Standard Supports 2020

LISEGA

Standard Supports 2020

Edition: September 2018

The LISEGA product program covers all components required for the implementation of modern concepts in the support of pipe systems.

These components correspond to the LISEGA standardization philosophy and are organized in a modular system with load and attachment compatibility.

Containing the complete product program, this catalog is in full compliance with LICAD, the LISEGA pipe support design program.

The catalog and LICAD can be downloaded from www.lisega.de.

LISEGA reserves the right to introduce revisions in the interest of further technical development.

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(LISEGA affiliate for fasteners)

Standard Supports 2020

Performance with System

Customers and their suppliers depend on each other for mutual success. We at LISEGA want to show ourselves to be partners of value to our customers with a comprehensive and effective performance package. We are prepared to provide top performance day in and day out. Our goal is customer satisfaction and only if we achieve that objective are we satisfied too – that's where our motivation is coming from.

Right from the beginning, some five decades ago, we have concentrated exclusively on pipe supports, thoroughly and comprehensively.

The quality and efficient utilization of our products are just as important to us as our reliability and low application costs.

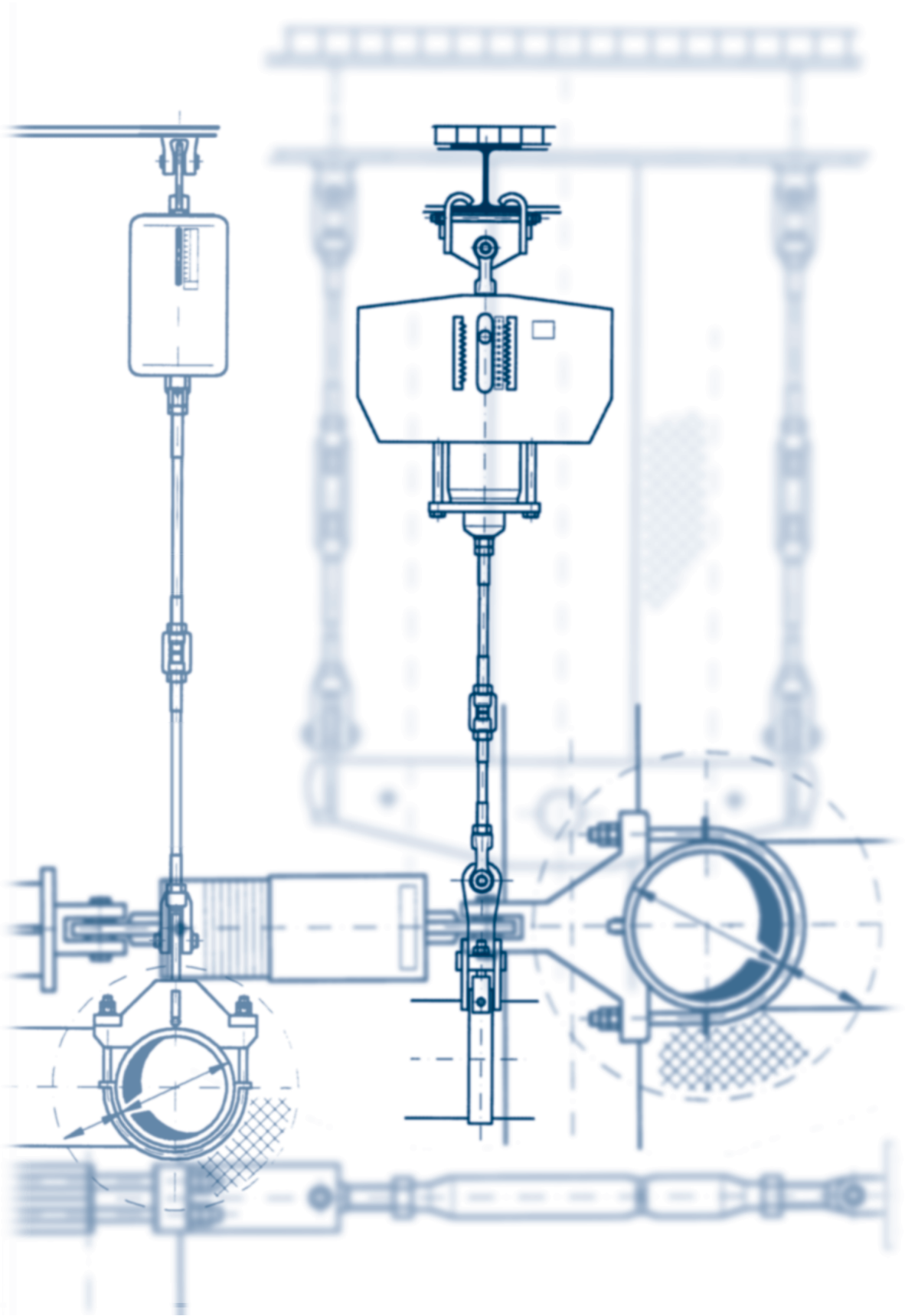
Hans-Herlof Hardtke,
President of the LISEGA Group

The basis is a well-engineered product program of more than 12,000 standardized support components forming a clearly arranged functional modular system. The resulting efficiency, and in particular by using our LICAD design software, provides additional savings in costs both in planning and installation.

Confident that we have a committed work force to support us, the LISEGA management invests all its energy into satisfying customer requirements. For this, and for our mutual pleasure in seeking success, people at LISEGA are working together with our customers, goal-orientated and highly motivated by **performance with system**.

L I S E G A

Hans-Herlof Hardtke



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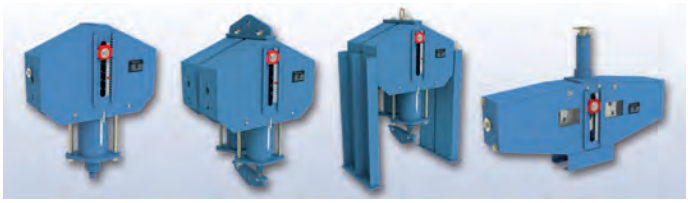

Product group 1
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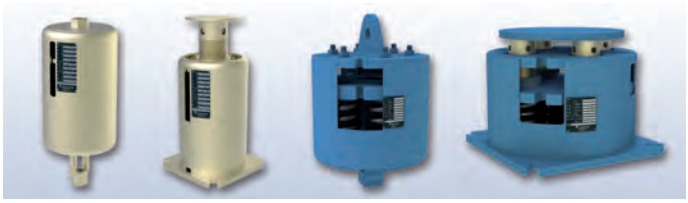

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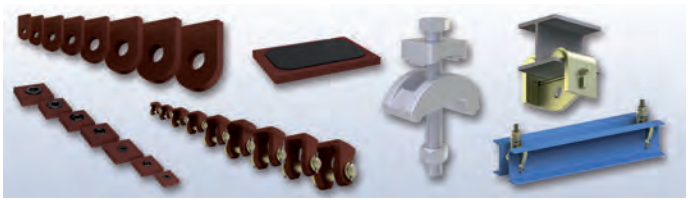

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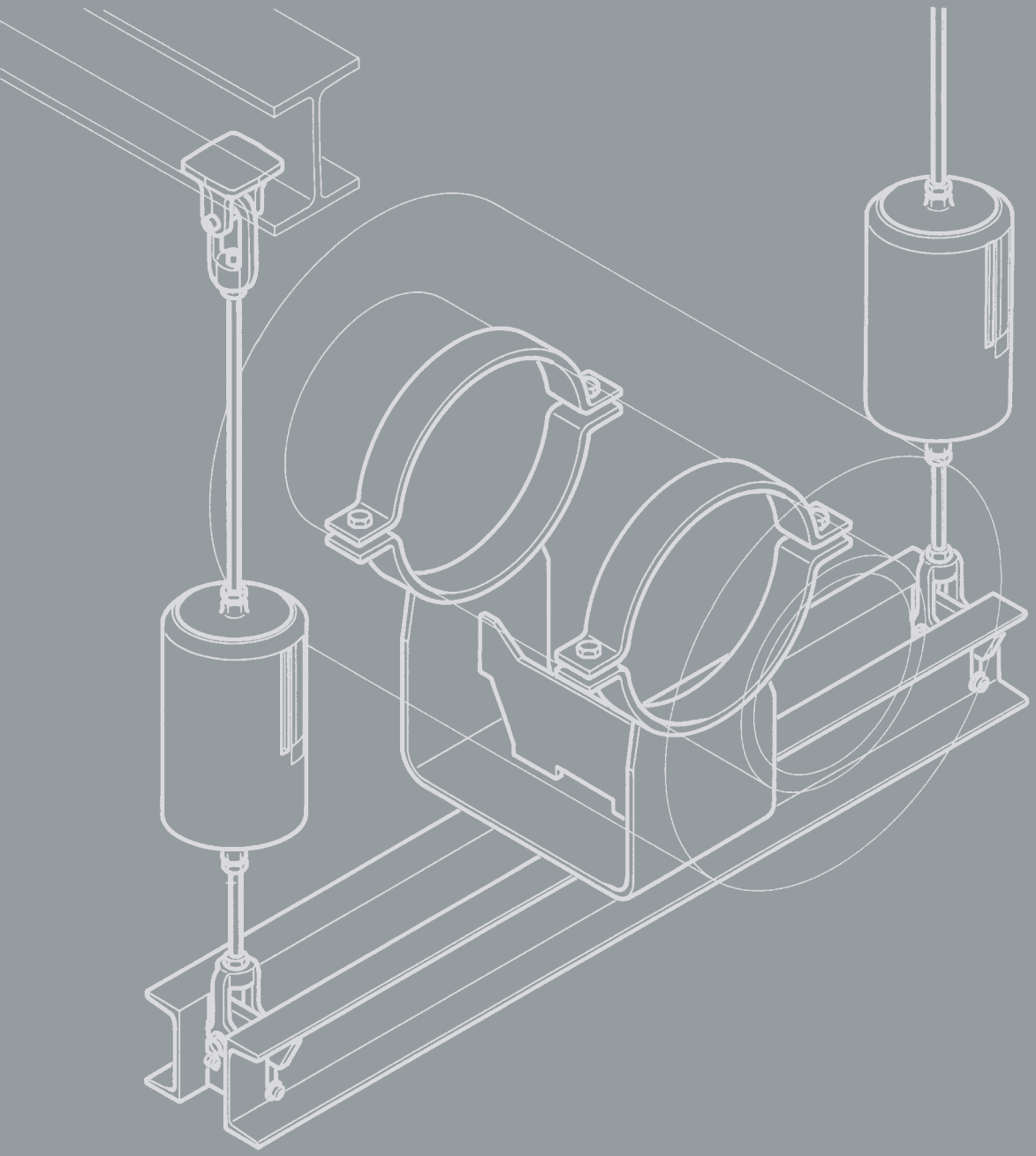

LISEGA

Technical specifications

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Technical specification

The products outlined in this catalog – Standard Supports 2020 – are fully in line with the latest developments in support technology and satisfy general requirements for plant installation at the highest level. For the general design of LISEGA standard supports, standardized criteria are applied. They are described in the following Technical specifications and apply to the contents of this catalog. Component related features are outlined in the corresponding sections of the product group sections and in the type data sheets.

Unless expressly agreed otherwise, the stipulations in the catalog Standard Supports 2020 apply to all our shipments.

1. Standard Supports, requirements and definition

1.1 Requirements

For the support of industrial piping systems the use of standard supports is regarded as well-proven, up-to-date technology.

Only a high level of standardization can satisfy the demand for technically superior and economical support components. The complex requirements for modern pipe supports are:

- **reliable functioning**
- **maintenance-free operation**
- **quick delivery**
- **low component prices**
- **computerized design systems**
- **easy installation**
- **favorable performance weight ratio**

1.2 Definition

Standard supports must fulfill the following criteria:

- **component shapes are uniform and designed to make the optimum use of material**
- **components are compatible regarding dimensions and load capacity**
- **components are cataloged and clearly designated via an identification system**
- **components are manufactured in series production**
- **components comply with the approved standards and international codes**
- **the functional capacity, suitability and durability of the components is well proven**
- **components are certified and approved for use by independent certification bodies**

The relevant codes for pipe supports in German and European plant construction (power stations), the **DIN EN 13480-T3** and **VGB Guideline R 510 L**, require the preferential use of standard supports and define the criteria as follows:

“Standard Supports are pipe support components in which the design in form and dimensions, as well as the design data regarding loads, are specified, verified and cataloged and where the components are manufactured according to defined, reproducible processes, e.g. series production”.

2. LISEGA Standard Supports

2.1 Scope

At LISEGA, standard supports form the basis of a comprehensive performance package. A complete product program of more than **12,000 standardized components** covers all support situations, operational loads, temperatures and travel ranges normally experienced in piping systems in industrial plant construction:

- **≤ 650°C operating temperature for pipe clamps and clamp bases**
- **≤ 400kN nominal load for all mainly statically loaded components**
- **≤ 1000kN nominal load for rigid struts and standard snubbers**
- **≤ 5000kN design load for large-bore snubbers**
- **≤ 900mm travel range for constant hangers**
- **≤ 400mm travel range for spring hangers**

2.2 Design features

Specially developed components are available for the various support functions. Fundamental design principles were taken into consideration in the design and construction of the components:

- **symmetrical design shapes**
- **compact installation dimensions**
- **special, reliable functional principles**
- **extra-wide adjustment ranges**
- **fully compatible load ranges and connection dimensions**
- **integrated installation aids**

Moreover, LISEGA hangers feature **only one** upper connection point. Due to this, along with compact and symmetrical design shapes, load distribution free of imposed moments on the connections is ensured and easy installation made possible. The operating position of the moving parts (hangers, supports and snubbers) can be read directly off a linear travel indicator.

Load adjustment of the constant hangers and supports can be carried out at all times, even in the installed condition. Hangers and supports can be blocked **in any travel position**.

2.3 Principle of the optimum design

For the design and arrangement of support components, optimum coverage of the specific support function is the decisive factor. So **only one** design is required **for each function**, namely, the optimum one for the purpose. The project engineer is no longer forced to choose from a range of alternative solutions.

This not only facilitates application but also increases safety. In addition it is a prerequisite for the logical implementation of standardized construction according to the modular system.

- **There's only ONE best solution!**

3. The LISEGA Modular System

3.1 User benefits

The cost of pipe supports is a major factor in the total cost of a pipe system. The cost of the supports is the accumulated total arising from the individual costs of:

- **project management (processing)**
- **design and engineering work**
- **use of material (components) and**
- **installation and assembly work**

Moreover, the pipe supports are almost always critical for the commissioning deadlines and can, through delays in delivery, cause incalculable extra costs.

The goal of the LISEGA product strategy is to achieve optimum user benefits for customers at the lowest cost, following the **economic principle**.

The LISEGA modular system provides the corresponding basis. The standardization of components is the decisive prerequisite for:

- **rational series production**
- **favorable performance/weight ratios**
- **consistently high product quality**
- **ready availability from stock**
- **our special LICAD® design software**

The cumulative benefits from this result in reliable project processing at competitive prices with superior component quality. In addition, the user also benefits from cost reductions in labor-intensive sectors such as support engineering (design) and onsite installation. The assembly procedure for the pipe systems can also be streamlined by **first installing the supports, then mounting the piping directly into them.**

The economic principle:

= with the least possible effort, achieving the maximum possible benefit

= Total Cost Minimum/TCM

3.2 Functionality

The standardization of components at LISEGA is specifically directed toward their systematic interaction as support configurations. To this end, load and travel ranges as well as the geometry of the connections are harmonized. The LISEGA standard support program has been developed in this fashion as a fully functional and effective modular system. The individual components therein form modules and guarantee load compatibility. This enables a wide range of combinations to produce tailor-made support configurations as required. The comprehensive selection of components enables adaptation to widely differing support situations and application conditions.

First install the supports, then mounting the pipes!

3.3 Product groups

The standardized components are divided into **7 product groups** according to task and function (see standardized components table, page 0.3 and diagram on page 0.4).

Product groups
+ load groups
+ travel ranges
+ connection compatibility

= Modular System

3.4 Load groups

To ensure uniform loading in component combinations the product groups are arranged throughout according to clearly classified static and dynamic load groups (see page 0.5 and page 0.6).

Modular System
+ CAD design
+ IT Logistics System

= High-Tech Application

① Metric or UNC according to region of application.

Within a load group (nominal load), all components feature uniform load limits and safety margins. Within a load group the connection dimensions of the components (thread① and pin diameters) are uniform and compatible with the components in other product groups.

As different components can only be combined with each other within the same load group **the stresses on a load chain are consistent throughout**, whereby the clamps are selected in each case according to the relevant temperature, load and insulation thickness of the pipe system.

The incorrect combination of parts from different load groups is thus avoided.

3.5 Travel ranges

3.5.1 Constant and spring hanger travel ranges

Moving components such as constant and spring hangers are split into travel ranges corresponding to the usable spring travel of the standard springs used. The relevant travel range in each case is designated in the type designation by the 4th digit in the following table.

② For spring hangers and supports (product group 2) the springs are pre-stressed to approx. 1/3 of their nominal load. This results in the initial load.

constant hangers	
travel range [mm]	designation number
0 - 75	1 . . 1 . .
0 - 150	1 . . 2 . .
0 - 300	1 . . 3 . .
0 - 450	1 . . 4 . .
0 - 600	1 . . 5 . .
0 - 750	1 . . 6 . .
0 - 900	1 . . 7 . .

spring hangers	
travel range [mm] ②	designation number
0 - 50	2 . . 1 . .
0 - 100	2 . . 2 . .
0 - 200	2 . . 3 . .
0 - 300	2 . . 4 . .
0 - 400	2 . . 5 . .

3.5.2 Snubber travel ranges

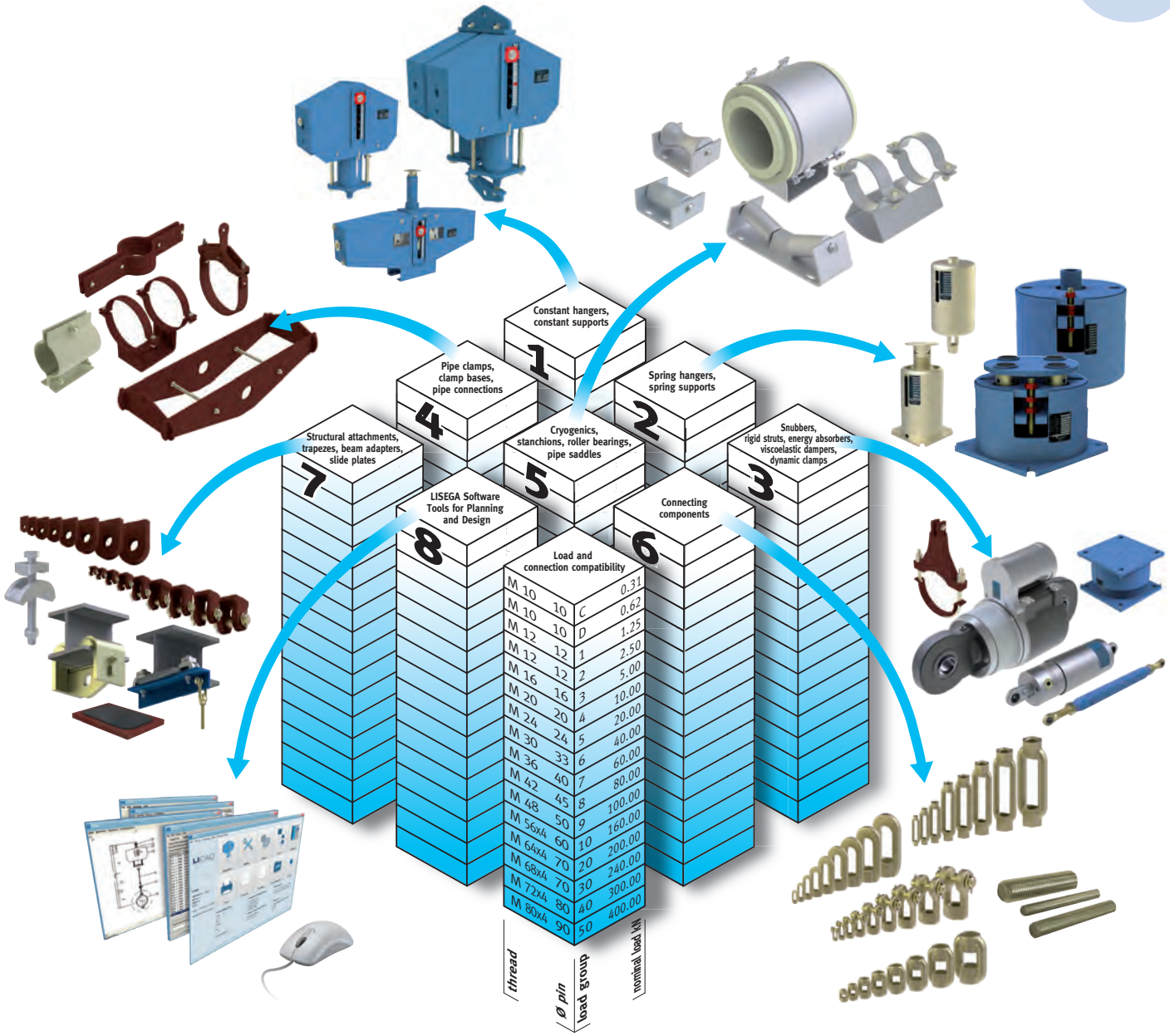
The LISEGA snubbers are grouped into standard stroke ranges denoted by the 4th digit of the type designation as in the following table.

snubbers		
stroke [mm]	type	designation number
150	30	3 . . 2 . .
300	30	3 . . 3 . .
400	30	3 . . 4 . .
500	30	3 . . 5 . .
600	30	3 . . 6 . .
750	30	3 . . 7 . .
100	30/31	3 . . 8 . .
200	30/31	3 . . 9 . .

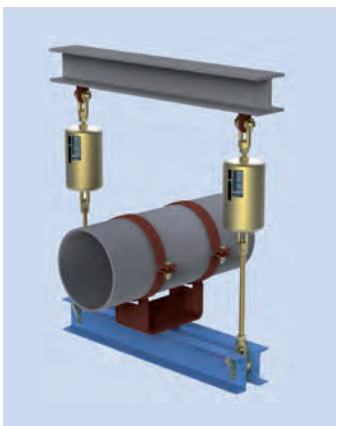
3.6 Standardized components

standardized components		
product group	unit type	unit designation
1 Constant hangers & supports	11	Constant hangers
	12-14	Constant hangers, multi-cell
	16	Constant supports, multi-cell
	17	Servo hangers
	18	Constant hangers, low profile
	19	Constant supports, low profile
	19	Angulating const. supp., low profile
	71	Brackets for constant hangers
	79	Constant hanger trapezes
2 Spring hangers & supports	20	Angulating spring supports
	21	Spring hangers
	22	Heavy duty spring hangers
	25	Spring hangers, seated
	26	Heavy duty spr. hang. (seated)
	27	Sway braces
	28	Heavy duty spring supports
	29	Spring supports
	72	Base plates
	79	Spring hanger trapezes
3 Dynamic components	30	Snubbers
	31	Large bore snubbers
	32	Energy absorbers
	33	Installation extensions
	34	Dynamic pipe clamps
	35	Weld-on brackets
	36-38	Dynamic pipe clamps
	39	Rigid struts
	3D	Viscoelastic dampers
	3L	Shear lugs
	3R	Pipe whip restraints
4 Pipe connecting components	40	U-bolts
	41	Weld-on lugs
	42-44	Horizontal clamps
	45,46,48	Riser clamps
	49	Clamp bases, lift-off restraints
	77	Connection plates
5 Pipe bearings and saddle components, cryogenic clamp bases	51	Cylinder roller bearings
	52	Double taper roller bearings
	53	Double cylinder roller bearings
	54	Weld-on pipe saddles
	54	Pipe saddle with pipe clamps
	55	Lift-off restraints
	56	Cryogenic clamp bases
	57	Cryogenic axial stops
	57	Weld-on pipe shoes
	58	Stanchions
6 Threaded connecting elements	60	Eye nuts
	61	Clevises
	62	Turnbuckles
	63	Hexagon nuts
	64	Rod couplings
	65	Tie rods L/R
	66	Tie rods
	67	Threaded rods / stud bolts
7 Structural attachment elements	70	Sliding components
	73	Weld-on clevises
	74	Weld-on plates with sph. washers
	75	Weld-on eye plates
	76	Beam adapters
	78	Beam clamps
	79	Trapezes

3.7 Modular system for load and connection compatibility








Cold load:
The cold load is the load determined by the pipe system calculations for the support point in shut down condition.

Set load (blocking load):
The set, present or blocking load is the load at which the spring or constant hanger is set and blocked. The set load is made up of the cold load and the dead weight of the components suspended from the spring or constant hanger. In part, blanket dead weights are already calculated into the cold loads. These must be taken into account when designing the hanger arrangement.

Hot load (operating load):
The hot or operating load is the load acting on the support point during normal operation. For spring hangers it is made up of the set load and the force resulting from spring travel multiplied by spring rate. For constant hangers the hot load corresponds to the set load.

Hydrostatic test load:
The hydrostatic test load is the load acting on the support during pressure testing, in general at 80°C.

Pickling (and clean) load:
The pickling load is the load distributed from the support points during pickling of the pipe system, in general at 200°C.

dynamically defined components product group 3		
load group	nominal load [kN]	Ø pin
1	3	10
2	4	10
3	8	12
4	18	15
5	46	20
6	100	30
7	200	50
8	350	60
9	550	70
10	1000	100
20	2000	120
30	3000	140
40	4000	160
50	5000	180

4. Permissible loads

4.1 Statically and dynamically loaded components

For permissible loads we distinguish between statically and dynamically loaded components. The components in product groups **1, 2, 4, 5, 6, and 7** are, according to their function, loaded in only one direction (static or quasi static) and are viewed as **statically determined components**. The units in product group **3** as well as their accessories are regarded as **dynamically determined components.**

4.1.1 Static components

The nominal load is used to denote the load group. For the statically determined components in product groups **1, 2, 6 and 7** the **nominal load** corresponds to the max. **set load** of spring elements such as spring hangers. The **max. operating load** (load case H) is, in the event of use as a rigid support, considerably higher than the nominal load and is adapted to the load capacity of the connection thread. This also includes spring hangers and constant hangers in blocked condition, whereby for **cold loads** in pressure tests (short duration) the emergency loads (load case HZ) can be exploited.

statically defined components product groups 1, 2, 6, 7				
load group	nominal load [kN]	Ø connection thread	wrench size	Ø pin
C	0.31	M10	16	10
D	0.62	M10	16	10
1	1.25	M12	18	12
2	2.5	M12	18	12
3	5.0	M16	24	16
4	10	M20	30	20
5	20	M24	36	24
6	40	M30	46	33
7	60	M36	55	40
8	80	M42	65	45
9	100	M48	75	50
10	160	M56x4	85	60
20	200	M64x4	95	70
30	240	M68x4	100	70
40	300	M72x4	105	80
50	400	M80x4	115	90

4.1.2 Dynamic components

For dynamically loaded components the nominal load corresponds to the operating load for load case H (under normal conditions) or level A/B. (ASME III / RCC-M).

As these components are generally used as safety devices for emergencies, load case HZ or level C (ASME III / RCC-M) are taken as the maximum occasionally occurring load condition. **In any case, the requirements set forth by the responsible project engineer apply.**

4.2 Product group 4

For product group 4 (pipe connections), a corresponding overlapping area in the load groups is taken into account, due to the wide temperature-dependent range of different loads. Data on the permissible loads for pipe-connecting components under consideration of the respective operating temperatures can be taken from the individual selection tables.

The permissible operating loads for long-term operation (load case H (under normal conditions), normal load, level A) are shown here. On higher short-term loading (e.g. hydrostatic tests) no permanent deformation is caused.

The permissible loads in load cases HZ (emergency (occasionally occurring operating conditions), level C) and HS (faulted condition, level D) depend on the codes to be complied with.

examples		
code	load case HZ (emergency)	load case HS (faulted condition)
ASME section III, NF	H x 1.5	H x 1.6
RCC-M	H x 1.33	H x 1.6
MSS SP-58	H x 1.2	no data
DIN EN 13480	H x 1.2	no data
VGB-R 510 L ①	H x 1.15	H x 1.5
KTA 3205.3 ①	H x 1.15	H x 1.5

4.3 Product group 5

The components in product group 5, clamp bases for cold pipe systems, low temperature systems (cryogenic) as well as roller bearings and pipe saddles, are regarded as static, however they are not considered to be part of the modular system with regard to the load group. As they are more comparable with components in secondary steelwork with respect to loading, they form a separate group. The nominal load here corresponds to the max. operating load according to load case H (normal operation conditions level A/B). For product group 5 see also 4.4.3, page 0.6.

① For components according to KTA 3205 qualification test the following applies: HZ = H x 1.5; HS = H x 1.7

4.4 Load tables

The permissible loads of the components are arranged in the form of a matrix (ordered according to load groups and load cases) in the following LISEGA load tables. The definition of the load cases are in line with **DIN EN 13480-T3, VGB-R 510 L, ASME B31.1, MSS SP-58, ASME section III, Div. 1, Subsection NF** and **KTA 3205**. The load table applies uniformly to all components in the LISEGA modular system and to other LISEGA components scheduled for use with standard components such as **special designs**.

4.4.1 Max. permissible load [kN] for statically determined components

load group	nominal load [kN] ①	normal operation ③ level A/B ② 80°C	normal operation ③ level A/B upset 150°C	emergency ④ level C 80°C	emergency ④ level C 150°C	faulted condition ⑤ level D 80°C	faulted condition ⑤ level D 150°C
C	0.31	0.7	0.8	0.7	1.1	1.0	1.4	1.3
D	0.62	1.7	2.5	2.2	3.3	2.9	4.3	3.8
1	1.25	2.8	4.2	3.7	5.6	5.0	7.2	6.4
2	2.5	4.4	6.7	6.0	9	8.0	13.3	12
3	5.0	8.5	11.3	10.1	15	13.4	22.2	20
4	10.0	14	23.3	20.9	31	27.8	41	37
5	20.0	27	34	30	46	41	61	55
6	40.0	43	56	50	74	66	96	86
7	60.0	63	83	74	108	97	140	126
8	80.0	85	114	102	150	135	195	175
9	100	112	151	135	196	176	255	230
10	160	178	222	199	295	265	381	343
20	200	215	297	266	395	355	512	461
30	240	270	340	305	452	406	585	526
40	300	320	380	340	505	450	650	585
50	400	400	490	440	650	585	840	755

4.4.2 Max. permissible loads [kN] for dynamically determined components, product group 3

load group	normal (F_N) / upset ⑥ level A/B 80°C	normal (F_N) / upset ⑥ level A/B 150°C	emergency ⑦ level C 80°C	emergency ⑦ level C 150°C	faulted condition ⑧ level D 80°C	faulted condition ⑧ level D 150°C
1 ⑨	3	2.9	4.0	3.8	5.2	5.0
2	4	3.9	5.3	5.1	6.9	6.7
3	8	7.5	10.6	9.7	13.7	12.6
4	18	16.5	23.9	22.0	31	28.5
5	46	44.0	61	58.5	77	74.5
6	100	94.5	141	127	180	162
7	200	175	267	239	336	301
8	350	339	472	423	655	588
9	550	535	735	715	935	910
10	1000	937	1335	1236	1740	1612
20	2000	1900	2660	2520	3440	3270
30	3000	2850	4000	3800	5160	4900
40	4000	3800	5320	5050	6880	6530
50	5000	4750	6650	6310	8600	8150

4.4.3 Max. permissible loads for roller bearings in product group 5

permissible loads [kN]						
normal operating conditions	4	8	16	35	60	120
occas. occur. operat. cond.	5.5	11	22	47	80	160

4.4.4 Max. permissible loads for viscouselastic dampers

permissible loads [kN]									
3D .. .. -D	2.5	5	10	20	30	40	60	80	100
3D .. .. -L	5.0	10	15	25	40	50			

① Max. operating load for spring and constant hanger corresponding to max. load on main springs. The load group allocation does not apply to types 18/19.

② Permissible loads according to design criteria for US standard "MSS SP-58" (ASME B 31.1 / B 31.3).

③ All loads are included here that can possibly occur during conventional operation of the plant, including startup and shutdown, weight tolerances, and hydrostatic tests.

④ Loads falling outside conventional operation are included here, according to the regulations in each case, also hydrostatic tests. Subsequent inspection of the whole support arrangement is strongly advised.

⑤ Due to the loads specified the yield stress of the components can be reached. At all events replacement is recommended.

⑥ All dynamic stresses possibly resulting from plant operation are included here including pressure shock forces from valve operations or possibly from operating basis earthquakes (O.B.E.).

⑦ All dynamic stresses beyond conventional operation and possibly safety shutdown earthquakes (S.S.E.) are included here. Subsequent inspection of the whole support arrangement is strongly recommended.

⑧ For the dynamic loads specified the yield stress of the components can be reached. At all events replacement is strongly recommended.

⑨ Load groups 1 and 2 are compatible regarding load and connections, whereby load group 1 refers to the smallest snubber and load group 2 to the corresponding rigid struts and weld-on brackets.

5. Type designation system

All components can be identified via coded type designations. **6 digits** contain all the information required for description of the **standard design**.

The type designation system is the prerequisite for the use of modern IT and enables the unrestricted integration of the LISEGA modular system into current CAD programs.

The LISEGA type designations can be decoded by way of the following tables.

The 1st digit describes the product group (PG)
PG 1 = Constant hangers and supports
PG 2 = Spring hangers and supports
PG 3 = Dynamic components
PG 4 = Pipe connecting components
PG 5 = Pipe bearings and saddle components, cryogenic clamp bases
PG 6 = Threaded connecting elements
PG 7 = Structural attachment elements

The digits 2 – 6 designate the further characteristics according to the following tables. The design for increased requirements (5th or 6th digit) is described on page 0.18.

PG 1 Constant hangers and supports

2nd digit	3rd digit	4th digit	5th digit	6th digit
design	load group	travel range [mm]	field of application	production series
1= constant hanger	C=M10 D=M10 1=M12 2=M12 3=M16 4=M20 5=M24 6=M30 7=M36 8=M42 9=M48	2=150 3=300 4=450 5=600 6=750 7=900	1= standard 5= standard ‹increased requirements›	3=2013 5=1985 9=1999
2= CH 2 x coupled	8≙LG10 9≙LG20		3= standard 4= standard with brackets 7= standard ‹increased requirements› 8= standard with brackets ‹increased requirements›	5=1985
3= CH 3 x coupled	8≙LG30 9≙LG40			
4= CH 4 x coupled	8≙LG40 9≙LG50			
6= heavy con. support	8≙160kN 9≙200kN	2=150 3=300	2= coupled 2 x	6=with high temp. SE* 7=with PTFE-SE* 9=without SE*
	8≙240kN 9≙300kN		3= coupled 3 x	
	8≙320kN 9≙400kN		4= coupled 4 x	
7= servo hanger	5=M24 6=M30 7=M36 8=M42 9=M48	2=150 3=300	1= standard 5= standard ‹increased requirements›	5=1985

*SE= sliding element

PG 1 Constant hangers and supports (continued)

2nd digit	3rd digit	4th digit	5th digit	6th digit
design	load group	travel range [mm]	field of application	production series
8= constant hanger, short	D=M10 1=M12 2=M12 3=M16 4=M20 5=M24 6=M30 7=M36 8=M42 9=M48	1= 75 2=150 3=300	1,2= standard 5,6= ‹increased requirements›	7=2007
9= constant support, short			1,2= standard constant support 3,4= standard angulating constant support 5,6= support ‹incr. requirem.› constant support 7,8= ‹increased requirements› angulating constant support	6=with high temp. SE* 7=with PTFE-SE*
9= angulating constant support, short				7=2007

PG 2 Spring hangers and supports

2nd digit	3rd digit	4th digit	5th digit	6th digit
design	load group	travel range [mm]	field of application	production series
1= spring hanger suspendet	C=M10 D=M10 1=M12 2=M12 3=M16 4=M20 5=M24 6=M30 7=M36 8=M42 9=M48	1= 50 2=100 3=200 4=300 5=400 9=installation Ext. f. type 20 & type 27 & type 29	2= standard 6= standard ‹increased requirements›	1=1991 4=1994 8=1978 9=1999
0= angulating spring support 0= installation extension for type 20 5= seated 7= sway brace 7= installation extension for type 27 9= spr. support			1= standard 5= standard ‹increased requirements› 2= telescopable spring support 6= ‹increased requirements›	1=1991 4=1994 6=with high temp. SE* 7=with PFTE-SE* 8=1978 9=1999
2= heavy spring hanger suspended 6= heavy spring hanger seated	1=LG10 2=LG20 3=LG30 4=LG40 5=LG50	1= 50 2=100 3=200	1= standard 5= standard ‹increased requirements› 2= standard 6= standard ‹increased requirements›	9=1999
8= heavy spring support				6=with high temp. SE* 7=with PFTE-SE*

PG 3 Dynamic components

2nd digit	3rd digit	4th digit	5th digit	6th digit
design	load group	travel range [mm]	field of application	production series
0= hydraulic snubber serial version 2= energy absorber 3= installation extension	1= 3 2= 4 3= 8 4= 18 5= 46 6= 100 7= 200 8= 350 9= 550 0=1000	2=150 3=300 4=400 5=500 8=100 9=200	1= standard 5= standard ‹increased requirements›	2=2002 3=1993 6=1986 8=1988 at type 32: 6=1996
1= hydraulic snubber large bore	2= 2000 3= 3000 4= 4000 5= 5000 9= 550 0= 1000	8=100 9=200		
5= weld-on bracket	19= 3 29= 4 39= 8 49= 18 59= 46 69=100	79= 200 89= 350 99= 550 09=1000 20=2000	1= standard 5= standard ‹increased requirements›	1=1991 3=1993 9=1989

PG 3 Dynamic components (continued)

2nd digit	3rd + 4th digit	5th digit	6th digit
design	pipe diameter load group [kN]	field of application	production series
6= dynamic pipe clamp with U-bolt	Pipe diameter in [mm/10] ⋮ T0=1016 T1=1067 T2=1118 T3=1168 T4=1219	standard 1=to 350°C 2=to 500°C 3=to 560°C 4=to 600°C	1–3= 1 x U-bolt 4–5= 2 x U-bolt
7= dynamic clamp with strap		standard ‹increased requirements› 6=to 350°C 7=to 500°C 8=to 560°C	1–6= 1 x Strap 7–9= 2 x Strap
9= rigid strut	2= 4 3= 8 4= 18 5= 46 6= 100 7= 200 8= 350 9= 550 0=1000	Middle installation dimension in mm/100	2–4= standard 7–9= ‹increased requirement›
L= shear lug	3rd to 6th digit corresponds to clamp type		

2nd digit	3rd + 4th digit	5th digit	6th digit
design	load group [kN]	travel vertical [mm]	travel horizontal [mm]
D= viscous-elastic damper	03 = 2.5 30 = 30 05 = 5 40 = 40 10 = 10 50 = 50 15 = 15 60 = 60 20 = 20 80 = 80 25 = 25 H1 =100	3=30 4=40 5=50	3=30 4=40 5=50
	.. .. ..-D = depend	.. .. ..-L = limit	

PG 4 Pipe clamps, clamp bases and pipe-connecting components

2nd digit	3rd + 4th digit	5th digit	6th digit
design	load group pipe diameter	field of application	production series
1= weld-on lug	D9= LGD 29= LG2 39= LG3 49= LG4 59= LG5 69= LG6 79= LG7	1=standard	for straight pipes max. insulation thickness in mm 1=10 2=100
	01= 21.3 02= 26.9 03= 33.7 04= 42.4 05= 48.3 06= 60.3 07= 73.0 08= 76.1 09= 88.9 10=108.0 11=114.3 13=133.0 14=139.7 16=159.0 17=168.3 19=193.7 22=219.1 24=244.5	1=standard	for pipe elbows R≈1.5OD max. insulation thickness in mm 3,4=10 5,6=100
horiz. clamp 2= 1-hole 2= 2-hole 3= 3-hole 4= with U-bolt or strap	26=267.0 27=273.0 32=323.9 36=355.6 37=368.0 41=406.4 42=419.0 46=457.2 51=508.0 56=558.8 61=609.6 66=660.4 71=711.2 76=762.0 81=812.8 86=863.6 91=914.4 97=965.2 T0= 1016 T1= 1067 T2= 1118 T3= 1168 T4= 1219	standard 1=to 350°C 2=to 500°C 3=to 560°C 4=to 600°C 5=to 650°C standard ‹increased requirements› 6=to 350°C 7=to 500°C 8=to 560°C	depending on load group and design
riser clamp 5= formed riser clamp 6= box clamp for shear lugs 8= box clamp for trunnions			

PG 4 Pipe clamps, clamp bases and pipe-connecting components (continued)

2nd digit	3rd + 4th digit	5th digit	6th digit
design	pipe diameter [mm]	field of application	production series
9= clamp base	01= 21.3 02= 26.9 03= 33.7 04= 42.4 05= 48.3 06= 60.3 07= 73.0 08= 76.1 09= 88.9 10= 108.0 11= 114.3 13= 133.0 14= 139.7 16= 159.0 17= 168.3 19= 193.7 22= 219.1 24= 244.5 26= 267.0 27= 273.0 32= 323.9 36= 355.6 37= 368.0 41= 406.4 42= 419.0 46= 457.2 51= 508.0 56= 558.8 61= 609.6 66= 660.4 71= 711.2 76= 762.0	standard 1=to 350°C 2=to 500°C 3=to 560°C 4=to 600°C 5=to 650°C standard ‹increased requirements› 6=to 350°C 7=to 500°C 8=to 560°C	1= low 2= medium 3= low, welded 4= medium, welded 5= high, welded
0= U-bolt	81= 812.8 86= 863.6 91= 914.4 97= 965.2 T0=1016 T1=1067 T2=1118 T3=1168 T4=1219	1= S235JR 3= 1.4301 ‹incr. requirem.› 6= S235JR 8= 1.4301	8= standard
9= lift-off restraint for clamp base	00= lift-off restraint	0= lift-off restraint	1–5= compon. size

PG 5 Roller bearings, pipe saddles and cryogenic clamp bases

2nd digit	3rd + 4th digit	5th digit	6th digit
design	load group [kN] pipe diameter	field of application	production series
1= cyl. roller bearing 2= double taper roller bearing 3= double cyl. roller bearing 5= lift-off restraint for roller bearing	04= 4kN 08= 8kN 12=120kN 16= 16kN 35= 35kN 60= 60kN	1= standard 2= movable laterally	9=1989
4= pipe saddle with pipe clamps, weld-on saddle, pipe tray	01= 21.3mm 02= 26.9mm 03= 33.7mm 05= 48.3mm 06= 60.3mm	1= weldable 2= with pipe clamps 3= support plate	
6= cryogenic clamp base 7= cryogenic axial stop	07= 73.0mm 08= 76.1mm 09= 88.9mm 10=108.0mm 11=114.3mm 13=133.0mm 14=139.7mm 16=159.0mm 17=168.3mm 19=193.7mm 22=219.1mm 24=244.5mm 26=267.0mm 27=273.0mm 32=323.9mm 36=355.6mm	Length: 3=150mm 5=300mm 7=500mm 8=750mm	Insulation thickness in mm 0= 25 1= 40 2= 50 3= 80 4=100 5=130 6=150 7=180 8=200 9=250
7= weld-on pipe shoe	37=368.0mm 41=406.4mm 42=419.0mm 46=457.2mm	1= Standard	1= out of T-section 2= out of U-section
8=stanchion	51=508.0mm 56=558.8mm 61=609.6mm 66=660.4mm 71=711.2mm 76=762.0mm 81=812.8mm 91=914.4mm 97=965.2mm	1= rigid pipe supports 2= pipe supports, adjustable	1,2=for str. pipes 3,4=for elbows R≈OD 5,6=for pipe elbows R≈1.5 OD

PG 6 Connecting components

2nd digit	3rd + 4th digit	5th digit	6th digit
design	load group	field of application	production series
0= eye nut 1= clevis 2= turnbuckle 4= rod coupling	D9= M10-0.62kN 29= M12-2.50kN 39= M16-5.00kN 49= M20-10.0kN 59= M24-20.0kN 69= M30-40.0kN	1= standard 5= standard ‹increased requirements›	2=1982 5=1995 8=1978 9=1999
3= hex. nut	79= M36-60.0kN 89= M42-80.0kN 99= M48-100kN 10= M56x4-160kN 20= M64x4-200kN 30= M68x4-240kN 40= M72x4-300kN 50= M80x4-400kN	2= standard 3= 25CrMo4 5= standard ‹increased requirements›	3=1993 8=1978 9=1999
5= tie rod L/R 6= tie rod R/R 7= stud bolt, threaded rod	D=M10 2=M12 3=M16 4=M20 5=M24 6=M30 7=M36 8=M42 9=M48 — Length: 0= LG10 - LG50 1=stud bolt 2= 500mm 3=1000mm 4=1500mm 5=2000mm 6=2500mm 7=3000mm 10=M56x4 20=M64x4 30=M68x4 40=M72x4 50=M80x4 } Length not stand-ardized	1= standard 5= standard ‹increased requirements›	

Type designation

1 2 3 4 5 6

- 6 — Production series/travel/variant
- 5 — Field of application/travel
- 4 — Travel range/pipe ø/function
- 3 — Load gr./pipe ø/thread ø
- 2 — Design
- 1 — Product group (PG)

Examples

1 1 5 3 1 5

- 5 — 1985
- 1 — Standard design
- 3 — Travel range 3 / 0-300mm
- 5 — Load gr. 5 / F_N = 20kN
- 1 — Individual design
- 1 — Constant hanger

4 9 5 1 8 5

- 5 — High design, welded
- 8 — 13CrMo4-5, increased requirements
- 51 — Pipe diameter 508mm
- 9 — Clamp base
- 4 — Pipe connection

3 9 6 2 5 4

- 4 — Standard design
- 25 — Medium length 2500mm
- 6 — Load group 6 / F_N = 100kN
- 39 — Rigid strut

PG 7 Structural attachments and trapezes

2nd digit	3rd digit	4th digit	5th digit	6th digit
design	load group	function	field of application	production series
0= sliding elements	Width 1= 50 2=100 3=150 4=200	Length 1= 50 2=100 3=150 4=200 6=300 7=390 8=490	1= welded 2= bolted, hot dip galvanized 3= bolted, hot dip galvanized	1= rectangular, up to 180°C 4= rectangular, up to 350°C
	05=ø 50 08=ø 85 10=ø 100	13=ø 130 17=ø 170 20=ø 200		2= round, up to 180°C 5= round, up to 350°C
1= support bracket for constant hanger	C...9= load group	2=150 3=300 4=450 5=600 6=750 7=900	6= standard 8= standard ‹increased requirements›	1= single support
1= support bracket for heavy constant hanger	8=160kN 9=200kN			2= coupled 2 x
	8=240kN 9=300kN			3= coupled 3 x
	8=320kN 9=400kN			4= coupled 4 x
2= base plate for spring hanger	D...9= load group	1, 2, 3, 9= dep. on design	2= standard 7= standard ‹increased requirements›	8= 1978
3= weld-on clevis 4= weld-on plate 5= weld-on eye plate	D...50= load group	0 > load group 9	1=standard 2=lift-off-restraints 5= standard ‹increased requirements›	2= 1982 3= 1993 9= 1989
6= beam adapter & combi-nations	D...4= size	2= beam adapter & bolts		1= 2001
	C...2= size	1= cantilever		6= vertical connection 7= horizontal connection
	00=guide			1...4= size
8= beam clamp	2..7= load group	1= standard		1= 1991
9= constant hanger trapeze	3rd to 5th digits correspond to single hangers in each case (see PG1)			3= 2013 5= 1985 7= 2007
9= spring hanger trapeze	3rd to 5th digits correspond to single hangers in each case (see PG2)			1= welded unit 9= with individual hangers
9= rigid trapeze	C...4= load group 2...9= load group 2...20= load group	2,3= depending on design type 0 > LG9	3= standard 8= standard ‹increased requirements›	7= L-section 9= U-section, centric connection 4= U-section
7= connecting plate	3rd to 6th digit correspond to the clamps to be coupled			

4 4 6 1 4 8

- 8 — Strap clamp for heavy loads
- 4 — Material 10CrMo9-10 standard design
- 61 — Pipe diameter 609.6mm
- 4 — Horizontal clamp, U-bolt or strap
- 4 — Pipe connection

Worldwide coverage of recognized standards

6. Standards and codes

In design, in stress and load calculations, as well as in production, the relevant European and other international standards are taken into account.

The material characteristics upon which all design calculations are based are taken from the relevant standards and technical codes.

the following codes apply:		
DIN EN 13480-T3	Metallic industrial pipe systems	Europe
VGB-R 510 L	Standard supports	Germany
KTA 3205.1/2/3	Nuclear regulations	Germany
AD-Merkblätter	Pressure vessels working group	Germany
RCC-M	Specifications for pipe supports	France
MSS SP-58	Pipe supports – material and design	USA
ANSI ASME B31.1 / B31.3	Pressure piping systems	USA
ASME section III Div. I - NF	Supports for nuclear components	USA
JSME S NC1	Nuclear design code	Japan
JEAG 4601	Nuclear design guide	Japan
SPIR-O-2008	Supports for nuclear plants for AES-2006	Russia

7. Materials

Materials are exclusively used that conform to DIN-EN, ASTM or CN steel material requirements.

As a matter of course only materials of guaranteed strength characteristics are used for the support components.

Preferred materials for pipe connections

Standardized selection of carbon steels and heat-resistant materials!

High temperature resistant materials for use at higher temperatures or cold tough materials e.g. until –60°C on request.

			temperature of medium in °C						
DIN-EN	ASTM	CN-Steel	≤350	≤450	≤500	≤530	≤560	≤600	≤650
S235JR	A 36	Q235B	x						
S235JR	A 516 Gr. 60		x						
S235JR	A 675 Gr. 55		x						
S355J2	A 675 Gr. 70	Q345B/Q345R	x						
S355J2	A 299	Q345B/Q345R	x						
S355J2	A 516 Gr. 70	Q345B/Q345R	x						
P235TR1	A 53 S Gr. A	20G	x						
P235GH	A 53 S Gr. A	20G	x						
P355NH	A 106 Gr. C	20G	x						
16Mo3	A 204	(Q345R)/15CrMoR	x	x	x				
13CrMo4-5	A 387 Gr. 12 Cl.2	15CrMoR	x	x	x	x	x		
10CrMo9-10	A 387 Gr. 22 Cl.2	12Cr1MoVR/12Cr2Mo1R	x	x	x	x	x	x	
X10CrMoVNb9-1+NT/QT	A 387 Gr. 91 Cl.2		x	x	x	x	x	x	x
X5CrNi18-10	A 240 TP 304	06Cr19Ni10	x	x	x	x			
42CrMo4+QT	A 193 B7	42CrMo	x						
	A 193 B8		x	x	x	x	x	x	x
X10CrMoVNb9-1+NT/QT	A 182 F91		x	x	x	x	x	x	x
21CrMoV5-7+QT		25Cr2MoVA	x	x	x	x	x		
25CrMo4+QT	A 194 Gr. 2H	25Cr2MoVA	x	x	x	x	x		

8. Welding

All welding is carried out as gas metal arc welding under protective gas according to DIN EN ISO 4063.

- **MAG/GMAW (= gas metal arc welding), Procedure no. 135**
- **MAG/FCAW (= flux core arc welding), Procedure no. 136**
- **WIG/GTAW (= gas tungsten arc welding), Procedure no. 141**

For these procedures (welding procedure specifications (WPS)) are on hand which are certified on the basis of the EN ISO 15614-1 and / or ASME section IX (WPQR).

The welders are qualified according to EN 287-1 and ASME section IX for the corresponding procedures and material classes, and the service personnel for welding equipment according to EN 1418 and ASME section IX.

LISEGA holds certifications according to:

- **DIN 18800-T7 Kl. E, recertification according to EN1090-1 – EXE 4 conformity certification for support components and EN 1090-2 Technical regulations for the execution of steel construction**
- **ASME section III Div. I Subs. NCA 4000 – NPT and NS stamp**
- **EN ISO 3834-2**
- **TRD 201/AD 2000 Leaflet HPO**
- **Technical Regulations for Steam Boilers/ Manufacture and inspection of pressure vessels by the German TÜV**

The current welding inspection team is qualified according to:

- **EN ISO 14731, welding engineers IWE and EWE (International/European welding engineer) and welding technicians, IWS (International Welding Expert)**
- **Certified welding inspectors according to AWS 1.1**
- **ASME section III Div. I Subs. NF-5500**
- **SNT-TC-1A**

Non-destructive testing VT, PT, MT, UT and RT (external) is conducted by test personnel qualified according to standards ISO 9712 Level II and SNT-TC-1A Level II. Supervision is carried out by personnel qualified according to ISO 9712 Level III and SNT-TC-1A Level III.

The tests are conducted on the basis of regulations:

- **EN ISO 5817 Assessment Group C**
- **EN ISO 17635 (ISO 10836) with relevant stipulations for the various ZfP procedures**
- **RCC-M Subs. H 4000 with MC 3000 – MC 7000**
- **ASME section V as required by subsection NF**

9. Surface treatment against corrosion

As a matter of principle, LISEGA products are designed for long-term operation, functioning reliably for the whole life of the plant. To limit maintenance work, particular attention is paid to protection against corrosion. It is important to specify the type of surface treatment for the environmental conditions prevailing. LISEGA offers a range of suitable corrosion protection systems based on the corrosivity categories and protection periods of EN ISO 12944:

- **Standard surface protection (9.1)**
- **Increased surface protection (9.2)**
- **Hot dip galvanized version (9.3)**
- **Surface protection for extreme applications (9.4)**

Wherever technically feasible, LISEGA uses low-solvent, environmentally friendly, "water-borne" paint finishes.

9.1 Standard corrosion protection

As protection against corrosion, the surfaces of LISEGA products are treated with high-quality protection systems. Our standard corrosion protection corresponds to the **Corrosion Category C3, medium protection period (M) according to EN ISO 12944** and is well suited to implementation in environments with a moderate industrial atmosphere. Typical fields of application in this regard are the interiors of production workshops with increased levels of humidity and dust or exteriors with a normal atmosphere.

Data on specified coat thicknesses correspond to NDFT (Nominal Dry Film Thickness) according to DIN EN ISO 12944, measured according to DIN EN ISO 2808.

9.1.1 Standard paint finish

Metallic surfaces of carbon steel exposed to the open air receive **shotblasting to SA 2 ½** (SP10 according to ASTM) and then a base of **zinc-rich primer 60µm** is applied. After curing an additional **top coating 60µm** is applied. The total dry film thickness of the coating amounts to **120µm**, color shade RAL 5012 – light blue.

Components falling into this category are constant hangers and supports, heavy spring hangers and supports, trapezes, installation extensions for snubbers etc., rigid strut tubes and viscoelastic dampers.

9.1.2 Cathodic electrophoretic dip coating of springs (CED)

High quality helical coil springs are an important element in LISEGA constant and spring hangers. Due to their exposed functional significance, all springs are treated with a cathodic electrophoretic dip coating (CED). The springs are shot-blasted and zinc-phosphated on their extended or peeled surfaces. Finally, a dual-component epoxy resin coating is applied in a galvanic process and baked at approx. 200°C.

9.1.3 Electro galvanizing

Spring hangers and spring supports, beam clamps and all threaded components and internal functional parts of the constant hangers and supports are galvanized with a coating thickness of approximately **12–15µm**.

9.1.4 Hot dip galvanizing

Roller bearings, pipe saddles and cold-block clamp bases are treated as standard with hot dip galvanization, coat thickness **60–80µm**.

9.1.5 Primer coating

Due to their special installation situation, mainly within the insulation, the pipe-surrounding components such as pipe clamps and clamp bases, weld-on brackets, weld-on eye plates, weld-on clevises, weld-on bearings and weld-on pipe supports (stanchions) are treated to higher quality transport protection with a weldable primer coating on a shot-blasted surface, coat thickness approximately **30µm**, color shade red brown.

9.1.6 Snubbers

Snubbers are manufactured completely from corrosion resistant materials and require no special coating.

The separate connection lugs of type 30, are manufactured from carbon-steel, and treated according to 9.1.7.

9.1.7 Snubber connections

Connecting lugs are electro galvanized according to 9.1.3 and fitted with corrosion-protected ball bushings. Installation extensions are treated with the standard paint coating according to 9.1.1. Weld-on brackets are given a weldable primer coat according to 9.1.5 and the connection pins are of stainless steel.

9.1.8 Rigid struts

The rigid strut tubes are given a standard color coating (9.1.1). The ball bushing joints are electro galvanized (9.1.3) and fitted with corrosion-protected ball bushings. Weld-on brackets are treated with a weldable primer coating (9.1.5), while the connecting pins are stainless steel.

9.2 Increased corrosion protection

Increased corrosion protection according to **EN ISO 12944, Corrosivity Category C4, medium protection period (M)**, is recommended in aggressive atmospheres, such as in the open in industrial areas and in coastal regions with moderate saline exposure or in the case of internal applications in chemical plants.

Increased corrosion protection is ensured through corresponding additional measures for surface treatment according to 9.2.1 to 9.2.5 on the basis of the standard treatment.

9.2.1 Increased corrosion protection for carbon steel surfaces

Painted surfaces corresponding to the standard version (9.1.1), such as constant hangers and supports, support brackets, trapezes, installation extensions, rigid strut tubes and viscoelastic dampers are topcoated with an additional coat of **60µm** on an already existing coat of **120µm**, so that a specified coat thickness of **180µm** is achieved, color shade RAL 5012 – light blue.

Functional components lying within the constant hanger bodies are also treated according to corrosivity category C4, medium protection (M), in line with EN ISO 12944.

9.2.2 Increased corrosion protection for electro galvanized surfaces

Surfaces electro galvanized as standard according to 9.1.3, such as spring hangers and supports, are given a layer of adhesion primer of **40µm** thickness plus a topcoat of **60µm** to create a total layer thickness of **115µm**, color shade RAL 5012 – light blue.

Threaded parts from product group 6 are not given additional surface coats and can if required be supplied hot dip galvanized.

9.2.3 Increased corrosion protection for spherical bearings

The connecting elements of rigid struts and snubbers receive a special coating containing zinc and aluminum lamellas with an additional organic topcoat, layer thickness approx. **20–25µm.**

9.2.4 Increased corrosion protection for LISEGA helical coil springs

On top of the standard CED coating according to 9.1.2 a supplementary paint layer with a specified thickness of **60µm** is applied.

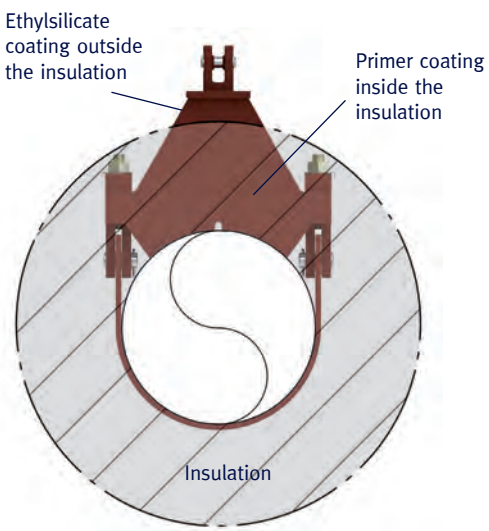
9.2.5 Increased corrosion protection for pipe clamps and clamp bases, product groups 3 and 4

Pipe clamps and clamp bases for an application range up to 350°C can, if required, be supplied hot dip galvanized.

application range [type]	coating for increased corrosion protection
up to 350°C	
[3. .. 1. / 4. .. 1.] [3. .. 6. / 4. .. 6.]	hot dip galvanization

Pipe clamps and clamp bases for a range over 350°C are given a coating which corresponds in the stability of its maximum working temperature to the following table.

application range [type]	coating for increased corrosion protection
over 350°C	within the insulation:
[3. .. 2. / 4. .. 2.]	Primer (as transport protection)
[3. .. 3. / 4. .. 3.]	Coat thickness approx. 30µm
[3. .. 4. / 4. .. 4.]	
[3. .. 5. / 4. .. 5.]	outside the insulation:
[3. .. 7. / 4. .. 7.]	Ethylsilicate coating
[3. .. 8. / 4. .. 8.]	Specified coat thickness 80µm



Coating in example of pipe clamps, insulated at T > 350°C

Threaded parts and boltings of the straps, plates, U-bolts and clamps of the pipe-surrounding components must, for increased corrosion protection and a working temperature over 350°C, be located within the insulation in accordance with the installation instructions.

The pin connection of pipe clamps and the end plates of the LISEGA vertical clamps with the adjoining components of the product group 6 must be located outside the insulation.

9.3 Hot dip galvanized version

As an alternative to 9.2, all components in the LISEGA product program can also be supplied as hot dip galvanized version or, where this is not suitable for technical reasons, made from corrosion resistant materials. Components receive a hot dip galvanized coating of approx. **60–80µm**. Internal functional components, threads, small parts etc. are hot dip galvanized by spin coating and have a thickness of approximately **40µm.**

For components not suited to hot dip galvanization due to the material used or the application area, the version 'Increased corrosion protection C4' corresponding to 9.2 represents a good alternative.

9.3.1 Constant hangers and supports, product group 1

If required, constant hangers and supports can be supplied hot dip galvanized. When ordering it should be stated whether corrosion protection C3 according to 9.1 is sufficient or C4 according to 9.2 is required. The difference consists in the additional treatment of the inner functional components.

9.3.2 Components in product group 2

Spring hangers and supports are available ex stock in hot dip galvanized versions.

9.3.3 Pipe clamps and clamp bases, product group 3 and 4

See section 9.2.5.

9.3.4 Components in product group 5

Roller bearings, cryogenic clamp bases and pipe saddles are supplied in hot dip galvanized versions as a standard.

9.3.5 Components in product group 6

Connecting rods and other connecting components, tie rods and threaded rods, threaded clevises, threaded eye nuts, turnbuckles and couplings can be supplied ex stock in hot dip galvanized versions.

9.4 Surface protection in extremely aggressive atmosphere

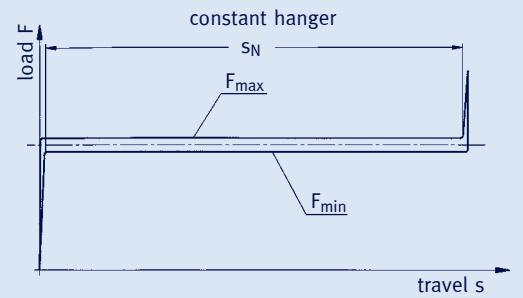
For use in extremely aggressive atmospheres such as e.g. seawater, offshore or aggressive chemical vapors, well-tested corrosion protection systems suitable for all conditions or correspondingly high corrosion resistant materials can be supplied.

10. Operational behavior

10.1 Function

10.1.1 Constant hangers / supports

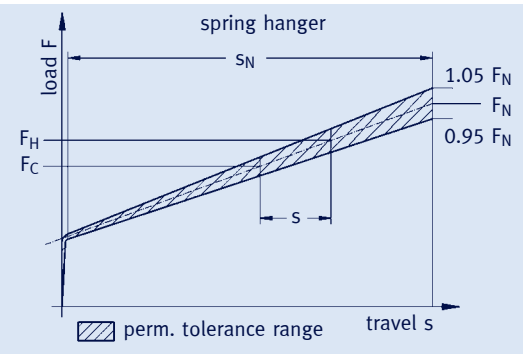
Constant hangers and constant supports of the product group 1 are designed, so that in theory, minimum load deviation occurs over the whole operating range. The total deviation arising from springs, bearing friction and production tolerances is restricted to ±5% in series production. Load adjustment is made to an accuracy level of 2%.



F_N = nominal load
F_{min} = minimum load (upward travel)
F_{max} = maximum load (downward travel)
s_N = nominal travel (incl. reserve)

10.1.2 Spring hangers / supports

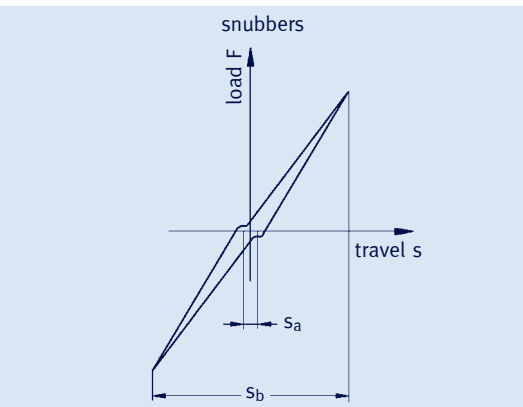
For spring hangers and spring supports in product group 2 the load changes linearly in line with the spring travel. The deviation of the spring hysteresis from theoretical values, which results from spring hysteresis and production tolerances, amounts to less than ±5% within the operational travel.



F_N = nominal load
s_N = nominal travel (incl. reserve)
F_H = hot load a (operating load) for downward operational travel
F_C = cold load a (installation load)
s = operational travel

10.1.3 Snubbers

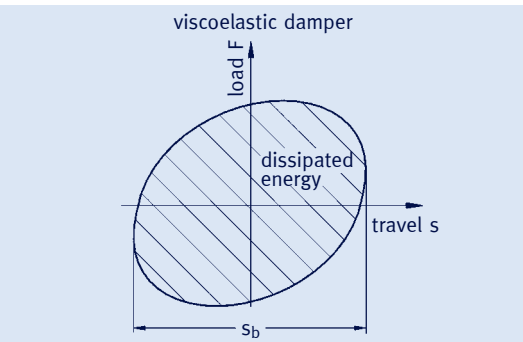
Snubbers are designed, in the event of an impact load between the component to be secured and the building structure, to produce an instantaneous rigid connection. Slow displacement due to thermal expansion must not be resisted. Hence the locking mechanism that blocks the component reacts to velocity. The individual functional data are specified in section 3, page 3.7.



s_a = piston rod tolerance
s_b = piston rod travel

10.1.4 Viscoelastic dampers

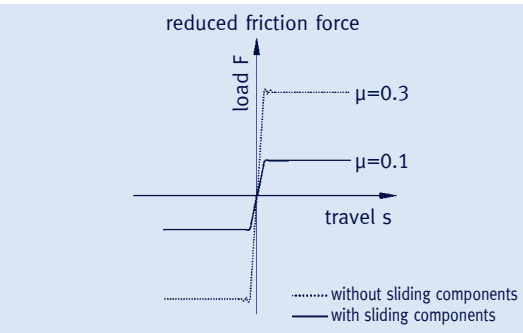
Viscoelastic dampers are employed to reduce operational vibrations from machines or plant components to a harmless level by means of broadband damping. The kinetic energy is thereby transformed into heat via a viscous mass. The damping resistance in all degrees of freedom is decisive for its effectiveness. The individual functional data are specified in section 3, page 3.13.



s_b = operational stroke

10.1.5 Slide plates

Slide plates are used to reduce the lateral forces produced by the change in position of the sliding bearing-points. In the LISEGA slide plates, low-friction materials are used with self-lubricating characteristics that reduce friction forces by up to 2/3 at an operating temperature of max. 350°C. The individual design data are given in section 7, page 7.10.



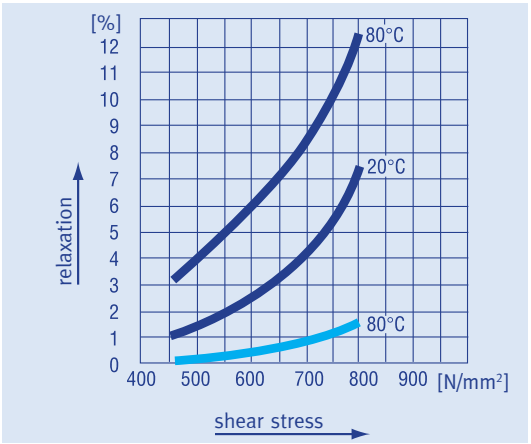
Reduction in reaction forces in the piping system by the use of slide plates.

10.2 Spring relaxation

When under loading and depending on time and temperature, standard helical compression springs lose a considerable amount of their internal stress through relaxation or settling loss. If no special measures are taken to counter this, in constant and spring hangers, it can in the long-term lead to a reduction of more than 10% in the set ultimate load.

In contrast to common practise, LISEGA **exclusively** uses specially treated springs that exhibit practically no relaxation.

In these springs the expected settling loss is anticipated through hot setting. This method is called **prerelaxation**.



Relaxation behavior of helical coil springs

cold set helical coil springs (loosely based on DIN 2089)

LISEGA hot set helical coil springs, qualified by the KTA qualification tests and VGB type tests

11. Connection dimensions

11.1 Installation dimension E

For the simple determination of the required rod lengths in load chains, the installation **dimension E** is specified for all components apart from tie rods and threaded rods (product group 6).

This E dimension denotes the respective installation length of the components minus the thread engagement depths (X dimensions) of the connecting tie rods and threaded rods.

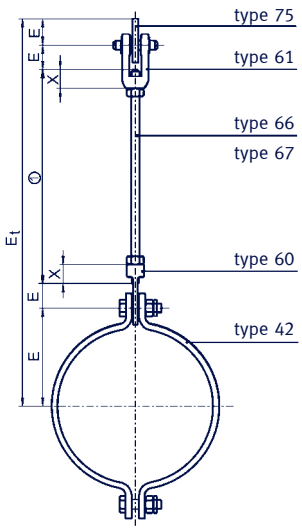
The length of the rods required is given by the total installation height (pipe axis to reference edge of connection surface) minus the sum of the E dimensions of the components to be connected.

To determine the total length of the rods in a load chain all the E dimensions are added together. The sum is compared with the total installation dimension. If a difference results which is greater than the sum of the thread engagement depths (X dimensions), then the chain selected is correct for the total installation height.

For load chains solely with pinned connections the **minimum installation dimension** results from the sum of all E dimensions.

Product-related details are to be found in the selection tables.

Simple method for checking the installation possibilities with the E dimension!



X = Thread depth
E_t = Total installation dimension ($E_t=E_{total}$)
① = Length adapted to individual installation conditions

components (extract)	reference basis for installation dimension "E"
product group 1	
constant hangers constant supports servohangers	• upper starting position (0 on travel scale) • on deviation in blocking position to the new blocking position is also to be considered
product group 2	
spring hangers	• upper starting position (0 on travel scale) • on deviation in blocking position the blocking position is also to be considered
spring supports (without type 29 .. 2.)	• upper starting position (0 on travel scale) • independent of blocking position due to adjustment available in the support tube
product group 3	
snubbers	• specification of "E min" and "E max" corresponding to possible travel • for installation instructions the planned installation position incl. travel reserves is to be taken into account
viscoelastic damper	• middle position
product group 4	
pipe clamps	• distance from pipe axis to pin connection or bottom of clamp bases
product group 6	
threaded connections	• middle line of pin or lower edge of thread engagement depth up to upper edge of thread engagement depth
product group 7	
structural attachments	• middle line of pin up to face of structure

11.2 Regulation of total installation length

11.2.1 Turnbuckle function of connection threads

For length adjustment in installed condition (setting pipe installation position, creating force-fitting) the lower connections on the constant and spring hangers are designed to function as turnbuckles. In this way convenient future adjustment of installation lengths (connecting rods) is ensured. The length adjustment amounts to:

- **300mm for constant hangers type 11**
- **150mm for constant hangers type 18**
- **the adjustment possibilities of a type 62 turnbuckle for spring hangers type 21**
- **min. 140mm for spring hangers type 22**
- **for spring hangers types 25 and 26 the load-bearing rods are led through the weld-on support tube and held by an adjusting nut. Adjustment can be made within the scope of the available thread length of the rods.**

All connecting threads are right-hand.

11.2.2 Constant and spring supports

For types 19, 16, 28, and 29, the installation height is adjustable independently of the respective presetting by using the threaded support tube designed as a spindle. The necessary load is reached during installation by the turning of the threaded support tube.

11.2.3 Turnbuckles type 62, tie rods L/R type 65

For rigid hangers with short installation lengths a defined reserved length for connection components types 60 and 61 usually enables sufficient length adjustment. For greater installation lengths the use of a turnbuckle L/R type 62 in combination with a tie rod L/R type 65 is recommended for the purpose of simpler adjustability. For easy accessibility this combination should always be placed at the lowest end of the load chain.

11.2.4 Rigid struts type 39

The connections for the rigid struts type 39 are supplied as standard as right/left fine thread for length adjustability in installed condition. Flat faces on the rigid strut body enable easy adjustment with an ordinary wrench.

Further instructions are given in the corresponding installation instructions.

12. Quality Management and IMS

For the effective management and supervision of the organization (Corporate Governance) the **Integrated Management System (IMS)** summarizes in a centralized structure the established methods and regulations in the company for observation of the demands in the main sectors.

The IMS covers the areas:

- **fundamental company principles**
- **quality management**
- **environmental protection**
- **work and health protection**
- **organizational procedures**
- **international export certification**

Through the utilization of synergies and the pooling of resources, lean and effective management is possible. In IMS the data from the various systems are gathered, analyzed and evaluated centrally according to the requirements of modern **CAQ (Computer-aided quality)** solutions. The system takes into account recognized standards and guidelines including the corresponding reporting system. Relevant approvals from authorized bodies can be found in the table on page 0.18.

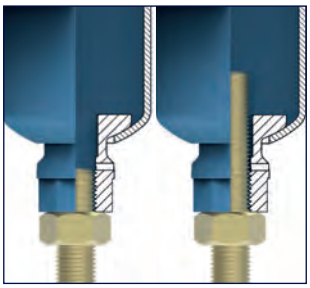
12.1 Quality management

Our quality management (QM) monitors and regulates all activities affecting quality in the company. The independent QM department is the leading system in IMS and has overall supervision of the clearly targeted function of the processes integrated into IMS and the observation of rules and regulations.

One of the most important corporate principles at LISEGA is superior product quality, a vital element which also encompasses the activities and close partnership with our business partners. The organization and behavior of our personnel are correspondingly attuned to this.

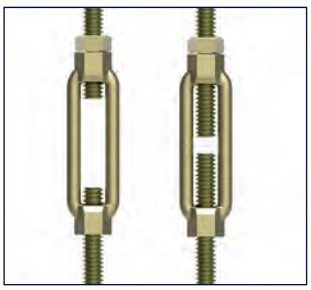
The particular measures ensuring quality undertaken by QM are outlined in the **quality management program (QMP)**, which covers the whole organization. These measures and activities to promote quality are an integral component in the processing cycle and are firmly rooted in the procedures.

Constructive devices available for the subsequent adjustment of installation lengths!

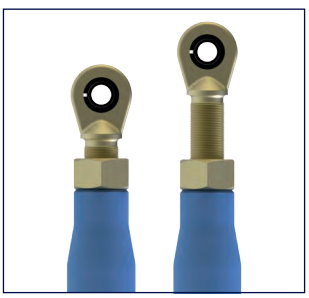


Constant hanger type 11

Spring support type 29



Turnbuckle type 62



Rigid strut type 39

The QMP, as an integral component, forms an entity with the processing cycle!

Following international codes and standards, the QMP is described in detail in the **Quality Management Manual (QMM)**. The QMM takes into account all the recognized European and other international standards, especially **DIN EN ISO 9001** and **ASME section III Div. 1 Subs. NCA 4000** including **Subs. NF** and **KTA 1401, RCC-M H**.

The QMM covers the whole organization of the LISEGA Group and is applied generally both in the conventional sector as well as in areas with **increased requirements**, such as the **nuclear industry**. The scope of the traceability of material, and testing the corresponding documentation can also be adapted exactly to special demands by the activation of further verification levels. All international requirements, including those affecting the nuclear field, can be covered by the QMM. The relevant approvals are available and are regularly renewed.

12.2 Raw material and goods reception

All the materials used are monitored by way of a receiving inspection check by quality management regarding compliance with the technical specifications. The materials used are, according to requirements, certified by material test approvals according to ASME and DIN EN 10204.

12.3 Production supervision

The supervision of production is carried out through constant quality control according to QMM. In particular, for nuclear applications the international quality stipulations according to the codes ASME section III NF / NCA 4000 (USA), RCC-M section H (FR), KTA (DE), DIN EN 13480-T5 and NNSA (CN) are fulfilled.

12.4 Final inspection

Before shipment, constant hangers and spring hangers, as well as snubbers and dampers are subjected, under the responsibility of Quality Management, to function tests on special test benches. The measurement and testing is performed with correctly calibrated test and measurement equipment. The measurements are recorded and can if required be accessed and documented. All the testing faculties are regularly inspected and checked by qualified personnel according to EN ISO 7500-1.

12.5 Documentation on delivery

If required, the materials used are documented by certification via material tests according to ASME and DIN EN 10204. In addition, the results of the functional test can be confirmed by the issue of an acceptance test certificate, also by an independent test institute if so desired. Computerized verification in line with special requirements and special quality-related documents can be agreed upon between customer, producer and supervisor.

13. Suitability tests, type tests

For the use of serially produced standard supports in industrial piping installations, especially in plants with more stringent requirements, e.g. nuclear power stations, special suitability and type tests are required worldwide. The test programs specified mainly involve the following steps:

- **inspection of the quality management program**
- **inspection of the materials used**
- **inspection of the design documentation**
- **verification of the computer-based tensile stress values**
- **experimental testing on**
  - **function**
  - **overload capacity**
  - **continuous load capacity**

On successful testing, suitability is regarded as proven and general approval can be issued for use in industrial piping installations.

Type and suitability tests have been carried out for the major part of the LISEGA product range by the various German and international, independent institutions. They therefore also comply with the requirements of current European codes.

- **DIN EN 13480–T3 Section 13**
- **RCC-M H5300, H5400**
- **KTA 3205.3**
- **VGB-R 510 L**

Certifications can be supplied upon request.

14. Standard version and increased requirements

Our standard supports are absolutely equal in design and function for both the conventional market and where increased requirements are concerned, e.g. in the nuclear field. Hence they do not differ in design or construction. However, due to additional quality assurance requirements and materials with supplementary certification in these sectors, a separate production process may be required.

For areas with increased requirements, all components right up to the finished product must be traceable through batch restamping and the units themselves identifiable according to KTA and ASME codes. In the type designation the increased requirement level is indicated in the 5th digit and for rigid struts in the 6th digit. The relevant component documentation refers to this and to the number of the production order.

In this catalog the standard component, i.e. the one for conventional applications, is identified by the type designations. As the functional data and component dimensions specified are identical to the increased requirements version, in all cases the selection of products can be made using the catalog. **However, when planning or ordering, it is important to verify the part number associated with the requirement level.**

The order examples on the individual data sheets should be noted. The type code under Sect. 5 (pages 0.7 and 0.8) can also be used for this.

Separate production processes of components meeting increased requirements for the traceability of certified materials!

the most important certifications in the LISEGA Group

certification code	certifing body	certification No. ①
ISO 9001	TÜV Nord BSI TÜV Rheinland AFAQ LRQA TÜV Nord	78 100 034445 FS 557331 01 100 038965 1996 / 5030.4 MEA6011026/1 07 100 010963
EN 1090-1:2009/A1:2011	TÜV Nord	0045-CPR-1090-1.00151 TÜVNORD.2013.003
Cl. E; DIN 18800-7:2008-11, DIN 18801	TÜV Nord	DIN 18800-7 / 0513-EW /13/0
AD 2000 Leaflet-HP0	TÜV Nord	07-203-1282-HP-0513/13
DIN EN ISO 3834-2	TÜV Nord	07-204-1280-HS-0513/15
BS OHSAS 18001:2007 „Safety management“	TÜV Nord AFAQ	78 116 034445 2010/38940.1
DIN EN ISO 14001:2009 „Environmental“	TÜV Nord	78 104 034445
SCC	TÜV Nord	78 106 034445
ASME section III Div. I NCA 4000 NS - Certificate for supports	ASME	N 3092 N 3025
ASME section III Div. I NCA 4000 NPT - Stamp for supports	ASME	N 3169 N 2951
KTA 1401	VGB, EnBW Kernkraft, RWE, E.ON, Vattenfall	
NNSA Designing NNSA Manufacturing	China National Nuclear Safety Administration	1405 1406
TN VED / Rostechnazor	Federal Service for Ecological, Technological and Atomic Supervision	PPC 00-043746
GOST R	RST Expert	РОСС DE.АГ80.Н02052 РОСС DE.АГ80.Н02053 РОСС DE.АГ80.Н02054
SPIR-O-2008	ATT=Atomic Techno Test	РОСС RU.0001.01АЭ00.00.10.2849
SSMFS 2008:13	INSPECTA NUCLEAR AB	5477
ASME section III Div. I, Subs. NF Class 1, 2, 3, MC, ASME section XI	Tractebel Belgium	3365

① At the time of publication. Current certificates can be downloaded from our website.

Piping can only be as good as its supports!

15. Form of shipment

Unless specified otherwise, all products are classified according to component types and shipped in appropriate packaging for transport or for short-term storage. They are clearly marked and, if necessary, protected against corrosion by special measures. If long-term storage is required, different packaging can be agreed on for this purpose.

Specific requirements can, where applicable, be found in the data sheets or installation instructions. Complete pipe supports (load chains of different components) can on request be pre-assembled, bundled, and labeled.

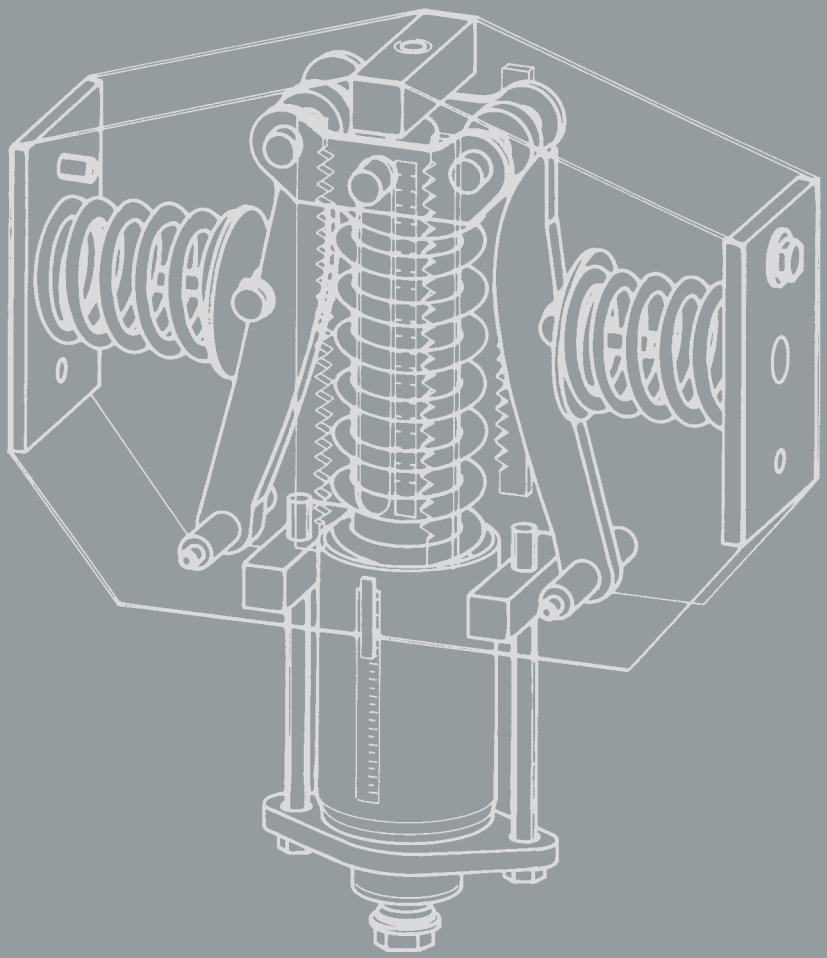
16. Warranty

For all LISEGA components a 2-year warranty is issued from date of commissioning, limited to 3 years after transfer of ownership.

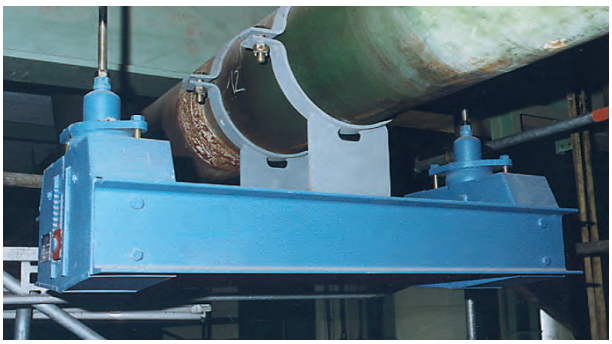
17. Technical modifications

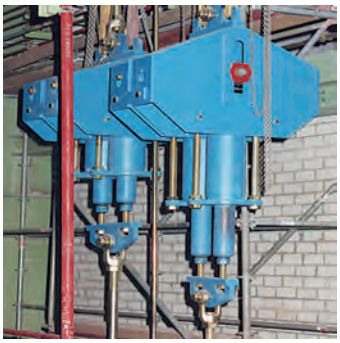
Modifications in the interests of further technical development as well as deviations for technical reasons in the dimensions, loads and weights in the range of the selection tables are expressly reserved. Dimensions are often used as maximum dimensions for clash tests. If required, the exact manufacturing dimensions can be provided.

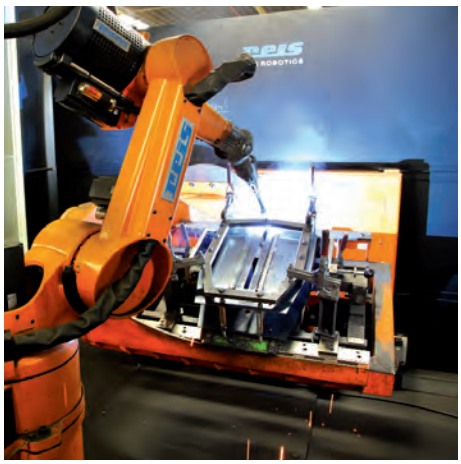
Constant hangers, constant supports

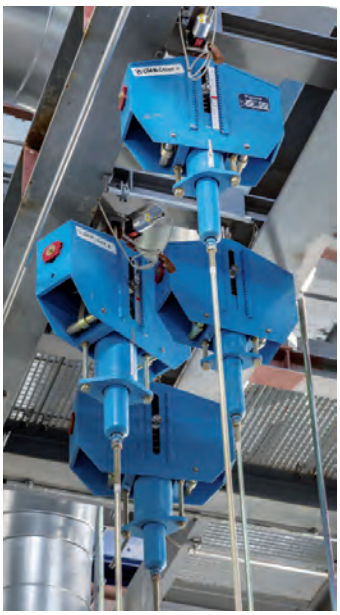


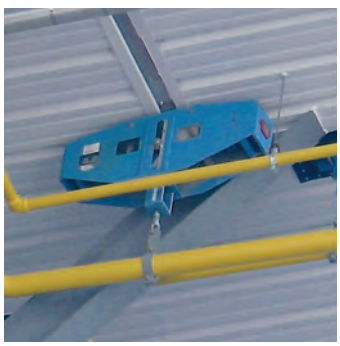
LISEGA











Constant hangers, constant supports

Contents **Page**

Field of application

To avoid unacceptable forces and moments in pipe systems, the thermal expansion of the piping must not be restricted.

Constant hangers types 11-14, Constant supports type 16

Minor thermal displacement in the pipe systems in the vertical direction can be compensated by spring supports or spring hangers. Due to the resulting proportionally increasing force deviation corresponding to the spring rate, their use is limited to a displacement range specified by the designer (see product group 2, pp 2.5 and 2.6).

In the case of greater vertical displacement the use of constant hangers or constant supports is required. For these special designs, the spring force is transformed into a constant force throughout the displacement range (see function principle, page 1.5).

The proportional loads of the pipe system can in this way be constantly distributed over the whole displacement range without significant deviations. As a rule, for LISEGA constant hangers the use of type 11, tried and tested over 100,000 times, provides the standard solution.

Constant hanger type 11

The function principle is based on the arrangement of three springs resulting in the parallelogram of forces. The design is distinguished by highly functional accuracy along with wide load adjustment ranges. The favorable performance-to-weight ratios and symmetrical designs enable easy installation. For further typical advantages, see page 1.3.

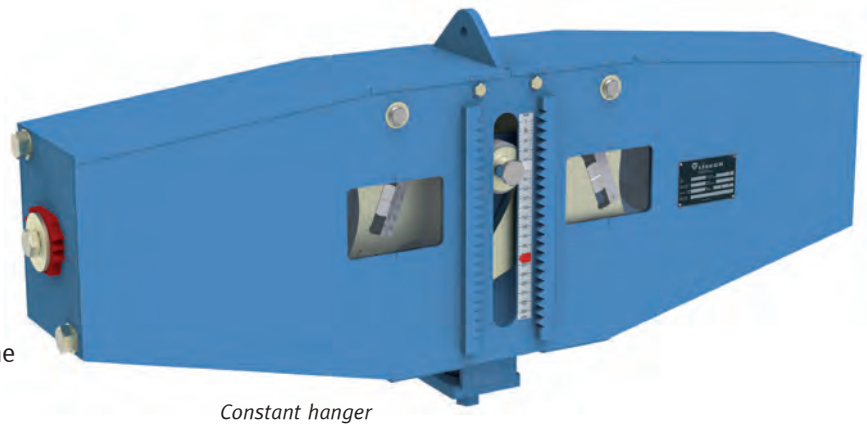
Constant hanger in a coal-fired power station

Final assembly of a constant hanger

Installation inspection of a constant hanger

Constant hangers type 18

As a rule, the pipe support engineer allows for sufficient installation space for the supports required. However, due to limitations of space the installation height can be too small for the typical standard solution with type 11.



Constant hanger type 18

This sometimes occurs, especially when reconstruction existing plants. To provide the optimum solution in such cases, type 18, a low profile design, is available from the LISEGA hanger range, besides the main type 11 series.

The function principle of this design is based on the lever principle. Unlike the usual lever-arm type hangers, the load displacement here is linear and is constant, following the LISEGA principle (see function principle, page 1.6).

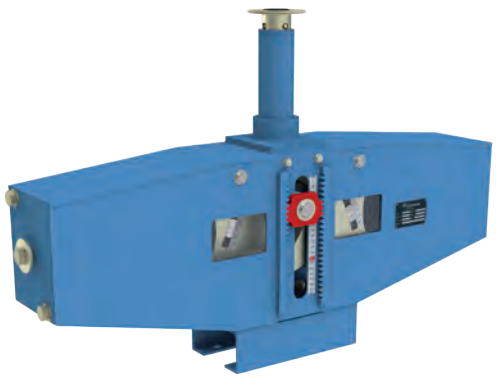
In the case of constant hangers, the pipe systems are suspended from roof constructions or the steelwork. If the piping is laid out near ground level it may be appropriate to take up the loads from below with constant supports.

Constant supports type 19

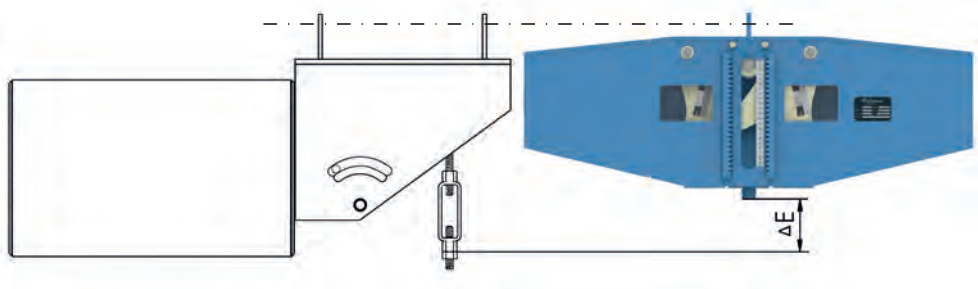
Due to its compact design, constant support type 19 thereby replaces its predecessor, type 16, as standard. Type 16 continues to be standard only in the heavy-duty range (load range 100 – 400kN) for its coupling capacity.

On the basis of their special function principles and modes of design, LISEGA constant hangers and supports have, for the past five decades, proven their outstanding operational safety and reliability many thousands of times. Further descriptions of their mode of operation and function are set out on page 1.6 and their design features from page 1.7.

For the operational safety and long life of the pipe systems and hence of the plant itself, the consistent functional accuracy of the constant hangers is of utmost importance.



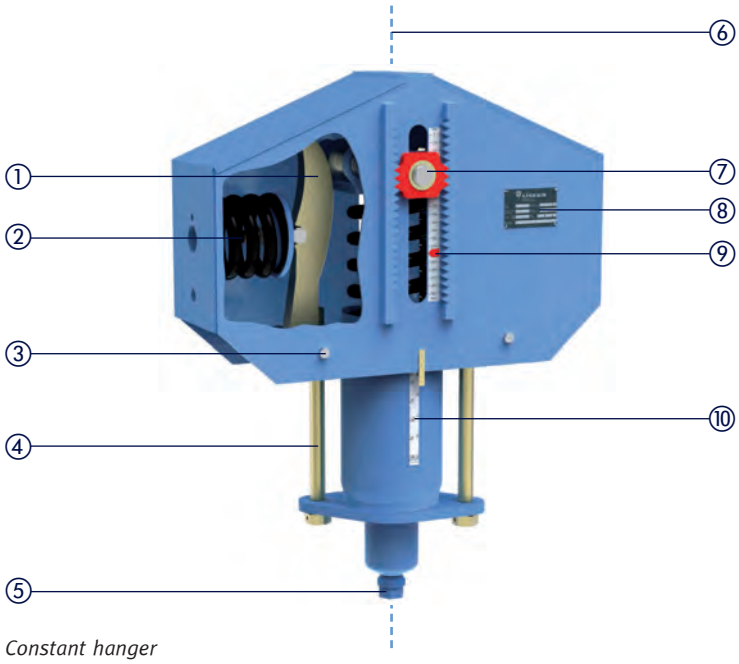
Constant support type 19



Space-saving design of type 18 compared to a conventional lever-arm hanger

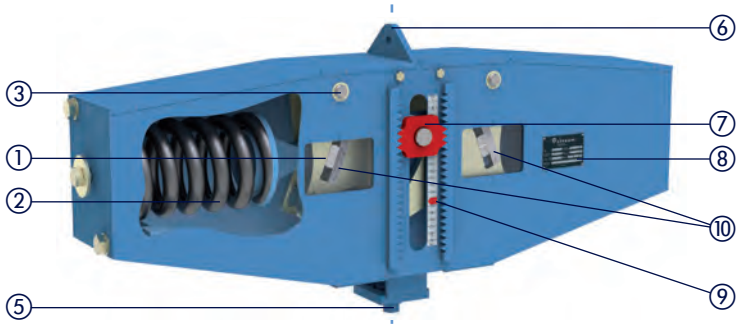
In comparison with conventional lever-arm type hangers the new LISEGA type 18 is lower profile and enables the creation of support chains in the smallest of spaces.

Special benefits of LISEGA constant hangers and supports

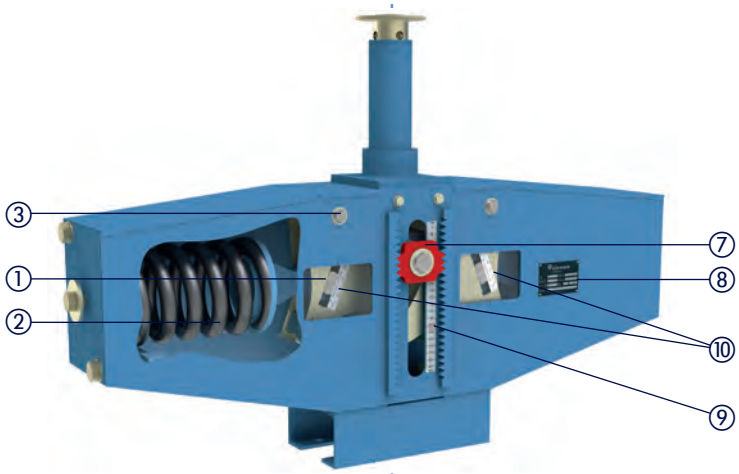


Constant hanger type 11

axis of symmetry



Constant hanger type 18



Constant support type 19

The user can profit from a variety of special benefits where LISEGA constant hangers are concerned.

Significant savings are possible, especially regarding labor-intensive ancillary support costs such as planning, installation and operation.

① Principle-based constancy by way of a special function principle.

② Pre-relaxed springs eliminate any significant loss of load-bearing capacity.

③ Reduced friction due to minimized number of bearing points.

④ Especially wide load adjustment range avoids hanger replacement when operational loads change.

⑤ Turnbuckle and swivel joint function allows greater adjustment of pipe installation position.

⑥ Load application free of moments due to a single suspension point.

⑦ Blocking device through fine rasterization nearly infinitely variable.

⑧ Name plate contains complete technical specifications.

⑨ Directly readable travel scale with marking for hot/cold positions.

⑩ Load scale with permanent marking of set load.

✓ Symmetrical design ensures direct flow of forces through axis of symmetry.

✓ Favorable performance-weight ratios for reduced installation loads.

✓ Arranged by load groups and travel ranges to simplify selection (modular system).

✓ Consistent functional behavior due to high-quality corrosion protection and maintenance-free chemically nickelized finishes.

✓ Readily adaptable to installation situation via corresponding designs and standardized accessories.

✓ Double load-tube guiding of constant supports for transmission of side loads.

✓ Secure connection of load chains due to load- and connection-compatible modular components.

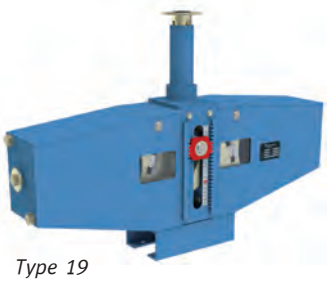
LISEGA constant hanger and support types

As fixed elements in the pipe system concept, the pipe supports must operate smoothly as functional connections between the pipe system and the surrounding structure.

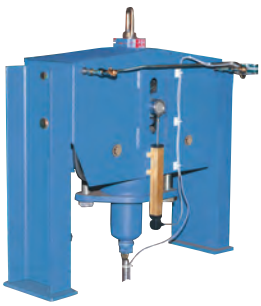
Type 11

Type 11 with support brackets

Type 18



Type 19



Type 17 with support brackets

Pipe systems are usually very complex layouts with restricted space. To allow for optimum use of the different spatial conditions, various designs are available as standard for the different application situations. All components are available either from stock or at short notice.

Constant hanger type 11 C3 19 to 11 96 15

Standard design for use as suspension for loads up to load group 9 (100kN) and travel range 6 (750mm). Travel range 7 (900mm) is available on request. If no space restrictions or other specifications are to be considered, this is the preferred product.

Constant hanger type 11 with support brackets type 71 C3 .1 to 71 96 .1

Standard design with support brackets bolted at the LISEGA factory for use as seated versions.

Constant hanger type 18 D3 17 to 18 93 17

Serial standard design in special low profile version as alternative suspension to type 11, if the installation height is limited.

Constant support type 19 D3 17 to 19 93 17

Serial standard design for use as support if constant support from below is required.

Note: This version replaces the taller single-cell constant hanger type 16 (see Standard Supports Catalog 2010) and is especially suitable in restricted spaces. Type 16 can still be supplied if required.

Heavy constant support type 16

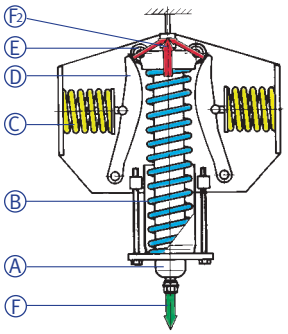
Special design as multi-cell constant support type 16, if heavy loads have to be distributed.

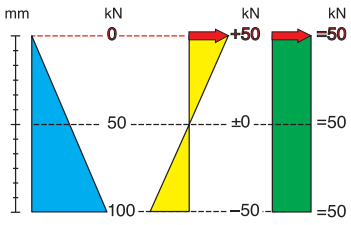
Servohanger type 17 52 15 to 17 93 15

Servohangers are equipped with additional active load regulation and can reduce overloading in the piping system to a permissible harmless level.

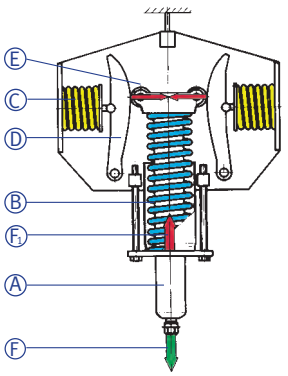
Type 16

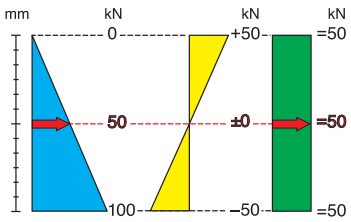
Mode of operation and function Types 11, 12, 13, 14, 16, 79



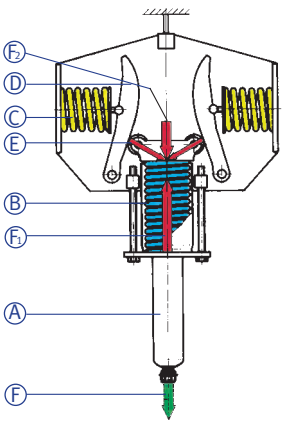


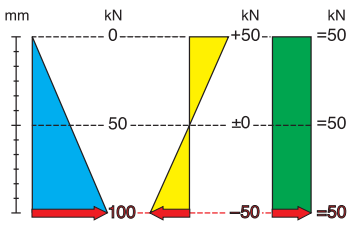
Upper position





Middle position





Lower position

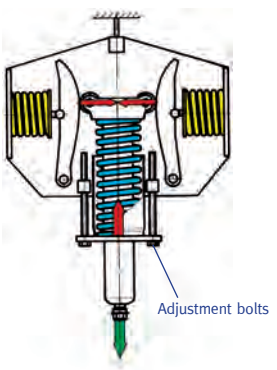
The LISEGA Function Principle

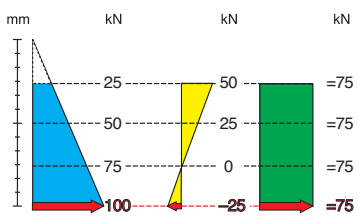
The LISEGA Function Principle is based on the interaction of the force from a mainspring and the resulting force of two connected balance springs. The force directions of the pre-loaded compensating springs are thereby angled against each other in the shape of a parallelogram of forces.

The suspended load Ⓕ acts directly on the mainspring Ⓑ via the load tube Ⓐ. The pre-loaded compensating springs Ⓒ act additionally on the load tube as the resulting force F_2 via pivoting cams Ⓓ and roller supports Ⓔ. The mainspring force F_1 and the resulting force F_2 change on the shifting of the load over the displacement range in accordance with the specified spring constants, the cam path, and the angular position of the cam components.

The course of the resulting force corresponds to the characteristics of the mainspring. In this way the mainspring force is balanced out, without deviations, to a constant support force.

- **The LISEGA function principle leads to absolute constancy which by theory can easily be proven.**
- **The LISEGA function principle permits an especially wide load adjustment range of 40% – 100% of the nominal load.**





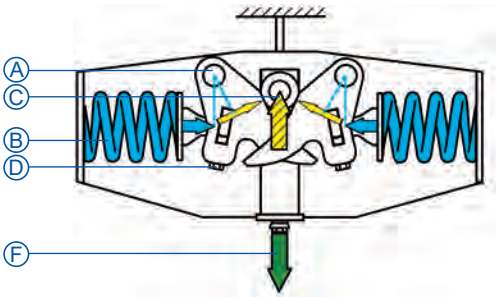
$F_1 + F_2 = F_{75\%}$

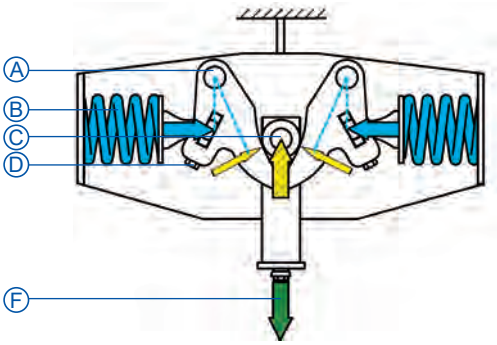
Load adjustment

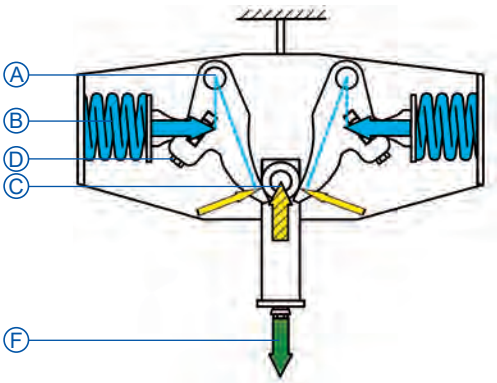
The load adjustment is carried out by a pre-loading of the mainspring. As the characteristics of the resulting balancing force and the mainspring are the same, only a linear shifting of the initial force thereby occurs F_1. This way, the change in force is the same at every point of the movement and the ultimate load remains constant at each load setting.

The remaining travel range changes proportionally to the load alterations.

Mode of operation and function Types 18, 19







Function principle for LISEGA constant hangers type 18 and constant supports type 19
The function principle is based on the lever principle, by which variable spring forces are transformed into a constant support force by way of lever mechanics.

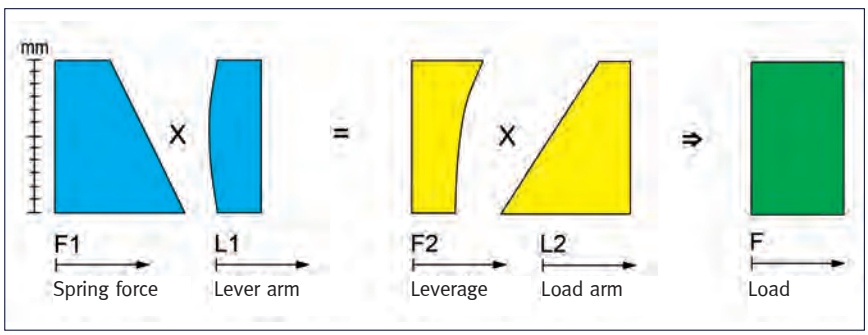
Two lever arms Ⓐ, symmetrically arranged at an angle to each other, thereby act as one system with pre-loaded springs Ⓑ. On a vertical change in position of the load Ⓕ to be taken up, the displacement is distributed over rollers Ⓒ and defined bearing surfaces onto the lever systems. Through the pairing arrangement of the levers the displacement runs linearly in the axis of symmetry, whereby the lever conditions that thereby change do so proportionally to the correspondingly changing spring preloading. In this way the load stays in balance with the set set load in every travel position.

Sinus-shaped load deviations from the lever movement in the form of an arc are balanced by correspondingly machined cam profiles. This way the load distribution is held constant with mathematical accuracy in every position.

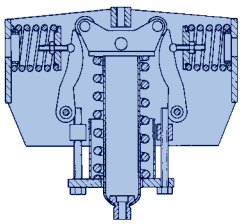
Load adjustment

The set load is adjustable within a range of approx. 50% to 100% of the maximum hanger force. By way of an adjusting hex-head bolt Ⓓ the length of the lever arm force is continuously variable.

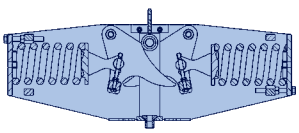
On all load settings the available travel range remains unchanged. The whole working travel range is always available.



Design features



LISEGA constant hanger type 11 standard design



LISEGA constant hanger type 18 compact design

Design Structure

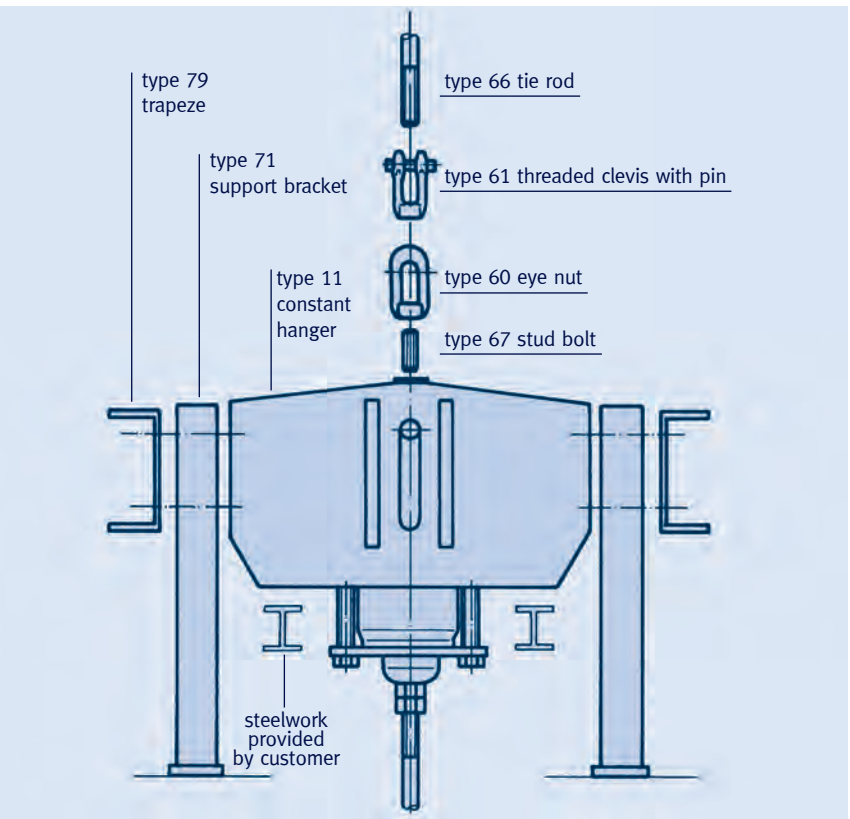
A steel body encases the moving parts such as springs and cam lever. The compact arrangement of the individual components enables small external dimensions. The body is designed to bear loads and is mass-produced for the attachment of standardized connections.

Connection possibilities

The connection threads correspond to the respective LISEGA load group, whereby the upper connection thread (type 11) has a defined thread engagement depth and the lower one is designed as a adjusting nut for length compensation.

Due to their design, type 11 constant hangers can also be seated directly on suitable supporting components without the need for accessories. In addition, special support brackets can be bolted on using the standard tapped holes provided. Type 11 constant hangers above load group 9 (heavy duty) and type 18 constant hangers are fitted with yoke plates (only on top) for a pined connection, instead of connection threads.

▼ *Serial connection types*



Performance range

Constant hangers and supports are produced as standardized single-cell hangers in load groups C to 9. In addition, type 11 constant hangers in sizes 8 and 9 are coupled to form hangers for higher loads (heavy duty). In this way a standard performance range from 0.13kN to 500kN is covered. Constant hangers are manufactured in the seven standard travel ranges 75 / 150 / 300 / 450 / 600 / 750 / 900 mm and constant supports up to 300mm.

Standards and calculations

Component design and layout correspond to the applicable national and international standards and recognized technical specifications with regard to load capacity, function and lifespan. This applies equally to the materials used, the welding technology and other processes. The relevant details are clearly defined in the technical specifications, page 0.9.

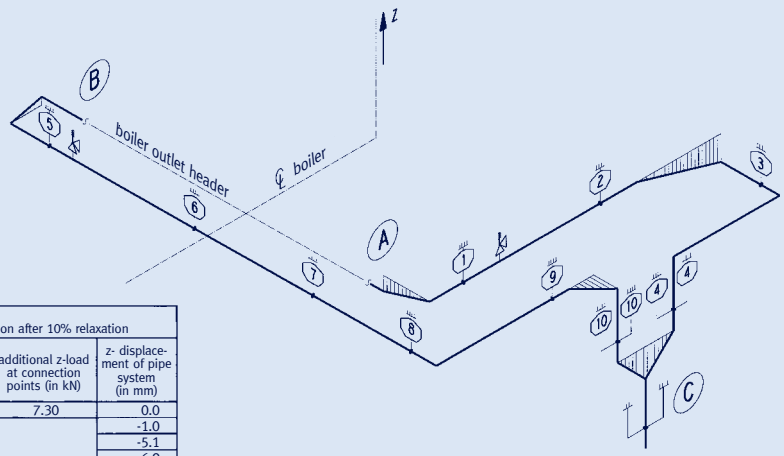
Springs

The springs are crucial components for the smooth functioning of constant hangers and supports – their long-term functional efficiency is vital for the operational safety of hangers and supports. The relevant standards are the basis for the design of LISEGA helical coil springs. Details can be found in the **technical specifications**, section 0.

Spring relaxation

When subjected to loads and temperature over a period of time, conventional helical coil springs lose part of their reset force through relaxation (settling loss). In constant and spring hangers this can, in the long term, lead to a reduction in the set ultimate load of more than 10% (see calculation example).

LISEGA exclusively uses springs that, through an artificial aging process, show no appreciable settling loss. The spring relaxation normally to be expected is anticipated by producing preplastification in a hot setting process with greater coil lengths.



connection point / hanger	planned condition: set load of hanger	condition after 10% relaxation: hanger load	additional z-load at connection points (in kN)	z- displacement of pipe system (in mm)
A			7.30	0.0
1	58.93	53.04		-1.0
2	67.50	60.75		-5.1
3	54.33	48.90		-6.9
4	78.35	70.52		0.3
B			17.25	0.0
5	58.42	52.58		-4.4
6	58.31	52.48		-20.7
7	35.97	32.37		-30.4
8	47.65	42.89		-36.4
9	54.10	48.69		-19.2
10	67.26	60.53		-1.0
C			36.70	0.0

Calculation example of cumulative additional loads due to hanger relaxation

A pipe system was observed (dia = 525mm, s = 27mm, temperature = 540°C, pressure = 50 bar). The effect of a 10% loss of force in the hangers was assumed. Due to this loss, the pipe system is displaced by 36.4mm.

The maximum primary stresses were calculated in the vicinity of the boiler connection. They stand 93% above the planned stress condition.

The permissible stresses for the boiler connection are exceeded by 9% (calculations according to Regulation B31.1).

Corrosion protection

The constant hangers are finished with a LISEGA standard coating which, together with a metallically pure treated surface, offers superior corrosion protection with high mechanical stability. Bearings and bearing bolts for the constant hangers are plated or made of non-rusting materials. All threaded components and cams are electro galvanized.

The surface of the spring is given a special finish (**technical specifications,** page 0.11).

Constant hangers with standard corrosion protection need no maintenance if installed in buildings or in locations protected from the weather. For operation in the open or in special situations, corresponding extra corrosion protection can be arranged – see the corrosion protection section in **technical specifications**, page 0.10.

Paintshop

Spring testing at material reception

Function testing

Functional performance

The special functional principle of LISEGA constant hangers guarantees constancy across the entire travel range. This is also unaffected by shifts in load. Only a minor adjustment force produced by tolerances and bearing friction is to be taken into account. The hysteresis so produced is kept within strict limits due to the design principle and modern production processes.

In effect, the deviation in the set load of LISEGA constant hangers on the serial average can, on normal load setting, be kept to ± 3%.

Applying a selection process, with limited load and travel ranges, it is possible to reduce this even further.

Calibration, testing and blocking of a constant hanger type 12 on a 500kN test bench

The typical permissible deviations are set out in the following international codes:

- **MSS SP-58 (USA), max. ± 6% in relation to the operating load**
- **VGB-R510L and KTA 3205.3, Germany, max. ± 5% in relation to the operating load. The deviation in load adjustment (medium load) is limited to ± 2%**
- **DIN EN 13480-T3 max. ± 5% in relation to the operating load**

Function testing

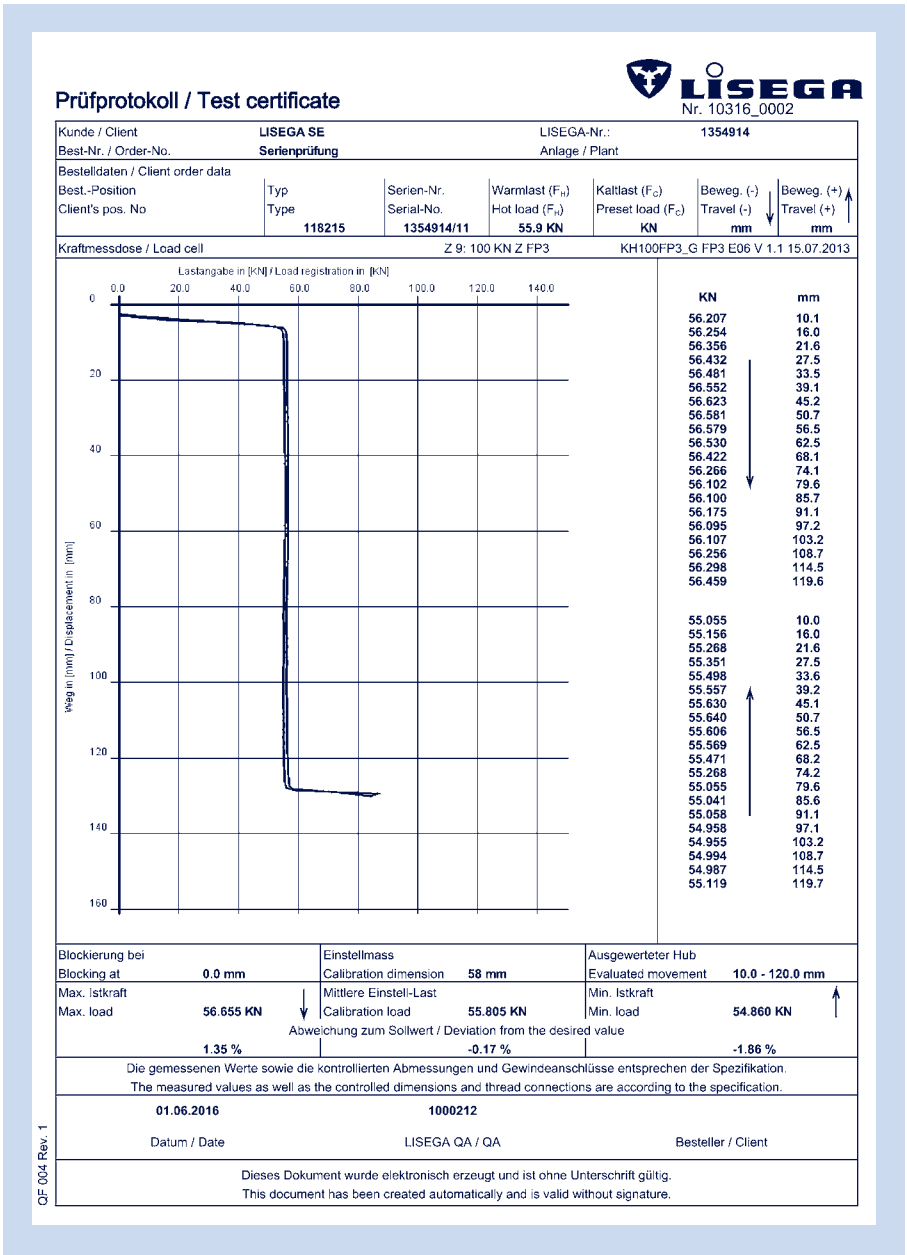
Before shipment, all constant hangers and supports are tested for flawless functioning and set to the load ordered. The test results are recorded.

The calibration values are stamped onto a riveted name plate. The adjusted load is also marked permanently on the load scale. Hot and cold positions are noted on the travel scale in red and white respectively.

The respective travel positions can be read directly off the travel scale in mm or inches.

Acceptance testing of a constant hanger

The set load in each case can be read directly off a load scale in kN or lbs. For the functional tests, test benches operating quasi-statically with capacities up to 1,000 kN are on hand. The test benches are checked regularly by an independent supervisory body.



Prüfprotokoll / Test certificate

LISEGA

Nr. 10316_0002

Kunde / Client	LISEGA SE	LISEGA-Nr.:	1354914
Best-Nr. / Order-No.	Serienprüfung	Anlage / Plant	

Bestelldaten / Client order data

Best.-Position / Client's pos. No	Typ / Type	Serien-Nr. / Serial-No.	Warmlast (F_H) / Hot load (F_H)	Kaltlast (F_C) / Preset load (F_C)	Beweg. (-) / Travel (-)	Beweg. (+) / Travel (+)
	118215	1354914/11	55.9 KN	KN	mm	mm

Kraftmessdose / Load cell: Z 9: 100 KN Z FP3 — KH100FP3_G FP3 E06 V 1.1 15.07.2013

Lastangabe in [KN] / Load registration in [KN]

Weg in [mm] / Displacement in [mm]

KN	mm
56.207	10.1
56.254	16.0
56.356	21.6
56.432	27.5
56.481	33.5
56.552	39.1
56.623	45.2
56.581	50.7
56.579	56.5
56.530	62.5
56.422	68.1
56.266	74.1
56.102	79.6
56.100	85.7
56.175	91.1
56.095	97.2
56.107	103.2
56.256	108.7
56.298	114.5
56.459	119.6
55.055	10.0
55.156	16.0
55.268	21.6
55.351	27.5
55.498	33.6
55.557	39.2
55.630	45.1
55.640	50.7
55.606	56.5
55.569	62.5
55.471	68.2
55.268	74.2
55.055	79.6
55.041	85.6
55.058	91.1
54.958	97.1
54.955	103.2
54.994	108.7
54.987	114.5
55.119	119.7

Blockierung bei / Blocking at	Einstellmass / Calibration dimension	Ausgewerteter Hub / Evaluated movement
0.0 mm	58 mm	10.0 - 120.0 mm
Max. Istkraft / Max. load: 56.655 KN	Mittlere Einstell-Last / Calibration load: 55.805 KN	Min. Istkraft / Min. load: 54.860 KN
Abweichung zum Sollwert / Deviation from the desired value: 1.35 %	-0.17 %	-1.86 %

Die gemessenen Werte sowie die kontrollierten Abmessungen und Gewindeanschlüsse entsprechen der Spezifikation.
The measured values as well as the controlled dimensions and thread connections are according to the specification.

01.06.2016	1000212	
Datum / Date	LISEGA QA / QA	Besteller / Client

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QF 004 Rev. 1

Example of a test certificate in a standard delivery inspection

LISEGA testing technology is constantly under improvement and represents state-of-the-art technology. These improvements cover test benches for constant hangers and supports, spring hangers and supports, as well as snubbers.

The testing facilities are in operation at all production sites within the LISEGA group, while mobile units are available for use at customer locations.

32 test benches are on hand for constant and spring hangers or constant and spring supports in the load range from 1kN to 1000kN. All LISEGA test benches are tested at regular intervals according to DIN EN ISO 7500 with calibrated load cells and measurement amplifiers.

All components are tested in installation condition and adjustment.

Testing a constant hanger on a LISEGA 120kN test bench

Mobile LISEGA 50kN snubber test bench PR50

Testing a spring hanger on a LISEGA 120kN test bench

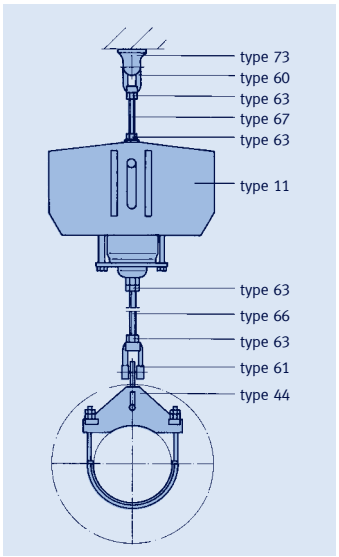
Installation overview

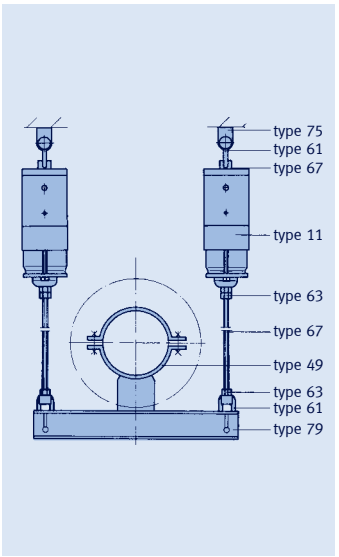
Universal adaption to existing installation spaces

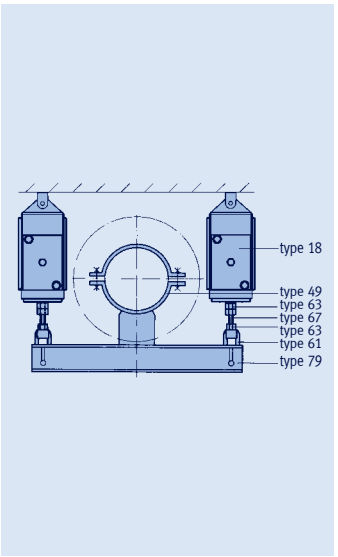
The installation of the constant hangers can be adapted to any situation in the plant through the use of universal accessory components from the modular system.

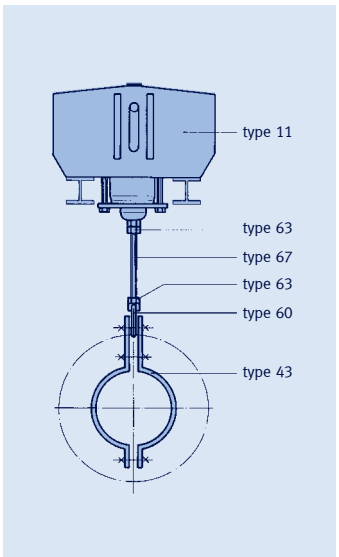
Automatic designing

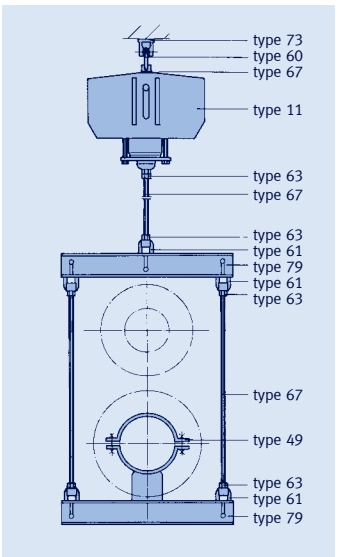
All configurations can be created in just a few steps via the LICAD design software in the shortest of time with the input of 6 parameters – with parts lists and drawings.

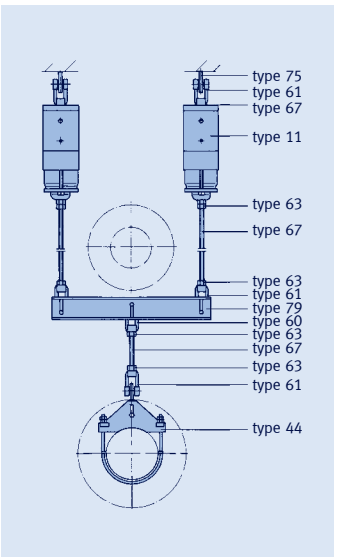


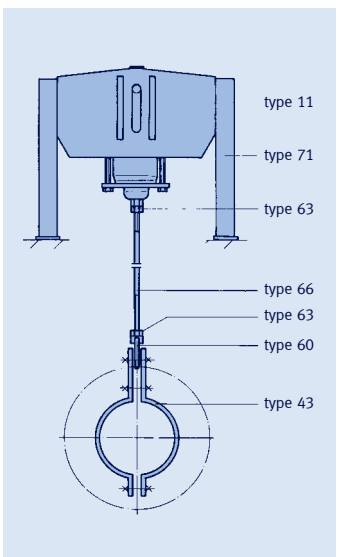


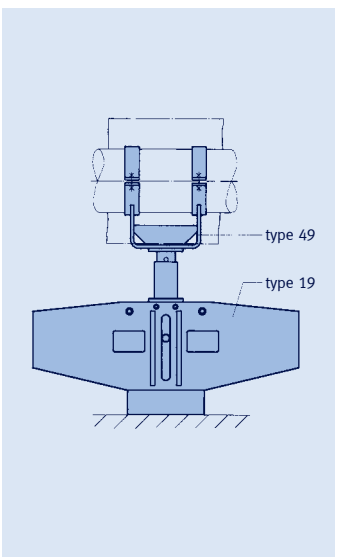


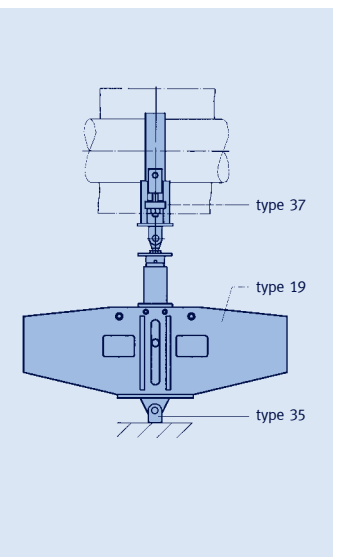


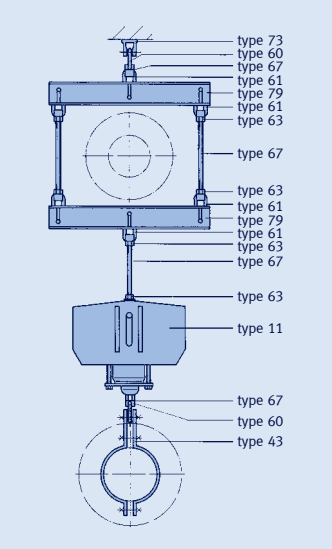








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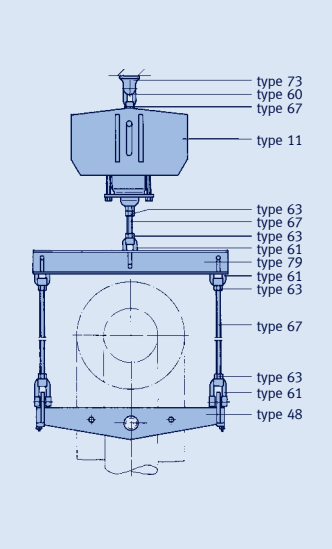
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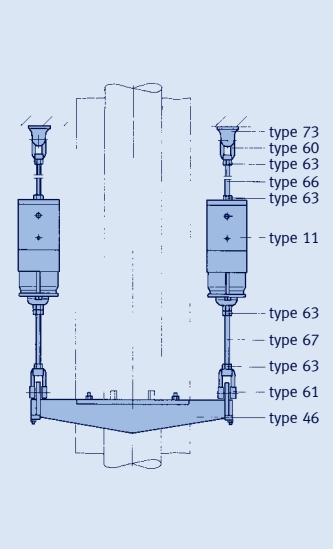
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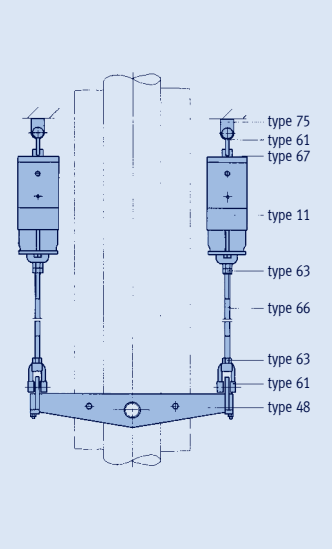
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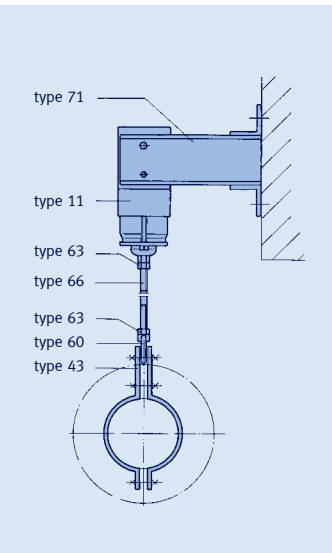
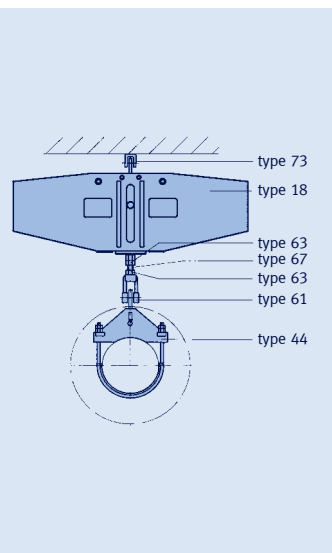
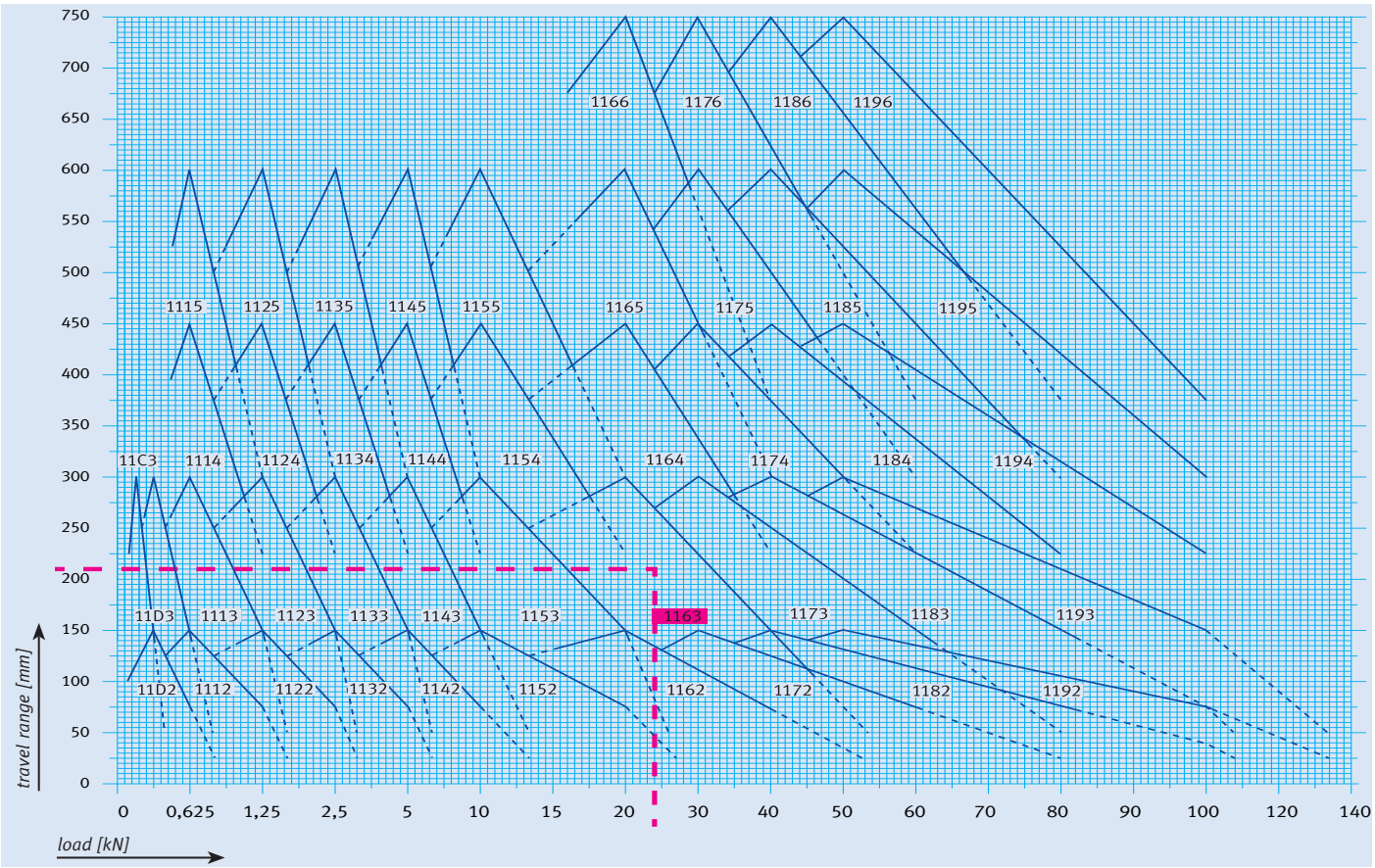
type 61
type 48


type 71
type 11
type 63
type 66
type 63
type 60
type 43


type 73
type 18
type 63
type 67
type 63
type 61
type 44

Selection overview
Types 11, 12, 13, 14, 16, 79 ⑥

Constant hangers, heavy duty constant supports ①



Selection example: 24kN/210mm

type designation					load [kN]									
			11 C3	–	0.13 ②	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22
			11 D3	11 D2	0.25 ②	0.27	0.29	0.31	0.33	0.35	0.38	0.40	0.42	0.44
	11 15	11 14	11 13	11 12	0.50	0.54	0.58	0.63	0.67	0.71	0.75	0.79	0.83	0.88
	11 25	11 24	11 23	11 22	1.00	1.08	1.17	1.25	1.33	1.42	1.50	1.58	1.66	1.75
	11 35	11 34	11 33	11 32	2.00	2.17	2.33	2.50	2.67	2.83	3.00	3.17	3.33	3.50
	11 45	11 44	11 43	11 42	4.00	4.33	4.66	5.00	5.33	5.66	6.00	6.33	6.66	7.00
	11 55	11 54	11 53	11 52	8.00	8.67	9.33	10.00	10.67	11.33	12.00	12.67	13.33	14.00
11 66	11 65	11 64	11 63	11 62	16.00	17.33	18.66	20.00	21.33	22.66	24.00	25.33	26.66	28.00
11 76	11 75	11 74	11 73	11 72	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00
11 86	11 85	11 84	11 83	11 82	32.00	34.66	37.33	40.00	42.66	45.33	48.00	50.66	53.33	56.00
11 96	11 95	11 94	11 93	11 92	40.00	43.33	46.66	50.00	53.33	56.66	60.00	63.33	66.66	70.00
12 86	12 85	12 84	12 83⑤	12 82⑤	64.00	69.33	74.66	80.00	85.33	90.66	96.00	101.30	106.66	112.00
12 96	12 95	12 94	12 93⑤	12 92⑤	80.00	86.66	93.30	100.00	106.70	113.30	120.00	126.70	133.30	140.00
13 86	13 85	13 84	13 83⑤	13 82⑤	96.00	104.00	112.00	120.00	128.00	136.00	144.00	152.00	160.00	168.00
13 96	13 95	13 94	13 93⑤	13 92⑤	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00
14 86	14 85	14 84	14 83⑤	14 82⑤	128.00	138.70	149.30	160.00	170.70	181.30	192.00	202.70	213.30	224.00
14 96	14 95	14 94	14 93⑤	14 92⑤	160.00	173.30	186.70	200.00	213.30	226.70	240.00	253.30	266.70	280.00
...2..(150mm) ④					135	140	145	150	145	140	135	130	125	120
...3..(300mm) ④					270	280	290	300	290	280	270	260	250	240
...4..(450mm) ④					405	420	435	450	435	420	405	390	375	360
...5..(600mm) ④					540	560	580	600	580	560	540	520	500	480
...6..(750mm) ④					675	700	725	750	725	700	675	650	625	600

Intermediate values can be interpolated.

① For the selection of constant supports and angulating constant supports type 16, the load group and travel range of the corresponding constant hangers type 11 apply.

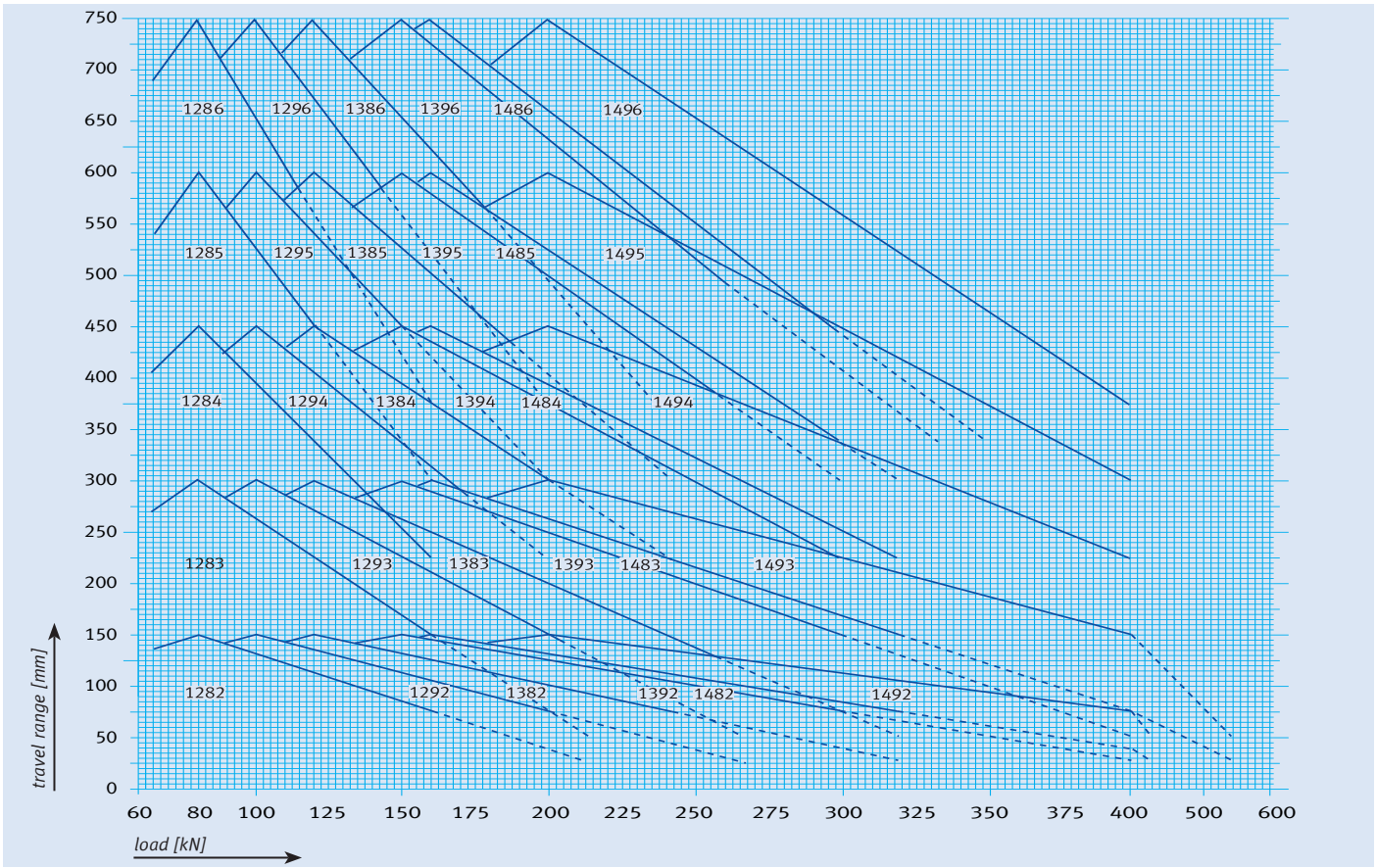
② Loads < 0.25kN or 0.13kN on request.

③ This range is only adjustable ex works.

④ Total travel, travel range 7 (900mm) supplied on request.

⑤ Selection also applies to heavy duty constant support type 16.

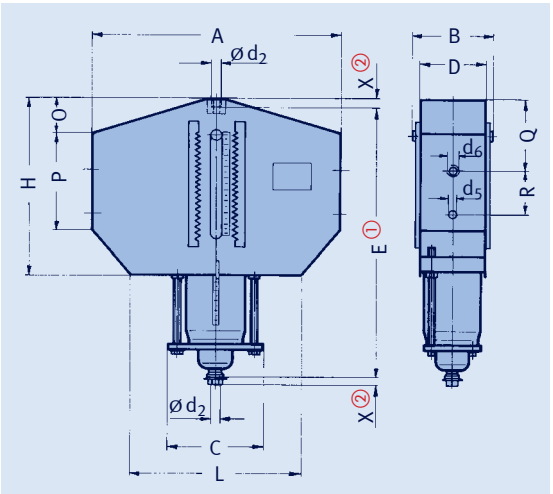
⑥ Based on type 11



load [kN]									③ 0.37	③ 0.42	type designation				
0.23	0.24	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.37	0.42	–	11 C3			
0.46	0.48	0.50	0.52	0.54	0.56	0.58	0.60	0.63	0.73	0.83	11 D2	11 D3			
0.92	0.96	1.00	1.04	1.08	1.13	1.17	1.21	1.25	1.45	1.66	11 12	11 13	11 14	11 15	
1.83	1.92	2.00	2.08	2.16	2.25	2.33	2.42	2.50	2.91	3.33	11 22	11 23	11 24	11 25	
3.67	3.83	4.00	4.17	4.33	4.50	4.67	4.83	5.00	5.83	6.66	11 32	11 33	11 34	11 35	
7.33	7.66	8.00	8.33	8.66	9.00	9.33	9.66	10.00	11.66	13.33	11 42	11 43	11 44	11 45	
14.67	15.33	16.00	16.67	17.33	18.00	18.67	19.33	20.00	23.33	26.66	11 52	11 53	11 54	11 55	
29.33	30.66	32.00	33.33	34.66	36.00	37.33	38.66	40.00	46.66	53.33	11 62	11 63	11 64	11 65	11 66
44.00	46.00	48.00	50.00	52.00	54.00	56.00	58.00	60.00	70.00	80.00	11 72	11 73	11 74	11 75	11 76
58.66	61.33	64.00	66.66	69.33	72.00	74.66	77.33	80.00	93.33	106.66	11 82	11 83	11 84	11 85	11 86
73.33	76.66	80.00	83.33	86.66	90.00	93.33	96.66	100.00	116.66	133.33	11 92	11 93	11 94	11 95	11 96
117.30	122.66	128.00	133.30	138.66	144.00	149.30	154.66	160.00	186.66	213.33	12 82⑤	12 83⑤	12 84	12 85	12 86
146.70	153.30	160.00	166.70	173.30	180.00	186.70	193.30	200.00	233.33	266.66	12 92⑤	12 93⑤	12 94	12 95	12 96
176.00	184.00	192.00	200.00	208.00	216.00	224.00	232.00	240.00	280.00	320.00	13 82⑤	13 83⑤	13 84	13 85	13 86
220.00	230.00	240.00	250.00	260.00	270.00	280.00	290.00	300.00	350.00	400.00	13 92⑤	13 93⑤	13 94	13 95	13 96
234.70	245.30	256.00	266.70	277.30	288.00	298.70	309.30	320.00	373.35	426.70	14 82⑤	14 83⑤	14 84	14 85	14 86
293.30	306.70	320.00	333.30	346.70	360.00	373.30	386.60	400.00	466.65	533.30	14 92⑤	14 93⑤	14 94	14 95	14 96
115	110	105	100	95	90	85	80	75	50	25	mm④				
230	220	210	200	190	180	170	160	150	100	50	mm④				
345	330	315	300	285	270	255	240	225	mm④						
460	440	420	400	380	360	340	320	300	mm④						
575	550	525	500	475	450	425	400	375	mm④						

Constant hangers Type 11

Constant hangers
type 11 C3 19 to 11 96 15
Serialized standard design, delivery from stock.



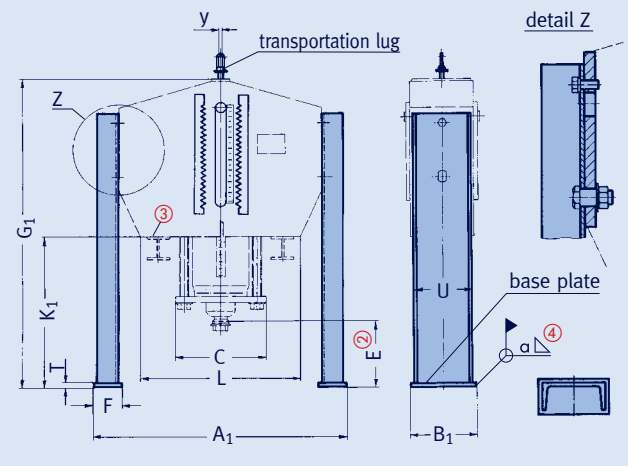
① Dimension E for uppermost blocking position, in other blocking positions E lengthens accordingly.

② X = minimum thread engagement depth. At the lower connection, maximum thread engagement depth = X + 300mm.

type	A	B	C	D	d_2	d_5	d_6	E①	H	L	O	P	Q	R	X②	weight [kg]
11 C3 19	350	130	150	105	M10	9	Ø 9	530	455	250	40	265	240	43	15	14
11 D2 19	300	110	155	86	M10	11	Ø11	350	250	230	0	195	125	43	15	10
11 D3 19	410	130	170	106	M10	11	Ø11	545	445	260	45	280	255	43	15	19
11 12 15	385	130	140	106	M12	12	M10	375	265	285	25	135	40	86	15	15
11 13 15	415	130	140	106	M12	12	M10	645	445	285	20	270	165	86	15	25
11 14 15	435	130	140	106	M12	12	M10	935	615	285	25	325	225	86	15	34
11 15 15	465	135	150	108	M12	12	M10	1225	795	295	25	450	350	86	15	52
11 22 15	445	160	180	132	M12	12	M10	385	270	350	20	140	45	86	15	21
11 23 15	460	160	185	132	M12	12	M10	650	455	360	45	270	195	86	15	35
11 24 15	480	160	185	132	M12	12	M10	945	635	360	45	320	245	86	15	48
11 25 15	530	165	195	136	M12	12	M10	1215	810	370	25	460	365	86	15	75
11 32 15	445	170	190	132	M16	12	M10	390	275	360	10	165	30	112	20	27
11 33 15	490	170	190	132	M16	12	M10	675	470	360	70	260	180	110	20	43
11 34 13	545	185	210	150	M16	12	M10	960	645	370	40	370	260	110	20	66
11 35 13	615	190	220	155	M16	12	M10	1240	820	370	40	465	360	110	20	105
11 42 15	500	185	220	150	M20	16	M12	440	315	400	25	260	135	105	25	44
11 43 15	570	185	220	150	M20	16	M12	740	495	410	110	250	210	105	25	66
11 44 13	610	185	220	150	M20	16	M12	1040	675	410	55	370	275	105	25	86
11 45 13	665	190	240	155	M20	16	M12	1285	855	420	65	540	455	105	25	145
11 52 15	590	230	270	190	M24	20	M16	470	345	490	30	210	70	115	30	73
11 53 15	710	230	270	190	M24	20	M16	770	515	490	105	285	215	126	30	115
11 54 15	745	230	285	190	M24	20	M16	1105	705	490	75	410	310	126	30	159
11 55 15	845	230	285	190	M24	20	M16	1405	880	490	60	530	415	135	30	212
11 62 15	725	275	335	230	M30	25	M16	555	420	580	40	240	85	145	35	134
11 63 15	815	275	335	230	M30	25	M16	900	565	580	160	300	260	145	35	183
11 64 15	845	275	345	230	M30	25	M16	1285	750	600	150	355	310	149	35	264
11 65 15	885	275	345	230	M30	25	M16	1630	925	600	120	460	380	149	35	337
11 66 15	1145	280	345	232	M30	25	M16	2030	1330	600	155	650	600	149	35	495
11 72 15	780	300	380	252	M36	35	M20	610	455	650	50	285	110	170	45	195
11 73 15	850	300	380	252	M36	35	M20	945	635	650	140	300	205	170	45	262
11 74 15	1000	300	400	252	M36	35	M20	1375	785	650	195	400	360	179	45	378
11 75 15	1160	305	400	256	M36	35	M20	1710	975	660	65	665	490	184	45	550
11 76 15	1275	305	400	256	M36	35	M20	2150	1425	660	210	710	675	184	45	690
11 82 15	815	320	390	256	M42	35	M20	705	585	650	50	330	115	200	50	263
11 83 15	945	320	390	256	M42	35	M20	1140	715	650	215	340	280	200	50	364
11 84 15	1110	320	400	256	M42	35	M20	1645	925	670	305	390	420	200	50	509
11 85 15	1200	320	420	256	M42	35	M20	2085	1115	690	125	740	595	200	50	731
11 86 15	1260	325	420	260	M42	35	M20	2585	1625	690	250	850	825	200	50	965
11 92 15	865	350	435	276	M48	35	M24	760	630	750	50	350	135	195	60	336
11 93 15	1095	350	435	276	M48	35	M24	1190	785	750	250	355	325	195	60	475
11 94 15	1240	350	455	276	M48	35	M24	1735	960	770	380	380	480	195	60	677
11 95 15	1255	355	455	280	M48	35	M24	2160	1090	770	250	585	570	195	60	862
11 96 15	1305	355	455	280	M48	35	M24	2700	1620	770	290	800	820	195	60	1130

Order details:
constant hanger
type 11 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down
blocking position
(as required): ...mm

Support brackets Type 71 for constant hangers Type 11



Support brackets for constant hangers type 11 type 71 C3 .1 to 71 96 .1
Serialized standard design, delivery from stock.

Material:
base plates of brackets:
plate t ≤ 15mm : S235JR
plate t ≥ 20mm : S355J2

constant h. type	bracket type①	A_1	B_1	C	E②	F	G_1	K_1	L	T	U	y	α④	weight [kg]
11 C3 19	71 C3 .1	420	70	150	265	40	810	355	250	6	60	13	3	5
11 D2 19	71 D2 .1	370	70	155	145	40	510	260	230	6	60	13	3	5
11 D3 19	71 D3 .1	480	70	170	265	40	825	380	260	6	60	13	3	8
11 12 15	71 12 .1	495	115	140	145	60	535	270	285	8	100	17	3	12
11 13 15	71 13 .1	525	115	140	265	60	925	480	285	8	100	17	3	17
11 14 15	71 14 .1	545	115	140	385	60	1335	720	285	8	100	17	3	25
11 15 15	71 15 .1	575	115	150	505	60	1745	950	295	8	100	17	3	31
11 22 15	71 22 .1	575	140	180	145	75	545	275	350	8	120	17	3	15
11 23 15	71 23 .1	590	140	185	265	75	930	475	360	8	120	17	3	21
11 24 15	71 24 .1	610	140	185	385	75	1345	710	360	8	120	17	3	31
11 25 15	71 25 .1	660	140	195	505	75	1735	925	370	8	120	17	3	38
11 32 15	71 32 .1	575	140	190	150	75	560	285	360	10	120	25	3	16
11 33 15	71 33 .1	620	140	190	270	75	965	495	360	10	120	25	3	23
11 34 13	71 34 .1	675	140	210	400	75	1380	735	370	10	120	25	3	32
11 35 13	71 35 .1	745	140	220	520	75	1780	960	370	10	120	25	3	40
11 42 15	71 42 .1	640	160	220	155	80	620	305	400	10	140	25	3	18
11 43 15	71 43 .1	710	160	220	275	80	1040	545	410	10	140	25	3	29
11 44 13	71 44 .1	750	160	220	425	80	1490	815	410	10	140	25	3	41
11 45 13	71 45 .1	805	160	240	600	80	1910	1055	420	10	140	25	3	49
11 52 15	71 52 .1	750	200	270	160	90	660	315	490	12	180	25	3	30
11 53 15	71 53 .1	870	200	270	280	90	1080	565	490	12	180	25	3	42
11 54 15	71 54 .1	905	200	285	400	90	1535	830	490	12	180	25	3	58
11 55 15	71 55 .1	1005	200	285	520	90	1955	1075	490	12	180	25	3	72
11 62 15	71 62 .1	915	250	335	165	110	755	335	580	12	220	25	4	45
11 63 15	71 63 .1	1005	250	335	285	110	1220	655	580	12	220	25	4	62
11 64 15	71 64 .1	1035	250	345	405	110	1725	975	600	12	220	25	4	90
11 65 15	71 65 .1	1075	250	345	525	110	2190	1265	600	12	220	25	4	112
11 66 15	71 66 .1	1335	250	345	345	110	2410	1080	600	12	220	25	4	112
11 72 15	71 72 .1	980	270	380	175	115	830	375	650	15	240	25	4	56
11 73 15	71 73 .1	1050	270	380	295	115	1285	650	650	15	240	25	4	80
11 74 15	71 74 .1	1200	270	400	415	115	1835	1050	650	15	240	25	4	106
11 75 15	71 75 .1	1360	270	400	535	115	2290	1315	660	15	240	25	4	128
11 76 15	71 76 .1	1475	270	400	280	115	2475	1050	660	15	240	25	4	128
11 82 15	71 82 .1	1025	280	390	180	120	935	350	650	15	240	40	5	65
11 83 15	71 83 .1	1155	280	390	300	120	1490	775	650	15	240	40	5	91
11 84 15	71 84 .1	1320	300	400	420	120	2115	1190	670	15	260	40	5	139
11 85 15	71 85 .1	1410	320	420	540	120	2675	1560	690	15	280	40	5	184
11 86 15	71 86 .1	1470	320	420	270	120	2905	1280	690	15	280	40	5	184
11 92 15	71 92 .1	1105	300	435	190	140	1010	380	750	20	260	40	5	82
11 93 15	71 93 .1	1335	300	435	310	140	1560	775	750	20	260	40	5	109
11 94 15	71 94 .1	1480	320	455	430	140	2225	1265	770	20	280	40	5	162
11 95 15	71 95 .1	1495	340	455	550	140	2770	1680	770	20	320	40	5	273
11 96 15	71 96 .1	1545	340	455	260	140	3020	1400	770	20	320	40	5	273

① The 5th digit in the type designation denotes the design:
6 for support brackets, bolted, standard design,
8 for support brackets, bolted, for increased requirements.

② Dimension E for uppermost blocking position, in other positions E changes accordingly.

③ The constant hangers can in principle be directly seated and welded to the structure. Care must be taken to allow access to adjusting bolts and adjusting nut. If this is not possible, supports type 71 are appropriate.

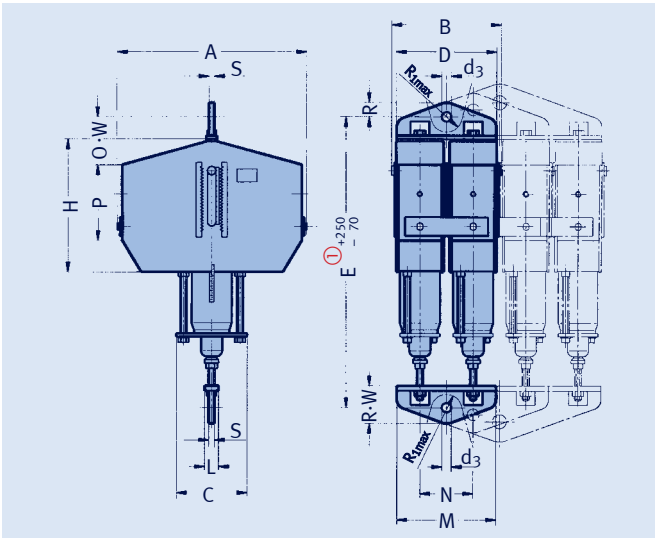
④ Minimum weld seam.

Longer support brackets are available on request.

Order details:
constant hanger
type 11 .. ..
with support bracket
type 71 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down
blocking position
(as required): ...mm

Constant hangers Types 12-14

Constant hangers
type 12 82 35 to 14 96 35
Standard design, multi-cell arrangement, delivery from stock.

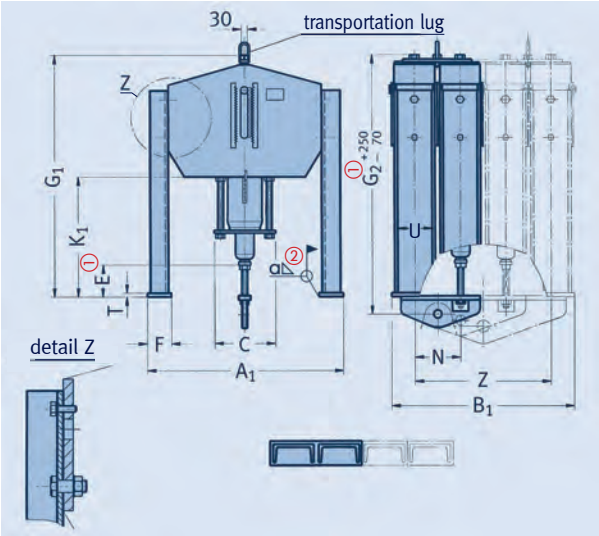


① Dimension E for uppermost blocking position, in other blocking positions E changes accordingly.

type	A	B	C	D	d_3	E①	H	L	M	N	O	P	R	R_{1max}	S	W	weight [kg]
12 82 35	867	635	390	555	60	1205	585	80	540	300	50	330	90	95	30	160	615
12 83 35	997	635	390	555	60	1640	715	80	540	300	215	340	90	95	30	160	820
12 84 35	1162	635	400	555	60	2145	925	80	540	300	305	390	90	95	30	160	1110
12 85 35	1252	635	420	555	60	2585	1115	80	540	300	125	740	90	95	30	160	1555
12 86 35	1312	645	420	565	60	3085	1625	80	545	304	250	850	90	95	30	160	2020
12 92 35	917	695	435	605	70	1310	630	90	590	330	50	350	105	110	35	175	785
12 93 35	1147	695	435	605	70	1740	785	90	590	330	250	355	105	110	35	175	1070
12 94 35	1292	695	455	605	70	2285	960	90	590	330	380	380	105	110	35	175	1475
12 95 35	1307	705	455	615	70	2710	1090	90	595	334	250	585	105	110	35	175	1845
12 96 35	1357	705	455	615	70	3250	1620	90	595	334	290	800	105	110	35	175	2380
13 82 35	867	935	390	855	70	1305	585	80	840	2x300	50	330	105	125	35	210	955
13 83 35	997	935	390	855	70	1740	715	80	840	2x300	215	340	105	125	35	210	1265
13 84 35	1162	935	400	855	70	2245	925	80	840	2x300	305	390	105	125	35	210	1700
13 85 35	1252	935	420	855	70	2685	1115	80	840	2x300	125	740	105	125	35	210	2370
13 86 35	1312	950	420	870	70	3185	1625	80	850	2x304	250	850	105	125	35	210	3070
13 92 35	917	1025	435	935	80	1420	630	90	920	2x330	50	350	120	140	35	230	1215
13 93 35	1147	1025	435	935	80	1850	785	90	920	2x330	250	355	120	140	35	230	1640
13 94 35	1292	1025	455	935	80	2395	960	90	920	2x330	380	380	120	140	35	230	2245
13 95 35	1307	1040	455	950	80	2820	1090	90	930	2x334	250	585	120	140	35	230	2810
13 96 35	1357	1040	455	950	80	3360	1620	90	930	2x334	290	800	120	140	35	230	3615
14 82 35	867	1235	390	1155	80	1385	585	80	1140	3x300	50	330	120	180	35	250	1305
14 83 35	997	1235	390	1155	80	1820	715	80	1140	3x300	215	340	120	180	35	250	1715
14 84 35	1162	1235	400	1155	80	2325	925	80	1140	3x300	305	390	120	180	35	250	2300
14 85 35	1252	1235	420	1155	80	2765	1115	80	1140	3x300	125	740	120	180	35	250	3190
14 86 35	1312	1250	420	1170	80	3265	1625	80	1150	3x304	250	850	120	180	35	250	4125
14 92 35	917	1355	435	1265	90	1460	630	90	1250	3x330	50	350	135	180	40	250	1665
14 93 35	1147	1355	435	1265	90	1890	785	90	1250	3x330	250	355	135	180	40	250	2230
14 94 35	1292	1355	455	1265	90	2435	960	90	1250	3x330	380	380	135	180	40	250	3040
14 95 35	1307	1375	455	1280	90	2860	1090	90	1260	3x334	250	585	135	180	40	250	3790
14 96 35	1357	1375	455	1280	90	3400	1620	90	1260	3x334	290	800	135	180	40	250	4870

Order details:
constant hanger
type 1. .. 35
marking: ...
set load: ...kN
travel: ...mm up/down
blocking position
(as required): ...mm

Constant hangers Type 12-14 with support brackets



Constant hangers type 12-14 with support brackets type 12 82 45 to 14 96 45
Standard design, delivery from stock.

Material:
base plates of brackets:
plate t ≤ 15mm : S235JR
plate t ≥ 20mm : S355J2

type	A_1	B_1	C	E①	F	G_1	$G_2$①	K_1	N	T	U	Z	a②	weight [kg]
12 82 45	1025	580	390	180	120	985	1095	350	300	15	240	300	4	707
12 83 45	1155	580	390	300	120	1540	1530	775	300	15	240	300	4	964
12 84 45	1320	600	400	420	120	2175	2040	1190	300	15	260	300	4	1380
12 85 45	1410	620	420	540	120	2730	2480	1560	300	15	280	300	4	1901
12 86 45	1470	620	420	270	120	2960	2980	1280	304	15	280	304	4	2356
12 92 45	1105	630	435	190	140	1070	1190	380	330	20	260	330	5	907
12 93 45	1335	630	435	310	140	1615	1620	775	330	20	260	330	5	1242
12 94 45	1480	650	455	430	140	2285	2170	1265	330	20	280	330	5	1752
12 95 45	1495	675	455	550	140	2830	2595	1680	334	20	320	334	5	2356
12 96 45	1545	675	455	260	140	3080	3135	1400	334	20	320	334	5	2892
13 82 45	1025	880	390	180	120	985	1145	350	300	15	240	600	4	1087
13 83 45	1155	880	390	300	120	1550	1585	775	300	15	240	600	4	1464
13 84 45	1320	900	400	420	120	2175	2090	1190	300	15	260	600	4	2044
13 85 45	1410	920	420	540	120	2730	2530	1560	300	15	280	600	4	2848
13 86 45	1470	920	420	270	120	2960	3030	1280	304	15	280	608	4	3555
13 92 45	1105	960	435	190	140	1070	1245	380	330	20	260	660	5	1378
13 93 45	1335	960	435	310	140	1620	1680	775	330	20	260	660	5	1883
13 94 45	1480	980	455	430	140	2285	2225	1265	330	20	280	660	5	2647
13 95 45	1495	1010	455	550	140	2830	2650	1680	334	20	320	668	5	3551
13 96 45	1545	1010	455	260	140	3080	3190	1400	334	20	320	668	5	4344
14 82 45	1025	1180	390	180	120	990	1190	350	300	15	240	900	4	1465
14 83 45	1155	1180	390	300	120	1550	1625	775	300	15	240	900	4	1970
14 84 45	1320	1200	400	420	120	2175	2130	1190	300	15	260	900	4	2745
14 85 45	1410	1220	420	540	120	2730	2570	1560	300	15	280	900	4	3817
14 86 45	1470	1230	420	270	120	2960	3070	1280	304	15	280	912	4	4756
14 92 45	1105	1290	435	190	140	1075	1270	380	330	20	260	990	5	1866
14 93 45	1335	1290	435	310	140	1620	1700	775	330	20	260	990	5	2540
14 94 45	1480	1310	455	430	140	2285	2245	1265	330	20	280	990	5	3559
14 95 45	1495	1340	455	550	140	2830	2670	1680	334	20	320	1002	5	4766
14 96 45	1545	1340	455	260	140	3080	3210	1400	334	20	320	1002	5	5841

① Dimensions E and G_2 for uppermost blocking position, in other blocking positions E and G_2 changes accordingly.

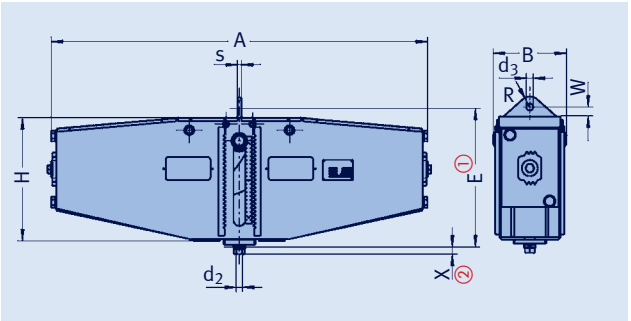
② Minimum weld seam.

Other lengths are also available on request.

Order details:
constant hanger with support brackets
type 1. .. ..
marking: ...
set load: ...kN
travel: ...mm up/down
blocking position (as required): ...mm

Constant hangers Type 18

Constant hangers
type 18 D3 17 to 18 93 17
Standard design,
delivery from stock.



① Dimension E for uppermost blocking position, in other blocking positions E lengthens accordingly.

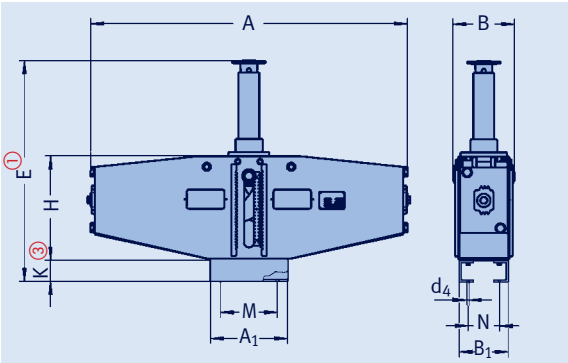
② X = minimum thread engagement depth. At lower connection max. thread engagement depth = X + 150mm.

Max. permissible loads:
- Emergency (C) at 80°C = set load x 1.33
- Faulted condition (D) at 150°C = set load x 1.66
- Max. load in a blocked state at 80°C = set load x 1.5.

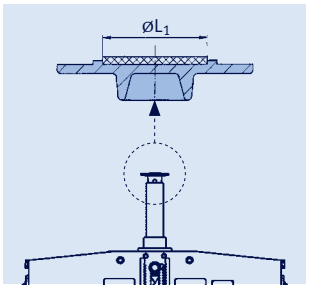
type	min. load [kN]	max. load [kN]	travel	A	B	d_2	d_3	E①	H	R	s	W	X②	weight [kg]
18 D3 17	0.21	0.51	300	973	205	M10	17	464	430	25	10	24	15	51
18 D1 27	0.21	0.72	75	610	205	M10	17	267	234	25	10	24	15	31
18 D2 27	0.21	0.72	150	664	205	M10	17	304	270	25	10	24	15	35
18 D3 27	0.37	0.72	300	973	205	M10	17	464	430	25	10	24	15	53
18 11 27	0.54	1.71	75	610	205	M12	17	267	234	25	10	24	15	32
18 12 27	0.54	1.71	150	664	205	M12	17	304	270	25	10	24	15	36
18 13 27	0.54	1.71	300	973	205	M12	17	464	430	25	10	24	15	59
18 21 17	1.25	3.0	75	610	205	M12	17	267	234	25	10	24	15	32
18 22 17	1.25	3.0	150	664	205	M12	17	304	270	25	10	24	15	40
18 23 17	1.25	3.0	300	973	205	M12	17	464	430	25	10	24	15	59
18 21 27	2.2	4.0	75	610	205	M12	17	267	234	25	10	24	15	32
18 22 27	2.2	4.0	150	664	205	M12	17	304	270	25	10	24	15	40
18 23 27	2.2	4.0	300	973	205	M12	17	464	430	25	10	24	15	59
18 31 17	2.8	5.15	75	652	205	M16	21	282	244	30	10	36	20	38
18 32 17	2.8	5.15	150	837	233	M16	21	336	293	30	10	36	20	76
18 33 17	2.8	5.15	300	1099	233	M16	21	483	440	30	10	36	20	100
18 31 27	3.8	6.8	75	652	205	M16	21	282	244	30	10	36	20	38
18 32 27	3.8	6.8	150	837	233	M16	21	336	293	30	10	36	20	76
18 33 27	3.8	6.8	300	1099	233	M16	21	483	440	30	10	36	20	101
18 41 17	5.0	9.3	75	755	233	M20	21	328	286	30	10	36	25	72
18 42 17	5.0	9.3	150	934	261	M20	21	351	302	30	10	36	25	105
18 43 17	5.0	9.3	300	1099	233	M20	21	482	440	30	10	36	25	107
18 41 27	6.9	12.4	75	755	233	M20	25	331	286	40	15	32	25	72
18 42 27	6.9	12.4	150	934	261	M20	25	354	302	40	15	32	25	117
18 43 27	6.9	12.4	300	1288	261	M20	25	500	455	40	15	32	25	158
18 51 17	9.2	16.2	75	755	233	M24	25	330	286	40	15	32	30	73
18 52 17	9.2	16.2	150	934	261	M24	25	353	302	40	15	32	30	118
18 53 17	9.2	16.2	300	1288	261	M24	25	499	455	40	15	32	30	159
18 51 27	11.9	21.9	75	812	261	M24	25	334	290	40	15	32	30	99
18 52 27	11.9	21.9	150	1055	276	M24	25	372	315	40	15	34	30	166
18 53 27	11.9	21.9	300	1426	276	M24	25	508	460	40	15	34	30	221
18 61 17	16.15	29.9	75	878	261	M30	34	358	315	50	18	34	35	119
18 62 17	16.15	29.9	150	1140	291	M30	34	380	333	50	18	34	35	201
18 63 17	16.15	29.9	300	1592	291	M30	34	514	467	50	18	34	35	273
18 61 27	22.1	40.5	75	878	261	M30	41	368	315	65	20	44	35	123
18 62 27	22.1	40.5	150	1302	278	M30	41	392	335	65	20	44	35	205
18 63 27	22.1	40.5	300	1720	302	M30	41	527	472	65	20	44	35	343
18 71 17	29.8	47.0	75	976	276	M36	41	395	340	65	20	44	45	164
18 72 17	29.8	47.0	150	1446	291	M36	41	398	343	65	20	44	45	242
18 73 17	29.8	47.0	300	1720	302	M36	41	578	472	65	20	44	45	357
18 71 27	35.0	60.0	75	1072	291	M36	41	417	362	65	22	44	45	201
18 72 27	35.0	60.0	150	1570	302	M36	41	425	370	65	22	44	45	313
18 73 27	35.0	60.0	300	1935	362	M36	41	571	513	65	22	44	45	534
18 81 17	44.2	80.0	75	1251	302	M42	51	462	390	80	25	64	50	283
18 82 17	44.2	80.0	150	1805	362	M42	51	486	413	80	25	64	50	518
18 83 17	44.2	80.0	300	1965	347	M42	51	621	547	80	25	64	50	725
18 91 17	59.0	100.0	75	1520	302	M48	51	457	385	80	25	64	60	332
18 92 17	59.0	100.0	150	1805	362	M48	51	486	413	80	25	64	60	520
18 93 17	59.0	100.0	300	1965	347	M48	51	621	547	80	25	64	60	756

Order details:
constant hanger
type 18 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down
blocking position
(as required): ...mm

Constant supports Type 19



Constant supports type 19 D3 17 to 19 93 17
Standard design, delivery from stock.



Load plate with integrated slide plate. This must be considered in the selection of clamp bases.

type ②	min. load [kN]	max. load [kN]	travel	A	A_1	B	B_1	d_4	E ①	H	K ③	M	N	weight [kg]
19 D3 17	0.21	0.51	300	973	245	205	163	14.5	913	430	80	185	103	59
19 D1 27	0.21	0.72	75	610	245	205	163	14.5	490	234	80	185	103	37
19 D2 27	0.21	0.72	150	664	245	205	163	14.5	600	270	80	185	103	42
19 D3 27	0.37	0.72	300	973	245	205	163	14.5	913	430	80	185	103	60
19 11 27	0.54	1.71	75	610	245	205	163	14.5	490	234	80	185	103	38
19 12 27	0.54	1.71	150	664	245	205	163	14.5	600	270	80	185	103	43
19 13 27	0.54	1.71	300	973	245	205	163	14.5	913	430	80	185	103	66
19 21 17	1.25	3.0	75	610	245	205	163	14.5	490	234	80	185	103	38
19 22 17	1.25	3.0	150	664	245	205	163	14.5	600	270	80	185	103	47
19 23 17	1.25	3.0	300	973	245	205	163	14.5	913	430	80	185	103	66
19 21 27	2.2	4.0	75	610	245	205	163	14.5	490	234	80	185	103	38
19 22 27	2.2	4.0	150	664	245	205	163	14.5	600	270	80	185	103	47
19 23 27	2.2	4.0	300	973	245	205	163	14.5	913	430	80	185	103	67
19 31 17	2.8	5.15	75	652	245	205	163	14.5	499	244	80	185	103	43
19 32 17	2.8	5.15	150	837	300	233	189	18.5	639	293	100	210	124	85
19 33 17	2.8	5.15	300	1099	300	233	189	18.5	969	440	100	210	124	112
19 31 27	3.8	6.8	75	652	245	205	163	14.5	499	244	80	185	103	43
19 32 27	3.8	6.8	150	837	300	233	189	18.5	639	293	100	210	124	85
19 33 27	3.8	6.8	300	1099	300	233	189	18.5	969	440	100	210	124	113
19 41 17	5.0	9.3	75	755	300	233	189	18.5	565	286	100	210	124	80
19 42 17	5.0	9.3	150	934	300	261	205	18.5	667	302	100	210	140	116
19 43 17	5.0	9.3	300	1099	300	233	189	18.5	969	440	100	210	124	118
19 41 27	6.9	12.4	75	755	300	233	189	18.5	565	286	100	210	124	80
19 42 27	6.9	12.4	150	934	300	261	205	18.5	667	302	100	210	140	127
19 43 27	6.9	12.4	300	1288	300	261	205	18.5	987	455	100	210	140	176
19 51 17	9.2	16.2	75	755	300	233	189	18.5	577	286	100	210	124	84
19 52 17	9.2	16.2	150	934	300	261	205	18.5	668	302	100	210	140	131
19 53 17	9.2	16.2	300	1288	300	261	205	18.5	987	455	100	210	140	176
19 51 27	11.9	21.9	75	812	300	261	205	18.5	581	290	100	210	140	111
19 52 27	11.9	21.9	150	1055	400	276	220	22.5	713	315	120	280	150	183
19 53 27	11.9	21.9	300	1426	400	276	220	22.5	1016	460	120	280	150	241
19 61 17	16.15	29.9	75	878	300	261	205	18.5	607	315	100	210	140	130
19 62 17	16.15	29.9	150	1140	400	291	233	22.5	718	333	120	280	163	219
19 63 17	16.15	29.9	300	1592	400	291	233	22.5	1021	467	120	280	163	294
19 61 27	22.1	40.5	75	878	300	261	205	18.5	607	315	100	210	140	134
19 62 27	22.1	40.5	150	1302	400	278	220	22.5	717	335	120	280	150	221
19 63 27	22.1	40.5	300	1720	400	302	240	22.5	1041	472	120	280	170	370
19 71 17	29.8	47.0	75	976	400	276	220	22.5	655	340	120	280	150	182
19 72 17	29.8	47.0	150	1446	400	291	233	22.5	728	343	120	280	163	263
19 73 17	29.8	47.0	300	1720	400	302	240	22.5	1041	472	120	280	170	384
19 71 27	35.0	60.0	75	1072	400	291	233	22.5	672	362	120	280	163	218
19 72 27	35.0	60.0	150	1570	400	302	240	22.5	757	370	120	280	170	333
19 73 27	35.0	60.0	300	1935	400	362	300	22.5	1111	513	120	280	230	565
19 81 17	44.2	80.0	75	1251	400	302	240	22.5	744	390	120	280	170	303
19 82 17	44.2	80.0	150	1805	400	362	300	22.5	829	413	120	280	230	552
19 83 17	44.2	80.0	300	1965	400	347	285	22.5	1186	547	120	280	215	774
19 91 17	59.0	100.0	75	1520	400	302	240	22.5	739	385	120	280	170	352
19 92 17	59.0	100.0	150	1805	400	362	300	22.5	829	413	120	280	230	553
19 93 17	59.0	100.0	300	1965	400	347	285	22.5	1186	547	120	280	215	804

① Dimension E for uppermost blocking position, in other blocking positions E shortens accordingly and allows adjustment of + 60mm.

② Type 19 .. .7 is fitted with a load plate with PTFE slide plate as standard. If needed, this type can also be supplied with a high temperature slide plate, type 19 .. .6 (see table below).

③ Under certain circumstances the support bracket with the height K can be dispensed with. It should however be ensured that the load adjustment bolts are accessible.

type 19* with slide plate up to 180°C	type 19* with slide plate up to 350°C	$øL_{1\ max.}$
19 D. .7	19 D. .6	40
19 1. .7	19 1. .6	40
19 2. .7	19 2. .6	40
19 3. .7	19 3. .6	65
19 4. .7	19 4. .6	65
19 5. .7	19 5. .6	65
19 6. .7	19 6. .6	110
19 7. .7	19 7. .6	150
19 8. .7	19 8. .6	150
19 9. .7	19 9. .6	150

* *friction value of the slide plates see table on page 7.11*

Max. permissible loads:
- Emergency (C) at 80°C = set load x 1.33
- Faulted condition (D) at 150°C = set load x 1.66.
- Max. load in a blocked state at 80°C = set load x 1.5.

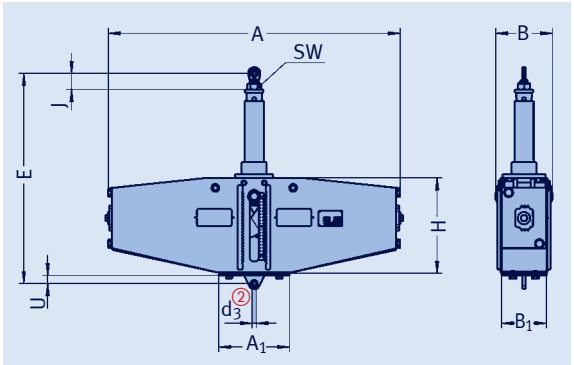
The sliding surface of the mating component should be fitted with stainless steel plating.
This is indicated by the suffix "SP" in the type designation (e.g., clamp base type 49 22 25-SP).

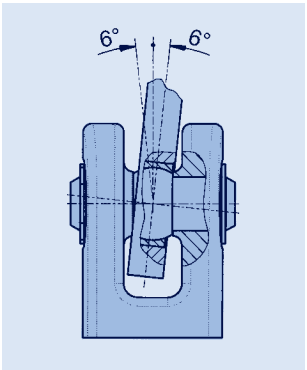
Order details: constant support type 19 .. .., marking: ..., set load: ...kN, travel: ...mm up/down, blocking position (as required): ...mm

Angulating constant supports Type 19

Angulating constant supports type 19 D3 37 to 19 93 37
Standard design, delivery from stock.

For large horizontal displacements in the pipe systems the constant supports can be fitted with ball bushing joints.





The ball bushing joints for the connection are designed to fit weld-on bracket type 35.

① Dimension E for uppermost blocking position, in other blocking positions E shortens accordingly and allows adjustment of +200mm.

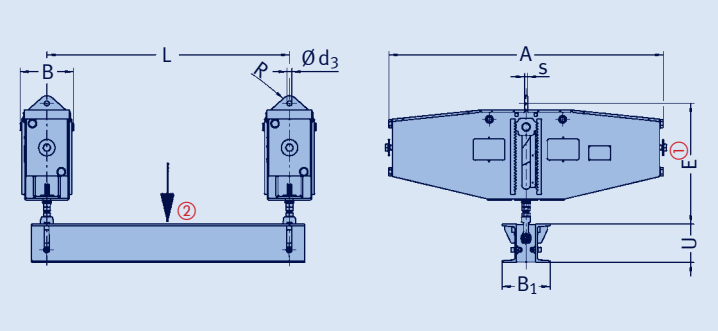
② Connection possibilities: See bolt diameter of weld-on brackets type 35 or dynamic clamps (product group 3).

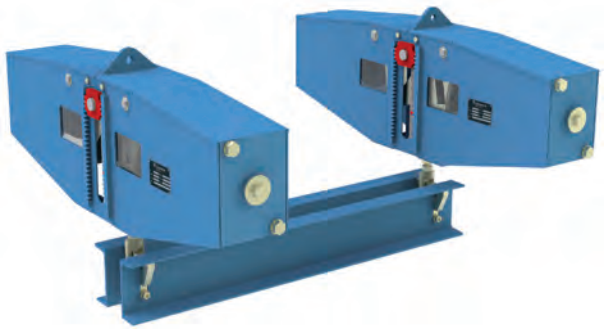
Max. permissible loads:
- Emergency (C) at 80°C = set load x 1.33
- Faulted condition (D) at 150°C = set load x 1.66.
- Max. load in a blocked state at 80°C = set load x 1.5.

Order details:
angulating constant support type 19 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down
blocking position (as required): ...mm

type	min. load [kN]	max. load [kN]	travel	A	A_1	B	B_1	d_3 ②	E ①	J	H	SW	U	weight [kg]
19 D3 37	0.21	0.51	300	973	245	205	163	10	903	45	430	27	23	57
19 D1 47	0.21	0.72	75	610	245	205	163	10	480	45	234	27	23	35
19 D2 47	0.21	0.72	150	664	245	205	163	10	590	45	270	27	23	40
19 D3 47	0.37	0.72	300	973	245	205	163	10	903	45	430	27	23	58
19 11 47	0.54	1.71	75	610	245	205	163	10	480	45	234	27	23	36
19 12 47	0.54	1.71	150	664	245	205	163	10	590	45	270	27	23	41
19 13 47	0.54	1.71	300	973	245	205	163	10	903	45	430	27	23	65
19 21 37	1.25	3.0	75	610	245	205	163	12	490	53	234	34	25	37
19 22 37	1.25	3.0	150	664	245	205	163	12	600	53	270	34	25	45
19 23 37	1.25	3.0	300	973	245	205	163	12	913	53	430	34	25	65
19 21 47	2.2	4.0	75	610	245	205	163	12	490	53	234	34	25	37
19 22 47	2.2	4.0	150	664	245	205	163	12	600	53	270	34	25	45
19 23 47	2.2	4.0	300	973	245	205	163	12	913	53	430	34	25	66
19 31 37	2.8	5.15	75	652	245	205	163	15	512	59	244	36	30	42
19 32 37	2.8	5.15	150	837	300	233	189	15	632	59	293	36	30	83
19 33 37	2.8	5.15	300	1099	300	233	189	15	965	59	440	36	30	110
19 31 47	3.8	6.8	75	652	245	205	163	15	512	59	244	36	30	43
19 32 47	3.8	6.8	150	837	300	233	189	15	632	59	293	36	30	83
19 33 47	3.8	6.8	300	1099	300	233	189	15	965	59	440	36	30	111
19 41 37	5.0	9.3	75	755	300	233	189	15	561	59	286	36	30	78
19 42 37	5.0	9.3	150	934	290	261	205	15	663	59	302	36	30	114
19 43 37	5.0	9.3	300	1099	300	233	189	15	965	59	440	36	30	117
19 41 47	6.9	12.4	75	755	300	233	189	15	561	59	286	36	30	79
19 42 47	6.9	12.4	150	934	290	261	205	15	663	59	302	36	30	125
19 43 47	6.9	12.4	300	1288	290	261	205	15	982	59	455	36	30	175
19 51 37	9.2	16.2	75	755	300	233	189	20	609	80	286	60	40	86
19 52 37	9.2	16.2	150	934	290	261	205	20	700	80	302	60	40	133
19 53 37	9.2	16.2	300	1288	290	261	205	20	1020	80	455	60	40	178
19 51 47	11.9	21.9	75	812	290	261	205	20	613	80	290	60	40	112
19 52 47	11.9	21.9	150	1055	400	276	220	20	727	80	315	60	40	184
19 53 47	11.9	21.9	300	1426	400	276	220	20	1030	80	460	60	40	242
19 61 37	16.15	29.9	75	878	300	261	205	20	641	80	315	60	40	133
19 62 37	16.15	29.9	150	1140	400	291	220	20	732	80	333	60	40	220
19 63 37	16.15	29.9	300	1592	400	291	220	20	1035	80	467	60	40	295
19 61 47	22.1	40.5	75	878	300	261	205	20	641	80	315	60	40	136
19 62 47	22.1	40.5	150	1302	400	278	220	20	731	80	335	60	40	222
19 63 47	22.1	40.5	300	1720	400	302	220	20	1058	80	472	60	40	372
19 71 37	29.8	47.0	75	976	400	276	220	30	708	93	340	60	60	186
19 72 37	29.8	47.0	150	1446	400	291	233	30	781	93	343	60	60	267
19 73 37	29.8	47.0	300	1720	380	302	240	30	1094	93	472	60	60	389
19 71 47	35.0	60.0	75	1072	398	291	233	30	725	93	362	60	60	222
19 72 47	35.0	60.0	150	1570	400	302	240	30	810	93	370	60	60	338
19 73 47	35.0	60.0	300	1935	400	362	300	30	1156	93	513	60	60	569
19 81 37	44.2	80.0	75	1251	400	302	240	30	789	93	390	60	60	305
19 82 37	44.2	80.0	150	1805	400	362	300	30	881	93	413	60	60	559
19 83 37	44.2	80.0	300	1965	400	347	285	30	1238	93	547	60	60	781
19 91 37	59.0	100.0	75	1520	400	302	240	50	812	106	385	70	70	358
19 92 37	59.0	100.0	150	1805	400	362	300	50	904	106	413	70	70	565
19 93 37	59.0	100.0	300	1965	400	347	285	50	1261	106	547	70	70	815

Constant hanger trapezes Type 79





type	④ min. load [kN]	④ max. load [kN]	travel	L_{max}	A	B	d_3	E①	R	s	U	B_1	weight for ③ L=1000 ± per 100mm [kg]	[kg]
79 D3 17	0.42	1.02	300	1700	973	205	17	569	25	10	80	140	119	1.7
79 D1 27	0.42	1.44	75	1700	610	205	17	372	25	10	80	140	81	1.7
79 D2 27	0.42	1.44	150	1700	664	205	17	409	25	10	80	140	89	1.7
79 D3 27	0.74	1.44	300	1700	973	205	17	569	25	10	80	140	123	1.7
79 11 27	1.08	3.42	75	1700	610	205	17	393	25	10	80	140	81	1.7
79 12 27	1.08	3.42	150	1700	664	205	17	430	25	10	80	140	89	1.7
79 13 27	1.08	3.42	300	1700	973	205	17	590	25	10	80	140	135	1.7
79 21 17	2.5	6.0	75	1700	610	205	17	393	25	10	80	140	79	1.7
79 22 17	2.5	6.0	150	1700	664	205	17	430	25	10	80	140	95	1.7
79 23 17	2.5	6.0	300	1700	973	205	17	590	25	10	80	140	135	1.7
79 21 27	4.4	8.0	75	1700	610	205	17	393	25	10	80	140	79	1.7
79 22 27	4.4	8.0	150	1700	664	205	17	430	25	10	80	140	95	1.7
79 23 27	4.4	8.0	300	1700	973	205	17	590	25	10	80	140	135	1.7
79 31 17	5.6	10.3	75	1800	652	205	21	410	30	10	120	190	104	2.7
79 32 17	5.6	10.3	150	1800	837	233	21	464	30	10	120	190	180	2.7
79 33 17	5.6	10.3	300	1800	1099	233	21	611	30	10	120	190	228	2.7
79 31 27	7.6	13.6	75	1800	652	205	21	410	30	10	120	190	104	2.7
79 32 27	7.6	13.6	150	1800	837	233	21	464	30	10	120	190	180	2.7
79 33 27	7.6	13.6	300	1800	1099	233	21	611	30	10	120	190	230	2.7
79 41 17	10	18.6	75	1800	755	233	21	472	30	10	140	200	178	3.2
79 42 17	10	18.6	150	1800	934	261	21	488	30	10	140	200	244	3.2
79 43 17	10	18.6	300	1800	1099	233	21	626	30	10	140	200	248	3.2
79 41 27	13.8	24.8	75	1800	755	233	25	475	40	15	140	200	178	3.2
79 42 27	13.8	24.8	150	1800	934	261	25	491	40	15	140	200	268	3.2
79 43 27	13.8	24.8	300	1800	1288	261	25	644	40	15	140	200	350	3.2
79 51 17	18.4	32.4	75	1800	755	233	25	489	40	15	180	230	194	4.4
79 52 17	18.4	32.4	150	1800	934	261	25	512	40	15	180	230	284	4.4
79 53 17	18.4	32.4	300	1800	1288	261	25	658	40	15	180	230	366	4.4
79 51 27	23.8	43.8	75	1800	812	261	25	493	40	15	180	230	246	4.4
79 52 27	23.8	43.8	150	1800	1055	276	25	521	40	15	180	230	380	4.4
79 53 27	23.8	43.8	300	1800	1426	276	25	667	40	15	180	230	490	4.4
79 61 17	32.3	59.8	75	2400	878	261	34	521	50	18	260	310	320	7.6
79 62 17	32.3	59.8	150	2400	1140	291	34	544	50	18	260	310	482	7.6
79 63 17	32.3	59.8	300	2400	1592	291	34	678	50	18	260	310	628	7.6
79 61 27	44.2	81	75	2400	878	261	41	531	65	20	260	310	328	7.6
79 62 27	44.2	81	150	2400	1302	278	41	556	65	20	260	310	492	7.6
79 63 27	44.2	81	300	2400	1720	302	41	690	65	20	260	310	770	7.6
79 71 17	59.6	94	75	2400	976	276	41	586	65	20	300	350	430	9.2
79 72 17	59.6	94	150	2400	1446	291	41	589	65	20	300	350	586	9.2
79 73 17	59.6	94	300	2400	1720	302	41	769	65	20	300	350	812	9.2
79 71 27	70	120	75	2400	1072	291	41	607	65	22	300	350	504	9.2
79 72 27	70	120	150	2400	1570	302	41	617	65	22	300	350	728	9.2
79 73 27	70	120	300	2400	1935	362	41	762	65	22	300	350	1170	9.2
79 81 17	88.4	160	75	1800 ②	1251	302	51	677	80	25	300	350	672	9.2
79 82 17	88.4	160	150	1800 ②	1805	362	51	702	80	25	300	350	1142	9.2
79 83 17	88.4	160	300	1800 ②	1965	347	51	836	80	25	300	350	1554	9.2
79 91 17	118	200	75	1800 ②	1520	302	51	694	80	25	300	350	762	9.2
79 92 17	118	200	150	1800 ②	1805	362	51	725	80	25	300	350	1138	9.2
79 93 17	118	200	300	1800 ②	1965	347	51	859	80	25	300	350	1612	9.2

Constant hanger trapezes type 79 D3 17 to 79 93 17

① Dimension E for uppermost blocking position, for other blocking positions E lengthens accordingly.

② The L_{max} dimensions can be lengthened to 2400mm, on reduction of the permissible center load by 5% per 100mm extension.

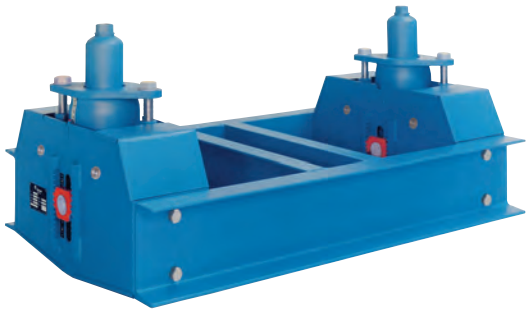
③ When selecting the constant hanger trapeze the weight of the channels and the clamp base weight must be added to the operating load.

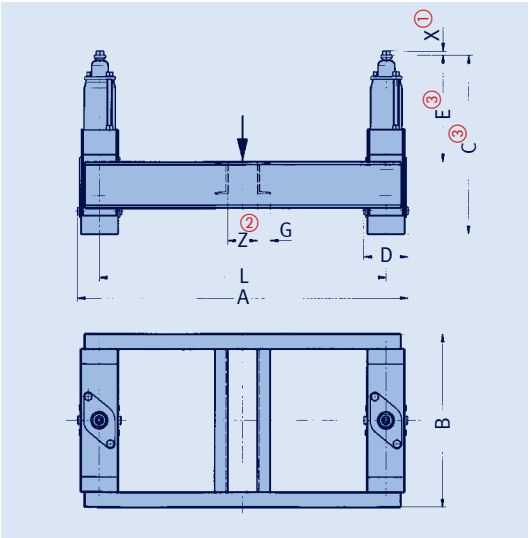
④ Max. permissible loads:
- Emergency (C) at 80°C = set load x 1.33
- Faulted condition (D) at 150°C = set load x 1.66.
- Max. load in a blocked state at 80°C = set load x 1.5.

Order details:
trapeze type 79 .. ..
L = ...mm
marking: ...
set load: ...kN
of the support point
trave: ...mm up/down
blocking position
(as required): ...mm

Constant hanger trapezes Type 79

Constant hanger trapezes types 79 D2 15 to 79 96 15
This design of trapeze is used if the standard design type 79 .2 34 does not fit due to extremely restricted installation space. The trapezes are supplied bolted ex works.





① X = min. thread engagement depth + 300mm engagement possibility.

② Dimension L and dimension Z are to be stated when ordering.

③ Dimension E and dimension C at blocking position 0mm, in other blocking positions E and C lengthens accordingly.

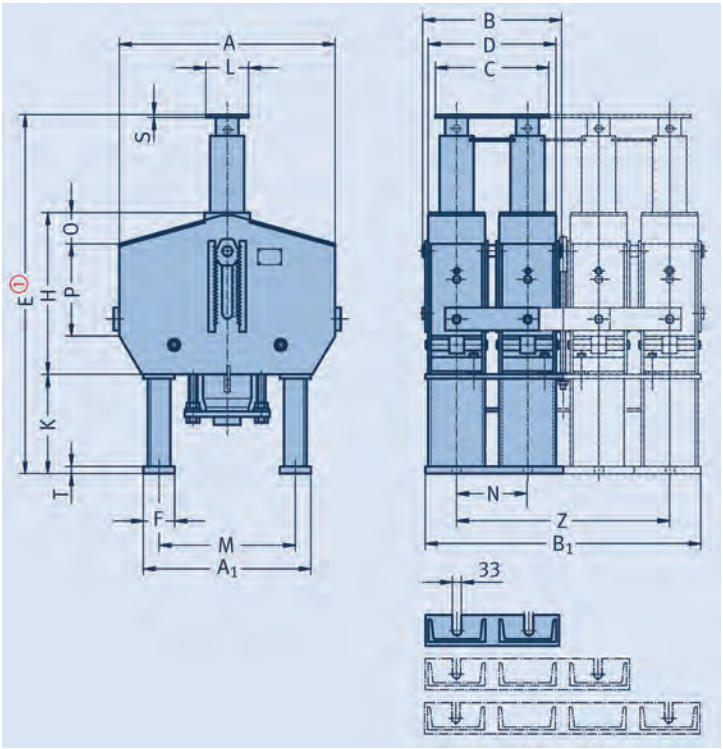
④ When selecting the constant hanger trapeze its total weight and the clamp base weight must be added to the operating load.

⑤ The L_{max} dimensions can be lengthened to 2400mm on load reduction by 5% per 100mm extension.

type	A_{max}	B	C③	D	E③	G	⑤ L_{max}	X①	total weight [kg] L=1000 ④	weight change [kg/m] ④
79 D2 15	1210	325	365	110	180	15	1100	15	30	6.6
79 D3 15	1230	435	560	130	245	15	1100	15	48	6.6
79 12 15	1930	515	390	130	235	30	1800	15	61	23.8
79 13 15	1930	545	660	130	380	30	1800	15	81	23.8
79 22 15	1960	575	400	160	240	30	1800	15	74	23.8
79 23 15	1960	590	665	160	355	30	1800	15	103	23.8
79 32 15	2170	605	410	170	235	45	2000	20	104	36.4
79 33 15	2170	650	695	170	370	45	2000	20	137	36.4
79 34 13	2170	700	960	185	560	45	2000	20	174	36.4
79 35 13	2170	775	1240	190	735	45	2000	20	255	36.4
79 42 15	2185	640	465	185	190	55	2000	25	153	44.0
79 43 15	2185	710	765	185	415	55	2000	25	199	44.0
79 44 13	2185	750	1040	185	625	55	2000	25	253	44.0
79 45 13	2190	805	1285	190	685	55	2000	25	370	44.0
79 52 15	2330	740	500	230	275	65	2100	30	230	50.6
79 53 15	2330	860	800	230	420	65	2100	30	318	50.6
79 54 15	2330	895	1135	230	660	65	2100	30	408	50.6
79 55 15	2330	1005	1435	230	845	65	2100	30	528	58.8
79 62 15	2375	895	590	275	315	70	2100	35	384	66.4
79 63 15	2375	985	935	275	480	70	2100	35	486	66.4
79 64 15	2375	1015	1320	275	815	70	2100	35	650	66.4
79 65 15	2375	1055	1665	275	1085	70	2100	35	798	66.4
79 66 15	2380	1315	2065	280	1265	70	2100	35	1120	66.4
79 72 15	2400	970	655	300	320	85	2100	45	549	83.6
79 73 15	2400	1040	990	300	560	85	2100	45	688	83.6
79 74 15	2400	1200	1420	300	820	85	2100	45	941	92.4
79 75 15	2405	1360	1755	305	1020	85	2100	45	1296	92.4
79 76 15	2405	1475	2195	305	1275	85	2100	45	1600	92.4
79 82 15	2420	1015	755	320	380	95	2100	50	746	119.0
79 83 15	2420	1145	1190	320	650	95	2100	50	959	119.0
79 84 15	2420	1310	1695	320	1015	95	2100	50	1263	119.0
79 85 15	2420	1400	2135	320	1275	95	2100	50	1715	119.0
79 86 15	2425	1460	2635	325	1545	95	2100	50	2190	119.0
79 92 15	2450	1065	820	350	430	100	2100	60	908	119.0
79 93 15	2450	1295	1250	350	665	100	2100	60	1207	119.0
79 94 15	2450	1440	1795	350	1055	100	2100	60	1625	119.0
79 95 15	2455	1455	2220	355	1395	100	2100	60	1997	119.0
79 96 15	2455	1505	2760	355	1680	100	2100	60	2530	119.0

Order details:
trapeze type 79 .. ..
L = ...mm
Z = ...mm
marking: ...
set load: ...kN
of the support point
travel: ...mm up/down
blocking position
(as required): ...mm

Heavy duty constant supports Type 16



Heavy duty constant support types 16 82 29 to 16 93 49

type③	A	A_1	B	B_1	C	D	E①	E②	F	H	K	L	M	N	O	P	S	T	Z	weight [kg]
16 82 29	867	640	635	580	500	555	1120	1132	120	585	300	200	490	300	50	330	15	15	300	635
16 83 29	997	640	635	580	500	555	1855	1867	120	715	755	200	490	300	215	340	15	15	300	920
16 92 29	917	740	695	630	570	605	1190	1202	140	630	320	240	570	330	50	350	20	20	330	805
16 93 29	1147	740	695	630	570	605	1915	1927	140	785	745	240	570	330	250	355	20	20	330	1165
16 82 39	867	640	935	880	800	855	1120	1132	120	585	300	200	490	300	50	330	15	15	600	965
16 83 39	997	640	935	880	800	855	1855	1867	120	715	755	200	490	300	215	340	15	15	600	1395
16 92 39	917	740	1025	960	900	935	1190	1202	140	630	320	240	570	330	50	350	20	20	660	1220
16 93 39	1147	740	1025	960	900	935	1915	1927	140	785	745	240	570	330	250	355	20	20	660	1765
16 82 49	867	640	1235	1180	1100	1155	1120	1132	120	585	300	200	490	300	50	330	15	15	900	1295
16 83 49	997	640	1235	1180	1100	1155	1855	1867	120	715	755	200	490	300	215	340	15	15	900	1865
16 92 49	917	740	1355	1290	1230	1265	1190	1202	140	630	320	240	570	330	50	350	20	20	990	1635
16 93 49	1147	740	1355	1290	1230	1265	1915	1927	140	785	745	240	570	330	250	355	20	20	990	2365

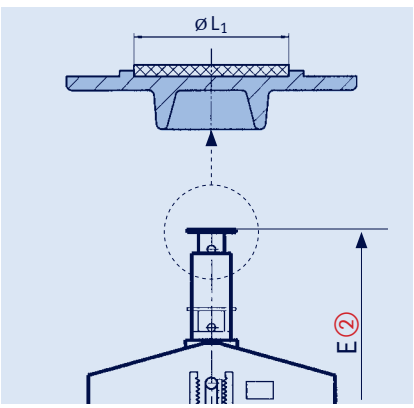
① Dimension E for uppermost blocking position, in other blocking positions E shortens accordingly and allows adjustment of +60mm.

② Dimension E for constant supports according to E ①, which are additionally fitted with a slide plate.

③ Type 16 .. .9 is supplied as standard with a corrosion protected load plate without a slide plate. If lateral movement occurs the use of sliding plates are recommended. Please note the table on the right.

When using slide plates the sliding surfaces of the mating components should be fitted with stainless steel plating.

This is indicated by the suffix 'SP' in the type designation (e.g., clamp base type 49 22 25-SP).



Load plate with integrated slide plate

type 16 with slide plate*		
up to 180°C	up to 350°C	$ØL_1$
16 82 .7	16 82 .6	110
16 83 .7	16 83 .6	110
16 92 .7	16 92 .6	150
16 93 .7	16 93 .6	150

* *Friction value of the slide plates see table on page 7.11.*

Order details:
constant support
type 16 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down
blocking position
(as required): ...mm

Servohangers Type 17

Under certain conditions, pipe systems or other components are restricted in their thermal displacement through friction or other influences, despite the use of spring and constant hangers or constant supports. In such cases servohangers can actively overcome the restriction.

Application

In standard cases, the weight of the pipe systems is practically in equilibrium with the set load of the constant hangers and constant supports. The sum of the deviations occurring and the additional stresses in the piping due to this then remain within the permissible harmless range.

In certain cases, the sum of the deviations occurring can also exceed a permissible level and considerably reduce the life of the piping systems or their connections (in the creep strength range) in the form of additional secondary stresses.

Deviations can arise through:

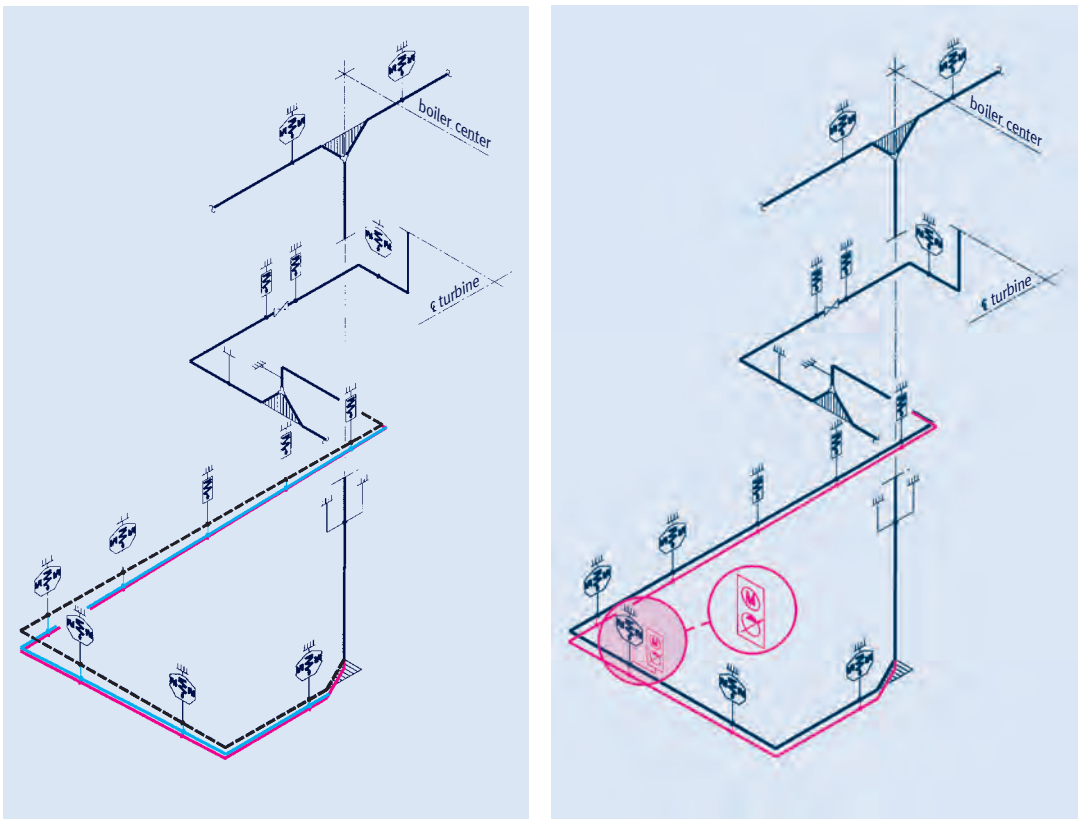
- **wall thickness tolerances of the piping, if these are not weighed extra and the weight differences taken into account**
- **insulation weights not determinable in advance**
- **mechanical friction and production tolerances for constant hangers (permissible +/– 5%)**
- **spring relaxation**
- **pipe statics that are not always readily determinable**
- **practical deviations from the theoretically planned load distribution**

A combination of deviations can cumulatively reach significant levels. These deviations have a particularly negative effect in flexible, 'soft' pipe systems. Vertical expansion can be obstructed or even completely suppressed here, even with relatively slight individual deviations.

Apart from the additional loads caused, impermissible sagging can result, due to spring hysteresis in the pressure-stressed system, with a reversed incline. In addition to possible creep rupture, in the event of an incorrectly positioned incline, dangerous water hammer can occur.

In such cases it would be advisable to supplement the passively reacting constant hangers with the active LISEGA servohangers.

Typical cases of application for LISEGA servohangers:



original cold position

hot position

new cold position

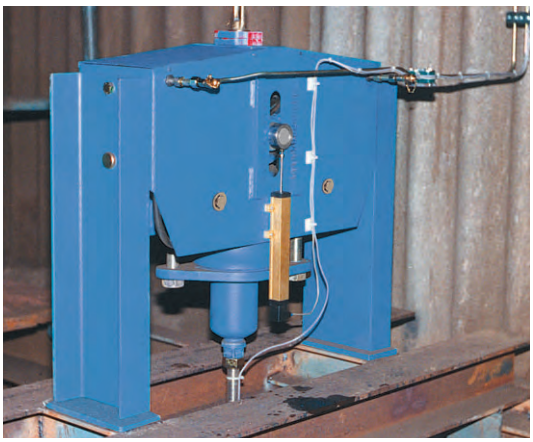
without servohangers (diagram on left) the pipe system remains in the hot position

with servohangers (diagram on right) the pipe system shifts to its specified positions

Through use of the hydraulic servo support the pipe system can now be repositioned to the specified elevation.

Design and mode of operation

The type 11 constant hanger forms the basis for the servohanger. To overcome load differences it is additionally fitted with an auxiliary hydraulic device that can exert an active supplementary force in both directions (servo support).



In standard cases, the temperature of the pipe system to be supported is used as a control parameter. The temperature in each case is transformed electronically into the corresponding travel position. In the theoretical / actual comparison procedure, the control ensures a regulated approach to the actual vertical elevation position.

Electro hydraulic control

The hydraulic unit and the control are located separately from each other in a separate switch cabinet situated near the servohanger (max. distance 16m).

The hydraulic pistons for control of the movement are located in the load tube of the constant hanger.

Safety switch

The electro hydraulic control is designed so that in the event of an operational breakdown (e.g. power loss) only the servo support is lost, but the unit will continue to function effectively as a constant hanger.

For theoretical (temp.) / actual (travel) deviations a tolerance range can be set. If the deviation is outside these values, the control switches off automatically.

Manual switch-off

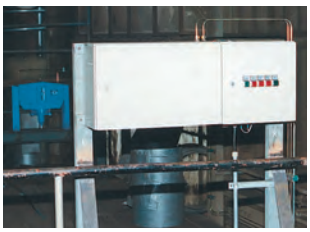
For any maintenance work required on the system or the boiler, the servo support can be switched on or off manually.

Design sizes

Load Groups 5 (F_N 20kN) to 9 (F_N 100kN) with travel ranges 2 (150mm) and 3 (300mm) are considered standard. For other cases, special designs can be supplied.

Operating instructions

Installation and commissioning instructions, as well as servicing recommendations, are included in the scope of supply.

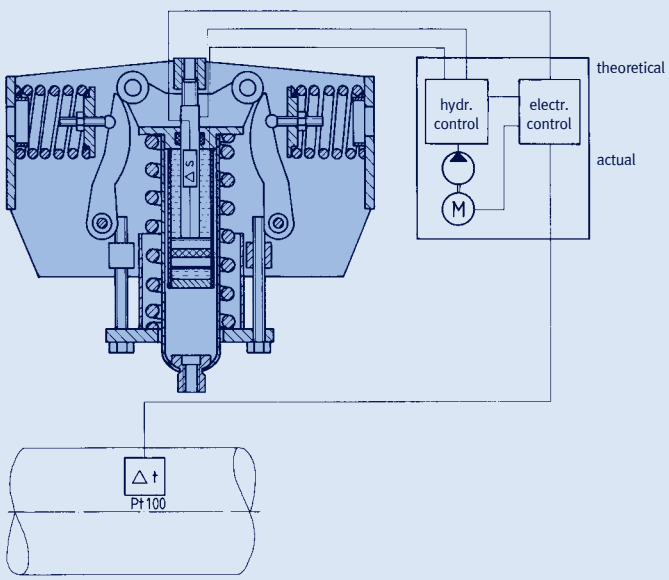


Servohanger switch cabinet

① For this, see also selection table constant hangers, pages 1.13 and 1.14.

② 2 = travel range 2
3 = travel range 3

servohanger type ②	nominal load F_N [kN]	set load ① [kN]	load-dependent travel ① travel range 2 [mm]	travel range 3 [mm]	additional servo force [kN]
17 5. 15	20	8 – 20	75 – 150	150 – 300	± 8
17 6. 15	40	16 – 40	75 – 150	150 – 300	± 20
17 7. 15	60	24 – 60	75 – 150	150 – 300	± 20
17 8. 15	80	32 – 80	75 – 150	150 – 300	± 20
17 9. 15	100	40 – 100	75 – 150	150 – 300	± 20



Function chart

Installation and operating instructions Types 11, 12-14, 18, 19

① blocking device
② guide pin
③ name plate
④ red marking for hot position
⑤ retaining bolt with washer for blocking device (after deblocking)
⑥ travel scale
⑦ blocking strip
⑧ indicator for set load
⑨ load scale
⑩ load adjustment hood
⑪ load adjustment bolt
⑫ load tube
⑬ inspection hole for min. thread engagement depth
⑭ adjusting nut (with swivel joint)

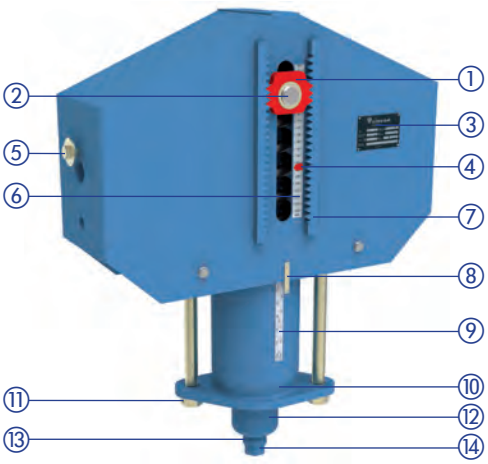
1 Transport and storage

During transport, care must be taken that connecting threads, blocking devices and load adjustment bolts are not damaged. When storing in the open air, the supports must be protected from dirt and water.

2 Delivery condition

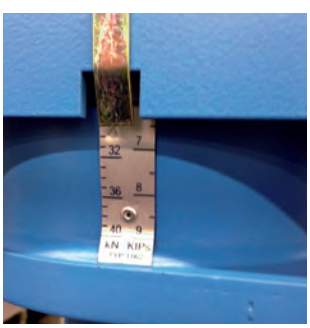
If not otherwise agreed, LISEGA constant hangers are set to the desired cold load position (installation condition) and blocked. The adjustment values can be read off the load and travel scale as well as the name plate.

On the travel scale the theoretical hot position is marked with a red sticker and the theoretical cold position with a white one. At the delivery inspection the customer specified load set at the factory is permanently marked on the load scale with an "X". The reading is made at the level of the guide pin center.

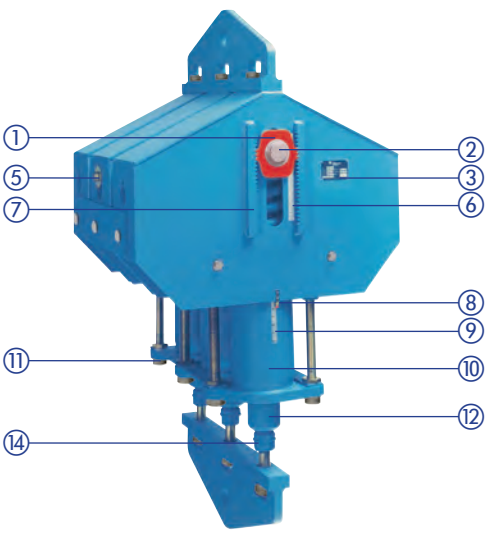


Constant hanger type 11

Travel scale with cold/hot marking

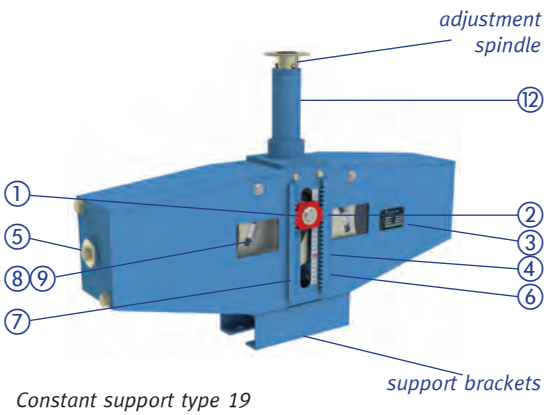


Load scale with indicator

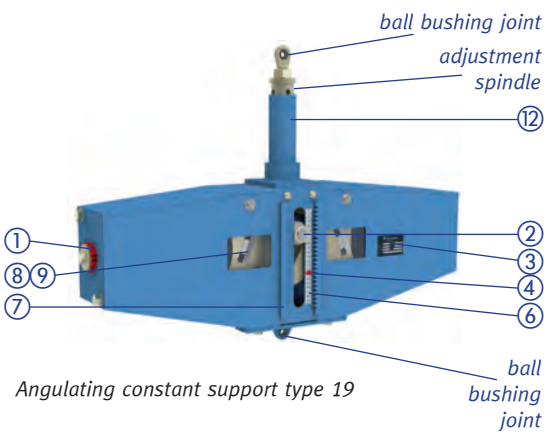


Coupled constant hanger type 12-14

Low profile constant hanger type 18



Constant support type 19



Angulating constant support type 19

Name plate with stamped operating data

Stamped on the plate are:

- **type**
- **serial number**
- **LISEGA order number**
- **calibration load (set load)**
- **inspector**
- **travel**
- **ident. number**

Connections type 11 C3 .. - 11 96 .. (single cell hangers)

The upper connection is designed as an inner thread with limited engagement depth. The lower connection is designed as a spherical adjusting nut pivotable in all directions by min. 4°. The connection threads are greased and sealed with plastic caps.

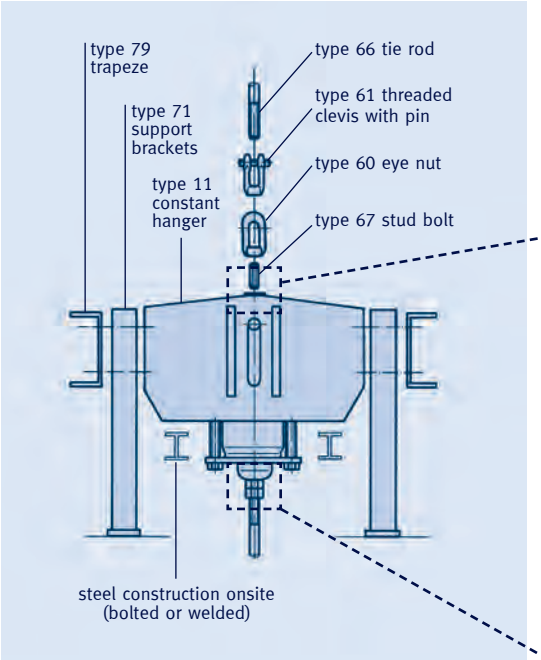
When connecting to the connecting rods, care must be taken that the lower rod is screwed into the adjusting nut **at least to the inspection hole**. A further thread engagement depth of at least 300mm is available.

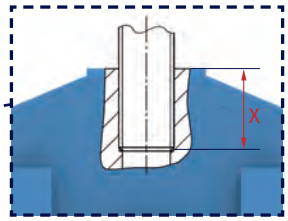
Connections type 12 82 ..- 14 96 .. (heavy duty)

The upper connection is designed as a yoke plate. The lower connection is also designed as a yoke plate and fastened to the spherical adjusting nuts of the individual constant hanger cells, whereby pivoting of min. 4° is possible.

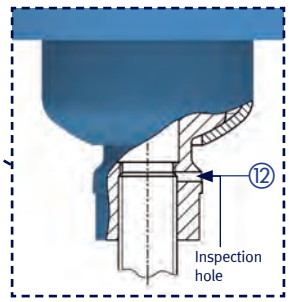
Constant hangers type 11 (seated)

These constant hangers for all load sizes can be directly seated. They can also be supplied with serial support brackets type 71 which, depending on the order specifications, can be connected and bolted via precision-fit boreholes at works or on site. The base plates of the support brackets can be welded to the contact surface. On request, support brackets with slot holes for bolting can be supplied.





Min. thread engagement depth „X“ of upper connection (see selection table type 11, page 1.15)



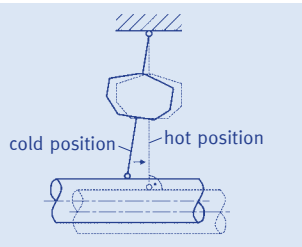
Min. thread engagement depth of connection rod in load tube

Connections type 18

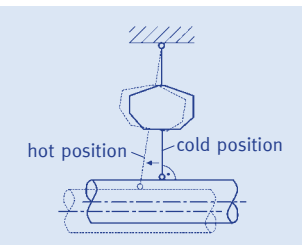
The upper connection is designed as a yoke plate and the lower one as a spherical adjusting nut, pivotable in all directions by min. 4°. The connection threads are greased and sealed with plastic caps.

Connections type 19

The upper connections of the constant supports are fitted either with a load plate or slide plate to reduce friction from lateral displacement, or with a ball-joint lug for angulating constant supports. The lower connections are therefore either a pedestal or a lug. During welding work at the pedestal the components inside constant supports must be protected.



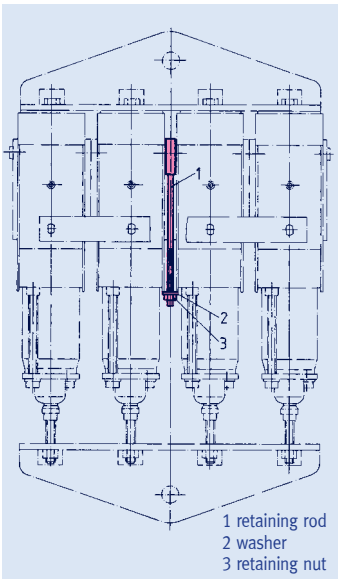
Rods vertical during plant operation



Rods vertical in installation condition

Transport lock type 12 82 .. – 14 96 .. (heavy duty)

Coupled constant hangers are supplied with a transport locking device (marked in red) consisting of a retaining rod, washer and retaining nut.



Transport lock type 12 82 .. – 14 96 ..

The transport lock is loosened only on completion of hanger installation and at the same time as the removal of the blocking devices.

For this, the retaining nut with washer marked in red are removed at the lower end with a socket wrench. Both parts are to be stored in the same place as the blocking devices. When making the force-fit connection, care must be taken that the lower threaded rods are screwed into the adjusting nuts at least up to the inspection hole. The installation dimension of the lower yoke plate can be lengthened with the adjusting nuts by 250mm or shortened by 70mm.

3 Installation of the constant hangers

When installing, the specifications of the **installation instructions for pipe systems** must be followed. Special attention must thereby be paid to the desired installation position of the suspension rods throughout the whole support chain. There are two possibilities here:

A) The connecting rods are to be installed at an angle according to the expected horizontal displacement in the pipe system. A perpendicular position is hereby anticipated in operating condition.

B) The connecting rods are to be installed vertically for the purpose of better inspection. A controlled angled position in operating condition is thereby permitted.

In all events, uniform specifications for the whole installation should exist.

The connecting rods and points are to be coupled force-locked.

Type 11 C3 .. – 11 96 .. (single cell hanger)

For installation of the constant hangers, transport lugs or other assembly devices can be screwed into the threaded holes on the sides. After deblocking of the hanger (see point 4) the blocking devices are to be screwed on here for safe keeping. For constant hangers with support brackets type 71 the hangers are fitted with transport lugs instead of the upper connection – these can also store the blocking devices.

Constant hangers types 12 82 .. – 14 96 ..

For installation of the hangers, the side openings of the upper yoke plate can be used for hooking on. For hangers with support brackets, the upper yoke plate is replaced by a transport lug.

4 Deblocking

Requirements

The correct deblocking of the constant hangers in accordance with the following instructions is crucial for the subsequent faultless functioning of the pipe systems.

As far as possible, the blocking devices are to be removed, immediately / shortly before commissioning.

The blocking devices must be removed as a matter of principle in a systematic way, one after the other, beginning at a fixed point or connection point.

The whole system should be inspected beforehand according to point 3 of these installation instructions.

Actual and theoretical condition

When it has been ensured that all connections are firmly force-locked, the suspended weight is completely taken up by the constant hangers or supports.

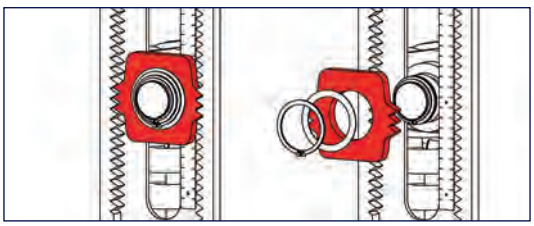
If the weight load corresponds to the set load and the piping system shows no sign of stress, then the planned equilibrium has been achieved. The blocking devices can be easily removed.

In practice however, slight stresses in the piping systems and hence resulting load shifting can hardly be avoided.

In the same way, the loads, which are usually determined theoretically, can show larger tolerances. As a result, the deviations can lead (according to under- or over-load) to corresponding jamming of the guide pin in the lower or upper section of the blocking device.

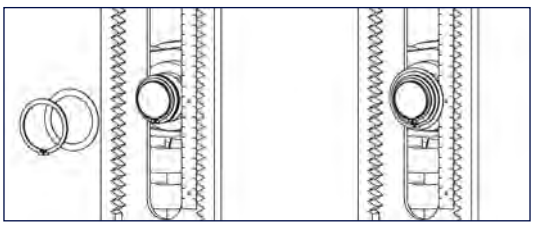
Procedure
The blocking devices can only be removed when the guide pin is centered in them. The set load is made up of the cold load and the extra weight of the hanger components suspended. If the guide pin is lying at the top or the bottom, the load adjustment must be adapted before deblocking (see point 5, load correction):

When removing the blocking devices, care must be taken that only the outer locking ring is loosened.



Blocked condition

① Dismantling of the outer locking ring and blocking device



② Assembly of the outer locking ring

③ Completed: deblocked condition

In cases of requirement, e.g. for revisions, the hangers or supports can be blocked again in any position. For this, the blocking devices are placed on the guide pin and secured. The blocking devices should be firmly bolted to the side of the constant hanger body in types 11 to 14, when they are not in use.

Load distribution
Under no circumstances should the blocking devices be removed by force!

By loosening or tightening the connecting rods with a few turns of the adjusting nut in the case of constant hangers, or corresponding adjustment of the support tube for constant supports, stresses in the pipe system can be compensated for and the guide pin is then free.

The geometrical position of the pipe system must not be altered when balancing stresses!

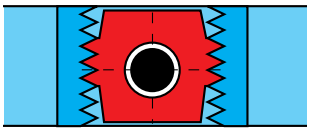
As later adjustment at one point can cause a renewed slight shift at another, the procedure must be repeated if necessary at different points. For clear control it is recommended that, as a matter of principle, the blocking devices should only be removed when all the guide pins are centered in them.

5 Load correction type 11, 12-14

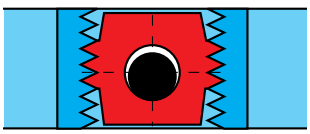
Load correction is necessary if the set load (set at the LISEGA facility) deviates from the weight actually applied. In this case, with LISEGA hangers the set load can also be adjusted in the installed condition.

It should thereby be taken into account that for load increases the remaining travel is shorter. In most cases this is not critical, due to the travel and load reserves available. For safety reasons this should be checked with the catalog data. Any changes in the installation dimension caused by load corrections must be compensated for within the load chain.

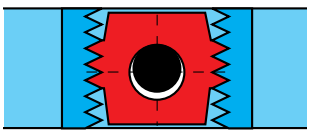
Procedure:
1) Loosen both of the load adjustment locknuts.



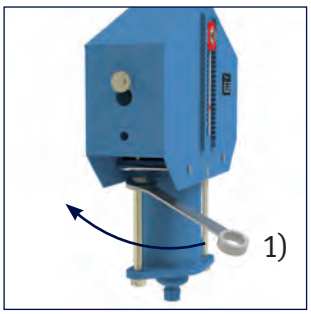
a) Guide pin is free:
Set load of the constant hangers agrees with the weight applied. Blocking device can be removed.

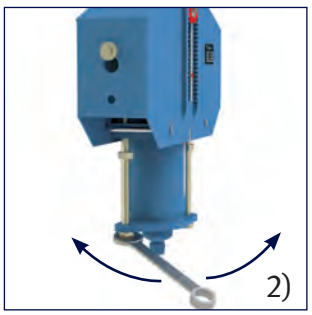


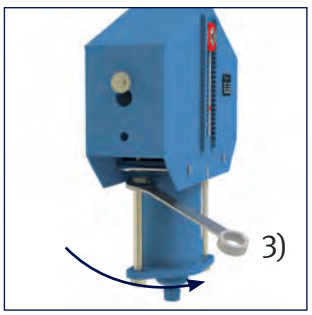
b) Guide pin lies at bottom:
Set load of constant hanger is smaller than weight applied. Loosen connecting rod or increase set load.



c) Guide pin lies on top:
Set load of constant hanger is larger than weight applied. Tighten connecting rod or decrease set load.







2) Alternate tightening or loosening the two load adjustment bolts, by a ¼ turn in each case. The base plate of the load adjustment hood and the lower edge of the constant hanger body must thereby remain parallel.

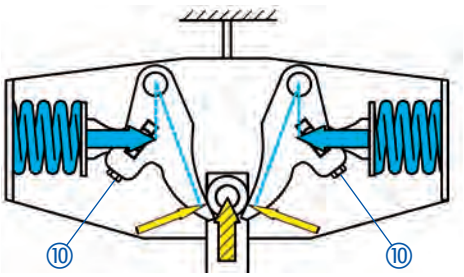
   The procedure is completed as soon as the guide pin no longer lies at the top or the bottom of the blocking device. If, for constant hangers of higher load groups, the necessary adjustment forces are too big and manual adjustment is not possible, auxiliary devices must be used (see point 6, auxiliary devices).

3) Tighten the locknuts of the load adjustment bolts. Now deblocking can continue.

Load correction types 18, 19

By way of the load adjustment bolts ⑩ the length of the lever of the leverage arm is altered on the left and right respectively.

On load adjustment the working travel remains unaltered.

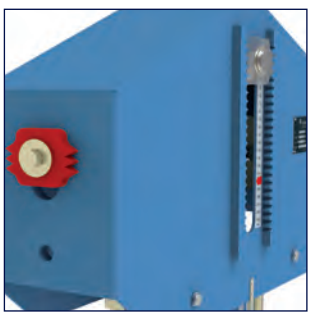


Procedure:

1) Unlock tab washer.

2) Turn load adjustment bolts equally on both sides until the guide pin is free.

3) Secure load adjustment bolts against twisting by locking the tab washers.

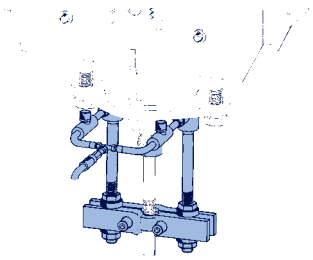


Blocking device bolted to front side

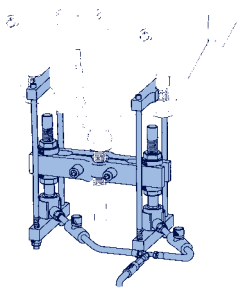
6 Auxiliary devices

Tightening or loosening of the connecting rods, as well as load calibration, can be performed manually on all hangers. For hangers in the higher load groups this work can require a great deal of effort due to the higher load calibration.

To facilitate the work, an auxiliary device can be made available with which a hydraulic load take-up using a handpump can be effected. It is operated by LISEGA personnel.



Installation device, used to relieve the load adjustment bolts



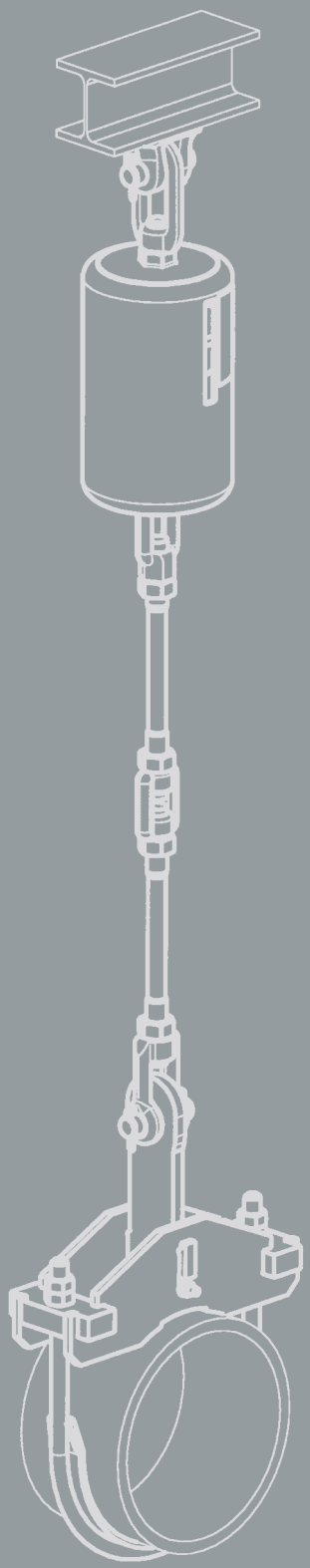
Installation device, used to relieve the adjusting nut

7 Inspection and maintenance

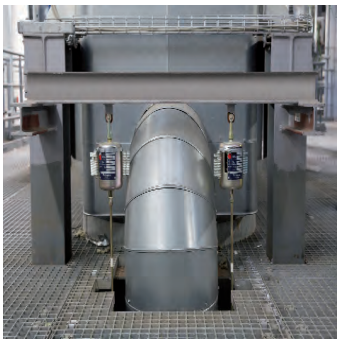
The flawless functioning of the constant hangers and supports can be checked in every operating situation by examining the position of the guide pin.

Under normal operating conditions, maintenance is not required.

Spring hangers, spring supports



LISEGA




SN 50

Spring hangers, spring supports

Contents **Page**

Field of application

To avoid constraining the system, thermal expansion in high-temperature piping must not be restricted. The piping must therefore be supported in a correspondingly elastic manner.

Spring components

To balance slight vertical displacement in the pipe systems, spring components are used as supports. These components function on the basis of preset helical coil springs which exert a variable supporting load over the range of movement in accordance with their specifie spring characteristics. Load variations resulting from this are limited through the stress analysis calculations, depending on the sensitivity of the piping.

The relevant basis for the function of the spring components are specified in the current guidelines (see technical specifications, page 0.5).

LISEGA spring hangers and supports

A range of spring component designs are available for optimum adaptation to the **various structural requirements**. The ideal choice depends on the installation situation.

Spring hangers and supports are as a rule calibrated in such a way that the spring force and pipe load are the same in the cold position (see page 0.5). The corresponding hot load position results from the theoretical pipe displacement (travel) and the spring rate.

The difference in force between hot and cold positions acts on the pipe system as a reaction force and is governed by the relevant design specifications. Further information can be found on page 0.5.

As standard practice, the permissible force deviation between cold position (blocking position) and hot position should not exceed 25 % in relation to the hot load.

Moreover, as a rule constant **hangers/supports** are used that maintain a **constant hanger/support** force over the whole displacement range.

Selection of spring hangers

The reaction force depends on the spring rate (stiffness) of the respective coil springs. The change in force from cold to hot position results from the displacement. The greater the spring rate, the greater the change in load and accordingly the reaction force in the pipe system. For optimum selection of spring hangers and supports, LISEGA has divided the load ranges into 5 travel ranges.

Details of their application can be found in the **selection table** (see pages 2.5 and 2.6), in the **installation and operating instructions** (page 2.19) and the **technical specifications** (page 0.3).

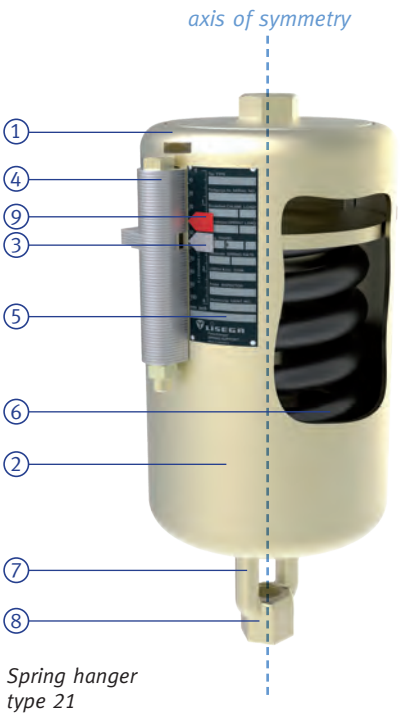
Load setting and blocking

Spring hangers and supports are checked for function and preset at the factory to the cold or blocking load and blocked in both directions of movement. This enables installation of the support in the designated installation space without time-consuming adjustments.

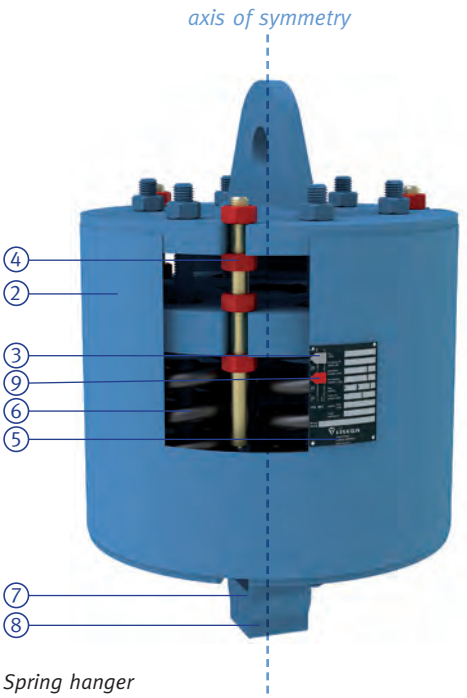
In addition, the supplementary loads arising through pickling, flushing or pressure testing are held by the blocking devices.

- **cold and hot positions are shown on the travel scale by white and red marking respectively**
- **the blocking devices have continuously variable settings and can be reused in any spring position**

Special advantages of LISEGA spring hangers



Spring hanger type 21



Spring hanger type 22

The user can profit from a wide range of special benefits with LISEGA spring hangers.

Significant savings are possible, particularly with regard to ancillary labor-intensive support costs such as planning, installation and operation.

① No welding (types 20, 21, 27).

② Fully electro galvanized surfaces.

For heavy duty designs: coated surfaces.

③ The cold or blocking position is marked on the travel scale (white arrow).

④ Fully adjustable blocking system.

⑤ On the spring hangers, the preset values are noted on the riveted name plate.

⑥ Special prerelaxed springs with a CED (cathodic electrophoretic dip coating) finis prevent any significant loss in load capacity.

⑦ Integrated connecting elements.

⑧ Variable connection possibilities within the load group selected and the possibility of later adjustment for load setting.

⑨ The theoretical hot position (operating position) is marked on the travel scale (red arrow).

✔ Five travel ranges from 0 to 400mm, load group C to load group 9
Three travel ranges from 0 to 200mm, load group 10 to load group 50.

✔ Load application free of moments by coinsiding the load axis with the axis of symmetry.

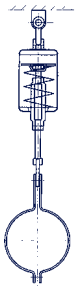
✔ Favorable performance-to-weight-ratios for reduced assembly weights.

✔ Modular system simplifies selection (load groups and travel ranges).

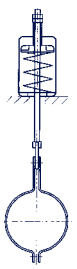
✔ Flexible installation configurations using standardized components.

✔ Secure connection of load chains through the load and connection compatibility of system components.

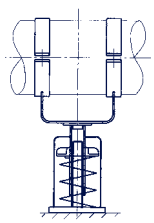
Overview of types
Spring hangers and spring supports



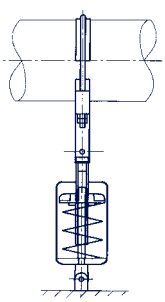
Spring hanger type 21



Spring hanger type 25



Spring support type 29



Angulating spring support type 20

0.04 – 100kN

Spring hanger type 21

This design is the most commonly used and is fitted with an upper connection for suspension. It is used where the surrounding structure offers a suitable connection point and sufficient installation space. The upper connections can be universally adapted to the existing conditions using standard components.

Spring hanger type 25

This version is used especially if the permissible deflection of a support chain when using type 21 was exceeded or if, due to shortage of space, a type 21 spring hanger cannot be installed. The connection is made by a rod fed through the hanger.

Spring support type 29

If the surrounding conditions do not permit suspensions, this design offers a suitable alternative as a support. For larger horizontal displacements of the support load and of steel/steel slide plate contact, under certain circumstances the functioning of the support can be adversely affected by any lateral forces generated. It is recommended to avoid this risk by using LISEGA slide plates. In this case the mating components must have a stainless steel surface and if necessary be fitted with a twist restraint.

Angulating spring support type 20

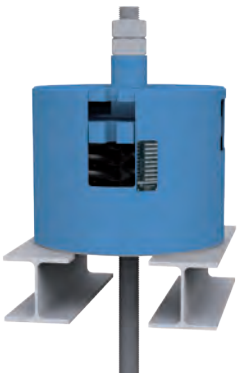
In contrast to the type 29 spring supports, lateral displacements can be absorbed practically free of friction forces by this design. This way, resulting forces in all planes, both in vertical as well as horizontal directions of movement, are almost completely eliminated.

The angulating spring supports act in compression. They are fitted on one side with an adjustable load tube and a rotating ball bushing joint and on the other with a fixed ball bushing joint. The joints provide the appropriate connection to the type 35 weld-on brackets and the dynamic clamps in product group 3.

Heavy duty design 53 – 400kN

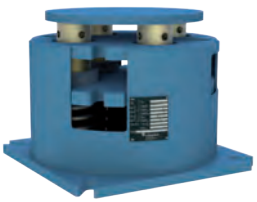
Spring hanger type 22

This design corresponds functionally to type 21 and is available for higher loads up to 400kN.



Spring hanger type 26

This design corresponds functionally to the seated spring hanger type 25 and is available for higher loads up to 400kN.



Spring support type 28

This design corresponds functionally to spring support type 29 and is available for higher loads up to 400kN. Here too, LISEGA sliding components can be used as an option.

Sway braces type 27

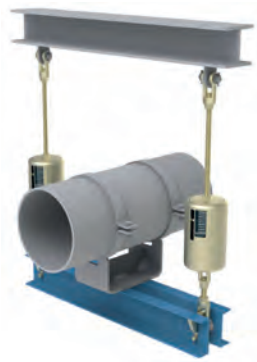
These special components act in compression and tension directions and are used to stabilize the position of pipe systems and other plant equipment. The connection components correspond with those in product group 3 (dynamic components).

With the LISEGA sway braces type 27 the following settings can be made:

- **load pre-tensioning**
- **installation dimensions**
- **free stroke**

Spring hanger trapezes type 79

These commonly used components combine the advantages of the spring hanger with the easy-to-install, weld-free plug-in trapezes. For restricted spaces the spring hanger trapezes can be supplied as special welded designs.



Telescopic spring supports type 29 .. 2.

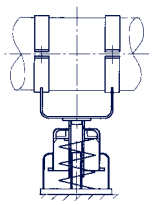
As a special design of type 29 these telescoping spring supports are used for lower E dimensions. They are fitted as standard with a PTFE slide plate.

Add-on components

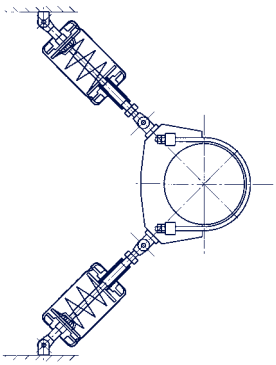
Slide plate for spring supports type 29/28
To reduce friction between the load plate and mating component (e.g. clamp base), PTFE sliding materials (up to 180°C) or suitable material for higher temperatures (up to 350°C) are used. The mating component should in this case have a stainless steel sliding surface. The selection of slide plates can be found on page 2.11.

Installation extension for spring support type 29
To bridge larger installation heights, adapted installation extensions can be ordered (see page 2.11).

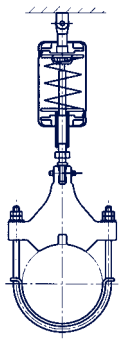
Base plate for spring hanger type 25
If required, type 25 can be supplied with the base plate type 72 for bolting or welding. A selection can be found on page 2.9.



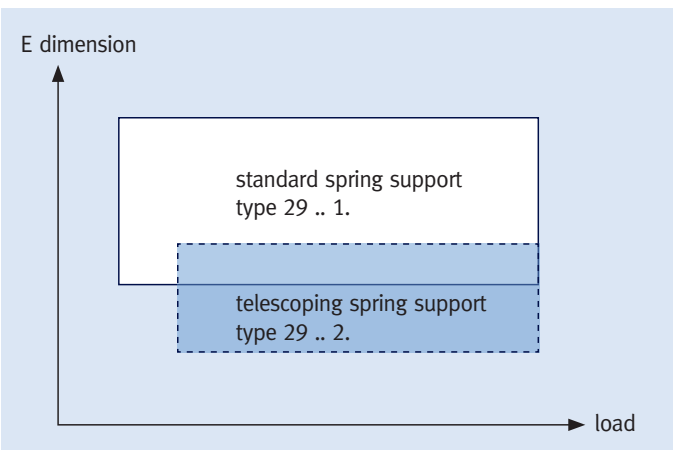
Spring support type 29 .. 2. (telescopic)



Sway brace type 27 angled arrangement



Sway brace type 27 simple arrangement



Extended field of application with telescopic spring support 29 .. 2.

Selection overview, spring components

Selection criteria for spring hangers and supports

Permissible force variation
The permissible force variation from cold load (installation load) to hot load (operating load) is limited internationally by the common specifications for pipe system calculations to **max 25% of the operating load**. In principle however, it is dependent on the pipe systems allowable stress.

Maximum travel
To avoid functional variations through instability from springs with long travel, **maximum travel of 50mm** should not, as a rule, be exceeded.

Spring rates
In order to offer the largest possible field of application while at the same time complying with these specifications LISEGA spring components are divided into 5 travel ranges with correspondingly different spring rates.

Extra-long springs
Travel ranges 4 and 5 belong to the 'extra-long spring travel' category and should only be used after careful consideration of the travel and variability, especially in sensitive, 'soft' pipe systems.

Design type
The choice of a suitable design type is dependent on the respective support configuration and/or installation conditions.

Economical size
The following selection procedures can be followed to determine the most economical component size:

Spring hangers type 21, spring hangers type 25 for seating, spring supports type 29, angulating spring supports type 20

travel range ①					type designation										
					21 C2 19	21 D. 19	21 1. 18	21 2. 18	21 3. 18	21 4. 18	21 5. 18	21 6. 18	21 7. 18	21 8. 18	21 9. 18
						25 D. 19	25 1. 18	25 2. 18	25 3. 18	25 4. 18	25 5. 18	25 6. 18	25 7. 18	25 8. 18	25 9. 18
					29 C2 19	29 D. 19	29 1. 18	29 2. 18	29 3. 18	29 4. 18	29 5. 18	29 6. 18	29 7. 18	29 8. 18	29 9. 18
...1..	...2..	...3..	...4.. ②	...5..		20 D. 19	20 1. 14	20 2. 14	20 3. 14	20 4. 14	20 5. 14	20 6. 14	20 7. 14	20 8. 14	20 9. 14
working travel [mm] ③					load [kN]										
0	0	0	0	0	0.04	0.12	0.41	0.83	1.66	3.33	6.66	13.33	20.00	26.66	33.33
2.5	5	10	15	20	0.05	0.14	0.45	0.91	1.83	3.66	7.33	14.66	22.00	29.33	36.66
5.0	10	20	30	40	0.06	0.16	0.50	1.00	2.00	4.00	8.00	16.00	24.00	32.00	40.00
7.5	15	30	45	60	0.07	0.18	0.54	1.08	2.16	4.33	8.66	17.33	26.00	34.66	43.33
10.0	20	40	60	80	0.08	0.20	0.58	1.16	2.33	4.66	9.33	18.66	28.00	37.33	46.66
12.5	25	50	75	100	0.09	0.22	0.62	1.25	2.50	5.00	10.00	20.00	30.00	40.00	50.00
15.0	30	60	90	120	0.10	0.24	0.66	1.33	2.66	5.33	10.66	21.33	32.00	42.66	53.33
17.5	35	70	105	140	0.11	0.26	0.70	1.41	2.83	5.66	11.33	22.66	34.00	45.33	56.66
20.0	40	80	120	160	0.12	0.28	0.75	1.50	3.00	6.00	12.00	24.00	36.00	48.00	60.00
22.5	45	90	135	180	0.13	0.30	0.79	1.58	3.16	6.33	12.66	25.33	38.00	50.66	63.33
25.0	50	100	150	200	0.14	0.32	0.83	1.66	3.33	6.66	13.33	26.66	40.00	53.33	66.66
27.5	55	110	165	220	0.16	0.34	0.87	1.75	3.50	7.00	14.00	28.00	42.00	56.00	70.00
30.0	60	120	180	240	0.17	0.36	0.91	1.83	3.66	7.33	14.66	29.33	44.00	58.66	73.33
32.5	65	130	195	260	0.18	0.38	0.95	1.91	3.83	7.66	15.33	30.66	46.00	61.33	76.66
35.0	70	140	210	280	0.19	0.40	1.00	2.00	4.00	8.00	16.00	32.00	48.00	64.00	80.00
37.5	75	150	225	300	0.20	0.42	1.04	2.08	4.16	8.33	16.66	33.33	50.00	66.66	83.33
40.0	80	160	240	320	0.21	0.44	1.08	2.16	4.33	8.66	17.33	34.66	52.00	69.33	86.66
42.5	85	170	255	340	0.22	0.46	1.12	2.25	4.50	9.00	18.00	36.00	54.00	72.00	90.00
45.0	90	180	270	360	0.23	0.48	1.16	2.33	4.66	9.33	18.66	37.33	56.00	74.66	93.33
47.5	95	190	285	380	0.24	0.50	1.20	2.41	4.83	9.66	19.33	38.66	58.00	77.33	96.66
50.0	100	200	300	400	0.25	0.52	1.25	2.50	5.00	10.00	20.00	40.00	60.00	80.00	100.00
					spring rate c [N/mm]										
											33.3	66.6	100.0	133.3	166.6
									11.1	22.2	44.4	88.9	133.3	177.8	222.2
						2.1	4.1	8.3	16.6	33.3	66.6	133.3	200.0	266.6	333.3
					2.1	4.1	8.3	16.6	33.3	66.6	133.3	266.6	400.0	533.3	666.6
						8.3	16.6	33.3	66.6	133.3	266.6	533.3	800.0	1066.6	1333.3

In cases where a smaller 'E' dimension than that of type 29 ..1. is required, we recommend the use of telescopic spring support type 29 .. 2. (see page 2.17).

Determination of the most favorable size

1. Selection of the most favorable spring hanger/support

Example:

Operating load	F = 6000N
Permissible deviation	p < 25%
Travel (upwards)	s = 15mm

The max. permissible spring rate produces:

$$\text{Spring rate} \leq \frac{(\text{permissible deviation}) \cdot (\text{operating load})}{(\text{working travel})}$$

$$c \leq \frac{0.25 \cdot 6000N}{15mm} = 100N/mm$$

Selection type	25 42 18
Spring rate	c = 66.6N/mm
Cold load	F_K = 7000N

2. Determination force variation (percentage)

Example:

6000N operating load, working travel 15mm (upwards), a spring hanger type 25 42 18 with a spring rate of c = 66.6 N/mm was selected:

$$\text{Change in force} = \frac{(\text{working travel}) \cdot (\text{spring rate})}{(\text{operating load})}$$

$$\Delta F = \frac{15mm \cdot 66.6N/mm}{6000N} = 0.1665$$

$$\Delta F\,[\%] = 16.65\%$$

Spring hangers type 22, spring hangers type 26 for seating, spring supports type 28

working range ①			type designation				
			22 1. 19	22 2. 19	22 3. 19	22 4. 19	22 5. 19
			26 1. 19	26 2. 19	26 3. 19	26 4. 19	26 5. 19
...1..	...2..	...3..	28 1. 19	28 2. 19	28 3. 19	28 4. 19	28 5. 19
working travel [mm] ③			load [kN]				
0	0	0	53.33	66.66	80.00	100.00	133.33
2.5	5	10	58.66	73.33	88.00	110.00	146.66
5.0	10	20	64.00	80.00	96.00	120.00	160.00
7.5	15	30	69.33	86.66	104.00	130.00	173.33
10.0	20	40	74.66	93.33	112.00	140.00	186.66
12.5	25	50	80.00	100.00	120.00	150.00	200.00
15.0	30	60	85.33	106.66	128.00	160.00	213.33
17.5	35	70	90.66	113.33	136.00	170.00	226.66
20.0	40	80	96.00	120.00	144.00	180.00	240.00
22.5	45	90	101.33	126.66	152.00	190.00	253.33
25.0	50	100	106.66	133.33	160.00	200.00	266.66
27.5	55	110	112.00	140.00	168.00	210.00	280.00
30.0	60	120	117.33	146.66	176.00	220.00	293.33
32.5	65	130	122.66	153.33	184.00	230.00	306.66
35.0	70	140	128.00	160.00	192.00	240.00	320.00
37.5	75	150	133.33	166.66	200.00	250.00	333.33
40.0	80	160	138.66	173.33	208.00	260.00	346.66
42.5	85	170	144.00	180.00	216.00	270.00	360.00
45.0	90	180	149.33	186.66	224.00	280.00	373.33
47.5	95	190	154.66	193.33	232.00	290.00	386.66
50.0	100	200	160.00	200.00	240.00	300.00	400.00
			spring rate c [N/mm]				
			533.3	666.6	800	1000	1333.3
			1066.6	1333.3	1600	2000	2666.6
			2133.3	2666.6	3200	4000	5333.3

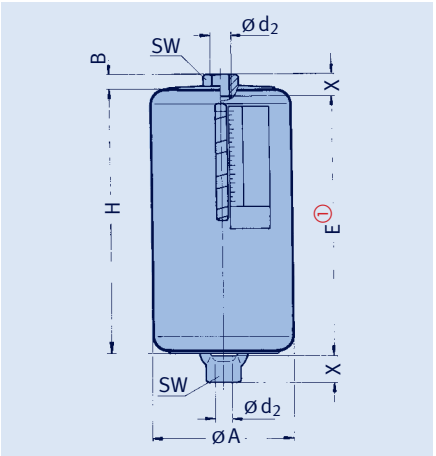
① Travel range = 4th digit of type designation.
For the availability of the different travel ranges, see dimension tables on pages 2.7 to 2.17.

② The use of springs with extra-long travel is to be treated with reservation due to the relatively large spring hysteresis.

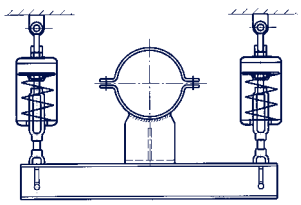
③ The actual travel is subject to tolerances and may differ to theoretical values.

Spring hangers Type 21

Spring hanger
type 21 C2 19 to 21 95 18
Standard design,
delivery from stock.



① Dimension 'E' increases on loading by the corresponding spring travel (see load table on page 2.5).

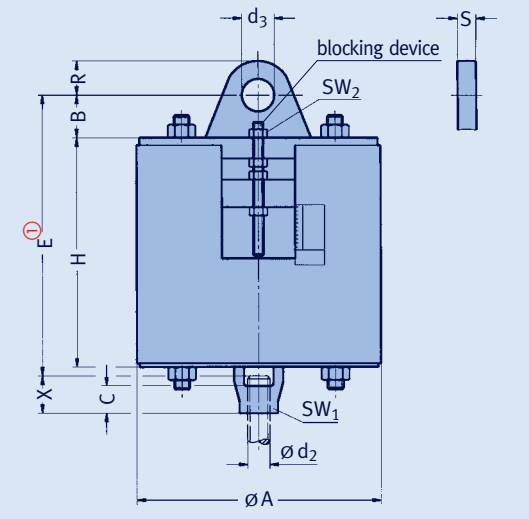


In restricted spaces the spring hangers can be used with type 79 trapezes (see page 2.14).

type	ø A	B	ø d_2	E①	H	SW	X	weight [kg]
21 C2 19	80	11	M10	205	205	19	15	1.9
21 D2 19	90	11	M10	250	245	19	15	3.0
21 D3 19	90	11	M10	475	470	19	15	5.0
21 11 18	90	11	M12	155	145	19	15	2.1
21 12 18	90	11	M12	250	245	19	15	3.1
21 13 18	90	11	M12	475	470	19	15	5.5
21 21 18	115	12	M12	155	150	19	15	3.8
21 22 18	115	12	M12	255	250	19	15	5.3
21 23 18	115	12	M12	475	460	19	15	8.6
21 31 18	115	13	M16	160	155	24	20	4.3
21 32 18	115	13	M16	255	250	24	20	6.0
21 33 18	115	13	M16	475	470	24	20	9.7
21 34 18	115	13	M16	840	725	24	20	14.0
21 41 18	155	17	M20	185	180	30	25	9.2
21 42 18	155	17	M20	290	290	30	25	12.8
21 43 18	155	17	M20	525	525	30	25	20.0
21 44 18	155	17	M20	920	800	30	25	29.0
21 51 18	180	21	M24	215	215	36	30	16.5
21 52 18	180	21	M24	305	305	36	30	20.5
21 53 18	180	21	M24	540	540	36	30	32.0
21 54 18	180	21	M24	1035	825	36	30	46.0
21 55 18	180	21	M24	1275	1065	36	30	57.0
21 61 18	220	24	M30	245	245	46	35	31.0
21 62 18	220	24	M30	360	360	46	35	40.0
21 63 18	220	24	M30	640	640	46	35	62.0
21 64 18	220	24	M30	1205	980	46	35	90.0
21 65 18	220	24	M30	1490	1265	46	35	114.0
21 71 18	245	30	M36	280	285	55	45	48.0
21 72 18	245	30	M36	405	410	55	45	63.0
21 73 18	245	30	M36	675	680	55	45	89.0
21 74 18	245	30	M36	1300	1070	55	45	133.0
21 75 18	245	30	M36	1575	1345	55	45	160.0
21 81 18	245	30	M42	305	320	65	50	58.0
21 82 18	245	30	M42	470	485	65	50	80.0
21 83 18	245	30	M42	845	860	65	50	126.0
21 84 18	245	30	M42	1430	1330	65	50	182.0
21 85 18	245	30	M42	1810	1710	65	50	228.0
21 91 18	275	36	M48	330	355	75	60	84.0
21 92 18	275	36	M48	505	530	75	60	111.0
21 93 18	275	36	M48	870	895	75	60	164.0
21 94 18	275	36	M48	1515	1395	75	60	243.0
21 95 18	275	36	M48	1885	1765	75	60	296.0

Order details:
spring hanger type 21 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down

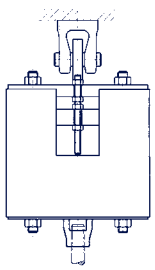
Heavy duty spring hangers
Type 22



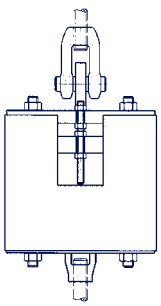
Spring hangers
type 22 11 19 to 22 53 19

type	ø A	B	C	ø d_2	ø d_3	E①	H	R	S	SW_1	SW_2	X	weight [kg]
22 11 19	525	80	60	M56x4	62	440	350	90	30	85	46	65	240
22 12 19	525	80	60	M56x4	62	560	470	90	30	85	46	65	270
22 13 19	525	80	60	M56x4	62	840	750	90	30	85	46	65	340
22 21 19	545	95	70	M64x4	72	475	370	105	30	95	46	75	285
22 22 19	545	95	70	M64x4	72	595	490	105	30	95	46	75	320
22 23 19	545	95	70	M64x4	72	875	770	105	30	95	46	75	410
22 31 19	590	95	75	M68x4	72	490	385	105	30	100	46	80	360
22 32 19	590	95	75	M68x4	72	610	505	105	30	100	46	80	405
22 33 19	590	95	75	M68x4	72	890	785	105	30	100	46	80	510
22 41 19	625	115	80	M72x4	82	555	430	120	35	105	55	85	455
22 42 19	625	115	80	M72x4	82	685	560	120	35	105	55	85	515
22 43 19	625	115	80	M72x4	82	955	830	120	35	105	55	85	625
22 51 19	645	140	90	M80x4	92	630	480	135	35	115	65	95	550
22 52 19	645	140	90	M80x4	92	800	650	135	35	115	65	95	655
22 53 19	645	140	90	M80x4	92	1175	1025	135	35	115	65	95	865

① Dimension 'E' increases on loading by the corresponding spring travel (see load table on page 2.6).

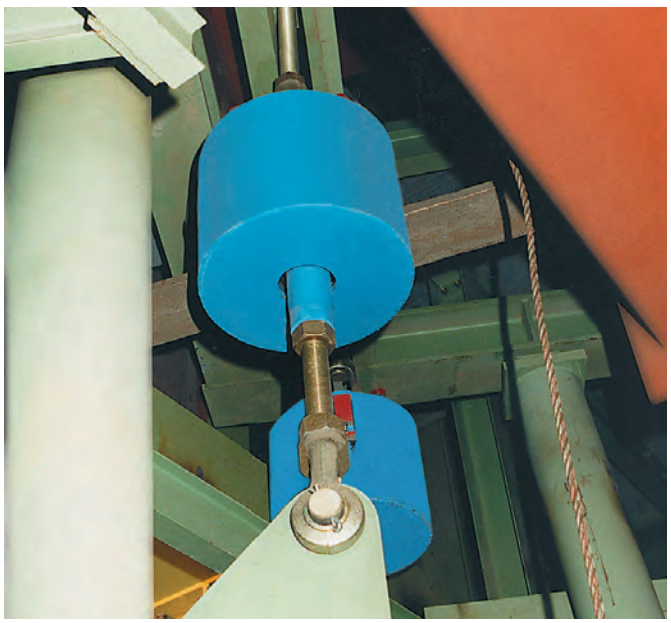


Spring hanger type 22 with weld-on clevis type 73 mounted



Spring hanger type 22 with threaded clevis type 61 mounted

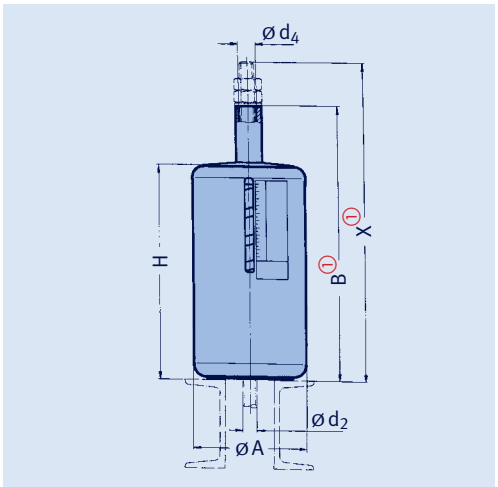
◀ Typical installation situations



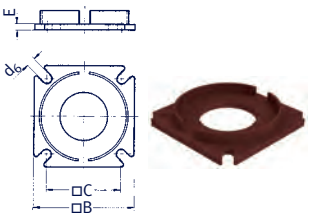
Order details:
spring hanger type 22 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down

Spring hangers Type 25

Spring hangers for seating type 25 D2 19 to 25 93 18
Standard design,
delivery from stock.



It is recommended to use the type 25 with the base plate type 72.



type	B	C	d_6	E	[kg]
72 D9 28	125	95	12	8	1.0
72 19 28	125	95	12	8	1.0
72 29 28	150	115	14	10	1.6
72 39 28	150	115	14	12	1.8
72 49 28	190	140	18	12	3.0
72 59 28	220	170	18	12	4.0
72 69 28	260	200	23	15	6.9
72 79 28	290	215	23	20	10.9
72 89 28	290	215	27	20	10.9
72 99 28	340	255	33	25	18.2

load group

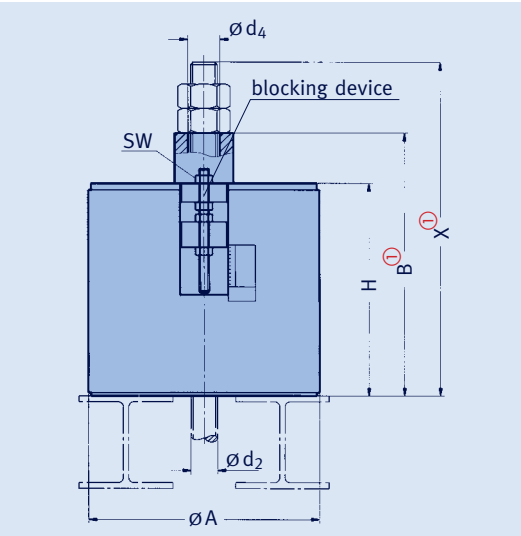
type	ø A	B ①	ø d_2	ø d_4	H	X_{max} ①	weight [kg]
25 D2 19	90	350	M10	13	245	380	2.8
25 D3 19	90	675	M10	13	470	705	4.9
25 11 18	90	200	M12	13	145	230	2.1
25 12 18	90	350	M12	13	245	380	3.1
25 13 18	90	675	M12	13	470	705	5.5
25 21 18	115	205	M12	13	150	235	3.5
25 22 18	115	355	M12	13	250	385	5.1
25 23 18	115	665	M12	13	460	695	8.4
25 31 18	115	210	M16	18	155	250	3.7
25 32 18	115	355	M16	18	250	395	5.3
25 33 18	115	675	M16	18	470	715	8.9
25 41 18	155	230	M20	25	180	280	8.0
25 42 18	155	395	M20	25	290	445	11.5
25 43 18	155	730	M20	25	525	780	18.6
25 51 18	180	265	M24	28	215	325	14.5
25 52 18	180	405	M24	28	305	465	18.0
25 53 18	180	740	M24	28	540	800	29.0
25 61 18	220	300	M30	34	245	375	26.0
25 62 18	220	465	M30	34	360	540	35.0
25 63 18	220	845	M30	34	640	920	56.0
25 71 18	245	350	M36	40	300	440	40.0
25 72 18	245	530	M36	40	430	620	53.0
25 73 18	245	900	M36	40	700	990	79.0
25 81 18	245	385	M42	47	335	495	44.0
25 82 18	245	605	M42	47	500	715	66.0
25 83 18	245	1075	M42	47	875	1185	111.0
25 91 18	275	415	M48	54	370	535	67.0
25 92 18	275	645	M48	54	545	765	92.0
25 93 18	275	1110	M48	54	910	1230	143.0

① Dimensions B and X are reduced on loading by the corresponding spring travel (see load table on page 2.5).

For special applications, e.g. in extremely restricted spaces, spring hangers type 25 can be supplied as a trapeze unit.

Order details:
spring hanger type 25 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down

Heavy duty spring hangers Type 26



Spring hangers for seating type 26 11 19 to 26 53 19

type	ø A	B ①	ø d_2	ø d_4	H	SW	X_{max} ①	weight [kg]
26 11 19	510	395	M56x4	60	345	46	530	205
26 12 19	510	565	M56x4	60	465	46	700	235
26 13 19	510	945	M56x4	60	745	46	1080	310
26 21 19	560	405	M64x4	70	355	46	560	265
26 22 19	560	575	M64x4	70	475	46	730	300
26 23 19	560	955	M64x4	70	755	46	1110	390
26 31 19	610	420	M68x4	70	370	46	585	345
26 32 19	610	590	M68x4	70	490	46	755	390
26 33 19	610	970	M68x4	70	770	46	1135	490
26 41 19	610	470	M72x4	80	420	55	645	395
26 42 19	610	650	M72x4	80	550	55	825	450
26 43 19	610	1025	M72x4	80	825	55	1200	555
26 51 19	610	530	M80x4	90	480	65	725	465
26 52 19	610	750	M80x4	90	650	65	945	545
26 53 19	610	1220	M80x4	90	1020	65	1415	725

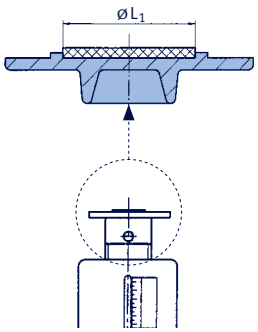
① Dimensions B and X are reduced on loading by the corresponding spring travel (see load table on page 2.6).

Spring assemblies as special design for use on a power station boiler.

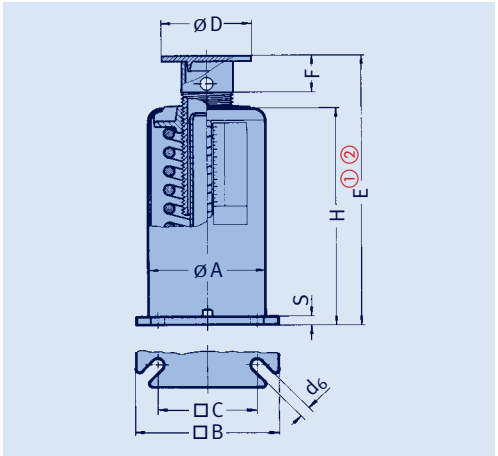
Order details:
spring hanger type 26
marking: ...
set load: ...kN
travel: ...mm up/down

Spring supports Type 29

Spring supports
type 29 C2 19 to 29 93 18
Standard design,
delivery from stock.



Load plate with integrated slide plate.



When using slide plates the sliding surfaces of the mating components should be fitted with stainless steel plating. This is indicated by the suffix 'SP' in the type designation (e.g., clamp base type 49 22 25-SP).

type 29* with slide plate		
up to 180°C	up to 350°C	ø L_1
29 C2 17	29 C2 16	40
29 D. 17	29 D. 16	40
29 1. 17	29 1. 16	40
29 2. 17	29 2. 16	40
29 3. 17	29 3. 16	40
29 4. 17	29 4. 16	65
29 5. 17	29 5. 16	65
29 6. 17	29 6. 16	110
29 7. 17	29 7. 16	110
29 8. 17	29 8. 16	150
29 9. 17	29 9. 16	150

* friction values of the sliding components, see table on page 7.11.

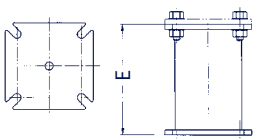
For large horizontal displacements, beside the use of slide plates the use of clamp bases with twist restraints is also recommended.

Order details:
spring support type 29 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down

type ②	øA	□B	□C	d_6	E①②	F	H	øD	S	weight [kg]
29 C2 19	80	105	75	10	270	36	210	80	6	2.6
29 D1 19	90	125	95	12	195	36	145	80	8	3.2
29 D2 19	90	125	95	12	305	36	245	80	8	4.3
29 D3 19	90	125	95	12	550	36	470	80	8	6.6
29 11 18	90	125	95	12	195	36	145	80	8	3.4
29 12 18	90	125	95	12	305	36	245	80	8	4.6
29 13 18	90	125	95	12	550	36	470	80	8	7.2
29 21 18	115	150	115	14	200	36	150	100	10	5.6
29 22 18	115	150	115	14	310	36	250	100	10	7.6
29 23 18	115	150	115	14	540	36	460	100	10	11.1
29 31 18	115	150	115	14	205	36	155	100	12	6.3
29 32 18	115	150	115	14	310	36	250	100	12	8.4
29 33 18	115	150	115	14	550	36	470	100	12	13.0
29 41 18	155	190	140	18	240	48	180	120	12	11.9
29 42 18	155	190	140	18	360	48	290	120	12	16.0
29 43 18	155	190	140	18	615	48	525	120	12	25.0
29 51 18	180	220	170	18	270	50	210	150	12	20.0
29 52 18	180	220	170	18	370	50	300	150	12	24.3
29 53 18	180	220	170	18	625	50	535	150	12	37.0
29 61 18	220	260	200	23	305	50	245	170	15	34.0
29 62 18	220	260	200	23	430	50	360	170	15	44.0
29 63 18	220	260	200	23	730	50	640	170	15	68.0
29 71 18	245	290	215	23	360	52	300	200	20	53.0
29 72 18	245	290	215	23	500	52	425	200	20	68.0
29 73 18	245	290	215	23	790	52	695	200	20	97.0
29 81 18	245	290	215	27	400	55	335	200	20	60.0
29 82 18	245	290	215	27	575	55	500	200	20	84.0
29 83 18	245	290	215	27	965	55	870	200	20	133.0
29 91 18	275	340	255	33	440	60	370	240	25	91.0
29 92 18	275	340	255	33	625	60	545	240	25	118.0
29 93 18	275	340	255	33	1010	60	910	240	25	173.0

① Dimension 'E' is independent of the load adjustment; it changes on loading by the respective spring travel (see load table on page 2.5). Adjustment possibility + 30mm.

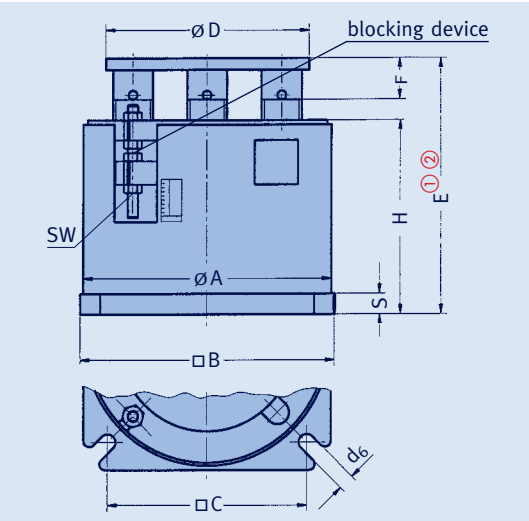
② Type 29 .. 1. is supplied as standard with a electro galvanized load plate without a slide plate. If slide plates are used, the 'E' dimension increases by 2.5mm. Please note the recommendation from the table on page 7.12.

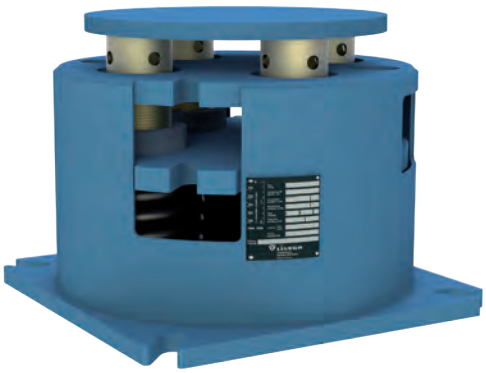


type 29 .9 15-E...
E = ... mm
load group

To bridge greater installation heights, adapted installation extensions can be ordered.

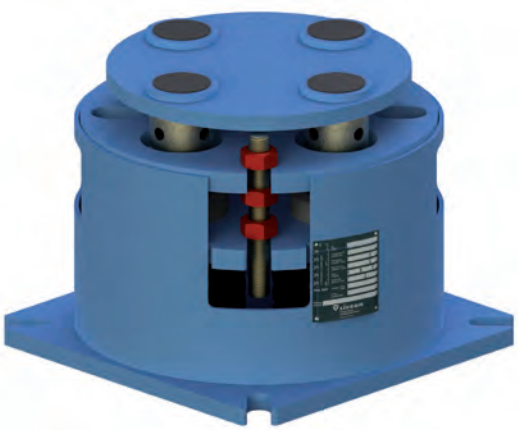
Heavy duty spring supports Type 28



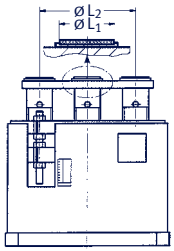


type ②	ø A	□ B	□ C	ø D	d_6	E ① ②	F	H	S	SW	weight [kg]
28 11 19	510	530	440	420	33	405	60	330	25	46	230
28 12 19	510	530	440	420	33	535	60	450	25	46	260
28 13 19	510	530	440	420	33	835	60	730	25	46	360
28 21 19	560	580	490	420	33	450	65	370	25	46	310
28 22 19	560	580	490	420	33	585	65	500	25	46	350
28 23 19	560	580	490	420	33	880	65	775	25	46	460
28 31 19	610	630	530	450	33	460	65	380	25	46	380
28 32 19	610	630	530	450	33	595	65	510	25	46	430
28 33 19	610	630	530	450	33	890	65	785	25	46	555
28 41 19	610	630	530	450	39	505	70	425	30	55	440
28 42 19	610	630	530	450	39	685	70	595	30	55	520
28 43 19	610	630	530	450	39	1075	70	965	30	55	740
28 51 19	610	630	530	480	39	560	75	475	35	65	495
28 52 19	610	630	530	480	39	750	75	655	35	65	580
28 53 19	610	630	530	480	39	1135	75	1020	35	65	785

Typical application



Spring support type 28 11 19 to 28 53 19



When using slide plates the sliding surfaces of the mating component should be fitted with stainless steel plating. This is indicated by the suffix “SP” in the type designation (e.g., clamp base type 49 97 14-SP).

① Dimension ‘E’ is independent of the load adjustment; it changes on loading by the respective spring travel (see load table page 2.6). Adjustment possibility + 30mm.

② Type 28 is supplied as standard with a coated load plate without slide plate. When slide plates are used, the ‘E’ dimension increases by 2mm. Please note following tables.

type 28* with slide plate up to 180°C	ø L_1	ø L_2
28 1. 17	80	300
28 2. 17	80	300
28 3. 17	110	310
28 4. 17	110	310
28 5. 17	150	300

type 28* with slide plate up to 350°C	ø L_1	ø L_2
28 1. 16	80	300
28 2. 16	80	300
28 3. 16	110	310
28 4. 16	110	310
28 5. 16	150	300

* friction values of slide plates, see table on page 7.11.

Order details:
spring support type 28 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down

Angulating spring supports Type 20

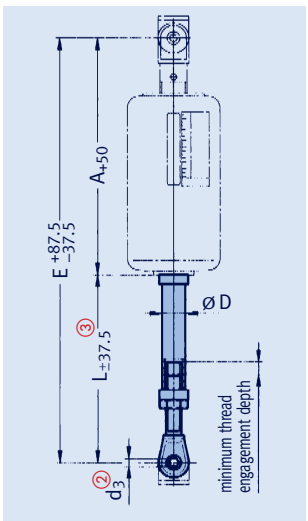
Angulating spring supports type 20 D2 19 to 20 93 14
Standard design,
delivery from stock.

① Dimension 'E' is independent of the load adjustment and changes on loading by the respective spring travel (see load table page 2.5). Adjustment possibility + 50mm.

② Connection possibilities: see pin diameter of weld-on brackets type 35 or dynamic clamps in product group 3.

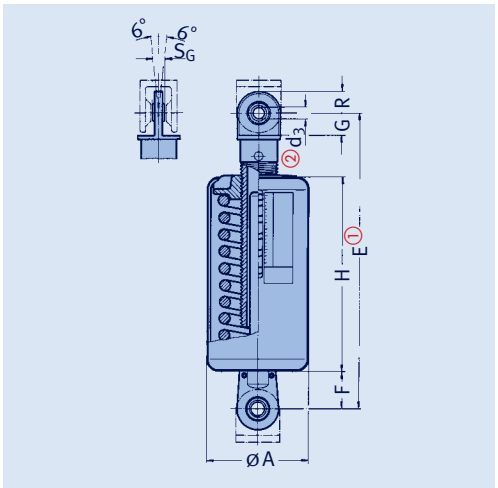
Order details:
angulating spring support
type 20 .. ..
marking: ...
set load: ...kN
travel: ...mm up/down

Installation extensions for angulating spring supports type 20 D9 19 to 20 99 14



③ Installation dimensions > E_{max} with load reduction possible. Shorter L dimensions can be supplied, but then without adjustment possibility of ±37.5mm.

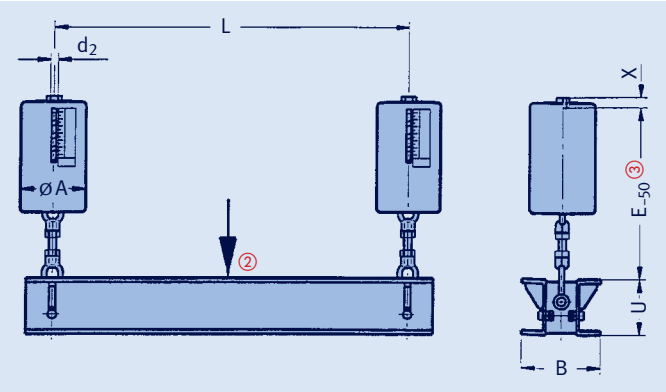
Order details:
installation extension for
angulating spring support
type 20 .9 ..
L = ...mm

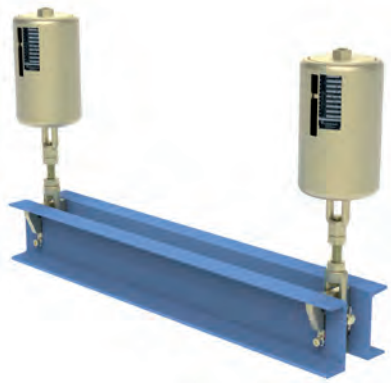


type	ØA	Ø d_3 ②	E ①	F	G	H	R	S_G	weight [kg]	weld-on bracket ②
20 D2 19	90	10	370	45	15	260	15	9	4	35 29 13
20 D3 19	90	10	615	45	15	485	15	9	7	35 29 13
20 12 14	90	10	370	45	15	260	15	9	4	35 29 13
20 13 14	90	10	615	45	15	485	15	9	8	35 29 13
20 22 14	115	12	380	50	19	260	20	10	7	35 39 13
20 23 14	115	12	615	50	19	475	20	10	11	35 39 13
20 32 14	115	15	390	58	21	260	23	12	7	35 49 13
20 33 14	115	15	645	58	21	495	23	12	12	35 49 13
20 42 14	155	15	440	58	21	300	23	12	15	35 49 13
20 43 14	155	15	700	58	21	540	23	12	25	35 49 13
20 52 14	180	20	470	65	31	315	30	16	24	35 59 19
20 53 14	180	20	730	65	31	555	30	16	37	35 59 19
20 62 14	220	20	535	65	31	370	30	16	45	35 59 19
20 63 14	220	20	835	65	31	655	30	16	69	35 59 19
20 72 14	245	30	650	100	50	430	45	22	70	35 69 19
20 73 14	245	30	940	100	50	700	45	22	101	35 69 19
20 82 14	245	30	735	100	52	505	45	22	87	35 69 19
20 83 14	245	30	1125	100	52	875	45	22	139	35 69 19
20 92 14	275	50	815	130	62	550	60	35	120	35 79 19
20 93 14	275	50	1200	130	62	910	60	35	182	35 79 19

type	for type	A_{+50}	ØD	Ø d_3 ②	$E^{+87.5}_{-37.5}$ min	$E^{+87.5}_{-37.5}$ max	$L_{\pm37.5}$ min ③	$L_{\pm37.5}$ max	weight for L_{min} [kg]	tube [kg/m]
20 D9 19	20 D2 19	325	42	10	525	1220	200	895	1.1	3.8
20 D9 19	20 D3 19	570	42	10	770	1220	200	650	1.1	3.8
20 19 14	20 12 14	325	42	10	525	1220	200	895	1.1	3.8
20 19 14	20 13 14	570	42	10	770	1220	200	650	1.1	3.8
20 29 14	20 22 14	330	48	12	535	1465	205	1135	1.3	4.4
20 29 14	20 23 14	565	48	12	770	1465	205	900	1.3	4.4
20 39 14	20 32 14	332	60	15	547	1460	215	1128	2.5	8.4
20 39 14	20 33 14	587	60	15	802	1460	215	873	2.5	8.4
20 49 14	20 42 14	382	60	15	597	1460	215	1078	2.5	8.4
20 49 14	20 43 14	642	60	15	857	1460	215	818	2.5	8.4
20 59 14	20 52 14	405	76	20	675	1950	270	1545	8.0	14.6
20 59 14	20 53 14	665	76	20	935	1950	270	1285	8.0	14.6
20 69 14	20 62 14	470	76	20	740	1950	270	1480	8.0	14.6
20 69 14	20 63 14	770	76	20	1040	1950	270	1180	8.0	14.6
20 79 14	20 72 14	550	89	30	835	1925	285	1375	10.6	21.1
20 79 14	20 73 14	840	89	30	1125	1925	285	1085	10.6	21.1
20 89 14	20 82 14	635	89	30	920	2425	285	1790	10.6	21.1
20 89 14	20 83 14	1025	89	30	1310	2425	285	1400	10.6	21.1
20 99 14	20 92 14	685	102	50	1015	2410	330	1725	16.5	30.6
20 99 14	20 93 14	1070	102	50	1400	2410	330	1340	16.5	30.6

Spring hanger trapezes Type 79





trapeze type	nominal load [kN]②	ød_2	L_{max}	E③ at travel range 1	2	3	U	A	B	X	weight [kg] L=1000mm at travel range⑤ 1	2	3	± per 100mm [kg]
79 D.①19	1.04	M10	1700	–	385	610	80	90	140	15	–	26	30	1.7
79 1. 19	2.5	M12	1700	290	385	610	80	90	140	15	24	26	31	1.7
79 2. 19	5	M12	1700	290	390	610	80	115	140	15	28	31	37	1.7
79 3. 19	10	M16	900	315	410	630	80	115	140	20	29	32	39	1.7
79 3. 19	10	M16	1800	300	395	615	120	115	190	20	41	45	52	2.7
79 4. 19	20	M20	1400	345	450	685	120	155	190	25	53	60	74	2.7
79 4. 19	20	M20	1800	345	450	685	140	155	200	25	61	68	82	3.2
79 5. 19	40	M24	1250	405	495	730	140	180	200	30	77	85	108	3.2
79 5. 19	40	M24	1800	390	480	715	180	180	230	30	93	101	124	4.4
79 6. 19	80	M30	1250	445	560	840	200	220	250	35	138	156	200	5.1
79 6. 19	80	M30	2400	435	550	830	260	220	310	35	174	192	236	7.6
79 7. 19	120	M36	1800	505	630	900	260	245	310	45	214	244	296	7.6
79 7. 19	120	M36	2400	500	625	895	300	245	350	45	245	275	327	9.2
79 8. 19	160	M42	1200	560	725	1100	260	245	310	50	242	286	378	7.6
79 8. 19	160	M42	1800④	555	720	1095	300	245	350	50	273	317	410	9.2
79 9. 19	200	M48	1800④	610	785	1150	300	275	350	60	335	390	495	9.2

Spring hanger trapezes (bolted version) type 79 D. 19 to 79 9. 19

① The 4th digit of the type designation refers to the travel range of the spring hanger 1=50mm, 2=100mm, 3=200mm.

② Permissible center loading of the other load cases, see table 4.4.1, page 0.6 (nominal load 120kN, see load group 9).

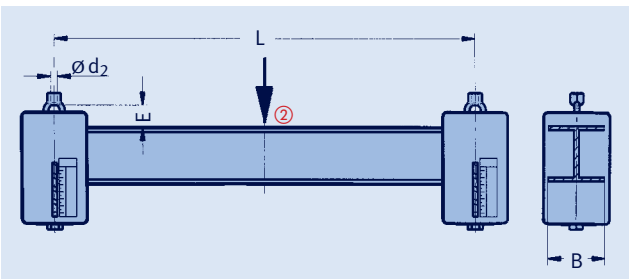
③ The 'E' dimension increases on loading by the corresponding spring travel (see load table on page 2.5).

④ The 'L'_{max} dimensions can be lengthened by up to 2400mm on reduction of the permissible center loading by 5% per 100mm extension.

⑤ When selecting the spring hanger trapeze the weight of the 'U' profiles and the clamp base weight must be added to the operating load.

⑥ When selecting the spring hanger trapeze, its total weight and the weight of the clamp bases must be added to the operating load.

Order details:
spring hanger trapeze type 79 .. 19
L = ...mm, marking: ...,
set load: ...kN
travel: ...mm up/down

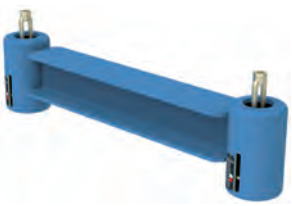


travel range①	'E' dimension approximately ③
1	30
2	55
3	105

① ... ③ see above.

trapeze type	nominal load [kN]②	ød_2	L_{max}	B	weight [kg] L=1000mm at travel range⑥ 1	2	3	± per 100mm [kg]
79 D.①11	1.04	M10	1400	80	–	16	20	1.1
79 1. 11	2.5	M12	1400	100	19	21	26	1.6
79 2. 11	5	M12	1600	100	26	29	35	2.0
79 3. 11	10	M16	1600	100	27	30	38	2.0
79 4. 11	20	M20	1750	120	41	48	63	2.7
79 5. 11	40	M24	2100	160	68	76	99	4.3
79 6. 11	80	M30	2100	200	110	128	172	6.1
79 7. 11	120	M36	2100	240	159	189	241	8.3
79 8. 11	160	M42	2150	260	186	230	322	9.3
79 9. 11	200	M48	2200	280	243	297	403	10.3

Spring hanger trapezes (welded version) type 79 D. 11 to 79 9. 11



In restricted spaces this version can be supplied as a special design.

Order details:
spring hanger trapeze type 79 .. 11
L = ...mm, marking: ...
set load: ...kN
travel: ...mm up/down

Sway braces Type 27

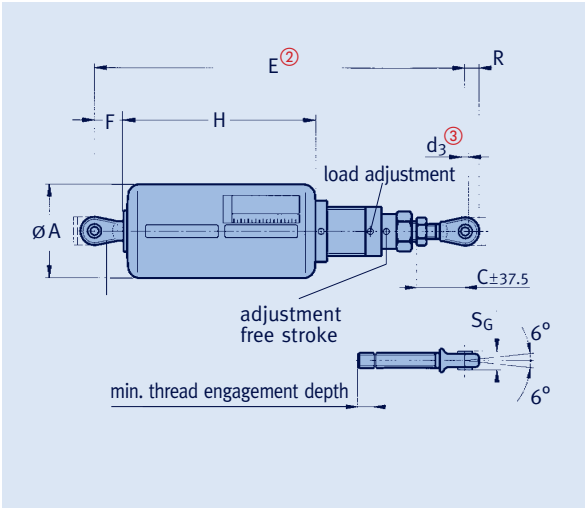
Sway braces type 27 D2 19 to 27 62 19

The maximum working travel including free stroke amounts to ±25mm

① Load adjustment is made ex works according to customer specifications

② The 'E' dimension is independent of the load adjustment; adjustment possibility ±37.5mm.

③ Connection possibilities: see pin diameter of weld-on brackets type 35 or dynamic clamps in Product Group 3.



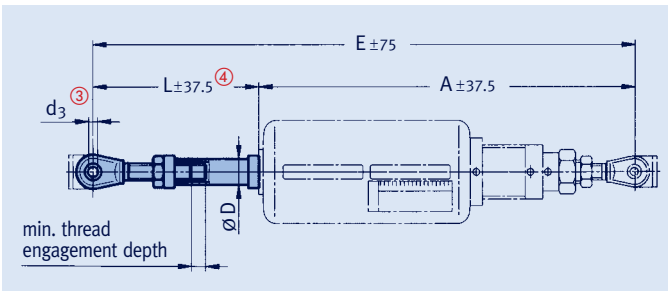
type	nominal load [kN]	set load ① [kN] min	max	spring rate [N/mm]	ø A	C±37.5	ø d3 ③	E ②	F	H	R	SG	weld-on bracket type ③	weight [kg]
27 D2 19	0.52	0.12	0.42	4.1	90	90	10	640	50	295	15	9	35 29 13	5.5
27 12 19	1.25	0.41	1.04	8.3	90	90	10	640	50	295	15	9	35 29 13	5.8
27 22 19	2.50	0.83	2.08	16.6	115	90	12	650	50	300	19	10	35 39 13	10.0
27 32 19	5.00	1.66	4.16	33.3	115	90	15	665	55	305	21	12	35 49 13	11.0
27 42 19	10.00	3.33	8.33	66.6	155	90	15	730	55	355	21	12	35 49 13	23.0
27 52 19	20.00	6.66	16.66	133.3	180	100	20	810	75	380	30	16	35 59 19	39.0
27 62 19	40.00	13.33	33.33	266.6	220	100	20	875	75	445	30	16	35 59 19	62.0

Order details:
sway brace type 27 .2 19
marking: ...
set load: ...kN
travel: ...mm up/down

Installation extensions for sway braces type 27 D9 19 to 27 69 19

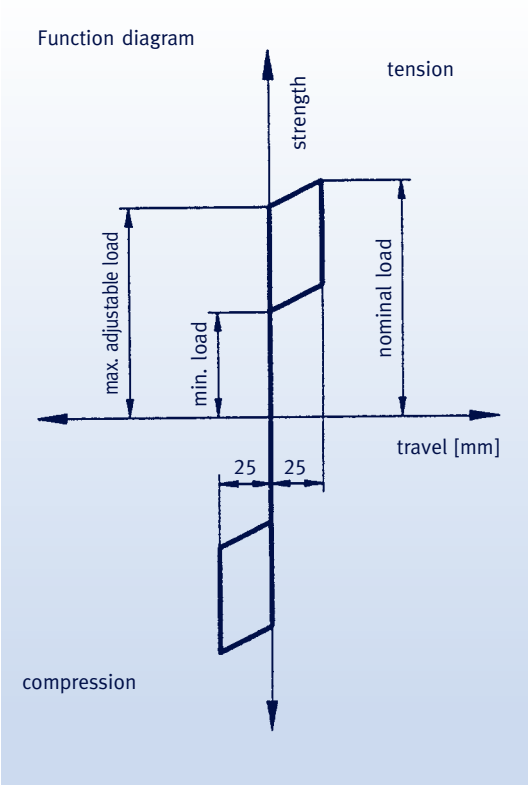
If required, sway braces can be supplied with installation extensions mounted at the factory.
An exceeding of the maximum lateral displacement of ±6° is to avoid.

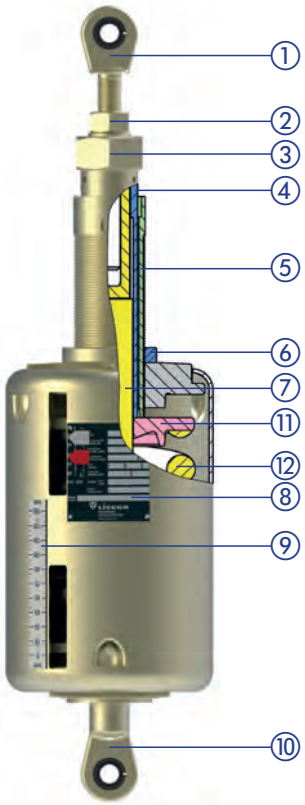
④ Installation dimensions > E_{max} on load reduction possible. Shorter L dimensions can be supplied, but then without adjustment possibility of ±37.5mm.



type	A±37.5	ø D	ø d3 ③	E±75 min	E±75 max	L±37.5 ④ min	L±37.5 ④ max	weight for Lmin [kg]	weight tube [kg/m]
27 D9 19	590	42	10	790	1600	200	1010	1.1	3.8
27 19 19	590	42	10	790	1600	200	1010	1.1	3.8
27 29 19	600	48	12	805	2000	205	1400	1.3	4.4
27 39 19	610	60	15	825	2000	215	1390	2.5	8.4
27 49 19	675	60	15	890	2000	215	1325	2.5	8.4
27 59 19	735	76	20	1005	2400	270	1665	8.0	14.6
27 69 19	800	76	20	1070	2400	270	1600	8.0	14.6

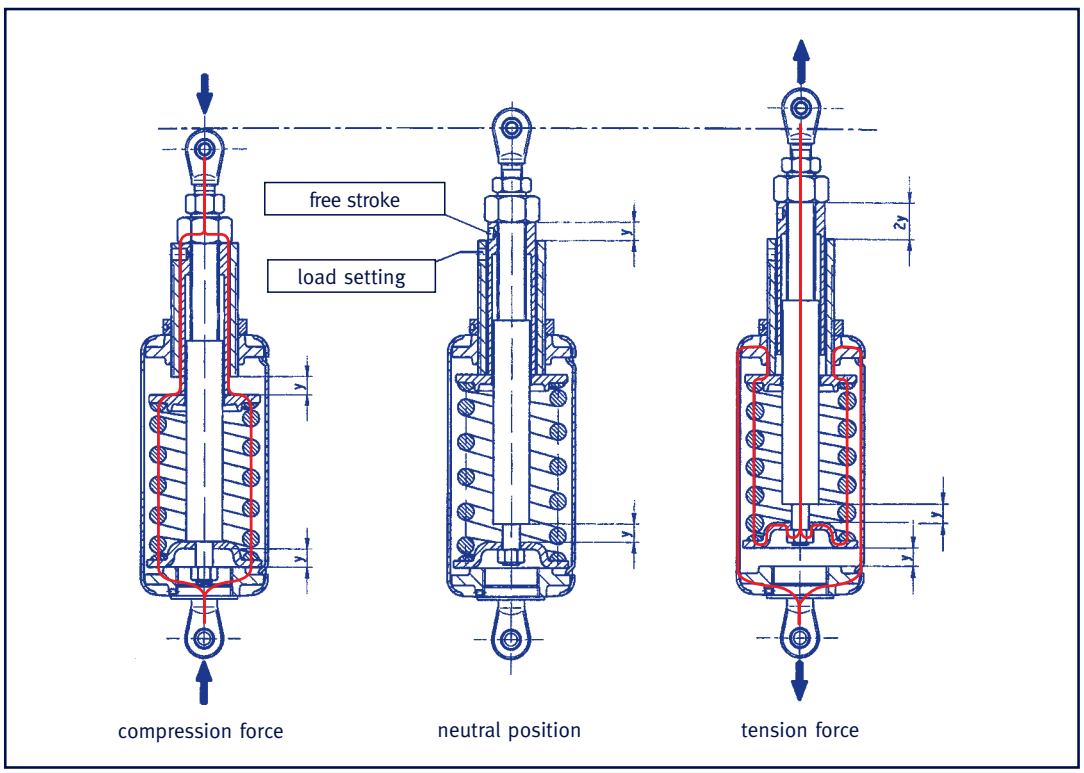
Order details:
installation extension
for sway brace
type 27 .9 19
L = ...mm





① upper ball bushing joint
② lock nut
③ lock nut
④ guide pipe
⑤ threaded pipe
⑥ lock nut
⑦ guide rod
⑧ type plate with travel scale
⑨ travel scale
⑩ lower ball bushing joint
⑪ spring plate
⑫ spring

Load and installation length are adjustable for the respective requirements (see installation and operating instructions).



For LISEGA sway braces a free stroke of 0 – 25mm can be set. The travel is reduced in compression and tension directions in accordance with the free stroke selected.

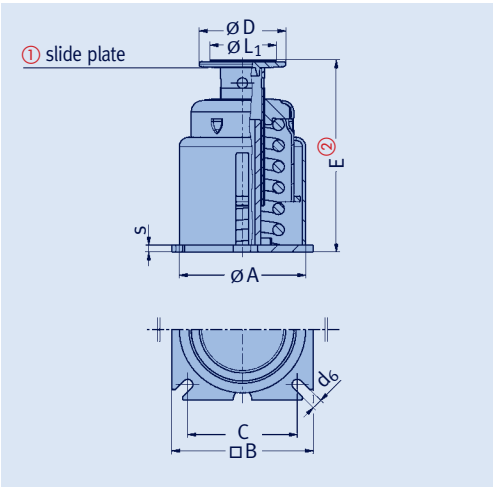
Load transmission on alternating force direction

Telescopic spring supports Type 29

Spring supports, telescopic type 29 D1 27 to 29 93 27

As a special design of type 29 the telescopic spring supports are used for **small E dimensions**.

The sliding surfaces of the mating component should be fitted with stainless steel plating. This is indicated by the suffix 'SP' in the type designation (e.g., clamp base type 49 22 25-SP).



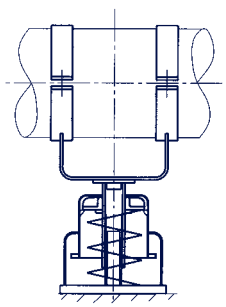
$$E\ [mm] = E \text{ at min. load } [mm] - \frac{\text{adjustment load [kN]} - \text{min. load [kN]}}{\text{spring rate [N/mm]}} \times 1000$$

① The telescopic spring support is fitted as standard with a load plate with a PTFE slide plate. If required, this type can also be supplied with a high-temperature slide plate.

The 6th digit of the type designation denotes the design:
7 for standard design with PTFE slide plate (up to 180°C)
6 for design with high-temperature slide plate (up to 350°C).

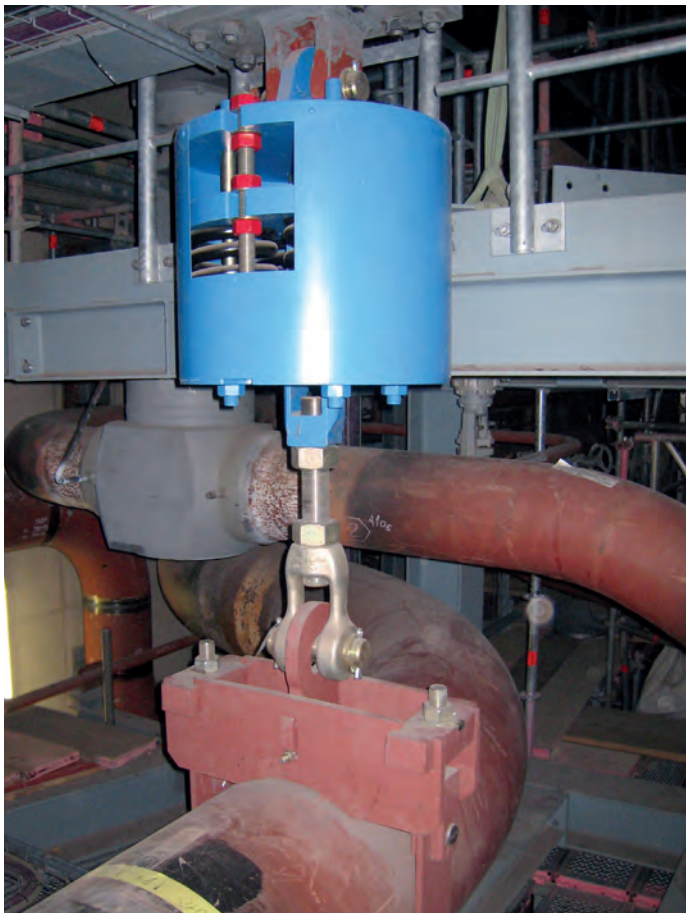
For friction values of sliding components see table on page 7.11.

② The 'E' dimension depends on the load setting; it changes on loading by the respective spring travel. Adjustment possibility +20mm.



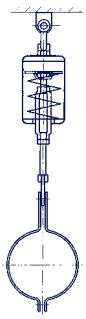
type ①	ØA	B	C	ØD	d_6	$ØL_1$	s	E at min. load ②	E at max. load ②	min. load [kN]	max. load [kN]	spring rate [N/mm]	weight [kg]
29 D1 2.	130	155	125	80	12	40	8	210	170	0.20	0.52	8.3	5.0
29 D2 2.	130	155	125	80	12	40	8	310	230	0.20	0.52	4.1	6.5
29 D3 2.	130	155	125	80	12	40	8	535	375	0.20	0.52	2.1	9.5
29 11 2.	130	155	125	80	12	40	8	210	170	0.58	1.25	16.6	5.5
29 12 2.	130	155	125	80	12	40	8	310	230	0.58	1.25	8.3	7.0
29 13 2.	130	155	125	80	12	40	8	530	370	0.58	1.25	4.1	10.0
29 21 2.	155	180	145	100	14	40	10	215	175	1.16	2.5	33.3	8.0
29 22 2.	155	180	145	100	14	40	10	315	235	1.16	2.5	16.6	10.5
29 23 2.	155	180	145	100	14	40	10	525	365	1.16	2.5	8.3	15.0
29 31 2.	155	180	145	100	14	40	12	220	180	2.33	5	66.6	8.5
29 32 2.	155	180	145	100	14	40	12	320	240	2.33	5	33.3	11.0
29 33 2.	155	180	145	100	14	40	12	540	380	2.33	5	16.6	16.5
29 41 2.	195	220	180	120	18	65	12	235	195	4.66	10	133.3	15.0
29 42 2.	195	220	180	120	18	65	12	335	255	4.66	10	66.6	20.0
29 43 2.	195	220	180	120	18	65	12	560	400	4.66	10	33.3	29.0
29 51 2.	220	245	200	150	18	65	12	260	220	9.33	20	266.6	24.0
29 52 2.	220	245	200	150	18	65	12	370	290	9.33	20	133.3	30.0
29 53 2.	220	245	200	150	18	65	12	590	430	9.33	20	66.6	43.0
29 61 2.	275	305	245	170	23	110	18	300	260	18.66	40	533.3	44.0
29 62 2.	275	305	245	170	23	110	18	410	330	18.66	40	266.6	53.0
29 63 2.	275	305	245	170	23	110	18	675	515	18.66	40	133.3	80.0
29 71 2.	300	330	265	200	23	110	20	325	295	36.00	60	800	63.0
29 72 2.	300	330	265	200	23	110	20	435	375	36.00	60	400	76.0
29 73 2.	300	330	265	200	23	110	20	675	555	36.00	60	200	105.0
29 81 2.	300	330	270	200	27	150	22	360	335	53.33	80	1066.6	71.0
29 82 2.	300	330	270	200	27	150	22	500	450	53.33	80	533.3	91.0
29 83 2.	300	330	270	200	27	150	22	835	735	53.33	80	266.6	142.0
29 91 2.	325	370	295	245	33	150	25	400	375	66.66	100	1333.3	96.0
29 92 2.	325	370	295	245	33	150	25	555	505	66.66	100	666.6	124.0
29 93 2.	325	370	295	245	33	150	25	875	775	66.66	100	333.3	181.0

Order details:
spring support type 29 .. 2.
marking: ...
set load: ...kN
travel: ...mm up/down

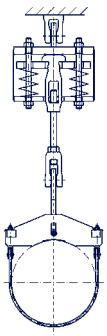


Installation and operating instructions Types 21, 22, 25, 26, 29, 28, 20, 27

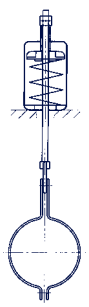
① upper connection
② travel scale
③ blocking device
④ name plate
⑤ lower connection
⑥ spring plate
⑦ cover plate
⑧ securing strap
⑨ support tube



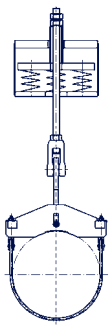
Spring hanger type 21



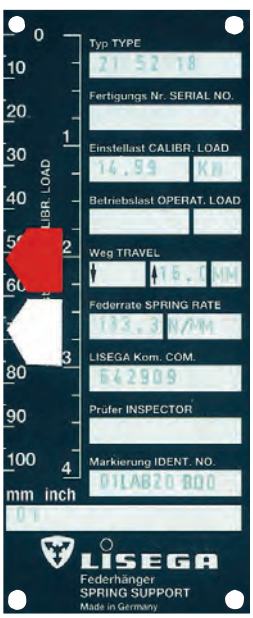
type 22



Spring hanger type 25



type 26



Name plate for spring hangers

1 Transport and storage

When transporting, care must be taken that connecting threads and blocking devices are not damaged. When storing in the open air the hangers must be protected from water and dirt.

2 Delivery condition

If not otherwise specified, LISEGA spring hangers are set and blocked at the desired cold position (installation condition). Special blocking devices fix the spring plates in both directions. The adjustment values can be read off the travel scale or name plate.

Stamped on the name plate are:

- **type number and if required serial number**
- **set load and spring rate**
- **operating load and travel**
- **marking and commission number**
- **inspector**

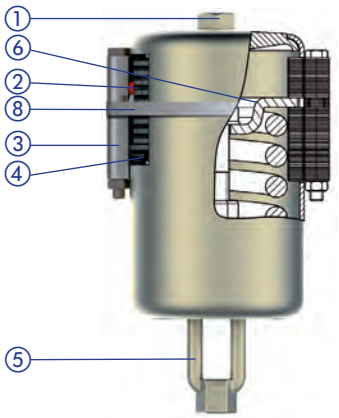
On the travel scale the theoretical hot position is marked with a red sticker and the theoretical cold one with a white one. In addition the position of the spring plate on the travel scale is stamped with an “X”. The reading is made at the lower edge of the spring plate (at the upper edge for trapezes type 79 .. 11). The production number is stamped on the body of the spring hanger.

Depending on the connection the spring hangers are fitted at the top with an inner right-hand thread, a lug for connecting pins or a fixe support tube. The threads are greased and sealed with plastic caps. Depending on the design, the lower connection is fitted with a right-hand thread (turnbuckle) or, as with type 25/26, consists of a support tube for the connecting rod.

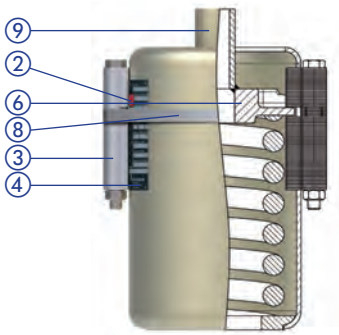
The spring supports types 28/29 are equipped with an adjustable support tube with a loosely seated but guided load plate. As delivered the support tube is screwed in and the thread greased.

3 Installation

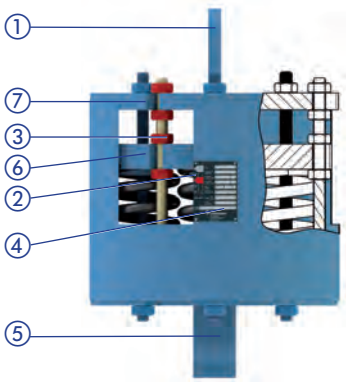
When installing, the requirements of the **installation instructions for the piping systems** should also be observed, especially the desired installation position of the connecting rods over the whole load chain. There are two possibilities:



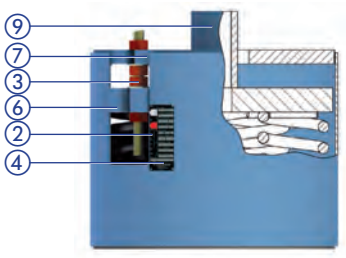
Spring hanger type 21 (blocked)



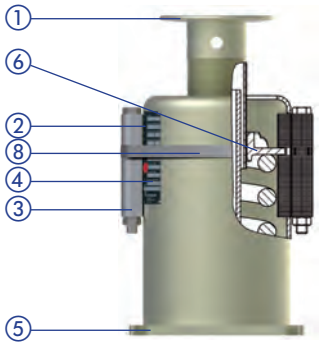
Spring hanger type 25 (blocked)



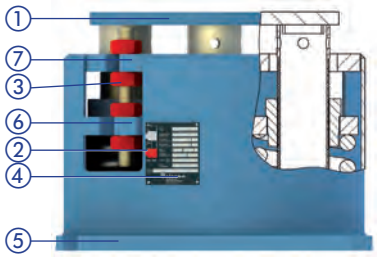
Spring hanger type 22 (blocked)



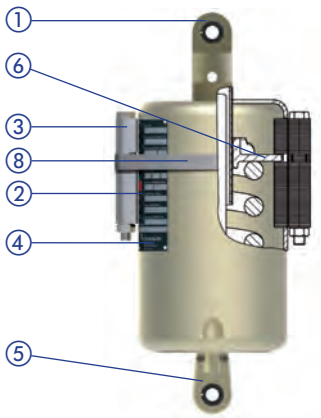
Spring hanger type 26 (blocked)



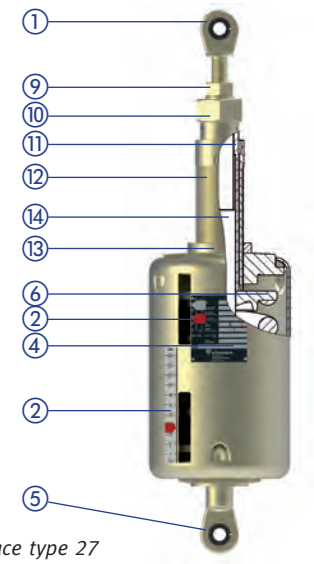
Spring support type 29 (blocked)



Spring support type 28 (blocked)

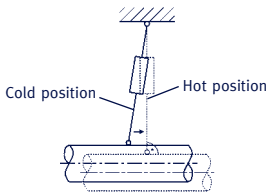


Angulating spring support type 20 (blocked)



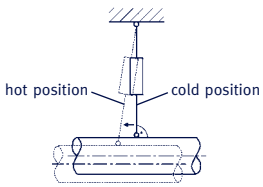
Sway brace type 27

A) The connecting rods are to be installed at an angle to correspond to the expected horizontal displacement of the pipe systems. A perpendicular position in operating condition is to be hereby expected.



Rods vertical during plant operation

B) The connecting rods are to be installed vertically for better controllability. A controlled angled position is thereby permitted in operating conditions.



Rods vertical in installation condition

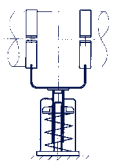
Uniform specifications should at all events apply for the whole plant.

The connecting rods and points must be connected by force-locking. Attention must be paid to the minimum engagement depth of the threaded components.

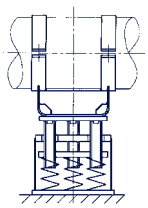
Installation of types 21, 22
The force-locked connection for type 21 is produced by screwing the connecting rods into the upper and lower connection threads. The lower connection thread is designed as a turnbuckle. Type 22 has a pin-lug upper connection. For adjustment the available turnbuckle length in the spring hanger in each case can be used.

Installation types 25, 26
Spring hangers types 25 and 26 are placed on the existing steelwork and correspondingly aligned. The position aligned is to be fixe against horizontal displacement. The force-locked connection is produced via the connecting rod, which is fed through the support tube and tightened and locked with two nuts.

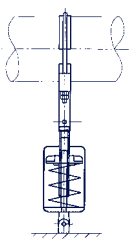
① load plate or ball bushing joint at top
② travel scale
③ stop
④ name plate
⑤ base plate or ball bushing joint at bottom
⑥ spring plate
⑦ cover plate
⑧ securing strap
⑨ lock nut
⑩ lock nut
⑪ guide tube
⑫ threaded tube
⑬ lock nut
⑭ guide rod



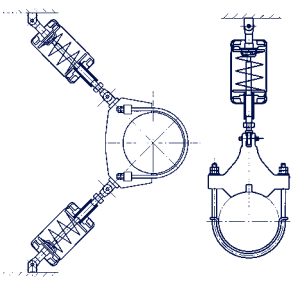
Spring support type 29



Spring support type 28

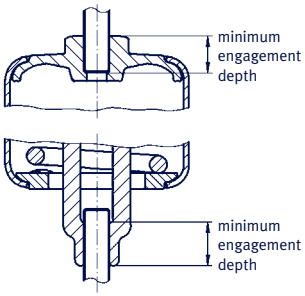


Angulating spring support type 20



Sway brace type 27 angled arrangement

Sway brace type 27 simple arrangement



Minimum engagement depth of threaded rods by example of type 21

The blocking device for spring hangers and spring supports types 21, 25, 29 and 20 consist of sheet metal lamellas adjustable to any desired load position. Up to 3 blocking devices can be inserted into a spring hanger.

Installation of types 28, 29

The spring supports 28 and 29, are to be connected in the design location by welding or bolting the base plate to the building structure. The load distribution is applied through the load plate and an adjustable support tube (type 29), or several adjustable ones (type 28). To accommodate installation tolerances the support tubes may be further screwed out only to a maximum of 30mm. The instructions on page 7.12 are to be followed for the correct installation of the slide plates.

Installation of type 20

The angulating spring supports are fitted at the top with an adjustable ball bushing joint and at the bottom with a fixed ball bushing joint or an installation extension – suitable for connection to a weld-on bracket type 35 or to the dynamic clamps type 36 or 37. After alignment of the angulating spring support the lower weld-on bracket is attached to the surrounding structure (see installation instructions for weld-on brackets type 35). The load distribution is applied through the upper pin connection (weld-on bracket or dynamic clamp) to the length-adjustable support tube. To accommodate installation length tolerances the support tube may be further screwed out by a maximum of 50mm.

Installation of type 27

The sway braces are fitted at the top with an adjustable ball bushing joint and at the bottom with a fixed ball bushing joint or an installation extension – suitable for connection to a weld-on bracket type 35 or to the dynamic clamp type 36 or 37. The load presetting, and if necessary the free stroke, are adjusted at works according to customer specifications. After alignment of the connection points the welding of the weld-on brackets and the connection of the connection pins of the brackets or dynamic clamps types 36/37 are carried out. The adjustable ball bushing joints permit regulation of the installation length by ±37.5mm.

4 Deblocking

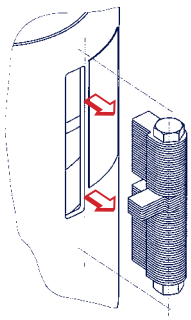
The spring hangers/supports may only be deblocked when the set load is fully applied on all the supports making up a support system. If this is the case the blocking devices can be easily removed. If the devices are jammed, the load actually applied does not agree with the theoretical setting (see point 5, load correction).

Procedures for types 21, 25, 29, 20

Removal of the securing strap:

The securing strap is removed with an appropriate tool. Great care must be taken that the free ends of the metal strap do not snap upwards in an uncontrolled way.

Removal of the blocking devices:



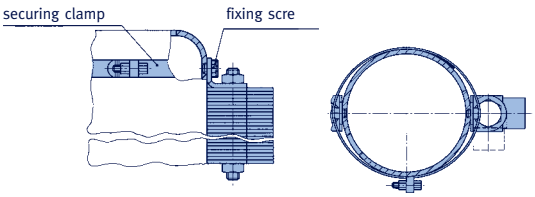
The device is removed from the casing.

When removing the blocking devices, proceed as a matter of principle in a systematic way, step by step, beginning with a fixed point or connection point. Never remove the devices by force!

Storage of blocking devices:

Type 29 with blocking devices attached

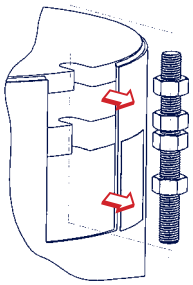
Removed blocking devices must either be stored separately or, for really safe keeping, fixed at the hanger by using the optional LISEGA permanent attachment.



If the original blocking devices have been misplaced and the spring needs to be blocked, e.g. at revisions, they can be supplied by LISEGA at short notice.

Procedure for types 22, 26, 28

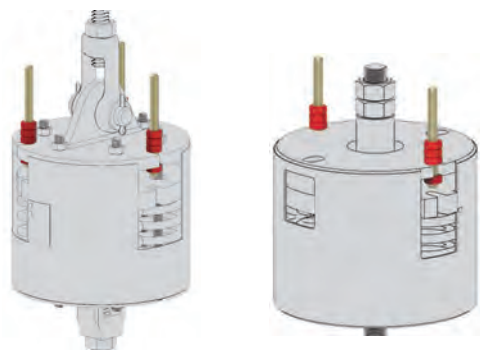
Removal of blocking devices:



The blocking devices are removed from the casing.

Storage of blocking devices:

Removed blocking devices must either be stored separately or, insofar as sufficient space is available and freedom of movement for the spring plate is allowed, screwed to the cover plate.



5 Load correction

Before every load adjustment, under all circumstances the technical department responsible must be consulted.

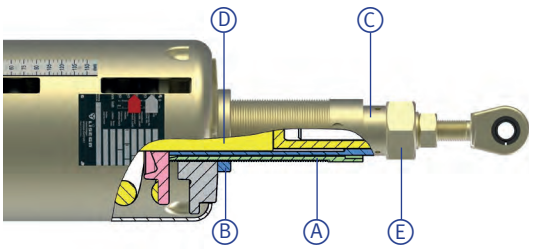
Type 21, 22
Load adjustment can be carried out by loosening or tightening the turnbuckle.

Type 25, 26
Load adjustment can be made by loosening or tightening the load nut.

Type 20, 28, 29
Load adjustment can be made by adjusting the support tube of the spring supports.

Load correction and adjustment of the free stroke, type 27
Load adjustment is made by rotating the outer threaded tube (A). For this, loosen the large lock nut (B). To maintain the E dimension the play thereby created must be balanced by readjusting the guide tube (C).

A free stroke can be set for the LISEGA sway braces. For this, the guide tube (C) opposite the inner guide rod (D) must be correspondingly screwed out (loosen middle lock nut (E)). The working travel is reduced in the direction of compression according to the free stroke selected.



6 Auxiliary devices

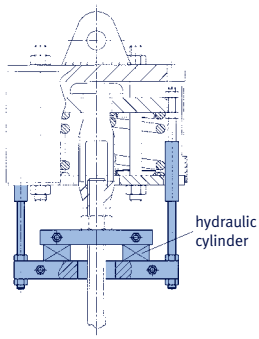
To facilitate load adjustment or deblocking, an auxiliary installation device can be supplied for the higher load groups. The load transfer is then taken up by means of a hydraulic pump. This is operated by LISEGA technicians.

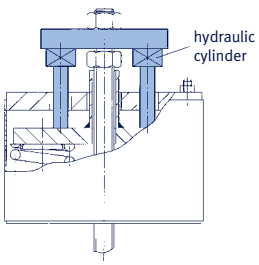
7 Inspection and maintenance

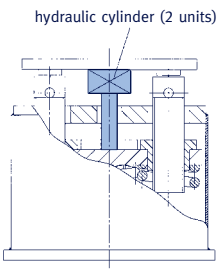
The flawless functioning of the spring hangers can be checked in every operating situation by noting the position of the spring plate.

Under normal operating conditions no maintenance is required.

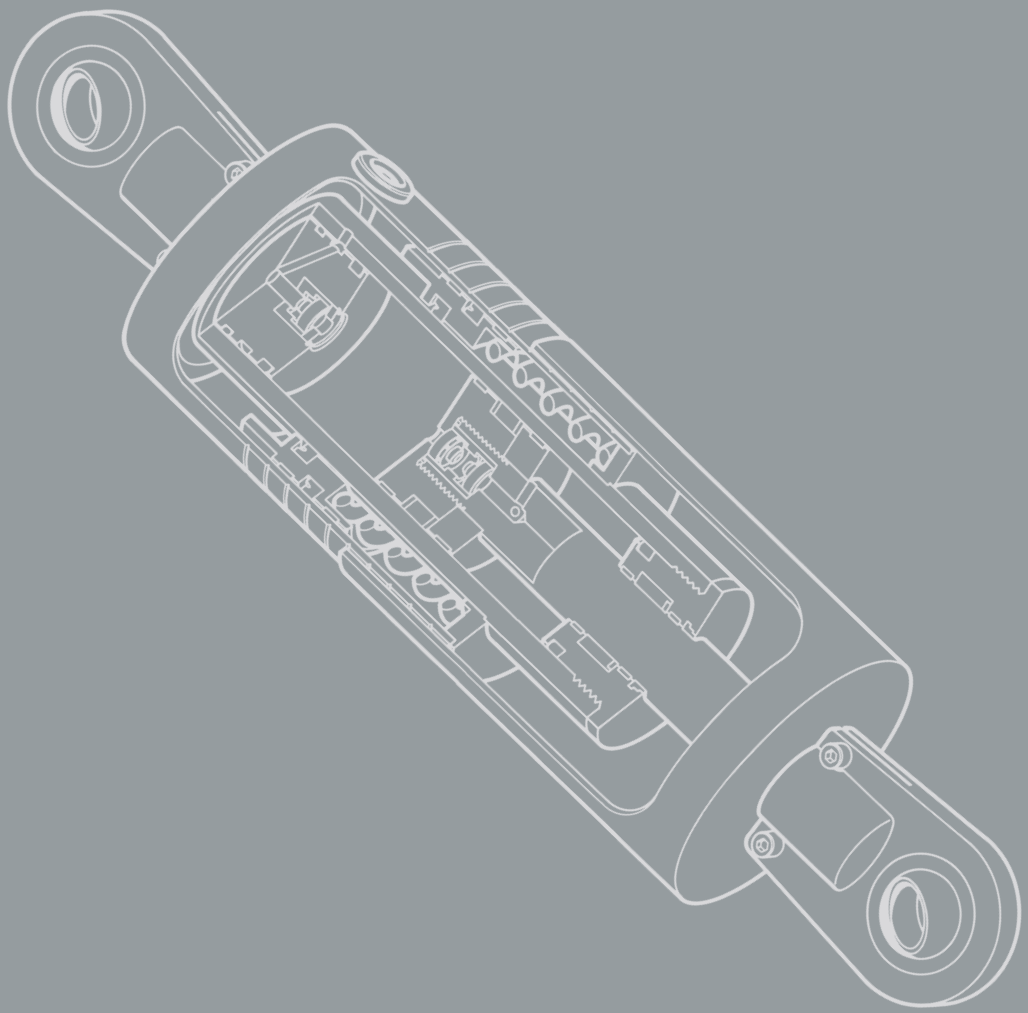
The blocking devices of types 22, 26 and 28 consist of threaded studs and nuts by means of which any load setting desired can be carried out.







Snubbers, rigid struts, energy absorbers, viscoelastic dampers, dynamic clamps

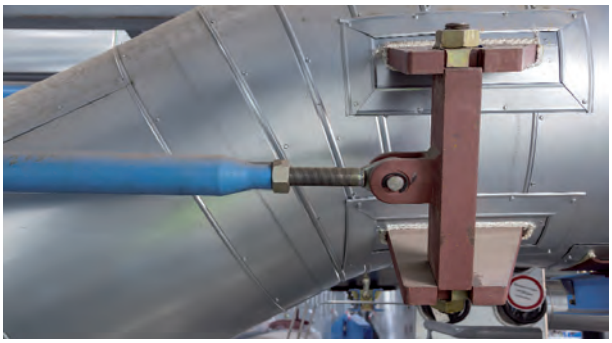


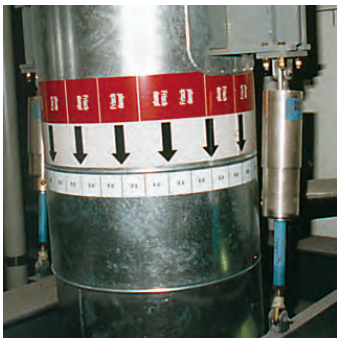
3

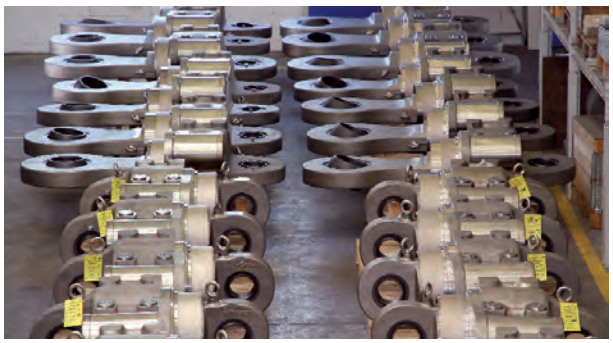
SNUBBERS, RIGID STRUTS, ENERGY ABSORBERS, VISCOELASTIC DAMPERS, DYNAMIC CLAMPS

PRODUCT GROUP 3

LISEGA







Snubbers, rigid struts, energy absorbers, viscoelastic dampers, dynamic clamps

Contents **Page**

Field of application

To avoid unacceptable stresses and moments in the piping systems, unplanned deflections in the piping or other plant components must be prevented. Thermal displacement must, however, not be obstructed!

Dynamic events

Whenever unplanned dynamic events occur, the support components in LISEGA product group 3 have the task of protecting the piping or other affected parts from damage.

The unwanted jolting displacement of plant components can be caused by:

A. Internal events, for example:

- **start-up / shut-down**
- **pressure impacts from valve operations**
- **water hammer**
- **boiler detonations**
- **pipe rupture**

B. External events, for example:

- **wind loads**
- **seismic events**
- **aircraft crashes**
- **explosions**

Components affected can be:

- **pipe systems**
- **pumps**
- **valve assemblies**
- **pressure vessels**
- **steam generators**
- **boilers, heat exchangers**

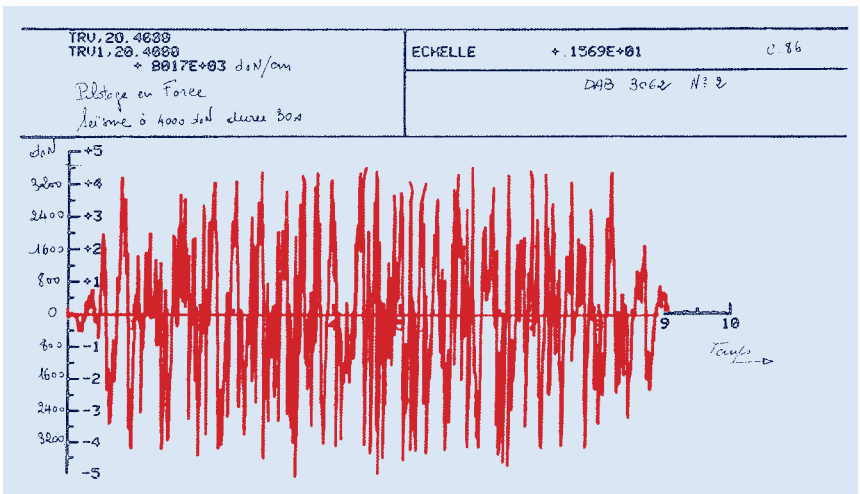


Diagram of an operating basis earthquake (O.B.E.)

Components in product group 3

For the absorption and transfer of dynamic load cases, specially designed supports are required. With product group 3, LISEGA provides a complete system in which all fields of application are covered by the corresponding ideal component. In this way the implementation of optimum concepts is possible for the user.

LISEGA product group 3 includes the following main products:

- **Snubbers (shock absorbers), types 30 and 31**
- **Rigid struts, type 39**
- **Energy absorbers, type 32**
- **Viscoelastic dampers, type 3D**
- **Pipe whip restraints, type 3R**

For proper implementation of the main components a complete range of connection possibilities are available:

- **Installation extensions, type 33**
- **Weld-on brackets, type 35**
- **Dynamic clamps, types 36 and 37**
- **Dynamic riser clamps, type 34**

The component connections are designed to be compatible with the LISEGA modular system and are subject to uniform calculation criteria. A **'table of permissible loads'** can be found on page 0.6 of the **'technical specifications'**.

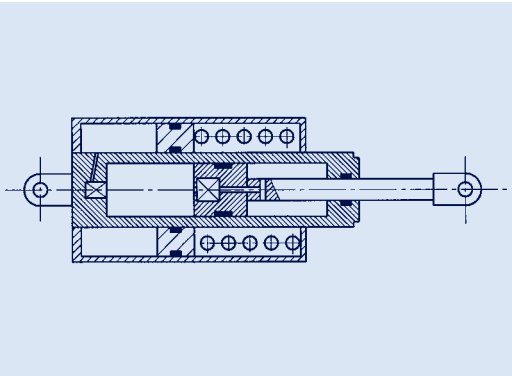
The stress analyses forming the basis correspond to the international guidelines and codes and are additionally supported by practical experiments and testing.

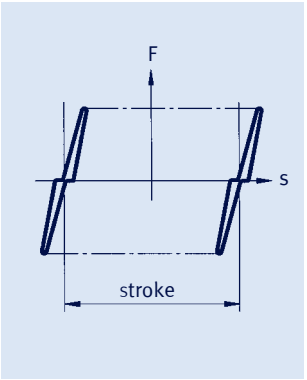
Design Report Summaries according to **ASME III NF** and **RCC-M** are available.

Main products

Snubbers type 30, 31

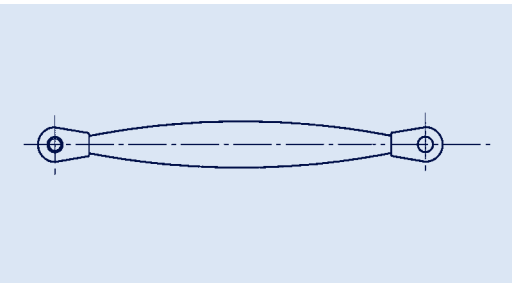
The use of snubbers (shock absorbers) is pre-ferred in thermally operating plant components. In a dynamic event, snubbers provide an instantaneous, fixed, practically rigid connection between the component to be secured and the surrounding structure. In this way the dynamic energy from abrupt displacement can at once be transmitted and harmlessly dissipated. The thermal displacements during routine operation are not restricted.

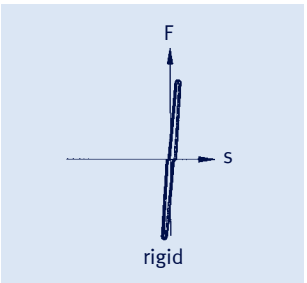




Rigid struts type 39

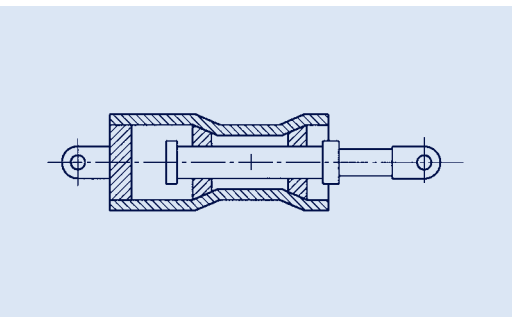
If operational displacements have to be restricted, e.g. in zero crossings, rigid struts are used. These components form rigid connections from connection point to connection point and do not permit movement of any kind in the axial direction. As they are fitted with articulated bearings they permit slight lateral displacement.

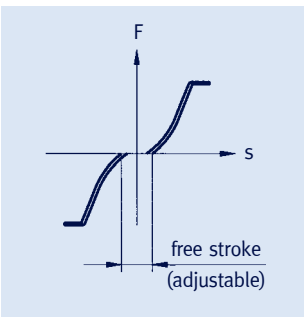




Energy absorbers type 32

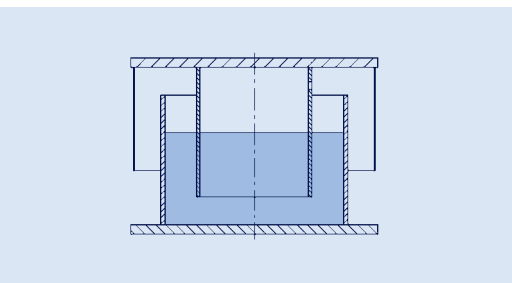
If only minor operational displacement is expected at the load application point, energy absorbers can be used. These components allow slight movements limited in the end positions by an adjustable gap. Any components affected are protected from overloading because, due to the design, excess dynamic energy applied is transformed into plastic deformation of the absorber.

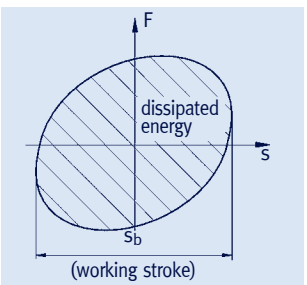




Viscoelastic dampers type 3D

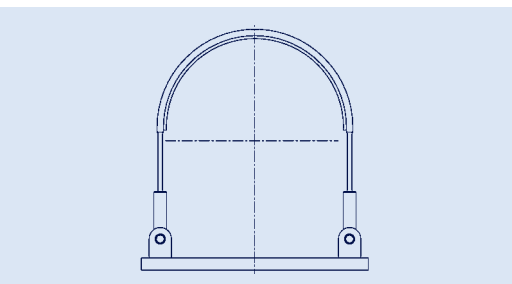
Dynamic loads from mechanical, hydrodynamic or other external events can seriously damage plant components and pipe systems. Viscoelastic dampers can absorb these vibrations and load peaks. A highly viscous fluid thereby absorbs the kinetic energy and dampens any vibrations.

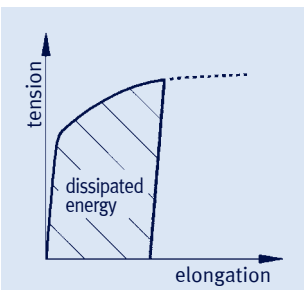




Pipe whip restraints type 3R

Pipe whip restraints are a specially designed type of pipe restraints. In the event of a bursting pipe system, it will transform the suddenly released kinetic energy into plastic deformation and hold the pipe in a safe position. Any overloading of the steelwork is thereby prevented.





Instructions on use

The components in product group 3 are dynamically stressed. When using them, the following points must be observed for their effective functioning:

1. In the conception of **dynamic fixed points** the rigidity of the **whole system**, i.e. of all components in the support chain, must be taken into account.

2. In the selection of the sizes to be used, the **sum of all loads occurring** must be considered.

3. For given loads it must be clearly determined **beyond all doubt which design load** (H, HZ, HS and/or Level A, B, C, D) the data corresponds to. The **'table of permissible loads'** on page 0.6 of the **'technical specifications'** must be observed.

4. The stroke length of snubbers should not be fully utilized. A **travel reserve of 10mm** in both directions is recommended.

5. When arranging components, **sufficient lateral freedom of movement** must be ensured so that no jamming occurs at the connections.

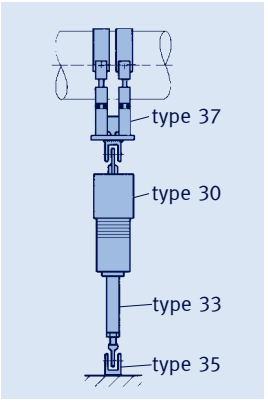
6. In the case of **parallel arrangement of snubbers** it is recommended to take load reserves into account. Instead of 50% in each case, both snubbers should be designed to take at least 70% of the calculation load.

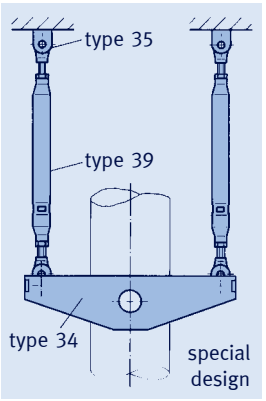
7. The **installation drawings** should clearly indicate the degree of freedom of possible angulation of the components.

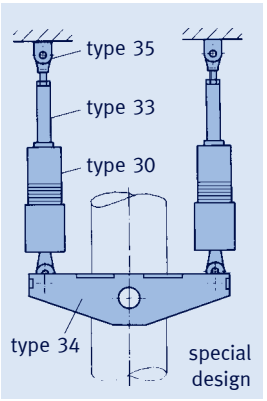
8. Any necessary torque values for threaded connections in the structural attachments should be indicated.

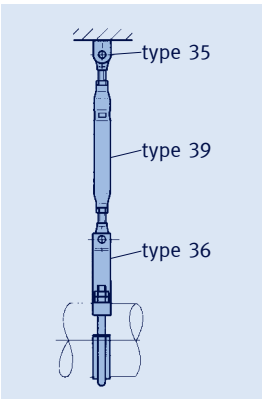
9. Before commissioning the plant, all support points should once again be **visually inspected**.

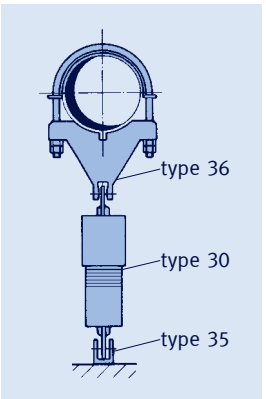
10. The **LISEGA instructions for commissioning** are to be observed, as well as inspection and maintenance recommendations.

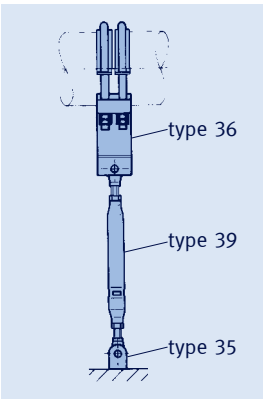


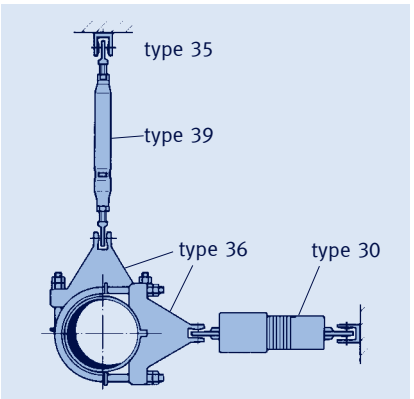


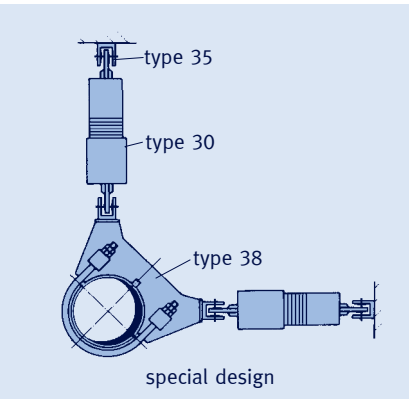


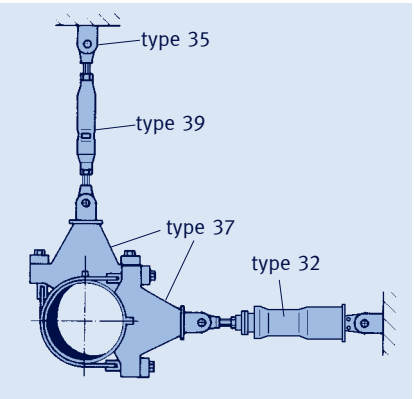


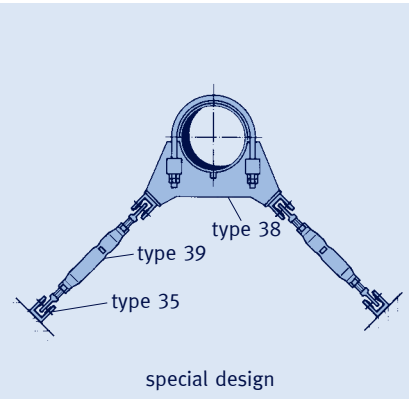












Snubbers Type 30, 31

LISEGA snubbers have stood the test of time in practical applications for well over four decades and have thereby proven their outstanding reliability. Extensive operational experience has, together with continuous further development, led to highly acclaimed state-of-the-art products and to worldwide market leadership.

Access to snubbers after installation is almost always difficult and, due to possible danger to personnel from radiation when installed in nuclear power plants, is subject to stringent safety regulations. For this reason the most stringent demands are made on reliable, maintenance-free, continuous functionality.

For the reliable operational safety of snubbers, besides the function principle and whole design, the highest quality of critical components is crucial:

- **sealing systems**
- **piston and rod guides**
- **hydraulic fluid**
- **sliding surfaces**
- **corrosion-resistant materials**
- **corrosion-free interiors**
- **control valves**

The most common cause of failure in snubbers is usually premature wear and tear and corrosion. For this reason LISEGA snubbers are made of corrosion resistant materials. In addition, any form of metallic contact within the unit is eliminated by the use of special guide bands.

Snubbers type 30

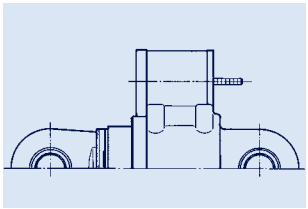
At LISEGA, sealing systems, guides and hydraulic fluid are certified by reliable qualification procedures to give at least 23 years of trouble-free operation under normal operating conditions in a nuclear power station.

The following quality features prove the superior functioning and long life of LISEGA snubbers:

- **corrosion-resistant materials**
- **special sealing systems**
- **vibration-resistant special guides**
- **pressurized hydraulic systems**
- **dynamic functional behavior**
- **exchangeable valves (type 31)**
- **tested and approved for min. 23 years maintenance-free operation**
- **60-year design life**
- **certified by suitability tests according to KTA 3205.3**
- **approvals according to ASME-NCA 3800**

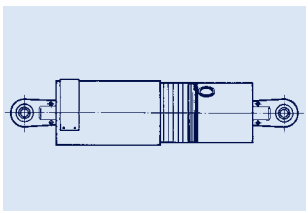
Final inspection of snubbers type 31

Design features
Snubbers Type 30, 31



Design features

The snubbers form a closed hydraulic system **without external bolted pressure fittings.** The individual parts of the units are connected **without welding** by precision fit and screw connections, and are mechanically secured.



As a **protection against corrosion**, LISEGA snubbers are manufactured exclusively from **corrosion resistant materials**. The connecting lugs are made of electro galvanized carbon steel.

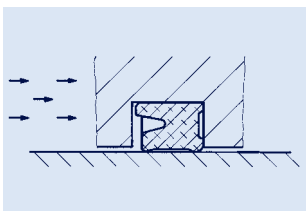
The **guides on piston rods and pistons** are made of a special friction-resistant, non-metallic material.

The **compensating reservoir** is sealed against the atmosphere by a preloaded piston so that slight **excess pressure is maintained in the hydraulic system.** This ensures the permanent functioning of all seals and the positive feed of hydraulic fluid to the cylinder regardless of the installed orientation.

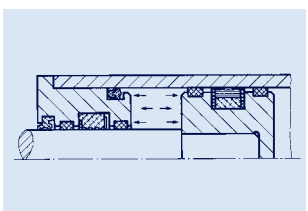
The **control valves** are vital for dynamic function. To achieve high functional accuracy the valve parameters have been optimized by extensive testing and special calculation models.

Seals

The decisive design features for long-lasting function are the sealing systems. Besides the hydraulic fluid and guide bands, they form part of the non-metallic materials and are therefore exposed to natural aging and wear.



The most important requirement for a long-lasting sealing effect is the choice of the correct sealing material. The crucial factor thereby is the seal's restitution behavior ('shape memory') or compression set, providing the lowest possible stress relaxation.



For optimum utilization of material properties the special shape of the seals are also important, while for final functional efficiency the best combination of the following features are critical:

- **thermal resistance**
- **radiation resistance**
- **resistance to wear, especially high-frequency vibrations**
- **good restitution behavior ('shape memory')**
- **good dry run characteristics**
- **limited tendency to diffusion in seal surfaces**
- **minimal transfer from static to sliding friction (stick-slip effect)**

A special mixture of **fluorelastomer VITON** has proved to offer the optimum solution here. In addition, the following prerequisites must be fulfilled to gain full benefit from the special characteristics:

- **special sealing geometry**
- **supporting composite materials**
- **optimum consistency (mixture proportions)**
- **optimized hardening**
- **precision of sliding surfaces**
- **design of the installation spaces for defined preloading of the seals**

Ordinary seals do not fulfill these demands in snubbers and have been shown to lead to premature failure. For this reason, as early as 1984 LISEGA, in collaboration with a renowned seal manufacturer, began to develop **specific sealing systems** that have since proved themselves in practice.

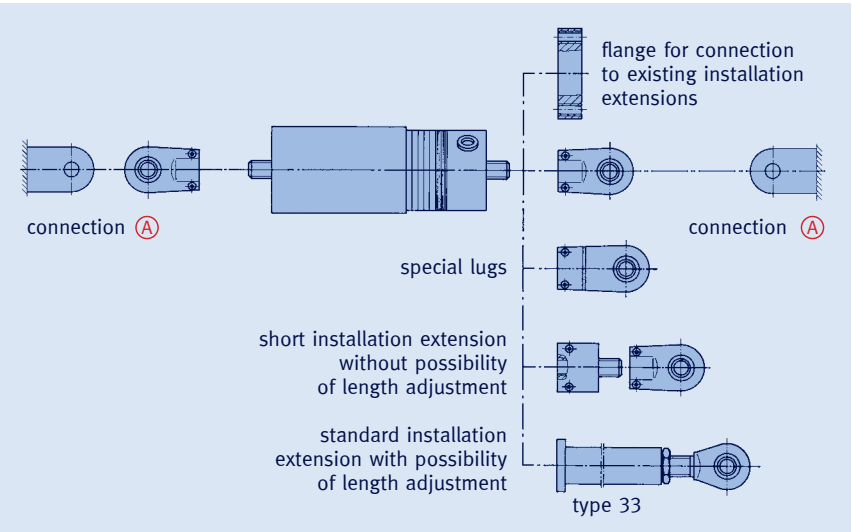
In 1992, after other successful certification procedures through artificial aging and long-term trials, a certification process for LISEGA snubbers was conducted on behalf of a European nuclear operator. The result: a **maintenance-free operating period of min. 23 years in nuclear applications was confirmed.**

Design features
Snubbers Type 30, 31

Type 30

Connection possibilities

A special range of connection components and adapters are available, so that in the event of an exchange the existing connections on site can still be used.



Ⓐ Connection possibilities: See pin diameters of weld-on brackets type 35 or dynamic clamps in product group 3.

① Control valves to achieve greater functional accuracy (type 30: internal).

② Name plate with all technically relevant data.

③ Control indicators: The piston position of the snubbers can be read off on all sides via the scale rings on the snubber casing. A robust steel casing connected to the piston rod serves as an indicator and at the same time protects the piston rod from mechanical damage, pollution and radiant heat.

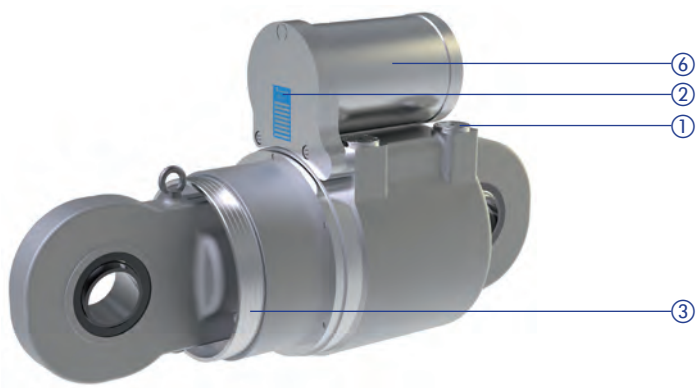
④ Connection lugs (carbon steel) electro galvanized (only type 30).

⑤ Inspection glass in the compensating reservoir / indicator bar. The fluid level of the reservoir is shown by the position of the reservoir piston. For type 30 the minimum level can be checked through the inspection glass; for type 31 there is a marked indicator bar at the rear of the external compensating reservoir.

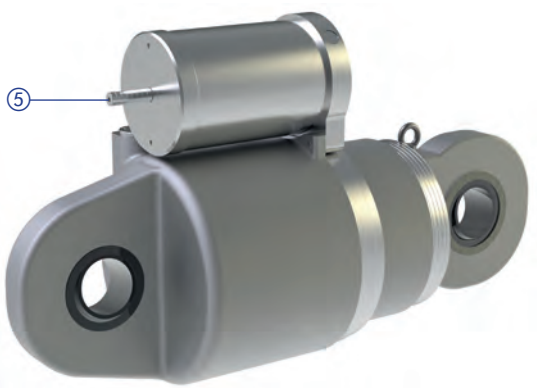
⑥ The reservoir is sealed against the atmosphere by means of a spring loaded piston so that slight excess pressure in the hydraulic system constantly keeps the seals under slight pressure (type 30: located inside).

✓ Corrosion resistant materials.

✓ Radiation-resistant, wear-resistant seals.



Type 31



For details of design and materials see **technical specifications** page 0.1.

Mode of operation and function Snubbers Type 30, 31

In the event of an impact on the component to be secured, an instantaneous, practically rigid connection is to be made between the component and a fixed point on the surrounding structure.

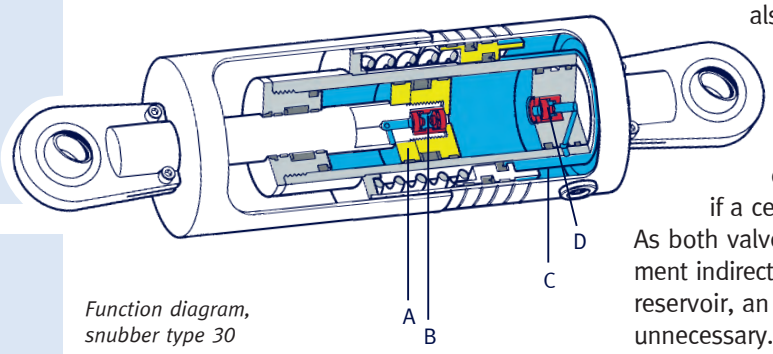
Function

Control valves

The function of the LISEGA hydraulic snubbers type 30 is controlled by a main control valve (B) positioned axially in the hydraulic piston (A). On slow displacement of the piston (≤ 2mm/s) the valve is held open by spring force and the hydraulic fluid can freely flow from one cylinder chamber into the other. On rapid piston displacement above a velocity limit (approx. >2mm/s), back pressure develops on the valve disk and closes the valve. The hydraulic flow is interrupted and the displacement blocked. Due to the compressibility of the hydraulic fluids, damaging load peaks are also prevented.

On displacement in pressure direction, the compensating valve (D) also closes almost synchronously with the piston valve.

If the pressure on the closed valve is reduced, e.g. by reversal of the displacement direction, the valve opens independently.



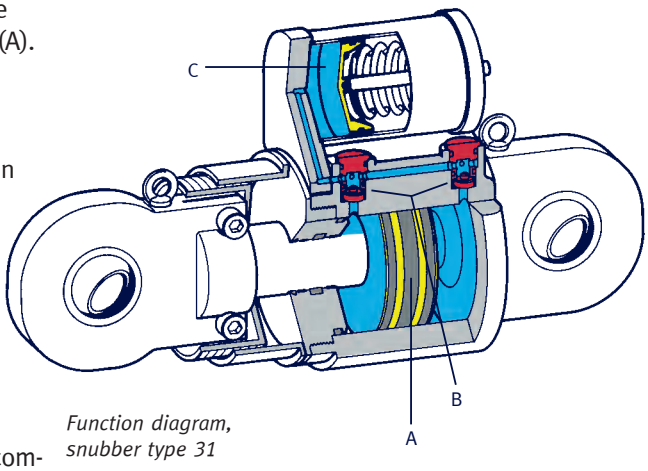
Function diagram, snubber type 30

Bypass

To prevent the valves from remaining in a blocked condition they are designed with a bypass system. This permits a gentle after-flow at continuous force and ensures the safe opening of the valves in both cylinder chambers through rapid pressure balance. The compensating valve works synchronously with the main valve in the same way.

Compensating reservoir

To balance the piston rod volume, as well as to change the volume of hydraulic fluid on change of temperature, volume compensation via a co-axially arranged compensating reservoir (C) takes place. The connection between reservoir chamber and the working cylinder is regulated by the compensating valve (D).



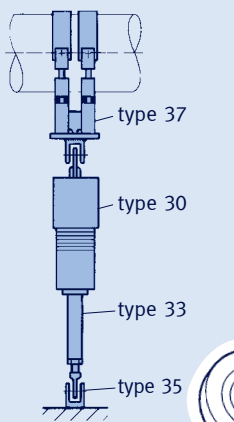
Function diagram, snubber type 31

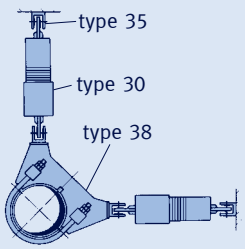
Large bore design type 31

The mode of functioning of the LISEGA hydraulic snubbers type 31 is based in principle on the same concept as for type 30. The particularities of size require a different arrangement of the compensating reservoir (C). At the same time a different arrangement of the valves are also necessary. The valves (B) work similarly to those on type 30. Here too, the flow of hydraulic fluid in the respective direction of movement is interrupted by closure of the corresponding valve if a certain limit of velocity is exceeded. As both valves stand with the given arrangement indirect connection with the compensating reservoir, an additional compensating valve is unnecessary.

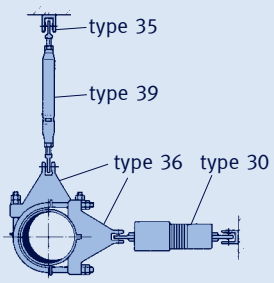
In service testing

The valve system is designed to be replaceable, so that all the snubbers type 31 need not be removed for routine function testing. In this way, in the event of a recurrent test only the valve units are replaced by a previously certified valve assembly. A special shut-off device thereby prevents loss of fluid. The replaced valve assembly can subsequently be tested on a test snubber and prepared for future use. This design meet the intent of sub component testing according to ASME OM Code, Subsection ISTD.





special design



Function Tests Snubbers type 30, 31

3

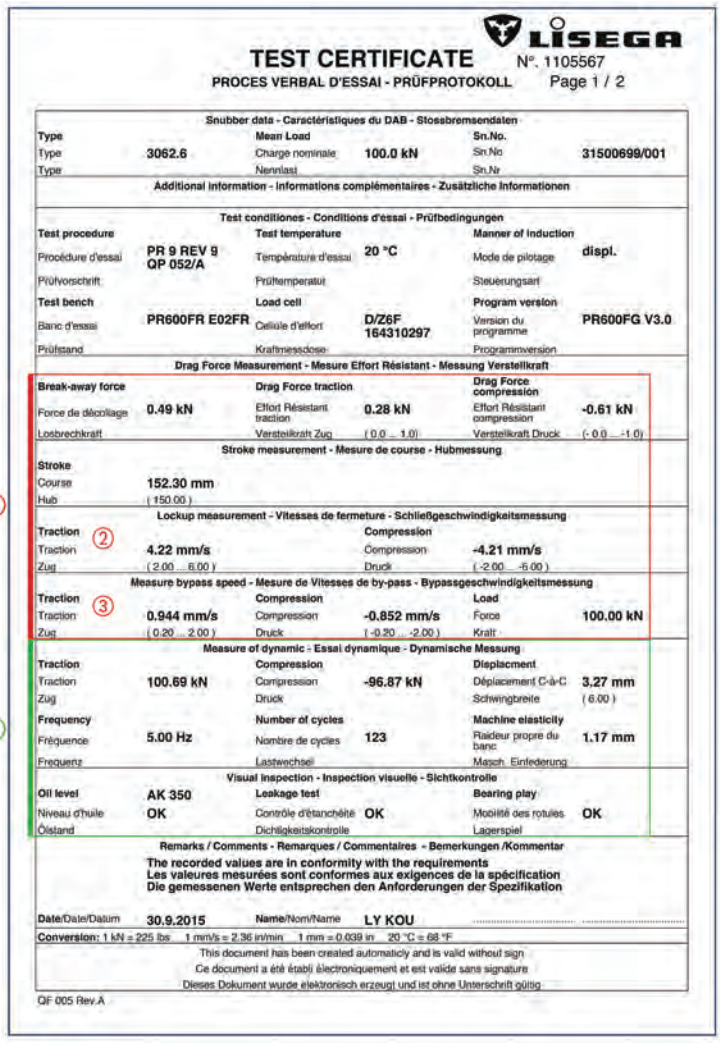
Especially stringent safety demands in the nuclear field require flawless proof of the function parameters for snubbers. This applies both to initial delivery inspection and to recurrent tests.

The LISEGA test technology is permanently improved in-house and complies with the most up-to-date technical standards. The test benches function as dynamic Hydropuls® units with optional force- or travel-controlled excitation. The frequency bands range from 0.5 – 30Hz, and the test loads from 0.5 up to 8600kN. For standard tests LISEGA has test facilities of its own manufacture in different factories and in various sizes. Mobile units are often used on site at customer request. The test facilities are used worldwide today and are operated by the customers' own personnel.

Variable test programs permit the testing of all snubber makes.

LISEGA test benches are also manufactured for customers.

All LISEGA's test benches are calibrated at regular intervals on the basis of DIN EN ISO 7500 with calibrated load cells and measurement amplifiers.



TEST CERTIFICATE N°. 1105567
PROCES VERBAL D'ESSAI - PRÜFPROTOKOLL Page 1 / 2

Snubber data - Caractéristiques du DAB - Stossbremsendaten

Type		Mean Load		Sn.No.	
Type	3062.6	Charge nominale	100.0 kN	Sn.No	31500699/001
Type		Nennlast		Sn.Nr	

Additional information - Informations complémentaires - Zusätzliche Informationen

Test conditiones - Conditions d'essai - Prüfbedingungen

Test procedure		Test temperature		Manner of induction	
Procédure d'essai	PR 9 REV 9 QP 052/A	Température d'essai	20 °C	Mode de pilotage	displ.
Prüfvorschrift		Prüftemperatur		Steuerungsart	
Test bench		**Load cell**		**Program version**	
Banc d'essai	PR600FR E02FR	Cellule d'effort	D/Z6F 164310297	Version du programme	PR600FG V3.0
Prüfstand		Kraftmessdose		Programmversion	

Drag Force Measurement - Mesure Effort Résistant - Messung Verstellkraft

Break-away force		Drag Force traction		Drag Force compression	
Force de décollage	0.49 kN	Effort Résistant traction	0.28 kN	Effort Résistant compression	-0.61 kN
Losbrechkraft		Verstellkraft Zug	(0.0 ... 1.0)	Verstellkraft Druck	(- 0.0 ... -1.0)

Stroke measurement - Mesure de course - Hubmessung

Stroke	
Course	152.30 mm
Hub	(150.00)

Ⓐ

Lockup measurement - Vitesses de fermeture - Schließgeschwindigkeitsmessung

Traction ②		Compression	
Traction	4.22 mm/s	Compression	-4.21 mm/s
Zug	(2.00 ... 6.00)	Druck	(-2.00 ... -5.00)

Measure bypass speed - Mesure de Vitesses de by-pass - Bypassgeschwindigkeitsmessung

Traction ③		Compression		Load	
Traction	0.944 mm/s	Compression	-0.852 mm/s	Force	100.00 kN
Zug	(0.20 ... 2.00)	Druck	(-0.20 ... -2.00)	Kraft	

Measure of dynamic - Essai dynamique - Dynamische Messung

Traction		Compression		Displacment	
Traction	100.69 kN	Compression	-96.87 kN	Déplacement C-à-C	3.27 mm
Zug		Druck		Schwingbreite	(6.00)
Frequency		**Number of cycles**		**Machine elasticity**	
Fréquence	5.00 Hz	Nombre de cycles	123	Raideur propre du banc	1.17 mm
Frequenz		Lastwechsel		Masch. Einfederung	

Ⓑ

Visual inspection - Inspection visuelle - Sichtkontrolle

Oil level	AK 350	Leakage test		Bearing play	
Niveau d'huile	OK	Contrôle d'étanchéité	OK	Mobilité des rotules	OK
Ölstand		Dichtigkeitskontrolle		Lagerspiel	

Remarks / Comments - Remarques / Commentaires - Bemerkungen /Kommentar

The recorded values are in conformity with the requirements
Les valeures mesurées sont conformes aux exigences de la spécification
Die gemessenen Werte entsprechen den Anforderungen der Spezifikation

Date/Date/Datum 30.9.2015 Name/Nom/Name LY KOU

Conversion: 1 kN = 225 lbs 1 mm/s = 2.36 in/min 1 mm = 0.039 in 20 °C = 68 °F

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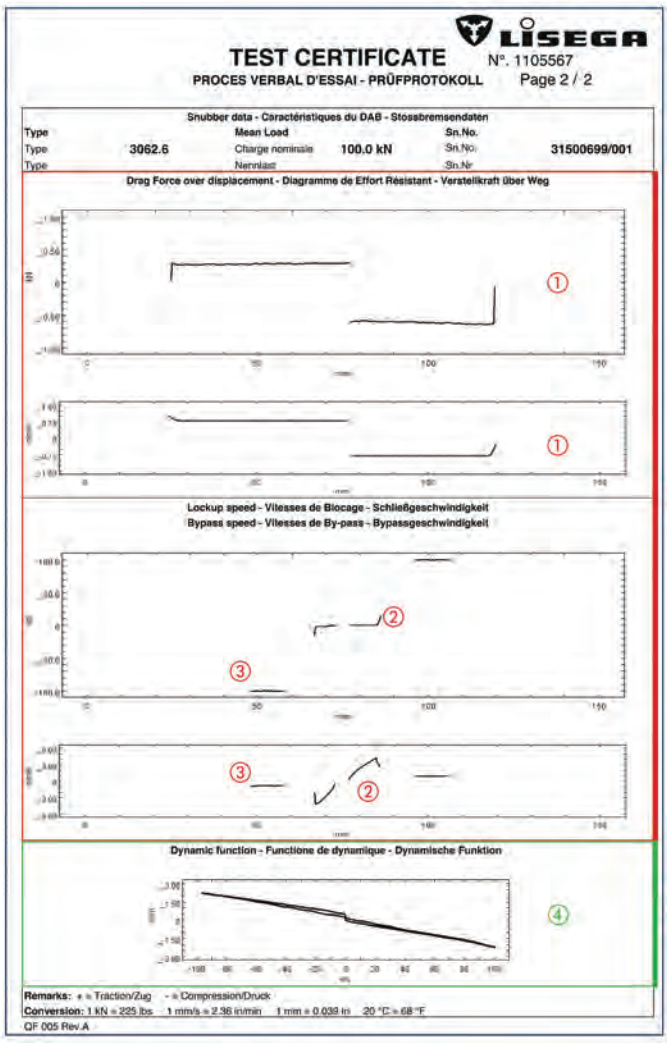
QF 005 Rev.A

Inspection report with test diagrams page 1



TEST CERTIFICATE N°. 1105567
PROCES VERBAL D'ESSAI - PRÜFPROTOKOLL Page 2 / 2

Snubber data - Caractéristiques du DAB - Stossbremsendaten

Type		Mean Load		Sn.No.	
Type	3062.6	Charge nominale	100.0 kN	Sn.No.	31500699/001
Type		Nennlast		Sn.Nr	

Drag Force over displacement - Diagramme de Effort Résistant - Verstellkraft über Weg

Ⓐ

Lockup speed - Vitesses de Blocage - Schließgeschwindigkeit
Bypass speed - Vitesses de By-pass - Bypassgeschwindigkeit

Dynamic function - Fonctione de dynamique - Dynamische Funktion

Ⓑ

Remarks: + = Traction/Zug - = Compression/Druck
Conversion: 1 kN = 225 lbs 1 mm/s = 2.36 in/min 1 mm = 0.039 in 20 °C = 68 °F

QF 005 Rev.A

Inspection report with test diagrams page 2

Ⓐ **Quasi-static function tests**

① Drag force [kN]
② Lockup speed [mm/s]
③ Bypass speed [mm/s]

Ⓑ **Dynamic function tests**

④ Load and travel amplitude

Operational performance Snubbers Type 30, 31

Operational performance

On dynamic loading, LISEGA snubbers offer a constant, predictable, functional performance subject to the load spectrum.

The specified values correspond to the recognized international specifications and practical requirements. Observation of the values is certified and recorded during factory testing.

Specified function values

LISEGA snubbers comply, as a standard, with the following functional data. The values apply to alternating or dynamic loading.

By means of design adaptation or use of special oil special parameters can be taken into account.

	type 30		type 31	
	travel range 8, 2, 9 ①	travel range 3 (stroke 300)	travel range 8 (stroke 100)	travel range 9 (stroke 200)
piston rod travel s_b at F_N, R_t ② and 1-35Hz	≤ 6mm	≤ 8mm	≤ 10mm	≤ 12mm
piston rod play s_a (lost motion)	≤ 0.5mm ④ up till load development on change in load direction			
lockup velocity at R_t ②	2-6mm/s			
bypass velocity at F_N und R_t ②	0.2-2mm/s ⑤			
maximum resistance against movement (drag force) ③	for F_N ≤ 8kN 2.5% F_N for F_N > 8kN largest value of 200N or 1%F_N	largest value of 300N or 1.5%F_N	1%F_N	

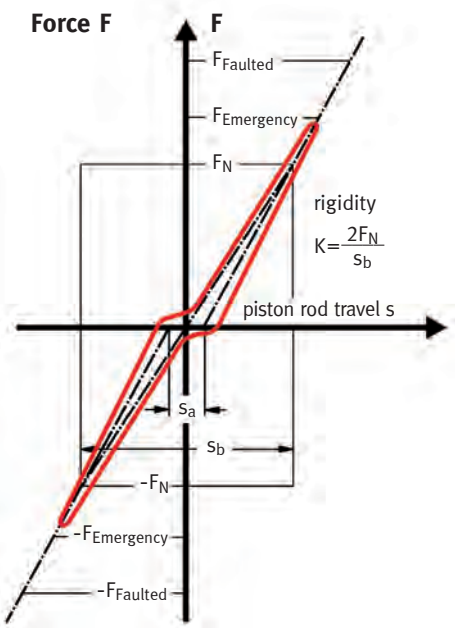
① Travel range 8≙100mm, travel range 2≙150mm, travel range 9≙200mm.

② R_t = room temperature (20°C ±4°C). At ambient temperatures of 150°C (short duration, max. 1h) the piston rod travel may be increased by up to 50% due to reduced fluid viscosity.

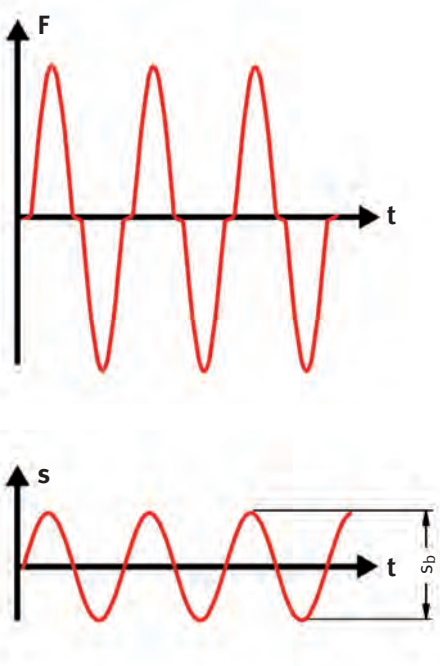
③ Measured at a constant piston rod speed of approx. 0.3mm/s. Breakaway force is kept at less than 1.5 of given values. F_N = nominal load.

④ If required, s_a can be increased to ≥ 0.5mm (KTA 3205.3).

⑤ Bypass velocity < 0.2mm/s on request.



Force – travel diagram



Force and travel amplitudes

2500kN test bench at LISEGA

Permissible stress factors Snubbers Type 30, 31

Operational demands

LISEGA hydraulic snubbers are designed as standard for the following operational demands. The specified values are certified by KTA suitability tests.

Other values can be agreed in exceptional cases by design adaptations.

Test facilities for snubbers in Zeven plant, Germany

loading due to ambient temperature	continuous operation	max. 80°C
	short-term max. 1h/temp. cycle max. 40h/year	max. 150°C
relative air humidity	at 10-150°C	100%
wet steam atmosphere	up to max. 150°C	X=1
energy dose	cumulative	10^5J/kg =10^5gray (=10^7rad)
ambient pressure	continuous operation	0.5-1 bar
	short-term	5 bar excess pressure

The values apply to the whole snubber, incl. seals and hydraulic fluid. The data for the fluid are:

hydraulic fluid (silicon oil)	setting point	– 50°C
	flash point	> 300°C
	ignition point	≈ 500°C

Resistance to fatigue

Proof of operational durability is based on the following accumulated load cycles:

nominal load F_N	load cycle
10%	2,000,000
50%	100,000
80%	20,000
100% (Level A/B)	10,000
133% (Level C)	100
172% (Level D)	10

The load cycle figures correspond to an assumed maximum dynamic load capacity from diverse load events over a period of 40 years. They also comply to the requirements of the test programs of the KTA suitability tests performed. The test results certify that the snubbers endure these loads while maintaining their operational capability.

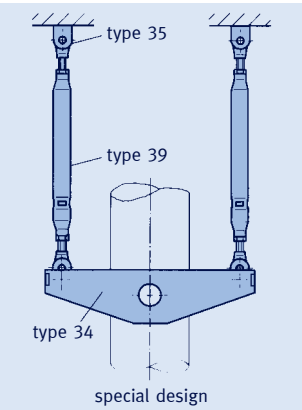
Due to their specially designed guides, the snubbers are extremely resilient to any continuous operational vibrations. This is proven by confirmed practical experience.

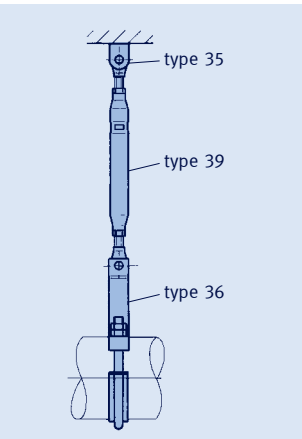
It should be taken into account that the number of possible active parameters, such as frequencies, amplitudes, forms of vibration, effective directions, as well as any possible simultanity, allow no uniform definition of permanent operational vibrations.

Special testing of snubbers type 31. Test load up to 8600kN.

Mode of operation and function
Rigid struts Type 39

In contemporary support concepts, rigid struts play an important role in the safe guiding of pipe systems. The reliable positioning of piping is a crucial factor in the operational safety and long life of the whole system.





Tasks

The LISEGA rigid struts type 39 provide a range of important functions for the operational safety of pipe systems:

- **Transmission of displacement from unplanned load events (see page 3.1)**
- **Guiding of pipe systems for the control of planned thermal displacement direction**
- **Stabilization of flexible pipe systems by fixed so-called 'zero positions'**
- **Design of axial stops**

Mode of operation

Rigid struts perform as hinged rigid connections between pipe systems and structure. No resistance is offered to slight displacements in the pipe system around the angular displacement of the rigid struts. Movement axially to the rigid strut is not possible.

Design

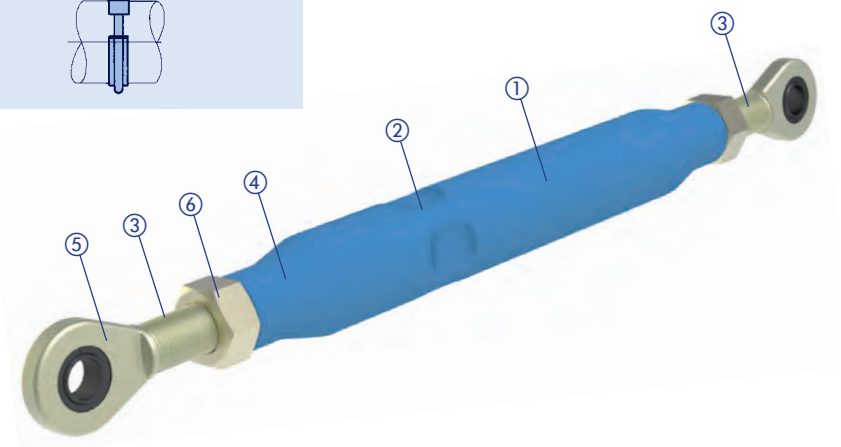
The rigid strut consists of a rigid body with a ball bushing joint for connection at each end. Attachment to the structure is made via a weld-on bracket type 35 and connection to the piping using dynamic clamps from product group 3. The selection tables for connecting components can be found on page 3.22 or pages 3.29 to 3.43.

Up to load group 8 the body consists of a tube tapered at the ends, depending on alternative manufacturing technologies.

The shape corresponds to the flow of force and permits a favourable power / weight ratio. The connections are ball bushing joints acting as turnbuckles with right- and left-hand threads, permitting length adjustment within a range of 150mm or 300mm. Flat faces on the body of the tube allow the safe use of a wrench and so facilitate length adjustments in the installed condition.

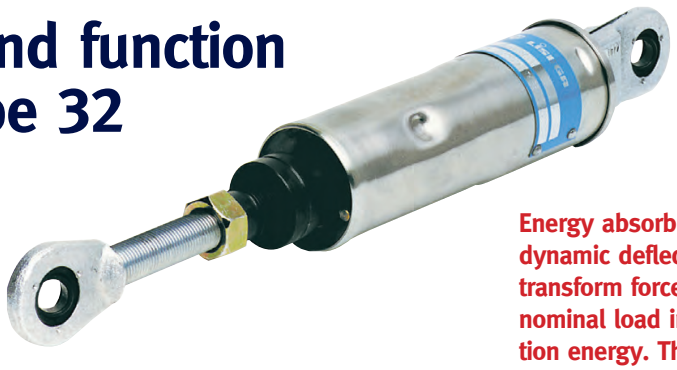
The ball bushing joints are provided with fine threading to guarantee secure locking.

The bodies are produced in standard lengths and are available from stock. LISEGA rigid struts are suitability-tested according to KTA 3205.3 and designed in accordance with the ASME-BPV Code.



① surface with standard paint coating.
② flat face for easy adjustment.
③ length-adjustable with right-hand / left-hand threads.
④ body, free of welding up to load group 8.
⑤ electro galvanized ball bushing joints with fine thread.
⑥ safe locking of ball bushing joints by means of fine threads and electro galvanized lock nuts.

Mode of operation and function
Energy absorber Type 32



Energy absorbers restrict dynamic deflections and transform forces above the nominal load into deformation energy. The steelwork is thus protected.

Mode of operation and function

The energy absorber functions by means of an adjustable free stroke to absorb thermal displacement. The adjustment of the free stroke can be carried out (for medium sizes) within a range of ± 25mm. In this range the pipe system can move freely without resistance.

Dynamic events, however, are limited in their movement by the use of stops. The forces arising are thereby led into the building structure up to the specified nominal load and, above that, transformed into deformation energy. Connected components are in this way protected in a controlled manner from overloading.

For this reason energy absorbers are ideal as protection:

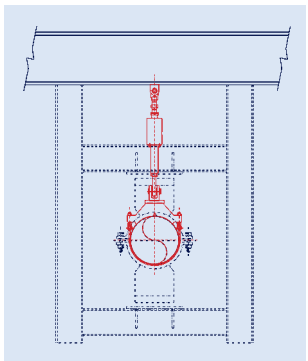
- **against water hammer**
- **as a substitute for complex framework constructions**
- **as whip restraints**

If such an event has occurred, the forward thrust of the disk affected can be read from the position of the indicator bar (G).

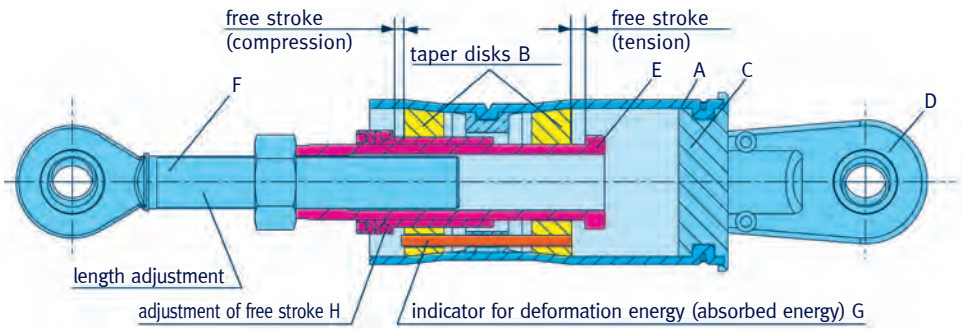
For further use of the energy absorber the free stroke on the adjustment device (H) only needs to be re-regulated for the new position. **Corresponding procedures can be repeated up to maximum deformation travel (s).** Further information is available on page 3.23.

Installation

The energy absorbers are designed in accordance with the load group in product group 3 (dynamic components) and are correspondingly compatible in respect of loads and connections with the connection components in this product group. Please also note the instructions on page 3.1.



Energy absorber, used instead of a double guide. In this way the framework can be avoided.



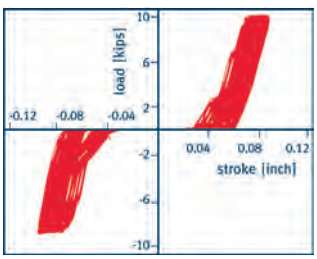
The design consists of an austenitic tubular casing (A) with defined size, into which taper disks (B) with defined force have been pressed. The tube is sealed with a fixed base (C) fitted with a connecting lug (D). The force transmission over the whole unit is made via the stops (E) and the push rod (F).

If a dynamic event exceeds the compression force of the taper disks, the taper disk affected is driven forward and widens the cover tube. In this way the excess force is diverted from the connection components by transformation into deformation energy.

Function certification

LISEGA energy absorbers have gone through an exhaustive test program to prove their functional reliability. In numerous dynamic and static stress tests, as well as load capacity tests, their safety has been clearly demonstrated.

Energy absorbers are maintenance-free during operation and require no in-service testing.



Measured force/travel path with oscillating loads > nominal load

Mode of operation and function
Viscoelastic damper Type 3D

Dynamic loads from mechanical, hydrodynamic or external events can severely damage pipe systems and other plant components. Viscoelastic dampers can considerably reduce such vibrations.

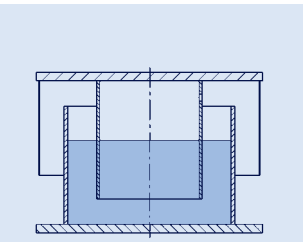
Vibrations occur through inner events from mechanical or hydrodynamic processes, or in the case of external events such as wind loads, traffic vibrations or earthquakes.

Impermissibly high vibrations can thereby cause serious damage to pipe systems. By means of special components they must be protected. To avoid stresses in the whole system, displacements from thermal expansion in the piping system may only be minimally obstructed.

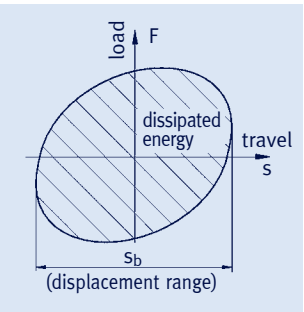
Viscoelastic dampers have proved in practice to offer reliable protection for pipe systems and installations. In particular, vibrations caused by sudden peak loads can be reduced to an acceptable level by such dampers.

The LISEGA viscoelastic damper consists of a casing filled with viscous fluid that allows relative displacement between the connecting plates and at the same time dampens in all directions, dissipating the kinetic energy (transformed into heat).

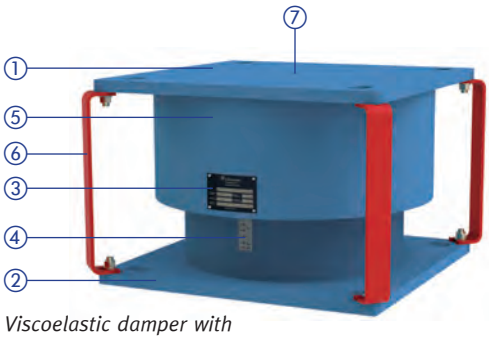
Viscoelastic dampers transmit only dynamic loads, not static ones. The reaction force of the damper is thereby proportional to the velocity and frequency of the vibrations. LISEGA offers fluids with varying damping characteristics in relation to application temperature and frequency.



Construction of the LISEGA viscoelastic damper



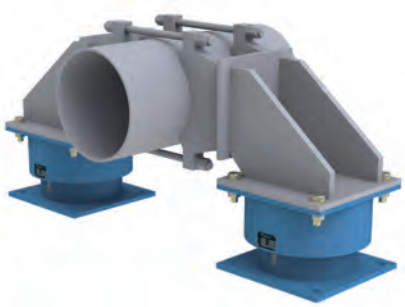
Hysteresis of a viscoelastic damper



Viscoelastic damper with transport brackets without offset

Viscoelastic damper with adjusted offset

①② connecting plates
③ name plate
④ position indicator
⑤ maintenance-free dust cover
⑥ transport brackets
⑦ inner connection thread M16 for transport purposes
✓ load range 2.5kN to 100kN
✓ frequency range up to 35Hz
✓ temperature range from – 10°C to 80°C
✓ travel range up to 50mm



Pipe whip restraints Type 3R

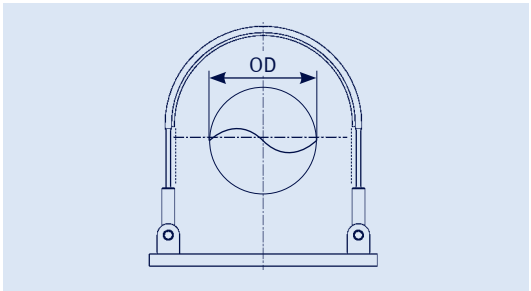
Pipe whip restraints

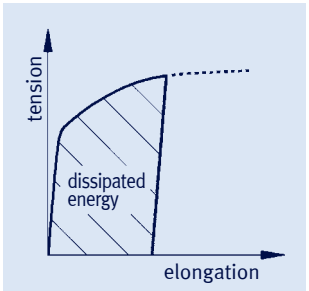
Special designs in the field of dynamic pipe supports are pipe whip restraints. Beside energy absorber type 32, a design type with round-steel U-bolts has proved widely successful, especially for large loads.

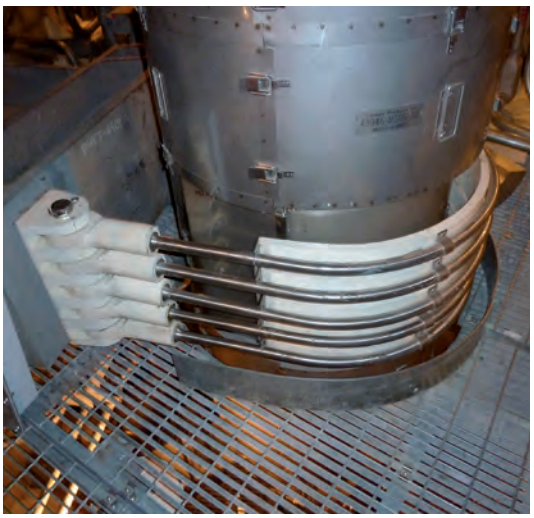
Pipe whip restraints are common in nuclear installations and are designed to instantaneously absorb the kinetic energy of bursting pipe systems in faulted conditions. For this, the elongation behavior of the surrounding steel U-bolts is utilized; these are designed to cope with the dynamic forces to be expected.

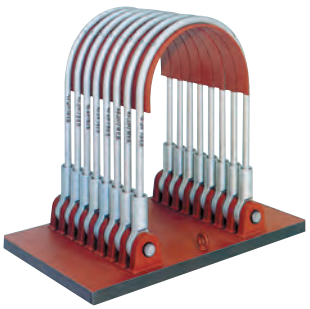
Pipe whip restraints are designed according to the customer's design parameters and manufactured by LISEGA as special components.

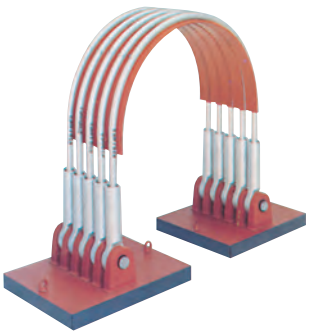
Pipe whip restraints are important as safety elements and are therefore subject to stringent quality requirements with regard to design and manufacture. As the result of countless deliveries to modern nuclear installations LISEGA has clearly proved its qualification for the supply of these components.

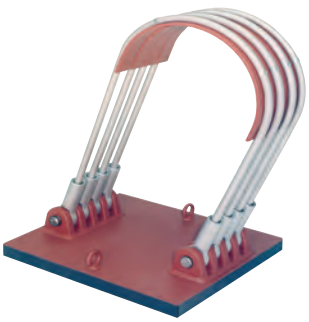






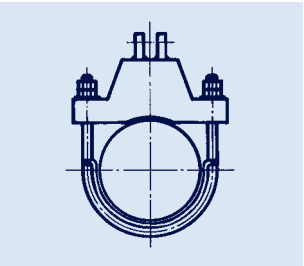




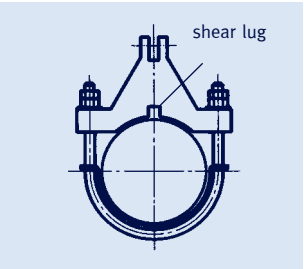


Mode of operation and function
Dynamic clamps Type 34, 36, 37

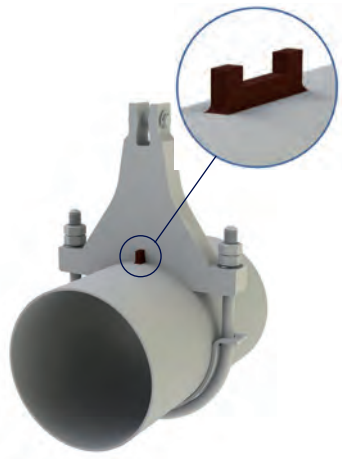
For the dynamic supports the pipe clamp design must also be carefully considered. Despite properly functioning main components (rigid struts, snubbers, energy absorbers) the functioning of the whole system can be seriously affected by faulty pipe clamps.



Friction-fit clamp (static)



Form-fit clamp (dynamic)



Type 36 with shear lug type 3L

Function

In the high temperature range and/or over a longer period of time, friction fit clamps cannot safely transmit dynamic loads, even with bolt pre-stressing, due to the creep strength behavior of the materials (long-term fatigue). Even over-sized bolts, which might under certain circumstances severely constrict the piping ('pipe squeezers'), are not solving the problem.

- **A typical fault is a clamp design that is too 'soft', so that the necessary stiffness rule is not achieved**
- **Attention must also be paid to connections to clamps free of play**
- **To prevent constraints, sufficient space must be ensured for lateral displacement in the event of pipe system movements**

To transmit dynamic loads, clamps are required that absorb dynamic forces and transmit them further. Dynamic forces are created by alternating loads; displacement can thereby result due to eccentrically applied forces. The dynamic clamp should therefore be form-fitted (shear lugs) to prevent contortion. In this way, defined, verifiable conditions are produced. Certification is the responsibility of the pipe system designer.

The shear lugs keep the dynamic clamps in the expected force direction and are practically unstressed. Lateral forces would not occur under dynamic load cases because friction forces between the pipe and the clamp insure the firm positioning.

Due to the minimal forces to be absorbed the weld seam stresses can be minimalized, despite the small shear lug sizes. As a rule they lie under 35% of the yield stress (creep strength) limit for load case H (level A/B), in accordance with the permissible ASME or DIN values. From a table the LISEGA shear lugs can be selected on page. 3.44.

Dynamic clamps type 36, 37

To achieve the optimum solution in each case and at the same time the most favorable performance/weight ratios, LISEGA offers 4 standard designs.

The selection tables are classified according to pipe diameters. The type designation for the relevant clamp is found by way of the temperature ranges and permissible loads. After that the installation dimensions must be checked against the scale drawings. Special attention must be paid to the lug connections on the rigid struts, snubbers or energy absorbers. If the standard pin connection d1 is not suitable, a different weld-on bracket type 35 can be supplied. The 'E' dimension of the clamp is changed according to the table below.

If the customer order does not show a particular modification of the layout, the bracket connection is fitted so that the main angulation range runs along the pipe axis.

Type 36 .. .1/2/3

Type 37 .. .1/2/3/4/5/6

Type 36 .. .4/5

Type 37 .. .7/8/9

theor. load group	max. load group of dynamic clamps							
	1, 2	3	4	5	6	7	8	9
	'E' dimension reduction about ΔE							
1,2	0	4	10	20	45	60	85	125
3		0	6	16	41	56	81	121
4			0	10	35	50	75	115
5				0	25	40	65	105
6					0	15	40	80
7						0	25	65
8							0	40
9								0

Reduction of the E_{max} dimension for dynamic clamps type 36 and 37 on selection of a smaller connection than given in the column 'max. load group' in the selection tables.

For the support of austenitic pipe systems, the pipe clamps can be fitted with stainless steel inlay plates made of stainless steel 1.4301 (X5 CrNi 1810). These plates must be ordered separately, see page 4.7.

Dynamic clamps as statically stressed clamps

The specified permissible loads (in the selection tables on pages 3.29 to 3.43) are designed for dynamic operation with snubbers or rigid struts according to the load spectrum on page 3.10.

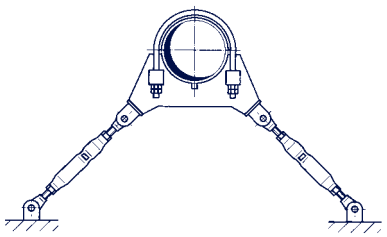
The dynamic clamps can also be exposed to **permanent static stress**. For this, the specified permissible stresses are reduced according to the following table:

design temperature	permissible permanent tension stress
up to 350°C	100%
351°C – 450°C	100%
451°C – 500°C	80%
501°C – 510°C	80%
511°C – 530°C	65%
531°C – 560°C	55%
561°C – 580°C	65%
581°C – 600°C	60%

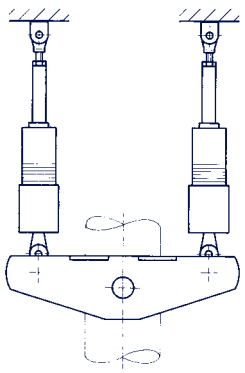
These specifications relate to the creep strength dependent on time in the 200,000 h range at temperature ≥ 450°C.

Special designs

In some cases special designs are advisable in addition to the dynamic clamps type 36 and 37. In particular, for parallel and angulating arrangements, standardized design and calculation methods have been proved successful.

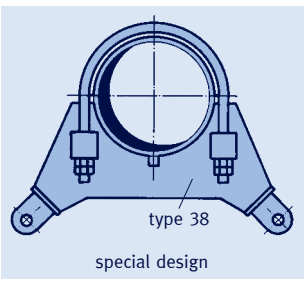


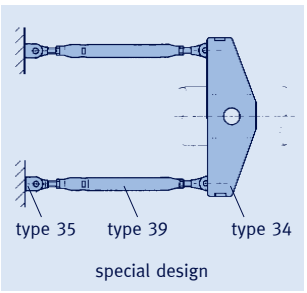
Special clamp for angulating arrangement

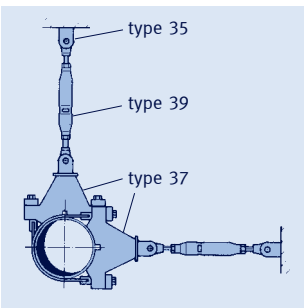


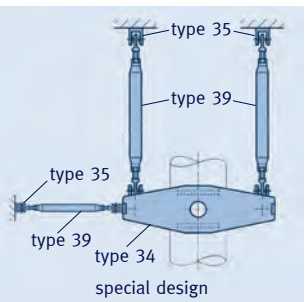
Dynamic pipe clamp type 34 with snubbers and twist restraints

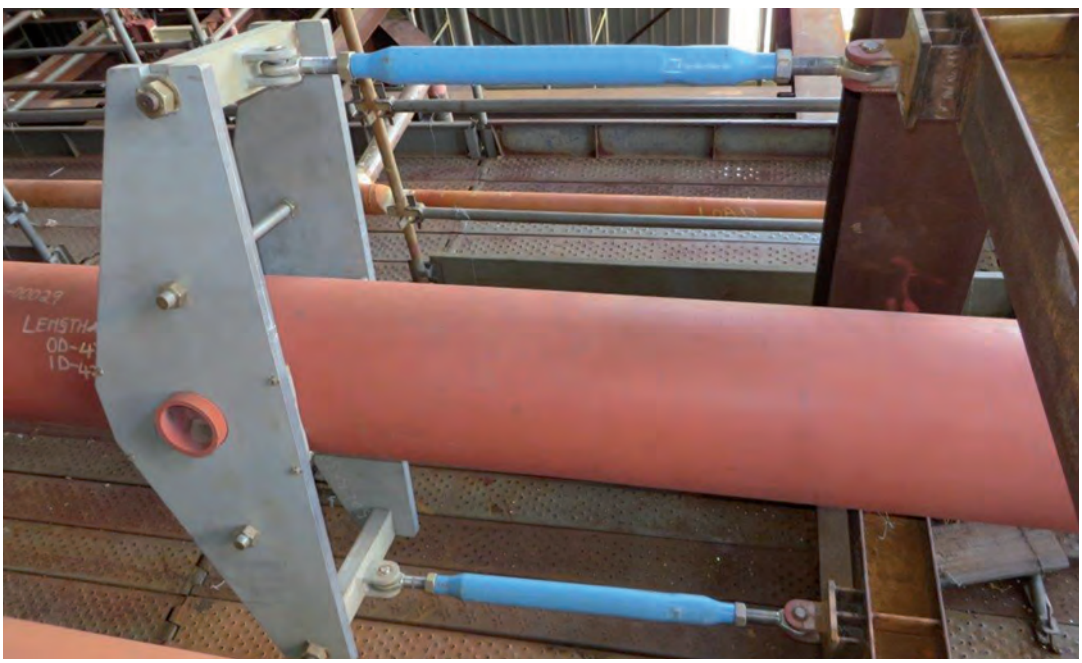
Special design type 37 with pin of weld-on bracket in pipe axis direction











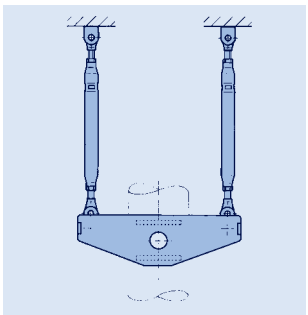
Horizontal axial stop with rigid strut type 39 and pipe clamp type 34 incl. spacer

Dynamic clamps Type 34

Dynamic stresses frequently arise in the direction of the pipe axis (e.g. from shock impacts or other forms of excitation). To absorb these loads the special dynamic clamp type 34 was developed.

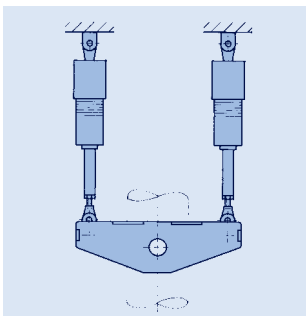
In vertically and horizontally running pipe systems, special clamps are being increasingly used for the defined determination of the pipe system positioning and also for the absorption of dynamic stresses in the direction of the pipe axis. The loads thereby occurring must be distributed via a form-fitting connection to the piping (trunnions). For this purpose LISEGA has developed the dynamic clamp type 34.

Type 34

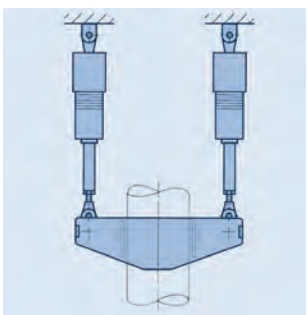


Type 34 as axial stop with spacer

The basis of this design was the long time successful box-frame clamp type 46/48. The load distribution in dynamic clamp type 34 is effected by the use of reinforced cross-beams with weld-on brackets type 35 for connection to the dynamic main products type 30, 32, 39.



Type 34 with snubbers type 30 and twist restraints



Type 34 with rotated trunnion hole and snubber type 30

Design

For the design of the dynamic clamps type 34 the following parameters are required:

- **load (dynamic, static)**
- **pipe system temperature**
- **insulation thickness**
- **span width of the connections**
- **connection size and alignment of weld-on brackets type 35**
- **trunnion sizes**
- **trunnion tolerances**
- **position (horizontal/vertical)**
- **main components connected (type 30, 39, 32)**
- **twist restraint/recess dimensions if required**
- **spacer if required**

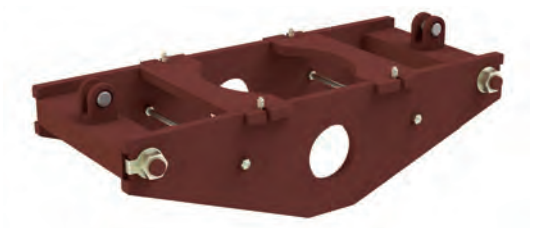
Due to the wide range of possible combinations and design parameters, dynamic clamps type 34 are designed individually on request.

Type 34 with snubbers and position-securing devices

Securing positions

Position securing measures ensure that the clamp cannot angle around the pipe (with the trunnion as pivot). The position-securing device is not dynamically stressed. It is either a recess in the trunnion socket-hole or additional plates.

Type 34 with recesses



Type 34 with additional plates

Horizontal axial stop with rigid struts type 39 and pipe clamp type 34

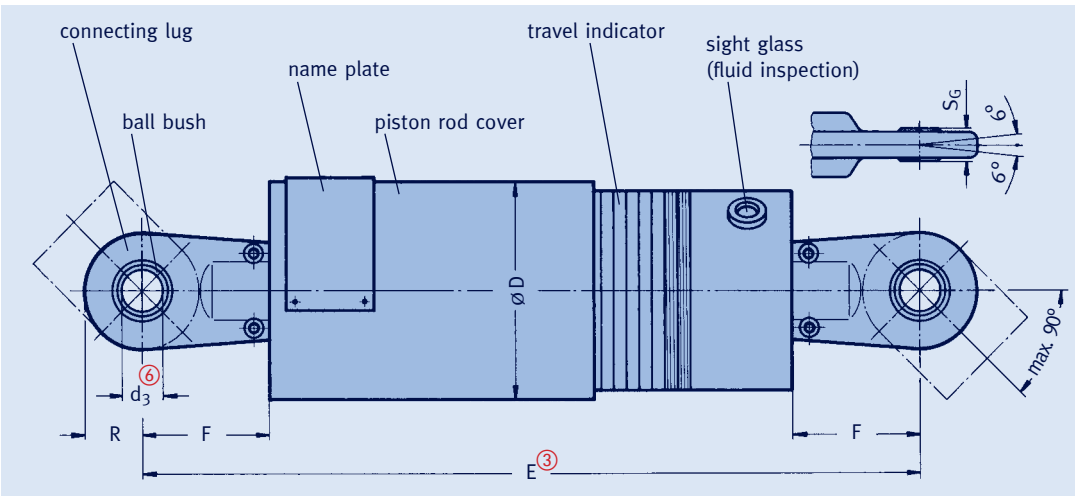
Pipe system secured with snubber type 30 on dynamic clamps type 36

Snubbers Type 30

Snubbers
type 30 18 16 to 30 03 12
Serial standard design.
Delivery from stock.

Only corrosion-resistant materials are used.

The connecting lugs attached by a connection thread (material P250GH, C45E+QT, S355J2, A668Cl. C/F, SA299) are electro galvanized.



type	nom. load [kN] ①	emergency Level C ②	stroke ⑤	ø D	ø d_3 ⑥	E ③ min	E ③ max	F ④	R	S_G	weight [kg]
30 18 16	3	4.0	100	54	10	220	320	18	15	9	1.9
30 38 16	8	10.6	100	70	12	315	415	50	20	10	4.3
30 39 16	8	10.6	200	70	12	410	610	50	20	10	5.7
30 42 16	18	23.9	150	85	15	395	545	58	22.5	12	8.3
30 43 16	18	23.9	300	85	15	545	845	58	22.5	12	12
30 52 13	46	61	150	135	20	445	595	65	30	16	20
30 53 13	46	61	300	135	20	595	895	65	30	16	29
30 62 16	100	141	150	170	30	535	685	100	45	22	37
30 63 16	100	141	300	170	30	685	985	100	45	22	51
30 72 16	200	267	150	200	50	615	765	130	60	35	61
30 73 16	200	267	300	200	50	765	1065	130	60	35	78
30 82 16	350	472	150	270	60	730	880	165	75	44	122
30 83 16	350	472	300	270	60	880	1180	165	75	44	147
30 92 13	550	735	150	300	70	760	910	165	105	49	175
30 93 13	550	735	300	300	70	910	1210	165	105	49	207
30 02 12	1000	1335	150	390	100	935	1085	240	147	70	390
30 03 12	1000	1335	300	390	100	1085	1385	240	147	70	460

① See technical specifications, table: 'permissible loads' (page 0.6) and 'welding of weld-on brackets' (page 3.22).

② Usual design load for earthquakes and similar load cases. See also technical specifications on page 0.6.

③ E_{min} = piston rod retracted
E_{max} = piston rod extended
To bridge greater installation lengths, installation extensions type 33 (page 3.21) can be used.

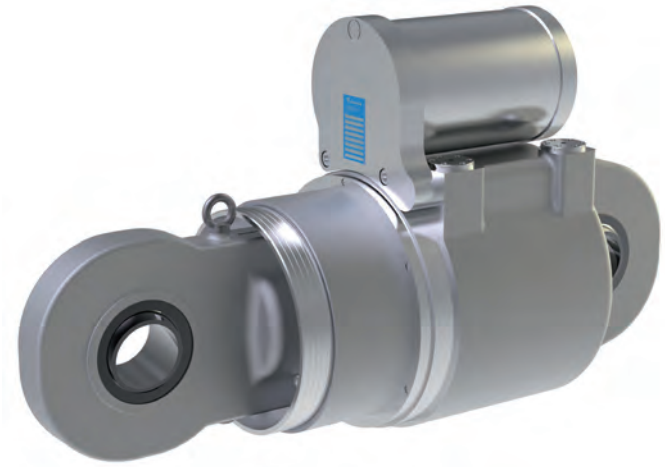
④ On replacement of other makes, the connection dimensions such as pin diameters and lug lengths can be adapted to the connection designs already existing in the plant.

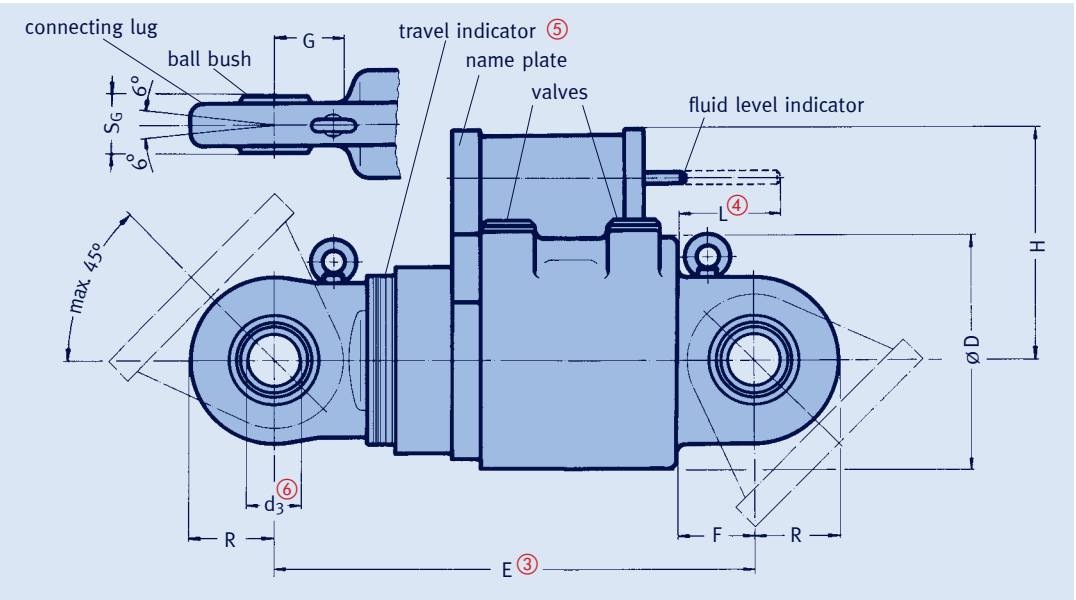
⑤ If required, snubbers with longer strokes can be supplied.

⑥ Connection possibilities: see pin diameters of weld-on bracket type 35 or dynamic clamps in product group 3.

Order details:
snubber type 30 .. ..
with 2 weld-on brackets
type 35 .. ..
marking: ...

Snubbers Type 31





Snubbers type 31 98 16 to 31 58 16

Snubbers type 31 are specially conceived for the absorption of particularly heavy loads. They are mainly used in nuclear power stations to protect steam generators and large pumps. Due to the normally very restricted installation space they are typically custom-built for the given conditions. The table on this page therefore serves as general orientation for initial planning.

The body and connecting lugs are made of high-tensile stainless steel castings.

type	nom. load [kN]①	emergency Level C②	stroke ⑤	ø D	ø d_3 ⑥	E③ min	E③ max	F	G	H	L_{max} ④	R	S_G	weight [kg]
31 98 16	550	735	100	240	70	620	720	95	90	310	115	105	49	152
31 99 16	550	735	200	240	70	735	935	95	90	310	145	105	49	181
31 08 16	1000	1335	100	330	100	765	865	120	110	385	145	140	70	285
31 09 16	1000	1335	200	330	100	880	1080	120	110	385	200	140	70	338
31 28 16	2000	2660	100	440	120	870	970	160	155	450	150	160	85	648
31 38 16	3000	4000	100	540	140	1020	1120	190	180	620	100	200	90	968
31 48 16	4000	5320	100	580	160	1050	1150	205	200	585	255	245	105	1300
31 58 16	5000	6650	100	630	180	1140	1240	230	220	670	205	290	105	1750

Order details:
snubber type 31 .. ..
with 2 weld-on brackets type 35 .. ..
marking: ...

① See technical specifications, table: 'permissible loads' (page 0.6) and 'welding of weld-on brackets' (page 3.22).

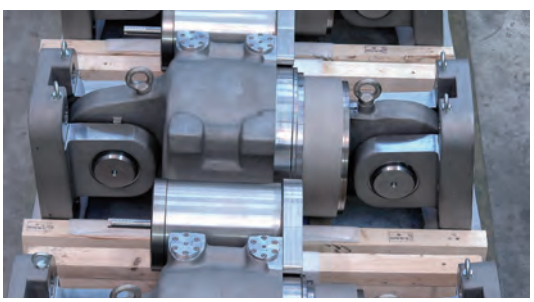
② Usual design load for earthquakes and similar load cases. See also technical specifications on page 0.6.

③ E_{min} = piston rod retracted
E_{max} = piston rod extended.

④ L_{max} at 80°C.

⑤ Design of travel indicator for travel range 8 (100mm stroke).

⑥ Connection possibilities: see pin diameters of weld-on brackets type 35 or dynamic clamps in product group 3.



Snubber type 31 in special configuration

LISEGA snubbers type 31 are fitted with exchangeable valves for in-service tests on site.

Installation extensions Type 33

Installation extensions type 33 18 18 to 33 03 12
Serial standard design.

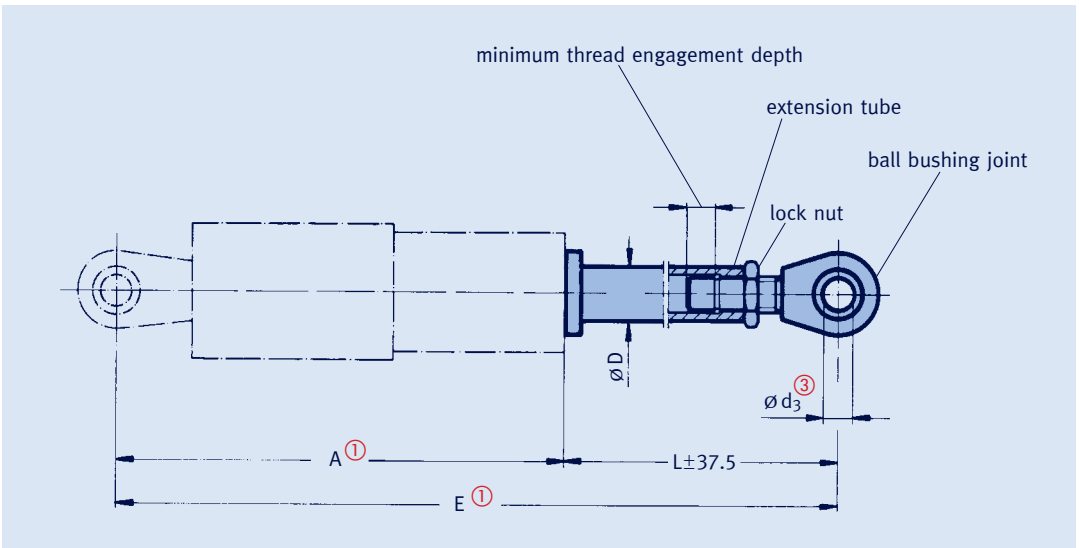
Type 33 installation extensions are used if greater installation lengths are required.

Connection to the snubber or energy absorber is made at the cylinder base. By means of serially-produced screw connections the change over easily be made from standard connecting lugs to installation extensions. This also applies to special connections, which are particularly useful when exchanging other makes, as in this way the connections on site can still be used. Further connection possibilities can be found on page 3.6.

An exceeding of the maximum lateral displacement of ±6° is to avoid.

Material:

tube	P355NH
ball	P250GH
bushing	C45E+QT
joints	S355J2
	42CrMo4+QT



type	nom. load [kN]	snubber stroke	A ①	Ød3 ③	D max	E①② min	E①② max	L±37.5② min	L±37.5② max	weight [kg] Lmin	weight [kg] +per 100mm
33 18 18	3	100	240	10	25	445	760	205	520	0.80	0.39
33 38 18	8	100	315	12	30	515	760	200	445	1.00	0.55
33 39 18	8	200	460	12	30	660	690	200	230	1.00	0.55
33 42 18	18	150	412	15	35	617	1175	205	763	1.60	0.75
33 43 18	18	300	635	15	35	840	930	205	295	1.60	0.75
33 52 13	46	150	455	20	49	720	1405	265	950	3.70	0.73
33 53 13	46	300	680	20	49	945	1180	265	500	3.70	0.73
33 62 18	100	150	510	30	64	780	1900	270	1390	6.00	2.00
33 63 18	100	300	735	30	64	1005	1700	270	965	6.00	2.00
33 72 18	200	150	560	50	83	875	2415	315	1855	12.00	3.20
33 73 18	200	300	785	50	83	1100	2040	315	1255	12.00	3.20
33 82 18	350	150	640	60	102	1030	2400	390	1760	22.50	4.75
33 83 18	350	300	865	60	102	1255	2320	390	1455	22.50	4.75
33 92 13	550	150	670	70	115 127	1155 1671	1670 2870	485 1001	1000 2200	41.00 44.50	5.50 7.20
33 93 13	550	300	895	70	115 127	1380 1696	1695 2795	485 801	800 1900	41.00 44.50	5.50 7.20
33 02 12	1000	150	770	100	160	1415	2300	645	1530	92.00	9.50
33 03 12	1000	300	995	100	160	1640	2325	645	1330	92.00	9.50

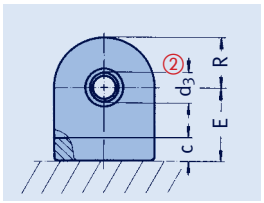
① For middle piston position.

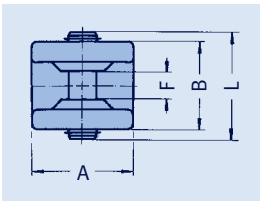
② Installation dimensions larger than 'E' max. possible on load reduction. Smaller 'L' dimensions can also be supplied without adjustment possibility.

③ Connection possibilities: see pin diameters of weld-on brackets type 35 or dynamic clamps in product group 3.

Order details:
installation extension
type 33 .. ..
L = ...mm for
hydr. snubber
or energy absorber

Weld-on brackets Type 35





Weld-on brackets type 35 19 13 to 35 20 19
Serial standard design.

This component is designed for connection of snubbers type 30 and 31, energy absorbers type 32 and for rigid struts type 39, 16, 20 and 27 and provides for attachment to the structure.

The brackets are made of the easily weldable carbon steel S355J2 and the precision-fit stainless steel connecting pins.

Order details:
weld-on bracket
type 35 .. ..

type	nom. load [kN]①	A	B	C	ø$d_3$②	E	F	L	R	weight [kg]
35 19 13	3	25	32	12	10	30	9.5	42	13	0.2
35 29 13	4	25	32	12	10	30	9.5	42	13	0.2
35 39 13	8	30	37	12	12	34	10.5	46	15	0.3
35 49 13	18	35	43	13	15	40	12.5	52	18	0.5
35 59 19	46	54	54	15	20	50	16.5	65	27	1.0
35 69 19	100	90	79	23	30	75	22.5	95	45	3.7
35 79 19	200	110	100	25	50	90	35.5	115	55	7.9
35 89 19	350	150	130	34	60	115	45	160	75	17.0
35 99 11	550	180	230	40	70	155	50	220	80	41.0
35 09 13	1000	390	310	58	100	212	72	305	100	132.0
35 20 19	2000	520	320	65	120	245	87	320	135	215.0

① See technical specifications, table 'permissible loads' (page 0.6) and 'welding of weld-on brackets' (as shown below).

② Fit: H7 f8.

■ **If required, weld-on / bolt-on brackets in larger sizes are suppliable**

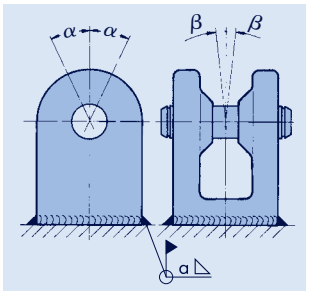
type	a α=15° β= 6°	a α=30° β= 6°	a α=45° β= 6°
35 19 13	3.0	3.0	3.0
35 29 13	3.0	3.0	3.0
35 39 13	3.0	3.0	3.0
35 49 13	3.0	4.0	5.0
35 59 19	5.5	7.0	8.0
35 69 19	7.5	9.5	11.0
35 79 19	10.5	13.5	15.5
35 89 19	14.5	18.0	21.0
35 99 11	15.0	20.0	23.0
35 09 13	14.0	17.0	19.0
35 20 19	23.0	–	–

Weld-on brackets should always be arranged so that the max. angulation results in the direction of the greatest thermal expansion during operation ($\sphericalangle\alpha$). The lateral deflection is restricted to $\pm 6°$ ($\sphericalangle\beta$). Misalignment of the weld-on brackets should be avoided due to the restricted possibility of movement caused.

The minimum weld seam thickness 'a' for weld-on brackets type 35 is dependent on the angulations α and β. In the calculations a permissible stress of 90N/mm² in load case H (level A/B) was assumed.

On increasing the angulation α to 90°, the permissible loads are reduced by approx. 15% on constant weld seam thickness (a at α = 45°).

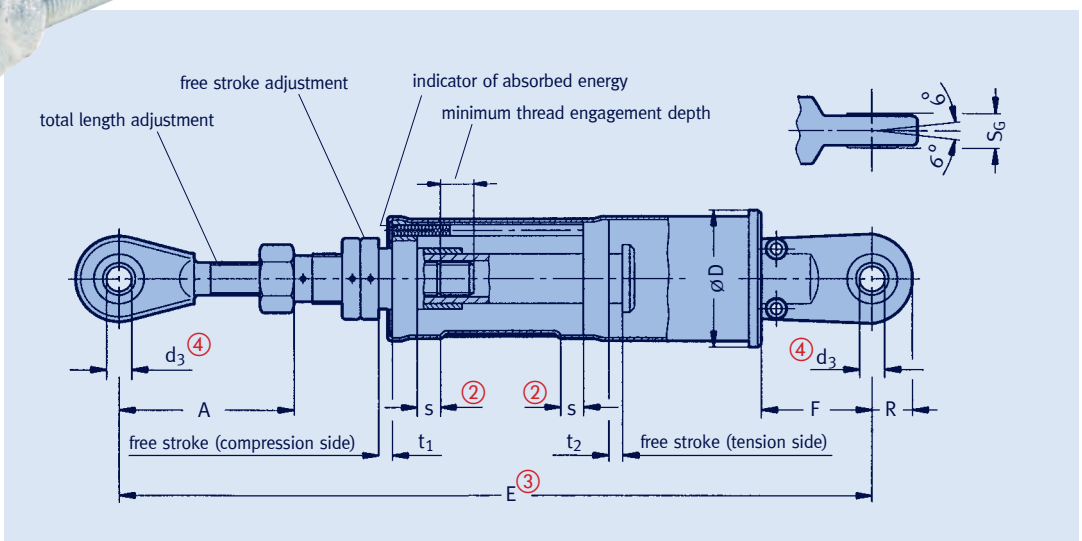
The basis for the permissible loads is provided by the relevant load table (**'technical specifications'**, page 0.6).



Max. angulation type 35

Energy absorber Type 32

Energy absorber
type 32 18 16 to 32 92 16
Serial standard design.



① If the nominal load is exceeded, the increasing force and displacement are transformed into deformation energy.

② Max. deformation travel in compression and tension directions.

③ 'E' dimensions on middle position of the free strokes t_1/t_2 and length adjustment 'A' dimension. If t_2 changes, the 'E' dimension is correspondingly reduced or increased.

④ Connection possibilities: see pin diameters of weld-on brackets Type 35 or dynamic clamps in Product Group 3.

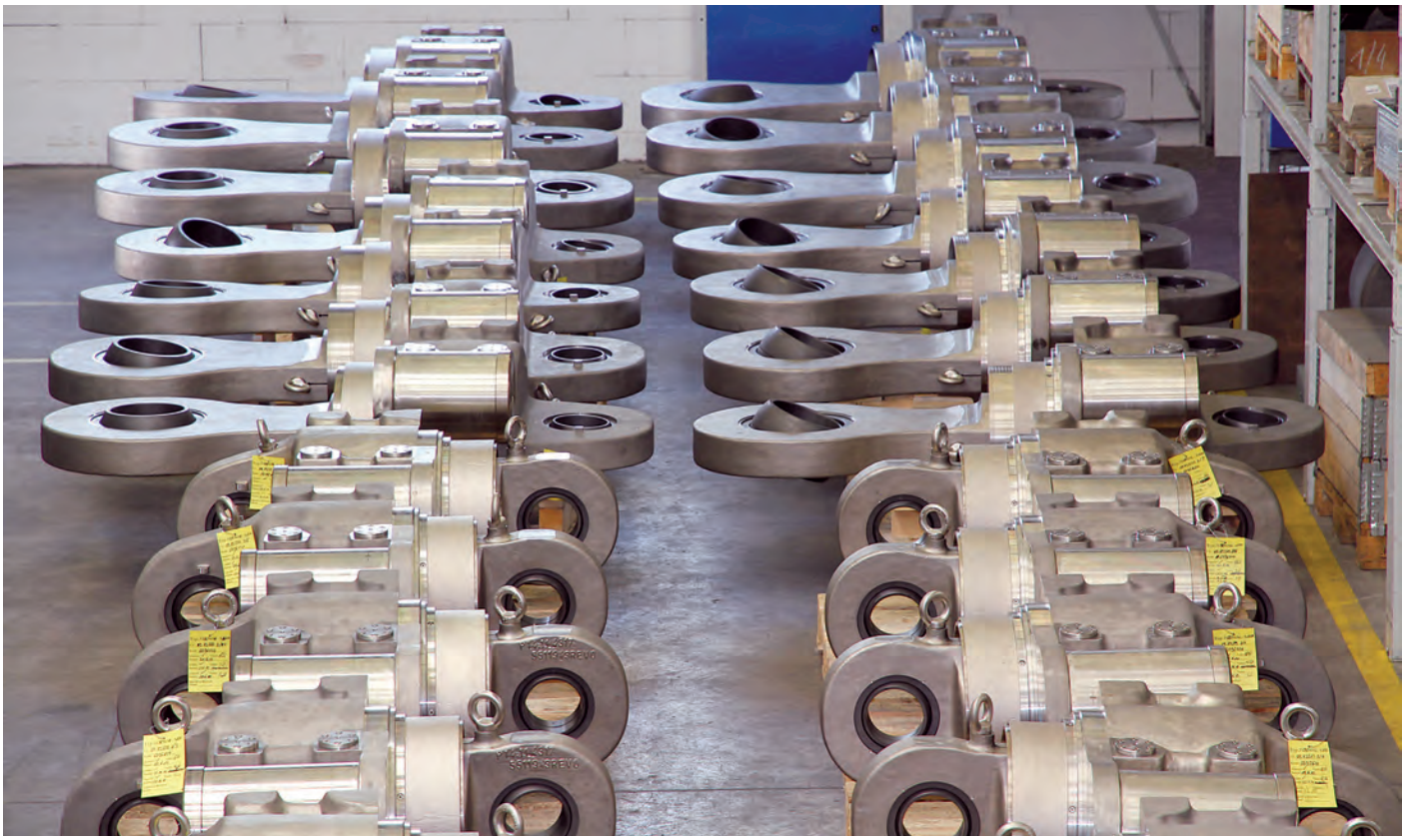
type	nom. load [kN]①	s②	t_1	t_2	ø D	ø d_3 ④	E③	A	F	R	S_G	weight [kg]
32 18 16	3	5.0	0-20	0-20	56	10	300	85 ± 50	18	15	9	0.8
32 38 16	8	5.0	0-22	0-22	60	12	355	95 ± 50	50	20	10	1.8
32 42 16	18	5.0	0-25	0-25	80	15	440	125 ± 75	58	22.5	12	3.6
32 52 16	46	5.0	0-25	0-25	115	20	490	150 ± 75	65	30	16	11.5
32 62 16	100	6.5	0-25	0-25	130	30	575	165 ± 75	100	45	22	18.5
32 72 16	200	9.5	0-28	0-28	195	50	715	175 ± 75	130	60	35	47.0
32 82 16	350	12.5	0-30	0-30	250	60	945	225 ± 75	165	75	44	105.0
32 92 16	550	on request										

Individual application

The standard designs shown in the table above represents only part of the suppliable range. The products can be adapted by LISEGA to the particular requirements of the user.

This applies especially to those cases where loads and strokes exceed standard parameters.

Order details:
energy absorber
type 32 .. 16
t_1 = ...mm, t_2 = ...mm
marking: ...

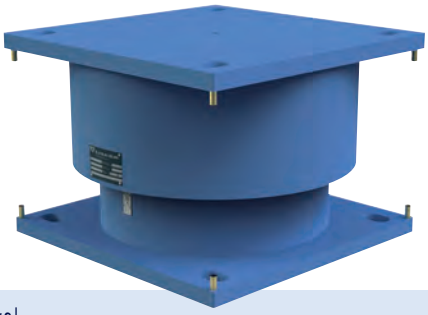


Snubbers type 31 prior to delivery

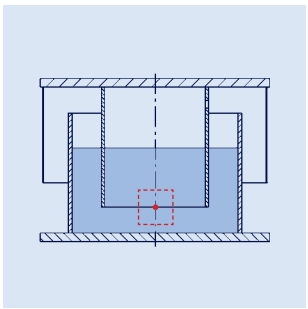
Type 31

Commissioning of type 30

Viscoelastic damper Type 3D .. 44-D



Viscoelastic damper type 3D 03 44-D to 3D H1 44-D



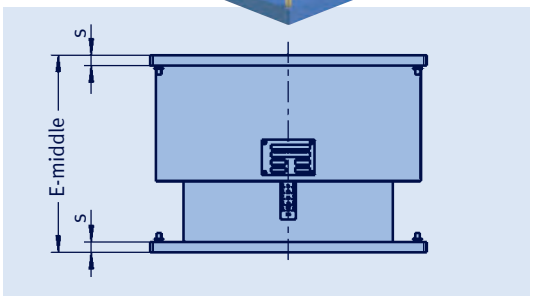
= working range round the mid-position

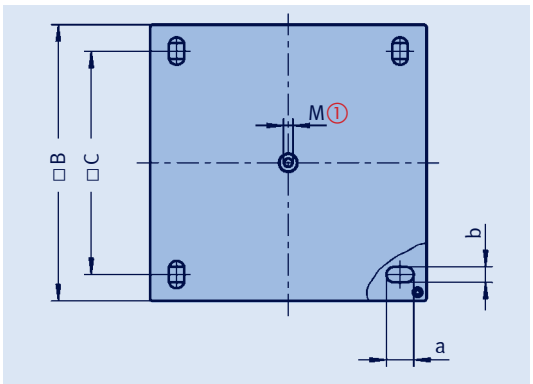
Selection and dimensions

When selecting viscoelastic dampers attention should be paid to the **temperature existing on site**. These dampers are available for application temperatures ranging from 20°C to 80°C, whereby the various damping media cover a temperature range of 10°C in each case. **For this reason the correct selection of application temperature is important.**

The choice of damper size depends on the nominal load. The offset in horizontal and vertical directions must be considered for the cold load position. For LISEGA dampers in the 44-D series this amounts in each case to ± 40mm in horizontal/vertical directions.

The operation of the dampers should be in the center position. In order to achieve the necessary damping resistance, the viscous dampers should not exceed a tolerance of ±20mm from the center position in any operating condition. Before any start-up the dampers require preheating at operating temperature.





Further information about vibration reducing products are to be taken from the product catalogue VICODA.

- **load range: 2.5kN up to 100kN**
- **frequency range: up to 35Hz**
- **temperature range: 20°C up to 80°C (in 10°C stages)**
- **offset (cold position) to mid-position: up to ± 40mm (horizontal/vertical)**

The table values are minimum values at ordered working temperature. At lower temperatures the damping resistance increases. If required, the equivalent stiffness (kN/mm) can be given in vertical and horizontal directions.

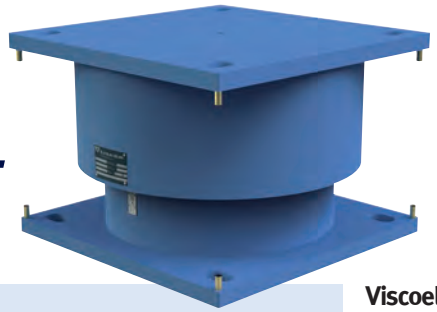
① Inner thread for transport ring screw.

Order details:
viscoelastic damper
type 3D .. 44-D
marking: ...
nominal load: ...kN
offset: ...
x: ...mm, y: ...mm, z: ...mm
operating temperature: ...°C

type	nominal load [kN]	E	□B	□C	s	a	b	M①	weight [kg]
3D 03 44-D	2.5	240	270	215	8	34	14	–	16
3D 05 44-D	5	240	290	230	8	34	14	–	19
3D 10 44-D	10	240	340	270	10	38	18	M16	31
3D 20 44-D	20	280	390	320	12	42	22	M16	51
3D 30 44-D	30	320	440	350	15	46	26	M16	84
3D 40 44-D	40	335	470	380	18	46	26	M16	109
3D 60 44-D	60	350	510	410	20	53	33	M16	149
3D 80 44-D	80	390	535	430	25	59	39	M16	191
3D H1 44-D	100	405	580	460	30	59	39	M16	246

type	nominal load [kN]	vertical damping resistance [kNs/m] 5 [Hz]	10 [Hz]	15 [Hz]	20 [Hz]	25 [Hz]	30 [Hz]	35 [Hz]	horizontal damping resistance [kNs/m] 5 [Hz]	10 [Hz]	15 [Hz]	20 [Hz]	25 [Hz]	30 [Hz]	35 [Hz]
3D 03 44-D	2.5	15.7	12.0	10.2	9.1	8.3	7.7	7.3	14.0	10.8	8.6	7.0	6.0	5.4	5.1
3D 05 44-D	5	27.8	21.1	18.0	16.0	14.7	13.7	12.9	23.7	18.3	14.6	12.0	10.2	9.1	8.6
3D 10 44-D	10	47.3	36.0	30.7	27.4	25.0	23.3	21.9	37.4	28.8	22.9	18.9	16.1	14.4	13.6
3D 20 44-D	20	89.3	67.9	57.9	51.6	47.3	44.0	41.4	94.0	72.5	57.8	47.5	40.6	36.3	34.2
3D 30 44-D	30	143.9	109.4	93.2	83.2	76.2	70.9	66.7	148.7	114.5	91.5	75.1	64.2	57.4	54.1
3D 40 44-D	40	162.7	123.7	105.4	94.1	86.1	80.1	75.4	229.9	177.1	141.2	116.2	99.2	88.7	83.6
3D 60 44-D	60	189.4	144.0	122.7	109.5	100.3	93.3	87.8	293.0	225.8	180.0	148.1	126.5	113.1	106.6
3D 80 44-D	80	229.9	174.8	148.9	132.9	121.7	113.2	106.5	367.3	283.0	225.6	185.6	158.5	141.8	133.7
3D H1 44-D	100	340.2	258.7	220.4	196.7	180.1	167.6	157.7	554.1	427.0	340.4	280.0	239.2	214.0	201.7

Viscoelastic dampers Type 3D .. 33-L, 3D .. 55-L



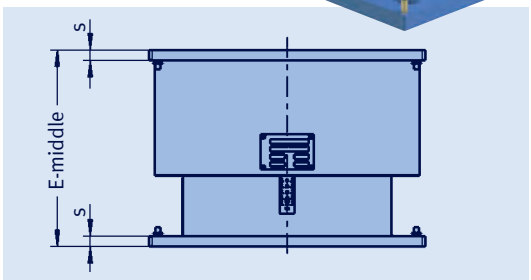
Selection and dimensions

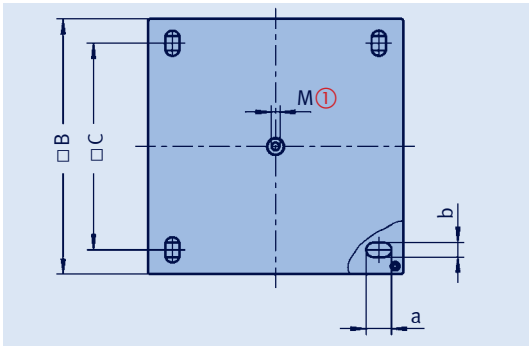
When selecting viscoelastic dampers the **temperature on site** is important. Series 3D .. ..-L is designed for use in a temperature range from -10°C up to +40°C. In this temperature range the damper functions with relatively constant characteristics. The values were determined for a temperature of 20°C.

The choice of damper size depends on the nominal load. The offset in horizontal and vertical directions must be taken into account for the cold load position. For LISEGA dampers in the 33-L and 55-L series it amounts to ± 30mm and ± 50mm respectively in horizontal / vertical directions.

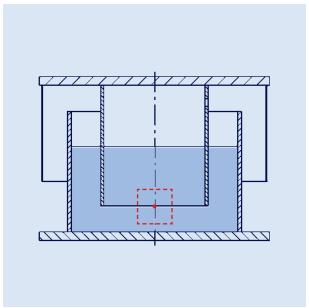
The operation of the dampers should be in the center position. In order to achieve the necessary damping resistance, the viscous dampers should not exceed a tolerance of ±20mm from the center position in any operating condition. The dampers do not need to be preheated to operating temperature before start-up.

The table values are minimum values at 20°C. At lower temperatures the damping resistance increases. If required, the equivalent stiffness (kN/mm) can be given in vertical and horizontal directions.





Viscoelastic dampers type 3D 05 33-L to 3D 50 55-L



· = working range round the mid-position

- **load range: 2.5kN up to 50kN**
- **frequency range: up to 35Hz**
- **temperature range: – 10°C up to + 40°C**
- **offset (cold position) to mid-position: up to ± 30mm (type 3D .. 33-L) up to ± 50mm (type 3D .. 55-L) (horizontal/vertical)**

Further information about vibration reducing products are to be taken from the product catalogue VICODA.

① Inner thread for transport ring bolt

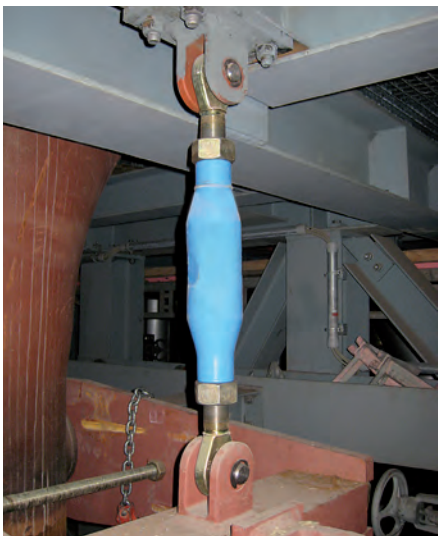
type	nominal load [kN]	E	□B	□C	s	a	b	M①	weight [kg]
3D 05 33-L	5	270	260	195	10	38	18	M16	21
3D 10 33-L	10	270	295	230	10	38	18	M16	30
3D 15 33-L	15	280	335	265	15	42	22	M16	48
3D 25 33-L	25	290	425	340	20	46	26	M16	106
3D 40 33-L	40	300	540	440	25	53	33	M16	193
3D 50 33-L	50	380	590	480	30	59	39	M16	288

type	nominal load [kN]	E	□B	□C	s	a	b	M①	weight [kg]
3D 05 55-L	5	390	325	260	10	38	18	M16	39
3D 10 55-L	10	390	360	290	10	42	22	M16	49
3D 15 55-L	15	410	420	345	20	46	26	M16	107
3D 25 55-L	25	410	525	420	20	46	26	M16	158
3D 40 55-L	40	490	590	470	25	53	33	M16	282
3D 50 55-L	50	500	730	590	30	59	39	M16	489

Order details:
viscoelastic damper
type 3D .. ..–L
marking: ...
nominal load: ...kN
offset: ...
x: ...mm, y: ...mm z: ...mm
operating temperature: ...°C

type	nominal load [kN]	vertical damping resistance [kNs/m] 5 [Hz]	10 [Hz]	15 [Hz]	20 [Hz]	25 [Hz]	30 [Hz]	35 [Hz]	horizontal damping resistance [kNs/m] 5 [Hz]	10 [Hz]	15 [Hz]	20 [Hz]	25 [Hz]	30 [Hz]	35 [Hz]
3D 05 ..-L	5	9.6	7.3	6.3	5.6	5.1	4.8	4.5	11.0	8.2	7.0	6.2	5.6	5.2	4.9
3D 10 ..-L	10	18.6	14.1	12.1	10.8	9.9	9.2	8.7	22.8	17.1	14.5	12.9	11.8	10.9	10.2
3D 15 ..-L	15	28.2	21.5	18.4	16.4	15.1	14.0	13.2	38.9	29.3	24.8	22.0	20.1	18.6	17.5
3D 25 ..-L	25	52.2	39.8	34.0	30.4	27.8	25.9	24.4	95.0	71.5	60.5	53.8	49.1	45.5	42.8
3D 40 ..-L	40	98.0	74.8	63.8	57.0	52.3	48.7	45.8	206.4	155.3	131.5	116.9	106.7	99.0	92.9
3D 50 ..-L	50	166.0	126.7	108.1	96.7	88.6	82.5	77.7	416.4	313.4	265.4	235.9	215.2	199.7	187.5

Rigid struts Type 39



Selection

When selecting rigid struts from the below tables, these points must be noted:

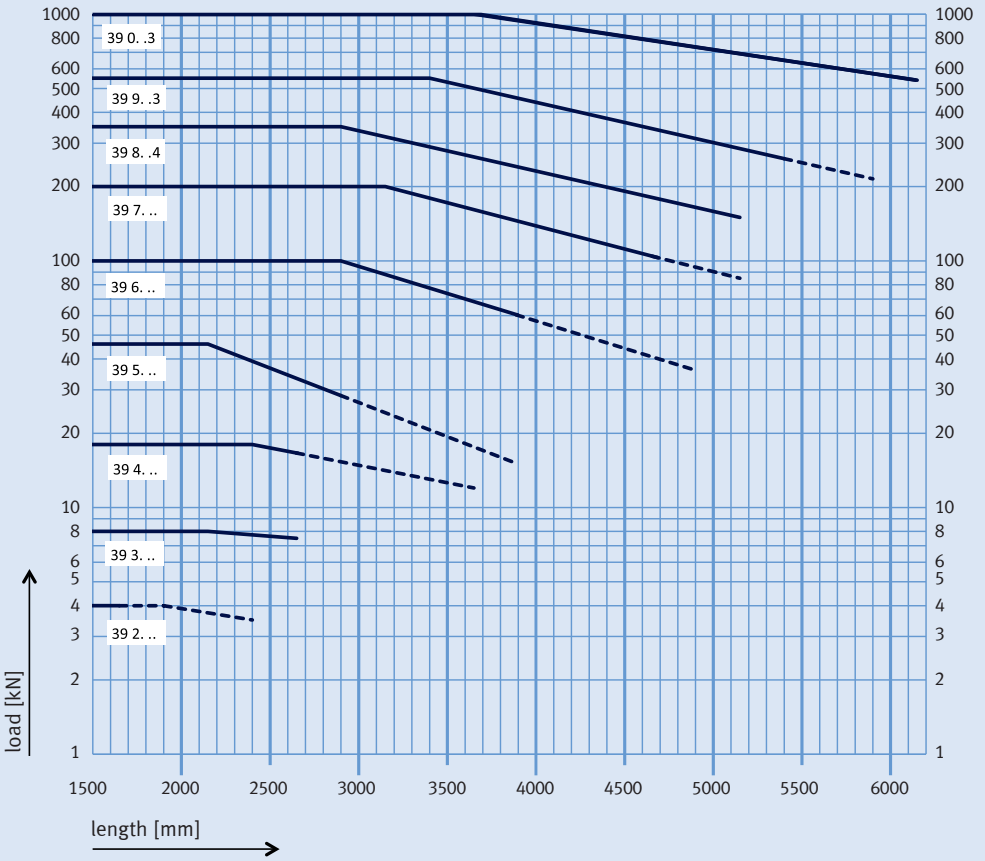
1. The specified operating load must be covered by the nominal load.
2. The load group is determined at the same time by the nominal load.
3. The adjustment range available for the rigid struts is given for the specified installation length.
4. The weight is specified at the intersection between load group and adjustment range. If the intersection lies below the red boundary line, it is a matter of an extended length with reduced load that must be checked in the diagram on page 3.28 for agreement with the specified operating load.
5. When ordering, the type designation is to be completed at the 3rd digit by entering the load group number.

Permissible loads and weights

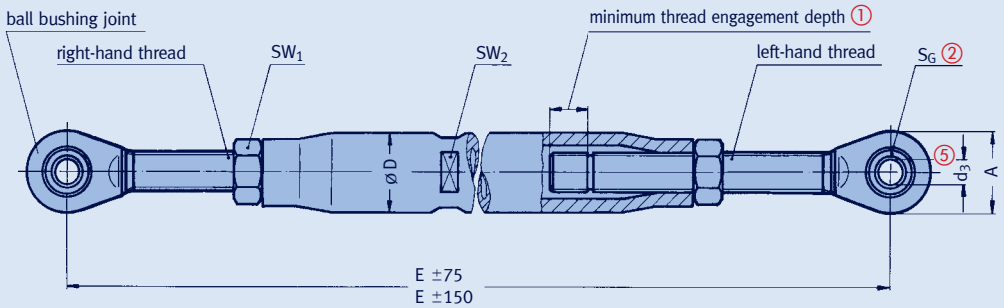
			nominal load [kN]										nominal load [kN]	
			4	8	18	46	100	200	350				550	1000
			load group ①										load group ①	
type ①	adjustment range	'E' middle	2	3	4	5	6	7	8	type	adjustment range	'E' middle	9	0
			weight [kg]										weight [kg]	
39 .0 32	300 - 450	375	1.4	2.1	2.3					39 .0 83	800 - 950	875	71	
39 .0 42	400 - 550	475	1.9	2.8	3.0	7.0	7.6			39 .0 93	900 - 1050	975	77	162
39 .0 52	500 - 650	575	2.3	3.5	3.7	8.5	9.1	15.9		39 .1 03	1000 - 1150	1075	82	172
39 .0 74	600 - 900	750	2.4	3.4	4.9	8.8	13	22		39 .1 13	1100 - 1250	1175		182
39 .0 84	750 - 900	825							40	39 .1 23	1200 - 1350	1275		192
39 .1 04	850 - 1150	1000	3.3	4.5	6.5	11	17	28	47	39 .1 33	1300 - 1450	1375		231
39 .1 24	1100 - 1400	1250	4.1	5.5	8.0	13	21	34	57	39 .1 23	1100 - 1400	1250	88	
39 .1 54	1350 - 1650	1500	4.9	6.6	10	14	25	40	67	39 .1 53	1350 - 1650	1500	121	247
39 .1 74	1600 - 1900	1750	(5.8)	7.6	11	16	29	46	77	39 .1 73	1600 - 1900	1750	139	270
39 .2 04	1850 - 2150	2000	(6.6)	12.5	13	18	33	52	86	39 .2 03	1850 - 2150	2000	157	294
39 .2 24	2100 - 2400	2250	(7.4)	14.1	15	20	37	58	96	39 .2 23	2100 - 2400	2250	175	350
39 .2 54	2350 - 2650	2500		15.7	16	22	41	65	106	39 .2 53	2350 - 2650	2500	193	379
39 .2 74	2600 - 2900	2750			(18)	24	45	71	115	39 .2 73	2600 - 2900	2750	211	409
39 .3 04	2850 - 3150	3000			(19)	(26)	49	77	125	39 .3 03	2850 - 3150	3000	229	438
39 .3 24	3100 - 3400	3250			(21)	(28)	53	83	135	39 .3 23	3100 - 3400	3250	247	467
39 .3 54	3350 - 3650	3500			(23)	(30)	57	89	144	39 .3 53	3350 - 3650	3500	265	497
39 .3 74	3600 - 3900	3750				(31)	61	95	154	39 .3 73	3600 - 3900	3750	283	526
39 .4 04	3850 - 4150	4000					(65)	101	164	39 .4 03	3850 - 4150	4000	301	555
39 .4 24	4100 - 4400	4250					(69)	107	174	39 .4 23	4100 - 4400	4250	319	585
39 .4 54	4350 - 4650	4500					(73)	113	183	39 .4 53	4350 - 4650	4500	337	614
39 .4 74	4600 - 4900	4750					(77)	(119)	193	39 .4 73	4600 - 4900	4750	355	644
39 .5 04	4850 - 5150	5000						(126)	203	39 .5 03	4850 - 5150	5000	372	673
										39 .5 23	5100 - 5400	5250	390	702
reduced loads for overlength (below red line) see diagram on page 3.28										39 .5 53	5350 - 5650	5500	(408)	732
slenderness ratio λ ≤ 150, for greater lengths the slenderness ratio can range between										39 .5 73	5600 - 5900	5750	(426)	761
150 and 200; the weight of these rigid struts is given in brackets.										39 .6 03	5850 - 6150	6000		790

① The type designation is to be completed in the 3rd digit with the load group.

Load diagram for extended lengths



doted line: slenderness ratio: $150 \leq \lambda \leq 200$



type ③	nom. load [kN]	A	ø D	ø d3 ⑤	E ④ min	E max	SW1	SW2	SG ②
39 2. ..	4	30	(30) 38	10	300	1900	27	(27) 32	9
39 3. ..	8	38	(38/40) 43/57	12	300	2150	32	(32) 36/46	10
39 4. ..	18	45	(38/40) 57	15	300	2400	36	(32) 46	12
39 5. ..	46	60	(57/60) 61	20	400	2150	60	50	16
39 6. ..	100	82	(57/60) 83	30	400	2900	60	(50) 70	22
39 7. ..	200	120	(70/75) 102	50	500	3150	70/75	(60) 85	35
39 8. .4	350	150	115	60	750	2900	95	100	44
39 9. .3	550	210	115/127	70	800	3400	110	100/110	49
39 0. .3	1000	293	159/169	100	1000	3650	155	135/145	70

Rigid struts
type 39 20 32 to 39 06 03

The diagram on the left shows the reduced load values against nominal load that must be taken into account for extended lengths.

Material:

body	P235GH
	P355NH
ball	P250GH
bushing	C45E+QT
joint	S355J2
	42CrMo4+QT

An exceeding of the maximum lateral displacement of ±6° is to avoid.

① Minimum thread engagement depth on the ball bushing joint marked by an undercut.

② Ball bushing width.

③ The type designation is to be completed by the length index (4th and 5th or 4th to 6th digits in the type designation, page 3.27).

④ Due to their design, the rigid struts have freely variable adjustment, with right-hand / left-hand threads, similar to a turnbuckle. Shorter installation lengths for rigid struts are possible as special designs.

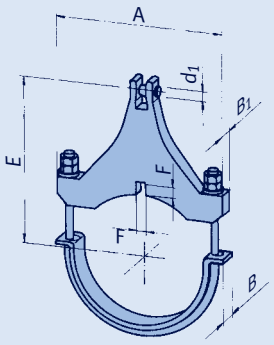
⑤ Connection possibilities: see pin diameters of weld-on brackets type 35 or dynamic clamps type 36 / 37 in product group 3.

(...) Values in brackets: up to E_{max} = 650mm.

Depending on load group and length the rigid struts are subject to alternative manufacturing technologies which may result in designs different to the shown.

Order details:
rigid strut type 39 .. ..

Dynamic clamps
Selection overview OD 33.7 – OD 88.9

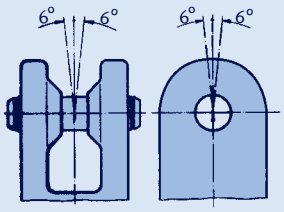


type 36 .. .1

① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).



load angle ≤ 6°

OD 33.7 (ND 25)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 03 11	4.0	4.0	4.0								10	110	75	50	20	9	2	0.9
36 03 21			4.0	4.0	4.0						10	155	75	50	20	9	2	1.1
36 03 31					4.0	4.0	4.0	3.2			10	160	75	50	20	9	2	1.1
36 03 41								4.0	3.2	2.4	10	160	75	50	20	9	2	1.1

OD 42.4 (ND 32)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 04 11	8.0	8.0	8.0								12	130	85	50	20	9	3	1.2
36 04 21			7.2	6.3	5.8						12	175	85	50	20	9	3	1.4
36 04 31					4.0	4.0	4.0	3.1			10	175	85	50	20	9	2	1.3
36 04 41								4.0	3.3	2.5	10	175	85	50	20	9	2	1.3

OD 48.3 (ND 40)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 05 11	8.0	8.0	7.9								12	130	90	50	20	9	3	1.2
36 05 21			7.2	6.3	5.9						12	175	90	50	20	9	3	1.5
36 05 31					4.0	4.0	4.0	3.2			10	175	90	50	20	9	2	1.4
36 05 41								4.0	3.2	2.4	10	175	90	50	20	9	2	1.4

OD 60.3 (ND 50)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 06 11	16	15	12								15	150	110	50	25	9	4	1.9
36 06 21			8.0	8.0	8.0						12	190	110	50	25	9	3	2.2
36 06 31					8.0	8.0	7.9	5.1			12	195	110	50	25	9	3	2.2
36 06 41								6.5	5.3	3.8	12	195	110	50	25	9	3	2.2

OD 73.0 (ND 65)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 07 11	16	14	13								15	160	120	50	25	9	4	2.2
36 07 21			8.0	8.0	8.0						12	210	120	50	25	9	3	2.7
36 07 31					8.0	8.0	7.6	4.9			12	215	120	50	25	9	3	2.6
36 07 41								6.3	5.1	3.8	12	215	120	50	25	9	3	2.6

OD 76.1 (ND 65)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 08 11	16	14	13								15	160	125	50	25	9	4	2.2
36 08 21			8.0	8.0	8.0						12	210	125	50	25	9	3	2.7
36 08 31					8.0	8.0	7.6	4.9			12	215	125	50	25	9	3	2.7
36 08 41								6.3	5.1	3.8	12	215	125	50	25	9	3	2.7

OD 88.9 (ND 80)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 09 11	27	24	22								20	185	150	50	30	11	5	3.8
36 09 21			18	18	18						15	230	150	50	30	11	4	4.4
36 09 31					17	17	15	9.8			15	235	150	50	30	11	4	4.3
36 09 41								12	10	7.2	15	235	150	50	30	11	4	4.3

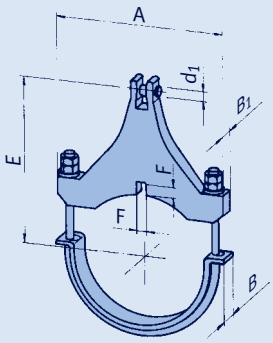
Dynamic clamps
Selection overview OD 108.0 – OD 159.0

OD 108.0 (ND 100)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 10 11	32	29	26								20	205	165	50	35	11	5	5.0
36 10 21			18	18	18						15	265	165	50	35	11	4	6.2
36 10 31					16	16	14	9.1			15	270	165	50	30	11	4	5.3
36 10 41								11	9.3	6.8	15	270	165	50	30	11	4	5.3

OD 114.3 (ND 100)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 11 11	31	29	26								20	210	175	50	35	11	5	5.1
36 11 21			18	18	18						15	270	175	50	35	11	4	6.5
36 11 24	46	46	46	46	42						20	280	175	100	60	13	5	12.3
36 11 31					16	16	13	9.0			15	280	175	50	30	11	4	5.5
36 11 34					41	41	35	22			20	290	175	100	60	13	5	12.4
36 11 41								11	9.1	6.8	15	280	175	50	30	11	4	5.6
36 11 44								28	21	14	20	290	175	100	60	13	5	12.4



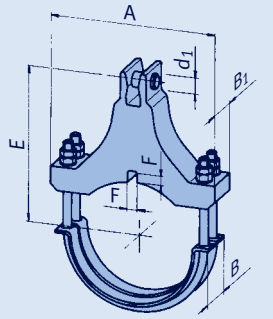
type 36 .. .1

OD 133.0 (ND 125)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 13 11	31	28	26								20	225	190	50	35	11	5	5.8
36 13 21			18	18	17						15	275	190	50	30	11	4	6.3
36 13 24	46	46	46	46	43						20	285	190	100	60	13	5	13.5
36 13 31					16	16	13	9.1			15	285	190	50	30	11	4	6.1
36 13 34					42	41	35	22			20	295	190	100	60	13	5	13.7
36 13 41								11	8.5	6.5	15	285	190	50	30	11	4	6.1
36 13 44								29	23	16	20	295	190	100	60	13	5	13.7

OD 139.7 (ND 125)

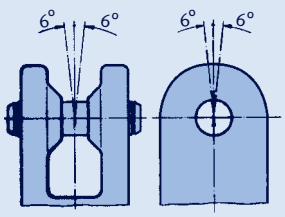
type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 14 11	31	28	26								20	230	200	50	35	11	5	6.1
36 14 21			18	18	16						15	285	200	50	30	11	4	6.7
36 14 24	60	55	50	43	40						30	320	200	100	60	13	6	16.9
36 14 31					16	16	13	8.9			15	295	200	50	30	11	4	6.4
36 14 34			46	45	41	40	34	22			20	305	200	100	60	13	5	14.5
36 14 41								11	8.5	6.5	15	295	200	50	30	11	4	6.4
36 14 44								29	23	16	20	305	200	100	60	13	5	14.5



type 36 .. .4

OD 159.0 (ND 150)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 16 11	30	28	25								20	245	220	50	35	11	5	6.8
36 16 21			18	18	16						15	300	220	50	30	11	4	7.5
36 16 24	59	54	49	43	40						30	335	220	100	60	13	6	18.7
36 16 31					16	15	13	8.8			15	310	220	50	30	11	4	7.2
36 16 34			46	44	41	40	34	22			20	320	220	100	60	13	5	16.2
36 16 41								11	8.8	6.7	15	310	220	50	30	11	4	7.2
36 16 44								28	23	17	20	320	220	100	60	13	5	16.2



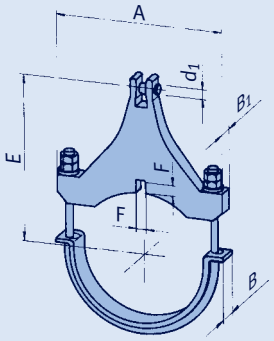
load angle ≤ 6°

① Calculation of intermediate values: linear interpolation.

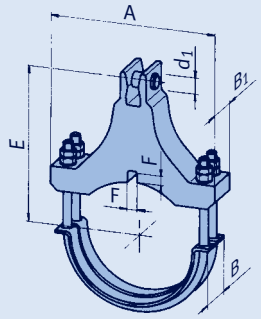
② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).

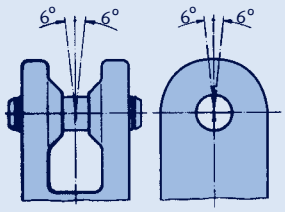
Dynamic clamps
Selection overview OD 168.3 – OD 219.1



type 36 .. .1/2



type 36 .. .4



load angle ≤ 6°

OD 168.3 (ND 150)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 17 11	29	26	24								20	270	230	50	35	11	5	7.7
36 17 12	50	46	36								30	270	240	50	45	11	6	11.4
36 17 21			18	17	16						15	315	230	50	30	11	4	8.1
36 17 22			35	29	28						20	315	240	50	40	11	5	11.0
36 17 24	59	54	49	43	40						30	340	230	100	60	13	6	19.5
36 17 31					16	15	13	8.6			15	320	230	50	30	11	4	7.7
36 17 32					18	18	18	14			15	320	240	50	40	11	4	10.4
36 17 34	100	95	87	76	70	69	58	38			30	345	240	100	80	16	6	26.8
36 17 41								11	9	6.8	15	320	230	50	30	11	4	7.7
36 17 42								16	13	9.8	15	320	240	50	40	11	4	10.4
36 17 44								49	40	29	30	345	240	100	80	16	6	26.9

OD 193.7 (ND 175)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 19 11	50	46	41								30	285	265	50	45	11	6	12.7
36 19 12	65	59	54								30	285	275	50	45	13	6	14.1
36 19 21			33	29	27						20	355	265	50	40	11	5	13.3
36 19 22			52	45	42						30	355	275	50	45	13	6	18.0
36 19 24	100	95	87	76	70						30	355	265	100	80	13	6	29.8
36 19 31					18	18	18	14			15	350	265	50	40	11	4	12.3
36 19 32					39	39	34	23			20	350	275	50	45	13	5	15.5
36 19 34					68	67	57	37			30	375	265	100	80	16	6	31.1
36 19 41								17	13	10	15	350	265	50	40	11	4	12.4
36 19 42								25	20	15	20	350	275	50	45	13	5	15.5
36 19 44								47	38	29	30	375	265	100	80	16	6	31.1

OD 219.1 (ND 200)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 22 11	49	45	41								30	310	290	50	45	11	6	14.4
36 22 12	65	59	55								30	310	300	50	45	13	6	16.0
36 22 21			32	28	26						20	385	290	50	40	11	5	14.2
36 22 22			50	44	41						30	385	300	50	45	13	6	20.2
36 22 24	100	93	85	74	68						30	385	290	100	80	13	6	34.1
36 22 31					18	18	18	14			15	370	290	50	40	11	4	12.3
36 22 32					40	40	35	22			20	370	300	50	45	13	5	16.4
36 22 34					67	66	56	36			30	395	290	100	80	16	6	34.7
36 22 41								17	13	10	15	370	290	50	40	11	4	12.3
36 22 42								26	20	15	20	370	300	50	45	13	5	16.4
36 22 44								47	38	28	30	395	290	100	80	16	6	34.7

① Calculation of intermediate values: linear interpolation.

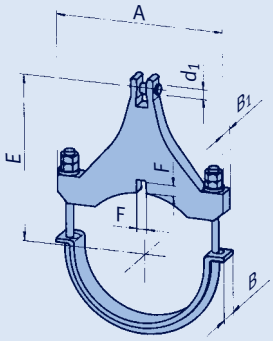
② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).

Dynamic clamps
Selection overview OD 244.5 – OD 273.0

OD 244.5 (ND 225)

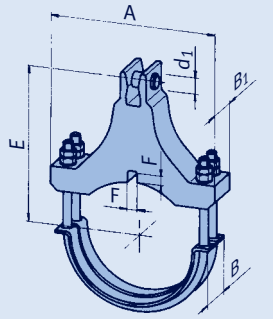
type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 24 11	49	45	41								30	320	315	50	45	11	6	15.3
36 24 12	65	59	53								30	320	330	50	45	13	6	17.0
36 24 21			32	28	26						20	400	315	50	40	11	5	15.3
36 24 22			50	44	40						30	400	330	50	45	13	6	21.6
36 24 24	100	92	85	74	68						30	400	315	100	80	13	6	36.0
36 24 25	149	137	125	109	100						50	415	330	100	90	16	7	49.2
36 24 31					18	18	18	14			15	395	315	50	40	11	4	13.7
36 24 32					37	37	33	22			20	395	330	50	45	13	5	17.9
36 24 34					63	62	55	36			30	420	315	100	80	16	6	36.6
36 24 35					95	93	83	54			30	420	330	100	90	16	6	44.3
36 24 41								18	14	10	15	395	315	50	40	11	4	13.7
36 24 42								24	18	13	20	395	330	50	45	13	5	17.9
36 24 44								44	34	26	30	420	315	100	80	16	6	36.6
36 24 45								66	52	38	30	420	330	100	90	16	6	44.3



type 36 .. .1/2

OD 267.0 (ND 250)

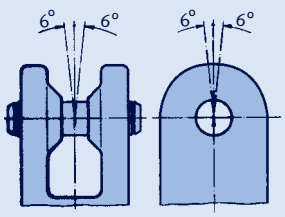
type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 26 11	49	44	41								30	335	340	50	45	11	6	16.5
36 26 12	65	59	54								30	335	350	50	45	13	6	18.2
36 26 21			32	28	26						20	410	340	50	40	11	5	16.0
36 26 22			50	44	40						30	410	350	50	45	13	6	22.2
36 26 24	100	93	85	74	68						30	410	340	100	80	13	6	37.3
36 26 25	150	137	125	109	101						50	425	350	100	90	16	7	51.0
36 26 31					18	18	18	14			15	410	340	50	40	11	4	14.4
36 26 32					38	38	34	22			20	410	350	50	45	13	5	18.8
36 26 34					66	64	55	35			30	435	340	100	80	16	6	38.3
36 26 35					97	96	83	54			30	435	350	100	90	16	6	46.5
36 26 41								18	14	11	15	410	340	50	40	11	4	14.4
36 26 42								25	19	15	20	410	350	50	45	13	5	18.9
36 26 44								46	36	27	30	435	340	100	80	16	6	38.3
36 26 45								68	53	40	30	435	350	100	90	16	6	46.5



type 36 .. .4/5

OD 273.0 (ND 250)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 27 11	48	44	40								30	345	345	50	45	11	6	17.2
36 27 12	65	59	54								30	345	355	50	45	13	6	18.9
36 27 14	110	101	88								50	360	345	100	80	13	7	34.9
36 27 15	165	151	130								50	360	355	100	90	16	7	42.4
36 27 21			32	27	25						20	420	345	50	40	11	5	16.5
36 27 22			50	43	40						30	420	355	50	45	13	6	22.8
36 27 24			84	73	67						30	420	345	100	80	13	6	38.4
36 27 25			124	108	100						50	435	355	100	90	16	7	52.5
36 27 31					18	18	18	13			15	435	345	50	40	11	4	15.4
36 27 32					37	37	32	21			20	435	355	50	45	13	5	20.1
36 27 34					63	62	53	34			30	460	345	100	80	16	6	41.5
36 27 35					95	94	81	52			30	460	355	100	90	16	6	49.5
36 27 41								17	14	10	15	435	345	50	40	11	4	15.4
36 27 42								24	18	13	20	435	355	50	45	13	5	20.1
36 27 44								44	36	27	30	460	345	100	80	16	6	41.5
36 27 45								67	52	38	30	460	355	100	90	16	6	49.5



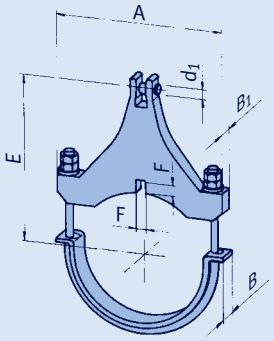
load angle ≤ 6°

① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).

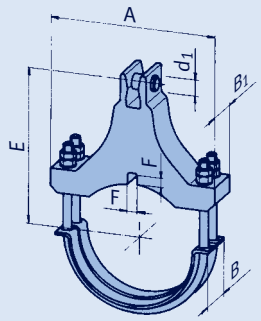
Dynamic clamps
Selection overview OD 323.9 – OD 355.6



type 36 .. .1/2/3

OD 323.9 (ND 300)

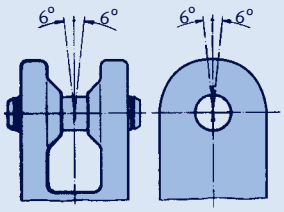
type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load ② gr.	wt. [kg]
36 32 11	44	40	37								20	380	400	60	40	11	5	20
36 32 12	65	59	56								30	380	415	60	45	13	6	24
36 32 13	100	100	88								30	380	430	60	60	13	6	34
36 32 14	163	149	137								50	395	415	120	90	16	7	52
36 32 15	200	200	177								50	395	430	120	120	16	7	72
36 32 21			31	27	25						20	450	400	60	40	11	5	21
36 32 22			49	43	40						30	450	415	60	45	13	6	28
36 32 23			88	73	69						30	450	430	60	60	13	6	38
36 32 24			123	107	99						50	465	415	120	90	16	7	61
36 32 25			186	172	165						50	465	430	120	120	21	7	86
36 32 31					18	18	18	13			15	450	400	60	40	11	4	20
36 32 32					38	38	32	21			20	470	415	60	45	13	5	25
36 32 33					71	70	59	38			30	470	430	60	60	13	6	39
36 32 34					98	97	82	53			30	470	415	120	90	16	6	56
36 32 35					157	155	145	94			50	485	430	120	120	21	7	85
36 32 41								17	14	11	15	450	400	60	40	11	4	19
36 32 42								25	19	15	20	470	415	60	45	13	5	25
36 32 43								48	37	27	30	470	430	60	60	13	6	39
36 32 44								69	56	42	30	470	415	120	90	16	6	56
36 32 45								117	91	71	50	485	430	120	120	21	7	85



type 36 .. .4/5

OD 355.6 (ND 350)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load ② gr.	wt. [kg]
36 36 11	44	40	37								20	395	435	60	40	11	5	22
36 36 12	65	59	56								30	395	445	60	45	13	6	26
36 36 13	100	100	96								30	395	465	60	60	13	6	36
36 36 14	165	151	138								50	410	445	120	90	16	7	56
36 36 15	200	200	193								50	410	465	120	120	16	7	77
36 36 21			30	26	24						20	480	435	60	40	11	5	22
36 36 22			48	42	39						30	480	445	60	45	13	6	30
36 36 23			89	74	71						30	480	465	60	60	13	6	42
36 36 24			121	105	97						50	495	445	120	90	16	7	66
36 36 25			186	172	165						50	495	465	120	120	21	7	93
36 36 31					18	18	18	13			15	475	435	60	40	11	4	21
36 36 32					38	37	31	20			20	495	445	60	45	13	5	27
36 36 33					70	69	59	38			30	495	465	60	60	13	6	41
36 36 34					97	96	81	53			30	495	445	120	90	16	6	61
36 36 35		200	200	175	164	162	143	93			50	510	465	120	120	21	7	91
36 36 41								17	13	10	15	475	435	60	40	11	4	21
36 36 42								26	20	16	20	495	445	60	45	13	5	27
36 36 43								49	39	28	30	495	465	60	60	13	6	42
36 36 44								68	55	41	30	495	445	120	90	16	6	61
36 36 45								119	95	73	50	510	465	120	120	21	7	91



load angle ≤ 6°

① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).

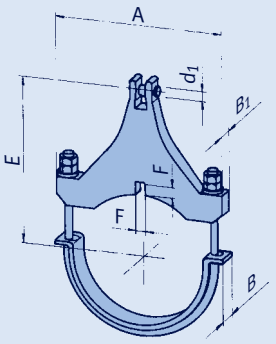
Dynamic clamps
Selection overview OD 368.0 – OD 406.4

OD 368.0 (ND 350)

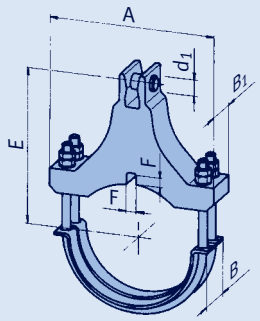
type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 37 11	44	41	37								20	400	445	60	40	11	5	22
36 37 12	65	59	56								30	400	455	60	45	13	6	26
36 37 13	100	100	99								30	400	475	60	60	13	6	36
36 37 14	166	151	139								50	415	455	120	90	16	7	57
36 37 15	279	256	181								60	440	475	120	120	16	8	88
36 37 21			31	27	24						20	485	445	60	40	11	5	23
36 37 22			48	42	39						30	485	455	60	45	13	6	31
36 37 23			89	76	72						30	485	475	60	60	13	6	42
36 37 24			121	105	97						50	500	455	120	90	16	7	67
36 37 25			186	168	159						50	500	475	120	120	21	7	94
36 37 31					18	18	18	13			15	480	445	60	40	11	4	22
36 37 32					38	37	31	20			20	500	455	60	45	13	5	28
36 37 33					70	69	59	38			30	500	475	60	60	13	6	42
36 37 34					97	96	81	53			30	500	455	120	90	16	6	62
36 37 35		200	200	178	167	165	143	93			50	515	475	120	120	21	7	92
36 37 41								17	14	11	15	480	445	60	40	11	4	23
36 37 42								23	18	14	20	500	455	60	45	13	5	27
36 37 43								49	39	29	30	500	475	60	60	13	6	42
36 37 44								68	55	41	30	500	455	120	90	16	6	62
36 37 45								120	97	73	50	515	475	120	120	21	7	93

OD 406.4 (ND 400)

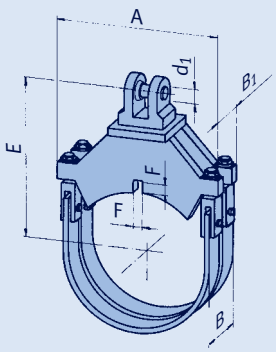
type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 41 11	43	40	36								20	430	485	60	40	11	5	24
36 41 12	65	59	54								30	430	495	60	45	13	6	29
36 41 13	100	100	100								30	430	515	60	60	13	6	40
36 41 14	163	150	137								50	445	495	120	90	16	7	64
36 41 15	277	253	232								60	470	515	120	120	21	8	98
36 41 21			30	26	24						20	510	485	60	40	11	5	25
36 41 22			48	41	38						30	510	495	60	45	13	6	34
36 41 23			89	77	71						30	510	515	60	60	13	6	46
36 41 24			120	105	97						50	525	495	120	90	16	7	73
36 41 25			186	172	165						50	525	515	120	120	21	7	104
37 41 27	350	338	290	244	229						60	580	490	310	230	21	8	187
36 41 31					18	18	18	13			15	510	485	60	40	11	4	24
36 41 32					37	36	31	20			20	530	495	60	45	13	5	30
36 41 33					69	68	58	37			30	530	515	60	60	13	6	46
36 41 34					96	94	80	52			30	530	495	120	90	16	6	67
36 41 35					164	162	142	92			50	545	515	120	120	21	7	99
37 41 37					226	223	215	161			60	600	490	310	230	21	8	191
36 41 41								17	14	10	15	510	485	60	40	11	4	23
36 41 42								25	19	15	20	530	495	60	45	13	5	30
36 41 43								48	39	29	30	530	515	60	60	13	6	46
36 41 44								67	55	41	30	530	495	120	90	16	6	67
36 41 45								118	96	72	50	545	515	120	120	21	7	101
37 41 47		307	291	266	250	247	231	161	126	94	60	600	490	310	230	21	8	191



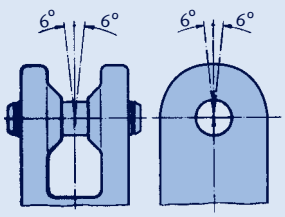
type 36 .. .1/2/3



type 36 .. .4/5



type 37 .. .7



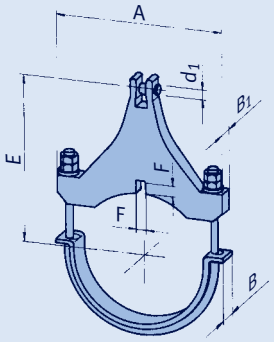
load angle ≤ 6°

① Calculation of intermediate values: linear interpolation.

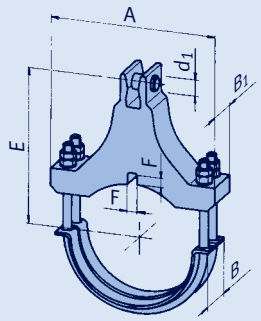
② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).

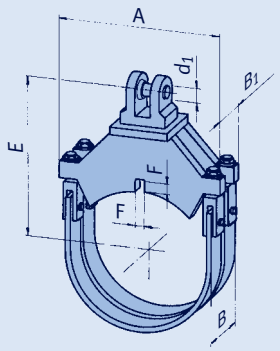
Dynamic clamps
Selection overview OD 419.0 – OD 457.2



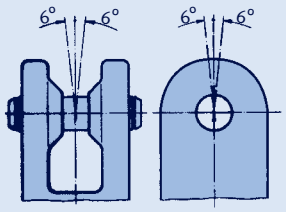
type 36 .. .1/2/3



type 36 .. .4/5



type 37 .. .7/8



load angle ≤ 6°

OD 419.0 (ND 400)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 42 11	43	39	36								20	440	495	60	40	11	5	25
36 42 12	65	59	55								30	440	510	60	45	13	6	30
36 42 13	100	100	100								30	440	525	60	60	13	6	42
36 42 14	163	149	136								50	455	510	120	90	16	7	66
36 42 15	276	253	231								60	480	525	120	120	21	8	101
36 42 21			29	26	24						20	530	495	60	40	11	5	26
36 42 22			47	40	37						30	530	510	60	45	13	6	35
36 42 23			87	76	70						30	530	525	60	60	13	6	48
36 42 24			118	103	95						50	545	510	120	90	16	7	76
36 42 25			186	172	165						50	545	525	120	120	21	7	108
37 42 27	350	336	289	243	228						60	595	500	310	230	21	8	192
36 42 31					18	18	18	13			15	520	495	60	40	11	4	25
36 42 32					37	36	31	20			20	540	510	60	45	13	5	31
36 42 33					69	68	57	37			30	540	525	60	60	13	6	48
36 42 34					95	93	79	51			30	545	510	120	90	16	6	69
36 42 35					158	156	140	91			50	560	525	120	120	21	7	102
37 42 37					226	224	215	161			60	605	500	310	230	21	8	194
36 42 41								17	14	10	15	520	495	60	40	11	4	24
36 42 42								25	21	15	20	540	510	60	45	13	5	31
36 42 43								48	39	29	30	540	525	60	60	13	6	47
36 42 44								66	54	40	30	545	510	120	90	16	6	69
36 42 45								117	93	69	50	560	525	120	120	21	7	104
37 42 47		307	291	266	250	247	231	161	126	94	60	605	500	310	230	21	8	194

OD 457.2 (ND 450)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
36 46 11	42	38	35								20	470	535	60	40	13	5	29
36 46 12	65	59	55								30	470	545	60	45	13	6	34
36 46 13	100	100	100								30	470	565	60	60	13	6	47
36 46 14	160	147	134								50	485	545	120	90	16	7	72
36 46 15	273	250	229								60	510	565	120	120	21	8	111
36 46 21			29	26	24						20	550	535	60	40	13	5	29
36 46 22			46	40	37						30	550	545	60	45	13	6	38
36 46 23			87	76	70						30	550	565	60	60	13	6	52
36 46 24			115	100	92						50	585	545	120	90	16	7	84
36 46 25			186	172	165						50	585	565	120	120	21	7	118
37 46 27	350	336	289	242	228						60	615	540	310	230	21	8	203
36 46 31					18	18	18	13			15	550	535	60	40	13	4	27
36 46 32					36	35	30	19			20	570	545	60	45	13	5	35
36 46 33					68	66	56	37			30	570	565	60	60	13	6	52
36 46 34					93	92	78	51			30	575	545	120	90	16	6	74
36 46 35					166	163	139	90			50	590	565	120	120	21	7	114
37 46 37					225	222	214	160			60	635	540	310	230	21	8	208
37 46 38	550	504	433	364	342	337	321	223			70	675	550	340	250	26	9	294
36 46 41								16	13	10	15	550	535	60	40	13	4	26
36 46 42								25	20	15	20	570	545	60	45	13	5	34
36 46 43								47	38	29	30	570	565	60	60	13	6	52
36 46 44								65	53	40	30	575	545	120	90	16	6	75
36 46 45								116	94	70	50	590	565	120	120	21	7	115
37 46 47								160	125	94	60	635	540	310	230	21	8	208
37 46 48								223	170	125	70	675	550	340	250	26	9	294

① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).

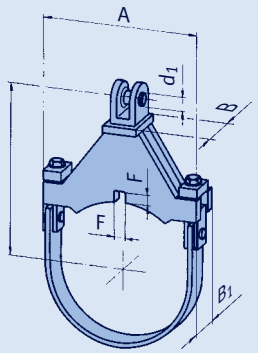
Dynamic clamps
Selection overview OD 508.0 – OD 558.8

OD 508.0 (ND 500)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 51 11	82	62	45								30	515	595	170	130	13	6	43
37 51 12	133	101	73								50	530	620	170	136	13	7	66
37 51 13	182	142	108								60	560	640	230	180	16	8	105
37 51 14	269	206	153								70	600	660	330	260	21	9	187
37 51 17	365	294	213								70	600	590	320	230	21	9	213
37 51 21			69	58	54						30	595	575	140	104	13	6	41
37 51 22			95	80	75						50	620	590	170	130	13	7	66
37 51 23			131	110	104						50	620	605	180	136	16	7	90
37 51 24			213	179	168						60	650	625	240	180	21	8	150
37 51 25			235	197	184						60	650	635	240	190	21	8	181
37 51 26	350	314	269	227	212						60	650	670	250	190	21	8	200
37 51 28	550	520	446	375	352						70	650	605	340	250	26	9	298
37 51 31					53	52	45	31			30	625	580	140	104	13	6	42
37 51 32					75	74	71	49			30	625	600	170	130	13	6	63
37 51 33					102	101	95	72			50	640	600	180	136	16	7	92
37 51 34					166	164	156	109			60	665	640	230	180	21	8	148
37 51 35					183	180	170	132			60	665	640	240	190	26	8	182
37 51 38					340	336	319	222			70	710	605	340	250	26	9	318
37 51 41								31	24	18	30	625	580	145	104	13	6	42
37 51 42								50	39	29	30	625	600	170	130	13	6	63
37 51 43								74	58	43	30	625	600	180	140	16	6	92
37 51 44								110	84	62	50	640	640	235	180	21	7	138
37 51 45								134	105	77	50	640	640	240	190	26	7	173
37 51 48	550	535	488	447	430	427	394	275	215	158	70	710	625	395	290	26	9	397

OD 558.8 (ND 550)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 56 11	81	62	44								30	550	645	170	130	13	6	47
37 56 12	133	100	72								50	565	670	170	136	13	7	70
37 56 13	181	142	108								60	595	690	230	180	16	8	111
37 56 14	269	206	153								70	635	705	330	260	21	9	195
37 56 17	365	295	213								70	635	645	320	230	21	9	228
37 56 21			67	57	53						30	640	630	140	104	13	6	45
37 56 22			94	79	74						50	655	640	170	130	13	7	70
37 56 23			131	110	103						50	655	655	180	136	16	7	96
37 56 24			212	178	167						60	680	675	240	180	21	8	157
37 56 25			234	197	184						60	680	685	240	190	21	8	190
37 56 26	350	313	269	226	211						60	680	720	250	190	21	8	210
37 56 28	550	504	433	364	342						70	725	655	340	250	26	9	337
37 56 31					53	52	45	31			30	650	630	140	104	13	6	46
37 56 32					75	74	72	49			30	650	650	170	130	13	6	67
37 56 33					102	101	95	72			50	665	650	180	136	16	7	96
37 56 34					166	164	155	108			60	695	690	230	180	21	8	154
37 56 35					182	180	170	132			60	695	690	240	190	21	8	191
37 56 38					340	336	319	222			70	735	655	340	250	26	9	334
37 56 39	550	550	485	408	382	377	355	276			70	735	665	400	290	26	9	410
37 56 41								31	24	18	30	650	630	145	104	13	6	46
37 56 42								50	39	29	30	650	650	170	130	13	6	67
37 56 43								72	57	42	50	665	650	180	136	16	7	100
37 56 44								108	82	61	60	695	690	235	180	21	8	154
37 56 45								132	103	76	60	695	690	240	190	21	8	191
37 56 48								222	169	125	70	735	655	340	250	26	9	334
37 56 49		550	537	473	443	437	396	276	216	159	70	735	665	400	290	26	9	410

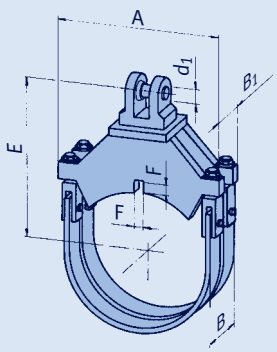


type 37 .. .1/2/3/4/5/6

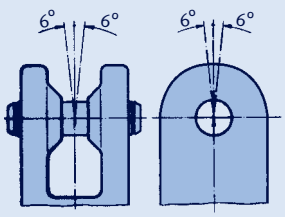
① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).

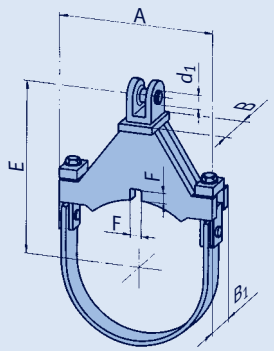


type 37 .. .7/8/9



load angle ≤ 6°

Dynamic clamps
Selection overview OD 609.6 – OD 660.4

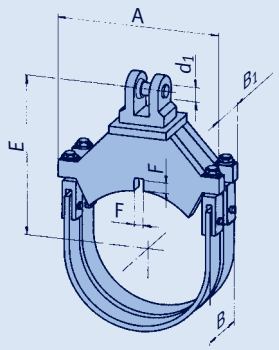


type 37 .. .1/2/3/4/5/6

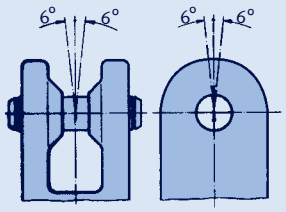
① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).



type 37 .. .7/8/9



load angle ≤ 6°

OD 609.6 (ND 600)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load ② gr.	wt. [kg]
37 61 11	82	62	45								30	575	700	170	130	16	6	50
37 61 12	128	101	73								50	590	720	180	136	16	7	73
37 61 13	182	143	108								60	620	740	230	180	16	8	115
37 61 14	272	206	155								70	660	760	330	260	16	9	199
37 61 17	368	297	214								70	660	695	320	230	21	9	239
37 61 18	543	412	297								70	660	705	335	250	21	9	299
37 61 21			67	57	53						30	670	680	140	104	16	6	49
37 61 22			94	79	75						50	685	690	170	130	16	7	75
37 61 23			131	110	103						50	685	705	180	136	16	7	101
37 61 24			211	177	167						60	715	725	240	180	21	8	166
37 61 25			233	196	183						60	715	735	240	190	21	8	199
37 61 26			268	225	211						60	715	770	250	190	21	8	220
37 61 28	550	501	430	362	340						70	760	705	340	250	26	9	359
37 61 31					52	52	45	30			30	685	680	140	104	16	6	50
37 61 32					75	74	71	49			30	685	700	170	130	16	6	72
37 61 33					102	100	95	72			50	700	700	180	136	16	7	101
37 61 34					164	163	154	108			60	730	740	230	180	21	8	163
37 61 35					181	179	170	131			60	730	740	240	190	21	8	201
37 61 38					338	334	317	221			70	770	705	340	250	26	9	357
37 61 39	550	550	483	406	380	375	355	275			70	770	720	400	290	26	9	438
37 61 41								31	24	18	30	685	680	145	104	16	6	50
37 61 42								50	39	29	30	685	700	170	130	16	6	72
37 61 43								72	56	42	50	700	700	180	136	16	7	106
37 61 44								108	82	60	60	730	740	235	180	21	8	163
37 61 45								131	102	75	60	730	740	240	190	21	8	201
37 61 48		550	533	471	440	435	394	275	214	158	70	770	720	400	290	26	9	438
37 61 49						427	416	346	268	209	70	770	730	435	340	26	9	510

OD 660.4 (ND 650)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load ② gr.	wt. [kg]
37 66 11	82	62	45								30	605	750	170	130	16	6	51
37 66 12	127	101	73								50	620	770	185	136	16	7	78
37 66 13	182	143	109								60	650	790	230	180	16	8	120
37 66 14	272	206	155								70	690	810	330	260	16	9	207
37 66 17	369	298	215								70	690	745	320	230	21	9	252
37 66 18	545	413	298								70	690	755	335	250	21	9	316
37 66 21			69	58	55						30	700	730	145	110	16	6	56
37 66 22			96	81	76						50	715	745	175	136	16	7	86
37 66 23			131	110	103						50	715	760	180	136	16	7	105
37 66 24			211	177	166						60	750	775	240	180	21	8	175
37 66 25			233	196	183						60	750	785	240	190	21	8	209
37 66 26			267	225	210						60	750	820	250	190	21	8	231
37 66 28	550	500	429	361	339						70	790	755	340	250	26	9	382
37 66 31					54	53	46	31			30	715	730	145	110	16	6	57
37 66 32					76	75	73	50			30	715	755	175	136	16	6	84
37 66 33					102	101	95	72			50	730	755	180	136	16	7	106
37 66 34					166	164	155	108			60	755	790	230	180	21	8	171
37 66 35					182	180	170	132			60	755	790	240	190	21	8	209
37 66 38					338	334	317	221			70	795	755	340	250	26	9	377
37 66 39	550	550	483	406	380	375	355	275			70	795	770	400	290	26	9	460
37 66 41								32	25	18	30	715	730	145	110	16	6	57
37 66 42								51	39	30	30	715	755	180	136	16	6	89
37 66 43								72	56	42	50	730	755	180	136	16	7	111
37 66 44								108	82	61	60	755	790	235	180	21	8	171
37 66 45								132	103	76	60	755	790	240	190	21	8	209
37 66 48		535	488	447	430	427	394	275	215	158	70	795	770	400	290	26	9	460
37 66 49						427	416	346	268	209	70	795	780	435	340	26	9	536

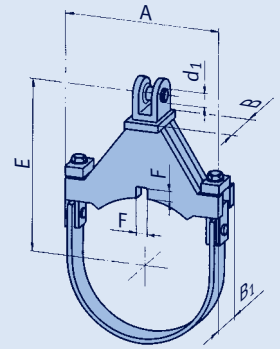
Dynamic clamps
Selection overview OD 711.2 – OD 762.0

OD 711.2 (ND 700)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 71 11	82	62	45								30	635	800	170	130	16	6	54
37 71 12	126	101	73								50	650	825	190	136	16	7	83
37 71 13	182	143	109								60	680	840	230	180	16	8	127
37 71 14	272	206	156								70	720	860	330	260	16	9	213
37 71 15	328	253	186								70	720	880	355	260	21	9	245
37 71 18	546	414	299								70	720	810	335	250	21	9	331
37 71 21			69	58	55						30	725	780	145	110	16	6	59
37 71 22			96	81	76						50	745	795	175	136	16	7	87
37 71 23			131	110	103						50	745	810	180	136	16	7	111
37 71 24			213	179	168						60	770	830	240	180	21	8	178
37 71 25			235	198	185						60	770	840	240	190	21	8	217
37 71 26			270	227	213						60	770	875	250	190	21	8	240
37 71 28	550	503	432	363	341						70	815	810	340	250	26	9	396
37 71 31					54	53	46	31			30	740	780	145	110	16	6	59
37 71 32					76	75	73	50			30	740	805	175	136	16	6	89
37 71 33					102	101	95	73			50	755	805	180	136	16	7	112
37 71 34					167	165	156	109			60	780	845	230	180	21	8	175
37 71 35					183	181	170	133			60	780	845	240	190	21	8	217
37 71 38					338	334	317	221			70	825	810	340	250	26	9	394
37 71 39	550	550	484	407	381	376	355	275			70	825	820	400	290	26	9	483
37 71 41								32	25	18	30	740	780	145	110	16	6	59
37 71 42								51	40	30	30	740	805	180	136	16	6	94
37 71 43								73	57	43	50	755	805	180	136	16	7	117
37 71 44								109	83	61	60	780	845	235	180	21	8	175
37 71 45								133	103	76	60	780	845	240	190	21	8	217
37 71 48		550	550	486	455	449	407	284	222	163	70	785	820	400	290	26	9	458
37 71 49						427	416	347	269	210	70	825	835	435	340	26	9	567

OD 762.0 (ND 750)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 76 11	82	62	44								30	665	850	170	130	16	6	58
37 76 12	126	101	73								50	680	875	190	136	16	7	85
37 76 13	182	143	109								60	710	895	235	180	16	8	133
37 76 14	285	216	156								70	750	910	330	260	16	9	226
37 76 15	329	251	187								70	750	930	345	260	21	9	249
37 76 16	407	308	233								70	750	935	370	260	21	9	276
37 76 18	547	414	299								70	750	860	335	250	21	9	349
37 76 21			69	57	54						30	760	835	145	110	16	6	63
37 76 22			96	81	76						50	775	845	175	136	16	7	92
37 76 23			131	110	103						50	775	860	180	136	16	7	117
37 76 24			213	179	168						60	800	880	240	180	21	8	186
37 76 26			271	228	213						60	800	925	250	190	21	8	249
37 76 28	550	504	433	364	342						70	845	860	340	250	26	9	417
37 76 31					54	53	46	31			30	765	835	145	110	16	6	63
37 76 32					77	76	73	51			30	765	855	175	136	16	6	89
37 76 33					103	102	95	73			50	780	855	180	136	16	7	117
37 76 34					168	166	157	110			60	805	895	230	180	21	8	182
37 76 35					185	182	170	133			60	805	895	240	190	21	8	225
37 76 38					341	336	320	223			70	850	860	340	250	26	9	411
37 76 39	550	550	487	410	383	378	355	277			70	850	870	400	290	26	9	504
37 76 41								32	25	18	30	765	835	145	110	16	6	63
37 76 42								52	40	30	30	765	855	180	140	16	6	94
37 76 43								74	58	43	50	780	855	180	140	16	7	123
37 76 44								110	83	61	60	805	895	235	180	21	8	182
37 76 45								133	104	77	60	805	895	240	190	21	8	225
37 76 48		550	538	475	444	439	398	277	216	160	70	850	870	400	290	26	9	504
37 76 49						427	416	349	271	211	70	850	885	435	340	26	9	582

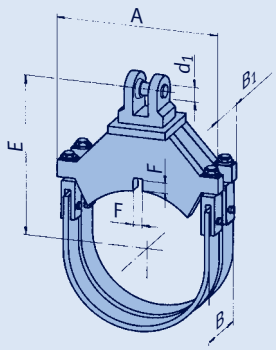


type 37 .. .1/2/3/4/5/6

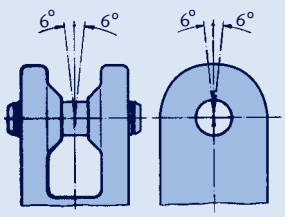
① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).

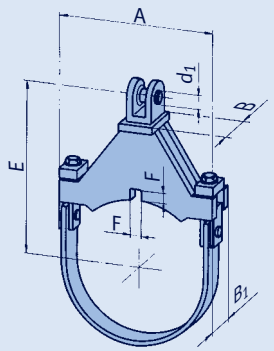


type 37 .. .8/9



load angle ≤ 6°

Dynamic clamps
Selection overview OD 812.8 – OD 863.6

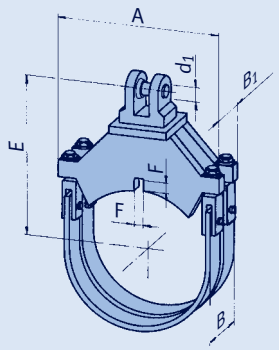


type 37 .. .1/2/3/4/5/6

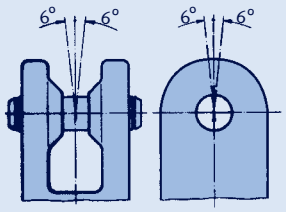
① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).



type 37 .. .8/9



load angle ≤ 6°

OD 812.8 (ND 800)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 81 11	76	59	42								30	700	905	170	130	16	6	60
37 81 12	126	100	72								50	715	925	185	136	16	7	90
37 81 13	183	143	108								60	745	950	235	180	16	8	135
37 81 14	284	215	155								70	785	960	330	260	16	9	235
37 81 15	328	248	186								70	785	985	345	260	21	9	258
37 81 16	399	307	233								70	785	985	370	260	21	9	286
37 81 18	545	413	298								70	785	910	335	250	21	9	372
37 81 21			69	58	54						30	790	885	145	110	16	6	67
37 81 22			96	81	76						50	805	895	175	136	16	7	101
37 81 23			131	110	103						50	805	910	180	136	16	7	123
37 81 24			214	180	169						60	830	930	240	180	21	8	195
37 81 26			271	228	213						60	830	975	250	190	21	8	261
37 81 28	550	505	434	365	343						70	875	910	340	250	26	9	440
37 81 31					54	54	46	32			30	790	885	145	110	16	6	66
37 81 32					77	76	74	51			30	790	905	175	136	16	6	98
37 81 33					103	102	95	71			50	805	905	180	136	16	7	121
37 81 34					169	167	158	107			60	830	945	230	180	21	8	191
37 81 35					186	183	170	134			60	830	945	240	190	21	8	234
37 81 38					343	338	321	224			70	875	910	340	250	26	9	432
37 81 39	550	550	490	412	385	381	360	279			70	875	920	400	290	26	9	523
37 81 41								32	25	19	30	790	885	145	110	16	6	66
37 81 42								52	40	30	30	790	905	180	140	16	6	104
37 81 43								74	58	43	50	805	905	180	140	16	7	127
37 81 44								110	84	62	60	830	945	250	180	21	8	193
37 81 45								134	105	77	60	830	945	270	190	21	8	236
37 81 48		550	541	478	447	441	400	279	217	160	70	875	920	400	290	26	9	523
37 81 49						427	416	351	273	213	70	875	935	435	340	26	9	612

OD 863.6 (ND 850)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 86 11	79	61	43								30	725	955	155	130	16	6	66
37 86 12	125	100	72								50	740	980	170	136	16	7	101
37 86 13	179	143	109								60	770	990	215	180	16	8	145
37 86 14	277	216	156								70	810	1015	295	260	16	9	243
37 86 15	317	248	187								70	810	1035	295	260	21	9	273
37 86 16	387	307	233								70	815	1040	305	260	21	9	304
37 86 18	518	415	300								70	810	965	335	250	21	9	393
37 86 21			69	58	55						30	815	935	145	110	16	6	72
37 86 22			96	81	76						50	830	950	180	136	16	7	113
37 86 23			132	111	104						50	830	965	200	136	16	7	136
37 86 24			215	181	170						60	855	985	260	180	21	8	211
37 86 26			273	229	214						60	855	1030	240	190	21	8	286
37 86 28	550	509	437	367	345						70	900	965	340	250	26	9	474
37 86 31					55	54	47	32			30	815	935	145	110	16	6	70
37 86 32					77	76	74	51			30	815	960	180	136	16	6	109
37 86 33					104	103	95	72			50	830	960	180	136	16	7	133
37 86 34					170	168	159	110			60	855	1000	235	180	21	8	207
37 86 35					187	184	170	135			60	855	1000	235	190	21	8	255
37 86 38					345	341	323	225			70	900	965	340	250	26	9	465
37 86 39	550	550	493	415	388	383	360	281			70	900	975	400	290	26	9	564
37 86 41								32	25	19	30	815	935	145	110	16	6	70
37 86 42								52	41	31	30	815	960	180	140	16	6	116
37 86 43								74	58	44	50	830	960	180	140	16	7	140
37 86 44								111	84	62	60	855	1000	250	180	21	8	207
37 86 45								135	105	78	60	855	1000	270	190	21	8	255
37 86 48		550	545	481	450	444	403	281	219	162	70	900	975	400	290	26	9	566
37 86 49						427	416	353	274	214	70	900	990	435	340	26	9	659

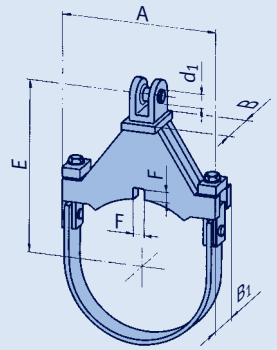
Dynamic clamps
Selection overview OD 914.4 – OD 965.2

OD 914.4 (ND 900)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 91 11	75	61	43								30	760	1005	180	130	16	6	69
37 91 12	121	100	72								50	775	1030	185	136	16	7	100
37 91 13	181	143	108								60	805	1045	250	180	16	8	146
37 91 14	285	216	156								70	845	1065	330	260	16	9	245
37 91 15	329	248	186								70	845	1085	365	260	21	9	275
37 91 16	400	301	233								70	845	1090	390	260	21	9	306
37 91 18	544	413	299								70	845	1015	335	250	21	9	394
37 91 21			69	58	55						30	840	985	145	110	16	6	72
37 91 22			97	81	77						50	855	1000	175	136	16	7	112
37 91 23			132	111	104						50	855	1015	220	136	16	7	137
37 91 24			216	181	170						60	880	1035	240	180	21	8	213
37 91 26			274	230	215						60	880	1080	250	190	21	8	288
37 91 28	550	511	438	368	346						70	925	1015	340	250	26	9	478
37 91 29	550	550	495	416	390						70	925	1025	400	290	26	9	574
37 91 31					54	53	46	32			30	850	985	145	110	16	6	73
37 91 32					77	76	74	51			30	850	1010	175	136	16	6	110
37 91 33					103	102	95	68			50	865	1010	180	136	16	7	134
37 91 34					170	168	156	97			60	880	1050	230	180	21	8	206
37 91 35					187	185	170	135			60	880	1050	240	190	21	8	258
37 91 38					343	339	322	225			70	935	1015	340	250	26	9	475
37 91 39					387	382	360	280			70	935	1025	400	290	26	9	579
37 91 41								32	25	18	30	850	985	145	110	16	6	73
37 91 42								52	40	30	30	850	1010	180	140	16	6	117
37 91 43								74	58	43	50	865	1010	180	140	16	7	141
37 91 44								111	84	62	60	880	1050	260	180	21	8	208
37 91 45								135	106	78	60	880	1050	320	190	21	8	264
37 91 48		550	544	479	449	443	402	280	219	161	70	935	1025	400	290	26	9	579
37 91 49						427	416	353	274	214	70	935	1040	435	340	26	9	680

OD 965.2 (ND 950)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 97 11	75	58	41								30	785	1055	155	130	16	6	72
37 97 12	128	103	74								50	800	1080	180	150	16	7	112
37 97 13	181	146	111								60	830	1090	230	195	16	8	163
37 97 14	277	216	156								70	870	1115	295	260	16	9	262
37 97 15	328	249	187								70	870	1135	290	260	21	9	296
37 97 16	387	324	234								70	870	1140	295	260	21	9	353
37 97 18	518	415	300								70	870	1065	335	250	21	9	430
37 97 21			69	59	55						30	865	1040	145	110	16	6	81
37 97 22			100	84	79						50	880	1060	180	146	16	7	118
37 97 23			144	119	113						50	880	1080	225	186	16	7	152
37 97 24			225	186	177						60	905	1090	250	205	21	8	231
37 97 26			295	247	232						60	905	1130	300	250	21	8	308
37 97 28	550	513	440	370	348						70	950	1065	340	250	26	9	512
37 97 29	550	550	498	418	391						70	950	1075	400	290	26	9	603
37 97 31					51	51	48	33			30	875	1040	145	120	16	6	81
37 97 32					79	78	76	52			30	875	1060	180	146	16	6	115
37 97 33					115	113	105	67			50	890	1080	225	186	16	7	151
37 97 34					170	168	166	98			60	905	1105	240	205	21	8	224
37 97 35					202	199	185	140			60	905	1125	295	250	21	8	293
37 97 38					345	341	324	226			70	960	1065	340	250	26	9	510
37 97 39		550	512	431	403	398	380	292			70	960	1075	440	330	26	9	613
37 97 41								33	26	19	30	875	1040	145	120	16	6	81
37 97 42								53	41	31	30	875	1080	180	150	16	6	124
37 97 43								82	64	48	50	890	1080	225	190	16	7	159
37 97 44								115	88	65	60	905	1100	240	205	21	8	221
37 97 45								146	114	84	60	905	1120	295	250	21	8	288
37 97 48		550	546	482	450	445	403	281	220	162	70	960	1075	400	290	26	9	608
37 97 49						427	416	354	275	215	70	960	1090	435	340	26	9	690

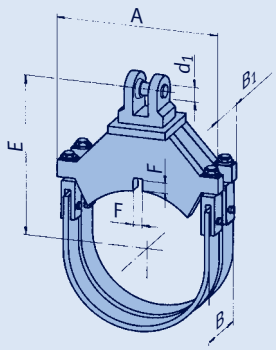


type 37 .. .1/2/3/4/5/6

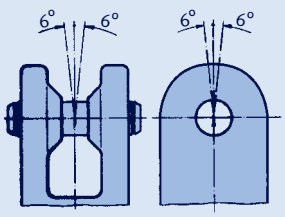
① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15).
Fit: H7 f8.

③ Shear lug dimensions:
F minus 1mm;
B_1 plus 2mm
(see page 3.44).

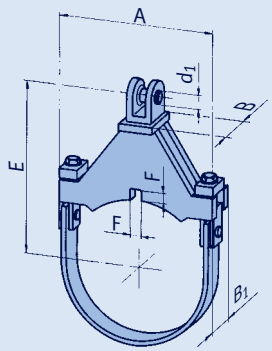


type 37 .. .8/9



load angle ≤ 6°

Dynamic clamps
Selection overview OD 1016 – OD 1067

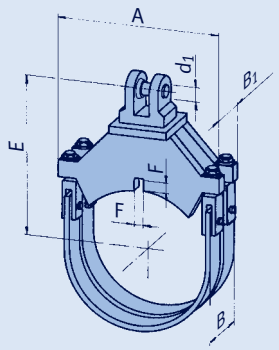


type 37 .. .1/2/3/4/5/6

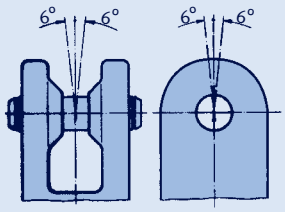
① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).



type 37 .. .8/9



load angle ≤ 6°

OD 1016 (ND 1000)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 T0 11	77	59	42								30	810	1110	165	130	16	6	76
37 T0 12	120	102	74								50	825	1130	180	150	16	7	111
37 T0 13	182	142	111								60	855	1140	230	195	16	8	166
37 T0 14	281	217	157								70	895	1165	295	260	16	9	267
37 T0 15	323	250	188								70	895	1185	295	260	21	9	298
37 T0 16	387	328	237								70	895	1190	305	270	21	9	359
37 T0 18	518	416	301								70	895	1115	335	250	21	9	435
37 T0 21			70	59	55						30	890	1090	145	110	16	6	82
37 T0 22			100	84	79						50	905	1110	180	146	16	7	117
37 T0 23			141	117	111						50	905	1130	225	186	16	7	155
37 T0 24			225	187	177						60	930	1140	250	205	21	8	236
37 T0 26			290	240	228						60	930	1180	300	250	21	8	324
37 T0 28	550	515	442	371	349						70	975	1115	340	250	26	9	519
37 T0 29	550	550	499	420	393						70	975	1125	400	290	26	9	606
37 T0 31					52	51	48	33			30	900	1090	145	120	16	6	81
37 T0 32					79	78	76	52			30	900	1110	180	146	16	6	113
37 T0 33					115	114	106	66			50	915	1130	225	186	16	7	154
37 T0 34					171	169	167	103			60	930	1155	240	205	21	8	226
37 T0 35					203	200	185	137			60	930	1175	295	250	21	8	295
37 T0 38					346	342	325	226			70	985	1115	340	250	26	9	513
37 T0 39		550	514	433	405	400	380	293			70	985	1125	440	330	26	9	620
37 T0 41								33	26	19	30	900	1090	145	120	16	6	81
37 T0 42								53	42	31	30	900	1130	180	150	16	6	122
37 T0 43								82	64	48	50	915	1130	225	190	16	7	159
37 T0 44								116	88	65	60	930	1150	240	205	21	8	225
37 T0 45								147	114	84	60	930	1170	295	250	21	8	288
37 T0 48		550	548	484	452	447	405	282	220	163	70	985	1125	400	290	26	9	614
37 T0 49						427	416	356	276	216	70	985	1140	435	340	26	9	726

OD 1067 (ND 1050)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 T1 11	76	59	42								30	835	1160	165	130	16	6	86
37 T1 12	120	100	75								50	850	1185	180	150	16	7	121
37 T1 13	182	141	111								60	880	1190	230	195	16	8	179
37 T1 14	281	218	157								70	920	1220	295	260	16	9	282
37 T1 15	323	254	187								70	930	1240	295	260	21	9	318
37 T1 16	387	327	236								70	930	1245	305	270	21	9	362
37 T1 18	518	417	302								70	920	1170	335	250	21	9	470
37 T1 21			70	59	55						30	915	1140	145	110	16	6	88
37 T1 22			100	84	79						50	930	1165	180	146	16	7	127
37 T1 23			144	119	113						50	930	1185	225	186	16	7	166
37 T1 24			226	187	177						60	955	1195	250	205	21	8	251
37 T1 26			289	239	227						60	955	1235	300	250	21	8	342
37 T1 28	550	516	443	373	350						70	1000	1170	340	250	26	9	559
37 T1 29	550	550	501	421	394						70	1000	1180	400	290	26	9	655
37 T1 31					52	51	48	33			30	925	1140	145	120	16	6	88
37 T1 32					80	79	76	53			30	925	1165	180	146	16	6	123
37 T1 33					115	114	105	66			50	940	1185	225	186	16	7	165
37 T1 34					171	169	168	98			60	955	1210	240	205	21	8	243
37 T1 35					203	201	186	137			60	955	1230	295	250	21	8	317
37 T1 38					348	343	326	227			70	1010	1170	340	250	26	9	550
37 T1 39		550	516	434	406	401	382	293			70	1010	1180	440	330	26	9	664
37 T1 41								33	26	19	30	925	1140	145	120	16	6	88
37 T1 42								53	42	31	30	925	1185	180	150	16	6	134
37 T1 43								82	64	48	50	940	1185	225	190	16	7	170
37 T1 44								116	89	65	60	955	1205	240	205	21	8	240
37 T1 45								147	115	85	60	955	1225	290	250	21	8	308
37 T1 48			550	485	454	448	407	283	221	163	70	1010	1180	400	290	26	9	659
37 T1 49						427	416	357	277	216	70	1010	1195	435	340	26	9	770

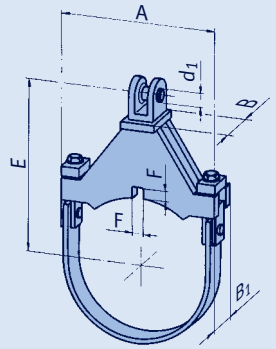
Dynamic clamps
Selection overview OD 1118 – OD 1168

OD 1118 (ND 1100)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 T2 11	77	59	42								30	860	1210	165	130	16	6	86
37 T2 12	120	100	75								50	875	1235	180	150	16	7	127
37 T2 13	186	138	109								60	905	1240	235	195	16	8	180
37 T2 14	281	217	158								70	945	1270	295	260	16	9	290
37 T2 15	323	254	188								70	955	1290	295	260	21	9	321
37 T2 16	387	326	239								70	955	1295	310	280	21	9	403
37 T2 18	518	414	303								70	945	1220	335	250	21	9	472
37 T2 21			70	59	55						30	940	1190	145	110	16	6	87
37 T2 22			100	82	78						50	955	1215	180	146	16	7	126
37 T2 23			148	121	114						50	955	1235	230	190	16	7	174
37 T2 24			227	191	179						60	980	1245	250	205	21	8	256
37 T2 26			294	243	231						60	980	1285	300	250	21	8	347
37 T2 28	550	518	445	374	351						70	1025	1220	340	250	26	9	557
37 T2 29	550	550	503	423	395						70	1025	1230	400	290	26	9	656
37 T2 31					52	51	48	33			30	950	1190	145	120	16	6	86
37 T2 32					80	79	76	52			30	950	1215	180	146	16	6	122
37 T2 33					116	114	106	67			50	965	1235	225	186	16	7	169
37 T2 34					172	170	168	98			60	980	1260	240	205	21	8	247
37 T2 35					204	201	185	139			60	980	1280	295	250	21	8	323
37 T2 38					349	344	327	228			70	1035	1220	340	250	26	9	553
37 T2 39		550	518	436	408	402	382	293			70	1035	1230	440	330	26	9	668
37 T2 41								34	26	19	30	950	1190	145	120	16	6	88
37 T2 42								54	42	31	30	950	1235	180	150	16	6	131
37 T2 43								80	62	47	50	965	1235	225	190	16	7	169
37 T2 44								116	89	65	60	980	1255	240	205	21	8	243
37 T2 45								148	115	85	60	980	1275	295	250	21	8	312
37 T2 48			550	487	456	450	408	284	222	164	70	1035	1230	400	290	26	9	664
37 T2 49						427	416	358	278	217	70	1035	1245	435	340	26	9	773

OD 1168 (ND 1150)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 T3 11	75	58	41								30	885	1260	165	130	16	6	93
37 T3 12	120	98	75								50	900	1285	180	150	16	7	127
37 T3 13	181	139	111								60	930	1295	235	195	16	8	194
37 T3 14	279	219	158								70	970	1320	295	260	16	9	295
37 T3 15	323	254	188								70	980	1340	295	260	21	9	342
37 T3 16	387	326	239								70	980	1345	310	280	21	9	414
37 T3 18	518	420	303								70	970	1270	335	250	21	9	495
37 T3 21			70	59	56						30	965	1240	145	110	16	6	94
37 T3 22			101	85	80						50	980	1265	180	146	16	7	138
37 T3 23			149	121	114						50	980	1285	230	190	16	7	186
37 T3 24			227	189	179						60	1005	1295	250	205	21	8	272
37 T3 26			293	242	230						60	1005	1335	300	250	21	8	369
37 T3 28	550	519	446	375	352						70	1050	1270	340	250	26	9	563
37 T3 29	550	550	504	424	397						70	1050	1280	400	290	26	9	654
37 T3 31					52	51	48	33			30	975	1240	145	120	16	6	94
37 T3 32					80	79	77	53			30	975	1265	180	146	16	6	133
37 T3 33					116	115	107	66			50	990	1285	225	186	16	7	180
37 T3 34					172	170	169	98			60	1005	1310	240	205	21	8	264
37 T3 35					205	202	186	138			60	1005	1330	295	250	21	8	342
37 T3 38					350	345	328	229			70	1060	1270	340	250	26	9	594
37 T3 39		550	520	437	409	404	383	293			70	1060	1280	440	330	26	9	667
37 T3 41								34	26	19	30	975	1240	145	120	16	6	94
37 T3 42								54	42	32	30	975	1285	180	150	16	6	144
37 T3 43								80	62	47	50	990	1285	225	190	16	7	182
37 T3 44								117	89	66	60	1005	1305	240	205	21	8	260
37 T3 45								148	115	85	60	1005	1325	295	250	21	8	333
37 T3 48			550	488	457	451	409	285	222	164	70	1060	1280	400	290	26	9	661
37 T3 49						427	416	359	279	218	70	1060	1295	435	340	26	9	831

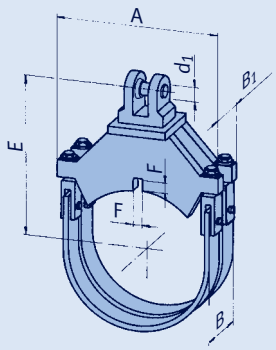


type 37 .. .1/2/3/4/5/6

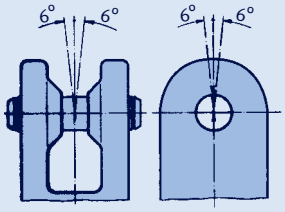
① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).

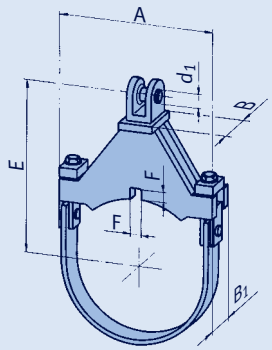


type 37 .. .8/9

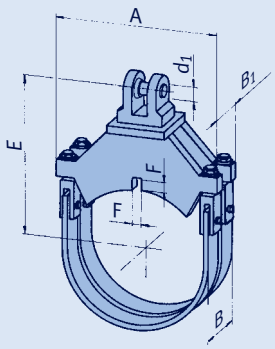


load angle ≤ 6°

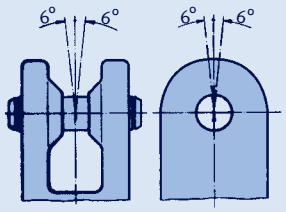
Dynamic clamps
Selection overview OD 1219



type 37 .. .1/2/3/4/5/6



type 37 .. .8/9



load angle ≤ 6°

OD 1219 (ND 1200)

type	permissible load [kN] ① 100	250	350	450	500	510	530	560	580	600°C	d_1 ②	E_{max} ②	A	B	B_1	F ③	max load gr. ②	wt. [kg]
37 T4 11	74	56	40								30	910	1315	165	130	16	6	93
37 T4 12	122	99	75								50	925	1335	180	150	16	7	136
37 T4 13	183	137	108								60	955	1345	235	195	16	8	195
37 T4 14	281	217	159								70	995	1370	295	260	16	9	310
37 T4 15	323	254	189								70	1005	1390	295	265	21	9	362
37 T4 16	387	322	240								70	1005	1395	310	280	21	9	415
37 T4 18	518	415	304								70	995	1320	335	250	21	9	530
37 T4 21			67	55	52						30	990	1295	145	110	16	6	94
37 T4 22			101	84	80						50	1005	1315	180	146	16	7	139
37 T4 23			147	121	115						50	1005	1335	230	190	16	7	186
37 T4 24			228	189	179						60	1030	1345	250	205	21	8	275
37 T4 26			293	242	230						60	1030	1385	300	250	21	8	373
37 T4 28	550	521	447	376	353						70	1075	1320	340	250	26	9	607
37 T4 29		550	505	425	398						70	1075	1330	400	290	26	9	708
37 T4 31					52	51	49	31			30	1000	1295	145	120	16	6	92
37 T4 32					80	79	77	52			30	1000	1315	180	146	16	6	134
37 T4 33					116	115	107	66			50	1015	1335	225	186	16	7	183
37 T4 34					173	171	169	98			60	1030	1360	240	205	21	8	267
37 T4 35					206	204	188	139			60	1030	1380	295	255	21	8	364
37 T4 38					350	346	329	229			70	1085	1320	340	250	26	9	596
37 T4 39		550	521	438	410	405	385	293			70	1085	1330	440	330	26	9	718
37 T4 41								34	26	19	30	1000	1295	145	120	16	6	94
37 T4 42								54	42	32	30	1000	1335	180	150	16	6	142
37 T4 43								78	60	45	50	1015	1335	225	190	16	7	183
37 T4 44								117	89	66	60	1030	1355	240	205	21	8	263
37 T4 45								148	116	85	60	1030	1375	295	250	21	8	337
37 T4 48			550	490	458	452	410	286	223	165	70	1085	1330	400	290	26	9	712
37 T4 49						427	416	361	280	218	70	1085	1345	435	340	26	9	831

① Calculation of intermediate values: linear interpolation.

② The connection load group is to be specified when ordering. On selection of a smaller load group than that shown in the table, the 'E' dimensions of the clamp are reduced (see table on page 3.15). Fit: H7 f8.

③ Shear lug dimensions: F minus 1mm; B_1 plus 2mm (see page 3.44).

Shear lugs
Type 3L

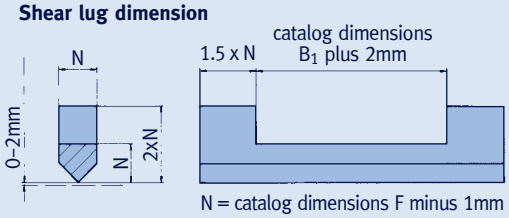
The shear lugs secure the position of the dynamic clamps in the expected direction of force and are practically unstressed. Even in a load case, friction forces from the pipe-clamp-contact ensure firm positioning. Lateral forces are negligable.

Due to the minimal forces to be absorbed, the weld seam stresses can be kept at a low level, despite the small dimensions of the shear lugs. As a rule they lie under 35% of the yield strength or creep stress limit for load case H (level A/B) according to the permissible ASME or EN values.

Selection

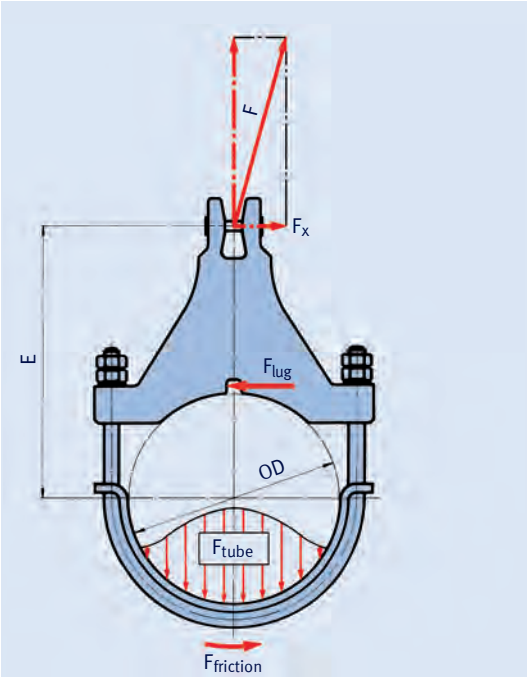
The selection of suitable shear lugs is made after selection of the dynamic clamp and the corresponding dimensions F and B1 according to the selection tables of dynamic clamps on pages 3.29 – 3.43

Shear lug dimension



N = catalog dimensions F minus 1mm

The specified materials for the shear lugs are materials delivered from stock and delivered at short notice. The customer is responsible for the suitability of the pipe material on hand and for the weld seam sizes.



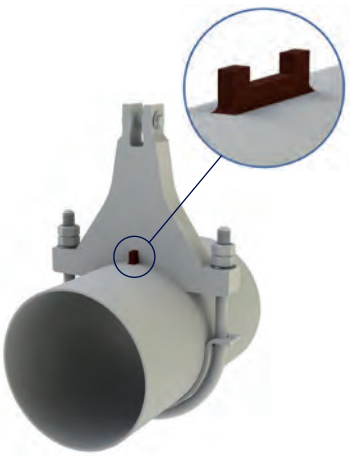
$F_{friction} = F_{tube} \cdot \mu$

μ = 0.1...0.4 (friction value)

$$F_x \cdot E = (F_{lug} + F_{friction}) \cdot \frac{OD}{2}$$

Force distribution in a dynamic clamp with shear lug

To secure dynamic clamps type 36/37 against misalignment due to compressive stress and off-axis load applications, LISEGA offers standardized shear lugs.



type number									
1st digit	2nd digit	3rd digit	4th digit	5th digit	6th digit		7th digit	8th digit	material①
3	L	.	.	.	.	–	0	1	S235JR
						–	0	2	S355J2
		3rd – 6th digits of pipe clamps				–	0	3	16Mo3
		type numbers e.g.: 36 22 31				–	0	4	13CrMo4-5
		2	**2**	**3**	**1**	–	0	5	10CrMo9-10
						–	0	6	X10CrMoVNb9-1

① Different materials on request.

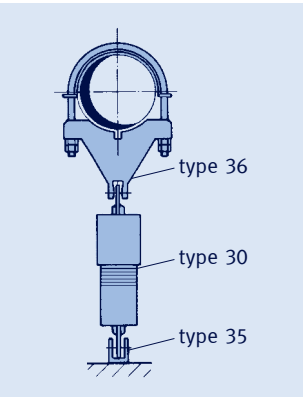
Order details:
shear lug
type 3L .. .. - ..

Order example

For shear lug on a pipe clamp type 36 22 31 for a pipe made from material 13CrMo4-5:
Order number 3L 22 31-04

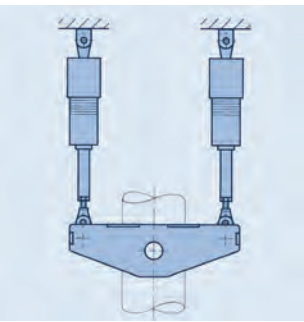
Installation and operating instructions Type 30

Snubbers are precision components of crucial importance for safety. Correspondingly, great care must be taken when dealing with them. Attention to the following points in these instructions is the prerequisite for their proper functioning.



Typical installation situation for type 30

① name plate
② piston rod cover
③ sight glass
④ travel indicator
⑤ connecting lug



Hanger with snubber type 30 and dynamic clamp type 34 with twist restraints

1 Transport and storage

LISEGA snubbers are high-precision components of great relevance for safety that must be treated with special care during transport, storage, unpacking and handling before and after installation. At this the temperatures should not fall below –20°C.

Snubbers and their ancillary components must be stored in enclosed spaces. They must be protected from dirt and damage. It is recommended that they should be left in their original packaging until installation. Any transport damage incurred or damage caused during their handling on installation must be reported at once to the manufacturer.

Snubbers are not suitable in any way as substitutes for steps or ladders. Before work such as sand blasting, welding, painting etc. is carried out in the close vicinity of a snubber, the snubber must be dismantled, removed and protected.

2 Delivery condition

The snubbers are supplied as fully operational components including hydraulic fluid. On type 30 the connecting lugs are bolted on one side to the base of the snubber and on the other to the piston rod and secured with clamping bolts.

LISEGA snubbers are manufactured entirely of corrosion resistant materials. They therefore require no additional surface treatment. The threaded connecting lugs are electro galvanized and white chromatized.

Weld-on brackets type 35 are supplied separately with the appropriate pins. The surface protection hereby consists of a weldable primer.

For shipment the type 30 snubbers are packed singly with retracted pistons in suitable crates.

Name plate type 30

Stamped on the name plate are:

- **type designation**
- **nominal load**
- **theoretical stroke**
- **oil type and volume**
- **serial number**
- **order number**
- **marking and ident. number, if required**

3 Installation

The snubbers must be inspected for damage before installation. It must also be ensured that the connecting lugs are firmly attached. The connection components on site and the connecting brackets must be fully welded.

The arrangement of the connection brackets must always be selected so that the maximum deflection angle is in the direction of the greatest operational heat expansion. The lateral displacement is restricted to a maximum of ± 6°. Misalignment of the connection brackets should be prevented, due to the limited possibility of movement.

Any welding at the connections or in their vicinity should take place before installation of the snubbers.

For installation, the type 30 snubbers are to be brought to the required installation dimension (dimension from connection pin to connection pin) by extending the piston rods to the necessary installation dimension.

To avoid undesirable blockage of the snubber the rods must be extended slowly, smoothly and below lock-up velocity. The piston rod of the smaller snubbers can be shifted manually. The dead weight of the large-bore snubbers can also be utilized by suspending the snubber from the connecting lug of the piston rod.

The snubbers can be installed in any orientation. The piston rod should be connected to the heat-conducting component so that any radiated heat can be dissipated through the protective cover. When a snubber installation extension is used, the extension should be connected to the heat source.

The snubbers should be installed in such way that the sight glasses for fluid checks are easily visible from the maintenance walkway.

The connection to the connecting structures must be force- and form-locked. Bolted connections, which are in the flow of force must have sufficiently high pretension.

If after installation of the snubber welding work on the connections has to be carried out, care must be taken that no welding current passes through the snubber.

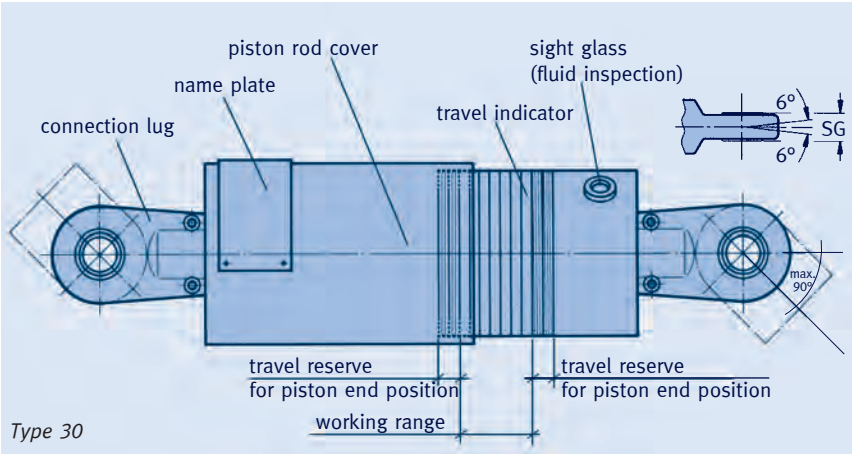
After assembly of a complete system the subsequent inspection of every point of application is recommended:

A. Inspection of all connection points for force- and form-fitting attachment (locking- bolts on the connection lugs, securing of pins, boltings at connections).

B. Inspection of the installation position for freedom of movement on expansion. Care must be taken that the connection lugs in the connection brackets remain freely movable and that the piston cannot run into the end of snubber travel.

A travel reserve of min. 10mm at the end positions is recommended for the piston position. The position can be read off the travel indicator.

Before commissioning of the plant a final visual inspection of all snubbers and their installation positions is recommended.



Type 30

4 Inspection and maintenance

Under normal operating conditions the snubbers are designed to function trouble-free for the maximum lifespan of a plant. To maintain the operating capacity of the snubbers at all times preventive maintenance is recommended. For this, see page 3.47, ‘Maintenance recommendations’.


Restraint of a vertical pipe system section by type 30 snubbers with installation extension type 33 and dynamic clamp type 34.

Installation and operating instructions Maintenance recommendations snubbers

Snubbers are crucially important components for the safety of a plant. They serve to protect the piping systems and other components from dynamic overloading from unplanned load cases. As these events occur unpredictably, the full functional safety of the snubbers at all times must be guaranteed.

Under normal operating conditions the service life of the snubbers is designed to match the maximum operational life (60 years) of a plant. The seals and hydraulic fluid should be exchanged at least once during this period, at the latest after 23 years.

Under certain conditions of use (extreme loading), premature aging or increased mechanical wear cannot be excluded. In accordance with the stringent demands concerning reliability, preventive maintenance is recommended. The performance of maintenance work is the responsibility of the plant operator.

Measures

1. **Regular inspection –**
   Visual inspection once a year

2. **Extended testing –**
   Function test, at the latest after 12 years of operation

Implementation

The inspection and maintenance work must be carried out by specially trained personnel.

If required, this work can be performed by specially trained LISEGA service technicians. Fully certified testing facilities are available for dynamic function tests – these mobile test benches can be brought to the plant.

1 Regular inspection

The regular inspection consists of a visual check and should be carried out once a year on all components installed. The first inspection should be directly before commissioning.

In the course of this inspection not only the snubbers but also the installation situation and surrounding conditions must be controlled. The procedure should be carried out with a checklist containing the following information:

- **all positions to be inspected, with details of their locations.**
- **planned, operation-related displacements in connections**
- **special ambient or operational conditions**
- **maintenance measures previously carried out**

Test bench for snubbers

The following points are to be checked at the installation position:

- **name plate data, for conformity with check list**
- **connections at attachment points for force-fitting**
- **freedom of movement for the snubbers on operational deflections**
- **position of piston rod for sufficient stroke, incl. travel reserve (min. 10mm)**
- **external condition for possible signs of damage or leakage**
- **immediate surroundings for any indications of unusual operational stresses, e.g. increased temperature**
- **inspection glass for fluid level**

As long as the reservoir piston is not visible in inspection glass there is sufficient fluid reserve in the reservoir. If the reservoir piston is visible a leakage of fluid must be assumed.

Observations and conclusions must be recorded on the checklist and if necessary supplemented by recommendations for corrective measures.

2 Extended inspection
A supplementary inspection is carried out after an operational period of 12 years in which a small selection of the snubbers installed (min. 2 units per type) are subjected to an additional function test.

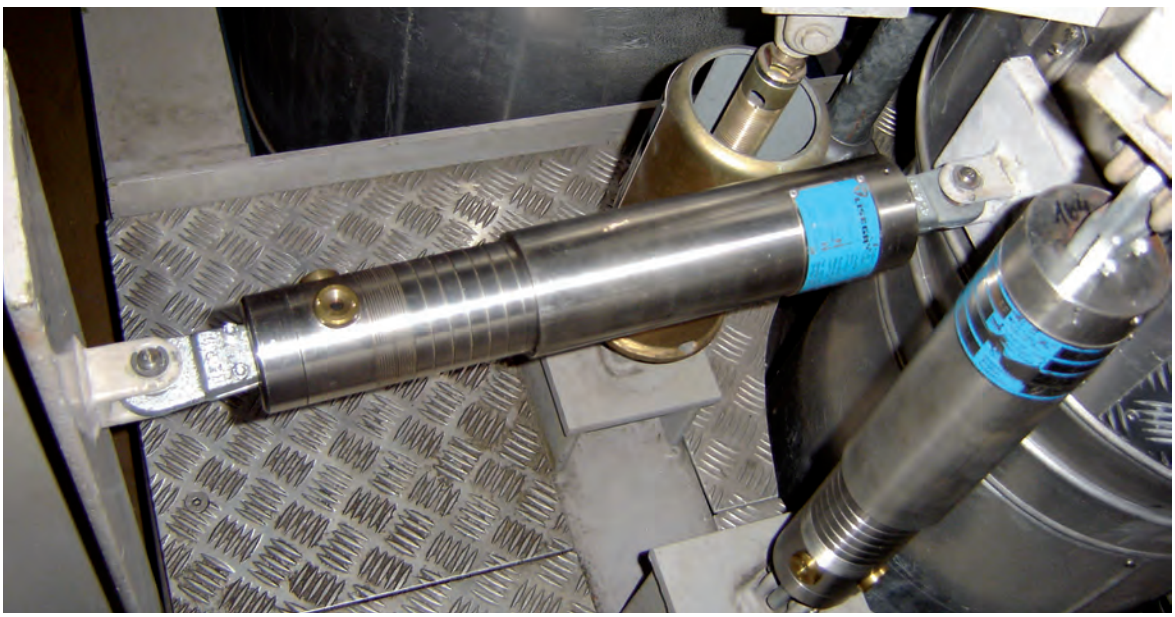
After successful testing the snubbers can be re-installed. If any anomalies in behavior are noted, the components in question should be dismantled and the condition of the functionally important individual units examined. The plant management is responsible for any necessary corrective measures and for their documentation.

The scope of the inspections and the selection of the snubbers to be tested should be agreed on between the plant management and the service engineer involved. The different forms of stress (temperature, radiation, loads, operational vibrations) should receive particular attention.

The time-point and scope of the next extended inspection is to be determined on the basis of the recorded test findings.

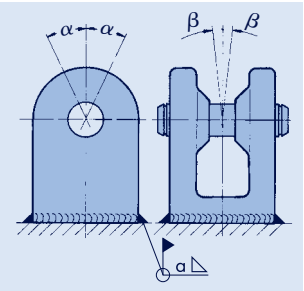
It is recommended that, after 23 years of operation at the latest, the seals and hydraulic fluid should be exchanged. After the professional execution of this work, the use of original LISEGA spare parts, and successful function testing, the snubbers can go into operation for a further 23 years.

Securing pipe systems with snubbers type 30



Use of snubbers type 30

Installation and operating instructions Type 35



Max. angulation of type 35

type	a α=15° β= 6°	a α=30° β= 6°	a α=45° β= 6°
35 19 13	3.0	3.0	3.0
35 29 13	3.0	3.0	3.0
35 39 13	3.0	3.0	3.0
35 49 13	3.0	4.0	5.0
35 59 19	5.5	7.0	8.0
35 69 19	7.5	9.5	11.0
35 79 19	10.5	13.5	15.5
35 89 19	14.5	18.0	21.0
35 99 11	15.0	20.0	23.0
35 09 13	14.0	17.0	19.0
35 20 19	23.0	–	–

Explanation of weld seam symbols:

a = 

a in mm

1 Delivery condition

LISEGA weld-on brackets type 35 are supplied painted and with fitted pins. The surface protection typically consists of a weldable primer, unless otherwise noted.

2 Installation

The connection components and connecting brackets on site must be fully welded.

The arrangement of the weld-on brackets should always be so arranged that the max. angulation is in the direction of the operational thermal expansion ($\sphericalangle \alpha$). The lateral displacement is restricted to max. ± 6° ($\sphericalangle \beta$). Any misalignment of the weld-on brackets should be prevented due to the hereby limited freedom of movement.

Welding at the connecting components or in their immediate vicinity should be carried out before installation of the snubbers, rigid struts, etc.

The following procedure is recommended for the welding of the brackets:

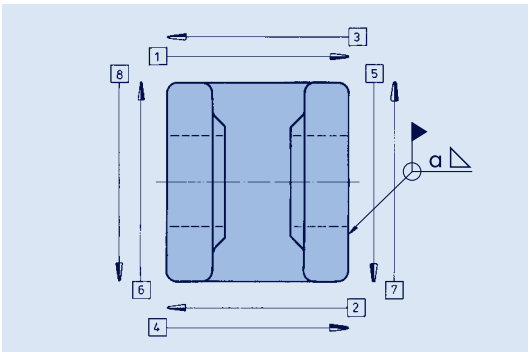
The minimum weld seam thickness 'a' for weld-on brackets type 35 depends on the angulations α and β. In the calculation a permissible stress of 90N/mm² in load case H (level A/B) was the basis.

On an increase in the angulation α to 90° the permissible stresses are reduced by approx. 15% at constant weld seam thickness (a min. at α = 45°).

The relevant load table (**"technical specifications"** page 0.6) applies for the permissible stresses.

Welding procedure

1. Remove pins from weld-on bracket.
2. Preheat weld-on bracket from type 35 79 19 and above to appr. 100°C.
3. Use base electrodes.
4. Apply the weld seam in layers to avoid welding distortion **(Welding sequence: see below).**
5. Allow the weld-on bracket to cool down to 100°C after every layer.



Note: Welding must be carried out only by qualified personnel and is to be supervised by the technical department. When mounted vertically, vertical welds should be made in upwards direction.

3 Surface protection

After completion of the attachment, the primer surface of the weld-on brackets can be painted. It is urgently advised to do this **before** installation of the snubber.

Installation and operating instructions Type 3D

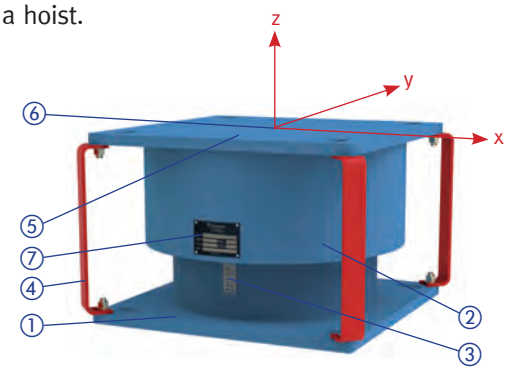
1 Transport and storage

Care must be taken during transport that the viscoelastic damper type 3D is always in upright position to avoid any leakage of the damping medium. When storing in the open the dampers are to be protected from dirt and water.

2 Delivery condition

LISEGA viscoelastic dampers are delivered preset to cold condition (offset). This is ensured by the transport brackets, which keep the offset position fixed in place between the upper and lower sections of the damper. If not ordered otherwise the blocking position (offset position x = 0, y = 0, z = 0) is supplied.

For a weight greater than 20kg, an M16 inner thread of limited engagement depth is located in the upper connection plate for attachment to a hoist.



① lower connection plate
② casing
③ position indicator
④ transport bracket
⑤ upper connection plate
⑥ connection thread M16 for hoist
⑦ name plate

The following information is stamped on the name plate:

- **type**
- **serial and commission number**
- **nominal load**
- **operating temperature**
- **ident. number**

3 Installation

For installation, attention must be paid to the requirements of the installation instructions for the pipe systems. The LISEGA viscoelastic damper, which is supplied with installation load (cold load) is transported to the place of assembly in an upright position. A force-fitting connection of the upper and lower connection plates is made to the pipe system and steelwork. For this, the transport brackets must be removed. The bolt torque values can be found in the table at the side.

4 Commissioning

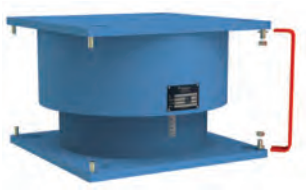
For types 3D.. ..-D it is recommended that the plant should be started up slowly so that the dampers can adjust to operating temperatures, otherwise strong reaction forces could develop that exceed the specified nominal loads. If required, the dampers could be brought to operational temperature by means of supplementary heating. During commissioning the relative position of the upper and lower connection plates changes to hot load position, as calculated beforehand.

During operation the damper should function roughly in middle position, otherwise the dynamic characteristics of the damper change. If the middle position in the tolerance range is not reached the calculations are to be reviewed.

5 Inspection and maintenance

LISEGA viscoelastic dampers are in principle free of maintenance, but an annual visual inspection is recommended. For revision purposes the transport brackets can be attached again.

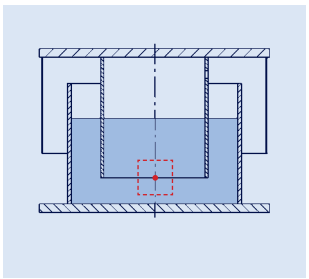
Name plate type 3D



Removal of transport brackets

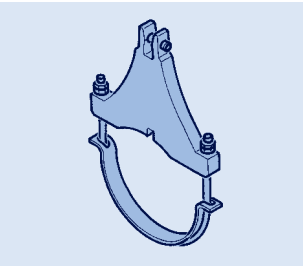
thread size	bolt torque values * [Nm] 4.6	5.6
M 12	29	39
M 16	71	95
M 20	138	184
M 24	235	315
M 30	475	635
M 36	1080	1440

** Values according to VDI 2230 Appendix A, friction value μ = 0.14*

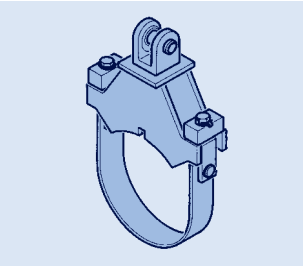


= *Working range of type 3D at the middle position*

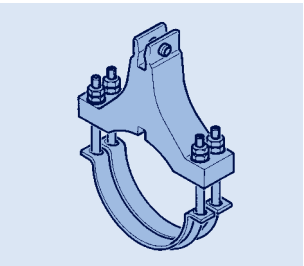
Installation and operating instructions Type 36, 37



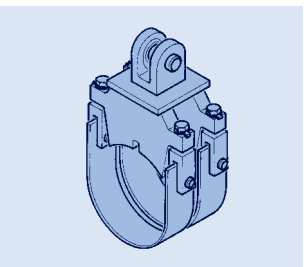
Type 36 .. .1/2/3



Type 37 .. .1/2/3/4/5/6



Type 36 .. .4/5



Type 37 .. .7/8/9

1 Transport and storage

Care must be taken that the dynamic clamps are not damaged during transport. It is recommended that the components are only stored in dry, enclosed spaces. If storage in the open is unavoidable, the clamps must be protected from dirt and water.

2 Delivery condition

LISEGA dynamic clamps are supplied with all the necessary boltings for installation. For reasons of dispatch optimization the clamps may be delivered partially assembled.

Shear lugs

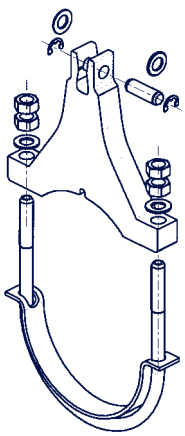
In order to avoid any kind of twist of the clamp it is recommended that shear lugs be fitted. See also page 3.44.

The dimensions of the recesses for the shear lugs can be found in the selection tables for dynamic clamps on pages 3.29 – 3.43.

3 Installation

Type 36

This design consists of a massive upper section with integrated connecting bracket and, depending on the load range, with one or two U-bolts and a shim plate.



For installation the pre-assembled U-bolts must be removed. The upper part, fitted with a lug recess, is seated on the shear lug. The U-bolt is inserted from the opposite side together with the shim plate and at first only loosely screwed. The position of the clamp is to be checked again for proper alignment. The bolts can then be tightened and locked.

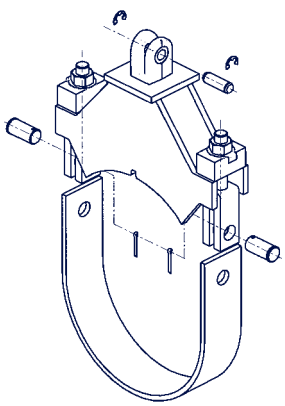
Type 37

This design is the heavy duty version for large pipe diameters and heavy loads.

As a rule, type 35, the weld-on bracket suitable for the load, is already welded on. If the bracket is delivered separately at customer request, the welding instructions on page 3.49 are to be followed when welding.

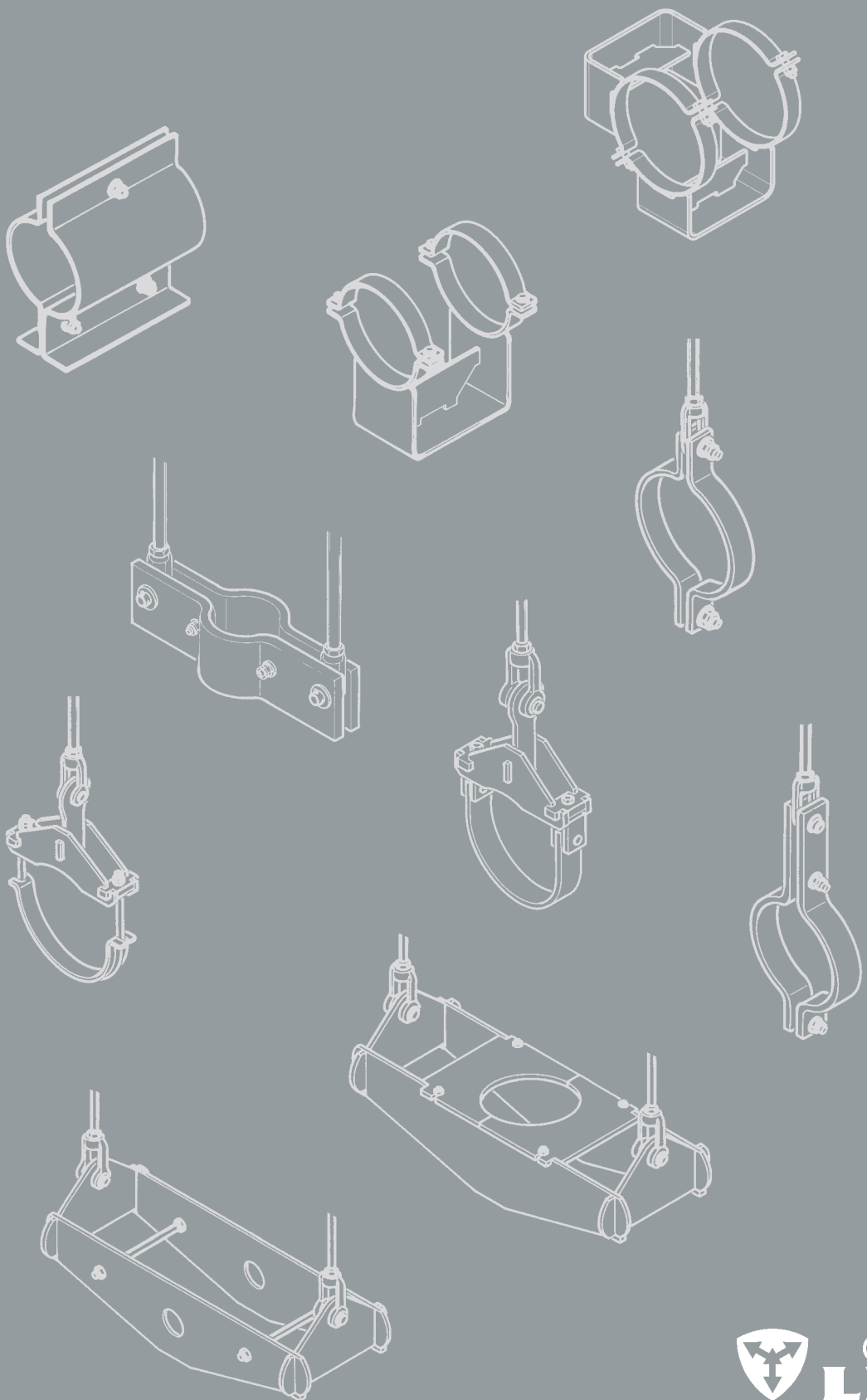
The counterpart to the upper section of the clamp consists, depending on the load, of one or two flat steel straps which are connected by pins to the upper section for transport.

For installation the flat steel straps must be removed by loosening the pin connections. The upper part with the lug recess is seated on the shear lug. From the opposite side the flat steel strap is inserted into the bolt-on clevis and fastened with the pins, which are then locked with splints.



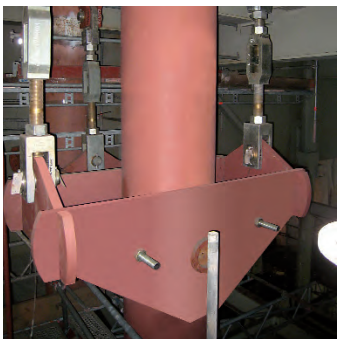
The position of the clamp must be checked once again for proper alignment. The bolts can then be firmly tightened. To avoid unintentional loosening the hexagon nuts on the bolts must be locked with tab washers.

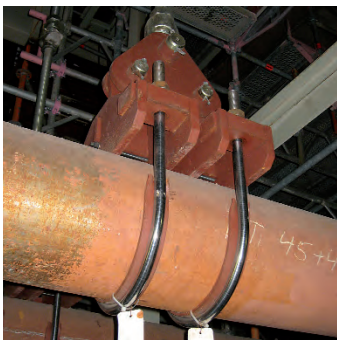
Pipe clamps, clamp bases, pipe connecting parts



PRODUCT GROUP 4

LISEGA





Pipe clamps, clamp bases, pipe connecting parts

Contents **Page**

Field of application

In high temperature pipe systems, pipe clamps and clamp bases are the most highly stressed and hence the most vulnerable components in the support chain due to the effects of such high temperatures. However, pipe clamps are seldom checked, as access is difficult after commissioning due to the surrounding insulation.

Standardization

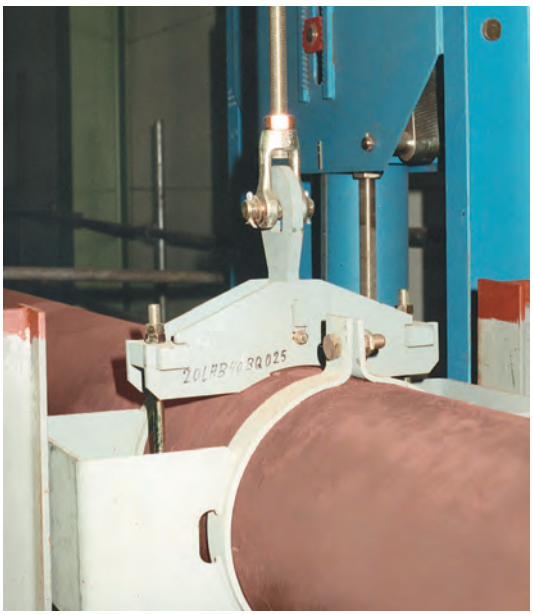
Pipe clamps, clamp bases, pipe weld-on lugs and U-bolts all fall into the category of pipe connections. For these products, the design criteria of the pipe systems lead to wide variations, and so to a particularly large number of components. The dynamic clamps of product group 3 also belong in principle to this group. The design of both horizontal and vertical piping is determined by:

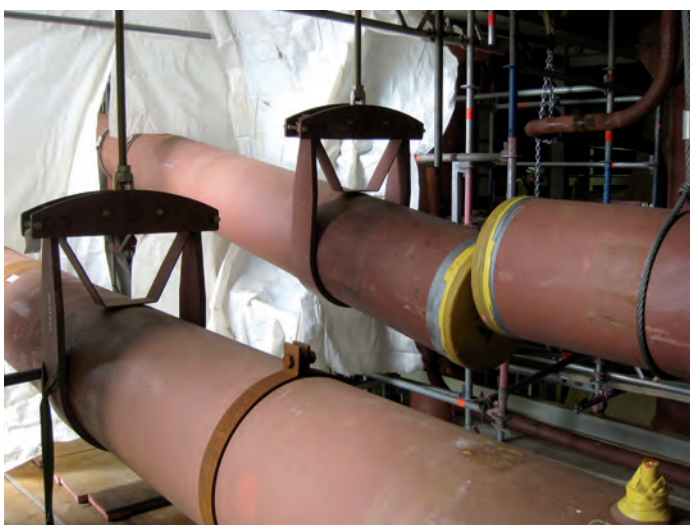
- **diameters**
- **loads**
- **temperature of the medium**
- **insulation thicknesses**

For proper coverage of the whole spectrum with safe components, LISEGA provides a complete program of standardized products for the whole field of application.

Following the special requirements of this field the corresponding ideal design has been developed.

Diameters range from OD 21.3 to OD 1219, the temperature range extends to 650°C and the permissible loads – divided into economical areas of operation – cover the highest level of the practical field of application.





These standardized components form an integral part of the LISEGA modular system, so load and connection compatibility are correspondingly assured.

Quality

Because of their critical field of application the design and construction of the pipe-surrounding components require special attention.

As a matter of principle, just as much care and attention should be given to the pipe supports as to the piping itself, since **the pipe systems can never be better than their supports!**

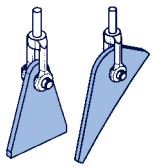
The most important prerequisite for reliable component quality is comprehensive standardization.

When choosing suitable products the customer should therefore place his confidence in com ponents of proven quality.

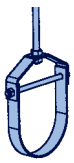
Plant designers, constructors and operators can all benefit from the standardization of the whole spectrum of application with state-of-the-art design:

- **complete and clearly structured data tables simplify planning**
- **all supplies from a single source through integration into a comprehensive support program (LISEGA modular system)**
- **superior quality at competitive prices through rational series production and technically advanced designs**
- **consistent standardization enables short lead times**
- **favorable performance / weight ratios, easy-to-install designs and connection compatibility of LISEGA components allow efficient installation**
- **design in accordance with current codes ensures maximum operational safety**
- **heat loss reduced through compact component dimensions**
- **certifications by independent testing institutes can be supplied**
- **for pipe clamps used at higher temperature ranges, materials certified according to EN 10204-3.1 are used**

Product description
Horizontal clamps Type 41, 42, 43, 44



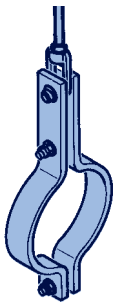
Type 41



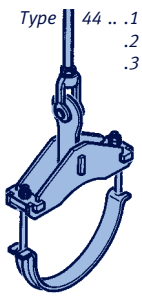
Type 42 .. 17

Type 42 .. .9

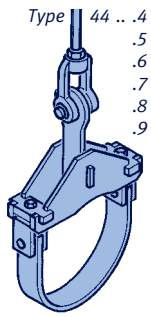
Type 43



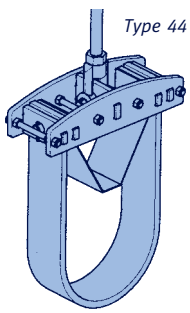
Type 44 .. .1
.2
.3



Type 44 .. .4
.5
.6
.7
.8
.9



Type 44 .. 51
.2
.3
.4
.5
.6
.7



1 Weld-on lug type 41

This type is mainly used as a pipe connection for pipe systems under 80°C on horizontal pipes or pipe elbows.

2.1 Horizontal clamp type 42 .. 17

This clamp can be used as a construction clamp or hanger clamp in cold piping systems. The field of application is limited to smaller pipe dimensions.

2.2 Horizontal clamp type 42 .. .9

This clamp is used for larger pipe dimensions.

3 Horizontal clamp type 43

This hanger clamp follows the traditional fla steel design. Its use is limited to an economical range up to an individual weight of approximately 25kg. Connection to the load chain is made by pin and LISEGA threaded eye nuts type 60.

The application range of the pipe clamps can extend over several LISEGA load groups due to the interdependency of load and temperature in material properties. For this, the eye nuts are so designed that at least three corresponding pin diameters can be accommodated.

4 Horizontal clamp type 44

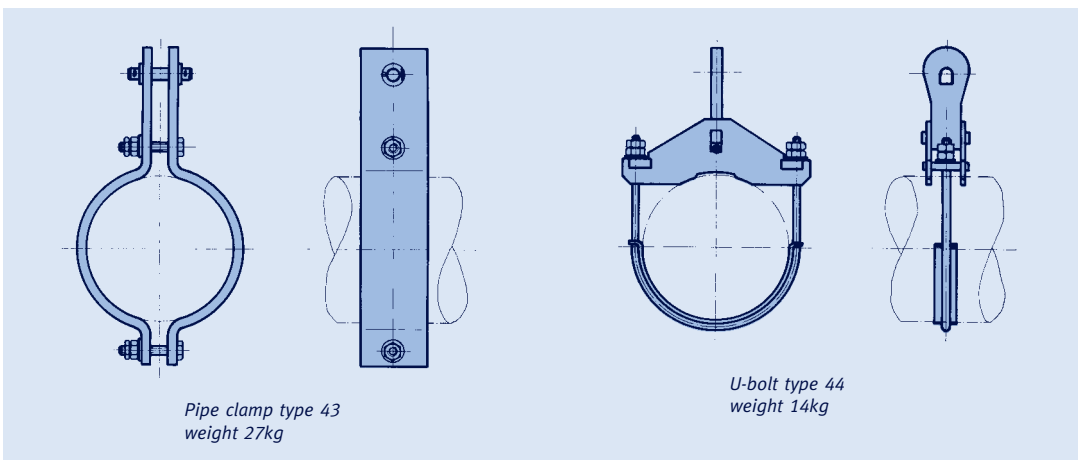
A rigid yoke takes up the load from a pipe-surrounding U-bolt with a shim plate. From certain diameters, temperatures or load ranges, a flat steel strap is used instead of a round steel U-bolt.

Completely eliminating welds, the individual components are form-fitted with plug connec tions and bolted to each other (Patent No. DE 3817059).

Horizontal clamp type 44 is used where type 43 reaches economic limits. These are essentially the high temperature, large pipe diameters in high load ranges.

Connection to the load chain is made with a lug and LISEGA clevis type 61. The connection lug is designed to accommodate connection pins in a number of LISEGA load groups.

Same function → reduced weight



Weight reduction through type 44:
Comparison of a LISEGA pipe clamp with a pipe clamp of traditional shape following the same design criteria, load 32kN, temperature 300°C.

Product description
Riser clamps Type 45, 46, 48

1 Riser clamp type 45

With the riser clamp type 45 the lower load and temperature ranges are covered. This design is particularly economical for its diameter range.

Connection to the vertical piping is made with shear lugs welded to the pipe. The design and fitting of the lugs is the responsi bility of the piping manufacturer.

Connection to the load chain is made with pins and LISEGA threaded eye nuts type 60. At least 3 LISEGA load groups can be covered.

When ordering, the span required (dimension L) must be specified.

2 Riser clamp type 46/48

The design of this riser clamp uses the box shape for its economical use of material.

The individual parts are connected without welding by means of connections, then locked to each other (Patent No. DE 3817015).

Connection to the vertically arranged pipe system can be made in two different ways and so requires two different designs:

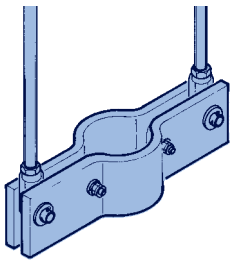
- **Type 46, for load support using 4 shear lugs welded to the pipe. Two lugs are in general used only for ND ≤ 150 and must be so arranged that they are located directly above the side section.**
- **Type 48, for load support using trunnions welded to the pipe.**

The bore hole diameter for trunnions amounts to approximately 1/3 of the pipe diameter in accordance with ASME Code Case N3923 and DIN EN 13480-3.

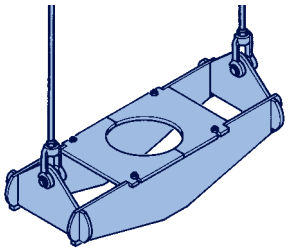
Connection to the load chain is done with integrated lugs designed for connection to LISEGA threaded clevises type 61.

The connecting lugs are shaped in such a way that they can accommodate the connection pins for several LISEGA load groups.

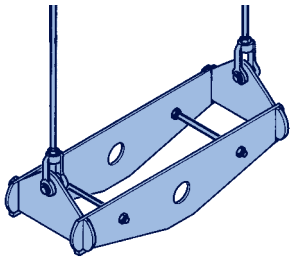
The inner dimensions of the box, which are required for the later trunnion calculations (N dimension) can, depending on the pipe diameter OD, be taken from the table at the bottom right.



Riser clamp type 45 with connections



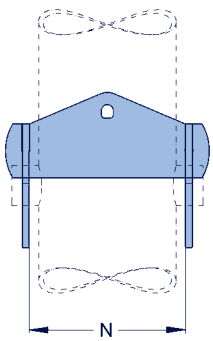
Riser clamp type 46 with connections



Riser clamp type 48 with connections

Materials of pipe clamps and clamp bases

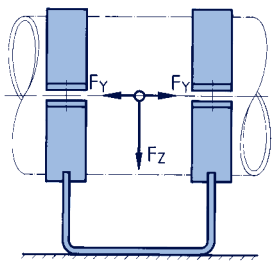
clamp materials / type	S235JR	S355J2	16Mo3	13CrMo4-5	21CrMoV5-7	10CrMo9-10	X10CrMoVNb9-1
horizontal clamps							
type 41	x	x					
type 42	x		x	x		x	x
type 43	x		x	x		x	x
type 44	x	x	x	x	x	x	x
riser clamps							
type 45	x			x		x	x
type 46	x	x	x	x		x	
type 48	x	x	x	x		x	x
clamp bases							
type 49 .. .1	x						
type 49 .. .2	x						
type 49 .. .3	x						
type 49 .. .4	x						
type 49 .. .5			x	x		x	x



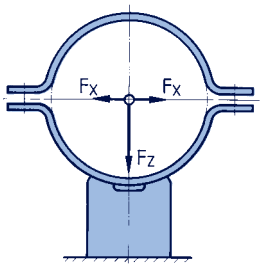
Inner width of box (N-dim.) of riser clamps type 46/48

pipe diameter	N-Dim.
≤ OD 100	OD + 12mm
OD 100 ≤ OD 400	OD + 22mm
> OD 400	OD + 32mm

Product description
Clamp base Type 49



$F_Y = \mu \cdot F_Z$



$F_X = \mu \cdot F_Z$

Possible load applications on a clamp base.

μ = friction coefficient

material	μ
steel / steel	~0.3
steel / PTFE	~0.1
steel / high temperature component to 280°C	~0.1...0.18
steel / high temperature component from 280°C to 350°C	~0.25

Further information on page 7.11.

Clamp bases are generally used as slide bearings (loose supports) for horizontally arranged pipe systems.

As with pipe clamps, the application spectrum covers a diameter range from OD 21.3 to OD 1219 and a temperature range up to 600°C; for OD up to 88.9: 650°C.

In addition to the support load, the operating temperature of the pipe system is an essential criterion in the design of clamp bases; the material to be used is determined by this. The installation height is governed by the thickness of the insulation.

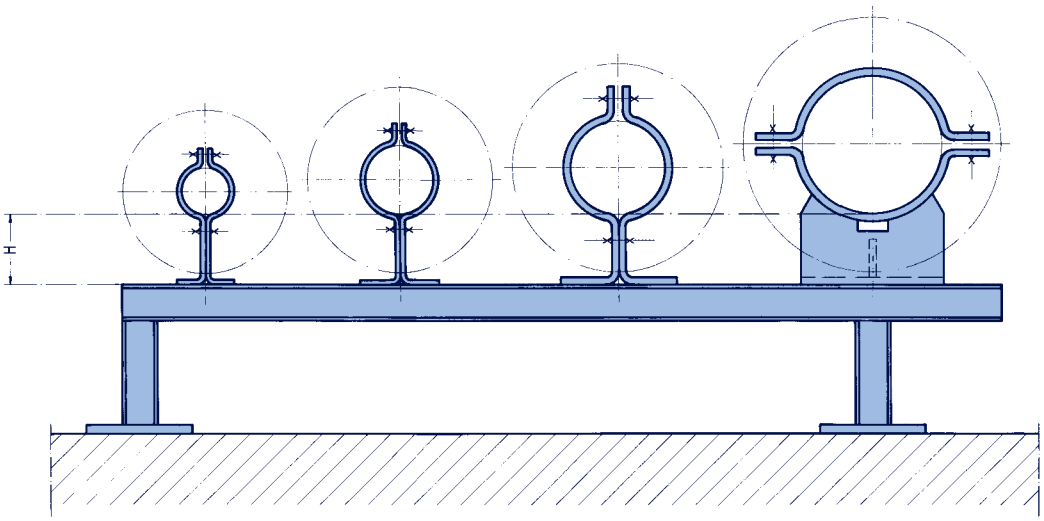
Fixed installation heights are assigned to the temperature ranges in order to keep the number of sizes within a reasonable range.

The fixed installation heights relate, for all diameters, to the respective lower rim of the pipe and change by 50mm or 100mm increments.

The standard dimensions selected for the support height of the pipes, as well as the length of the slide bases, cover the majority of applications.

Different applications, according to temperature and loads, require different clamp base designs.

If required, components with special dimensions can be supplied. A small selection is shown on page 4.9 in the section ‘Special designs’.



Clamp base heights dependent on temperature of the medium and on pipe diameter

temp. up to 350°C	H	50	100	150	200
	pipe Ø	21.3–88.9	21.3–558.8	108–1219	323.9–1219

temp. up to 500°C	H	100	150	200	250	300
	pipe Ø	21.3–26.9	33.7–76.1	88.9–193.7	219.1–457.2	508–1219

temp. up to 560°C	H	150	200	250	300
	pipe Ø	21.3–76.1	88.9–168.3	193.7–323.9	355.6–1219

temp. up to 600°C (650°C)	H	150 (200)	200 (250)	250	300
	pipe Ø	21.3–76.1	88.9–168.3	193.7–323.9	355.6–1219

1 Clamp bases for low temperatures and small pipe diameters

The design (version 1) for this field of application consists of two omega-shaped halves. On installation with the piping the lower section is firml bolted and forms the slide base.

In the upper section the pipe is held in position by bolting.

Through the free space under the pipe gained by the design (version 1) of the component, constant ventilation of this area is ensured. This is essential for cold pipe systems, as otherwise pipe corrosion caused by moisture could result after only a short time. These clamp bases are electro galvanized as a standard.

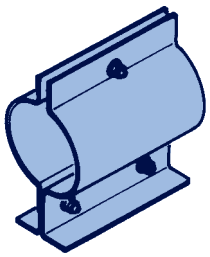
2 Clamp bases for medium and high temperatures

This design (version 2) consists of a shaped lower metal plate, firmly welded to two pipe clamps. The lower section is fitted, according to the respective design load, with a reinforcing gusset.

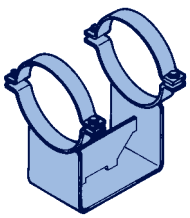
These clamp bases can be used in a variety of ways. By using two lower sections set against each other, a double guide can be easily produced (Fig. 2). By additionally fitting lateral guides, guidance from all sides can be provided.
The shape of the base plate permits the simple mounting of lift-off restraints (Fig. 1). The lower section is so designed that it can be fitte with a stainless steel plate as a sliding surface for a slide component. See also ‘product supplements’, page 4.7.

3 Special designs

- **If required, special lengths or heights are possible. For very large expansion displacement it might be more expedient to arrange for correspondingly long support surfaces on site.**
- **For special pipe diameters not contained in the selection tables, either corresponding intermediate sizes are supplied, or suitable inlay plates are provided for slight diameter differences.**
- **If required, double or multiple guides on the basis of standard clamp bases can be supplied. See also page 4.8.**

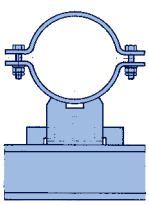


Version 1:
Clamp base for smaller pipe diameters type 49 .. .1, 49 .. .2 up to ND150.



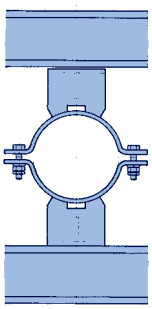
Version 2:
Clamp base for medium and high temperatures type 49 .. .3, 49 .. .4, 49 .. .5.

Examples of use:



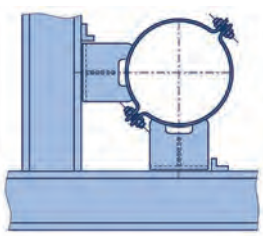
(Fig. 1)

Clamp base type 49 with lift-off restraint. Permissible loads and dimensions, see page 4.68.



(Fig. 2)

Clamp base type 49 .. .. G2P as double guide.



Clamp base type 49 .. .. G2A as guide.

Product supplements for pipe clamps and clamp bases

Pipe clamps and clamp bases are often equipped with supplementary parts for special applications. For this purpose LISEGA offers a wide variety of possibilities.

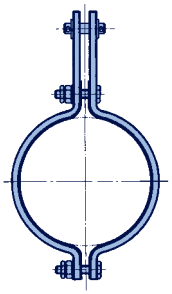
1 Stainless steel inlay plates

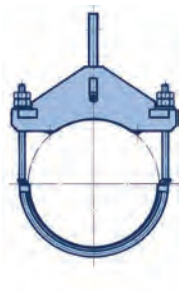
For the support of austenitic pipe systems, all LISEGA pipe clamps and clamp bases can be fitted with stainless steel inlay plates of the material 1.4301 (X5CrNi18-10). These plates must be ordered separately and are offered with the following type numbers:

For type series 36: Stainless steel plate 36 .. ..-IP
For type series 37: Stainless steel plate 37 .. ..-IP
For type series 42: Stainless steel plate 42 .. 09-IP
For type series 43: Stainless steel plate 43 .. ..-IP
For type series 44: Stainless steel plate 44 .. ..-IP
For type series 45: Stainless steel plate 45 .. ..-IP
For type series 46/48: Stainl.st.plate 46/48 .. ..-IP
For type series 49 .. 11/12:
Stainless steel plate 49 .. .. -IP
For type series 49 .. 13/14/25/35/45/55:
Stainless steel plate 2x 42 .. 09-IP

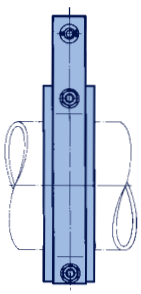
Examples: For a pipe clamp type 44 27 13
→ inlay plate type 44 27 13-IP.
For a clamp base type 49 11 25
→ 2x inlay plate type 42 11 09-IP.

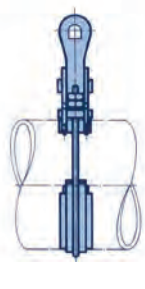
Material thickness: 0.5mm





Type 43 with inlay plate





Type 44 with inlay plate

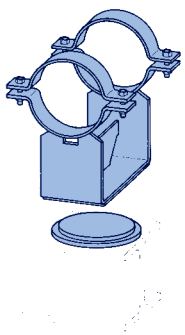
Stainless steel slide plate under clamp base type 49, high temperature slide plate and spring support type 29

2 Stainless steel slide plates

To reduce friction resistance in clamp bases, all of them can be fitted with stainless steel sliding surfaces of the material 1.4301 (X5CrNi18-10). These sliding surfaces, in combination with PTFE slide plates **type 70** (up to 180°C) or the **new LISEGA high temperature sliding material (up to 350°C)**, reduce friction forces by approx. 10–20% of the support load. See also section 'slide plates' page 7.10 This version of the clamp bases with slide plates must be ordered separately. For this, please add the type number suffix "SP":

Examples: 49 22 14-SP
49 27 14G2A-SP

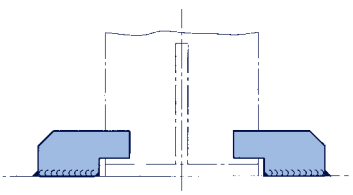
The installation height of the clamp base increases by approximately 3mm.



Lift-off restraint

3 Lift-off restraints type 49 00 01 to 49 00 05

The clamp bases can if required be fitted with lift-off restraints. These restraints ensure that the clamp base remains in position if the support load is too small or the clamp base cannot be welded on. They can be ordered according to the selection tables (page 4.68).



4 Connection plates type 77

Two pipe clamps types 43 and 44 can be coupled with connection plates. This way the load can be doubled. A selection is shown on page 4.67.

When ordering, this is made clear by replacing the type designation of the clamps with “77”.

Example type 43:
77 09 39 for clamps 43 01 19 – 43 09 59
77 17 39 for clamps 43 10 19 – 43 17 59
77 19 39 for clamps 43 19 19 – 43 19 59

Example type 44:
77 66 38 for type 44 66 38

The load group must be specified for type 44, as the upper connection (type 60) must be correspondingly selected.

5 Anti-corrosion separating tape

Separating tapes are used when the pairing of dissimilar materials in pipe and pipe supports must be electrically separated to prevent local corrosion. This way, the piping can be fitted with supports of more econom ical martensitic materials, and still be more effectively protected.

The adhesive separating tapes can be applied in a temperature range from –35°C to +210°C and are largely resistant to acids, bases and solvents. They are applied as adhesive tape (in part multilayered) to the grease-free piping at the point where the pipe clamp body surrounds the pipe. The material thickness amounts to only 0.5mm.

The tapes are supplied in different widths to suit the clamps in whole meter lengths. The order designation is:

Order details:
Anti-corrosion separating tape type 42 00 ..
L = ...m

6 Pipe guides type 49 .. .. G..

It is often necessary to limit the piping in its displacement horizontally, vertically or in both directions. On the basis of the type 49 standard designs (version 2), pipe guides are offered here as a variant corresponding to the standard design in form and load capacity. The order number is made up from the standard type number and the desired features of the design.

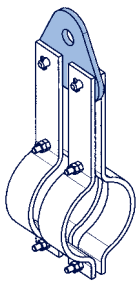
Example:

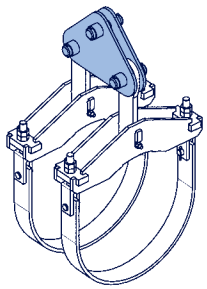
type 49 standard:	**49 .. ..**
type 49 double guide parallel:	**49 .. .. G2P**
type 49 lateral guide angulated:	**49 .. .. G2A**
type 49 triple lateral guide:	**49 .. .. G3**
type 49 foursided guide:	**49 .. .. G4**

These designs can be fitted with extra slide plates.

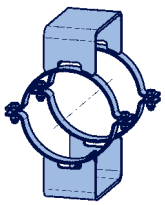
Pipe bearing (type 49 .. .. G2P)

type	width [mm]	type	width [mm]
42 00 04	b=40	42 00 11	b=110
42 00 05	b=50	42 00 12	b=120
42 00 06	b=60	42 00 15	b=150
42 00 07	b=70	42 00 17	b=170
42 00 08	b=80	42 00 20	b=200
42 00 09	b=90	42 00 22	b=220
42 00 10	b=100		

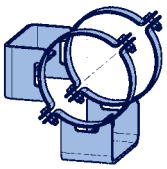




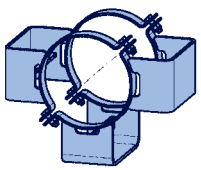
Connection plates type 77 on pipe clamps type 43/44



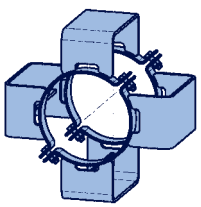
Type 49 .. .. G2P



Type 49 .. .. G2A



Type 49 .. .. G3



Type 49 .. .. G4

Special designs

For pipe supports, the application of standardized components has long since proven itself through enormous savings in time and costs where design, shipment and installation are concerned. This applies particularly to pipe clamps and clamp bases.

However, the general complexity of pipe systems requires an extremely wide range of applications for these components, which in special cases demands the use of special designs. For the technically correct solution it is necessary in such cases to rely on experienced professionals, who can offer tried-and-tested solutions and calculation processes.

Special designs

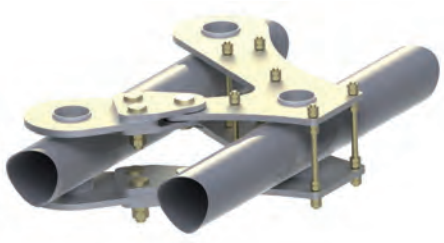
The standardized LISEGA program of pipe-surrounding support components is comprehensive and covers all general cases of applications, going well beyond the usual spectrum in this field. In spite of this, more complicated cases sometimes occur where only a special design can provide the best solution. Among other things, special designs are most often called for in the following situations:

- **unusually restricted spaces**
- **avoidance of interferences**
- **custom-made anchors**
- **exceptionally high load requirements**
- **special pipe diameters**
- **especially high temperatures (up to 1000°C)**
- **larger insulation thicknesses**
- **unusual angles in piping**
- **special trunnion diameters**
- **twist restraints / shear lugs**

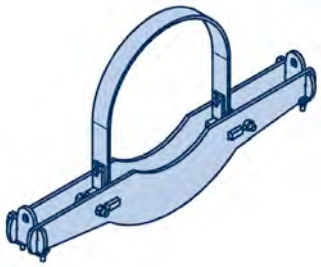
LISEGA's customers are not left alone in such situations. For these special problem cases, an experienced team of technicians and engineers is on hand, ready to react rapidly and flexibl with the right solutions. They are backed up by a range of computer software programs developed in-house. On top of this, a broad repertoire of tried-and-tested basic designs is available.

There's no problem that can't be solved – this conviction is powerful motivation for LISEGA's experts. We are happy to give our customers proof of this at any time!

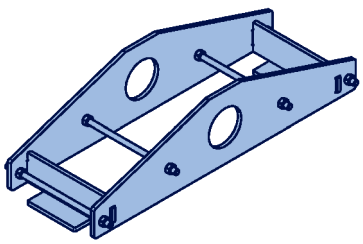
Support for a vertical pipe section with special design type 45



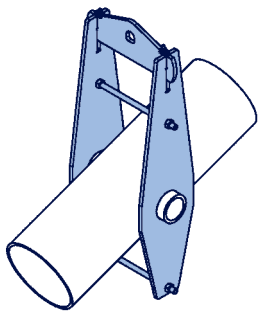
LISEGA triple joint (special design)



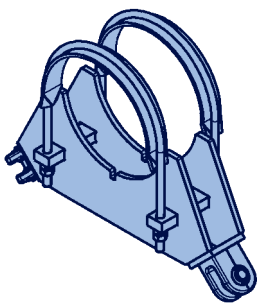
Special design type 40



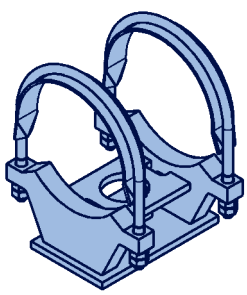
Special design type 48 (seated)



Special design type 48 for an angulating pipe system



Special design type 38



Special design type 49 with displacement control

Selection of pipe clamps and clamp bases

The following points are important for application:

1 All data needed for determination of the correct component and a clearly defined order are outlined in the selection tables.

2 The connection geometries are compatible with those of the LISEGA connection components. Due to the wide load application range, connection components from several LISEGA load groups can be attached.

The dimensions and geometries listed in the selection tables can vary slightly as regards design: The permissible loads apply as shown.

3 The lengths of the connecting lugs are so designed that the connection points always lie outside the economical insulation thicknesses.

4 All pipe clamps and clamp bases can be fitted with corresponding stainless steel inlay plates for use with pipe systems made of austenitic materials. These components can be found on page 4.7.

5 When selecting a suitable pipe clamp the **following sequence** is to be followed:

5.1 Determination of the relevant page for the outer diameter (OD) of the pipe system to be supported. The normal pipe tolerances are covered.

5.2 Determination of the relevant temperature range in the column for the desired support type, horizontal or vertical.

5.3 Determination of the permissible load to be covered. The permissible operational load taken from the selection table must not be exceeded at any time. The linear interpolation of the permissible load for intermediate temperatures is allowed.

5.4 Checking of installation dimension E and width B for agreement with the installation conditions on site. The dimensions can be taken from the selection tables.

5.5 Checking of the span width in riser clamps (L DIM.).

5.6 Decision as to whether trunnions or shear lugs are to be used for riser clamps type 46/48.

5.7 Agreement of the connection with the load chain required can be checked via the LISEGA load group ranges.

5.8 Specify the component selected by entering the relevant LISEGA type number.

6 When selecting a suitable clamp base the points 5.1 – 5.4 should be followed.

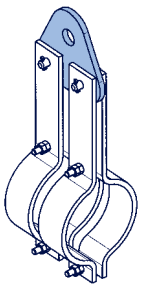
Attention must also be paid to selection of the correct height (dimension H) which depends on the thickness of the insulation.

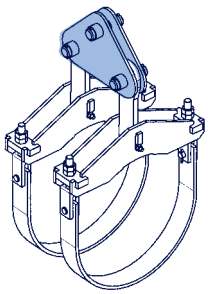
6.1 The heights specified (dimension H) and the lengths (dimension A) are standard dimensions (see selection tables) and cover the most common cases of application. If required, the components can be supplied with different dimensions.

7 Pipe clamps and clamp bases can be supplied as special designs for unusual applications and conditions (see pages 4.6 to 4.9 for this).

8 In the design and construction of LISEGA pipe clamps and clamp bases, their application in cases of increased requirements was also taken into account. In accordance with the LISEGA quality management system, separate manufacturing is required for this. The type designation thereby changes in the 5th digit by addition of a 5 (see also pages 0.7 and 0.8 on this).

The selection tables on the following pages offer an overview of the fields of application. They are classified in rising stages according to pipe diameters. All pipe clamps and clamp bases coming into consideration for a planned pipe system can therefore be found on one page. The high-temperature range (600°C – 650°C) is included as a supplementary section. The shown loads of the LISEGA pipe clamps consider a force applied conically below 4°.





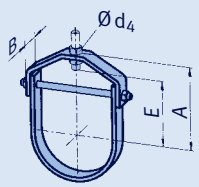
By coupling two pipe clamps with connection plates type 77 the loads can be doubled. A selection can be found on page 4.67.

Selection table OD 21.3

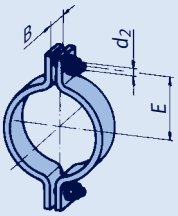
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

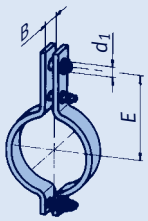
Pipe clamps, clamp bases, OD 21.3 (ND 15), type 42, 43, 45, 49



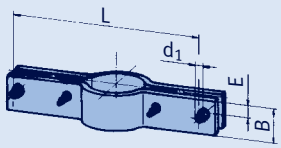
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_4	E	A	B	wt. [kg]	load group
42 01 17	2.5										10.5	22	43	26	0.14	C-D



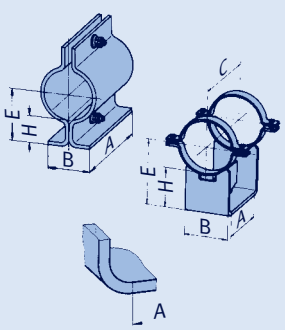
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 01 19	5.3	4.0	2.9								M10	28	30	0.3	C-2
Heat-resistant materials, see pages 0.9 and 4.4															



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 01 19	6.1	4.7	3.4								12	100	30	0.5	C-2
43 01 39			5.8	5.2	4.3	3.6	2.3	1.2			12	135	30	0.6	C-2
43 01 49					6.7	5.9	4.5	2.8	2.1	1.5	12	135	30	0.6	C-2



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	wt. [kg]	load group
45 01 11	4.4	3.6	2.5								12	25	50	250	2.2	C-4
45 01 11	3.7	2.9	2.1								12	25	50	300	2.5	C-4
45 01 11	2.7	2.2	1.5								12	25	50	400	3.2	C-4
45 01 11	2.1	1.7	1.2								12	25	50	500	3.8	C-4
45 01 11	1.9	1.4	1.0								12	25	50	600	4.4	C-4
45 01 31	9.0	7.6	6.5	5.6	4.9	4.0	2.6	1.3			12	25	70	300	4.2	C-4
45 01 31	6.6	5.6	4.8	4.1	3.6	3.0	1.9	1.0			12	25	70	400	5.3	C-4
45 01 31	5.2	4.4	3.8	3.3	2.8	2.3	1.5	0.8			12	25	70	500	6.4	C-4
45 01 31	4.3	3.7	3.1	2.7	2.3	1.9	1.2	0.6			12	25	70	600	7.5	C-4
45 01 41	8.7	7.8	7.3	6.4	4.9	4.3	3.2	2.0	1.5	1.1	12	25	70	300	4.2	C-4
45 01 41	6.4	5.8	5.4	4.7	3.6	3.2	2.4	1.5	1.1	0.8	12	25	70	400	5.3	C-4
45 01 41	5.0	4.5	4.2	3.7	2.8	2.5	1.9	1.2	0.8	0.6	12	25	70	500	6.4	C-4
45 01 41	4.2	3.7	3.5	3.0	2.3	2.0	1.5	1.0	0.7	0.5	12	25	70	600	7.5	C-4



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 01 11	1.1	0.8	0.6								61	100	40	–	50	0.6
49 01 12	1.6	1.2	0.9								111	150	65	–	100	1.3
49 01 25	3.7	2.8	2.4	1.9	1.8						111	175	70	230	100	1.6
49 01 35	4.2	3.8	3.2	2.8	2.6	2.6	2.5	1.7			161	175	100	230	150	2.3
49 01 45	5.1	4.6	4.4	3.9	3.7	3.6	3.4	2.3	1.7	1.3	161	175	100	230	150	2.7

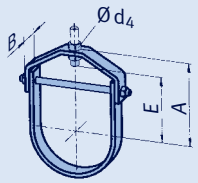
Selection table OD 26.9

Temp. of medium > 600°C
from page 4.52

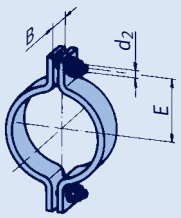
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 26.9 (ND 20), type 42, 43, 45, 49

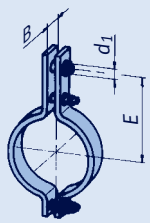
	permissible load [kN]														wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_4	E	A	B	[kg]	group
42 02 17	2.5										10.5	25	48	26	0.15	C-D



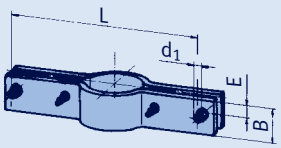
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 02 19	5.3	4.0	2.9								M10	33	30	0.3	C-2
Heat-resistant materials, see pages 0.9 and 4.4															



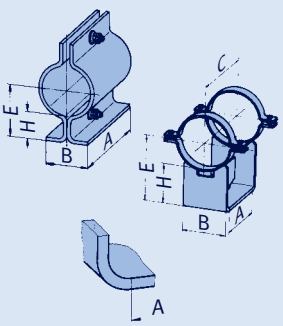
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	[kg]	group
43 02 19	6.1	4.7	3.4								12	110	30	0.5	C-2
43 02 39			5.8	5.2	4.3	3.6	2.3	1.2			12	135	30	0.6	C-2
43 02 49					6.7	5.9	4.5	2.8	2.1	1.5	12	135	30	0.6	C-2



	permissible load [kN]														wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	[kg]	group
45 02 11	4.6	3.7	2.6								12	25	50	250	2.2	C-4
45 02 11	3.7	3.0	2.1								12	25	50	300	2.5	C-4
45 02 11	2.7	2.2	1.6								12	25	50	400	3.2	C-4
45 02 11	2.2	1.7	1.2								12	25	50	500	3.8	C-4
45 02 11	1.8	1.4	1.0								12	25	50	600	4.4	C-4
45 02 31	9.3	7.8	6.7	5.8	5.0	4.1	2.7	1.4			12	25	70	300	4.2	C-4
45 02 31	6.8	5.7	4.9	4.2	3.7	3.0	2.0	1.0			12	25	70	400	5.3	C-4
45 02 31	5.3	4.5	3.8	3.3	2.9	2.4	1.5	0.8			12	25	70	500	6.4	C-4
45 02 31	4.4	3.7	3.2	2.7	2.4	2.0	1.2	0.6			12	25	70	600	7.5	C-4
45 02 41	8.9	8.1	7.5	6.5	5.0	4.4	3.3	2.1	1.5	1.1	12	25	70	300	4.2	C-4
45 02 41	6.5	5.9	5.5	4.8	3.7	3.2	2.4	1.5	1.1	0.8	12	25	70	400	5.3	C-4
45 02 41	5.1	4.6	4.3	3.7	2.9	2.5	1.9	1.2	0.9	0.6	12	25	70	500	6.4	C-4
45 02 41	4.2	3.8	3.5	3.1	2.4	2.1	1.6	1.0	0.7	0.5	12	25	70	600	7.5	C-4



	permissible load [kN]															wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	[kg]
49 02 11	1.1	0.8	0.6								63	100	40	–	50	0.6
49 02 12	1.6	1.2	0.9								113	150	65	–	100	1.4
49 02 25	3.7	2.8	2.4	1.9	1.8						113	175	70	230	100	1.6
49 02 35	4.3	3.8	3.3	2.8	2.7	2.6	2.6	1.7			163	175	100	230	150	2.3
49 02 45	5.1	4.6	4.4	4.0	3.7	3.7	3.4	2.3	1.8	1.3	163	175	100	230	150	2.7

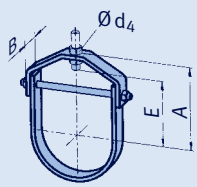


Selection table OD 33.7

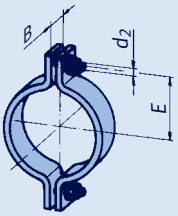
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

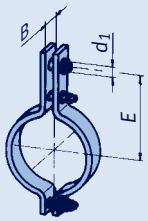
Pipe clamps, clamp bases, OD 33.7 (ND 25), type 42, 43, 45, 49



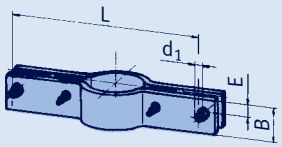
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_4	E	A	B	wt. [kg]	load group
42 03 17	2.5										10.5	32	54	26	0.16	C-D



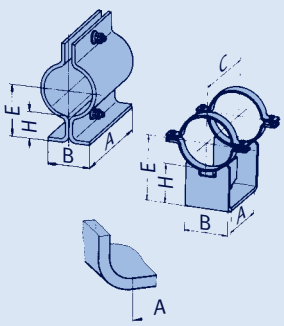
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 03 19	5.3	4.0	2.9								M10	36	30	0.4	C-2
Heat-resistant materials, see pages 0.9 and 4.4															



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 03 19	6.1	4.7	3.4								12	120	30	0.6	C-2
43 03 39		6.5	5.8	5.2	4.3	3.6	2.3	1.2			12	165	30	0.8	C-2
43 03 49				6.7	6.7	6.7	5.3	3.4	2.5	1.8	12	165	40	1.1	C-2



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	wt. [kg]	load group
45 03 11	5.8	4.6	3.3								12	25	60	250	2.7	C-4
45 03 11	4.7	3.8	2.7								12	25	60	300	3.0	C-4
45 03 11	3.4	2.7	2.0								12	25	60	400	3.8	C-4
45 03 11	2.6	2.2	1.5								12	25	60	500	4.5	C-4
45 03 11	2.2	1.8	1.3								12	25	60	600	5.3	C-4
45 03 31	9.6	8.1	6.9	6.0	5.2	4.3	2.8	1.4			12	25	70	300	4.2	C-4
45 03 32	10	10	9.8	9.3	9.0	9.0	8.9	7.3			12	25	90	300	10.2	C-4
45 03 31	6.9	5.9	5.0	4.3	3.7	3.1	2.0	1.0			12	25	70	400	5.3	C-4
45 03 32	10	10	9.8	9.3	9.0	9.0	8.9	5.3			12	25	90	400	13.0	C-4
45 03 31	5.4	4.6	3.9	3.4	2.9	2.4	1.6	0.8			12	25	70	500	6.4	C-4
45 03 32	10	10	9.8	9.3	9.0	9.0	8.2	4.2			12	25	90	500	15.8	C-4
45 03 31	4.5	3.8	3.2	2.8	2.4	2.0	1.3	0.6			12	25	70	600	7.5	C-4
45 03 32	10	10	9.8	9.3	9.0	9.0	6.8	3.5			12	25	90	600	18.7	C-4
45 03 41	9.3	8.3	7.8	6.8	5.2	4.6	3.5	2.2	1.6	1.2	12	25	70	300	4.2	C-4
45 03 42							8.9	8.7	8.2	6.1	12	25	90	300	10.2	C-4
45 03 41	6.7	6.0	5.6	4.9	3.8	3.3	2.5	1.6	1.1	0.8	12	25	70	400	5.3	C-4
45 03 42							8.9	8.1	6.0	4.5	12	25	90	400	13.0	C-4
45 03 41	5.2	4.7	4.4	3.8	3.0	2.6	1.9	1.2	0.9	0.6	12	25	70	500	6.4	C-4
45 03 42						9.0	8.9	6.4	4.7	3.5	12	25	90	500	15.8	C-4
45 03 41	4.3	3.9	3.6	3.1	2.4	2.1	1.6	1.0	0.7	0.5	12	25	70	600	7.5	C-4
45 03 42						9.0	8.4	5.3	3.9	2.9	12	25	90	600	18.7	C-4



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 03 11	1.1	0.8	0.6								67	100	45	–	50	0.7
49 03 12	1.6	1.2	0.9								117	150	70	–	100	1.5
49 03 25	3.3	2.8	2.4	1.9	1.8						167	175	102	230	150	2.3
49 03 35	4.6	4.1	3.5	3.0	2.8	2.8	2.7	1.9			167	175	102	230	150	2.4
49 03 45	5.1	4.6	4.4	4.0	3.7	3.7	3.4	2.3	1.8	1.3	167	175	102	230	150	2.8

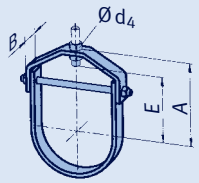
Selection table OD 42.4

Temp. of medium > 600°C
from page 4.52

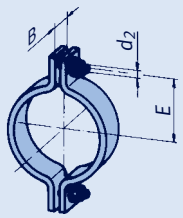
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 42.4 (ND 32), type 42, 43, 45, 49

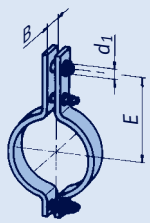
	permissible load [kN]														wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_4	E	A	B	[kg]	group
42 04 17	2.5										10.5	45	66	26	0.19	C-D



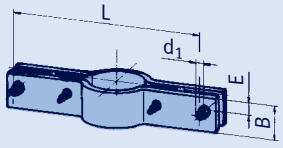
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 04 19	5.3	4.0	2.9								M10	40	30	0.4	C-2
Heat-resistant materials, see pages 0.9 and 4.4															



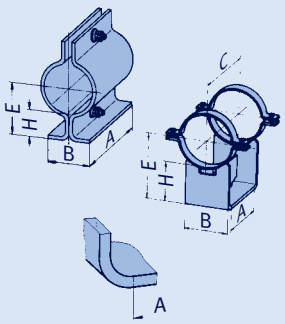
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	[kg]	group
43 04 19	6.1	4.7	3.4								12	135	30	0.7	C-2
43 04 39	6.7	6.5	5.8	5.2	4.3	3.6	2.3	1.2			12	180	30	0.9	C-2
43 04 49			6.7	6.7	6.7	6.7	5.3	3.4	2.5	1.8	12	180	40	1.2	C-2



	permissible load [kN]														wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	[kg]	group
45 04 11	9.0	7.2	5.1								12	25	70	300	4.3	C-4
45 04 11	6.5	5.2	3.7								12	25	70	400	5.4	C-4
45 04 11	5.1	4.0	2.9								12	25	70	500	6.5	C-4
45 04 11	4.1	3.3	2.4								12	25	70	600	7.6	C-4
45 04 39							5.0	2.8			12	25	70	350	7.2	C-D
45 04 31	18	15	13	11	10	8.4	5.5	2.8			16	30	70	350	7.2	1-4
45 04 32	24	24	23	22	22	21	13	7.1			16	30	100	350	13.4	1-4
45 04 39						5.0	4.1	2.1			12	25	70	450	8.9	C-D
45 04 31	14	12	10	8.8	7.6	6.3	4.1	2.1			16	30	70	450	8.9	1-4
45 04 32	24	24	23	21	19	16	10	5.4			16	30	100	450	16.5	1-4
45 04 39						5.0	3.3	1.7			12	25	70	550	10.5	C-D
45 04 31	11	9.6	8.2	7.1	6.1	5.1	3.3	1.7			16	30	70	550	10.5	1-4
45 04 32	24	23	20	17	15	13	8.5	4.3			16	30	100	550	19.7	1-4
45 04 39					5.0	4.3	2.8	1.4			12	25	70	650	12.2	C-D
45 04 31	9.5	8.0	6.9	5.9	5.1	4.3	2.8	1.4			16	30	70	650	12.2	1-4
45 04 32	23	19	17	14	13	10	7.1	3.6			16	30	100	650	22.8	1-4
45 04 41					9.9	9.0	6.8	4.3	3.2	2.4	12	25	70	350	7.0	C-4
45 04 42					22	22	17	10	8.1	6.0	16	30	100	350	13.4	1-4
45 04 41			10	10	7.7	6.8	5.1	3.2	2.4	1.8	12	25	70	450	8.6	C-4
45 04 42			23	22	19	17	13	8.3	6.1	4.6	16	30	100	450	16.5	1-4
45 04 41	10	9.9	9.2	8.0	6.2	5.4	4.1	2.6	1.9	1.4	12	25	70	550	10.3	C-4
45 04 42	24	24	22	19	15	13	10	6.6	4.9	3.7	16	30	100	550	19.7	1-4
45 04 41	9.1	8.3	7.7	6.7	5.2	4.5	3.4	2.2	1.6	1.2	12	25	70	650	11.9	C-4
45 04 42	22	20	19	16	13	11	8.8	5.5	4.1	3.1	16	30	100	650	22.8	1-4



	permissible load [kN]															wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	[kg]
49 04 11	1.1	0.8	0.6								71	100	45	–	50	0.7
49 04 12	1.6	1.2	0.9								121	150	70	–	100	1.6
49 04 25	3.3	2.9	2.4	2.0	1.8						171	175	102	230	150	2.4
49 04 35	4.7	4.2	3.6	3.1	2.9	2.9	2.8	1.9			171	175	102	230	150	2.4
49 04 45	5.2	4.7	4.5	4.0	3.8	3.7	3.5	2.4	1.8	1.3	171	175	102	230	150	2.9

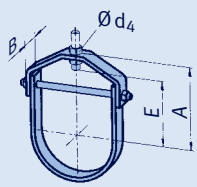


Selection table OD 48.3

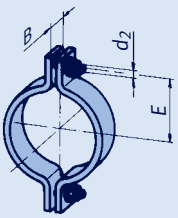
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

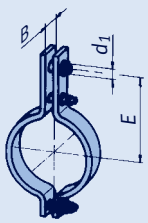
Pipe clamps, clamp bases, OD 48.3 (ND 40), type 42, 43, 45, 49



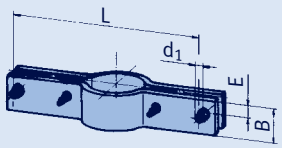
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_4	E	A	B	wt. [kg]	load group
42 05 17	2.5										10.5	54	77	26	0.25	C-D



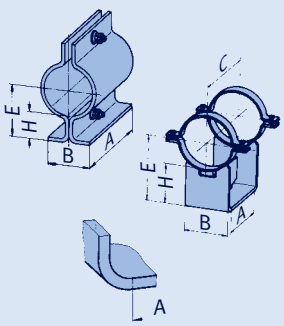
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 05 19	5.3	4.0	2.9								M10	45	30	0.4	C-2
Heat-resistant materials, see pages 0.9 and 4.4															



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 05 19	6.1	4.7	3.4								12	140	30	0.7	C-2
43 05 39	6.7	6.5	5.6	4.8	4.3	3.6	2.3	1.2			12	185	30	0.9	C-2
43 05 49		6.7	6.7	6.7	6.7	6.7	5.3	3.4	2.5	1.8	12	185	40	1.2	C-2



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	wt. [kg]	load group
45 05 11	10	8.1	5.8								12	25	80	300	4.9	C-4
45 05 11	7.7	5.9	4.2								12	25	80	400	6.2	C-4
45 05 11	5.9	4.6	3.3								12	25	80	500	7.4	C-4
45 05 11	4.9	3.7	2.7								12	25	80	600	8.7	C-4
45 05 39							5.0	3.3			12	25	80	350	8.3	C-D
45 05 31	22	18	16	13	12	9.9	6.5	3.3			16	30	80	350	8.3	1-4
45 05 32	24	24	23	22	22	22	17	8.9			16	30	120	350	16.1	1-4
45 05 39						5.0	4.9	2.5			12	25	80	450	10.1	C-D
45 05 31	16	14	12	10	9.0	7.5	4.9	2.5			16	30	80	450	10.1	1-4
45 05 32	24	24	23	22	22	19	13	6.7			16	30	120	450	19.9	1-4
45 05 39						5.0	3.9	2.0			12	25	80	550	12.0	C-D
45 05 31	13	11	9.6	8.3	7.2	6.0	3.9	2.0			16	30	80	550	12.0	1-4
45 05 32	24	24	23	21	19	16	10	5.3			16	30	120	550	23.6	1-4
45 05 39					5.0	4.9	3.2	1.6			12	25	80	650	13.9	C-D
45 05 31	11	9.3	8.0	6.9	6.0	4.9	3.2	1.6			16	30	80	650	13.9	1-4
45 05 32	24	24	20	17	16	13	8.7	4.4			16	30	120	650	27.4	1-4
45 05 41						9.8	8.0	5.0	3.7	2.8	12	25	80	350	8.0	C-4
45 05 42						22	21	13	10	7.5	16	30	120	350	16.1	1-4
45 05 41				10	9.1	8.0	6.0	3.8	2.8	2.1	12	25	80	450	9.9	C-4
45 05 42					22	21	16	10	7.5	5.6	16	30	120	450	19.9	1-4
45 05 41		11	10	9.4	7.2	6.4	4.8	3.0	2.2	1.7	12	25	80	550	11.7	C-4
45 05 42			23	22	19	17	12	8.2	6.0	4.5	16	30	120	550	23.6	1-4
45 05 41	10	9.6	8.9	7.8	6.0	5.3	4.0	2.5	1.8	1.4	12	25	80	650	13.6	C-4
45 05 42		24	23	20	16	14	10	6.8	5.0	3.7	16	30	120	650	27.4	1-4



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 05 11	1.1	0.8	0.6								74	100	50	–	50	0.8
49 05 12	1.6	1.2	0.9								124	150	75	–	100	1.7
49 05 25	3.3	2.9	2.4	2.0	1.8						174	175	102	230	150	2.4
49 05 35	4.7	4.2	3.6	3.1	2.9	2.9	2.8	1.9			174	175	102	230	150	2.5
49 05 45	5.3	4.8	4.5	4.0	3.8	3.7	3.5	2.4	1.8	1.3	174	175	102	230	150	2.9

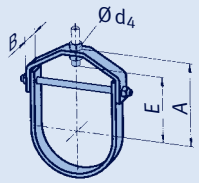
Selection table OD 60.3

Temp. of medium > 600°C
from page 4.52

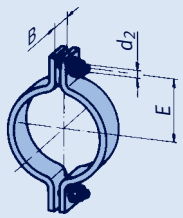
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 60.3 (ND 50), type 42, 43, 45, 49

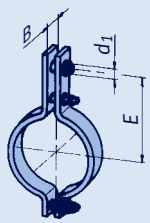
	permissible load [kN]														wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_4	E	A	B	[kg]	group
42 06 17	2.5										10.5	75	94	26	0.27	C-D



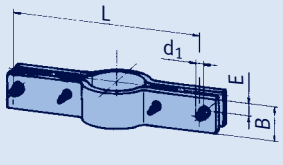
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 06 19	6.7	5.5	4.0								M12	55	40	0.8	C-2
Heat-resistant materials, see pages 0.9 and 4.4															

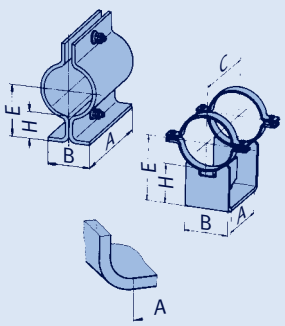


	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	[kg]	group
43 06 19	7.5	5.7	4.1								12	155	40	1.2	C-4
43 06 39	9.2	8.6	8.2	7.8	6.3	5.2	3.4	1.8			12	200	50	1.6	C-4
43 06 49						6.0	6.0	4.7	3.4	2.5	12	200	50	2.1	C-4



	permissible load [kN]														wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	[kg]	group
45 06 11	9.0	6.7	4.8								12	25	70	300	4.4	C-4
45 06 12	24	18	13								16	30	80	300	7.4	1-4
45 06 11	6.5	4.8	3.4								12	25	70	400	5.5	C-4
45 06 12	17	13	9.4								16	30	80	400	9.3	1-4
45 06 11	5.1	3.8	2.7								12	25	70	500	6.6	C-4
45 06 12	13	10	7.4								16	30	80	500	11.2	1-4
45 06 11	4.1	3.1	2.2								12	25	70	600	7.7	C-4
45 06 12	11	8.5	6.1								16	30	80	600	13.1	1-4
45 06 39							5.0	3.7			12	25	100	400	11.6	C-D
45 06 31	24	20	17	15	13	11	7.4	3.7			16	30	100	400	11.6	1-4
45 06 32	24	24	23	22	22	22	15	8.0			16	30	120	400	18.1	1-4
45 06 39							5.0	2.9			12	25	100	500	13.9	C-D
45 06 31	18	16	13	11	10	8.6	5.6	2.9			16	30	100	500	13.9	1-4
45 06 32	24	24	23	22	22	18	12	6.2			16	30	120	500	21.9	1-4
45 06 39						5.0	4.5	2.3			12	25	100	600	16.3	C-D
45 06 31	15	13	11	9.6	8.4	7.0	4.5	2.3			16	30	100	600	16.3	1-4
45 06 32	24	24	23	20	18	15	9.8	5.0			16	30	120	600	25.7	1-4
45 06 39						5.0	3.8	1.9			12	25	100	700	18.6	C-D
45 06 31	12	11	9.4	8.1	7.1	5.9	3.8	1.9			16	30	100	700	18.6	1-4
45 06 32	24	22	19	17	15	12	8.2	4.2			16	30	120	700	29.4	1-4
45 06 41						9.8	9.1	5.7	4.2	3.2	12	25	100	400	11.2	C-4
45 06 42						22	19	12	9.0	6.7	16	30	120	400	18.1	1-4
45 06 41					9.9	9.2	7.0	4.4	3.2	2.4	12	25	100	500	13.6	C-4
45 06 42					22	19	14	9.4	7.0	5.2	16	30	120	500	21.9	1-4
45 06 41			10	10	8.5	7.5	5.6	3.5	2.6	2.0	12	25	100	600	15.9	C-4
45 06 42			23	22	18	16	12	7.6	5.6	4.2	16	30	120	600	25.7	1-4
45 06 41		11	10	9.2	7.1	6.3	4.7	3.0	2.2	1.6	12	25	100	700	18.3	C-4
45 06 42	24	23	21	19	15	13	10	6.4	4.7	3.5	16	30	120	700	29.4	1-4





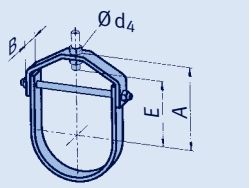
	permissible load [kN]															wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	[kg]
49 06 11	1.2	0.9	0.7								80	150	50	–	50	1.3
49 06 12	1.7	1.3	0.9								130	200	75	–	100	2.4
49 06 25	4.0	3.4	2.8	2.3	2.1						180	220	110	285	150	3.5
49 06 35	4.7	4.2	3.6	3.1	2.9	2.9	2.8	1.9			180	220	110	285	150	3.6
49 06 45	6.6	6.0	5.7	5.1	4.8	4.7	4.4	3.0	2.3	1.6	180	220	110	290	150	4.2

Selection table OD 73

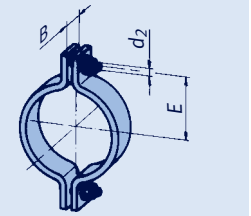
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

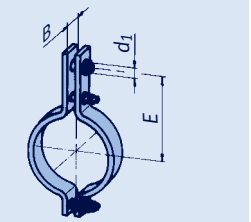
Pipe clamps, clamp bases, OD 73 (ND 65), type 42, 43, 45, 46, 48, 49



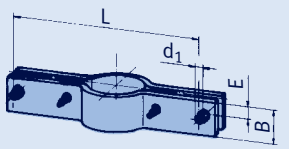
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_4	E	A	B	wt. [kg]	load group
42 07 17	5.0										13	95	120	32	0.52	C-2



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 07 19	6.7	5.5	4.0								M12	60	40	0.8	C-2
Heat-resistant materials, see pages 0.9 and 4.4															

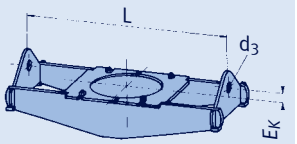


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 07 19	7.5	5.7	4.1								12	165	40	1.2	C-4
43 07 39	9.2	8.6	8.2	7.8	6.3	5.2	3.4	1.8			12	215	50	1.8	C-4
43 07 49					6.1	6.0	6.0	4.7	3.4	2.5	12	215	50	2.3	C-4

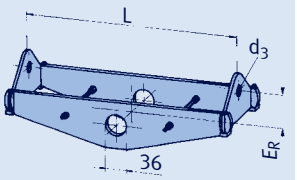


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	wt. [kg]	load group
45 07 19			5.0								12	25	70	300	6.6	C-D
45 07 11	17	13	9.2								16	30	70	300	6.6	1-4
45 07 12	27	23	16								16	30	100	300	9.3	1-4
45 07 19			5.0								12	25	70	400	8.2	C-D
45 07 11	14	10	7.5								16	30	70	400	8.2	1-4
45 07 12	22	16	11								16	30	100	400	11.7	1-4
45 07 19			5.0								12	25	70	500	9.9	C-D
45 07 11	11	8.3	6.0								16	30	70	500	9.9	1-4
45 07 12	17	12	9.1								16	30	100	500	14.0	1-4
45 07 19		5.0	4.7								12	25	70	600	11.5	C-D
45 07 11	9.0	6.6	4.7								16	30	70	600	11.5	1-4
45 07 12	13	10	7.3								16	30	100	600	16.4	1-4

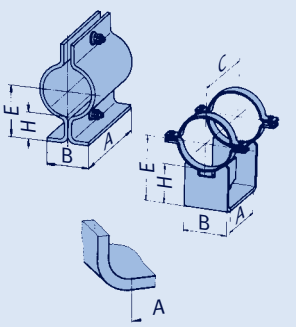
① type 46



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①0731	19	18	18	16	11	10	8.0	5.0			21	350	750	15	8.0	15	70	7.0	14	C-4
4. 07 32	22	21	21	20	15	13	10	6.6			21	350	750	25	8.0	17	75	7.0	16	C-4
4. 07 33	46	45	44	41	28	25	20	12			25	350	750	30	12	27	100	11	23	3-5
4. 07 41							7.3	5.3	3.9	21	350	750	15	7.0	15	70	6.0	14	C-4	
4. 07 42							11	8.1	5.9	21	350	750	25	9.0	19	85	7.0	17	C-4	
4. 07 43					25	24	18	13	10	25	350	750	30	12	27	115	9.0	24	3-5	



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 07 11	1.2	0.9	0.7								87	150	55	–	50	1.5
49 07 12	1.7	1.3	0.9								137	200	80	–	100	2.6
49 07 25	4.0	3.4	2.8	2.3	2.1						187	220	110	285	150	3.7
49 07 35	7.0	6.3	5.5	4.6	4.3	4.3	4.2	2.6			187	220	110	285	150	3.8
49 07 45	9.5	8.6	8.2	7.4	6.8	6.8	5.8	3.8	2.8	2.0	187	220	110	290	150	4.3

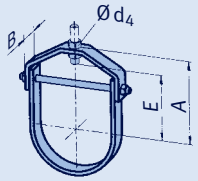
Selection table OD 76.1

Temp. of medium > 600°C
from page 4.52

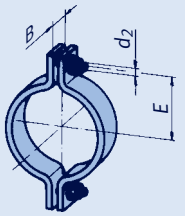
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 76.1 (ND 65), type 42, 43, 45, 46, 48, 49

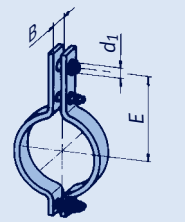
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_4	E	A	B	wt. [kg]	load group
42 08 17	5.0										13	95	120	32	0.54	C-2



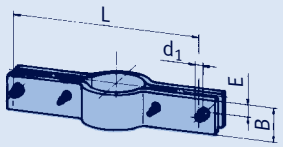
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 08 19	6.7	5.5	4.0								M12	60	40	0.9	C-2
Heat-resistant materials, see pages 0.9 and 4.4															



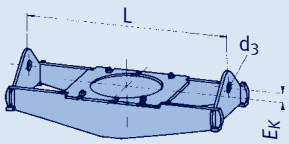
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 08 19	7.5	5.7	4.1								12	165	40	1.2	C-4
43 08 39	9.2	8.6	8.2	7.7	6.3	5.2	3.4	1.8			12	215	50	1.8	C-4
43 08 49				6.3	6.1	6.0	6.0	4.7	3.4	2.5	12	215	50	2.3	C-4



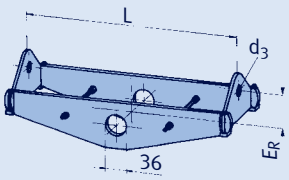
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	wt. [kg]	load group
45 08 19			5.0								12	25	70	300	6.6	C-D
45 08 11	17	13	9.2								16	30	70	300	6.6	1-4
45 08 12	27	23	16								16	30	100	300	9.4	1-4
45 08 19			5.0								12	25	70	400	8.3	C-D
45 08 11	14	10	7.5								16	30	70	400	8.3	1-4
45 08 12	22	16	11								16	30	100	400	11.7	1-4
45 08 19			5.0								12	25	70	500	9.9	C-D
45 08 11	11	8.3	6.0								16	30	70	500	9.9	1-4
45 08 12	17	12	9.1								16	30	100	500	14.1	1-4
45 08 19		5.0	4.7								12	25	70	600	11.6	C-D
45 08 11	9.0	6.6	4.7								16	30	70	600	11.6	1-4
45 08 12	13	10	7.3								16	30	100	600	16.4	1-4



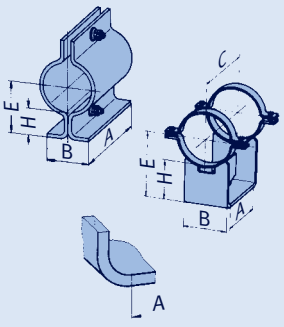
① type 46



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①0831	19	18	18	16	11	10	8.0	5.0			21	350	750	15	8.0	15	70	7.0	14	C-4
4. 08 32	23	22	21	20	15	13	10	6.7			21	350	750	15	9.0	18	75	7.0	16	C-4
4. 08 33	47	45	44	41	28	25	20	12			25	350	750	30	13	27	100	11	23	3-5
4. 08 41								7.3	5.3	3.9	21	350	750	15	7.0	15	70	6.0	14	C-4
4. 08 42								11	8.1	5.9	21	350	750	25	9.0	19	85	7.0	17	C-4
4. 08 43						25	24	18	13	10	25	350	750	30	12	27	115	9.0	24	3-5



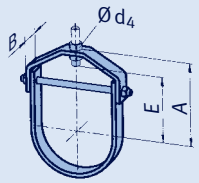
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 08 11	1.2	0.9	0.7								88	150	55	–	50	1.5
49 08 12	1.7	1.3	0.9								138	200	80	–	100	2.6
49 08 25	3.9	3.4	2.8	2.3	2.1						188	220	110	285	150	3.7
49 08 35	7.0	6.3	5.4	4.6	4.3	4.3	4.2	2.6			188	220	110	285	150	3.8
49 08 45	9.7	8.8	8.4	7.6	7.0	6.9	5.9	3.9	2.8	2.1	188	220	110	290	150	4.3

Selection table OD 88.9

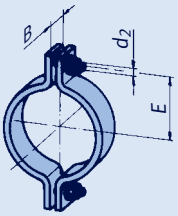
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

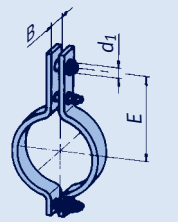
Pipe clamps, clamp bases, OD 88.9 (ND 80), type 42, 43, 45, 46, 48, 49



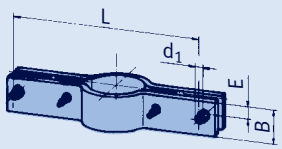
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_4	E	A	B	wt. [kg]	load group
42 09 17	5.0										13	100	121	32	0.60	C-2



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 09 19	6.3	4.5	3.5								M12	70	40	1.0	C-2
Heat-resistant materials, see pages 0.9 and 4.4															

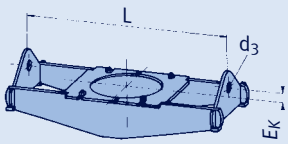


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 09 18	2.5	2.5	2.5								12	170	40	1.4	C-D
43 09 19	7.4	5.7	4.1								16	170	40	1.4	1-4
43 09 38			2.5	2.5	2.5	2.5	2.5	1.7			12	235	50	1.9	C-D
43 09 39	11	9.9	8.5	7.3	6.3	5.2	3.4	1.7			16	235	50	1.9	1-4
43 09 49					6.1	6.0	6.0	4.7	3.4	2.5	12	235	50	2.5	C-4

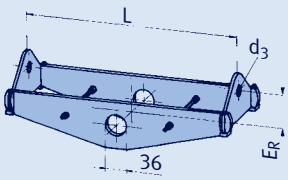


① type 46

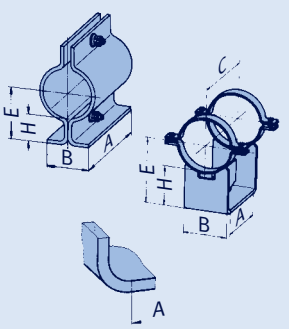
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	wt. [kg]	load group
45 09 19			5.0								12	25	70	300	6.7	C-D
45 09 11	17	13	9.5								16	30	70	300	6.7	1-4
45 09 12	27	23	16								16	30	100	300	9.5	1-4
45 09 19			5.0								12	25	70	450	9.2	C-D
45 09 11	12	8.9	6.4								16	30	70	450	9.2	1-4
45 09 12	19	14	10								16	30	100	450	13.0	1-4
45 09 19		5.0	3.7								12	25	70	600	11.6	C-D
45 09 11	9.0	6.6	4.7								16	30	70	600	11.6	1-4
45 09 12	13	10	7.3								16	30	100	600	16.5	1-4
45 09 19		5.0	3.7								12	25	70	750	14.1	C-D
45 09 11	7.1	5.2	3.7								16	30	70	750	14.1	1-4
45 09 12	10	7.9	5.6								16	30	100	750	20.1	1-4



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①0931	17	16	16	15	11	10	7.9	5.0			21	350	850	15	8.0	19	75	7.0	16	C-4
4. 09 32	22	21	20	20	15	13	10	6.7			21	350	850	25	8.0	24	85	7.0	19	C-4
4. 09 33	45	44	42	40	28	25	20	12			25	350	850	35	12	35	100	10	27	3-5
4. 09 41								7.3	5.3	3.9	21	350	850	15	8.0	18	75	7.0	17	C-4
4. 09 42								10	8.1	5.9	21	350	850	25	9.0	24	100	8.0	21	C-4
4. 09 43					27	27	26	19	14	10	25	350	850	35	13	36	105	9.0	29	3-5



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 09 11	1.8	1.4	1.0								94	150	60	–	50	2.3
49 09 12	2.5	1.9	1.3								144	200	85	–	100	3.8
49 09 25	3.9	3.4	2.8	2.3	2.1						244	270	146	340	200	5.4
49 09 35	7.0	6.3	5.4	4.6	4.3	4.3	4.2	2.6			244	270	146	340	200	5.8
49 09 45	10.1	8.9	8.4	7.6	7.0	6.9	6.5	4.5	3.3	2.4	244	270	146	340	200	6.7

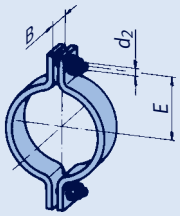
Selection table OD 108

Temp. of medium > 600°C
from page 4.52

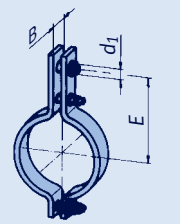
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 108 (ND 100), type 42, 43, 45, 46, 48, 49

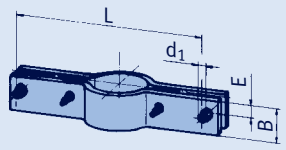
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 10 19	10	7.8	6.0								M16	90	50	2.0	1-4
Heat-resistant materials, see pages 0.9 and 4.4															



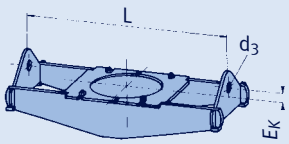
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 10 18	2.5	2.5	2.5								12	200	50	2.5	C-D
43 10 19	10	8.3	6.0								16	200	50	2.5	1-4
43 10 29			3.3	2.8	2.0						12	240	40	1.3	C-4
43 10 38				2.5	2.5	2.5	2.5	2.4			12	270	50	3.0	C-D
43 10 39			11	10	8.6	7.1	4.6	2.4			16	270	50	3.0	1-4
43 10 48							2.5	2.5	2.5	2.5	12	270	70	4.1	C-D
43 10 49	15	14	14	13	13	13	12	7.8	5.7	4.3	16	270	70	4.1	1-4



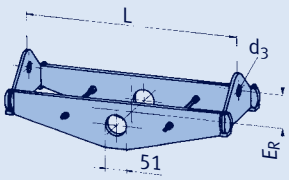
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	wt. [kg]	load group
45 10 19			5.0								12	25	80	350	8.7	C-D
45 10 11	17	13	9.7								16	30	80	350	8.7	1-4
45 10 19			5.0								12	25	80	500	11.6	C-D
45 10 11	12	9.3	6.7								16	30	80	500	11.6	1-4
45 10 19			5.0								12	25	80	650	14.4	C-D
45 10 11	9.4	7.0	5.0								16	30	80	650	14.4	1-4
45 10 19		5.0	4.0								12	25	80	800	17.2	C-D
45 10 11	7.5	5.6	4.0								16	30	80	800	17.2	1-4



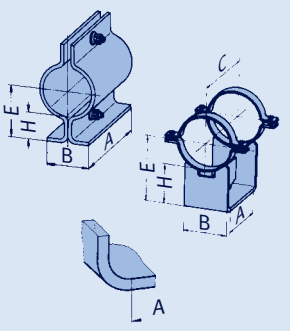
① type 46



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.① 1012	19	14	10								25	350	800	5	9.0	18	70	7.0	16	3-5
4. 10 31	22	22	21	20	16	15	11	6.6			21	350	950	15	10	26	85	8.0	23	C-4
4. 10 32	39	37	37	34	23	21	16	10			25	350	950	25	15	37	85	10	31	3-5
4. 10 33	69	66	64	60	40	37	29	18			34	350	950	35	19	51	120	16	44	3-6
4. 10 41								10	8.1	5.9	21	350	950	15	10	28	100	8.0	26	C-4
4. 10 42								14	10	7.9	25	350	950	25	14	36	110	10	31	3-5
4. 10 43							27	26	20	15	34	350	950	35	18	52	130	15	44	3-6



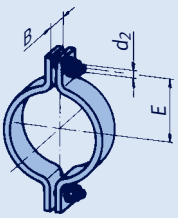
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 10 11	2.3	1.8	1.3								154	150	95	–	100	4.0
49 10 12	3.2	2.4	1.8								204	200	125	–	150	6.3
49 10 25	4.8	4.2	3.5	2.8	2.6						254	265	152	345	200	7.9
49 10 35	7.6	6.8	5.8	4.9	4.7	4.6	4.5	2.6			254	265	152	345	200	8.1
49 10 45	10.3	8.9	8.4	7.6	7.0	6.9	6.5	4.5	3.3	2.4	254	270	152	350	200	9.3

Selection table OD 114.3

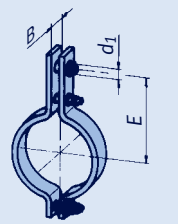
Temp. of medium > 600°C from page 4.52

Load doubling via type 77, see page 4.67

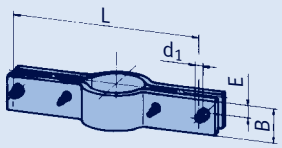
Pipe clamps, clamp bases, OD 114.3 (ND 100), type 42, 43, 45, 46, 48, 49



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 11 19	10	7.8	6.0								M16	90	50	2.1	1-4
Heat-resistant materials, see pages 0.9 and 4.4															

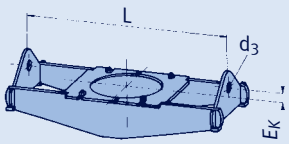


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 11 18	2.5	2.5	2.5								12	200	50	2.6	C-D
43 11 19	10	8.3	6.0								16	200	50	2.6	1-4
43 11 29			3.3	2.7	2.0						12	240	40	1.5	C-4
43 11 38				2.5	2.5	2.5	2.5	2.4			12	270	50	3.0	C-D
43 11 39			11	9.6	8.6	7.1	4.6	2.4			16	270	50	3.0	1-4
43 11 48							2.5	2.5	2.5	2.5	12	270	70	4.2	C-D
43 11 49	15	14	14	13	13	13	12	7.8	5.7	4.3	16	270	70	4.2	1-4

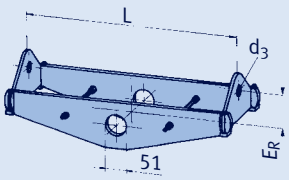


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	wt. [kg]	load group
45 11 19			5.0								12	25	80	350	8.8	C-D
45 11 11	17	13	9.7								16	30	80	350	8.8	1-4
45 11 19			5.0								12	25	80	500	11.6	C-D
45 11 11	12	9.3	6.7								16	30	80	500	11.6	1-4
45 11 19			5.0								12	25	80	650	14.4	C-D
45 11 11	9.4	7.0	5.0								16	30	80	650	14.4	1-4
45 11 19		5.0	4.0								12	25	80	800	17.3	C-D
45 11 11	7.5	5.6	4.0								16	30	80	800	17.3	1-4

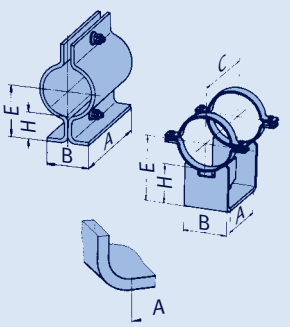
① type 46



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①1112	19	14	10								25	350	800	5	9.0	18	70	7.0	16	3-5
4. 11 31	22	22	21	20	16	15	11	6.6			21	350	950	15	10	28	85	8.0	23	C-4
4. 11 32	37	36	35	33	23	21	16	10			25	350	950	25	16	37	85	10	31	3-5
4. 11 33	67	64	63	59	40	37	29	18			34	350	950	35	20	51	120	16	44	3-6
4. 11 41								10	8.1	5.9	21	350	950	15	10	29	100	8.0	26	C-4
4. 11 42								14	10	7.9	25	350	950	25	14	36	110	10	31	3-5
4. 11 43							27	26	20	15	34	350	950	35	18	53	130	15	44	3-6



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 11 11	2.3	1.8	1.3								157	150	95	–	100	4.1
49 11 12	3.2	2.4	1.8								207	200	125	–	150	6.4
49 11 25	4.9	4.2	3.5	2.9	2.7						257	265	152	345	200	7.9
49 11 35	7.6	6.8	5.9	5.0	4.7	4.7	4.5	2.7			257	265	152	345	200	8.3
49 11 45	10.3	8.9	8.4	7.6	7.0	6.9	6.5	4.5	3.3	2.4	257	265	152	350	200	9.4

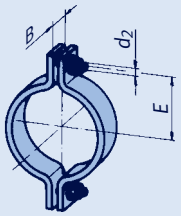
Selection table OD 133

Temp. of medium > 600°C
from page 4.52

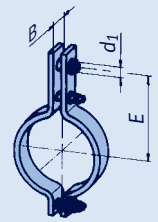
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 133 (ND 125), type 42, 43, 45, 46, 48, 49

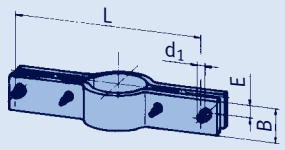
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 13 19	10	7.8	5.5								M16	100	50	2.2	1-4
Heat-resistant materials, see pages 0.9 and 4.4															



	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	[kg]	group
43 13 18	2.5	2.5	2.5								12	220	50	2.8	C-D
43 13 19	10	8.3	6.0								16	220	50	2.8	1-4
43 13 28			2.5	2.5	2.5						12	270	50	2.3	C-D
43 13 29			5.1	4.3	3.1						16	270	50	2.3	1-4
43 13 38					2.5	2.5	2.5	2.5			12	290	60	3.9	C-D
43 13 39	16	13	12	10	8.8	7.3	4.8	2.5			16	290	60	3.9	1-4
43 13 48								2.5	2.5	2.5	12	290	70	5.6	C-D
43 13 49		14	14	13	13	13	10	6.9	5.1	3.8	16	290	70	5.6	1-4

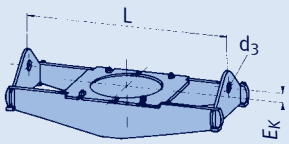


	permissible load [kN]														wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	[kg]	group
45 13 19			5.0								12	25	90	400	11.1	C-D
45 13 11	18	14	10								16	30	90	400	11.1	1-4
45 13 19			5.0								12	25	90	550	14.3	C-D
45 13 11	13	9.7	6.9								16	30	90	550	14.3	1-4
45 13 19			5.0								12	25	90	700	17.5	C-D
45 13 11	9.9	7.4	5.3								16	30	90	700	17.5	1-4
45 13 19		5.0	4.2								12	25	90	850	20.6	C-D
45 13 11	8.0	5.9	4.2								16	30	90	850	20.6	1-4

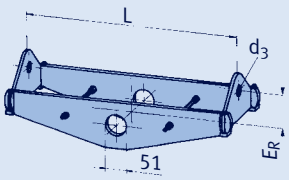


① type 46

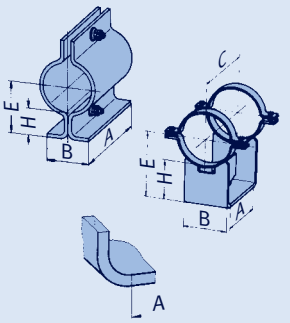
	permissible load [kN]										L		type 46			type 48			load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	min	max	E_K	[kg min]	[kg max]	E_R	[kg min]	[kg max]	group
4.① 1312	23	19	13								25	370	850	10	12	23	70	8.0	20	3-5
4. 13 31	24	23	23	22	20	17	13	7.1			21	400	1000	15	13	34	95	9.0	26	C-4
4. 13 32	40	38	38	35	25	22	17	11			25	400	1000	30	17	43	100	13	36	3-5
4. 13 33	72	70	67	62	45	40	31	18			34	400	1000	40	26	59	130	19	50	4-6
4. 13 41								12	9.2	7.0	21	400	1000	15	13	34	105	11	31	C-4
4. 13 42							25	18	13	10	25	400	1000	30	18	45	115	13	38	3-5
4. 13 43						33	33	31	23	17	34	400	1000	40	26	66	145	20	53	4-6



① type 48



	permissible load [kN]															wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	[kg]
49 13 11	2.5	2.0	1.4								167	150	105	–	100	5.3
49 13 12	3.8	3.0	2.0								217	200	130	–	150	8.3
49 13 25	8.1	7.0	5.8	4.8	4.4						267	270	160	350	200	9.6
49 13 35	12.1	10.9	9.3	8.0	7.5	7.4	7.0	3.7			267	270	160	350	200	9.8
49 13 45							6.5	4.5	3.3	2.4	267	275	160	350	200	9.7

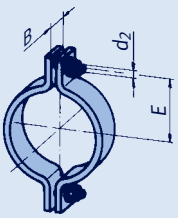


Selection table OD 139.7

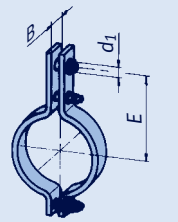
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

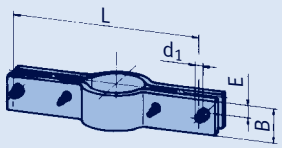
Pipe clamps, clamp bases, OD 139.7 (ND 125), type 42, 43, 45, 46, 48, 49



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 14 19	9.6	7.4	5.3								M16	105	50	2.4	1-4
Heat-resistant materials, see pages 0.9 and 4.4															

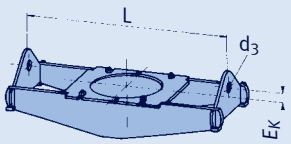


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 14 18	2.5	2.5	2.5								12	225	50	2.9	C-D
43 14 19	10	8.3	5.9								16	225	50	2.9	1-4
43 14 28			2.5	2.5	2.5						12	275	50	2.5	C-D
43 14 29			5.1	4.1	3.1						16	275	50	2.5	1-4
43 14 38					2.5	2.5	2.5	2.4			12	295	60	4.1	C-D
43 14 39	16	13	11	10	8.8	7.3	4.8	2.4			16	295	60	4.1	1-4
43 14 48							2.5	2.5	2.5	2.5	12	295	70	5.7	C-D
43 14 49		14	14	13	13	13	10	6.9	5.1	3.8	16	295	70	5.7	1-4

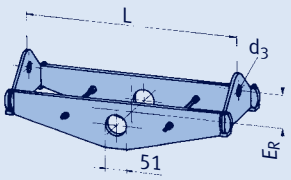


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	L	wt. [kg]	load group
45 14 19			5.0								12	25	90	400	11.2	C-D
45 14 11	18	14	10								16	30	90	400	11.2	1-4
45 14 19			5.0								12	25	90	550	14.3	C-D
45 14 11	13	9.7	6.9								16	30	90	550	14.3	1-4
45 14 19			5.0								12	25	90	700	17.5	C-D
45 14 11	9.9	7.4	5.3								16	30	90	700	17.5	1-4
45 14 19		5.0	4.2								12	25	90	850	20.7	C-D
45 14 11	8.0	5.9	4.2								16	30	90	850	20.7	1-4

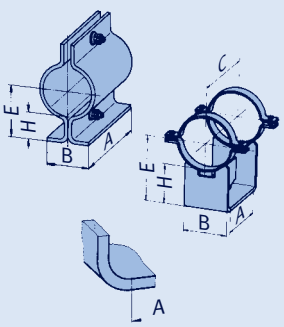
① type 46



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①1412	22	18	12								25	400	850	10	11	24	70	8.0	20	3-5
4. 14 31	24	23	23	22	20	17	13	7.1			21	400	1000	15	13	34	95	10	27	C-4
4. 14 32	41	39	39	36	26	23	17	11			25	400	1000	30	20	44	100	13	36	3-5
4. 14 33	70	68	67	62	45	40	30	18			34	400	1000	40	26	59	130	20	50	4-6
4. 14 41								12	9.3	6.9	21	400	1000	15	14	35	105	11	31	C-4
4. 14 42							25	18	13	10	25	400	1000	30	19	46	115	13	38	3-5
4. 14 43						33	33	31	23	17	34	400	1000	40	25	66	145	20	53	4-6



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 14 11	2.5	2.0	1.4								170	150	105	–	100	5.5
49 14 12	3.8	3.0	2.0								220	200	130	–	150	8.5
49 14 25	8.2	7.0	5.9	4.8	4.5						270	270	160	350	200	9.7
49 14 35	12.3	11.0	9.3	8.0	7.6	7.5	7.1	3.8			270	270	160	350	200	10.1
49 14 45							6.5	4.5	3.4	2.5	270	275	160	350	200	9.9

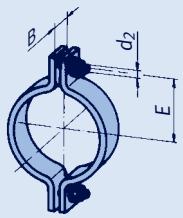
Selection table OD 159

Temp. of medium > 600°C
from page 4.52

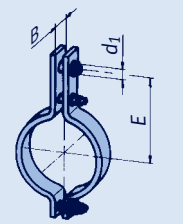
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 159 (ND 150), type 42, 43, 46, 48, 49

type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 16 19	8.6	6.6	4.7								M16	115	50	2.5	1-4
Heat-resistant materials, see pages 0.9 and 4.4															

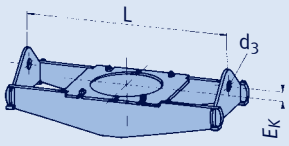


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 16 18	2.5	2.5	2.5								12	245	50	3.1	C-D
43 16 19	9.7	7.5	5.4								16	245	50	3.1	1-4
43 16 28			2.5	2.5	2.5						12	300	50	3.4	C-D
43 16 29	11	9.5	7.9	6.4	4.9						16	300	50	3.4	1-4
43 16 38					2.5	2.5	2.5	2.5			12	315	80	6.9	C-D
43 16 39	15	14	14	13	13	13	8.5	4.3			16	315	80	6.9	1-4
43 16 48								2.5	2.5	2.5	12	315	80	8.4	C-D
43 16 49						12	12	9.3	6.9	5.1	16	315	80	8.4	1-4

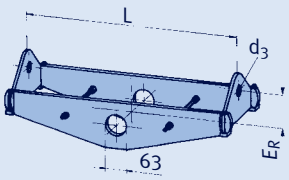


① type 46

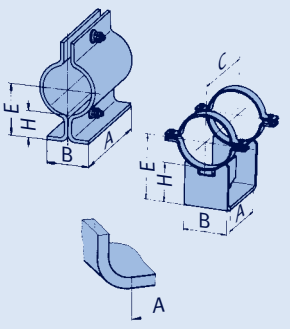
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	E_K	type 46 [kg min]	type 46 [kg max]	E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①1611	18	15	11								21	400	900	15	11	23	90	9.0	21	C-4
4. 16 12	29	24	17								25	400	900	15	13	32	85	10	25	3-5
4. 16 31		24	23	22	19	17	13	7.0			21	450	1050	25	16	36	100	11	31	C-4
4. 16 32	49	47	47	44	30	28	21	13			25	450	1050	40	23	52	120	17	44	3-5
4. 16 33	84	80	79	71	53	47	36	21			34	450	1050	50	32	75	150	25	63	4-6
4. 16 41								12	9.3	7.0	21	450	1050	25	17	38	110	13	35	C-4
4. 16 42								19	14	10	25	450	1050	40	21	51	130	17	45	3-5
4. 16 43						36	36	35	26	20	34	450	1050	50	33	79	165	26	67	4-6



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 16 11	2.5	2.0	1.4								180	200	115	–	100	6.7
49 16 14	4.4	3.8	3.6								230	240	140	340	150	9.2
49 16 25	9.3	8.1	6.7	5.5	5.0						280	315	171	395	200	11.0
49 16 35	17	15	13	11	10	10	9.9	5.5			280	320	171	400	200	12.7
49 16 45							9.5	6.5	4.9	3.6	280	320	171	400	200	12.4

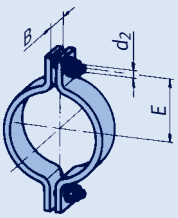


Selection table OD 168.3

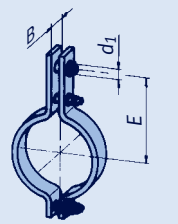
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 168.3 (ND 150), type 42, 43, 46, 48, 49

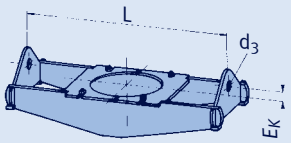


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 17 19	8.2	6.3	4.5								M16	120	50	2.6	1-4
Heat-resistant materials, see pages 0.9 and 4.4															

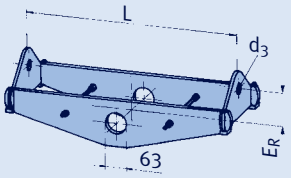


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 17 18	2.5	2.5	2.5								12	250	50	3.2	C-D
43 17 19	9.3	7.1	5.1								16	250	50	3.2	1-4
43 17 28			2.5	2.5	2.5						12	300	50	3.6	C-D
43 17 29	11	9.5	7.9	6.4	4.9						16	300	50	3.6	1-4
43 17 38					2.5	2.5	2.5	2.5			12	320	80	7.3	C-D
43 17 39	15	14	14	13	13	13	8.5	4.3			16	320	80	7.3	1-4
43 17 48								2.5	2.5	2.5	12	320	80	8.5	C-D
43 17 49						12	12	9.3	6.9	5.1	16	320	80	8.5	1-4

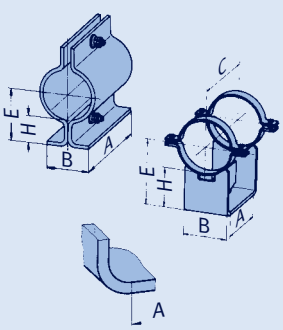
① type 46



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①17 11	18	15	11								21	410	900	15	12	23	90	9.0	22	C-4
4. 17 12	29	24	17								25	410	900	15	17	33	85	10	25	3-5
4. 17 31		24	23	22	19	17	13	7			21	450	1050	25	16	38	100	11	31	C-4
4. 17 32	49	47	47	43	31	28	21	13			25	450	1050	40	23	53	120	17	44	3-5
4. 17 33	84	80	79	72	53	47	36	21			34	450	1050	50	33	74	150	26	64	4-6
4. 17 41								12	9.3	6.9	21	450	1050	25	17	38	110	13	35	C-4
4. 17 42								19	14	10	25	450	1050	40	23	53	130	18	45	3-5
4. 17 43						36	36	35	26	20	34	450	1050	50	34	80	165	26	67	4-6



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 17 11	2.5	2.0	1.4								184	200	120	–	100	6.9
49 17 14	4.7	4.1	3.9								234	240	152	340	150	9.6
49 17 25	9.5	8.2	6.8	5.6	5.2						284	315	171	395	200	11.1
49 17 35	17	15	13	11	10	10	10	5.6			284	320	171	400	200	12.7
49 17 45							9.6	6.6	4.9	3.6	284	320	171	400	200	12.5

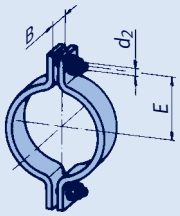
Selection table OD 193.7

Temp. of medium > 600°C from page 4.52

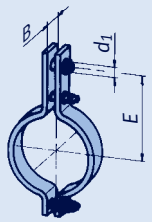
Load doubling via type 77, see page 4.67

Pipe clamps, clamp bases, OD 193.7 (ND 175), type 42, 43, 46, 48, 49

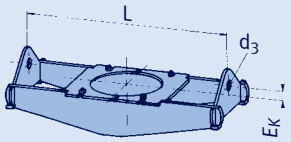
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 19 19	7.1	5.5	3.9								M16	135	50	2.9	1-4
Heat-resistant materials, see pages 0.9 and 4.4															



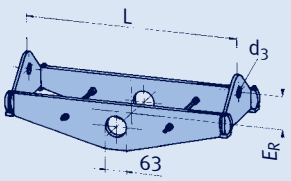
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	[kg]	group
43 19 18	2.5	2.5	2.5								12	270	50	4.7	C-D
43 19 19	12	10	7.2								16	270	50	4.7	1-5
43 19 28			2.5	2.5	2.5						12	335	50	4.2	C-D
43 19 29			6.8	5.5	4.2						16	335	50	4.2	1-5
43 19 38		10	10	9.6	9.4	9.3	9.2	7.5			16	355	70	10.8	1-3
43 19 39	23	21	20	19	19	19	14	7.5			20	355	70	10.8	3-6
43 19 48						11.3	11.3	11.3	11	8.6	16	355	100	15.4	1-3
43 19 49						19	19	15	11	8.6	20	355	100	15.4	3-6



① type 46

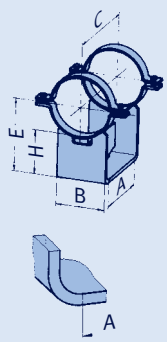


① type 48



	permissible load [kN]										L		type 46			type 48			load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	min	max	E_K	[kg min]	[kg max]	E_R	[kg min]	[kg max]	group
4.①1911	24	19	14								21	450	950	15	15	29	80	10	26	C-4
4. 19 12	38	31	22								25	460	950	20	18	41	90	13	33	3-5
4. 19 21		25	25	23	16						21	460	1000	15	17	39	100	12	32	C-4
4. 19 22	42	41	40	37	26						25	460	1000	30	24	51	110	16	42	3-5
4. 19 31					15	15	11	6.0			21	550	1150	25	19	41	110	15	32	C-4
4. 19 32					28	25	19	10			25	550	1150	30	27	54	110	19	42	3-5
4. 19 33	46	43	42	40	39	35	26	13			25	550	1150	40	34	64	130	24	52	3-5
4. 19 34	91	83	81	78	70	64	48	25			41	550	1150	50	48	98	160	37	79	4-7
4. 19 41								10	8.0	5.9	21	550	1150	25	20	42	115	17	37	C-4
4. 19 42								17	13	10	25	550	1150	30	28	58	130	21	50	3-5
4. 19 43								24	18	13	25	550	1150	40	36	77	140	26	61	3-5
4. 19 44						60	58	46	34	24	41	550	1150	50	53	108	160	39	89	4-7

	permissible load [kN]															wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	[kg]
49 19 13	4.6	4.2	4.0								197	240	130	345	100	8.7
49 19 14	7.3	6.2	5.9								247	240	152	355	150	11.6
49 19 25	12	11	9.3	7.6	7.0						297	320	181	400	200	13.3
49 19 35	24	21	18	16	15	14	14	9.0			347	315	203	415	250	18.7
49 19 45							13	9.4	7.1	5.2	347	315	203	415	250	18.7

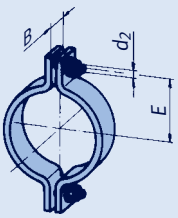


Selection table OD 219.1

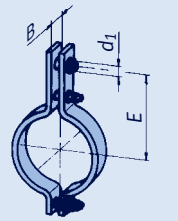
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

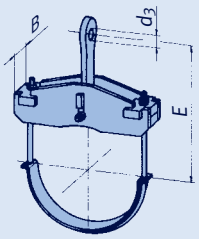
Pipe clamps, clamp bases, OD 219.1 (ND 200), type 42, 43, 44, 46, 48, 49



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 22 19	6.7	5.2	3.7								M16	145	50	3.1	1-4
Heat-resistant materials, see pages 0.9 and 4.4															

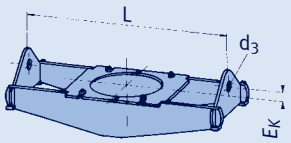


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 22 18	2.5	2.5	2.5								12	295	50	5.0	C-D
43 22 19	11	9.0	6.4								16	295	50	5.0	1-5
43 22 28			2.5	2.5	2.5						12	365	50	5.6	C-D
43 22 29	12	11	9.4	7.7	5.5						16	365	50	5.6	1-5

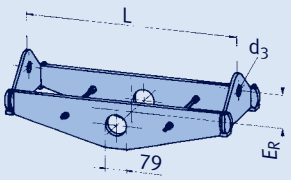


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 22 12	30	25	20								34	275	85	9.0	3-6
44 22 31			12	10	9.4	9.3	8.9	6.1			21	375	94	9.0	C-4
44 22 32	34	30	28	26	24	23	20	11			34	375	96	13	4-6
44 22 33	67	59	53	45	41	40	39	20			46	375	122	22	5-8
44 22 41								8.9	6.9	5.1	21	375	103	10	C-4
44 22 42								19	14	11	34	375	110	15	4-6
44 22 43	79	69	66	59	56	55	50	33	24	18	46	375	132	24	5-8

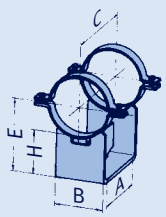
① type 46

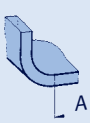


① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①2211	24	20	14								21	480	1100	15	16	38	105	12	36	C-4
4. 22 12	43	33	24								25	480	1100	25	24	54	110	16	46	3-5
4. 22 21		33	33	30	21						25	480	1200	35	26	64	120	18	52	3-5
4. 22 22	50	48	48	44	30						34	480	1200	40	30	75	150	24	64	4-6
4. 22 31					15	15	11	6.1			21	550	1350	25	21	50	130	17	44	C-4
4. 22 32				36	35	32	24	13			25	550	1350	40	36	79	150	25	67	3-5
4. 22 33	61	59	57	55	51	45	34	18			41	550	1350	50	44	102	170	32	83	4-7
4. 22 34	113	108	105	101	88	79	60	31			46	550	1350	60	64	142	200	48	119	5-8
4. 22 41								10	8.0	5.9	21	550	1350	25	22	54	130	19	50	C-4
4. 22 42								23	17	12	25	550	1350	40	39	93	155	28	76	3-5
4. 22 43							36	32	24	18	41	550	1350	50	48	113	185	34	93	4-7
4. 22 44						61	60	55	42	31	46	550	1350	60	69	165	200	51	133	5-8





type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 22 13	7.1	6.5	6.2								210	235	130	350	100	10.1
49 22 14	10	9.2	8.6								260	250	156	365	150	13.6
49 22 25	12	12	10	8.9	8.2						360	325	210	410	250	16.5
49 22 35	27	26	22	19	18	17	17	9.6			360	315	210	415	250	20.2
49 22 45							15	10	8.1	6.0	360	315	210	415	250	19.8

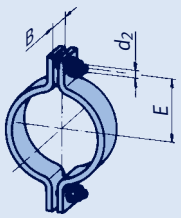
Selection table OD 244.5

Temp. of medium > 600°C from page 4.52

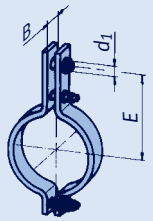
Load doubling via type 77, see page 4.67

Pipe clamps, clamp bases, OD 244.5 (ND 225), type 42, 43, 44, 46, 48, 49

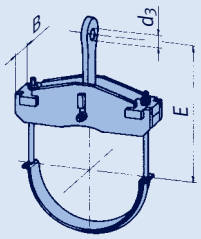
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 24 19	6.1	4.7	3.3								M16	160	50	3.3	1-4
Heat-resistant materials, see pages 0.9 and 4.4															



	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	[kg]	group
43 24 18	2.5	2.5	2.5								12	310	50	6.1	C-D
43 24 19	12	11.4	8.2								16	310	50	6.1	1-5
43 24 28			2.5	2.5	2.5						12	390	50	5.8	C-D
43 24 29		10	8.7	7.1	5.5						16	390	50	5.8	1-5

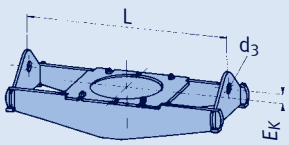


	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	[kg]	group
44 24 12	20	16	13								34	300	75	9.0	3-6
44 24 13	40	35	29								46	330	81	12	5-8
44 24 31			11	9.8	9.1	9.0	8.5	6.0			21	390	94	9.0	C-4
44 24 32			29	26	24	23	20	11			34	390	96	14	4-6
44 24 33	65	57	52	44	41	40	39	20			46	390	122	23	5-8
44 24 41								8.9	6.9	5.0	21	390	103	11	C-4
44 24 42								18	14	11	34	390	110	16	4-6
44 24 43	79	68	65	59	55	54	50	33	24	18	46	390	132	25	5-8

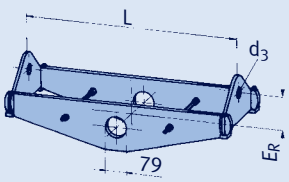


① type 46

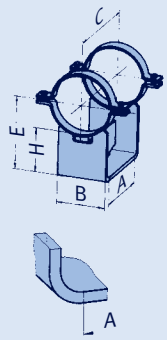
	permissible load [kN]											L		type 46			type 48			load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	min	max	E_K	[kg min]	[kg max]	E_R	[kg min]	[kg max]	group
4.①2411	30	25	18								25	490	1100	25	21	47	100	14	39	3-5
4. 24 12	50	42	30								34	500	1100	35	33	63	120	21	52	4-6
4. 24 21			38	35	25						25	500	1200	40	30	68	130	21	56	3-5
4. 24 22	57	55	54	49	34						34	520	1200	45	39	80	150	28	70	4-6
4. 24 31					18	16	13	7.0			25	550	1350	30	25	56	110	17	47	3-5
4. 24 32				41	40	36	27	14			25	550	1350	45	40	86	150	28	74	3-5
4. 24 33	66	64	62	59	56	50	38	20			41	550	1350	50	50	110	160	34	88	4-7
4. 24 34	122	117	113	109	96	86	66	35			46	550	1350	60	72	156	180	51	124	5-8
4. 24 41								12	9.2	6.9	25	550	1350	30	26	61	120	20	54	3-5
4. 24 42								24	18	13	25	550	1350	45	43	100	150	29	80	3-5
4. 24 43							37	36	27	20	41	550	1350	50	53	123	160	36	98	4-7
4. 24 44							64	61	46	34	46	550	1350	60	77	178	190	54	142	5-8



① type 48



	permissible load [kN]																wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H		[kg]
49 24 13	7.1	6.6	6.2								222	235	130	350	100		10.6
49 24 14	11	10	9.5								272	250	171	365	150		14.9
49 24 25	21	18	15	12	11						372	315	222	415	250		20.5
49 24 35	34	32	30	26	24	24	21	12			372	320	222	420	250		24.4
49 24 45						24	22	15	11	8.7	372	320	222	420	250		24.4

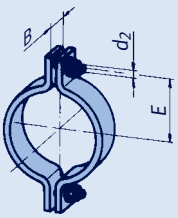


Selection table OD 267

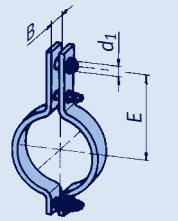
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

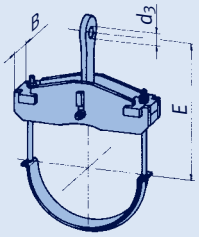
Pipe clamps, clamp bases, OD 267 (ND 250), type 42, 43, 44, 46, 48, 49



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 26 19	6.3	4.9	3.5								M20	175	60	4.6	3-4
Heat-resistant materials, see pages 0.9 and 4.4															

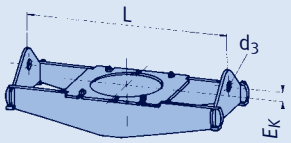


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 26 18	9.6	9.0	8.6								16	340	70	12.0	1-3
43 26 19	28	21	15								24	340	70	12.0	3-6
43 26 28			11.3	11.3	9.6						16	410	70	10.5	1-3
43 26 29		18	15	12	9.6						24	410	70	10.5	3-6

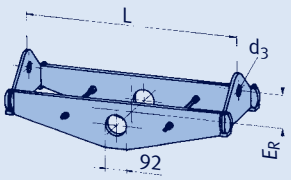


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 26 12	26	22	16								34	340	75	10	4-6
44 26 13	61	54	44								46	360	112	20	5-8
44 26 31			10	9.1	8.5	8.4	8.0	5.6			21	425	94	10	C-4
44 26 32			25	23	22	21	19	11			34	425	96	16	4-6
44 26 33			48	40	37	36	35	20			46	425	122	24	5-8
44 26 41								7.9	6.3	4.9	21	425	110	13	C-4
44 26 42								20	15	11	34	425	117	19	4-6
44 26 43	72	61	59	53	50	49	45	33	24	18	46	425	132	27	5-8

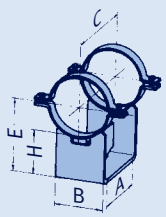
①type 46

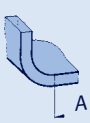


①type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①2611	35	29	21								25	520	1150	35	25	55	105	18	47	3-5
4. 26 12	54	43	31								34	550	1150	45	37	69	130	26	59	4-6
4. 26 21			40	37	26						25	550	1300	30	35	78	140	26	66	3-5
4. 26 22	58	56	55	51	36						34	560	1300	50	42	99	150	33	85	4-6
4. 26 31					20	20	15	8.0			25	600	1400	30	35	66	120	21	55	3-5
4. 26 32				42	40	37	28	15			25	600	1400	50	47	96	150	33	79	3-5
4. 26 33	73	67	65	62	58	53	40	21			41	600	1400	50	57	120	160	42	98	4-7
4. 26 34	134	122	119	115	100	90	69	36			46	600	1400	70	83	172	185	57	137	5-8
4. 26 41								14	10	7.9	25	600	1400	30	36	74	140	25	64	3-5
4. 26 42								27	20	15	25	600	1400	50	51	111	175	35	90	3-5
4. 26 43							39	38	28	21	41	600	1400	50	64	137	165	44	110	4-7
4. 26 44						70	70	65	49	36	46	600	1400	70	90	199	205	63	158	5-8





type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 26 13	8.7	7.9	7.5								234	240	160	365	100	13.7
49 26 14	17	15	14								284	255	171	395	150	19.3
49 26 25	25	21	18	14	13						384	340	229	450	250	24.6
49 26 35	41	35	34	31	29	25	22	14			384	345	229	460	250	29.3
49 26 45					27	27	25	17	13	9.8	384	345	229	460	250	28.3

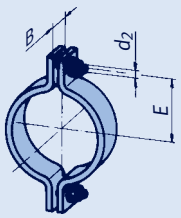
Selection table OD 273

Temp. of medium > 600°C
from page 4.52

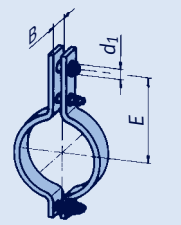
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 273 (ND 250), type 42, 43, 44, 46, 48, 49

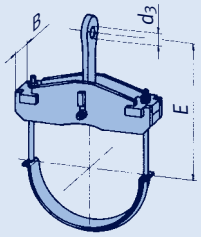
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 27 19	6.2	4.7	3.4								M20	180	60	4.7	3-4
Heat-resistant materials, see pages 0.9 and 4.4															



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 27 18	9.6	9.0	8.6								16	340	70	12.5	1-3
43 27 19	27	21	15								24	340	70	12.5	3-6
43 27 28			11.3	11.3	9.6						16	415	70	11.0	1-3
43 27 29		18	15	12	9.6						24	415	70	11.0	3-6

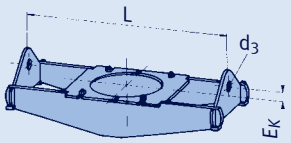


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 27 12	26	22	16								34	340	75	10	4-6
44 27 13	60	54	44								46	360	112	20	5-8
44 27 31			10	9.2	8.6	8.5	8.1	5.7			21	425	94	10	C-4
44 27 32			26	24	22	21	19	11			34	425	96	16	4-6
44 27 33			48	40	38	37	36	21			46	425	122	25	5-8
44 27 41								8.0	6.4	5.0	21	425	110	13	C-4
44 27 42								20	15	11	34	425	117	19	4-6
44 27 43	73	62	60	54	51	50	46	33	24	18	46	425	132	27	5-8

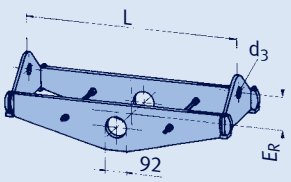


① type 46

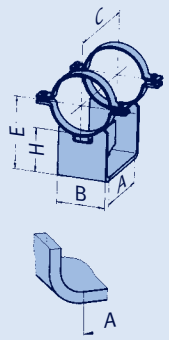
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	[kg min]	[kg max]	type 48 E_R	[kg min]	[kg max]	load group
4.①2711	35	29	20								25	480	1150	35	27	57	105	16	47	3-5
4. 27 12	53	43	31								34	520	1150	45	39	70	130	25	59	4-6
4. 27 21			41	39	27						25	550	1300	45	36	80	140	29	69	3-5
4. 27 22	57	55	54	50	36						34	570	1300	50	47	100	150	34	85	4-6
4. 27 31					20	20	15	8.0			25	600	1400	30	35	67	120	22	55	3-5
4. 27 32				42	41	37	28	15			25	600	1400	50	48	97	150	33	79	3-5
4. 27 33	73	67	65	62	58	53	40	21			41	600	1400	50	58	121	160	42	98	4-7
4. 27 34	134	122	119	115	100	89	69	36			46	600	1400	70	88	173	185	57	137	5-8
4. 27 41								14	10	7.9	25	600	1400	30	37	75	140	25	64	3-5
4. 27 42								27	20	14	25	600	1400	50	51	111	175	35	90	3-5
4. 27 43							39	38	28	20	41	600	1400	50	65	138	165	44	111	4-7
4. 27 44						70	70	65	49	35	46	600	1400	70	94	203	205	63	159	5-8



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 27 13	8.7	7.9	7.5								237	240	160	360	100	13.9
49 27 14	17	15	14								287	255	171	395	150	19.4
49 27 25	25	22	18	14	13						387	340	229	450	250	24.7
49 27 35	39	35	34	31	29	25	22	14			387	345	229	460	250	29.5
49 27 45					28	28	25	17	13	10	387	345	229	460	250	28.5

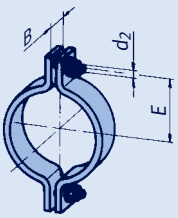


Selection table OD 323.9

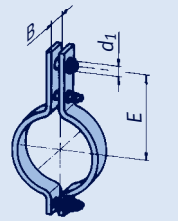
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

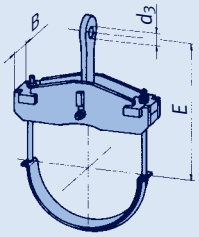
Pipe clamps, clamp bases, OD 323.9 (ND 300), type 42, 43, 44, 46, 48, 49



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 32 19	5.4	4.2	3.0								M20	205	60	5.3	3-4
Heat-resistant materials, see pages 0.9 and 4.4															

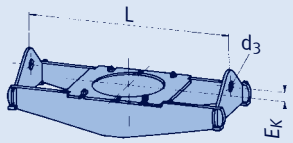


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 32 18	9.6	9.0	8.6								16	375	80	16.0	1-3
43 32 19	28	22	15								24	375	80	16.0	3-6
43 32 28			11.3	11.3	11.3						16	440	70	15.0	1-3
43 32 29	29	24	19	16	13						24	440	70	15.0	3-6

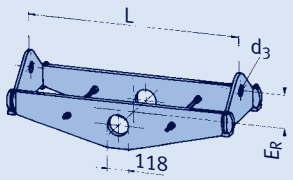


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 32 12	38	32	25								46	375	80	17	5-8
44 32 13	73	61	51								51	390	113	28	6-9
44 32 31			21	20	19	18	16	11			25	470	110	19	3-5
44 32 32			46	39	36	35	34	20			41	470	115	27	5-7
44 32 33	89	78	74	62	58	57	55	36			46	470	165	47	5-8
44 32 41								17	13	9.8	25	470	143	22	3-5
44 32 42								32	24	18	41	470	132	31	5-7
44 32 43	90	73	70	63	59	58	57	55	41	30	46	470	189	53	5-8

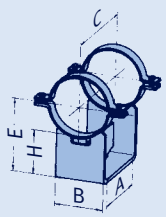
① type 46

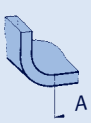


① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①3211	30	25	18								25	570	1200	35	31	58	120	22	52	3-5
4. 32 12	54	43	31								34	570	1200	40	42	77	140	30	69	4-6
4. 32 13	85	62	49								41	590	1200	55	63	101	135	39	90	5-7
4. 32 21			28	27	20						25	620	1300	30	41	72	120	27	64	3-5
4. 32 22		62	61	56	39						34	650	1300	30	56	111	150	42	93	4-6
4. 32 23	88	85	84	77	55						46	700	1300	30	76	132	160	58	109	5-8
4. 32 31					29	27	21	12			25	620	1400	50	49	89	150	32	76	3-5
4. 32 32				68	63	56	43	22			41	650	1400	50	76	135	180	51	111	4-7
4. 32 33	99	96	93	89	85	75	58	31			46	670	1400	50	89	164	195	61	131	5-8
4. 32 34	125	124	122	115	110	98	75	40			46	670	1400	50	106	190	205	71	154	5-8
4. 32 35	202	185	179	166	144	131	101	53			51	790	1400	50	145	239	200	88	181	6-9
4. 32 41								21	16	11	25	700	1400	50	55	106	165	39	88	3-5
4. 32 42								40	29	21	41	700	1400	50	83	153	180	53	122	4-7
4. 32 43							62	54	40	30	46	700	1400	50	98	190	210	70	145	5-8
4. 32 44							78	70	53	39	46	700	1400	50	115	224	225	80	174	5-8
4. 32 45						102	101	93	70	51	51	800	1400	50	154	268	235	101	212	6-9





type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 32 13	13	12	11								262	250	180	375	100	17.2
49 32 14	20	17	16								362	255	229	395	200	27.0
49 32 25	30	26	22	18	16						412	340	248	450	250	27.8
49 32 35	46	40	38	34	32	28	25	16			412	345	254	460	250	32.7
49 32 45	48	43	41	37	34	34	32	22	16	12	412	345	254	460	250	32.3

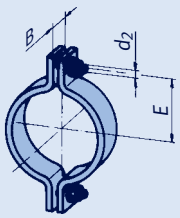
Selection table OD 355.6

Temp. of medium > 600°C from page 4.52

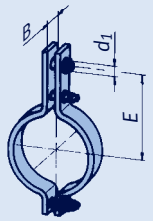
Load doubling via type 77, see page 4.67

Pipe clamps, clamp bases, OD 355.6 (ND 350), type 42, 43, 44, 46, 48, 49

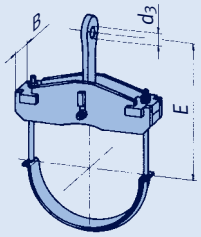
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 36 19	5.1	3.9	2.8								M20	220	60	5.7	3-4
Heat-resistant materials, see pages 0.9 and 4.4															



	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	[kg]	group
43 36 18	9.6	9.0	8.6								16	390	90	19.0	1-3
43 36 19	29	23	16								24	390	90	19.0	3-6
43 36 28			11.3	11.3	11.3						16	470	90	20.5	1-3
43 36 29	33	28	23	19	15						24	470	90	20.5	3-6

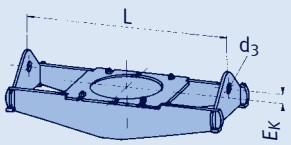


	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	[kg]	group
44 36 12	48	41	32								46	400	85	20	6-8
44 36 13	82	66	53								51	420	113	30	6-9
44 36 31			21	20	19	18	16	11			25	485	110	21	3-5
44 36 32			47	39	36	35	34	21			41	485	122	31	5-7
44 36 33	89	78	74	62	58	57	55	36			46	485	165	49	5-8
44 36 41								17	13	9.9	25	485	143	24	3-5
44 36 42								32	24	18	41	485	132	33	5-7
44 36 43	90	74	70	64	60	59	57	55	42	31	46	485	189	55	5-8

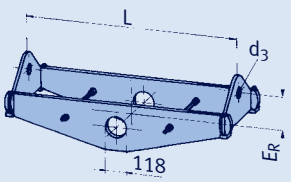


	permissible load [kN]										L		type 46			type 48			load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	min	max	E_K	[kg min]	[kg max]	E_R	[kg min]	[kg max]	group
4.①3611	37	30	21								34	660	1300	35	45	74	120	30	66	4-6
4. 36 12	64	50	40								34	660	1300	40	57	106	130	41	92	4-6
4. 36 13	93	72	55								46	660	1300	60	77	131	145	48	96	6-8
4. 36 21			25	24	17						25	660	1400	30	38	76	115	29	66	3-5
4. 36 22			35	33	24						34	660	1400	40	58	99	140	35	79	4-6
4. 36 23	80	77	76	71	49						41	770	1400	40	84	144	155	60	117	5-7
4. 36 24	100	96	95	88	62						51	790	1400	45	95	166	160	68	131	6-9
4. 36 31					25	24	18	10			25	700	1500	40	52	91	135	32	74	3-5
4. 36 32					32	32	25	13			34	700	1500	50	63	117	160	40	90	4-6
4. 36 33				74	67	60	46	24			41	710	1500	60	89	158	180	60	125	4-7
4. 36 34	134	129	125	120	112	102	79	41			46	720	1500	60	118	226	205	82	173	5-8
4. 36 35	195	186	180	174	167	149	115	61			51	790	1500	70	176	287	230	104	218	6-9
4. 36 41								18	13	10	25	700	1500	40	56	103	155	37	86	3-5
4. 36 42								25	19	14	34	700	1500	50	68	129	170	46	106	4-6
4. 36 43								43	32	23	41	800	1500	60	104	183	190	69	141	4-7
4. 36 44							73	72	54	40	46	800	1500	60	136	252	240	102	196	5-8
4. 36 45						139	138	107	80	58	51	800	1500	70	186	335	245	119	256	6-9

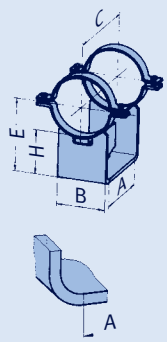
①type 46



①type 48



	permissible load [kN]														wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	[kg]
49 36 13	22	21	19								278	300	230	445	100	25
49 36 14	26	22	21								378	300	235	455	200	34
49 36 25	31	30	30	24	22						428	400	260	510	250	34
49 36 35	62	59	52	45	42	42	39	23			478	400	280	525	300	46
49 36 45		56	54	48	45	44	41	28	21	15	478	400	280	525	300	46

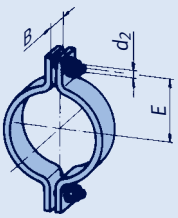


Selection table OD 368

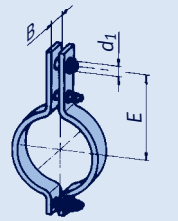
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

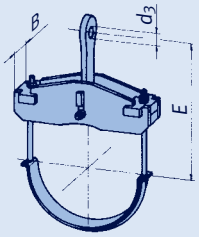
Pipe clamps, clamp bases, OD 368 (ND 350), type 42, 43, 44, 46, 48, 49



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 37 19	5.0	3.9	2.8								M20	225	60	5.8	3-4
Heat-resistant materials, see pages 0.9 and 4.4															

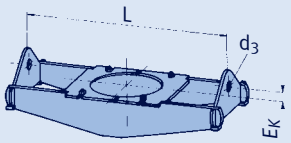


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 37 18	9.6	9.0	8.6								16	395	90	18.5	1-3
43 37 19	29	22	16								24	395	90	18.5	3-6
43 37 28			11.3	11.3	11.3						16	475	90	21.0	1-3
43 37 29	33	28	23	19	15						24	475	90	20.5	3-6

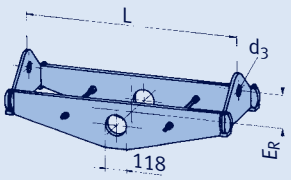


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 37 12	48	41	32								46	400	85	20	6-8
44 37 13	70	62	53								51	420	113	31	6-9
44 37 31			22	21	19	18	16	11			25	490	110	21	3-5
44 37 32			47	39	37	36	35	21			41	490	122	31	5-7
44 37 33	91	79	75	63	58	57	56	36			46	490	165	50	5-8
44 37 41								17	13	9.8	25	490	143	24	3-5
44 37 42								32	24	18	41	490	132	33	5-7
44 37 43			70	64	60	59	58	55	42	31	46	490	189	56	5-8

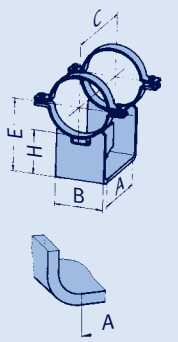
① type 46



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①3711	37	30	21								34	680	1300	35	46	73	120	31	67	4-6
4. 37 12	66	50	40								34	680	1300	40	62	107	130	42	93	4-6
4. 37 13	93	73	55								46	680	1300	60	80	133	145	49	96	6-8
4. 37 21			25	23	17						25	680	1400	30	39	78	115	29	66	3-5
4. 37 22			35	33	24						34	680	1400	40	49	101	140	36	79	4-6
4. 37 23	80	77	76	70	49						41	770	1400	40	79	144	155	61	117	5-7
4. 37 24	100	96	95	88	62						46	790	1400	45	101	169	160	68	132	6-8
4. 37 31					25	24	18	10			25	700	1500	40	53	93	135	32	75	3-5
4. 37 32					32	32	24	13			34	700	1500	50	64	115	160	41	90	4-6
4. 37 33				76	69	61	47	25			41	720	1500	60	89	161	180	62	127	4-7
4. 37 34	137	129	125	121	112	102	79	41			46	740	1500	60	124	229	220	85	177	5-8
4. 37 35	199	199	191	178	167	149	114	61			51	820	1500	70	179	292	230	108	220	6-9
4. 37 41								18	13	10	25	750	1500	40	59	104	155	39	86	3-5
4. 37 42								25	19	13	34	750	1500	50	72	131	170	49	106	4-6
4. 37 43								43	32	23	41	750	1500	60	100	180	190	67	142	4-7
4. 37 44							79	72	54	40	46	750	1500	60	135	255	240	98	197	5-8
4. 37 45						139	138	106	80	58	51	850	1500	70	195	339	245	125	257	6-9



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 37 13	22	21	19								284	300	230	445	100	25
49 37 14	27	23	22								384	300	241	460	200	34
49 37 25	32	31	30	24	23						434	400	260	510	250	35
49 37 35	63	61	54	46	43	42	40	24			484	400	292	525	300	48
49 37 45	65	59	56	50	47	46	43	30	22	16	484	400	292	525	300	47

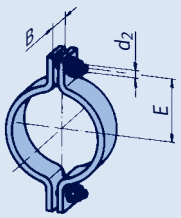
Selection table OD 406.4

Temp. of medium > 600°C
from page 4.52

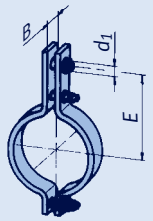
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 406.4 (ND 400), type 42, 43, 44, 46, 48, 49

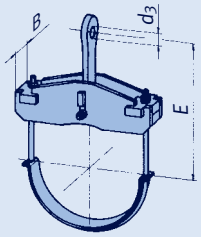
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 41 19	8.0	6.2	4.5								M24	255	70	9.7	3-5
Heat-resistant materials, see pages 0.9 and 4.4															



	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	[kg]	group
43 41 18	9.6	9.0	8.6								16	430	100	23.0	1-3
43 41 19	30	23	16								24	430	100	23.0	3-6
43 41 28			11.3	11.3	11.3						16	500	100	24.5	1-3
43 41 29	33	28	23	20	15						24	500	100	24.5	3-6

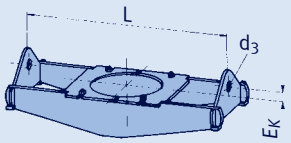


	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	[kg]	group
44 41 12	59	49	40								51	440	92	26	6-9
44 41 13	93	75	63								61	450	135	35	7-10
44 41 22			36	28	26						41	500	117	25	5-7
44 41 23			61	48	44						51	500	135	38	6-9
44 41 31					18	17	15	11			25	520	110	23	3-5
44 41 35					38	37	36	24			46	520	144	44	5-8
44 41 36	101	93	81	67	63	62	60	33			51	520	149	63	6-9
44 41 41								16	12	9.6	25	520	143	26	3-5
44 41 45								42	31	23	46	520	164	58	5-8
44 41 46	151	139	132	117	109	108	98	64	48	34	51	520	189	92	6-9

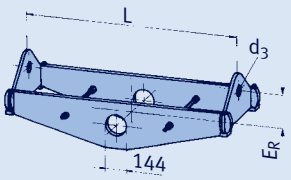


	permissible load [kN]											L		type 46			type 48			load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	min	max	E_K	[kg min]	[kg max]	E_R	[kg min]	[kg max]	group
4.①4111	44	36	26								34	780	1400	30	60	95	155	43	87	4-6
4. 41 12	75	55	43								41	780	1400	40	73	131	160	56	111	5-7
4. 41 13	109	85	67								46	780	1400	55	109	150	175	73	132	6-8
4. 41 21			29	28	20						25	780	1500	40	59	95	145	40	85	3-5
4. 41 22			41	39	28						34	780	1500	40	77	123	150	49	102	4-6
4. 41 23	95	91	90	84	58						41	820	1500	50	109	185	180	79	149	5-7
4. 41 24	118	114	112	104	73						46	820	1500	60	121	213	180	85	172	6-8
4. 41 31					30	28	21	12			25	800	1600	45	70	116	160	44	99	3-5
4. 41 32					47	44	35	20			41	800	1600	50	98	163	180	64	132	4-7
4. 41 33				83	78	71	55	29			46	800	1600	70	120	205	200	80	159	5-8
4. 41 34	141	129	125	121	112	100	77	41			46	800	1600	70	148	250	220	97	203	5-8
4. 41 35	236	232	225	210	193	174	134	71			51	870	1600	80	221	375	260	149	286	6-9
4. 41 41								21	16	11	25	800	1600	45	76	135	175	51	114	3-5
4. 41 42								36	27	20	41	800	1600	50	107	188	205	73	153	4-7
4. 41 43								51	38	27	46	800	1600	70	131	234	225	85	187	5-8
4. 41 44							77	72	54	40	46	800	1600	70	164	290	225	106	232	5-8
4. 41 45						142	141	125	94	69	51	900	1600	80	247	422	265	159	322	6-9

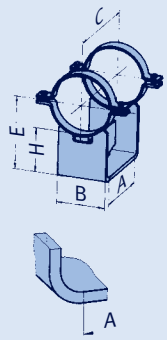
①type 46



①type 48



	permissible load [kN]																wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H		[kg]
49 41 13	25	23	22								303	280	260	450	100		33
49 41 14	47	40	37								403	300	241	480	200		44
49 41 25	59	53	43	35	32						453	400	273	535	250		47
49 41 35	90	84	72	61	57	57	55	34			503	400	300	550	300		63
49 41 45	91	83	79	71	66	64	60	41	30	23	503	400	300	550	300		63

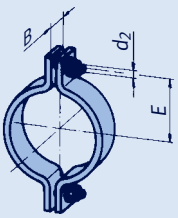


Selection table OD 419

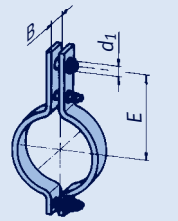
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

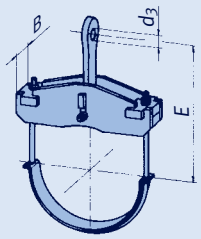
Pipe clamps, clamp bases, OD 419 (ND 400), type 42, 43, 44, 46, 48, 49



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 42 19	8.0	6.2	4.4								M24	260	70	9.7	3-5
Heat-resistant materials, see pages 0.9 and 4.4															

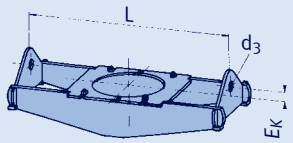


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	wt. [kg]	load group
43 42 18	9.6	9.0	8.6								16	435	100	23	1-3
43 42 19	29	22	16								24	435	100	23	3-6
43 42 28			11.3	11.3	11.3						16	500	100	24.5	1-3
43 42 29	33	28	23	19	15						24	500	100	25	3-6

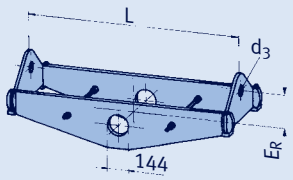


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 42 12	59	49	40								51	445	92	26	6-9
44 42 15	151	116	84								61	460	162	60	7-10
44 42 22			36	28	26						41	500	117	26	5-7
44 42 25			75	59	53						51	500	140	44	6-9
44 42 31					18	17	15	11			25	525	110	23	3-5
44 42 35					38	37	36	25			46	525	144	44	5-8
44 42 36		98	85	71	67	65	64	34			51	525	149	64	6-9
44 42 41								16	12	9.6	25	525	143	27	3-5
44 42 45								42	31	23	46	525	164	58	5-8
44 42 46	151	140	133	118	110	108	99	64	48	34	51	525	189	96	6-9

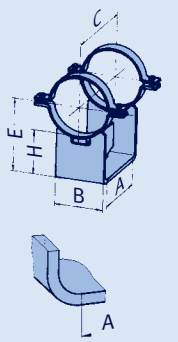
① type 46



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①4211	43	35	25								34	800	1400	30	62	94	155	44	88	4-6
4. 42 12	74	55	43								41	800	1400	40	75	131	160	58	112	5-7
4. 42 13	109	85	67								46	800	1400	55	112	162	175	75	132	6-8
4. 42 21			29	28	20						25	800	1500	40	61	97	145	41	85	3-5
4. 42 22			41	39	28						34	800	1500	40	78	124	150	50	103	4-6
4. 42 23	95	91	90	83	58						41	830	1500	50	103	184	180	80	155	5-7
4. 42 24	117	114	113	104	73						46	830	1500	60	125	214	180	87	173	6-8
4. 42 31					30	28	21	12			25	800	1600	45	72	118	160	44	99	3-5
4. 42 32					47	45	35	20			41	800	1600	50	96	166	180	64	133	4-7
4. 42 33				83	78	70	54	29			46	800	1600	70	122	204	200	81	160	5-8
4. 42 34	139	129	125	121	113	100	77	41			46	810	1600	70	152	261	220	99	204	5-8
4. 42 35	234	230	223	209	194	176	136	71			51	890	1600	80	228	381	260	153	287	6-9
4. 42 41								21	16	11	25	800	1600	45	78	137	175	51	114	3-5
4. 42 42								36	27	20	41	800	1600	50	106	185	205	73	154	4-7
4. 42 43								50	38	28	46	800	1600	70	134	237	225	86	187	5-8
4. 42 44							77	72	54	40	46	900	1600	70	175	293	225	116	224	5-8
4. 42 45						140	139	125	94	69	51	900	1600	80	252	427	265	160	323	6-9



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 42 13	37	32	24								310	300	241	420	100	31
49 42 14	47	40	37								410	300	241	480	200	44
49 42 25	61	53	43	35	32						460	400	273	535	250	48
49 42 35	91	85	72	61	57	57	55	34			510	400	300	555	300	64
49 42 45	92	85	80	72	67	65	61	42	32	23	510	400	300	555	300	64

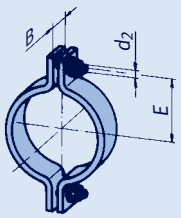
Selection table OD 457.2

Temp. of medium > 600°C from page 4.52

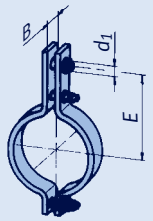
Load doubling via type 77, see page 4.67

Pipe clamps, clamp bases, OD 457.2 (ND 450), type 42, 43, 44, 46, 48, 49

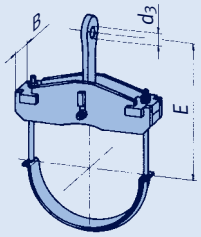
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 46 19	7.5	5.8	4.1								M24	280	70	10.4	3-5
Heat-resistant materials, see pages 0.9 and 4.4															



	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_1	E	B	[kg]	group
43 46 18	9.6	9.0	8.6								16	450	100	24	1-3
43 46 19	27	21	15								24	450	100	24	3-6

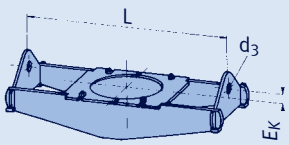


	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	[kg]	group
44 46 12	59	50	39								51	470	112	30	6-9
44 46 13	81	66	51								51	470	113	36	7-9
44 46 15	150	117	84								61	480	162	62	7-10
44 46 22			28	22	20						41	540	96	24	5-7
44 46 23			58	45	42						51	540	122	36	6-9
44 46 25			69	55	50						51	540	136	46	6-9
44 46 31					14	13	11	10			25	560	102	25	3-5
44 46 32					32	31	30	20			46	560	135	40	5-8
44 46 35		87	76	63	59	58	57	33			51	560	149	66	6-9
44 46 36	151	145	125	104	98	97	94	52			51	560	209	114	6-9
44 46 41								15	12	9.1	25	560	143	29	3-5
44 46 42								32	24	17	46	560	145	44	5-8
44 46 45		133	126	112	104	103	98	64	47	34	51	560	189	96	6-9
44 46 46	151	148	140	127	120	117	114	91	66	47	51	560	229	145	6-9

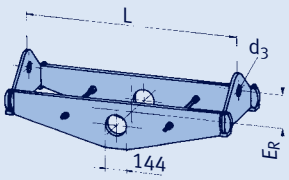


	permissible load [kN]										L		type 46			type 48			load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	min	max	E_K	[kg min]	[kg max]	E_R	[kg min]	[kg max]	group
4.①4611	45	36	26								34	770	1450	35	71	112	150	47	97	4-6
4. 46 12	60	46	35								41	820	1450	40	76	125	155	59	109	5-7
4. 46 13	120	92	73								46	850	1450	50	131	173	170	86	143	6-8
4. 46 14	151	112	89								51	850	1450	60	138	214	185	86	156	6-9
4. 46 21			36	34	24						34	800	1600	45	81	131	160	50	107	4-6
4. 46 22			59	55	40						41	800	1600	50	103	170	170	69	141	5-7
4. 46 23	139	133	132	119	85						46	930	1600	55	160	262	185	113	210	6-8
4. 46 24	156	152	150	138	98						51	930	1600	55	172	298	200	123	232	7-9
4. 46 31					50	46	35	20			41	900	1700	50	117	184	180	75	147	4-7
4. 46 32					58	53	42	22			46	900	1700	50	132	206	190	81	158	5-8
4. 46 33				123	112	101	78	41			46	900	1700	60	184	287	225	116	224	5-8
4. 46 34	275	252	244	236	227	203	156	83			51	930	1700	70	298	456	245	175	331	6-9
4. 46 35	298	285	276	267	257	233	181	94			61	980	1700	85	333	513	250	204	366	7-10
4. 46 41								36	27	20	41	900	1700	50	128	211	195	86	171	4-7
4. 46 42								41	31	22	46	900	1700	50	142	242	210	92	185	5-8
4. 46 43								72	54	40	46	900	1700	60	197	326	235	125	254	5-8
4. 46 44						157	145	109	80	51	1000	1700	70	318	528	295	205	387	6-9	
4. 46 45						201	199	163	123	90	61	1000	1700	85	357	577	295	228	416	7-10

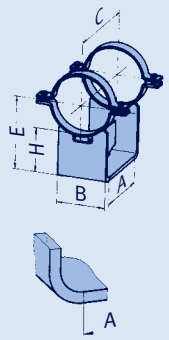
① type 46



① type 48



	permissible load [kN]																wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H		[kg]
49 46 13	37	32	24								329	350	241	485	100		36
49 46 14	75	57	41								429	350	260	500	200		49
49 46 25		55	44	36	33						479	400	292	535	250		51
49 46 35	100	94	80	68	64	64	62	39			529	400	324	555	300		68
49 46 45	105	95	90	81	75	74	70	48	36	26	529	400	324	555	300		69

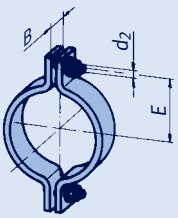


Selection table OD 508

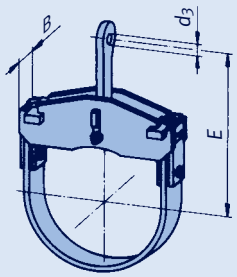
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 508 (ND 500), type 42, 44, 46, 48, 49

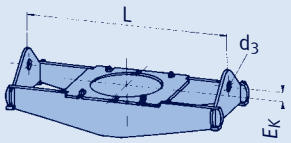


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 51 19	6.9	5.4	3.8								M24	305	70	11.4	3-5
Heat-resistant materials, see pages 0.9 and 4.4															

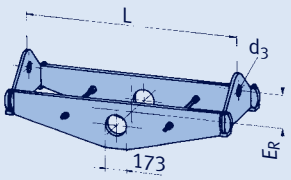


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 51 14	10	8.9	7.5								21	500	80	25	1-4
44 51 15	28	24	19								34	500	80	27	4-6
44 51 16	57	48	37								51	500	92	35	6-9
44 51 17	98	81	65								61	500	162	58	7-10
44 51 18	189	158	125								71	520	222	106	8-30
44 51 25			16	13	12						25	570	99	28	3-5
44 51 26			30	23	22						41	570	100	31	5-7
44 51 27			59	47	42						51	570	122	42	6-9
44 51 28			117	100	90						61	570	164	75	7-10
44 51 35					17	16	14	11			25	590	128	37	3-5
44 51 36					35	34	33	23			46	590	144	48	5-8
44 51 37					81	80	68	35			51	590	189	82	6-9
44 51 38		155	147	140	131	122	98	52			61	590	196	118	7-10
44 51 45								19	15	11	25	590	164	42	3-5
44 51 46								40	30	22	46	590	164	63	5-8
44 51 47								65	48	35	51	590	196	108	6-9
44 51 48	222	222	217	202	189	186	164	113	84	63	61	590	254	190	7-10

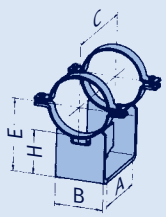
① type 46

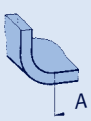


① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①5111	44	37	26								34	860	1500	35	86	123	160	60	111	4-6
4. 51 12	68	51	39								41	860	1500	40	94	150	175	71	133	5-7
4. 51 13	119	93	73								46	900	1500	60	151	193	175	97	159	6-8
4. 51 14	171	127	101								51	900	1500	65	173	234	180	101	182	6-9
4. 51 21			42	40	29						34	920	1650	50	104	153	170	67	130	4-6
4. 51 22			60	55	40						41	920	1650	60	122	192	180	77	151	5-7
4. 51 23	136	130	129	117	83						46	1000	1650	60	182	295	200	129	231	6-8
4. 51 24	168	162	160	147	103						61	1050	1650	60	235	335	220	148	259	7-10
4. 51 31					45	45	35	20			41	1000	1800	60	139	208	200	85	162	4-7
4. 51 32					59	54	42	23			46	1000	1800	70	154	234	200	97	181	5-8
4. 51 33				123	113	102	79	41			46	1000	1800	80	208	327	230	136	252	5-8
4. 51 34	268	250	242	234	227	205	158	84			51	1030	1800	80	324	512	265	199	375	6-9
4. 51 35	335	308	298	288	282	254	195	104			61	1030	1800	90	393	601	300	248	456	7-10
4. 51 41								36	27	20	41	1000	1800	60	151	238	210	97	188	4-7
4. 51 42								41	31	22	46	1000	1800	70	169	270	225	111	209	5-8
4. 51 43								72	54	40	46	1000	1800	80	230	380	250	149	287	5-8
4. 51 44						156	145	109	80	51	1050	1800	80	363	589	315	243	435	6-9	
4. 51 45					202	201	182	137	100	61	1050	1800	90	429	687	315	275	499	7-10	





type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 51 13	46	40	29								354	350	241	500	100	42
49 51 14	84	66	49								454	350	280	500	200	52
49 51 25		62	61	54	50						554	400	330	550	300	70
49 51 35	129	125	107	90	85	84	81	48			554	395	330	565	300	81
49 51 45	148	135	129	116	108	107	99	68	52	38	554	400	330	580	300	87

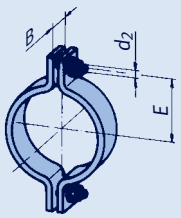
Selection table OD 558.8

Temp. of medium > 600°C from page 4.52

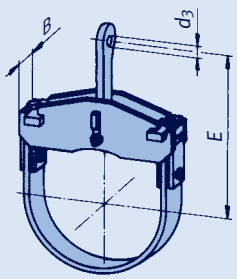
Load doubling via type 77, see page 4.67

Pipe clamps, clamp bases, OD 558.8 (ND 550), type 42, 44, 46, 48, 49

type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 56 19	17	13	9.9								M30	350	90	24	5-6
Heat-resistant materials, see pages 0.9 and 4.4															

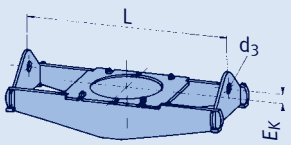


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 56 14	20	17	15								34	530	85	31	3-6
44 56 15	45	38	29								46	530	107	36	5-8
44 56 16	75	60	45								51	530	113	44	6-9
44 56 17	101	84	67								61	530	162	60	7-10
44 56 18	182	151	120								71	545	222	110	8-30
44 56 25			24	19	18						34	600	100	33	4-6
44 56 26			59	47	43						51	600	122	46	6-9
44 56 27			69	55	51						51	600	132	49	6-9
44 56 28			116	99	90						61	600	164	80	7-10
44 56 35					35	34	33	25			46	620	138	51	5-8
44 56 36					83	82	68	35			51	620	189	89	6-9
44 56 37		137	130	124	120	119	98	52			61	620	196	121	7-10
44 56 38	200	175	166	158	150	149	126	83			61	620	229	166	7-10
44 56 45								40	31	23	46	620	164	68	5-8
44 56 46								65	48	35	51	620	196	121	6-9
44 56 47								86	66	47	61	620	216	152	7-10
44 56 48	222	222	222	211	194	188	167	115	85	63	61	620	254	211	7-10

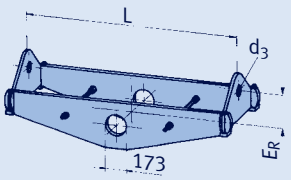


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①5611	44	34	25								34	820	1550	40	84	130	170	61	117	4-6
4. 56 12	67	52	39								41	880	1550	50	111	162	185	76	128	5-7
4. 56 13	131	98	77								51	920	1550	60	164	227	195	101	177	6-9
4. 56 14	202	155	123								51	930	1550	65	206	283	205	118	237	7-9
4. 56 21			43	41	30						34	960	1700	55	117	171	180	74	140	4-6
4. 56 22			57	55	40						41	960	1700	60	137	203	190	83	159	5-7
4. 56 23		133	131	118	86						51	1100	1700	65	233	323	205	147	247	6-9
4. 56 24	208	200	194	182	128						51	1100	1700	65	282	405	240	182	306	7-9
4. 56 31					53	53	41	22			41	1100	1900	60	168	254	200	107	191	4-7
4. 56 32					71	70	54	30			46	1100	1900	60	204	324	230	130	235	5-8
4. 56 33					95	90	70	40			46	1100	1900	70	239	360	240	148	271	5-8
4. 56 34	276	252	245	237	227	205	158	83			51	1100	1900	90	368	563	270	224	422	6-9
4. 56 35	402	364	352	343	340	306	236	126			61	1180	1900	100	506	746	320	321	553	7-10
4. 56 41								40	29	21	41	1100	1900	60	186	289	225	122	224	4-7
4. 56 42								54	40	30	46	1100	1900	60	229	348	220	140	265	5-8
4. 56 43								72	54	40	46	1100	1900	70	266	419	260	171	318	5-8
4. 56 44							172	145	109	80	51	1100	1900	90	411	654	285	246	470	6-9
4. 56 45							231	217	163	120	61	1200	1900	100	567	860	360	359	623	7-10

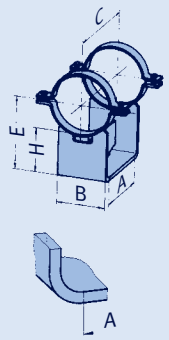
①type 46



①type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 56 13	55	44	32								380	400	241	570	100	71
49 56 14	107	84	62								480	395	292	585	200	89
49 56 25		70	66	56	52						580	450	343	620	300	100
49 56 35	161	147	127	105	99	97	91	55			580	450	350	635	300	116
49 56 45	167	150	142	128	119	111	107	73	55	40	580	450	350	650	300	120

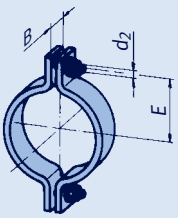


Selection table OD 609.6

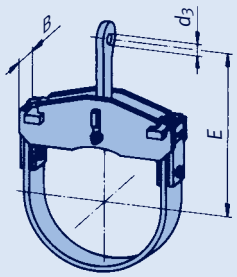
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 609.6 (ND 600), type 42, 44, 46, 48, 49

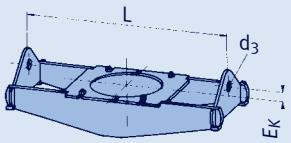


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 61 19	16	13	9.3								M30	375	90	26	5-6
Heat-resistant materials, see pages 0.9 and 4.4															

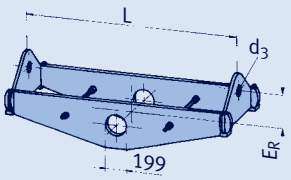


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 61 14	29	24	21								34	560	115	37	3-6
44 61 15	56	45	38								51	560	98	44	6-9
44 61 16	80	69	50								51	560	119	50	6-9
44 61 17	110	87	74								61	560	162	66	7-10
44 61 18	195	159	125								71	580	222	114	8-30
44 61 25			23	22	21						41	645	120	43	4-7
44 61 26			55	43	39						51	645	122	49	6-9
44 61 27			86	71	67						61	645	143	75	7-10
44 61 28			110	92	85						61	645	164	86	7-10
44 61 35					38	37	36	25			46	685	164	62	5-8
44 61 36					78	77	66	35			51	685	189	100	6-9
44 61 37		128	122	116	110	108	91	52			61	685	209	142	7-10
44 61 38	268	248	215	179	169	165	137	82			71	685	229	182	8-30
44 61 45								39	29	21	46	685	182	76	5-8
44 61 46								64	47	34	51	685	196	119	6-9
44 61 47							141	106	81	59	61	685	260	214	7-10
44 61 48	340	305	291	263	247	243	219	142	103	77	71	685	254	244	8-30

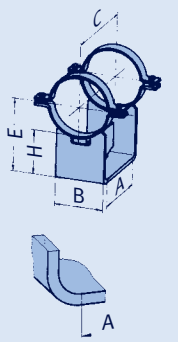
① type 46



① type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.①61 11	60	47	35								41	1000	1600	40	122	165	185	87	150	4-7
4. 61 12	89	69	55								46	1000	1600	45	151	199	195	108	184	6-8
4. 61 13	127	97	77								51	1000	1600	50	176	244	190	115	191	6-9
4. 61 14	186	141	112								51	1000	1600	55	217	293	205	130	242	7-9
4. 61 15	224	167	132								61	1000	1600	65	275	340	230	142	280	7-10
4. 61 21			60	57	42						41	1010	1800	60	155	231	190	105	190	4-7
4. 61 22			117	112	80						51	1060	1800	60	252	362	220	150	273	6-9
4. 61 23	193	186	184	171	120						51	1090	1800	60	310	477	235	188	336	7-9
4. 61 24	245	236	233	217	152						61	1110	1800	70	381	540	265	231	397	8-10
4. 61 31					55	53	41	22			41	1200	2000	60	191	266	220	125	217	4-7
4. 61 32					93	90	70	40			46	1200	2000	70	274	398	235	172	299	5-8
4. 61 33					127	123	96	53			46	1200	2000	90	324	469	280	202	347	5-8
4. 61 34	263	247	239	231	220	198	152	80			51	1210	2000	90	417	613	285	264	467	6-9
4. 61 35	398	361	349	340	337	306	235	125			61	1240	2000	110	565	820	325	357	609	7-10
4. 61 36	494	472	458	442	419	375	288	156			71	1260	2000	110	677	962	360	433	718	8-30
4. 61 41								39	30	22	41	1200	2000	60	211	316	230	135	242	4-7
4. 61 42								71	54	40	46	1200	2000	70	302	463	275	197	350	5-8
4. 61 43								96	72	53	46	1200	2000	90	365	541	280	233	409	5-8
4. 61 44								141	106	78	51	1300	2000	90	486	708	295	298	515	6-9
4. 61 45							256	217	162	120	61	1300	2000	110	646	952	355	403	683	7-10
4. 61 46						306	303	272	205	150	71	1300	2000	110	766	1127	365	482	793	8-30



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 61 13	76	74	54								455	400	273	570	150	80
49 61 14	117	88	64								505	395	311	585	200	95
49 61 25		73	70	64	59						605	450	362	620	300	108
49 61 35	172	152	131	108	102	99	94	59			605	450	370	635	300	122
49 61 45	191	173	165	148	138	125	121	83	62	45	605	450	370	650	300	128

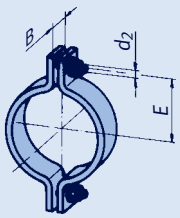
Selection table OD 660.4

Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

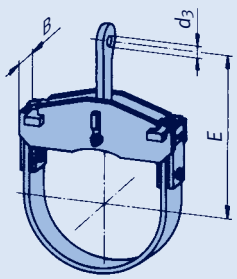
Pipe clamps, clamp bases, OD 660.4 (ND 650), type 42, 44, 46, 48, 49

	permissible load [kN]													wt.	load
type ①	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 66 19	15	12	8.8								M30	400	90	28	5-6



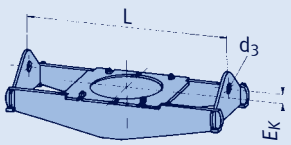
① Heat-resistant materials, see pages 0.9 and 4.4

	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	[kg]	group
44 66 14	34	28	24								41	610	115	41	4-7
44 66 15	58	47	36								51	610	113	48	6-9
44 66 16	86	71	57								51	610	162	66	6-9
44 66 17	130	106	85								61	610	162	79	7-10
44 66 18	183	145	116								71	610	210	118	8-30
44 66 19	306	241	174								71	635	229	172	9-30
44 66 25			22	22	20						41	680	120	44	4-7
44 66 26			61	48	44						51	680	132	55	6-9
44 66 27			101	83	76						61	680	158	83	7-10
44 66 28			169	142	134						71	680	196	135	8-30
44 66 35					40	39	38	25			46	700	164	65	5-8
44 66 36					80	79	77	52			51	700	196	127	6-9
44 66 37					113	112	96	53			61	700	209	146	7-10
44 66 38	281	260	226	188	175	173	139	83			71	700	229	191	8-30
44 66 45								39	30	22	46	700	164	79	5-8
44 66 46								78	60	44	51	700	216	160	6-9
44 66 47						160	153	112	84	60	61	700	260	222	7-10
44 66 48	340	312	298	270	253	249	222	142	105	78	71	700	254	250	8-30

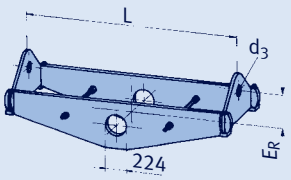


	permissible load [kN]											L		type 46			type 48			load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	min	max	E_K	[kg min]	[kg max]	E_R	[kg min]	[kg max]	group
4.②6611	60	46	36								41	1030	1650	40	133	177	200	103	173	5-7
4. 66 12	90	71	56								46	1050	1650	50	170	216	215	127	210	6-8
4. 66 13	136	102	81								51	1050	1650	55	212	270	200	137	218	6-9
4. 66 14	217	159	126								61	1050	1650	60	271	355	245	170	291	7-10
4. 66 15	257	196	155								61	1050	1650	70	303	395	235	185	303	8-10
4. 66 21			66	63	45						41	1120	1900	65	188	267	220	133	237	4-7
4. 66 22			118	111	80						51	1250	1900	65	294	390	245	191	312	6-9
4. 66 23		195	192	176	125						51	1250	1900	70	356	491	260	232	385	7-9
4. 66 24	256	246	243	223	158						61	1280	1900	80	408	591	270	281	453	8-10
4. 66 31					61	60	47	25			41	1250	2050	65	228	331	225	150	260	4-7
4. 66 32					91	90	70	40			46	1250	2050	65	301	429	245	190	328	5-8
4. 66 33					155	139	107	57			46	1250	2050	90	364	527	290	233	401	5-8
4. 66 34	273	250	242	234	225	202	155	82			51	1250	2050	90	467	666	305	296	504	6-9
4. 66 35	399	362	350	340	337	308	237	125			61	1320	2050	100	621	885	315	391	643	7-10
4. 66 36	488	474	460	439	421	378	291	155			71	1320	2050	110	735	1044	355	467	759	8-30
4. 66 41								45	33	24	41	1250	2050	65	243	364	235	168	295	4-7
4. 66 42								72	54	40	46	1250	2050	65	332	491	285	221	386	5-8
4. 66 43								100	74	54	46	1250	2050	90	401	588	295	263	461	5-8
4. 66 44								146	110	80	51	1250	2050	90	510	769	315	334	562	6-9
4. 66 45							262	218	164	120	61	1350	2050	100	698	1011	350	433	726	7-10
4. 66 46						329	321	272	204	150	71	1350	2050	110	827	1198	360	518	834	8-30

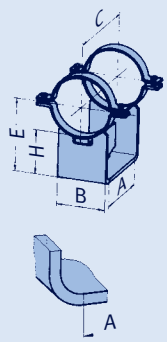
② type 46



② type 48



	permissible load [kN]																wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H		[kg]
49 66 13	89	76	56								480	400	300	570	150		86
49 66 14	122	96	71								530	395	330	585	200		101
49 66 25	113	99	81	66	61						630	450	370	620	300		113
49 66 35	167	161	160	128	120	116	103	72			630	450	381	650	300		134
49 66 45	214	194	185	166	154	145	139	96	72	53	630	450	381	650	300		136

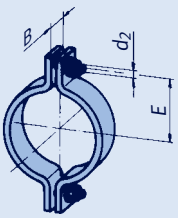


Selection table OD 711.2

Temp. of medium > 600°C from page 4.52

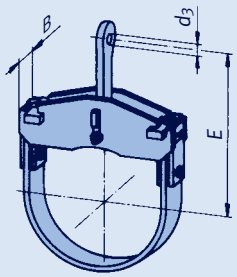
Load doubling via type 77, see page 4.67

Pipe clamps, clamp bases, OD 711.2 (ND 700), type 42, 44, 46, 48, 49



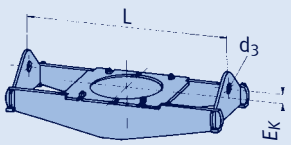
① Heat-resistant materials, see pages 0.9 and 4.4

type ①	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 71 19	14	11	8.1								M30	430	90	30	5-6

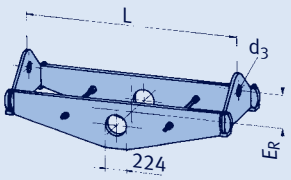


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 71 14	42	35	30								41	630	143	58	4-7
44 71 15	95	76	63								51	630	162	71	6-9
44 71 16	125	102	83								61	630	168	82	7-10
44 71 17	152	121	88								71	630	181	99	8-30
44 71 18	188	145	115								71	630	222	133	8-30
44 71 19	307	243	176								71	650	235	187	9-30
44 71 25			33	26	24						41	720	122	51	5-7
44 71 26			56	44	41						51	720	138	63	6-9
44 71 27			78	68	62						61	720	149	88	7-10
44 71 28			118	98	88						71	720	164	100	8-30
44 71 29			168	141	132						71	720	196	143	8-30
44 71 35					40	39	38	25			46	740	164	72	5-8
44 71 36					72	71	67	35			51	740	189	108	6-9
44 71 37					109	108	92	52			61	740	209	156	7-10
44 71 38		235	205	170	160	157	138	82			71	740	229	198	8-30
44 71 39	340	316	274	229	215	210	175	91			71	740	267	257	9-30
44 71 45								42	32	23	46	740	189	95	5-8
44 71 46								90	66	47	51	740	229	180	6-9
44 71 47								115	85	63	61	740	276	243	7-10
44 71 48		298	285	258	242	238	221	143	105	78	71	740	254	262	8-30

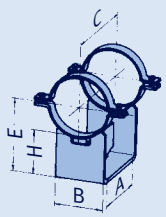
② type 46

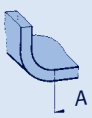


② type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.②7111	73	57	44								41	1030	1700	45	168	213	195	124	197	5-7
4. 71 12	119	90	72								46	1080	1700	55	212	276	240	147	231	6-8
4. 71 13	173	135	107								51	1080	1700	60	256	357	225	160	293	7-9
4. 71 14	234	181	144								51	1090	1700	80	312	412	230	191	309	7-9
4. 71 15	264	204	162								61	1090	1700	90	349	439	215	214	337	8-10
4. 71 21			73	70	50						46	1200	2000	70	232	323	220	152	266	5-8
4. 71 22			116	111	80						51	1210	2000	70	315	436	240	195	341	6-9
4. 71 23		201	198	185	129						51	1320	2000	70	401	581	250	276	441	7-9
4. 71 24	255	245	242	223	158						61	1350	2000	90	487	648	280	309	488	8-10
4. 71 31					63	60	46	27			41	1300	2100	70	256	364	235	163	278	4-7
4. 71 32					94	90	70	40			46	1300	2100	70	333	459	250	203	342	5-8
4. 71 33				180	175	158	121	64			51	1300	2100	100	447	638	285	268	441	6-9
4. 71 34	273	250	242	234	225	202	155	82			51	1310	2100	100	519	719	305	313	524	6-9
4. 71 35	399	362	350	340	337	307	236	125			61	1390	2100	100	681	949	335	432	676	7-10
4. 71 36	533	488	473	457	440	394	303	162			71	1450	2100	130	849	1146	345	522	780	8-30
4. 71 41								49	37	27	41	1300	2100	70	284	409	240	186	317	4-7
4. 71 42								72	54	40	46	1300	2100	70	361	526	290	236	402	5-8
4. 71 43								115	86	63	51	1300	2100	100	492	720	305	297	513	6-9
4. 71 44								145	109	80	51	1400	2100	100	577	821	315	375	583	6-9
4. 71 45							228	217	163	120	61	1400	2100	100	759	1081	355	462	733	7-10
4. 71 46						338	335	283	213	155	71	1450	2100	130	936	1316	370	578	879	8-30





type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 71 13	95	79	58								506	400	320	570	150	92
49 71 14	135	106	78								556	395	350	585	200	107
49 71 25	118	114	100	82	76						656	450	394	635	300	129
49 71 35	203	195	188	157	147	135	120	82			656	450	413	650	300	147
49 71 45	240	215	205	184	171	165	160	111	83	61	656	450	413	650	300	147

Selection table OD 762

Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

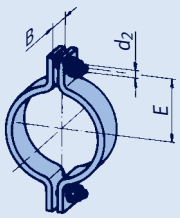
Pipe clamps, clamp bases, OD 762 (ND 750), type 42, 44, 46, 48, 49

type ①	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 76 19	13	10	7.7								M30	455	90	31	5-6

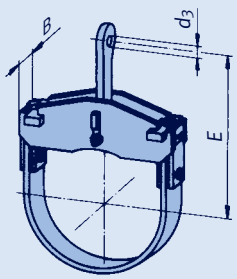
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 76 14	54	45	37								41	670	156	72	4-7
44 76 15	83	67	53								51	670	162	73	6-9
44 76 16	120	95	76								61	670	168	84	7-10
44 76 17	151	116	87								71	670	181	102	8-30
44 76 18	196	151	120								71	670	222	133	8-30
44 76 19	308	239	174								71	690	235	188	9-30
44 76 25			54	43	40						51	760	138	67	6-9
44 76 26			76	64	59						61	760	149	91	7-10
44 76 27			117	97	88						71	760	164	112	8-30
44 76 28			156	121	113						71	760	196	148	8-30
44 76 29	307	284	242	192	176						71	760	218	206	9-30
44 76 35					40	39	38	26			46	770	171	86	5-8
44 76 36					71	70	67	35			51	770	189	122	6-9
44 76 37					108	106	91	52			61	770	209	163	7-10
44 76 38					158	156	139	83			71	770	225	220	8-30
44 76 39	340	340	338	284	266	261	202	106			71	770	260	297	9-30
44 76 45								50	38	28	46	770	196	133	5-8
44 76 46								90	66	47	51	770	218	189	6-9
44 76 47								115	85	63	61	770	276	253	7-10
44 76 48							223	143	106	78	71	770	260	285	8-30
44 76 49			340	340	340	340	309	195	146	108	71	770	279	375	9-30

type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.②7611	74	57	43								41	1120	1750	45	186	231	215	145	218	5-7
4. 76 12	120	92	73								46	1120	1750	55	232	300	215	161	257	6-8
4. 76 13	183	137	108								51	1150	1750	65	297	364	245	187	314	7-9
4. 76 14	236	182	144								51	1150	1750	80	359	446	260	216	343	7-9
4. 76 15	308	237	188								61	1150	1750	90	451	509	255	256	394	8-10
4. 76 21			74	69	50						46	1400	2200	70	270	378	250	190	316	5-8
4. 76 22			117	111	80						51	1400	2200	70	369	500	250	242	403	6-9
4. 76 23		206	201	190	132						51	1420	2200	80	474	683	300	316	516	7-9
4. 76 24	301	289	285	262	184						61	1490	2200	90	602	775	300	396	621	8-10
4. 76 31					71	69	53	30			41	1500	2300	80	324	450	260	210	342	4-7
4. 76 32					94	90	70	40			46	1500	2300	80	393	531	270	254	402	5-8
4. 76 33					149	140	109	60			51	1500	2300	100	512	697	310	313	502	6-9
4. 76 34				237	225	202	155	83			51	1500	2300	100	597	811	330	386	616	6-9
4. 76 35	397	365	352	343	340	306	236	125			61	1500	2300	110	802	1084	360	495	796	7-10
4. 76 36	603	552	535	517	506	461	354	188			71	1580	2300	140	1146	1443	400	695	1023	8-30
4. 76 41								54	41	30	41	1500	2300	80	359	495	275	243	393	4-7
4. 76 42								72	54	40	46	1500	2300	80	427	605	285	286	469	5-8
4. 76 43								108	82	60	51	1500	2300	100	571	798	335	361	590	6-9
4. 76 44								145	109	80	51	1500	2300	100	667	937	340	437	706	6-9
4. 76 45							253	219	163	120	61	1500	2300	110	880	1231	365	538	881	7-10
4. 76 46						385	382	326	246	179	71	1600	2300	140	1187	1613	430	751	1152	8-30

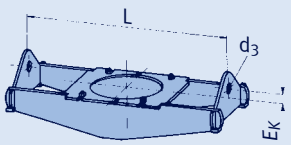
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 76 13	111	96	71								531	400	343	590	150	104
49 76 14	157	124	91								581	395	370	585	200	115
49 76 25	151	144	114	94	87						681	445	400	635	300	136
49 76 35	274	238	217	182	171	165	147	104			681	450	420	650	300	157
49 76 45	276	250	238	214	199	193	186	128	96	70	681	450	420	650	300	157



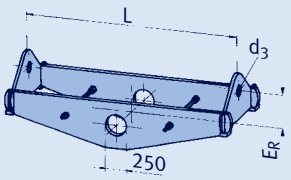
① Heat-resistant materials,
see pages 0.9 and 4.4

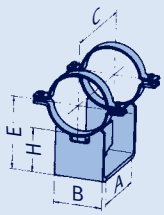


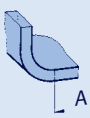
②type 46



②type 48





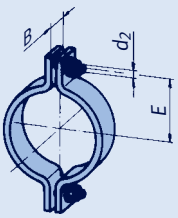


Selection table OD 812.8

Temp. of medium > 600°C
from page 4.52

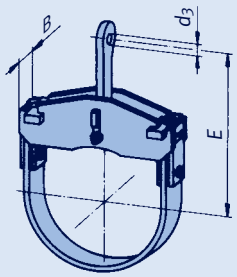
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 812.8 (ND 800), type 42, 44, 46, 48, 49



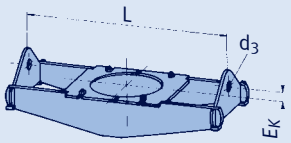
① Heat-resistant materials, see pages 0.9 and 4.4

type ①	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 81 19	13	10	7.4								M30	480	90	33	5-6

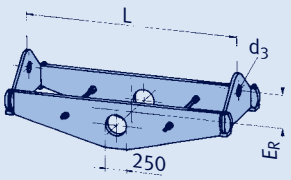


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 81 14	54	44	37								41	700	156	76	4-7
44 81 15	89	71	57								51	700	162	78	6-9
44 81 16	122	98	79								61	700	168	90	7-10
44 81 17	154	119	87								71	700	181	109	8-30
44 81 18	208	168	125								71	700	222	149	8-30
44 81 19	308	239	174								71	720	235	198	9-30
44 81 25			55	43	40						51	790	138	72	6-9
44 81 26			77	65	59						61	790	149	98	7-10
44 81 27			119	100	87						71	790	171	120	8-30
44 81 28			164	127	119						71	790	196	153	8-30
44 81 29	307	292	248	196	180						71	790	218	218	9-30
44 81 35					69	68	67	35			51	810	189	121	6-9
44 81 36					104	103	86	52			61	810	209	173	7-10
44 81 37					150	149	138	83			71	810	225	231	8-30
44 81 38					159	158	153	89			71	810	276	264	8-30
44 81 39	340	340	336	280	259	258	201	105			71	810	260	312	9-30
44 81 45								85	65	47	51	810	218	197	6-9
44 81 46								114	84	63	61	810	283	263	7-10
44 81 47							218	142	105	78	71	810	260	300	8-30
44 81 48			340	340	339	334	310	197	146	108	71	810	286	410	9-30

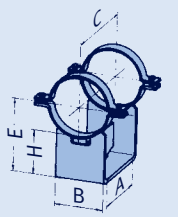
② type 46

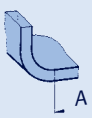


② type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.②8111	90	68	55								46	1200	1800	45	214	267	215	162	266	5-8
4. 81 12	135	102	81								51	1200	1800	60	268	331	240	177	279	6-9
4. 81 13	210	156	123								61	1200	1800	70	360	446	255	224	338	7-10
4. 81 14	271	208	165								61	1200	1800	90	447	559	245	257	392	8-10
4. 81 15	323	250	198								71	1200	1800	100	544	615	265	281	448	9-30
4. 81 21			74	70	50						46	1500	2300	80	296	419	250	209	338	5-8
4. 81 22			117	111	80						51	1500	2300	80	405	545	250	271	438	6-9
4. 81 23		226	219	207	145						61	1560	2300	90	586	762	320	386	597	7-10
4. 81 24	332	319	315	289	204						71	1560	2300	100	750	971	320	449	717	8-30
4. 81 31					81	80	62	34			46	1600	2400	90	396	520	280	261	398	5-8
4. 81 32					104	102	80	46			46	1600	2400	90	466	635	300	295	461	5-8
4. 81 33					149	140	109	60			51	1600	2400	100	563	755	330	343	537	6-9
4. 81 34				228	220	198	152	81			51	1600	2400	110	665	903	350	420	654	6-9
4. 81 35	400	363	351	341	338	306	236	125			61	1600	2400	120	881	1166	370	540	854	7-10
4. 81 36	662	606	587	568	556	502	386	207			71	1600	2400	150	1341	1771	415	773	1153	8-30
4. 81 41								60	45	34	46	1600	2400	90	433	598	295	282	447	5-8
4. 81 42								82	62	46	46	1600	2400	90	523	709	300	335	532	5-8
4. 81 43								108	81	60	51	1600	2400	100	631	869	340	394	628	6-9
4. 81 44								147	108	80	51	1600	2400	110	746	1021	350	477	761	6-9
4. 81 45							250	219	163	120	61	1600	2400	120	976	1335	370	591	947	7-10
4. 81 46						398	394	365	273	200	71	1600	2400	150	1350	1879	465	818	1322	8-30





type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 81 13	118	102	74								556	400	362	590	150	109
49 81 14	162	128	94								606	395	400	585	200	122
49 81 25	158	152	130	108	100						706	445	425	635	300	145
49 81 35	280	243	218	184	173	168	150	106			706	450	425	650	300	161
49 81 45	332	301	286	257	240	232	210	154	116	85	706	445	425	650	300	167

Selection table OD 863.6

Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

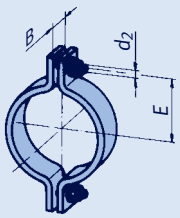
Pipe clamps, clamp bases, OD 863.6 (ND 850), type 42, 44, 46, 48, 49

	permissible load [kN]													wt.	load
type ①	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 86 19	13	10	7.2								M30	504	100	37	5-6

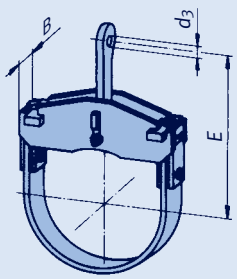
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	[kg]	group
44 86 14	51	42	36								41	735	171	81	4-7
44 86 15	88	70	59								51	735	162	86	6-9
44 86 16	151	119	87								61	735	203	117	7-10
44 86 17	208	173	125								71	735	222	161	8-30
44 86 18	300	221	176								71	735	248	215	8-30
44 86 19	308	238	172								71	760	229	215	9-30
44 86 25			78	65	60						51	815	149	101	7-9
44 86 26			119	100	87						71	815	171	124	8-30
44 86 27			168	137	125						71	815	198	169	8-30
44 86 28			188	149	136						71	815	218	223	8-30
44 86 29	307	296	254	201	184						71	815	218	233	9-30
44 86 35					102	101	87	52			61	845	210	191	7-10
44 86 36					151	150	138	82			71	845	225	248	8-30
44 86 37					187	185	175	91			71	845	276	300	8-30
44 86 38	340	340	333	280	263	260	200	104			71	845	270	319	9-30
44 86 46								109	84	60	61	845	276	294	7-10
44 86 47							216	142	105	78	71	845	276	334	8-30
44 86 48			340	340	340	335	308	197	146	108	71	845	286	441	9-30

	permissible load [kN]											L		type 46			type 48			load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	min	max	E_K	[kg min]	[kg max]	E_R	[kg min]	[kg max]	group
4.②8611	90	70	55								46	1230	1850	45	238	286	215	176	296	5-8
4. 86 12	135	101	80								51	1230	1850	60	284	352	240	198	310	6-9
4. 86 13	202	156	124								61	1250	1850	70	377	458	255	235	376	7-10
4. 86 14	273	208	165								61	1250	1850	90	508	572	245	260	437	8-10
4. 86 15	319	248	196								71	1250	1850	100	563	641	265	283	466	9-30
4. 86 21			73	70	50						46	1550	2350	80	336	451	250	225	366	5-8
4. 86 22			116	110	80						51	1550	2350	80	443	592	250	295	469	6-9
4. 86 23		226	218	181	146						61	1550	2350	90	595	807	320	376	596	7-10
4. 86 24	331	318	314	262	204						71	1550	2350	100	769	1013	320	469	745	8-30
4. 86 31					83	80	62	34			46	1650	2450	90	395	530	280	270	417	5-8
4. 86 32					101	100	80	46			46	1650	2450	90	476	643	300	317	490	5-8
4. 86 33					153	140	109	60			51	1650	2450	100	558	746	330	371	576	6-9
4. 86 34				224	218	197	152	80			51	1650	2450	110	678	914	350	450	695	6-9
4. 86 35	397	361	349	340	337	306	235	124			61	1650	2450	120	896	1218	370	580	903	7-10
4. 86 36	661	605	586	567	555	504	388	206			71	1650	2450	150	1354	1800	415	786	1214	8-30
4. 86 41								60	45	34	46	1650	2450	90	461	629	295	303	477	5-8
4. 86 42								81	61	46	46	1650	2450	90	556	749	300	351	556	5-8
4. 86 43								106	80	60	51	1650	2450	100	645	884	340	422	665	6-9
4. 86 44								143	108	80	51	1650	2450	110	769	1042	350	486	770	6-9
4. 86 45							212	211	162	120	61	1650	2450	120	977	1344	370	625	996	7-10
4. 86 46							373	359	272	200	71	1650	2450	150	1398	1923	465	872	1375	8-30

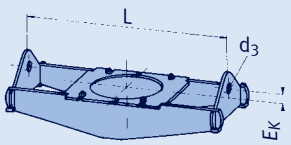
	permissible load [kN]															wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	[kg]
49 86 13	136	115	84								582	450	360	650	150	126
49 86 14	242	190	154								632	445	420	660	200	145
49 86 25	203	176	153	139	129						732	495	451	715	300	176
49 86 35	406	355	305	252	238	233	209	148			732	495	480	715	300	200
49 86 45	536	406	460	414	353	320	283	199	156	117	732	495	485	755	300	232



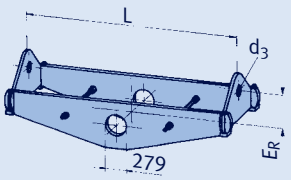
① Heat-resistant materials,
see pages 0.9 and 4.4

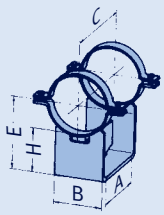


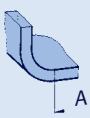
②type 46



②type 48





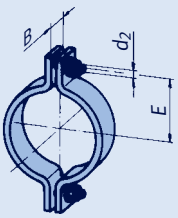


Selection table OD 914.4

Temp. of medium > 600°C from page 4.52

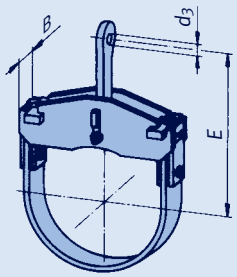
Load doubling via type 77, see page 4.67

Pipe clamps, clamp bases, OD 914.4 (ND 900), type 42, 44, 46, 48, 49



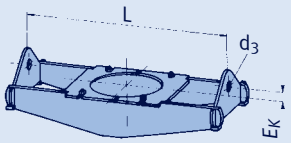
① Heat-resistant materials, see pages 0.9 and 4.4

type ①	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 91 19	13	10	7.6								M30	530	100	40	5-6

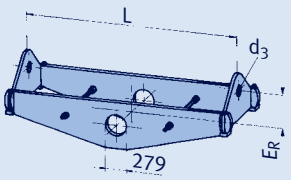


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 91 14	51	43	36								41	760	156	83	4-7
44 91 15	88	70	56								51	760	162	86	6-9
44 91 16	153	117	87								61	760	201	120	7-10
44 91 17	208	170	125								71	760	222	163	8-30
44 91 18	254	209	167								71	760	229	220	8-30
44 91 19	308	238	172								71	785	235	220	9-30
44 91 25			78	65	60						51	840	149	107	7-9
44 91 26			120	101	88						71	840	171	133	8-30
44 91 27			169	133	125						71	840	196	168	8-30
44 91 28			188	149	136						71	840	218	224	9-30
44 91 29	307	297	255	201	184						71	840	218	238	9-30
44 91 35					102	101	85	52			61	870	209	191	7-10
44 91 36					152	150	139	83			71	870	225	251	8-30
44 91 37					186	184	170	90			71	870	276	289	9-30
44 91 38	340	340	329	274	255	252	202	105			71	870	260	340	9-30
44 91 46								115	85	63	61	870	283	293	7-10
44 91 47							218	143	105	78	71	870	260	330	8-30
44 91 48			340	340	340	335	308	198	146	108	71	870	286	439	9-30

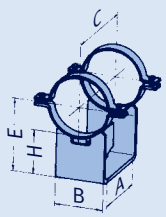
② type 46

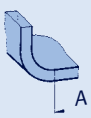


② type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.②9111	96	72	57								46	1300	1900	50	262	320	255	204	310	5-8
4. 91 12	135	102	81								51	1300	1900	60	309	379	240	214	329	6-9
4. 91 13	214	158	125								61	1300	1900	70	442	514	240	263	407	7-10
4. 91 14	280	210	167								61	1300	1900	90	556	618	265	305	471	8-10
4. 91 15	332	249	197								71	1300	1900	100	616	704	295	339	537	9-30
4. 91 21			84	81	60						46	1600	2400	80	383	514	250	272	407	5-8
4. 91 22			122	117	85						51	1600	2400	90	487	643	270	316	498	6-9
4. 91 23		215	208	197	140						61	1600	2400	100	666	861	300	414	639	7-10
4. 91 24	317	305	301	275	200						71	1600	2400	100	862	1105	325	482	756	8-30
4. 91 25	387	371	367	332	240						71	1600	2400	110	930	1278	345	562	876	9-30
4. 91 31					91	90	70	40			46	1700	2500	100	500	645	300	314	479	5-8
4. 91 32					140	139	109	60			46	1700	2500	110	636	828	330	390	594	5-8
4. 91 33					203	185	145	80			51	1700	2500	110	771	1021	350	469	718	6-9
4. 91 34	444	424	410	399	395	360	277	147			61	1700	2500	130	1152	1500	385	691	1035	7-10
4. 91 35	680	630	610	590	576	518	398	214			71	1760	2500	130	1532	1945	455	913	1291	8-30
4. 91 36	680	680	680	680	676	608	468	252			71	1780	2500	160	1750	2116	440	998	1447	9-30
4. 91 41								72	54	40	46	1700	2500	100	547	737	300	342	537	5-8
4. 91 42								109	81	60	46	1700	2500	110	692	942	345	443	694	5-8
4. 91 43								145	110	80	51	1700	2500	110	851	1154	370	544	849	6-9
4. 91 44							260	255	192	140	61	1700	2500	130	1216	1655	445	764	1136	7-10
4. 91 45							410	364	272	200	71	1800	2500	130	1581	2091	445	946	1451	8-30
4. 91 46						476	468	438	330	240	71	1800	2500	160	1776	2393	490	1109	1642	9-30





type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 91 13	137	116	85								607	450	362	650	150	129
49 91 14	249	193	157								657	450	420	660	200	149
49 91 25	203	176	153	140	130						757	500	451	715	300	180
49 91 35	397	346	309	255	240	236	209	148			757	500	483	715	300	203
49 91 45	542	486	466	419	356	323	285	201	156	118	757	495	483	755	300	236

Selection table OD 965.2

Temp. of medium > 600°C from page 4.52

Load doubling via type 77, see page 4.67

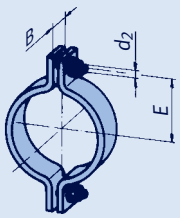
Pipe clamps, clamp bases, OD 965.2 (ND 950), type 42, 44, 46, 48, 49

	permissible load [kN]													wt.	load
type ①	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 97 19	13	10	7.4								M30	554	100	41	5-6

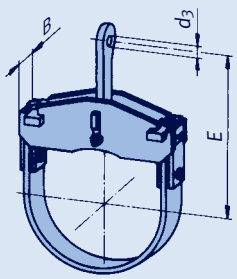
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	[kg]	group
44 97 14	51	43	36								41	785	171	89	4-7
44 97 15	89	71	60								51	785	162	94	6-9
44 97 16	149	119	87								61	785	203	130	7-10
44 97 17	208	173	126								71	800	222	179	8-30
44 97 18	299	233	175								71	800	248	241	9-30
44 97 19	366	295	215								81	820	276	309	10-40
44 97 25			85								51	865	182	118	7-9
44 97 26			123	103	97						71	865	189	144	8-30
44 97 27			171	137	126						71	865	210	193	8-30
44 97 28			246	193	178						71	865	218	246	9-30
44 97 29	380	346	299	247	227						81	880	255	317	10-40
44 97 35					101	99	85	52			61	900	210	200	7-10
44 97 36					148	146	140	83			71	900	225	265	8-30
44 97 37					188	185	170	91			71	900	270	304	8-30
44 97 38					201	199	192	105			71	900	276	352	9-30
44 97 39		340	311	259	241	238	232	155			71	900	286	464	9-30
44 97 46								107	83	61	61	900	276	307	7-10
44 97 47								143	106	78	71	900	276	349	8-30
44 97 48			340	340	340	335	305	198	147	108	71	900	286	463	9-30

	permissible load [kN]											L		type 46			type 48			load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	min	max	E_K	[kg min]	[kg max]	E_R	[kg min]	[kg max]	group
4.②9711	96	72	57								46	1350	2000	50	285	347	295	267	363	5-8
4. 97 12	134	101	80								51	1400	2000	60	338	419	300	300	389	6-9
4. 97 13	216	160	127								61	1400	2000	70	437	546	315	304	450	7-10
4. 97 14	278	209	166								61	1400	2000	90	542	643	330	349	536	8-10
4. 97 15	383	287	227								71	1400	2000	100	745	825	330	406	602	9-30
4. 97 16	492	370	293								81	1400	2000	100	863	995	370	455	690	10-40
4. 97 21			83	80	60						46	1650	2450	80	417	554	305	312	442	5-8
4. 97 22			118	114	85						51	1650	2450	90	523	696	345	351	546	6-9
4. 97 23			208	181	143						61	1650	2450	100	703	888	375	438	670	7-10
4. 97 24		304	295	250	200						71	1650	2450	100	858	1114	405	540	831	8-30
4. 97 25	435	427	419	345	280						71	1650	2450	110	1037	1399	450	670	1019	9-30
4. 97 26	575	556	542	441	360						81	1700	2450	110	1244	1647	460	813	1203	10-40
4. 97 31					90	89	70	40			46	1750	2550	100	511	659	330	336	509	5-8
4. 97 32					139	139	109	60			46	1750	2550	110	639	842	345	429	647	5-8
4. 97 33					201	185	145	80			51	1750	2550	110	764	1002	395	519	777	6-9
4. 97 34				383	380	359	276	147			61	1750	2550	130	1174	1539	430	761	1097	7-10
4. 97 35	680	626	606	586	574	520	400	213			71	1770	2550	130	1556	2000	465	1022	1377	8-30
4. 97 36	680	680	680	680	673	612	471	250			71	1770	2550	160	1805	2257	485	1060	1542	9-30
4. 97 37	760	760	742	715	689	684	570	310			81	1770	2550	160	1897	2506	520	1164	1733	10-40
4. 97 41								71	53	40	46	1750	2550	100	586	777	300	373	589	5-8
4. 97 42								106	80	60	46	1750	2550	110	746	990	345	471	727	5-8
4. 97 43								140	106	80	51	1750	2550	110	875	1166	370	552	858	6-9
4. 97 44								252	189	140	61	1750	2550	130	1249	1679	445	815	1249	7-10
4. 97 45							385	368	270	200	71	1750	2550	130	1599	2152	445	970	1500	8-30
4. 97 46							472	422	318	239	71	1750	2550	160	1807	2433	490	1121	1734	9-30
4. 97 47						586	581	557	419	310	71	1780	2550	160	2166	2914	490	1290	1966	9-30

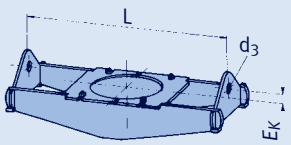
	permissible load [kN]																wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	[kg]
49 97 13	139	118	87								633	450	400	650	150	137
49 97 14	249	197	160								683	445	460	660	200	159
49 97 25	258	225	178	146	136						783	500	490	715	300	191
49 97 35	414	358	308	255	240	237	231	163			783	500	520	715	300	214
49 97 45	551	500	475	427	386	339	300	212	165	125	783	500	520	755	300	249



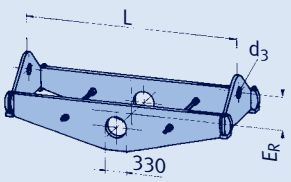
① Heat-resistant materials, see pages 0.9 and 4.4

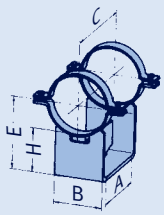


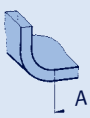
②type 46



②type 48





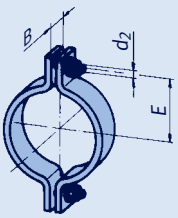


Selection table OD 1016

Temp. of medium > 600°C
from page 4.52

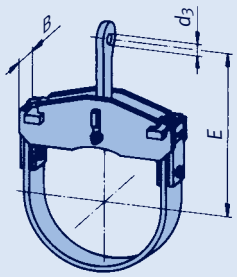
Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 1016 (ND 1000), type 42, 44, 46, 48, 49



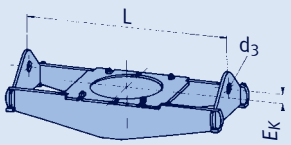
① Heat-resistant materials, see pages 0.9 and 4.4

type ①	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 T0 19	31	23	16								M30	592	150	85	5-6

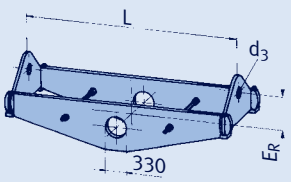


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 T0 14	92	73	60								51	810	162	97	6-9
44 T0 15	149	120	87								61	810	203	137	7-10
44 T0 16	208	173	125								71	850	222	184	8-30
44 T0 17	288	230	174								71	850	248	252	9-30
44 T0 18	373	295	212								81	860	276	323	10-40
44 T0 19	405	359	259								91	915	276	370	20-50
44 T0 24			87	69	63						51	890	182	123	7-9
44 T0 25			123	103	97						71	890	189	150	8-30
44 T0 26			171	137	125						71	890	210	198	8-30
44 T0 27			249	197	180						71	890	218	254	9-30
44 T0 28			299	242	222						81	910	276	326	10-40
44 T0 29	380	380	343	280	258						81	910	283	376	10-40
44 T0 35					99	98	84	52			61	930	210	205	7-10
44 T0 36					146	144	139	83			71	930	225	274	8-30
44 T0 37					188	185	170	91			71	930	270	311	8-30
44 T0 38					199	197	192	105			71	930	276	361	9-30
44 T0 39					242	239	232	155			71	930	286	478	9-30
44 T0 46								107	82	61	61	930	255	315	7-10
44 T0 47								143	106	78	71	930	276	359	8-30
44 T0 48			340	340	333	328	304	198	147	108	71	930	286	476	9-30

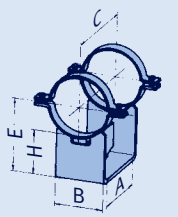
② type 46

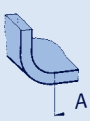


② type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.② T011	97	72	57								46	1570	2200	50	323	395	295	318	411	5-8
4. T0 12	134	101	80								51	1570	2200	60	380	467	300	330	466	6-9
4. T0 13	216	159	126								61	1600	2200	70	492	608	315	352	520	7-10
4. T0 14	321	235	187								61	1600	2200	90	655	817	330	414	600	8-10
4. T0 15	458	351	279								71	1600	2200	100	880	1048	330	506	766	9-30
4. T0 16	606	459	364								81	1600	2200	100	1195	1267	370	609	870	10-40
4. T0 21			86	81	60						46	1800	2600	80	462	619	305	338	531	5-8
4. T0 22			119	114	84						51	1800	2600	90	583	758	345	388	588	6-9
4. T0 23			208	181	141						61	1800	2600	100	782	1002	375	487	743	7-10
4. T0 24			303	253	200						71	1800	2600	100	1016	1232	405	604	903	8-30
4. T0 25		436	427	360	285						71	1800	2600	110	1176	1537	450	798	1123	9-30
4. T0 26	562	541	512	416	390						81	1820	2600	110	1338	1730	460	865	1222	10-40
4. T0 31					91	90	70	40			46	1900	2700	100	561	728	330	391	567	5-8
4. T0 32					141	140	109	60			46	1900	2700	110	710	916	345	474	699	5-8
4. T0 33					188	185	145	80			51	1900	2700	110	852	1107	395	577	850	6-9
4. T0 34					388	359	276	147			61	1900	2700	130	1338	1655	430	802	1192	7-10
4. T0 35	680	627	608	588	574	520	400	213			71	1900	2700	130	1688	2156	465	1097	1492	8-30
4. T0 36	680	680	680	680	676	611	470	250			71	1900	2700	160	1911	2444	485	1143	1679	9-30
4. T0 37	760	760	760	760	760	742	581	310			81	1980	2700	160	2140	2736	520	1370	1889	10-40
4. T0 41								71	53	40	46	1900	2700	100	663	854	300	425	633	5-8
4. T0 42								107	80	60	46	1900	2700	110	828	1082	345	522	794	5-8
4. T0 43								139	108	80	51	1900	2700	110	980	1275	370	617	931	6-9
4. T0 44								253	189	139	61	1900	2700	130	1382	1841	445	910	1352	7-10
4. T0 45							370	367	270	199	71	1900	2700	130	1771	2344	445	1083	1635	8-30
4. T0 46							433	424	320	240	71	1900	2700	160	2029	2649	490	1249	1831	9-30
4. T0 47						588	583	556	419	310	81	1900	2700	160	2407	3182	490	1443	2153	10-40





type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 T0 13	175	133	108								658	435	410	705	150	231
49 T0 14	299	221	179								708	445	470	715	200	251
49 T0 25	289	251	200	164	152						808	495	500	760	300	291
49 T0 35	414	358	308	255	240	237	231	163			808	495	540	760	300	311
49 T0 45	553	502	477	428	386	339	300	212	165	125	808	500	540	810	300	346

Selection table OD 1067

Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

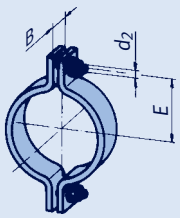
Pipe clamps, clamp bases, OD 1067 (ND 1050), type 42, 44, 46, 48, 49

	permissible load [kN]													wt.	load
type ①	100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	[kg]	group
42 T1 19	31	23	16								M30	618	150	89	5-6

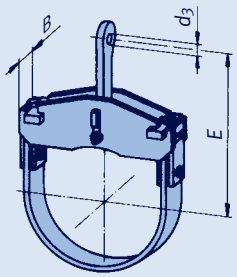
	permissible load [kN]													wt.	load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	[kg]	group
44 T1 14	92	73	61								51	835	162	104	6-9
44 T1 15	151	118	87								61	835	203	144	7-10
44 T1 16	208	172	125								71	875	222	195	8-30
44 T1 17	293	236	175								71	875	248	266	9-30
44 T1 18	373	297	214								81	885	276	338	10-40
44 T1 19	405	357	258								91	940	276	379	20-50
44 T1 24			87	69	63						51	915	182	129	7-9
44 T1 25			123	104	97						71	915	189	157	8-30
44 T1 26			172	137	125						71	915	210	208	8-30
44 T1 27			252	198	180						71	915	218	266	9-30
44 T1 28			300	241	223						81	935	276	342	10-40
44 T1 29	380	380	347	280	258						81	935	283	392	10-40
44 T1 35					99	98	84	52			61	955	210	215	7-10
44 T1 36					146	144	139	83			71	955	225	287	8-30
44 T1 37					188	185	170	91			71	955	270	326	8-30
44 T1 38					199	197	191	106			71	955	276	377	9-30
44 T1 39					242	239	233	157			71	955	286	501	9-30
44 T1 46								107	83	61	61	955	276	331	7-10
44 T1 47								143	106	79	71	955	276	376	8-30
44 T1 48			340	340	334	329	304	199	146	108	71	955	286	499	9-30

	permissible load [kN]											L		type 46			type 48			load
type	100	250	350	450	500	510	530	560	580	600°C	d_3	min	max	E_K	[kg min]	[kg max]	E_R	[kg min]	[kg max]	group
4.② T111	97	72	57								46	1500	2250	50	336	417	295	312	423	5-8
4. T1 12	134	102	81								51	1640	2250	60	407	498	300	345	493	6-9
4. T1 13	213	159	126								61	1650	2250	70	527	646	315	374	552	7-10
4. T1 14	317	234	186								61	1650	2250	90	702	865	330	436	663	8-10
4. T1 15	464	353	280								71	1650	2250	100	935	1139	330	565	800	9-30
4. T1 16	595	458	364								81	1650	2250	100	1124	1300	370	635	900	10-40
4. T1 21			84	81	60						46	1850	2650	80	504	642	305	365	560	5-8
4. T1 22			118	114	84						51	1850	2650	90	627	790	345	404	607	6-9
4. T1 23			208	182	140						61	1850	2650	100	832	1066	375	507	767	7-10
4. T1 24			295	256	200						71	1850	2650	100	1034	1290	405	631	930	8-30
4. T1 25		435	422	364	286						71	1850	2650	110	1251	1624	450	789	1164	9-30
4. T1 26	594	544	508	413	390						81	1870	2650	110	1424	1824	460	903	1265	10-40
4. T1 31					93	90	70	40			46	1950	2750	100	603	763	330	407	602	5-8
4. T1 32					141	140	109	60			46	1950	2750	110	757	969	345	493	721	5-8
4. T1 33					188	185	145	80			51	1950	2750	110	904	1164	395	599	876	6-9
4. T1 34					388	359	277	147			61	1950	2750	130	1417	1722	430	836	1235	7-10
4. T1 35	680	627	608	588	574	520	400	213			71	1950	2750	130	1865	2256	465	1121	1543	8-30
4. T1 36	680	680	680	680	676	614	473	250			71	1950	2750	160	2026	2557	485	1190	1735	9-30
4. T1 37	760	760	760	760	760	741	580	310			81	1950	2750	160	2265	2859	520	1387	1969	10-40
4. T1 41								71	54	40	46	1950	2750	100	708	896	300	441	670	5-8
4. T1 42								107	81	60	46	1950	2750	110	873	1138	345	546	838	5-8
4. T1 43								147	108	80	51	1950	2750	110	1052	1372	370	645	964	6-9
4. T1 44								253	189	140	61	1950	2750	130	1481	1926	445	943	1398	7-10
4. T1 45							358	356	270	200	71	1950	2750	130	1877	2462	445	1126	1688	8-30
4. T1 46							479	431	324	240	71	1950	2750	160	2139	2842	490	1299	1876	9-30
4. T1 47						582	580	570	419	310	81	1950	2750	160	2601	3357	490	1490	2216	10-40

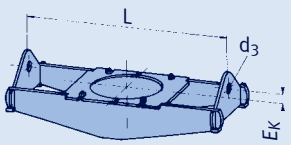
	permissible load [kN]																wt.
type	100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	[kg]
49 T1 13	172	134	109								684	435	440	705	150	243
49 T1 14	301	222	180								734	445	500	715	200	263
49 T1 25	290	251	200	166	154						834	495	530	760	300	304
49 T1 35	414	358	308	255	240	237	231	163			834	495	570	760	300	324
49 T1 45	550	498	473	425	387	342	302	214	165	125	834	500	570	810	300	361



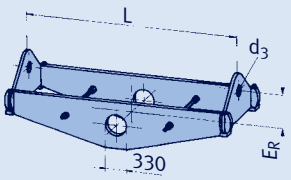
① Heat-resistant materials,
see pages 0.9 and 4.4

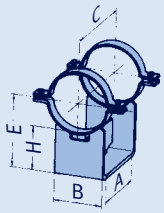


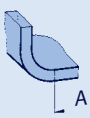
② type 46



② type 48





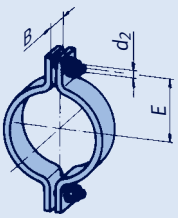


Selection table OD 1118

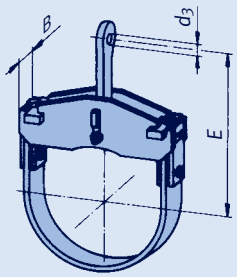
Temp. of medium > 600°C
from page 4.52

Load doubling via type 77,
see page 4.67

Pipe clamps, clamp bases, OD 1118 (ND 1100), type 42, 44, 46, 48, 49



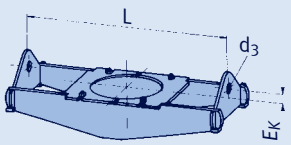
① Heat-resistant materials, see pages 0.9 and 4.4



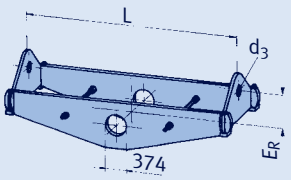
type ①	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 T2 19	31	23	16								M30	644	150	93	5-6

type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 T2 14	92	74	59								51	860	162	109	6-9
44 T2 15	151	113	87								61	860	203	151	7-10
44 T2 16	207	164	125								71	900	222	200	8-30
44 T2 17	294	232	174								71	900	248	277	9-30
44 T2 18	369	296	214								81	915	276	346	10-40
44 T2 19	405	358	259								91	965	276	397	20-50
44 T2 24			88	69	63						51	940	182	132	7-9
44 T2 25			123	104	98						71	940	189	161	8-30
44 T2 26			172	137	125						71	940	210	213	8-30
44 T2 27			249	195	181						71	940	218	272	9-30
44 T2 28			301	241	223						81	960	276	349	10-40
44 T2 29	380	380	348	280	259						81	960	283	401	10-40
44 T2 35					100	98	84	52			61	980	210	220	7-10
44 T2 36					146	144	139	83			71	980	225	294	8-30
44 T2 37					188	185	170	91			71	980	270	332	8-30
44 T2 38					200	197	193	106			71	980	276	384	9-30
44 T2 39					242	239	233	157			71	980	286	511	9-30
44 T2 46								107	83	61	61	980	276	338	7-10
44 T2 47								143	106	79	71	980	276	383	8-30
44 T2 48			340	340	334	329	305	199	147	109	71	980	286	509	9-30

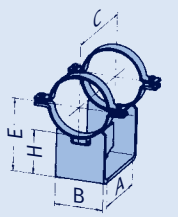
② type 46

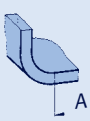


② type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.② T2 11	97	72	57								46	1560	2300	50	362	458	295	357	480	5-8
4. T2 12	136	101	80								51	1570	2300	60	427	540	300	373	573	6-9
4. T2 13	213	159	126								61	1670	2300	70	562	685	315	459	608	7-10
4. T2 14	320	235	187								61	1670	2300	90	718	918	330	514	721	8-10
4. T2 15	471	354	280								71	1690	2300	100	992	1206	330	612	868	9-30
4. T2 16	598	459	364								81	1690	2300	100	1230	1409	370	680	984	10-40
4. T2 21			90	81	60						46	1900	2700	80	532	677	305	415	637	5-8
4. T2 22			119	116	85						51	1900	2700	90	664	833	345	496	667	6-9
4. T2 23			208	178	142						61	1900	2700	100	869	1118	375	546	817	7-10
4. T2 24			300	252	200						71	1900	2700	100	1097	1355	405	679	992	8-30
4. T2 25		435	429	366	285						71	1900	2700	110	1385	1713	450	843	1238	9-30
4. T2 26	539	524	508	419	390						81	1970	2700	110	1545	1965	460	983	1335	10-40
4. T2 31					92	90	70	40			46	2000	2800	100	642	807	330	436	661	5-8
4. T2 32					141	140	109	60			46	2000	2800	110	806	1020	345	536	774	5-8
4. T2 33					186	185	144	80			51	2000	2800	110	958	1226	395	606	894	6-9
4. T2 34					389	360	277	146			61	2000	2800	130	1491	1809	430	893	1300	7-10
4. T2 35	680	629	610	590	576	518	399	213			71	2030	2800	130	1963	2377	465	1159	1634	8-30
4. T2 36	680	680	680	680	673	612	471	250			71	2030	2800	160	2134	2691	485	1280	1828	9-30
4. T2 37	760	760	760	760	760	741	580	310			81	2030	2800	160	2382	3000	520	1482	2111	10-40
4. T2 41								72	54	40	46	2000	2800	100	754	956	300	497	719	5-8
4. T2 42								107	80	60	46	2000	2800	110	926	1187	345	600	890	5-8
4. T2 43								146	108	80	51	2000	2800	110	1109	1440	370	687	1026	6-9
4. T2 44								257	189	140	61	2000	2800	130	1571	2040	445	966	1430	7-10
4. T2 45							406	367	271	200	71	2000	2800	130	1989	2574	445	1202	1784	8-30
4. T2 46							480	430	324	240	71	2000	2800	160	2292	2993	490	1329	1981	9-30
4. T2 47						589	584	569	419	310	81	2000	2800	160	2773	3519	490	1570	2318	10-40





type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 T2 13	174	135	110								709	435	450	700	150	251
49 T2 14	305	223	181								759	445	510	715	200	272
49 T2 25	292	254	204	167	155						859	495	550	760	300	315
49 T2 35	414	358	308	255	240	237	231	163			859	495	590	760	300	335
49 T2 45	551	500	475	427	389	343	304	214	166	126	859	500	590	810	300	373

Selection table OD 1168

Temp. of medium > 600°C from page 4.52

Load doubling via type 77, see page 4.67

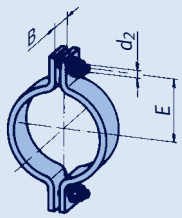
Pipe clamps, clamp bases, OD 1168 (ND 1150), type 42, 44, 46, 48, 49

type ①	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 T3 19	31	23	16								M30	670	150	97	5-6

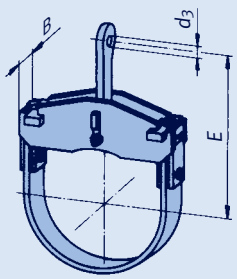
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 T3 14	95	75	63								51	885	162	113	6-9
44 T3 15	152	116	87								61	885	203	156	7-10
44 T3 16	208	168	125								71	925	222	211	8-30
44 T3 17	302	240	174								71	925	248	288	9-30
44 T3 18	360	290	210								81	985	276	368	10-40
44 T3 19	405	357	258								91	1000	276	414	20-50
44 T3 24			87	68	63						51	965	182	138	7-9
44 T3 25			124	104	98						71	965	189	169	8-30
44 T3 26			173	137	125						71	965	210	223	8-30
44 T3 27			251	199	182						71	965	225	307	9-30
44 T3 28			302	237	221						81	985	276	365	10-40
44 T3 29	380	380	346	274	256						81	985	283	419	10-40
44 T3 35					100	98	84	52			61	1005	210	231	7-10
44 T3 36					146	144	140	83			71	1005	225	308	8-30
44 T3 37					188	185	170	91			71	1005	270	348	8-30
44 T3 38					200	197	192	106			71	1005	276	403	9-30
44 T3 39					231	231	225	156			71	1020	286	539	9-30
44 T3 46								107	83	61	61	1005	276	354	7-10
44 T3 47								144	106	79	71	1005	276	402	8-30
44 T3 48			340	340	334	329	301	198	148	109	71	1005	298	532	9-30

type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.② T311	95	72	57								46	1630	2350	50	389	482	295	373	493	5-8
4. T3 12	135	101	80								51	1650	2350	60	459	577	300	391	588	6-9
4. T3 13	213	159	126								61	1720	2350	70	598	730	315	494	658	7-10
4. T3 14	318	234	186								61	1720	2350	90	761	969	330	531	756	8-10
4. T3 15	471	355	282								71	1750	2350	100	1050	1271	330	639	891	9-30
4. T3 16	592	460	365								81	1750	2350	100	1263	1443	370	714	1029	10-40
4. T3 21			87	80	60						46	1950	2750	80	565	707	305	428	651	5-8
4. T3 22			124	116	85						51	1950	2750	90	704	876	345	511	693	6-9
4. T3 23			209	179	143						61	1950	2750	100	907	1171	375	607	879	7-10
4. T3 24			301	252	201						71	1950	2750	100	1160	1422	405	704	1021	8-30
4. T3 25		434	422	366	285						71	1950	2750	110	1424	1795	450	878	1274	9-30
4. T3 26	580	531	514	421	390						81	2060	2750	110	1637	2060	460	983	1380	10-40
4. T3 31					93	90	70	40			46	2050	2850	100	678	849	330	453	675	5-8
4. T3 32					141	139	107	60			46	2050	2850	110	859	1070	345	555	797	5-8
4. T3 33					184	183	145	80			51	2050	2850	110	1013	1287	395	632	926	6-9
4. T3 34				398	394	357	275	147			61	2050	2850	130	1576	1904	430	928	1343	7-10
4. T3 35	665	617	602	589	576	522	402	213			71	2050	2850	130	2119	2497	465	1167	1688	8-30
4. T3 36	680	680	680	680	673	608	468	250			71	2100	2850	160	2264	2798	485	1339	1885	9-30
4. T3 37	760	760	760	760	759	742	580	310			81	2100	2850	160	2524	3209	520	1548	2180	10-40
4. T3 41								71	54	40	46	2050	2850	100	798	992	300	512	741	5-8
4. T3 42								106	80	60	46	2050	2850	110	995	1257	345	621	916	5-8
4. T3 43								147	108	80	51	2050	2850	110	1188	1508	370	716	1054	6-9
4. T3 44								258	189	140	61	2050	2850	130	1662	2131	445	1005	1476	7-10
4. T3 45							410	367	271	200	71	2050	2850	130	2104	2700	445	1249	1838	8-30
4. T3 46							480	424	319	240	71	2120	2850	160	2471	3158	490	1417	2044	9-30
4. T3 47						588	583	571	420	309	81	2120	2850	160	2941	3684	490	1672	2399	10-40

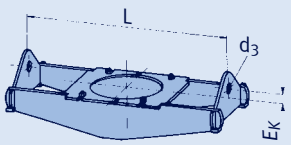
type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 T3 13	174	137	111								734	435	470	700	150	261
49 T3 14	308	225	183								784	445	540	715	200	284
49 T3 25	294	255	204	167	156						884	495	580	760	300	328
49 T3 35	409	358	308	255	240	237	231	163			884	495	620	760	300	348
49 T3 45	549	497	472	425	396	359	347	240	180	132	884	500	620	810	300	388



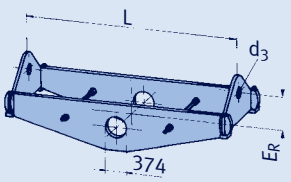
① Heat-resistant materials, see pages 0.9 and 4.4

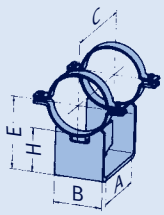


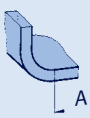
② type 46



② type 48





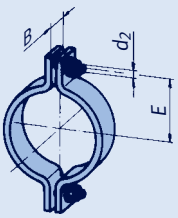


Selection table OD 1219

Temp. of medium > 600°C from page 4.52

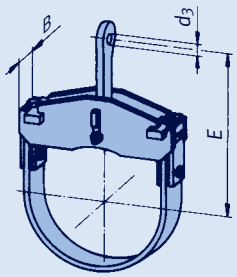
Load doubling via type 77, see page 4.67

Pipe clamps, clamp bases, OD 1219 (ND 1200), type 42, 44, 46, 48, 49



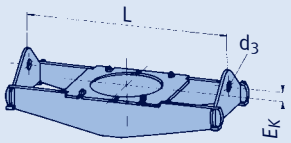
① Heat-resistant materials, see pages 0.9 and 4.4

type ①	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_2	E	B	wt. [kg]	load group
42 T4 19	31	23	16								M30	694	150	100	5-6

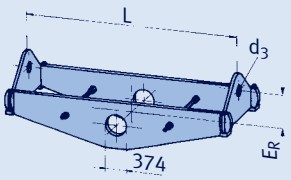


type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	E	B	wt. [kg]	load group
44 T4 14	95	76	60								51	910	162	119	6-9
44 T4 15	152	121	87								61	910	203	167	7-10
44 T4 16	208	166	125								71	950	222	217	8-30
44 T4 17	301	235	174								71	950	248	301	9-30
44 T4 18	361	290	210								81	1010	276	376	10-40
44 T4 19	405	359	260								91	1030	276	424	20-50
44 T4 24			90	70	64						51	990	182	143	7-9
44 T4 25			124	102	95						71	990	189	172	8-30
44 T4 26			170	134	125						71	990	210	228	8-30
44 T4 27			250	197	182						71	990	225	313	9-30
44 T4 28			301	239	221						81	1010	283	395	10-40
44 T4 29	380	380	347	277	256						81	1020	283	432	10-40
44 T4 35					100	98	85	52			61	1030	210	236	7-10
44 T4 36					151	149	140	83			71	1030	225	318	8-30
44 T4 37					188	185	170	92			71	1030	270	355	8-30
44 T4 38					200	197	192	106			71	1030	276	410	9-30
44 T4 39					234	231	227	157			71	1045	286	549	9-30
44 T4 46								107	83	61	61	1030	276	360	7-10
44 T4 47								144	106	79	71	1030	276	409	8-30
44 T4 48			340	340	334	330	303	200	148	110	71	1030	298	544	9-30

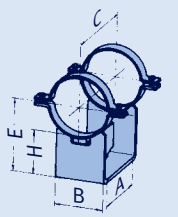
② type 46

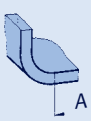


② type 48



type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	d_3	L min	L max	type 46 E_K	type 46 [kg min]	type 46 [kg max]	type 48 E_R	type 48 [kg min]	type 48 [kg max]	load group
4.② T411	97	72	57								46	1780	2400	50	419	512	295	402	506	5-8
4. T4 12	134	101	80								51	1780	2400	60	497	602	300	418	603	6-9
4. T4 13	213	159	126								61	1780	2400	70	638	777	315	512	690	7-10
4. T4 14	320	235	186								61	1800	2400	90	874	1024	330	567	793	8-10
4. T4 15	481	354	281								71	1800	2400	100	1112	1341	330	670	928	9-30
4. T4 16	592	459	364								81	1800	2400	100	1384	1565	370	766	1129	10-40
4. T4 21			90	80	60						46	2000	2800	80	600	752	305	441	666	5-8
4. T4 22			122	116	85						51	2000	2800	90	757	923	345	527	709	6-9
4. T4 23			208	179	141						61	2000	2800	100	976	1230	375	629	911	7-10
4. T4 24			297	252	200						71	2000	2800	100	1216	1504	405	734	1057	8-30
4. T4 25		435	427	367	285						71	2030	2800	110	1521	1892	450	923	1317	9-30
4. T4 26	580	540	505	410	390						81	2120	2800	110	1725	2156	460	1026	1425	10-40
4. T4 31					92	90	70	40			46	2100	2900	100	726	896	330	473	690	5-8
4. T4 32					141	140	109	60			46	2100	2900	110	911	1116	345	580	817	5-8
4. T4 33					189	185	144	80			51	2100	2900	110	1073	1348	395	654	952	6-9
4. T4 34				396	392	360	277	146			61	2100	2900	130	1651	1992	430	967	1415	7-10
4. T4 35	656	609	594	581	574	522	402	213			71	2170	2900	130	2199	2587	465	1241	1733	8-30
4. T4 36	680	680	680	680	675	613	472	250			71	2180	2900	160	2409	2915	485	1402	1942	9-30
4. T4 37	760	760	760	759	751	741	580	310			81	2180	2900	160	2701	3383	520	1571	2238	10-40
4. T4 41								71	54	40	46	2100	2900	100	846	1049	300	533	761	5-8
4. T4 42								105	80	60	46	2100	2900	110	1055	1328	345	647	948	5-8
4. T4 43								146	108	80	51	2100	2900	110	1245	1574	370	741	1088	6-9
4. T4 44								247	189	140	61	2100	2900	130	1761	2240	445	1039	1515	7-10
4. T4 45						405	361	270	200		71	2100	2900	130	2224	2836	445	1297	1889	8-30
4. T4 46						473	426	321	240		71	2230	2900	160	2630	3277	490	1500	2108	9-30
4. T4 47						568	565	420	310		81	2230	2900	160	3142	3861	490	1770	2531	10-40





type	permissible load [kN] 100	250	350	450	500	510	530	560	580	600°C	E	A	B	C	H	wt. [kg]
49 T4 13	175	137	112								760	435	490	700	150	271
49 T4 14	308	227	185								810	445	560	715	200	294
49 T4 25	294	256	206	169	157						910	495	610	760	300	341
49 T4 35	483	422	363	298	280	277	270	192			910	495	650	760	300	367
49 T4 45	546	494	470	422	393	360	348	240	180	132	910	500	650	810	300	402

Selection table OD 21.3 - 42.4
Temperatures 600-650°C

Pipe clamps, clamp bases, OD 21.3 (ND 15), type 45, 49

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	L	wt. [kg]	load group
45 01 51	3.5	3.1	2.7	2.3	2.0	1.7	12	25	70	300	3.9	C-4
45 01 51	2.6	2.2	1.9	1.7	1.5	1.2	12	25	70	400	5.0	C-4
45 01 51	2.0	1.8	1.5	1.3	1.1	1.0	12	25	70	500	6.1	C-4
45 01 51	1.7	1.5	1.3	1.1	0.9	0.8	12	25	70	600	7.2	C-4

type	permissible load [kN] 600	610	620	630	640	650°C	E	A	B	C	H	wt. [kg]
49 01 55	4.4	4.0	3.6	3.2	2.8	2.5	211	250	140	330	200	5.6

Pipe clamps, clamp bases, OD 26.9 (ND 20), type 45, 49

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	L	wt. [kg]	load group
45 02 51	3.6	3.2	2.7	2.4	2.1	1.8	12	25	70	300	3.9	C-4
45 02 51	2.6	2.3	2.0	1.7	1.5	1.3	12	25	70	400	5.0	C-4
45 02 51	2.0	1.8	1.6	1.3	1.2	1.0	12	25	70	500	6.1	C-4
45 02 51	1.7	1.5	1.3	1.1	1.0	0.8	12	25	70	600	7.2	C-4

type	permissible load [kN] 600	610	620	630	640	650°C	E	A	B	C	H	wt. [kg]
49 02 55	4.5	4.0	3.6	3.2	2.8	2.5	213	250	140	330	200	5.7

Pipe clamps, clamp bases, OD 33.7 (ND 25), type 43, 45, 49

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 03 59	4.4	3.9	3.4	3.0	2.7	2.3	12	235	50	1.4	C-2

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	L	wt. [kg]	load group
45 03 51	3.7	3.3	2.8	2.5	2.1	1.8	12	25	70	300	3.9	C-4
45 03 52	9.3	9.3	9.2	8.0	6.9	6.0	12	25	100	300	8.1	C-4
45 03 51	2.7	2.4	2.0	1.8	1.5	1.3	12	25	70	400	5.0	C-4
45 03 52	8.8	7.7	6.7	5.9	5.1	4.4	12	25	100	400	10.5	C-4
45 03 51	2.1	1.8	1.6	1.4	1.2	1.0	12	25	70	500	6.1	C-4
45 03 52	6.9	6.0	5.3	4.6	4.0	3.4	12	25	100	500	12.8	C-4
45 03 51	1.7	1.5	1.3	1.1	1.0	0.8	12	25	70	600	7.2	C-4
45 03 52	5.6	5.0	4.3	3.7	3.2	2.8	12	25	100	600	15.2	C-4

type	permissible load [kN] 600	610	620	630	640	650°C	E	A	B	C	H	wt. [kg]
49 03 55	4.7	4.2	3.8	3.3	2.9	2.6	217	250	140	330	200	6.0

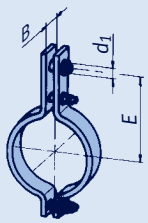
Pipe clamps, clamp bases, OD 42.4 (ND 32), type 43, 45, 49

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 04 59	4.4	3.9	3.4	3.0	2.7	2.3	12	240	50	1.4	C-2

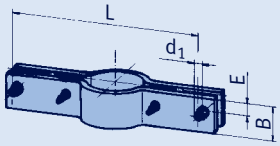
type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	L	wt. [kg]	load group
45 04 51	7.3	6.4	5.5	4.8	4.2	3.5	12	25	70	350	6.6	C-4
45 04 52	18	16	14	12	10	9.2	16	30	100	350	12.8	1-4
45 04 51	5.5	4.8	4.2	3.6	3.2	2.7	12	25	70	450	8.2	C-4
45 04 52	14	12	10	9.3	8.1	6.9	16	30	100	450	15.9	1-4
45 04 51	4.4	3.9	3.4	2.9	2.5	2.2	12	25	70	550	9.9	C-4
45 04 52	11	9.9	8.6	7.5	6.5	5.6	16	30	100	550	19.0	1-4
45 04 51	3.7	3.2	2.8	2.4	2.1	1.8	12	25	70	650	11.5	C-4
45 04 52	9.4	8.3	7.2	6.3	5.4	4.7	16	30	100	650	22.2	1-4

type	permissible load [kN] 600	610	620	630	640	650°C	E	A	B	C	H	wt. [kg]
49 04 55	5.2	4.7	4.1	3.7	3.2	2.9	221	250	140	330	200	6.1

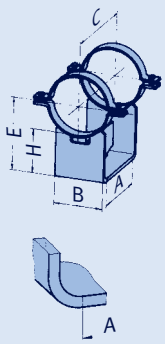
type 43



type 45

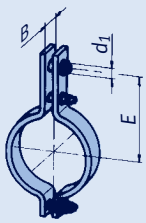


type 49

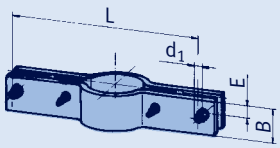


Selection table OD 48.3 - 73
Temperatures 600-650°C

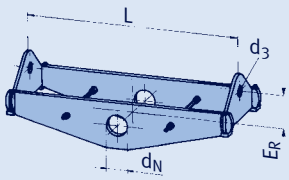
type 43



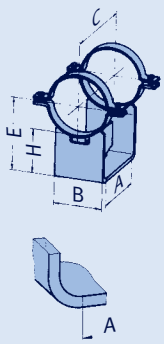
type 45



type 48



type 49



Pipe clamps, clamp bases, OD 48.3 (ND 40), type 43, 45, 49

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 05 59	4.4	3.9	3.4	3.0	2.7	2.3	12	240	50	1.4	C-2

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	L	wt. [kg]	load group
45 05 51	8.6	7.5	6.6	5.7	5.0	4.2	12	25	80	350	7.5	C-4
45 05 52	20	20	17	15	13	11	16	30	120	350	15.4	1-4
45 05 51	6.5	5.7	4.9	4.3	3.7	3.2	12	25	80	450	9.4	C-4
45 05 52	17	15	13	11	10	8.6	16	30	120	450	19.1	1-4
45 05 51	5.2	4.5	3.9	3.4	3.0	2.5	12	25	80	550	11.3	C-4
45 05 52	13	12	10	9.2	8.0	6.9	16	30	120	550	22.9	1-4
45 05 51	4.3	3.8	3.3	2.8	2.5	2.1	12	25	80	650	13.2	C-4
45 05 52	12	10	8.8	7.7	6.7	5.7	16	30	120	650	26.7	1-4

type	permissible load [kN] 600	610	620	630	640	650°C	E	A	B	C	H	wt. [kg]
49 05 55	5.2	4.7	4.2	3.7	3.2	2.9	224	250	140	330	200	6.2

Pipe clamps, clamp bases, OD 60.3 (ND 50), type 43, 45, 49

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 06 59	4.7	4.6	4.6	4.6	4.2	3.6	12	250	50	2.4	C-4

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	L	wt. [kg]	load group
45 06 51	9.3	8.6	7.5	6.5	5.6	4.8	12	25	100	400	10.7	C-4
45 06 52	20	18	15	13	12	10	16	30	120	400	17.4	1-4
45 06 51	7.5	6.6	5.7	5.0	4.3	3.7	12	25	100	500	13.0	C-4
45 06 52	16	14	12	10	9.0	7.9	16	30	120	500	21.2	1-4
45 06 51	6.0	5.3	4.6	4.0	3.5	3.0	12	25	100	600	15.4	C-4
45 06 52	13	11	9.9	8.6	7.5	6.4	16	30	120	600	24.9	1-4
45 06 51	5.1	4.5	3.9	3.4	2.9	2.5	12	25	100	700	17.7	C-4
45 06 52	10	9.6	8.3	7.3	6.3	5.4	16	30	120	700	28.7	1-4

type	permissible load [kN] 600	610	620	630	640	650°C	E	A	B	C	H	wt. [kg]
49 06 55	5.9	5.3	4.8	4.2	3.7	3.3	230	250	140	330	200	6.6

Pipe clamps, clamp bases, OD 73 (ND 65), type 43, 48, 49

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 07 59	4.7	4.6	4.6	4.6	4.2	3.6	12	255	50	2.5	C-4

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	[kg] min	[kg] max	load group
48 07 51	7.9	7.0	6.2	5.4	4.6	4.1	21	36	70	350	750	6.0	14	C-4
48 07 52	11	10	9.0	8.0	7.0	6.0	21	36	70	350	750	8.0	18	C-4
48 07 53	19	17	15	13	11	10	25	36	100	350	750	10	23	3-5

type	permissible load [kN] 600	610	620	630	640	650°C	E	A	B	C	H	wt. [kg]
49 07 55	5.9	5.3	4.8	4.2	3.7	3.3	237	250	140	330	200	6.8

Selection table OD 76.1 - 133
Temperatures 600-650°C

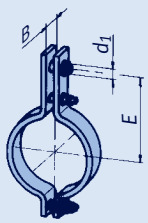
Pipe clamps, clamp bases, OD 76.1 (ND 65), type 43, 48, 49

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 08 59	4.7	4.6	4.6	4.6	4.2	3.6	12	255	50	2.5	C-4

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 08 51	7.9	7.0	6.2	5.4	4.6	4.1	21	36	70	350	750	6.0	14	C-4
48 08 52	11	10	9.0	8.0	7.0	6.0	21	36	70	350	750	8.0	18	C-4
48 08 53	19	17	15	13	11	10	25	36	100	350	750	10	23	3-5

type	permissible load [kN] 600	610	620	630	640	650°C	E	A	B	C	H	wt. [kg]
49 08 55	6.1	5.5	4.9	4.4	3.8	3.4	238	250	140	330	200	6.9

type 43



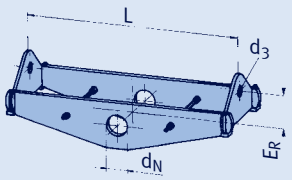
Pipe clamps, clamp bases, OD 88.9 (ND 80), type 43, 48, 49

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 09 59	4.7	4.6	4.6	4.6	4.2	3.6	12	260	50	2.7	C-4

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 09 51	8.1	7.2	6.4	5.5	4.8	4.2	21	36	75	350	850	7.0	17	C-4
48 09 52	11	10	9.0	7.9	6.8	6.0	21	36	85	350	850	7.0	21	C-4
48 09 53	19	17	15	13	11	10	25	36	100	350	850	10	28	3-5

type	permissible load [kN] 600	610	620	630	640	650°C	E	A	B	C	H	wt. [kg]
49 09 55	8.9	8.0	7.2	6.3	5.6	4.9	294	305	170	385	250	10.0

type 48



Pipe clamps, OD 108 (ND 100), type 43, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 10 59	9.7	9.2	8.2	7.1	6.1	5.1	16	270	70	5.1	1-4

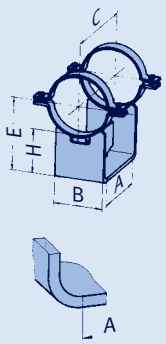
type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 10 51	11	10	9.1	8.0	7.0	6.1	21	51	85	350	950	9.0	25	C-4
48 10 52	15	13	12	10	9.2	8.0	25	51	95	350	950	10	30	3-5
48 10 53	30	27	24	21	18	16	34	51	140	350	950	17	48	3-6

Pipe clamps, OD 114.3 (ND 100), type 43, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 11 59	9.7	9.2	8.2	7.1	6.1	5.1	16	275	70	5.2	1-4

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 11 51	11	10	9.1	8.0	7.0	6.1	21	51	85	350	950	9.0	25	C-4
48 11 52	15	13	12	10	9.2	8.0	25	51	95	350	950	10	30	3-5
48 11 53	30	27	24	21	18	16	34	51	140	350	950	17	48	3-6

type 49



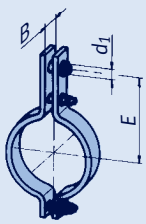
Pipe clamps, OD 133 (ND 125), type 43, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 13 59	9.7	9.6	9.5	8.9	7.9	6.8	16	290	80	8.1	1-4

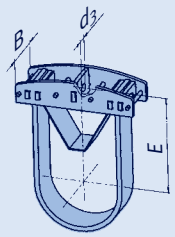
type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 13 51	13	12	10	9.2	8.0	7.0	21	51	95	400	1000	11	30	C-4
48 13 52	19	17	15	13	11	9.9	25	51	110	400	1000	13	37	3-5
48 13 53	33	29	26	23	19	17	34	51	150	400	1000	21	55	4-6

Selection table OD 139.7 - 219.1
Temperatures 600-650°C

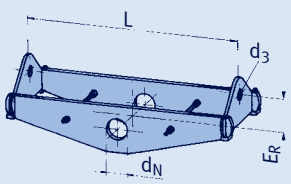
type 43



type 44



type 48



Pipe clamps, OD 139.7 (ND 125), type 43, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 14 59	9.7	9.6	9.5	8.9	7.9	6.8	16	295	80	8.2	1-4

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 14 51	13	12	10	9.2	8.0	7.0	21	51	95	400	1000	11	30	C-4
48 14 52	19	17	15	13	11	9.9	25	51	110	400	1000	14	37	3-5
48 14 53	33	29	26	23	19	17	34	51	150	400	1000	21	55	4-6

Pipe clamps, OD 159 (ND 150), type 43, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 16 59	9.7	9.6	9.5	8.9	7.9	6.8	16	315	80	8.8	1-4

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 16 51	13	12	10	9.2	8.0	7.0	21	63	100	450	1050	12	31	C-4
48 16 52	21	19	17	15	13	11	25	63	125	450	1050	15	40	3-5
48 16 53	40	36	32	28	24	21	34	63	150	450	1050	26	69	4-6

Pipe clamps, OD 168.3 (ND 150), type 43, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 17 59	9.7	9.6	9.5	8.9	7.9	6.8	16	320	80	9.1	1-4

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 17 51	13	12	10	9.2	8.0	7.0	21	63	100	450	1050	12	31	C-4
48 17 52	21	19	17	15	13	11	25	63	125	450	1050	15	40	3-5
48 17 53	40	36	32	28	24	21	34	63	150	450	1050	26	70	4-6

Pipe clamps, OD 193.7 (ND 175), type 43, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_1	E	B	wt. [kg]	load group
43 19 59	15.1	14.9	14.9	14.8	13.4	11.6	20	355	100	16	3-6

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 19 51	11	10	9.0	8.0	6.9	6.0	21	63	110	550	1150	16	34	C-4
48 19 52	17	17	15	13	11	10	25	63	125	550	1150	20	45	3-5
48 19 53	28	25	22	19	16	14	25	63	150	550	1150	25	59	3-5
48 19 54	50	44	39	34	29	26	41	63	160	550	1150	51	102	4-7

Pipe clamps, OD 219.1 (ND 200), type 44, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	E	max B	max insul.	wt. [kg]	load group
44 22 51	11	10	8.9	7.7	6.7	5.6	21	430	115	280	18	C-4
44 22 52	27	23	20	18	15	13	34	460	105	280	33	4-6
44 22 53	40	35	30	26	23	19	46	485	165	280	50	5-8

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 22 51	11	10	9.2	8.1	7.1	6.1	21	79	130	550	1350	16	43	C-4
48 22 52	26	23	20	17	15	13	25	79	150	550	1350	23	67	3-5
48 22 53	34	31	27	24	20	18	41	79	170	550	1350	30	79	4-7
48 22 54	61	54	48	42	36	31	46	79	200	550	1350	54	133	5-8

Selection table OD 244.5 - 323.9
Temperatures 600-650°C

Pipe clamps, OD 244.5 (ND 225), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 24 51	11	10	9.1	8.0	6.8	5.8	21	440	120	280	20	C-4
44 24 52	26	23	19	17	15	12	34	475	105	280	34	4-6
44 24 53	40	35	30	27	23	19	46	500	172	280	53	5-8

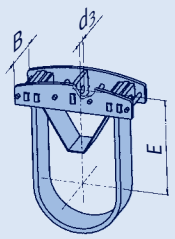
	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 24 51	14	12	11	9.7	8.4	7.3	25	79	110	550	1350	17	47	3-5
48 24 52	27	25	22	19	17	14	25	79	150	550	1350	27	71	3-5
48 24 53	40	36	32	28	24	21	41	79	160	550	1350	38	97	4-7
48 24 54	68	60	53	46	40	35	46	79	180	550	1350	62	153	5-8

Pipe clamps, OD 267 (ND 250), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 26 51	11	10	9.1	8.1	6.8	5.8	21	455	125	280	21	C-4
44 26 52	27	23	20	17	15	13	34	485	112	280	36	4-6
44 26 53	42	37	32	28	24	20	46	505	182	280	57	5-8

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 26 51	15	14	12	11	9.5	8.3	25	92	120	600	1400	21	52	3-5
48 26 52	29	26	23	20	17	15	25	92	150	600	1400	29	75	3-5
48 26 53	41	37	33	29	25	22	41	92	160	600	1400	41	100	4-7
48 26 54	74	65	58	50	43	38	46	92	195	600	1400	68	158	5-8

type 44

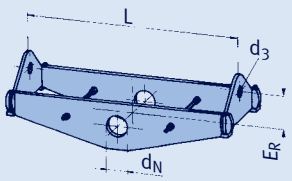


Pipe clamps, OD 273 (ND 250), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 27 51	10	10	9.1	8.1	6.8	5.8	21	455	125	280	21	C-4
44 27 52	27	23	20	17	15	13	34	485	112	280	37	4-6
44 27 53	40	37	32	28	24	20	46	505	182	280	57	5-8

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 27 51	15	14	12	11	9.5	8.3	25	92	120	600	1400	21	53	3-5
48 27 52	29	26	23	20	17	15	25	92	150	600	1400	29	75	3-5
48 27 53	41	37	33	29	25	22	41	92	160	600	1400	41	100	4-7
48 27 54	74	65	58	50	43	38	46	92	195	600	1400	69	159	5-8

type 48



Pipe clamps, OD 323.9 (ND 300), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 32 51	18	18	18	15	13	11	25	500	100	290	35	3-5
44 32 52	30	30	29	27	23	20	34	510	175	290	55	4-6
44 32 53	60	59	53	47	40	34	46	530	147	290	80	5-8
44 32 54	82	80	70	62	53	43	51	545	195	290	105	6-9

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 32 51	23	21	18	16	14	12	25	118	150	700	1400	32	70	3-5
48 32 52	40	39	34	30	26	23	41	118	180	700	1400	48	103	4-7
48 32 53	60	53	47	41	35	31	46	118	180	700	1400	61	129	5-8
48 32 54	71	68	60	52	45	40	46	118	210	700	1400	75	156	5-8
48 32 55	92	90	80	70	61	53	51	118	250	800	1400	94	183	6-9
48 32 56	150	136	120	106	92	80	51	118	250	800	1400	120	238	6-9

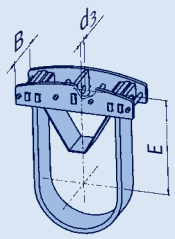
Selection table OD 355.6 - 406.4
Temperatures 600-650°C

Pipe clamps, OD 355.6 (ND 350), type 44, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	E	max B	max insul.	wt. [kg]	load group
44 36 51	21	20	18	16	13	11	25	520	105	290	39	3-5
44 36 52	30	30	29	27	23	20	34	525	182	290	59	4-6
44 36 53	56	54	52	46	39	33	46	545	147	290	84	5-8
44 36 54	92	80	69	61	52	43	51	555	195	290	113	6-9

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 36 51	20	18	16	13	12	10	25	118	140	700	1500	32	72	3-5
48 36 52	28	25	22	19	16	14	34	118	160	700	1500	37	87	4-6
48 36 53	48	42	37	32	28	24	41	118	180	800	1500	65	126	4-7
48 36 54	73	71	63	55	48	42	46	118	220	800	1500	89	178	5-8
48 36 55	120	105	93	81	70	62	51	118	240	800	1500	108	220	6-9
48 36 56	177	158	140	122	106	93	51	118	240	800	1500	138	286	6-9

type 44

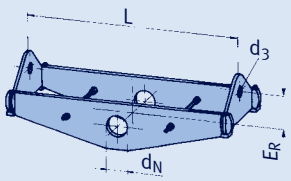


Pipe clamps, OD 368 (ND 350), type 44, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	E	max B	max insul.	wt. [kg]	load group
44 37 51	20	19	18	16	14	12	25	530	112	290	41	3-5
44 37 52	30	30	29	28	24	20	34	535	190	290	63	4-6
44 37 53	54	53	52	47	40	33	46	550	150	290	87	5-8
44 37 54	91	79	69	60	51	43	51	560	195	290	115	6-9

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 37 51	20	18	16	13	12	10	25	118	140	750	1500	33	72	3-5
48 37 52	28	25	22	19	16	14	34	118	160	750	1500	39	87	4-6
48 37 53	48	42	37	32	28	24	41	118	180	750	1500	63	127	4-7
48 37 54	73	71	63	55	48	42	46	118	220	750	1500	86	179	5-8
48 37 55	120	105	93	81	70	62	51	118	240	850	1500	113	221	6-9
48 37 56	177	158	140	122	106	93	51	118	240	850	1500	145	287	6-9

type 48



Pipe clamps, OD 406.4 (ND 400), type 44, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	E	max B	max insul.	wt. [kg]	load group
44 41 51	19	18	17	15	13	11	25	560	112	300	44	3-5
44 41 52	45	44	42	37	32	26	46	580	140	300	84	5-8
44 41 53	78	77	68	60	51	43	51	580	200	300	121	6-9
44 41 54	108	106	94	81	68	57	51	590	190	300	138	6-9

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 41 51	23	21	18	16	14	12	25	144	160	800	1600	43	96	3-5
48 41 52	41	36	32	28	24	21	41	144	180	800	1600	62	128	4-7
48 41 53	54	49	43	38	33	29	46	144	200	800	1600	72	149	5-8
48 41 54	82	72	64	56	48	42	46	144	240	800	1600	94	195	5-8
48 41 55	137	125	110	96	83	73	51	144	230	900	1600	128	254	6-9
48 41 56	196	186	165	144	125	109	61	144	230	900	1600	177	348	7-10

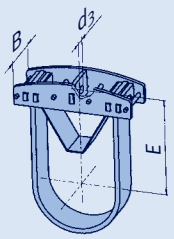
Selection table OD 419 - 508
Temperatures 600-650°C

Pipe clamps, OD 419 (ND 400), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 42 51	18	18	18	16	14	12	25	565	115	300	45	3-5
44 42 52	46	45	44	38	33	28	46	585	140	300	87	5-8
44 42 53	77	76	71	62	53	45	51	585	210	300	127	6-9
44 42 54	105	104	94	82	69	57	51	595	195	300	140	6-9

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 42 51	23	21	18	16	14	12	25	144	160	800	1600	43	97	3-5
48 42 52	41	36	32	28	24	21	41	144	180	800	1600	62	128	4-7
48 42 53	54	49	43	38	33	29	46	144	200	800	1600	73	150	5-8
48 42 54	82	72	64	56	48	42	46	144	240	900	1600	103	196	5-8
48 42 55	137	125	110	96	83	73	51	144	230	900	1600	129	255	6-9
48 42 56	196	186	165	144	125	109	61	144	230	900	1600	178	349	7-10

type 44

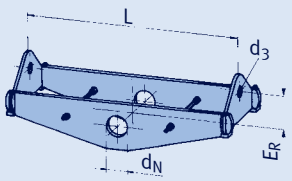


Pipe clamps, OD 457.2 (ND 450), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 46 51	19	19	18	16	14	12	25	590	122	300	50	3-5
44 46 52	38	37	33	29	24	20	46	600	140	300	80	5-8
44 46 53	71	70	64	56	48	40	51	605	195	300	128	6-9
44 46 54	108	106	101	89	76	64	51	620	315	300	176	6-9
44 46 55	144	143	137	120	103	89	61	640	255	300	218	7-10

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 46 51	39	36	32	28	24	21	41	144	170	900	1700	73	142	4-7
48 46 52	46	41	36	32	27	24	46	144	190	900	1700	78	152	5-8
48 46 53	73	70	62	54	47	41	46	144	230	900	1700	110	211	5-8
48 46 54	153	144	128	111	96	84	51	144	255	1000	1700	185	340	6-9
48 46 55	168	161	143	126	109	95	61	144	275	1000	1700	199	363	7-10
48 46 56	260	242	214	187	162	142	61	144	275	1000	1700	241	496	7-10

type 48



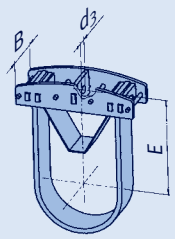
Pipe clamps, OD 508 (ND 500), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 51 51	19	18	17	15	13	11	25	615	122	300	54	3-5
44 51 52	39	38	36	32	27	23	46	630	140	300	92	5-8
44 51 53	76	75	72	63	54	45	51	635	230	300	152	6-9
44 51 54	122	113	99	86	72	60	61	650	220	300	209	7-10
44 51 55	161	160	146	128	110	94	61	665	280	300	264	7-10

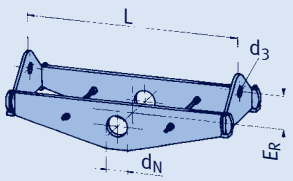
	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 51 51	41	36	32	28	24	21	41	173	185	1000	1800	87	164	4-7
48 51 52	46	41	36	32	28	24	46	173	200	1000	1800	94	174	5-8
48 51 53	78	71	63	55	48	42	46	173	235	1000	1800	129	240	5-8
48 51 54	144	144	128	111	96	84	51	173	275	1050	1800	186	352	6-9
48 51 55	202	179	158	138	119	105	61	173	310	1050	1800	236	407	7-10
48 51 56	284	266	236	206	178	156	61	173	310	1050	1800	303	547	7-10

Selection table OD 558.8 - 660.4
Temperatures 600-650°C

type 44



type 48



Pipe clamps, OD 558.8 (ND 550), type 44, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	E	max B	max insul.	wt. [kg]	load group
44 56 51	37	36	36	32	27	23	46	655	140	300	100	5-8
44 56 52	77	76	72	63	54	46	51	665	242	300	167	6-9
44 56 53	117	114	100	86	73	60	61	675	230	300	225	7-10
44 56 54	145	143	134	116	97	80	61	690	312	300	273	7-10
44 56 55	229	226	199	173	145	120	71	705	277	300	369	8-30

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 56 51	44	39	34	30	26	23	41	173	200	1100	1900	103	184	4-7
48 56 52	61	54	48	42	37	32	46	173	235	1100	1900	128	226	5-8
48 56 53	79	71	63	55	48	42	46	173	240	1100	1900	148	264	5-8
48 56 54	149	141	125	109	94	83	51	173	280	1100	1900	216	391	6-9
48 56 55	236	217	192	168	146	128	61	173	355	1200	1900	327	546	7-10
48 56 56	324	322	288	251	217	190	61	173	355	1200	1900	401	672	7-10

Pipe clamps, OD 609.6 (ND 600), type 44, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	E	max B	max insul.	wt. [kg]	load group
44 61 51	39	38	37	33	28	24	46	695	140	310	113	5-8
44 61 52	80	79	73	64	55	46	51	705	255	310	186	6-9
44 61 53	116	113	99	86	72	60	61	715	239	310	246	7-10
44 61 54	164	162	159	137	115	96	71	740	230	310	332	8-30
44 61 55	249	245	221	194	163	135	71	750	328	310	445	8-30

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 61 51	43	39	34	30	26	23	41	199	220	1200	2000	123	209	4-7
48 61 52	83	73	65	57	49	43	46	199	225	1200	2000	171	294	5-8
48 61 53	101	93	83	72	62	55	46	199	280	1200	2000	194	338	5-8
48 61 54	147	141	125	110	95	83	51	199	295	1300	2000	249	418	6-9
48 61 55	223	215	190	166	143	126	61	199	355	1300	2000	331	573	7-10
48 61 56	280	266	236	207	179	157	71	199	350	1300	2000	429	689	8-30
48 61 57	424	399	353	308	267	234	71	199	350	1300	2000	517	851	8-30

Pipe clamps, OD 660.4 (ND 650), type 44, 48

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	E	max B	max insul.	wt. [kg]	load group
44 66 51	36	36	35	32	27	23	46	720	140	310	119	5-8
44 66 52	76	75	72	63	54	45	51	730	260	310	200	6-9
44 66 53	120	113	99	86	72	60	61	745	250	310	265	7-10
44 66 54	164	162	157	136	114	95	71	770	235	310	355	8-30
44 66 55	247	244	222	194	163	135	71	775	338	310	477	8-30

type	permissible load [kN] 600	610	620	630	640	650°C	d_3	d_N	E_R	L min	L max	wt. [kg] min	wt. [kg] max	load group
48 66 51	51	45	40	35	30	26	41	224	230	1250	2050	155	262	4-7
48 66 52	82	72	64	56	48	42	46	224	230	1250	2050	190	320	5-8
48 66 53	113	99	88	77	66	58	46	224	280	1250	2050	223	377	5-8
48 66 54	158	144	127	111	96	84	51	224	310	1250	2050	263	458	6-9
48 66 55	226	219	194	170	147	129	61	224	330	1350	2050	361	615	7-10
48 66 56	300	270	239	209	181	159	71	224	350	1350	2050	448	709	8-30
48 66 57	440	401	355	310	268	235	71	224	350	1350	2050	534	874	8-30

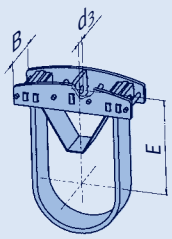
Selection table OD 711.2 - 812.8
Temperatures 600-650°C

Pipe clamps, OD 711.2 (ND 700), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 71 51	50	50	45	39	34	28	46	740	165	310	146	5-8
44 71 52	75	74	72	63	54	45	51	760	270	310	217	6-9
44 71 53	116	112	99	85	72	60	61	770	255	310	286	7-10
44 71 54	148	147	142	123	103	86	61	785	217	310	326	7-10
44 71 55	206	203	187	161	136	113	71	795	287	310	449	8-30
44 71 56	265	262	248	218	186	155	71	810	265	310	542	9-30

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 71 51	56	49	43	38	33	29	41	224	230	1300	2100	168	280	4-7
48 71 52	77	72	64	56	48	42	46	224	230	1300	2100	201	333	5-8
48 71 53	127	112	99	87	75	66	51	224	280	1300	2100	247	416	6-9
48 71 54	154	141	125	109	95	83	51	224	310	1400	2100	292	471	6-9
48 71 55	228	218	194	170	147	129	61	224	335	1400	2100	383	640	7-10
48 71 56	316	282	250	218	189	166	71	224	355	1450	2100	495	759	8-30
48 71 57	469	427	379	330	286	251	71	224	355	1450	2100	600	1016	9-30

type 44

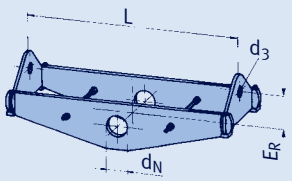


Pipe clamps, OD 762 (ND 750), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 76 51	50	49	46	40	35	29	46	770	175	310	160	5-8
44 76 52	78	77	72	63	54	45	51	790	280	310	235	6-9
44 76 53	116	113	99	86	72	60	61	800	265	310	305	7-10
44 76 54	164	162	160	138	116	97	71	815	252	310	421	8-30
44 76 55	225	222	210	181	153	127	71	820	330	310	537	9-30
44 76 56	322	320	292	256	220	180	81	835	322	310	700	10-40

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 76 51	61	54	48	42	36	32	41	250	260	1500	2300	214	345	4-7
48 76 52	82	72	64	56	48	42	46	250	260	1500	2300	252	393	5-8
48 76 53	121	107	94	83	72	63	51	250	310	1500	2300	300	480	6-9
48 76 54	144	143	127	110	96	84	51	250	340	1500	2300	344	558	6-9
48 76 55	230	216	192	168	145	127	61	250	330	1500	2300	425	713	7-10
48 76 56	364	322	286	250	217	190	71	250	410	1600	2300	632	960	8-30
48 76 57	507	485	430	375	325	285	71	250	410	1600	2300	798	1214	9-30

type 48



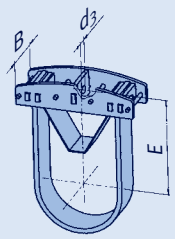
Pipe clamps, OD 812.8 (ND 800), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 81 51	76	75	73	64	55	46	51	825	295	320	257	6-9
44 81 52	119	113	99	86	72	60	61	840	277	320	335	7-10
44 81 53	164	162	150	130	109	91	71	850	245	320	436	8-30
44 81 54	166	164	163	151	127	106	71	855	287	320	493	8-30
44 81 55	225	222	208	180	151	126	71	855	340	320	572	9-30
44 81 56	325	323	294	258	221	180	81	875	338	320	754	10-40

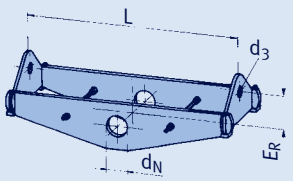
	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 81 51	69	61	54	47	41	36	46	250	280	1600	2400	257	395	5-8
48 81 52	85	82	73	63	55	48	46	250	300	1600	2400	292	451	5-8
48 81 53	118	107	95	83	72	63	51	250	330	1600	2400	329	519	6-9
48 81 54	151	144	128	111	96	85	51	250	350	1600	2400	379	598	6-9
48 81 55	232	219	194	170	147	129	61	250	350	1600	2400	474	773	7-10
48 81 56	381	366	324	283	245	215	71	250	450	1600	2400	706	1100	8-30
48 81 57	563	545	483	421	365	320	71	250	450	1600	2400	901	1390	9-30

Selection table OD 863.6 - 965.2
Temperatures 600-650°C

type 44



type 48



Pipe clamps, OD 863.6 (ND 850), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 86 51	85	76	65	57	49	41	51	845	270	320	265	6-9
44 86 52	122	116	100	88	76	65	61	870	245	320	340	7-10
44 86 53	164	160	139	121	102	85	71	880	236	320	438	8-30
44 86 54	203	188	163	143	120	100	71	890	280	320	499	8-30
44 86 55	225	222	197	171	144	119	71	885	335	320	583	9-30
44 86 56	339	335	292	256	220	180	81	910	347	320	806	10-40

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 86 51	74	65	58	50	43	38	46	279	280	1650	2450	290	434	5-8
48 86 52	89	87	77	68	59	51	46	279	300	1650	2450	323	496	5-8
48 86 53	122	112	100	88	76	66	51	279	330	1650	2450	365	566	6-9
48 86 54	171	157	139	121	105	92	51	279	350	1650	2450	423	662	6-9
48 86 55	256	246	218	191	165	145	61	279	350	1650	2450	576	892	7-10
48 86 56	409	387	343	301	261	229	71	279	450	1650	2450	779	1192	8-30
48 86 57	617	575	510	444	385	338	71	279	450	1650	2450	989	1500	9-30

Pipe clamps, OD 914.4 (ND 900), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 91 51	81	79	72	63	54	45	51	870	305	320	299	6-9
44 91 52	116	113	99	86	72	60	61	895	293	320	380	7-10
44 91 53	164	162	148	128	107	90	71	905	255	320	487	8-30
44 91 54	166	164	163	155	130	109	71	915	312	320	567	8-30
44 91 55	225	222	208	179	151	126	71	910	360	320	649	9-30
44 91 56	330	328	294	258	221	180	81	935	357	320	849	10-40

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 91 51	81	71	63	55	48	42	46	279	300	1700	2500	315	468	5-8
48 91 52	121	108	96	84	73	64	46	279	330	1700	2500	373	575	5-8
48 91 53	163	144	128	111	96	84	51	279	350	1700	2500	428	659	6-9
48 91 54	278	252	223	197	171	150	61	279	385	1700	2500	623	948	7-10
48 91 55	393	366	324	283	245	215	71	279	470	1800	2500	829	1205	8-30
48 91 56	473	432	383	334	290	254	71	279	450	1800	2500	921	1350	9-30
48 91 57	685	646	573	501	434	380	81	279	450	1800	2500	1160	1695	10-40

Pipe clamps, OD 965.2 (ND 950), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 97 51	77	75	65	57	49	41	51	895	287	320	298	6-9
44 97 52	110	109	97	85	73	60	61	920	250	320	373	7-10
44 97 53	160	157	139	121	102	85	71	930	250	320	483	8-30
44 97 54	184	181	161	141	121	100	71	940	296	320	549	8-30
44 97 55	218	217	191	167	143	119	71	935	350	320	664	9-30
44 97 56	332	330	291	255	220	180	81	960	360	320	886	10-40

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 97 51	81	80	71	62	53	47	46	330	300	1750	2550	360	552	5-8
48 97 52	127	126	111	98	85	74	46	330	330	1750	2550	437	664	5-8
48 97 53	166	147	130	114	98	86	51	330	350	1750	2550	469	721	6-9
48 97 54	289	255	226	197	171	150	61	330	385	1750	2550	672	1015	7-10
48 97 55	398	373	330	288	250	219	71	330	470	1850	2550	899	1295	8-30
48 97 56	468	444	393	343	297	261	71	330	450	1850	2550	965	1450	9-30
48 97 57	718	665	590	516	447	392	81	330	450	1850	2550	1215	1825	10-40

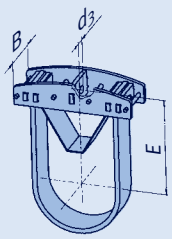
Selection table OD 1016 - 1118
Temperatures 600-650°C

Pipe clamps, OD 1016 (ND 1000), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 T0 51	73	72	65	57	49	40	51	920	290	320	314	6-9
44 T0 52	114	111	96	85	73	60	61	950	255	320	396	7-10
44 T0 53	164	159	138	121	102	85	71	960	255	320	513	8-30
44 T0 54	193	187	162	142	120	100	71	970	303	320	587	8-30
44 T0 55	234	223	193	170	146	119	71	970	340	320	715	9-30
44 T0 56	329	327	288	252	217	180	81	990	365	320	930	10-40
44 T0 57	422	419	385	338	290	240	91	1000	370	320	1151	20-50

	permissible load [kN]										L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 T0 51	100	89	79	68	59	52	46	330	300	1800	2600	388	591	5-8
48 T0 52	155	137	121	106	92	80	46	330	330	1800	2600	470	710	5-8
48 T0 53	171	159	141	124	107	94	51	330	350	1800	2600	507	769	6-9
48 T0 54	301	280	248	216	187	164	61	330	385	1800	2600	730	1100	7-10
48 T0 55	426	410	363	319	276	242	71	330	470	1900	2600	980	1405	8-30
48 T0 56	510	486	431	376	326	286	71	330	450	1900	2600	1090	1560	9-30
48 T0 57	766	735	652	570	494	433	81	330	450	1900	2600	1380	1987	10-40

type 44

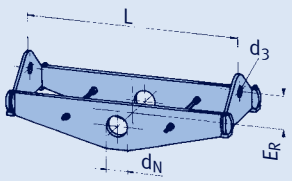


Pipe clamps, OD 1067 (ND 1050), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 T1 51	75	74	64	56	48	40	51	950	295	320	333	6-9
44 T1 52	114	113	97	85	73	60	61	980	265	320	424	7-10
44 T1 53	164	160	140	121	102	85	71	985	261	320	546	8-30
44 T1 54	196	185	160	141	120	100	71	1000	312	320	619	8-30
44 T1 55	237	224	194	170	144	119	71	1000	350	320	758	9-30
44 T1 56	338	335	292	256	220	180	81	1020	382	320	991	10-40
44 T1 57	427	421	391	343	290	240	91	1030	385	320	1226	20-50

	permissible load [kN]										L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 T1 51	99	87	77	68	59	51	46	330	300	1850	2650	404	605	5-8
48 T1 52	151	139	123	107	93	81	46	330	330	1850	2650	493	742	5-8
48 T1 53	163	161	143	125	108	95	51	330	350	1850	2650	531	802	6-9
48 T1 54	282	280	248	218	188	165	61	330	385	1850	2650	763	1140	7-10
48 T1 55	430	407	361	315	273	239	71	330	470	1950	2650	1015	1445	8-30
48 T1 56	516	484	429	375	325	285	71	330	450	1950	2650	1135	1615	9-30
48 T1 57	766	733	650	566	491	430	81	330	450	1950	2650	1435	2050	10-40

type 48



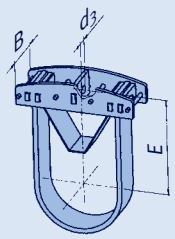
Pipe clamps, OD 1118 (ND 1100), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 T2 51	76	73	63	55	48	40	51	980	300	320	351	6-9
44 T2 52	110	108	95	83	71	60	61	1010	265	320	440	7-10
44 T2 53	164	157	136	120	102	85	71	1015	268	320	566	8-30
44 T2 54	200	182	158	138	119	100	71	1020	318	320	662	8-30
44 T2 55	232	221	191	168	144	119	71	1030	355	320	792	9-30
44 T2 56	324	323	292	256	220	180	81	1050	392	320	1041	10-40
44 T2 57	427	421	385	337	290	240	91	1065	390	320	1285	20-50

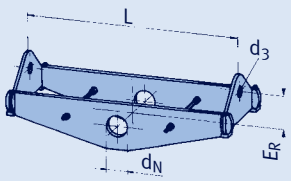
	permissible load [kN]										L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 T2 51	99	87	77	68	58	51	46	374	300	1900	2700	436	653	5-8
48 T2 52	142	139	123	107	93	81	46	374	330	1900	2700	535	788	5-8
48 T2 53	181	161	143	125	108	95	51	374	350	1900	2700	570	880	6-9
48 T2 54	279	279	248	218	189	166	61	374	385	1900	2700	780	1165	7-10
48 T2 55	433	408	361	315	273	240	71	374	470	2000	2700	1035	1530	8-30
48 T2 56	502	485	430	375	325	285	71	374	450	2000	2700	1160	1655	9-30
48 T2 57	766	731	648	567	492	431	81	374	450	2000	2700	1515	2150	10-40

Selection table OD 1168 - 1219
Temperatures 600-650°C

type 44



type 48



Pipe clamps, OD 1168 (ND 1150), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 T3 51	73	72	64	56	48	40	51	1005	312	320	372	6-9
44 T3 52	120	112	97	85	73	60	61	1025	275	320	485	7-10
44 T3 53	164	156	136	119	102	85	71	1045	274	320	594	8-30
44 T3 54	196	184	160	140	120	100	71	1045	328	320	699	8-30
44 T3 55	241	218	189	166	142	119	71	1060	360	320	831	9-30
44 T3 56	328	326	286	251	215	180	81	1075	392	320	1078	10-40
44 T3 57	427	421	381	334	287	240	91	1095	395	320	1335	20-50

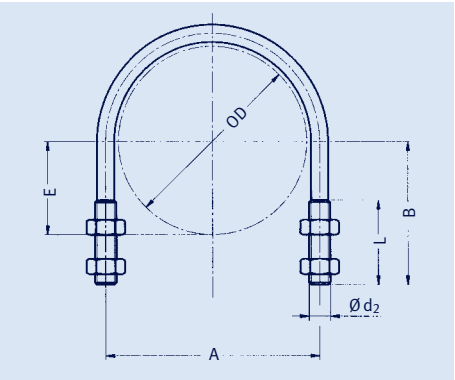
	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 T3 51	94	87	77	68	59	52	46	374	300	1950	2750	456	673	5-8
48 T3 52	139	139	123	108	93	82	46	374	330	1950	2750	559	816	5-8
48 T3 53	173	161	143	126	109	96	51	374	350	1950	2750	595	907	6-9
48 T3 54	279	278	248	216	187	164	61	374	385	1950	2750	809	1242	7-10
48 T3 55	441	408	361	315	273	240	71	374	470	2050	2750	1130	1580	8-30
48 T3 56	510	486	431	376	326	286	71	374	450	2050	2750	1205	1780	9-30
48 T3 57	766	733	650	568	492	431	81	374	450	2050	2750	1575	2217	10-40

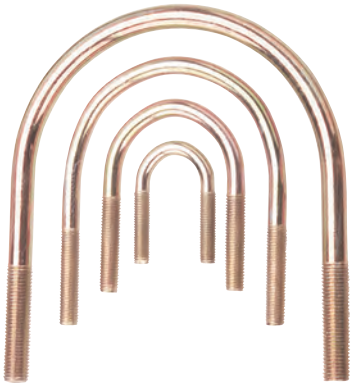
Pipe clamps, OD 1219 (ND 1200), type 44, 48

	permissible load [kN]								max	max	wt.	load
type	600	610	620	630	640	650°C	d_3	E	B	insul.	[kg]	group
44 T4 51	77	74	64	56	48	40	51	1035	322	320	397	6-9
44 T4 52	116	112	97	85	73	60	61	1050	280	320	506	7-10
44 T4 53	164	158	137	120	102	85	71	1080	284	320	633	8-30
44 T4 54	197	186	161	141	121	100	71	1075	335	320	739	8-30
44 T4 55	236	219	190	166	143	119	71	1090	370	320	874	9-30
44 T4 56	337	325	281	247	212	180	81	1110	405	320	1130	10-40
44 T4 57	427	421	381	334	287	240	91	1125	405	320	1404	20-50

	permissible load [kN]									L		wt. [kg]		load
type	600	610	620	630	640	650°C	d_3	d_N	E_R	min	max	min	max	group
48 T4 51	90	88	78	69	59	52	46	374	300	2000	2800	521	694	5-8
48 T4 52	139	139	123	108	93	82	46	374	330	2000	2800	577	839	5-8
48 T4 53	165	161	143	125	108	95	51	374	350	2000	2800	617	934	6-9
48 T4 54	282	280	248	216	188	164	61	374	385	2000	2800	885	1285	7-10
48 T4 55	446	407	361	316	274	240	71	374	470	2100	2800	1175	1635	8-30
48 T4 56	523	485	430	375	325	285	71	374	450	2100	2800	1255	1830	9-30
48 T4 57	740	733	649	568	492	432	81	374	450	2100	2800	1635	2287	10-40

U-bolts
Type 40



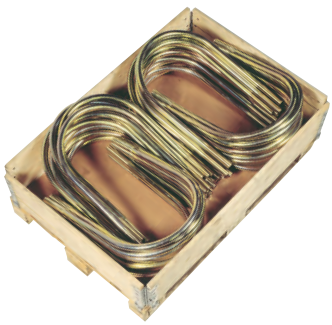


U-bolts
type 40 01 .8 to 40 91 .8

Type 40 mainly serves to fasten pipe systems to existing steel structures.

type	OD	A	B	d_2 x L	E	weight [kg]
40 01 .8	21.3	30	70	M6 x 65	11	0.05
40 02 .8	26.9	35	70	M6 x 65	13	0.05
40 03 .8	33.7	40	70	M6 x 65	17	0.05
40 04 .8	42.4	53	75	M10 x 65	21	0.15
40 05 .8	48.3	60	75	M10 x 65	24	0.16
40 06 .8	60.3	72	85	M10 x 70	30	0.18
40 07 .8	73.0	87	95	M12 x 75	37	0.30
40 08 .8	76.1	91	95	M12 x 75	38	0.31
40 09 .8	88.9	103	100	M12 x 75	44	0.32
40 10 .8	108.0	123	115	M12 x 75	54	0.36
40 11 .8	114.3	130	115	M12 x 75	57	0.37
40 14 .8	139.7	155	130	M12 x 75	70	0.42
40 17 .8	168.3	188	155	M16 x 95	84	0.91
40 22 .8	219.1	238	180	M16 x 95	110	1.08
40 27 .8	273.0	295	215	M20 x 110	137	2.07
40 32 .8	323.9	350	245	M20 x 110	162	2.35
40 36 .8	355.6	381	260	M20 x 110	178	2.55
40 41 .8	406.4	432	285	M20 x 110	203	2.80
40 46 .8	457.2	485	320	M24 x 125	229	4.55
40 51 .8	508.0	537	345	M24 x 125	254	4.90
40 56 .8	558.8	587	370	M24 x 125	279	5.35
40 61 .8	609.6	638	395	M24 x 125	305	5.70
40 66 .8	660.4	689	425	M24 x 125	330	6.15
40 71 .8	711.2	740	450	M24 x 125	356	6.50
40 76 .8	762.0	790	475	M24 x 125	381	6.90
40 81 .8	812.8	843	501	M24 x 125	406	7.30
40 86 .8	864.0	895	526	M24 x 125	432	7.70
40 91 .8	914.4	943	550	M24 x 125	457	8.00

└→ 5th digit: 1 = carbon steel
3 = stainless steel



Order details:
U-bolt
type 40 .. .8

Scope of delivery:
incl. 4 nuts

Weld-on lugs for pipes Type 41

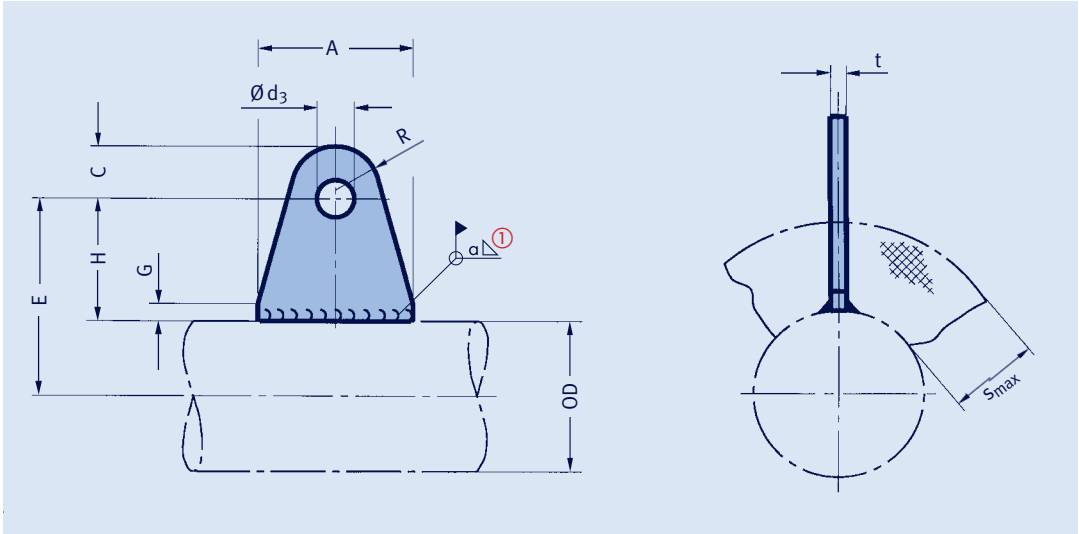
Weld-on lugs for pipes type 41 D9 11 to 41 79 12

① Permissible load at 80°C = normal operating conditions (load case H / level A/B) of the corresponding load group (3rd digit in the type designation, see "Max. permissible load for static components", page 0.6).

Existing stress in the specified weld seam < 50 N/mm² at 4° load angle.

Material: carbon steel

type 41 .. 11 s_{max} = 10mm
type 41 .. 12 s_{max} = 100mm



type	A	Ø d_3	H	R	C	G	t	a ①	weight [kg]
41 D9 11	30	10.5	25	15.0	15	10	8	3.0	0.06
41 D9 12	30	10.5	115	15.0	15	10	8	3.0	0.23
41 29 11	35	12.5	25	17.5	22	10	10	3.0	0.11
41 29 12	65	12.5	115	17.5	22	10	10	3.0	0.49
41 39 11	45	16.5	30	22.5	28	10	12	4.5	0.21
41 39 12	70	16.5	120	22.5	28	10	12	4.5	0.75
41 49 11	80	20.5	40	30.0	37	10	15	4.5	0.53
41 49 12	120	20.5	125	30.0	37	10	15	4.5	1.60
41 59 11	85	24.5	40	32.5	40	10	20	5.5	0.75
41 59 12	130	24.5	130	32.5	40	10	20	5.5	2.30
41 69 11	120	34.0	50	40.0	50	10	25	6.5	1.60
41 69 12	165	34.0	140	40.0	50	10	25	6.5	4.10
41 79 11	170	41.0	60	50.0	65	10	30	6.5	3.20
41 79 12	230	41.0	150	50.0	65	10	30	6.5	7.30

Reduction factors of permissible load at increased temperatures:

T	F perm. (T)
250°C	0.7 F perm. (80°C)
350°C	0.5 F perm. (80°C)

Order details:
weld-on lug for pipes
type 41 .9 1.

Weld-on lugs for pipe elbows Type 41

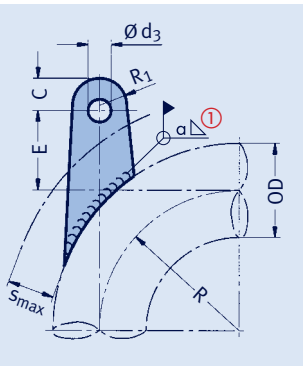
S_{max} = 10mm				S_{max} = 100mm									
type	E	a	weight [kg]	type	E	a	weight [kg]	OD	load ① group	C	R_1	t	d_3
41 06 13	35	3.0	0.13	41 06 15	135	3.0	0.44	60.3	C-2	22	17.5	8	12.5
41 07 13	30	3.0	0.13	41 07 15	135	3.0	0.44	73.0	C-2	22	17.5	8	12.5
41 08 13	35	3.0	0.13	41 08 15	135	3.0	0.44	76.1	C-2	22	17.5	8	12.5
41 09 13	30	3.0	0.13	41 09 15	135	3.0	0.44	88.9	C-2	22	17.5	8	12.5
41 09 14	35	3.0	0.24	41 09 16	140	4.5	0.75	88.9	2-3	28	22.5	10	16.5
41 10 13	30	3.0	0.13	41 10 15	135	3.0	0.44	108.0	C-2	22	17.5	8	12.5
41 10 14	35	3.0	0.25	41 10 16	140	4.5	0.75	108.0	2-3	28	22.5	10	16.5
41 11 13	30	3.0	0.14	41 11 15	135	3.0	0.45	114.3	C-2	22	17.5	8	12.5
41 11 14	35	3.0	0.25	41 11 16	140	4.5	0.75	114.3	2-3	28	22.5	10	16.5
41 13 13	25	3.0	0.14	41 13 15	135	3.0	0.46	133.0	C-2	22	17.5	8	12.5
41 13 14	30	3.0	0.25	41 13 16	140	4.5	0.77	133.0	2-3	28	22.5	10	16.5
41 14 13	25	3.0	0.14	41 14 15	135	3.0	0.47	139.7	C-2	22	17.5	8	12.5
41 14 14	40	4.5	0.62	41 14 16	145	4.5	1.60	139.7	3-4	37	30.0	15	20.5
41 16 13	25	3.0	0.14	41 16 15	135	3.0	0.47	159.0	C-2	22	17.5	8	12.5
41 16 14	40	4.5	0.62	41 16 16	145	4.5	1.70	159.0	3-4	37	30.0	15	20.5
41 17 13	25	3.0	0.25	41 17 15	140	4.5	0.78	168.3	2-3	28	22.5	10	16.5
41 17 14	40	5.5	0.87	41 17 16	150	5.5	2.30	168.3	4-5	40	32.5	18	24.5
41 19 13	20	3.0	0.25	41 19 15	135	4.5	0.78	193.7	2-3	28	22.5	10	16.5
41 19 14	35	5.5	0.88	41 19 16	145	5.5	2.30	193.7	4-5	40	32.5	18	24.5
41 22 13	20	3.0	0.25	41 22 15	135	4.5	0.80	219.1	2-3	28	22.5	10	16.5
41 22 14	35	5.5	0.90	41 22 16	145	5.5	2.30	219.1	4-5	40	32.5	18	24.5
41 24 13	15	3.0	0.25	41 24 15	130	4.5	0.80	244.5	2-3	28	22.5	10	16.5
41 24 14	30	5.5	0.90	41 24 16	145	5.5	2.40	244.5	4-5	40	32.5	18	24.5
41 26 13	10	3.0	0.25	41 26 15	125	4.5	0.80	267.0	2-3	28	22.5	10	16.5
41 26 14	25	5.5	0.90	41 26 16	140	5.5	2.40	267.0	4-5	40	32.5	18	24.5
41 27 13	15	3.0	0.26	41 27 15	130	4.5	0.80	273.0	2-3	28	22.5	10	16.5
41 27 14	25	5.5	0.90	41 27 16	145	5.5	2.40	273.0	4-5	40	32.5	18	24.5
41 32 13	15	4.5	0.62	41 32 15	130	4.5	1.70	323.9	3-4	37	30.0	15	20.5
41 32 14	25	6.5	1.40	41 32 16	145	6.5	3.70	323.9	5-6	50	40.0	20	34.0
41 36 13	-10	4.5	0.62	41 36 15	115	4.5	1.70	355.6	3-4	37	30.0	15	20.5
41 36 14	5	6.5	1.50	41 36 16	125	6.5	3.70	355.6	5-6	50	40.0	20	34.0
41 37 13	0	4.5	0.62	41 37 15	120	4.5	1.80	368.0	3-4	37	30.0	15	20.5
41 37 14	15	6.5	1.50	41 37 16	130	6.5	3.70	368.0	5-6	50	40.0	20	34.0
41 41 13	-15	4.5	0.65	41 41 15	105	4.5	1.80	406.4	3-4	37	30.0	15	20.5
41 41 14	-5	6.5	1.50	41 41 16	115	6.5	3.70	406.4	5-6	50	40.0	20	34.0
41 42 13	-10	4.5	0.65	41 42 15	115	4.5	1.80	419.0	3-4	37	30.0	15	20.5
41 42 14	5	6.5	1.50	41 42 16	125	6.5	3.80	419.0	5-6	50	40.0	20	34.0
41 46 13	-20	5.5	0.90	41 46 15	100	5.5	2.40	457.2	4-5	40	32.5	18	24.5
41 46 14	0	6.5	3.40	41 46 16	120	6.5	7.10	457.2	6-7	65	50.0	25	41.0
41 51 13	-30	5.5	0.90	41 51 15	95	5.5	2.50	508.0	4-5	40	32.5	18	24.5
41 51 14	-10	6.5	3.40	41 51 16	110	6.5	7.10	508.0	6-7	65	50.0	25	41.0
41 56 13	-40	5.5	0.90	41 56 15	85	5.5	2.50	558.8	4-5	40	32.5	18	24.5
41 56 14	-20	6.5	3.40	41 56 16	105	6.5	7.10	558.8	6-7	65	50.0	25	41.0
41 61 13	-45	5.5	0.90	41 61 15	80	5.5	2.50	609.6	4-5	40	32.5	18	24.5
41 61 14	-30	6.5	3.40	41 61 16	95	6.5	7.10	609.6	6-7	65	50.0	25	41.0
41 66 13	-55	5.5	0.90	41 66 15	70	5.5	2.50	660.4	4-5	40	32.5	18	24.5
41 66 14	-35	6.5	3.40	41 66 16	85	6.5	7.10	660.4	6-7	65	50.0	25	41.0
41 71 13	-65	5.5	0.90	41 71 15	60	5.5	2.50	711.2	4-5	40	32.5	18	24.5
41 71 14	-45	6.5	3.40	41 71 16	80	6.5	7.20	711.2	6-7	65	50.0	25	41.0
41 76 13	-75	5.5	0.90	41 76 15	50	5.5	2.50	762.0	4-5	40	32.5	18	24.5
41 76 14	-55	6.5	3.40	41 76 16	70	6.5	7.20	762.0	6-7	65	50.0	25	41.0

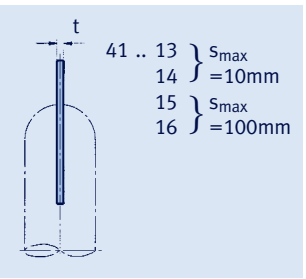
① Permissible loads at 80°C = normal operating conditions (load case H / level A/B) of the specified load group in each case (see "Max. permissible load for static components", page 0.6).

Stress existing in the specified weld seam < 50 N/mm² at 4° load angle.

Weld-on lugs for pipe elbows (R ≈ 1.5 OD) type 41 06 13 to 41 76 16

Material: carbon steel





Reduction factors of permissible load at increased temperatures:

T	F perm. (T)
250°C	0.7 F perm. (80°C)
350°C	0.5 F perm. (80°C)

Order details:
weld-on lug for pipe elbows R ≈ 1.5 OD
type 41 .. 1.

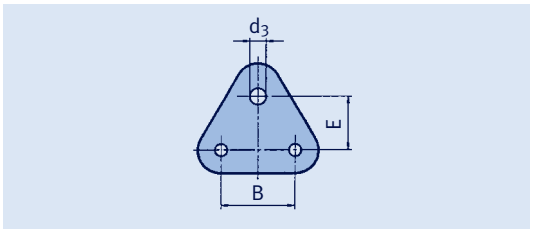
Connection plates Type 77

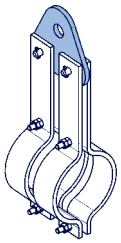
Connection plates for coupling pipe clamps type 43

type 77 09 39 to 77 19 39

By coupling 2 pipe clamps with type 77 the loads can be doubled.

Order details:
connection plate
type 77.. 39





type	for clamps	load group	d_3	E	B	weight [kg]
77 09 39	43 01 19 up to 43 09 59	D-5	25	65	90	0.8
77 17 39	43 10 19 up to 43 17 59	3-6	34	70	90	1.2
77 19 39	43 19 19 up to 43 19 59	4-7	46	90	105	2.4

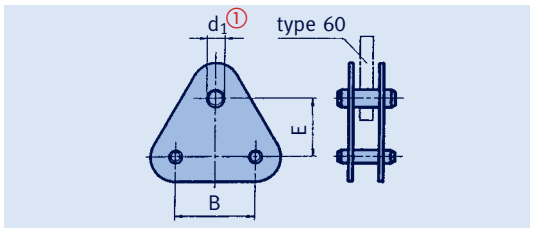
Connection plates for coupling pipe clamp type 44 up to 600°C

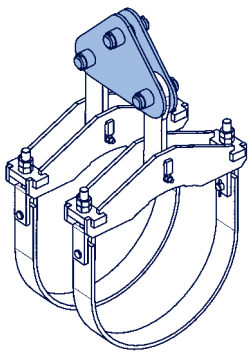
type 77 22 .. to 77 T4 ..

Type designation of the connection plates: the figures 44 of the clamps to be coupled must be replaced by the figures 77.

Example:
connection plate for
type 44 66 38 → 77 66 38.

① The load group for the upper connection (type 60) must be stated when ordering.

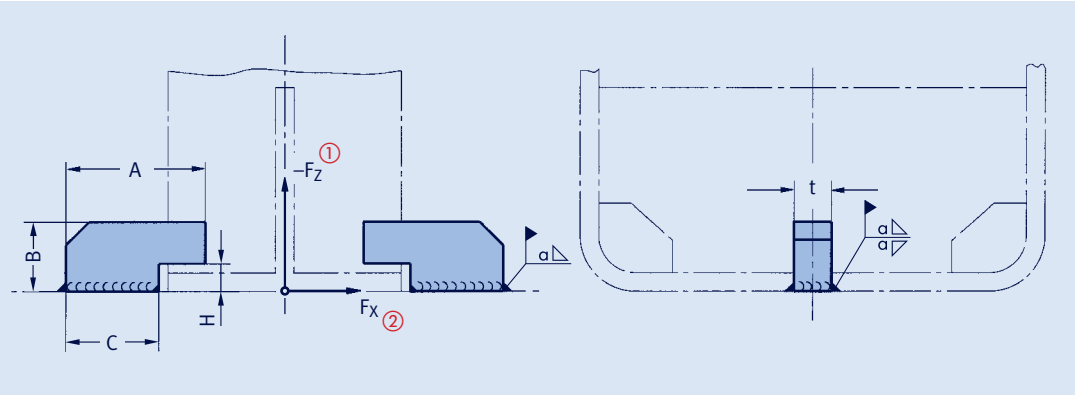




type	load group①	$d_1$① min	$d_1$① max	E	Bmax	weight [kg]
77 22 .. up to 77 27 ..	5-10	33	60	135	180	10-23
77 32 .. up to 77 37 ..	5-30	33	70	140	225	11-32
77 41 .. up to 77 46 ..	6-30	40	70	140	275	16-52
77 51 .. up to 77 56 ..	7-50	45	90	200	300	30-75
77 61 .. up to 77 91 ..	7-50	45	90	190	325	31-78
77 97 .. up to 77 T4 ..	7-50	45	90	190	390	47-81

Order details:
connection plate
type 77.. ..
load group ...

Lift-off restraints for clamp bases Type 49



Lift-off restraints for clamp base type 49 type 49 00 01 to 49 00 05

Material:
plate t ≤ 15mm : S235JR
plate t ≥ 20mm : S355J2

type	for clamp bases	A	B	C	H	t	max load F_X [kN] ②	a	wt./pair [kg]
49 00 01	49 01 11 up to 49 17 11	35	15	23	8	8	6	3.0	0.1
49 00 01	49 01 12 up to 49 14 12	35	15	23	8	8	6	3.0	0.1
49 00 01	49 01 25 up to 49 11 25	35	15	23	8	8	6	3.0	0.1
49 00 01	49 01 35 up to 49 06 35	35	15	23	8	8	6	3.0	0.1
49 00 01	49 01 45 up to 49 11 45	35	15	23	8	8	6	3.0	0.1
49 00 01	49 01 55 up to 49 09 55	35	15	23	8	8	6	3.0	0.1
49 00 02	49 19 13 up to 49 32 13	55	32	35	17	12	12	4.0	0.3
49 00 02	49 16 14 up to 49 32 14	55	32	35	17	12	12	4.0	0.3
49 00 02	49 13 25 up to 49 32 25	55	32	35	17	12	12	4.0	0.3
49 00 02	49 07 35 up to 49 32 35	55	32	35	17	12	12	4.0	0.3
49 00 02	49 13 45 up to 49 32 45	55	32	35	17	12	12	4.0	0.3
49 00 03	49 36 13 up to 49 51 45	80	45	55	22	15	25	5.0	0.7
49 00 04	49 56 13 up to 49 91 45	110	50	80	22	20	50	7.0	1.5
49 00 05	49 97 13 up to 49 T4 45	115	50	85	22	25	60	8.0	1.9

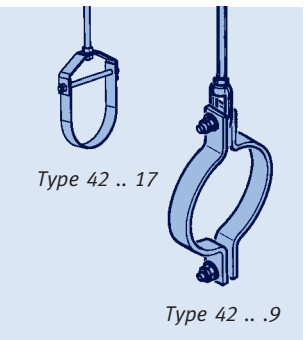
① The following short duration lift-off loads are permissible for the clamp bases:
type 49 01 .. to 49 76 .. 10%
type 49 81 .. to 49 T4 .. 7%
of the catalog load.

② When used as a guide it must be ensured that the pipe supports are secured against rotation about the pipe axis. F_X is the max. lateral load at a weld seam stress of 50 N/mm² in the load case H (level A/B). Simultaneous lift-off loads are taken into consideration.

On request special lift-off restraints for type 49 .. .. -SP can be delivered.

Order details:
lift-off restraint
type 49 00 ..

Installation and operating instructions Type 42, 43, 44, 45, 46, 48



Type 42 .. 17

Type 42 .. .9

1 Transport and storage

Care must be taken during transport that none of the clamp components are damaged. When stored in the open the clamps must be protected from dirt and water.

2 Delivery condition

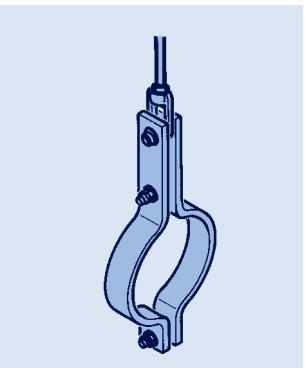
LISEGA pipe clamps are delivered ready for installation, with all the necessary bolts. For reason of more optimize dispatch clamps can be supplied partially assembled.

3 Installation

3.1 Horizontal clamp

Type 42

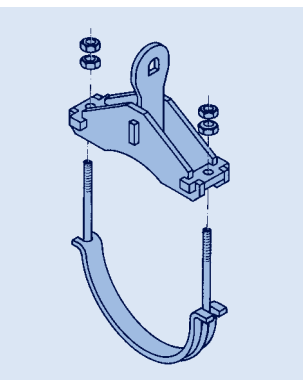
This clamp is used as a horizontal clamp in connection with threaded eye nut type 60. When tightening the bolts, care must be taken that the clamp halves are parallel to each other. The bolts are to be secured with lock nuts.



Type 43

Type 43

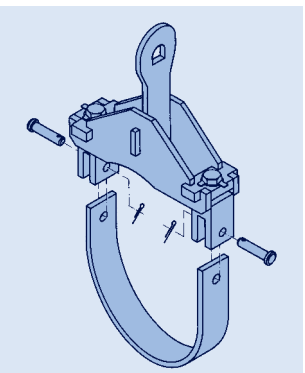
Connection is made with this horizontal clamp via a separate connection pin with a threaded eye nut type 60. The pins must be secured with the cotter pins provided; otherwise proceed as with type 42.



Type 44 U-bolt design

Type 44 U-bolt/ strap for temperatures up to 600°C

These clamps consist of an upper section with a connecting lug and, depending on load and temperature range, a U-bolt with an inlay plate or a flat steel strap as lower section. For installation, remove the pre-assembled lower part by loosening the locking nuts or removing the connection pins. The upper section is seated on the piping and the lower one inserted and held by bolting the U-bolt or gib the flat steel strap. After alignment of the clamp the bolts are to be firmly tightened. The U-bolts are secured with lock nuts and the flat steel straps with tab washers under the hexagon nuts.



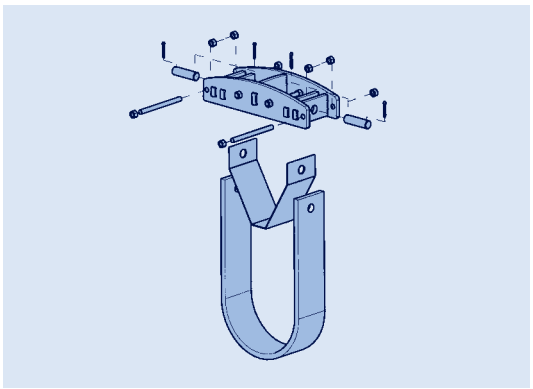
Type 44 strap design

Type 44 for temperatures over 600°C

These clamps consist of an upper section with a connection lug and restrainer and a flat steel strap as lower part.

For installation the restraint and strap must be taken off by removing the outer threaded rods and the connection pins. After attaching the upper section to the hanging part the restraint and strap can be reconnected.

Afterwards they are pinned and the threaded rods are fitted. All parts must then be firml secured.

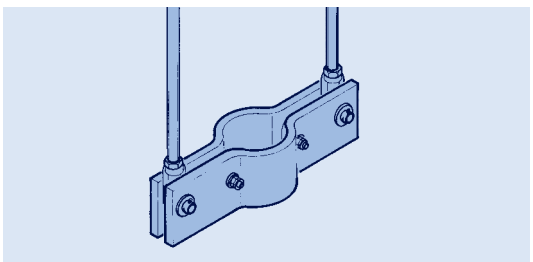


Installation of type 44 for temperatures over 600°C

3.2 Riser clamps

Type 45

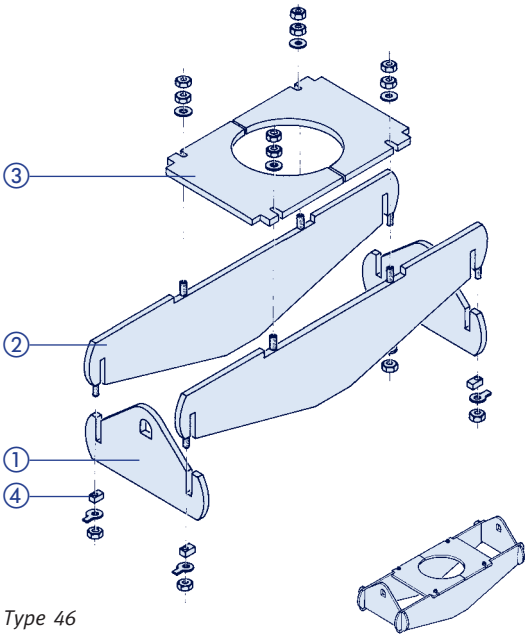
When installing these clamps care must be taken to place the spacers supplied onto the bolts between the clamp halves. The bolts are then tightened and locked. The clamp is hung up via the outer support pins, which are secured with washers and cotter pins. The specified height of the clamp is set by tightening the suspended parts and creating a force-and form-fitting connection with the shear lugs.



Riser clamp type 45 with connection components

Type 46
This riser clamp is supplied in single parts sealed in plastic shrink wrap.

For installation it is best to first fit the fron plates ① into the suspended parts. These parts should be tightened at the lowest level, then both side plates ② can be attached one after another. In the case of large clamps, the opposite side must hereby be temporarily propped up.



Type 46

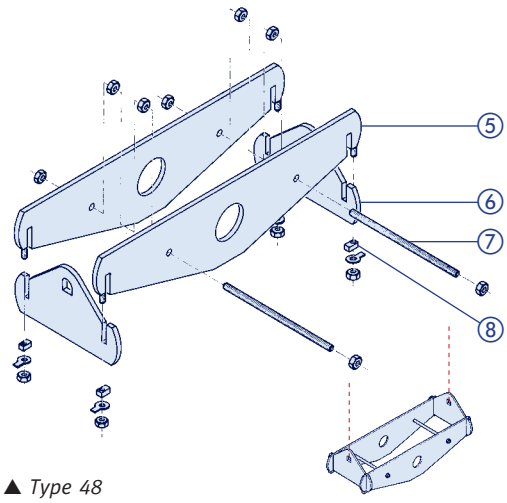
After that, the top plates ③ for the shear lugs are inserted and bolted on. The connection points between front and side plates are secured by aligning and firmly tightening the pre-assembled locking plates ④.

The specified height is set by tightening the suspended parts, creating a force- and form-fitting connection with the shear lugs.

Type 48
This riser clamp is supplied in single parts sealed in shrink wrap. First of all, a side plate ⑤ should be prepared by attaching the threaded rods ⑦.

For installation, both side plates are seated on the trunnions and connected with the threaded rods. The nuts should be only loosely tightened here. For large clamps the components should be temporarily propped up.

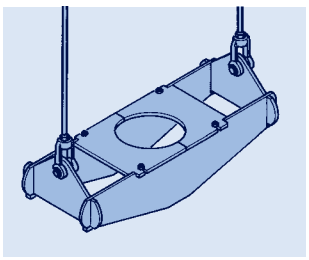
The front plates ⑥ can now be pushed from below into the intake slots and connected to the suspended parts. The connection points between front and side plates are made by aligning and firmly tightening the pre-assembled locking plates ⑧. The specified height of the clamp is set by tightening the suspended parts, creating a force- and form-fittin connection with the trunnions.



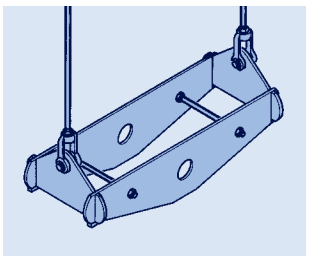
▲ *Type 48*

4 Inspection and maintenance

The horizontal clamp functions flawlessly in any operating condition if the secured boltings are free of any play. Under normal operating conditions maintenance is not required.

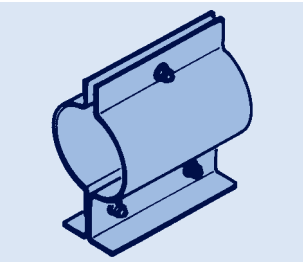


Riser clamp type 46 with connection components

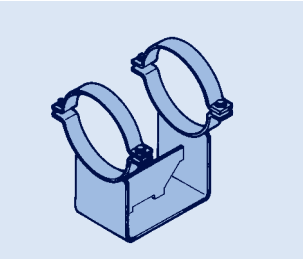


Riser clamp type 48 with connection components

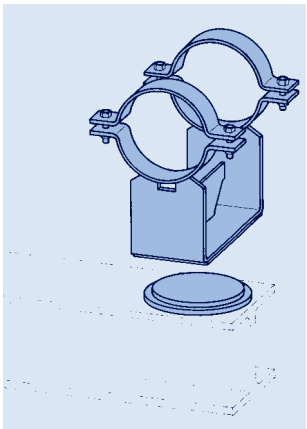
Installation and operating instructions Type 49



Clamp bases for smaller pipe diameters type 49 .. .1, 49 .. .2 up to ND150



Clamp bases for medium and high temperatures type 49 .. .3, 49 .. .4, 49 .. .5



Clamp base type 49 with slide plate

1 Transport and storage

Care must be taken during transport that no clamp base components are damaged. When stored in the open, the clamp bases must be protected from dirt and water.

2 Delivery condition

If not agreed otherwise, LISEGA clamp bases are delivered pre-assembled and ready for installation. For reasons of efficient dispatch clamp bases can be delivered partially assembled. In any event the clamp base is supplied with all the necessary bolts.

3 Installation

Type 49

LISEGA clamp bases are slidable supports that are fastened to pipe systems by clamping tension. On installation it is essential that the whole clamp base bottom lies flush and can slide unobstructed over the given stretches.

If required, the lower parts can be welded to the supporting surface.

Different designs are used depending on the height of the support, the pipe diameter, the support load and the operating temperature. The following points are hereby to be observed:

Type 49 .. .1 and 49 .. .2

This clamp base design is made up of two halves to be fitted to each side of the pipe. The cornered surfaces form the base. In this lower part the clamp base halves are firmly bolted to each other. The upper bolting serves for clamping tension in the piping against slipping.

Type 49 .. .3, 49 .. .4 and 49 .. .5

The base part of the clamp base forms a firm support for the pipe to be laid in. The upper half provides clamping tension and is to be firmly bolted

4 Inspection and maintenance

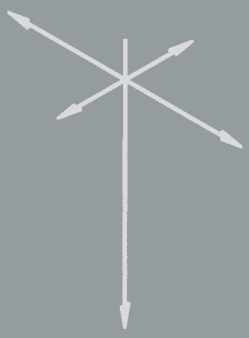
Under normal circumstances no maintenance is required.

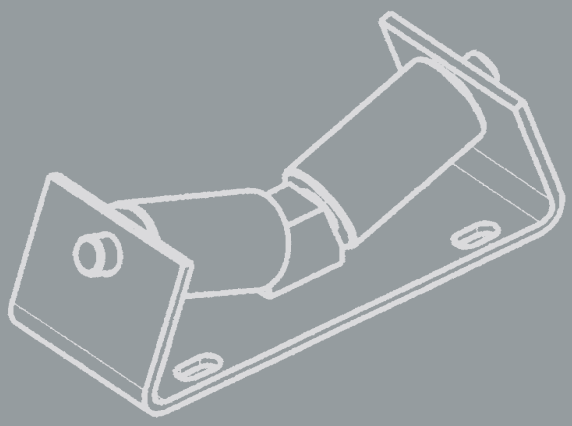
Type 49 .. .1 and 49 .. .2

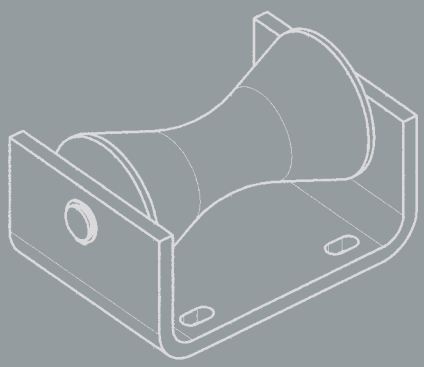
Type 49 .. .3 and 49 .. .4

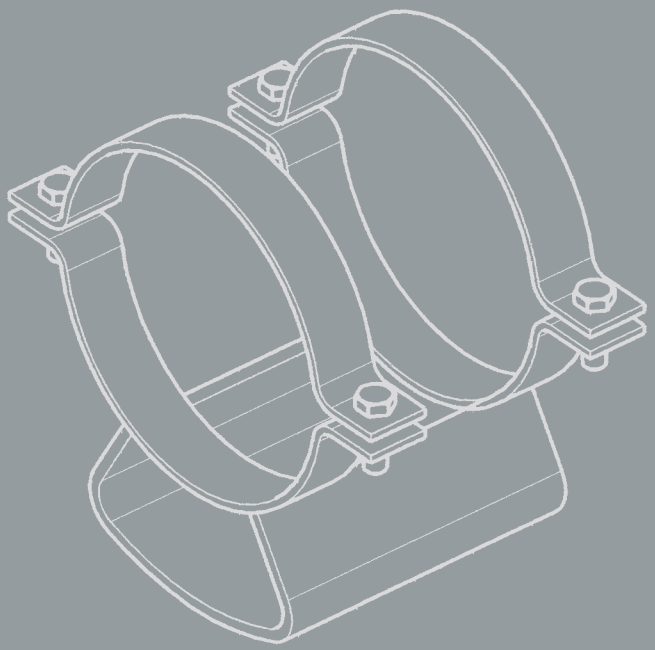
Type 49 .. .3, 49 .. .4 and 49 .. .5

Roller bearings, pipe saddles, cryogenic clamp bases

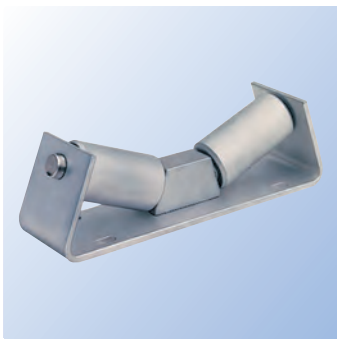


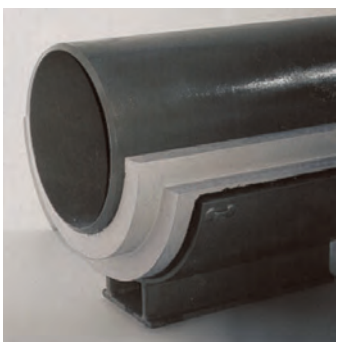


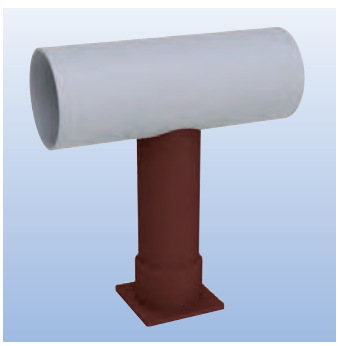


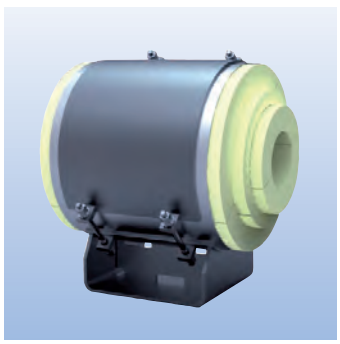


LISEGA









Roller bearings, pipe saddles, cryogenic clamp bases

Contents **Page**

Roller bearings and pipe saddles Type 51, 52, 53, 54, 55

Pipe systems arranged horizontally over longer stretches are supported by movable support bearings and fixed points. To ensure thermal expansion displacement with little friction, the bearing points are designed to be rolling or sliding.

For pipe systems of larger diameters and especially where high loads are caused by fluids and insulation weights, the optimum solution is provided by roller bearings of high load-bearing capacity, great reliability and extremely low friction resistance.

LISEGA standard roller bearings and pipe saddles

These components offer a suitable standard solution for a wide range of applications within product group 5.

For use outside the standard range specially modified designs can be supplied.

Design features and execution

In the development of standard roller bearings, the particular practical requirements that had to be met, were taken into account.

The design of the roller bearing enables optimum corrosion protection through hot dip galvanization.

The bearing axles are made of austenitic material with polished surfaces. As bearings for the rollers, bushings made of a sintered teflon / bronze composite material are fitted. They are maintenance-free and guarantee smooth dry run characteristics. A formed collar on the bushings minimizes starting friction on lateral loading.

The bearing axles are permanently fixed in the middle section of the base body of the double cylinder roller bearings. Special securing devices on the side bracket are not required.

The rollers are of high-tensile carbon steel. The running surfaces are machined.

To balance lateral offset in anchor bolts on site, the intake holes of the base body are slotted. The installation height (E dimensions) within a load group range are the same for rigid and laterally movable roller bearings.

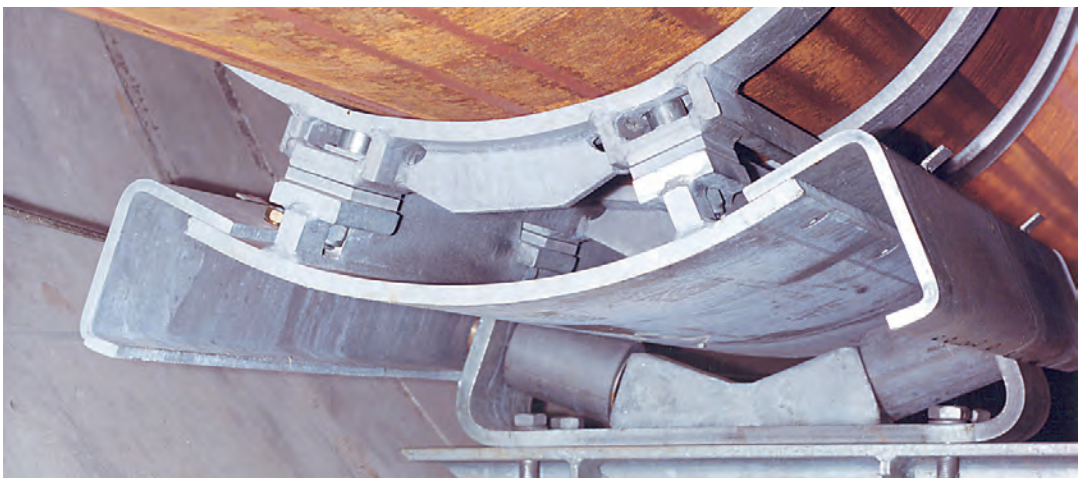
Data on material quality, norms, calculations and welding can be found in the **technical specifications**, pages 0.9 and 0.10.

Manufacture and storage

Standardization of the products permits efficient series production and storage for most components. For individual manufacture or fabrication in small batches, modern order logistics ensures rapid production and delivery.

Technical data for roller bearings:

- **rolling resistance of the rollers max. 4%**
- **rolling resistance on lateral displacement max. 4%**
- **temperature range for nominal load – 30°C to + 80°C**
- **permissible lateral loading 35% of nominal load**
- **permissible lift-off load 10% of nominal load**



Special pipe saddle type 54 with double cylinder roller bearing type 53 and lift-off restraints type 55

Roller bearings

The roller bearings can be fastened with simple bolted connections or welded to the supporting surface. In all cases the whole base plate must lie flush on the surface.

On slight lateral offset of existing anchor bolts the roller bearings can be easily aligned using the existing slot holes.

Pipe saddles

Pipe saddles for welding are supplied with a weldable primer as corrosion protection (see technical specifications, pages 0.10 and 0.11).

Clamp-fastened pipe saddles are supplied ready-to-install. Close attention must be paid to true-to-size seating and sufficient pre-stressing.

Lift-off restraints

When installing lift-off restraints, normal displacement over the whole range must be ensured to allow sufficient play between rollers and lift-off restraints.

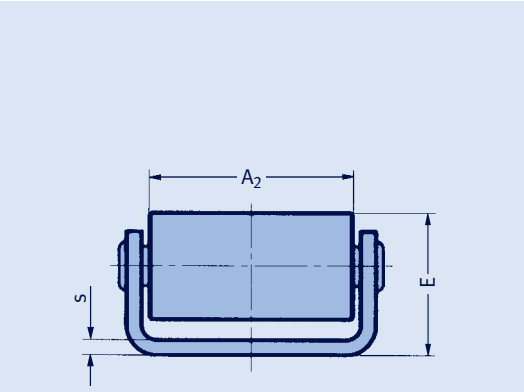
Their special design and their manufacturing quality offer the following benefits in application:

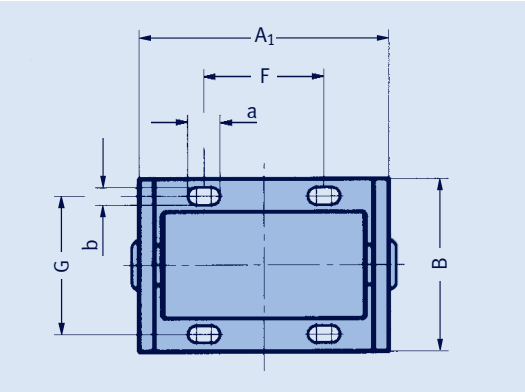
- **maintenance of minimum rolling resistance (max. 4%)**
- **absorption of realistic lateral loading for double taper and double cylinder roller bearings (35% of the support load)**
- **for double cylinder roller bearings the whole support load can be carried by a single roller**
- **absorption of lateral displacement possible by laterally movable designs**
- **safe and simple design of lift-off restraints**
- **pipe saddles facilitate load transmission into the pipe walls**
- **pipe saddle design minimizes heat transmission**
- **hot dip galvanized corrosion protection for all roller bearings**
- **maintenance-free operation**
- **roller axle made of non-rusting steel**
- **teflon-bronze composite bushings**
- **wide range of support diameters (OD 60mm – OD 1350mm)**
- **high load capacity (max. support load 120kN)**
- **low installation heights (see selection table for ‘E’ dimensions)**

Roller bearings
Type 51, 52

Cylinder roller bearings
type 51 08 19 to 51 35 19

Surface:
hot dip galvanized



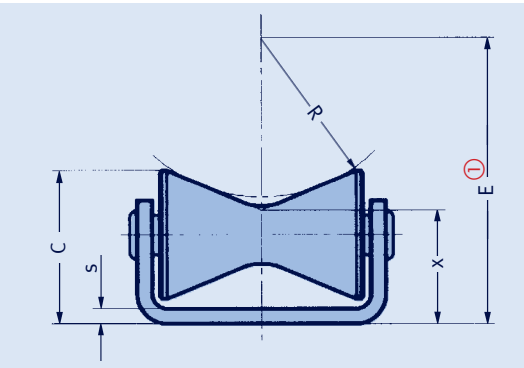


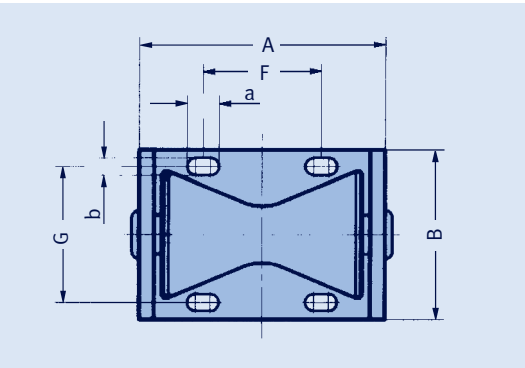
Order details:
cylinder roller bearing
type 51 .. 19

type	load F_N [kN]	A_1	A_2	B	E	F	G	a	b	s	weight [kg]
51 08 19	8	90	70	80	50	35	60	20	10	5	1.2
51 16 19	16	120	100	100	60	55	75	24	12	6	2.4
51 35 19	35	145	120	130	85	60	95	26	14	10	5.5

Double taper roller bearings
type 52 04 19 to 52 35 19

Surface:
hot dip galvanized





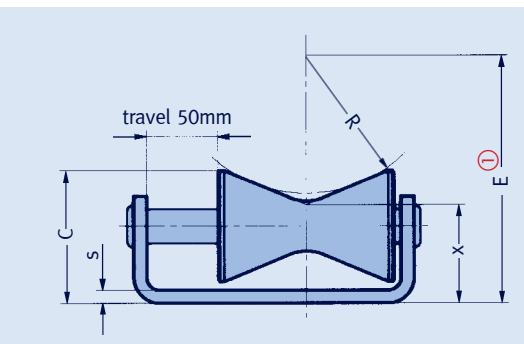
① E = 1.064 x R + x

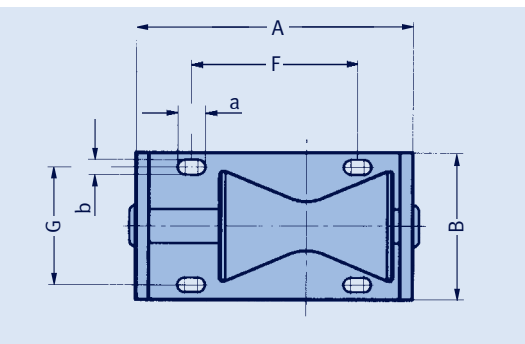
Order details:
double taper roller bearing
type 52 .. 19

type	load F_N [kN]	R	A	B	C	E ① min.	E ① max.	F	G	a	b	s	x	weight [kg]
52 04 19	4	27 – 100	105	90	70	83	160	55	70	20	10	4	54	1.8
52 08 19	8	84 – 130	135	100	85	153	202	75	75	20	10	6	64	3.3
52 16 19	16	110 – 165	165	120	100	191	250	90	90	24	12	8	74	5.4
52 35 19	35	136 – 230	230	160	135	247	347	130	120	26	14	12	102	14.0

Double taper roller bearings (laterally movable)
type 52 04 29 to 52 35 29

Surface:
hot dip galvanized



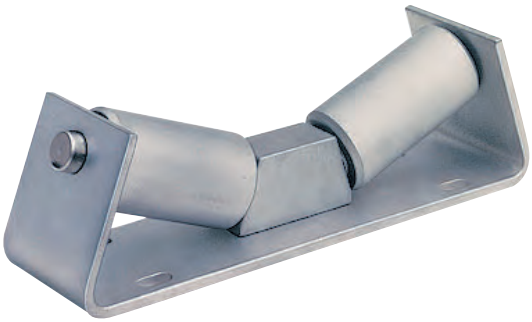


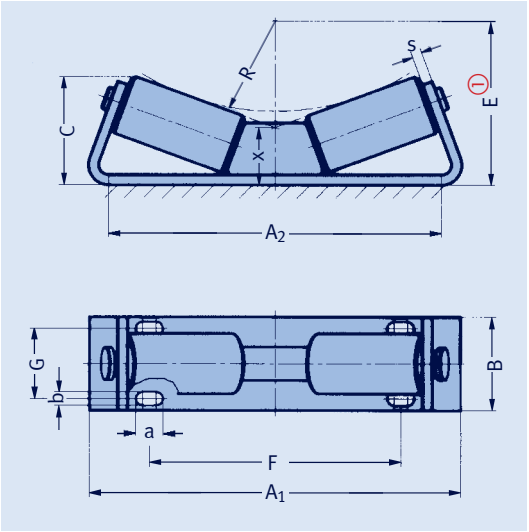
① E = 1.064 x R + x

Order details:
double taper roller bearing (laterally movable)
type 52 .. 29

type	load F_N [kN]	R	A	B	C	E ① min.	E ① max.	F	G	a	b	s	x	weight [kg]
52 04 29	4	27 – 100	155	90	70	83	160	105	70	20	10	4	54	2.0
52 08 29	8	84 – 130	185	100	85	153	202	120	75	20	10	6	64	3.6
52 16 29	16	110 – 165	215	120	100	191	250	140	90	24	12	8	74	6.0
52 35 29	35	136 – 230	280	160	135	247	347	180	120	26	14	12	102	15.5

Double cylinder roller bearings Type 53





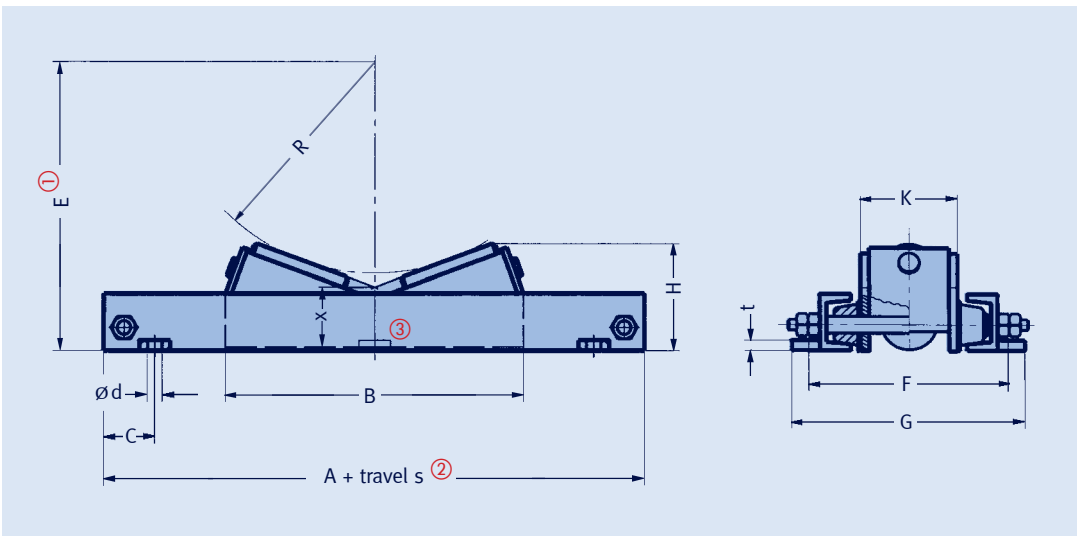
Double cylinder rollers bearing type 53 08 19 to 53 12 19

Surface:
hot dip galvanized

type	load F_N [kN]	R	A_1	A_2	B	C	E ① min.	E ① max.	F	G	a	b	s	x	weight [kg]
53 08 19	8	30 – 190	210	190	80	65	72	242	140	60	20	10	5	40	2.5
53 16 19	16	85 – 310	310	285	100	90	135	375	230	75	24	12	6	45	5.5
53 35 19	35	175 – 440	420	370	130	110	240	520	320	90	26	14	10	53	14.0
53 60 19	60	250 – 520	490	430	150	135	329	615	370	100	31	18	12	63	23.0
53 12 19	120	400 – 675	620	525	180	165	495	785	460	115	31	22	18	70	48.0

① E = 1.064 x R + x

Order details:
double cylinder roller bearing
type 53 .. 19



Double cylinder roller bearings (laterally movable) type 53 08 29 to 53 12 29

travel s = lateral pipe movement

Surface:
hot dip galvanized

type	load F_N [kN]	R	A	B	C	ød	E ① min.	E ① max.	F	G	H	K	t	x	weight [kg] for s = 100mm	weight [kg] + per 100mm
53 08 29	8	30 – 190	260	210	50	10	72	242	145	165	65	60	5	40	6	0.6
53 16 29	16	85 – 310	350	300	50	12	135	375	160	185	90	75	5	45	10	0.6
53 35 29	35	175 – 440	475	410	60	14	240	520	215	245	110	100	6	53	23	1.0
53 60 29	60	250 – 520	530	465	70	18	329	615	250	290	130	120	8	63	35	1.0
53 12 29	120	400 – 675	700	635	80	23	495	785	315	360	160	145	10	70	70	1.7

① E = 1.064 x R + x
② Travel s = 100...600mm.
③ Middle fixed point from travel s = 300mm.

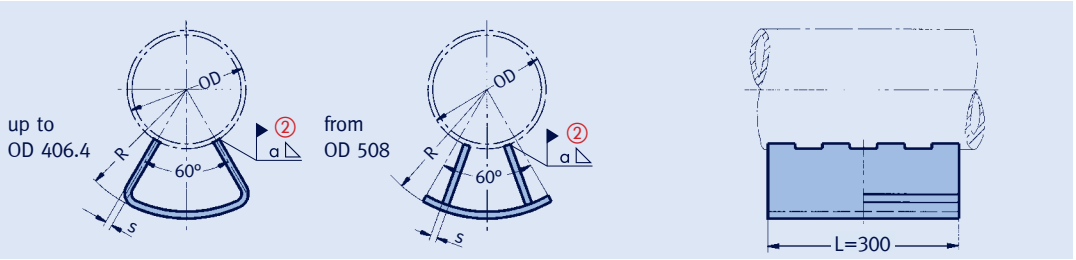
Order details:
double cylinder roller bearing (laterally movable)
type 53 .. 29
with s = ...mm

Weld-on pipe saddles Type 54
Pipe saddles with clamps Type 54

Weld-on pipe saddles
type 54 06 19 to 54 81 19

Material:
plate s ≤ 15mm: S235JR
plate s ≥ 20mm: S355J2

Surface:
weldable primer



type	load F_N [kN] ①	OD	R	a②	s	weight [kg]
54 06 19	1.4	60.3	80 – 180	3.0	3	1.4 – 3.5
54 08 19	1.4	76.1	90 – 190	3.0	3	1.5 – 3.7
54 09 19	1.4	88.9	95 – 195	3.0	3	1.5 – 3.8
54 11 19	1.8	114.3	110 – 210	3.0	3	1.5 – 4.0
54 14 19	4.0	139.7	120 – 220	3.0	4	2.0 – 5.0
54 17 19	4.0	168.3	135 – 235	3.0	5	3.0 – 6.5
54 19 19	5.0	193.7	150 – 250	3.0	5	3.0 – 6.8
54 22 19	8.0	219.1	160 – 260	4.0	6	4.0 – 8.0
54 27 19	12	273.0	190 – 290	4.0	10	6.7 – 13.5
54 32 19	20	323.9	215 – 315	4.0	12	9.6 – 18
54 36 19	20	355.6	230 – 330	4.0	12	10 – 18
54 41 19	38	406.4	255 – 355	5.0	15	13 – 25
54 51 19	50	508.0	325 – 415	5.0	10	10 – 16
54 61 19	65	609.6	375 – 465	5.0	12	12 – 21
54 71 19	100	711.2	430 – 520	6.0	15	16 – 26
54 81 19	120	812.8	480 – 570	6.0	20	19 – 33

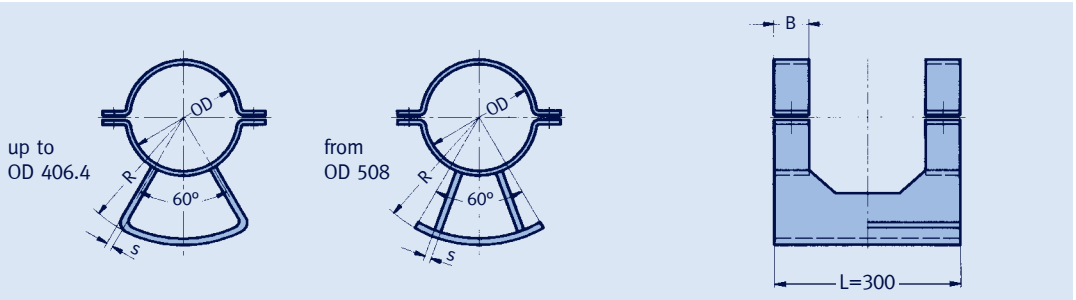
① Load at pipe temperature ≤ 150°C

② Minimum weld seam

Order details:
weld-on pipe saddle
type 54 .. 19
R = ...mm

Pipe saddles with clamps
type 54 06 29 to 54 81 29

Surface:
hot dip galvanized

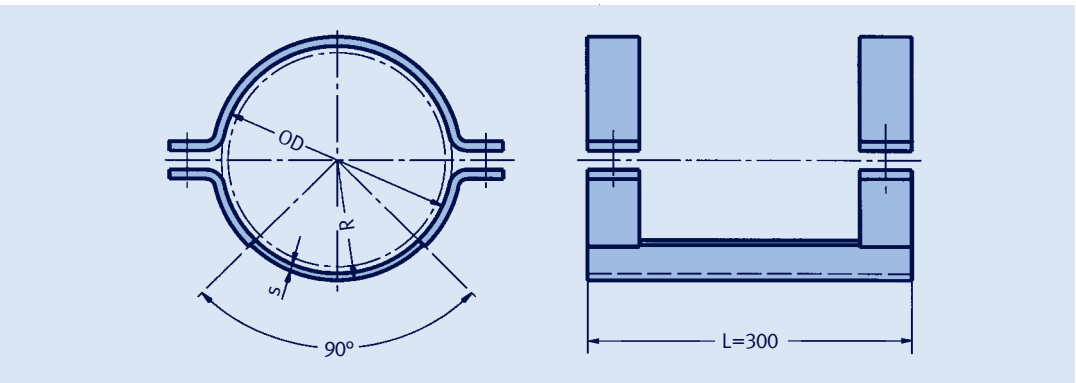


type	load F_N [kN] ①	OD	R	B	s	weight [kg]
54 06 29	1.4	60.3	80 – 180	40	3	2.5 – 4.8
54 08 29	1.4	76.1	90 – 190	40	3	2.8 – 5.8
54 09 29	1.4	88.9	95 – 195	40	3	3.1 – 6.0
54 11 29	1.8	114.3	110 – 210	50	3	5.0 – 7.0
54 14 29	4.0	139.7	120 – 220	50	4	6.0 – 9.0
54 17 29	4.0	168.3	135 – 235	50	5	7.0 – 12
54 19 29	5.0	193.7	150 – 250	50	5	8.0 – 13
54 22 29	8.0	219.1	160 – 260	50	6	9.0 – 15
54 27 29	12	273.0	190 – 290	60	10	15 – 20
54 32 29	20	323.9	215 – 315	60	12	19 – 26
54 36 29	20	355.6	230 – 330	60	12	21 – 30
54 41 29	38	406.4	255 – 355	70	15	30 – 40
54 51 29	50	508.0	325 – 415	70	10	32 – 38
54 61 29	65	609.6	375 – 465	90	12	63 – 72
54 71 29	100	711.2	430 – 520	90	15	75 – 86
54 81 29	120	812.8	480 – 570	90	20	84 – 98

① Load at pipe temperature ≤ 150°C

Order details:
pipe saddle with clamps
type 54 .. 29
R = ...mm

Pipe trays with clamps Type 54
Lift-off restraints Type 55

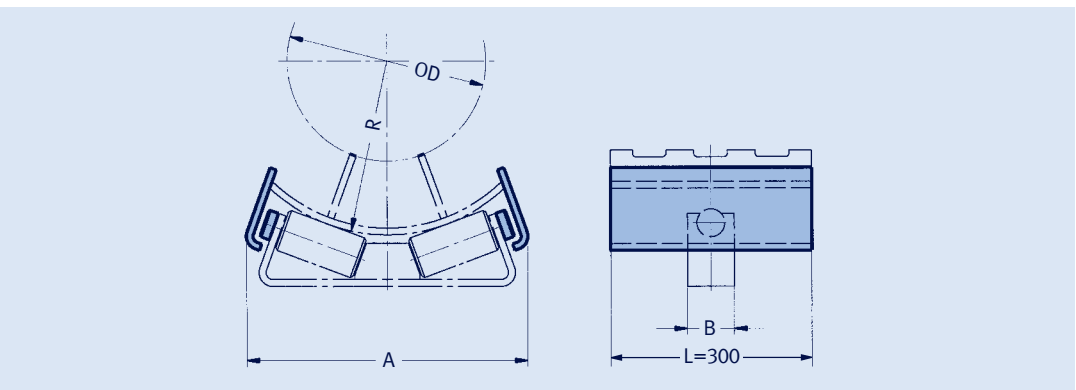


Pipe trays with clamps type 54 06 39 to 54 81 39

Surface:
hot dip galvanized

type	load F_N [kN]	OD	R	s	weight [kg]
54 06 39	0.8	60.3	34	3	1.7
54 08 39	0.8	76.1	41	3	2.0
54 09 39	1.2	88.9	48	5	2.6
54 11 39	1.5	114.3	62	5	4.7
54 14 39	4.0	139.7	75	5	5.4
54 17 39	4.0	168.3	90	5	5.9
54 19 39	5.0	193.7	102	5	6.6
54 22 39	8.0	219.1	116	6	7.5
54 27 39	10	273.0	143	6	11
54 32 39	15	323.9	170	8	14
54 36 39	20	355.6	188	10	16
54 41 39	35	406.4	214	10	24
54 51 39	40	508.0	264	10	28
54 61 39	60	609.6	317	12	56
54 71 39	80	711.2	370	15	68
54 81 39	100	812.8	421	15	75

Order details:
pipe tray with clamps
type 54 .. 39



Lift-off restraints type 55 08 19 to 55 12 19

Surface:
hot dip galvanized

type	compatible with roller bearing, type	A	B	R
55 08 19	53 08 19	226	80	30 – 190
55 16 19	53 16 19	335	100	85 – 310
55 35 19	53 35 19	455	130	175 – 440
55 60 19	53 60 19	560	150	250 – 520
55 12 19	53 12 19	700	180	400 – 675

Order details:
lift-off restraint
type 55 .. 19
for special pipe saddles
type 54 .. .9
R = ...mm

Cryogenic pipe supports HIPAC® Type 56, 57

Warehouse for moulded insulations

Preassembled insulated supports

Special design for ø 1625.6mm

insulation thickness [mm]	insulation level thickness [mm]
80	40 / 40
100	50 / 50
130	50 / 40 / 40
150	50 / 50 / 50
180	50 / 80 / 50
200	50 / 100 / 50
250	75 / 100 / 75

Supports for cold and cryogenic applications

LISEGA offers a complete product program of insulated pipe supports for all kinds of low temperature pipe systems. These products are normally used in industrial processes for the production, transport and distribution of liquefied gases. These can be propane and butane (LPG), methane (LNG), ethylene, nitrogen, ammonia etc..

LISEGA insulated pipe supports are standardized and designed according to recognized international technical codes and standards. They cover pipe sizes ranging from OD 21.3mm to OD 965.2mm, with insulation thicknesses from 25mm to 250mm. The supports are made from materials suitable for the specified loads and temperatures (temperature of medium as low as -196°C).

Insulating material

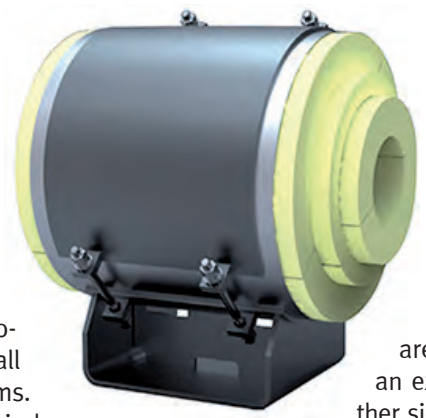
The material of the insulated standard pipe supports is made from fire-retarding polyurethane foam of high density (HD-PUF) and forms an integral part of the piping insulation.

Production of HD-PUF insulation

The HD-PUF insulation is molded in heavy duty molds under carefully controlled conditions in respect of temperature and air humidity. This process ensures dimensional stability as well as clean sharp edges that fit neatly with the adjacent line insulation material on site.

To guarantee form stability, the molds are stored for a fixed period of time in order to cure. For insulations of higher thicknesses stepped joints are provided to match the layering of the adjoining line insulation. This method, also known as “shiplapping“, provides a reliable interlocking connection to each layer and prevents a direct heat path from the surface of the insulation through to the surface of the piping.

The stepped joints are 25mm long but can be supplied in 50mm steps on request. Insulation foam with thicknesses up to 50mm are single-layer designs without stepping.



Insulation foam with thicknesses of 80mm to 100mm are single layer with an extended step at either side. For type 56, insulation foam thicknesses of 130mm and higher are supplied as double-layer with two steps. To achieve load transmission for axial stop type 57, the HD-PUF insulation is designed as single-layers.

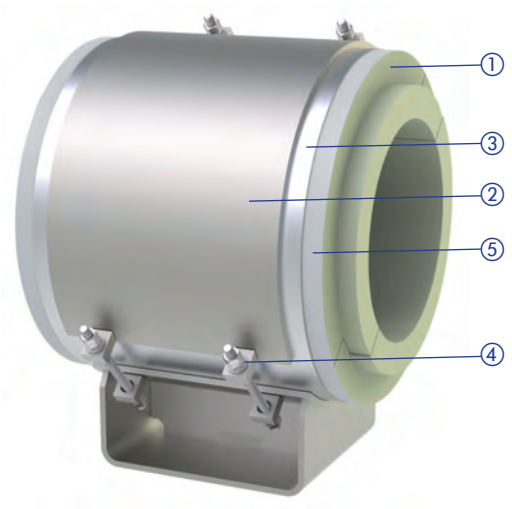
Both single-layer and double-layer HD-PUF insulation have stepped longitudinal joints. The size of these joints must be adjusted during installation to a specified gap dimension to ensure a clamping force from the insulated, pipe support on the piping. Once installed the longitudinal gaps are then filled with a flexible insulating foam. The clamping force, which is applied by means of disc spring bolting, prevents relative movement between pipe support and piping.

A laminated aluminum/polyester vapor barrier is factory-bonded to the outer surface of the HD-PUF insulation. The vapor barrier overlaps the longitudinal joints and is sealed at site with a special vapor barrier adhesive tape. Directly after installation of the insulated pipe support, all exposed HD-PUF surfaces must be protected from moisture. For this purpose a cryogenic, elastomeric coating is applied as vapor barrier.

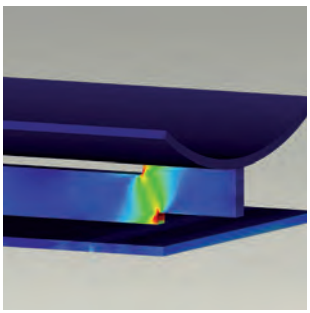
For the HD-PUF insulation three standard color-coded densities for various load requirements are available.

160kg/m³ – yellow
224kg/m³ – red
320kg/m³ – green

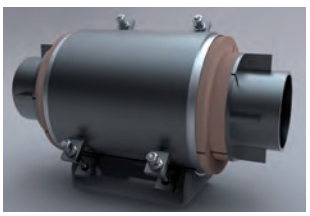
Special advantages of HIPAC® insulated pipe supports



① HD-PUF insulation with stepped longitudinal joints and stepped front ends
② steel cradle
③ metal protective shield
④ disc spring bolting
⑤ vapor barrier



Finite element analysis of a special design



Insulated standard pipe support type 57

Insulated pipe support base

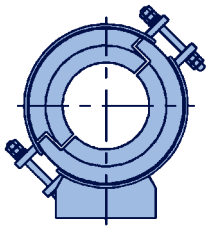
LISEGA standardized insulated pipe supports are designed to be clamped mechanically to the piping by means of disc spring bolting. The pipe support steel cradle, which houses the HD-PUF insulation, is made of carbon steel and hot-dip galvanized as standard.

Material grades, welding and surface treatment comply with the LISEGA standard specifications. The integrated LISEGA quality assurance system applies to both the manufacture and preassembly of the pipe supports. Inspection and testing procedures guarantee compliance with the required specifications.

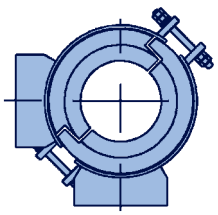
LISEGA insulated standard pipe supports are supplied with detailed installation instructions. Every support is clearly marked according to the LISEGA type designation system. The flexible gap filler insulation foam, as well as the special vapor barrier sealing tape are part of the scope of supply. Additional site installation materials such as cryogenic adhesives and mastics can be supplied on request.

LISEGA insulated pipe supports are completely preassembled and supplied in appropriate packaging to protect them from surface damage and humidity during transport and storage.

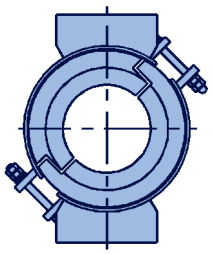
Preassembled insulated pipe supports



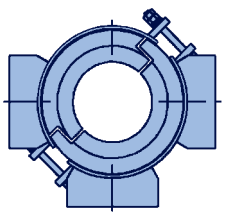
Type 56 .. ..



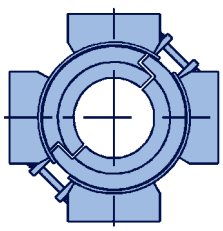
Type 56 .. .. G2A



Type 56 .. .. G2P



Type 56 .. .. G3



Type 56 .. .. G4

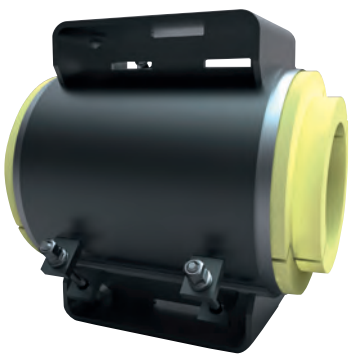
Design

Type 56 is a conventional insulated pipe support and functions as a slide or guide support. Type 57 is similar to type 56 but serves as an axial stop that absorbs increased axial loads by means of thrust rings. The thrust rings on the piping consist of two half-rings which are welded together at site to form a single ring. The rings, which are movable on the piping, are fixed by means of shear lugs welded onto the pipe.

This patented design offers the advantage of fixing the insulated pipe support to the piping after final positioning. There is no need to disassemble any existing or already installed steelwork. The thrust rings and shear lugs are made of stainless steel and form part of the scope of supply.

Double and multiple clamp base pipe supports

For high vertical loads or high lateral loads, double clamp bases or guided supports are required. For this purpose, LISEGA's insulated pipe supports can be extended as required. Each variant is given a suffix after the 6th digit which describes the type of guide used. The pipe support can be ordered in the following designs:



Insulated double clamp base type 56 .. .. G2P

G2A: Angulated clamp base pipe support (laterally guided)
G2P: Double clamp base pipe support (parallely guided)
G3: Triple clamp base pipe support
G4: Quadruple clamp base pipe support

Type 56 as well as type 57 can be ordered with these guide options. A type 57 can be used e.g. as a quadruple pipe support in a vertical pipe.

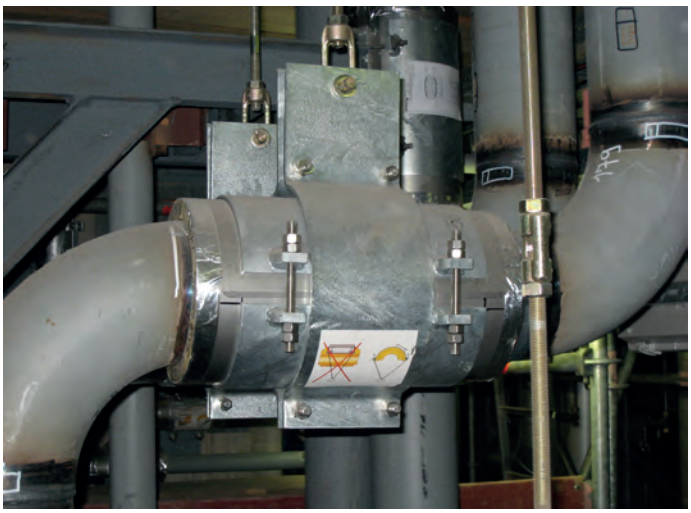
Special design

LISEGA takes pride in offering solutions to their clients and will gladly assist in any special inquiry.

- **Special pipe sizes can be accommodated.**
- **For large axial movements, special lengths can be supplied.**
- **The use of an insulated pipe support as a hanger (e.g. in combination with spring or constant hangers) is possible. In this case the shoe of the clamp base is replaced by a special pipe clamp type 43. The clamp is then designed for the particular conditions existing in each case.**

- **Deviations from the standard HD-PUF densities can be supplied, e.g. a density of 500kg/m³ for high loads.**
- **The use of the pipe support on sliding components is possible. For this purpose a stainless steel plate is fixed to the underside of the shoe.**
- **For special applications when increased loads have to be absorbed, laminated wooden blocks can be utilized.**
- **The installation dimension 'E' can be adjusted but it must be considered that changes in the 'E' dimension can influence the design and the permissible loads. The actual operating loads must therefore be specified when ordering.**

All details required for product selection can be found in the special HIPAC® catalog.



Suspension with cryogenic pipe clamps

Cryogenic clamp base type 56

Pipes held in position with cryogenic supports

Final inspection of cryogenic clamp bases

Weld-on pipe shoes Type 57

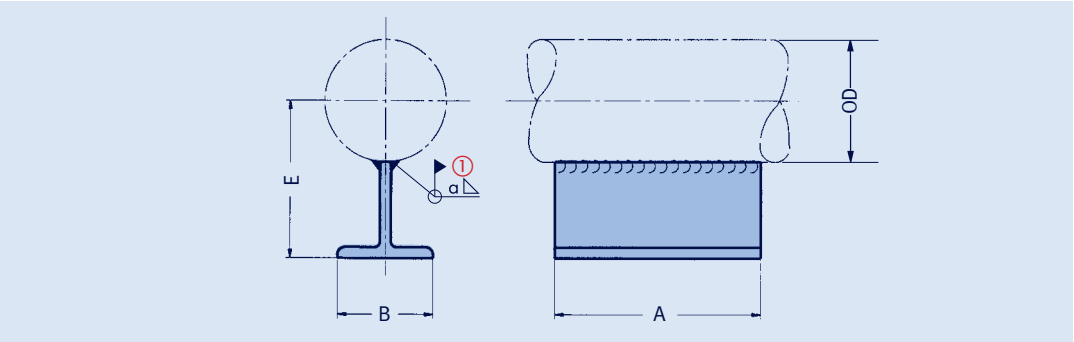
Weld-on pipe shoes made from T/U profiles type 57 .. 11 and 57 .. 12

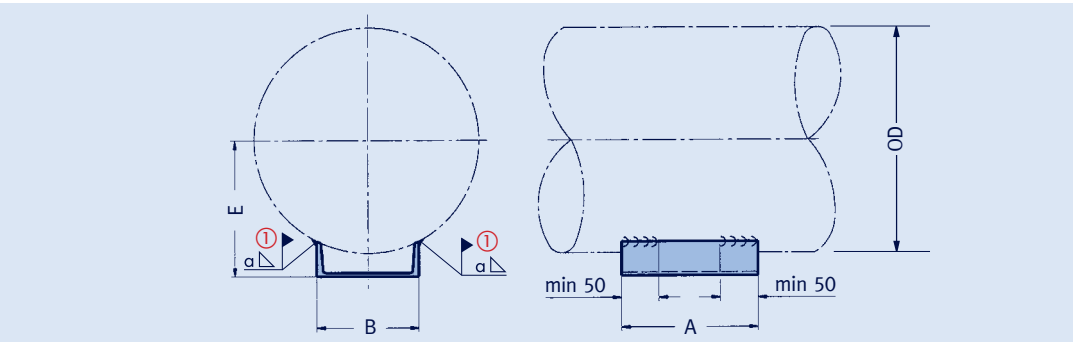
For use at low pipe loads and temperatures ≤ 80°C

Material: S235JR

Surface: weldable primer

Type designation:
57 .. 11 (T–Shoe)
57 .. 12 (U–Shoe)





① Weld seam on site – for specified weld seam thickness and permissible load, the weld seam stress is smaller than 50N/mm².

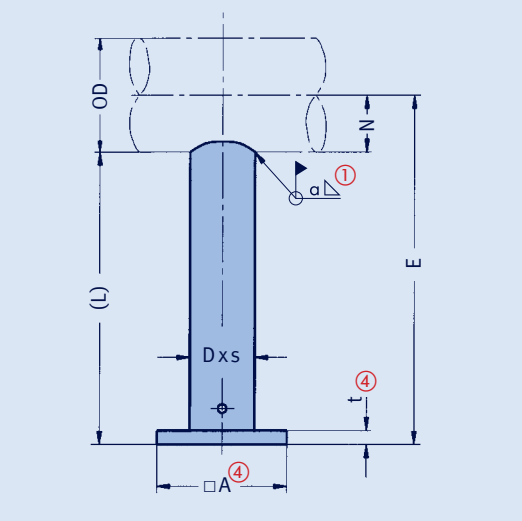
type	load F [kN] at 80°C	OD	A	B	E	a ①	weight [kg]
57 03 11	1.0	21.3	100	70	81	3.0	0.8
57 03 11	1.0	26.9	100	70	83	3.0	0.8
57 03 11	1.0	33.7	100	70	87	3.0	0.8
57 03 11	1.0	42.4	100	70	91	3.0	0.8
57 03 11	1.0	48.3	100	70	94	3.0	0.8
57 07 11	1.5	60.3	150	70	100	3.0	1.2
57 07 11	1.5	73.0	150	70	107	3.0	1.2
57 07 11	1.5	76.1	150	70	108	3.0	1.2
57 07 11	1.5	88.9	150	70	115	3.0	1.2
57 13 11	2.0	108.0	150	100	154	3.0	2.5
57 13 11	2.0	114.3	150	100	157	3.0	2.5
57 13 11	2.0	133.0	150	100	167	3.0	2.5
57 13 11	2.0	139.7	150	100	170	3.0	2.5
57 13 11	2.0	159.0	150	100	180	3.0	2.5
57 13 11	2.0	168.3	150	100	184	3.0	2.5
57 24 12	6.0	193.7	250	100	135	5.0	2.7
57 24 12	6.0	219.1	250	100	150	5.0	2.7
57 24 12	6.0	244.5	250	100	163	5.0	2.7
57 24 12	6.0	267.0	250	100	175	5.0	2.7
57 24 12	6.0	273.0	250	100	178	5.0	2.7
57 36 12	8.0	323.9	250	160	210	5.0	4.7
57 36 12	10	355.6	250	160	226	5.0	4.7
57 36 12	10	368.0	250	160	233	5.0	4.7
57 42 12	10	406.4	250	200	255	5.0	6.3
57 42 12	10	419.0	250	200	262	5.0	6.3
57 42 12	12	457.2	250	200	283	5.0	6.3
57 51 12	15	508.0	250	240	312	5.0	8.3
57 51 12	15	558.8	250	240	340	5.0	8.3
57 61 12	20	609.6	250	300	370	5.0	11.6
57 61 12	20	660.4	250	300	400	5.0	11.6

Order details:
weld-on pipe shoe type 57 .. 1.

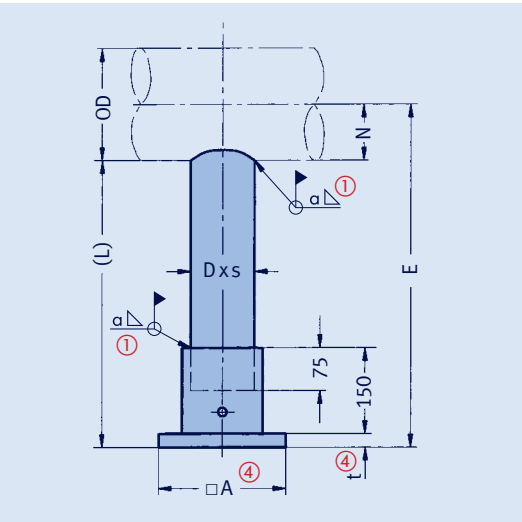
Stanchions for horizontal pipes Type 58

type ③	OD	D x s	stanchions type	α ②	N	E_{min}	E_{max}
58 05 .1	48.3	33.7 x 4.5	a	3.0	24	250	1000
58 06 .1	60.3	33.7 x 4.5	a	3.0	30	250	1000
58 06 .2	60.3	48.3 x 5.0	b	3.0	30	250	1100
58 07 .1	73.0	33.7 x 4.5	a	3.0	37	250	1000
58 07 .2	73.0	48.3 x 5.0	b	3.0	37	250	1100
58 08 .1	76.1	33.7 x 4.5	a	3.0	38	250	1000
58 08 .2	76.1	48.3 x 5.0	b	3.0	38	250	1100
58 09 .1	88.9	33.7 x 4.5	a	3.0	44	250	1000
58 09 .2	88.9	48.3 x 5.0	b	3.0	44	250	1100
58 10 .1	108.0	48.3 x 5.0	b	3.0	54	300	1150
58 10 .2	108.0	73.0 x 7.0	c	3.0	54	300	1150
58 11 .1	114.3	48.3 x 5.0	b	3.0	57	300	1150
58 11 .2	114.3	73.0 x 7.0	c	3.0	57	300	1150
58 13 .1	133.0	48.3 x 5.0	b	3.0	67	300	1150
58 13 .2	133.0	73.0 x 7.0	c	3.0	67	300	1150
58 14 .1	139.7	73.0 x 7.0	c	3.0	70	300	1150
58 14 .2	139.7	88.9 x 5.6	d	3.0	70	300	1150
58 16 .1	159.0	73.0 x 7.0	c	3.0	80	300	1150
58 16 .2	159.0	88.9 x 5.6	d	3.0	80	300	1150
58 17 .1	168.3	73.0 x 7.0	c	3.0	84	300	1150
58 17 .2	168.3	88.9 x 5.6	d	3.0	84	300	1150
58 19 .1	193.7	88.9 x 5.6	d	3.0	97	350	1150
58 19 .2	193.7	114.3 x 8.8	e	5.0	97	350	1150
58 22 .1	219.1	88.9 x 5.6	d	3.0	110	350	1200
58 22 .2	219.1	114.3 x 8.8	e	5.0	110	350	1200
58 24 .1	244.5	88.9 x 5.6	d	3.0	122	350	1200
58 24 .2	244.5	114.3 x 8.8	e	5.0	122	350	1200
58 26 .1	267.0	114.3 x 8.8	e	5.0	134	350	1200
58 26 .2	267.0	139.7 x 10	f	7.0	134	350	1200
58 27 .1	273.0	114.3 x 8.8	e	5.0	137	350	1200
58 27 .2	273.0	139.7 x 10	f	7.0	137	350	1200
58 32 .1	323.9	139.7 x 10	f	7.0	162	400	1250
58 32 .2	323.9	219.1 x 8.0	g	5.0	162	400	1250
58 36 .1	355.6	139.7 x 10	f	7.0	178	400	1250
58 36 .2	355.6	219.1 x 8.0	g	5.0	178	400	1250
58 37 .1	368.0	139.7 x 10	f	7.0	184	400	1250
58 37 .2	368.0	219.1 x 8.0	g	5.0	184	400	1250
58 41 .1	406.4	139.7 x 10	f	7.0	203	450	1300
58 41 .2	406.4	219.1 x 8.0	g	5.0	203	450	1300
58 42 .1	419.0	139.7 x 10	f	7.0	210	450	1300
58 42 .2	419.0	219.1 x 8.0	g	5.0	210	450	1300
58 46 .1	457.2	219.1 x 8.0	g	5.0	229	500	1300
58 46 .2	457.2	323.9 x 10	h	7.0	229	500	1300
58 51 .1	508.0	219.1 x 8.0	g	5.0	254	500	1350
58 51 .2	508.0	323.9 x 10	h	7.0	254	500	1350
58 56 .1	558.8	219.1 x 8.0	g	5.0	279	550	1350
58 56 .2	558.8	323.9 x 10	h	7.0	279	550	1350
58 61 .1	609.6	323.9 x 10	h	7.0	305	550	1400
58 66 .1	660.4	323.9 x 10	h	7.0	330	600	1400
58 71 .1	711.2	323.9 x 10	h	7.0	356	600	1450
58 76 .1	762.0	323.9 x 10	h	7.0	381	650	1450
58 81 .1	812.8	323.9 x 10	h	7.0	406	650	1500
58 91 .1	914.4	323.9 x 10	h	7.0	457	700	1550

For the selection of stanchions consult the table and diagram on page 5.15.



Type 58 .. 11
Type 58 .. 12



Type 58 .. 21
Type 58 .. 22

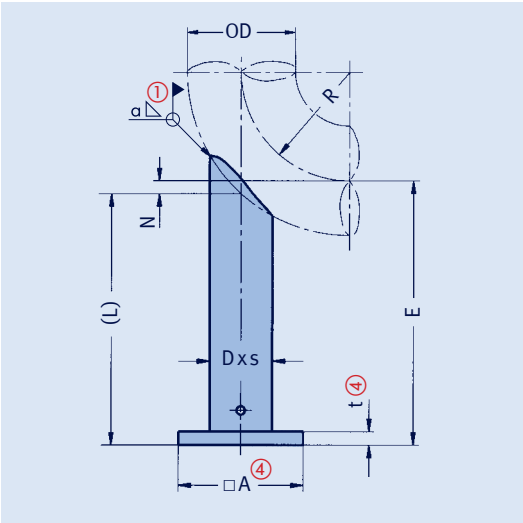
① ... ④ See page 5.15.

Example: Telescopic stanchion for pipe
OD = 244.5mm, E = 800mm (as sliding shoe).
The stanchion length amounts to: L = E-N
(see data in selection table)
L = 800mm – 122mm = 678mm.

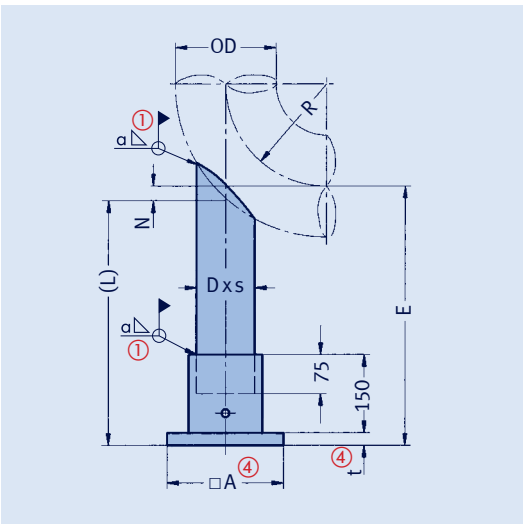
For stanchion D = 88.9 mm (designation 'd').
Permissible load = 0.36 x 11kN
(see table and diagram on page 5.15) = 3.96kN.

Order details:
stanchion for
horizontal pipes
type 58 .. .., E = ...mm

Stanchions for short radius elbows (R ≈ OD) Type 58



Type 58 .. 13
Type 58 .. 14



Type 58 .. 23
Type 58 .. 24

①...④ See page. 5.15.

Example: Stanchion for short radius elbow radius R ≈ OD, OD = 419mm, E = 750mm (as anchor). Stanchion length: L = E-N (see data in selection table), L = 750mm – 50mm = 700mm.

For stanchion D = 139.7mm (designation 'f'). Permissible load = 0.41 x 22.5kN (see table and diagram on page 5.15) = 9.2kN.

stanchions type ③	OD	D x s	stanchions type	α ②	N	E_{min}	E_{max}
58 05 .3	48.3	33.7 x 4.5	a	3.0	10	250	1000
58 06 .3	60.3	33.7 x 4.5	a	3.0	10	250	1000
58 06 .4	60.3	48.3 x 5.0	b	3.0	10	250	1100
58 07 .3	73.0	33.7 x 4.5	a	3.0	15	250	1000
58 07 .4	73.0	48.3 x 5.0	b	3.0	15	250	1100
58 08 .3	76.1	33.7 x 4.5	a	3.0	15	250	1000
58 08 .4	76.1	48.3 x 5.0	b	3.0	15	250	1100
58 09 .3	88.9	33.7 x 4.5	a	3.0	15	250	1000
58 09 .4	88.9	48.3 x 5.0	b	3.0	15	250	1100
58 10 .3	108.0	48.3 x 5.0	b	3.0	15	250	1100
58 10 .4	108.0	73.0 x 7.0	c	3.0	15	250	1100
58 11 .3	114.3	48.3 x 5.0	b	3.0	20	250	1100
58 11 .4	114.3	73.0 x 7.0	c	3.0	20	250	1100
58 13 .3	133.0	48.3 x 5.0	b	3.0	20	250	1100
58 13 .4	133.0	73.0 x 7.0	c	3.0	20	250	1100
58 14 .3	139.7	73.0 x 7.0	c	3.0	25	300	1100
58 14 .4	139.7	88.9 x 5.6	d	3.0	25	300	1100
58 16 .3	159.0	73.0 x 7.0	c	3.0	25	300	1100
58 16 .4	159.0	88.9 x 5.6	d	3.0	25	300	1100
58 17 .3	168.3	73.0 x 7.0	c	3.0	30	300	1100
58 17 .4	168.3	88.9 x 5.6	d	3.0	30	300	1100
58 19 .3	193.7	88.9 x 5.6	d	3.0	30	300	1100
58 19 .4	193.7	114.3 x 8.8	e	5.0	30	300	1100
58 22 .3	219.1	88.9 x 5.6	d	3.0	35	300	1100
58 22 .4	219.1	114.3 x 8.8	e	5.0	35	300	1100
58 24 .3	244.5	88.9 x 5.6	d	3.0	35	300	1100
58 24 .4	244.5	114.3 x 8.8	e	5.0	35	300	1100
58 26 .3	267.0	114.3 x 8.8	e	5.0	40	300	1100
58 26 .4	267.0	139.7 x 10	f	7.0	40	300	1100
58 27 .3	273.0	114.3 x 8.8	e	5.0	45	350	1100
58 27 .4	273.0	139.7 x 10	f	7.0	45	350	1100
58 32 .3	323.9	139.7 x 10	f	7.0	50	350	1100
58 32 .4	323.9	219.1 x 8.0	g	5.0	50	350	1100
58 36 .3	355.6	139.7 x 10	f	7.0	40	350	1100
58 36 .4	355.6	219.1 x 8.0	g	5.0	40	350	1100
58 37 .3	368.0	139.7 x 10	f	7.0	45	350	1100
58 37 .4	368.0	219.1 x 8.0	g	5.0	45	350	1100
58 41 .3	406.4	139.7 x 10	f	7.0	50	350	1100
58 41 .4	406.4	219.1 x 8.0	g	5.0	50	350	1100
58 42 .3	419.0	139.7 x 10	f	7.0	50	350	1100
58 42 .4	419.0	219.1 x 8.0	g	5.0	50	350	1100
58 46 .3	457.2	219.1 x 8.0	g	5.0	55	400	1150
58 46 .4	457.2	323.9 x 10	h	7.0	55	400	1150
58 51 .3	508.0	219.1 x 8.0	g	5.0	60	400	1150
58 51 .4	508.0	323.9 x 10	h	7.0	60	400	1150
58 56 .3	558.8	219.1 x 8.0	g	5.0	65	450	1150
58 56 .4	558.8	323.9 x 10	h	7.0	65	450	1150
58 61 .3	609.6	323.9 x 10	h	7.0	70	450	1150
58 66 .3	660.4	323.9 x 10	h	7.0	80	450	1150
58 71 .3	711.2	323.9 x 10	h	7.0	85	450	1150
58 76 .3	762.0	323.9 x 10	h	7.0	90	450	1150
58 81 .3	812.8	323.9 x 10	h	7.0	95	500	1150
58 91 .3	914.4	323.9 x 10	h	7.0	110	550	1200

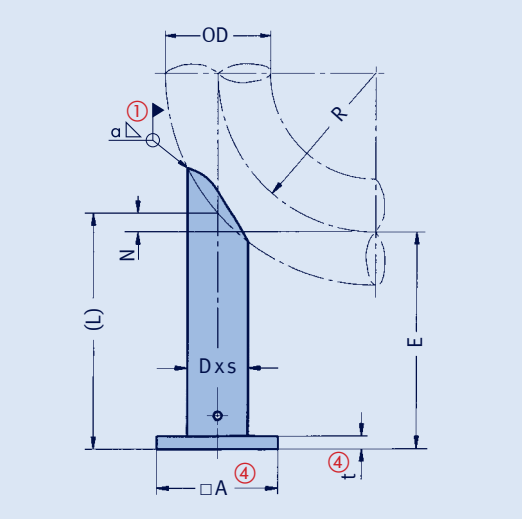
Order details:
stanchion for short radius elbows R ≈ OD
type 58 .. .., E = ...mm

For the selection of stanchions consult the table and diagram on page 5.15.

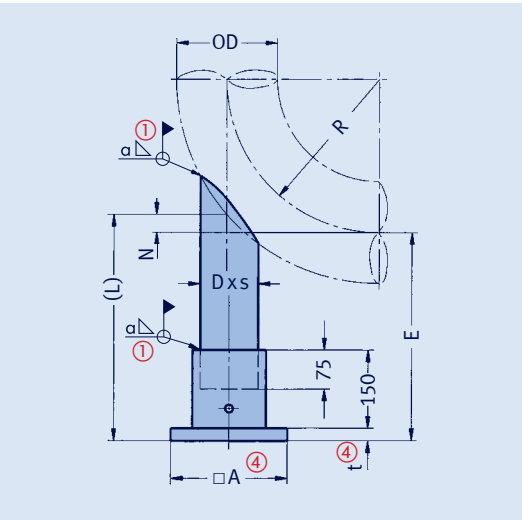
Stanchions for long radius elbows (R ≈ 1.5 OD) Type 58

type ③	OD	D x s	stanchions type	α ②	N	E_{min}	E_{max}
58 05 .5	48.3	33.7 x 4.5	a	3.0	0	200	1000
58 06 .5	60.3	33.7 x 4.5	a	3.0	0	250	1000
58 06 .6	60.3	48.3 x 5.0	b	3.0	0	250	1050
58 07 .5	73.0	33.7 x 4.5	a	3.0	5	250	1000
58 07 .6	73.0	48.3 x 5.0	b	3.0	5	250	1050
58 08 .5	76.1	33.7 x 4.5	a	3.0	0	250	1000
58 08 .6	76.1	48.3 x 5.0	b	3.0	0	250	1050
58 09 .5	88.9	33.7 x 4.5	a	3.0	5	250	1000
58 09 .6	88.9	48.3 x 5.0	b	3.0	5	250	1050
58 10 .5	108.0	48.3 x 5.0	b	3.0	5	250	1050
58 10 .6	108.0	73.0 x 7.0	c	3.0	5	250	1050
58 11 .5	114.3	48.3 x 5.0	b	3.0	10	250	1050
58 11 .6	114.3	73.0 x 7.0	c	3.0	10	250	1050
58 13 .5	133.0	48.3 x 5.0	b	3.0	10	250	1050
58 13 .6	133.0	73.0 x 7.0	c	3.0	10	250	1050
58 14 .5	139.7	73.0 x 7.0	c	3.0	15	250	1050
58 14 .6	139.7	88.9 x 5.6	d	3.0	15	250	1050
58 16 .5	159.0	73.0 x 7.0	c	3.0	15	250	1050
58 16 .6	159.0	88.9 x 5.6	d	3.0	15	250	1050
58 17 .5	168.3	73.0 x 7.0	c	3.0	15	250	1050
58 17 .6	168.3	88.9 x 5.6	d	3.0	15	250	1050
58 19 .5	193.7	88.9 x 5.6	d	3.0	20	250	1050
58 19 .6	193.7	114.3 x 8.8	e	5.0	20	250	1050
58 22 .5	219.1	88.9 x 5.6	d	3.0	25	250	1050
58 22 .6	219.1	114.3 x 8.8	e	5.0	25	250	1050
58 24 .5	244.5	88.9 x 5.6	d	3.0	25	250	1050
58 24 .6	244.5	114.3 x 8.8	e	5.0	25	250	1050
58 26 .5	267.0	114.3 x 8.8	e	5.0	30	250	1050
58 26 .6	267.0	139.7 x 10	f	7.0	30	250	1050
58 27 .5	273.0	114.3 x 8.8	e	5.0	30	250	1050
58 27 .6	273.0	139.7 x 10	f	7.0	30	250	1050
58 32 .5	323.9	139.7 x 10	f	7.0	40	300	1050
58 32 .6	323.9	219.1 x 8.0	g	5.0	40	300	1050
58 36 .5	355.6	139.7 x 10	f	7.0	65	250	1000
58 36 .6	355.6	219.1 x 8.0	g	5.0	65	250	1000
58 37 .5	368.0	139.7 x 10	f	7.0	65	250	1000
58 37 .6	368.0	219.1 x 8.0	g	5.0	65	250	1000
58 41 .5	406.4	139.7 x 10	f	7.0	70	300	1000
58 41 .6	406.4	219.1 x 8.0	g	5.0	70	300	1000
58 42 .5	419.0	139.7 x 10	f	7.0	75	300	1000
58 42 .6	419.0	219.1 x 8.0	g	5.0	75	300	1000
58 46 .5	457.2	219.1 x 8.0	g	5.0	80	300	1000
58 46 .6	457.2	323.9 x 10	h	7.0	80	300	1000
58 51 .5	508.0	219.1 x 8.0	g	5.0	90	350	1000
58 51 .6	508.0	323.9 x 10	h	7.0	90	350	1000
58 56 .5	558.8	219.1 x 8.0	g	5.0	100	350	1000
58 56 .6	558.8	323.9 x 10	h	7.0	100	350	1000
58 61 .5	609.6	323.9 x 10	h	7.0	110	400	950
58 66 .5	660.4	323.9 x 10	h	7.0	115	400	950
58 71 .5	711.2	323.9 x 10	h	7.0	125	450	950
58 76 .5	762.0	323.9 x 10	h	7.0	135	450	950
58 81 .5	812.8	323.9 x 10	h	7.0	145	500	950
58 91 .5	914.4	323.9 x 10	h	7.0	160	550	900

For the selection of stanchions consult the table and diagram on page 5.15.



Type 58 .. 15
Type 58 .. 16



Type 58 .. 25
Type 58 .. 26

①...④ See page 5.15.

Example: Stanchion for long radius elbow radius R ≈ 1.5 OD, OD = 419mm, E = 750mm (as anchor). Stanchion length: L = E+N (see data in selection table), L = 750mm +75mm = 825mm.

For stanchion D = 139.7mm (designation 'f'). Permissible load = 0.37 x 22.5kN (see table on page 5.15) = 8.3kN.

Order details:
stanchion for long radius elbows
R ≈ 1.5 OD
type 58 .. .., E = ...mm

Stanchions Type 58

① Field weld

② The weld seam stress amounts to max. 50N/mm² for the specified weld seam thickness and permissible loads.

③ Type designation:
58 .. 1. stanchion
58 .. 2. telescopic stanchion

④ Table data A x t.

⑤ The permissible loading of the stanchion in dependence on length can be found in the diagram.

⑥ Max. lateral loading of stanchion = 100% of specified vertical load.

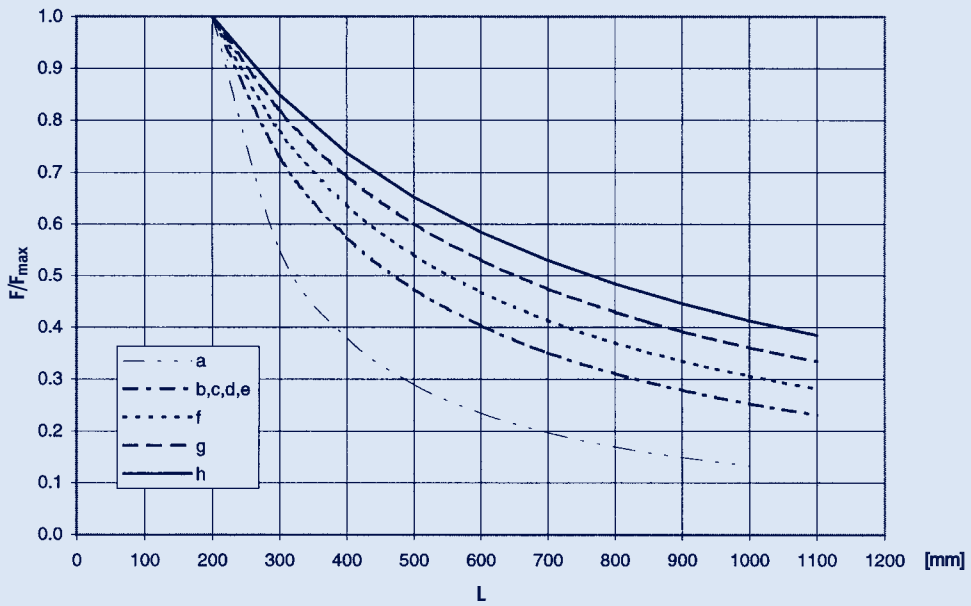
For welding designs of this type, the load transmission to the piping, and observing the allowable stress of the pipes must be guaranteed by the user.

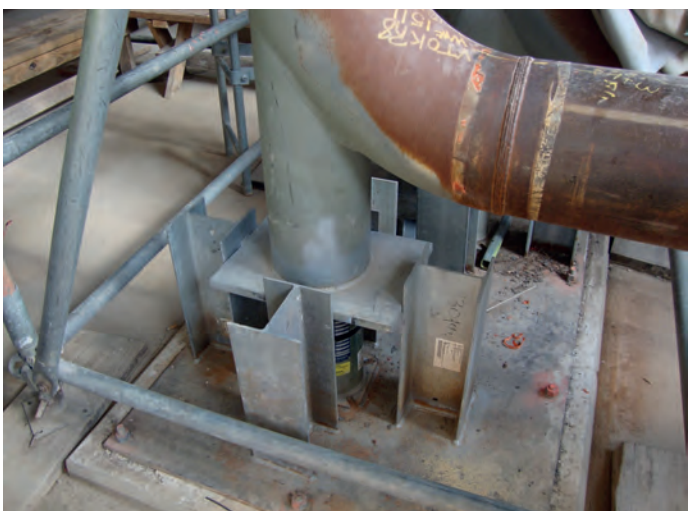
Materials:
base plate S235JR
S355J2
stanchion P235GH

Surface protection:
weldable primer

pipe type	D x s	④ A x t	maximum permissible load at 80°C vertical load only [kN]	⑤ sliding [kN]	⑥ fixed anchor [kN]	weight [kg] for L = 200mm 58 .. 1.	58 .. 2.	+ per 100mm
a	33.7 x 4.5	90 x 10	9.5	1.9	1.1	1.3	1.8	0.32
b	48.3 x 5.0	115 x 10	22	3.7	2.3	2.1	4.0	0.53
c	73.0 x 7.0	130 x 10	34	7.9	5.0	3.5	4.4	1.1
d	88.9 x 5.6	150 x 10	40	11	7.1	4.0	6.6	1.2
e	114.3 x 8.8	190 x 12	78	25	16.0	7.7	10.8	2.3
f	139.7 x 10	215 x 15	96	35	22.5	11.7	15.8	3.2
g	219.1 x 8.0	305 x 20	150	69	43.5	22.1	26.8	4.2
h	323.9 x 10	405 x 25	330	185	113.0	45.7	54.1	7.7

Permissible load in dependence on length of stanchion for slide bearing or fixed point

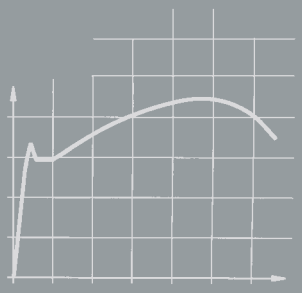


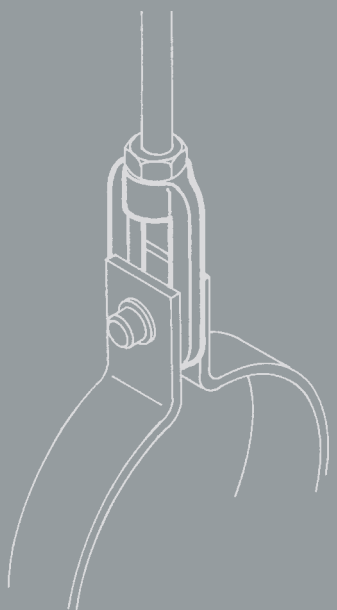


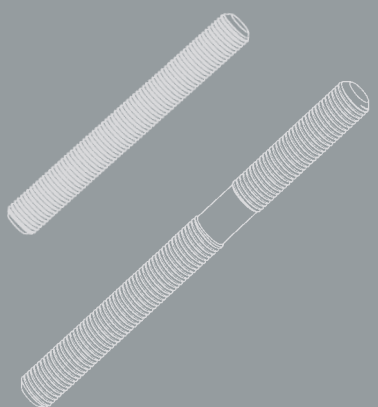
Type 58 stanchion for pipe elbows as stop free of moments in X-Y direction with type 29 spring support

Type 58 stanchions as guides for horizontally running pipe system with type 29 spring support

Threaded connecting elements

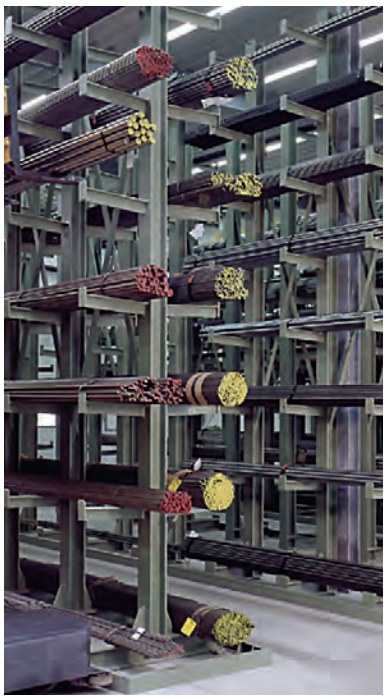


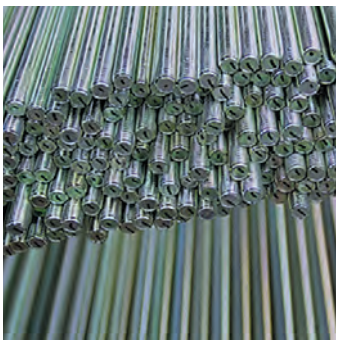




PRODUCT GROUP 6

LISEGA





Thread connecting elements

Contents **Page**

Threaded connections Type 60 to 64

Precision-fit threads, reliable material properties and design with sufficient load reserves are prerequisites for the reliability of the whole load chain.

Eye nut type 60

Threaded clevis with pin type 61

Turnbuckle type 62

Rod coupling type 64

The connections in product group 6 are specially shaped bolting components to attach the connecting rods to other support components. They connect components in the load chains with their counterparts, such as lugs, clevis or eye plates.

The connections in product group 6 form an independent group within the modular system and were specially designed for optimum use as pipe support components.

They are largely drop forged and, except for turnbuckle type 62, so designed that they enable a little length regulation despite low installation heights.

The permissible loads correspond to the load tables for statically determined components on page 0.6 of the **technical specifications**.

Eye nut type 60 is used as a transition from a rod to a pin connection; threaded clevis with pin type 61 joins a rod to a lug connection.

Turnbuckle type 62 is fitted with a right-hand thread on one side and a left-hand thread on the other. It is used in combination with tie rod type 65 for length regulation and the pre-stressing of load chains.

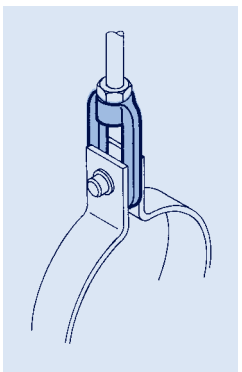
If required, rod coupling type 64 is used to form rod lengths longer than 12 foot [3.66m].

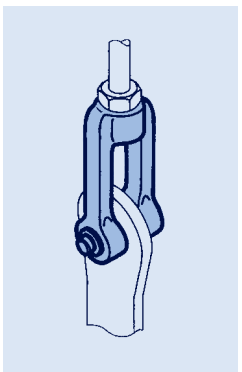
All threads (except in turnbuckle type 62) are right-hand and available in both UNC and metric versions.

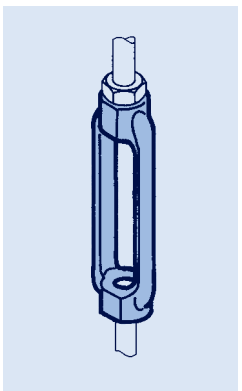
For corrosion protection the components are electro galvanized as standard, coating thickness approximately 0.47 – 0.59 mil [12-15µm]. For use in particularly aggressive atmospheres hot dip galvanized components can be supplied.

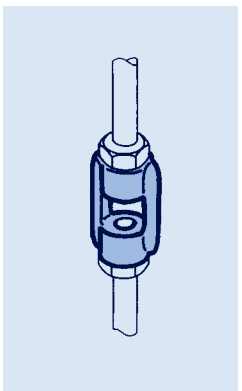
If required, the components can be supplied with material certificates.

It is often necessary to use the connection components in areas above the standard field of application, where higher temperatures apply.









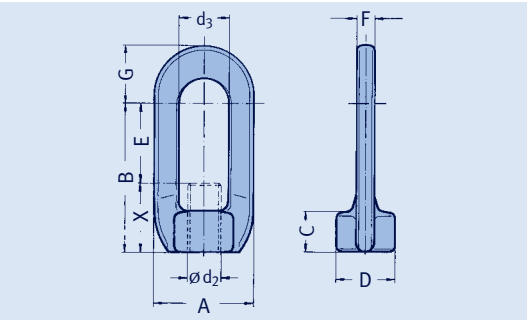
The LISEGA connections offer special benefits:

- **universal application possibilities**
- **load and connection compatibility with the LISEGA modular system**
- **drop forged and heat-treated**
- **electro galvanized as standard, hot-dip galvanized if required**
- **approval through special type tests**

For this, LISEGA SE offers products made from the material 10CrMo9-10 for the connection to special designs (see page 4.9). The upper load limits for use up to 500°C corresponds to the nominal load (see chapter 4.1.1 on page 0.5) of the respective load groups. The type numbers are described as follows:

Eye nuts	: 60 .9 04-HT; (60 D9 04-HT to 60 99 04-HT)
Threaded clevises with pin	: 61 .9 04-HT; (61 D9 04-HT to 61 99 04-HT)
Turnbuckles	: 62 .9 04-HT; (62 D9 04-HT to 62 99 04-HT)
Rod couplings	: 64 .9 04-HT; (64 D9 04-HT to 64 99 04-HT)

Eye nuts Type 60
Threaded clevises with pin Type 61



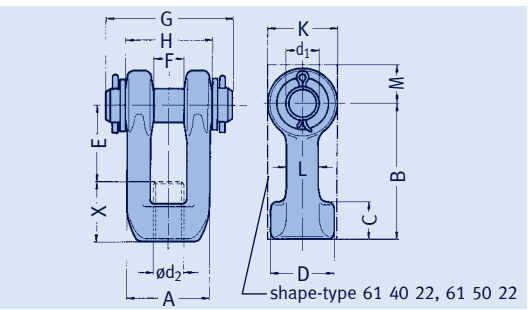
Eye nuts
type 60 D9 19 to 60 50 12

Material: P250GH
drop forged.

From load group 40
welded design
material: S355J2.

type	A	B	C	D	ø d_2	d_3	E	F	G	X	weight [kg]
60 D9 19	24	40	11	17	M10	13	25	5	15	15	0.05
60 29 12	33	60	15	24	M12	17	40	6	19	20	0.10
60 39 12	44	75	20	30	M16	25	45	10	26	30	0.20
60 49 12	59	90	25	35	M20	29	55	10	35	35	0.40
60 59 12	72	110	30	44	M24	35	65	15	44	45	0.80
60 69 12	88	127	37	50	M30	42	75	17	54	52	1.20
60 79 12	100	140	45	60	M36	47	75	20	62	65	2.00
60 89 12	110	157	52	70	M42	52	85	25	72	72	2.90
60 99 12	120	180	60	80	M48	62	85	30	78	95	4.70
60 10 12	135	200	65	95	M56x4	62	105	40	80	95	7.70
60 20 12	150	230	70	105	M64x4	72	130	40	85	100	8.80
60 30 12	160	230	70	110	M68x4	72	130	40	90	100	9.30
60 40 12	220	250	120	125	M72x4	82	100	50	110	150	27.00
60 50 12	250	280	140	140	M80x4	92	120	60	125	160	45.00

Order details:
eye nut
type 60..1.



Threaded clevises with pin
type 61 D9 19 to 61 50 12

Material: P250GH

From load group 10 and
further material: S355J2,
drop forged.

From load group 40 and
further flame cut design
material: S355J2.

Pins
C35E+QT complete
with cotter pin
DIN EN ISO 1234 and
washers DIN 1441.

From load group 40 and
further material: S355J2.

Order details:
threaded clevis with pin
type 61..1.

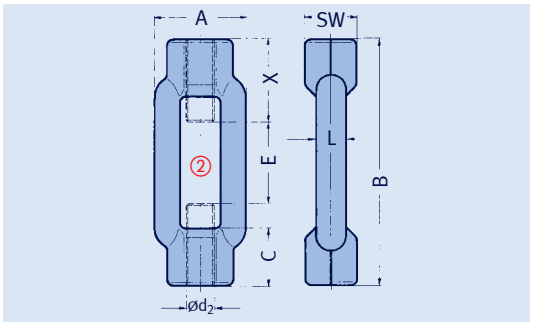
type	A	B	C	D	ø d_1	ø d_2	E	F	G	H	K	L	M	X	weight [kg]
61 D9 19	23	50	11	17	10	M10	35	11	50	25	21	5x9	–	15	0.1
61 29 12	33	70	15	25	12	M12	50	12	60	34	24	8x12	–	20	0.2
61 39 12	42	80	20	33	16	M16	50	17	70	44	32	11x15	–	30	0.4
61 49 12	55	90	25	40	20	M20	55	20	90	57	46	16x21	–	35	1.0
61 59 12	65	110	30	46	24	M24	65	22	105	68	53	19x25	–	45	1.6
61 69 12	72	130	35	51	33	M30	80	27	125	80	64	19x29	–	50	2.7
61 79 12	85	150	40	61	40	M36	90	32	140	93	80	22x36	–	60	4.4
61 89 12	100	170	50	72	45	M42	100	37	165	110	90	27x40	–	70	7.2
61 99 12	120	180	60	83	50	M48	95	42	185	130	100	33x44	–	85	10.4
61 10 12	130	215	65	90	60	M56x4	120	50	210	150	120	30x45	–	95	14.8
61 20 12	155	230	70	110	70	M64x4	130	60	245	175	150	35x55	–	100	24.4
61 30 12	155	230	70	110	70	M68x4	125	60	245	175	150	35x55	–	105	24.4
61 40 12	150	240	80	–	80	M72x4	130	56	230	150	150	–	90	110	42.0
61 50 12	165	260	90	–	90	M80x4	140	64	240	165	180	–	110	120	60.0

Turnbuckles Type 62
Rod couplings Type 64

Turnbuckles
type 62 D9 19 to 62 50 15

Material: S235JR
drop forged.

From load group 10
flame cut design
material: S355J2.



① One side right-hand, other side left-hand thread.

② The ends of the threaded rods must not come into contact.

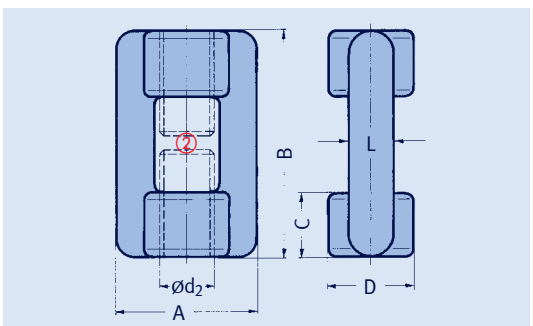
type	A	B	C	SW	ø d2 ①	E	L	X	weight [kg]
62 D9 19	30	125	18	16	M10	35	9x 8	45	0.15
62 29 12	34	125	21	18	M12	35	11x 9	45	0.20
62 39 19	42	150	27	24	M16	50	14x11	50	0.40
62 49 19	52	170	33	30	M20	60	17x14	55	0.70
62 59 19	62	240	39	36	M24	80	22x17	80	1.20
62 69 12	74	255	45	46	M30	85	23x20	85	1.80
62 79 12	86	295	55	55	M36	95	28x23	100	3.00
62 89 12	104	330	63	65	M42	100	32x27	115	4.80
62 99 12	130	355	75	75	M48	105	40x35	125	7.80
62 10 15	110	300	60	80	M56x4	80	80x23	110	10.00
62 20 15	130	320	70	90	M64x4	80	90x28	120	15.00
62 30 15	140	330	75	100	M68x4	80	100x30	125	18.00
62 40 15	150	390	80	100	M72x4	90	100x33	150	22.00
62 50 15	165	410	90	120	M80x4	90	120x37	160	32.00

Order details:
turnbuckle
type 62..1.

Rod couplings
type 64 D9 19 to 64 50 15

Material: S235JR
drop forged.

From load group 10
flame cut design
material: S355J2.



type	A	B	C	D	ø d2	L	weight [kg]
64 D9 19	34	45	15	21	M10	11x 9	0.1
64 29 18	34	45	15	21	M12	11x 9	0.1
64 39 18	42	60	20	27	M16	14x11	0.2
64 49 18	52	75	25	32	M20	17x14	0.5
64 59 18	62	90	30	39	M24	22x17	0.7
64 69 18	74	105	35	45	M30	23x20	1.2
64 79 18	86	120	40	55	M36	28x23	1.6
64 89 18	104	150	50	63	M42	32x27	2.6
64 99 18	130	180	60	75	M48	40x35	5.1
64 10 15	110	190	60	80	M56x4	80x23	7.0
64 20 15	130	220	70	90	M64x4	90x28	11.0
64 30 15	140	240	75	100	M68x4	100x30	14.0
64 40 15	150	250	80	100	M72x4	100x33	15.0
64 50 15	165	280	90	120	M80x4	120x37	23.0

Order details:
rod coupling
type 64 .. 1.

Connecting rods Type 63, 65, 66, 67

Application
Threaded and tie rods connect the support components to each other in order to bridge installation heights. They can be used as rigid supports with the connection components and in elastic load chains with spring and constant hangers.

Materials and loads
Only materials with guaranteed mechanical properties regarding good homogeneity and sufficient charpy-test values (ductility) are used. The permissible loads correspond to the load table for statically determined components in the technical specifications on page 0.6.

Rolled threads
All threads are manufactured in a rolling process. By rolling the threads are not cut. Through the rolling process the material is made to flow and is plastically formed. In this way the surface is given additional notch-free high-quality strength.

Friction resistance is thereby reduced; this has a favorable effect on any adjustment of the rods under load. On top of that, safety reserves exceeding the demands of the design specifications are created.

Designs
Threaded rods type 67 with continuous threading up to M48 and tie rods type 66 (from M20) are available in fixed 500mm length increments in the length range from 500mm up to 3,000mm. The tie rods have thread lengths of 300mm on one side and 600mm on the other. The short thread is for length adjustment, e.g. as a connection for spring and constant hangers. The long thread is for the fitted length. This can be shortened as required according to the installation height on site.

Standard lengths
Larger tolerances in the building structure have led to increasing problems with fitted lengths instead of easier installation, especially when the connection threads are too short. The use of standardized fixed lengths is therefore more and more common because of their greater flexibility. Fitting can be easily carried out with hanging rods already mounted at the upper end.

Laborious measurement with the risk of error is thereby avoided. Structural tolerances can be compensated for.

Length adjustment
Tie rods type 65 with right-hand / left-hand threads are always used in combination with turnbuckle type 62 and fitted with standard lengths. They are designed for length adjustment and force-fit prestressing of load chains.

All other bolted connections are exclusively right-hand threads and on installation must be locked with a hexagon nut type 63.

Corrosion protection
For corrosion protection all rod types are electro galvanized, layer thickness approx. 12-15µm. If required, hot-dip galvanization is available.

Hot dip galvanized threaded rods M10/M12 are available in lengths up to 1,000mm. Longer length can be prepared by rod couplings.

Certification
If required, all components can be supplied with certificates according to DIN EN 10204-2.2 or 3.1.

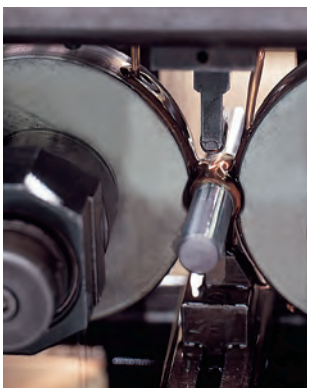
Special properties:
- **materials with proven characteristics**
- **rolled threads**
- **notch-free surfaces**
- **electro galvanized surfaces**
- **standard lengths**
- **in-house manufacture**

Often there is a need to use the connecting members even in areas which are above the standard range of application and can exposed to with higher temperatures. For this LISEGA SE offers products made from the material 21CrMoV57 or 25CrMo4 for hex nuts for the connection to special designs (see page 4.9). The load limits for use up to 500°C correspond to the nominal load of each load groups.

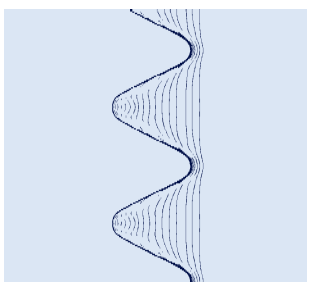
The type numbers are described as follows:

Tie rod L/R	:	65 .1 03-HT; (65 D1 03-HT to 65 91 03-HT)
Stud bolt	:	67 .1 03-HT; (67 D1 03-HT to 67 91 03-HT)
Threaded rod	:	67 .. 03-HT; (67 D2 03-HT to 67 95 03-HT)
Tie rod	:	66 .. 03-HT; (66 46 03-HT to 66 97 03-HT)
Hexagon nut	:	63 .9 3. ; (63 D9 39 and 63 19 38 to 63 99 38)

The pipe systems are embedded in load chains, where the connecting rods are important elements. When selecting them great attention must be paid to quality so that these seemingly simple components do not form the weakest link in the chain. The decisive factors for their load-bearing capacity are, beside adequate dimensioning, material quality and design conforming to standards.



Manufacture of threaded components



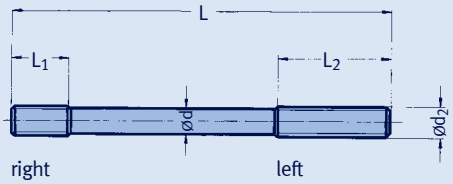
Fiber flow of rolled thread

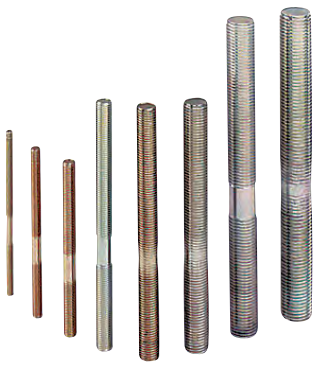
Tie rods L/R Type 65
Hexagon nuts Type 63
Stud bolts Type 67

Tie rods left-hand/right-hand type 65 D1 19 to 65 50 13

Material:
M10 to M16: S235JR
from M20: S355J2.

LISEGA threaded rods should only be replaced in kind.





type	ø d	ø d_2	L	L_1 right	L_2 left	weight [kg]
65 D1 19	8.75	M10	250	80	130	0.1
65 21 13	10.74	M12	250	80	130	0.2
65 31 13	14.54	M16	250	80	130	0.3
65 41 13	18.20	M20	250	80	130	0.5
65 51 13	21.85	M24	350	120	190	1.0
65 61 13	27.55	M30	350	120	190	1.6
65 71 13	33.15	M36	350	120	190	2.4
65 81 13	38.91	M42	450	160	220	4.2
65 91 13	44.53	M48	450	160	220	5.5
65 10 13	53.22	M56x4	550	200	270	9.6
65 20 13	61.20	M64x4	550	200	270	12.7
65 30 13	65.20	M68x4	550	200	270	14.4
65 40 13	69.20	M72x4	600	220	300	17.7
65 50 13	77.20	M80x4	600	220	300	22.1

Order details:
tie rod L/R
type 65..1.

Hexagon nuts type 63 D9 29 to 63 50 28

Material: grade 8 hexagon nuts DIN EN ISO 4032 as counter nuts for threaded rods M10 – M80x4.

type	size	weight [kg]
63 D9 29	M10	0.01
63 29 28	M12	0.02
63 39 28	M16	0.03
63 49 28	M20	0.06
63 59 28	M24	0.11
63 69 28	M30	0.22
63 79 28	M36	0.39
63 89 28	M42	0.65
63 99 28	M48	0.98
63 10 28	M56x4	1.40
63 20 28	M64x4	1.90
63 30 28	M68x4	2.25
63 40 28	M72x4	2.60
63 50 28	M80x4	3.40

Order details:
hexagon nut
type 63..2.

Stud bolts type 67 D1 19 to 67 91 13

Material:
M10 to M16: S235JR
from M20: S355J2.

LISEGA threaded rods should only be replaced in kind.

type	L	ø d_2	weight [kg]
67 D1 19	30	M10	0.02
67 21 13	35	M12	0.03
67 31 13	50	M16	0.07
67 41 13	60	M20	0.12
67 51 13	75	M24	0.22
67 61 13	90	M30	0.42
67 71 13	110	M36	0.75
67 81 13	125	M42	1.17
67 91 13	145	M48	1.77

Order details:
stud bolt
type 67..1.

Tie rods Type 66
Threaded rods Type 67

threaded rod type 67

tie rod type 66

Threaded rods / tie rods type 67 D2 19 to 67 50 13 / type 66 46 13 to 66 50 13

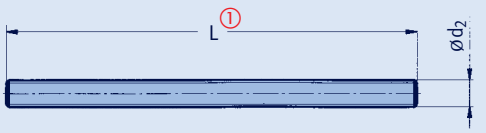
Material:
M10 to M16: S235JR
from M20: S355J2.

LISEGA threaded rods should only be replaced in kind.

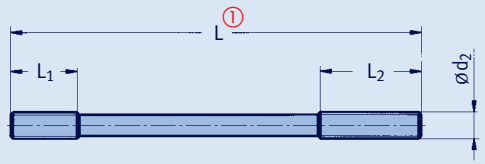
Ø d_2	type designation at L= 500	1000	1500	2000	2500	3000	weight [kg/m]
M 10	67 D2 19	67 D3 19	67 D4 19	67 D5 19	67 D6 19	67 D7 19	0.5
M 12	67 22 13	67 23 13	67 24 13	67 25 13	67 26 13	67 27 13	0.7
M 16	67 32 13	67 33 13	67 34 13	67 35 13	67 36 13	67 37 13	1.3
M 20	67 42 13	67 43 13	67 44 13	67 45 13	66 46 13	66 47 13	2.0
M 24	67 52 13	67 53 13	67 54 13	67 55 13	66 56 13	66 57 13	2.9
M 30	67 62 13	67 63 13	67 64 13	67 65 13	66 66 13	66 67 13	4.7
M 36	67 72 13	67 73 13	67 74 13	67 75 13	66 76 13	66 77 13	6.8
M 42	67 82 13	67 83 13	67 84 13	67 85 13	66 86 13	66 87 13	9.3
M 48	67 92 13	67 93 13	67 94 13	67 95 13	66 96 13	66 97 13	12.2

Standard lengths avoid problems caused when installation lengths are too short. They can be flexibly adapted by shortening to suit the installation situation on site.

Order details:
threaded rod / tie rod
type 6. .. ..

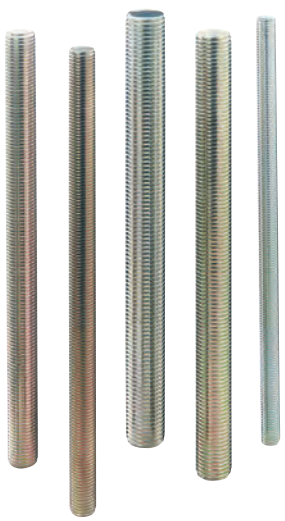


threaded rod type 67



tie rod type 66

① L=max. 6,000mm, longer lengths on request

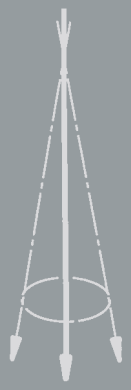


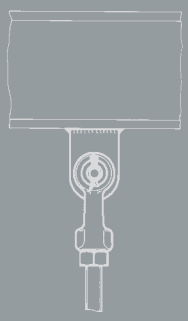
Connecting rods from M56x4 can be supplied as threaded rods type 67 or as tie rods type 66 with individual rolled thread lengths.

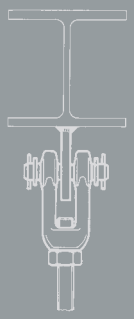
Ød_2	type designation (L / L_1 / L_2 please note at order)		weight [kg/m]
M 56x4	66 10 13	67 10 13	17.5
M 64x4	66 20 13	67 20 13	23.1
M 68x4	66 30 13	67 30 13	26.2
M 72x4	66 40 13	67 40 13	29.5
M 80x4	66 50 13	67 50 13	36.8

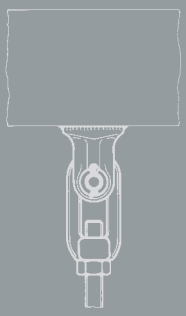
Order details:
from M56x4:
threaded rod / tie rod
type 6. .. ..
L = ...mm
L_1 = ...mm
L_2 = ...mm

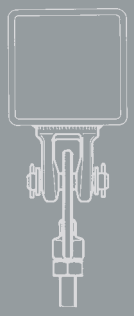
Structural attachments, trapezes, clamps, slide plates

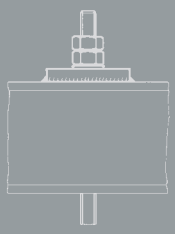


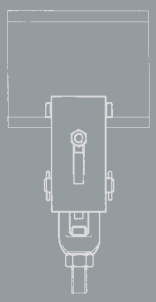


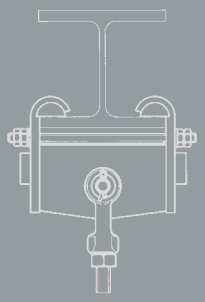


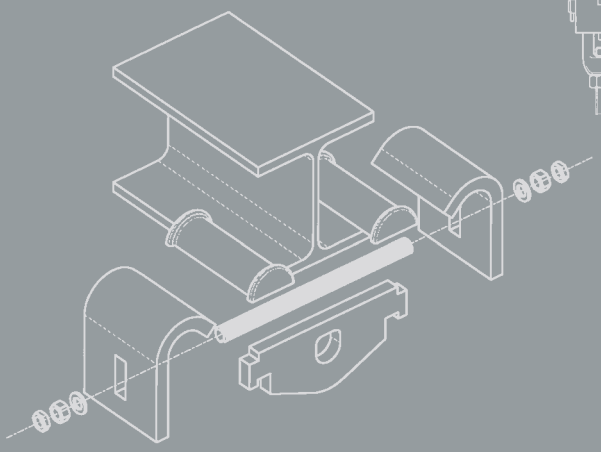


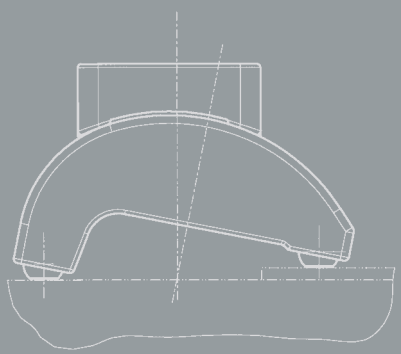


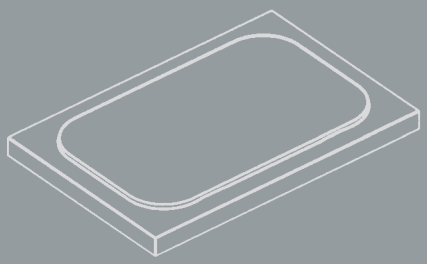






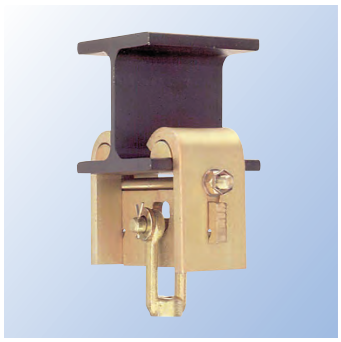


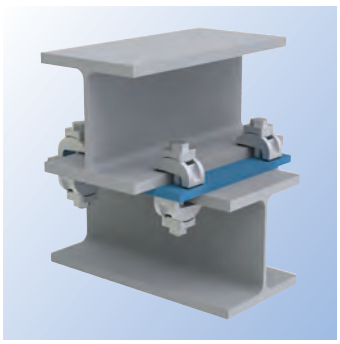


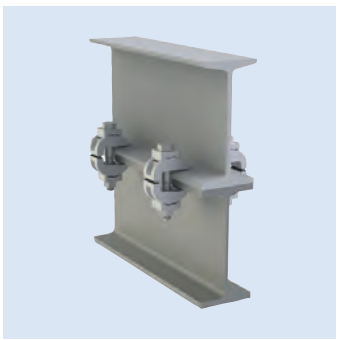


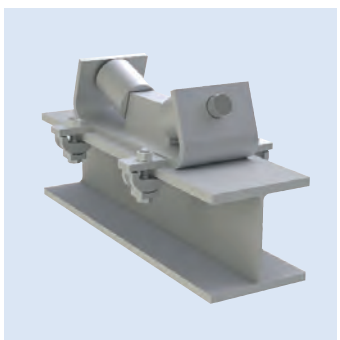
PRODUCT GROUP 7

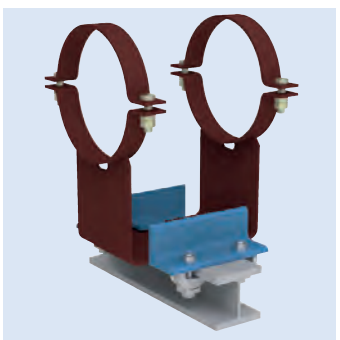
LISEGA











Structural attachments, trapezes, clamps, slide plates

Contents **Page**

Structural attachments, trapezes, clamps, slide plates

Special components for welding or clamping are available for connecting the pipe supports to the supporting structure. In order to fulfill safety requirements the connections must be suitable.

Product group 7

Connecting components for the direct attachment to the structure and trapezes form part of product group 7.

The permissible loads for the components correspond to the load table for statically determined components in the 'technical specifications', page 0.6.

For weld-on clevises type 73 – well suited for connection to hollow sections - and weld-on eye plates type 75 the specified minimum weld seam thicknesses must be taken into account. These are calculated not to exceed a maximum weld seam stress of 75N/mm² (load case H / level A/B). An angulation of up to 6° was considered in the basis of the load calculation.

The weld-on plates type 74 enable use of the maximum pendulum length in restricted spaces by means of a plug connection. Here too, an angulation of up to 6° was considered in the basis of the load calculation.

The hot dip galvanized beam adapters type 76 allow clamp connections instead of welded connections, for example at extensions of piping systems or steel structures in existing plants.

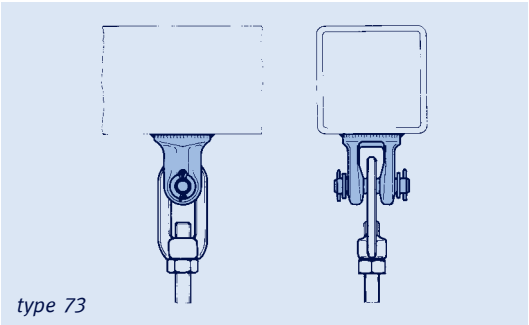
Beam clamps type 78 are designed for **weld-free** connection on site. They are suitable for all beam widths and flange slopes. When ordering, please state beam widths and flange thicknesses.

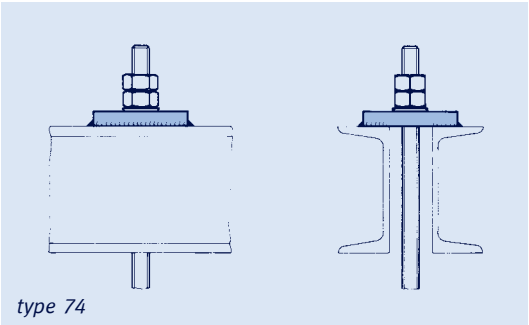
For protection against corrosion the components are given a weldable primer coating (30µm) or are electro galvanized (layer thickness 12-15µm).

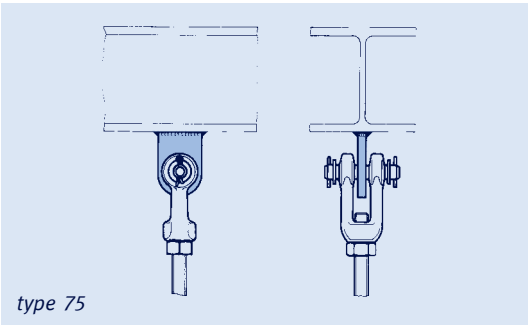
Trapezes type 79 are for the attachment of clamp bases type 49 and type 56 and can be used for rigid suspension as well as for connection with spring and constant hangers.

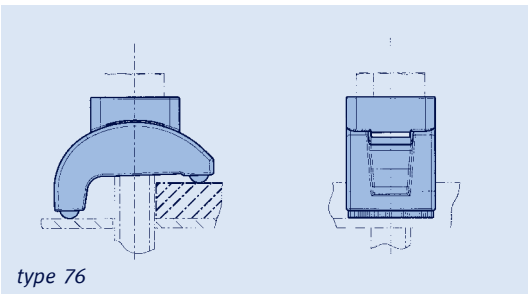
The trapeze profiles are protected against corrosion according to LISEGA standard color coating (see page 0.10).

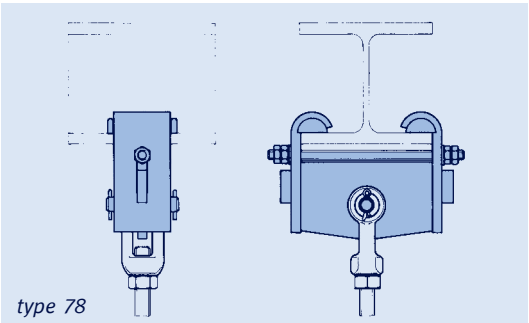
All components can on request be supplied with material certifications.





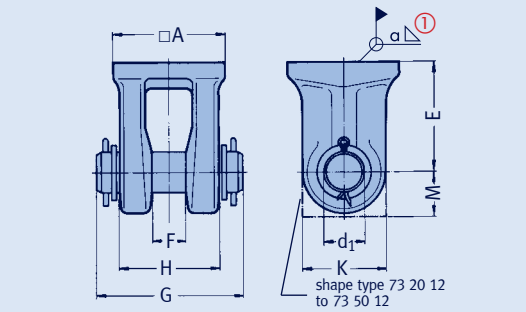






Standardized connection possibilities

Weld-on clevises Type 73
Weld-on eye plates Type 75



Weld-on clevises
type 73 29 13 to 73 50 12

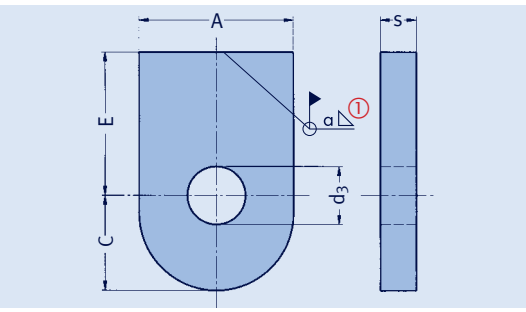
Material: S355J2 drop forged.

From load group 20:
flame cut design
made of S355J2.
pin: C35E+QT.

type	□A	ød_1	E	F	G	H	K	M	min. weld seam ①	weight [kg]
73 29 13	40	12	35	12	60	34	24	–	3.0	0.3
73 39 13	50	16	40	17	70	44	32	–	3.0	0.4
73 49 13	65	20	50	20	90	57	46	–	3.0	1.1
73 59 13	75	24	60	22	105	68	53	–	3.0	2.1
73 69 12	95	33	90	27	125	80	64	–	3.5	3.8
73 79 12	120	40	110	32	140	93	80	–	4.0	6.8
73 89 12	120	45	120	37	165	110	90	–	5.5	9.2
73 99 12	120	50	130	42	185	120	100	–	7.5	11.1
73 10 12	150	60	140	50	210	150	120	–	8.5	18.5
73 20 12	170x175	70	150	60	245	165	170	75	9.0	37.0
73 30 12	170x175	70	150	60	245	165	170	75	10.5	37.0
73 40 12	150x190	80	170	56	230	150	150	90	12.5	38.0
73 50 12	180x220	90	195	64	240	165	180	110	13.5	58.0

① Calculation of the weld seams was based on a permissible stress of 75N/mm² in load case H (level A/B).

Order details:
weld-on clevis 73 .. 1.



Weld-on eye plates
type 75 D1 19 to 75 50 12
Material: S235JR
From load group 6: S355J2

type	A	ød_3	E	C	s	min. weld seam ①	weight [kg]
75 D1 19	30	10.5	40	18	6	3.0	0.10
75 21 12	35	12.5	45	22	8	4.0	0.13
75 31 12	45	16.5	50	28	10	4.5	0.24
75 41 12	60	20.5	55	37	12	6.0	0.45
75 51 12	65	24.5	60	40	15	7.0	0.65
75 61 12	80	34	70	50	20	8.5	1.25
75 71 12	100	41	80	65	25	9.5	2.35
75 81 12	120	46	90	75	30	10.5	3.9
75 91 12	130	51	100	80	30	13.5	4.6
75 10 12	150	61	110	90	40	15.5	7.7
75 20 12	170	71	120	100	45	18.0	10.6
75 30 12	180	71	130	110	45	20.5	12.6
75 40 12	220	81	140	120	50	18.5	18.5
75 50 12	250	91	150	135	60	20.0	27.5

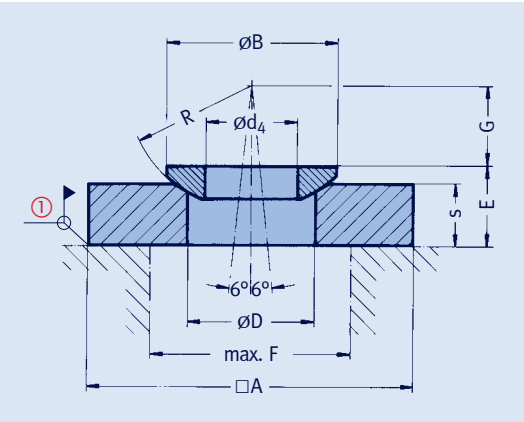
① Calculation of the weld seams was based on a permissible stress of 75 N/mm² in load case H (level A/B).

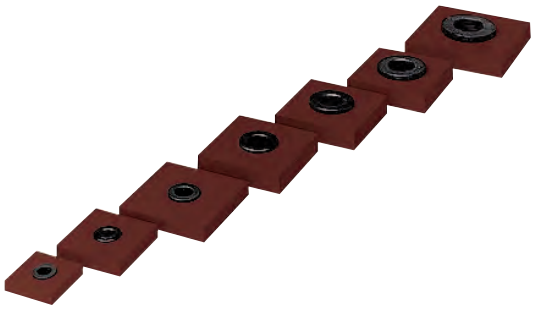
Order details:
weld-on eye plate
type 75 .. 1.

Weld-on plates with spherical washer Type 74

Weld-on plates with spherical washer type 74 D1 19 to 74 50 13

Material spherical washer: case-hardened steel.
From load group 5: C15.
weld-on plate: S235JR.
For s ≥ 20: S355J2.



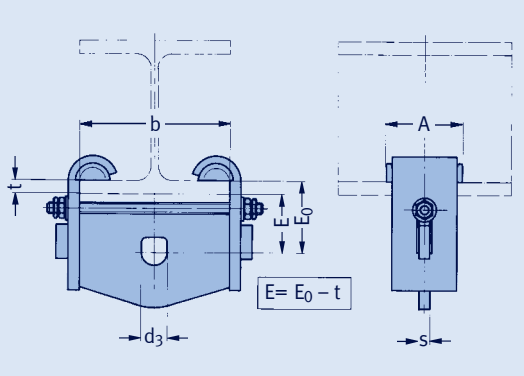


① LISEGA recommends tack welding of the weld-on plate for fixing positions or welding all round as specified.

type	for rod	□A	ØB	ØD	Ød4	E	max. F	G	R	s	weight [kg]
74 D1 19	M10	60	21	15	10.5	12	35	10	15	10	0.3
74 21 13	M12	70	24	18	13	17	40	11	17	15	0.6
74 31 13	M16	70	30	25	17	17	45	15	22	15	0.6
74 32 13	M16	95	30	25	17	22	45	15	22	20	1.4
74 33 13	M16	130	30	25	17	22	45	15	22	20	2.7
74 41 13	M20	70	36	30	21	18	50	18	27	15	0.6
74 42 13	M20	95	36	30	21	23	50	18	27	20	1.4
74 43 13	M20	130	36	30	21	23	50	18	27	20	2.7
74 51 13	M24	95	44	35	25	24	55	21	32	20	1.4
74 52 13	M24	130	44	35	25	24	55	21	32	20	2.7
74 61 13	M30	130	56	45	31	35	60	27	41	30	4.0
74 62 13	M30	170	56	45	31	35	60	27	41	30	6.8
74 71 13	M36	130	68	50	37	37	70	32	50	30	4.0
74 72 13	M36	170	68	50	37	37	70	32	50	30	6.8
74 81 13	M42	130	78	59	43	39	90	37	58	30	4.0
74 82 13	M42	170	78	59	43	39	90	37	58	30	6.8
74 91 13	M48	130	92	66	50	46	120	41	67	35	4.5
74 92 13	M48	170	92	66	50	41	120	41	67	30	6.8
74 10 13	M56x4	225	103	76	58	47	140	50	79	35	13.9
74 20 13	M64x4	250	120	89	66	54	150	59	93	40	19.6
74 30 13	M68x4	250	128	95	70	61	160	64	100	45	22.0
74 40 13	M72x4	300	136	98	75	61	160	70	107	45	31.8
74 50 13	M80x4	350	152	110	83	64	180	78	120	45	43.3

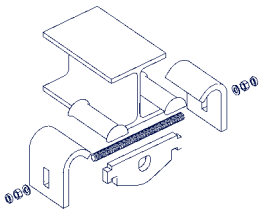
Order details:
weld-on plate with spherical washer type 74 .. 1.

Beam clamps Type 78
Trapezes Type 79



Trägerklammern
Typ 78 21 11 bis 78 71 11

Surface: electro galvanized

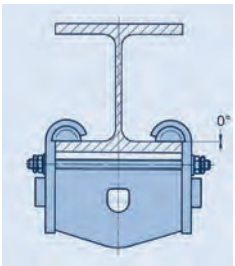


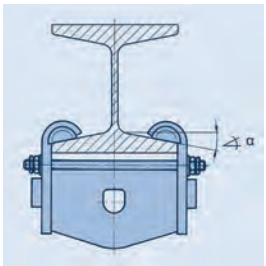
type	d_3	A	E_0 up to beam width b= 46	82	100	125	140	180	220	260	300	s	t_{max} ②	weight [kg]
78 21 11	17	80	55	55	65	65	65	75	85	95	95	8	15	0.8 – 1.8
78 31 11	21	80	–	70	70	70	70	80	90	100	110	10	20	2.0 – 3.6
78 41 11	25	125	–	–	–	85	90	90	100	105	115	15	25	6.7 – 8.9
78 51 11	34	125	–	–	–	95	95	105	115	130	140	15	25	6.8 – 9.5
78 61 11	41	180	–	–	–	–	–	100	100	110	110	20	30	17.7 – 19.8
78 71 11 ①	51	180	–	–	–	–	–	115	115	125	130	20	30	18.2 – 20.8

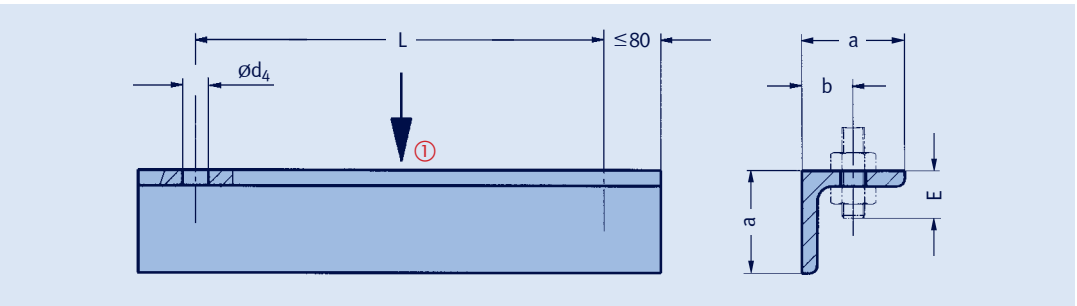
① Load sizes 8 + 9 can also be connected. The permissible load amounts to 100kN in load case H (level A/B).

② Larger 't' dimension possible on request – E_0 increases correspondingly. When ordering please state beam width 'b' and flange thickness 't'.

Order details:
beam clamp
type 78 .1 11
beam width b = ...mm
flange thickness t = ...mm







Trapezes for the use of lower loads at temperatures ≤ 80°C type 79 C2 37 to 79 42 37

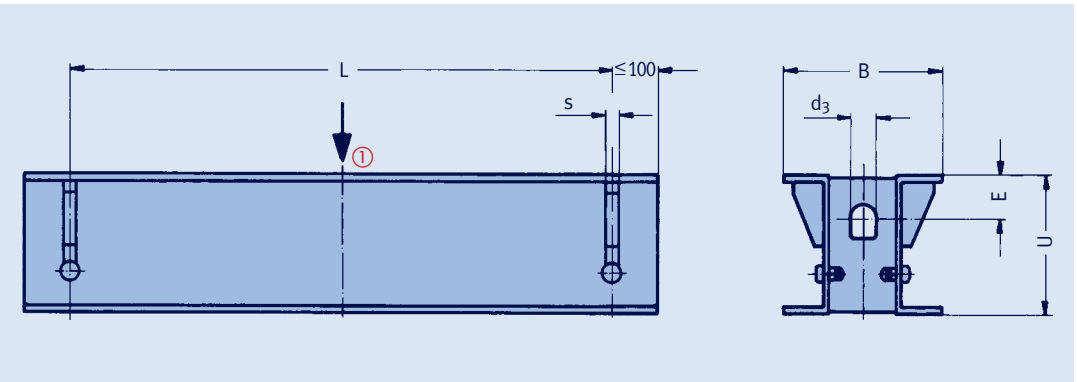
① The permissible center load is to be taken from the respective trapeze load group (3rd digit in the type designation).

type	L_{max}	E	a	b	ød4	weight [kg] for L=1000mm	±per100mm
79 C2 37	1000	25	40	22	11	1.7	0.30
79 D2 37	1000	25	60	25	11	2.6	0.46
79 12 37	600	25	60	25	11	2.6	0.46
79 12 37	1000	25	70	28	11	3.8	0.64
79 22 37	600	30	70	28	14	3.8	0.64
79 22 37	1100	30	80	32	14	6.0	1.00
79 32 37	600	30	80	32	14	6.0	1.00
79 32 37	1200	30	100	35	14	9.6	1.50
79 42 37	600	40	100	38	18	9.6	1.50
79 42 37	1200	40	130	42	18	15.6	2.40

Order details:
trapeze
type 79 .2 37, L = ...mm

Trapezes Type 79

Trapezes type 79 22 34 to 79 20 34



① The permissible center load is to be taken from the respective trapeze load group (3rd digit or 3rd and 4th digits in the type designation).

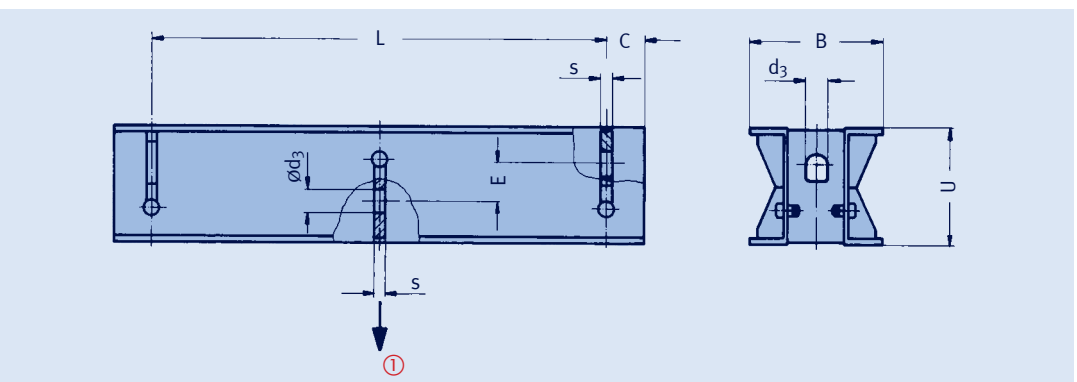
② The L_{max} dimensions can be lengthened up to 2400mm on load reduction of 5% per 100mm extension.

③ Connection possible for the specified load groups.

type	load ③ group	d_3 ≥	s ≤	L_{max} ②	E	U	B	weight [kg] for L=1000mm	±per100mm
79 22 34	D – 4	21	10	1700	20	80	140	19	1.7
79 32 34	D – 4	21	10	1700	20	80	140	19	1.7
79 42 34	3 – 4	21	12	900 1800	20 40	80 120	140 190	19 31	1.7 2.7
79 52 34	4 – 5	25	18	1400 1800	40 40	120 140	190 200	31 38	2.7 3.2
79 62 34	5 – 6	34	20	1250 1800	40 55	140 180	200 230	38 54	3.2 4.4
79 72 34	6 – 7	41	25	1400 1800	60 65	180 200	230 250	54 65	4.4 5.1
79 82 34	6 – 8	46	25	1250 2400	70 80	200 260	250 310	65 102	5.1 7.6
79 92 34	7 – 9	51	30	1800 2400	85 90	260 300	310 350	102 129	7.6 9.2
79 10 34	8 – 10	61	30	2000	95	300	350	129	9.2
79 20 34	9 – 10	61	30	1800	95	300	350	129	9.2

Order details:
trapeze
type 79 .. 34, L = ...mm

Trapezes type 79 23 39 to 79 93 39



① The permissible load for the middle connection is to be taken from the respective trapeze load group (3rd digit in the type designation).

② L_{max} can be lengthened to 2400mm for type 79 23 39 to 79 73 39 on reduction of the permissible load by 5% for every 100mm.

③ Connection possible for the specified load groups.

type	load ③ group	d_3	L_{max} ②	E	U	B	C	s	weight [kg] for L=1000mm	±per100mm
79 23 39	D – 4	21	1700	40	80	140	40	10	19	1.7
79 33 39	D – 4	21	1700	40	80	140	40	10	19	1.7
79 43 39	3 – 5	25	1800	40	120	190	50	12	32	2.7
79 53 39	4 – 6	34	1800	60	140	200	60	18	40	3.2
79 63 39	5 – 7	41	1800	65	180	230	70	20	56	4.4
79 73 39	6 – 8	46	1800	65	200	250	80	25	68	5.1
79 83 39	6 – 9	51	2400	95	260	310	90	25	108	7.6
79 93 39	7 – 10	61	2400	120	300	350	100	30	138	9.2

On request types 79 10 39 and 79 20 39 can be delivered.

Order details:
trapeze
type 79 .3 39, L = ...mm

Beam adapters Type 76

On alterations or extensions of the pipe systems or steelwork in existing plants, clamp connections are frequently preferred to welded connections. Clamp connections are strictly specified in cases where welding connections are excluded for safety reasons.

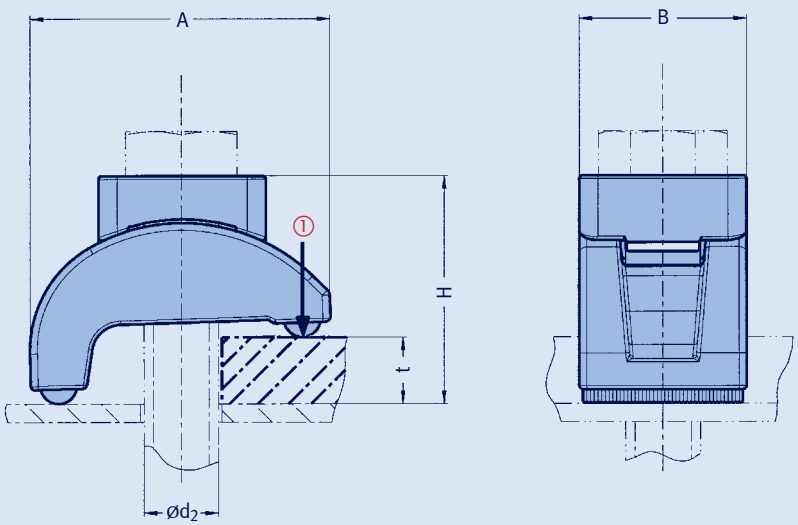
The safety of the clamping effect of such connections depends essentially on the nature of the existing contact surfaces and the prestressing forces applied. The design of the clamping components used is therefore decisive for a reliable connection.

For the creation of safe and reliable clamp connections LISEGA offers the beam adapter system type 76. These components enable the connection of very different components to existing steelwork without welding or drilling.

Assembly is simple and timesaving. On tightening, LISEGA beam adapters adjust independently to the existing beam thickness.

If the specified tightening torques are observed, lasting security of the connections is guaranteed. Any corrosion protection already present, such as hot-dip galvanization or paint coatings, incurs no damage.

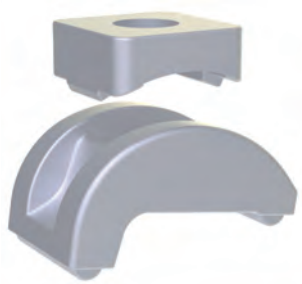
The special support segments are the main feature of the LISEGA beam adapters. Due to their shape they automatically adapt to any position and to existing profile angles.



type	on bolting 8.8 support load [kN] ①	on bolting 8.8 torque value [Nm] max ②	A	B	Ød2	H_{min}	H_{max}	t (clamp thickness) min	t (clamp thickness) max	weight [kg]
76 D2 11	2.5	35	48	24	M10	31	37	3	15	0.1
76 22 11	6.0	70	57	30	M12	37	45	4	17	0.2
76 32 11	8.5	150	70	37	M16	44	54	6	20	0.3
76 42 11	15.0	300	83	46	M20	55	65	6	25	0.6

Beam adapters type 76 D2 11 to 76 42 11

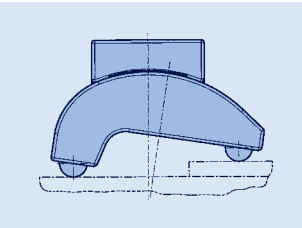
Material:
cast iron hot dip galvanized

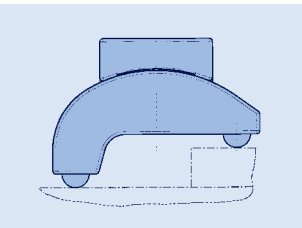


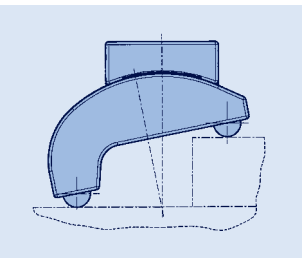
① The loads specified correspond to this in load case H (level A/B) 'Max. permissible loads' page 0.6. For further load cases see table.

② Friction value μ = 0.14.

Order details:
beam adapter (without bolt) type 76 .. 11
bolts for beam adapters, see page 7.7.







Typical utilization of beam clamps at different material thicknesses

The hardened support segments have a circular groove profile that is pressed into the contact surface on tightening. This way, **a form-fit contact is produced which ensures that no shifting in any direction takes place.**

Example of use:
Attachment of clamp base to steel beam

Example of connections with beam adapters

Cross-connection

The safe connection of beam profiles to each other is produced very easily with an inlay plate and 8 LISEGA beam adapters. The load-bearing capacity of a cross-connection can be found in the table below.

Bolts for beam adapters

bolt type	dimensions	weight [kg]
76 D2 11 – 065	M10 x 65	0.06
76 D2 11 – 080	M10 x 80	0.07
76 D2 11 – 100	M10 x 100	0.08
76 22 11 – 070	M12 x 70	0.09
76 22 11 – 090	M12 x 90	0.10
76 22 11 – 120	M12 x 120	0.12
76 32 11 – 090	M16 x 90	0.19
76 32 11 – 120	M16 x 120	0.23
76 32 11 – 150	M16 x 150	0.27
76 42 11 – 120	M20 x 120	0.39
76 42 11 – 150	M20 x 150	0.45
76 42 11 – 180	M20 x 180	0.51

Hexagon bolts DIN EN ISO 4017,
thread to head, grade 8.8, hot dip galvanized,
including a hexagon nut
DIN EN ISO 4032, grade 8, hot dip galvanized.

Load-bearing capacity of cross-connections with LISEGA beam adapters

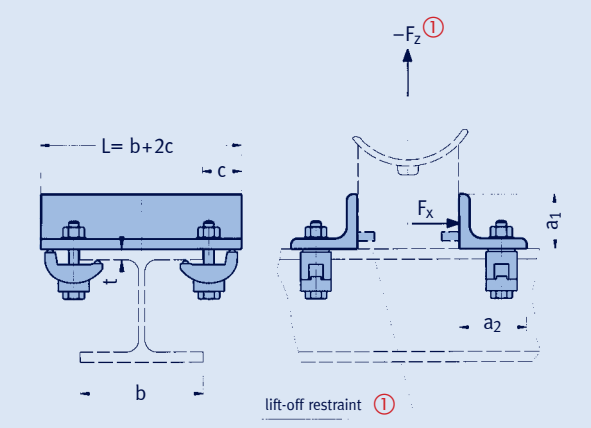
type	load capacity [kN] with 4 bolts (8.8)	thickness of intermed. plate
76 D2 11	10	10
76 22 11	24	12
76 32 11	34	15
76 42 11	60	18

Profile connection

The connection of profiles to each other can be made either directly or by using an inlay plate.

Order details:
bolt for beam adapter
type 76 .2 11- ...

Guides with beam adapters Type 76 for clamp bases Type 49 Cantilevers with beam adapters Type 76 .. 16



Guide with beam adapters for clamp bases type 76 00 11 to 76 00 14

Material: guide S235JR

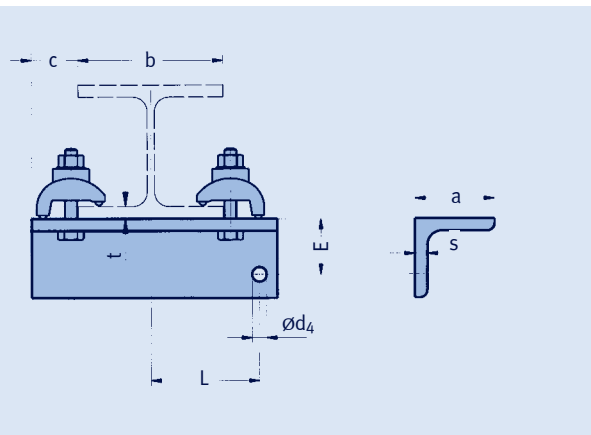
type	type ① with lift-off restraint	torque value [Nm] ②	F_x [kN]	$-F_z$ ① [kN]	a_1	a_2	b_{min}	c	t_{max}	total weight [kg] for b=100	+per 100mm
76 00 11	76 00 21	35	1.0	3.5	30	50	42	40	15	1.7	0.60
76 00 12	76 00 22	70	1.7	4.5	30	60	50	45	17	2.8	0.95
76 00 13	76 00 23	150	2.8	6.5	40	80	64	55	20	4.9	1.40
76 00 14	76 00 24	300	4.7	6.5	40	80	73	65	25	7.2	1.40

① If required, the guides can be supplied with an additional lift-off restraint (width 80mm). (When ordering also specify clamp base type.)
Fz: the permissible short duration lift-off load is limited in every case by the permissible lift-off load of the clamp base. See page 4.68 for this.

② Friction value μ = 0.14

Order details:
lateral guide
type 76 00 1., b = ...mm

Order details:
lateral guide with lift-off restraint
type 76 00 2. – 49 .. ..
(clamp base type), b = ...mm



Cantilever with beam adapters type 76 C1 16 to 76 21 16

Material: cantilever S235JR

L_{min} = 0 mm $L_{max} = \frac{b}{2} + c$

type	torque value [Nm] ①	a x s	b_{min}	b_{max}	c	ø d_4	E	t_{max}	weight [kg] for b=100 L=50	+per 100mm
76 C1 16	35	40x6	42	300	40	11	25	15	0.9	0.35
76 D1 16	70	60x6	50	300	45	11	45	17	1.5	0.55
76 11 16	150	70x7	55	300	55	14	48	20	2.5	0.75
76 21 16	300	80x8	64	300	65	17	55	25	3.9	1.00

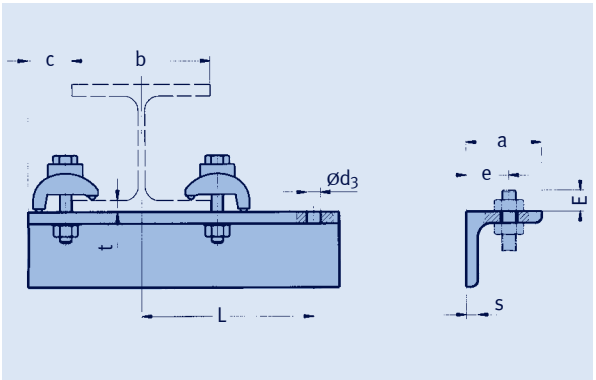
① Friction value μ = 0.14

Order details:
cantilever with beam adapters
type 76 .1 16
b = ...mm, L = ...mm

Cantilevers with beam adapters Type 76 .. 17

Cantilevers with beam adapters types 76 C1 17 to 76 21 17

Material: cantilever S235JR

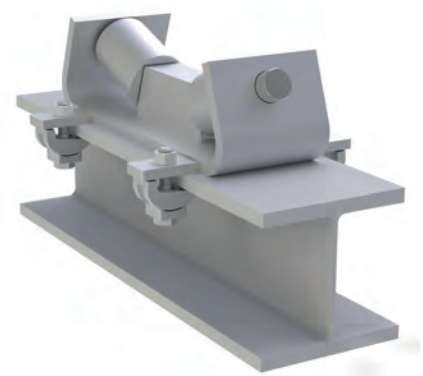


$$L >= \frac{b}{2} + c$$

① Friction value μ = 0.14

type	① torque value [Nm]	a x s	b_{min}	c	ød3	e	E	t_{max}	L_{max} up to beam width b= 82	100	125	140	180	220	260	300	weight [kg] for b=100 L = 100	+per 100mm
76 C1 17	35	40x6	46	40	11	22	20	15	120	230	270	310	320	340	360	380	1.0	0.35
76 D1 17	70	60x6	55	45	11	25	20	17	105	170	200	250	280	340	360	380	1.8	0.55
76 11 17	150	70x7	64	55	14	28	25	20	110	140	170	200	230	290	350	380	2.8	0.75
76 21 17	300	80x8	73	65	14	30	25	25	145	160	190	235	265	290	310	330	4.4	1.00

Order details:
cantilever with beam adapters
type 76 .1 17
b = ...mm, L = ...mm



Example of use:
roller bearing fitted at works with lateral support plates

Example of use:
clamp base on trapeze

Slide plates Type 70

Application and field of use

The pipe systems resting on pipe bearings are subject to displacement as a result of thermal expansion. This displacement must be permitted to prevent unacceptable stresses that could damage the piping system. Furthermore, the slight friction caused by these movements is reduced by inserting slide plates between the clamp base and supporting framework.

During the planning phase the reduction of friction forces is extremely important. Since friction forces can represent considerable additional forces to the operational loads, they are usually distributed into the supporting framework (building structure or secondary steelwork) by the use of low friction materials/surfaces.

By lowering friction forces the dimensioning of building structures and secondary steelwork can be, under the aspect of cost saving, reduced. Also the reaction forces in the pipe statics.

Slide plates are commonly used in all pipe systems in industrial processes / chemical plants, in the power station field, in liquefied gas transport or in district heating pipe systems.

Through the use of slide plates friction forces can be reduced about 60%. Instead of steel / steel sliding contact with a friction coefficient of $\mu \approx 0.3$, through the use of slide plates and a stainless steel plate as a counterface on the clamp base side the friction coefficient can be reduced to as little as $\mu \approx 0.1$ (dry).

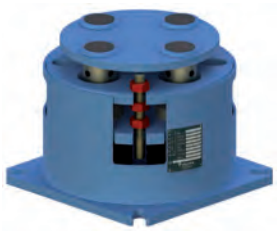
LISEGA slide plates consist of different low-friction materials for different temperature ranges. For use at a constant temperature up to 180°C (at the bottom of the clamp base) the standard PTFE slide plate is recommended. For temperatures above 180°C to a maximum of 350°C a special high-temperature material is used.

Advantages of the low-friction materials

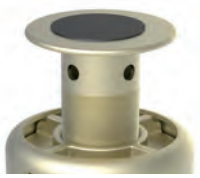
- **high mechanical wear resistance**
- **temperature resistance up to 350°C**
- **suitable for use in aggressive environmental conditions due to their high chemical resistance**
- **self-lubricating**
- **permanent freedom from maintenance**
- **long lifespan**
- **excellent load-bearing capacity**

Clamp bases are seated on slide plates allowing movement with reduced friction – this means the pipe systems can move without constraint during thermal expansion.

Weld-on slide plates

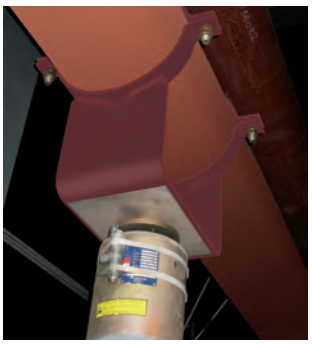


Type 28 with embedded slide plates



Type 29 with load plate and PTFE slide plates

Typical use of slide plates under clamp bases



Other fields of application for LISEGA slide plates are uses where heavy loads must be moved horizontally. By using slide plates the force required for movement can be reduced by as much as 60%. The use of slide plates has a favorable effect on the whole pipe system layout.

Build of the slide plates

LISEGA slide plates for the temperature range up to 180°C are made of the low-friction material PTFE. For temperatures from 180°C up to 350°C a special high-temperature material is used that not only increases heat resistance but also optimizes the mechanical properties.

The LISEGA slide plate to weld on consists basically of a supporting plate of carbon steel with a weldable primer coating in which the low-friction material is embedded.

Optionally these supporting plates can be supplied hot dip galvanized.

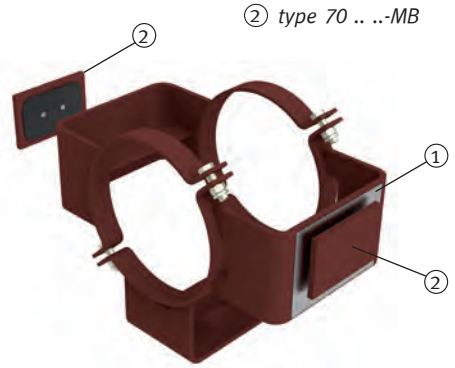
The LISEGA slide plates for bolting are hot dip galvanized as standard.

The counterface is a stainless steel plate. Optionally **the stainless steel plate, that must be ordered separately,** can be welded to carbon steel support plate or it is attached to the bottom of the clamp base in the factory and can be used immediately.

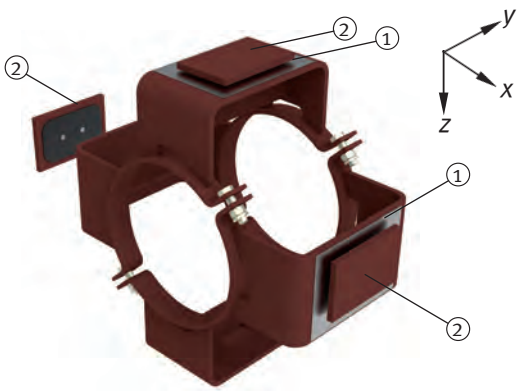
Use of slide plates for pipe guides type 49 .. .. G..

Specially developed for vertical installation, such as for example for type 49 .. .. G.. pipe guides, the slide plate is bolted to the support plate.

① *stainless steel plate*
② *type 70 .. ..-MB*

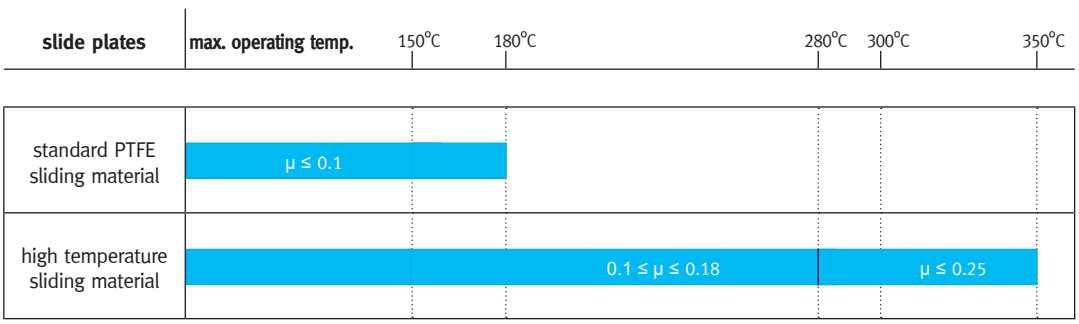


slide bearing / guide through clamp base type 49 .. .. G3-SP with slide plates



X-Z-stop with guide in Y direction through clamp base Type 49 .. .. G4-SP with slide plates

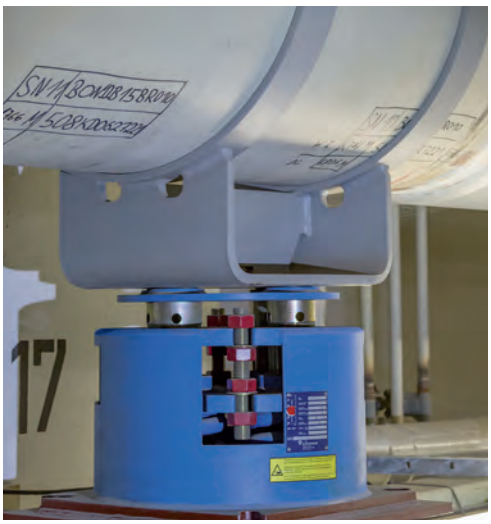
Friction values μ in dependence on operating temperature



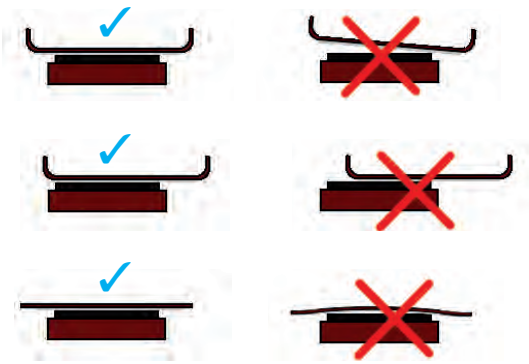
Information on construction and assembly of slide plates

- **Parallel installation of the slide plates and counterfaces is required.**
- **In every possible bearing position the slide plates must be fully covered by the counterfaces.**
- **The components are to be fitted so that any bending of the slide plates or counterfaces is prevented.**

Clamp base type 49 on slide plate with clamp connection to steelwork



Clamp base type 49 and spring support type 28 with slide plates



Installation of slide plates

- **Type 70 .. 1. Is tack-welded with single datum points. If all-round welding is required, the temperature of the PTFE material must not hereby exceed 260°C. When welding, the PTFE material or the restraining surfaces of the support plate must be protected from dirt.**
- **It is recommended to install the slide plates only horizontally. For vertical installation type 70 .. ..-MB is to be used. When it has been ensured that the counterface is always in contact with the PTFE, the standard component shape 70 .. .. can also be used.**
- **Type 70 .. 2. and type 70 .. 3. are bolted to the steelwork with M10 or M12 cylinder bolts. These bolts do not form part of the scope of supply.**

Special sizes can be supplied on request.

load% nom. load / type	travel range 1				travel range 2				travel range 3			
	40%	60%	80%	100%	40%	60%	80%	100%	40%	60%	80%	100%
29 C. 1.												
29 D. 1.												
29 1. 1.								■		■	■	■
29 2. 1.								■		■	■	■
29 3. 1.				■			■	■	■	■	■	■
29 4. 1.				■		■	■	■	■	■	■	■
29 5. 1.				■		■	■	■	■	■	■	■
29 6. 1.			■	■		■	■	■	■	■	■	■
29 7. 1.		■	■	■	■	■	■	■	■	■	■	■
29 8. 1.		■	■	■	■	■	■	■	■	■	■	■
29 9. 1.	■	■	■	■	■	■	■	■	■	■	■	■

■ *Recommended use of slide plates for spring supports type 29 .. 1.*

Slide plates to weld-on Type 70

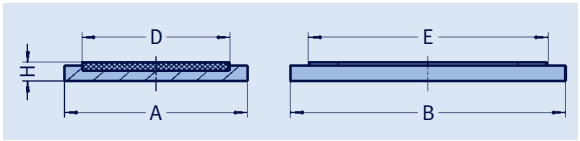
Slide plates to weld-on (rectangular shape) type 70 11 1. to 70 48 1.

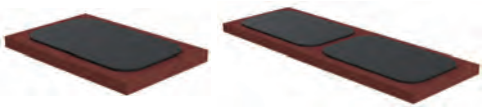
Material: S235JR

Surface: weldable primer

① The 6th digit is to be filled out in dependence of the operating temperature.

② For friction values of slide plates: see table on page 7.11.





type ①	max. load [kN] .. .. .1 150°C	180°C	.. .. .4 350°C ②	A	B	H	sliding surface D x E	weight [kg]
70 11 1.	13	7	25	50	50	10	ø 40	0.2
70 12 1.	22	13	40	50	100	10	30 x 80	0.3
70 13 1.	37	22	70	50	150	10	30 x 130	0.4
70 14 1.	52	31	100	50	200	10	30 x 180	0.6
70 16 1.	82	49	160	50	300	10	30 x 280	0.8
70 17 1.	105	62	205	50	390	10	2 x 30 x 180	1.0
70 18 1.	135	80	265	50	490	10	2 x 30 x 230	1.3
70 22 1.	59	36	120	100	100	12	80 x 80	0.7
70 23 1.	98	60	200	100	150	12	80 x 130	1.0
70 24 1.	138	84	280	100	200	12	80 x 180	1.3
70 26 1.	219	132	440	100	300	12	80 x 280	1.9
70 27 1.	280	168	560	100	390	12	2 x 80 x 180	2.5
70 28 1.	360	216	720	100	490	12	2 x 80 x 230	3.1
70 33 1.	163	99	330	150	150	12	130 x 130	1.4
70 34 1.	228	138	460	150	200	12	130 x 180	1.9
70 36 1.	358	216	720	150	300	12	130 x 280	2.7
70 37 1.	465	276	920	150	390	12	2 x 130 x 180	3.6
70 38 1.	595	354	1180	150	490	12	2 x 130 x 230	4.4
70 44 1.	318	192	640	200	200	12	180 x 180	2.4
70 46 1.	498	300	1000	200	300	12	180 x 280	3.6
70 47 1.	645	384	1280	200	390	12	2 x 180 x 180	5.4
70 48 1.	825	492	1640	200	490	12	2 x 180 x 230	6.8

Order details:
slide plate to weld-on
type 70 .. 1.

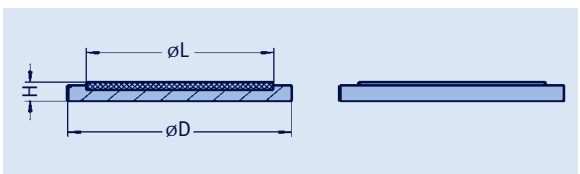
Slide plates to weld-on (round shape) type 70 05 1. to 70 20 1.

Material: S235JR

Surface: weldable primer

① The 6th digit is to be filled out in dependence of the operating temperature.

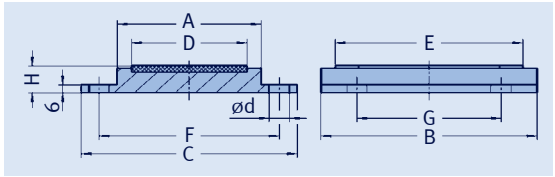
② For friction values of slide plates: see table on page 7.11.



type ①	max. load [kN] .. .. .2 150°C	180°C	.. .. .5 350°C ②	øD	H	sliding surface øL	weight [kg]
70 05 1.	13	7	25	50	10	40	0.1
70 08 1.	33	19	65	85	12	65	0.4
70 10 1.	50	30	100	100	12	80	0.5
70 13 1.	90	57	190	130	12	110	0.9
70 17 1.	175	106	350	170	12	150	1.4
70 20 1.	254	152	505	200	12	180	1.9

Order details:
slide plate to weld-on
type 70 .. 1.

Slide plates for bolting Type 70



Slide plates for bolting (rectangular shape lengthwise) type 70 11 2. to 70 48 2.

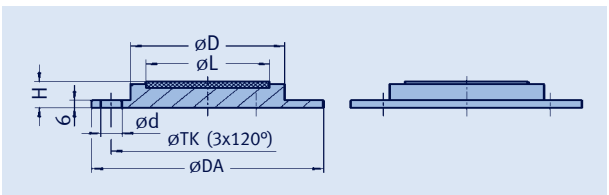
Surface: hot dip galvanized

type ①	max. load [kN] .. .. .1 150°C	180°C	.. .. .4 350°C ②	sliding surface A	B	H	D x E	C	F	G	qty holes	ød	weight [kg]
70 11 2.	13	7	25	50	50	22	ø 40	100	75	0	2	12	0.5
70 12 2.	22	13	40	50	100	22	30 x 80	100	75	60	4	12	1.0
70 13 2.	37	22	70	50	150	22	30 x 130	100	75	100	4	12	1.5
70 14 2.	52	31	100	50	200	22	30 x 180	100	75	150	4	12	2.0
70 16 2.	82	49	160	50	300	22	30 x 280	100	75	250	4	12	2.9
70 17 2.	105	62	205	50	390	22	2 x 30 x 180	100	75	300	4	12	3.8
70 18 2.	135	80	265	50	490	22	2 x 30 x 230	100	75	350	4	12	4.7
70 22 2.	59	36	120	100	100	22	80 x 80	150	125	60	4	14	1.7
70 23 2.	98	60	200	100	150	22	80 x 130	150	125	100	4	14	2.5
70 24 2.	138	84	280	100	200	22	80 x 180	150	125	150	4	14	3.3
70 26 2.	219	132	440	100	300	22	80 x 280	150	125	250	4	14	5.0
70 27 2.	280	168	560	100	390	22	2 x 80 x 180	150	125	300	4	14	6.4
70 28 2.	360	216	720	100	490	22	2 x 80 x 230	150	125	350	4	14	8.1
70 33 2.	163	99	330	150	150	22	130 x 130	200	175	100	4	14	3.6
70 34 2.	228	138	460	150	200	22	130 x 180	200	175	150	4	14	4.7
70 36 2.	358	216	720	150	300	22	130 x 280	200	175	250	4	14	7.0
70 37 2.	465	276	920	150	390	22	2 x 130 x 180	200	175	300	4	14	9.1
70 38 2.	595	354	1180	150	490	22	2 x 130 x 230	200	175	350	4	14	11.4
70 44 2.	318	192	640	200	200	22	180 x 180	250	225	150	4	14	6.1
70 46 2.	498	300	1000	200	300	22	180 x 280	250	225	250	4	14	9.0
70 47 2.	645	384	1280	200	390	22	2 x 180 x 180	250	225	300	4	14	11.7
70 48 2.	825	492	1640	200	490	22	2 x 180 x 230	250	225	350	4	14	14.7

① The 6th digit is to be filled out in dependence of the operating temperature.

② For friction values of slide plates: see table on page 7.11.

Order details:
slide plate for bolting
type 70 .. 2.



Slide plates for bolting (round shape) type 70 05 2. to 70 20 2.

Surface: hot dip galvanized

type ①	max. load [kN] .. .. .2 150°C	180°C	.. .. .5 350°C ②	sliding surface øD	øOD	H	øL	øTK	ød	weight [kg]
70 05 2.	13	7	25	50	90	22	40	70	12	0.5
70 08 2.	33	19	65	85	125	22	65	105	12	1.2
70 10 2.	50	30	100	100	150	22	80	125	14	1.6
70 13 2.	90	57	190	130	180	22	110	155	14	2.5
70 17 2.	175	106	350	170	220	22	150	195	14	3.9
70 20 2.	254	152	505	200	260	22	180	230	18	5.4

① The 6th digit is to be filled out in dependence of the operating temperature.

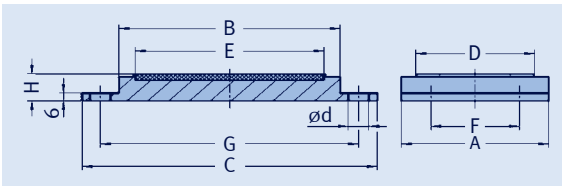
② For friction values of slide plates: see table on page 7.11.

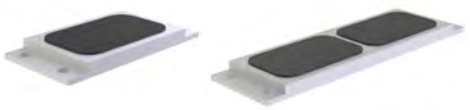
Order details:
slide plate for bolting
type 70 .. 2.

Slide plates for bolting Type 70

Slide plates for bolting (transverse rectangular shape) type 70 12 3. to 70 48 3.

Surface: hot dip galvanized





① The 6th digit is to be filled out in dependence of the operating temperature.

② For friction values of slide plates: see table on page 7.11.

type ①	max. load [kN] .. .. .1 150°C	180°C	.. .. .4 350°C ②	sliding surface A	B	H	D x E	C	F	G	qty holes	ød	weight [kg]
70 12 3.	22	13	40	50	100	22	30 x 80	150	0	125	2	12	0.9
70 13 3.	37	22	70	50	150	22	30 x 130	200	0	175	2	12	1.3
70 14 3.	52	31	100	50	200	22	30 x 180	250	0	225	2	12	1.6
70 16 3.	82	49	160	50	300	22	30 x 280	350	0	325	2	12	2.3
70 17 3.	105	62	205	50	390	22	2 x 30 x 180	440	0	415	2	12	3.0
70 18 3.	135	80	265	50	490	22	2 x 30 x 230	540	0	515	2	12	3.7
70 23 3.	98	60	200	100	150	22	80 x 130	200	60	175	4	14	2.4
70 24 3.	138	84	280	100	200	22	80 x 180	250	60	225	4	14	3.1
70 26 3.	219	132	440	100	300	22	80 x 280	350	60	325	4	14	4.5
70 27 3.	280	168	560	100	390	22	2 x 80 x 180	440	60	415	4	14	5.8
70 28 3.	360	216	720	100	490	22	2 x 80 x 230	540	60	515	4	14	7.1
70 34 3.	228	138	460	150	200	22	130 x 180	250	100	225	4	14	4.6
70 36 3.	358	216	720	150	300	22	130 x 280	350	100	325	4	14	6.6
70 37 3.	465	276	920	150	390	22	2 x 130 x 180	440	100	415	4	14	8.5
70 38 3.	595	354	1180	150	490	22	2 x 130 x 230	540	100	515	4	14	10.6
70 46 3.	498	300	1000	200	300	22	180 x 280	350	150	325	4	14	8.8
70 47 3.	645	384	1280	200	390	22	2 x 180 x 180	440	150	415	4	14	11.3
70 48 3.	825	492	1640	200	490	22	2 x 180 x 230	540	150	515	4	14	14.0

Order details:
slide plate for bolting type 70 .. 3.

Material: S235JR

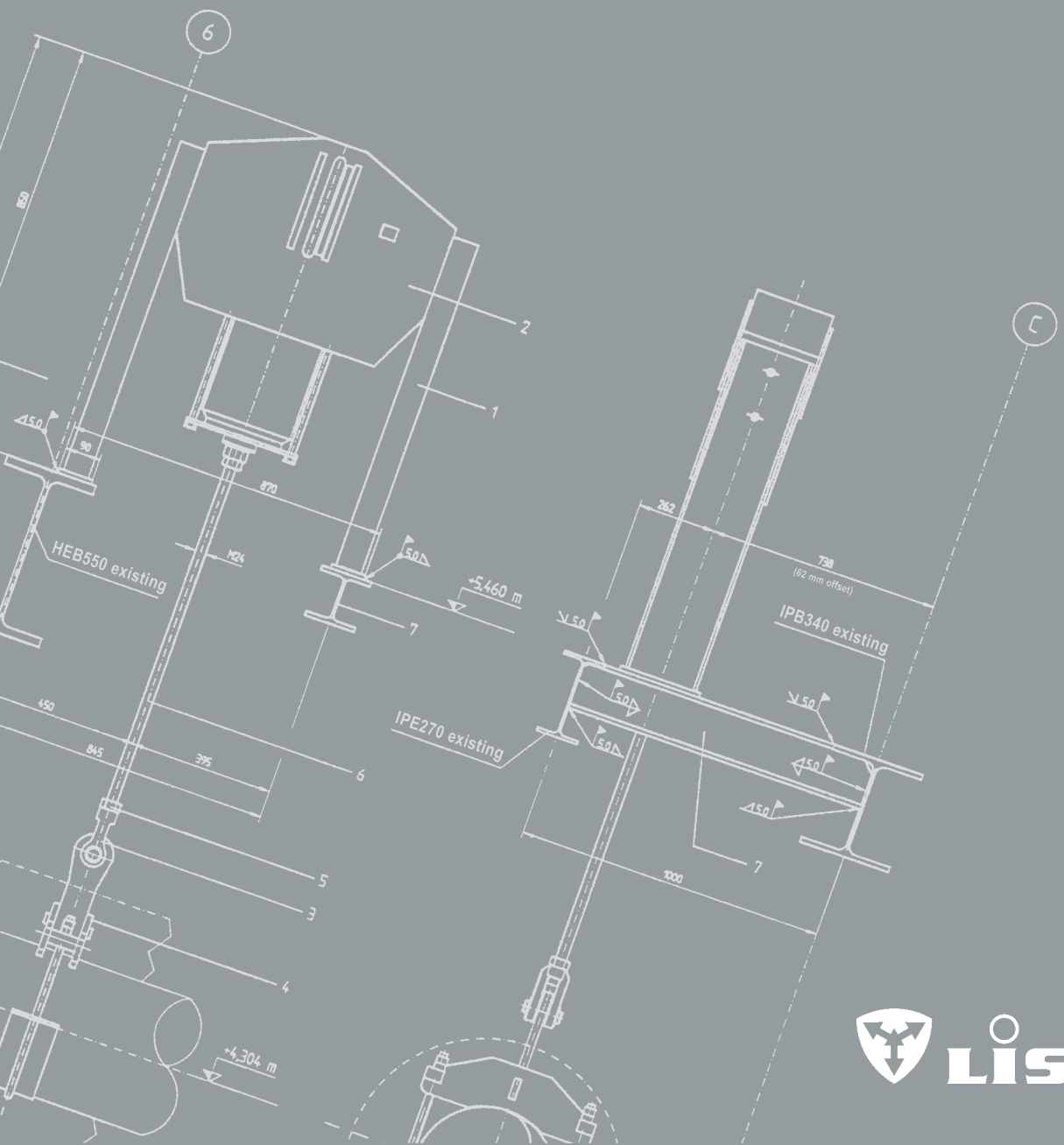
Surface: weldable primer

Slide plate type 70 .. ..-MB for vertical or overhead installation

Supplementary order details:
slide plate 70 .. ..-MB

LISEGA software tools for planning and design

LICAD®
PIPE SUPPORT DESIGNER

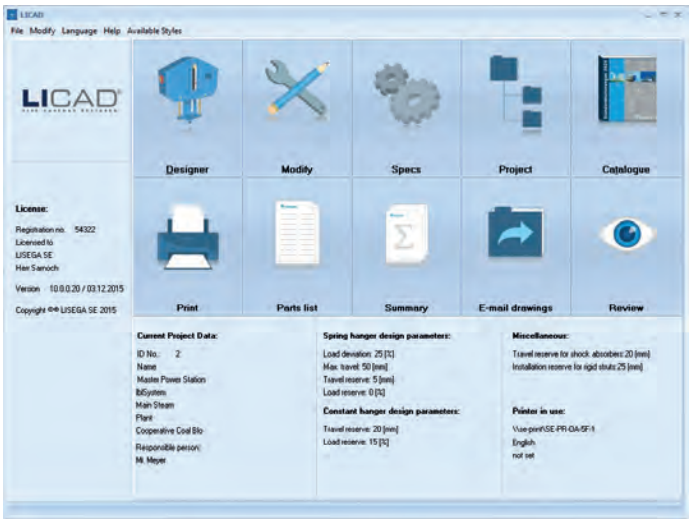


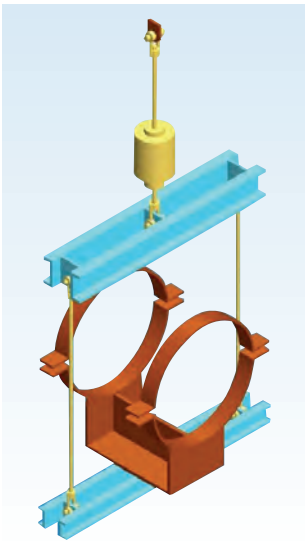
8

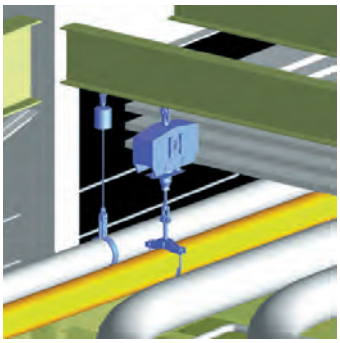
LISEGA SOFTWARE TOOLS FOR PLANNING AND DESIGN

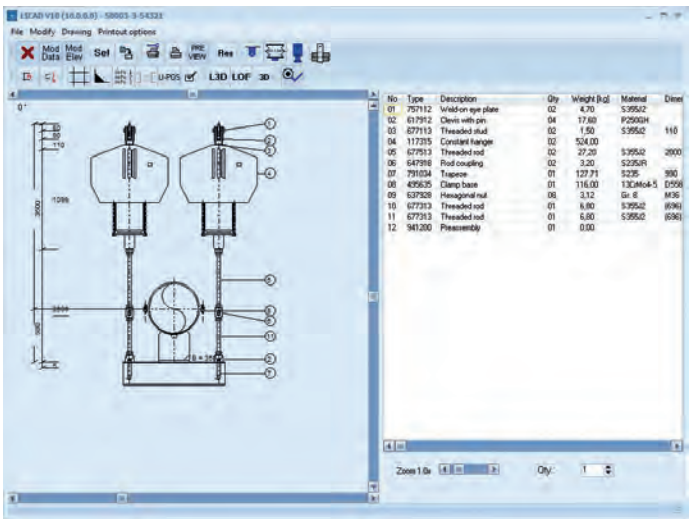
PRODUCT GROUP 8

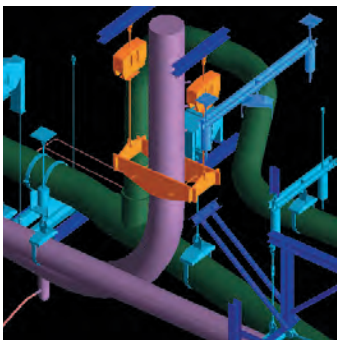
LISEGA











LICAD®
PIPE SUPPORT DESIGNER

LISEGA software tools for planning and design

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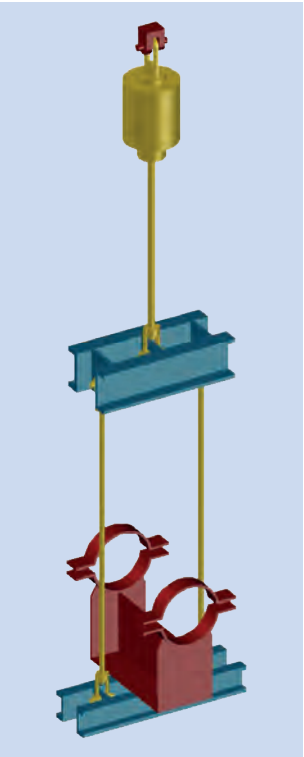
LISEGA software tools for planning and design



The intelligent solution for support design

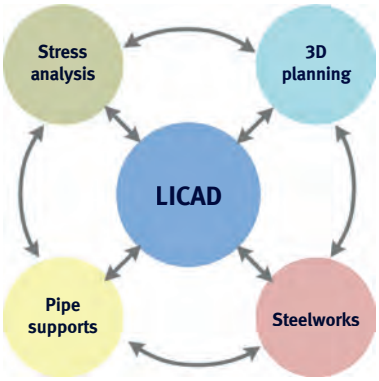
LISEGA's unique modular system was the prerequisite for the creation of highly sophisticated user software. The solutions we offer open up new opportunities for increased efficiency in design, optimized quality and significant savings in project man-hours.

In general, the model design of plants is carried out with CAD, including CAE systems. Through the integration of LICAD® into different CAD systems, the benefits for the efficient layout of piping systems have been vastly improved.

The LICAD® program has set new standards in this field. It enables the creation of support drawings and lists of materials in minutes instead of hours. LICAD® is an intelligent front-end program that supplies the necessary interface data from only one source for all CAD programs currently in use.

From the point of view of quality this single-source function is particularly important.

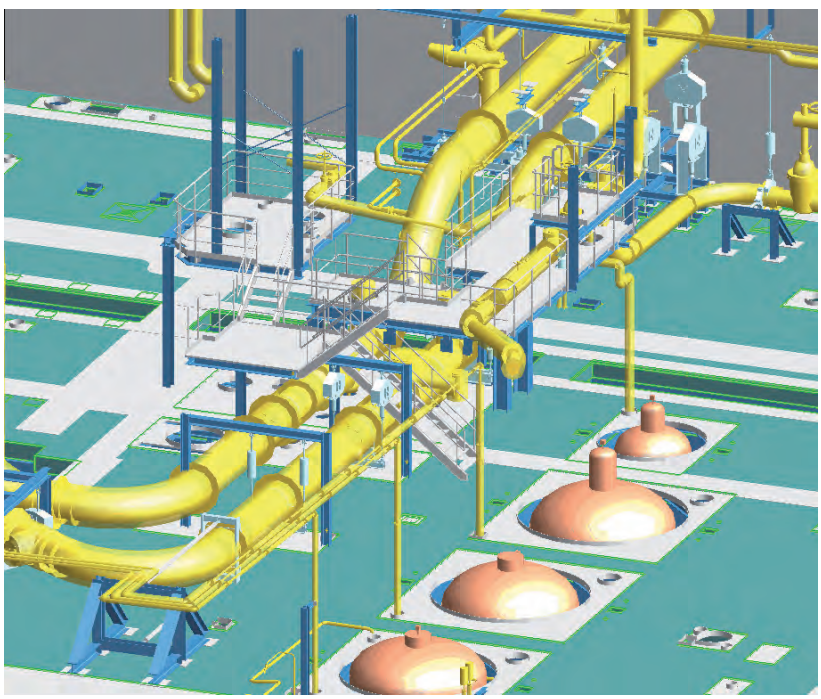
To provide the LICAD® user with the widest possible range of applications, LISEGA has developed supplementary user software. The whole package covers:



Planning of a plant

- **LICAD® planning and design program for pipe supports**
- **Interfaces for import and export of tables and databases**
- **Interfaces with 3D-CAD component packages**
- **2D / 3D libraries for different CAD programs**
- **Internet communication system for downloading the latest program versions and information on projects, including drawings and orders**
- **Interface to stress analysis and steelwork software**

LICAD® PIPE SUPPORT DESIGNER



Support configurations can be integrated via the export function into complex 3D views.

Planning software LICAD®

Software with profit effect

Needed first – designed last

As a rule the project planning of complex pipe systems runs through numerous phases of optimization. The design of pipe supports inevitably takes place at the end of the whole process and so their deployment frequently comes far too late. **Although the supports are needed on site beforehand for optimum installation of the pipe systems, they lie right at the end of the planning chain** - all the more important to avoid unnecessary delay. The time factor is now crucial.

LICAD® speeds up the planning process

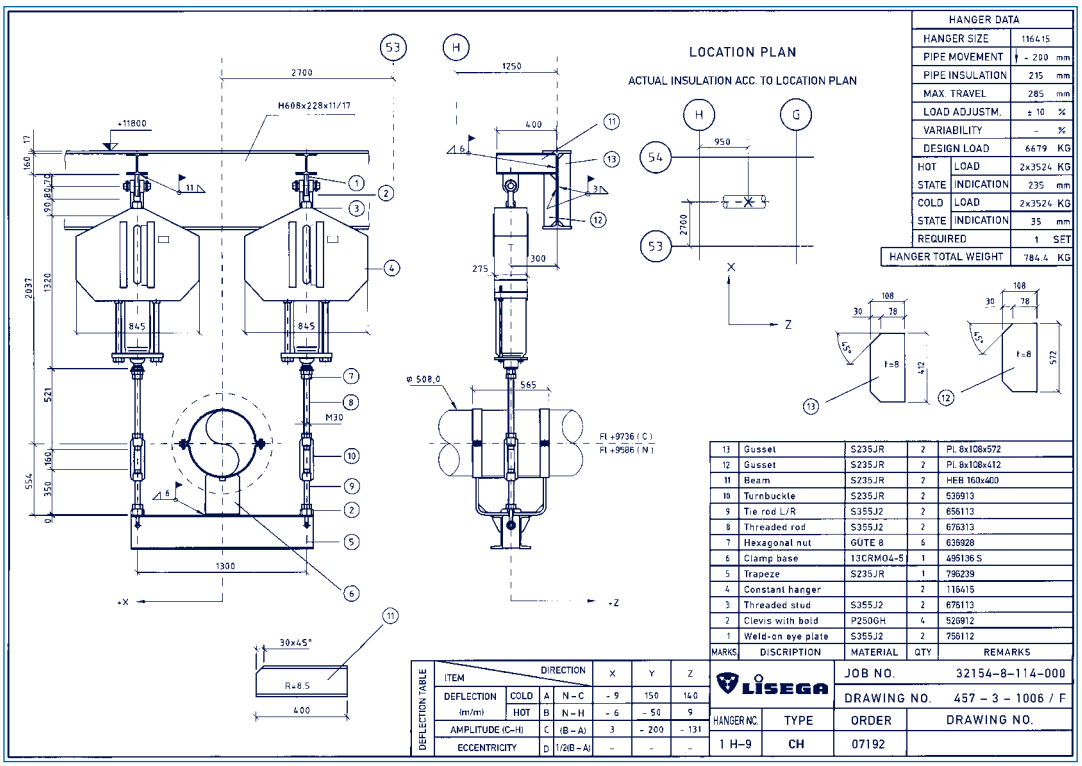
LICAD®, the LISEGA design program for pipe supports, sets the highest standards in efficiency. With LICAD the laborious poring over catalogs and the paintaking preparation of lists of material are a things of the past. Support designs and load chains no longer need to be manually configured and then drawn up at great expense and effort. What would otherwise take hours to produce can be done by computer in minutes – at the click of a mouse!

Future-orientated logistics

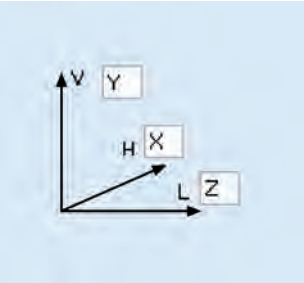
With LICAD®, great savings in time are possible in the logistics process, from planning right through to delivery. For example, the LICAD® data can, if required, be transmitted directly for processing on the same day by e-mail as a computerized order list. This fits in perfectly with ever-tighter order deadlines.

The downloading and use of LICAD® is free of charge.

In the current version the following languages are available for menu navigation and print editions: Chinese, German, English, French, Italian, Japanese, Polish, Portuguese, Russian, Spanish and Hungarian.



AutoCAD® drawing, generated on the basis of a LICAD® design



Free determination of axes

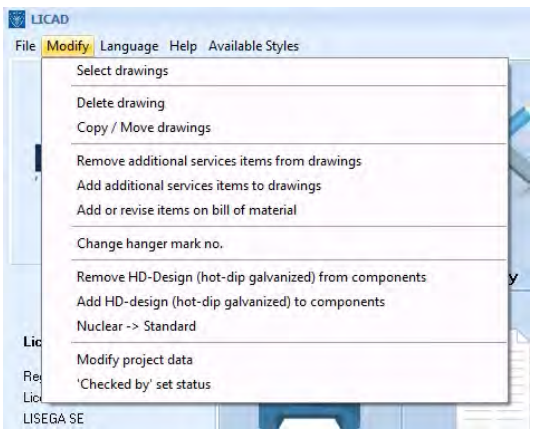
LICAD® is simple to use

The relevant data for industrial support points is entered using menu-driven program control. Only 6 parameters are needed to find the optimum solution.

- **pipe diameter**
- **temperature of medium**
- **operating load**
- **displacement**
- **installation height**
- **support configuration**

From this input, the appropriate load chains are automatically generated. The selection of optimum spring and constant hangers thereby follows automatically, whereby the specific customer requirements such as, for example, travel and load reserves according to **ASME B 31.1, VGB-R 510 L, DIN EN 13480** or other optimum parameters are taken into account. This is ensured by the corresponding entries in the options menu.

Taking this information into account, LICAD's programmed algorithm chooses the most economical solution.



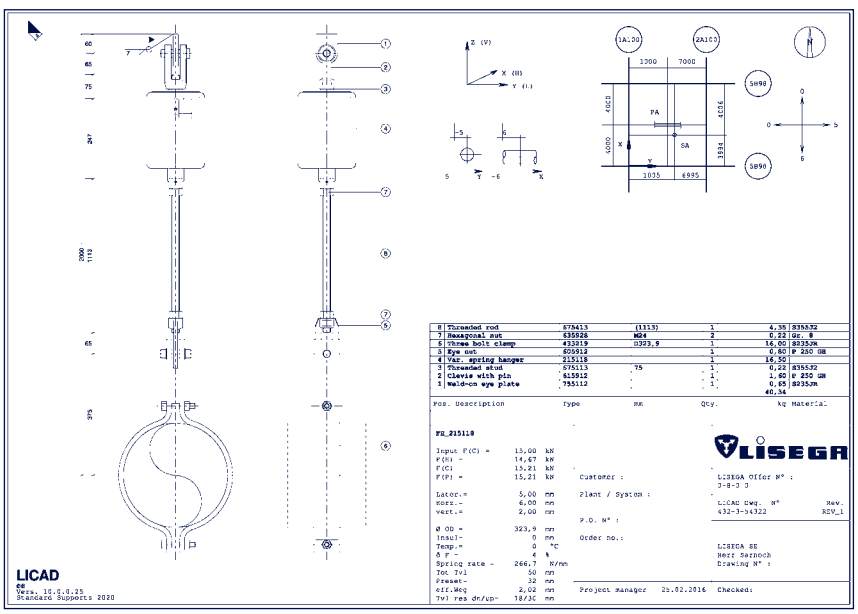
Further options for editing of drawings

True-to-scale drawings

The support chains created are automatically saved as complete assemblies and can be printed out as drawings or modified at any time. They are true to scale and contain all relevant details, including parts lists with weights and materials and optionally with location plan or other freely editable information.

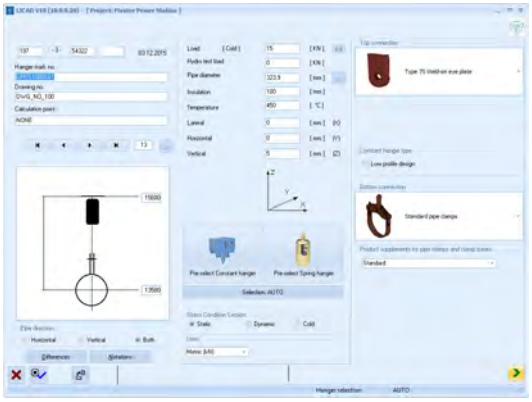
LISEGA modular system forms the basis

The basis of the program is a database system in which the whole LISEGA standard product program is stored as a modular system of absolute functionality. From more than 12,000 standard components, all fully compatible regarding loads and connections, more than 100 standard configurations cover practically all normal installation situations.

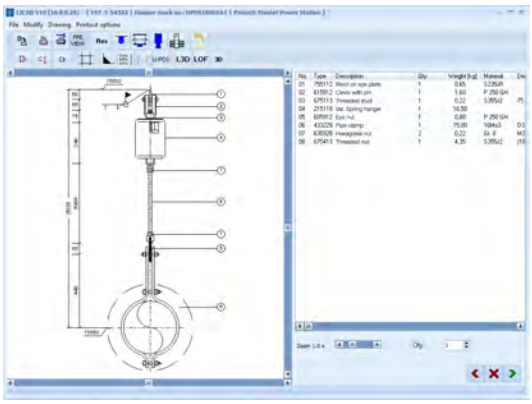


LICAD® drawing generated by a standard printer

All essential functions at a glance



Clearly arranged queries on the essential data for the support in question



Support design with detailed parts list

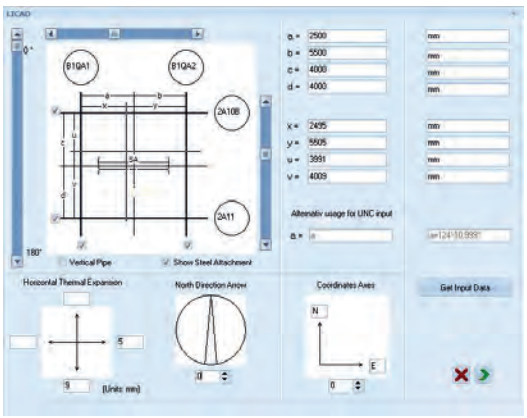
Auxiliary designs for steelwork

LICAD® generates ready-to-install load chains from standard supports, from structural attachment to pipe-surrounding component. More or less complex auxiliary designs are necessary for connection to the existing structures (secondary steelwork).

Through its special interface the LICAD® designs can be exported into a separate CAD program (e.g. AutoCAD®, MicroStation®) and supplemented as required.

Interference checks

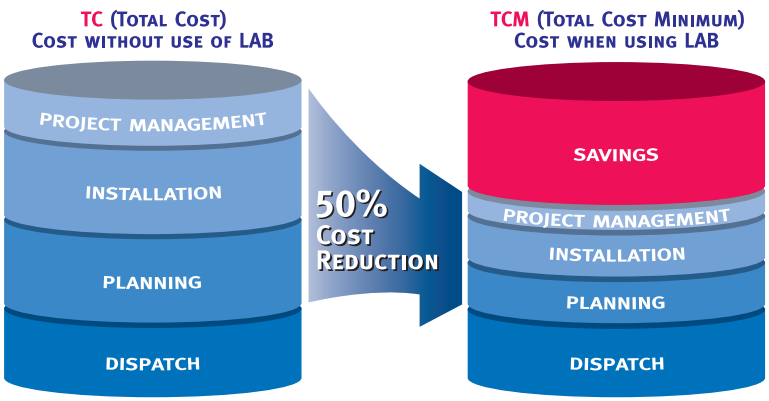
For larger plant projects the design of the building structure, including steelwork, main components and connecting piping system, is carried out via 3D CAD programs such as **Smart™ 3D (Intergraph), PlantSpace (Bentley Systems), Plant 3D (AutoDESK) or PDMS™ (AVEVA)**. Planning continuity, as well as the need to consider possible interference, make it necessary to fully include the pipe supports.



Location plan with axis designations and dimensioning

LICAD® saves up to 50% of planning costs

LICAD® runs smoothly on any modern PC with Windows and is easy to use. Due to its particular effectiveness LICAD® has long been an indispensable tool in support planning for countless engineering offices. Potential savings in costs of **up to 50%** simply cannot be ignored!



Possible savings in costs through LISEGA Application Benefits (LAB)

Interfaces and component libraries

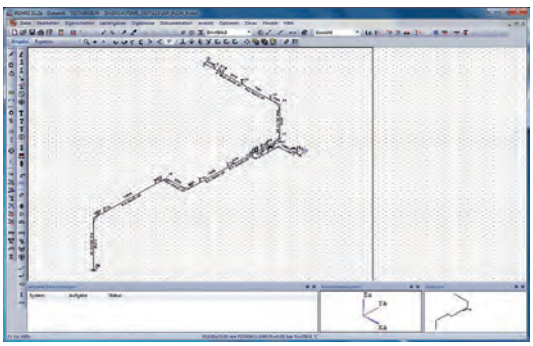
LICAD® contains a wide range of interfaces and component libraries for well-known CAE, CAD and steelwork programs.

This benefits resources and makes for significant savings in time when designing pipe systems!

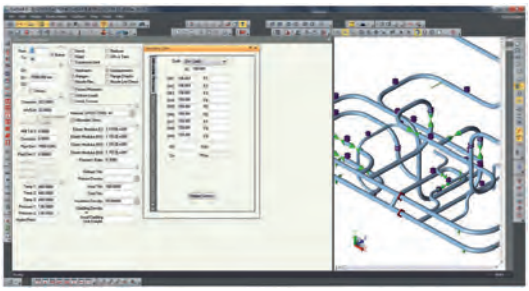
Interfaces and CAE systems

A broad spectrum of interfaces enable the import and export of data already entered from, and to, CAD and CAE systems.

This basis of the selection of a support chain is formed by the design data from the pipe calculations of the pipe system. One of the CAE systems is the ROHR2® program system (Sigma Co.), which is used for the static and dynamic analysis of complex piping systems and common skeletal structures.



Pipe stress analysis with ROHR2®

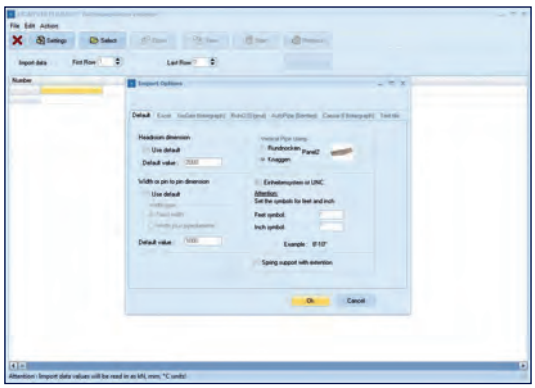


Pipe stress analysis with CAESAR II®

Data from AutoPIPE® (Bentley systems) or CAESAR II® (Intergraph Co.) can continue to be included and used in the selection of the appropriate supports. The data gained from the CAE systems can be sent directly to CAD programs after generation of the supports.

This procedure enables a considerable increase in efficiency and savings in time when designing complex pipe systems.

The interfaces to the CAE systems mentioned above are part of the basic LICAD® package. Optional interfaces for downloading can be found on the LISEGA homepage.



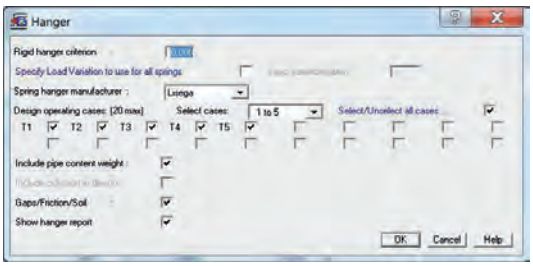
Import of design data

Export of design data from CAESAR II® for LICAD®

Interfaces to CAD programs

Via defined interfaces the LICAD® support designs can be transmitted true to scale and without any further efforts to the known CAD programs. LICAD® supports the export formats DXF, LOF, L3D and ITM. The data are used for the transmission of graphic information and design data. The relevant additional applications are available in the CAD systems for the import of these data.

Pipe systems in AutoPIPE®



AutoPIPE® hanger filter

Export of 2D data

Via a DXF export file the support designs, including dimensioning, can be exported optionally with parts lists, site plans, and title block to CAD programs (e.g. AutoCAD® or MicroStation®). This interface is part of the basic LICAD® package. For export, the material list (STL) and design data (TEC) files are additionally generated; they can be used for further evaluations.

Export to 3D CAD programs

On the basis of component libraries the drawings prepared in LICAD® can be transformed into 3D drawings via add-ons in various CAD programs. This is possible for:

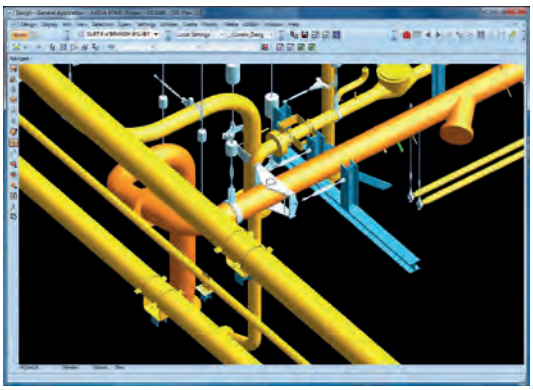
- **AutoCAD®, Autodesk**
- **AutoCAD® Plant 3D, Autodesk**
- **MicroStation®, Bentley Systems**
- **SmartPlant® 3D /Smart™ 3D, Intergraph®**
- **PDS®, Intergraph®**
- **SUPPORT MODELER®, Intergraph®**

For the above mentioned programs the corresponding modules are to be uploaded and installed.

For the **PDMS™** software from **AVEVA** no add-on is registered. A menu extension is available by which data can be conventionally imported and exported.

LICAD® plug-ins

LICAD® plug-ins for different systems are also available. These are used in cases where supports are to be designed interactively in a 3D model. The advantage of a plug-in is that the geometric data of the connection points for the support, as well as pipe diameters, height notations and, if required, the design data are exported directly to the program. There is no longer any need to take measurements in the model. The support chain is automatically displayed in the 3D model.

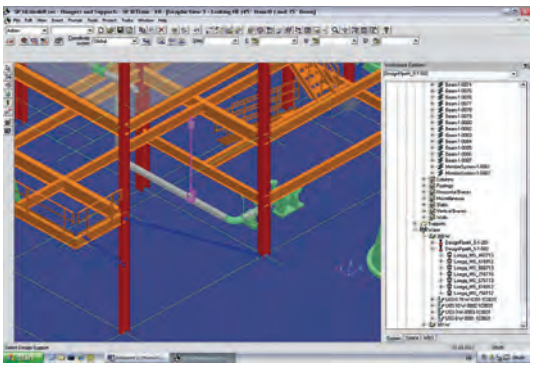


Model in PDMS™ after data import from LICAD®

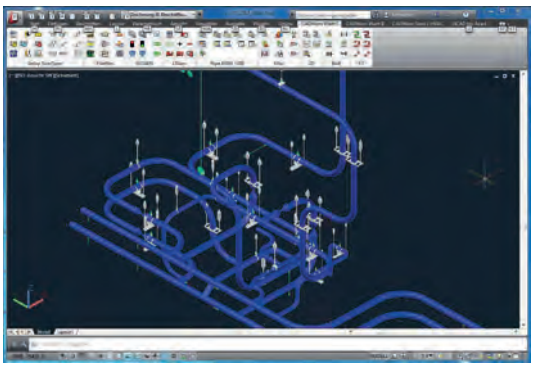
The attributes of the material lists are also imported, depending on the system.

Important: In order for the plug-ins to function, LICAD® must be installed at the respective work station.

INTERGRAPH
CADWorx®



LISEGA standard supports in SmartPlant® 3D

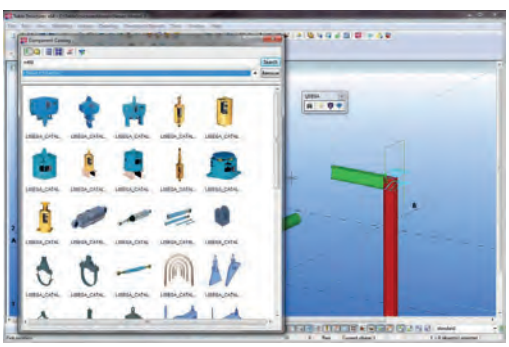


LISEGA supports in CADWorx®

Component Libraries

For further designing in the 2D and 3D modes, comprehensive LISEGA component libraries are available, amongst other things, for the following CAD programs:

- **AutoCAD®, Autodesk**
- **AutoCAD® Plant 3D, Autodesk**
- **MicroStation®, Bentley Systems**
- **SmartPlant® 3D / Smart™ 3D, Intergraph®**
- **PDS®, Intergraph®**
- **PDMS™, AVEVA™**
- **SUPPORT MODELER®, Intergraph®**
- **TEKLA Structures, TEKLA®**

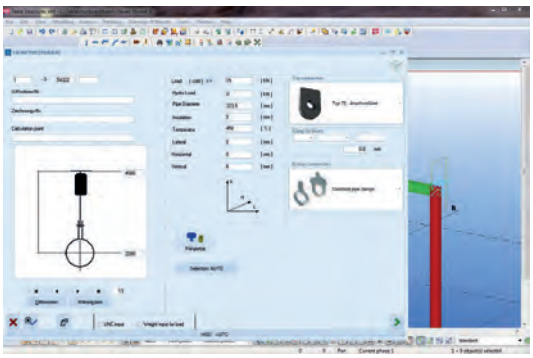


LISEGA component library in TEKLA®

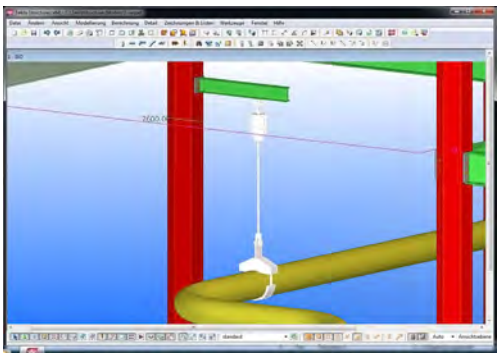
Interface to steelwork programs

Through LICAD®, the most suitable standard support configurations for each case are determined and from this the corresponding load chains, including all individual parts, are specified.

In plant construction, standard supports are the connecting links between pipe systems and steelwork. In ideal cases they can be directly connected to the existing plant structure, but often a further step is necessary, that is, the use of additional steelwork components as connecting elements (secondary steel). It therefore makes sense to be able to display standard supports in steelwork programs. For this, LICAD® provides interfaces to steelwork programs (e.g. TEKLA Structures software). By means of the plug-in function, LICAD® is integrated into the steelwork program and supports can be directly planned in accordance with the requirements of the model.



LICAD® plug-in for TEKLA Structures



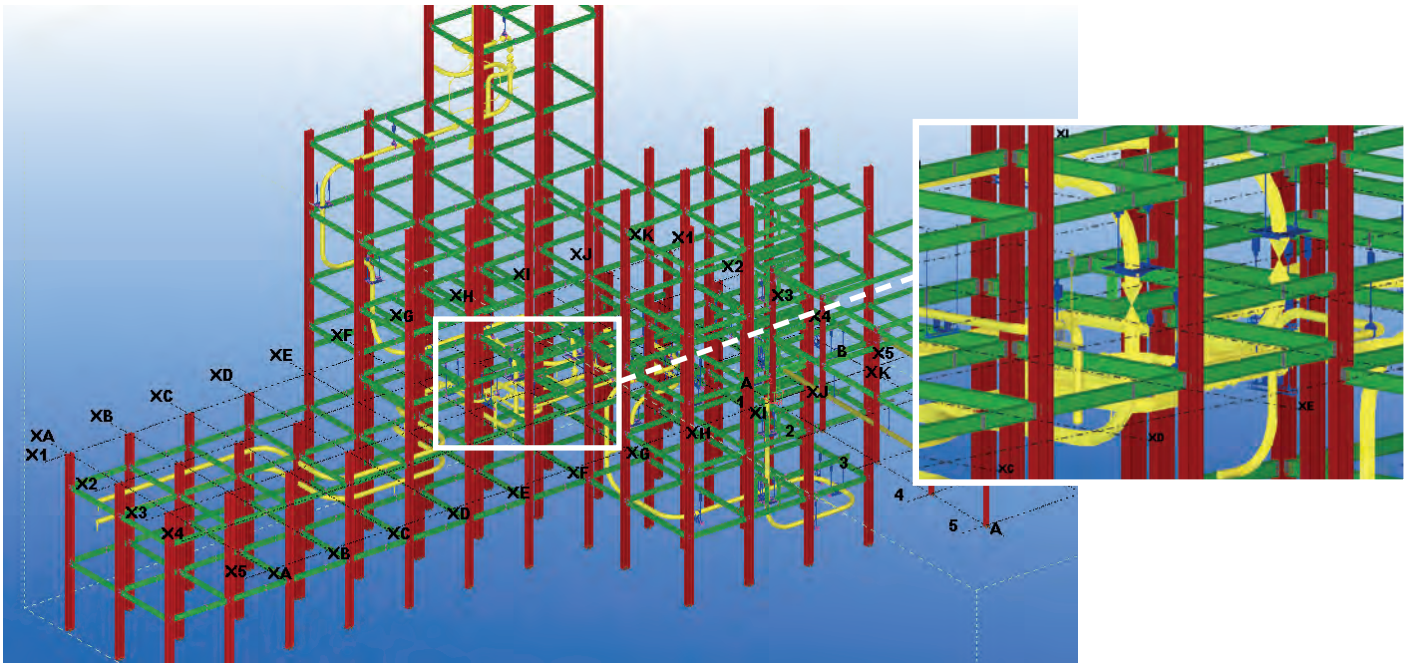
Interactively designed support in TEKLA Structures

TEKLA®
A TRIMBLE COMPANY

Simple modeling and rapid alteration of 3D models

This, together with all other plant components in the model, enables the execution of a clash check, which is necessary when planning complex plants.

With the development of the steelwork interface LISEGA supplies a tool that can reduce the enormous investment in time and so optimize the quality of the planning process.



Primary steelwork and pipe systems with supports as reference in TEKLA®

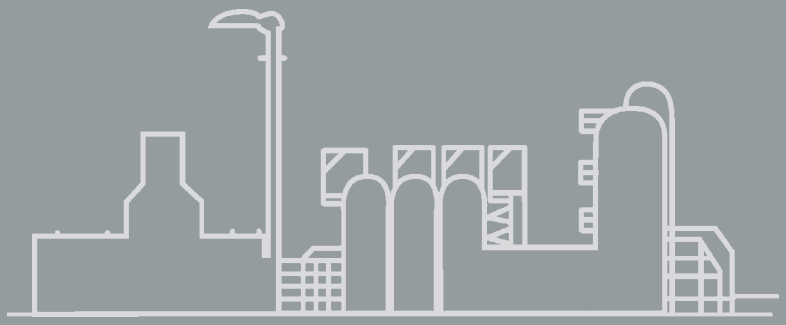
LICAD® updates

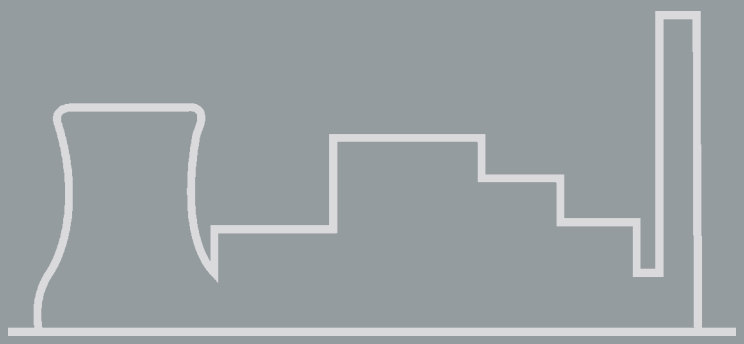
LICAD® and other software packages are being constantly updated and expanded. The applicable program version and interfaces in each case can be found on the LISEGA homepage for downloading.

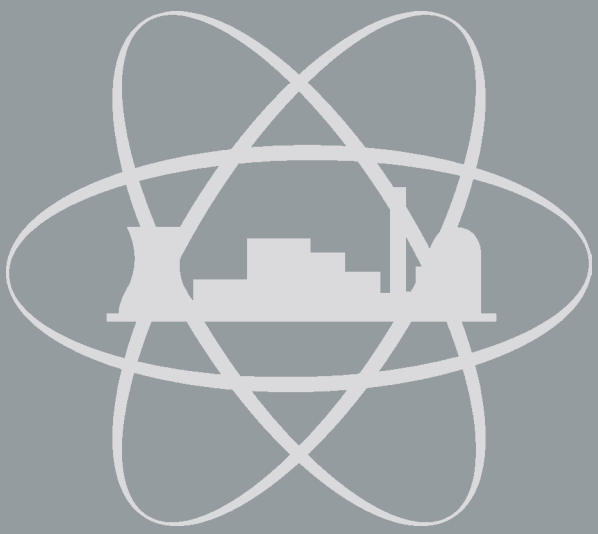
The necessary license numbers are thereby forwarded automatically by e-mail to the recipient. Further license numbers can be obtained by telephone.

The use of LICAD® software is free of charge.

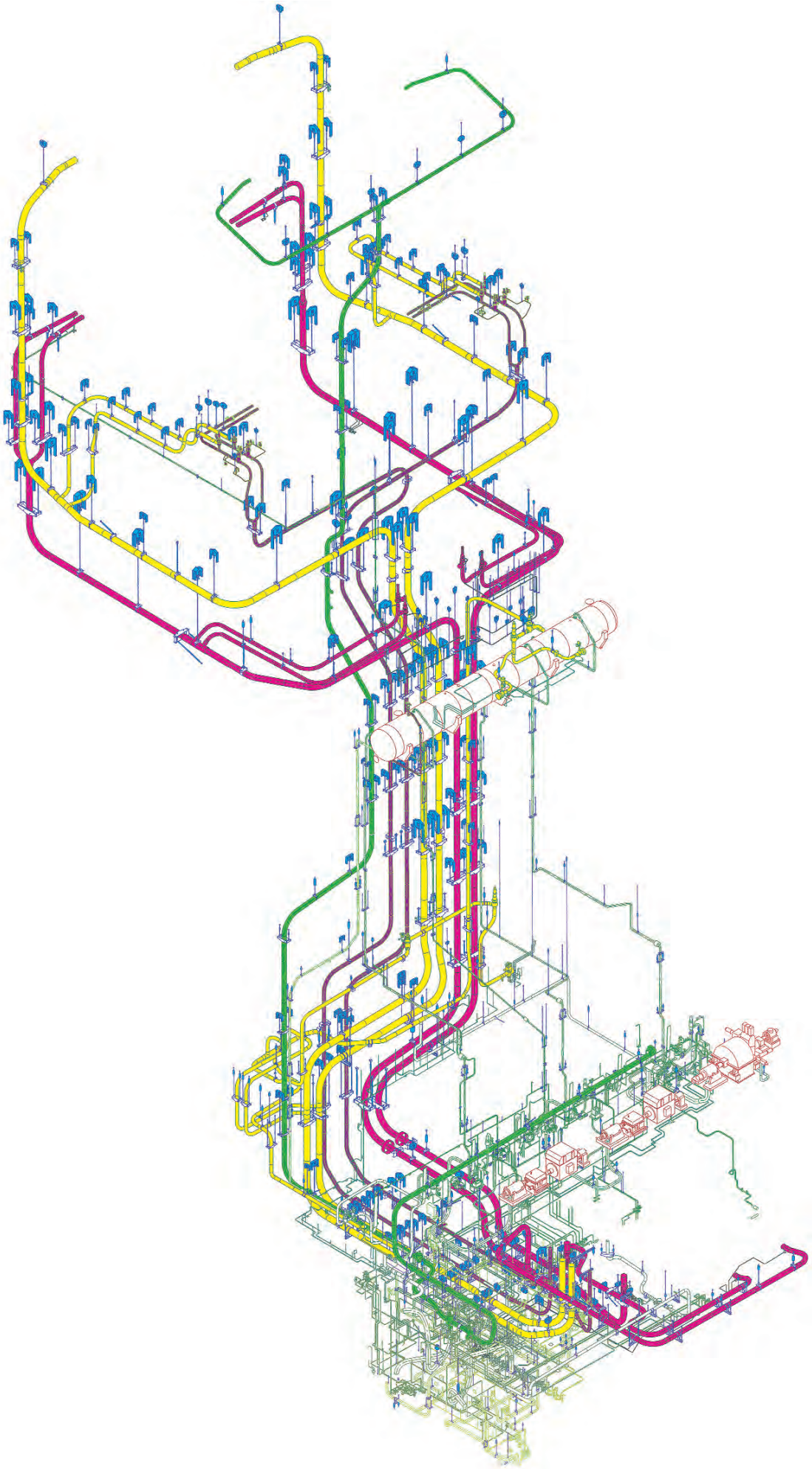
Supplementary services, engineering, field service







LISEGA



Supplementary services, engineering, field service

Contents **Page**

Supplementary services

The LISEGA product program presented in this catalog STANDARD SUPPORTS incorporates the latest technical developments with respect to the proper support of pipe systems in industrial plant construction.

The relevant international stipulations are observed to the fullest extent.

Special fields of application
The standard design described covers the normal field of application. In special sectors, for example, nuclear or offshore installations, supplementary measures with regard to material quality or corrosion protection may be required. The implementation of particular customer specifications is ensured by the integrated quality management system. Certificates of approval are supplied with the order.

Service areas
The LISEGA performance package includes not only the product spectrum but a range of services within the framework of product application. In the field of engineering they cover the whole process chain from pipe system design to support planning in all the current 3D design sectors. The service field comprises the usual support when commissioning, right through to plant analyses and walk-downs. Through the use of specially developed software for support design highly effective support is available, e.g. in the 3D CAD sector.

Standardized supplementary services
By means of tightly-focused supplementary services the LISEGA standard program can be adapted to particular requirements. In this way the field of application of the products is widened and the LISEGA performance package optimized. All major supplementary services are standardized in line with the LISEGA modular system and cataloged in product group 9.

9.0 Supplementary services

9.1 Adjustment work
Constant and spring hangers/supports are adjusted to installation load on a hydraulic test bench via computerized force and travel measurement, then blocked.

9.1.1 Storage of the blocking devices
On request the spring hangers/supports can be equipped for permanent storage of the blocking devices (after deblocking) on the casing. This is standard practice on the constant hangers.

9.2 Quality assurance

9.2.1 Inspection reports
If required, inspection reports with digitally recorded values can be supplied as function verification for constant hangers, spring hangers and snubbers.

9.2.2 In-service tests
In-service tests can be performed on the mechanically operating components of any make in the respective LISEGA factories or by using mobile test benches directly within the plant itself.

9.2.3 Material certification
The following material certification can be supplied on request.

9.2.4 Supplier's certificate
Manufacturer and shipment in compliance with the order can be confirmed with a supplier's certificate according to DIN EN 10204-2.1.

9.2.5 Material certificates DIN EN 10204-2.2
The materials used in all catalog components can be verified by verification certificates according to DIN EN 10204-2.2.

Compilation of component documentation

9.2.6 Acceptance test certificates DIN EN 10204-3.1

Components exposed to the direct flow of force such as, for example, the springs in constant and spring hangers or supports, can be supplied with certificates according to DIN EN 10204-3.1.

9.2.7 Complete traceability through acceptance test certificates DIN EN 10204-3.1

Due to separate fabrication, complete traceability is possible of materials in all catalog components with test certificates according to DIN EN 10204-3.1.

9.2.8 Pre-examination documents

The standardized products were largely certified by independent inspection bodies by specified suitability and type tests according to KTA 3265.3 and VGB-R 510 L.

Pre-examination documents such as design drawings, parts lists, calculations, test sequence schedules and welding plans can be produced for special designs, particularly non-standardized components (also for other codes).

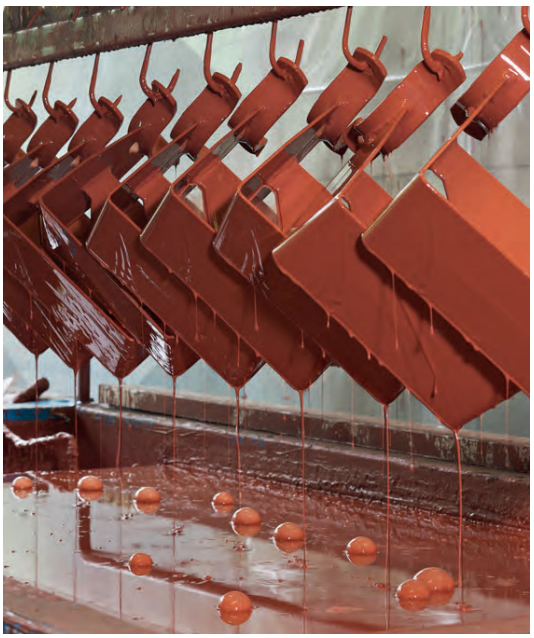
9.2.9 Increased quality requirements

For applications subject to increased safety and quality demands, such as nuclear installations, the highest level of the quality assurance program is implemented. All stages of order processing and execution are followed according to recognized procedures, in line with the quality stipulations in the standard codes KTA or ASME section III, NCA and NF.

The following areas are thereby taken into special account:

- **material acquisition from approved suppliers**
- **complete traceability of materials**
- **strict supervision of manufacture**

All areas are fully documented.



Cataphoretic immersion priming

9.3 Surface treatment

In addition to specified standardized surface protection, further corrosion protection can be supplied according to technical specifications, from page 0.10.

Spray painting

Pre-assembly of load chains

Special treatment

Besides the standard designs available from stock, special designs providing extra corrosion protection can be agreed on. For this, separate manufacturing may be required.

9.4 Pre-assembly

If not otherwise agreed, the components belonging to one scope of supply will be packed in bundles according to types.

9.4.1 Pre-assembly of load chains

For simple handling and time-saving assembly at site, the individual components are supplied already pre-assembled into load chains, according support drawings bundled and marked.

Constant and spring hangers/supports, as well as larger pipe clamps (bulky components), are kept separate for easier handling and are correspondingly marked.

9.4.2 Pre-assembly of pipe clamps and clamp bases

Pipe clamp and clamp base halves are bolted ready for shipment and supplied as complete units.

9.5 Labelling and marking

If not otherwise agreed, the components are sorted according to type, packed and marked with quantity, type number and order number. Additional labeling and marking can, if required, be applied.

9.5.1 Marking of individual parts

If required, all components can be marked individually with type, support position number or order number.

9.5.2 Second name plate

If required, spring hangers and constant hangers can be fitted with a second name plate.

9.5.3 Second load and travel scale

If required, constant spring hangers/spring supports can be fitted with a second travel scale and constant hangers/supports with a second load scale.

9.6 Packaging

Appropriate forms of packaging are provided for the various requirements.

Load chains, pre-assembled, bundled and marked

9.6.1 Inland packaging
For road or rail transport, sturdy wooden crates or pallets are offered, fitted with skids for fork-lifting.

9.6.2 Seaworthy packaging
For sea transport, special wooden crates are used, with skids for fork-lifting and with reinforced side walls for any transport by crane. The lids of the crates are lined inside with plastic shrink wrap as protection against moisture.

Other special forms of packaging can be agreed upon in detail.

9.6.3 Export control and shipment processing
As a globally operating export company, LISEGA and all its affiliated companies take full responsibility for completely fulfilling all customs and export stipulations.

To ensure and properly execute export control, LISEGA has set up structures that correspond, on the one hand, to legal requirements and, on the other, to a smooth and effective work flow.

By certification as "Authorized Economic Operator" (AEO-F) in the year 2009 and as "Known Consignor" in March 2012, LISEGA has shown that it meets all prerequisites for the support of a secure supply chain.

Together with the simplified customs procedures granted by the AEO certificate for the accelerated export of goods, the independent declaration of preferences, as well as the package acceptance free of any control for airfreight due to our "Known Consignor" status, this contributes noticeably to the trouble-free preferential export processing of LISEGA products.

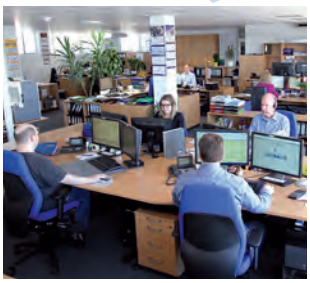
The personnel in our export office all have comprehensive and regularly updated expert knowledge in all aspects of shipment processing.

Should LISEGA not already be responsible for customs clearance according to the terms of delivery, we will assume this at the customer's request, also in the form of direct representation, after being granted power of attorney for customs.

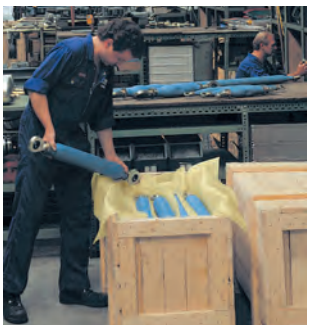
Our notable competence in shipping processing is matched by the high standards of packaging and marking at LISEGA, fully covering all international standardized stipulations in the land, sea and air transport sectors. This is confirmed by the unanimously high acceptance shown by our customers.

9.7 Transport

If requested, we will take charge of the logistics processing for shipment of the components to the construction site or any other shipping addresses.



Project-related order logistics



Seaworthy packaging

Part of the dispatch department

Engineering support design

The proper functional integration of pipe supports into the existing piping and plant concept has a decisive influence on the long-term behavior of the pipe systems. Support design should therefore be given the same care and attention as the piping itself. In this regard, selection of the component, the availability of the latest design software and especially the long experience of the planning engineers have a decisive influence on the quality of design.

Engineering support design

Besides stringent demands concerning quality it is also important in support planning to fulfill strict requirements regarding tight schedules and economic targets. In order not to endanger the budgets and logistics of entire projects, complete planning phases are outsourced to engineering offices specialized in the work.

As a specialist, LISEGA has long been qualified in the processing of complex planning projects by offering the relevant expertise from over 50 years' experience in support technology. At all LISEGA locations highly qualified and experienced technicians and engineers are on hand.For internationally overlapping projects and whenever required, the engineering sections of the individual locations work in collaboration with each other.

The following benefits are offered to the customer when using LISEGA's planning expertise:

- **economical limitation of their own personnel deployment**
- **high security and professional execution through the use of experienced specialists**
- **rapid and flexible processing of the whole project, from ordering to shipping, following the principle 'All from a single source'**
- **quick delivery due to prompt processing**
- **complete and permanent computerized documentation**
- **highly qualified experts always on hand for follow-up service**

Pipe supports for complete plants, including secondary steelwork are conceived, planned and reproduced in drawings. On the basis of the LISEGA modular system and decades of experience, ready-to-install load chains – from structural attachments to pipe-surrounding components – are generated from standard supports.

Should components be required that do not form part of the standard LISEGA program (e.g. anchors etc.) LISEGA can provide appropriate solutions.

Recognized international technical codes and standards, as well as customer specifications, are thereby taken into account.

The relevant pipe stress analysis data are observed for the design and dimensioning of supports, as well as the detailed pipe system layout plans and structural situation.

Besides LISEGA's LICAD® program, the latest software is applied for the efficient conversion of the support situations into 2D or 3D models and for the economical generation of drawings. The following standard programs are currently being used:

- **LICAD®**
- **AutoCAD®**
- **MicroStation®**
- **PDMS™**
- **STAAD.Pro® (static/dynamic calculations for secondary steelwork)**
- **SmartPlant® review**
- **Navisworks®**
- **ROHR2®**
- **CAESAR II®**

Engineering in Zeven, Germany

Analysis of complex support systems

Shown below is an example of a planning sequence for a suitable LISEGA support design in **seven steps**. Depending on needs and specifications the engineering services can also be offered individually.

Pipe system calculations

The following typical load cases are generally calculated per support point for new and existing plants:

1. **Primary loads**
   - **weight and internal pressure**

2. **Secondary loads (thermal expansion)**
   - **operating loads**
   - **design conditions**
   - **boiler out of service**
   - **(AB operation of pumps)**

3. **Occasional loads**
   - **earthquakes**
   - **wind**
   - **pressure impact loads**

4. **Test loads**
   - **water pressure tests**
   - **pickling (acid clean)**

On the basis of the stipulations and information, ready-to-install load chains from standard attachments to pipe-surrounding components are generated with the LISEGA design program LICAD®.

For the calculations the codes ASME B31.1, ASME B31.3 and DIN EN 13480 are usually followed. When ordering, the desired code issue according to version and year must be stated.

In existing plants it is frequently necessary, for reasons of operational safety, to update pipe systems and their supports to meet the requirements of the latest technology. Very often, sufficient calculation documentation on the original layout design is no longer available. If required, the stress analysis can also be supplied for these pipe systems.

LICAD®

In accordance with calculations and customer stipulations, the installed load chain is generated from standard supports with the LICAD design program, from structural attachments right through to pipe-surrounding components.

R E S U L T S -- Program ROHR2 BBS/31.0 -- Page 34
Commiss. AGX43458 Date 13.12.11 10:54:35
B0LCJ30/35/50/55BR010 B0LCJ35/55BR020

support point *function* *marking number*

L i n e 3 P o i n t 329 S HR B0LCJ55BQ008
Support in Absolute Coordinate System

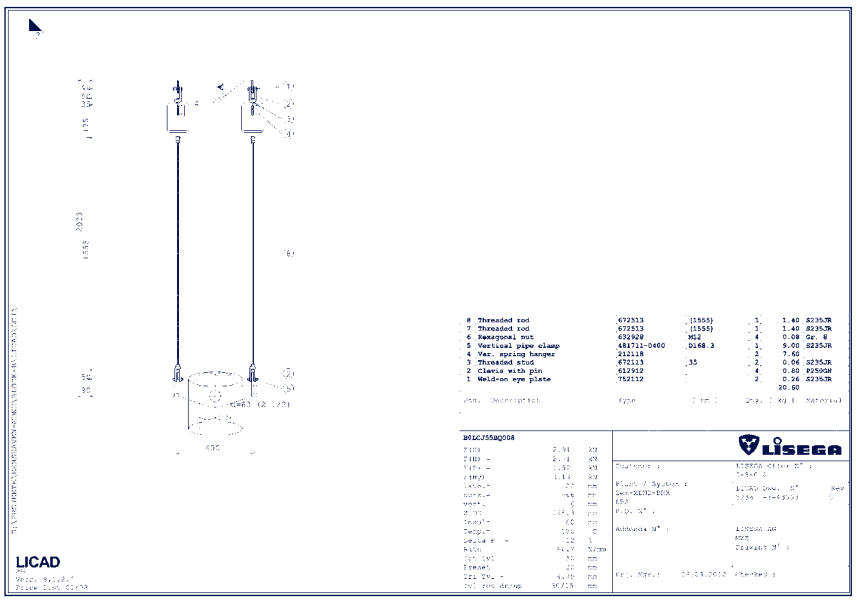
Spring hanger

load cases

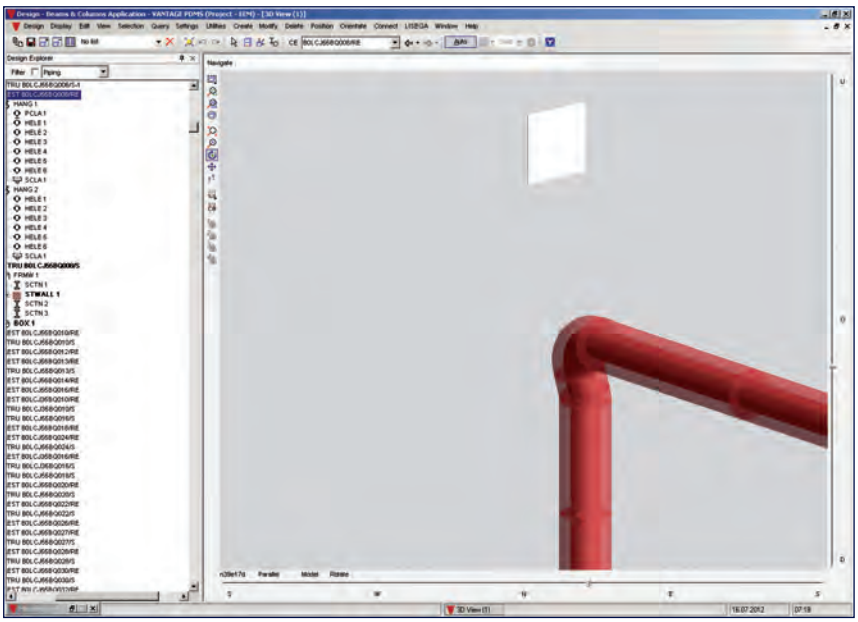
LoadCase	WX PX mm mrad	WY PY mm mrad	WZ PZ mm mrad	AQX AMX kN kNm	AQY AMY kN kNm	AQZ AMZ kN kNm
Dead Weight	-0.10 -0.03	-0.15 -0.26	0.00 0.10	0.000 0.000	0.000 0.000	-2.906 0.000
Operation Load 1	-7.51 1.98	2.29 0.22	2.91 2.29	0.000 0.000	0.000 0.000	-2.712 0.000
Operation Load 2	-1.46 1.35	3.37 0.93	2.16 1.28	0.000 0.000	0.000 0.000	-2.762 0.000
Operation Load 3	-6.88 1.91	2.36 0.31	2.82 2.19	0.000 0.000	0.000 0.000	-2.718 0.000
Earthq.dyn.1_X	51.28 4.54	13.63 1.18	2.48 11.21	0.000 0.000	0.000 0.000	0.165 0.000
Earthq.dyn.1_Y	27.28 3.16	12.87 2.54	2.10 5.95	0.000 0.000	0.000 0.000	0.140 0.000
Earthq.dyn.1_Z	2.55 0.41	1.72 0.39	0.97 0.58	0.000 0.000	0.000 0.000	0.065 0.000
Extreme value	-65.65 7.54	22.19 3.76	6.30 14.99	0.000 0.000	0.000 0.000	-3.131 0.000
Hydraulic Test	-0.09 -0.03	-0.15 -0.25	0.00 0.09	0.000 0.000	0.000 0.000	-2.906 0.000

travel + twist *loads and moments*

Step 1: Pipe stress analysis (ROHR 2®): travel / deflections / loads / moments (pipe stress analysis as iterative process)



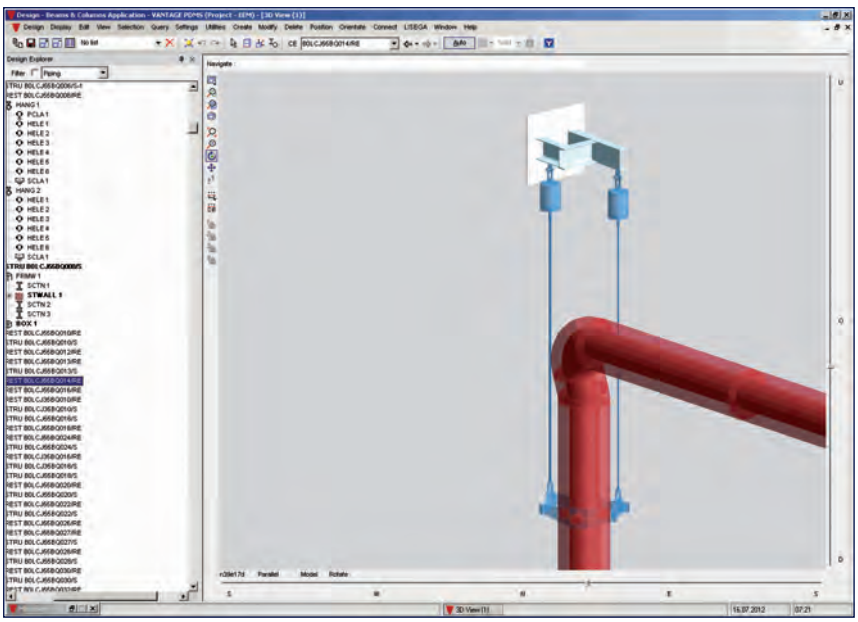
Step 2: Application of LICAD® - technical selection of pipe support



Step 3: Checking the technical data and surrounding structure in the 3D model (e.g. PDMS™, PDS®, SmartPlant®)

Support design in 3D

For the design of pipe supports in 3D the customer provides a model complete with pipe systems, steelwork, building structures and components, as well as all the necessary databases. In addition, any specific requirements are to be indicated for the design of the pipe supports.



Step 4: Integration of the LICAD® support into the 3D model with collision analysis and integration of secondary steelwork

The support designs are planned directly in 3D (PDMS / SmartPlant), including the secondary steelwork required, and laid out. The load chains generated in LICAD® are imported via existing interfaces into the 3D model. Any secondary steelwork needed can be supplemented directly in PDMS.

Finally, a check is made for any possible interference. The customer receives a database of the 3D model that contains all the support designs checked for freedom from interference.

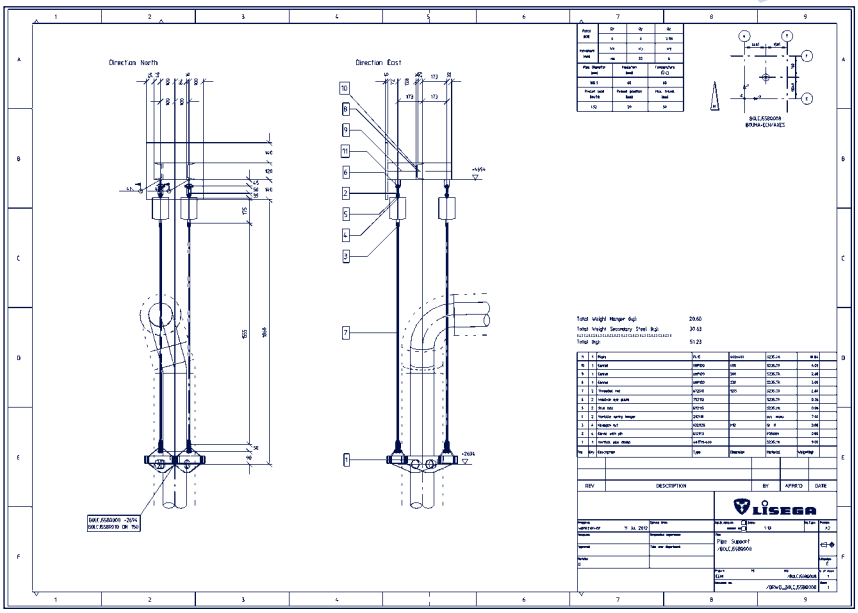
In almost all other 3D programs LISEGA can, by way of the viewer, edit the characteristics necessary for support design.

Generation of 3D models with MicroStation® for PDS®

For the creation of 3D models on MicroStation® the pipe supports are first generated as 2D displays from a sketch. The 2D data are transformed by LICAD® into 3D data and exported via an interface into the MicroStation® 3D model. Any secondary steelwork required is supplemented in the 3D model. In PDS® the completed 3D models can be used for collision tests.

Generation of drawings

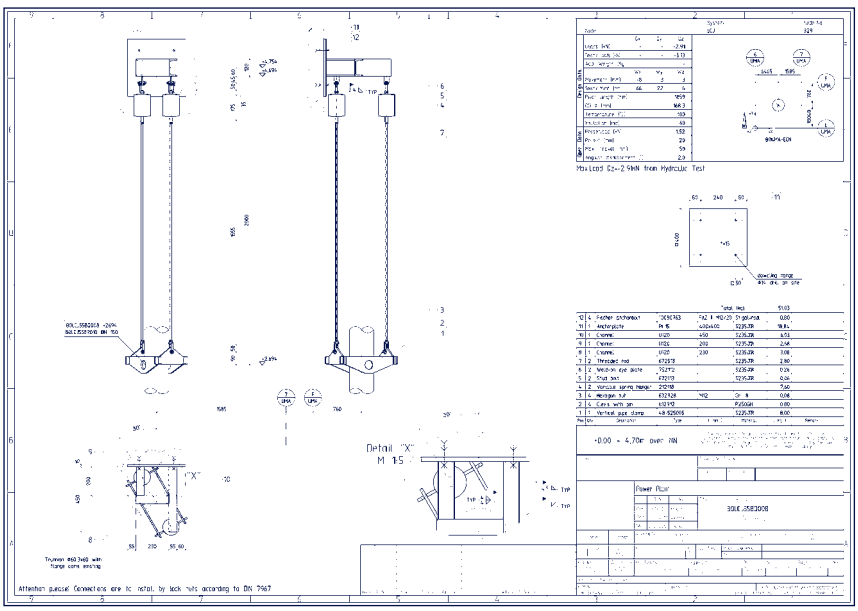
A 2D drawing is generated directly from the PDMS™ model in DXF format with different views. Parts list, site plan and all the technical specifications are stored as data sets and can be further edited. If required an isometric display of the support on the drawing is possible.



Step 5: Extract from the 2D drawing with parts list, loads, displacements and site plan from the 3D model

From the drawing generated automatically in Step 5, a production drawing in DWG (AutoCAD®), DXF or DGN (MicroStation®) format is generated. In this, all the information required for installation, including welding specifications, borehole patterns etc. can be seen.

The title block can be individually designed.



Step 6: Generation of a detail drawing (installation drawing) with different views and sections

Static calculation of secondary steel including structural attachment loads

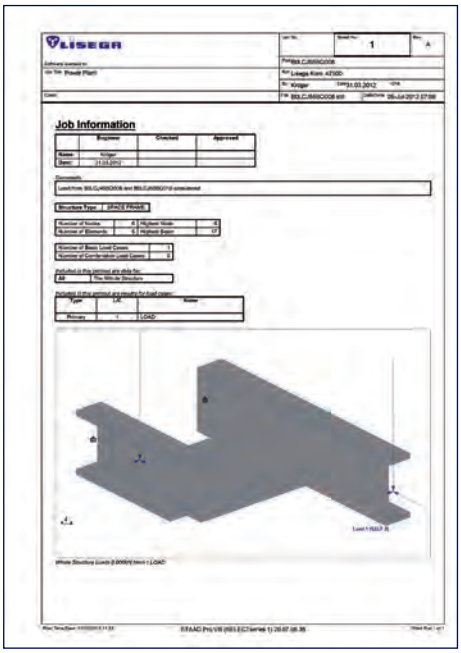
LISEGA supplies the design report summary for the dimensioning of the planned secondary steel according to the AISC code or Eurocode 3. This summary is provided with the STAAD.Pro® statics program.

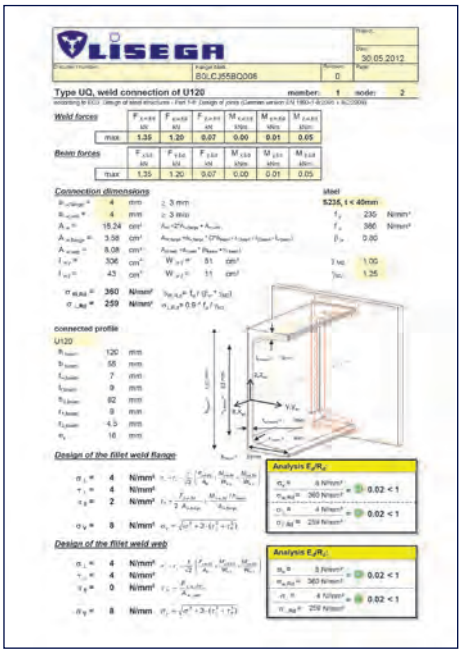
Anchor certification

Individual certificates can be provided for most anchor manufacturers with the aid of the corresponding design programs. For economic planning a standard has been developed by which individual certificates can be dispensed with. If required the necessary documentation can be produced.

Welding certification

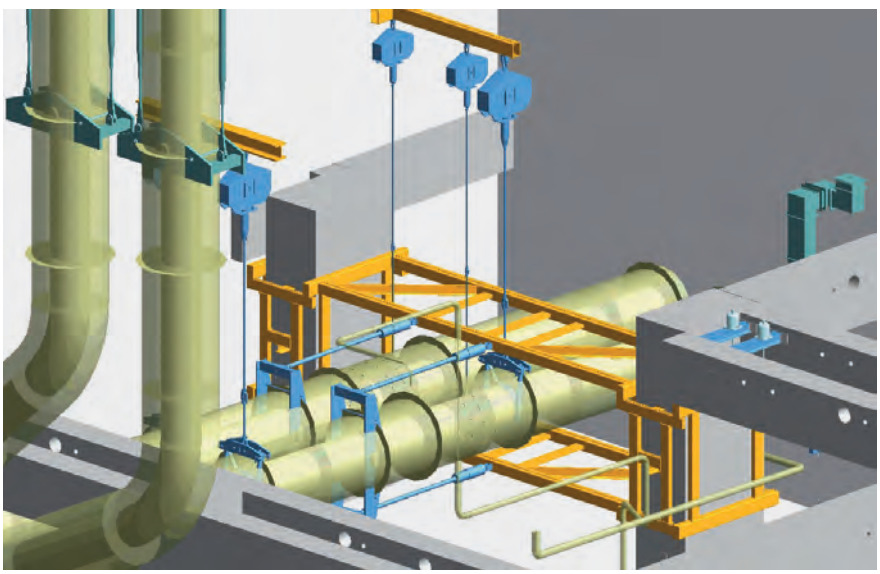
In accordance with the specified codes, individual weld seam certification for steelwork attachments can be provided.





Step 7: provision of certification (optional)

- *statics secondary steel incl. structural attachments*
- *anchors*
- *weld seam*



Pipe supports with complex secondary steel design in 3D model

Field service

Plant service

Additional stress and strain due to deficient realized pipe restraints can lead during operation to lasting damage that can considerably increase the risk of malfunction and breakdowns in the plant.

Frequently occurring defects in the pipe supports are:

- **poor support designs**
- **faulty installation**
- **incorrect load settings**
- **unsuitable layout**
- **deficient quality of support components**

A particular problem often arises in aged installations when spring and constant hangers with springs that are not pre-relaxed (see page 1.15 on this). In these cases an ever-increasing loss of ultimate load occurs due to growing relaxation over time.
The resulting load deviations can lead to impermissible additional stresses, especially at sensitive points such as connections. Timely inspection in the plant can contribute to the prompt identification and elimination of critical stresses.

LISEGA service team on construction site

For this special service we offer the resources of an international market leader, with qualified and experienced specialists on hand at all LISEGA Group locations.

Our experts check the thermal pipe displacement and inspect the support systems. They prepare detailed reports on this and propose suitable solutions. For the presentation and documentation of the findings, special software is applied.

The service team is specially trained for the execution of such services in the pipe support field and works strictly in accordance with quality management stipulations and recognized safety guidelines.

The operational safety of pipe systems and hence the readiness and long life of the plants depend in great measure on the condition and functional capacity of the supports used.

To avoid costly damage and breakdowns, regular inspections of the thermal pipe displacement and the condition of the supports – particularly in older plants – is urgently recommended!

Recording List for Pipe Supports

LISEGA

Plant Name: [redacted]
Piping System: 1AB-H01- Main Steam Unit 1
Elevation means pipe elevation

Temp.(1): ambient
Temp.(1): 540°C
Temp.(2):
Temp.(2): 540°C

Recording cold (1): May 2000
Recording hot (1): Nov. 2000
Recording cold (2):
Recording hot (2): April 2013

Performed by:
Name: by others
Name: [redacted], Lisega SE
Name:
Name: [redacted] Lisega SE

		Information on the Name Plate							Recording during cold set							Recording during operation								real travel G		Max. possible travel postion		Poss. travel	See separate lists	
		A						B	C	E	E	E1	E1.1	E1.2	E1.3	D	F	F	F1	F1.1	F1.2	F1.3							
No.	Elevation (m)		Type	Serial Number	Calibr. load (KN)	Theor travel Up (mm)	Theor travel Down (mm)	Load scale (KN)	White sticker (mm)	Actual May 13 (mm)	Actual (2) (mm)	Dev. (mm)	Up wards (mm)	Down wards (mm)	Travel is poss.?	Red sticker (mm)	Actual Nov.00 (mm)	Actual Apr.13 (mm)	Dev. wards (mm)	Up wards (mm)	Down wards (mm)	Travel is poss.?	Theor. travel (mm)	Nov. 2000 (mm)	April 2013 (mm)	(mm)	(mm)	(mm)	Information	Remarks
U1	39.0	1AB- H-01-001	118215	9877505/48	65.53		76		13	35		-22	35	67	no	89	105	102	-13	102	0	yes	-76	-70	-67	0 - 102	102		X
U1	39.0	1AB- H-01-001	118215	9877505/66	65.53		76		13	35		13	0	102	yes	89	107	108	-19	108	-6	yes	-76	-72	-73	0 - 102	102		X
U1	34.0	1AB- H-01-002	guide																										X
U1	30.0	1AB- H-01-003	119315	9877940/24	83.40		157		27	80		27	0	200	yes	184	179	192	-8	192	8	yes	-157	-99	-112	0 - 200	200		
U1	30.0	1AB- H-01-003	119315	9877940/18	83.40		157		22	85		22	0	200	yes	179	205	193	-14	193	7	yes	-157	-120	-108	0 - 200	200		
U1	30.0	1AB- H-01-003	306316	98614353/05													265	273		273				-180	-273	0 - 300			X
U1	30.0		116315	9876599/50	22.82							50	0	249	yes	210				223	26	yes	-160	-110	-123	0			

Record from a hanger inspection

Controlling a pipe support

The service package covers the following fields of performance:

Inspection of pipe supports

- **inspection of general condition of pipe supports**
- **load and travel checking of the spring hangers**
- **function testing of constant and spring hangers with mobile test facilities at the plant or on stationary test benches at the LISEGA facility.**

Testing constant hangers on-site with a mobile test bench

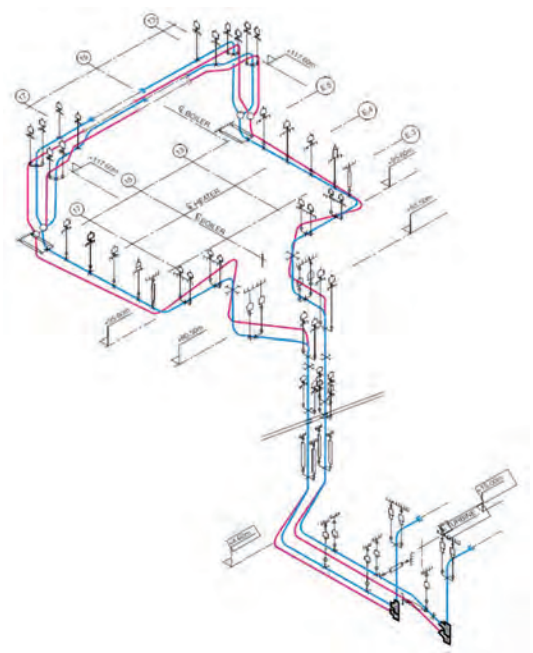
Inspection of pipe system displacement

- **inspection of the general condition of the piping sections and if necessary the geometric positioning**
- **inspection of the pipe systems for unrestricted freedom of movement in all three planes**
- **determination of the vertical displacement at all support points, at the pipe system connections and selected points in all three planes**

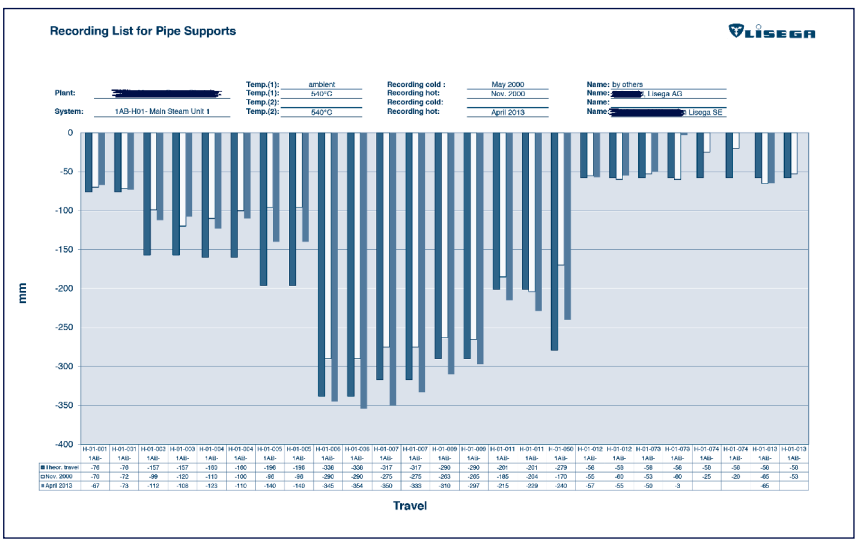
Design of supports at the plant

- **design and layout of pipe supports for updating and modifications in older plants**
- **measurement work at the plant**
- **elaboration of solutions to problems arising from restrictions in space**
- **design of pipe supports via LICAD® and AutoCAD**
- **preparation of lists of parts and materials**

Discussion of findings and observations from the inspection of pipe systems



Cold-/hot position of a pipe system



Graphic display of pipe system displacement

Construction supervision, installation and commissioning

- material receipt and control
- organization and administration of warehouse stocks
- pre-assembly and arrangement of complete support configurations
- installation of supports at designated points
- supervision of installation of piping into supports prepared
- inspection of the system for correct installation according to drawings and installation and operating instructions
- deblocking and commissioning of supports in line with agreed procedures
- load and travel checks after commissioning according to requirements
- inspection for freedom of movement in pipe systems in all 3 planes
- subsequent regulation of hangers if load differences are detected

Testing, maintenance and inspection of snubbers of all makes

- visual inspection for signs of possible malfunctioning
- dismounting of snubbers according to stipulations or requirements and documentation of external condition and surrounding conditions
- function testing on mobile test benches at the plant or on corresponding test facilities at the LISEGA facility
- dismantling of snubbers and inspection of individual components for wear and damage

Inspection of supports at the plant

- exchange of all seals, hydraulic fluid and any other components showing noticeable wear
- final function tests according to test program and specifications on hand
- re-installation of snubbers at the plant
- provision of complete final documentation

The wide spectrum of the LISEGA service package applies in particular to pipe supports and their application. If properly implemented, LISEGA service work makes a valuable contribution to the functional safety and long life of complex piping systems.

Visual inspection of snubbers

Testing snubbers of different makes at the plant using a mobile LISEGA test bench.

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Standard Supports 2020

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