

MC33-V4A to MC64-V4A Industrial Shock Absorbers

The best corrosion protection

Self-compensating, stainless steel

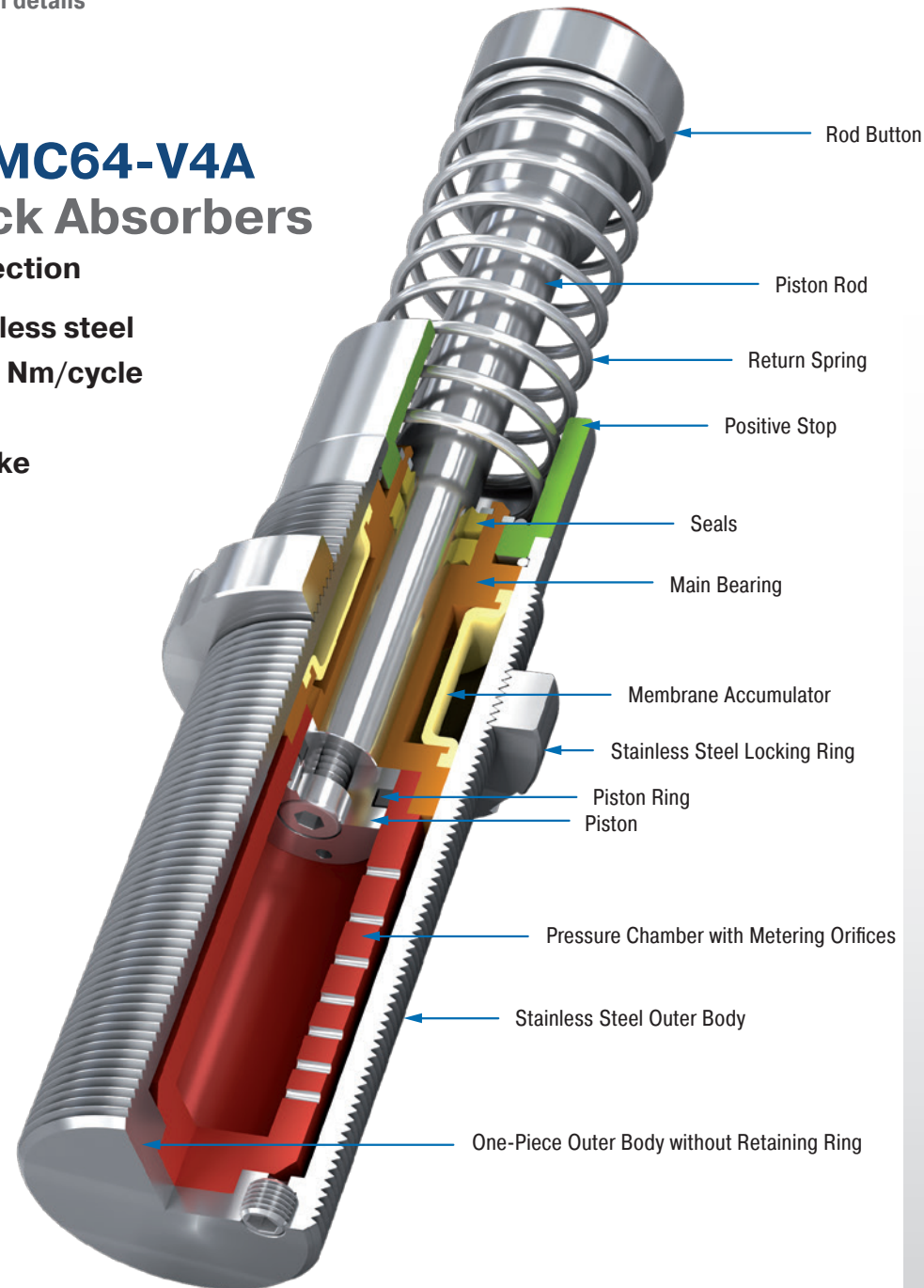
Energy capacity from 170 Nm/cycle
to 3,730 Nm/cycle

23.1 mm to 99.4 mm stroke

MC33EUM-V4A

MC45EUM-V4A

MC64EUM-V4A



The identification numbers listed are the respective standard units of the corresponding shock absorber series. Special types can have deviating identification numbers.

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General instructions

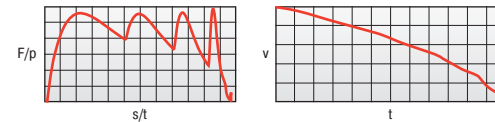
This manual is for the disruption-free use of the product types listed on page 1; its compliance is a prerequisite for the fulfilment of any warranty claims.

Therefore, make sure to read this manual before use.

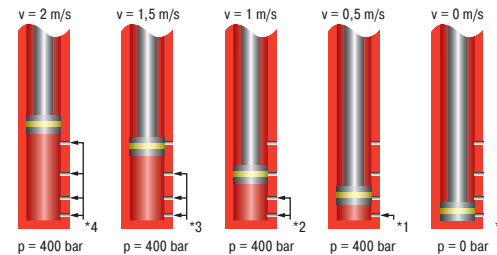
Please always maintain the specified limits from the performance table (technical data). Take into account the predominant environmental conditions and restrictions. Note the regulations of the trade association, TÜV or corresponding national, international and European regulations. Installation and commissioning only according to mounting instructions.

the entire stroke. A requirement for a constant rate of deceleration is the correct calculation of the industrial shock absorber and therefore the correct selection of the right metering orifice pattern or the right hardness level of the shock absorber. The hardnesses are graded from -0 to -4 (hard).

General Function



F = Force (N) p = Internal pressure (bar) s = Stroke (m)
t = Deceleration time (s) v = Velocity (m/s)



* The load velocity reduces continuously as you travel through the stroke due to the reduction in the number of metering orifices (*) in action. The internal pressure remains essentially constant and thus the Force vs. stroke curve remains linear.

Calculation and design

In order to ensure an optimum, fault-free and durable function of the industrial shock absorbers they must be correctly dimensioned and designed. The following parameters must be known and used in the calculation:

- Moving mass [kg]
- Impact velocity of the mass into the shock absorber(s) [m/s]
- Additionally acting propelling force, propelling power or propelling torque [N, kW, Nm]
- Number of shock absorbers acting in parallel [n]
- Number of strokes or cycles per hour [1/h]

The correct size of the shock absorbers can be determined with the ACE online calculation programme at www.ace-ace.de. You can also send us the completed online form via e-mail for checking.

Or make use of our free calculation service by phoning: +49 (0)2173 - 9226-20.

WARNING

! The dampers must be dimensioned in such a way that the calculated values do not exceed the maximum values of the respective performance table (technical data):

W_j [Nm/cycle]

W_i [Nm/h]

Effective weight m_e

Max. side load angle [°]

! For a correct damping design the shock absorber must represent the only braking system. Additional braking systems, such as a pneumatic end position damping length, must not overlap with the end position damping length by the shock absorber and must be disabled.

Safety information

WARNING

! If ACE industrial shock absorbers are used where a failure of the product could lead to personal injuries and/or material damage, additional safety elements must be implemented.

! Free-moving masses can lead to injuries by crushing during installation of the shock absorber. Secure moving masses against inadvertent starting with suitable safety precautions before installing the shock absorbers.

Intended use

ACE industrial shock absorbers are used wherever moving masses are to be slowed down in a defined end position. The industrial shock absorbers are designed for force capacity in an axial direction. Within the permissible load limits the industrial shock absorber also acts as a stop.

Description and function

The ACE industrial shock absorbers MC33-V4A to MC64-V4A are maintenance-free, ready-to-install hydraulic components with numerous metering openings.

During the slowing down process the moving mass moves with kinetic energy and, if necessary, an additional drive energy in the axial direction of the piston rod with a defined impact velocity against the rod end button of the shock absorber. Alternatively, numerous shock absorbers can also be used in parallel. During the initiated slowing down process the piston rod is pushed into the shock absorber. The hydraulic oil located before the piston is displaced through all metering orifices at the same time. The number of effective metering openings reduces in proportion to the driven stroke. The retraction speed reduces. The dynamic pressure applied in front of the piston corresponds to the counterforce applied by the shock absorber and remains approximately constant over

Delivery and storage

- After delivery please check the shock absorber for any damage.
- The shock absorber can become damaged if it falls. Carefully remove shock absorber from the packaging.
- Shock absorbers can generally be stored in any position.
- Storage in the original packaging is preferred.
- Always store shock absorbers in a dry place in order to avoid oxidation.
- The recommended maximum storage time is three years.

Maintenance and care

Regularly check the shock absorbers for oil loss, return of the piston rod and external damage.

Shock absorbers are machine elements that are subject to continuous wear. Increased service life results in reduced damping effect. If this is no longer sufficient, the shock absorbers must be replaced or exchanged as appropriate.

Disassembly and disposal

Take account of environmental protection (recovery of problematic substances) during disposal of the shock absorber. The MC industrial shock absorbers are filled with NSF-H1 approval special oil. The corresponding data sheet is available on request.

Faulty dampers can be sent to our service department for determination of the cause of failure.

Mounting instructions and mounting accessories

Installation instructions

Before installation and use check whether the identification number on the damper or on the packaging matches the respective designation on the delivery note. Industrial shock absorbers are maintenance-free and ready to install.

Operating temperature range: -12 °C to 66 °C

Mounting: As required but always in such a way that the entire damper stroke is used. The dampers must always be mounted in such a way that the forces are introduced centrally over the piston rod. The maximum permissible side load angle (see table) must not be exceeded. If there is a side load angle, it generally leads to a reduction in service life. In the case of maximum permissible values being exceeded a side load adapter must be used.

Self-compensating: The MC range of shock absorbers is self-compensating. In a selectable range according to a table, the different effects of power, weight, temperature and speed balance out independently. The shock absorbers are divided into five hardness ranges (me min. to me max.) as standard. The grading ranges from -0 (very soft) to -4 (very hard).

Commissioning

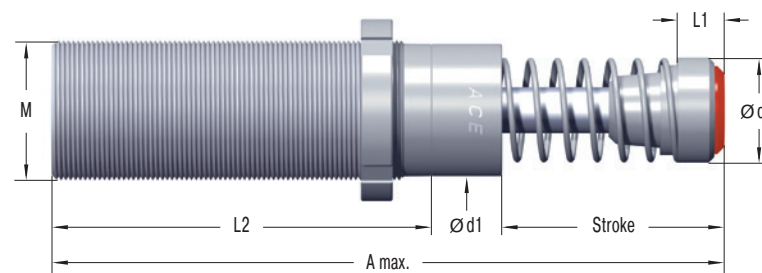
- After installation, start a test run of the moving mass at reduced operating speed to begin with.

During the test run

- Gradually accelerate the load capacity up to the subsequent operating speed. You can find this in the calculation for your application. In the correct final setting, the piston rod of the shock absorber reaches the end position (positive stop) without a hard stop.

Mounting accessories

Information on the corresponding mounting accessories can be found on the following pages.



Dimensions

TYPES	Stroke mm	A max. mm	d1 mm	d2 mm	L1 mm	L2 mm	M
MC3325EUM-V4A	23.2	151.2	30	29.2	13.2	83	M33x1.5
MC3350EUM-V4A	48.6	202.2	30	29.2	13.2	108	M33x1.5

Performance data

TYPES	Max. Energy Capacity		Effective Weight			Return Force min. N	Return Force max. N	Return Time s	Side Load Angle max. °	Weight kg
	W ₃ Nm/cycle	W ₄ Nm/h	¹ me min. kg	¹ me max. kg	Hardness					
MC3325EUM-0-V4A	170	75,000	3	11	-0	45	90	0.03	4	1.57
MC3325EUM-1-V4A	170	75,000	9	40	-1	45	90	0.03	4	0.51
MC3325EUM-2-V4A	170	75,000	30	120	-2	45	90	0.03	4	1.57
MC3325EUM-3-V4A	170	75,000	100	420	-3	45	90	0.03	4	1.55
MC3325EUM-4-V4A	170	75,000	350	1,420	-4	45	90	0.03	4	1.57
MC3350EUM-0-V4A	330	85,000	5	22	-0	45	135	0.06	3	1.64
MC3350EUM-1-V4A	330	85,000	18	70	-1	45	135	0.06	3	1.63
MC3350EUM-2-V4A	330	85,000	60	250	-2	45	135	0.06	3	1.63
MC3350EUM-3-V4A	330	85,000	210	840	-3	45	135	0.06	3	1.61
MC3350EUM-4-V4A	330	85,000	710	2,830	-4	45	135	0.06	3	1.63

¹ It is permissible to exceed the stated energy in emergency stop situations. In the event of such a case, please contact ACE.

² If side load angle is higher contact ACE.

Model type prefix

Standard types

MC: self-contained with return spring, self-compensating

Special types

MCA: not self-contained, without spring. Use only with external air/oil tank.









MCS: not self-contained, with spring. Use only with external air/oil tank.

MCN: self-contained, without spring

Packaging disposal

Please dispose of the transportation packaging in an environmentally-friendly manner. Recycling packaging materials saves raw materials and reduces waste. The packaging materials do not contain any prohibited materials.

WARNING

-  Temperature effect: The W₃ and me values given in the performance table (see manual or catalogue) are valid for room temperature. Deviating values apply to higher temperatures.
-  During installation of the dampers moving masses can lead to injuries due to inadvertent starting. Secure moving masses against inadvertent moving.
-  The dampers may be unsuitable for use and have an insufficient damping effect. Check the specific suitability of the dampers before installation.
-  If operated outside of the operating temperature range, the damper can lose its function. Operating temperature range must be maintained. Do not paint dampers due to heat emission.
-  Fluids, gases and dirt particles in the surrounding area can attack or destroy the seal system of the damper and cause it to fail. Protect or encapsulate piston rod and seal system from external materials in the surrounding area.
-  Damage to the piston rod surface can destroy the seal system. Do not grease, oil piston rod etc. and protect against dirt particles.
-  The piston rod can be torn from the damper. Do not load the piston rod with tensile stress.
-  Damper can tear off upon impact. Always lay out the connection structure in such a way that the maximum occurring forces can be absorbed with sufficient safety. The maximum reacting forces listed in the calculation range may deviate from the actually occurring reacting forces, as these are based on theoretical values.

Mounting instructions and mounting accessories

M33x1.5 mounting accessories

MC33-V4A

Before installation check whether the identification number on the packaging matches the respective designation on the delivery note.

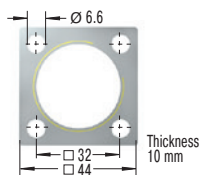
Note the dimensioning for mounting when using accessory parts. Bolts for fitting of accessories are not included.

If you have any questions, please phone +49 (0)2173 - 9226-20 for free advice.

When using accessory parts and mounting elements also note the

QF33-V4A

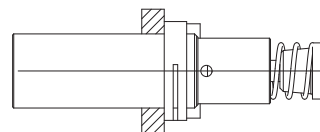
Square Flange



mounting instructions for accessories delivered separately.

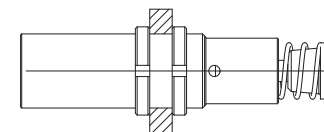
Mounting types

Mounting with Square Flange QF-V4A



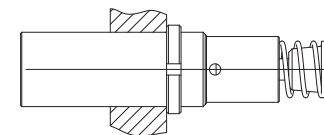
Mount with 4 bolts
 Torque max.: 11 Nm
 Clamping torque: > 90 Nm

Mounting of damper in borehole with two locking rings



Torque: 80 Nm

Screwing the damper into a threaded hole with additional locking ring



Torque: 80 Nm

Mounting instructions and mounting accessories

Installation instructions

Before installation and use check whether the identification number on the damper or on the packaging matches the respective designation on the delivery note. Industrial shock absorbers are maintenance-free and ready to install.

Operating temperature range: -12 °C to 66 °C

Mounting: As required but always in such a way that the entire damper stroke is used. The dampers must always be mounted in such a way that the forces are introduced centrally over the piston rod. The maximum permissible side load angle (see table) must not be exceeded. If there is a side load angle, it generally leads to a reduction in service life. In the case of maximum permissible values being exceeded a side load adapter must be used.

Self-compensating: The MC range of shock absorbers is self-compensating. In a selectable range according to a table, the different effects of power, weight, temperature and speed balance out independently. The shock absorbers are divided into five hardness ranges (me min. to me max.) as standard. The grading ranges from -0 (very soft) to -4 (very hard).

Commissioning

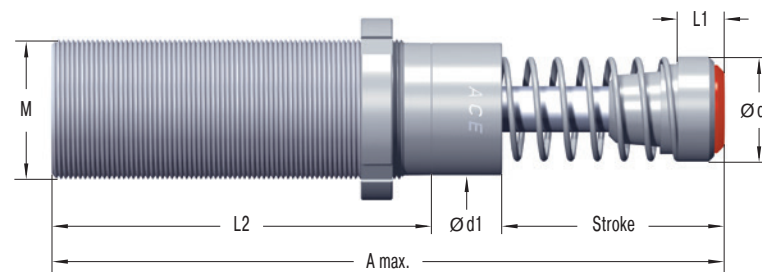
- After installation, start a test run of the moving mass at reduced operating speed to begin with.

During the test run

- Gradually accelerate the load capacity up to the subsequent operating speed. You can find this in the calculation for your application. In the correct final setting, the piston rod of the shock absorber reaches the end position (positive stop) without a hard stop.

Mounting accessories

Information on the corresponding mounting accessories can be found on the following pages.



Dimensions

TYPES	Stroke mm	A max. mm	d1 mm	d2 mm	L1 mm	L2 mm	M
MC4525EUM-V4A	23.1	164.5	42	42	19.4	95	M45x1.5
MC4550EUM-V4A	48.5	214.4	42	42	19.4	120	M45x1.5
MC4575EUM-V4A	73.9	265.4	42	42	19.4	145	M45x1.5

Performance data

TYPES	Max. Energy Capacity		Effective Weight			Return Force min. N	Return Force max. N	Return Time s	Side Load Angle max. °	Weight kg
	W ₃ Nm/cycle	W ₄ Nm/h	¹ me min. kg	¹ me max. kg	Hardness					
MC4525EUM-0-V4A	370	107,000	7	27	-0	70	100	0.03	4	1.14
MC4525EUM-1-V4A	370	107,000	20	90	-1	70	100	0.03	4	2.09
MC4525EUM-2-V4A	370	107,000	80	310	-2	70	100	0.03	4	1.14
MC4525EUM-3-V4A	370	107,000	260	1,050	-3	70	100	0.03	4	1.31
MC4525EUM-4-V4A	370	107,000	890	3,540	-4	70	100	0.03	4	1.31
MC4550EUM-0-V4A	740	112,000	13	54	-0	70	145	0.08	3	1.41
MC4550EUM-1-V4A	740	112,000	45	180	-1	70	145	0.08	3	1.36
MC4550EUM-2-V4A	740	112,000	150	620	-2	70	145	0.08	3	1.37
MC4550EUM-3-V4A	740	112,000	520	2,090	-3	70	145	0.08	3	1.41
MC4550EUM-4-V4A	740	112,000	1,800	7,100	-4	70	145	0.08	3	1.39
MC4575EUM-0-V4A	1,130	146,000	20	80	-0	50	180	0.11	2	1.59
MC4575EUM-1-V4A	1,130	146,000	70	270	-1	50	180	0.11	2	1.59
MC4575EUM-2-V4A	1,130	146,000	230	930	-2	50	180	0.11	2	1.50
MC4575EUM-3-V4A	1,130	146,000	790	3,140	-3	50	180	0.11	2	1.59
MC4575EUM-4-V4A	1,130	146,000	2,650	10,600	-4	50	180	0.11	2	1.59

¹ It is permissible to exceed the stated energy in emergency stop situations. In the event of such a case, please contact ACE.

² If side load angle is higher contact ACE.

WARNING

- Temperature effect:** The W₃ and me values given in the performance table (see manual or catalogue) are valid for room temperature. Deviating values apply to higher temperatures.
- During installation of the dampers moving masses can lead to injuries due to inadvertent starting. Secure moving masses against inadvertent moving.**
- The dampers may be unsuitable for use and have an insufficient damping effect. Check the specific suitability of the dampers before installation.**
- If operated outside of the operating temperature range, the damper can lose its function. Operating temperature range must be maintained. Do not paint dampers due to heat emission.**
- Fluids, gases and dirt particles in the surrounding area can attack or destroy the seal system of the damper and cause it to fail. Protect or encapsulate piston rod and seal system from external materials in the surrounding area.**
- Damage to the piston rod surface can destroy the seal system. Do not grease, oil piston rod etc. and protect against dirt particles.**
- The piston rod can be torn from the damper. Do not load the piston rod with tensile stress.**
- Damper can tear off upon impact. Always lay out the connection structure in such a way that the maximum occurring forces can be absorbed with sufficient safety. The maximum reacting forces listed in the calculation range may deviate from the actually occurring reacting forces, as these are based on theoretical values.**

Packaging disposal

Please dispose of the transportation packaging in an environmentally-friendly manner. Recycling packaging materials saves raw materials and reduces waste. The packaging materials do not contain any prohibited materials.

Model type prefix

Standard types

MC: self-contained with return spring, self-compensating

Special types

MCA: not self-contained, without spring. Use only with external air/oil tank.

MCS: not self-contained, with spring. Use only with external air/oil tank.

MCN: self-contained, without spring

Mounting instructions and mounting accessories

M45x1.5 mounting accessories

MC45-V4A

Before installation check whether the identification number on the packaging matches the respective designation on the delivery note.

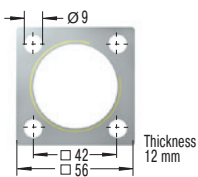
Note the dimensioning for mounting when using accessory parts. Bolts for fitting of accessories are not included.

If you have any questions, please phone +49 (0)2173 - 9226-20 for free advice.

When using accessory parts and mounting elements also note the

QF45-V4A

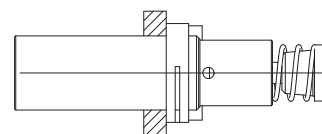
Square Flange



mounting instructions for accessories delivered separately.

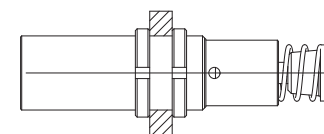
Mounting types

Mounting with Square Flange QF-V4A



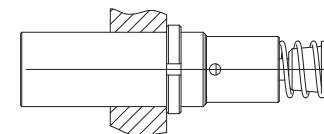
Mount with 4 bolts
 Torque max.: 27 Nm
 Clamping torque: > 200 Nm

Mounting of damper in borehole with two locking rings



Torque: 235 Nm

Screwing the damper into a threaded hole with additional locking ring



Torque: 235 Nm

Mounting instructions and mounting accessories

Installation instructions

Before installation and use check whether the identification number on the damper or on the packaging matches the respective designation on the delivery note. Industrial shock absorbers are maintenance-free and ready to install.

Operating temperature range: -12 °C to 66 °C

Mounting: As required but always in such a way that the entire damper stroke is used. The dampers must always be mounted in such a way that the forces are introduced centrally over the piston rod. The maximum permissible side load angle (see table) must not be exceeded. If there is a side load angle, it generally leads to a reduction in service life. In the case of maximum permissible values being exceeded a side load adapter must be used.

Self-compensating: The MC range of shock absorbers is self-compensating. In a selectable range according to a table, the different effects of power, weight, temperature and speed balance out independently. The shock absorbers are divided into five hardness ranges (me min. to me max.) as standard. The grading ranges from -0 (very soft) to -4 (very hard).

Commissioning

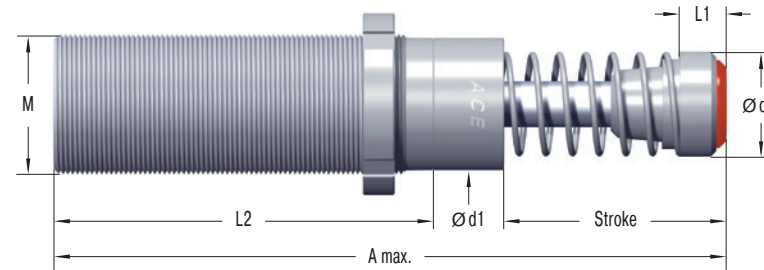
- After installation, start a test run of the moving mass at reduced operating speed to begin with.

During the test run

- Gradually accelerate the load capacity up to the subsequent operating speed. You can find this in the calculation for your application. In the correct final setting, the piston rod of the shock absorber reaches the end position (positive stop) without a hard stop.

Mounting accessories

Information on the corresponding mounting accessories can be found on the following pages.



Dimensions

TYPES	Stroke mm	A max. mm	d1 mm	d2 mm	L1 mm	L2 mm	M
MC6450EUM-V4A	48.6	244.1	60	60	19.1	140	M64x2
MC64100EUM-V4A	99.4	345.1	60	60	19.1	191	M64x2

Performance data

TYPES	Max. Energy Capacity		Effective Weight			Return Force min. N	Return Force max. N	Return Time s	Side Load Angle max. °	Weight kg
	W _s Nm/cycle	W _h Nm/h	¹ me min. kg	¹ me max. kg	Hardness					
MC6450EUM-0-V4A	1,870	146,000	35	140	-0	90	155	0.12	4	2.90
MC6450EUM-1-V4A	1,870	146,000	140	540	-1	90	155	0.12	4	2.90
MC6450EUM-2-V4A	1,870	146,000	460	1,850	-2	90	155	0.12	4	3.61
MC6450EUM-3-V4A	1,870	146,000	1,600	6,300	-3	90	155	0.12	4	2.90
MC6450EUM-4-V4A	1,870	146,000	5,300	21,200	-4	90	155	0.12	4	2.90
MC64100EUM-0-V4A	3,730	192,000	70	280	-0	105	270	0.34	3	4.01
MC64100EUM-1-V4A	3,730	192,000	270	11,000	-1	105	270	0.34	3	3.99
MC64100EUM-2-V4A	3,730	192,000	930	3,700	-2	105	270	0.34	3	3.99
MC64100EUM-3-V4A	3,730	192,000	3,150	12,600	-3	105	270	0.34	3	3.70
MC64100EUM-4-V4A	3,730	192,000	10,600	42,500	-4	105	270	0.34	3	3.70

¹ It is permissible to exceed the stated energy in emergency stop situations. In the event of such a case, please contact ACE.

² If side load angle is higher contact ACE.

Model type prefix

Standard types

MC: self-contained with return spring, self-compensating

Special types

MCA: not self-contained, without spring. Use only with external air/oil tank.









MCS: not self-contained, with spring. Use only with external air/oil tank.

MCN: self-contained, without spring

Packaging disposal

Please dispose of the transportation packaging in an environmentally-friendly manner. Recycling packaging materials saves raw materials and reduces waste. The packaging materials do not contain any prohibited materials.

WARNING

-  Temperature effect: The W_s and me values given in the performance table (see manual or catalogue) are valid for room temperature. Deviating values apply to higher temperatures.
-  During installation of the dampers moving masses can lead to injuries due to inadvertent starting. Secure moving masses against inadvertent moving.
-  The dampers may be unsuitable for use and have an insufficient damping effect. Check the specific suitability of the dampers before installation.
-  If operated outside of the operating temperature range, the damper can lose its function. Operating temperature range must be maintained. Do not paint dampers due to heat emission.
-  Fluids, gases and dirt particles in the surrounding area can attack or destroy the seal system of the damper and cause it to fail. Protect or encapsulate piston rod and seal system from external materials in the surrounding area.
-  Damage to the piston rod surface can destroy the seal system. Do not grease, oil piston rod etc. and protect against dirt particles.
-  The piston rod can be torn from the damper. Do not load the piston rod with tensile stress.
-  Damper can tear off upon impact. Always lay out the connection structure in such a way that the maximum occurring forces can be absorbed with sufficient safety. The maximum reacting forces listed in the calculation range may deviate from the actually occurring reacting forces, as these are based on theoretical values.

Mounting instructions and mounting accessories

M64x2 mounting accessories

MC64-V4A

Before installation check whether the identification number on the packaging matches the respective designation on the delivery note.

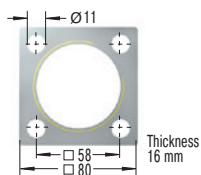
Note the dimensioning for mounting when using accessory parts. Bolts for fitting of accessories are not included.

If you have any questions, please phone +49 (0)2173 - 9226-20 for free advice.

When using accessory parts and mounting elements also note the

QF64-V4A

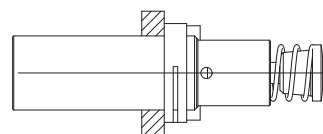
Square Flange



mounting instructions for accessories delivered separately.

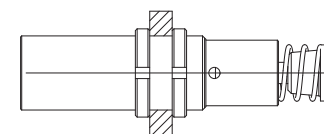
Mounting types

Mounting with Square Flange QF-V4A



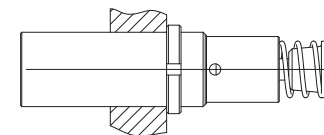
Mount with 4 bolts
 Torque max.: 50 Nm
 Clamping torque: > 210 Nm

Mounting of damper in borehole with two locking rings



Torque: 780 Nm

Screwing the damper into a threaded hole with additional locking ring



Torque: 780 Nm

Manual

Warranty

Fundamentally, all modifications to the product by third parties lead to exclusion from the warranty.

Obvious defects must be reported to the vendor in writing immediately after delivery, no later than one week, but in any case before processing or installation, otherwise the assertion of a warranty claim is excluded. A timely dispatch is sufficient to keep the term.

The vendor is to be given an opportunity to check on site. If the complaint is justified the vendor offers warranty by repair or replacement at its own discretion. If the rectification fails, the buyer may choose to demand reduction of payment or cancellation of the contract. If there is only a minor lack of conformity, particularly with only minor defects, the buyer nevertheless has a right of withdrawal.

If, after failed rectification, the buyer chooses to cancel the contract due to a defect of title or material defect, they are not entitled to additionally claim for damages.

If, after failed fulfilment, the buyer chooses compensation, the goods remain with the buyer, if this is reasonable. The compensation is limited to the difference between the purchase price and the value of the defective item. This does not apply if the vendor maliciously causes the breach of contract.

The quality of the goods is only considered as agreed upon with the product description of the vendor. Public statements, claims or advertising of the manufacturer do not represent an additional contractual specification of quality of the goods.

If the buyer receives defective mounting instructions, the buyer is only obligated to deliver defect-free mounting instructions and only if the defect to the mounting instructions prevents proper mounting.

The warranty period is two years and begins upon completion. Exchange and return of custom products are fundamentally excluded. The factory conditions of the manufacturing factory apply to parts not manufactured and processed by the vendor, which can be viewed by the orderer at the vendor at any time. Construction and installation parts are delivered according to the present standard of engineering.

Service life

In general industrial shock absorbers are machine elements that are subject to wear. Wear parts such as seals, pressure chambers and pistons are excluded from the general warranty. The wear of seals is largely dependent upon the operating conditions and the respective application and its operating parameters.

In general with this model of industrial shock absorber with grooved ring wiper seal system an average service life of three to five million load changes can be expected. Adverse environmental and operating conditions can significantly reduce the expected service life.

Technical data

Energy capacity: 170 Nm/cycle to 3,730 Nm/cycle

Impact velocity range: 0.15 m/s to 5 m/s (depending on type and calculation of effective weight). Other speeds on request.

Operating temperature range: -12 °C to +66 °C. Other temperatures on request.

Mounting: in any position

Positive stop: integrated

Material: Outer body, main bearing, accessories, locking ring: V4A (1.4404, AISI 316L)

Piston rod: Hard chrome plated steel

Piston rod seal: NBR

Rod end button: V4A (1.4404, AISI 316L) with elastomer insert

Return spring: Stainless steel

Permissible torque of locknut:

MC33-V4A: 80 Nm

MC45-V4A: 235 Nm

MC64-V4A: 780 Nm

Damping medium: Special oil NSF-H1 approved

Application field: Linear slides, Swivel units, Turntables, Food industry, Medical technology, Portal systems, Machines and plants, Tool machines, Machining centres

Note: The damper includes a PP head for noise reduction. It is permissible to exceed the stated energy in emergency stop situations and continuous use (with external cooling). In the event of such a case, please contact ACE.

Safety instructions: External materials in the surrounding area can attack the sealing components and lead to a shorter service life. Please contact ACE for appropriate solution suggestions. Do not paint the shock absorbers due to heat emission.

On request: Special oils, other special options and special accessories are available on request.