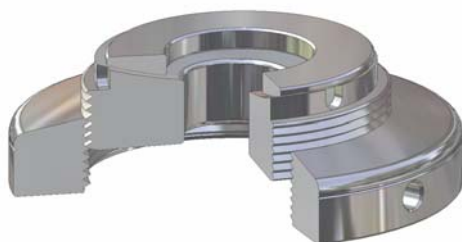
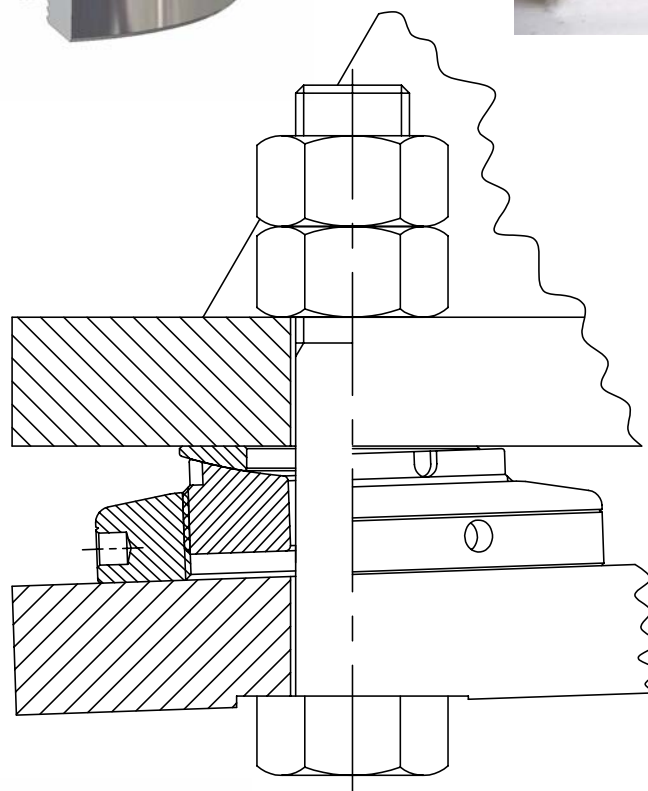
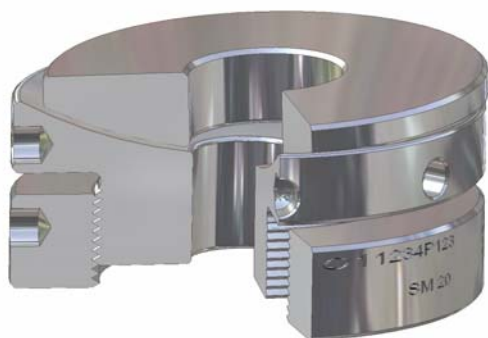




An SKF Group Company



Vibracon[®] manual



Contents

	Version
Chapter 1 Vibracon® Brochure	9
Chapter 2 How to order Vibracon® chocks	2.1
Chapter 3 Vibracon® References and Approvals	2.3
Chapter 4 Vibracon® Installation Procedure	2
Chapter 5 Vibracon® Frequently Asked Questions	2
Chapter 6 Vibracon® Application Design Instructions	2.1
Chapter 7 Other products and services of the Machine Support Group	2

Introduction

Vibracon® chocks are permanent, strong and re-usable machinery mounting chocks for all types of rotating or critically aligned machinery. Vibracon® chocks are mechanically stiff chocks that make accurate mounting simple and quick. The Vibracon® advantages are elimination of the trial and error alignment process characteristic for the "mill and shim" method and adjustability during the life cycle of the machinery.

The Vibracon® chock has many configurations and material options to satisfy technical concerns, in end user environments and production line costs. All Vibracon® chocks include the spherical top plate and mating middle section. This self leveling configuration accommodates the angular differences that are inherent with mounting surfaces. The height adjustment feature has the greatest range in the industry, which makes the Vibracon® chock easy to install.

Vibracon® chocks are the most economical means to establish a perfect mounting plane. The Vibracon® advantage is the capability to perfectly create the mounting plane within minutes and repeatedly for Production or Service Managers and Accountants.

In this manual we will inform you about all facts of the Vibracon®. If you have further questions or if you need additional information, please remember The Machine Support Group is a 24/7 organization. Please don't hesitate to contact one of our offices as mentioned below.

Machine Support B.V.

Kaartenmakerstraat 7
NL-2984 CB Ridderkerk
The Netherlands
Phone (+) 31 (0)180 483828
Fax (+) 31 (0)180 483829
e-mail info@machinesupport.com

Machine Support, Inc.

109B 86th street
Virginia Beach, VA 23451
United States
Phone (+) 1 877 621 1777
(+) 1 757 417 7411
Fax (+) 1 757 417 7412
e-mail varmecky@machinesupport.com

Machine Support, Inc.

2 Redland Place
The Woodlands, TX 77382
United States
Phone (+) 1 281 298 5001
Fax (+) 1 281 657 7597
e-mail parsons@machinesupport.com

Machine Support, Inc.

218 Venture Blvd.
Houma, LA 70360
United States
Phone (+) 1 985 851 5100
Fax (+) 1 985 851 0061
e-mail morner@machinesupport.com

Machine Support U.A.E.

P.O. Box 8807
Dubai
United Arab Emirates
Phone (+) 971 (0) 433 92215
Fax (+) 971 (0) 433 91952
e-mail info@machinesupport.com

Machine Support Singapore

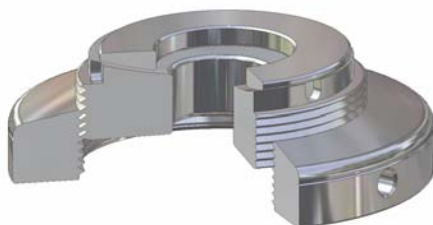
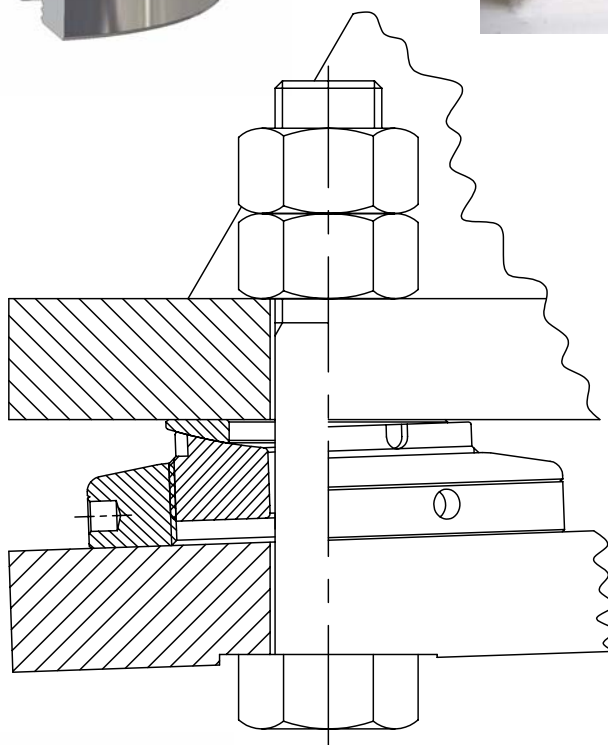
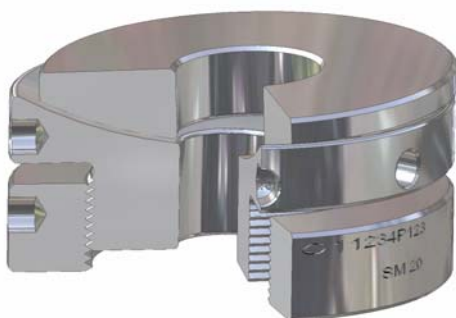
16 Tuas Avenue 10
Singapore 639140
Singapore
Phone (+) 65 6861 0484
Fax (+) 65 6861 0191
e-mail doodewaard@machinesupport.com



An SKF Group Company



How to order Vibracon[®] chocks



2 *How to order Vibracon® chocks*

2.1	<i>HOW TO SELECT THE RIGHT VIBRACON® CHOCK SIZE?</i>	3
2.2	<i>HOW TO GET A VIBRACON® CHOCKING PROPOSAL FREE OF CHARGE?</i>	3
2.3	<i>HOW TO ORDER VIBRACON® CHOCKS?</i>	4
2.3.1	<i>The Original</i>	4
2.3.1.1	<i>Article numbers Vibracon® Original chocks</i>	5
2.3.2	<i>The Low Profile</i>	5
2.3.2.1	<i>Article numbers Vibracon® Low Profile chocks</i>	6
2.3.3	<i>The extended Vibracon® Original and Low Profile</i>	6
2.3.3.1	<i>Article numbers Vibracon® additional bottom rings</i>	7

APPENDIX 1 DATA SHEETS FOR VIBRACON® CALCULATION

APPENDIX 2 EXAMPLE OF CHOCKING PROPOSAL

2.1 How to select the right Vibracon® chock size?

To get an indication which size of Vibracon® should be used, the following parameters will give you an impression:

- What is the size of the bolthole in the component bed plate?
- What is the minimum distance (pitch) between two adjacent holes?

The type indication of Vibracon® is related to the foundation bolts for which they can be used. For instance the Vibracon® SM30 is developed to be used in combination with a hexagonal bolt M30 but it is also possible to use one size of bolt diameter bigger, in this example a bolt M33.

2.2 How to get a Vibracon® chocking proposal free of charge?

As a part of our service, Machine Support offers you a free of charge calculation proposal for the mounting of your component. To prepare this calculation we need information concerning the component, the available chocking height and some information concerning the foundation.

The fastest way to receive a chocking proposal for your application is to fill out one of the appropriate datasheets (APPENDIX 1). The datasheets can also be downloaded from our website www.machinesupport.com we ask you to send the completed datasheets by e-mail to:

info@machinesupport.com

The used calculation software is approved by the Classification Societies involved for marine applications. On request Machine Support will make contact with the OEM to support you with getting an agreement on the chocking proposal.

Normally you will receive, within one day, a calculation as mentioned in APPENDIX 2.

A full proposal consists of four sheets:

- Report of all information related to the selection of the chock, including operating forces on the chocks plus foundation hardware information;
- Illustration of the top view of the component that shows the location of the chocks, the position of the positioning and / or collision chocks and the fitted bolts (if required);
- Illustration of the cross section of the foundation bolt in which the clamping length and foundation bolt are specified;
- Illustration of the cross section of the fitted bolt, if required, in which the clamping length and fitted bolt are specified.

Machine Support, upon request, will submit our report to the involved Classification Society for approval. Costs for this service are on an as negotiated and per event basis.

2.3 How to order Vibracon® chocks?

In the Vibracon® brochure (see chapter 1) you will find an overview of the standard elements. If you have a specific component which has to be chocked and the standard elements will not fit, please don't hesitate to send in your demands and we will find out if we can provide you a proper solution.

Based on the unique article numbers the chocks can be ordered by fax, mail or e-mail. As soon as we have received your order we will send you an order conformation in reply.

Vibracon® chocks are always on stock at Machine Support in the Netherlands. However, it is recommended to check the delivery time before ordering. Our local dealers of the elements also have some elements on stock.

A list of all distributors is available on the website from Machine Support:

www.machinesupport.com

2.3.1 The Original

Vibracon® SM chocks are machinery mounting chocks that are easily and accurately adjusted. The chocks accommodate up to a 4° angular difference between machine and the mounting base without expensive machining of the base or extra work of installing epoxy resin chocks.

The self levelling capability combined with the height adjustment feature eliminates the possibility of a soft foot in the production line and for the life cycle of the machinery.



Figure 2.3.1 Vibracon® Original

2.3.1.1 Article numbers *Vibracon®* Original chocks

The article numbers of the different sizes of chocks are as follows:

<i>Material DIN 1.1191</i>	<i>Material DIN 1.4404 (AISI 316L)</i>
SM12CS	SM12SS
SM16CS	SM16SS
SM20CS	SM20SS
SM24CS	SM24SS
SM30CS	SM30SS
SM36CS	SM36SS
SM42CS	SM42SS
SM48CS	SM48SS
SM56CS	SM56SS
SM64CS	SM64SS

Figure 2.3.1.1 Article numbers Original *Vibracon®* chocks

2.3.2 The Low Profile

The Low Profile chocks offer an economic solution for repair projects or fixed design systems where expensive milled chocks, shims or epoxy resins were applied. The *Vibracon®* SM Low Profile configuration addresses those applications where the chock height between the foundation and component has been established by the previous design. Most of the other chocking methods are time consuming and do not support the life cycle needs of the machine owners and installation activities on a tight schedule. A variety of adjustment tools for confined installation spaces is available.



Figure 2.3.2 *Vibracon®* Low Profile

2.3.2.1 Article numbers Vibracon® Low Profile chocks

The article numbers of the different sizes of chocks are as follows:

Material DIN 1.7225 (other materials on request)
SM12LP
SM16LP
SM20LP
SM24LP
SM30LP
SM36LP
SM42LP

Figure 2.3.2.1 Article numbers Vibracon® Low Profile chocks

2.3.3 The extended Vibracon® Original and Low Profile

It can happen that the maximum element height is not sufficient to fill up the gap between the foundation top plate and the bed plate of the component. In that situation it is possible to introduce a so called additional bottom ring to extend the maximum height of the Vibracon® Original and Low Profile chocks. This ring will be mounted between the base plate of the chock and the top plate of the foundation. As an alternative for the additional bottom ring Machine Support can also provide Vibracon® extended bottom rings.

As a rule of thumb, the height of the chocks should not exceed the diameter of the elements. For instance the maximum height of a Vibracon® SM30, with a diameter of 140 mm, should not exceed a chock height of 140 mm.

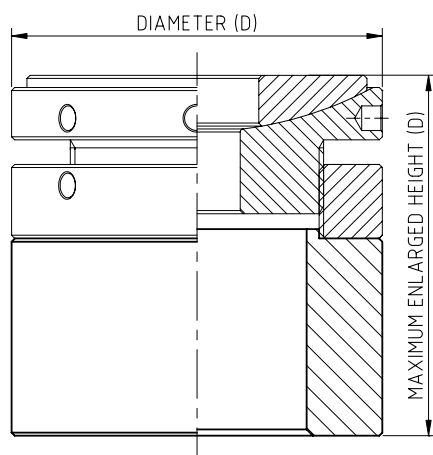


Figure 2.3.3.1 SM element with additional bottom ring

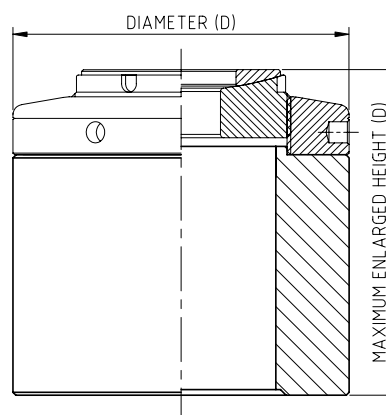


Figure 2.3.3.2 SM - LP element with additional bottom ring

2.3.3.1 Article numbers *Vibracon*[®] additional bottom rings

The article numbers of the additional bottom rings are as follows:

Material: DIN 1.0570 / 1.1191

<i>Article no.</i>	<i>Height additional ring</i>	<i>Max. extended height (D) SM element</i>	<i>Max. extended height (D) SM - LP element</i>
SM12EV	22 mm	60 mm	Not available
SM16EV	35 mm	80 mm	65 mm
SM20EV	50 mm	100 mm	80 mm
SM24EV	63 mm	120 mm	93 mm
SM30EV	78 mm	140 mm	108 mm
SM36EV	93 mm	160 mm	133 mm
SM42EV	118 mm	190 mm	163 mm
SM48EV	135 mm	220 mm	Not available
SM56EV	140 mm	230 mm	Not available
SM64EV	155 mm	250 mm	Not available

Figure 2.3.3.1 Article numbers *Vibracon*[®] additional bottom rings

APPENDIX 1

DATASHEET FOR VIBRACON CALCULATION



Machine Support B.V., The Netherlands

Phone : +31 (0)180 483828
Fax : +31 (0)180 483829
Website : www.machinesupport.com
E-mail : info@machinesupport.com

Selection of Vibracon SM element for Diesel/Gas/Turbine Engines

Please insert data into coloured cells

Shipyards / Customer :
Shipname / Project :
Classification society :
Object :
Make / type :

Engine

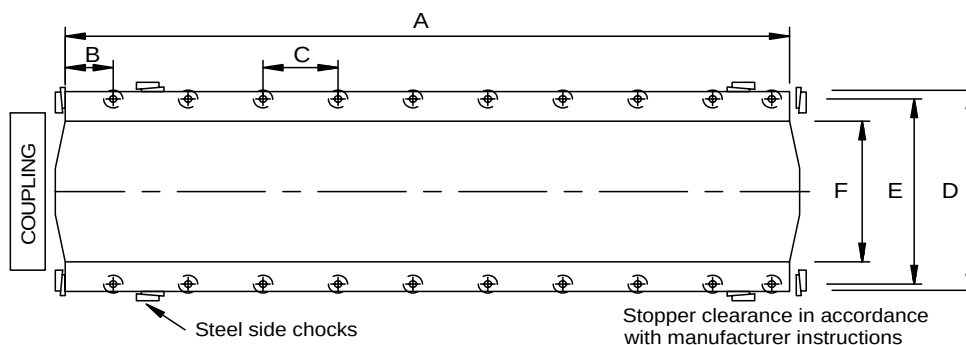
Mass : (kg)
Power : (kW)
Revolutions : (rpm)
Number of elements : (-)
Foundation bolthole diameter : (mm)
Fitted bolthole diameter : (mm)

Top View of engine

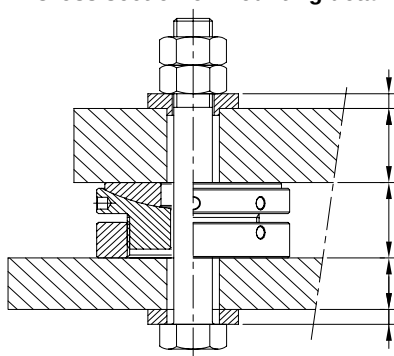
Total length of the component : (mm)
Location first hole (seen from coupling) : (mm)
Pitch between other holes (on one side) : (mm)
Total width of the component : (mm)
Pitch of boltholes (left to right) : (mm)
Foundation width (inside) : (mm)

LEGEND

A
B
C
D
E
F



Cross section of mounting detail



Top sleeve length : (mm)
Bed plate thickness : (mm)
Chock height : (mm)
Top plate thickness : (mm)
Bottom sleeve length : (mm)

LEGEND

G
H
J
K
L

Remarks:

Address information

Company :
Contact :
Phone :
Fax :
E-mail :

MS-F-333 REV. 04 D.D. 03.05.2005



Machine Support B.V., The Netherlands

Phone : +31 (0)180 483828
Fax : +31 (0)180 483829
Website : www.machinesupport.com
E-mail : info@machinesupport.com

Selection of Vibracon SM element for (Marine) Gearboxes

Please insert data into coloured cells

Shipyards / Customer	:		
Shipname / Project	:		
Classification society	:		
Object	:		
Make / type	:		

Gearbox

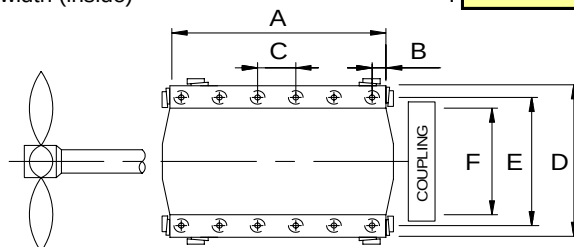
Mass	:		(kg)
Power	:		(kW)
Revolutions	:		(rpm)
Number of elements	:		(-)
Foundation bolthole diameter	:		(mm)
Fitted bolthole diameter	:		(mm)
Reduction rate	:		(-)
Average distance of boltholes	:		(mm)
Distance between centre line of shaft and top plate	:		(mm)
Propulsion efficiency	:		(N/kW)

(For and aft chocks capable of transmitting 3 times nominal propeller thrust must be installed)

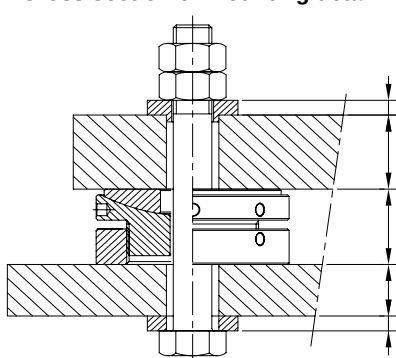
Top View of gearbox

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

LEGEND



Cross section of mounting detail



Top sleeve length	:		(mm)	G
Bed plate thickness	:		(mm)	H
Chock height	:		(mm)	J
Top plate thickness	:		(mm)	K
Bottom sleeve length	:		(mm)	L

LEGEND

Remarks:

Address information

Company	:	
Contact	:	
Phone	:	
Fax	:	
E-mail	:	

MS-F-332 REV. 04 D.D. 03.05.2005



Machine Support B.V., The Netherlands

Phone : +31 (0)180 483828
Fax : +31 (0)180 483829
Website : www.machinesupport.com
E-mail : info@machinesupport.com

Selection of Vibracon SM element for Generators/E-motors/Pumps/Comp.

Please insert data into the coloured cells

Shipyards / Customer :
Shipname / Project :
Classification society :
Object :
Make / type :

Generator

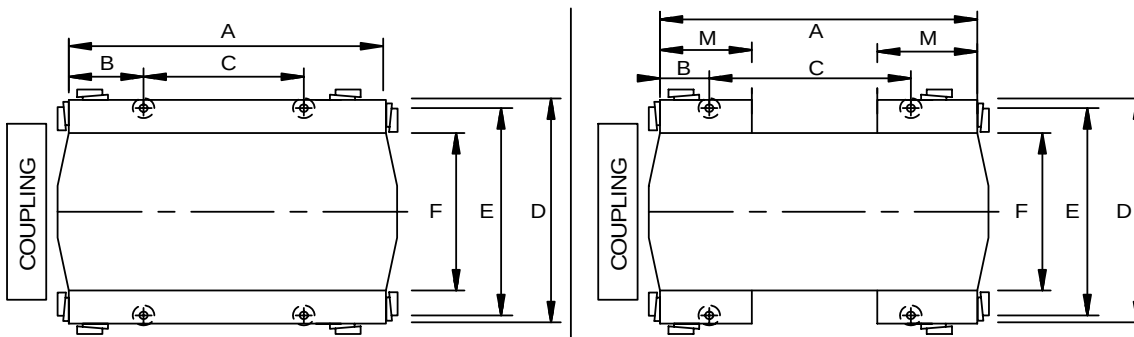
Mass : (kg)
Power : (kW)
Revolutions : (rpm)
Number of elements : (-)
Foundation bolthole diameter : (mm)
Fitted bolthole diameter : (mm)

Top View of generator

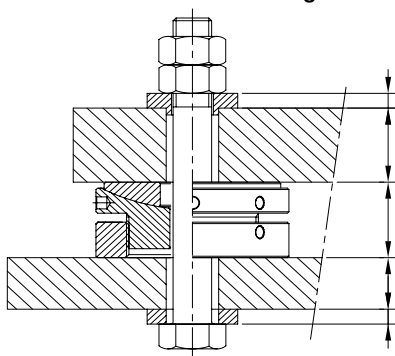
Total length of generator : (mm)
Location first hole (seen from coupling) : (mm)
Pitch between other holes (on one side) : (mm)
Total width of the component : (mm)
Pitch of boltholes (left to right) : (mm)
Foundation width (inside) : (mm)
Foot length : (mm)

LEGEND

A
B
C
D
E
F
M



Cross section of mounting detail



Top sleeve length : (mm)
Bed plate thickness : (mm)
Chock height : (mm)
Top plate thickness : (mm)
Bottom sleeve length : (mm)

LEGEND

G
H
J
K
L

Remarks:

Address information

Company :
Contact :
Phone :
Fax :
E-mail :

MS-F-334 REV. 04 D.D. 03.05.2005

APPENDIX 2

EXAMPLE OF CHOCKING PROPOSAL



Machine Support B.V., The Netherlands
Phone : +31 (0)180 483828
Fax : +31 (0)180 483829
Website : www.machinesupport.com
E-mail : info@machinesupport.com

Shipyard / Customer	:	Slippstödin ehf
Shipname / Project	:	Baldvin NC-100
Classification society	:	Det Norske Veritas
Object	:	Piston engine
Make / type	:	MaK 6M32

Selection of Vibracon SM element

Machine

Mass (if engine with water +oil)	:	37500	(kg)
Power	:	2880	(kW)
Revolutions	:	600	(rpm)
Foundation width (bolt distance)	:	1400	(mm)
Number of elements	:	18	(-)
Bolthole diameter	:	35	(mm)

Correction / Safety factor	:	2	(-)
Minimum required Vibracon SM element	:	30	(-)

Advised Vibracon SM element	:	30	(-)
------------------------------------	---	-----------	-----

Element load (maximum)	:	24,05	(kN)
Element load (minimum)	:	16,78	(kN)
Machine load	:	48,11	(kN)

Calculation of holding down bolts' torque

Foundation bolt

Foundation bolts	:	14 * M30 (L =420 mm)	(-)
Material	:	grade 8.8	(-)
E-modul	:	207000	(N/mm ²)
Yield strength	:	630	(N/mm ²)

Elongation foundation bolt	:	0,62	(mm)
Tension per bolt	:	243,3	(kN)
Tensile stress	:	468,7	(N/mm ²)
Disposable yield strength	:	74	(%)
Equivalent stress	:	552,0	(N/mm ²)
Disposable yield strength < 90 %	:	88	(%)

Tightening torque	:	1460	(Nm)
--------------------------	---	-------------	-------------

Fitted stud bolt

Fitted bolts	:	4 * M30 (L =462 mm)	(-)
Material	:	42 CrMo 4	(-)
E-modul	:	207000	(N/mm ²)
Yield strength	:	750	(N/mm ²)

Elongation of fitted bolt	:	0,57	(mm)
Tension per bolt	:	243,3	(kN)
Tensile stress	:	468,7	(N/mm ²)
Disposable yield strength	:	62	(%)
Equivalent stress	:	552,0	(N/mm ²)
Disposable yield strength < 90%	:	74	(%)

Tightening torque	:	1460	(Nm)
--------------------------	---	-------------	-------------

MS REF. NUMBER : NE-04-0155-01-PW

MS-F-331 BLAD 1/1 REV.00 D.D. 01.08.2001

REV. 27

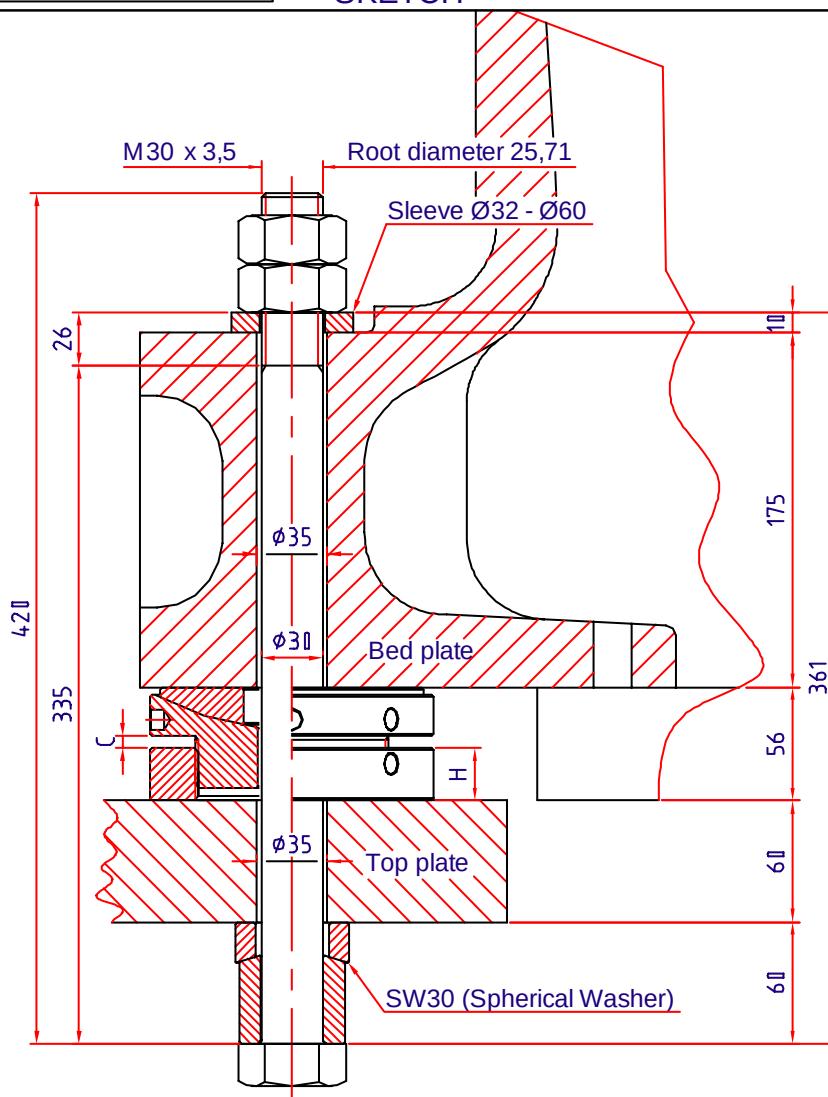
MACHINE SUPPORT Laser Alignment, Mounting Services and Products SKETCH Machine Support B.V. the Netherlands Phone : +31 (0)180 483828 Fax : +31 (0)180 483829 Website : www.machinesupport.com E-mail : info@machinesupport.com		<table border="1"> <thead> <tr> <th data-bbox="1003 1073 1060 1856">PROJECT DATA</th><th data-bbox="1003 611 1060 1073">VIBRACON DATA</th><th data-bbox="1003 226 1060 611">APPROVAL</th></tr> </thead> <tbody> <tr> <td data-bbox="1060 1073 1247 1856"> Shipyard / customer : Slippstødin ehf Shipname / project : Baldvin NC-100 Classification society : Det Norske Veritas Object : Piston Engine Make / type : MaK 6M32 </td><td data-bbox="1060 611 1247 1073"> Vibracon Type : SM30 Standard Bottom Ring (H = 26 mm) Maximum adjustment : 12 mm Minimum height : 50 mm Maximum height : 62 mm </td><td data-bbox="1060 226 1247 611"></td></tr> <tr> <td data-bbox="1247 1073 1367 1856"> A - Collision stopper (with wedge shaped chocks) B - Steel side stopper (with wedge shaped chocks) Stopper clearances in accordance with manufacturer instructions </td><td data-bbox="1247 611 1367 1073"></td><td data-bbox="1247 226 1367 611"></td></tr> </tbody> </table>	PROJECT DATA	VIBRACON DATA	APPROVAL	Shipyard / customer : Slippstødin ehf Shipname / project : Baldvin NC-100 Classification society : Det Norske Veritas Object : Piston Engine Make / type : MaK 6M32	Vibracon Type : SM30 Standard Bottom Ring (H = 26 mm) Maximum adjustment : 12 mm Minimum height : 50 mm Maximum height : 62 mm		A - Collision stopper (with wedge shaped chocks) B - Steel side stopper (with wedge shaped chocks) Stopper clearances in accordance with manufacturer instructions		
PROJECT DATA	VIBRACON DATA	APPROVAL									
Shipyard / customer : Slippstødin ehf Shipname / project : Baldvin NC-100 Classification society : Det Norske Veritas Object : Piston Engine Make / type : MaK 6M32	Vibracon Type : SM30 Standard Bottom Ring (H = 26 mm) Maximum adjustment : 12 mm Minimum height : 50 mm Maximum height : 62 mm										
A - Collision stopper (with wedge shaped chocks) B - Steel side stopper (with wedge shaped chocks) Stopper clearances in accordance with manufacturer instructions											
MS REF. NUMBER: NE-04-0155-01-PW											

MS-F-336 BLAD 1/1 REV.00 D.D. 01.08.2001



Machine Support B.V. The Netherlands
Phone +31 (0)180 483828
Fax +31 (0)180 483829
Website www.machinesupport.com
E-mail info@machinesupport.com

SKETCH



MS REF. NUMBER: NE-04-0155-01-PW

FOUNDATION BOLT

Bolt material : grade 8.8
Yield strength : 630 N/mm²
Size of foundation bolt : M 30 x 3,5 L = 420 mm
Stretch : 0,62 mm
Tightening torque : 1460 Nm
Shipyard / customer : Slippstödin ehf
Shipname / project : Baldvin NC-100
Classification society : Det Norske Veritas
Object : Piston Engine
Make / type : MaK 6M32

APPROVAL

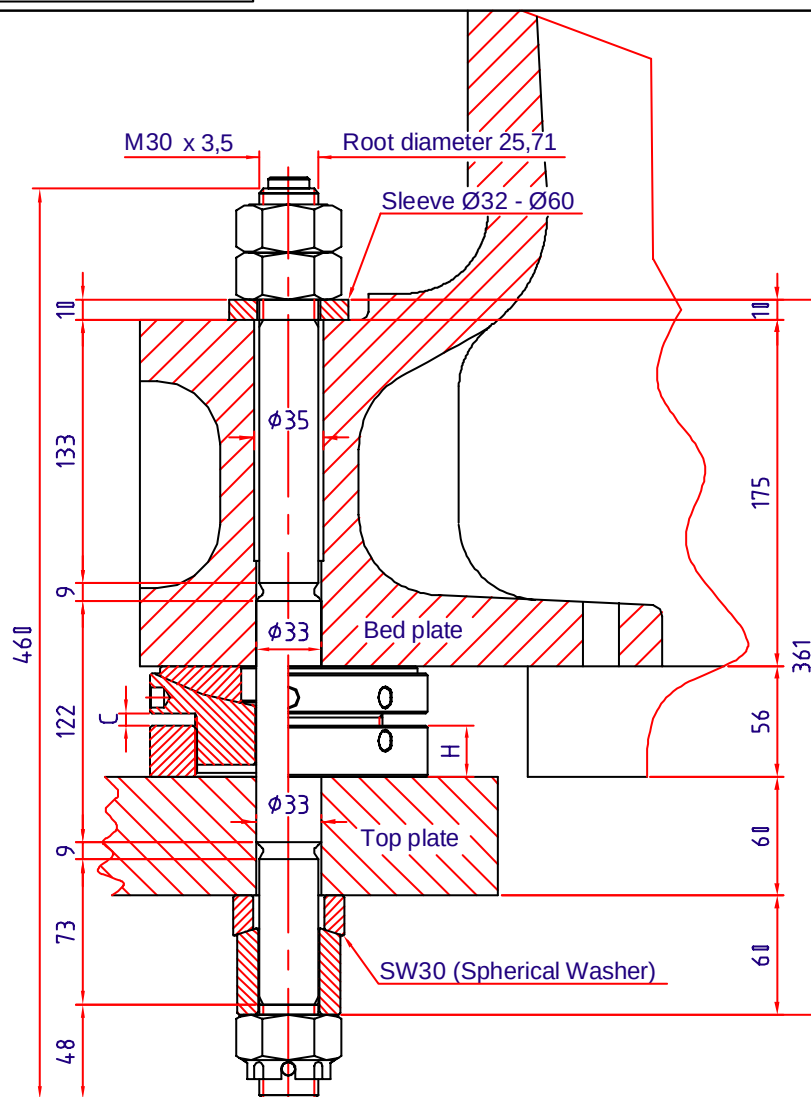
Calculations are valid for bolts with ISO Metric screw thread and coarse pitch, minimum material grade 8.8, yield strength > 630 N/mm², oil lubricated thread courses and nut mating surfaces without slide additives.

MS-F-337 BLAD 1/1 REV.00 D.D. 01.08.2001



SKETCH

Machine Support B.V. The Netherlands
Phone +31 (0)180 483828
Fax +31 (0)180 483829
Website www.machinesupport.com
E-mail info@machinesupport.com



MS REF. NUMBER: NE-04-0155-01-PW	FITTED BOLT	APPROVAL
	Bolt material : 42 CrMo 4 Yield strength : 750 N/mm² Size of fitted bolt : M 30 x 3,5 L = 460 mm Stretch : 0,57 mm Tightening torque : 1460 Nm Shipyard / customer : Slippstødin ehf Shipname / project : Baldvin NC-100 Classification society : Det Norske Veritas Object : Piston Engine Make / type : MaK 6M32	
Calculations are valid for bolts with ISO Metric screw thread and coarse pitch, minimum material grade 8.8, yield strength > 630 N/mm ² , oil lubricated thread courses and nut mating surfaces without slide additives		

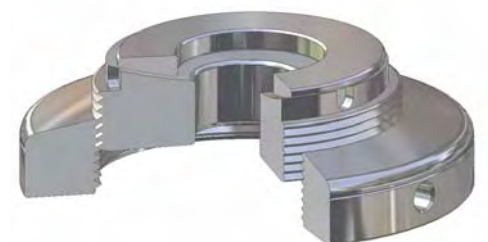
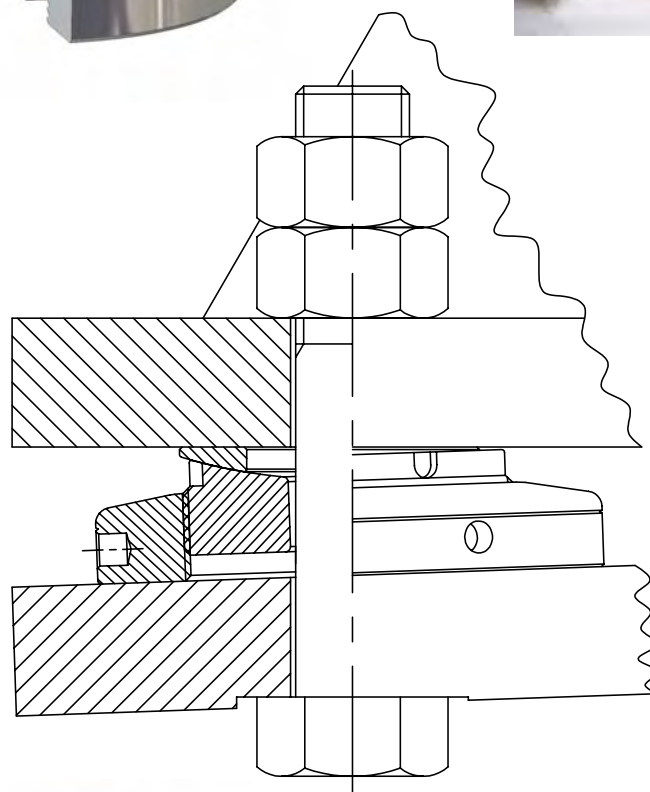
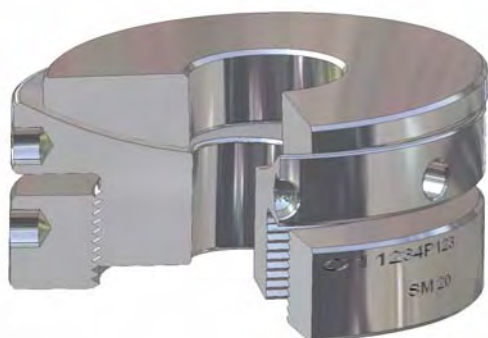


An SKF Group Company



Vibracon[®]

References and Approvals



3 *References and approvals*

3.1	<i>MARINE APPLICATIONS</i>	3
3.2	<i>INDUSTRIAL APPLICATIONS</i>	5
3.3	<i>MARINE CLASSIFICATION SOCIETY TYPE APPROVALS</i>	7
3.3.1	<i>American Bureau of Shipping Type Approval</i>	7
3.3.2	<i>American Bureau of Shipping Design Assessment</i>	8
3.3.3	<i>American Bureau of Shipping Design Assessment Low Profile</i>	9
3.3.4	<i>American Bureau of Shipping Manufacturing Assessment</i>	10
3.3.5	<i>Bureau Veritas</i>	11
3.3.6	<i>Bureau Veritas Low Profile</i>	12
3.3.7	<i>China Classification Society</i>	13
3.3.8	<i>Det Norske Veritas (also valid for Low Profile)</i>	14
3.3.9	<i>Germanischer Lloyd</i>	15
3.3.10	<i>Germanischer Lloyd Low Profile</i>	16
3.3.11	<i>Lloyd's Register of Shipping</i>	17
3.3.12	<i>Lloyd's Register of Shipping Low Profile</i>	18
3.3.13	<i>Rina</i>	19
3.3.14	<i>Rina Low Profile</i>	20

APPENDIX 1 CURRENT REFERENCE LIST OF ENGINES MOUNTED ON VIBRACON® CHOCKS

APPENDIX 2 CURRENT REFERENCE LIST OF GEARBOXES MOUNTED ON VIBRACON® CHOCKS

3 Approvals and references of Vibracon® chocks

This list of approvals and references is just a summary of applications known to Machine Support. Since the introduction in 1988, more than 250,000 chocks have been sold around the world for various applications. If you are looking for a reference of a specific application please contact your local agent or Machine Support.

For marine diesel and gearbox applications we have a detailed reference list. For all other applications we just mention the name of the manufacturer and the country of origin.

3.1 Marine applications

Classification societies

- Lloyd's Register of Shipping
- Det Norske Veritas
- Scheepvaart inspectie
- Navsea (US Navy)
- Bureau Veritas
- CCS
- Rina
- Class NK
- Germanischer Lloyd
- American Bureau of Shipping

Diesel engines

- | | |
|-----------------------|---------------------------------|
| • ABC | Belgium |
| • Brons Industrie | The Netherlands |
| • Caterpillar | United States |
| • Caterpillar MAK | Germany |
| • Cummins | United States |
| • Detroit | United States |
| • Deutz | Germany |
| • Guascor | Spain |
| • Isotta Fraschini | Italy |
| • Lister Blackstone | United Kingdom |
| • MAN Rollo | Germany |
| • Mirrlees Blackstone | United kingdom |
| • Mitsubishi | Japan |
| • Pielstick | United Kingdom |
| • Rolls Royce | Norway |
| • Sulzer | Italy |
| • Wärtsilä | Finland, Italy, The Netherlands |

For our current reference list of diesel engines projects see APPENDIX 1

Gear boxes

- | | |
|-------------------------|---------|
| • Finnoy | Norway |
| • Flender | Germany |
| • Heimdal | Norway |
| • Kvaerner Eureka | Norway |
| • Lohmann & Stolterfoht | Germany |
| • Masson | France |
| • Renk | Germany |
| • Reintjes | Germany |
| • Rolls Royce | Norway |

- Ulstein Norway
- Volda Norway

Gear boxes (continue)

- Wärtsilä NSD Norway
- Twin Disc United States
- ZF France

For our current reference list of gearbox projects see APPENDIX 2

PTO shaft generators

- ABB Finland, France
- A. van Kaijk Germany
- Leroy Somer France
- Siemens Germany

Generator sets (under the generator)

- Caterpillar MaK Germany
- Deutz MWM Germany
- MAN B&W Germany
- Wärtsilä NSD The Netherlands, Finland, Italy

Shaft bearings

- SKF Sweden
- Blohm & Voss Ind. Germany
- Cooper United Kingdom
- Cedervall Spain

E-motors (for propulsion, dredging pumps, bow thrusters, winches....)

- ABB Finland, France
- A. van Kaijk Germany
- Leroy Somer France
- Siemens Germany

Shipyards (various applications)

The Netherlands

- | | | |
|----------------------------|----------------------|------------------------------|
| • Van der Giessen-de Noord | • YVC Ysselwerf | • Verolme Heusden |
| • YVC Bolnes | • IHC Sliedrecht | • De Merwede |
| • IHC Kinderdijk | • Wilton Feijenoord | • Ferus Smit |
| • Pattje Shipyard | • SW Visscher | • Niestern en Sander |
| • Padmos Stellendam | • Verolme Botlek | • Mf. Dolderman |
| • Oranjewerf | • SW Peters | • Niehuis & van de Berg |
| • Rijkswerf | • Shipdock Amsterdam | • Vlaardingen Oost |
| • SW Reimerswaal | • Mf. A&L Hoekman | • Mf. Luyt |
| • SW Nederlof | • Keppel Verolme | • Damen Shiprepair Rotterdam |

Germany

- | | | |
|------------------------|-------------------|---------------|
| • Volkswerft Stralsund | • Kvaerner Warnow | • Peterswerft |
| • Norderwerft | • Aker MTW | • Braun |
| • HDW | • Blohm+Voss | |

Norway

- Kvaerner Kleven Leirvik
- Kvaerner Kleven Ulsteinvik
- Aukra Shipyard
- Solstrand
- Langsten Shipyard
- Ulstein Shipyard
- Moen Shipyard
- Aas Mek.
- Aker Brattvaag
- Søvikness Shipyard
- Larsnes Shipyard
- Vågland Shipyard

Spain

- Asea Sestao
- Asea Sevilla
- Bazan Ferrol

United Kingdom

- Ferguson Shipyard
- Cammell Laird

United States

- General Dynamic
- Bollinger Shipyard
- Dakota Creek

Shipowners

- Stena Line
- H.A.M.
- Dredging International
- Smit International
- Chemgas
- Tidewater
- P&O ferries
- Jan de Nul
- Seatrade
- AP Müller
- Wagenborg Shipping
- Edison Chouest
- Ballast Nedam
- Boskalis
- Dockwise
- Maersk
- Jo Tankers

3.2 Industrial applications

Compressor sets

- | | |
|----------------------------|--------------------------|
| • Atlas Copco | Germany |
| • El Paso Energy | USA |
| • Caledonian compressors | United Kingdom |
| • GTI Koudetechnik | The Netherlands |
| • Gresco | The Netherlands |
| • Mannesmann Demag Delaval | Germany, The Netherlands |
| • Mycom Europe | Belgium |
| • The Hanover Company | USA / Canada |
| • Thomassen International | The Netherlands |
| • Toromont | USA / Canada |
| • Universal Compressors | USA |

Pump sets (under the E-motor)

- | | |
|---------------------|-----------------|
| • BW/IP | The Netherlands |
| • Stork Pompen (NL) | The Netherlands |
| • Lewa | Germany |

- Nijhuis Fire Protection The Netherlands

Steam and gas turbines (under the generator, gearbox and/or turbine)

- Alstom Germany, Sweden, United Kingdom
- Siemens Germany
- Centrax United Kingdom

Diesel Power Plants (under the generator)

- Wärtsilä NSD The Netherlands, Finland, Sweden
- Caterpillar MaK Germany
- MTU Germany

Paper machines

- Voith Germany

Turbine stations

- Voith transmissions Inc. USA

Production

- Hunter Douglas The Netherlands

3.3 Marine Classification Society Type Approvals

Attachment To
Certificate No.
00-RO 68591 - X



Port of
ROTTERDAM, NETH.

Date: 24 January 2000

Manufacturer : Machine Support B.V.
Kaartenmakerstraat 7
2984 CB Ridderkerk
The Netherlands

Tel.: +31 180-483828
Fax: +31 180-483829
E-mail: info@machinesupport.com
Website: www.machinesupport.com

**Equipment/
Component** : Vibracon SM Elements

Model : SM 12-16-20-24-30-36-42-48-56-64

Description : Adjustable Steel Chock

Intended service : Chocking of Propulsion Plants and Auxiliary Machinery

Ratings : Dependant on Configuration of Components

Standards : ABS Rules

Service restrictions : None

Comments : None



This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of American Bureau of Shipping or a statutory, industrial or manufacturer's standard and is issued solely for the use of the Bureau, its committees, its clients, or other authorized entities. **This certificate is governed by the terms and conditions on the reverse side hereof.**

Form AB 257 (7/90)-2

Figure 3.3.1 American Bureau of Shipping Type Approval



CERTIFICATE NUMBER

03-LD407181/1-PDA

DATE

21 January 2009

ABS TECHNICAL OFFICE

London Engineering Department

CERTIFICATE OF Design Assessment

This is to Certify that a representative of this Bureau did, at the request of
SKF MACHINE SUPPORT - RIDDERKORK

assess design plans and data for the below listed product. This assessment is a representation by the Bureau as to the degree of compliance the design exhibits with applicable sections of the Rules. This assessment does not waive unit certification or classification procedures required by ABS Rules for products to be installed in ABS classed vessels or facilities. This certificate, by itself, does not reflect that the product is Type Approved. The scope and limitations of this assessment are detailed on the pages attached to this certificate. It will remain valid as noted below or until the Rules or specifications used in the assessment are revised (whichever occurs first).

PRODUCT: Vibracon SM Elements

MODEL: SM 12-16-20-24-30-36-42-48-56-64

ABS RULE: 2009 Steel Vessel Rules 1-1-4/7.7 & 4-2-1/11.3

OTHER STANDARD:

AMERICAN BUREAU OF SHIPPING


Xiaonan Niu
Engineering Type Approval Co-ordinator

AB258(07/03)

NOTE: This certificate evidences compliance with one or more of the Rules, Guides, standards or other criteria of American Bureau of Shipping or a statutory, industrial or manufacturer's standard and is issued solely for the use of the Bureau, its committees, its clients or other authorized entities. Any significant changes to the aforementioned product without ABS approval will result in this certificate becoming null and void. This certificate is governed by the terms and conditions on the reverse side hereof.

TX 05/05 5099B
A4 1000

Figure 3.3.2 American Bureau of Shipping Design Assessment



CERTIFICATE NUMBER

03-LD407503/1-PDA

DATE

21 January 2009

ABS TECHNICAL OFFICE

London Engineering Department

CERTIFICATE OF Design Assessment

This is to Certify that a representative of this Bureau did, at the request of
SKF MACHINE SUPPORT - RIDDERKORK

assess design plans and data for the below listed product. This assessment is a representation by the Bureau as to the degree of compliance the design exhibits with applicable sections of the Rules. This assessment does not waive unit certification or classification procedures required by ABS Rules for products to be installed in ABS classed vessels or facilities. This certificate, by itself, does not reflect that the product is Type Approved. The scope and limitations of this assessment are detailed on the pages attached to this certificate. It will remain valid as noted below or until the Rules or specifications used in the assessment are revised (whichever occurs first).

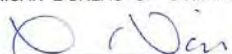
PRODUCT: Vibracon SM Elements

MODEL: SM16LP, SM20LP, SM24LP, SM30LP, SM36LP, SM42LP

ABS RULE: 2009 Steel Vessel Rules 1-1-4/7.7 & 4-2-1/11.3

OTHER STANDARD:

AMERICAN BUREAU OF SHIPPING


Xiaonan Niu
Engineering Type Approval Co-ordinator

AB258(07/03)

NOTE: This certificate evidences compliance with one or more of the Rules, Guides, standards or other criteria of American Bureau of Shipping or a statutory, industrial or manufacturer's standard and is issued solely for the use of the Bureau, its committees, its clients or other authorized entities. Any significant changes to the aforementioned product without ABS approval will result in this certificate becoming null and void. This certificate is governed by the terms and conditions on the reverse side hereof.

TX 05/05 5098B
A4 1000

Figure 3.3.3 American Bureau of Shipping Design Assessment Low Profile



CERTIFICATE
NUMBER RO 601183-X

PLANT LOCATION Ridderkerk

ABS OFFICE Rotterdam

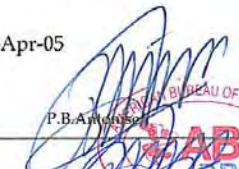
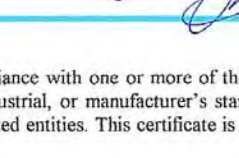
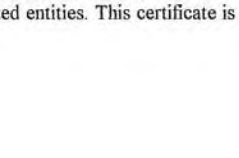
CERTIFICATE OF Manufacturing Assessment

This is to Certify that a representative of this Bureau did, at the request of
MACHINE SUPPORT BV

Attend their facilities at the location noted above, in order to carry out an audit of their facilities and associated quality assurance and quality control procedures. The facility is considered capable of consistently manufacturing;

VIBRACON ELEMENTS

in compliance with their ABS Product Design Assessment Certificates and the designated standards defined therein. The product listed on their current Product Design Assessment Certificates are eligible to be placed on this Bureau's *List of Type Approved Products*, subject to annual facility audits by a representative of this Bureau, and renewal of this Certificate after five (5) years.

ISSUE DATE	14-Apr-05	EXPIRATION DATE	13-Apr-10
SURVEYOR'S SIGNATURE	 P.B. Antonisen		
FIRST ANNUAL ENDORSEMENT	 P.B. Antonisen ABS Surveyor	Date:	21-APRIL 2006
SECOND ANNUAL ENDORSEMENT	 P.B. Antonisen ABS Surveyor	Date:	22-JUNE 2007
THIRD ANNUAL ENDORSEMENT	 P.B. Antonisen ABS Surveyor	Date:	15 MAY 2008
FOURTH ANNUAL ENDORSEMENT	 P.B. Antonisen ABS Surveyor	Date:	29-APRIL 2009

AB257 (03-04)

Note: This certificate evidences compliance with one or more of the Rules, Guides, standards, or other criteria of American Bureau of Shipping; or a statutory, industrial, or manufacturer's standard, and is issued solely for the use of the Bureau, its committees, its clients, or other authorized entities. This certificate is governed by the terms and conditions on the reverse side hereof.

Figure 3.3.4 American Bureau of Shipping Manufacturing Assessment

MARINE DIVISION

17 bis Place des Reflets - La Défense 2
92400 Courbevoie - France

Tel. 33 1 42 91 52 91
Fax. 33 1 42 91 28 94
www.veristar.com



Certificate number: 06593/C0 BV

File number : ACM 171/0902/001

Product code : 00201

This certificate is not valid when presented without the full attached schedule composed of 7 sections

TYPE APPROVAL CERTIFICATE

as per Bureau Veritas Classification Rules

This certificate is issued to

MACHINE SUPPORT B.V.
RIDDERKERK - NETHERLANDS

for the type of product

CHOCKING DEVICES FOR MACHINERY

Vibracon® SM - Readjustable Chocking Element

Regulations and standards :

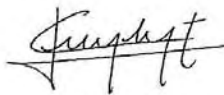
BUREAU VERITAS Rules for the Classification of Steel Ships.

This certificate is issued to attest that BUREAU VERITAS did undertake the relevant approval procedures for the product identified above which was found to comply with the relevant requirements of the Regulations and standards mentioned above.

This certificate is valid until : 21 Dec 2012

At Paris la Défense, on : 21 Dec 2007

For BUREAU VERITAS,
By order of the Secretary


L. COURREGE LONGUE

Approval office



Local office : BV ROTTERDAM

Surveyor : J. Huis



This certificate remains valid until the date stated above, unless cancelled or revoked, provided the conditions indicated in the subsequent page(s) are complied with and the product remains satisfactory in service. This certificate will not be valid if the applicant makes any changes or modifications to the approved product, which have not been notified to, and agreed in writing with BUREAU VERITAS. Should the specified regulations or standards be amended during the validity of this certificate, the product(s) is/are to be re-approved prior to it/they being placed on board vessels to which the amended regulations or standards apply. This certificate is issued within the scope of the General Conditions of BUREAU VERITAS Marine Division. Any Person not a party to the contract pursuant to which this document is delivered may not assert a claim against BUREAU VERITAS for any liability arising out of errors or omissions which may be contained in said document, or for errors of judgement, fault or negligence committed by personnel of the Society or of its Agents in establishment or issuance of this document, and in connection with any activities for which it may provide.

BV mod. Ad.E 530 August 2005

This certificate consists of 3 pages

BVM-sigs-101-12/07

Figure 3.3.5 Bureau Veritas Type Approval

MARINE DIVISION 17 Bis Place des Reflets - La Défense 2 92400 Courbevoie - France Tel. 33 1 42 91 53 48 Fax 33 1 42 91 28 94	 BUREAU VERITAS	Published on http://www.veristar.com Certificate N°: 13481/A0 BV The attached Schedule forms part of the certificate File Number : ACM 171/0902/001 Product Code : 00201
--	--	---

CERTIFICATE OF TYPE APPROVAL

*This is to certify that the product identified below was found to be in compliance with the
relevant hereunder stated Regulations & standards*

CHOCKING DEVICES FOR MACHINERY Vibracon ® SM - LP element

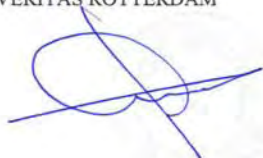
MANUFACTURED BY:

MACHINE SUPPORT B.V.
Ridderkerk - NETHERLANDS

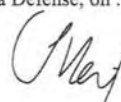
SPECIFIED REGULATIONS & STANDARDS :
BUREAU VERITAS Rules for the Classification of Steel Ships

The Approval is valid until : 10-09-2009

BUREAU VERITAS ROTTERDAM



At Paris la Défense, on : 10-09-2004



J.BENOIT
For the Secretary

This Certificate remains valid until the date stated on, hereunder, unless cancelled or revoked, provided the conditions in the attached schedule are complied with and the equipment remains satisfactory into service.
This Certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested.
This Certificate is not valid without the stamp of the above mentioned BUREAU VERITAS Inspection Center.
The manufacturer should notify BUREAU VERITAS of any modification or changes to the equipment in order to obtain a valid Certificate.
The latest published Regulations or Standards referred to, above, and the Marine Division General Conditions are applicable.

RTT3 (J.7) 10/00

Figure 3.3.6 Bureau Veritas Low Profile Type Approval



中国船级社
CHINA CLASSIFICATION SOCIETY

格式
Form CP302

编号
No. HBT04033014

船用产品型式认可证书

CERTIFICATE OF TYPE APPROVAL FOR MARINE PRODUCT

产品名称 Description	VIBRACON SM and SM-LP elements	制造厂名 Manufacturer	Machine Support B.V.
产品型号 Model	SM12-16-20-24-30-36-42-48-56-64; SM16LP-20LP-24LP-30LP-36LP-42LP	厂址 Address	Kaartenmakerstraat 7, 2948 CB Ridderkerk, the Netherlands
图纸批准号 Approval No. of drawing	HBT04033014-1		

产 品 明 细 Particulars

Description: Adjustable Steel Chock
Application: Chocking of Propulsion Plant and Aux. Machinery
Material: Used for Top, Center and Bottom Plates:
St 52-3 or CK35 for SM12-64 and SM16LP, SM20LP, SM24LP;
42CrMo4 or 34CrNiMo6 for SM30LP; SM36LP; SM42LP
Specified: Manufacturer's Specification
Ratings Depends on configuration of components

Operational Limitations:

Model: SM	12	16	20	24	30	36	42	48	56	64
Machine Load (kN)	8	15	25	35	60	90	120	160	225	300
Design Load(kN)	48	90	140	200	325	475	675	850	1150	1500

Model: SM-LP	16	20	24	30	36	42
Machine Load (kN)	15	25	35	60	90	120
Design Load(kN)	90	140	200	325	475	675

兹证明本社验船师根据本社规范和有关规则,对上述产品的图纸和技术文件进行了审查,并于 2004 年 3 月 11 日 到该厂进行了型式认可试验。产品图纸和试验结果均符合本社规范,现予认可。

THIS IS TO CERTIFY that the Surveyor to this Society has, in accordance with the Rules and relevant Regulations of this Society, examined the drawings and technical documents of the above-mentioned product, and carried out a type test on Mar. 11, 2004 and that both the drawings and test results are found to be in compliance with the Rules of this Society.

The Type Approval for the subject products is hereby granted.

本证书有效期至
This Cert. is valid until
发证日期
Date of issue

Mar. 10, 2008
Mar. 11, 2004



(Li Tao)

Surveyor to
China Classification Society

Figure 3.3.7 China Classification Society


DET NORSKE VERITAS
TYPE APPROVAL CERTIFICATE

CERTIFICATE NO. M-10939
This Certificate consists of 3 pages

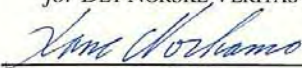
This is to certify that the
Engine Foundation
with type designation
Vibracon SM and SM-LP elements

Manufactured by
SKF Machine Support
Ridderkerk, Netherlands

is found to comply with
Det Norske Veritas' Rules for Classification of Ships/High Speed and Light Craft

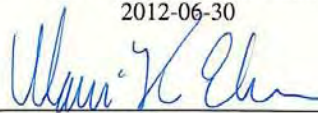
Application
The elements are approved for use as adjustable steel chocks for marine use i.e. for installation of propulsion engines, auxiliary engines and other machinery components.

Place and date
Høvik, 2008-06-26
for DET NORSKE VERITAS AS


Egil Alling
Head of Section


Local Office
DNV Rotterdam

This Certificate is valid until
2012-06-30


Hans-Kristian Eriksen
Surveyor

Notice: This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

If any person suffers loss or damage which is proved to have been caused by any negligent act or omission of Det Norske Veritas, then Det Norske Veritas shall pay compensation to such person for his proved direct loss or damage. However, the compensation shall not exceed an amount equal to ten times the fee charged for the service in question, provided that the maximum compensation shall never exceed USD 2 million. In this provision "Det Norske Veritas" shall mean the Foundation Det Norske Veritas as well as all its subsidiaries, directors, officers, employees, agents and any other acting on behalf of Det Norske Veritas.

DET NORSKE VERITAS AS

VERITASVEIEN 1, 1322 HØVIK, NORWAY

TEL: (+47) 67 57 99 00

FAX: (+47) 67 57 99 11

Form No.: 20.90a Issue: January 98

Page 1 of 3

Figure 3.3.8 Det Norske Veritas Type Approval


Germanischer Lloyd

Type Approval Certificate

This is to certify that the undernoted product(s) has/have been tested in accordance with the relevant requirements of the GL Type Approval System.

Certificate No.	14 718 - 99 HH
Company	Machine Support B.V. Kaartenmakerstraat 7 NL-2984 CB Ridderkerk
Product Description	VIBRACON SM adjustable steel chock
Type	SM12 - SM16 - SM20 - SM24 - SM30 - SM36 - SM42 - SM48 - SM56 - SM64
Environmental Category	None
Technical Data / Range of Application	Technical Data: Acc. to "General Design Table", Fig. 6.2, Version 1.0, Nov. 1999 Material of top, center and bottom plates: S355J2G3 (St 52-3) or CK35 Quality control acc. to Doc.-No. 991008/RV, "Material / Product Traceability", dated 1999-10-08 Range of Application: Chocking of propulsion plants and auxiliary machinery
Test Standard	Test programme in accordance with GL Rules and Regulations
Documents	Test report No. TMA 98-181 R (1-19) dated 1999-09-02 and GMA-98-05062 (1-8) dated 1998-05-28 of STORK FDO B.V., Amsterdam, The Netherlands. Test report No. 990929-01/RV (1-19) dated 1999-10-04 of MACHINE SUPPORT B.V., Ridderkerk, The Netherlands.
Remarks	Special conditions / restrictions acc. to pages 2 and 3 of this Certificate. General conditions acc. to GL "Regulations for the Seating of Propulsion Plants".
Valid until	2010-03-30

Page 1 of 3

File No. II.G.12

Hamburg, 2005-03-30

Germanischer Lloyd

This certificate is issued on the basis of "Guidelines for the Performance of Type Approvals Part 1, Procedure".


Hans-J. Götze

Type Approval Symbol 

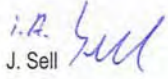

J. Sell

Figure 3.3.9 Germanischer Lloyd Type Approval

Type Approval Certificate

This is to certify that the undernoted product(s) has/have been tested in accordance with the relevant requirements of the GL Type Approval System.

Certificate No.	47 918 - 03 HH
Company	Machine Support B.V. Kaartenmakerstraat 7 2984 CB Ridderkerk, NETHERLANDS
Product Description	VIBRACON SM-LP adjustable steel chock (Low Profile)
Type	SM16LP - SM20LP - SM24LP - SM30LP - SM36LP - SM42LP
Environmental Category	None
Technical Data / Range of Application	Technical Data: Acc. to "General Design Table", Fig. 6.2, Version 1.0, Sept. 2003 Material of top, center and bottom plates: S355J2G3 (St 52-3) or CK45 : for SM16LP - SM20LP - SM24LP 42CrMo4 or 34CrNiMo6 : for SM30LP - SM36LP - SM42LP Quality control acc. to Doc.-No. 20030901-0-RV, "Material / Product Traceability", dated 2003-09-01 Range of Application: Chocking of propulsion plants and auxiliary machinery
Test Standard	Test program in accordance with GL Rules and Regulations
Documents	Test report No. 20030702-0-RV (1-19) dated 2003-08-08 and 20030718-0-RV (1-14) dated 2003-09-01 of MACHINE SUPPORT B.V., Ridderkerk, The Netherlands
Remarks	Special cond./restric. acc. to pages 2 and 3 of Certificate. General conditions acc. to GL "Guidelines for the Seating of Propulsion Plants & Aux. Machinery".
Valid until	2013-11-19
Page	1 of 3
File No.	II.G.12
Hamburg, 2008-10-15	

Type Approval Symbol



Germanischer Lloyd

Karl-Ernst Beese
Karl-Ernst Beese

Ulrich Sieler
Ulrich Sieler

This certificate is issued on the basis of "Guidelines for the Performance of Type Approvals Part 1, Procedure".

Figure 3.3.10 Germanischer Lloyd Low Profile Type Approval



Type Approval Certificate Extension

This is to certify that Certificate No. 00/30008(E1) for the undernoted products is extended and renumbered as shown.

This certificate is issued to:

PRODUCER	Machine Support B.V. Kaartenmakerstraat 7 2984 CB RIDDERKERK The Netherlands		
DESCRIPTION	Vibracon® SM Adjustable Steel Chock (St. 52.3 or Ck 45)		
TYPE	SM 12 SM 16 SM 20 SM 24	SM 30 SM 36 SM 42 SM 48	SM 56 SM 64
APPLICATION	Adjustable Steel Chock for main and auxiliary engines and equipment of ships		
SPECIFIED STANDARDS	Manufacturer's Specification Lloyd's Register's Rules and Regulations for the Classification of Ships		
RATINGS	Depends on configuration of components		

Certificate No.	00/30008(E2)
Issue Date	14 June 2004
Expiry Date	13 June 2009
Sheet	1 of 2

Lloyd's Register EMEA
P.O. Box 701, 3000 AS Rotterdam

A.M. Kemp
Type Approval Department
Rotterdam

THIS DOCUMENT IS SUBJECT TO THE TERMS AND CONDITIONS OVERLEAF

E.3.03.B

Figure 3.3.11 Lloyd's Register of Shipping Type Approval



LR Type Approval Certificate Extension

This is to certify that Certificate No. 03/30030 for the under noted products is extended and renumbered as shown.

This certificate is issued to:

PRODUCER	SKF Machine Support B.V. Kaartenmakerstraat 7 2984 CB RIDDERKERK The Netherlands
DESCRIPTION	Vibracon® SM-LP Adjustable Steel Chock for Main and Auxiliary Engines and Equipment of Ships
TYPE	SM 16LP SM 20LP SM 24LP SM 30LP SM 36LP SM 42LP
APPLICATION	Adjustable Steel Chock for main and auxiliary engines and equipment of ships
SPECIFIED STANDARDS	Manufacturer's Specification Lloyd's Register's Rules and Regulations for the Classification of Ships
MATERIALS	42CrMo4
RATINGS	Depends on configuration of components

Certificate No.	03/30030 (E1)
Issue Date	15 December 2008
Expiry Date	14 December 2013
Sheet	1 of 2

A.M. Kemp
Rotterdam Plan Approval
Lloyd's Register EMEA

Lloyd's Register EMEA
71 Fenchurch Street, London EC3M 4BS

"Lloyd's Register, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as the 'Lloyd's Register Group'. The Lloyd's Register Group assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register Group entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract."

A.5.13.8

Figure 3.3.12 Lloyd's Register of Shipping Low Profile Type Approval

TYPE APPROVAL CERTIFICATE
No. MAC374108CS/001



This is to certify that the product identified below is in compliance with the regulations herewith specified.

<i>Description</i>	Adjustable steel chocks
<i>Type</i>	VIBRACON SM
<i>Applicant</i>	SKF MACHINE SUPPORT KAARTENMAKERSTRAAT 7, NL 2984 CB RIDDERKERK THE NETHERLANDS
<i>Manufacturer</i>	SKF MACHINE SUPPORT
<i>Place of manufacture</i>	KAARTENMAKERSTRAAT 7 NL 2984 CB RIDDERKERK THE NETHERLANDS
<i>Reference standards</i>	RINA General Rules for Type Approval products, equipment and machinery
<i>Reference documents</i>	RINA Rules for testing and certification of materials and marine products

Issued in **Genoa** on **August 25, 2008**. This Certificate is valid until **August 24, 2013**

This certificate consists of this page and 1 enclosure



RINA
Marco Benzi
(Signature)

This certificate replaces the one no. MAC400403CS/2 dated 2 February 2004

RINA Società per azioni
Via Corsica, 12 - 16128 Genova
Tel +39 010 53851
Fax +39 010 5351000

Figure 3.3.13 Rina Type Approval

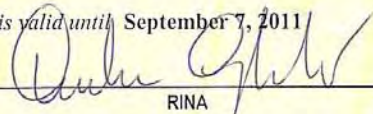
TYPE APPROVAL CERTIFICATE
No. MAC367506CS



This is to certify that the product identified below is in compliance with the regulations herewith specified.

<i>Description</i>	Adjustable steel chocks
<i>Type</i>	VIBRACON SM LP (Low Profile)
<i>Applicant</i>	MACHINE SUPPORT BV KAARTENMAKERSTRAAT 7 NL 2984 CB RIDDERKERK NETHERLANDS
<i>Manufacturer</i>	MACHINE SUPPORT BV
<i>Place of manufacture</i>	KAARTENMAKERSTRAAT 7 NL 2984 CB RIDDERKERK NETHERLANDS
<i>Reference standards</i>	RINA General Rules for Type Approval products, equipment and machinery
<i>Reference documents</i>	RINA Rules for testing and certification of materials and marine products

Issued in **Genoa** on **September 7, 2006**. This Certificate is valid until **September 7, 2011**


RINA
Andrea Cogliolo

This certificate consists of this page and 1 enclosure

RINA Società per azioni
Via Corsica, 12 - 16128 Genova
Tel. +39 010 53851
Fax +39 010 5351000

Figure 3.3.14 Rina Low Profile Type Approval

APPENDIX 1

CURRENT REFERENCE LIST OF ENGINES MOUNTED ON VIBRACON® CHOCKS



REFERENCE LIST: ENGINES ON VIBRACON

MS proj. no.	Engine type	Weight (Tons)	Vibracon®	Shipyard	Country	Owner	Ship name	Class
2004-0473	ABC 3MDX 640.00A	6,9	SM24LP	Gemeentelijk Havenbedrijf	Belgium	Havenbedrijf Antwerpen	m.v." M3 "	-
	ABC 6 DZC	10,6	SM24	Bazan Ferrol	Spain	Jan de Nul	Captain Nunez	ABS
2004-0035	ABC 8 DXC 750	11,5	SM20LPex	Gemeentelijk Havenbedrijf	Belgium	Havenbedrijf Antwerpen	crane Titan	-
	ABC 8 DZC	13,9	SM24	Bazan Ferrol	Spain	Jan de Nul	Captain Nunez	ABS
	Brons Industrie ARUB 215x12	11	SM16LP	Zeemacht	Belgium	Zeemacht / Belgium Navy	Tripartite Class (6 ships)	-
	Caterpillar 3406	2	SM16	Pacific Marine Equipment	United States	Valdez Oil	-	-
2004-0752	Caterpillar 3412	3,6	SM16	Casco Hemiksem N.V.	Belgium	-	m.v. " Rainbow "	SI
	Caterpillar 3412	2,6	SM20	Padmos	The Netherlands	-	ARM25	SI
	Caterpillar 3412	2,6	SM20	Padmos	The Netherlands	-	VD77	SI
	Caterpillar 3508	5,3	SM24	Pacific Marine Equipment	United States	Bristol Leader Inc	Bristo Leader	ABS
	Caterpillar 3508	5,3	SM24	Pacific Marine Equipment	United States	Transmar Shipping	Sterling Carrier	ABS
2004-1597	Caterpillar 3508	5,5	SM24ex	Technisch Bureau H&U	The Netherlands	-	m.v. " Jana "	LRS
	Caterpillar 3508	5,3	SM20	Niestern Sanders	The Netherlands	-	Heron	BV
	Caterpillar 3512	7,6	SM24	Pacific Marine Equipment	United States	Alaska Marine Lines	Arctic Bear	ABS
	Caterpillar 3512	7,6	MS24	Pacific Marine Equipment	United States	Deep Pacific Fisheries	Lilli Ann	ABS
	Caterpillar 3512	7,6	SM24	Pacific Marine Equipment	United States	IFA	Prince of Wales	ABS
2004-0613	Caterpillar 3512	7,6	SM24LP	Visserij Cooperatie Urk	The Netherlands	-	m.v. " 174 "	SI
	Caterpillar 3516	8	SM24	Dolderman	The Netherlands	-	-	SI
	Caterpillar 3516	8	SM24	Solstrand	Norway	-	Loran	DNV
	Caterpillar 3516	8,5	SM24	Pacific Marine Equipment	United States	Harley Marine Services	YTBN	ABS
	Caterpillar 3516	8,5	SM24	Pacific Marine Equipment	United States	Harley Marine Services	Millenium Star	ABS
	Caterpillar 3516	8,5	SM24	-	The Netherlands	Baggermij. Van der Kamp	M.V. "Hein"	-
	Caterpillar 3606	16		Våglund Båtbyggeri	Norway	-	Hull number 204	DNV
	Caterpillar 3606	16		Vaagland Verft	Norway	-	Ole Kr Nergård	DNV
	Caterpillar D398	6	SM24	Schram & Van Beek	The Netherlands	-	Trave	SI
	Caterpillar D399	7,8	SM20	-	The Netherlands	HAM	Zeeland	BV
	Cummins KTA-19M3	1,8	SM20	Werkhuizen Fl. Ketels	Belgium	-	MDB "Sagar"	BSI
	Cummins KTA-38M1	4,2	SM24	Werkhuizen Fl. Ketels	Belgium	-	Z19	BSI
	Cummins KTA-38M2	4,5	SM24	Werkhuizen Fl. Ketels	Belgium	-	Atlantis	LRS
	Cummins NTA14M	1	SM16	Werkhuizen Fl. Ketels	Belgium	-	-	-
	Detroit 12V2000	-		Pacific Marine Equipment	United States	BC Ferries	Quinsam	ABS
	Deutz SBV6M	17,5		Aas Mekaniske	Norway	-	Rohav	DNV
	Guascor	9		Asea Sestao	Spain	Statoil	-	LRS



REFERENCE LIST: ENGINES ON VIBRACON

MS proj. no.	Engine type	Weight (Tons)	Vibracon®	Shipyard	Country	Owner	Ship name	Class
	Issota Fraschini V6	6	SM16	US Navy	United States	US Navy	Pioneer	Navsea
2004-1531	Lister Blackstone EWSL 8 MA	11	SM30LP	Nico International	The Netherlands	Royal Boskalis Westminster	m.v. " Cetus "	BV
	MaK 6M20	10,7	SM20	-	Russia	Murmansk Trawling Fleet	N.Repnikov	RMI
2004-0034	MAK 6M25	21,5	SM24LP	Shipyard K-Damen	The Netherlands	Den Herder - Yerseke	m.v."Scelveringhe"	LRS
	MaK 6M32	37,5	SM30	-	Russia	Murmansk Trawling Fleet	Leonid Galchenko	RMI
	MaK 6M32	37,5	SM30	Slippstödin ehf	Iceland	Samherji hf	Baldvin NC-100	DNV
	MaK 8M282				Iceland		Gulliver	
	MaK 6M453	23	SM24	-	Turkey	Derpina Shipping & Trading Co	Lewis	LR
	MaK 8M453				Iceland		Otto N Thorlaksson	
2002-1926	MaK 8M20	13,9	SM20	De Alblas	The Netherlands	-	Hull number 330	BV
2004-0737	MaK 8M25	27	SM20LP	-	Norway	Herning Shipping AS	m.v. " Laila Theresa "	LRS
	MaK 8M32	44	SM30	Ferus Smit	The Netherlands	-	Hull number 344	BV
	MaK 9M20	14	SM20	Braun	Germany	Grieshaber	-	SI
2004-0034	MAK 9M32	50	SM20LP	Shipyard K-Damen	The Netherlands	Den Herder - Yerseke	m.v."Scelveringhe"	LRS
	MAN D2156	0,7	SM16	-	The Netherlands	B. Dijkstra	Noordvaarder	SI
	MAN Rollo	1,4	SM16LP	De Haas	The Netherlands	KNRM	Christien	ABS
	MAN Rollo	1,4	SM16LP	De Haas	The Netherlands	KNRM	Jan van Engelenburg	ABS
	Mirrlees Blackstone KV12 MAJ M	82	SM42LP	-	United States	Maritrans	Constitution	ABS
	Mirrlees Blackstone MB 275-6	20,5		Shipdock	The Netherlands	-	Britannia Beaver	BV
	Mitsubishi S12N MPTK	4,8	SM16LP	ASS Duisburg	Germany	-	Diamond	BV
	Mitsubishi S6A3	2,1	SM16	Padmos Stellendam	The Netherlands	-	GO18	SI
	Mitsubishi S6B-MPTK	1,2	SM16	-	Dubai	-	Opstad Frakt AS	GL
	Pielstick 2.5V400	54	SM36	Nicol & Andrew	United Kingdom	P&O Ship Management	European Diplomat	LR
	Rolls-Royce Bergen	18	SM24	Aker Bratvaag	Norway	-	UT755	
	Sulzer 12ZAV40	109	SM42	Wärtsilä Benelux	The Netherlands	ITC	Kigoria	LRS
2004-0031	Wärtsilä 12SW280	26	SM30LPex	Rotterdam United Shipyard	The Netherlands	Van Oord ACZ	Volvox Iberia	BV
	Wärtsilä 12SW280	26	SM30LPex	Rotterdam United Shipyard	The Netherlands	Van Oord ACZ	Volvox Iberia	BV
	Wärtsilä 12V32 LN (16x)	46,5	SM30	Wärtsilä Finland	Finland	Wärtsilä	Turkey project	-
	Wärtsilä 12V32 LN (22x)	46,5	SM30	Wärtsilä Finland	Finland	Wärtsilä	OCP project	-
	Wärtsilä 18TM410	145	SM42LP	Wärtsilä Zwolle	The Netherlands	-	Baldomero Lopez	ABS
	Wärtsilä 6F240	12,3	SM24	-	-	Costa Mare	Monreal Senator	GL
	Wärtsilä 6L20	10		Asea Sevilla	Spain	Cenargo	Dawn Merch	LRS
	Wärtsilä 6L240	10		Padmos Stellendam	The Netherlands	City of Antwerp	Work boat 84	BV



REFERENCE LIST: ENGINES ON VIBRACON

<i>MS proj. no.</i>	<i>Engine type</i>	<i>Weight (Tons)</i>	<i>Vibracon®</i>	<i>Shipyard</i>	<i>Country</i>	<i>Owner</i>	<i>Ship name</i>	<i>Class</i>
	Wärtsilä 6L26	19		Visser Den Helder	The Netherlands	-	Hull number 160	DNV
	Wärtsilä 6L38 B	52	SM30	Ferus Smit	The Netherlands	Flinter	Hull number 330	BV
	Wärtsilä 6L38 B	52	SM30	Ferus Smit	The Netherlands	Flinter	Hull number 331	BV
	Wärtsilä 6L38 B	52	SM30	Ferus Smit	The Netherlands	Flinter	Hull number 332	BV
2004-0031	Wärtsilä 6SW280	17,5	SM30LPex	Rotterdam United Shipyard	The Netherlands	Van Oord ACZ	Volvox Iberia	BV
	Wärtsilä 6SW280	17,5		Padmos Stellendam	The Netherlands	-	SL 27	SI
	Wärtsilä 8L32F	43	SM42	Aas Mekaniske	Norway	-	Rossvik	DNV
	Wärtsilä 9L240	16		Schram	The Netherlands	Chemgas	Blizzard	BV
	Wärtsilä 9L240	38,5		-	The Netherlands	Smit Internationale	Smit Sakhalin	LRS
	Wärtsilä 9L26	26		Ferus Smit	The Netherlands	Drent	Hull number 309	BV
	Wärtsilä 9L26	26		Marine Service Noord	The Netherlands	Drent	FS 309	BV
2004-0031	Wärtsilä 9SW280	22,9	SM30LPex	Rotterdam United Shipyard	The Netherlands	Van Oord ACZ	Volvox Iberia	BV
	Wärtsilä W12 V28SG A	39		Gubser Service	Zwitserland	Power (Nevskaya)	-	-
	Wärtsilä W28SG	40		Wärtsilä Zwolle	The Netherlands	Power	-	-
	Waukesha 9390	13,5	SM20	-	Australia	Agility	-	-
	Yanmar M220	8		Larsnes	Norway	-	Skarhaug	DNV

APPENDIX 2

CURRENT REFERENCE LIST OF GEARBOXES MOUNTED ON VIBRACON® CHOCKS



REFERENCE LIST: GEARBOXES ON VIBRACON

MS proj. no.	Gearbox type	Weight (Tons)	Vibracon®	Shipyard	Country	Shipowner	Ship name	Class
2004-0031	Flender GJZ 2700	20	SM42LP/SM36LP	Damen Shiprepair Rotterdam B.V.	The Netherlands	Van Oord ACZ	m.v. " Volvox Iberia "	BV
2004-0031	Flender GJZ 785 / 1289	6,4	SM24LPex	Damen Shiprepair Rotterdam B.V.	The Netherlands	Van Oord ACZ	m.v. " Volvox Iberia "	BV
2004-0034	Flender GRA750A	11,7	SM30	Shipyard K-Damen	The Netherlands	Den Herder - Yerseke	m.v."Scelveringhe"	LRS
2004-0034	Flender GRCA 530	3,5	SM24	Shipyard K-Damen	The Netherlands	Den Herder - Yerseke	m.v."Scelveringhe"	LRS
	Kumera AS NKHU-15000	1		Ulstein Verft AS	Norway		Hull 264	DNV
	Kvearner Eureka 2FGEC-280	1,9		Union Naval de Valencia	Spain		C338	RINA
	Kvearner Eureka 2FGEC-280	1,9		Union Naval de Valencia	Spain		C332	RINA
	Kvearner Eureka 2FGEC-280	1,9		Aker Bratvaag	Norway		Yardnumber 105	DNV
	Kvearner Eureka 2FGEC-280	1,9		Aker Bratvaag	Norway		Yardnumber 104	DNV
	Lohmann + Stolterfoht GCS 800	9,6		Scheepswerf Ferus Smit B.V.	The Netherlands		NB330	BV
	Lohmann + Stolterfoht GCS 800	9,6		Scheepswerf Ferus Smit B.V.	The Netherlands		NB331	BV
	Lohmann + Stolterfoht GCS 800	9,6		Scheepswerf Ferus Smit B.V.	The Netherlands		NB332	BV
2004-1046	Masson ZF W5200	1,5	SM20LPex	Dieselbedrijf Dordrecht	The Netherlands		m.v. " Velocity "	LRS
2004-1121	Masson ZF W5200	1,5	SM20	Dieselbedrijf Dordrecht	The Netherlands		m.v. " Amazone "	LRS
	Reintjes	9		Larsnes	Norway		Hull 42	DNV
2004-0473	Reintjes FÖU	1,2	SM20LP	Gemeentelijk Havenbedrijf	Belgium	Havenbedrijf Antwerpen	m.v. " M3 "	-
	Reintjes VA 2740 2K	7,8		Grands			M.V. "Otto N Porlaksson"	ABS
	Reintjes VA 2741			Wolfard's Werktuigbouw B.V.	The Netherlands		Yardnumber FSW 512	BV
	Reintjes WAF 2365	9,8		Wärtsilä Nederland	The Netherlands		M.V. "Java Sea"	ABS
	Reintjes WAF 2365	9,8		Wärtsilä Nederland	The Netherlands		M.V. "Adriatic Sea"	ABS
	Reintjes WAF 262	0,7		Verbeke bunkering N.V.	Belgium		M.V. "Jantar"	GL
	Reintjes WAF 340			Machinefabriek Padmos B.V.	The Netherlands		M.V. "Sara Maatje XII"	GL
	Reintjes WAF 340			Machinefabriek Padmos B.V.	The Netherlands		-	SI
2004-0752	Reintjes WAF 460	3,5	SM16LPex	Casco Hemiksem N.V.	Belgium		m.v. " Rainbow "	SI
	Reintjes WAF 560	1,5	SM16			Scheepsv. Bouter	m.v. " Leni "	SI
	Reintjes WAF 562 K21			Neue Ruhrorter Schiffswerft GmbH	Germany		M.V. "Melanie Z"	GL
	Reintjes WAF 661			Machinefabriek A & L Hoekman	The Netherlands		M.V. "NG 5"	GL
	Reintjes WAF 741/742	1,9		Causeway Machinery Ltd	UK		M.V. "Balmoral"	MCA
	Reintjes WAF 761			Florimond Ketels N.V.	Belgium		-	SI
	Reintjes WAF 771			Florimond Ketels N.V.	Belgium		-	SI
	Reintjes WAF 790			Machinefabriek A & L Hoekman	The Netherlands		M.V. "TX 34"	SI
	RENK HSU 800	11,5		Scheepswerf Ferus Smit B.V.	The Netherlands		NB344	BV
	RENK NDSQL-3200	60		Fincantieri	Italy			RINA
	RENK NDSQL-3200	60		Fincantieri	Italy			RINA



REFERENCE LIST: GEARBOXES ON VIBRACON

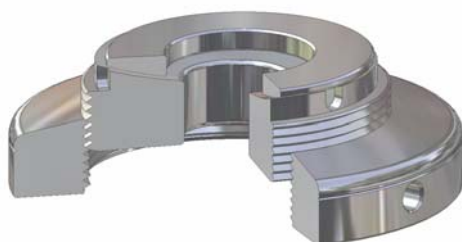
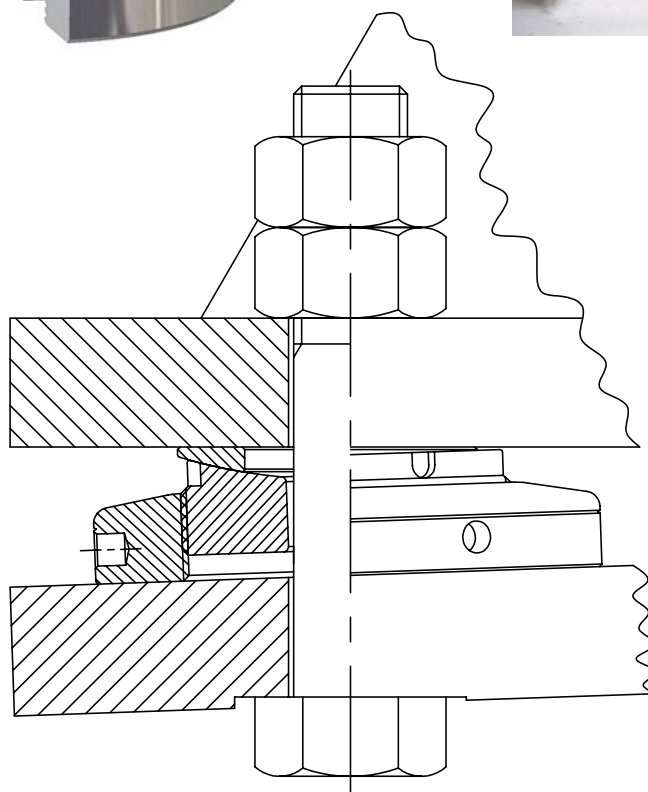
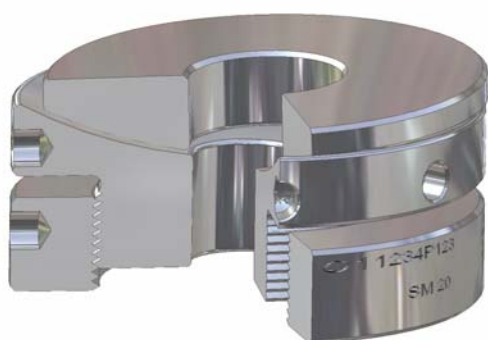
<i>MS proj. no.</i>	<i>Gearbox type</i>	<i>Weight (Tons)</i>	<i>Vibracon®</i>	<i>Shipyard</i>	<i>Country</i>	<i>Shipowner</i>	<i>Ship name</i>	<i>Class</i>
2004-0035	Rhenania 2ANps	8		Gemeentelijk Havenbedrijf	Belgium	Havenbedrijf Antwerpen	crane Titan	-
	Rolls Royce 600 AGSC-KP / 500 N	6		Aker Bratvaag	Norway		Yardnumber 104	DNV
	Rolls Royce 600 AGSC-KP / 500 N	6		Aker Bratvaag	Norway		Yardnumber 105	DNV
	Rolls Royce 600 AGSC-KP / 500 N	6		Aker Bratvaag	Norway		Yardnumber 84	DNV
	Ulstein 220 AGSC	2,1		Vestergaard Marine Service			M.V. "Vitus"	
	Wärtsilä SCV85-P53	9,5		Aas Mek Verksted	Norway		Yardnumber 157	DNV
2004-1267	ZF 7250	2,6	SM20	De Gerlien van Tiem	The Netherlands	-	m.v."Venezia"	SI
2004-1499	ZF W4400	1,5	SM20	Q-Shipping	The Netherlands	Q-Shipping	m.v."Oralake"	BV



An SKF Group Company



Vibracon® ***Installation Procedure***



4 **Vibracon® Installation Procedure**

Step 1 Check foundation quality

- a) The bottom ring area of the Vibracon® chock should be covered by the foundation for 100%. The spherical top part of the chock must have at least 75% contact with machine foot.
- b) Foundation roughness should be sandblasted quality of Sa 2.5 minimum or machined Ra 6.3
- c) The contact surface between foundation and bottom ring of the Vibracon® chock should be checked using the bottom ring of the element, until an evenly distributed bearing surface of a minimum which is given by the machinery manufacturer or classification society. In all other cases, we recommend a minimum bearing surface of 75 %.
- d) The taper between foundation and machine feet should be less then 4°.
- e) Foundation and machine foot should be free from paint and grease.

Step 2 The Vibracon® chocks' thread and spherical layers are protected with Molykote®. The chocks are ready for installation directly from the package!

Machine Support recommends the use of:

- Molykote® type P37 on the screw thread;
- Molykote® type TP42 on the convex / concave mating surface.

Step 3 Check if the Vibracon® chock is placed concentric with the bolt hole.

Step 4 Align the machine.

- a) Keep in mind while aligning the machine to add 0.10 mm (0.004") to the target alignment because of the fact that the Vibracon® chock will lose height at the moment the foundation bolts are secured. This will happen only the first time the chock is used because of the grease inside of the thread.
- b) Please remember: Vibracon® chocks are not designed for lifting machinery!
- c) Height change after 1 cycle (pitch):

SM12	1 mm	0.039"
SM16	1.5 mm	0.059"
SM20 / SM42	2 mm	0.078"
SM48 / SM64	3 mm	0.118"

Step 5 Tighten the foundation bolts. Machine Support recommends doing this in two steps.

Step 6 During or after tightening of the foundation bolts recheck the alignment and check for "soft foot". A "soft foot" occurs if one or more of the Vibracon® chocks are not carrying the same load as the other elements.

Step 7 After installing the machinery apply corrosion protection to the chock by painting or alternative method.

Step 8 The bolt tension must be checked after the test run.

Machine Support recommends the use of spherical washers in the bolt connection.

If you have any questions, please contact Machine Support.

Phone: +31 (0)180 48 38 28

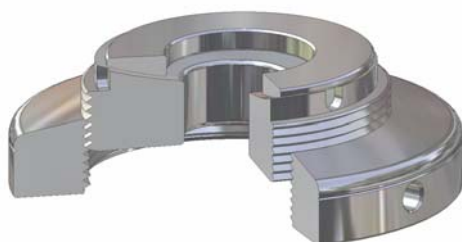
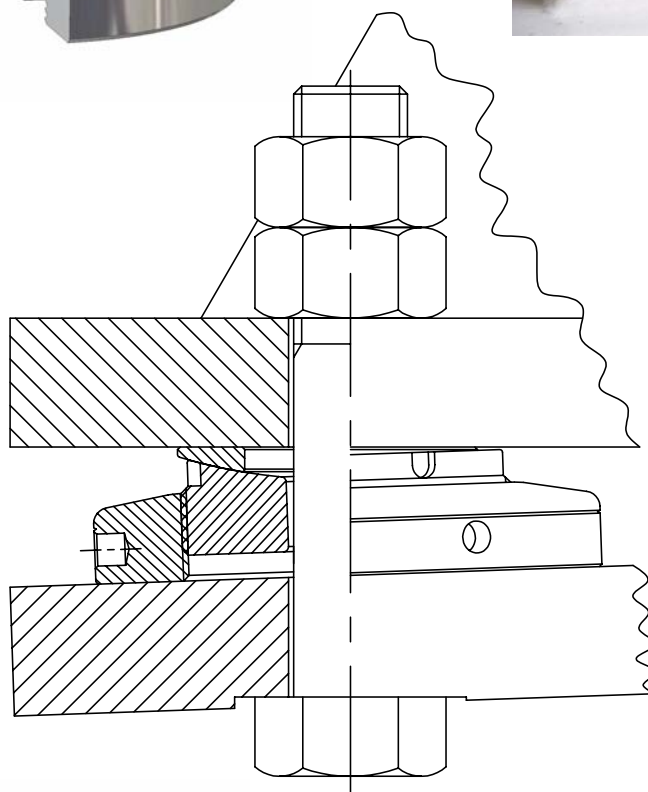
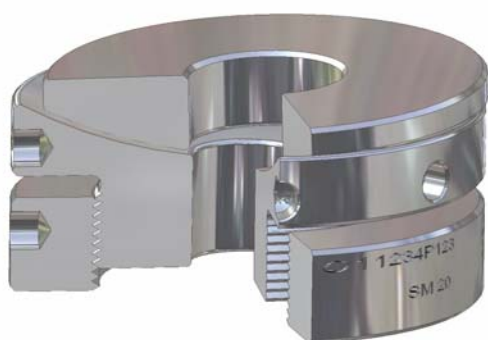


An SKF Group Company



Vibracon®

Frequently Asked Questions



5 *Vibracon® Frequently Asked Questions*

5.1 GENERAL QUESTIONS.....	3
5.1.1 What is a Vibracon® chock?	3
5.1.2 How long have Vibracon® chocks been in use?	3
5.1.3 Who is Machine Support ?.....	3
5.1.4 What are the benefits of Vibracon® chocks?	4
5.1.5 What is more cost effective: Vibracon® chocks, steel chocks,	
epoxy resin chocks or shims?.....	5
5.1.6 Where can we use the chocks?.....	5
5.1.7 Do we need special skills or tools to use the chocks?.....	7
5.1.8 How do we order Vibracon® chocks?	7
5.2 TECHNICAL QUESTIONS	8
5.2.1 Is it possible to chock a heavy machine on a Vibracon® chock?	8
5.2.2 Can we align a machine with a Vibracon chock?	8
5.2.3 How do we prevent the chock from rotating?	8
5.2.4 Are there any limits to the chock height?.....	8
5.2.5 What to do if we want to have elements with extended height?.....	8
5.2.6 What to do if we want to have chocks which are lower then the	
minimum height?	8
5.2.7 Is it possible to enlarge the bolt holes of the Vibracon® chock?	9
5.2.8 If we want to use fitting bolts, how should we do this?	9
5.2.9 If we want to use dowel pins, how should we do this?	10
5.3 MARINE APPLICATION QUESTIONS	11
5.3.1 Is the Vibracon® chock approved by classification societies?.....	11
5.3.2 What information does Machine Support need to make a calculation and a	
sketch of the chocking arrangement?.....	11
5.3.3 Example of a Vibracon® chocking proposal.....	11
5.3.4 What bolt torque should we apply?.....	16

5.1 General questions

5.1.1 What is a Vibracon® chock?

The Vibracon® chock is an universal adjustable steel chock. Universal refers to the fact that a Vibracon® chock can be used instead of rigid steel chocks, shims or epoxy resin chocks. Adjustable refers to the possibility of aligning and re-adjusting the chock at every re-alignment event. The name of the chock "Vibracon" suggests that the elements can absorb vibrations like a vibration damper. We want to point out that the Vibracon® chock is absolutely **not** a vibration damper (resilient mount).

5.1.2 How long have Vibracon® chocks been in use?

The design of the elements is based on products which are used to mount tool machines. In 1988 Machine Support designed the Original Vibracon® chocks. In 2003 Machine Support designed the low profile Vibracon® configuration. Both chocks have patents pending.



Figure 5.1.2.1 Vibracon® Original



Figure 5.1.2.2 Vibracon® Low Profile

The Vibracon® Original and Vibracon® Low Profile chocks are approved by all major shipbuilding classification societies and a large number of original equipment manufacturers.

5.1.3 Who is Machine Support?

Machine Support is a dedicated engineering service organization, which has been in operation for over 20 years. At present, the group consists of three companies with a wide network of affiliated dealers and services. During many successful years of operation, the company has developed a reputation of excellence in laser alignment services and mounting solutions for an increasingly global market.

The comprehensive capabilities of the company include the highest proficiency in the installation support of diesel engines, turbines and the alignment to generators, pumps, compressors and shaft lines. Machine Support also specialises in geometric alignments, such as measuring the line bore of diesel engines and measuring the straightness of stern tubes onboard marine vessels.

The majority of our business is in the marine segment, however we also perform work in the industrial segment, from which mainly pulp and paper. Machine Support's marine engineering services include the research and development into mounting products and advancement of machinery installation techniques. Furthermore, Machine Support is experienced in the support of owners, builders and engineering activities in obtaining classification society approvals or military qualification of the design for satisfactory machinery mountings. "Support" in the company's name represents more than just mounting of machinery.

Machine Support is ISO9001 and VCA certified.



Figure 5.1.3.1 Alignment and chocking of components are typical Machine Support activities.

5.1.4 What are the benefits of Vibracon® chocks?

In packaged units (like generator, compressor, turbine and pump sets) the benefits are:

- No parallel or angular soft foot problems, even when the skid is twisted;
- No machining of the base frame;
- No on site problems to arrange or install shims;
- Re-adjustable;
- In combination with laser alignment equipment, alignment time can be reduced by 50%;
- Existing chocking systems, steel chocks or epoxy resin with a height of only 20 mm, can be replaced by the Vibracon® Low Profile configuration (depending on Vibracon® size).

On board ships for chocking propulsion units and auxiliary equipment:

- No curing time like epoxy resin chocks;
- No time consuming fitting of rigid steel chocks;
- Chocking can be carried out when the ship is still in the dry dock, the alignment check and (if required) realignment has to be carried out after the ship has been launched;
- No parallel or angular soft foot problems, even if the foundation is not machined;
- No machining of foundation, only locally (where the elements will be fitted) machining if required.

5.1.5 What is more cost effective: Vibracon[®] chocks, steel chocks, epoxy resin chocks or shims?

In most of the applications the Vibracon[®] chocks will be cheaper because of:

- Reduced chocking time
- Always a perfect fitting chock
- No soft foot problems
- Installation of the Vibracon[®] chocks doesn't require special skills or tools
- Usually no machining of foundations or base frames is required

5.1.6 Where can we use the chocks?

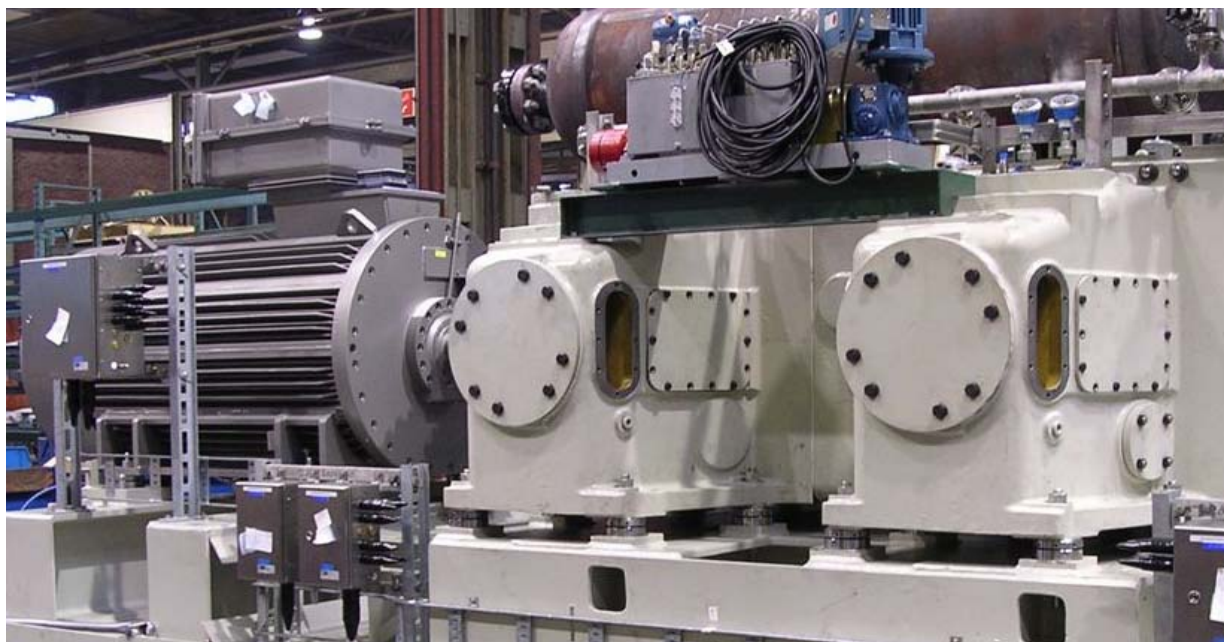


Figure 5.1.6.1 Several components mounted on Vibracon[®] chocks.



Figure 5.1.6.2 Generator of genset mounted on Vibracon[®] chocks.

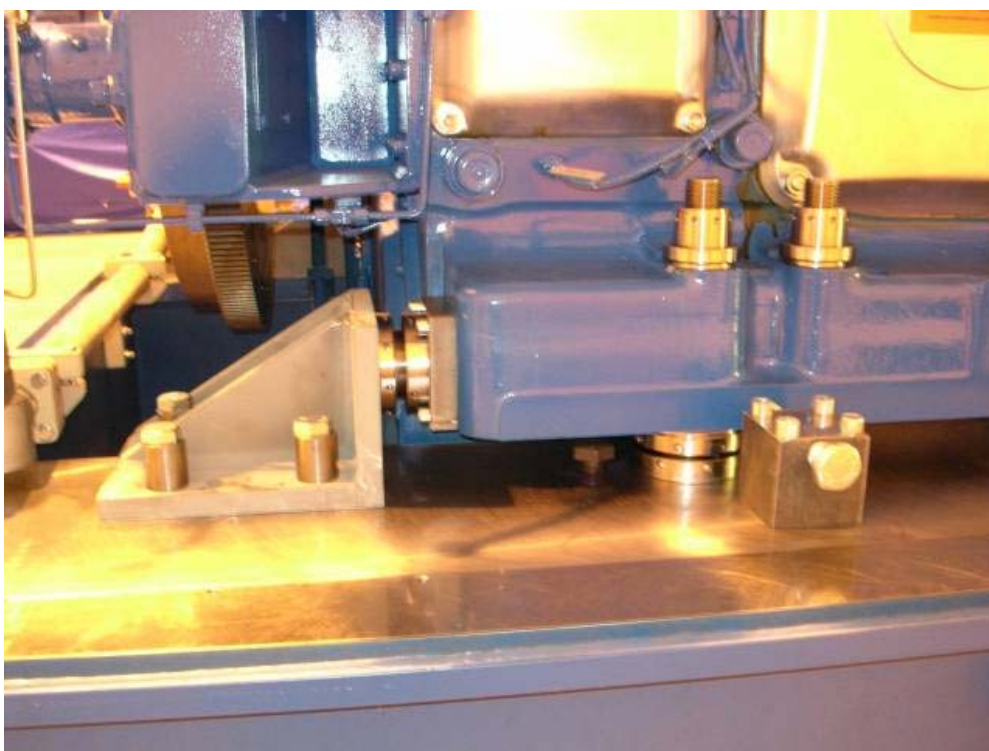


Figure 5.1.6.3 Detail of bracket with Vibracon[®] to create a fixed point (alternative for fitted bolts).



Figure 5.1.6.4 Overview of engine mounted on Vibracon® chocks on a concrete foundation.

In **production plants** the elements can be used under all kinds of rotating equipment, and also in production lines which need accurate alignment.

When Vibracon® chocks will be mounted on a concrete foundation, the maximum allowable surface pressure of the existing concrete has to be checked. In case the surface pressure will be too high then it is possible to reduce the surface pressure, with the use of an additional steel plate of sufficient surface and thickness, to an acceptable level.

5.1.7 Do we need special skills or tools to use the chocks?

Special skills or tools are not required to use Vibracon® chocks. Machine Support always advises you to contact your local dealer or Machine Support for support during the first time installation of the elements. Also, check the installation procedure (chapter 4). The use of laser alignment equipment is recommended but not necessary.

5.1.8 How do we order Vibracon® chocks?

Vibracon® chocks are always on stock at Machine Support in the Netherlands. However it is recommended to check the delivery time before ordering. Our local dealers of the elements also have some elements on stock. A list of all the distributors is available on the website from Machine Support: www.machinesupport.com.

5.2 Technical questions

5.2.1 Is it possible to chock a heavy machine on a Vibracon® chock?

Yes, the primary forces for this Vibracon® sizing consideration are:

F_{weight}	due to gravity
F_{torque}	due to the fact that the machine wants to rotate
F_{bolt}	due to the tightening torque of the foundation bolt

F_{bolt} is approximately 6 till 10 times F_{weight} and even 10 till 15 times F_{torque} .

This means that F_{bolt} is the critical force on the normal element

If we consider for example the Vibracon® SM 30 chock, we can see that we are tightening a M30 bolt against a M95 thread (internal thread size of a Vibracon® SM30). It is easy to understand that the Vibracon® chock can't be damaged by the machine forces unless the element sizes are wrongly calculated or the foundation bolts are insufficiently tightened.

5.2.2 Can we align a machine with a Vibracon chock?

No, the chocks are only meant for chocking! For aligning the machine, hydraulic tools or jack bolts are recommended. When the weight of the machine is compressing the element it will lock itself automatically due to friction in the thread.

5.2.3 How do we prevent the chock from rotating?

The Vibracon® chock will lock itself (due to friction in the thread) after the foundation bolts are tightened. It is not necessary to lock the chock in any other way.

5.2.4 Are there any limits to the chock height?

Yes, there are limits to the standard chocks. Please check in the table on the Vibracon brochure the minimum and maximum height of each type of chock. When designing a chocking arrangement, please have a look on the nominal height of the chock.

5.2.5 What to do if we want to have elements with extended height?

In this case, it is possible to use an additional bottom ring with an extended height (contact Machine Support or your local dealer). The maximum height of the chock should not exceed the diameter of the chock.

5.2.6 What to do if we want to have chocks which are lower than the minimum height?

It is allowed to reduce the Vibracon® Original to a minimum reduced height which is mentioned in chapter 6 figure 6.4.2 Reducing the height can be done on a lathe by machining the centre and bottom part of the chock. Keep in mind that the adjustment capabilities also will be reduced. At the minimum reduced height, you will only have 1 mm adjustment capability left!

5.2.7 Is it possible to enlarge the bolt holes of the Vibracon® chock?

To do so you always need approval from Machine Support and the classification society. It is allowed to enlarge the bolt hole of the elements in accordance with the following table:

Original Type	Low Profile Type	Bolt	Enlarged bolt hole (mm)
SM12		M16	17
SM16	SM16LP	M20	21
SM20	SM20LP	M24	25
SM24	SM24LP	M30	31
SM30	SM30LP	M36	37
SM36	SM36LP	M42	43
SM42	SM42LP	M48	49
SM48		M56	57
SM56		M64	65
SM64		M72	73

Figure 5.2.7 Table for enlarged bolt holes

Please contact your local dealer or Machine Support to calculate the bolt torque and recommended clamped length.

5.2.8 If we want to use fitting bolts, how should we do this?

In general, it is not necessary to ream through the Vibracon® chock. Reaming only the foot of the machine and the foundation usually will do. In some situations (for example in cases where no side and collision stoppers are installed) we also advise to ream the Vibracon® chocks. Please contact your local dealer or Machine Support for additional information on this matter.

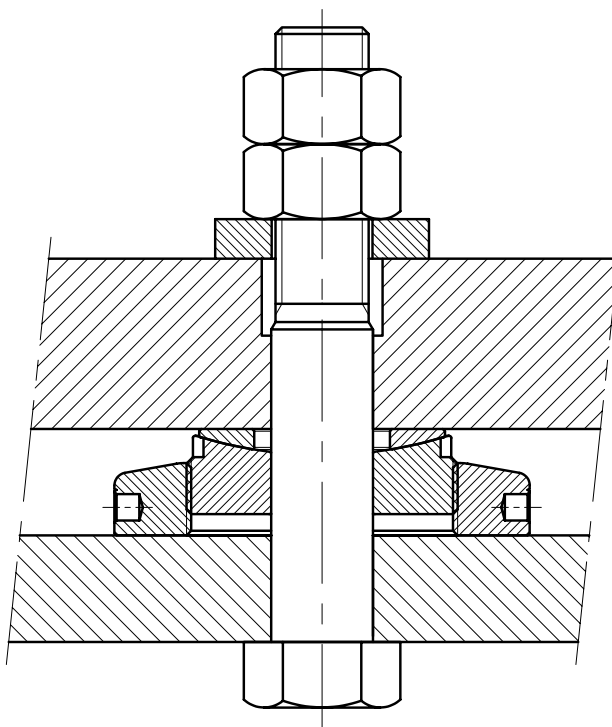


Figure 5.2.8 General arrangement for a fitted bolt

5.2.9 If we want to use dowel pins, how should we do this?

After the alignment and the securing of the foundation bolts, weld down a block of steel (which is just 1 mm lower than the chocks) near at least one of Vibracon® chocks or between two chocks. Drill a hole through the foot of the machine into this block. Now the dowel pin can be installed.

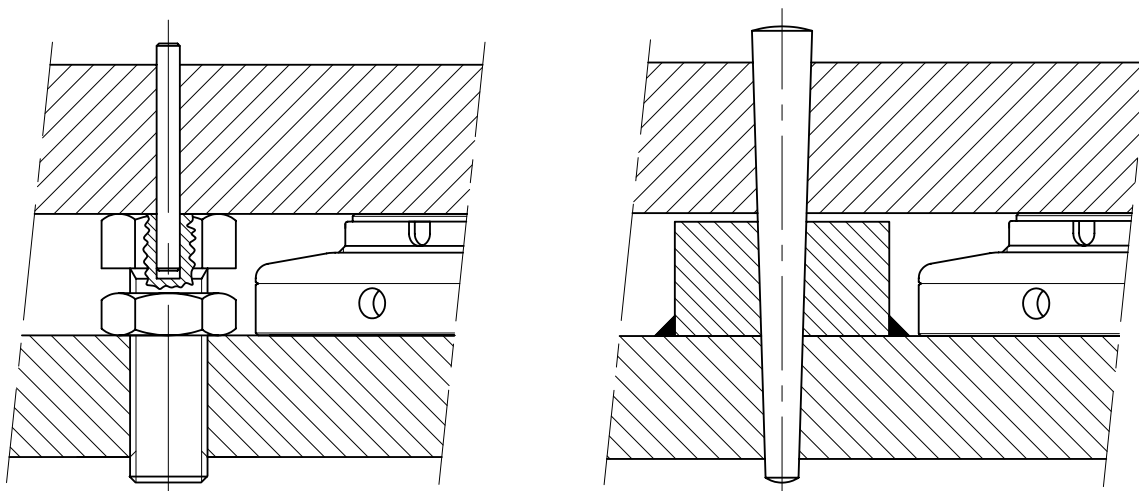


Figure 5.2.9 Alternatives for a dowel pin application

5.3 Marine application questions

5.3.1 Is the Vibracon® chock approved by classification societies?

Yes, the chock is approved by all major shipbuilding classification societies. However, it is always necessary to submit a calculation and a sketch of the chocking arrangement for approval for each application. This is mainly necessary for propulsion units and for some societies, also for auxiliary equipment. Contact your local dealer or Machine Support for assistance.

5.3.2 What information does Machine Support need to make a calculation and a sketch of the chocking arrangement?

For the production of a, free of charge, Vibracon® chocking proposal it is necessary to fill in a datasheet, which you can download from our website: www.machinesupport.com.

The following data is requested: *General*

- Yard or owner name
- Ship name or new building number
- Classification society
- Type of object
- Make / type

Machine

- Mass
- Power
- Revolutions
- Foundation width between bolts
- Number of elements
- Diameter of the existing bolt holes

Additional information when it concerns a gearbox:

- Reduction rate
- Average distance between bolt holes
- Difference in height between output shaft and foundation
- Propulsion efficiency

Drawing

- Foundation plan
- Chock height
- Thickness of machine foot
- Thickness of foundation
- Plan for fitted bolts
- Plan for steel end chocks

5.3.3 Example of a Vibracon® chocking proposal

Based on the completed datasheets, Machine Support B.V. can prepare a chocking proposal for your project. At the following pages, you will find an example of such a proposal.

		Machine Support B.V., The Netherlands																																																																																									
		Phone	: +31 (0)180 483828																																																																																								
		Fax	: +31 (0)180 483829																																																																																								
		Website	: www.machinesupport.com																																																																																								
		E-mail	: info@machinesupport.com																																																																																								
Shipyard / Customer		: Wärtsilä Nederland B.V.																																																																																									
Shipname / Project		: M.V. " Baldomero Lopez "																																																																																									
Classification society		: American Bureau of Shipping																																																																																									
Object		: Piston engine																																																																																									
Make / type		: Wärtsilä 18TM410																																																																																									
Selection of Vibracon SM element Machine <table> <tr> <td>Mass (if engine with water +oil)</td> <td>:</td> <td>145000</td> <td>(kg)</td> </tr> <tr> <td>Power</td> <td>:</td> <td>9700</td> <td>(kW)</td> </tr> <tr> <td>Revolutions</td> <td>:</td> <td>550</td> <td>(rpm)</td> </tr> <tr> <td>Foundation width (bolt distance)</td> <td>:</td> <td>20990</td> <td>(mm)</td> </tr> <tr> <td>Number of elements</td> <td>:</td> <td>24</td> <td>(-)</td> </tr> <tr> <td>Bolthole diameter</td> <td>:</td> <td>48</td> <td>(mm)</td> </tr> </table> <table> <tr> <td>Correction / Safety factor</td> <td>:</td> <td>2</td> <td>(-)</td> </tr> <tr> <td>Minimum required Vibracon SM element</td> <td>:</td> <td>42</td> <td>(-)</td> </tr> <tr> <td>Advised Vibracon SM element</td> <td>:</td> <td>42</td> <td>(-)</td> </tr> <tr> <td>Element load (maximum)</td> <td>:</td> <td>59,88</td> <td>(kN)</td> </tr> <tr> <td>Element load (minimum)</td> <td>:</td> <td>58,54</td> <td>(kN)</td> </tr> <tr> <td>Machine load</td> <td>:</td> <td>119,75</td> <td>(kN)</td> </tr> </table>				Mass (if engine with water +oil)	:	145000	(kg)	Power	:	9700	(kW)	Revolutions	:	550	(rpm)	Foundation width (bolt distance)	:	20990	(mm)	Number of elements	:	24	(-)	Bolthole diameter	:	48	(mm)	Correction / Safety factor	:	2	(-)	Minimum required Vibracon SM element	:	42	(-)	Advised Vibracon SM element	:	42	(-)	Element load (maximum)	:	59,88	(kN)	Element load (minimum)	:	58,54	(kN)	Machine load	:	119,75	(kN)																																								
Mass (if engine with water +oil)	:	145000	(kg)																																																																																								
Power	:	9700	(kW)																																																																																								
Revolutions	:	550	(rpm)																																																																																								
Foundation width (bolt distance)	:	20990	(mm)																																																																																								
Number of elements	:	24	(-)																																																																																								
Bolthole diameter	:	48	(mm)																																																																																								
Correction / Safety factor	:	2	(-)																																																																																								
Minimum required Vibracon SM element	:	42	(-)																																																																																								
Advised Vibracon SM element	:	42	(-)																																																																																								
Element load (maximum)	:	59,88	(kN)																																																																																								
Element load (minimum)	:	58,54	(kN)																																																																																								
Machine load	:	119,75	(kN)																																																																																								
Calculation of holding down bolts' torque Foundation stud bolt <table> <tr> <td>Foundation bolts</td> <td>:</td> <td>22 * M42 (L = 555 mm)</td> <td>(-)</td> </tr> <tr> <td>Material</td> <td>:</td> <td>42 CrMo 4</td> <td>(-)</td> </tr> <tr> <td>E-modul</td> <td>:</td> <td>207000</td> <td>(N/mm²)</td> </tr> <tr> <td>Yield strength</td> <td>:</td> <td>750</td> <td>(N/mm²)</td> </tr> </table> <table> <tr> <td>Elongation foundation bolt</td> <td>:</td> <td>0,92</td> <td>(mm)</td> </tr> <tr> <td>Tension per bolt</td> <td>:</td> <td>488,1</td> <td>(kN)</td> </tr> <tr> <td>Tensile stress</td> <td>:</td> <td>479,5</td> <td>(N/mm²)</td> </tr> <tr> <td>Disposable yield strength</td> <td>:</td> <td>64</td> <td>(%)</td> </tr> <tr> <td>Equivalent stress</td> <td>:</td> <td>625,0</td> <td>(N/mm²)</td> </tr> <tr> <td>Disposable yield strength < 90 %</td> <td>:</td> <td>83</td> <td>(%)</td> </tr> <tr> <td>Tightening torque</td> <td>:</td> <td>4100</td> <td>(Nm)</td> </tr> </table> Fitted stud bolt <table> <tr> <td>Fitted bolts</td> <td>:</td> <td>2 * M42 (L = 555 mm)</td> <td>(-)</td> </tr> <tr> <td>Material</td> <td>:</td> <td>42 CrMo 4</td> <td>(-)</td> </tr> <tr> <td>E-modul</td> <td>:</td> <td>207000</td> <td>(N/mm²)</td> </tr> <tr> <td>Yield strength</td> <td>:</td> <td>750</td> <td>(N/mm²)</td> </tr> </table> <table> <tr> <td>Elongation of fitted bolt</td> <td>:</td> <td>0,76</td> <td>(mm)</td> </tr> <tr> <td>Tension per bolt</td> <td>:</td> <td>488,1</td> <td>(kN)</td> </tr> <tr> <td>Tensile stress</td> <td>:</td> <td>479,5</td> <td>(N/mm²)</td> </tr> <tr> <td>Disposable yield strength</td> <td>:</td> <td>64</td> <td>(%)</td> </tr> <tr> <td>Equivalent stress</td> <td>:</td> <td>625,0</td> <td>(N/mm²)</td> </tr> <tr> <td>Disposable yield strength < 90%</td> <td>:</td> <td>83</td> <td>(%)</td> </tr> <tr> <td>Tightening torque</td> <td>:</td> <td>4100</td> <td>(Nm)</td> </tr> </table>				Foundation bolts	:	22 * M42 (L = 555 mm)	(-)	Material	:	42 CrMo 4	(-)	E-modul	:	207000	(N/mm ²)	Yield strength	:	750	(N/mm ²)	Elongation foundation bolt	:	0,92	(mm)	Tension per bolt	:	488,1	(kN)	Tensile stress	:	479,5	(N/mm ²)	Disposable yield strength	:	64	(%)	Equivalent stress	:	625,0	(N/mm ²)	Disposable yield strength < 90 %	:	83	(%)	Tightening torque	:	4100	(Nm)	Fitted bolts	:	2 * M42 (L = 555 mm)	(-)	Material	:	42 CrMo 4	(-)	E-modul	:	207000	(N/mm ²)	Yield strength	:	750	(N/mm ²)	Elongation of fitted bolt	:	0,76	(mm)	Tension per bolt	:	488,1	(kN)	Tensile stress	:	479,5	(N/mm ²)	Disposable yield strength	:	64	(%)	Equivalent stress	:	625,0	(N/mm ²)	Disposable yield strength < 90%	:	83	(%)	Tightening torque	:	4100	(Nm)
Foundation bolts	:	22 * M42 (L = 555 mm)	(-)																																																																																								
Material	:	42 CrMo 4	(-)																																																																																								
E-modul	:	207000	(N/mm ²)																																																																																								
Yield strength	:	750	(N/mm ²)																																																																																								
Elongation foundation bolt	:	0,92	(mm)																																																																																								
Tension per bolt	:	488,1	(kN)																																																																																								
Tensile stress	:	479,5	(N/mm ²)																																																																																								
Disposable yield strength	:	64	(%)																																																																																								
Equivalent stress	:	625,0	(N/mm ²)																																																																																								
Disposable yield strength < 90 %	:	83	(%)																																																																																								
Tightening torque	:	4100	(Nm)																																																																																								
Fitted bolts	:	2 * M42 (L = 555 mm)	(-)																																																																																								
Material	:	42 CrMo 4	(-)																																																																																								
E-modul	:	207000	(N/mm ²)																																																																																								
Yield strength	:	750	(N/mm ²)																																																																																								
Elongation of fitted bolt	:	0,76	(mm)																																																																																								
Tension per bolt	:	488,1	(kN)																																																																																								
Tensile stress	:	479,5	(N/mm ²)																																																																																								
Disposable yield strength	:	64	(%)																																																																																								
Equivalent stress	:	625,0	(N/mm ²)																																																																																								
Disposable yield strength < 90%	:	83	(%)																																																																																								
Tightening torque	:	4100	(Nm)																																																																																								

MS REF. NUMBER : E-02-1313-01a-RV

MS-F-331 BLAD 1/1 REV.00 D.D. 01.08.2001

Figure 5.3.3.1 Example of Vibracon[®] calculation report

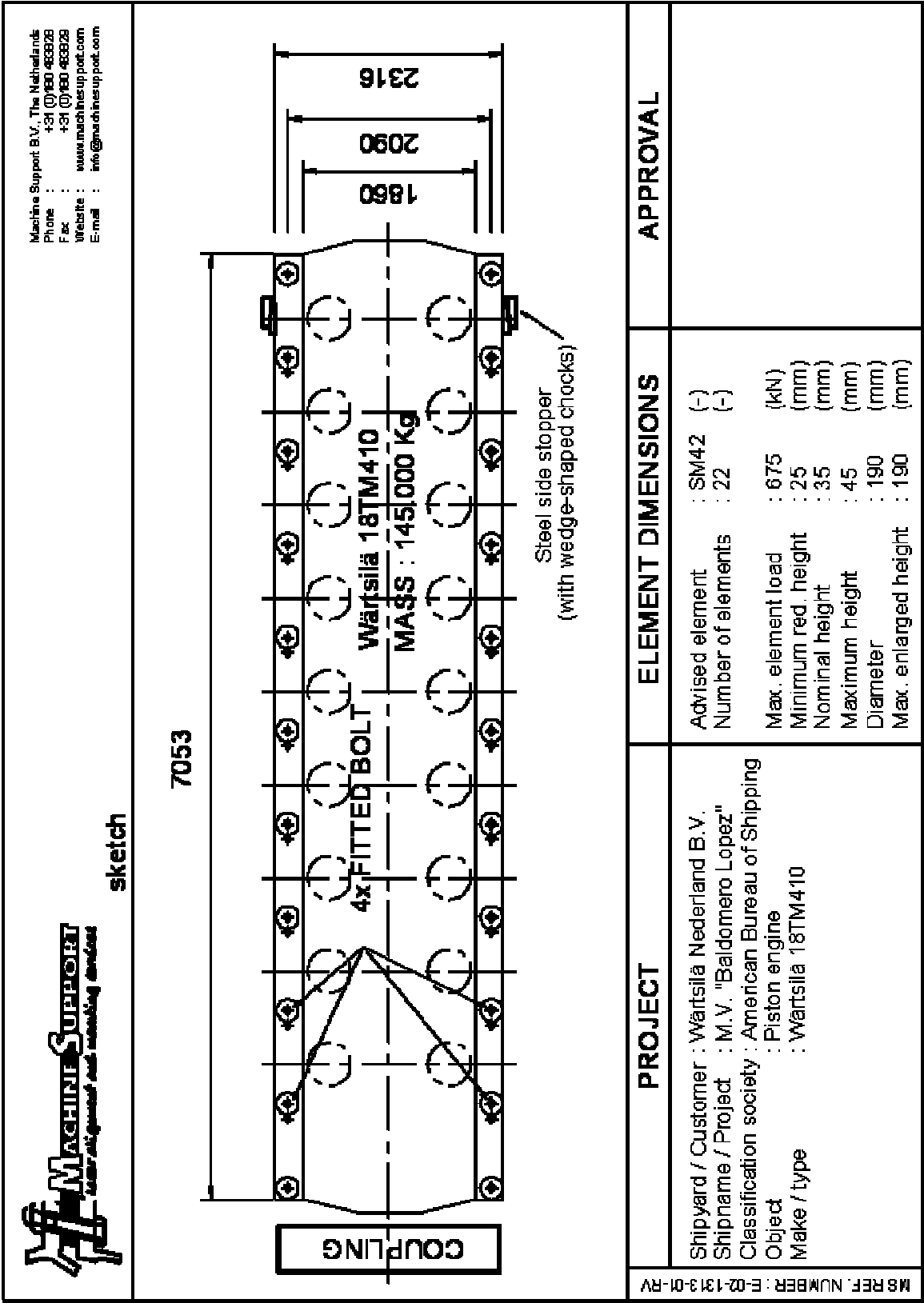


Figure 5.3.3.2 Example of Vibracon® calculation top view

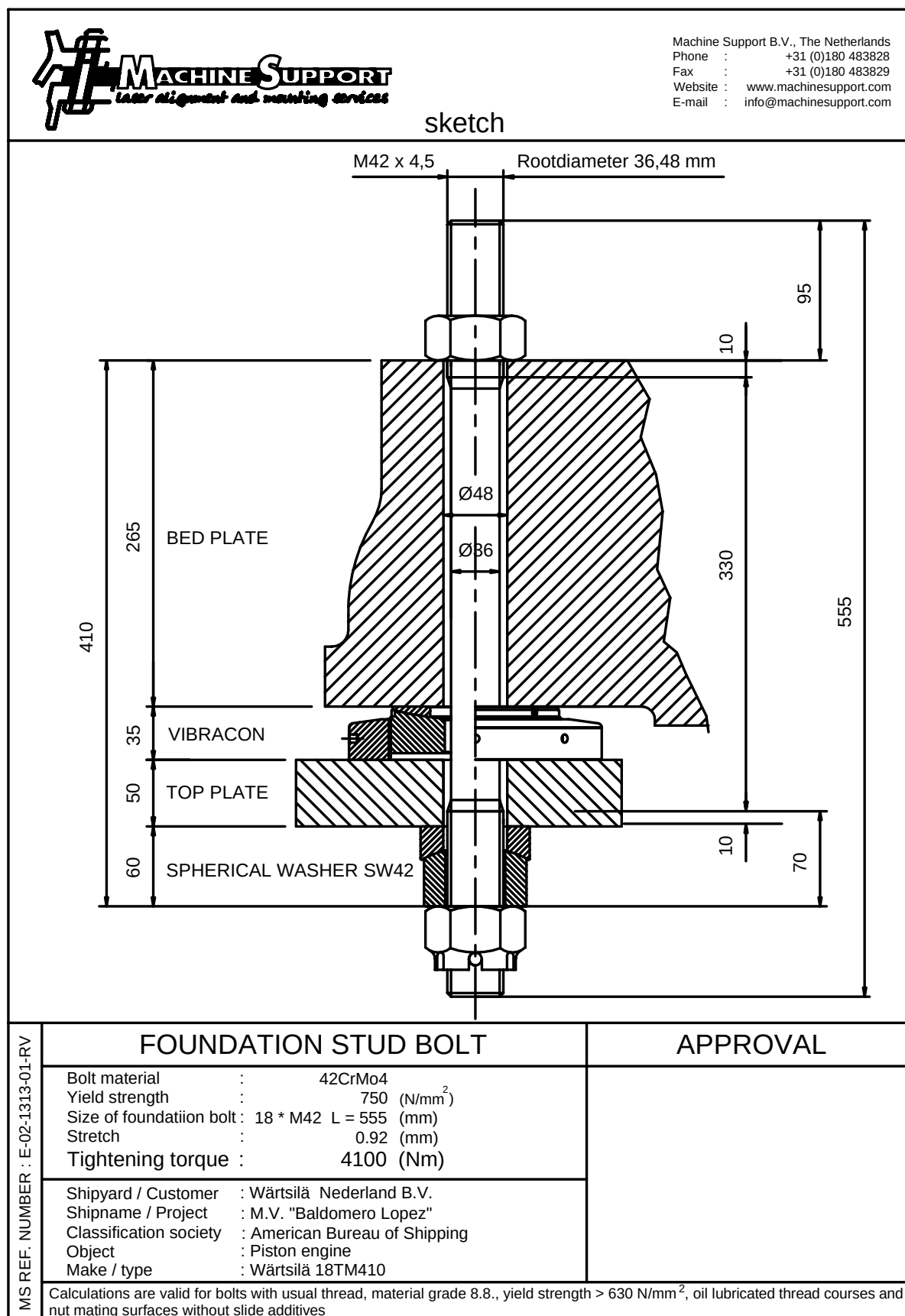
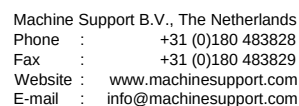


Figure 5.3.3.3 Example of Vibracon[®] calculation cross section of foundation bolt



MS REF. NUMBER : E-02-1313-01-RV	FITTED BOLT		APPROVAL
	Bolt material	: 42CrMo4	
	Yield strength	: 750 (N/mm ²)	
	Size of fitted bolt	: 4 * M42 L = 555 (mm)	
	Stretch	: 0.76 (mm)	
	Tightening torque	: 4100 (Nm)	
	Shipyards / Customer	: Wärtsilä Nederland B.V.	
	Shipname / Project	: M.V. "Baldomero Lopez"	
Classification society	: American Bureau of Shipping		
Object	: Piston engine		
Make / type	: Wärtsilä 18TM410		
Calculations are valid for bolts with usual thread, material grade 8.8., yield strength > 630 N/mm ² , oil lubricated thread courses and nut mating surfaces without slide additives			

Figure 5.3.3.4 Example of Vibracon® calculation cross section of fitted bolt.

5.3.4 What bolt torque should we apply?

Machine Support has developed bolt torque calculation software in close cooperation with original equipment manufacturers and classification societies. The philosophy of the calculating software is to reach a minimum bolt elongation (stretch) of 0.20 mm in the bolted connection. The bolts are to be tightened within the elastic range of the bolt material, in general Machine Support advises a maximum bolt tension related to 75% of the yield strength of the bolt material.

The values stated in our Vibracon[®] brochure are based on the above mentioned calculations rules. The mentioned values are valid for bolts with course thread, material grade 8.8, yield strength > 630 N/mm², oil lubricated thread courses and nut mating surfaces without slide additives.

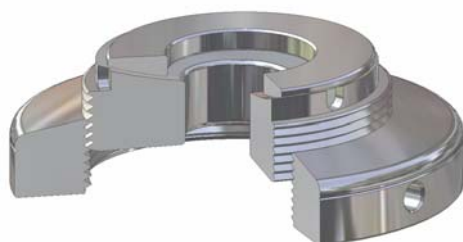
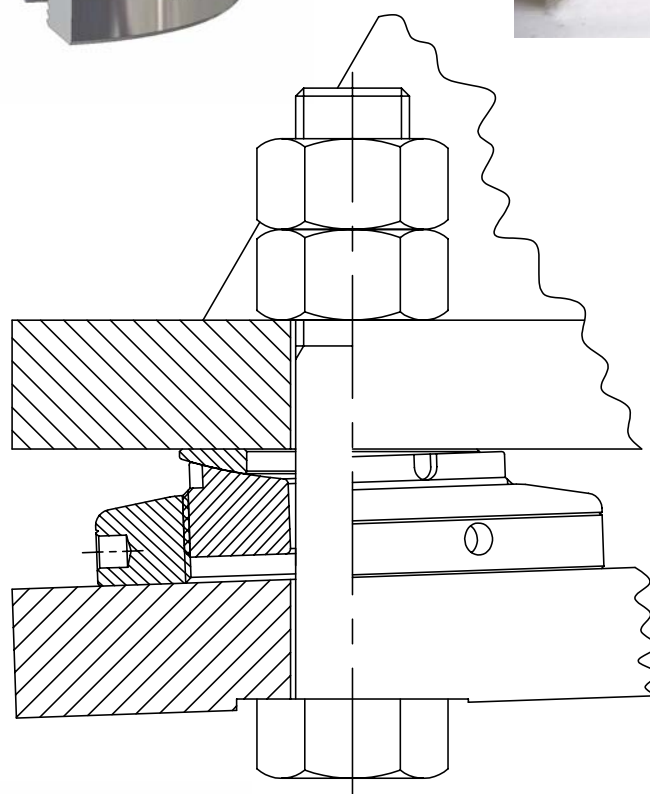
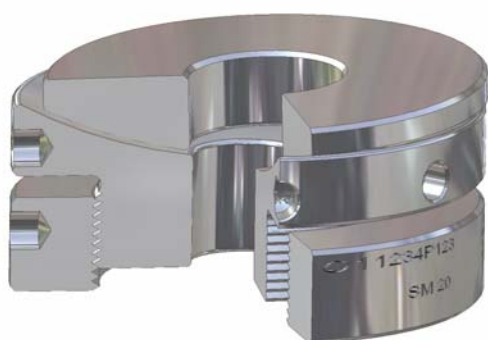
As a service to our customers, Machine Support offers you a chocking proposal, with the advised tightening torque included, for your application **free of charge!**



An SKF Group Company



Vibracon® ***Application Design Instructions***



6 <i>Vibracon® Application Design Instructions</i>
--

6.1	<i>CHOOSING THE ELEMENT SIZE.....</i>	3
6.2	<i>DETERMINING THE BOLT TORQUE AND LENGTH</i>	5
6.3	<i>MACHINING THE FOUNDATION: YES OR NO?</i>	6
6.4	<i>REDUCING THE HEIGHT OF THE VIBRACON® SM CHOCKS.....</i>	7
6.5	<i>EXTENDING THE HEIGHT OF THE CHOCKS.....</i>	8
6.6	<i>ENLARGING THE BOLT HOLE OF THE VIBRACON® CHOCK.....</i>	9
6.7	<i>FITTED BOLTS</i>	9
6.8	<i>GENERAL ARRANGEMENT INFORMATION VIBRACON® ORIGINAL</i>	10
6.9	<i>GENERAL ARRANGEMENT INFORMATION VIBRACON® LOW PROFILE</i>	12

6 Application design instructions

As a service to our customers, Machine Support offers you the engineering of a chocking proposal for your application free of charge. To receive a chocking proposal please take a look at chapter 2 paragraph 2.1 "How to get a Vibracon® chocking proposal free of charge"

This chapter is a guideline to design applications with Vibracon® chocks. The basic designs we are showing here, are approved by most shipbuilding classification societies, if not we will indicate this.

6.1 Choosing the element size

In general, we advise you to follow the machine designer's rules of foundation bolts. If for example an E-motor should be secured with M36 foundation bolts than just use SM36 Vibracon® chocks. It is always possible to request a detailed calculation of the size of chocks. Machine Support BV has special software for calculating the chock size and bolt data.

Starting to design a Vibracon® chocks application:

- check with all involved parties (machine manufacturer, shipyard, owner, classification society) if they approve on the use of the Vibracon®;
- inform your local dealer or Machine Support if there are any objections against the use of the elements;
- check the available chock height, for new installations we advise to use the nominal element height as the engineering height;
- check the bolt dimension;
- check the minimum distance between two bolts (minimum pitch);
- make sure that the bottom ring of the chock is fully supported;
- make sure that at least 75% of the top part of the chock is covered by the foot of the machine;
- if the pre-selected chock doesn't fit in your application please inform your local dealer or Machine Support.

For critical applications like propulsion units or large equipment (over 20 tons) we advise you to contact your local dealer or Machine Support for a detailed calculation and sound advice.

The method for determining the size of elements is based on the calculation of two forces:

$$F_{\text{weight}} = \frac{M \times 9.81}{n \times 1000} \quad (1)$$

$$F_{\text{torque}} = \frac{P}{R \times W \times 0.5 n} \times \frac{60000}{2 \times \pi} \quad (2)$$

Where: F_{weight} = Force due to the weight of the machine (kN)
 F_{torque} = Force due to the reaction torque of the machine (kN)
 M = Mass (kg)
 n = Number of elements (use all bolt holes, unless machine manufacturer has given his approval to reduce the number of bolts).
 P = Power (kW)
 R = Revolutions (rpm)
 W = Width of foundation, measured between bolt holes (mm)

When the chock dimension has to be calculated for a gearbox, it is preferred that the gearbox manufacturer submits the data for the maximum and minimum force on each bolt position.

If the gearbox manufacturer is not able to give these figures Machine Support can calculate these based on introducing a thrust force factor in combination with a tilting line.

The total machine load on the element is now:

$$F_{\text{vibracon}} = S \times (F_{\text{weight}} + F_{\text{torque}} + F_{\text{thrust}}) \quad (3)$$

Where S is a safety factor which is:

- 1.5 for non-reciprocating machinery like generators, E-motors and gearboxes.
- 2 for reciprocating machinery like diesel engines and reciprocating compressors.

After we have determined the machine load on the element it is possible to select a **minimum** size of Vibracon® chock with the "Standard Vibracon® Original general design table" figure 6.6.2 of chapter 6 or for the low profile configuration with the "Standard Vibracon® Low Profile general design table" figure 6.7.2 of chapter 6.

Very Important: If the size of the Vibracon® chock is smaller than the corresponding size of the bolt which the manufacturer has determined, then please select the chock that fits to this bolt size.

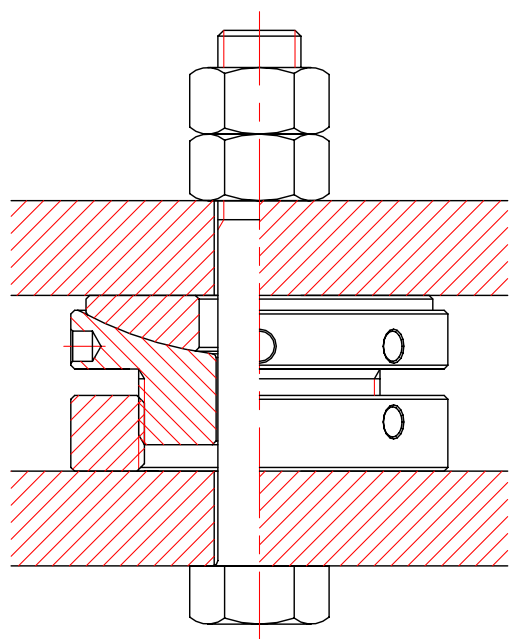


Figure 6.1.1 General arrangement of Vibracon®
Original

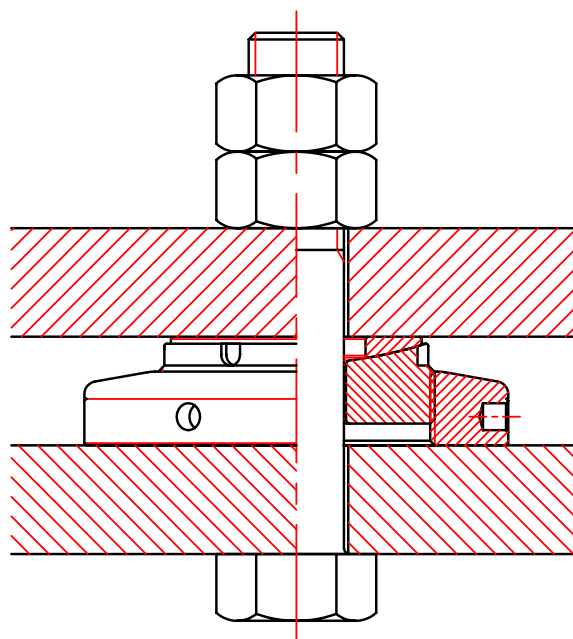


Figure 6.1.2 General arrangement of Vibracon®
Low Profile

6.2 Determining the bolt torque and length

We advise to use 8.8 graded bolts, yield strength $> 630 \text{ N/mm}^2$, in Vibracon® applications. The advised bolt torque can be found in the "Standard Vibracon® Original general design table" figure 6.6.2 or for the low profile configuration with the "Standard Vibracon® Low Profile general design table" figure 6.7.2 of chapter 6.

We advise to ensure that the foundation bolt has a minimum elongation of: **0.20 mm**

There are several alternatives to get enough elongation in the foundation bolt, the commonly used are mentioned below:

1. Creating enough clamping length by using an extension sleeve;
2. Reducing the shank diameter (contact your local dealer or Machine Support for a calculation of the elongation).

The clamping length is the total distance between bolt head and nut, this distance is equal to the sum of:

- Machine foot thickness (bed plate thickness)
- Final Vibracon® height
- Foundation thickness (top plate thickness)
- Extension sleeve height (alternatively the length of the spherical washer)

Machine Support recommends the use of so called spherical washers, of which the final height will be determined after the alignment has been performed, to ensure 100% mating surface of bolt head and nut mating surface to prevent bending stresses in the bolt connection.

If spherical washers are used ensure yourself that the mating surfaces are convex / concave instead of convex / conical!

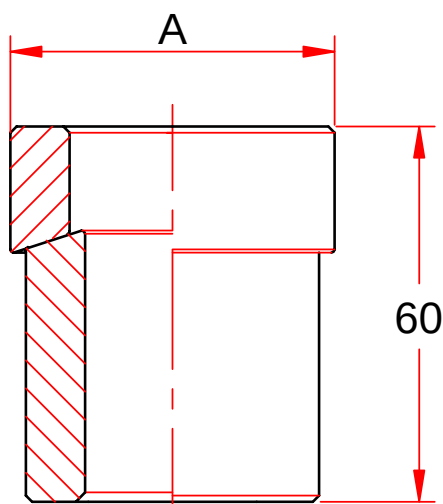


Figure 6.2.1 Machine Support Spherical Washers (SW)

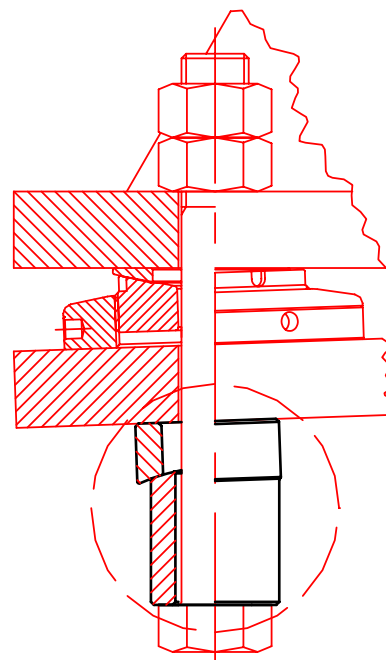


Figure 6.2.2 General arrangement of Machine Support Spherical Washers (SW)

Material: Alloy Steel DIN 1.7225 (other materials on request).

Article no.	Diameter (A)
SW16	33 mm
SW20	42 mm
SW24	47 mm
SW27	52 mm
SW30	56 mm
SW36	67 mm
SW42	82 mm
SW48	92 mm
SW56	102 mm
SW64	112 mm

Figure 6.2.3 Machine Support Spherical Washers (SW) table

The height of the Spherical Washer is 60 mm for all types.

6.3 Machining the foundation: Yes or No?

Before installing the chocks on a foundation, it should be checked for its quality:

- The bottom ring area of the Vibracon® should be covered by the foundation for 100%. The spherical top part of the chock must have at least 75% contact with machine foot;
- Foundation roughness should be sandblasted quality of Sa 2.5 minimum or machined Ra 6.3;
- To check the flatness of the top plate of the foundation, at the location of the Vibracon®, a feeler gauge of 0.05 is to be used to fit the circumference of the bottom ring of the element;
- The contact surface between foundation and bottom ring of the Vibracon® should be checked using the bottom ring of the element until a evenly distributed load bearing surface of a minimum which is given by the machinery manufacturer or classification society. In all other cases we recommend a minimum load bearing surface of 75%;
- The taper between foundation and machine feet should be less than 4°;
- The foundation and machine foot should be free from paint and grease.

If machining of the foundation is necessary, Machine Support can offer you the service to execute the machining with the component in position. Minimum required height is approx. 60 mm. With a special developed machining tool, the seating area of the Vibracon® bottom ring will be faced.

6.4 Reducing the height of the Vibracon® chocks

It is possible to reduce the height of the Vibracon® Original chocks, but this will also reduce the adjustment capability. Don't exceed the minimum reduced height as mentioned on the table on the Vibracon® brochure. Both centre part and bottom part of the chock have to be machined to reduce the height.

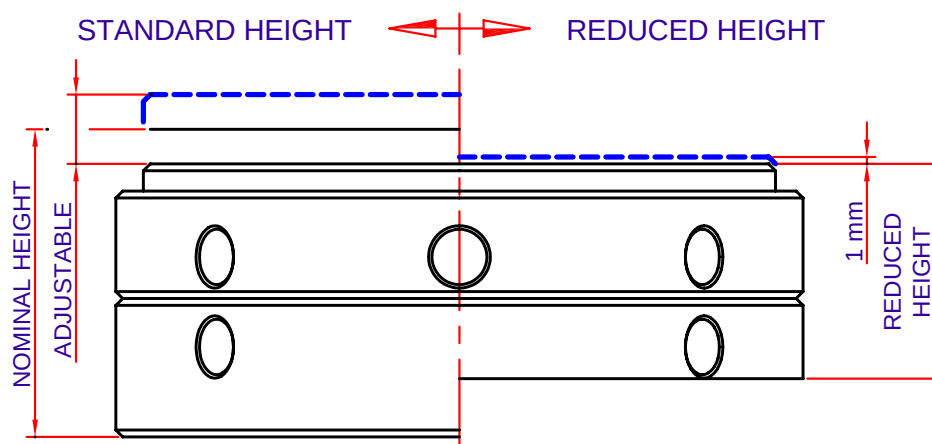


Figure 6.4.1 Reduced height of Vibracon® chock

Type	Nominal height (mm)	Adjustability (mm)	Reduced height (mm)	Adjustability (mm)
SM12	34	8	23	1
SM16	40	10	26	1
SM20	45	12	31	1
SM24	51	12	34	1
SM30	56	12	39	1
SM36	61	12	44	1
SM42	66	12	49	1
SM48	77	15	56	1
SM56	82	15	61	1
SM64	87	15	66	1

Figure 6.4.2 Vibracon® chock with reduced height

If you intend to reduce the Vibracon® Low Profile configuration please contact Machine Support for advise!

6.5 Extending the height of the chocks

It is also possible to order additional bottom parts for Vibracon® chocks. As a rule of thumb, the final height of the chock should not exceed the diameter of the chock.

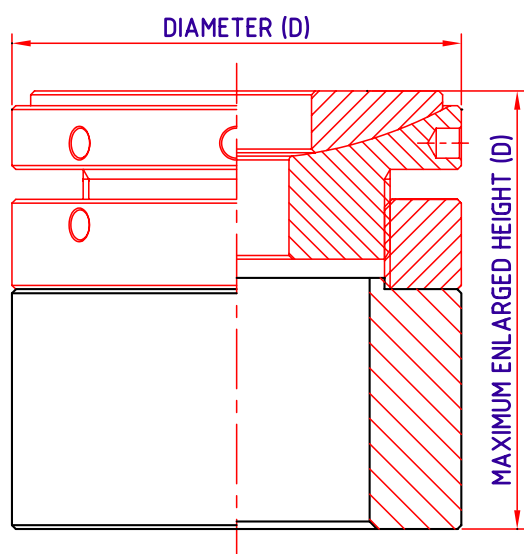


Figure 6.5.1 Extended Vibracon® Original

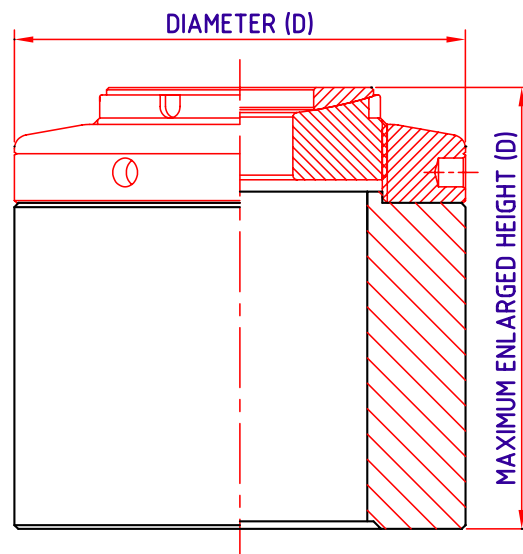


Figure 6.5.2 Extended Vibracon® Low profile

Material: DIN 1.0570 / 1.1191

Article no.	Height additional ring	Max. enlarged height (D) Vibracon® Original	Max. enlarged height (D) Vibracon® Low Profile
SM12EV	22 mm	60 mm	Not available
SM16EV	35 mm	80 mm	65 mm
SM20EV	50 mm	100 mm	80 mm
SM24EV	63 mm	120 mm	93 mm
SM30EV	78 mm	140 mm	108 mm
SM36EV	93 mm	160 mm	133 mm
SM42EV	118 mm	190 mm	163 mm
SM48EV	135 mm	220 mm	Not available
SM56EV	140 mm	230 mm	Not available
SM64EV	155 mm	250 mm	Not available

Figure 6.5.3 Additional bottom ring table

Additional Bottom Ring to be used together with the Vibracon® Original and Low Profile chocks

On request, Vibracon® chocks can be supplied with an extended base plate.

6.6 Enlarging the bolt hole of the Vibracon® chock

For this you always need approval from Machine Support and classification society. It is allowed to enlarge the bolt hole of the chocks in accordance with the following table:

Type	Bolt (M-size)	Enlarged bolt hole (mm)
SM12	16	17
SM16 / SM16LP	20	21
SM20 / SM20LP	24	25
SM24 / SM24LP	30	31
SM30 / SM30LP	36	37
SM36 / SM36LP	42	43
SM42 / SM42LP	48	49
SM48	56	57
SM56	64	65
SM64	72	73

Figure 6.6 Table for enlarged bolt holes

6.7 Fitted bolts

The use of fitted bolts with Vibracon® chocks can be done. It is up to the designer to decide if he wants to ream the elements as well. Machine Support advises reaming of the elements only when there are no dowel pins drilled or if no stoppers are installed around the component. Machine Support can supply special elements with a smaller hole diameter.

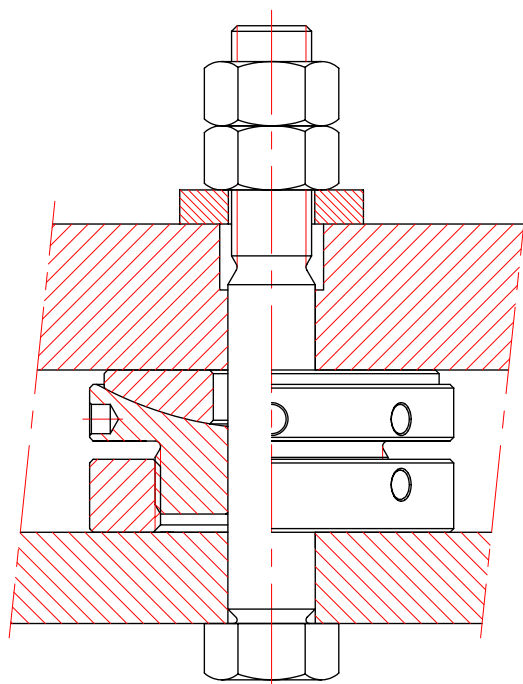


Figure 6.7.1 General arrangement of Vibracon®
Original

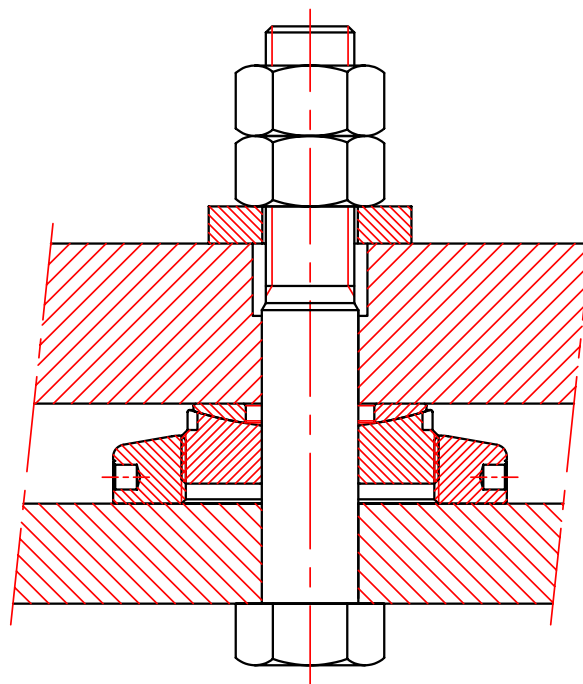


Figure 6.7.2 General arrangement of Vibracon®
Low Profile

The transmission of the propeller thrust to the ship's structure must to be achieved via front and rear stoppers. Fitted bolts must be provided exclusively for fixing and securing the plant components: they must not be taken into account in the transmission of propeller thrust.

6.8 General arrangement information *Vibracon® Original*

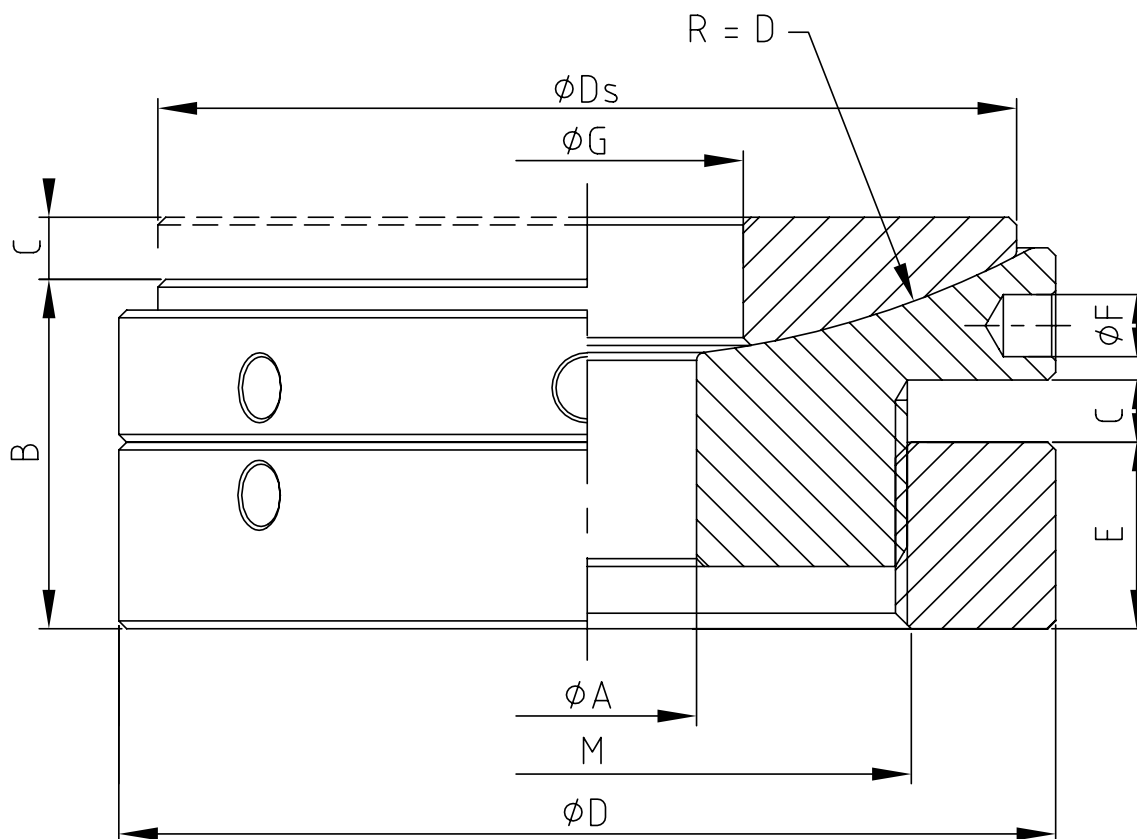


Figure 6.8.1 Vibracon® Original

Type		SM12		SM16		SM20		SM24		SM30		SM36		SM42		SM48		SM56		SM64	
Bolt size		M12	M14	M16	M18	M20	M22	M24	M27	M30	M33	M36	M39	M42	M45	M48	M52	M56	M60	M64	M68
Dimensions																					
	A (mm)	15		19		23		28		34		40		46		54		62		70	
	B (mm)	30		35		40		45		50		55		60		70		75		80	
	B min.	23		26		31		34		39		44		49		56		61		66	
	C (mm)	8		10		10		12		12		12		12		15		15		15	
	D (mm)	60		80		100		120		140		160		190		220		230		250	
	Ds (mm)	54		74		92		110		130		145		175		205		217		235	
	E (mm)	15		18		20		24		26		31		36		43		44		48	
	F (mm)	6		6		8		8		10		10		10		10		12		12	
	G (mm)	20		26		32		40		48		58		68		80		84		95	
	M (mm)	42 x 1		52 x 1.5		64 x 2		82 x 2		95 x 2		110 x 2		130 x 2		160 x 3		170 x 3		190 x 3	
	R (mm)	60		80		100		120		140		160		190		220		230		250	
Formula																					
Critical bolt force (8.8) $F_{0.2} = 0.785 \times d_k^2 \times 627$	(kN)	48	66	90	110	141	176	203	268	325	406	476	572	655	767	863	1035	1195	1396	1580	1810
Design load Fd $F_d = 1.25 \times F_{0.2}$	(kN)	60	82	113	137	176	221	254	335	407	507	595	715	819	959	1078	1294	1494	1745	1975	2262
Bolt tension Fb $F_b = 0.75 \times F_{0.2}$	(kN)	36		68		106		152		244		357		491		647		896		1185	
$F_b = F_e - F_m$	(kN)		40		75		115		165		265		385		555		690		925		1200
Machine load Fm max. allowed machine load	(kN)	8		15		25		35		60		90		120		160		225		300	
Shear at thread in element $= F_d / (3.142 \times M \times (E-C))$	(N/mm ²)	68,0	93,4	90,0	109,4	95,7	119,7	85,8	113,0	101,0	125,9	93,5	112,4	85,8	100,5	79,2	95,0	99,5	116,2	103,1	118,1
Load element / bed plate $= F_d / (0.785 \times (D^2 - M^2))$	(N/mm ²)	47,6	65,3	42,5	51,7	40,8	51,0	44,9	59,2	51,7	64,5	58,9	70,8	56,5	66,2	62,7	75,2	82,4	96,3	99,0	113,4
Load element / machine $= F_d / (0.785 \times (D_s^2 - G^2))$	(N/mm ²)	34,3	47,1	32,7	39,7	32,4	40,5	32,7	43,0	37,3	46,5	45,0	54,1	41,7	48,8	39,8	47,8	49,0	57,2	56,1	64,2
Load at spherical part $= F_d / (0.785 \times (M^2 - (G+2)^2))$	(N/mm ²)	59,4	81,6	74,9	91,0	76,4	95,6	65,2	85,9	79,4	99,0	89,1	107,2	86,9	101,8	72,8	87,3	88,5	103,4	94,3	108,0
Foundation bolt torque (max) $M_a = F_b(\max) \times dM / C \quad (C=5000)$	(Nm)	86	112	217	270	423	506	732	891	1464	1749	2570	3003	4126	4995	6211	7176	10038	10360	15168	16320
To become 0,25 mm elongation min. required clamping length	(mm)	163	199	153	176	153	171	154	180	150	167	148	161	146	148	145	159	142	158	140	157
Foundation bolt torque (min) clamping length 150 mm, elongation 0,2 mm $M_a = F_b(\min) \times dM / C \quad (C=5000)$	(Nm)	69	90	174	216	339	405	584	713	1171	1399	2056	2402	3300	3996	4969	5741	8028	8880	12134	13056
Maximum element force Fe max. allowed element force	(kN)	48		90		140		200		325		475		675		850		1150		1500	

Calculations are valid for bolts with usual thread, material grade 8.8, yield strength >630 N/mm², oil-lubricated thread courses and nut mating surfaces without slide additives

Figure 6.8.2 Standard Vibracon® Original general design table

6.9 General arrangement information *Vibracon*® Low Profile

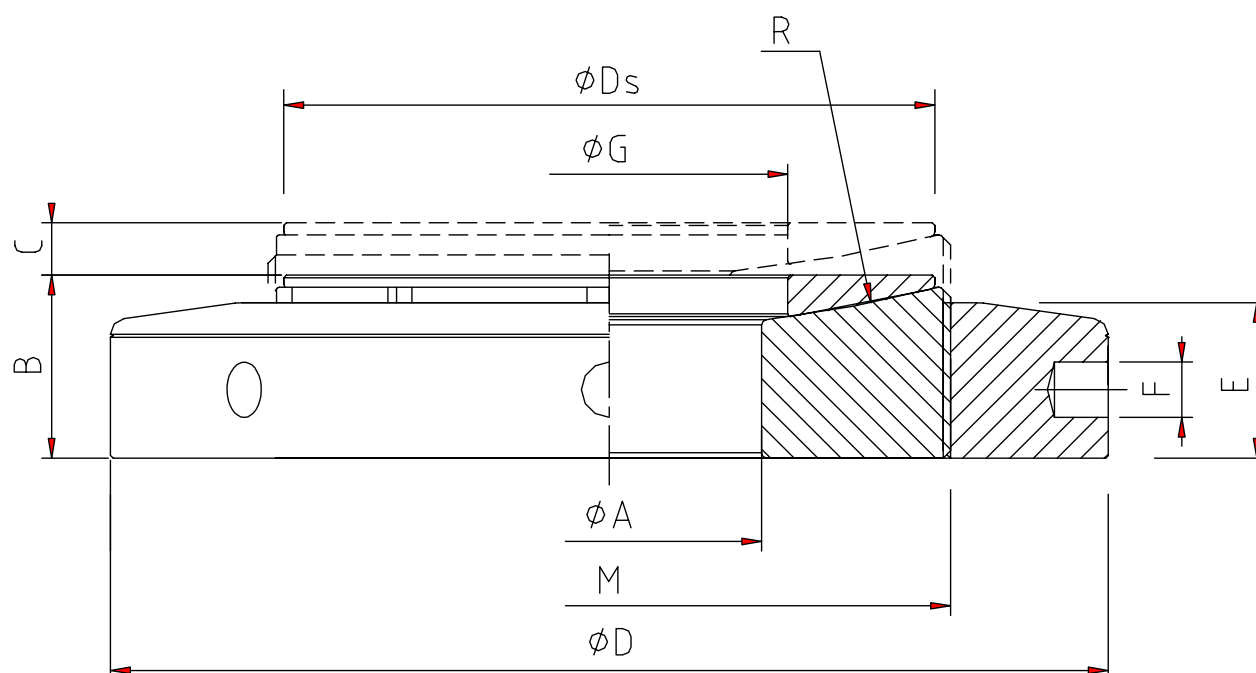
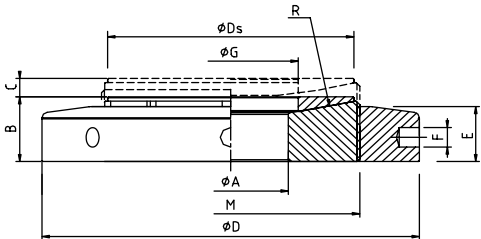


Figure 6.9.1 *Vibracon*® Low Profile dimensions

		Material DIN 1.7225											
Type		SM16LP		SM20LP		SM24LP		SM30LP		SM36LP		SM42LP	
Bolt size		M16	M18	M20	M22	M24	M27	M30	M33	M36	M39	M42	M45
Dimensions													
	A (mm)	19		23		29		35		40		46	
	B (mm)	20		20		20		20		30		35	
	C (mm)	10		10		10		10		10		10	
	D (mm)	80		100		120		140		160		190	
	Ds (mm)	46		58		76		90		104		124	
	E (mm)	17		17		17		17		27		32	
	F (mm)	6,2		6,2		6,2		6,2		6,2		6,2	
	G (mm)	26		32		40		48		58		68	
	M (mm)	52 x 1,5		64 x 2		82 x 2		95 x 2		110 x 2		130 x 2	
	R (mm)	100		100		100		250		250		250	
Minimum standard height	(mm)	20		20		20		20		30		35	
Nominal standard height	(mm)	25		25		25		25		35		40	
Maximum standard height	(mm)	30		30		30		30		40		45	
Formula													
Critical bolt force (8.8) $F_{0.2} = 0.785 \times dk^2 \times 627$	(kN)	90	110	141	176	203	268	325	406	476	572	655	767
Design load Fd $F_d = F_{0.2}$	(kN)	90		140		200		325		475		675	
Proof load (maximum height) F_p	(kN)	248		320		373		609		1626		2499	
Bolt tension Fb $F_b = 0.75 \times F_{0.2}$ $F_b = F_e - F_m$	(kN) (kN)	68 75		106 115		152 165		244 265		357 385		491 555	
Machine load Fm max. allowed machine load	(kN)	15		25		35		60		90		120	
Shear at thread in element $= (F_b + F_m) / (\pi \times M \times (E - C))$	(N/mm ²)	72,1	78,7	92,9	99,5	103,8	110,9	145,4	155,6	76,1	80,9	68,0	75,1
Load element / top plate foundation $= (F_b + F_m) / (0.785 \times (D^2 - M^2))$	(N/mm ²)	28,4	31,0	28,2	30,2	31,1	33,2	36,6	39,2	42,2	44,8	40,6	44,8
Load element / bedplate machine $= (F_b + F_m) / (0.785 \times (D_s^2 - G^2))$	(N/mm ²)	73,0	79,6	71,2	76,2	57,1	61,0	66,8	71,4	76,4	81,2	72,4	80,0
Load at spherical part inside element $= (F_b + F_m) / (2 \times \pi \times R \times h)$	(N/mm ²)	71,8	78,3	69,1	74,0	54,4	58,1	68,1	72,9	75,3	80,0	70,9	78,3
Foundation bolt torque (max) $M_a = F_b(\max) \times M / C \quad (C = 5000)$	(Nm)	215	270	420	500	730	890	1460	1745	2570	3000	4125	4995
To become 0,25 mm elongation min. required clamping length	(mm)	153	176	153	171	154	180	150	167	148	161	146	148
Foundation bolt torque (min) clamping length 150 mm, elongation 0,2 mm $M_a = F_b(\min) \times M / C \quad (C=5000)$	(Nm)	174	216	339	405	584	713	1171	1399	2056	2402	3300	3996
Maximum element load Fe max. allowed element force	(kN)	90		140		200		325		475		675	

Calculations are valid for bolts with usual thread, material grade 8.8, yield strength > 630 N/mm², oil-lubricated thread courses and nut mating surfaces without slide additives

Figure 6.9.2 Standard Vibracon® Low Profile general design table