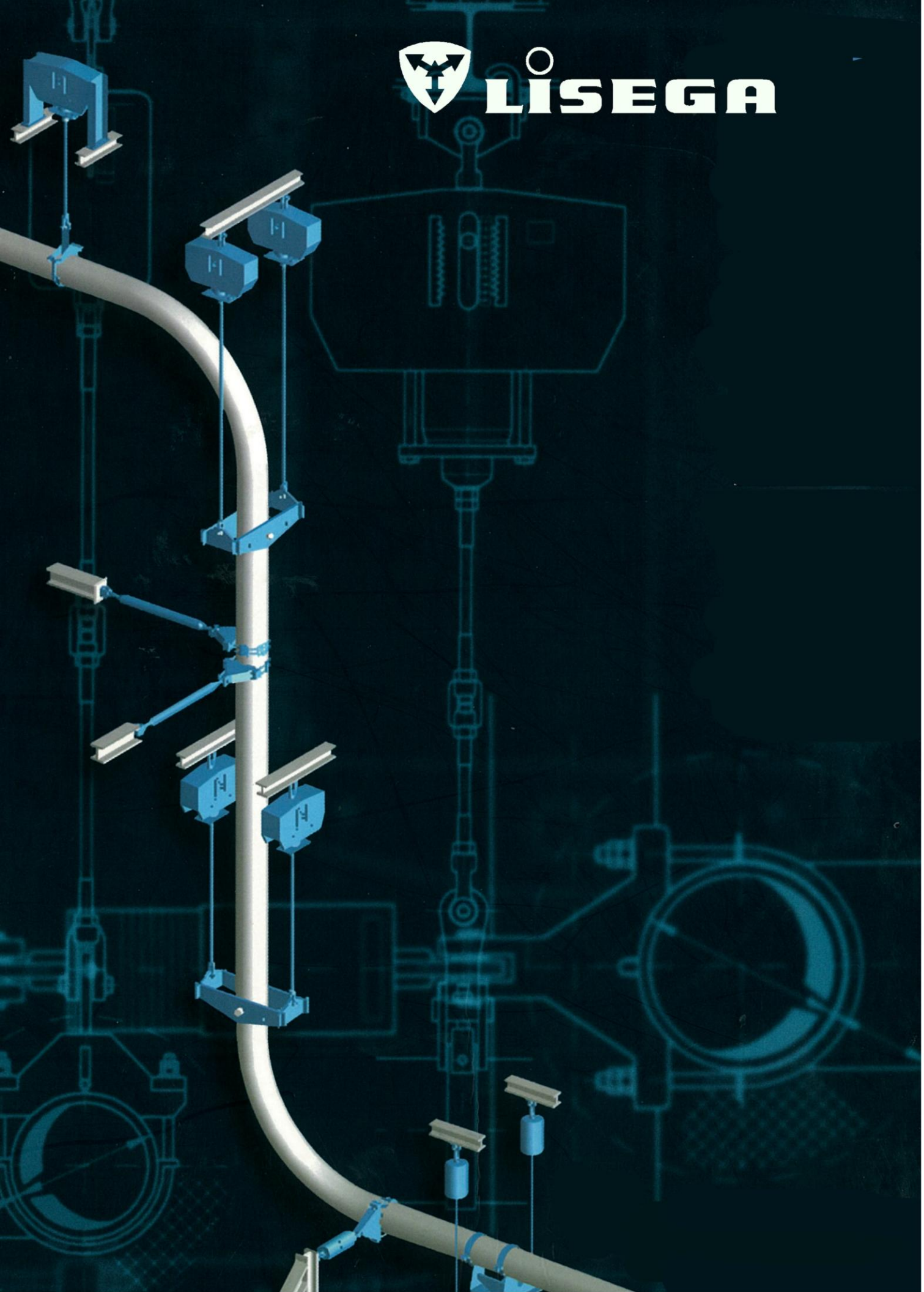
LISEGA



INSTALLATION AND OPERATION INSTRUCTION MANUAL

REVISION LOG

*** Any text modifications for the current revision will be in bold blue print ***

Rev.	Date	Description	Prep.	Chk.	App.
1	9/2/11	Complete overhaul of original	JPD	REF	JES
2	6/13/12	Added section 3.4, edited section 4.3			

TABLE OF CONTENTS

0. Technical Specifications

The products outlined in the LISEGA catalog 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, uniform criteria are applied. The following **Technical Specifications** outline component related features to inform, therefore allowing to correctly select the desired product.

The economic principle:

= from the least possible effort the maximum possible profit

= Total Cost Minimum/TCM

0.1 LISEGA Standard Supports

At LISEGA, standard supports form the basis of a comprehensive performance package. A complete program of more than 8000 standardized components thereby covers all operational loads, temperatures and travel ranges normally met in piping systems in industrial plant construction:

Product groups

+ load groups
+ travel ranges
+ connection compatibility

= Modular System

- ➔ **≤ 1200° operating temperature for pipe clamps and clamp bases**
- ➔ **90 kips nominal load for all mainly statically determined components**
- ➔ **224 kips nominal load for rigid struts and standard shock absorbers**
- ➔ **1124 kips design load for large bore shock absorbers**
- ➔ **36” travel range for constant hangers**
- ➔ **16” travel range for spring hangers**

0.1.2 Design Features

Specially developed components are available for the various support functions. In the design and construction of the units, fundamental design principles have been taken into consideration:

Modular System

+ CAD design
+ DP logitic systems

= High tech application

- ➔ **Symmetrical design shapes**
- ➔ **Compact installation dimensions**
- ➔ **Especially reliable function principles**
- ➔ **Extra wide adjustment ranges**
- ➔ **Fully compatible load ranges and connection dimensions**
- ➔ **Favorable performance/weight ratios**
- ➔ **Integrated installation aids**

In addition, LISEGA hangers feature only one upper attachment point. As a result, and due also to the compact and symmetrical design shape, the load transfer is free of moments to the connecting elements, which ensures simple installation. The operational position of the moving parts (hangers, supports and shock absorbers) can be read directly off a travel scale. Load setting of the constant hangers and supports can be adjusted at all times, even in the installed condition under load. Hangers and supports can be blocked in any travel position.

0.2 LISEGA Modular System

The standardization at LISEGA extends beyond the components to their systematic interaction. To this end, load and travel ranges as well as function and connections are meaningfully aligned.

In this way the LISEGA standard support program has been developed as a functional modular system with logical linking. The individual units form modules therein and are compatible regarding loads and connections. This enables the formation of meaningful combinations to produce support configurations fulfilling all requirements. The large selection of components makes adaptation possible to widely differing support application situations.

0.2.1 Product Groups

The standardized units are divided into 7 product groups according to their basic modes of function (see chart on p. 5).

0.2.2 Load Groups

To guarantee compatible loads in unit combinations, the load spectrum is split into fixed load groups.
Within a load group (nominal load), all components feature uniform load limits and stress safety characteristics. The connection shapes of the units (threads – either metric or UNC according to the market area – or pin diameters) are uniform within a group and

Standardized components

Product group	Group designation	Unit type	Unit designation
1	Constant hangers	11	constant hanger
		12-14	multi-cell constant hanger
		16	constant support
		16	angulating const. support
		17	servo hanger
		71	support
		79	const. hanger, trapeze
2	Spring hangers	20	articulated spring support
		21	spring hanger
		22	heavy duty spring hanger
		25	spring hanger, seated
		26	heavy d. spr. hang., seated
		27	sway brace
		28	heavy duty spring support
		29	variable spring support
		72	base plate
		79	spring hanger trapeze
3	Dynamically loaded components	30	shock absorber
		31	large bore shock absorber
		32	energy absorber
		33	installation extension
		35	weld-on bracket
		36-37	dynamic pipe clamp
		39	rigid strut
4	Pipe surrounding components	40	U-bolt
		41	weld-on lug
		42-44	horizontal clamp
		45-48	riser clamp
		49	clamp base, lift-off restraints
5	Pipe bearings and saddle components	51	cylinder roller bearing
		52	double taper roller bearing
		53	double cylinder roller bear.
		54	weld-on pipe saddle
		54	pipe saddle w. pipe clamp
		54	support tray
		55	lift-off restraint
		56	insulated pipe bearing
		57	weld-on pipe shoe
		58	stanchion
		58	elbow pad
6	Threaded connecting elements	60	eye nut
		61	clevis
		62	turnbuckle
		63	hexagon nut
		64	rod coupling
		65	tie rod L/R
		66	tie rod
		67	threaded rod / stud bolt
7	Structural attachment elements	73	weld-on clevis
		74	weld-on pl. w. spher. wash.
		75	weld-on eye nut
		76	beam adapter
		77	connecting plate
		78	beam clamp
		79	trapeze

thus compatible. Components of different product groups can therefore be connected only within a uniform load group to safe load chains and the faulty combination of different load groups is eliminated. As all units in a load group are designed uniformly regarding strength, the stresses on a complete chain of components are uniformly determined.

For permissible stresses, a difference is made between statically and dynamically determined components. The units in product groups 1, 2, 4, 5, 6 and 7 are stressed in only one load direction (statically or quasistatically) and are considered to be statically determined components. The components in Product Group 3, as well as their accessories, are loaded in alternating directions and are therefore regarded as dynamically determined components.

Statically defined components
Product group 1, 2, 4, 6, 7

Load group	Nominal load [lbs]	Ø Connection thread	Wrench size	Ø Pin
C	70	3/8	11/16	3/8
D	141	3/8	11/16	3/8
1	281	1/2	7/8	1/2
2	562	1/2	7/8	1/2
3	1125	5/8	1 1/16	5/8
4	2250	3/4	1 1/4	13/16
5	4495	1	1 5/8	1
6	8990	1 1/4	2	1 5/16
7	13490	1 1/2	2 3/8	1 9/16
8	17985	1 3/4	2 3/4	1 3/4
9	22480	2	3 1/8	2
10	35970	2 1/4	3 1/2	2 3/8
20	44960	2 1/2	3 7/8	2 3/4
30	53955	2 3/4	4 1/4	2 3/4
40	67400	3	4 5/8	3 1/8
50	90000	3 1/4	5	3 1/2

A. Static Components – The nominal load is used for the determination of load groups. For the statically determined components in Product Groups 1, 2, 4, 6, 7, the nominal load corresponds to the max. adjustment load of the spring elements, such as spring hangers and constant hangers. The maximum permissible hot load (load case H) lies considerably higher than the nominal load

when components are used as rigid supports, and is tied to the load capacity of the connection threads. LISEGA threaded rods should therefore only be replaced in kind. Spring and constant hangers in the blocked position also count as rigid supports, whereby for cold loads in hydrostatic tests (short duration) the emergency loads (level C) can be exploited.

For Product Group 4 (pipe connections) a limited area of overlapping in the load groups is foreseen, due to the temperature-related, variable spectrum of loading capacities. Data on the permissible loads relating to the respective operating temperature are set out for pipe connection components in the individual type and diameter data sheets.

B. Dynamic Components – For dynamically determined units, the stipulation of the nominal loads follows from the meaningful division of the standardizable load spectrum. Here, the nominal load corresponds at the same time to the operating load for load event level A/B (ASME).
Components should be selected by the design engineer based on the load conditions at the node point or location. The components can be selected for higher loads than those shown as the nominal. In each case the project engineer's instructions apply.

C. Product Group 5 – These pipe clamp bases for cold piping systems, cryogenic systems, roller bearings and pipe saddles, are regarded as statically determined, but are not directly related to hanger supports. As they are comparable with secondary steel components, they constitute a special group. The nominal load corresponds here to the max operational load according to level A.

Dyn. defined components Product group 3

Load group	Nominal load [lbs]	Ø Pin
–	–	–
–	–	–
1	675	0.39
2	900	0.39
3	1800	0.47
4	4000	0.59
5	10350	0.78
6	22450	1.18
7	44900	1.96
8	78600	2.36
9	123500	2.75
10	224000	3.93
20	448000	4.72
30	670000	5.51
40	900000	6.29
50	1124000	7.08

permissible loads (lbs)

Normal load H	900	1800	3600	7870	13500	27000
Emerg. load HZ	1235	2470	4945	10560	18000	36000

0.2.3 Travel Ranges

A. Static Components – Moving parts such as spring and constant hangers are divided into travel ranges corresponding to the usable spring travel of the standard spring employed. The appropriate travel range in each case is marked by the 4th digit of the type designation according to the following tables.

Constant hanger

Travel range		Designation No.
0 - 6	inch [150mm]	1. .2 . .
0 - 12	inch [300mm]	1. .3 . .
0 - 18	inch [450mm]	1. .4 . .
0 - 24	inch [600mm]	1. .5 . .
0 - 29½	inch [750mm]	1. .6 . .
0 - 35½	inch [900mm]	1. .7 . .

Spring hanger

Travel range		Designation No.
0 - 2	inch [50mm]	2. .1 . .
0 - 4	inch [100mm]	2. .2 . .
0 - 8	inch [200mm]	2. .3 . .
0 - 12	inch [300mm]	2. .4 . .
0 - 16	inch [400mm]	2. .5 . .

For spring hangers and supports (Product Group 2) the springs are already installed preset to approx. 1/3 of their nominal load. The initial load follows from this and the spring travel is correspondingly reduced.

B. Shock Absorbers – The maximum strokes of LISEGA shock absorbers are divided into economical stroke ranges as standard. These are designated in the 4th digit of the type designation according to the following table.

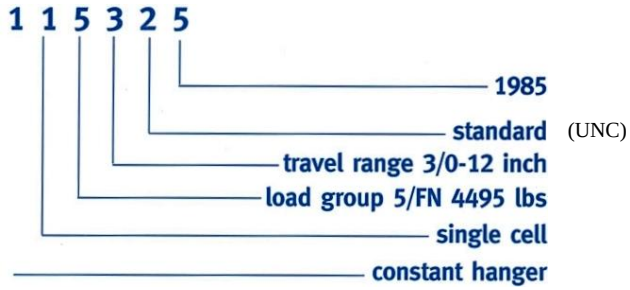
Shock absorber

Stroke		Type	Design. No.
5⅞	inch [150mm]	30	. . .2 . .
11¾	inch [300mm]	30	. . .3 . .
15¾	inch [400mm]	30	. . .4 . .
19¾	inch [500mm]	30	. . .5 . .
23⅝	inch [600mm]	30	. . .6 . .
29½	inch [750mm]	30	. . .7 . .
4	inch [100mm]	30/31	. . .8 . .
8	inch [200mm]	30/31	. . .9 . .

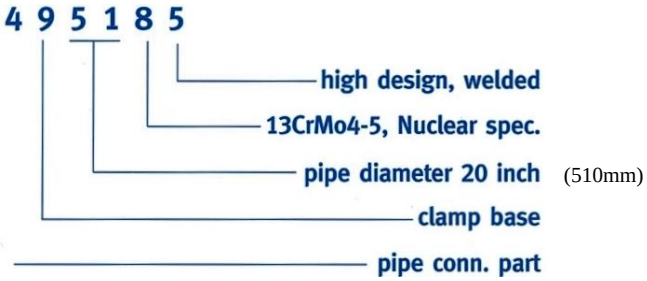
0.2.4 Type Designation

All components can be clearly identified via coded type designations. Six digits part numbers contain all the necessary information required. The type designation system facilitates the use of modern information technology and enables the unrestricted application of the modular system in current CAD programs. The examples shown below illustrate the logic in the type designation.

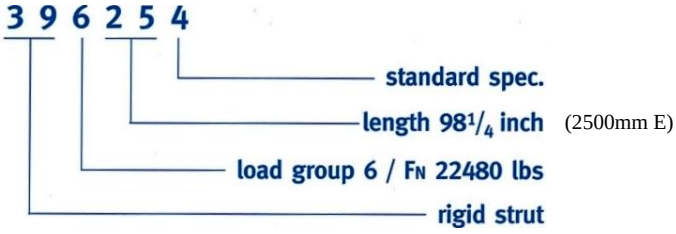
Example of Constant Hanger, type 11



Example of Clamp Base, type 49



Example of Rigid Strut, type 39



In the rigid strut example, the '3' states that this is a dynamic component and the '9' is reference to the strut. Other dynamic components will begin with a '3' and the '9' will change accordingly.

The LISEGA type designations can be decoded using the following tables:

PART NUMBER DEFINITION - IMPERIAL

Constant hangers and constant supports

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6
Product group	Model	Load group	Travel range	Field of application	Prod. series
1	1= constant hanger	C=3/8UNC-70lbs D=3/8UNC-141lbs 1=1/2UNC-281lbs	2=6inch 3=12inch 4=18inch 5=24inch 6=30inch 7=36inch	2=standard 6=nuclear application	5=1985 9=1999
	6= constant support/ angulating constant support	2=1/2UNC-562lbs 3=5/8UNC-1125lbs 4=3/4UNC-2250lbs 5=1UNC-4495lbs 6=1 1/4UNC-8990lbs 7=1 1/2UNC-13490lbs 8=1 3/4UNC-17985lbs 9=2UNC-22480lbs		STANDARD 1=std. design 2=angulated design NUCLEAR APPLICATION 5=std. design 6=ang. design	
	2= CH 2-cell coupl.	8=2 1/4UNC-35970lbs 9=2 1/2UNC-44960lbs		3=standard 7=nuclear application	
	3= CH 3-cell coupl.	8=2 3/4UNC-53955lbs 9=3UNC-67400lbs			
	4= CH 4-cell coupl.	8=3UNC-71940lbs 9=3 1/4UNC-90000lbs			
	7= servo hanger	5=1UNC-4495lbs 6=1 1/4UNC-8990lbs 7=1 1/2UNC-13490lbs 8=1 3/4UNC-17985lbs 9=2UNC-22480lbs	2=6inch 3=12inch	2=standard 6=nuclear application	

Spring hangers and spring supports

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6
Product group	Model	Load group	Travel range	Field of application	Prod. series
2	0= angul. spring supp. 0= extens. f. type 20 1= spring h. suspended 5= spring h. seated 7= sway brace 7= extens. f. type 27 9= spring sup.	C=3/8UNC-56lbs D=3/8UNC-120lbs 1=1/2UNC-281lbs 2=1/2UNC-562lbs 3=5/8UNC-1125lbs 4=3/4UNC-2250lbs 5=1UNC-4495lbs 6=1 1/4UNC-8990lbs 7=1 1/2UNC-13490lbs 8=1 3/4UNC-17985lbs 9=2UNC-22480lbs	1=2inch 2=4inch 3=8inch 4=12inch 5=16inch 9=extens. f. type 20 &. type 27	1,2=standard 5,6=nuclear application	4=1994 8=1978 9=1999
	2= SH, suspended 6= SH, seated 8= spring sup.	1=2 1/4UNC-35970lbs 2=2 1/2UNC-44960lbs 3=2 3/4UNC-53955lbs 4=3UNC-67400lbs 5=3 1/4UNC-90000lbs			

Dynamic components

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6
Product group	Model	Load group	Travel range	Field of application	Prod. series
3	0= hydraulic shock absor. stand. design 2= energy absorber 3= extension	1= 675lbs 4= 4000lbs 2= 900lbs 5=10350lbs 3= 1800lbs 6=22450lbs 7= 44900lbs 8= 78600lbs 9= 123500lbs 0= 224000lbs	2=5/8inch 3=11 3/4inch 4=15 3/4inch 5=19 3/4inch 8=4inch 9=8inch	1= standard 5= nuclear application	2=2002 3=1993 6=1986 8=1988 at Type 32 6=1996
	1= hydraulic shock absor. large bore	9= 123500lbs 0= 224000lbs 2= 448000lbs 3= 670000lbs 4= 900000lbs 5= 1124000lbs	8=4inch 9=8inch		

Dynamic components (cont.)

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6
Product group	Model	Load group	Travel range	Field of application	Prod. series
3	5= weld-on bracket	19= 675lbs 79= 44900lbs 29= 900lbs 89= 78600lbs 39= 1800lbs 99= 123500lbs 49= 4000lbs 09= 224000lbs 59= 10350lbs 20= 448000lbs 69= 22450lbs		1= standard 5= nuclear application	1=1991 3=1993 6=1986 9=1989
	6= dynamic pipe clamp with U-bolt	pipe diameter in inch-2.54 [mm/10]		STANDARD 1= up to 660°F 2= up to 930°F 3= up to 1040°F	1-6= U-bolts
	7=dynamic pipe clamp with strap			NUCLEAR APPLICATION 6= up to 660°F 7= up to 930°F 8= up to 1040°F	1-9= flat steel strap
	9= rigid struts	2 = 900lbs 3 = 1800lbs 4 = 4000lbs 5 = 10350lbs 6 = 22450lbs 7 = 44900lbs 8 = 78600lbs 9 = 123500lbs 0 = 224000lbs	middle instal-lation dimension in inch/4		3-4= standard 8-9= nuclear application

Pipe clamps and clamp base

Digit 1	Digit 2	Digit 3+4	Digit 5	Digit 6
Product group	Model	Pipe diameter in inch	Field of application	Prod. series
4	1= weld-on lug	D9 = 141lbs 59 = 4495lbs 29 = 562lbs 69 = 8990lbs 39 = 1125lbs 79 = 13490lbs 49 = 2250lbs	1= standard	f. straight pipes, max. insul. thickn. 1=3/8inch 2=4inch
		01 = 0.84 24 = 9.63 02 = 1.06 26 = 10.50 03 = 1.33 27 = 10.75 04 = 1.67 32 = 12.75 05 = 1.90 36 = 14.00	1= standard	for pipe elbows R≈1.5OD max. insul. thickn. 3,4=3/8inch 5,6=4inch
	horiz. clamp 2=clevis clamp 2=2 bolt clamp 3=3 bolt clamp 4= with U-bolt or strap riser clamps 5=formed riser clamp 6=riser cl., lugs 8=riser clamp, trunnions	06 = 2.37 37 = 14.50 07 = 2.87 41 = 16.00 08 = 3.00 42 = 16.50 09 = 3.50 46 = 18.00 10 = 4.25 51 = 20.00 11 = 4.50 56 = 22.00 13 = 5.25 61 = 24.00 14 = 5.50 66 = 26.00 16 = 6.25 71 = 28.00 17 = 6.63 76 = 30.00 19 = 7.63 81 = 32.00 22 = 8.63 91 = 36.00	STANDARD 1= up to 660°F 2= up to 930°F 3= up to 1040°F 4= up to 1110°F 5= up to 1200°F NUCLEAR APPLICATION 6= up to 660°F 7= up to 930°F 8= up to 1040°F	depends on load range and design
	9= clamp bases			1=low 2=medium 3=low, welded 4=medium, welded 5=high, welded
	0= U-bolts		2= carbon steel 4= stainless steel	8=standard
	9=Lift-off restraints for clamp bases	00=Lift-off restraints	0=Lift-off restraints	1-4=size

Tables for type designation decoding continued:

PART NUMBER DEFINITION - IMPERIAL

Roller bearings, cryogenic clamp bases

Digit 1	Digit 2	Digit 3+4	Digit 5	Digit 6
Product group	Model	Load group Pipe diameter	Field of application	Prod.-series
5	1=cylinder roller bearings 2=double taper roller bearings 3=double cylinder roller bearings 5=lift-off restr. f. roller bear.	04= 900lbs 08= 1800lbs 12= 27000lbs 16= 36000lbs 35= 78701bs 60= 13500lbs	1=standard 2=movable laterally	9=1989
	4=pipe saddle/ support tray	01 = 0.84 02 = 1.06 03 = 1.33 05 = 1.90 06 = 2.37	1=weldable 2=with pipe clamp 3=support plate	
	6= preinsulated pipes	07 = 2.87 08 = 3.00 09 = 3.50 10 = 4.25 11 = 4.50 13 = 5.25 14 = 5.50 16 = 6.25 17 = 6.63 19 = 7.63 22 = 8.63 24 = 9.63 26 = 10.50	1= 12inch long 2,4,6= 20inch long 9=cold block	Insul. thickn. 0=1inch 1=1 1/2inch 2=2inch 3=3inch 4=4inch 5=5inch 6=6inch 7=7inch 8=8inch 9=10inch 1= Cold Block
	7= weld-on pipe bases	27 = 10.75 32 = 12.75 36 = 14.00 37 = 14.50	1=standard	1=from T-sections 2=from C-sections
	8= stanchions	41 = 16.00 42 = 16.50 46 = 18.00 51 = 20.00 56 = 22.00 61 = 24.00 66 = 26.00 71 = 28.00 76 = 30.00	1= stanchions 2=telescopic stanchions	1,2= for streight pipes 3,4= for elbow R≈ OD 5,6= for elbow R≈1,5OD
	8=elbow pads	81 = 32.00 91 = 36.00	3=standard	1=carbon steel 2=stainless steel

Connecting elements, connecting rods

Digit 1	Digit 2	Digit 3+4	Digit 5	Digit 6
Product group	Model	Load group	Field of application	Prod.-series
6	0=eye nut 1=clevis 2=turn-buckle 4=rod coupling	D9 = 3/8UNC-141lbs 29 = 1/2UNC-562lbs 39 = 5/8UNC-1125lbs 49 = 3/4UNC-2250lbs 59 = 1UNC-4495lbs 69 = 1 1/4UNC-8990lbs 79 = 1 1/2UNC-13490lbs 89 = 1 3/4UNC-17985lbs 99 = 2UNC-22480lbs 10 = 2 1/4UNC-35970lbs 20 = 2 1/2UNC-44960lbs 30 = 2 3/4UNC-53955lbs 40 = 3UNC-67400lbs 50 = 3 1/4UNC-90000lbs	2=standard 6=nuclear 4=hot dip galvanized	2=1982 5=1995 8=1978 9=1999

Connecting elements, connecting rods (cont.)

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6
Product group	Model	Load group	Length	Field of application	Prod.-series
6	3=hexag. nut	D=3/8UNC-141lbs 2=1/2UNC-562lbs 3=5/8UNC-1125lbs 4=3/4UNC-2250lbs 5=1UNC-4495lbs 6=1 1/4UNC-8990lbs 7=1 1/2UNC-13490lbs 8=1 3/4UNC-17985lbs 9=2UNC-22480lbs	9 (Model 3)	1=standard 6=nuclear application	3=1993 8=1978 9=1999
	5=tie rod left/right 6=tie rod right/right 7=stud bolt/ threaded rod		1=not standardized 2=24inch 3=48inch 4=72inch 5=96inch 6=120inch 7=144inch	2=standard 6=nuclear application 4=hot dip galvanized	
		length not standardized: 10 = 2 1/4UNC-35970lbs; 20 = 2 1/2UNC-44960lbs; 30 = 2 3/4UNC-53955lbs; 40 = 3UNC-67400lbs; 50 = 3 1/4UNC-90000lbs			

Structural attachments and trapezes

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6
Product group	Model	Load group	Function	Field of application	Prod.-series
7	1= support for constant hanger	C = 3/8UNC-70lbs D = 3/8UNC-141lbs 1 = 1/2UNC-281lbs 2 = 1/2UNC-562lbs 3 = 5/8UNC-1125lbs 4 = 3/4UNC-2250lbs 5 = 1UNC-4495lbs 6 = 1 1/4UNC-8990lbs	2...7= travel range of constant hanger 6-36inch	STANDARD 6= bolted 7= loose NUCLEAR 8= bolted 9= loose	5,9 = bracket 1x 6 = bracket 2x 7 = bracket 3x 8 = bracket 4x
	2=base plate f. spring hanger 3=weld-on clevis 4=weld-on plate 5=weld-on eye nut 6=beam adapter and bolts 8=beam clamp	7 = 1 1/2UNC-13490lbs 8 = 1 3/4UNC-17985lbs 9 = 2UNC-22480lbs 10 = 2 1/4UNC-35970lbs 20 = 2 1/2UNC-44960lbs 30 = 2 3/4UNC-53955lbs 40 = 3UNC-67400lbs 50 = 3 1/4UNC-90000lbs	1, 2, 3, 9= depends on design	1=standard 5=nuclear application	1=1991/ 2001 2=1982 3=1993 4=1994 5=1985 6=1996 8=1978 9=1989
	9=trapeze 0=PTFE slide plate		2=2 connections 3=3 connections 1...3= travel range of spring hanger 2-8 inch	2=const.hang. trapeze 1 and 2= spring hanger trapeze 3=rigid trapeze	4, 6 and 9= U-sections 7= L-sections
	7=connecting plate	3rd to 6th digits correspond to clamps to be coupled			

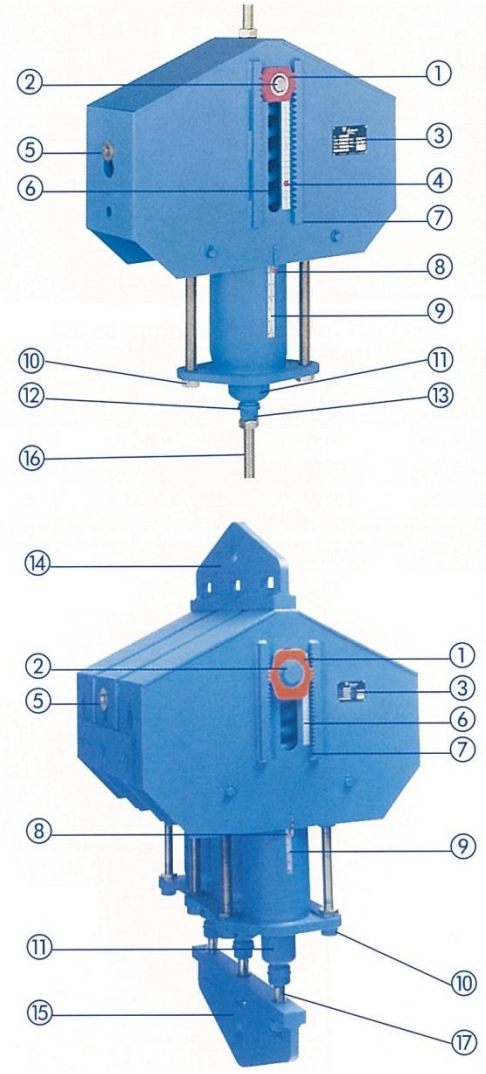
Constant hangers are mechanically acting devices. Their trouble free operation is vitally important for the safety of piping components. Careful attention must be paid to the following instructions to ensure trouble free operation.

1.1 Transport and Storage

Transport must be carried out carefully in order to avoid damage. It is particularly important that load adjustment screws and connection threads remain intact. If stored in the open, care must be taken to protect components from dirt and moisture.

1.2 Delivery Condition

LISEGA constant hangers are supplied set to the load specified in the order, and blocked in the required installation position. All hangers are supplied with a riveted name plate, as well as travel and load scale.

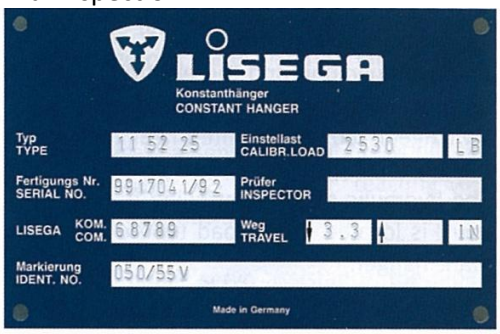


1) *Travel stop*
2) *Guide bolt*
3) *Name plate*
4) *red marking for hot position*
5) *Storage bolt with washer for travel stop after deblocking*
6) *Travel scale*
7) *Serrated travel stop strip*
8) *Adjustment load indicator*
9) *Load scale*
10) *Adjustment bolt*
11) *Load tube*
12) *Sight hole for min. screw-in depth*
13) *Load nut*
14) *Upper yoke plate*
15) *Lower yoke plate*
16) *Connecting rod*
17) *Tensioning bolt*

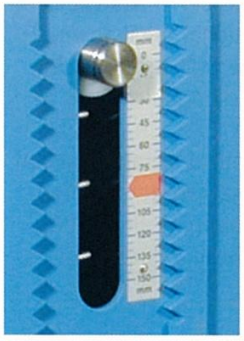
On the name plate are stamped:

- ➔ **Type**
- ➔ **Serial number**
- ➔ **Order number (if required)**
- ➔ **Set load**
- ➔ **Theoretical travel**
- ➔ **Marking (position number)**
- ➔ **Test stamp (if required)**

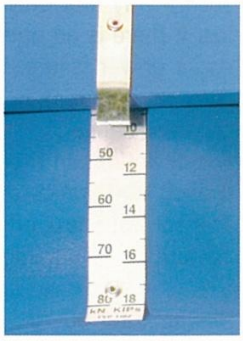
On the travel scale, the theoretical hot position is marked with a red sticker, the theoretical cold position with a white one. The load setting ordered is permanently stamped on the load scale with an X during final inspection.



Name plate with stamped operating data



Travel scale with cold/hot markings



Load scale with indicator

1.3 Constant Support Connection Specifications

1.3.1 Constant Hanger
Types 11 C3 .. - 11 96 (single cell)

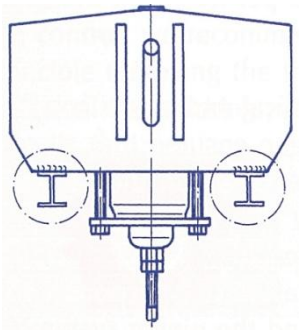
The upper connection is supplied as internal thread with limited thread engagement. The lower connection is a spherical load nut which can angulate through a maximum of 4° in all directions. Minimum thread can be verified through the sight hole above the load nut. The connection threads are filled with grease and sealed with plastic caps.

1.3.2 Constant Hanger
Types 12 82 - 14 96 (multi cells)

The upper connection is provided as standard in the form of a yoke for a connecting pin. The lower attachment exists of several tensioning bolts connected by a yoke plate.

1.3.3 Constant Hangers (seated)

Constant hangers of all sizes can be directly seated. They can also be supplied with serialized type 71 brackets. The brackets can be bolted on "in-house" or on site according to order using the precision fit holes provided. The base plates of the mountings can be either welded or bolted to the mounting surface.



1.3.4. Constant Supports type 16

Constant supports follow the same design principle as the constant hanger. Instead of the lower connection, they have an upper support tube with a threaded adjusting spindle and load plate.

1.4 Installation

When installing, the rules for the Installation Instructions for Piping are to be adhered to. Special attention must be paid to the desired installed position of the hanger rods in the whole support chain. Two possibilities are usual practice:

A. The hanger rods are to be installed at an angle in accordance with expected horizontal displacement of the piping. It is expected that the rods become vertical during operating conditions.

B. The hanger rods are to be installed vertically for better control. A controlled angled position during operating conditions is then permitted.

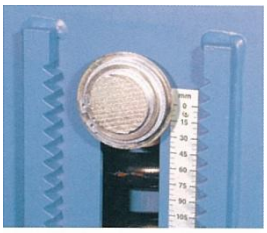
In all cases there should be a unified set of rules for the whole plant.

Attachment rods and points must be connected under actuation of load.

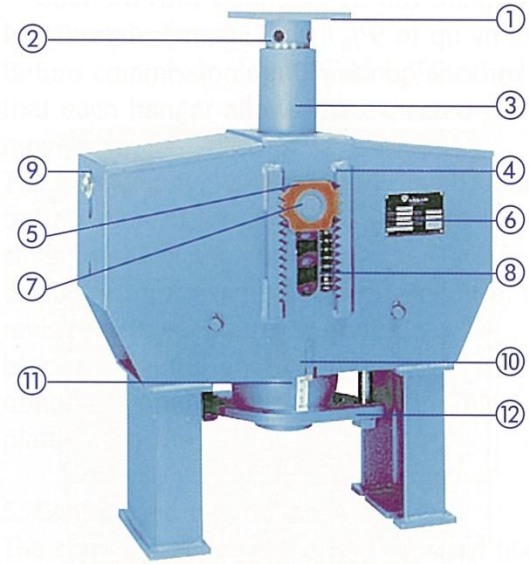
Blocking plate bolted laterally

1.4.1 Constant Hanger
Type 11 C3 - 11 96 (single cell)

Transport lugs or other installation aids can be screwed into the threaded holes provided on the sides. After deblocking the hangers (see **1.5** on **p. 12**), the blocking plates should be bolted on here for storage. For constant hangers with type 71 brackets, the hangers are supplied with transport lugs instead of the upper connection. The lugs can also accommodate the blocking plates. When removing the blocking plates from constant hanger types 11 82 to 11 96, care must be taken that only the larger circlip is removed. For connection to the connecting rod, care must be taken that the lower rod is threaded into the load nut at least up to the threaded sight hole. A further thread engagement of 12 inch [300mm] is provided.

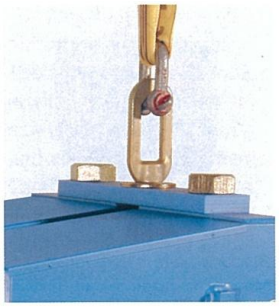


Blocking pin with circlips

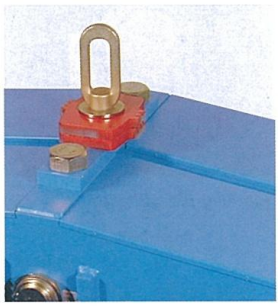


Constant support type 16

1) *Load plate*
2) *Adjusting spindle*
3) *Support tube*
4) *Serrated travel stop strip*
5) *Blocking plate*
6) *Name plate*
7) *Guide pin*
8) *Travel scale*
9) *Securing screw & washer for blocking plate after deblocking*
10) *Indicator for adjustment load*
11) *Load scale*
12) *Adjustment bolt*



Transport lug and correct connection



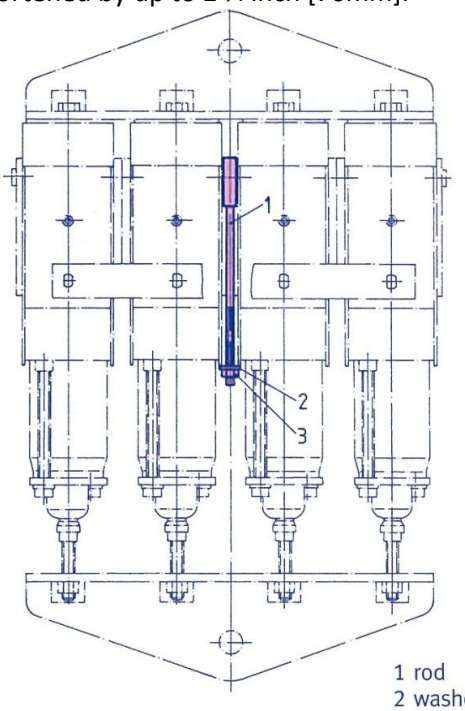
Safe storage of travel stop plates on constant hangers with brackets

1.4.2 Constant hanger Type 12 82 - 14 96

To install the hangers, the side openings of the upper yoke plate can be used for lifting. On hangers fitted with brackets, the upper yoke plate is substituted by a transport lug. Constant hangers types 14 82 - 14 96 (4 - cell design) are supplied with **a transport safety device marked in red** along the center axis. This serves to provide additional mid-blocking to the blocking pin on an unloaded hanger.

The transport safety device must not be loosened until after the complete installation of the hanger simultaneously with the removal of the blocking plates.

For this purpose the red locknut is removed at the lower end using a box spanner. Both parts are to be stored in the same place as the blocking plates. When making the load-actuating connection, care must be taken that the lower load anchors are screwed into the lower load nuts at least up to the sight hole. The installation dimension of the lower yoke plate can be extended with the load nuts by up to 9 $^{7}/_{8}$ inch [250mm] or shortened by up to 2 ¾ inch [70mm].



1 rod
2 washer
3 nut

1.5 Removing the Blocking Devices

The correct deblocking of the constant hangers as per the following instructions is decisive for the subsequent flawless functioning of the piping system.

The blocking devices should only be removed immediately before commissioning. The blocking devices must be removed systematically, i.e. from fixed point to connection or from connection to connection.

Prior to this, the whole system should be checked as per **1.4** on **p. 11.**

NOTE: Remember to replace the washers and C-Clips after removing the blocking (see **1.5.3** on **p. 13)**

1.5.1 Theoretical and Actual Condition

If it has been ensured that all connections are actuated by load, the load suspended will be completely taken over by the constant hanger supports.

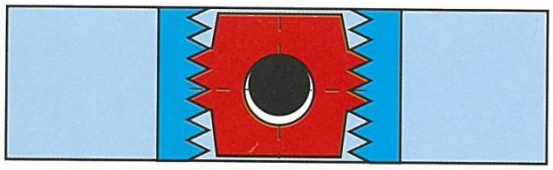
If the actual load corresponds to the installed load and the piping system shows no signs of constraints, the planned equilibrium has been achieved. The travel stop plates can now be removed.

In practice, however, slight constraints and therefore certain load displacements in the piping system can hardly be avoided. The theoretically determined loads can also show considerable tolerances. Deviations resulting from this can lead, according to increased or diminished loading, to a corresponding jamming of the blocking pin in the upper or lower part of the blocking plates.

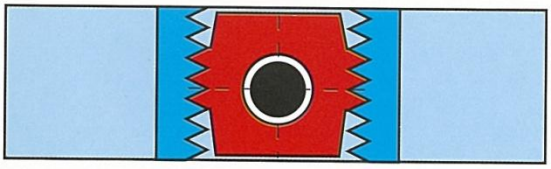
1.5.2 Load distribution

The travel stop plates must never be removed by force!

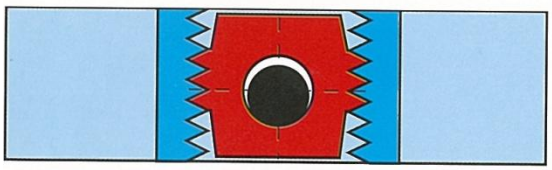
By loosening or tightening the connecting rods with a few turns of the load nut for constant hangers, or adjustment of the support tube for constant supports, the locked-up stress in the piping can be compensated so that the load pin is free. **However, the geometrical layout of the piping must not be altered when balancing these stresses.**
Because the adjustment of one position can lead to stressing at another location, this procedure must be repeated if necessary at different points.
For thorough control, we recommend as a matter of principle removing the travel stop plates only after all the load pins are free.



Load pin forced upwards:
Applied load is lower than set load.
Tighten connecting rod or reduce set load



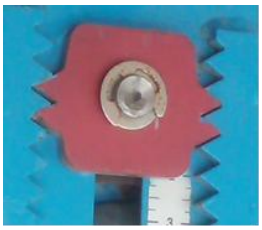
Load pin is free:
Applied load conforms with set load.
Blocking plate can be removed



Load pin forced downwards:
Applied load is higher than set load.
Loosen connecting rod or increase set load

1.5.3 Summary for Removing Blocking from Constant Supports

CAUTION: BEFORE REMOVING BLOCKING, CONSTANT MUST BE SET (LOADED).



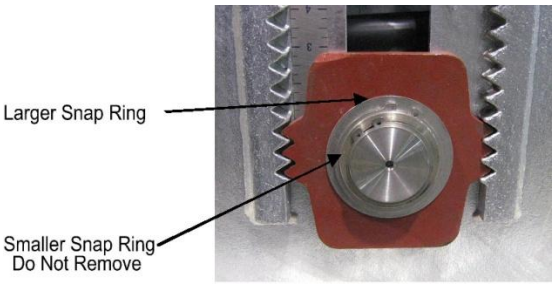
A. Remove C-Clip (or snap ring), washer, and blocking from pin on both sides of the constant.
Note: Never remove pin or plastic bushings from constant which are residing inside the constant casing behind the blocking.

B. Once the blocking has been removed, the blocking needs to be secured on the side of the constant's housing for future use. Under no circumstances, should the blocking be discarded at site. There is one bolt provided on each end of the constant specifically for storing the blocking when it is not needed. One blocking item should go on each end as shown in the picture.

C. Replace washers and C-Clips (or snap rings) to the pin as they were before the blocking was removed.

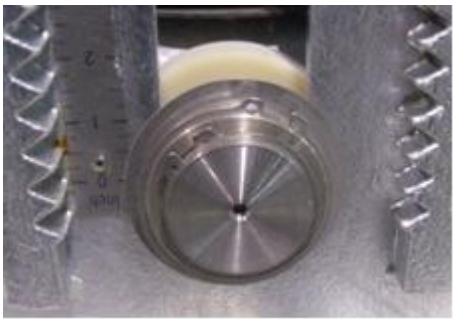
1.5.4 Additional Procedure Details for Load Group 8 and 9 Constants

A. When removing blocking from load group 8 and 9 constants (..82.. through ..96.. series), only remove the larger snap ring as seen in picture.



After removing the larger snap ring, do not try to remove the large ring assembly located behind the blocking as seen in the picture. The small snap ring is holding the large ring assembly.

B. Replace washer and larger snap ring after blocking is removed.



C. If the smaller snap ring is not replaced, the central pin could vibrate out of the constant as shown here. This should be prevented from happening and is not acceptable for working safety and operation of the constant hanger during its life cycle.

Unsafe Condition

1.6 Setting Type 12, 13 & 14 Multi-Cell Constant Spring Supports

A. To set multi-cell constant hangers, tighten the main rod (either the lower rod at the turnbuckle, or if using upper structural attachment Type 74, the nut at the top of the washer plate). If the main rod does not have either of these (2) means of adjustment, then use the following steps.

B. Apply a thread lubricant on the threaded rods at each cell's load nut. Before starting, uniformly tighten each.

C. Tighten one load nut (2) complete revolutions, then the next one (2) complete revolutions and so forth. Tighten consistently until both red travel stops are loose. Also ensure that the lower yoke plate is level. Remove the red travel stops per the instructions in paragraph **1.5.4**.

D. In many cases the load nuts are extremely difficult to turn. To reduce the friction on the threads, determine a method to temporary support the pipe. (Examples are: chain falls, jacking, over head crane.)

E. With the temporary support, lift up the pipe approximately 3/16". Tighten all the load nuts.

F. Let down on the temporary support and check to see if both the red travel stops are loose. If they are, the spring unit is set. Remove the red travel stops per the instructions in paragraph **1.5.4**.

G. If the travel stops are not loose, repeat step **E.** and **F.** until they become loose.

H. In cases where pairs of multiple cell units are used, such as with trapezes or riser clamps, do not remove any travel stops until all (4) travel stops are loose.

I. Remove transport safety device for type **14 82 XX – 14 96 XX (see paragraph 1.4.2).**

1.7 Load correction

If the blocking pins jam, and cannot be freed without displacement of the piping, significant deviations in the piping load can be assumed. The adjustment bolts of the constant hangers and supports can then be correspondingly set. Once more, this should

be done from position to position, as described in point **1.5.3** on page **13**. If this is done correctly, load differences can be practically balanced out by this method. Any load adjustments must as a matter of principle be agreed on with the technical department responsible for the piping system. Any new load setting values should be indicated on the load scales and recorded.

1.7.1 Load Adjustment Procedure for Type 11 Constant Hanger

A. LISEGA Constant Hangers are supplied with factory load and travel position settings as specified by the responsible design engineer. If after installation, the engineer determines that the actual load of any given constant hanger is higher or lower than originally specified, it is possible, through the implementation of this procedure, to adjust its load setting.

B. Load adjustment of all LISEGA constant hangers is carried out by adjusting the internal main spring. **Note:** the position blocking must be in place throughout the procedure. This is accomplished through the systematic repositioning of the two load adjustment bolts as illustrated in **FIGURE 1.**

C. First loosen the load adjustment bolt lock nuts. When increasing to the desired load, each load adjustment bolt should be equally and systematically turned clockwise (when looking up) in quarter turn increments, which reduces the compressed height of the internal main spring. The horizontal lower load tube flange must remain parallel to the bottom of the spring side plates.

D. Conversely, when decreasing the desired load, the load adjustment bolts should be equally and systematically turned counter clockwise (when looking up) in quarter turn increments, which lengthens the compressed height of the internal main spring. The horizontal lower load tube flange must remain parallel to the bottom of the spring side plates.

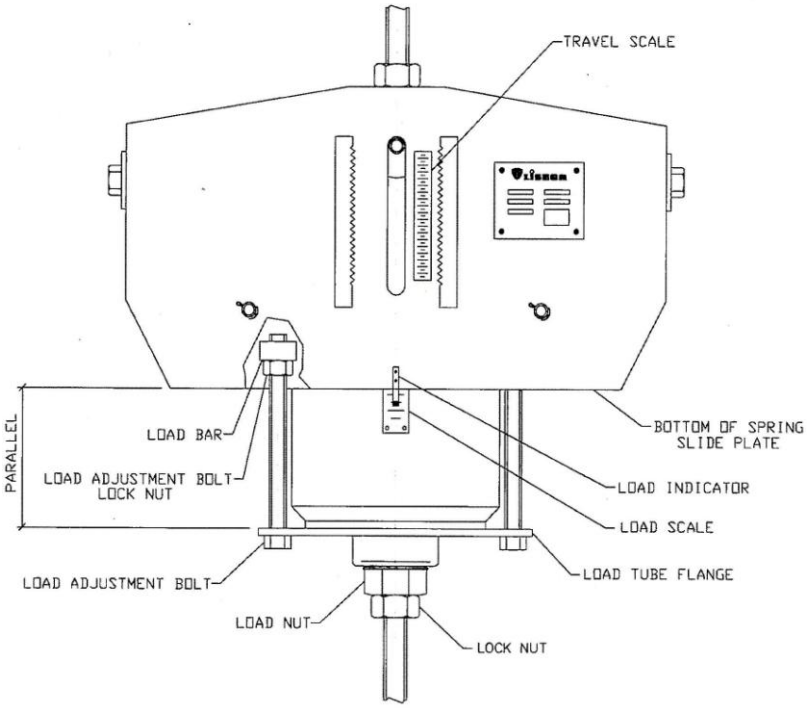
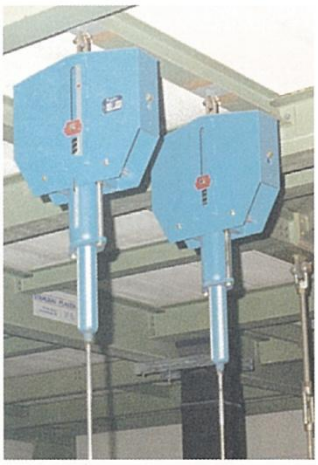


FIGURE 1

E. A direct read load scale, as shown in **FIGURE 1,** is affixed to the load tube which houses the main spring. An indicator, also shown in **FIGURE 1,** is affixed to the center of the side plate. Increased or decreased load settings can be determined by correlating the position of the indicator to the desired load as read from the load scale. The original load setting is marked with an "x" on the load scale in the shop. When load adjustment is completed, tighten lock nuts on the load adjustment bolts.

NOTE: When tightening/loosening the load adjustment bolts, be sure to measure from the bottom of the spring slide plate to the bottom of the load tube flange to ensure uniform adjustment. This will provide even distribution and proper functionality of the unit.



LISEGA constant hangers installed

F. Field adjustment of constant loads should also consider the effect of the new load setting on the designated hot-to-cold actual travel range. As such, dependent upon the correlation of total travel to actual travel, this adjustment can directly affect the amount of available travel. The engineer should determine through reference to LISEGA's catalog data, the correlation of the increased (or decreased) load and actual travel versus the constant's total travel. This engineering check insures that the new load setting will not jeopardize the overall operation of constant support and its ability to facilitate sufficient over travel protection.

G. The constant hanger is now ready for service. Check the entire installation, and adjust the connections to allow the spring to support the system. When the loads are correct, remove the position blocking.

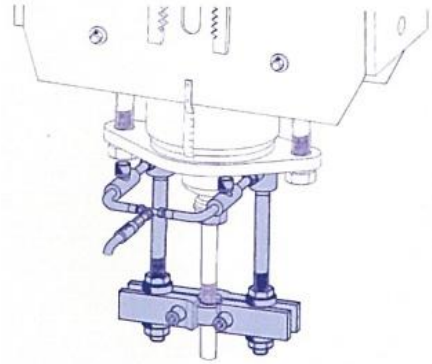
H. If new actual travel positions are required, the travel scale, as shown in **FIGURE 1,** should be re-marked to reflect the new hot and cold positions. The spring can be set to the new position by taking up or letting out on the hanger rod. Always verify that the minimum engagement of the threaded rod is maintained if not visible. This can be checked by inserting a nail, weld rod or some other item into the hole at the neck of the load nut when making the adjustment.

1.8 Installation devices

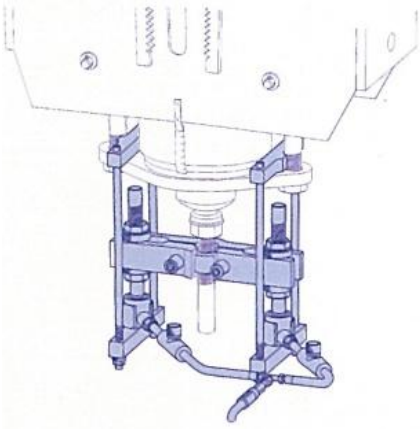
With all hangers, tightening or loosening the connecting rods, as well as load adjustment can be done by hand. With hangers and supports for higher load groups, however, this operation may need considerable force. To make this easier, an installation aid can be provided which takes on the load hydraulically with the aid of a hand pump.

1.9 Commissioning

Before commissioning it must be checked that each hanger allows the expected piping movement. The hanger travel can be read directly from the position of the blocking pin in the guide slots of the travel scale. If required, for example when carrying out revisions, hangers and supports can be blocked again in any travel position. This is done by mounting and securing the blocking plates onto the blocking bolt.



Installation device for relieving adjustment bolts



Installation device for relieving blocking device

2. Spring hangers and spring supports types 20, 21, 22, 25, 26, 27, 28, 29

2.1 Transport and storage

When transporting, threaded connections and travel stops must not be damaged. When stored in the open they should be protected from dirt and moisture.

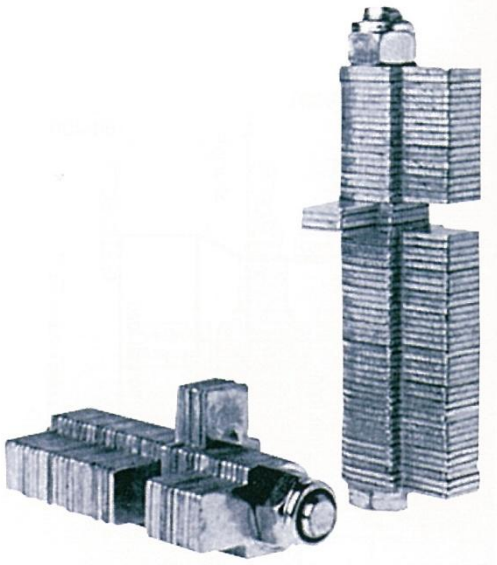
2.2 Delivery condition

Unless agreed otherwise, spring hangers and spring supports are delivered to the site blocked in the installation position. When hangers or supports are blocked (travel stop in both directions), the spring plate is locked by a special blocking device in the housing slots. Spring hangers and supports are supplied with a riveted name plate fitted with an integral travel scale.
The following information is stamped on the name plate:

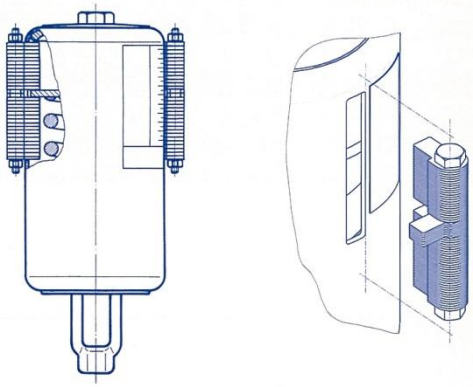
- **Order number if required**
- **Set load**
- **Theoretical travel**
- **Spring rate of the hanger or support**
- **Marking and position number**
- **Test stamp if required**

The serial number is stamped directly on the housing.

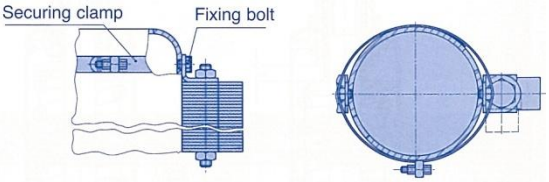
Name plate for spring hanger



The blocking units for single spring models consist of a set of hinged metal plates. Individual plates can be swivelled into any desired blocking position.



Blocking device for single spring models



If specially ordered, the stops can be bolted securely to the hanger or support after deblocking.

Spring hangers and supports are used to compensate for the thermal movement to be expected in piping systems. For trouble-free functioning, correct installation is essential, observing the following instructions:

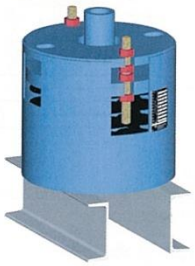
Spring hanger, type 21 (blocked)

Spring hanger, type 25 (blocked)

Spring support, type 29 (blocked)

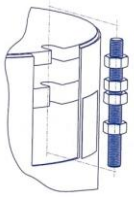
Angulated spring support, type 20

Spring hanger, type 22



Spring hanger, type 26

Spring support, type 28



Blocking device for heavy duty spring elements type 22 to 28

On the travel scale, the theoretical operating position is marked with a red, and the theoretical cold position with a white sticker. Also, the position of the spring plate is marked with an X on the travel scale. The read out is made at the bottom edge of the spring plate.

2.3 Variable Springs Connection Specifications

2.3.1 Spring Hangers, Type 21

Spring hangers, type 21, have upper and lower connections fitted with right-hand threads. At the top they consist of an internal thread engagement of limited depth, and at the bottom a turnbuckle. The threads are filled with grease and sealed with plastic caps.

2.3.2 Spring Hangers, Type 22

The upper connection of these hangers is supplied as a lug for a connecting pin. The lower connection consists of a turnbuckle with right-hand thread.

2.3.3 Spring Hangers, Type 25 & 26

Spring hangers, type 25 & 26 are provided with a fixed support tube to accommodate the connecting rod.

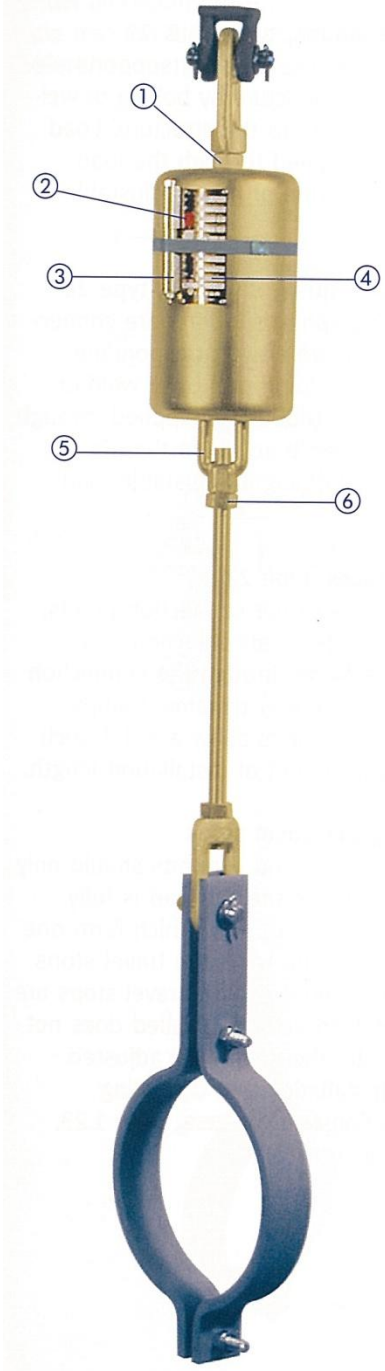
2.3.4 Spring Supports, Type 28 & 29

The spring supports are provided with either one or four adjustable support tubes fitted with a loosely mounted, but guided load plate. The support tubes are screwed in and the threads greased.

2.3.5 Angulating Spring Supports, Type 20

The angulating spring supports are provided at the top with an adjustable support tube and a rotatable ball bushing joint, at the bottom with a fixed ball bushing joint. The joints provide a suitable connection to the corresponding weld-on brackets type 35. The support tube is screwed in and the threads greased.

① *upper connection*
② *travel scale*
③ *blocking unit with securing band*
④ *name plate*
⑤ *lower connection (turnbuckle with right-hand thread)*
⑥ *counter nut*



Load chain with spring hanger

2.3.6 Sway Braces, Type 27

Sway braces are provided at the top with a length-adjustable ball bushing joint and at the bottom with a fixed lug suitable for connection to weld-on bracket type 35 or dynamic clamp type 36 or 37. Presetting of the load and if necessary the free stroke are carried out at the factory in accordance with customer requirements.

2.4 Installation

When installing, the rules given in **Installation Instructions for Piping** must also be observed. Special care must also be given to the installed position of the connecting rods over the whole support chain. Two possibilities are the norm:

A. The connecting rods are to be installed at an angle corresponding to the horizontal displacement to be expected. A vertical position of the rods is expected under normal operating conditions.

B. The connecting rods are to be installed vertically for easier checking. A controlled angled position under normal operating conditions is thereby permitted.

In each case there should be unified rules and regulations for the whole plant.

Connecting rods and points must be under load at connection points.

2.4.1 Spring Hangers, Type 21

Connection is made by screwing the connecting rod into the upper threaded connection hole in type 21, and by threading the lower connecting rod into the turnbuckle. As a tension range and length adjustment, the turnbuckle length available in the hanger can be used for the connecting rod.

2.4.2 Spring Hanger, Type 22

Connection is made by pinning the lug to the upper attachment point and by threading the lower connecting rod into the turnbuckle. As a tension range and length adjustment, the turnbuckle length available in the hanger can be used for the connecting rod.

2.4.3 Spring Hangers, Type 25 & 26

These spring hangers are set on beams and correspondingly positioned. Once the precise position is defined the unit should be secured against horizontal movement. The load actuated connection is made via the connecting rod, which is led throughout the support tube and tightened with a nut.

2.4.4 Spring Supports, Type 28 & 29

After positioning, these spring supports are connected to the structure by bolting or welding the base plate to the structure. Load distribution is applied through the load plate or through one or more adjustable load tubes.

2.4.5 Angulating Spring Supports, Type 20

The angulating spring supports are connected to the structure after corresponding positioning by welding the lower weld-on bracket. Load distribution is applied through the upper weld-on bracket via the pin connection to the height-adjustable load tube.

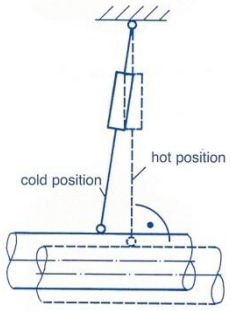
2.4.6 Sway Braces, Type 27

After positioning of the connection points, the weld-on brackets are attached and connection is made through the connection pins of the brackets or dynamic clamps. The ball bushing joints allow a ± 1 ½ inch [37.5 mm] adjustment of installation length.

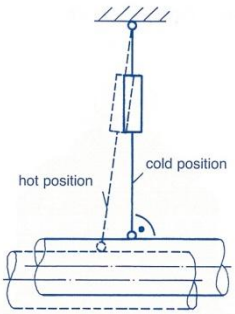
2.5 Removing the Travel Stops

The spring hangers and supports should only be deblocked when the set load is fully applied to all the supports, which form one system. If this is the case, the travel stops can easily be removed. If the travel stops are jammed, the load actually applied does not correspond with the theoretical adjusted load (See **1.5.1** and **1.5.2** on **p. 12-13**).

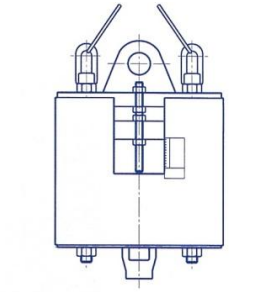
Sway brace, type 27



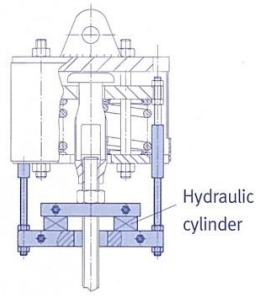
Case 1
Attachment rods vertical during plant operation

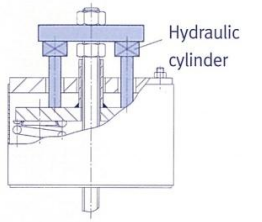


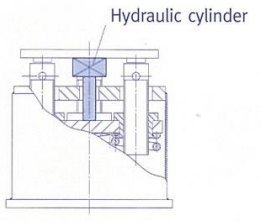
Case 2
Attachment rods vertical in installation condition



Spring hanger type 22 with eye nuts as transport lugs







Installation devices for readjustment of the set load for types 22, 26 and 28. The devices can equally well be used as deblocking aids.

2.5.1 Removing Blocking Device, Type 28

To remove blocking device on Type 28 Variable Spring, a flat body Porto-Power jack may be required.

A. Tighten all (4) support tubes, each with an equal force against the load flange. Use a solid steel rod and place it through both holes in the support tube, turning it counter clock-wise (when looking down).

B. Place a flat body Porto-Power of sufficient capacity under the load flange at the center of the spring unit.

C. On each of the blocking devices loosen the nut that is under the spring plate down approximately ½".

D. Using the Porto-Power, jack the load flange up approximately 3/16". Tighten all (4) support tubes as described in step **A.**

E. Release the pressure of the Porto-Power jack.

F. Top nut should now be loose and the lower edge of the spring plate should be even with the white marker.

G. If the lower edge of the spring plate is not even with white marker, but still higher, jack up on the load flange another 1/8". Tighten all (4) support tubes as described in step **A.** and release the pressure as described in step **E.**

H. When the lower edge of the spring plate is even with the white marker the spring is set. Remove the Porto-Power ram from under the load flange.

I. On each of the blocking devices, loosen the nut that is on top of the spring plate all the way up tight against the nut above it.

J. If the cold to hot movement of the spring is down, finish loosening each nut that is under the spring plate to a distance sufficient so they will not inhibit the cold to hot movement.

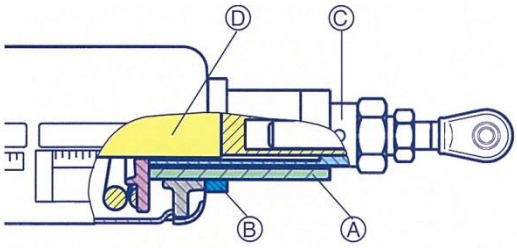
2.6 Load Adjustment

2.6.1 Spring Hangers, Spring Supports

For spring hangers the load can be adjusted by loosening or tightening the threaded rods at the lock nut. For spring supports, the load can be adjusted by a corresponding adjustment of the load tube. Under all circumstances, however, the appropriate technical department must be consulted before attempting any load adjustment.

2.6.2 Sway Braces, Type 27

Load adjustment is made by rotating the threaded tube (A). The large counter ring (B) is loosened to do this. In order to maintain the E dimension, the resulting gap is compen-sated for by adjustment of the guide tube.



For sway braces, a free stroke can be set. To do this, the guide tube (C) opposite the inner guide rod (D) is to be unthreaded (loosen middle lock nut). The working travel reduces in the direction compression in accordance with the free stroke selected.

2.6.3 Load Adjustment Procedure for Type 21 Variable Spring

LISEGA Type 21 variable springs are supplied with factory installed load/travel position settings as specified by the responsible design engineer. If, after installation, the engineer determines that the load of any given variable hanger location must be higher or lower than originally specified, it is possible to adjust the load setting.

A. Load adjustment of all LISEGA variable spring hangers is carried out by adjusting the main spring position. The amount of adjustment is determined using the new load setting, the original calibrated load setting, and the spring rate. The adjustment can only be made while the spring is installed, and when travel stops have been removed.

B. Determine the new required load setting. Note the Calibrated Load value and the Spring Rate on the nameplate. The Calibrated Load corresponds to the white position indicator on the travel scale.

C. Calculate the amount of spring adjustment.

$$T = \frac{[(\text{CALIBRATED LOAD}) - (\text{NEW LOAD})]}{(\text{SPRING RATE})}$$

D. Positive "T" indicates up adjustment. Negative "T" indicates down adjustment.

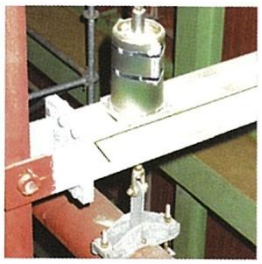
E. Measure the distance "T" from the white position indicator. Tighten or loosen the threaded rod at the turnbuckle at the bottom of the spring to adjust the spring coil to the new position. Use the bottom edge of the spring compression plate as an indicator. **(See FIGURE 3)**

F. Re-mark the new Cold and Hot travel position settings on the spring travel scale.

G. The variable spring hanger is now ready for service. Check the entire installation, and make any necessary adjustments as required by site installation practices.

2.6.4 Load Adjustment Procedure for Type 29 Variable Spring

LISEGA Type 29 variable springs are supplied with factory installed load/travel position settings as specified by the responsible design engineer. If, after installation, the engineer determines that the load of any given variable hanger location must be higher or lower than originally specified, it is possible to adjust the load setting.



A. Load adjustment of all LISEGA variable spring hangers is carried out by adjusting the main spring position. The amount of adjustment is determined using the new load setting, the original calibrated load setting, and the spring rate. The adjustment can only be made while the spring is installed, and when travel stops have been removed.

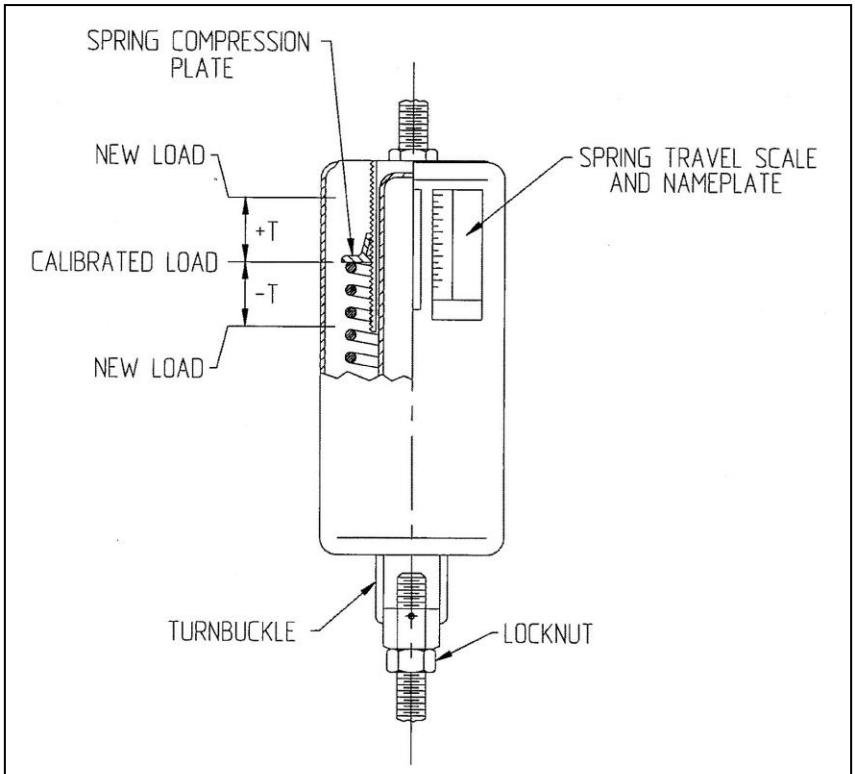


FIGURE 3

Example of an arrangement with type 25

1) *Connecting rod*
2) *Counter nut*
3) *Lock nut*
4) *Load tube*
5) *Travel stop*
6) *Travel scale*
7) *Name Plate*

B. Determine the new required load setting. Note the Calibrated Load value and the Spring Rate on the nameplate. The Calibrated Load corresponds to the white position indicator on the travel scale.

C. Calculate the amount of spring adjustment.

$$T = \frac{[(\text{CALIBRATED LOAD}) - (\text{NEW LOAD})]}{(\text{SPRING RATE})}$$

D. Positive "T" indicates up adjustment. Negative "T" indicates down adjustment.

E. Measure the distance "T" from the white position indicator. Rotate the threaded load column to adjust the spring coil to the new position. Use the bottom edge of the spring compression plate as an indicator. **(See FIGURE 4).**

F. Permanently re-mark the new Cold and Hot Travel Positions settings on the spring travel scale.

G. The variable spring hanger is now ready for service. Check the entire installation, and make any necessary adjustments as required by site installation practices.

2.7 Commissioning

Before commissioning it must be checked that each hanger or support allows the pre-calculated movement of the piping.
The working travel of the hanger or support can be read off at the bottom edge of the spring plate as travel in the blocking slots, and read directly off the travel scale.

2.8 Checking and maintenance

The correct functioning of the spring hangers or supports can be checked in all operating situations by noting the position of the spring plates. Under normal operating conditions no maintenance is required.

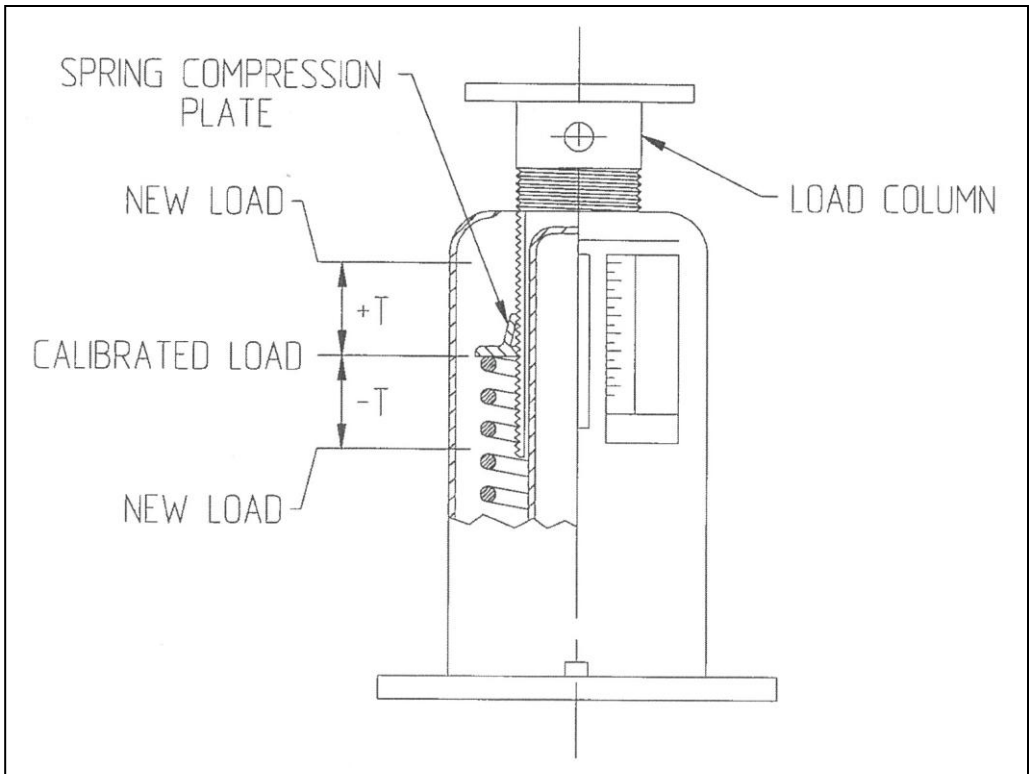


FIGURE 4

3. Hydraulic Snubbers, Struts and Dynamic Pipe Clamps

3.1 Hydraulic Snubbers, Type 30

3.1.1 General Precautions

This Procedure sets forth the guidelines for installation of the LISEGA series 30 snubber with attachment hardware. LISEGA hydraulic snubbers are precision components, and care should be exercised in uncrating, storage, and handling during installation. It is recommended that this entire document be reviewed prior to installation to avoid damage to the equipment or inadequate performance due to improper installation.

A. Snubbers should not be used as steps or ladders

B. Under no circumstances should the snubber body be sandblasted or painted! The snubber body is stainless steel. Should sandblasting be required on adjacent structure or pipe, the snubber assembly should be removed or masked.

C. When arc welding near the snubber assembly, assure that welding current **cannot** pass through the assembly.

D. Snubber assembly and pipe attachment must be properly aligned to minimize forces that could result in pipe clamp rotation or a bending moment in the assembly.

E. To avoid damage to attachment pins or spherical bushings, do not force pins into assembly, a light tapping with a fibre or plastic mallet (or similar tool) is acceptable.

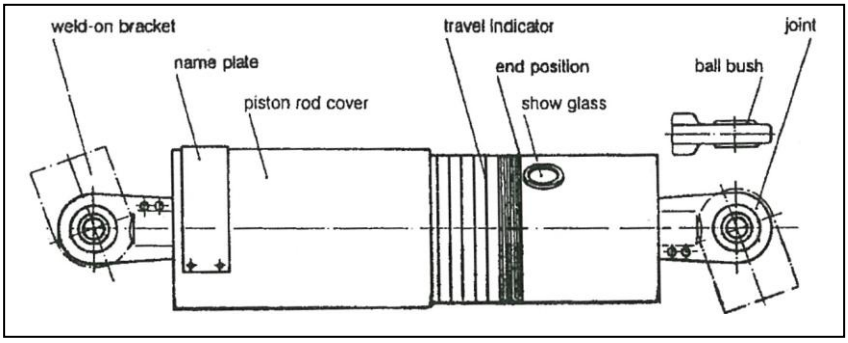
F. Should the snubber be accidentally dropped, check the function by slowly stroking the unit through its full travel. If there is no evidence of sticking or binding, internal damage is unlikely. If there is any question, contact LISEGA for assistance.

3.1.2 Transport Storage

Equipment should be stored in an enclosed building designed to minimize the possibility of flooding. Equipment should be left in original packaging whenever possible. Snubbers should be left in the fully retracted position until installed.

3.1.3 Delivery Condition

The snubbers are supplied as fully operational units, filled with fluid. Each snubber is equipped with a riveted name plate, stamped with the following data: **Type, Normal Load, Order Number, Hydraulic fluid type and viscosity,** and **Hanger Mark number** (if required)**.**

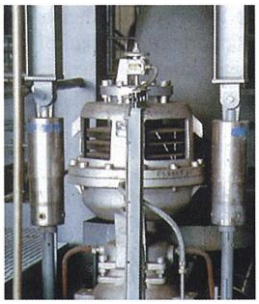


The snubbers are supplied in the fully retracted position. If attachment hardware is part of the order, these are usually supplied assembled as much as possible. If ordered with an extension, it is attached to the snubber body.

3.1.4 Installation Procedure for Type 30 Snubbers

A. Prior to installation, refer to hanger drawing for location and orientation of assembly and attachment hardware.

B. Locate pipe attachment per hanger drawing. Clamps should be installed snug to pipe, but not fully tightened, to allow for minor positioning adjustments if required.



C. For fit-up purposes, Type 35 Weld-on Brackets should be firmly clamped or tack welded in place (see point **'M'** for final welding specifications). It is recommended that the brackets be oriented with the lug ears parallel to the plane containing the largest off axis thermal movement, minimizing the chance of binding during system heat-up. Misalignment of the brackets at this step will cause limitations to the thermal growth, possibly resulting in unsatisfactory snubber performance and/or damage to the system.

NOTE: To be modified/replaced, the following instructions should be followed

D. Assemble snubber to configuration and dimensions shown on hanger drawing**.**

the threaded stud protruding from the rear plate of the snubber (see **FIGURE 5)**. Tighten the extension strut until the locking flange firmly contacts the rear plate of the snubber. Tighten the set screw to secure the locking flange to the rear plate of the snubber at the torque value given in **TABLE 1** on page **25.**

I. Extend snubber to cold/hot setting position per hanger drawing. The snubber must be stroked in a slow but steady manner to avoid activating the snubber, causing it to resist movement. Should the snubber become activated, remove or reverse load and then continue stroking in desired direction. Smaller snubbers may be readily stroked manually. Larger snubbers may be hung from the shroud end, and the weight of the assembly will assist in extending the snubber.

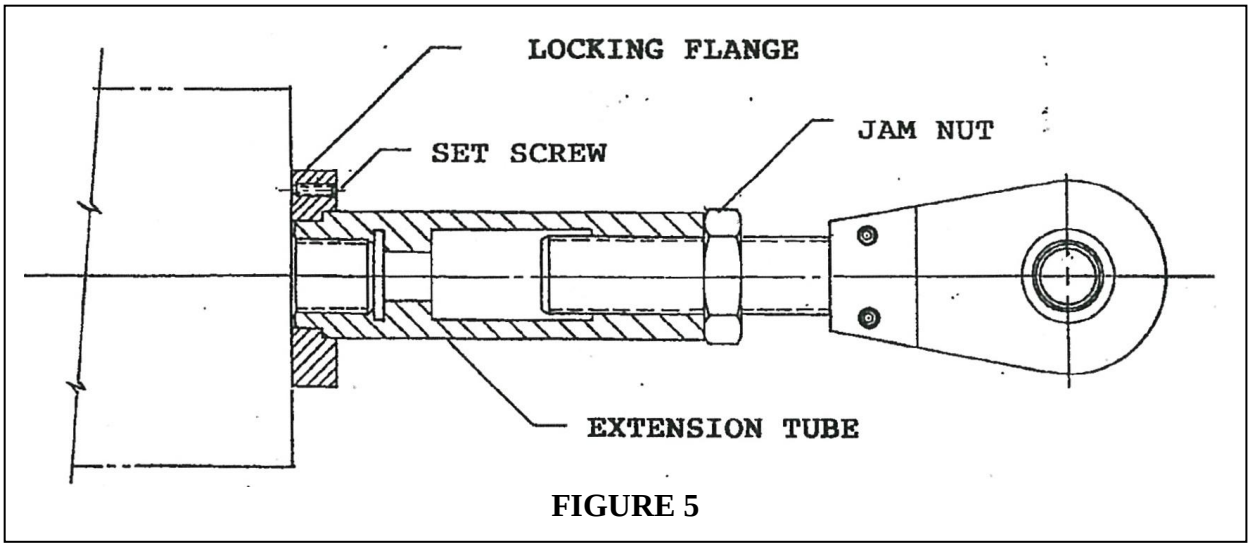
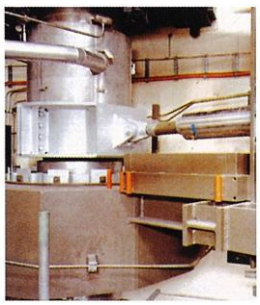


FIGURE 5



E. For minimum pin to pin configurations, no additional assembly is required.

F. For extended pin to pin configurations, an extension strut (Type 33) must be attached to the snubber.

G. For snubber Type 3018, the extension strut is bolted to the snubber at the rear flange, utilizing the three bolts supplied. Torque bolts to 22 in-lbs.

H. For Type 3038 through 3092, the extension strut is threaded directly onto

J. The snubber assembly may now be checked for fit-up to the attachment hardware.

K. Care must be taken to assure that the snubber has not moved from the cold position during handling. If any small adjustment must be made to align pin holes and spherical bearings (1/4" or less), the snubber may be extended or retracted as required.

L. For extended pin to pin assemblies, adjustment of up to ± 1 ½ inch may be accommodated using the extension strut. This is accomplished by loosening the lock nut and threading the paddle end in or out of the extension tube. A machined ring in the male threads of the paddle end will indicate minimum thread engagement with the extension tube. This thread relief should not extend beyond the extension tube. Retighten the lock nut either to the torque value provided in **TABLE 1,** or 1/4" turn past snug, where snug is defined as initial full contact between nut and extension tube.

NOTE: DO NOT make substantial length adjustments utilizing the stroke of the snubber. This practice can result in insuff-icient stroke remaining to accommodate thermal growth of the system or equipment.

M. Once assured of proper fit, remove assembly and complete installation of Weld-on bracket (per hanger drawing and weld detail located on this page). Do not weld while snubber assembly is installed.

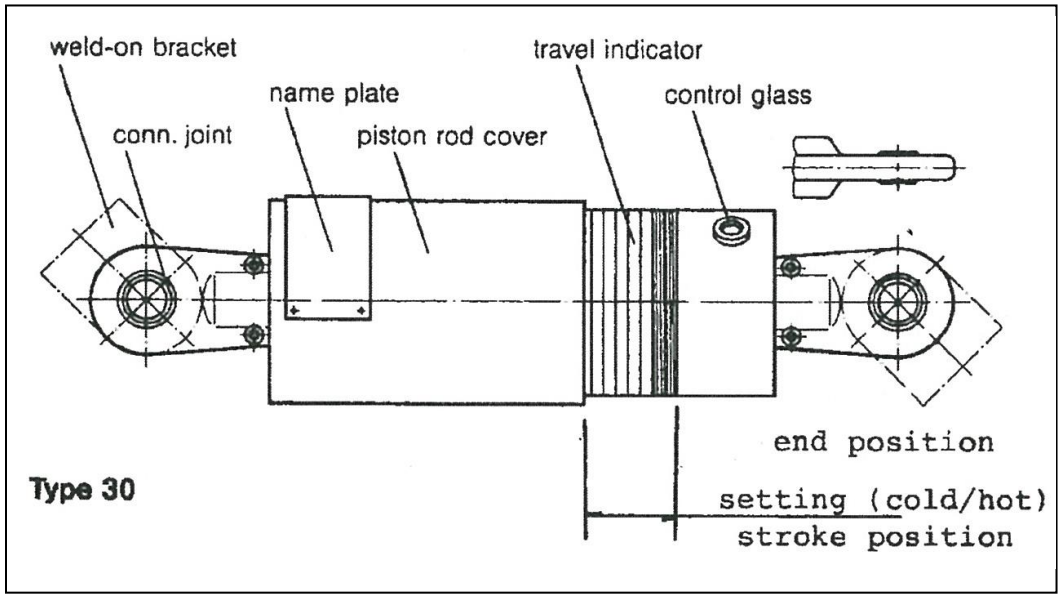
N. Install snubber assembly. Check for proper lug alignment and absence of binding by rotating snubber assembly side to side about its major axis. The snubber must rotate freely. If the assembly exhibits no rotational freedom, re-align paddles by rotating the paddle about its major axis until some rotation occurs.

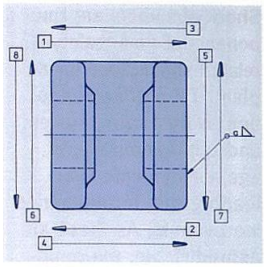
TABLE 1
EXTENSION FASTENER TIGHTENING TORQUES

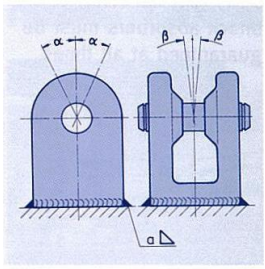
Size	Torque, Jam Nut (ft-lbs)	Nut Flats (in)	Set Screw (ft-lbs)
3018..	22	0.94	N/A
3038..	22	0.94	3
3042..	44	1.26	3
3052..	59	1.61	7
3062..	148	2.36	7
3072..	184	2.76	19
3082..	295	3.74	28
3092..	332	4.33	28

O. Tighten clamp per installation instructions for Type 36, 37, or 38 clamps, and check that all other threaded connections are secure.

P. To verify settings (cold/hot) on LISEGA Hydraulic Snubbers, measure from the end position (last machined ring) on the snubber body to the face of the piston rod cover as shown below:







Type	a (leg length) α=15° β= 6°	α=30° β= 6°	α=45° β= 6°
35 19 13	3/16	3/16	3/16
35 29 13	3/16	3/16	3/16
35 39 13	3/16	3/16	3/16
35 49 13	3/16	1/4	9/32
35 59 19	5/16	13/32	15/32
35 69 19	7/16	17/32	5/8
35 79 19	19/32	25/32	7/8
35 89 19	13/16	1 1/32	1 3/16
35 99 11	27/32	1 1/8	1 9/32
35 09 13	25/32	31/32	1 1/16
35 20 19	1 9/32	–	–

Type 35 Weld Detail
Note: Weld cannot be thicker than the material

Q. If the setting position requires adjustment, loosen lock nut, place a strap wrench around the extension tube or the snubber barrel and rotate until correct cold set position is achieved and then tighten the lock nut.

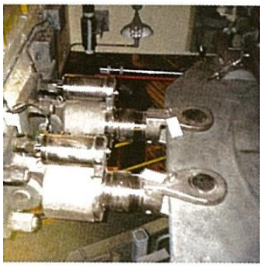
3.1.5 Fluid Level Inspection Procedure for Type 30 Snubbers

The purpose of this procedure is to provide guidance in the visual verification of reservoir fluid level in the LISEGA Type 30 Hydraulic Snubber. This procedure applies to all LISEGA Type 30 Hydraulic Snubbers.

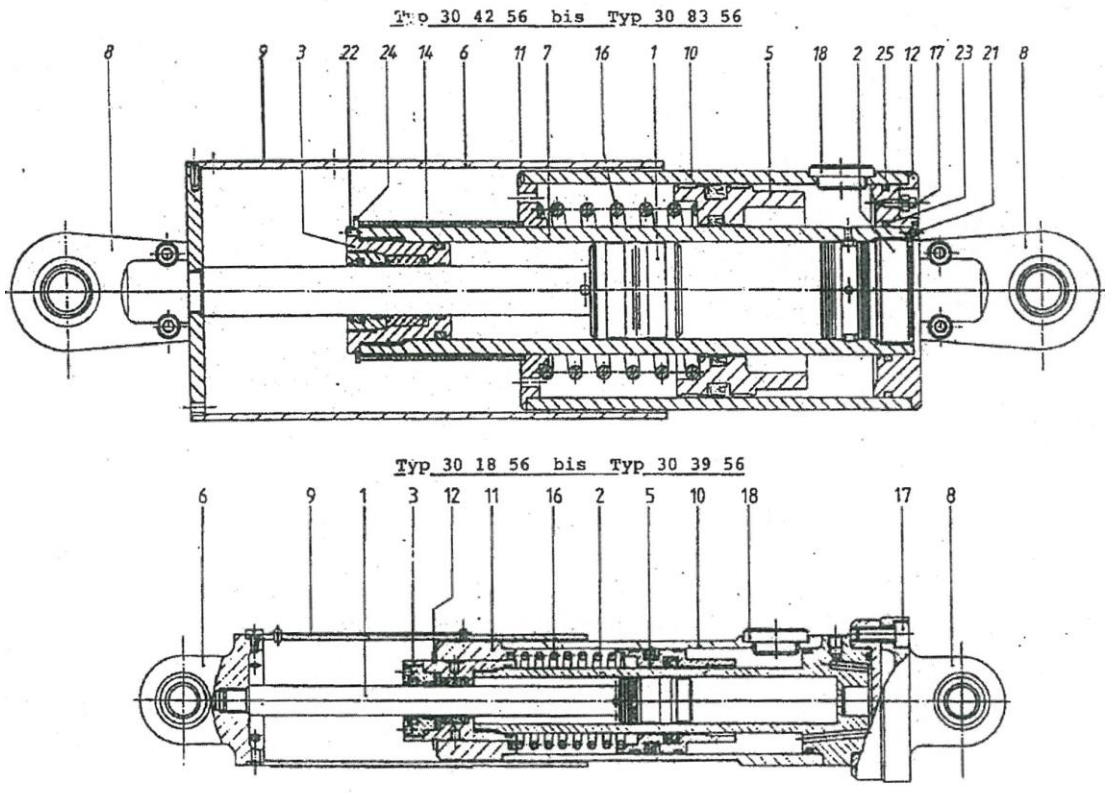
A. Locate sight-glass on reservoir of snubber. All Type 30 Snubbers have integral concentric reservoirs, and the snubber body is the reservoir housing. The sight-glass is located in a brass alloy housing near the back end of the snubber body.

B. The concentric reservoir on the Type 30 Snubber is pressurized through means of a spring (item 16) acting on the reservoir piston (item 5). This maintains a pressure on the fluid in the reservoir, assuring positive flow of fluid to the cylinder regardless of the orientation of the snubber. Should a snubber lose fluid for any reason, the reservoir piston will move across the sight-glass (item 18) as the spring maintains pressure against the remaining fluid. The leading edge of the reservoir piston acts as the fluid level indicator. During installation, the sight-glass should be oriented in such a way that visual inspections can be readily performed.

C. When reservoir is full, the sight-glass will reveal the silver color of the stainless steel cylinder tube. Should there be a loss of fluid, the reservoir piston will appear in the sight-glass instance, the gold color of the brass alloy will be observed in the sight-glass.



Hydraulic Shock Absorbers Type 30



D. Evidence of the fluid loss does not necessarily result in snubber failure, but rather implies degradation. In many cases there will still be sufficient fluid to allow for successful functional testing. The snubber should be functional tested in accordance with site approved test procedure to determine operability.

3.1.6 Snubber Maintenance

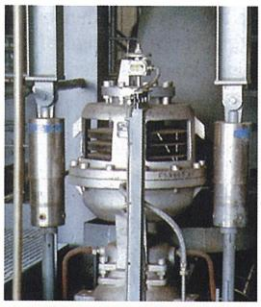
A. For normal operating conditions shock absorbers are designed to function for the entire 40 year life of a plant. The seals and hydraulic fluid should be changed at least once during this period, at the latest after 20 years. However, under certain conditions (extreme stresses) shock absorbers can experience premature ageing and increased mechanical wear. Preventive maintenance is recommended in order to make sure the shock absorbers remain fully operational and reliable. This maintenance is the responsibility of the plant operators.

B. Inspection and maintenance work should be carried out by specially trained personnel. LISEGA servicing specialists can do this if required.

C. Regular inspection should involve a visual inspection carried out once a year on all units installed. The first inspection should take place immediately before commissioning. During the regular inspection, not only the shock absorbers must be inspected, but also the environmental conditions and installation situation. The check list should include the following points:

- ➔ **All units to be inspected, noting installation position**
- ➔ **Planned operational connection displacements**
- ➔ **Special environmental or operating conditions.**
- ➔ **Any maintenance work previously carried out.**

Shock absorbers are components of great safety related significance for a plant. They offer protection to the piping system and other components against dynamic over-loading due to unplanned load events. As these are unpredictable, the complete functional safety of the shock absorbers must be guaranteed at all times.



Examples of shock absorber installation in nuclear plants

D. The following should be checked at the installed position:

- ➔ **Conformity of name plate data with check list.**
- ➔ **Correct form fitting of all connections for load actuation**
- ➔ **Correct freedom of movement of shock absorber during operating displacements**
- ➔ **Position of main piston rod as regards sufficient stroke, including travel reserve (minimum 3/8 inch [10 mm]).**
- ➔ **Exterior condition of shock absorber for any damage or leakage.**
- ➔ **Surrounding areas for possible signs of unusual operating conditions, e.g. increased temperature**

Fluid Indicator Level
As long as the reservoir piston cannot be seen through the sight glass there is sufficient fluid in the reservoir. If the piston is visible, it must be assumed that fluid has been lost.

Observations and findings are to be recorded on the check list and if required, recommendations for corrective action made.

E. An extended inspection needs to be carried out after 12 years of operation (at the latest), whereby a number of installed shock absorbers (min. 2 units per type) are subjected to an additional function test. After successful testing, the shock absorbers can be reinstalled for further service. In the event of deviations in performance, the shock absorber in question should be dismantled and the function-related parts inspected. The plant operators are responsible for taking and documenting any corrective measures.

The scope of testing and the selection of shock absorbers should be agreed on by the relevant plant department and the service engineer responsible. Special consideration is to be given to various stress factors (temperature, radiation, loads, operational vibrations.)

The timing and scope of the next extended inspection is to be decided on the basis of inspection results recorded.

F. After approximately 20 years of operation at the latest, it is recommended that the hydraulic fluid and seals are replaced in all shock absorbers. Following this work, carried out by trained personnel using original LISEGA spare parts, and after successful function testing, the shock absorbers can be used again for a further 20 years.

3.2 Rigid Struts, Type 39

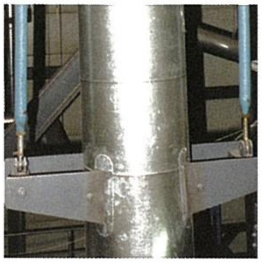
3.2.1 Installation Procedure for Type 39 Rigid Struts

A. Measure nominal centerline of pin to centerline of pin between pipe attachment and structural attachment. Verify that strut is approximately the same nominal length by measuring from centerline pin hole to centerline pin hole.

B. If strut length falls outside of measurements mentioned in the previous paragraph, back off the torque nuts approximately halfway down the available rod. While holding the rod ends fixed, turn tubular section of the strut either clockwise or counter-clockwise, until the desired nominal pin to pin dimension is achieved.

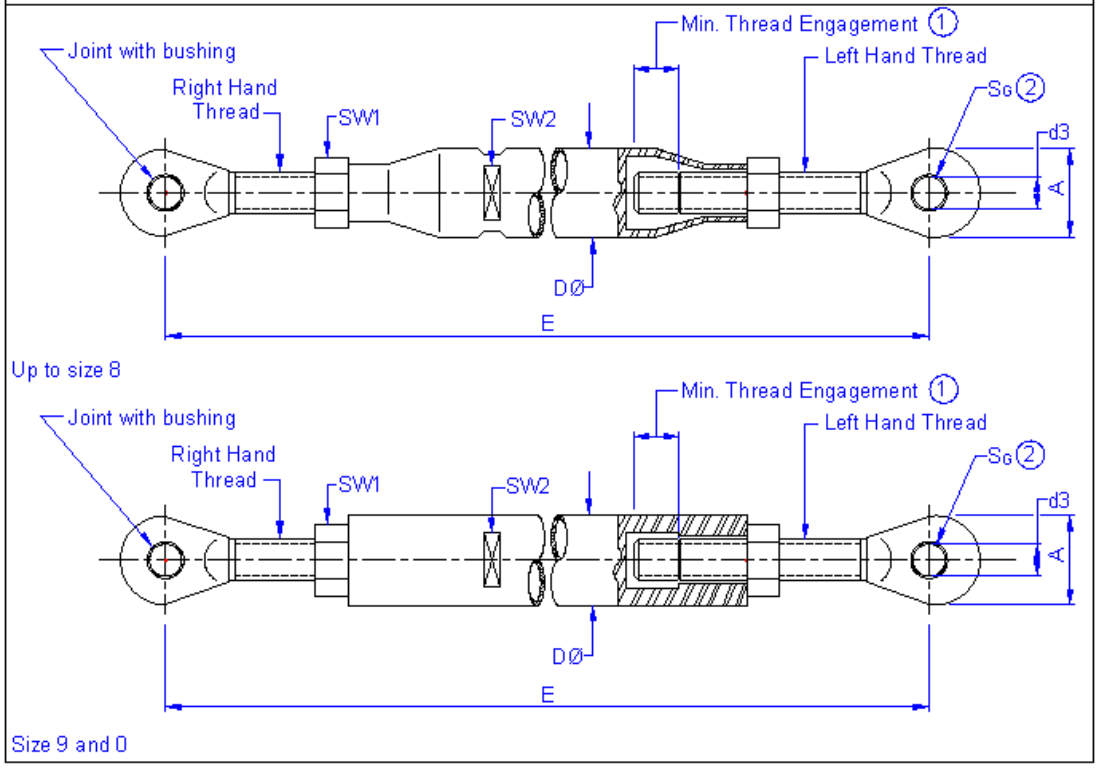
C. Ensure that the minimum thread engagement is attained by checking to see that the machined ring on the threaded rod does not extend outside of the center strut tube. For very short struts with a sight hole, check to ensure the rod threads are visible in the sight hole.

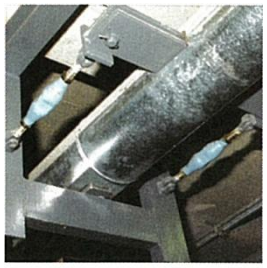
D. If the minimum thread engagement is not met, then the threaded paddle end must be engaged further to meet the minimum requirement. If the required overall dimension cannot be met, then a new strut will have to be obtained.

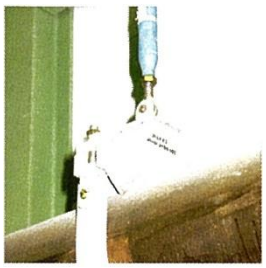


E. With torque nuts loose and well away from tubular ends, lift strut into place. Lower either end of the strut into either bracket, and carefully align the rod end hold with the two holes of the bracket. Gently push pin through the holes, until the pin appears on the other side of the bracket.

FIGURE 5

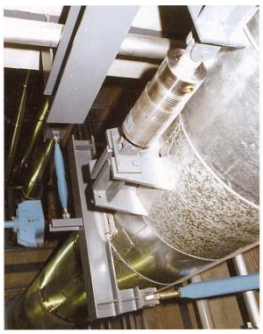






CAUTION: Do not force the pin. If excessive force is required to push pin through, remove the pin, clean the pin, and make sure that holes are perfectly aligned, and that the ball in the spherical bushing of the strut is also in line. Push the pin through again, and insert retaining ring or cotter pin in place on both ends.

F. Lower the strut into position with the other bracket (or clamp). Align holes by turning the Tubular section of the strut clockwise or counter-clockwise, utilizing the wrench flats. When the holes are perfectly aligned, repeat step '**E'.**



G. Turn jam nuts until tight with tubular ends. Torque the two nuts (left-hand and right-hand thread) either to the values provided in **TABLE 2** below, or tighten ¼ turn past snug, where snug is defined as full contact between the nut and tube surfaces.

H. When torque is completed, verify that minimum force is being exerted on the pipe by rotating the strut assembly back and forth by hand in the brackets. If the strut appears to be under force, loosen the locknuts and turn the tubular section of the strut to relieve the force, then repeat step **'F'**.

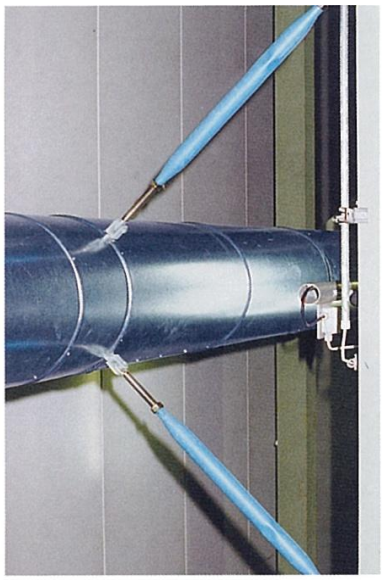


TABLE 2		
STRUT SIZE		**TORQUE ON NUTS**
		(±10% ft-lbs.)
3922		22
3932		37
3942		37
3952		148
3962		148
3972		155
3982		295
3992		332

3.3 Dynamic Pipe Clamps, Type 36, 37 and 38

NOTE: To prevent the clamps from twisting, it is recommended that a shear lug be welded to the pipe. The lug dimensions can be found at the bottom right of this page.

3.3.1 Transport and Storage

It is recommended that units be stored only in closed rooms. If storage in the open is unavoidable, they must be protected from dirt and moisture.

3.3.2 Delivery Condition

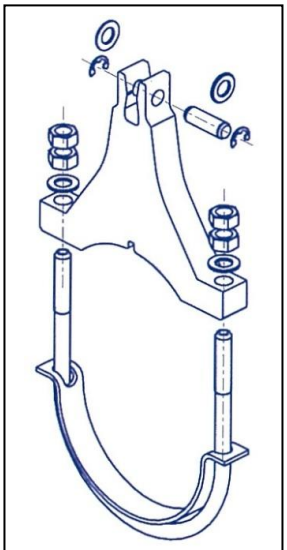
LISEGA dynamic pipe clamps are supplied ready for installation complete with all the nuts and bolts required.

3.3.3 Installation Procedure for Type 36 Dynamic Pipe Clamp

This design has a solid upper yoke with integrated connection bracket and, depending on the load range, one or two U-bolts with inlay plate are provided.
For installation, remove the preassembled U-bolts. Then place the yoke over the shear lug (if it is needed and/or existing, see **FIGURE 6**). Reassemble the U-bolt and inlay from the opposite side, tightening the nuts only lightly at first. Then check and position the clamp as required. Finally, the nuts can be properly tightened and countered.

3.3.4 Installation Procedure for Type 37 Dynamic Pipe Clamp

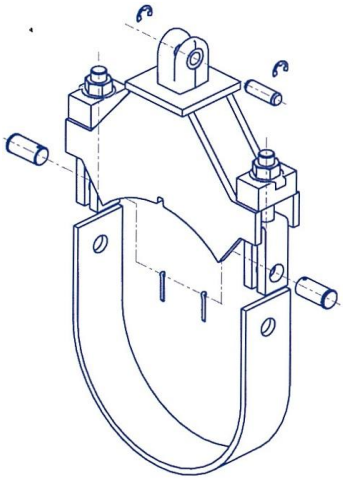
This is the heavier type for larger pipe diameters and higher loads. Normally, the bracket type 35 is welded to the upper yoke. If the bracket is supplied loose on customer request, it must be welded on site following the welding instructions found in Section 3 of the LISEGA 2010 Catalog (p. 3.16). The counterpart to the yoke consists of one or two flat steel straps depending on load. The straps are pinned to the yoke to make transport easier. For installation, the straps must be removed from the forked blocks by loosening the pin connection. The yoke is placed on the shear lug. From the opposite side the flat steel strap is fitted into the bolt-on clevises, fixed with the pins and secured by cotter pins. The clamp is then checked and positioned as required. Finally the nuts are properly tightened. The hex nuts must be locked in position by bending the tab washers to prevent unintentional loosing. Site approved lubrication is recommended.



Type 36

3.3.5 Installation Procedure for Type 38 Dynamic Pipe Clamp

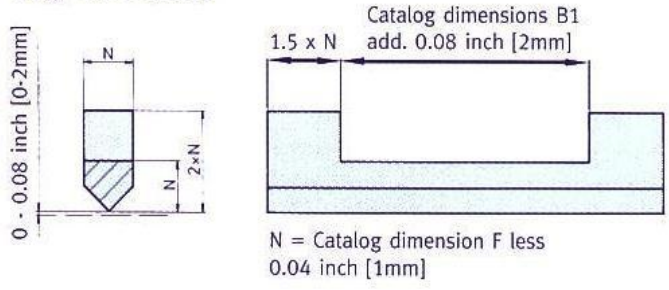
Installation is the same as Types 36 and 37 depending on strap or U-bolt assembly.



Type 37

Fig. 6

Lug dimensions



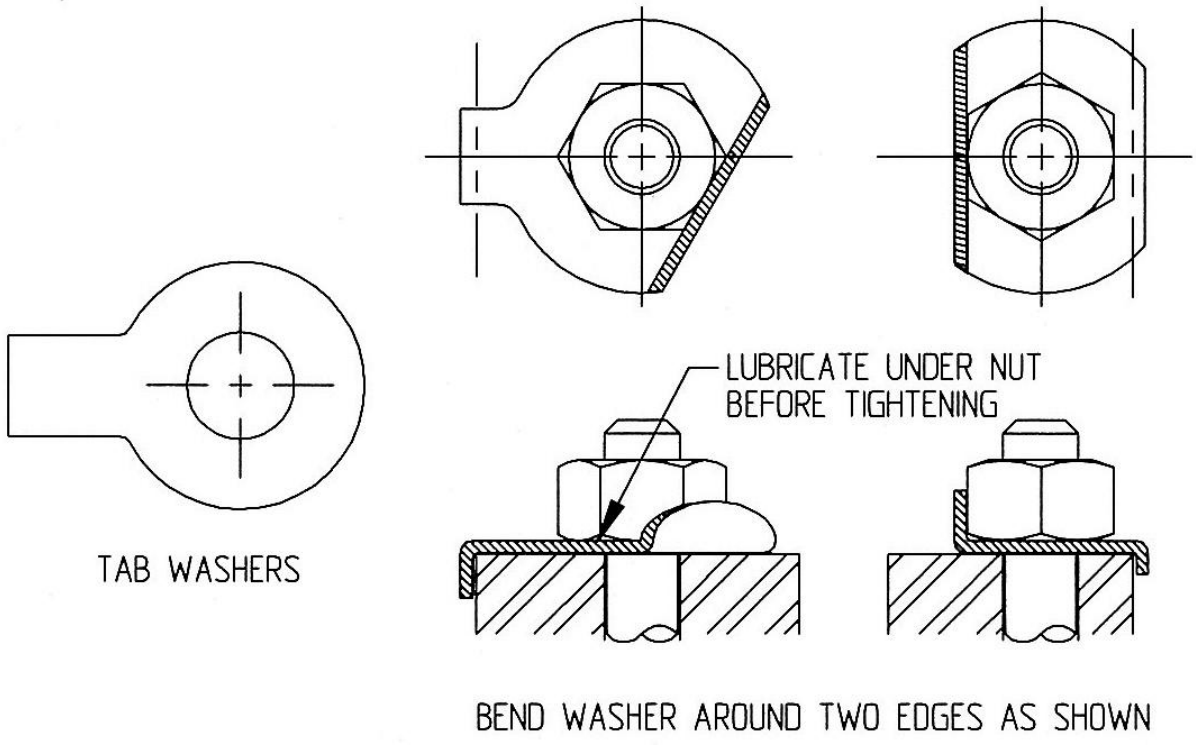


Figure 7

3.4 Friction Anchors

Place the bottom half of the anchor at the support point per applicable hanger drawing.
Weld the bottom half to support structure using appropriate weld size and procedure. If supporting structure is not flat, sequence weld to minimize distortion. Allow the bottom half to cool after welding.

Align top half with bottom half. Ensure that the top half and the bottom half are the same size and material type.

Install studs and nuts or bolts and nuts as delineated below.

Bolts (friction anchors with T-sections only) go through the top half and the bottom half, and studs (all others) are threaded into the bottom half.

Install tab washers and nuts. Do not lubricate threads.

Ensure nuts are uniformly snug tight and are completely engaged. Ensure there is a uniform gap between the top half and the bottom half of the anchor.

Bend tab washer over friction block as shown below.

Tighten the nuts in 1/3 increments to the torque values found in the table in the following 3 pages.

Bend tab washer up against nut as shown in Figure 7 above.

Comes with Studs and Nuts:

Type	Torque value (inch lb)	Torque value (Nm)
38 0a 14-F	48 ± 2	5.5 ± 0.2
38 0b 14-F	79 ± 3%	9 ± 3%
38 01 14-F	132 ± 3%	15 ± 3%
38 01 15-F	159 ± 3%	18 ± 3%
38 02 14-F	1106 ± 3%	125 ± 3%
38 02 15-F	663 ± 3%	75 ± 3%
38 02 16-F	177 ± 3%	20 ± 3%
38 03 14-F	1062 ± 3%	120 ± 3%
38 03 15-F	548 ± 3%	62 ± 3%
38 04 14-F	575 ± 3%	65 ± 3%
38 05 14-F	619 ± 3%	70 ± 3%
38 06 14-F	690 ± 3%	78 ± 3%
38 09 14-F	1106 ± 3%	125 ± 3%
38 11 14-F	2787 ± 3%	315 ± 3%
Type	**Torque value (inch lb)**	**Torque value (Nm)**
38 0b 17-F	79 ± 3%	9 ± 3%
38 01 17-F	132 ± 3%	15 ± 3%
38 01 18-F	840 ± 3%	95 ± 3%
38 02 17-F	1106 ± 3%	125 ± 3%
38 02 18-F	637 ± 3%	72 ± 3%
38 02 19-F	115 ± 3%	13 ± 3%
38 03 17-F	1106 ± 3%	125 ± 3%
38 03 18-F	548 ± 3%	62 ± 3%
38 04 17-F	575 ± 3%	65 ± 3%
38 05 17-F	885 ± 3%	100 ± 3%
38 05 18-F	2035 ± 3%	230 ± 3%
38 06 17-F	690 ± 3%	78 ± 3%

Type	Torque value (inch lb)	Torque value (Nm)
38 0a 14-A	48 ± 2	5.5 ± 0.2
38 0b 14-A	79 ± 3%	9 ± 3%
38 01 14-A	132 ± 3%	15 ± 3%
38 01 15-A	159 ± 3%	18 ± 3%
38 02 14-A	557 ± 3%	63 ± 3%
38 02 15-A	548 ± 3%	62 ± 3%
38 02 16-A	177 ± 3%	20 ± 3%
38 03 14-A	557 ± 3%	63 ± 3%
38 03 15-A	539 ± 3%	61 ± 3%
38 04 14-A	513 ± 3%	58 ± 3%
38 05 14-A	486 ± 3%	55 ± 3%
38 06 14-A	469 ± 3%	53 ± 3%
38 09 14-A	840 ± 3%	95 ± 3%
38 11 14-A	2345 ± 3%	265 ± 3%
Type	**Torque value (inch lb)**	**Torque value (Nm)**
38 0b 17-A	79 ± 3%	9 ± 3%
38 01 17-A	132 ± 3%	15 ± 3%
38 01 18-A	531 ± 3%	60 ± 3%
38 02 17-A	575 ± 3%	65 ± 3%
38 02 18-A	548 ± 3%	62 ± 3%
38 02 19-A	115 ± 3%	13 ± 3%
38 03 17-A	548 ± 3%	62 ± 3%
38 03 18-A	548 ± 3%	62 ± 3%
38 04 17-A	531 ± 3%	60 ± 3%
38 05 17-A	557 ± 3%	63 ± 3%
38 05 18-A	973 ± 3%	110 ± 3%
38 06 17-A	486 ± 3%	55 ± 3%

Comes with Studs and Nuts:

Type	Torque value (inch lb)	Torque value (Nm)
38 0a 04-F	**48 ± 2**	**5.5 ± 0.2**
38 0b 04-F	**79 ± 3%**	**9 ± 3%**
38 01 04-F	**132 ± 3%**	**15 ± 3%**
38 01 05-F	**159 ± 3%**	**18 ± 3%**
38 02 04-F	**1106 ± 3%**	**125 ± 3%**
38 02 05-F	**663 ± 3%**	**75 ± 3%**
38 02 06-F	177 ± 3%	20 ± 3%
38 03 04-F	1062 ± 3%	120 ± 3%
38 03 05-F	548 ± 3%	62 ± 3%
38 04 04-F	575 ± 3%	65 ± 3%
38 05 04-F	619 ± 3%	70 ± 3%
38 06 04-F	690 ± 3%	78 ± 3%
Type	**Torque value (inch lb)**	**Torque value (Nm)**
38 0b 07-F	79 ± 3%	9 ± 3%
38 01 07-F	132 ± 3%	15 ± 3%
38 01 08-F	840 ± 3%	95 ± 3%
38 02 07-F	1106 ± 3%	125 ± 3%
38 02 08-F	637 ± 3%	72 ± 3%
38 02 09-F	115 ± 3%	13 ± 3%
38 03 07-F	1106 ± 3%	125 ± 3%
38 03 08-F	548 ± 3%	62 ± 3%
38 04 07-F	575 ± 3%	65 ± 3%
38 05 07-F	885 ± 3%	100 ± 3%
38 05 08-F	2035 ± 3%	230 ± 3%
38 06 07-F	690 ± 3%	78 ± 3%

Type	Torque value (inch lb)	Torque value (Nm)
38 0a 04-A	**48 ± 2**	**5.5 ± 0.2**
38 0b 04-A	**79 ± 3%**	**9 ± 3%**
38 01 04-A	**132 ± 3%**	**15 ± 3%**
38 01 05-A	**159 ± 3%**	**18 ± 3%**
38 02 04-A	**531 ± 3%**	**60 ± 3%**
38 02 05-A	**531 ± 3%**	**60 ± 3%**
38 02 06-A	177 ± 3%	20 ± 3%
38 03 04-A	548 ± 3%	62 ± 3%
38 03 05-A	531 ± 3%	60 ± 3%
38 04 04-A	486 ± 3%	55 ± 3%
38 05 04-A	486 ± 3%	55 ± 3%
38 06 04-A	486 ± 3%	55 ± 3%
Type	**Torque value (inch lb)**	**Torque value (Nm)**
38 0b 07-A	79 ± 3%	9 ± 3%
38 01 07-A	132 ± 3%	15 ± 3%
38 01 08-A	531 ± 3%	60 ± 3%
38 02 07-A	575 ± 3%	65 ± 3%
38 02 08-A	531 ± 3%	60 ± 3%
38 02 09-A	115 ± 3%	13 ± 3%
38 03 07-A	575 ± 3%	65 ± 3%
38 03 08-A	548 ± 3%	62 ± 3%
38 04 07-A	531 ± 3%	60 ± 3%
38 05 07-A	548 ± 3%	62 ± 3%
38 05 08-A	1017 ± 3%	115 ± 3%
38 06 07-A	486 ± 3%	55 ± 3%

Comes with Bolts and Nuts:

Type	Torque value (inch lb)	Torque value (Nm)
38 0a 11-F	48 ± 2	5.5 ± 0.2
38 0b 11-F	79 ± 3%	9 ± 3%
38 01 11-F	132 ± 3%	15 ± 3%
38 01 12-F	159 ± 3%	18 ± 3%
38 02 11-F	1106 ± 3%	125 ± 3%
38 02 12-F	663 ± 3%	75 ± 3%
38 03 11-F	1062 ± 3%	120 ± 3%
38 03 12-F	548 ± 3%	62 ± 3%
38 04 11-F	575 ± 3%	65 ± 3%
38 05 11-F	619 ± 3%	70 ± 3%
38 06 11-F	690 ± 3%	78 ± 3%

Type	Torque value (inch lb)	Torque value (Nm)
38 0a 11-A	48 ± 2	5.5 ± 0.2
38 0b 11-A	79 ± 3%	9 ± 3%
38 01 11-A	132 ± 3%	15 ± 3%
38 01 12-A	159 ± 3%	18 ± 3%
38 02 11-A	531 ± 3%	60 ± 3%
38 02 12-A	531 ± 3%	60 ± 3%
38 03 11-A	548 ± 3%	62 ± 3%
38 03 12-A	531 ± 3%	60 ± 3%
38 04 11-A	513 ± 3%	58 ± 3%
38 05 11-A	486 ± 3%	55 ± 3%
38 06 11-A	442 ± 3%	50 ± 3%

Type	Torque value (inch lb)	Torque value (Nm)
38 0a 01-F	48 ± 2	5.5 ± 0.2
38 0b 01-F	79 ± 3%	9 ± 3%
38 01 01-F	132 ± 3%	15 ± 3%
38 01 02-F	159 ± 3%	18 ± 3%
38 02 01-F	1106 ± 3%	125 ± 3%
38 02 02-F	663 ± 3%	75 ± 3%
38 03 01-F	1062 ± 3%	120 ± 3%
38 03 02-F	548 ± 3%	62 ± 3%
38 04 01-F	575 ± 3%	65 ± 3%
38 05 01-F	619 ± 3%	70 ± 3%
38 06 01-F	690 ± 3%	78 ± 3%

Type	Torque value (inch lb)	Torque value (Nm)
38 0a 01-A	48 ± 2	5.5 ± 0.2
38 0b 01-A	79 ± 3%	9 ± 3%
38 01 01-A	132 ± 3%	15 ± 3%
38 01 02-A	159 ± 3%	18 ± 3%
38 02 01-A	548 ± 3%	62 ± 3%
38 02 02-A	548 ± 3%	62 ± 3%
38 03 01-A	557 ± 3%	63 ± 3%
38 03 02-A	531 ± 3%	60 ± 3%
38 04 01-A	504 ± 3%	57 ± 3%
38 05 01-A	486 ± 3%	55 ± 3%
38 06 01-A	477 ± 3%	54 ± 3%

4. Lisega Pipe Clamp Installation Procedures

Special clamps may be supplied with alternate lower connections.

4.1 Transport and Storage

If stored in the open, components should be protected from dirt and water.

4.2 Delivery Condition

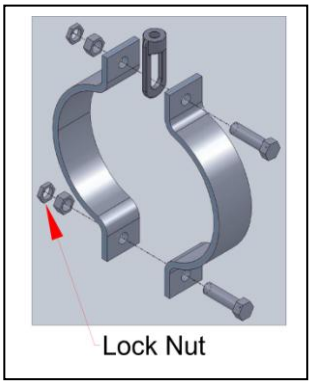
LISEGA pipe clamps and clamp bases are supplied ready for use complete with all bolting required.

4.3 Type 40 U-bolts & Pipe Straps

LISEGA standard U-bolts are shipped with the u-bolt along with four hexagonal nuts in accordance with the thread size. Installation requires two appropriately spaced holes that are 1/16" larger than the thread. A shim is required for ½" and ¾" u-bolts (see product drawing).

A. Insert the U-bolt threads through the two desired holes and tighten the provided hex nuts against the steel to secure pipe totally. Tighten to snug plus a ¼" turn.

B. All U-bolts for AP1000 will be used as a 2-directional restraint. They will not be used as an axial restraint. Therefore, the placement of the hexagonal nuts is critical. The first set of nuts will be threaded above the steel. Insert the ends through the desired steel location. The second set of nuts can then be threaded on so now there are hexagonal nuts above and below the steel. Additional nuts will be provided in order to lock the bottom nuts in place. If U-bolt clearances are not provided on the pipe support drawing, the first set of nuts are to be adjusted such that the sum of the clearances between the pipe and the supporting steel and the pipe and the U-bolt (180° away) is > 1/32" and less than or equal to 1/8". Once the U-bolt is in place and secured, these top nuts will be staked in place.



C. The LISEGA pipe strap is fabricated and inspected to meet the design clearance requirements. The strap should be located per the applicable hanger drawing, and welded as shown on the drawing. The forming process can cause some slight distortion on the edges of the pipe strap. The strap load rating is calculated based on weld size and material cross section. The edge distortion at the top of the radius is minimal and there is sufficient bearing area between the pipe strap and the pipe. Therefore, the slight "belling" of the edges of the strap is of no consequence, and the strap will meet all design and functional criteria.
NOTE: Paint should be removed at least 1" back from surface to be welded and strap should be re-coated after installation.

4.4 Type 42 Two Bolt Clamps Installation Procedure

A. This pipe clamp is used as a horizontal clamp with eye nut Type 60.

B. Place clamp halves around the pipe. Connect the clamp to the threaded rod by running the top bolt through the clamp halves and eye nut.

C. Tighten both bolts and hex nuts ensuring that the flat areas of the clamp halves are about the same distance apart from each other on both sides of the pipe. When tightening bolting it must be ensured that the halves are parallel to each other. Lock nuts are to be used.
NOTE: For alloy/high temperature clamps, an additional hex nut is supplied (one for each bolt) and must be used as a lock nut.

4.5 Type 43 Three Bolt Clamps Installation Procedure

A. With this horizontal clamp, connection is made via a separate connecting pin, with eye nut type 60. It has to be made sure that the pin is secured by the cotter pin provided. Otherwise, proceed as with type 42.

B. Place clamp halves around pipe. Tighten both bolts and hex nuts ensuring that the flat areas of the clamp halves are about the same distance apart from each other on both sides of the pipe, and then tighten the lock nuts. When tightening bolting it must be ensured that the halves are parallel to each other. Lock nuts are to be used.
NOTE: For alloy/high temperature clamps, an additional hex nut is supplied (one for each bolt) and must be used as a lock nut.

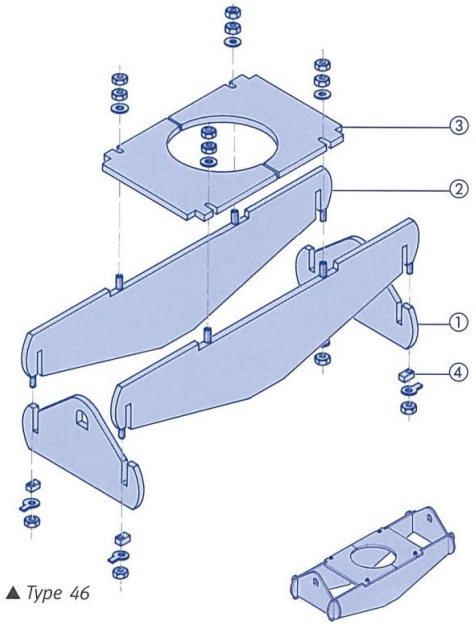
C. Connect the clamp to the threaded rod by running the pin through the clamp halves and eye nut. Place a washer on each end of the pin and secure the pin using the cotter pins. Once the cotter pin is pushed through the hole in the pin, bend the halves in opposite directions around the pin.

4.6 Type 44 Horizontal Clamp U-bolt/Strap Installation Procedure

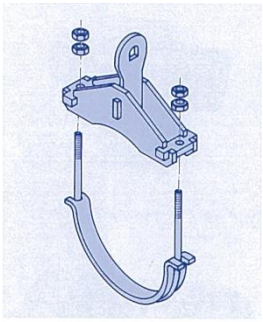
These horizontal clamps consist of an upper part with connecting lug and, depending on load or temperature range, a U-bolt with an inlay plate or a strap as lower part. For installation, the preassembled lower part is taken off by loosening the fastening nuts or removing the connecting pins. The upper part is seated on top of the pipe and the lower part fitted by threading the U-bolt on or pinning the flat steel strap on. After adjusting the clamp, the connections are tightened. The U-bolts are secured by lock nuts and the flat steel straps by tab washers for the hex nuts.

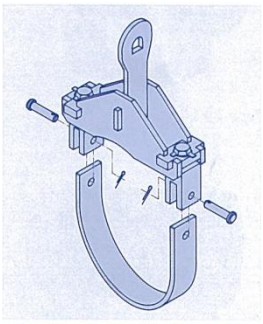
4.6.1 Type 44 Pipe Clamp over 1110°F[600°C] Installation Procedure

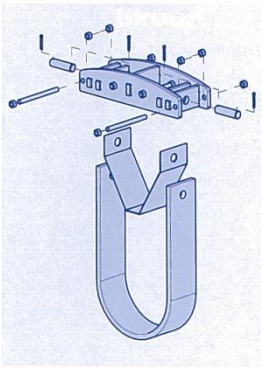
These clamps consist of a yoke with connecting lug and restraint, as well as a flat steel strap for the lower part. To install, the restraint and strap are taken off by removing the outer threaded rods and connecting bolts. The upper part is then fitted into the hanger. The restraint and strap are fitted again, bolted on, and the threaded rods mounted. All parts are to be checked for secure fit.



▲ Type 46


Type 44 with U-bolt


Type 44 with strap


Type 44 over 1110°F [600°C]

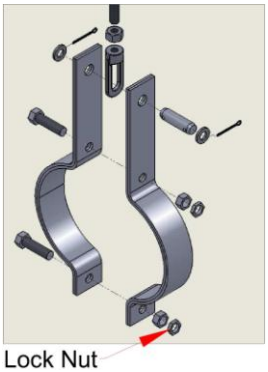
4.7 Type 45, 46 and 48 Riser Clamps Installation Procedure

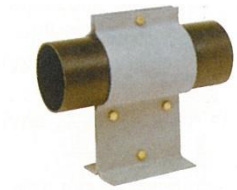
4.7.1 Type 45 Riser Clamp Installation Procedure

During installation, care must be taken to place the spacers between the clamp halves at the bolting. The bolting has to be tightened and secured by counter nuts. The clamp is mounted via the other supporting pins, which are secured by washers and cotter pins. The clamp is to be adjusted to the height indicated by tightening the supporting boltings so that it is form fitted for load actuation onto the shear lugs.

4.7.2 Type 46 Riser Clamp Installation Procedure

For installation we recommend hanging the





Type 49 .. .1 and 49 .. .2

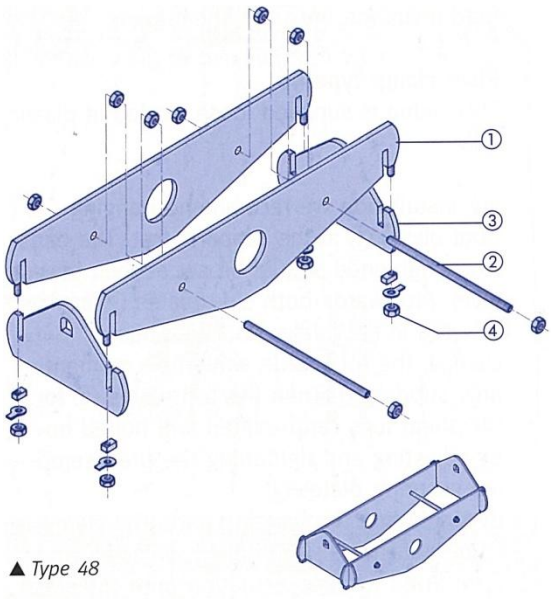
Type 49 .. .3, 4

Type 49 .. .3, 4, 5

plates (1) in the supports first. The parts to be tightened should be set at their lowest level. Afterwards both side plates (2) can be inserted in the intake slot. With heavy clamps, the other side should be temporarily supported. Then the top plates (3) for the shear lugs can be fitted and bolted on by adjusting and tightening the hex nuts on the pre-welded studs of the side plate. By tightening the hanger rods, the clamp is to be adjusted to the height indicated and to ensure that the shear lugs are resting on the load plates. Secure connection of the end and side plates is made by adjusting and tightening the securing plates (4).

4.7.3 Type 48 Riser Clamp Installation Procedure

A. First, one of the side plates (1) should be prepared using threaded rods (2). For installation both side plates are to be seated on the trunnions and connected by the rods on either side of the pipe. The nuts should be lightly tightened.



▲ *Type 48*

For heavy clamps, support with wooden blocks or ropes is required.

B. The end plates (3) are now fitted into the intake slots and connected to the hanging parts. Secure connection of the end and side plates is made by adjusting and tightening the securing plates (4). By tightening the supports the clamp is to be adjusted to the height indicated and form fitted for load actuation to the trunnions.

4.8 Type 49 Clamp Bases Installation Procedure

A. LISEGA clamp bases are sliding supports, connected to the pipe by clamping tension. During installation it is essential that the base plate lies flush and can glide unobstructed over the given surface. If required, the base plate may be welded to the supporting surface.

B. According to the particular field of application, different designs are used with regard to support height, pipe diameter, support load and operating temperature. The following points are hereby to be observed:

4.8.1 Type 49 .. .1 and 49 .. .2 Installation Procedure

This clamp base consists of two halves to be fitted to each side of the pipes (Omega Style). The cornered ends form the base plate. In the lower part, both halves are firmly connected to each other by bolting. Through clamping tension, the upper bolting secures the clamp base against slipping.

4.8.2 Type 49 .. .3 and 49 .. .5 Installation Procedure

The foot of this clamp base forms a solid support into which the pipe can be fitted. The upper part, providing clamping tensions, consists of half a clamp and is to be securely bolted (snug tight plus ¼" turn).

5. Pipe Bearings and Saddle Components

These items are standardized in LISEGA Product Group 5 for wide range of applications.

For applications outside the standard range, special designs can be offered.

5.1 Specification and Design of Roller Bearings

In the design of standard components, practical requirements find special consideration. The standard roller bearing is hot-dip galvanized and provides optimum corrosion protection. Except for the movable double cylinder roller bearing Type 53 .. 29, weldings have been dispensed with.

The bearing axles are made from austenitic material and have a polished surface. The slide bearings incorporate bushings made from a Teflon bronze sintered compound material fitted into the roller. The bearings are maintenance free and guarantee dry running qualities. The formed shoulder of each bushing minimizes the stick-slip drag effect on lateral loading. The bearing axles are permanently fixed in the middle section of the base. Special locking on the side bracket is not required.

The rollers are made from high tensile carbon steel. Their outer surfaces are machined.

To compensate for misaligned anchor bolts, on site, the base holes are slotted for additional adjustment.

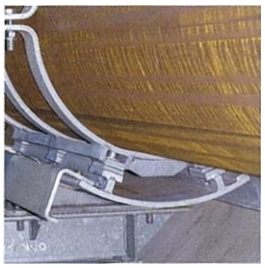
The height dimensions (E) within a load group range are identical for all roller bearings, including the lateral movement type.

5.2 Installation Instructions

5.2.1 Roller Bearings

The roller bearings can be fixed by simple bolt connections or welded to the contact surface of the pipe support. In each case the complete width of the base plate must be supported and secured.

Due to the slotted holes, roller bearings can easily be adjusted even with slightly misaligned anchor bolts.



5.2.2 Pipe Saddles

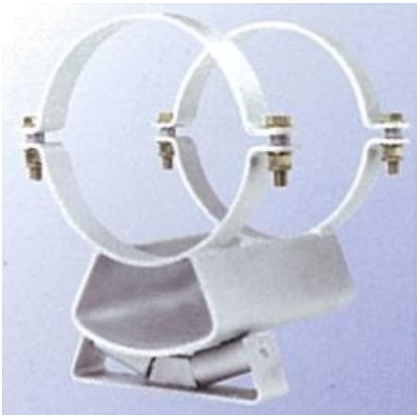
Care must be taken that the specified minimum weld size is applied.

Pipe saddles with clamps are supplied ready to install including all required bolting.

Care must be taken to ensure the correct positioning and adequate presetting of the bolts.

5.2.3 Lift-Off Restraints

When installing the lift-off restraint plate, care must be taken to ensure that the gap between plate and roller is sufficient for normal movement along the whole travel range.



6. Rod Connecting Elements

In the connection component field, precision fit threads, reliable material grades and designs with safe load reserves are the prerequisite for the dependability of the entire load chain.

Eye nut, type 60

Clevis with pin, type 61

Turnbuckle, type 62

Rod Coupling, type 64

The components in Product Group 6 are specially designed threaded elements for connecting the attachment rods to other support components that in part have differently designed connections that in part have differently designed connections such as lugs, clevises or eye nuts.

The connecting parts in Product Group 6 form an independent group within the modular system and have been specially designed for optimum suitability as pipe support components.

The components are designed (apart from turnbuckles type 62) to allow limited length adjustments.

The permissible loads correspond with the load table for statically determined pipe supports on p. **0.5** in the LISEGA catalog.

Eye nut Type 60 is used to join the rod to a pin connection, the clevis Type 61 to join it to a lug connection.

Turnbuckle Type 62 is supplied with a right-hand thread at one end and a left-hand thread at the other. It is used together with the tie rod Type 65 to provide length adjustment and presetting of the load chains.

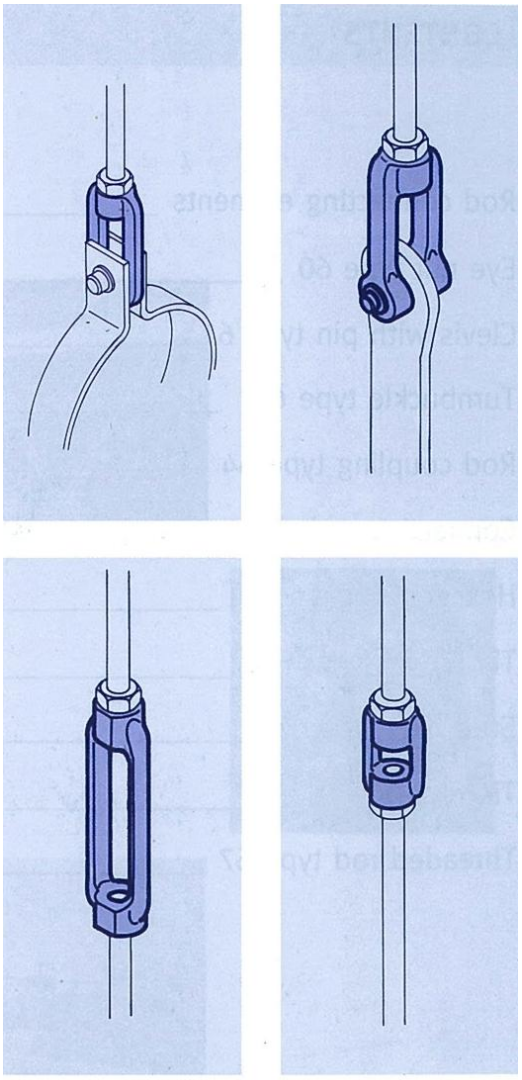
Coupling Type 64 is used to produce rod lengths greater than 12 feet [3.65m].

For corrosion protection, all components are supplied complete with a standard electro-galvanized finish (zinc thickness approx. 0.59m mil [15µm].

Thread engagement must equal at least one full diameter of the thread size in question.

For use in particularly aggressive environments, the components can be supplied with a hot dip galvanized finish.

Material certification can be supplied for all components if required.



LISEGA connecting components offer special advantages:

- ➜ universal application
- ➜ load and connection compatibility with the LISEGA modular system
- ➜ drop forged and heat treated
- ➜ standard electrogalvanized or if required, hot dip galvanized finish
- ➜ qualification by special type testing

6.1 Connecting Rods Type 63 to 67

6.1.1 Rolled Threads

All threads are manufactured using a rolling process. Thread rolling does not sever milling fibres as in thread cutting. By means of this thread rolling process the material is made to flow and thereby plastically formed. In this way, additional strengthening of the surface is achieved, free of notches and offering high surface quality.

In this way, frictional resistance is reduced, with a favorable effect on the adjustment of the rods' under loading. In addition, additional reserves for the bending and tensile strength properties result from this by comparison with the design calculations.

6.1.2 Types

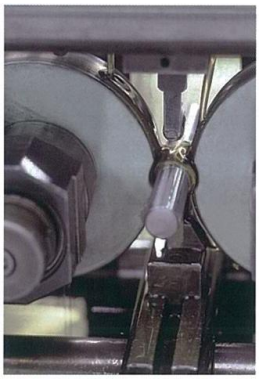
Fully threaded rods Type 67 up to 2" UNC are available in 24 inch length increments from 24 inches up to 12 feet.

6.1.3 Length Adjustment

Tie rods Type 65 with left/right hand threads are always used together with turnbuckle Type 62 and form standard lengths. They are designed for length adjustment and load-actuated presetting of load chains. All other thread connections are exclusively right-hand and have to be locked using hexagon nut Type 63.

6.1.4 Length Adjustment in the Field

Cut the rod to desired length. For safety, chamfer the cut end with a grinder and then reinstall.



Special advantages:

- ➜ materials with guaranteed properties
- ➜ rolled threads
- ➜ notch-free surfaces
- ➜ electrogalvanized finish
- ➜ standard lengths
- ➜ in-house manufacture

Manufacturing process of threaded rods.

7. Structural Attachments, Trapezes

As well as trapezes, the components of Product Group 7 include attachment elements connecting directly to the structure.

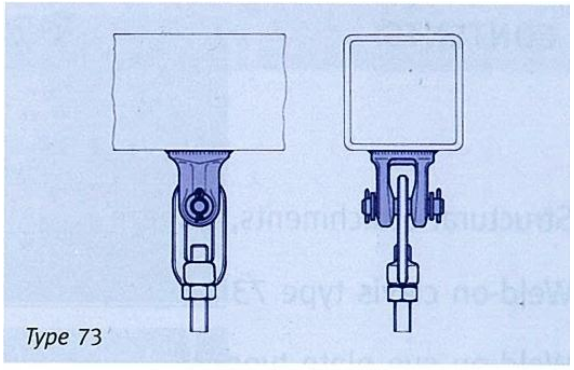
The permissible loads correspond with the load table for statically determined components (reference S**ection 0**).

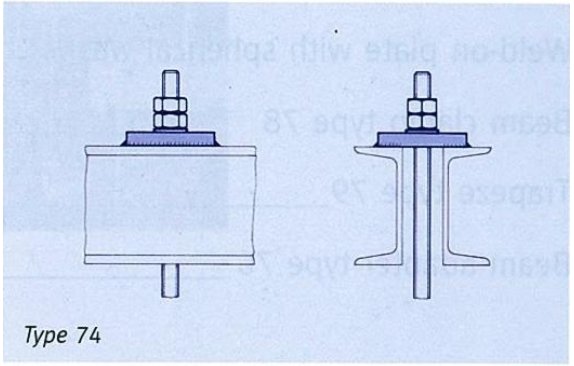
For weld-on clevis Type 73 and weld-on eye plate Type 75, the minimum weld thicknesses must be considered. These are designed in such a way that the maximum weld stresses do not exceed 10.9ksi [75N/mm^2] during normal operating conditions.

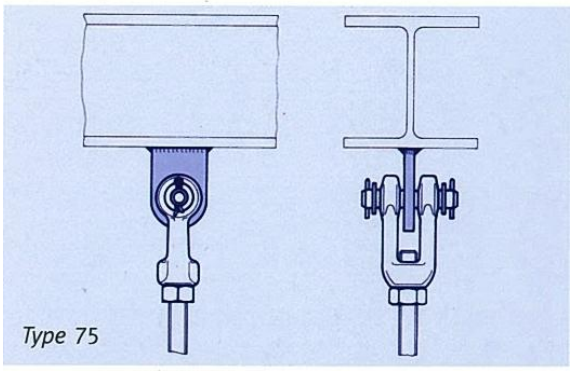
The weld-on clevis Type 73 is particularly suited for attachment to hollow sections. The beam clamp Type 78 is designed for unwelded attachment to beams at the job site. The beam width is to be specified when ordering.

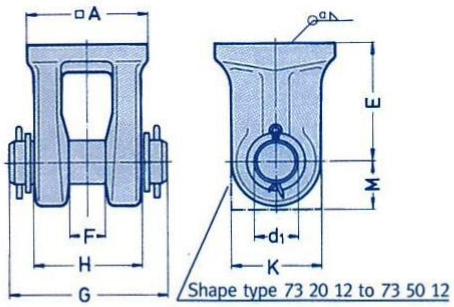
Trapeze Types 79 are suitable for use with clamp base Type 49. They can be used as rigid hangers or in conjunction with variable and constant hangers.

Material certification can be supplied for all components on request.

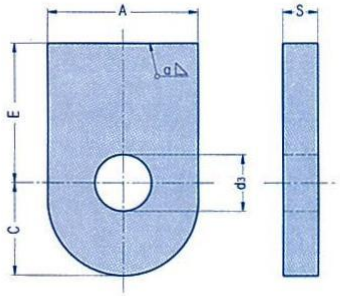

Type 73


Type 74


Type 75



Type	□A	Ød1	E	F	G	H	K	M	min.① Seam (leg length)	Weight (lbs)
73 29 13	1 5/8	0.48	1 3/8	7/16	2 3/8	1 3/8	1	–	3/16	0.7
73 39 13	2	0.63	1 5/8	5/8	2 3/4	1 3/4	1 1/4	–	3/16	0.9
73 49 13	2 1/2	0.79	2	3/4	3 1/2	2 1/4	1 3/4	–	3/16	2.4
73 59 13	3	0.95	2 3/8	13/16	4 1/8	2 5/8	2 1/8	–	3/16	4.6
73 69 12	3 3/4	1.30	3 1/2	1 1/16	4 7/8	3 1/8	2 1/2	–	1/4	8.4
73 79 12	4 3/4	1.58	4 3/8	1 1/4	5 1/2	3 5/8	3 1/8	–	1/4	15.0
73 89 12	4 3/4	1.78	4 3/4	1 7/16	6 1/2	4 3/8	3 1/2	–	5/16	20.3
73 99 12	4 3/4	1.97	5 1/8	1 5/8	7 1/4	4 3/4	3 7/8	–	7/16	24.5
73 10 12	5 7/8	2.37	5 1/2	1 15/16	8 1/4	5 7/8	4 3/4	–	1/2	40.8
73 20 12	6 3/4 x 6 7/8	2.76	5 7/8	2 5/16	9 5/8	6 1/2	6 3/4	3	9/16	82.0
73 30 12	6 3/4 x 6 7/8	2.76	5 7/8	2 5/16	9 5/8	6 1/2	6 3/4	3	5/8	82.0
73 40 12	5 7/8 x 7 1/2	3.15	6 3/4	2 3/16	9	5 7/8	5 7/8	3 1/2	3/4	84.0
73 50 12	7 1/8 x 8 5/8	3.55	7 5/8	2 1/2	9 1/2	6 1/2	7 1/8	4 3/8	13/16	128.0



Type	A	Ød3	E	C	S	min.① Seam (leg length.)	Weight (lbs)
75 D1 19	1 1/8	0.41	1 5/8	3/4	1/4	3/16	0.22
75 21 12	1 3/8	0.49	1 3/4	7/8	5/16	1/4	0.28
75 31 12	1 3/4	0.64	2	1 1/8	3/8	5/16	0.52
75 41 12	2 3/8	0.80	2 1/8	1 1/2	1/2	3/8	1.00
75 51 12	2 1/2	0.96	2 3/8	1 5/8	5/8	7/16	1.44
75 61 12	3 1/8	1.33	2 3/4	2	3/4	1/2	2.76
75 71 12	3 7/8	1.61	3 1/8	2 1/2	1	9/16	5.18
75 81 12	4 3/4	1.81	3 1/2	3	1 1/4	5/8	8.60
75 91 12	5 1/8	2.00	3 7/8	3 1/8	1 1/4	13/16	10.20
75 10 12	5 7/8	2.40	4 3/8	3 1/2	1 5/8	7/8	17.00
75 20 12	6 3/4	2.79	4 3/4	3 7/8	1 3/4	1 1/16	23.40
75 30 12	7 1/8	2.79	5 1/8	4 3/8	1 3/4	1 3/16	27.80
75 40 12	8 5/8	3.18	5 1/2	4 3/4	2	1 1/16	40.80
75 50 12	9 7/8	3.58	5 7/8	5 3/8	2 3/8	1 1/8	60.60