

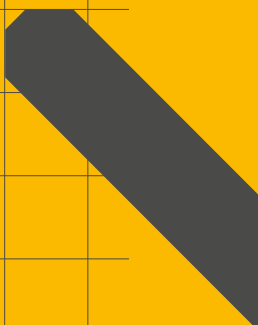
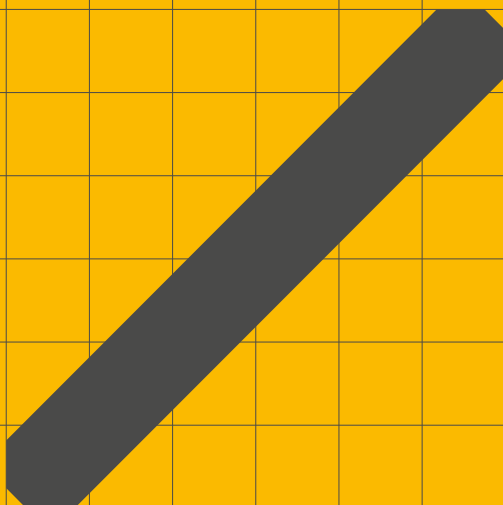
EWELLIX

MAKERS IN MOTION

INSTALLATION, OPERATION AND
MAINTENANCE MANUAL

Electro mechanical cylinder - CEMC





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NOTE

In the electronic document, hypertext links have been created to allow faster browsing inside the manual. To use these, please press CTRL key and while CTRL key is pressed, click on the hypertext link. To come back, please press ALT key and while ALT key is pressed, press on “left arrow” key.

Generally, all titles from table of contents are hypertext links. All other hypertext links are pointed out in yellow.

1.0 General information

1.1 Information in this manual

This manual provides important information on how to work with the actuator (also called the device) safely and efficiently. The Manual is part of the device, must always be kept and should be available for personnel to read at any time. All personnel working with the device must read and understand this manual before starting any work. Strict compliance with all specified safety notes and instructions is a basic requirement for safety at work.

Moreover, the accident prevention guidelines and general safety regulations applicable at the place of use of the device must also be complied with.

For better representation of circumstances, the illustrations in this manual are not necessarily to scale and may vary from the actual design of the device.

All information and notes in this manual were compiled with due consideration given to applicable standards and regulations, the present status of technology and our years of knowledge and experience.

1.2 Explanation of symbols and signal words

Safety precautions are identified by symbols and signal words defined on the right-hand side of this page. These signal words indicate the severity of the hazard.

Adhere to these safety precautions and take caution in order to avoid accidents that may result in personal injuries or damage to property.

DANGER

Indicates a dangerous situation, which will lead to death or serious personal injury, if the precautionary measures are ignored.

WARNING

Indicates a dangerous situation, which can lead to minor or moderate injury or property damage, if the precautionary measures are ignored.

CAUTION

Indicates a dangerous situation, which can lead to minor or moderate injury, if the precautionary measures are ignored.

NOTICE

Indicates information considered important, but not hazard-related (e.g. messages relating to property damage).



NOTE

Emphasizes useful hints and recommendations as well as information for efficient and trouble-free operation.

1.3 Limitation of liability

All information and notes in this manual were compiled under due consideration of valid standards and regulations, the present status of technology and our years of knowledge and experience.

The manufacturer will not be liable for damage resulting from:

- disregarding this manual
- unintended use
- employment of untrained personnel
- unauthorized conversions
- unauthorized technical modifications
- manipulation or removal of the screws on the device

Where the device has been customized, the actual product delivered maybe different from what is described in this manual. In this case, ask Ewellix for any additional instructions or safety precautions relevant to these actuators.

We reserve the right to make technical modifications in order to improve usability.

1.4 Copyright

This manual is protected by copyright law and to be used exclusively by Ewellix customers internal purpose.

Passing this manual on to third parties, duplication of any kind – even in the form of excerpts – as well as the use and/or dis- closure of the contents without the written consent of the manufacturer is not permitted, except for internal purposes.

Violation of Ewellix's copyright may become the subject of a future claim for damages.

1.5 Spare parts

The CEMC linear actuator is not meant to be repaired by customer personnel. All warranty and service claims become void without notice if any screws on the linear actuator have been loosened or removed.

1.6 Warranty terms

The applicable and effective warranty terms are those contained in the manufacturer's terms and conditions of sale contained in the Ewellix sales contract that governs this sale.

1.7 Customer service

Ewellix Customer Service is always available to provide technical information and to answer questions.

The contact information for Ewellix Customer Service can be found on www.ewellix.com.

⚠ WARNING

Risk of injury through the use of incorrect replacement parts. Installation or use of incorrect replacement parts may result in safety risks for personnel and may also cause damage, malfunction or complete failure of the drive.

Therefore:

- Defective original parts for the actuator must only be replaced by the manufacturer.



NOTE

All warranty and service claims become void without notice if any screws on the linear actuator have been manipulated.

1.8 General safety instructions

Ewellix Customer Service is always available to provide technical information and to answer questions.

The contact information for Ewellix Customer Service can be found on www.ewellix.com.

⚠ DANGER

In operation, Ewellix cylinders could make parts move and could have hot surfaces or parts fed by electrical current, depending on the situation. Serious or fatal injuries or property damage will occur if the information or precautionary measures given in this manual aren't followed.

Generally, all works related to transportation, setup/mounting (mechanical and electrical), start-up, maintenance or storage have to be carried out by qualified personnel in full compliance with relevant regulations.

1.8.1 Warning labels



The symbol to the left can be found on the actuator near the hot surface danger.

Hot surfaces on actuator can cause burns and should not be touched. Protection must be provided against accidental contact if necessary.

⚠ WARNING

Danger of injury caused by moving components

Rotating and/or linearly moving components can cause serious injuries.

Therefore:

- Do not work on, or place, hand, arms or any other parts of the body, close to moving components.

1.9 Future changes to user manual

To constantly improve the quality of its products, Ewellix reserves the right to modify this manual without informing its customers. It is the responsibility of the customer to have the current release of the manual so that the user will benefit from the latest information and advice. For more details, please contact your Ewellix sales representative.

In any event, Ewellix won't be liable for any adverse consequences to the Ewellix product user or any property because of user manual modification.

1.10 Responsibility of the owner and processor

The device is designed for commercial applications by its owner or processor. The processor is the contracting partner of the reseller or the manufacturer. The processor installs the device in a complete system (application).

The owner or processor of the system is therefore subject to the requirements of the Occupational Health and Safety Act.

In addition to the safety instructions in this manual, the owner or processor must do the following concerning these safety and accident prevention guidelines and environmental protection regulations applicable to the site of the system's installation:

- Inform themselves of applicable industrial safety regulations. They must also determine additional hazards that arise due to the specific working conditions prevailing at the site where the device is installed using risk assessment. The risk assessment must be implemented in the form of work instructions for device operation.
- Confirm that the work instructions created for the system, including the device, satisfy current legal requirements and must alter the instructions accordingly.
- Clearly regulate and specify the responsibilities for installation, operation, maintenance, and cleaning.
- Ensure that all employees who deal with the device have read and understood this manual.
- Provide personnel with the required protective equipment.
- Provide training for personnel at regular intervals and inform personnel of the hazards

In addition, the owner or processors must ensure that the device is in adequate working condition. They must do the following:

Ensure that the maintenance intervals described in these instructions are complied with.

Have all safety devices inspected regularly for function and completeness.

1.11 Personnel requirements

⚠ WARNING

Improper installation, operation and maintenance can result in serious injury death or property damage. Use only qualified, instructed, or trained personnel (as described below) who have read, understand and follow these instructions.

1.11.1 Qualifications

The following qualifications are specified for different areas of activity listed in this manual:

- An instructed person (operator): Instructed by the customer in an orientation session on the assigned tasks and possible dangers arising from in case of improper behaviour.
- Qualified personnel: Based on their professional training, know-how and experience as well as knowledge of the applicable standards and regulations are able to independently perform assigned work activities and to detect and avoid possible dangers
- Professional electrician: Based on his/her professional training, know-how and experience as well as knowledge of the applicable standards and regulations is able to independently perform work on electrical systems and to detect and avoid possible dangers.
In addition, the professional electrician has been trained for the special location where he/she works and knows the relevant standards and regulations.

Only persons who can be expected to perform their tasks reliably are permitted as personnel. Persons whose reaction capabilities are impaired, e.g. through the use of drugs, alcohol or medication for example, are not permitted.

1.12 Modifications of device

⚠ WARNING

To avoid hazardous situations and to ensure optimal performance, do not make changes or modifications to the device unless they have been specifically authorized by Ewellix.

2.0 General notes

2.1 General description of system components

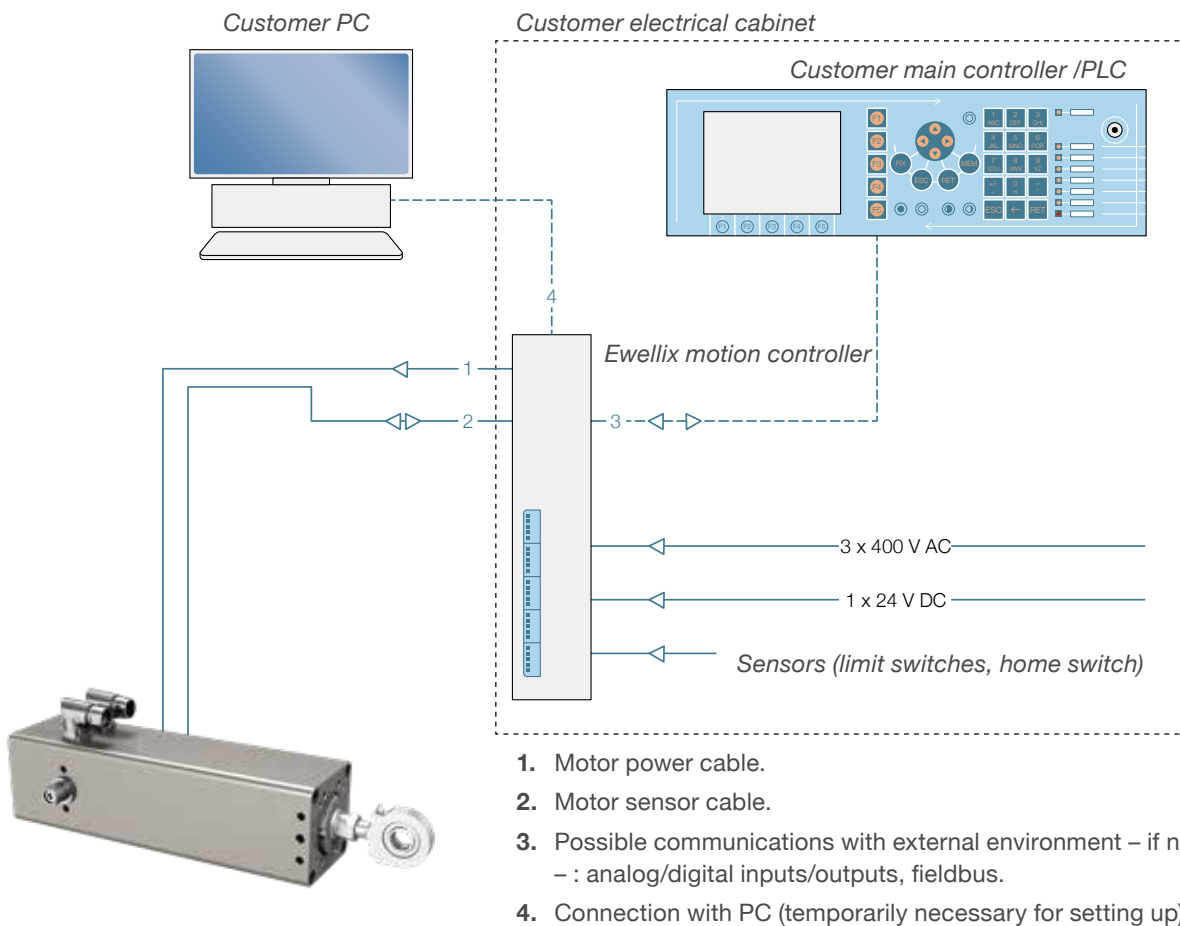
The scope of supply of Ewellix cylinders could include:

- Cylinder
- Motor power cable
- Motor sensor cable
- Motion controller
- Electronic interface to make connection between PC and motion controller

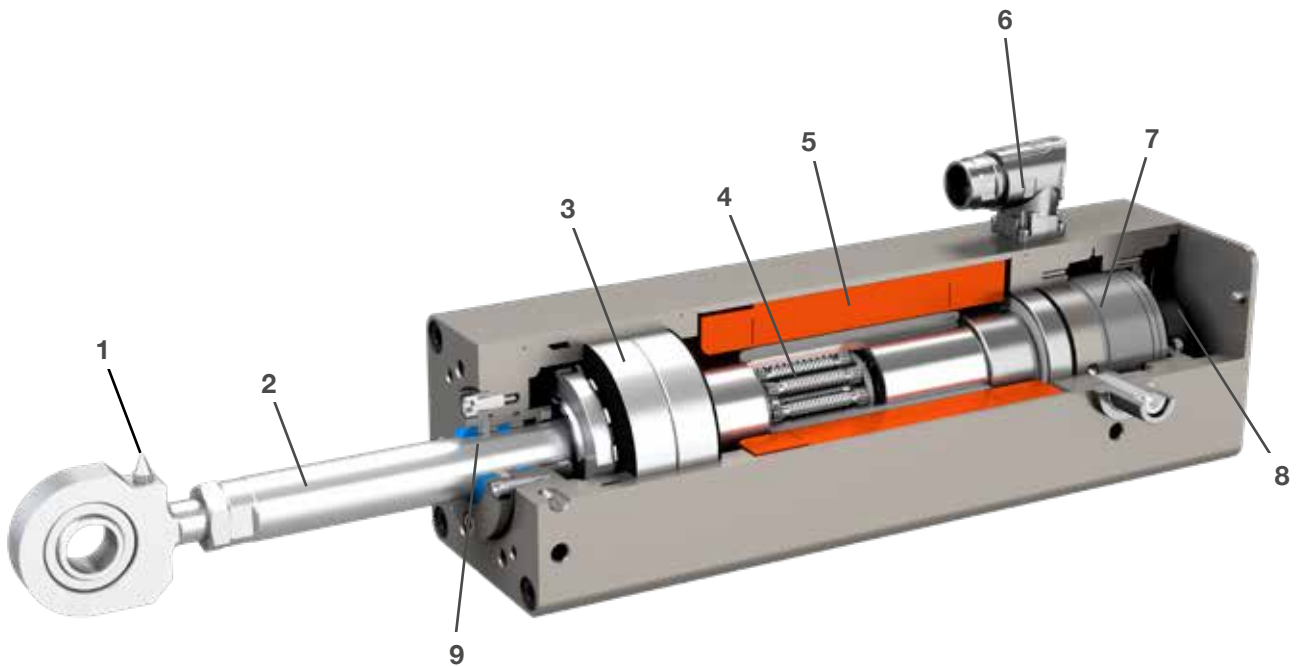
To know the exact definition of Ewellix supply, please read paragraph **2.4 Detailed description of supplied product, page 10.**

The general drawing in **fig 1**, illustrates the Ewellix electro-mechanical cylinder's relationship with the user's environment.

Fig. 1



2.2 General product description



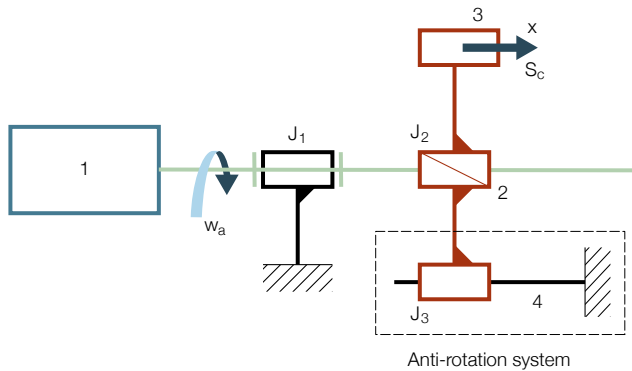
1. Lubrication nipple
2. Push tube
3. High quality angular contact ball bearings
4. High quality planetary inverted roller screw for highest axial load rating, low axial play and high efficiency
5. Integrated hollow shaft servo motor
6. Motor connectors
7. Fail safe brake option
8. Position feedback options for compatibility with main brands of robots/controllers
9. Scraper seal to keep contamination out

2.3 Operating principle

The operating principle of Ewellix electromechanical cylinders is described by the cinematic drawing in **fig. 2** (established in accordance with NF EN ISO 3952-1 standard).

Fig. 2

The operating principle of Ewellix electromechanical cylinders



Comments

- | | |
|------------|--|
| 1 | Motor rotor |
| ω_a | Rotating speed of motor shaft/roller screw |
| 2 | Inverted roller screw = screw gear changing rotation of nut (green color) into translation of screw and pushing tube of cylinder (red color). |
| 3 | Pushing tube of cylinder |
| S_c | Translation speed of pushing tube |
| x | Translation move of pushing tube |
| 4 | Anti-rotation of pushing tube. Depending on cylinder definition, this system is integrated into the cylinder or located on the customer's machine. |

Description of kinematic joints

- | | |
|-------|-----------------|
| J_1 | Revolute joint |
| J_2 | Screw joint |
| J_3 | Prismatic joint |



2.3.1 Relationships to be known

CEMC use inverted roller screw with direct drive to the nut body.

For each motor revolution cylinder moves of the lead value of the screw in millimeter.

2.4 Detailed description of supplied product

Generally, detailed description of supplied product is found either in High Performance Actuator Catalogue reference **PUB NUM IL-05001/1-EN-May 2020** or in CEMC datasheet reference **PUB NUM IL-07017/1-EN-May 2020**. If Ewellix provide CEMC version fitting completely catalogue reference, corresponding file number will be part of the serial number:

for a CEMC21xx: serial number = AR37703-xxxx

If serial number is not starting with these values, and if actuator definition is not described in High Performance Actuator catalogue, detailed description of the supplied product is given by the two following documents (called “documents for approval”):

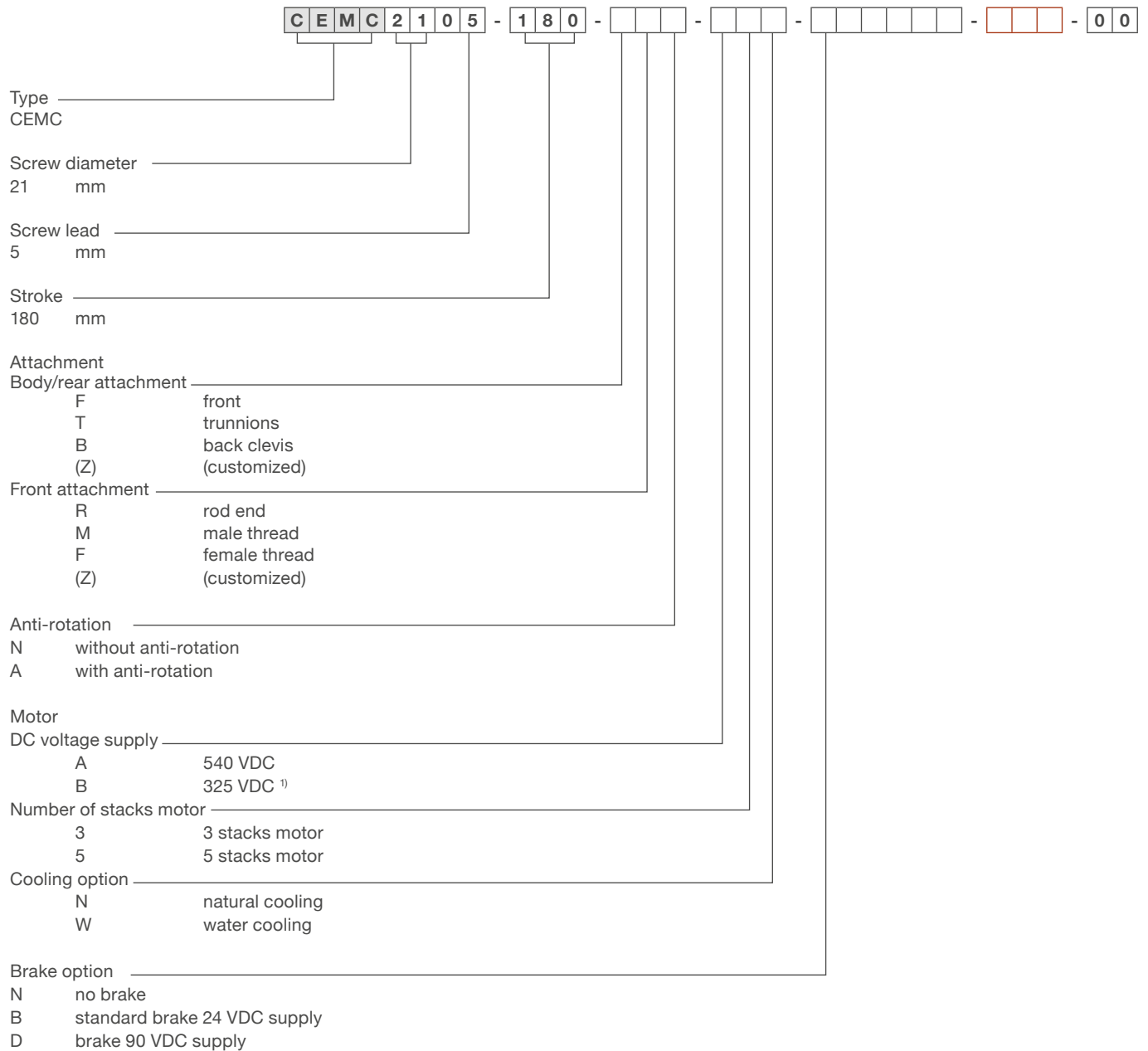
- Technical description
- Cylinder drawing

IMPORTANT: Before starting cylinder commissioning, actuator description data (actuator performances and dimensions) given in High Performance Actuator catalogue or in these two documents must be read. If there is a problem, please make contact with your local Ewellix representative.

2.5 Designation

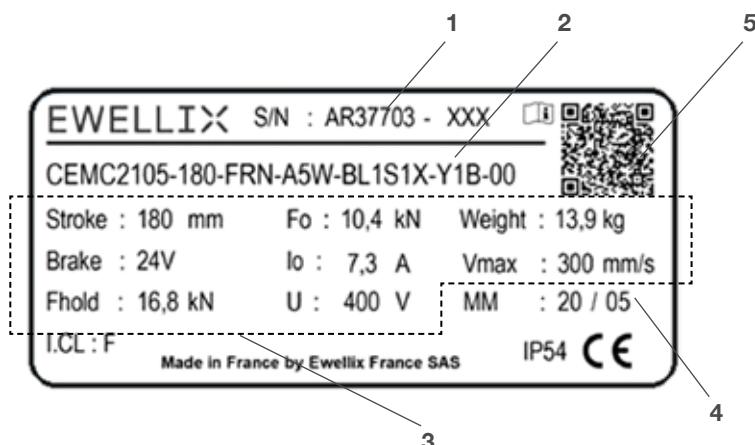
Ordering key

Linear units



¹⁾ Available on request. Please contact Ewellix.

2.6 Product label



1. Cylinder serial number
2. Cylinder reference
3. Cylinder performances
4. Manufacturing month (year/ month)
5. QR code link to CEMC user manual

2.7 Performances, operation limits and operation environment

For more details, please find actuator reference in High Performance Actuator catalogue reference **PUB NUM IL-05001/1- EN-May 2020** and read related technical data.

If actuator reference is not in High Performance Actuator catalogue (meaning customized product), please read the Ewellix sales offer and other documents for approval. The cylinder's performance and operational limits and operating environment are described in the technical requirements that define the cylinder selection.

2.8 Storage conditions

If the cylinder has to be stored for a long time (example: cylinder as a spare part), the following conditions must be observed:

- Cylinder has to be stored in horizontal position indoors with an ambient temperature between 15 and 40 °C.
- Cylinder has to be packed in the retracted position inside a plastic film with desiccant to protect the cylinder from humidity and condensation.

A cylinder that has been stored under the conditions described above for less than one year could be used by following the general recommendations for use (↳ **4.2 General recommendations for use, page 19**).

If storage time exceeds one year, re-lubricate the cylinder before it is first started (please read paragraph **5.0 Maintenance – upkeep – routine checks, page 23**, to know which parts are to be lubricated and how they are to be lubricated).

Then, cylinder can be used by following general recommendations for use (↳ **4.2 General recommendations for use, page 19**).

2.9 Disposal

Dispose of cylinders in accordance with applicable regulations and considering the different requirements for each material:

- Iron
- Aluminium
- Copper
- Plastic
- Electronic components
- Oil and grease (not mixed with solvents)

To know the exact definition of Ewellix supply, please read paragraph **2.3 Detailed description of supplied product, page 9**.

2.10 Warranty

IMPORTANT: Manufacturer's warranty is null and void if the cylinder is disassembled by end-user.

For any other information concerning warranty, please contact your local Ewellix representative.

3.0 Installation – general recommendations

3.1 Important notes

⚠ DANGER

Some components integrated into the Ewellix scope of supply, like controller, are “products bought on catalogue”. This means that the design and manufacturing of these components haven’t been done by Ewellix. For all these “products bought on catalogue”, it’s the user’s responsibility to read the associated manufacturer’s user manual before starting to install or to use the product.

⚠ WARNING

Risk of serious or fatal injuries by crushing because of vertical load fall.

Do not use the brake (of the motor or an additional brake) to hold a vertical load while an operator is under the load. Generally, the holding torque of the brake is created by means of friction discs and does not provide a positive lock. In any event, lock the vertical load in position by another means or move and stop the vertical load at the bottom position which is safe.

⚠ WARNING

Risk of serious or fatal injuries by crushing because of unintentional cylinder start-up.

Before starting any work on actuator, isolate the motor and brake from the power supply and safeguard them using lockout/tagout procedures against unintentional re-start.

⚠ WARNING

During operation, the cylinder surface temperature can reach high values. There is a risk of burns or fire. Before any work on the actuator, let it cool down.

3.2 Mechanical installation

3.2.1 Transportation – Handling

Observe relevant transport regulations during transportation.



NOTE

During actuator handling, please take care not to damage the limit switches and home switch (if these options have been taken).



NOTE

If actuator has no anti-rotation on the force tube, it is possible to extend or retract by turning force tube by hand.

The CEMC linear actuator is delivered as one packaged unit in a box or on pallets. When the shipment is received, immediately check that no damage has been done during transportation. If not, immediately inform the shipping company and Ewellix. If the shipment has been damaged, do not commission it.

Proceed as follow in conjunction with visible exterior transportation damage:

- Do not accept delivery or do so only with reservations.
- Record scope of damage on the transport documents or on the bill of delivery of the shipping company.
- Initiate complaint.



NOTE

Report any damage as soon as it has been recognized. Damage claims can only be asserted within the transporter's applicable complaint period.

Use suitable load suspension devices for transport and assembly.

Weights of cylinder is indicated on corresponding nameplates.

In case of a problem, please contact your local Ewellix representative.

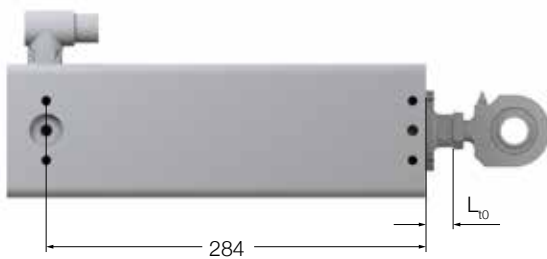
3.2.2 Visual cylinder position – L_{t0} and L_t

During mechanical installation or cylinder operation, it is sometimes required to know the cylinder position in relation to the “zero” position given in the cylinder drawing.

To do this, it's first required to know L_{t0} (= length of pushing tube which is visible when cylinder is in the “zero” position on the cylinder drawing) (→ fig. 3).

Fig. 3

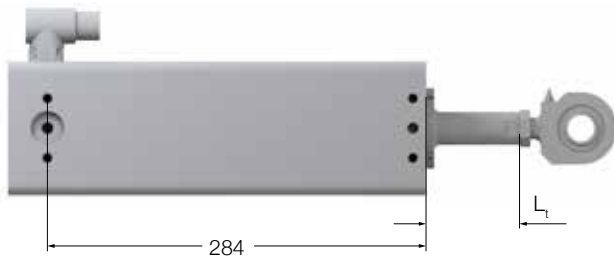
L_{t0} definition



Then, it's required to measure L_t : equivalent dimension of L_{t0} when cylinder is in any position (→ fig. 4).

Fig. 4

L_t



Then, cylinder position in relation to the “zero” position given in the cylinder drawing is equal to $L_t - L_{t0}$.

3.2.3 General recommendations for installation

1. When mounting the cylinder, check that all parts to which it is fixed are correctly aligned. This should be done throughout the complete stroke.
NOTE: Poor alignment will reduce the life of the cylinder.
2. Radial load or bending torque must not be applied to the cylinder pushing tube. Otherwise cylinder lifetime might be drastically reduced.
3. Avoid shocks on the pushing tube. Do not hit it with a hammer.

4. Check that cylinder can move freely and there is no obstruction over the full stroke.
5. Do not modify any part of cylinder
6. Do not add any part/component on cylinder

3.2.4 Cylinder attachment

Attachment type is given according to the type code shown in paragraph 2.5 Designation, page 11.

Please see CEMC catalogue for attachment detail or dedicated drawing for custom design.

Body/rear attachment	Instruction	Comment
Front (F)	Whatever working load is By 4x CHc M8 bolts Bolt quality class 12.9 Tightening torque 25 Nm	It is advised to use light thread locking glue on bolts (Loctite 222 or similar)
	If working load is < 10 kN By 4x CHc M6 bolts Bolt quality class 12.9 Tightening torque 15 Nm	For both bolt sizes, thread length engaged must be minimum 1.5 times bolt diameter
Trunnions (T)	Clean outer diameter surface before assembly	It is advised to use bushing on outer trunnions diameter
Back clevis (B)	Clean inner diameter surface before assembly	Bushing already included in the back clevis attachment

For custom body attachment please refer to specific document provided (drawing, technical description) or contact Ewellix for additional information needs.

Rod attachment	Instruction	Comment
Rod end (R)	–	–
Male thread (M)	Tightening torque 60 Nm	It is advised to use light thread locking glue (Loctite 222 or similar)
Female thread (F)	Tightening torque 60 Nm	It is advised to use light thread locking glue (Loctite 222 or similar)

For custom rod attachment please refer to specific document provided (drawing, technical description) or contact Ewellix for additional information needs.

3.2.5 Cylinder cooling

Cooling type is given according to the type code shown in paragraph 2.5 Designation, page 11.

For water cooling, please see CEMC catalogue for water in/outlet position and type or dedicated drawing for custom design.

3.3 Electrical installation

3.3.1 Motor/Feedback/Brake

CEMC is a motor integrated actuator type.

Motor and feedback type are given according to the type code shown in paragraph 2.5 Designation, page 11.

Please refer to the CEMC datasheet for feedback and brake references and technical specifications.

Please refer to the CEMC datasheet for both motor and feedback connectors definition. See example below giving connectors definition for R1 standard resolver feedback.

Prior to connect, please check that cabling is aligned between the actuator and the servo amplifier thanks to its documentation.

Example:

Intercontec BEDC 106 NN 00 00 1216 000



Standard feedback	R1-R2-S1-H1
M23 connector 6 pins	Data/signal
1	U
2	V
3	PE
4	Brake +
5	Brake -
6	W
Housing	Shield

■ Optional

Intercontec AEDC 138 NN 00 00 1215 000 (insert at 20°)



Standard feedback	R1
M23 connector 12 pins	Data/signal
1	Sin (S2)
2	Sin (S4)
3	-
4	-
5	-
6	-
7	Err + (R1)
8	PT1000
9	PT1000
10	Err - (R2)
11	Cos (S1)
12	Cos (S3)
Housing	Shield

⚠ DANGER

During and after operation, some parts of the cylinder carry dangerous voltages.

Electric shock hazard. Risk of serious or fatal injuries.

Strictly observe the safety instructions in this manual and the safety instructions of manuals associated with each commissioned equipment (servo amplifier, etc).

Do not unplug motor connectors before switching off the power supply of the corresponding servo amplifier.

First unplug the signal connector and then the power connector. Motor rotation can create voltage. Do not touch connector pins.

3.3.2 Connector orientation

Standard orientation of connectors is as per catalogue and datasheet (from rear to side front). CEMC actuators are equipped with rotatable connectors so that they can be rotated during actuator installation and without any dismantling of the screws retaining connectors on the body. When needed, carefully rotate connectors to the desired orientation, with clockwise or counterclockwise as described below (→ fig. 5).



NOTE

Do not apply excessive force while rotating connectors.



NOTE

Please never loosen the screws retaining connectors.

Fig. 5



3.3.3 Servoamplifier

If the servoamplifier is supplied by Ewellix, please read the manufacturer's technical documentation for the servoamplifier in order to know how to properly install it.

The exact servoamplifier reference can be found on the nameplate located on the servoamplifier.

If the servoamplifier manufacturer doesn't supply paper documentation or a documentation CD-ROM, it means that a user manual should be downloaded from the manufacturer's web site.

In case of a problem, please contact your local Ewellix representative.

4.0 Commissioning

⚠ DANGER

During and after operation, some parts of the cylinder carry dangerous voltages.

Electric shock hazard. Risk of serious or fatal injuries.

Strictly observe the safety instructions in this manual and the safety instructions of manuals associated with each commissioned equipment (servo amplifier, etc).

Do not unplug motor connectors before switching off the power supply of the corresponding servo amplifier.

First unplug the signal connector and then the power connector. Motor rotation can create voltage. Do not touch connector pins.

4.1 General procedure for commissioning

To perform the very first commissioning of a cylinder, the general principle is as follows:

1. On the computer, ensure installation of the software required for defining servo amplifier parameters – installation of hardware connection between computer and servo amplifier.
2. Switch on the servo amplifier (only auxiliary supply or low-level supply) to allow servo amplifier parameters definition.
3. Launch the software required for servo amplifier parameters definition. Check of connection between computer and servo amplifier.
4. Definition of servo amplifier parameters. At the very least, the following information has to be entered:
 - 4.1. Cylinder motor choice (if necessary, choice of resolver or encoder associated) and associated brake choice if necessary.
 - 4.2. Fill in the following data:
 - 4.2.1. Cylinder move for each motor revolution (please read paragraph **2.3 Operating principle, page 9**, for definition).
 - 4.2.2. Cylinder speed defined for application.
 - 4.2.3. Cylinder acceleration defined for application.
 - 4.2.4. Definition of starting control parameters (see servo amplifier's technical documentation).
 - 4.3. Save modifications in non-volatile memory.

⚠ WARNING

During operation, the cylinder surface temperature can reach high values. There's a risk of burns or fire. Before any work on the actuator, let it cool down.

⚠ DANGER

Customer should make sure that the commissioning steps suggested in the general procedure can't create any problems. The described procedure assumes that mechanical and electrical installation have been done correctly.



NOTE

Actuator is greased supplied.



NOTE

Before going on to step 5, please check that the parameters given in steps 1–4 have been correctly saved in the non-volatile memory. To do that, switch off and on the servo-amplifier. Then check that the parameter modifications have been correctly taken into account in the servo amplifier.

5. Switch on the power supply of the servo amplifier. Check the cylinder motor brake operation (for example: when the cylinder motor torque comes on, a brake clap has to be heard. Same thing when the cylinder motor torque turns off).
6. Make a small cylinder move (smaller than overstroke value which is written on catalogue) in a positive direction to see the actual direction of pushing tube move. Generally, the pushing tube extends when a positive move is ordered. Otherwise, please reverse the motor rotation direction.
7. Check the limit switch (if installed directly on the machine) in the retracted position by moving the cylinder slowly and gradually to that position.
8. Check the limit switch (if installed directly on the machine) in the extended position by moving the cylinder slowly and gradually to that position.
9. If a home switch has been installed (directly on the machine), check its operation by moving the cylinder slowly and gradually to a position where the home switch status changes.
10. Make a program for defining the zero reference and check that this program works correctly, whatever the cylinder starting position. Please read paragraph **4.3 How to define zero reference, page 19** before beginning to make a program.
11. Measure the two extreme positions (pushing the tube in the extended position and in the retracted position) within which the cylinder could move without activating the limit switches (these two positions will be defined in relation with zero reference defined just above).

For more detailed information about how to check the position control behaviour, please read paragraph **4.4 How to check position control behaviour – first approach**, page 20.

**NOTE**

Once all these steps have been achieved, it's advisable to make the cylinder move several times forward-backward slowly on the complete stroke and to check the position control behaviour while the cylinder speed and acceleration are gradually increased.

4.2 General recommendations for use

Cylinders include two internal mechanical stops: one in the retracted and one in the extended position. In all cases, these stops are only to be used manually at slow speed and under small loads. They are not designed for the cylinder to push into them with significant loads and speeds.

For initial operation, it is advised that the user slowly increases the cycle rate of the cylinder without overheating. As a general rule, the stabilized temperature of the cylinder should not exceed 70°C (whatever surface where measure is made). For more detailed information on that subject, please read paragraph **5.1 Lubrication – detailed description**.

Depending on the cycle rate, working cycle definition (load, speed, acceleration/deceleration profiles) and environmental conditions, the cylinder can heat more or less. For more detailed information on that subject, please read paragraph **5.1 Lubrication – detailed description**.

WARNING

For whatever reason, the cylinder move must not be stopped by a stiff mechanical stop except if the speed of the motor is low (value below or equal to a few percent of the maximum speed value) and the cylinder force is limited to a low value (by defining a limitation on motor current). Otherwise, the kinetic energy stored within the internal rotating parts of the cylinder will be stopped in a very short time. This will create very high loads (inside the cylinder and in the cylinder pushing tube) which might seriously damage the cylinder and its external environment.

4.3 How to define zero reference

WARNING

It is required to enable the limit switches in the servo amplifier, so that a zero-reference search using the home switch can be done from any starting cylinder position.

Case “home switch is fixed on the machine driven by the Ewellix cylinder”

Depending on the servo amplifier definition (read servo amplifier user manual to get corresponding information), it might be necessary to make sure that the length of cam detected by the home switch will be longer than the stroke achieved by the cylinder for one motor revolution. Once this precaution has been taken, the zero-reference definition opportunities offered by the servo amplifier are enough to answer all possible cases.

WARNING

The zero-reference defined by searching for the home switch will be reproducible for one cylinder but won't be identical between different cylinders.

Consequently, when an old cylinder is replaced by a new one, it is required to redefine all actuator positions to be reached during machine operation (in function of new cylinder zero reference). Otherwise it may occur unexpected actuator position with risk of heavy property damage.

Case “mechanical stop fixed on the machine driven by the Ewellix cylinder”

If a mechanical stop is used to set the zero position of the cylinder, principle is to detect a certain level of current (ie torque) on the motor showing a fixed position. Move and approach shall be done at very low speed (< 10mm/s) with relevant current limit (limit according to the application, friction, weight move, etc).

Anyhow read servo amplifier user manual to get corresponding information.

**NOTE**

To define a zero reference which will always stay the same, even when the cylinder is replaced by a new one, it is required to write a program which makes the pushing cylinder meet a mechanical stop and which defines the zero reference in relation to the reached position.

**NOTE**

As a general rule, there isn't necessarily a link between the zero defined by a zero-reference search and the zero-position given in the cylinder drawing. Very often these two zeros correspond to two different cylinder positions.

WARNING

At the time of first cylinder commissioning, it's advised as a first approach to check that the position control operates correctly without risk to generate a tracking error fault or overspeed fault (see the servo amplifier manufacturer's technical documentation to get more details on these two faults). These faults might generate heavy property damages.

4.4 How to check position control behaviour – first approach

Depending on the servo amplifier manufacturer, it's possible that tracking error fault or overspeed fault switch off torque on the cylinder motor (read servo amplifier documentation for more information). If this is the case and if this occurs when the cylinder is at maximum speed, the cylinder will keep moving because of the kinetic energy of the cylinders internal rotating parts. Consequently, it is very likely that the cylinder will stop suddenly against its internal mechanical stop or the machine's mechanical stop. In both cases, this might generate heavy property damage.

To avoid this from happening, it's advisable to check the behaviour of the position control.

As a first step, please read the servo amplifier technical documentation to see if there's an existing method or if specific tools have been developed by the servo amplifier manufacturer to make this check.

Otherwise, use the following method which is a simplified evaluation of position control behaviour.

4.4.1 Principle of evaluation method

Position control behaviour is estimated through measurements made with the servo amplifier scope tool (see servo amplifier technical documentation for more details) while the cylinder is making forward and backward moves. The scope tool allows the user to see a value evolution of the control variables in the function of time. In this way it is, for example, possible to see in one graph the evolution of cylinder speed and the evolution of motor current in the function of time.

To make an estimation of position control behaviour, it's required to see the speed set point, actual speed, tracking error and motor current of the cylinder (see servo amplifier technical documentation to know the corresponding variables name). Depending on observations made on the shape of acquired curves, it will be possible to estimate the risk of generating a tracking error fault or over speed fault on a scale ranging from zero to very high.

4.4.2 Detailed description of method

Put the cylinder into the final use conditions (cylinder has to be installed inside a machine and has to be able to achieve the work for which it has been designed) and decrease the maximum moving speed value (take maximum speed equal to 1/10th of maximum speed defined for the application) and acceleration/deceleration values (take value equal to 1/10th of acceleration / deceleration values defined for application).

First, start a cylinder forward movement and then a backward movement and make scope record at the same time. Look at the acquired graph and compare it with the two example graphs given below. Conclude about risk level to generate tracking error fault and/or over speed fault.

If the risk is low, increase speed value and acceleration/ deceleration values and remake measurements with the scope tool during a forward-backward cylinder movement. Remake an estimation of risk level to generate a fault. As long as the risk stays low, repeat this step until to values of speed, acceleration and deceleration defined for application are reached.

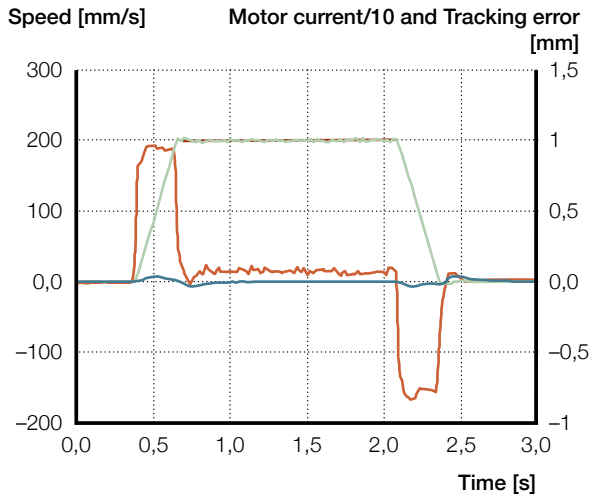
If the risk is becoming significant, do not keep increasing speed and/or acceleration/deceleration but try to reduce the speed overshoot value and/or tracking error value. To do that, study the servo amplifier technical documentation to identify actions to perform to reduce the risk level to

DANGER

Customer should be sure that the commissioning steps suggested in method described to the left can't create any problems.

Example:

Low risk of generating over speed or tracking error faults

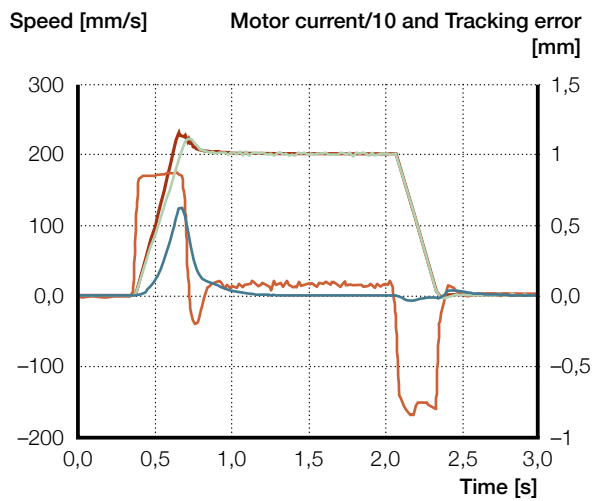


1. In this example, there is no difference between the speed setpoint and the actual speed. If a level triggering over-speed fault is established at 230 mm/s, for example, and if this graph stays identical on several forward-backward movements, then the risk of generating an overspeed fault is very low.
2. The value of tracking error is low (max $\sim 40 \mu\text{m}$). If the level triggering a tracking error fault is established at 0,7mm, for example, and if this graph stays identical on several forward-backward moves, then the risk to generate a tracking error fault is very low.

— Speed setpoint [mm/s] — Actual speed [mm/s] — Tracking error [mm] — Motor current/10 [A]

Example:

High risk to generate overspeed or tracking error faults



1. In this example, there is a big difference between the speed setpoint and the actual speed, which causes a speed overshoot phenomena (max speed near 230 mm/s) necessary to decrease tracking error. If the level triggering overspeed fault is established at 230 mm/s, for example, then the risk to generate an overspeed fault is very high.
2. The value of tracking error is significant (max $\sim 0,6 \text{ mm}$). If the level triggering a tracking error is established at 0,7 mm, for example, then the risk to generate a tracking error fault is very high.

— Speed setpoint [mm/s] — Actual speed [mm/s] — Tracking error [mm] — Motor current/10 [A]

4.5 Position control parameters to be known

Position control parameters determine the dynamic/stiffness of control but also its stability.

WARNING

In most cases, software for parameters setup and/or technical documentation supplied with the servo amplifier allow calculation or evaluation of control parameters value for current loop, speed loop and position loop. As a general rule, these parameters are adapted well enough so that the cylinder can correctly complete the tasks requested by the user. But it is the user's responsibility to confirm that it is effective in the context of its application.

For more details, please read technical documentation of the servo amplifier manufacturer.



NOTE

A position control that is too dynamic/ stiff could generate vibrations (=control instability) which would make noise and would be damaging for the system lifetime.

5.0 Maintenance, upkeep and routine checks

⚠ DANGER

During and after operation, some parts of the cylinder carry dangerous voltages. Electric shock hazard. Risk of serious or fatal injuries.

Strictly observe the safety instructions in this manual and the safety instructions of manuals associated with each commissioned equipment (servo amplifier, etc).

Do not unplug motor connectors before switching off the power supply of the corresponding servo amplifier. First unplug the signal connector and then the power connector.

Motor rotation can create voltage. Do not touch connector pins.

⚠ WARNING

During operation, the cylinder surface temperature can reach high values. There's a risk of burns or fire. Before any work on the actuator, let it cool down. .



NOTE

In the case of very dynamic applications, it's advisable to regularly check cylinder operation and its lubrication conditions.

5.1 Lubrication – detailed description

⚠ WARNING

In the following paragraphs, recommendations are given (type, frequency and grease quantity) for cylinder parts that need to be re-lubricated regularly. These recommendations have to be taken as a guide. In most need cases, these recommendations result in good lubrication conditions during the cylinders lifetime.

But it may occur, depending on the ambient temperature, on cylinder working cycle definition (speed, acceleration, load, cycle rate) and on the way the cylinder can dissipate its heat, that it's required to adapt the grease definition to the specific conditions of the application. As most of these parameters are known only by the user, it's the responsibility of the user to check that lubrication

recommendations suggested in this manual create good lubrication conditions.

As a general rule, the stabilized temperature of the cylinder has not to exceed 70°C (whatever surface is measured). If it's not the case, please contact your local Ewellix representative in order to get technical support. .

5.1.1 Lubricant information

For grease reference to be used, if actuator serial number is not starting with AR37703, and if actuator definition is not described in High Performance Actuator catalogue, please refer to the two following documents (called "documents for approval"):

- Drawing for approval
- Technical description

For catalogue and standard item, with serial number AR37703- xxxx, use standard grease:

Grease type: KLUBERSYNT HB 74-401

Viscosity: 380-430 cSt at 40 °C
38-48 cSt at 100 °C

NLGI classification: 1

Base oil type: synthetic

Soap: polyurea

Supplier: Klüber

For special request (such as food industry, extreme pressure additives, ...) please contact Ewellix



NOTE

During re-lubrication actions, please take the following indications into account:

- Work cleanly. Do not inject grease polluted by other products or particles.
- Too much grease generates heat inside the actuator. Avoid injecting air into lubrication paths.

5.1.2 Roller screw

The recommended lubrication interval is every 4 000 hours or 2 million of cycles, and at least once a year.

Interval of re-lubrication is function of several parameters and could be adjusted case by case to suit the real operating conditions (temperature, speed, load, ...).

Preferably, the recommended lubricant quantity can be applied in smaller doses throughout the same period.

Recommended lubricant quantity: 5 cm³.

5.1.3 Anti-rotation [option]

The anti-rotation system is maintenance free.

However, the grease nipple on the front body (see drawing chapter in CEMC datasheet) offers a possibility to re-lubricate if the environment or the process requires it. Please contact Ewellix.

5.1.4 Bearings

The bearings are greased for life.

5.1.5 Rod end [option]

The rod end is maintenance free.

5.2 Lubrication - Procedure

1. Plug the greasing device to the nipple placed on the push tube end.
2. Inject half the required amount of grease
3. Make ten double strokes slowly along the whole stroke to spread the grease along the screw shaft.
4. Repeat steps 2 & 3.
5. Monitor the actuator temperature level to be sure it does not overheat, especially if it is used under high speed.

This is a closed system. When re-lubricating, the old grease takes up free space in the cylinder.

If the free space is filled, the cylinder will overheat.

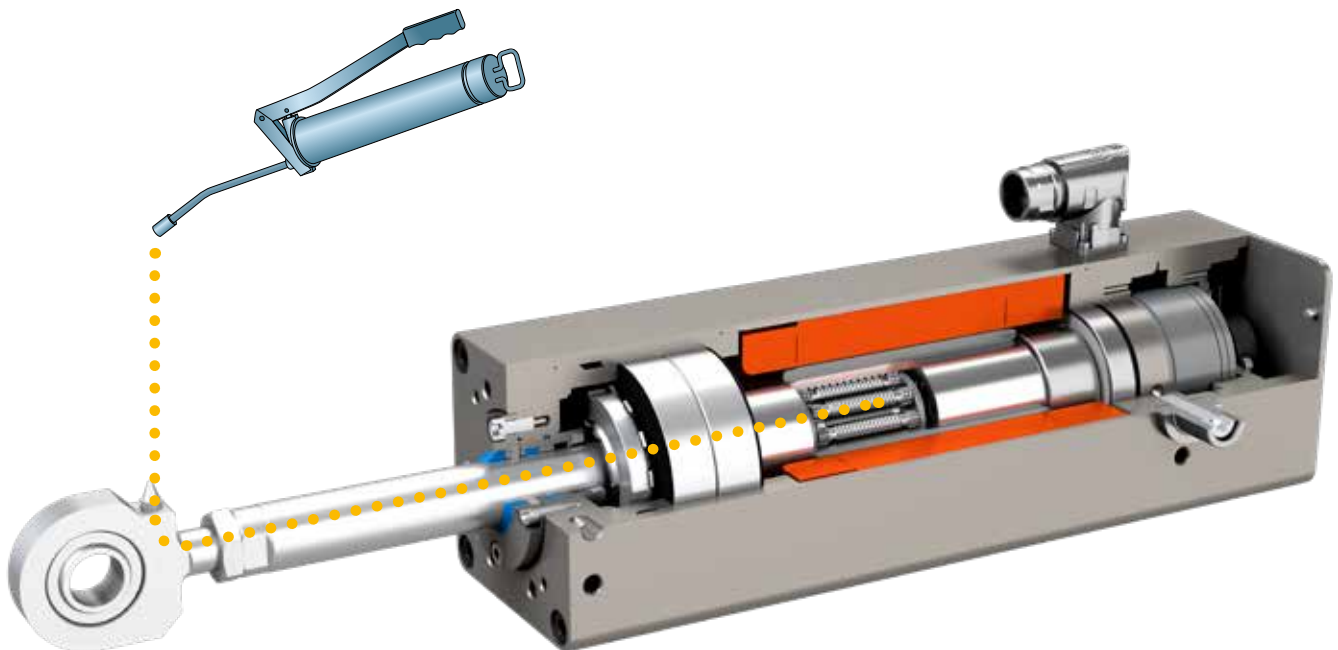
 **NOTE**

Re-lubrication operation can be performed at any position. Avoid injecting air into lubrication paths.

5.3 Brake

Brake holding force (ie. torque) is set at the delivery at the nominal value given in the CEMC datasheet.

It is advised to check regularly, and within the lifetime of the actuator, the brake holding capacity (ie. torque). Please refer to the documentation of the servo amplifier for the testing and running in procedure of brake (permanent magnet technology).



6.0 Malfunctions



NOTE

When a malfunction occurs, it isn't always obvious if the problem is mechanical or electrical. For example, for a given fault (for example; cylinder doesn't move), the root cause may be mechanical (for example; motor brake blocked) or electrical (for example: electrical power not validated in the servo amplifier). Consequently, in case of malfunction, please consider all possible causes (mechanical and electrical) to identify all possible solutions.

6.1 Mechanical malfunctions table

Malfunction	Possible cause(s)	Possible solution(s)
Cylinder doesn't move	Motor brake blocked	Check brake connection and supply voltage
	System moved by cylinder blocked	Check mobility of system moved by cylinder
Cylinder uses a lot of current and/or makes a noise when moving	Motor brake blocked	Check brake connection and supply voltage
	System moved by cylinder blocked	Check mobility of system moved by cylinder
Cylinder is too hot	Overloading	Measure RMS torque value on one complete cycle (including pause time before starting a new cycle). Send this information to Ewellix for analysis.
	Ambient temperature too high	Comply with permitted temperature range

6.2 Electrical malfunctions table

Malfunction	Possible cause(s)	Possible solution(s)
Cylinder doesn't move	Incorrect power connection	Check power connection
	Incorrect feedback connection	Check feedback connection
	No electrical power on cylinder motor	Check voltage, main switch status and fuses status above the servo amplifier. Check that the servo amplifier authorizes cylinder move and cylinder motor torque on
	Incorrect definition of cylinder move	Check that all move parameters (target position, speed and acceleration) are correctly defined in servo amplifier
	Servo amplifier fault	Read the technical documentation of the servo amplifier. In function of fault number, possible causes are suggested with associated solutions.
Cylinder moves a little and stops immediately with fault servo amplifier.	Incorrect power connection	Check power connection
	Incorrect feedback connection	Check feedback connection
	Servo amplifier fault	Read the technical documentation of the servo amplifier. In function of fault number, possible causes are suggested with associated solutions
Cylinder doesn't move in correct direction	Incorrect motor/feedback connections or incorrect servo amplifier parameter	
	Check power/feedback connections or change direction of movement in the servo amplifier parameters	
Cylinder vibrates in stop position	Position control parameters not adapted to application	Optimize the position control parameters definition in relation with the application

6.3 Before requiring Ewellix

If the problem hasn't been resolved, although all the solutions given in the previous two paragraphs have been considered and implemented, get in touch with your local Ewellix representative for information on contacting technical support.

Before requiring Ewellix assistance, please have the following information:

Serial number of the cylinder (e.g. ARxxxxx-yyyy).

Ex: AR37703-0223 corresponds to cylinder no 223 with 37703 design file number).

Malfunction nature and duration (continuous? sometimes? (estimated frequency?), malfunction occurs only one time?).

When and in what conditions the malfunction occurs (a detailed description is required).

If possible, take pictures or screen captures to illustrate malfunction description.



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