MecLev®

MECHANICAL LEVELLING

INFORMATION BOOK

ADJUSTABLE · SELF LEVELLING · ECONOMICAL · RE-USABLE

Version 1.4

www.meclev.com

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1. MECLEV® INTRODUCTION

1.1 INTRODUCTION

The MecLev® is an adjustable and re-usable steel mounting chock, that can be used for mounting all types of rotating or critically aligned machinery. The MecLev® is a mechanical stiff chock that is very easy to install and makes machinery alignment more simple, accurate and quick! The self-levelling feature (spherical top part adjust itself to the correct angle when installing the element) in combination with height adjustment, helps eliminate the risk of soft foot problems underneath your machinery!

Why use MecLev® instead of existing solutions?

- MecLev® elements help to align and re-align your machinery quick and accurate;
- MecLev® guarantees fast and simple elimination of soft foot under your machinery;
- MecLev® elements eliminate time consuming and expensive machining of steel chocks;
- MecLev® elements eliminate the extra work required when installing epoxy resin chocks;
- MecLev® elements are re-usable;
- MecLev® elements are self-levelling;
- MecLev® elements can handle angular difference between machine foot and foundation up to 4°;
- MecLev® offers the highest adjustable range on the market for adjustable chocks;
- MecLev® offers the highest rated load on the market for adjustable chocks;
- MecLev® offers the best mechanical properties on the market for adjustable chocks;
- MecLev® elements are designed by people with more than 25 years of field experience.

1.2 APPLICATIONS

MecLev® elements can be used for mounting all types of rotating or critically aligned machinery, in a great variety of industries all over the world. MecLev® elements can be used for:

- Mounting all types of critically aligned machinery;
- Mounting machinery which needs recurring re-alignment due to maintenance;
- Mounting machinery in a short time frame, no epoxy curing time or consuming machining work;
- Mounting machinery were angular differences between machine foot en mounting base occurs;
- Mounting machinery with soft foot problems.

Some applications

Compressors • Combustion Engines • Electric engines • Generators • Pumps • Gearboxes • Fans • Machining tools

1.3 INDUSTRY OVERVIEW

MecLev® adjustable chocks can be found in a wide variety of industries, some of them are;

- Marine/Navy
- Medical and health care
- Oil and gas
- Offshore
- Consumables
- Railways
- Solar energy
- Wind energy

2. MECLEV® ADJUSTABLE CHOCKS (MECHANICAL LEVELLING)

MecLev® adjustable chocks are used for mounting machinery easily and accurate, they offer an alternative for shims, rigid steel chocks or epoxy resin chocks. A MecLev® can be adjusted easily and accurate and eliminates parallel and angular soft foot in no time. Because these benefits, MecLev® elements can be installed in a short time frame. No time consuming machining work is needed, no extra work is required when working with epoxy resin chocks, no excessive time loss due to soft foot problems.

2.1 MECLEV® DESIGN FEATURES

2.1.1 STRONG DESIGN

The MecLev® range consists of 16 different elements, based on most commonly used foundation bolt sizes in various configurations. The standard MecLev® elements cover the whole range from M12 up to M72 sized bolts.
Dependable calculation and field test methods, resulted in elements that offer you not only the highest load ratings compared to other available adjustable chocks on the market, but also the most compact design while offering the highest adjustment range and lowest building heights.

The unique high mechanical stiffness properties results in as good as zero deformation when exposed to extreme high pressures. This makes alignment of your machinery more fast and easier than ever.
The high load rating properties makes the MecLev® appropriate for mounting even the heaviest applications with no risk of failure. (plastic deformation, cracks etc.)

2.1.2 BUTTRESS THREAD DESIGN

The MecLev® elements are provided with a so called DIN metric buttress thread type. This type of thread is specially designed to withstand large axial forces. The MecLev® thread design results in a high mechanical stiff and strong chock.

The buttress thread design is self-locking if the element is installed correctly! No locking systems like locking screws, Loctite or similar are required!

MecLev®

2.1.3 STANDARD SURFACE TREATMENT

All standard steel MecLev® elements are treated, which gives the elements its gunmetal look. The element parts are individually treated to achieve the highest quality. The treatment gives the MecLev® some important mechanical benefits:

- High resistance against corrosion;
- High resistance against metal fatigue;
- High wear resistance;
- Low surface roughness, Ra0,5. (results in smooth running parts!)

As an extra protection against corrosion and debris in the thread, we advise you to treat the elements with tectyl or similar protective product to increase the elements lifecycle to a maximum.

2.2 MOUNTING MACHINERY WITH MECLEV® ADJUSTABLE CHOCKS

Working with MecLev® elements can help you save time and reduce costs occurring when working with conventional steel chocks. It eliminates repeating re-alignments and the need for time consuming ''mill and shim'' methods to get your machinery aligned. Compared to epoxy resin chocks, time can be saved because MecLev® elements requires no damming work and curing time.

The spherical top part and height adjustable middle part of the MecLev® ensures that the elements can be installed in many configurations, since height and angular differences between mounting surfaces are no problem. Because MecLev® offers you the highest adjustment range on the market of adjustable chocks, elements can be installed easier and in more configurations than conventional adjustable chocks. Many years of field experience helped to design this enhanced mechanical chock that will help you to reduce costs and make machinery alignment for numerous applications a less difficult job.

MOUNTING YOU MACHINERY CAN NOW BE DONE IN 5 STEPS

1. Align your machinery with a jacking device like adjustment bolts or hydraulic jacks
2. Put the MecLev® elements in place
3. Release the jacking devices
4. Tighten the foundation bolts to required torque
5. Check the alignment and perform a soft foot check

3. WORKING WITH MECLEV® ADJUSTABLE CHOCKS

The following chapters below will provide you with all information, needed for selecting the correct type and number of elements for your application. Need extra help or technical support? Please visit our website www.meclev.com or contact one of our technical support facilities!

3.1 SELECTING YOUR MECLEV®

THERE ARE THREE WAYS TO DETERMINE THE CORRECT MECLEV® ELEMENT

1. Determining MecLev® size with help of bolt size method;
2. Determining MecLev® size with basic calculation method;
3. Determining MecLev® size with comprehensive chocking plan method. (recommended!)

1. Bolt Size Method

Select a MecLev® element based upon the mounting bolt size. For example: M24 Bolt => ML2024 (please refer to the bolt diameter dimension on the brochure or Appendix I). Take designer notes into account! (see following page)

2. Basic Chock Calculation Method

Provide weight, operating characteristics, foot print, gap and bolt size to your MecLev® dealer. A sizing calculation will be provided free of charge. Take designer notes into account! (see bottom of page)

3. Comprehensive Chocking Plan Method

Complete the corresponding data sheets provided in Appendix II (or download the files from our website) and submit them to your MecLev® dealer, who will provide you with a detailed MecLev® sizing calculation. This method recommends the proper chock size, positioning of chocks, bolting design and bolt torque.

Please use this method for all cases where Classification Society approval on the installation is required

Whatever method you use to select a MecLev®, always check the following points:

- The bottom side of the selected MecLev® should be fully supporting on the foundation structure;
- At least 75% of the top part of the MecLev® should be underneath the machine foot;
- The bolt-hole to bolt-hole distance of 2 adjacent MecLev® elements should not be less than the outside diameter of the selected element;
- When designing an installation containing MecLev® elements, select the proper element size first and use the “nominal height” (see selection table Appendix I or brochure) as a guideline for the gap between the foundation top plate and the machine bearing surface;
- In case your application does not accommodate a standard MecLev® element (e.g. where the available gap height is either too low or too high), please contact your MecLev® dealer for more information on our special solutions.

3.2 MECLEV® ADJUSTMENT TOOLS

The holes in the MecLev® elements allow for a large range of standard tools that can be used for easy adjustment on-site.

For cases where larger quantities of MecLev® elements need to be installed, we developed a range of special adjustment tools that make installation even easier. C-spanners and adjustment bars matching the holes in the MecLev® can be delivered on request from your MecLev® dealer.

3.3 MECLEV® TYPE MARKING

For quick and simple identification, each MecLev® is marked with type identification , rated load and year of production.

3.4 MECLEV® MOUNTING KITS

Since a MecLev® on his own might not be enough to mount your machinery properly, MecLev® offers you the option to order complete mounting kits. These kits may include:

- MecLev® elements;
- Adjusting tools (pin tools / hook spanners);
- Additional extending rings /extended bottom parts;
- 42CrMo4 Spherical Extension Sleeves, extension sleeves;
- Foundation bolts;
- Fitting bolts;
- Nuts /castle locknuts;
- Side stoppers / collision chocks;
- Bolt torque calculations;
- Plan approval certificate of the classification of your choice.

Fitting bolts

Spherical Extension Sleeve

Collision chocks

Need more info about complete mounting kits? Please visit our website www.meclev.com or contact one of our technical support facilities.

MecLev® Type LAS

4. MECLEV® INSTALLATION INSTRUCTIONS

4.1 PREREQUISITE FOR CHOCKING

The following subjects offers you the needed information when working with MecLev® elements. Taking these subjects into account will help you to create a sufficient chocking system between your machinery and foundation.

4.1.1 FOUNDATION DESIGN

Before considering use of MecLev® adjustable chocks in your configuration, it is always important to check the structural properties of the foundation. The foundation, combined with MecLev® elements must be able to withstand both the static and dynamic loads of the machinery that will take place when running. The relative small bearing area of the MecLev® will put more local stress on the supporting structure, than epoxy resin chocks for instants. In almost every circumstances this will not be a problem, but it's always important to keep in mind. While inspecting the structural properties, don't forget to include any environmental forces, like for instants pitching and rolling of a vessel.

Besides checking the foundation properties, it could be helpful to check the machinery mounting surfaces as well. For instance, some types of large electric motors are equipped with hollow mounting foots. When selecting a MecLev® with help of the ''bolt size method'', it could be that the mounting area of the hollow foot will not be suitable for use of that type of MecLev® element. Of course there is probably a simple solution for these problems, still it's better to foresee these problems when designing your system instead of figuring out afterwards!

Important: Check if the foundation/machinery properties are suitable in combination with the applied element reaction forces!

Always be aware that most industries have a different consideration for chocking requirements. Defining and understanding these topics are the responsibility of the machine designer, however, you can always contact your MecLev® dealer for advice!

System design considerations specific to the MecLev® are the element thickness (gap) and the support of the top and bottom part of the MecLev®

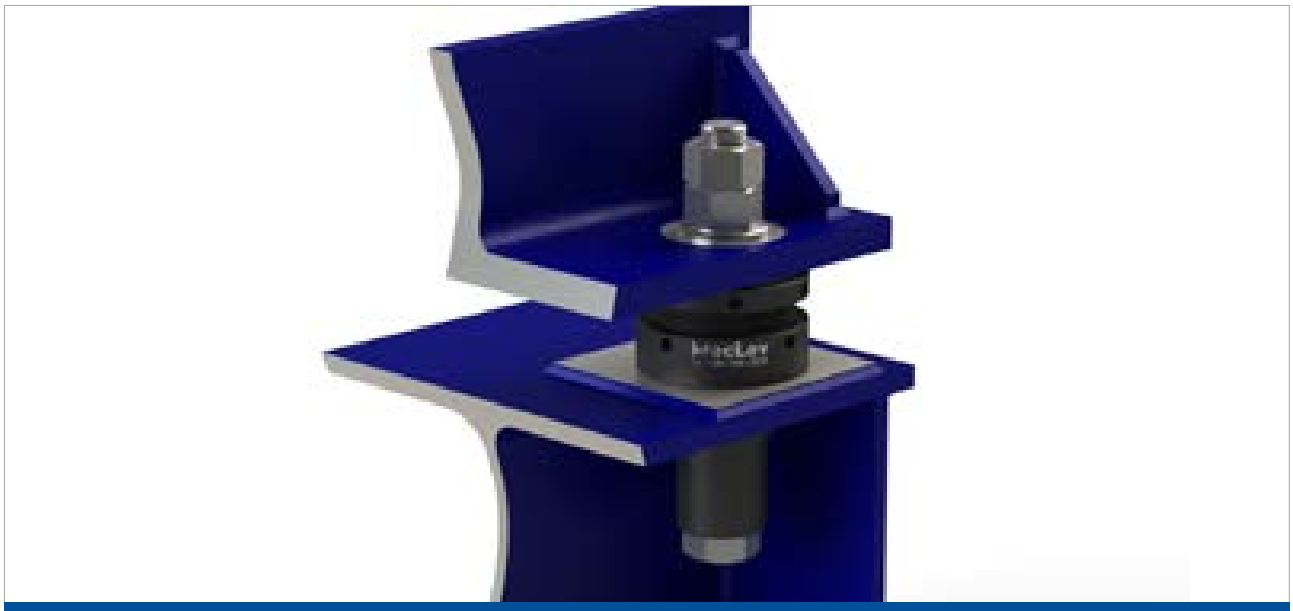
- Select a MecLev® element based upon the mounting bolt size. For designing new systems, always design with the MecLev® element nominal height. For existing systems, always check the available gap to determine the correct MecLev® element in your configuration.
- The MecLev® bottom part should be fully supporting on the foundation, the spherical top part should be underneath the machinery foot for at least 75%

✓ **Support area bottom part =100%**

✓ **Area spherical disc underneath machinery foot ≥75%**

✗ **Support area bottom part <100%**

✗ **Area spherical disc underneath machinery foot <75%**

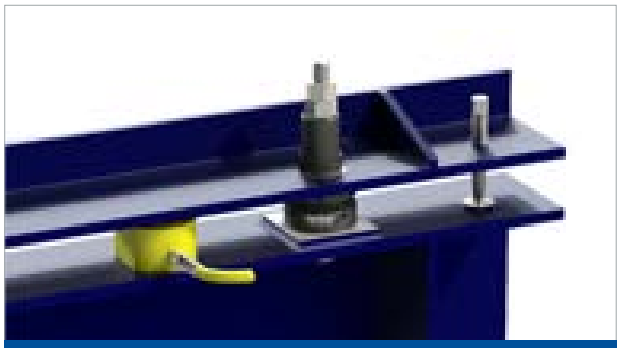


Example

4.1.2 JACKING DEVICES

Moving the machinery into plumb and/or alignment is usually done by using jacking bolts. There are other techniques such as hydraulic jacks or wedges, but no matter what jacking device is used, it should be clear of the MecLev®.

Since fine aligning of machinery can normally not be done accurately with help of hydraulic jacks or wedges, we advise you in those situations to use the table on page 15 to help you align faster and easier! Jack up the machinery, adjust your MecLev® elements to the needed installation height and lower the machinery. Always check the alignment, when needed, adjust! Please do not forget to remove the jacking devices after installation of the MecLev® elements.



Example

Note: A Meclev® is a mounting chock, please do not use it as a jacking device!

4.1.3 MACHINERY CHECKS

Clean the mounting surfaces of the machine mounting foot to remove any traces of corrosion, packaging materials, chocking resin residue, paint, etc. Also check for dents and other mechanical defects. A thin layer of shot primer can be used.

4.1.4 FOUNDATION CHECKS

Clean the mounting surfaces and check for unevenness's like corrosion, packaging materials, epoxy resins residue, paint etc. If painted, check if there is only a thin coat applied. (no more than 50µm / 0.05mm) When necessary, any foundation roughness is sandblasted with a quality of Sa 2.5 minimum or machined with a quality of Ra 6.3 minimum.

4.1.4.1 Rocker Check

Position the MecLev® in approximate final location, apply hand load on top of the MecLev® and try to rock the MecLev® element side-to-side. When the element rocks, investigate the reason and correct. In most situations the surface preparation is only some local sanding.

A more quantitative check can be done with help of a feeler gauge, but use of the rocker check is normally adequate!

4.1.4.2 Feeler Gauge Check

Push down on the MecLev® and examine the bearing area of the bottom part and the foundation with a 0.05mm (0.002”) feeler gauge. An acceptable mounting surface check is achieved when the feeler gauge does not pass completely underneath the bearing area of the MecLev’s bottom ring.

Wrong

Right

4.1.5 ALIGNMENT

Align machinery to cold alignment targets and add +0,05mm (0,002”) radial offset to the target alignment. The 0.05mm (0.002”) is a nominal dimension to accommodate the compression of the machinery/foundation parts that occurs when tightening the foundation bolt to the required torque values. A small part of this compression is the result of extrusion of the lubricant in the MecLev’s internal surfaces.

There will always be some slight variances due to machine load differences, chock sizes, foundation surface conditions and bolt stretch values, so always perform an alignment check after installation of the elements.

4.1.6 MECLEV® PREPARATION

Unpack the MecLev® from its packing tube. The tube is very easy to open and can be closed air tight again. Keep the MecLev® until installation packaged to prevent debris and other dust parts to penetrate into the MecLev® thread and between the spherical surfaces.

4.1.7 MECLEV® INSTALLATION

Place the MecLev® in position (concentric with the bolt hole). Fix the MecLev® by rotating it counter clock wise (unscrewing) by hand. Using 2 MecLev® tools (or similar), tighten each MecLev® by hand, adding a small amount of force is more than enough. Adding large forces can lead to soft foot* problems! Once all MecLev's have been fitted, remove the vertical jacking devices and install the foundation bolts.

Note: Always make sure that all jacking devices have been released prior to foundation bolt tightening!

After tightening all foundation bolts to the required torque, check the final alignment. The alignment should be within the cold alignment target tolerances. Always perform a soft foot* check to ensure all MecLev® elements carrying sufficient load.

4.1.8 PROTECTING THE MECLEV®

The MecLev® uses a relatively fine thread interface; debris in the thread will make the device hard to adjust. Keep the MecLev® in its shipping tube until the moment of installation to protect the thread from dust and debris.
The coating on the MecLev® ensures a high protection against corrosion, however it is advisable to treat the MecLev® elements after installation with an extra protection like paint or tectyl to increase the elements lifecycle.

Do not to allow excess paint entering the threads which would prevent the thread from moving in the future!

** Soft foot is the result of planar and/or angular offsets between the individual machinery mounting surfaces, which can result in excessive vibrations and shortened lifespan of your machinery. In some circumstances, vibrations can also loosen the foundation bolts of your machinery!*

4.2 INSTALLATION MANUAL

A short installation manual, that can be used as an installation guide line in the field, is described below. Note that this is a short version, for more details we recommend you to take note of chapter 4.1!

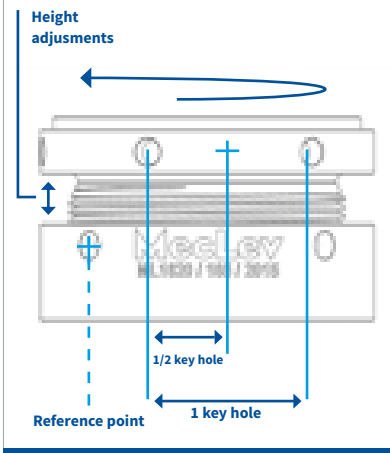
Step 1, Check installation conditions

a. The bottom ring of the MecLev® should be fully supporting on the foundation, the load bearing surface should be at least 75% (the rocker check is adequate!).
b. The spherical top part should be covered by the machine foot for at least 75%, the load bearing surface should be at least 75% (soft foot check is adequate!).
c. When necessary, any foundation roughness is sandblasted with a quality of Sa 2.5 minimum or machined with a quality of Ra 6.3 minimum.
d. The angular offset between mounting surfaces should be equal or less than 4°.
e. Mounting surfaces should be free of unevenness's, dirt and other debris. Paint layers up to 50µm / 0,05mm are acceptable.

Step 2, Alignment of machinery

a. Align machinery to cold alignment targets and add +0,05mm (0,002") radial offset to the target alignment.
b. Take MecLev® elements out of the package and put in place concentric with bolt holes.
c. Slightly tighten all MecLev® elements with help of MecLev® adjustment tools or similar.
d. Release jacking devises and tighten foundation bolts to required torque.
e. After tightening foundation bolts, perform an alignment check. When adjustment is required, the following table will help you to fine tune the MecLev® height;

Meclev® size	Key holes	Pitch [mm]	Height adjustment [mm]	
			1 key hole	½ key hole
ML-1216	5	2	0.400	0.200
ML-1620	6	2	0.330	0.167
ML-2024	8	2	0.250	0.125
ML-2430	8	2	0.250	0.125
ML-3036	8	2	0.250	0.125
ML-3642	8	2	0.250	0.125
ML-4248	10	2	0.200	0.100
ML-4856	10	3	0.300	0.150
ML-5664	10	3	0.300	0.150
ML-6472	10	3	0.300	0.150



Example

f. When alignment targets are set, perform a soft foot check to check sufficient load bearing on all MecLev® elements!
g. When necessary, threat MecLev® elements with an extra protection like paint or tectyl. Do not allow excess paint or tectyl entering the thread, which would prevent it from moving in the future!

5. APPLICATION DESIGN INSTRUCTIONS

This chapter can be used as a guideline to design applications, equipped with MecLev® elements. These design instructions are recognized by most shipbuilding classification societies.

5.1 CHOOSING MECLEV® ELEMENT SIZE

5.1.1 CHECKLIST

As a basic MecLev® rule, we recommend you to choose an element size corresponding the mounting bolt size of the machinery. For example: M24 Bolt => ML2024. In more difficult situations, it is always possible to request MecLev® for a detailed calculation to determine the correct element size and bolt data.

Designing applications with MecLev® chocks starts with checking the following points:

- Does all parties approve the use of MecLev® adjustable chocks? (machine manufacturer, shipyard, refinery, owner, classification society) When use is refused, please contact your local MecLev® dealer for help!
- Check the available chocking height of the installation and the element height of the needed MecLev® chock. The MecLev-L is designed especially for lower heights. Space to big/small? Check element reducing and extending possibilities at chapter 5.3!
- Determine foundation bolt dimensions.
- Check bolt-hole to bolt-hole distance (pitch)of the adjacent MecLev® elements, the distance should not be less than the outside diameter of the selected chock.
- Is the bottom ring of the MecLev® 100% supporting on the foundation?
- Is the spherical top part underneath the machine foot for at least 75%?

Notes

- When designing new installations, always use the nominal element height as design property and please take the above points into account!
- When the selected MecLev® chock doesn't fit your application, please contact your MecLev® dealer for support!

For large applications, we recommend you to contact MecLev® for a more detailed calculation and advice.

5.1.2 CALCULATING MINIMUM ELEMENT SIZE

In general we advise you to select your MecLev® element size corresponding the mounting bolt size of the machinery. To verify this selection, it is possible to check the total machine load on the elements. The total load should not exceed the rated load of the selected elements!

The total machine load on the MecLev® is the result of the sum of four individual forces:

$$F_{MecLev®} = F_{Bolt} + F_{Weight} + F_{Torque}$$

Where:	$F_{MecLev®}$	= Total machine load on element	(N)
	F_{Bolt}	= Force as result of applied bolt tension	(N)
	F_{Weight}	= Force as result of the weight of the machine	(N)
	F_{Torque}	= Force as result of torque reaction of the machine	(N)

5.1.2.1 F_{Bolt} (VDI 2230)

$$F_{bolt} = A \cdot \frac{v \cdot R_{p0,2min}}{\sqrt{1 + 3\left[\frac{3 \cdot d_2}{2 \cdot d_0}\left(\frac{P}{\pi d_2} + 1.155\mu_{Gmin}\right)\right]^2}}$$

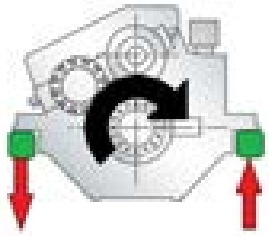
F_{Bolt}	Pre-load bolt	[N]
A0	Cross section area bolt	[mm2]
v	Percentage of stretch	[%]
$R_{p0.2min}$	Yield strength bolt material	[N/mm2]
d2	Pitch diameter thread	[mm]
d0	Smallest cross section bolt	[mm]
P	Pitch	[mm]
μ_{Gmin}	Friction coëfficiënt thread	-

5.1.2.2 F_{Weight}

$$F_{weight} = \frac{M \cdot 9.81}{n}$$

F_{Weight}	Static load	[N]
M	Mass machinery	[Kg]
n	Number of MecLev's	-

5.1.2.3 F_{Torque}



$$F_{torque} = \frac{T_{max}}{l_b}$$

F_{Torque}	Torque reaction force (red)	[N]
T_{max}	Maximum applied torque	[N·mm]
l_b	Pitch elements	[mm]

5.1.3 APPLICATION CONDITIONS

A MecLev® application must comply to the following condition;

$$F_{bolt} + F_{weight} \cdot Vf_s + F_{torque} \cdot Vf_{bf} \leq F_{ML}$$

F_{bolt}	Pre tension load	N
F_{weight}	Static load	N
Vf_s	Safety factor static loads	-
F_{torque}	Torque reaction force	N
V_{fbf}	Safety factor dynamic loads	-
F_{ML}	MecLev® element rated load	N

If the safety factor dynamic loads is unknown please contact your MecLev dealer. Typical safety factors are:

Vf_s = 1,5
Vf_{bf} = 2,0 (Machines with reciprocating motions, like compressors and diesel engines)
= 1,5 (Machines without reciprocating motions, like generators, E-motors, gearboxes)

When the calculated load is smaller than the rated load of the MecLev® element, your element type selection is correct!

With the calculated value, a minimum MecLev® size can be determined by selecting on rated element load.
When calculated values does not satisfies your needs, please contact your MecLev® dealer for a solution!

IMPORTANT, when the calculated MecLev® element is smaller than the machinery foundation bolt size, please use MecLev® elements that fits those bolt sizes!

5.2 BOLT TORQUE AND LENGTH

The people behind MecLev® have over 100 combined years of experience in machinery mounting, which also includes the installation of foundations bolts. The bolt stretch, as a direct result of the torque applied to the bolt or nut during installation, is critical to the life cycle performance of the machine.

Each industry has its own specifications for bolting, and each manufacturer and customer their own unique bolting preferences.

We use the size, material and style of bolting required by the customer for use in the bolt torque calculations which we provide free of charge. We have time proven solutions which have been used across multiple industries. MecLev® adjustable chocks are designed and tested with use of 8.8 graded bolts, yield strength > 640 N/mm^2. Off course other bolt grades can be used, but we recommend to use 8.8 graded bolts.

The standard advised bolt torque values for the various types of MecLev® chocks can be found in the MecLev® selection table. (Appendix I)

Bolt Torque & Stretch

We advise you to ensure the foundation bolts have a minimum elongation of 0,2mm to achieve a sufficient bolt connection. The bolt stretch need to be sufficient to accommodate for loss of stretch due to flattening of the surface roughness of the nut, bolt head, foundation interfaces and washers.

To achieve enough elongation in the bolted connection there must be enough stretch length available, this can be achieved by:

- Creating extra clamping length by adding an extension sleeve
- Reducing bolt shank diameter

The clamping length is the sum of components placed between the bolt head and nut:

- Machine foot thickness
- MecLev® element height (final installation height)
- Foundation thickness
- Extension sleeve height
  (or Spherical Extension Sleeves height)

$\Delta L \geq \Delta L_m$

Bolt stretch as a result of tension in the bolt can be calculated as:

$$\Delta L = F_{bolt}\left(\frac{L_1}{D_{s1}^2} + \frac{L_2}{D_{s2}^2} + \cdots + \frac{L_i}{D_{si}^2}\right) 618 \cdot 10^{-8}\,[mm]$$

Where;

ΔL	Bolt elongation	[mm]
ΔL_m	Required minimum elongation of bolt (→ 0,2mm)	[mm]
$L_1 \ldots L_i$	Individual part shank lengths of bolt corresponding to $D_{S1} \ldots D_{Si}$	[mm]
F_{bolt}	Pre-load bolt	[N]
$D_{S1} \ldots D_{Si}$	Individual shank diameters of bolt corresponding to $L_1 \ldots L_i$	[mm]

Please contact Meclev® for a free of charge calculation of the required bolt torque and resulting bolt stretch to make sure that your Meclev® application is tightened in the correct way.

5.3 MECLEV® SPHERICAL EXTENSION SLEEVES

Product description

The MecLev® Spherical Extension Sleeve (SES) is a bush combined with a spherical extension sleeve on one end, that assures 100% nut pull on critical bolt and stud assemblies. The SES elements are designed in order to combine the functionality of creating extra stretch length to bolted connections, as well as correcting angular misalignment between bolted planes up to 4°.

All Spherical Extension Sleeves have a standard length of 60mm, but alternative lengths are available on request.

Use & benefits

The contact area of the convex/concave surfaces is complete, meaning that no line contact between the rings is produced (possible break out of the concave ring), which guarantees a maximum transmission of the applied force. The special design of the convex/concave part guarantees 100% force transmission, which means that the bolts full tightening torque can be applied, and therefore zero clamping force reduction is required!

The use of Spherical Extension Sleeves avoids the need for (on-site) machining (spot-facing) of the plane parallel to the top plate.

Size	Outside diameter bottom washer (D)	Inside diameter top bush (d)	Height (H)	Weight
	mm	mm	mm	Kg
SES-16	36	17	60	0,25
SES-18	45	19	60	0,41
SES-20	45	21	60	0,39
SES-22	52	23	60	0,53
SES-24	52	25	60	0,50
SES-27	65	28	60	0,75
SES-30	65	31	60	0,70
SES-33	79	34	60	1,09
SES-36	79	37	60	1,04

Spherical Extension Sleeve

Example

Features & properties

- 100% force transmission, therefore no reduced torque is required
- SES-16, 20, 24, 27, 30, 33, 36 standard in stock, others available on request.
- Standard height 60mm, alternative lengths available on request.
- Material 42CrMo4, with QPQ treatment.
- Angular correction up to 4°.

IMPORTANT, When no spherical extension sleeve is applied within the bolted connection, check the need for spot-facing of the bolt head contact surface. A plane parallel to the top surface is required to achieve sufficient bolt force transmission and to prevent bolt bending!

5.4 EXTENDING AND REDUCING ELEMENT HEIGHT

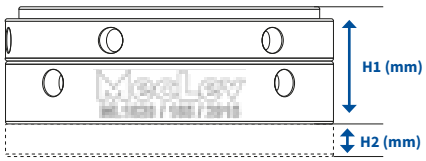
5.4.1 REDUCING ELEMENT HEIGHT

When installation height is an issue, it is possible to reduce the minimum height of the MecLev®. Note that with reducing the overall height of the element, you also reduce its adjustment height. When reducing the height of an element, don't exceed the minimum reducing height mentioned in the table.
(Min. reduced element height → Max. 1 mm adjustment height)

Min. reduced element height = min. element height - (max. height - min. height - 1)

5.4.1.2 Min. reducing height

MecLev® size	Min. reduced element height [H1] [mm]	Max. removing height [H2] [mm]
ML-1216	23	7
ML-1620	23	12
ML-2024	28	12
ML-2430	30	15
ML-3036	35	15
ML-3642	40	15
ML-4248	45	15
ML-4856	53	17
ML-5664	58	17
ML-6472	63	17
ML-1216LAS	15	5
ML-1620LAS	15	5
ML-2024LAS	15	5
ML-2430LAS	15	5
ML-3036LAS	15	5
ML-3642LAS	20	5



Example

5.4.2 EXTENDING ELEMENT HEIGHT

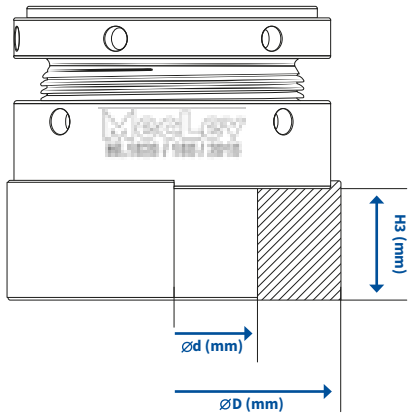
It is also possible to extend the height of an element with an additional bottom ring. The Maximum extended height should not exceed the outer diameter of the element! On request , we also supply MecLev® elements with extended bottom rings to reduce the number of components!

Max. height additional bottom ring (mm) = outside diameter element - maximum height element

Height (H) bottom ring (mm) = gap between machine foot and foundation - nominal height element

5.4.2.1 Bottom rings

Article code (additional bottom ring)	D [mm]	d [mm]	H3 [mm] Or on request!
ABR-1216	60	30	17
ABR-1620	80	40	27
ABR-2024	100	50	42
ABR-2430	120	60	54
ABR-3036	135	70	64
ABR-3642	155	80	79
ABR-4248	185	90	104
ABR-4856	215	100	122
ABR-5664	225	110	127
ABR-6472	245	120	142



Example

6. TYPE APPROVALS

Meclev elements are produced according to the highest European standards. If required, they can be delivered with type approval certificates from all major marine and offshore certification agencies. For more information and details, please contact one of the companies mentioned below.

7. TECHNICAL SUPPORT & SALES

EMHA BV
Noordeinde 13
3341 LW Hendrik Ido Ambacht
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+31 (0) 883 345 500

Rubber Design BV
Industrieweg 21
2995 BE Heerjansdam
The Netherlands
+31 (0) 786 778 778

Online information and documentation: www.meclev.com

APPENDIX I: MECLEV® SELECTION TABLE

MecLev® size	Bolt size	Tightening torque	Bolt size	Tightening torque	Bolt size	Tightening torque	Minimal height	Nominal height	Maximum height	Minimum reduced height	Maximum extended height	Outside diameter	Key holes	Pitch	Rated load	Weight
-	M	Nm	M	Nm	M	Nm	mm	mm	mm	mm	mm	mm	mm	mm	kN	Kg
ML-1216	12	81	14	129	16	200	30,0	34,0	38,0	23,0	55,0	55	5	2	120	0,5
ML-1620	16	200	18	287	20	405	35,0	41,5	48,0	23,0	75,0	75	6	2	165	1,1
ML-2024	20	405	22	556	24	698	40,0	46,5	53,0	28,0	95,0	95	8	2	245	2,0
ML-2430	24	698	27	1033	30	1402	45,0	53,0	61,0	30,0	115,0	115	8	2	320	3,3
ML-3036	30	1402	33	1898	36	2439	50,0	58,0	66,0	35,0	130,0	130	8	2	500	4,6
ML-3642	36	2439	39	3159	42	3904	55,0	63,0	71,0	40,0	150,0	150	8	2	700	6,7
ML-4248	42	3904	45	4876	48	5897	60,0	68,0	76,0	45,0	180,0	180	10	2	955	10,5
ML-4856	48	5897	52	7579	56	9454	70,0	79,0	88,0	53,0	210,0	210	10	3	1265	16,8
ML-5664	56	9454	60	11729	64	14119	75,0	84,0	93,0	58,0	220,0	220	10	3	1490	19,6
ML-6472	64	14119	68	*	72	*	80,0	89,0	98,0	63,0	240,0	240	10	3	1840	27,5
ML-1216LAS	12	81	16	200	20	405	20,0	25,0	30,0	15,0	55,0	55	5	2	175*	0,3
ML-1620LAS	16	200	20	405	24	698	20,0	25,0	30,0	15,0	75,0	75	6	2	305*	0,6
ML-2024LAS	20	405	24	698	30	1402	20,0	25,0	30,0	15,0	95,0	95	8	2	410*	1,0
ML-2430LAS	24	698	30	1402	36	2439	20,0	25,0	30,0	15,0	115,0	115	8	2	440*	1,4
ML-3036LAS	30	1402	36	3904	42	3904	20,0	25,0	30,0	15,0	130,0	130	8	2	500*	1,7
ML-3642LAS	36	2439	42	5897	48	5897	30,0	35,0	40,0	20,0	150,0	150	8	2	980*	3,1

* The maximum value vary in case of type approval; look for these values in the applicable certificate. Consider the application conditions in chapter 5.1.3 when verifying the maximum value.

Tightening torque according VDI 2230

- Thread friction = Bearing area friction = 0.15 (light oiled)
- Maximum % Yield in bolt material= 75%
- Dimension hexagon head bolt according: ISO4014:1999 Hexagon head bolts - Product grades A and B
- Dimension thread according: DIN13-1 :1999-11 General purpose ISO metric screw threads - Nominal sizes for 1 mm to 68 mm diameter coarse pitch threads
- Bolt material class 8.8 according: ISO898-1:1999 Bolts, screws and studs with specified property classes - Coarse thread and fine pitch thread
- Check minimum required bolt elongation (≥0.2mm) in combination with specified tightening torque, bolt elongation is increased with MecLev® Spherical Extension Sleeves
- For bolt sizes >M64 please contact your MecLev® dealer

When none of the elements suits your application, please contact MecLev® for a tailor made solution!

APPENDIX II: SELECTION SHEETS

Meclev® chock selection for diesel, gas & turbine engines

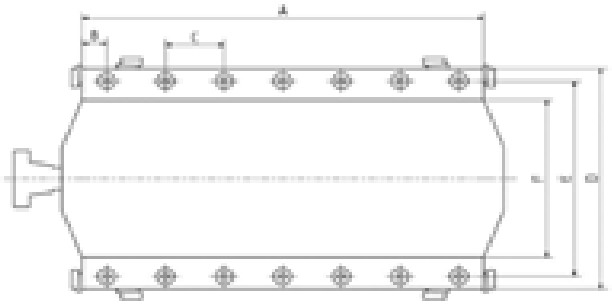
Shipyard / Customer	
Shipname / Project	
Classification society	
Object	
Make / type	

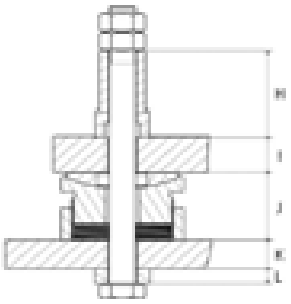
Engine

Mass		Kg
Power		kW
Revolutions		rpm
Number of elements		
Foundation bolthole diameter		mm
Fitted bolthole diameter		mm

Top View of engine

Total length of engine	A		mm
Location first hole (seen from flex. coupling)	B		mm
Pitch between other holes (on one side)	C		mm
Total width of engine	D		mm
Pitch of boltholes (left to right)	E		mm
Foundation width (inside)	F		mm





Cross section of mounting detail

Top sleeve length	H		mm
Bed plate thickness	I		mm
Chock height	J		mm
Top plate thickness	K		mm
Bottom sleeve length	L		mm

Remarks

Meclev® chock selection for (Marine) Gearboxes

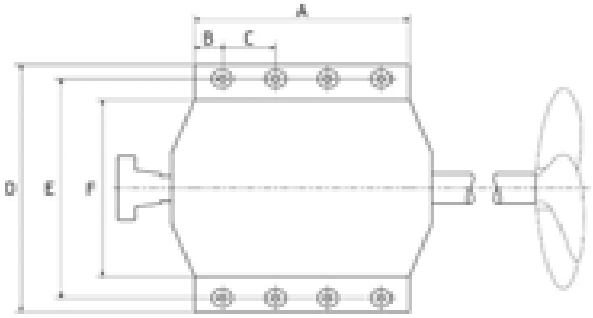
Shipyard / Customer	
Shipname / Project	
Classification society	
Object	
Make / type	

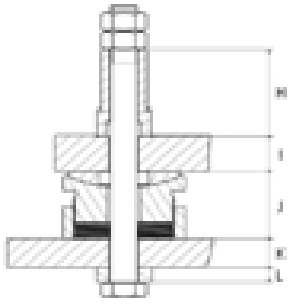
Gearbox

Mass		Kg
Power		kW
Revolutions		rpm
Foundation bolthole diameter		
Fitted bolthole diameter		mm
Reduction rate		mm
Average distance of boltholes		mm
Dist. between centre line of shaft and top plate mm		mm
Propulsion efficiency		N/kW

Top View of engine

Total length of gearbox	**A**		mm
Location first hole (seen from flex. coupling)	**B**		mm
Pitch between other holes (on one side)	**C**		mm
Total width of gearbox	**D**		mm
Pitch of boltholes (left to right)	**E**		mm
Foundation width (inside)	**F**		mm





Cross section of mounting detail

Top sleeve length	**H**		mm
Bed plate thickness	**I**		mm
Chock height	**J**		mm
Top plate thickness	**K**		mm
Bottom sleeve length	**L**		mm

Remarks

Meclev® chock selection for Generator, E-motor, Pump, Etc

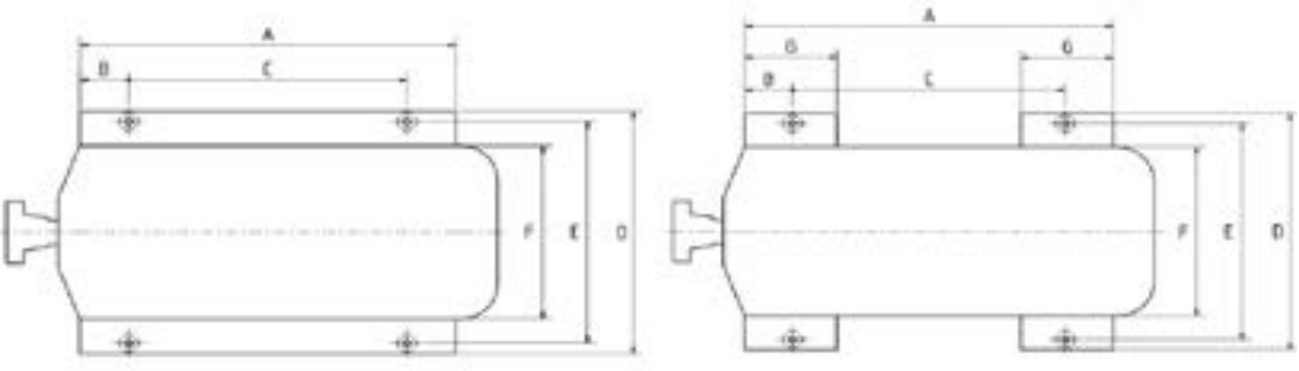
Shipyard / Customer	
Shipname / Project	
Classification society	
Object	
Make / type	

Generator

Mass		Kg
Power		kW
Revolutions		rpm
Number of elements		
Foundation bolthole diameter		mm
Fitted bolthole diameter		mm

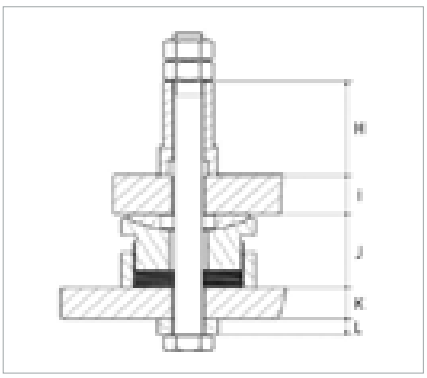
Top View of generator

Total lenght of component	**A**		mm
Location first hole (seen from flex. coupling)	**B**		mm
Pitch between other holes	**C**		mm
Total width of component	**D**		mm
Pitch of boltholes (left to right)	**E**		mm
Foundation width	**F**		mm
Foot lenght	**G**		mm



Cross section of mounting detail

Top sleeve length	**H**		mm
Bed plate thickness	**I**		mm
Chock height	**J**		mm
Top plate thickness	**K**		mm
Bottom sleeve length	**L**		mm



Remarks

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