the technical data for the rotary actuator complies with requirements.

The hatched area in front of the actuator (please see picture besides) <u>doesn't be</u> <u>used</u> as a support of the fitted hub or shaft.

Check the datum of the drive shaft (see chapter 9/10). It can be in any position.

Move the drive shaft W into the position required for installation. This happens either by turning the drive shaft W mechanically or through hydraulic operation of the rotary actuator.

When pressure is applied in port B1 (see Figure 2 on page 6) the drive shaft turns in direction B (clockwise) and the piston K moves in direction E1 up to the internal mechanical end position. This end position is the positive stop and is not adjustable.



When pressure is applied in port A1 the drive shaft turns in direction A (anticlockwise) and the piston K moves in direction E2 up to the internal mechanical end position.

This end position can only be adjusted if the rotary actuator is equipped with an angle of rotation setting Z2 (see Chapter 14) or Z4.





7. Installation

Paint or other parts stuck to the flange must be removed.

Property damage



CAUTION: Care should be taken to align the drive shaft W perfectly with the hub and the flange surfaces, to avoid exceeding the maximum permitted radial and axial forces. Destruction of the rotary actuator by unallowed radial and axial forces.

The introduction of force must come through the shaft.

Material damage



Caution: The required axial force for mounting the shaft W on the hub can be generated by pushing on the end of the continuos drive shaft W (see Figure 2 on page 6). Mounting using a different method can mean exceeding the axial force if there is tightness and this can lead to bearing damage.

The shaft W must exactly aligned with the hub and the flange side.

Additional care should be taken to ensure that the supply lines to the directional rotary are kept as short as possible to guarantee an exchange of hydraulic fluid.

Material damage: Damage of the rotary actuator by dirt particles



CAUTION: Before connecting the piping please check the pipe system in case of durt and if necessary it should be cleaned. Heat-treated pipes should be scoured.

Any contamination of the medium inevitably leads to the destruction of the surface.

When replacing parts the rotary actuator must be dismantled. It is therefore necessary to allow enough space for this to be carried out without any problem.



8. Start up



INFORMATION: Care must be taken during the start up. By handling incorrectly the rotary actuator could be damaged or ruined.

Material damage:



Caution: By rotary actuators with end cushioning Z1, is before opening with max. load, the end cushioning to be coordinated (see chapter 28).



INFORMATION: Before the first movement, the rotary actuator pressure chambers must be filled with hydraulic fluid. Filling the chambers and the first movement should ideally be undertaken without a load.

If this is not be possible for technical reasons, extra special care must be taken when filling the chambers and during the first operation.

The operating pressure and flows should be reduced to a minimum if possible.

When the cushion option is used the flow control screw should be closed and opened slowly allowing pressure in both directions. At the same time, bleed both pressure chambers by opening the bleed screws S1 then S2.

To ensure that bleeding is easy and clean it is recommended that bleed rotarys or test fittings are used instead of bleed screws S1 and S2.

Death / serious injury



WARNING: Death or serious injury by removing the air bleed screw of the rotary actuator at low pressure. Even at low pressure by removing or completely unscrewing the air bleeds can they already opposed fly like a missile.

It is not allowed to open the bleed screws more than one turn at a rotary actuator being under a higher pressure.

You also must pay attention that the oil is not drained unchecked to the surroundings when ventilating.

To ensure that bleeding is easy and clean it is recommended that bleed valves or test fittings are used instead of bleed screws S1 and S2.

Damage by unfilled rotary actuators:



CAUTION: A rotary actuator not filled with hydraulic fluid can be damaged or destroyed during its first operation depending on how it is used.

Operate with the rotary actuator only if both chambers of the rotary actuator pressure are filled with a suitable pressure fluid and vented. See Chapter Hydraulic fluid.



Once it has been determined that both pressure chambers have been filled and bled, operation can be started with caution. After the rotary actuator has completed a few movements, it can be operated with maximum pressure and with the maximum amount of oil.

Should the procedures described above not be possible for technical reasons, the rotary actuator must be filled using a hand pump or small unit via the threaded bores of the G1/8", S1, S2.

9. Drive shaft datum

The drive shaft datum is adjusted at the factory as shown in Figure 3, with the piston K resting against the end stop E1.



Figure 3

10. Adjusting the drive shaft datum

Adjustment of the drive shaft datum can be carried out individually. If possible setting should be carried out before the load is placed.

Bring the zeros of the drive shaft in the required position for the installation. This is done either by mechanically rotating of the drive shaft W or throug hydraulic activity of the rotary actuator.

Death / severe injury



WARNING: For changing the zero position is no payload from the outside allowed which act on the drive shaft, because the payload can can fall into dangerous movements after loosening the socket head cap screws Z.

If possible setting should be carried out before the load is placed.





Bring the piston K by pressurizing in port B1 or through mechanical turning of the shaft W in rotating direction B (clockwise) in the internal mechanical end position E1.

Before the cylinder cap screws Z are loosened and the rotary actuator is depressurised, we recommend monitoring the angle of rotation with a suitable measuring device (e.g. a lever on the shaft pivot and a dial gauge) to detect any possible changes in the angle of rotation and compensating by making the appropriate adjustment.

In the case of rotary actuators with the end cushioning Z1 (not illustrated) attachment, the back pressure should be neutralised by opening the bleed screws S1 and S2, otherwise the piston can be pushed out of the stroke stop flange by the back pressure (see Figure 2 on page 6). The back pressure action can also be neutralised by opening or turning the flow control screw DS anticlockwise.

Information: Both chambers of the rotary actuator must now be depressurised. It is recommended that bleed rotarys or test fittings are used instead of bleed screws S1 and S2.

To adjust the drive shaft, loosen the cylinder cap screws Z (look Figure 2 on page 6) until the bolt head is no longer in contact between the mounting surface and the heads of the cylinder cap screws.



By turning the drive shaft W in direction B (clockwise) the desired zero position can be reached.



Should the desired position be passed, the drive shaft W should not be turned back in direction A (anti-clockwise), but should be turned 360° forwards in direction B until the desired zero position is reached again.

Correction by turning the drive shaft W in direction A is not recommended.







INFORMATION: If adjusting the zero position by turning the drive shaft W in direction A is the only option, please contact the manufacturer.



CAUTION: Rotary actuators with the attachment end cushioning Z1 it should be noted that the slots and fixed holes of the cushioning rings DR could move to the area of the cushioning holes D during the adjustment of the datum. As a result the end cushioning would become ineffective (see section 28).

Should an adjustment of more than 10° be necessary for rotary actuators with end cushioning Z1, consultation with the factory is recommended.



If the adjustment made is correct, the cylinder cap screws Z (look Figure 2 on page 6) are to be tightened crosswise with an initial tension M_V and a finishing torque M_E . The tightening torques can be found in the Table 1 on page 14.



CAUTION: The M_V and M_E torques specified must be observed without fail.

Size (Piston-Ø)	Tightening torque M _V [Nm]	Finishing torque M _E [Nm]	Size of thread	Wrench size
40	5	14	M6	5
50	11	34	M8	6
63	11	34	M8	6
80	11	34	M8	6
100	11	34	M8	6
125	22	67	M10	8

Table 1



CAUTION: Before operation with load and max. speed the throttle screw DS is to screw in again and the damping is to be optimized (see Chapter 28), or close the bleed screw S1 and S2.

Death / severe injury



WARNING: In case of not professionally tightened or rather fixed socket head cap screws Z can after recommissioning the bottom or ather adjacend parts loosen. The rotary actuator is under pressure till up to 100 bar. Flying items or out spurting liquid can cause serious injury.

After adjustment, maintenance or repair work, the head cap screws Z are to be fasten with the given tightening $M_{\rm V}$ and $M_{\rm E}.$



11. Direction of rotation

When pressure is admitted in port A1 and view direction F the drive shaft turns in arrow direction A (anti-clockwise).

When pressure is admitted in port B1 and view direction F the drive shaft turns in arrow direction B (clockwise).

12. Operating pressure

The maximum operating pressure of the rotary actuator is 100 bar (1,450 psi).

The standard low friction seals allow the rotary actuator to breakaway at 6 bar (87 psi). The rotary actuator can be operating at approximately 10 bars (145 psi).

13. Backlash

Mechanical backlash required by the helical gears is approximately 20 angular minutes in the end position.





14. Setting angle of rotation Z2 (option)



Figure 4

KΜ

The standard Eckart rotary actuator has an end stop adjustment of $\pm 5^{\circ}$. This feature is standard on all E1 models with option Z2. This adjustment can only be made if the rotary actuator is not pressurized and at the end position E2.

In order to adjust the angle, the locking nut KM must first be loosened by turning a spanner wrench (DIN 3116) to the left. After this the adjusting insert RE can be set to desired angle using the same spanner wrench. By turning it to the right the angle of rotation becomes smaller and by turning it to the left the angle becomes greater. After the angle has been set the locking nut KM must be re-tightened by being turned to the right.



If the piston is resting against the adjustable stop on bottom RE (E2 position) it will make it difficult or impossible to adjust. The piston K must therefore be pushed slightly in direction E1 (the drive shaft W in direction B). Should the drive shaft W be turned by an external force in direction A then the piston K moves again against the adjustable stop on bottom RE, this should be prevented using appropriate measures.



It should be noted that rotary actuators with the attachment Z1– end cushioning, the use of the rotation angle setting changes the effect of the end cushioning in the end position area E2 also changes.



The Z4 option – angle of rotation setting is handled in the same manner as the standard angle of rotation described above. With the Z4 option the angle of rotation can be adjusted over the entire range or simply over a part of it. As noted above the actuator with the option end cushioning Z1 will only have a damping effect with full travel of the piston in the E2 area.



15. Hydraulic fluid

We recommend mineral oil-based hydraulic fluids in the HLP group as per DIN 51524/part 2 and VDMA, recommendation 24318.

Fluids without emulsifying agents will reduce the service life of the rotary actuator. For highly flammable fluids, please consult the manufacturer.

The recommended viscosity range is from 16 mm²/s and 68 mm²/s at 40° to 60°C (104°F to 140°F).

The rotary actuators are not filled at the factory.

16. Purity of the hydraulic fluid

The purity of the hydraulic fluid has big influence for the life time of the rotary actuator. Care should be taken to ensure that the hydraulic fluid used in the rotary actuator does not exceed the contamination classification 19/17/14 in accordance with ISO 4406:1999. We recommend to rinse the complete unit before commissioning and to filter the pressure fluid.

If the fluid is too viscous, contaminated or poor quality we recommend the replacement of the hydraulic fluid.

The required cleanliness level in the hydraulic system is determined by the easily soiled component of the hydraulic system (pump, rotary, etc.). Follow the specifications of the component manufacturers (pumps, rotarys, etc.). The cleanliness class has to be better than 19/17/14.

17. Changing the hydraulic fluids

The pressure change of liquid depends on the size of the existing facility and is carried out at regular intervals.

When refilling the entire system it is important to ensure that fluid of the same type, and from the same manufacturer is used.

By heavy influence of dirt or early aging of the hydraulic fluid, the system and the tank must be cleaned and rinsed, before refilling. New hydraulic fluid must always be filtered according to the required cleanliness level before filling, because it doesn't suit in the norm case with the purity level.

18. Purging

Before final commissioning of the hydraulic system is recommended to flush the entire hydraulic circuit thoroughly (without the rotary actuator), to remove any dirt, which could be penetrated when connecting the components.

If a later flush is getting necassary on the rotary actuator (e.g. due to the operating time), must the flush be done over the bleed screws G1/8" (see chapter 26).



19. Pressure fluid – temperature range

The permissible fluid temperature range, in which the rotary actuator can operate, depends on the used hydraulic fluid, in accordance with the proper viscosity of the hydraulic fluid and also the seals which are used.

The maximum temperature, at which the liquid pressure rotary actuator is operating, must move the pressure connections of the rotary actuator in the specified temperature limits. See meassure sheet.

When using hydraulic fluids based on mineral oil group HLP to DIN 51524 / part 2, the liquid temperature is between -25 °C and +70 °C. For this fluid and this temperature range, our rotary actuators are supplied as standard with the corresponding seals.

Are other fluids as above described used or other liquid temperatures expected please contact our company.

20. Leakage

The rotary actuator can be compared to well sealed linear cylinders because of its solid seals, therefore allowing the load to be held in any intermediate position.

21. End position

The piston K can be moved under load against the end stops E1 and E2 and held in this position. The end stops are however only designed to withstand the force created by the maximum allowable operating pressure relating to the maximum permissible torque output.

If the internal stops are used to limit the angle of rotation, the forces acting on the stops (including forces due to inertia) must not be greater than the forces, produced by the maximum permitted operating pressure (100 bar/1,450 psi).

If higher forces can be expected, we recommend installation of external stops or other methods of control such as end cushioning or control rotarys.

22. Torque

The stated torque figures are effective torques. For multi-shift, heavy duty or high frequency applications a safety factor between 1.2 and 1.5 is recommended. Torque output is equal in both directions.



23. Resetting forces

Damage: Damage to the rotary actuator

CAUTION: With hermetic closing of the rotary actuator (e.g. through hydraulic pilot operated check rotarys) and exertion of a resetting force on the drive shaft, holding pressure is created in the rotary actuator. If the holding pressure reaches the level of the operating pressure then an approximately 38 % higher torque acts on the drive shaft.

If Restoring forces are expected, should this be considered when choosing the size of the rotary actuator. When operating with the option cushioning Z1 is this also to be considered.

24. Pressure supply lines



INFORMATION: To guarantee an exchange of hydraulic fluids, the supply lines should be kept as short as possible. Dimension the interconnections according to the performance of the rotary actuator.

Furthermore, it is recommended that the directional control rotary is mounted directly on the rotary actuator. Only this ensures that a fluid exchange between the rotary actuator and fluid reservoir takes place.

Before connecting the pipes, the pipe line system must be checked and cleaned if necessary. Heat-treated tubes may need to be stained. This prevents dirt particles from entering the interior of the rotary actuator.

25. Check rotarys

Death / serious injury



CAUTION: By external heating and hermetic sealing of the rotary actuator (eg, hydraulic check rotarys), the hydraulik pressure rises in the rotary actuator for each 1° for about 6 - 8 bar. Thereby, the maximum pressure can be exceeded and destroy the rotary actuator.

Are operating conditions expected with high temperatue rise, provide appropriate protection measures (eg safety rotarys or switching cycles).

26. Air bleed

The rotary actuator is usually deliverd with air bleed screws. The air holes are designed to fit minimess connections. By Minimess vents is an easy and clean venting and flushing possible via hoses. The rotary actuator must be vented before taking in use.

27. Maintenance

In theory the rotary actuator does not require maintenance. However, care should be taken that the hydraulic fluids are changed at regular intervals (see chapter 17).



28. End cushioning Z1 (option)

The end cishioning Z1 enables a smooth braking or deceleration of the rotation prior before the final stop.



Figure 5

Operation (Figure 5 and Figure 2 on page 6)

Starting position

- Piston K ist in end position E2
- Port A1 is pressurised
- Port B1 is unpressurised

Changing the direction of oil flow

- Port B1 is pressurized
- Ball check valve R in port B1 opens
- Hydraulic fluid flows freely into the cylinder space
- Piston K moves in direction end position E1 (direction arrow piston K)
- Ball check valve R is closed in port A1
- Pressure fluid flows off freely through the holes D



Cushioning process

- Piston K now approaches the end position E1 and seals the holes D
- Piston speed is progressively reduced
- Piston K now completely covers holes D
- The pressure medium can now only escape through the hole Q with the adjusting screw DS to the port A1
- The cushioning effect can therefore be adjusted again by the adjusting screw DS; This cushioning phase runs linear

Rotary actuators with end cushioning have a special cushioning ring DR located on the piston. The cushioning ring is designed to cover the multiple cushioning holes. The cushioning ring is slit, and press fit to piston with additional locking pin.

During the cushioning phase, backflow of the hydraulic fluid is progressively metered out, which causes the hydraulic pressure to rise on the cushioned side of the piston, depending on the size of the momentum of inertia caused. Care should be taken to ensure that the anticipated cushioning pressure does not exceed the permitted maximum operating pressure.

Property damage:



Caution: Destruction of the rotary actuator by unauthorized drive pressure spikes.

It is important to ensure, that the expected cushioning damping isn't more than the working pressure.

Pressure measurements should therefore be taken using electronic pressure gauges where possible when starting up a rotary actuator for the first time.

It is important to check pressure when two or more units with the cushion option are operating. The rotary actuator running simultaneously or non-simultaneously must be balanced out to the same pressure valve.

Rotary actuators with end cushioning have a special cushioning ring DR located on the piston. The cushioning ring is designed to cover the multiple cushioning holes D. The cushioning rings are slit, and press fitted to the piston with an additional locking pin.

The pressure gauges should be connected to the threads of the G 1/8" bleed screws S1 and S2.

In the case of measurements on the supply lines, the cushioning pressure is not measured. The cushioning holes D are equipped with threads into which nozzles can be screwed. By using nozzles the cushioning effect and the cushioning pressure can be positively influenced. For information on this please consult the factory. Adjusting the cushioning rings will allow specific adjustments to the cushioning flow path. For more information on this please consult the factory.



Property damage



Caution: The temperature on rotary actuators with end cushioning Z1 increases more as a percentage during use than on rotary actuators without end cushioning Z1.

It is therefore imperative to ensure an exchange of hydraulic fluid (see chapters 16 and 24).



Information: When the flow control screw DS is fully closed, it is possible that the end position may not be reached.

Property damage: Leaks at throttle screw DS, sealing nut DM



Caution: The funktion of the rotary actuator can't be guaranteed if there is a leakage in the area of the throttle screw DS screw and of the nut DM.

The flow control screw DS is not protected from being fully unscrewed. When adjusting the flow control screw, it should only be unscrewed to the point where the measurement T is not exceeded (see Table 2 and Figure 5 on page 21).

After making sure that the seal nut DM is screwed firmly, should there no longer be any leaks.

Baugröße Size	40	50	63	80	100	125
T Anschluss A [mm] Port A [mm]	11	11	11	11	11	11
T Anschluss B [mm] Port B [mm]	11	11	11	11	11	16

Table 2

(i)

The measurement T can differ with individual models in the area of ports A1 and B1.



29. Positioning

Depending on the type of control system used with the rotary actuator the degree of rotation is infinitely variable.

If loads are driven in a neutral load status (e.g. horizontal index table), the compressibility of the hydraulic fluid and the tolerance of the gears (see section 13) should be considered.

The compressibility of mineral-based hydraulic fluids is approximately 0.5 -0.7 % per 100 bar (1,450 psi).

30. Storage

The rotary actuators are only provided with an oil film from the factory. If a long period of storage is anticipated the rotary actuator must be filled and/or treated with the appropriate preservative.

The rotary actuators should be stored at a constant temperature. They must not be exposed to extremes of cold and heat.

We recommend to put the rotary actuator on store by +5°C till +25°C, at a "favorable" relative humidity of about 65%.

31. Weight

Be aware of t weight of the E1 which can be up to 70 kg (154 lbs).



32. Replacement parts, list of replacement parts

Lists of replacement parts, dismantling and assembly instructions can be obtained from our customer service department.

