



THE RIGHT WAY FOR FITTING SYSTEMS

Hanging Parts > String Components > Suspension Clamps > Prefo  
Dead End Clamps > Compression Fittings > Accessories > Arcin  
gs > Counterweight Devices > Earthwire Fittings > OPGW Fittings  
Spacer Dampers > Vibration Dampers > Expanded Bundle T/L P  
Guy Tower Accessories > Hydraulic Presses > Compressed Ancho  
& Laboratory > Fittings > Hanging Parts > String Components >  
Armor Grip Suspension > Dead End Clamps > Compression Fittin  
ections and Corona Rings > Counterweight Devices > Earthwire  
ypical T/L Assemblies > Spacer Dampers > Vibration Dampers >  
ts > T/L Accessories > Guy Tower Accessories > Hydraulic Presse  
ices > Engineering & Laboratory > Fittings > Hanging Parts > Str  
Clamps > Preformed Armor Grip Suspension > Dead End Clamp  
ccessories > Arcing Protections and Corona Rings > Counterweig  
ittings > OPGW Fittings > Typical T/L Assemblies > Spacer Damp  
Expanded Bundle T/L Products > T/L Accessories > Guy Tower A  
resses > Compressed Anchor Devices > Engineering & Laborator



SALVI

**S**alvi, established in Milano in 1920, is exclusively specialized in the manufacture of hardware, fittings and damping systems for overhead transmission lines.

Our supplies, effected in more than 40 countries all around the world, have enriched and diversified this catalogue, wich now covers a range of products satisfying the requirements of a large number of customers.

Apart from the products shown here we can also design and manufacture special solutions for any particular case.



Salvi production is a synthesis of the best electrical and mechanical performances: accurate material selection, high mechanical and fatigue resistance, low Corona losses.

Everything is done in agreement with Customer's requirements and, when not specified, in compliance with International Standards.



Our Quality System, certified since 1994, is actually in compliance with ISO 9001-2000 while quality and reliability of each product are assured by a well established Quality Control and by our technologically advanced internal Laboratory.



## Index of Sections

### A. HANGING PARTS

- A.1 Shackle:
- Straight Shackle
  - 90° Shackle
  - U-Shackle
  - V-Shackle

A.2 U-clevis

A.3 90° Double Clevis

A.4 Trunnion Clevis

A.5 Pivoting Hinge

A.6 U-bolt

### B. STRING COMPONENTS

- B.1 Ball:
- Ball Eye
  - Long Ball Eye (one hole support)
  - Long Ball Eye (two holes support)
  - Ball Tongue
  - Long Ball Tongue (one hole support)
  - Long Ball Tongue (one hole 90° support)
  - Long Ball Tongue (two holes support)
  - Ball Clevis
  - Long Ball Clevis (one hole support)
  - Long Ball Clevis (two holes support)
  - Ball Y-Clevis
  - Long Ball Y-Clevis
  - Long Ball Clevis
- B.2 Socket:
- Socket Tongue
  - Long Socket Tongue (one hole support)
  - Long Socket Tongue (two holes support)
  - Socket Clevis
  - Long Socket Clevis (two holes support)
  - Socket Y-Clevis
  - Long Socket Y-Clevis (two holes support)
  - Long Socket Y-Clevis

B.3 Clevis Tongue:

- 90° Clevis Tongue
- 90° Clevis Tongue (two holes support)
- Y-Clevis Tongue

B.4 90° Double Tongue

B.5 Chain Link

B.6 Chain Tongue

B.7 Spacing Yokes

- Triangular
- Rectangular
- Triple Bundle
- Quadruple Bundle
- Sextuple Bundle
- Special Bundle

B.8 Extension Link:

- Double Tongue
- 90° Double Tongue
- Double Clevis
- Double Eye
- Clevis Tongue
- 90° Clevis Tongue
- Tongue Eye

B.9 Hot Line Extension Link:

- 90° Clevis Tongue
- Double Eye
- 90° Double Eye
- 90° Tongue Eye

B.10 Adjustable Extension Link:

- Long Type Adjustable
- Short Type Adjustable

B.11 Turnbuckle:

- Clevis Tongue
- Eye Tongue
- Eye Clevis
- Double Clevis
- Double Tongue
- Double Eye

### C. SUSPENSION CLAMPS

C.1 Standard

C.2 Corona Free

C.3 Corona Free Trunnion

C.4 Corona Free Poly-articulated



## Index of Sections

### D. PREFORMED ARMOR GRIP SUSPENSION

D.1 Preformed Armor Grip (AGS)

### E. DEAD END CLAMPS

E.1 U-Bolt Type Strain Clamp

### F. COMPRESSION FITTINGS

F.1 Dead-End, Mid Span Joint and Repair Sleeve for Bimetallic Conductors (ACSR and similar)

F.2 Dead-End, Mid Span Joint and Repair Sleeve for Monometallic Conductors (AAC, AAAC and similar)

### G. ACCESSORIES

G.1 Parallel Groove Clamp

G.2 Two and Three Bundle Rigid Spacer  
Four Bundle Jumper Rigid Spacer

G.3 Armor Rods

### H. ARCING PROTECTIONS AND CORONA RINGS

H.1 Arcing Horn

H.2 Arcing Racket

H.3 Corona Ring

### J. COUNTERWEIGHT DEVICES

J.1 Counterweights

J.2 Counterweight sets

### K. EARTHWIRE FITTINGS

K.1 Suspension Clamp

K.2 Dead-end and Mid Span Joint

K.3 Bolted Strain Clamp

K.4 Parallel Groove Clamp

K.5 Earthing Clamp

### L. OPGW FITTINGS

L.1 Armor Grip Suspension

L.2 Preformed Dead-end Set

L.3 Parallel Groove Clamp

L.4 Down-lead Clamp

### M. TYPICAL T/L ASSEMBLIES

M.1 Suspension & Tension Sets for Single Conductor

M.2 Suspension & Tension Sets for Two Bundle Conductors

M.3 Suspension & Tension Sets for Three Bundle Conductors

M.4 Suspension & Tension Sets for Four Bundle Conductors

M.5 Special Bundle Sets

M.6 Suspension & Tension Sets for Earthwire

M.7 Insulated Suspension & Tension Sets for Earthwire

M.8 Suspension & Tension Sets for OPGW

### N. SPACER DAMPERS

N.1 Spacer Damper

### O. VIBRATION DAMPERS

O.1 Vibration Damper

### P. EXPANDED BUNDLE T/L PRODUCTS

P.1 Spacing Yoke

P.2 Flexible Spacer Damper

### Q. T/L ACCESSORIES

Q.1 Spherical Day Marker

Q.2 Night Warning Light

Q.3 Bird Flight Diverter

### R. GUY TOWER ACCESSORIES

R.1 Rope Eye Terminal and Inverted Suspension Clamp

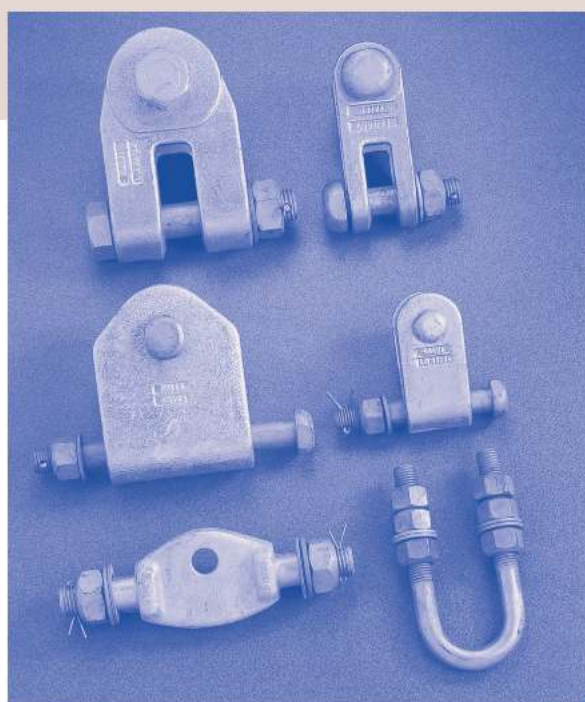
R.2 Anchor Device

### S. HYDRAULIC PRESSES

S.1 Hydraulic Presses

S.2 Power Supplies

S.3 Accessories



**H**anging Parts are used to attach the hardware to the tower steelwork. The Hanging Parts shown in this section are Salvi standard production and cover almost all transmission lines construction needs. Anyway Salvi is able to design and manufacture any other type of tower attachment according to particular customer requirements.

#### **Material and Manufacture**

Most of our Hanging Parts are manufactured from forged steel, which offers design flexibility, high strength and, at the same time, low weight and small dimension. All Hanging Parts are subjected to non destructive and destructive tests and they are hot dip galvanized. Salvi can also provide, upon request, ductile iron Hanging Parts for special applications.

#### **Mechanical Strength**

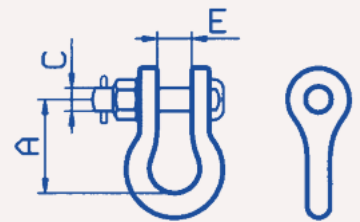
The ultimate strength shown in this section (U.T.S. column) is the load at which the failure can occur.

#### **Standards**

Our products are normally manufactured, galvanized, verified and tested in accordance with CEI, IEC, ASTM, AMSI and BS Standards. However, different standards, if required by Customer's specification, could also be applied.

## Straight Shackle

Code	U.T.S. kN	A mm	C mm	E mm	Note
2722-001	40	60	Ø12	14	Pin
2732-006	70	65	M16	18	
2713-002	120	65	Ø16	24	Pin
2713-006	120	65	M16	24	
2713S-006	160	65	M16	24	
2720-006	160	113	M16	24	
2720-010	280	113	M22	24	
2713-1-004	210	65	Ø20	24	Pin
2713-1-009	210	65	M20	24	
2720-009	210	113	M20	24	
2713-1S-009	227	65	M20	24	
2715-32-010	320	100	M22	32	
2775B-010B	320	65	M22	24	Hardened and tempered
2715-010	320	100	M22	24	
2715-011	360	100	1"W	24	
2715-012	360	100	M27	24	
2715-32-011	360	100	1"W	32	
2715-32-012	360	100	M27	32	
2730-011	360	130	1"W	42	
2715B-011B	420	100	1"W	24	Hardened and tempered
2715-32B-011B	460	100	1"W	32	Hardened and tempered
2715-32B-050	480	100	M30	32	Hardened and tempered
2715B-012B	480	100	M27	24	Hardened and tempered
2730-012	500	130	M27	42	
2718-049	600	130	M36	32	
2718-42-049	600	130	M36	42	
2745-067	890	200	M42	42	
2745-062	1200	200	M52	42	

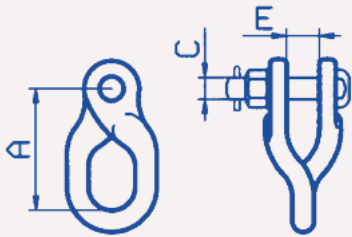


Material: hot dip galvanized forged steel



A.1

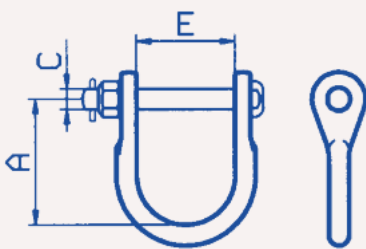
### 90° Shackle



Code	U.T.S. kN	A mm	C mm	E mm	Note
2741-001	70	70	Ø12	14	Pin
2705-002	120	90	Ø16	24	Pin
2705-006	120	90	M16	24	
2777-009	210	90	M20	24	
2777B-010	240	90	M22	24	Hardened and tempered

Material: hot dip galvanized forged steel

### U-Shackle



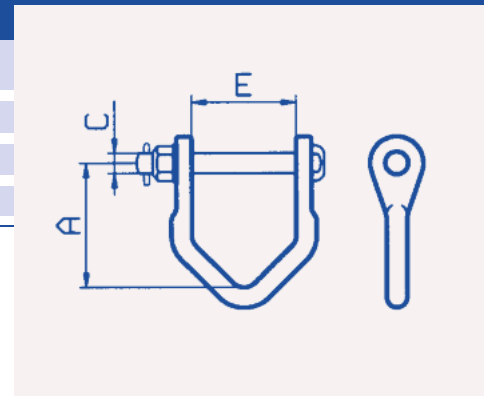
Code	U.T.S. kN	A mm	C mm	E mm	Note
2766-4-006	70	140	M16	80	
2766-8-007	80	135	M18	110	
2766-8-009	80	135	M20	110	
2766-11-006	80	218	M16	107	
2766-13-006	80	135	M16	110	
2735-1-006	120	98	M16	77	
27105-010	210	120	M22	104	
2770-012	320	145	M27	125	

Material: hot dip galvanized forged steel

## V-Shackle

Code	U.T.S. kN	A mm	C mm	E mm	Note
2735-006	120	97	M16	104	
2735-009	120	97	M20	104	
2735-11-006	120	100	M16	70	
2735-22-007	120	100	M18	77	

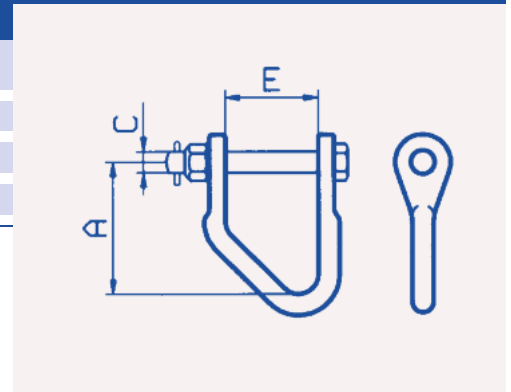
Material: hot dip galvanized forged steel



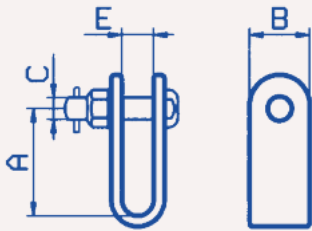
## V-Shackle

Code	U.T.S. kN	A mm	C mm	E mm	Note
2735-9-007	70	100	M18	70	
2766-007	70	220	M18	122	
2766-009	70	220	M20	122	
2735-9-009	70	100	M20	70	

Material: hot dip galvanized forged steel



## U-Clevis

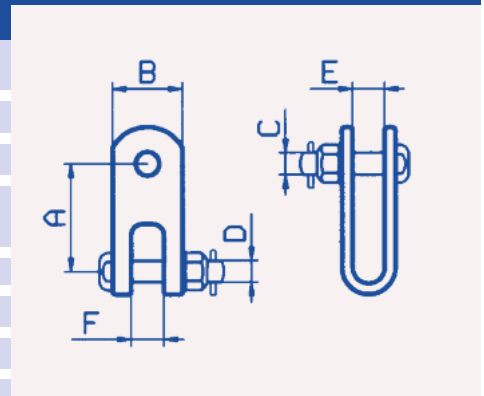


Code	U.T.S. kN	A mm	B mm	C mm	E mm	Note
3608-006	120	75	35	M16	24	
3609-002	120	80	24	Ø16	24	Pin
3609-006	120	80	24	M16	24	
3616-002	120	80	45	Ø16	24	Pin
3616-006	120	80	45	M16	24	
3636-013	120	110	45	Ø16	24	Pin
3641-006	120	79	55	M16	24	
3643-006	120	68	22	M16	20	
3643-1-006	120	67	22	M16	24	
3648-006	120	73	120	M16	24	
3649-006	120	55	45	M16	32	
3616-002B	135	80	45	Ø16	24	Pin
3641-002B	135	79	55	Ø16	24	Pin
3645-013B	135	120	65	Ø16	22	Pin
3645-1-002B	135	120	65	Ø16	24	Pin
3645S-006	160	120	65	M16	22	
3616-009	210	80	45	M20	24	
3641-009	210	79	55	M20	24	

Material: hot dip galvanized forged steel

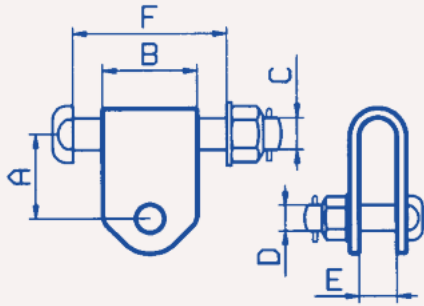
## 90° Double Clevis

Code	U.T.S. kN	A mm	B mm	C mm	D mm	E mm	F mm	Note
22175-006006	125	80	52	M16	M16	24/18	24	
22175-2002002	125	80	52	Ø16	Ø16	20	24	Pin
22175-2006006	125	80	52	M16	M16	20	24	
22175-006B006	160	80	52	M16	M16	24/18	24	Hardened and tempered bolt
22175-020016	160	80	52	M20	M16	24/18	24	
22175-3008008	160	80	52	3/4"W	3/4"W	20	24	
22175-3009006	160	80	52	M20	M16	20	24	
22176-3025016	160	79	52	M24	M16	20	24	
22176-004004	210	75	52	Ø20	Ø20	24	24	Pin
22176-009009	210	75	52	M20	M20	24	24	
22176-010004	210	75	52	M22	Ø20	24	24	Bolt/Pin
22174-050010	240	110	60	M30	M22	27	24	
22176S-009009	240	75	52	M20	M20	24	24	
22174-011010	300	110	60	1"W	M22	27	24	
22176-010010	300	75	52	M22	M22	24	24	Hardened and tempered
22176-010010B	320	75	52	M22	M22	24	24	Tempered bolt
22174-011011	360	108	60	1"W	1"W	27	24	
22174B-011011	420	108	60	1"W	1"W	27	24	Hardened and tempered
22174H-1-011B	480	108	60	1"W	1"W	27	24	Hardened and tempered
22173-050050	540	115	120	M30	M30	36	32,5	
22173-049050	681	115	120	M36	M30	36	32,5	Tempered bolt



Material: hot dip galvanized forged steel

## Trunnion Clevis

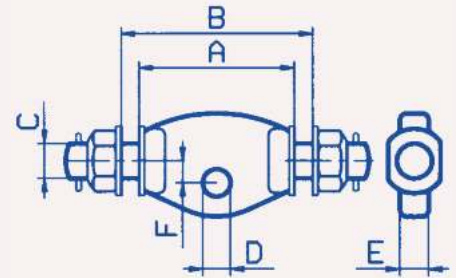


Code	U.T.S. kN	A mm	B mm	C mm	D mm	E mm	F mm	Note
1245A4053006	120	61	80	M24	M16	26	160	
1245A4053A006	120	61	80	M24	M16	26	125	
1245A4058006I	120	61	80	M24	M16	17	205	"C" stay bolt "E" with plain washers
1245A4058A006	120	61	80	M24	M16	26	250	"C" stay bolt
2703-009006	120	92	110	M20	M16	24	150	
3641-009002	120	69	55	M20	Ø16	24	78	Bolt/Pin
3641-009002S	120	69	55	M20	Ø16	24	113	Bolt/Pin
3641-009S002	120	69	55	M20	Ø16	24	125	Bolt/Pin
3645-009002B	135	110	65	M20	Ø16	22	113	Pin, hardened and tempered Pin
2703-009010	210	92	110	M20	M22	24	150	
2746-11009009	210	90	120	M20	M20	24	160	
2746-11-01009	210	90	120	M22	M20	24	160	
2746-8-009009	210	92	75	M20	M20	26	107	
2746-8-009009S	210	92	75	M20	M20	26	122	
2746-8-010009	210	90	75	M22	M20	26	107	
3641-009004S	210	69	55	M20	Ø20	24	113	Bolt/Pin
2703-050010	240	83	110	M30	M22	32	170	
2746-8-01010S	240	90	75	M22	M22	26	145	
1245A42010010	300	62	80	M22	M22	26	112	
27113-050010	300	90	120	M30	M22	26	170	"E" with plain washers
27116-012010	300	92	100	M27	M22	26	169	"E" with plain washers
1245A-010010B	320	62	80	M22	M22	26	112	

Material: hot dip galvanized forged steel

## Pivoting Hinge

Code	U.T.S. kN	A mm	B mm	C mm	D mm	E mm	F mm	Note
25109	210	122	148	M27	Ø22	22	17	
25109-1	300	122	148	M27	Ø24	22	8	
2796M053	300	80	105	M42	Ø24	22	60	Cut flame steel
25109-2	360	122	148	M27	Ø29	22	8	
2799M041	400	150	183	M36	Ø27	30	120	Cut flame steel
2710M012H	530	97	135	M27	Ø38	30	120	Cut flame steel
2797M064	600	180	213	M42	Ø38	30	120	Cut flame steel
2798M065	1060	200	238	M56	Ø54	40	139	Cut flame steel



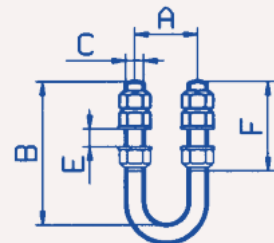
Material: hot dip galvanized forged steel

## U-Bolt

## A.6

## U-Bolt

Code	U.T.S. kN	A mm	B mm	C mm	E mm	F mm	Note
35596M	100	50	100	M16	12	65	
35598M	100	50	115	M16	17	70	
35594M	100	60	110	M16	20	73	
35597M	100	60	155	M16	55	110	
35508M	100	70	120	M16	30	85	
35520M	100	70	110	M16	12	65	
35599M	100	85	130	M16	30	85	
35531M1	120	50	152	M16	30	85	
35591M	120	65	152	M16	30	85	
35592M	120	65	215	M16	130	180	
35653M	210	65	220	M20	65	135	
35654M	210	65	220	M20	100	175	
35641M	210	70	160	M20	30	100	



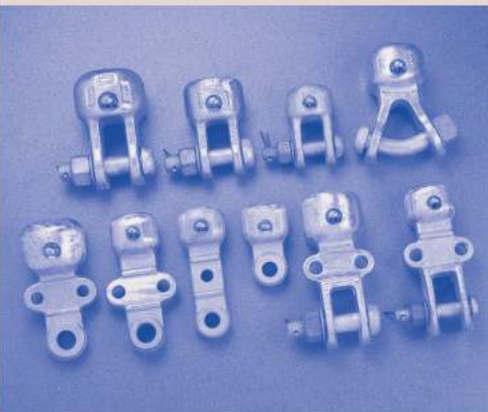
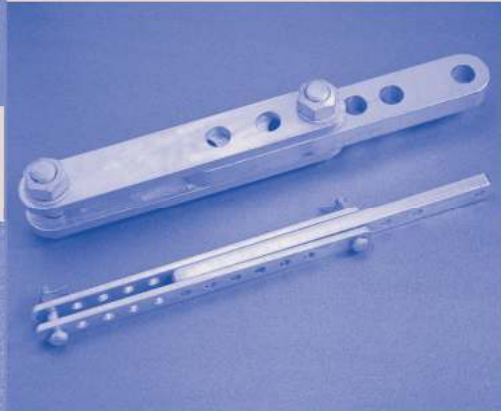
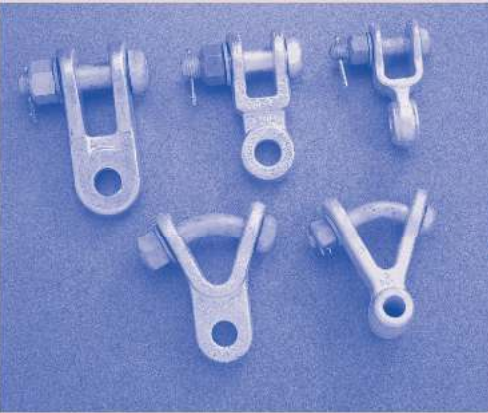
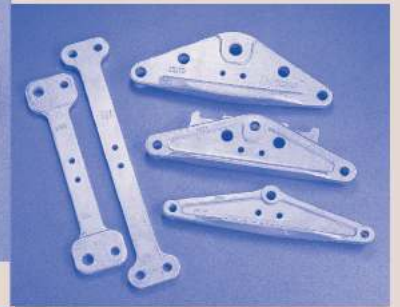
Material: hot dip galvanized steel





# String Components

B





**S**tring Components are the hardware of primary importance for suspension and tension assemblies to be installed between the attachment to tower and suspension or tension clamp. The String Components shown in this section are Salvi standard production and any possible combination can be selected in order to realize all generally used suspension and tension assemblies for medium and high voltage transmission lines.

Salvi is able to design the best combination of String Components in order to meet both the strength and electrical characteristics required for the assemblies. In addition Salvi can design and manufacture any other type of String Components according to particular customer requirements.

#### **Material and Manufacture**

Most of our String Components are manufactured from forged steel, which offers design flexibility, high strength and, at the same time, low weight and small dimension. In addition also cut flame steel and rolled plate steel can be used where particular shapes are required, such as extension and adjustable links, yokes for three and four bundle conductors and special yokes as well. All String Components are subjected to non-destructive and destructive tests and they are hot dip galvanized.

#### **Mechanical Strength**

The ultimate strength shown in this section (U.T.S. column) is the load at which the failure can occur.

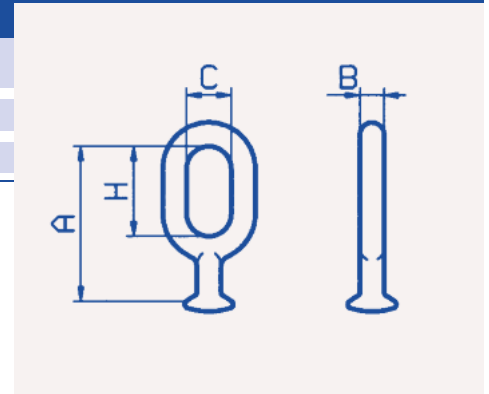
#### **Standards**

Our products are normally manufactured, galvanized, verified and tested in accordance with CEI, IEC, ASTM, AMSI and BS Standards. However, different standards, if required by Customer's specification, could also be applied.

## Ball Eye

Code	Class	U.T.S. kN	A mm	B mm	C mm	H mm	Note
2125	IEC16A	120	105	16	30	60	
2158	IEC20	210	115	20	30	60	
2182	IEC24	300	136	22	30	75	

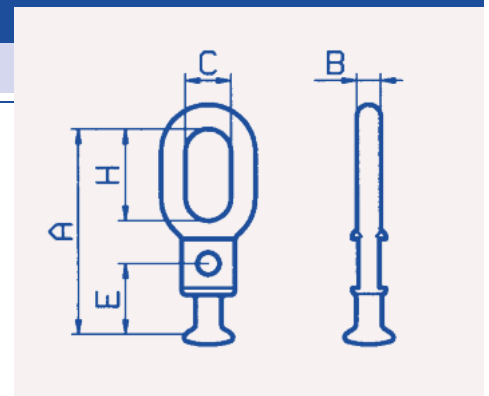
Material: hot dip galvanized forged steel



## Long Ball Eye (one hole support)

Code	Class	U.T.S. kN	A mm	B mm	C mm	E mm	H mm	Note
2137	IEC16A	120	137	16	30	49	60	

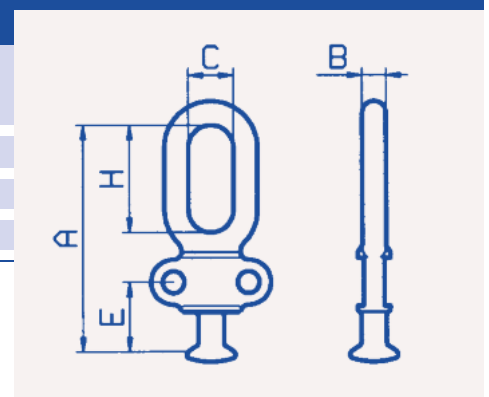
Material: hot dip galvanized forged steel



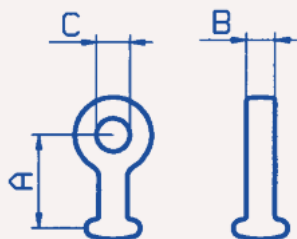
## Long Ball Eye (two holes support)

Code	Class	U.T.S. kN	A mm	B mm	C mm	E mm	H mm	Note
21113	ANSI 52-8 52-11	227	170	20	30	57	80	
2175	IEC16A	120	153	16	30	49	71	
2199	IEC20	210	170	20	30	57	80	
2176	IEC24	300	180	22	30	60	80	

Material: hot dip galvanized forged steel



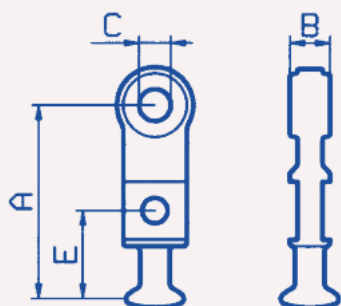
## Ball Tongue



Code	Class	U.T.S. kN	A mm	B mm	C mm	Note
2308	IEC11	40	40	12	Ø14	
2313	IEC16A	120	55	22	Ø18	

Material: hot dip galvanized forged steel

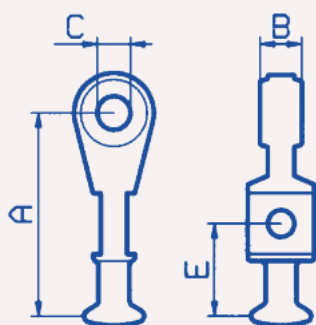
## Long Ball Tongue (one hole support)



Code	Class	U.T.S. kN	A mm	B mm	C mm	E mm	Note
2335	IEC16A	120	105	22	Ø18	47	
2335-1	IEC16A	120	105	22	Ø22	47	
2335-3	IEC16A	120	105	18	Ø22	47	
2333	IEC20	210	110	22	Ø22	57	

Material: hot dip galvanized forged steel

## Long Ball Tongue (one hole 90° support)



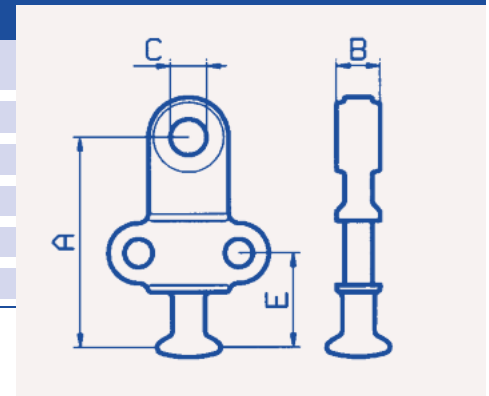
Code	Class	U.T.S. kN	A mm	B mm	C mm	E mm	Note
2338	IEC16A	120	105	22	Ø18	47	
2338-1	IEC16A	120	105	22	Ø22	47	

Material: hot dip galvanized forged steel

## Long Ball Tongue (two holes support)

Code	Class	U.T.S. kN	A mm	B mm	C mm	E mm	Note
2309	IEC16A	120	105	22	Ø18	47	
2309-1	IEC16A	120	105	22	Ø22	47	
2309-2	IEC16A	120	105	22	Ø24	47	
2309-3	IEC16A	120	105	18	Ø24	47	
2384	IEC20	210	110	22	Ø22	57	
2384-2	IEC20	210	110	22	Ø24	57	

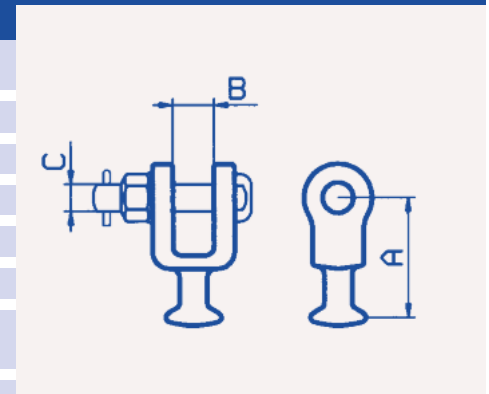
Material: hot dip galvanized forged steel



## Ball Clevis

Code	Class	U.T.S. kN	A mm	B mm	C mm	Note
2331-001	IEC11	40	51	14	Ø12	Pin
2223-006	IEC16A	120	70	24	M16	
2348-006	IEC20	160	90	24	M16	
2348-009	IEC20	210	90	24	M20	
2350-010	IEC24	300	90	24	M22	
2389-1-011	IEC28	400	120	32	1"W	
2223ANSI-006	ANSI 52-3 52-5	120	70	24	M16	
2385-009	ANSI 52-8 52-11	227	90	24	M20	

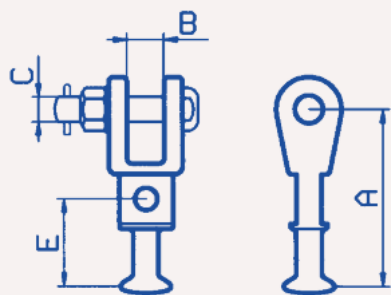
Material: hot dip galvanized forged steel





B.1

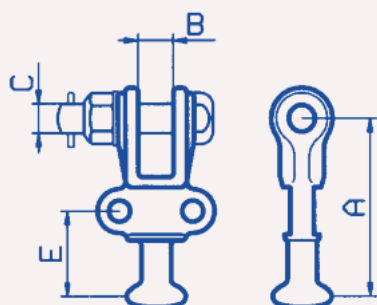
## Long Ball Clevis (one hole support)



Code	Class	U.T.S. kN	A mm	B mm	C mm	E mm	Note
2219-006	IEC16A	120	105	24	M16	47	

Material: hot dip galvanized forged steel

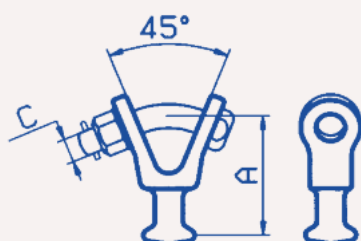
## Long Ball Clevis (two holes support)



Code	Class	U.T.S. kN	A mm	B mm	C mm	E mm	Note
2258-009	IEC20	210	120	24	M20	57	
22164-009	ANSI 52-8 52-11	227	120	24	M20	57	
22117-010	IEC 24	300	120	24	M22	57	

Material: hot dip galvanized forged steel

## Ball Y-Clevis



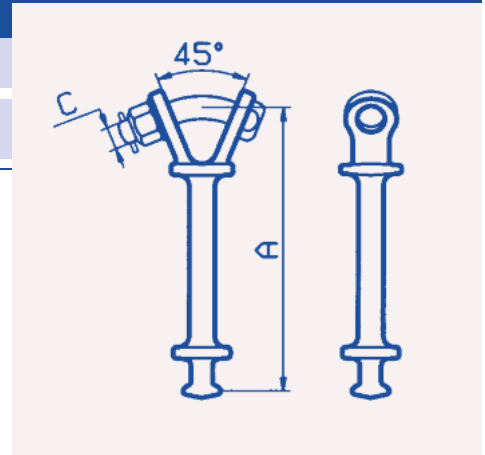
Code	Class	U.T.S. kN	A mm	C mm	Note
2265-043	ANSI 52-8 52-11	227	100	M20	

Material: hot dip galvanized forged steel

## Long Ball Y-Clevis

Code	Class	U.T.S. kN	A mm	C mm	Note
26153-043	ANSI 52-5	135	250	M20	
26157-043	ANSI 52-8 52-11	227	259	M20	

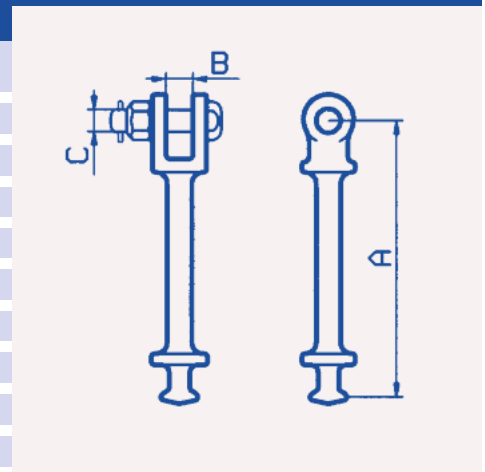
Material: hot dip galvanized forged steel



## Long Ball Clevis

Code	Class	U.T.S. kN	A mm	B mm	C mm	Note
2329-314-009	ANSI 52-5	135	314	24	M20	
2329-361-009	ANSI 52-5	135	361	24	M20	
2329-407-009	ANSI 52-5	135	407	24	M20	
2329-466-009	ANSI 52-5	135	466	24	M20	
2329-838-009	ANSI 52-5	135	838	24	M20	
2329-1028-009	ANSI 52-5	135	1028	24	M20	
2329-1178-009	ANSI 52-5	135	1178	24	M20	
2329-1377-009	ANSI 52-5	135	1377	24	M20	
2329-1410-009	ANSI 52-5	135	1410	24	M20	
2329-1556-009	ANSI 52-5	135	1556	24	M20	

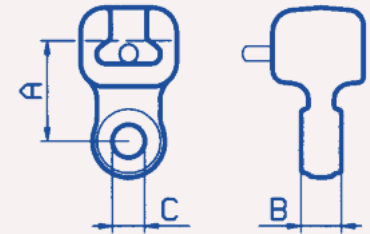
Material: hot dip galvanized forged steel





## Socket Tongue

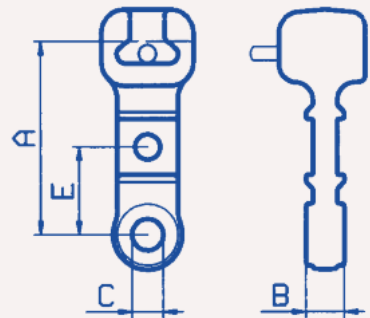
Code	Class	U.T.S. kN	A mm	B mm	C mm	Note
2421	IEC11	40	51	12	Ø14	
2422-2F	IEC16A	120	55	15	Ø18	
2422	IEC16A	120	55	22	Ø18	
2422-1	IEC16A	120	55	22	Ø22	
2422ANSI	ANSI 52-3 52-5	120	55	22	Ø18	



Material: hot dip galvanized forged steel

## Long Socket Tongue (one hole support)

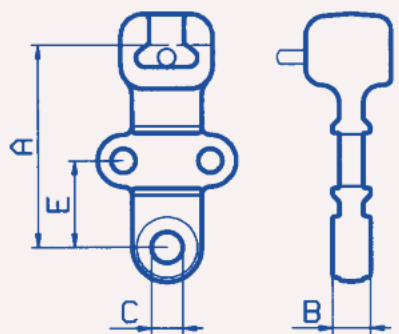
Code	Class	U.T.S. kN	A mm	B mm	C mm	E mm	Note
2434-2	IEC16A	120	110	16	Ø18	50	
2434-3	IEC16A	120	110	18	Ø22	50	
24203	IEC16A	120	165	22	Ø18	50	
2434	IEC16A	120	110	22	Ø18	50	
2434-9	ANSI 52-5	135	110	22	Ø18	50	



Material: hot dip galvanized forged steel

## Long Socket Tongue (two holes support)

Code	Class	U.T.S. kN	A mm	B mm	C mm	E mm	Note
24205-4	IEC16A	120	177	18	Ø22	62	
24205-5	IEC16A	120	177	18	Ø25	62	
2433-3	IEC16A	120	117	18	Ø22	50	
2433-9	IEC16A	120	117	19	Ø25	50	
2433	IEC16A	120	117	22	Ø18	50	
2433-1	IEC16A	120	117	22	Ø22	50	
24167-1	IEC20	210	110	22	Ø18	50	
24167-2	IEC20	210	110	18	Ø22	50	
24167	IEC20	210	110	22	Ø22	50	
24204	IEC20	210	165	22	Ø22	50	
24167-52-8	ANSI 52-8 52-11	227	110	22	Ø22	50	
2433ANSI	ANSI 52-3 52-5	120	116	22	Ø18	50	

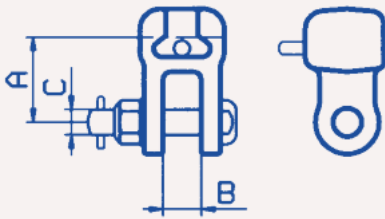


Material: hot dip galvanized forged steel





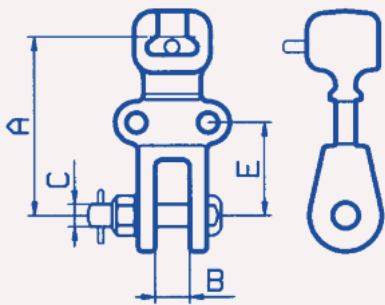
### Socket Clevis



Code	Class	U.T.S. kN	A mm	B mm	C mm	Note
2420-001	IEC11	40	45	14	Ø12	Pin
2464-006	IEC16A	120	55	24	M16	
2480-006	IEC20	160	68	24	M16	
2480-009	IEC20	210	68	24	M20	
2424-010	IEC24	300	80	24	M22	
2424-3-011	IEC24	300	80	24	1"W	
24208-011	IEC28	400	95	32	1"W	
2464ANSI-006	ANSI 52-3 52-5	120	55	24	M16	
2480-4-009	ANSI 52-8	210	68	24	M20	

Material: hot dip galvanized forged steel

### Long Socket Clevis (two holes support)



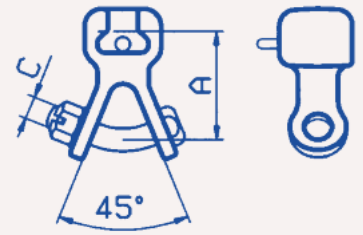
Code	Class	U.T.S. kN	A mm	B mm	C mm	E mm	Note
24138-006	IEC16A	120	125	24	M16	65	
24107-009	IEC20	210	125	24	M20	65	
24211-020	ANSI 52-8 52-11	227	125	24	M20	65	
2444-010	IEC24	300	128	24	M22	65	

Material: hot dip galvanized forged steel

## Socket Y-Clevis

Code	Class	U.T.S. kN	A mm	C mm	Note
2475-1-034	IEC20	210	95	M20	Milled nut
2475-034	ANSI 52-8 52-11	227	95	M20	Milled nut

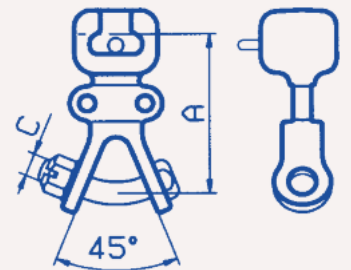
Material: hot dip galvanized forged steel



## Long Socket Y-Clevis (two holes support)

Code	Class	U.T.S. kN	A mm	C mm	Note
2478-1-034	IEC20	210	140	M20	Milled nut
2478-034	ANSI 52-8 52-11	227	140	M20	Milled nut

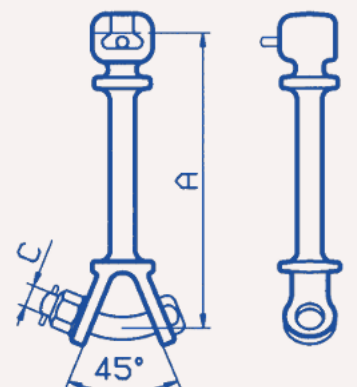
Material: hot dip galvanized forged steel



## Long Socket Y-Clevis

Code	Class	U.T.S. kN	A mm	C mm	Note
26154-043	ANSI 52-5	135	260	M20	
26158-043	ANSI 52-8 52-11	227	267	M20	

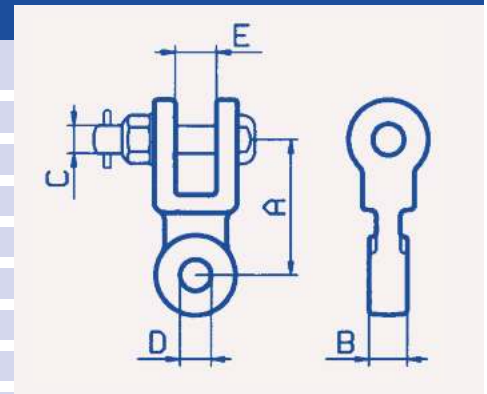
Material: hot dip galvanized forged steel





## 90° Clevis Tongue

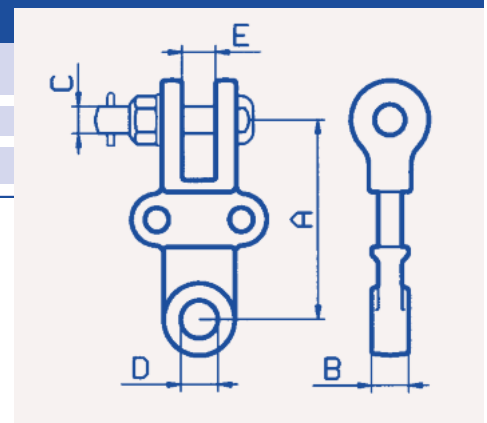
Code	U.T.S. kN	A mm	B mm	C mm	D mm	E mm	Note
2214-001	55	55	12	Ø12	Ø14	14	Pin
2260-016	120	78	22	M16	Ø18	18	
2260-5-006	120	78	18	M16	Ø22	18	
2261-2-006	120	78	22	M16	Ø22	24	
2261-006	160	78	22	M16	Ø18	24	
2261-12-006	120	78	18	M16	Ø22	24	
2261-5-006	160	78	18	M16	Ø22	24	
2261-10-009	210	78	19	M20	Ø22	24	
2261-4-009	210	78	22	M20	Ø22	24	
2262-1-009	210	90	22	M20	Ø22	24	
2262-6-009	210	90	22	M20	Ø24	24	
2262-010	300	90	22	M22	Ø24	24	
2262-12-011	320	90	22	1"W	Ø27,5	24	
2262-12H-011H	420	90	22	1"W	Ø27,5	24	
2264-049	670	160	35	M36	Ø38	32	Cut flame steel



Material: hot dip galvanized forged steel

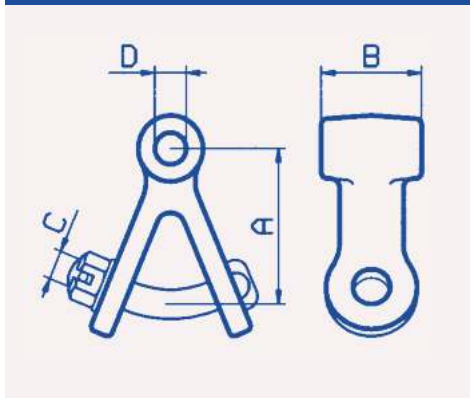
## 90° Clevis Tongue (two holes support)

Code	U.T.S. kN	A mm	B mm	C mm	D mm	E mm	Note
2277-006	120	116	22	M16	Ø22	19,5	
2277-1-008	160	116	22	3/4"W	Ø22	19,5	
2277-1-009	160	116	22	M20	Ø22	19,5	



Material: hot dip galvanized forged steel

## Y-Clevis Tongue



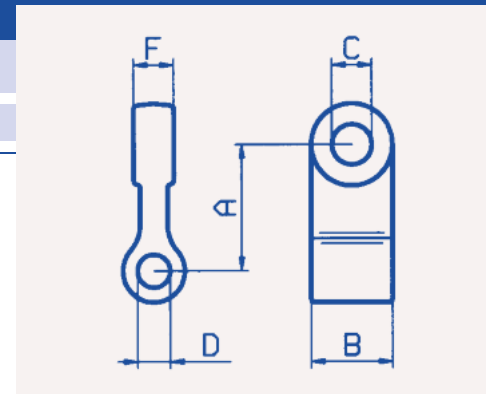
Code	U.T.S. kN	A mm	B mm	C mm	D mm	Note
2274-2-042	80	90	22	M16	Ø18	
2270-035	80	85	65	M16	Ø18	Milled nut
2275-5-042	80	90	21	M16	Ø18	
2274-1-055	120	90	22	M20	Ø18	
2274-055	227	90	22	M20	Ø22	

Material: hot dip galvanized forged steel

## 90° Double Tongue

Code	U.T.S. kN	A mm	B mm	C mm	D mm	F mm	Note
2215K	140	63	18	Ø27	Ø18	65	
3616-2	160	69	45	Ø22	Ø18	22	

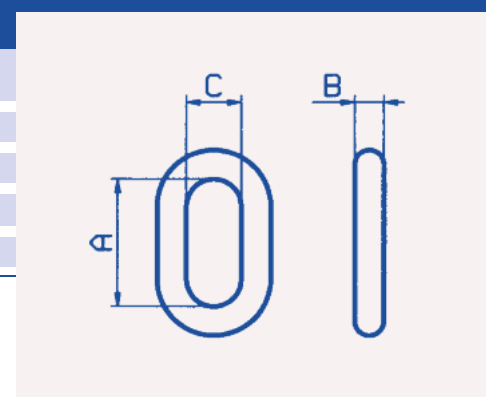
Material: hot dip galvanized forged steel



## Chain Link

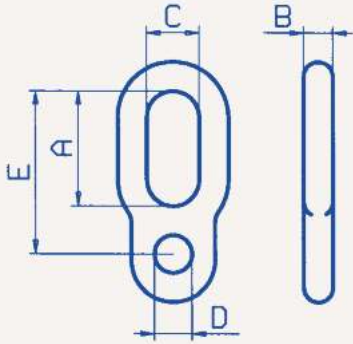
Code	U.T.S. kN	A mm	B mm	C mm	Note
2123	160	70	16	30	
2135	210	80	18	30	
2136	300	80	20	30	
2196	360	100	22	35	
2168	600	125	30	40	

Material: hot dip galvanized forged steel





## Chain Tongue

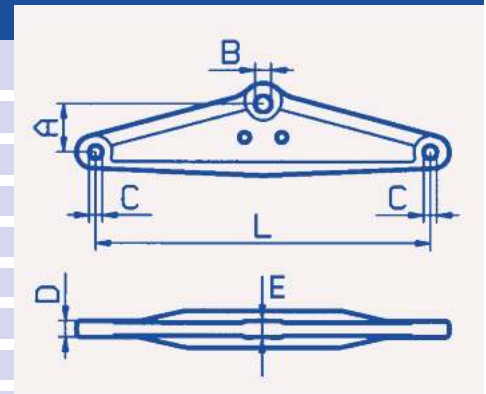


Code	U.T.S. kN	A mm	B mm	C mm	D mm	E mm	Note
2128	120	55	14	25	Ø18	78	

Material: hot dip galvanized forged steel

## Triangular Spacing Yoke

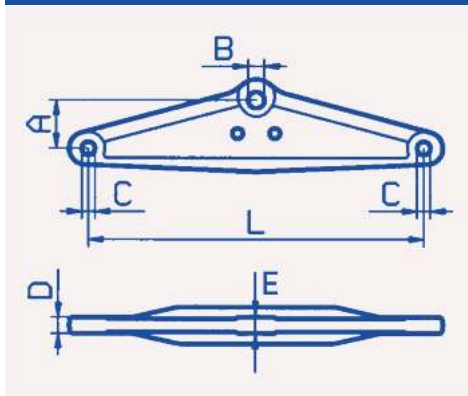
Code	L mm	U.T.S. kN	A mm	B mm	C mm	D mm	E mm	Note
2954	250	70	45	Ø14	Ø14	12	12	
2966A	300	120	60	Ø18	Ø18	22	22	
2966-3	300	210	60	Ø22	Ø18	22	22	
2966-4	300	210	60	Ø22	Ø22	22	22	
2966	330	120	60	Ø18	Ø18	22	22	
2966-1	330	210	60	Ø22	Ø18	22	22	
2966-2	330	210	60	Ø22	Ø22	22	22	
2983-14	400	120	60	Ø18	Ø22	22	22	
2983-8	400	120	60	Ø18	Ø18	22	22	Holes for H.L.M.
2983	400	140	60	Ø18	Ø18	22	22	
2983-1	400	210	60	Ø22	Ø18	22	22	
2983-15	400	210	60	Ø22	Ø22	22	22	Holes for H.L.M.
2983-3	400	210	60	Ø22	Ø22	22	22	
2983-4	400	210	60	Ø24	Ø22	22	22	
2983-12	400	227	60	Ø22	Ø18	22	22	Holes for H.L.M.
2982	400	230	67	Ø24	Ø22	22	22	
2983-13B	400	272	60	Ø24	Ø18	22	22	Hardened and tempered Holes for H.L.M.
2982-17	400	300	67	Ø24	Ø22	22	22	Holes for H.L.M.
2982-18	400	300	67	Ø24	Ø24	22	22	Holes for H.L.M.
2982-2	400	300	67	Ø24	Ø18	22	22	
2982-1	400	360	67	Ø27,5	Ø22	22	22	
2982-16	400	360	67	Ø27,5	Ø22	22	22	Holes for H.L.M.



Material: hot dip galvanized forged steel



## Triangular Spacing Yoke

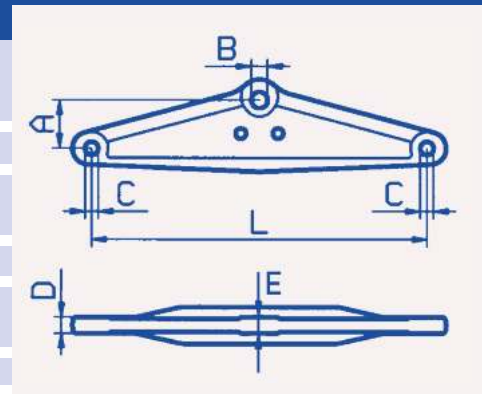


Code	L mm	U.T.S. kN	A mm	B mm	C mm	D mm	E mm	Note
2991-5	450	135	65	Ø25,5 Y form	Ø18	22	22	
2991-10	450	160	65	Ø18	Ø18	22	22	
29920	450	210	65	Ø22	Ø18	22	22	Lower H.L.M.
2991-1	450	227	65	Ø22	Ø22	22	22	
2991-2	450	227	65	Ø22	Ø22	22	22	Holes for H.L.M.
2991-3	450	227	65	Ø22	Ø18	22	22	Holes for H.L.M.
2991	450	230	65	Ø22	Ø18	22	22	
29900-24	450	300	75	Ø24	Ø24	22	22	H.L.M.
29900	450	320	65	Ø27,5	Ø22	22	22	H.L.M.
29900-12	450	320	75	Ø27,5	Ø18	22	22	H.L.M.
29900-42	450	320	75	Ø27,5	Ø18	22	22	H.L.M.
29900-35	450	330	65	Ø24	Ø25,5 Y form	22	22	H.L.M.
29900-19	450	360	75	Ø29	Ø22	22	22	H.L.M.
29900-21	450	360	75	Ø27,5	Ø22	22	22	H.L.M.
29900-31	450	360	75	Ø27,5	Ø25,5 Y form	22	22	H.L.M.
29900-9H	450	450	65	Ø27,5	Ø22	22	22	Hardened and tempered H.L.M. Holes for H.L.M.
29900-31H	450	454	75	Ø27,5	Ø25,5 Y form	22	22	Hardened and tempered H.L.M. Holes for H.L.M.
29900-39H	450	480	65	Ø29	Ø24	22	22	Hardened and tempered H.L.M.
2996-11	450	480	90	Ø32	Ø27,5	22	30	Holes for H.L.M.
2996-13	450	560	90	Ø32	Ø24	22	30	
2996-6	450	600	90	Ø38	Ø24	22	30	

Material: hot dip galvanized forged steel

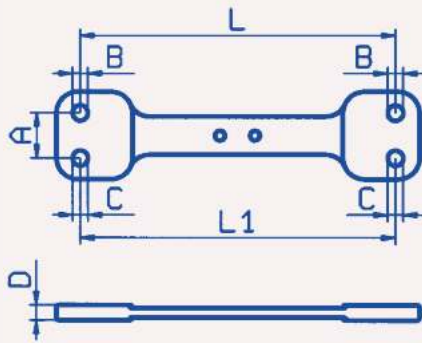
## Triangular Spacing Yoke

Code	L mm	U.T.S. kN	A mm	B mm	C mm	D mm	E mm	Note
29900-38	457	120	83	Ø18	Ø25,5 Y form	22	22	H.L.M. Holes for H.L.M.
2991-6	457	120	65	Ø18	Ø18	22	22	Holes for H.L.M.
29920-27	457	165	65	Ø25,5 Y form	Ø22	22	22	Lower H.L.M. Holes for H.L.M.
29900-40	457	300	80	Ø24	Ø18	22	22	H.L.M.
29900-41	457	300	80	Ø24	Ø22	22	22	H.L.M. Holes for H.L.M.
29900-25	457	320	75	Ø27,5	Ø24	22	22	H.L.M.
29900-44	457	320	80	Ø24	Ø25,5 Y form	22	22	H.L.M.
29900-37	457	330	65	Ø24	Ø18	22	22	II.L.M. Holes for II.L.M.
29900-27	457	360	65	Ø27,5	Ø22	22	22	II.L.M. Holes for II.L.M.
29900-36	457	360	65	Ø27,5	Ø25,5 Y form	22	22	II.L.M. Holes for H.L.M.
29900-21H	457	454	75	Ø27,5	Ø22	22	22	H.L.M. Hardened and tempered
29900-27H	457	460	65	Ø27,5	Ø22	22	22	H.L.M. Hardened and tempered Holes for H.L.M.
29900-36H	457	460	65	Ø27,5	Ø25,5 Y form	22	22	H.L.M. Hardened and tempered Holes for H.L.M.
2978	500	600	130	Ø38	Ø24	22	30	
29184-3	600	140	123	Ø18	Ø18	22	22	H.L.M.
29184-2	600	300	120	Ø24	Ø22	22	22	H.L.M.
29184	600	380	110	Ø27,5	Ø22	22	22	H.L.M.



Material: hot dip galvanized forged steel

## Rectangular Spacing Yoke

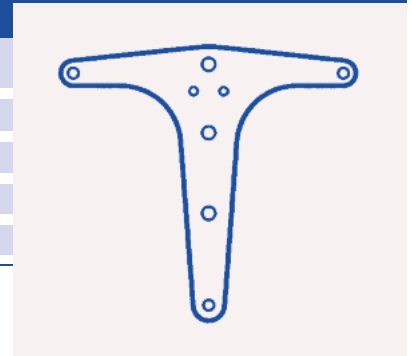


Code	U.T.S. kN	L mm	L1 mm	A mm	B mm	C mm	D mm	Note
2911-7	240	400	400	60	Ø18	Ø22	22	
2911-20	320	400	300	60	Ø22	Ø18	22	
2911-23	320	400	300	60	Ø18	Ø18	22	
2911-6	320	400	400	60	Ø18	Ø18	22	
2911	420	400	380	60	Ø22	Ø22	22	
2911-5	420	400	400	60	Ø22	Ø22	22	
2903-5	320	450	450	65	Ø18	Ø18	20	
29030-4	320	450	450	65	Ø24	Ø22	20	H.L.M.
29030-6	320	450	450	65	Ø22	Ø18	20	H.L.M.
29030-23	320	450	400	65	Ø18	Ø18	20	H.L.M. Holes for H.L.M.
2903-26	360	450	400	65	Ø24	Ø22	22	
2903-32	360	450	450	65	Ø22	Ø25,5 Y form	22	
2903	420	450	450	65	Ø22	Ø22	20	
2903-40	420	450	450	65	Ø22	Ø22	20	Holes for H.L.M.
2903-42	420	450	450	65	Ø22	Ø18	20	
29030-26	420	450	400	65	Ø24	Ø22	20	H.L.M. Holes for H.L.M.
29030-21	420	450	400	65	Ø22	Ø18	20	H.L.M. Holes for H.L.M.
2903-24	600	450	400	65	Ø24	Ø24	20	
29030-24	600	450	400	65	Ø24	Ø24	20	H.L.M. Holes for H.L.M.
2903-30	240	457	457	65	Ø18	Ø18	20	
29030-41	272	457	457	65	Ø18	Ø18	20	H.L.M. Holes for H.L.M.
29030-5	320	457	457	65	Ø18	Ø18	20	H.L.M.
29030-40	454	457	457	65	Ø22	Ø22	20	H.L.M. Holes for H.L.M.
2903-39	460	457	457	65	Ø22	Ø25,5 Y form	20	Holes for H.L.M.
2903-9	480	457	457	65	Ø24	Ø24	20	

Material: hot dip galvanized forged steel

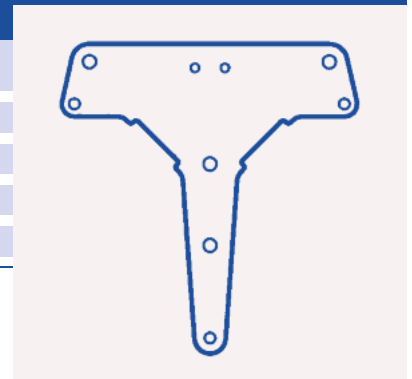
## Triple Bundle Spacing Yoke

Insulator set type	"I" suspension set
Hot line maintenance	According to customer requirements
Bundle conductors type	Three bundle conductors
Material	Galvanized cut flame steel
Note	Standard bundle spacing 400-450-457 mm



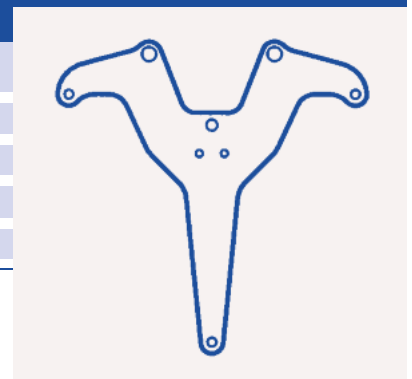
## Triple Bundle Spacing Yoke

Insulator set type	"V" suspension set
Hot line maintenance	According to customer requirements
Bundle conductors type	Three bundle conductors
Material	Galvanized cut flame steel
Note	Standard bundle spacing 450-457 mm

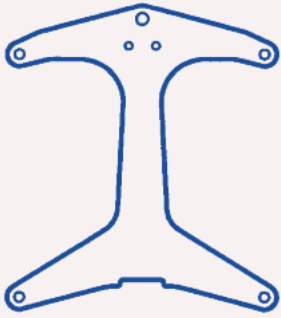


## Triple Bundle Spacing Yoke

Insulator set type	Single "1" suspension set
Hot line maintenance	According to customer requirements
Bundle conductors type	Three bundle conductors
Material	Galvanized cut flame steel
Note	Special bundle spacing

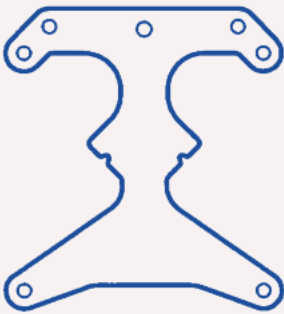


## Quadruple Bundle Spacing Yoke



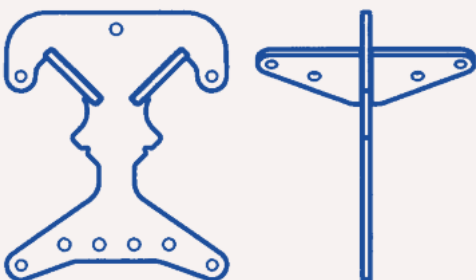
Insulator set type	“I” suspension set
Hot line maintenance	According to customer requirements
Bundle conductors type	Four bundle conductors
Material	Galvanized cut flame steel
Note	Standard bundle spacing 450-457 mm

## Quadruple Bundle Spacing Yoke



Insulator set type	“V” suspension set
Hot line maintenance	According to customer requirements
Bundle conductors type	Four bundle conductors
Material	Galvanized cut flame steel
Note	Standard bundle spacing 450-457 mm

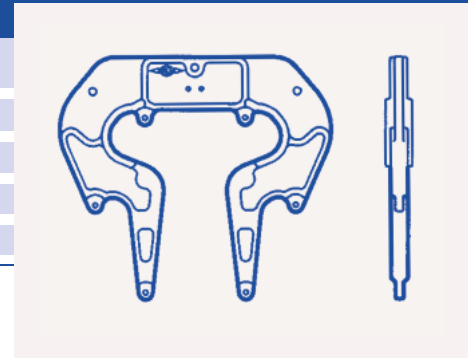
## Quadruple Bundle Spacing Yoke



Insulator set type	Double “V” suspension set
Hot line maintenance	According to customer requirements
Bundle conductors type	Four bundle conductors
Material	Galvanized cut flame steel
Note	Electrically welded. Spacing 457 mm

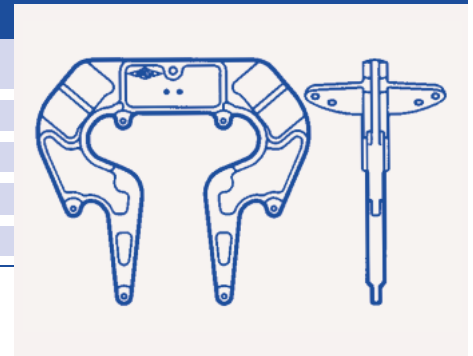
## Sextuple Bundle Spacing Yoke

Insulator set type	Single "V" suspension set
Hot line maintenance	According to customer requirements
Bundle conductors type	Six bundle conductors
Material	Galvanized cast iron
Note	Standard spacing 381 mm



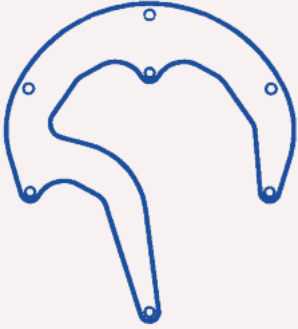
## Sextuple Bundle Spacing Yoke

Insulator set type	Double "V" suspension set
Hot line maintenance	According to customer requirements
Bundle conductors type	Six bundle conductors
Material	Galvanized cast iron
Note	Spacing 381 mm



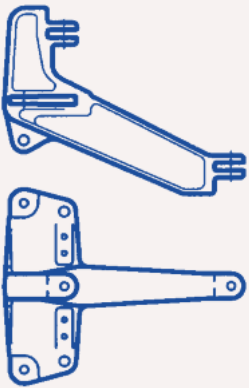


### Special Bundle Spacing Yoke



Insulator set type	Single "V" suspension set
Hot line maintenance	According to customer requirements
Bundle conductors type	Four "Diamond" bundle conductors
Material	Galvanized cut flame steel
Note	Standard spacing 457 mm

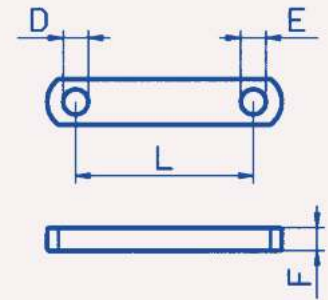
### Special Bundle Spacing Yoke



Insulator set type	Double tension set
Hot line maintenance	According to customer requirements
Bundle conductors type	Four bundle conductors
Material	Galvanized cast iron
Note	Spacing 450 mm

## Double Tongue Extension Link

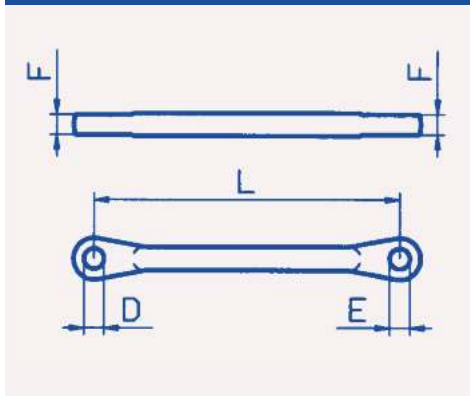
Code	U.T.S. kN	D mm	E mm	F mm	L mm	Note
26160-100	120	Ø18	Ø18	15	100	
26161-60	120	Ø18	Ø18	20	60	
26161-200	120	Ø18	Ø18	20	200	
26161-300	120	Ø18	Ø18	20	300	
26161-400	120	Ø18	Ø18	20	400	
26161-500	120	Ø18	Ø18	20	500	
26161-600	120	Ø18	Ø18	20	600	
26161-800	120	Ø18	Ø18	20	800	
26161-1000	120	Ø18	Ø18	20	1000	
26163-100	120	Ø18	Ø22	20	100	
26163-150	120	Ø18	Ø22	20	150	
26163-530	120	Ø18	Ø22	20	530	
26163-1050	120	Ø18	Ø22	20	1050	
2643-110	120	Ø22	Ø22	15	110	
2643-60	120	Ø22	Ø22	15	60	
26233-150	120	Ø26	Ø18	20	150	
2659-70	125	Ø22	Ø22	18	70	
2618-600	210	Ø24	Ø24	15	600	
2618-70	210	Ø24	Ø24	15	70	
26164-70	210	Ø22	Ø22	20	70	
26164-100	210	Ø22	Ø22	20	100	
26164-500	210	Ø22	Ø22	20	500	
2503-130	300	Ø24	Ø24	20	130	
2503-300	300	Ø24	Ø24	20	300	
2503-60	300	Ø24	Ø24	20	60	
2503-1550	320	Ø24	Ø24	20	1550	
26172-90	360	Ø27,5	Ø27,5	20	90	
2667-623	460	Ø27,5	Ø27,5	20	623	
26174-100	650	Ø38	Ø38	30	100	
26174-520	650	Ø38	Ø38	30	520	
26234-255	790	Ø35	Ø35	40	255	
2640-375	890	Ø44	Ø44	40	375	
2640-1010	890	Ø44	Ø44	40	1010	
26178-220	1200	Ø54	Ø54	40	220	



Material: hot dip galvanized steel



## Double Tongue Extension Link



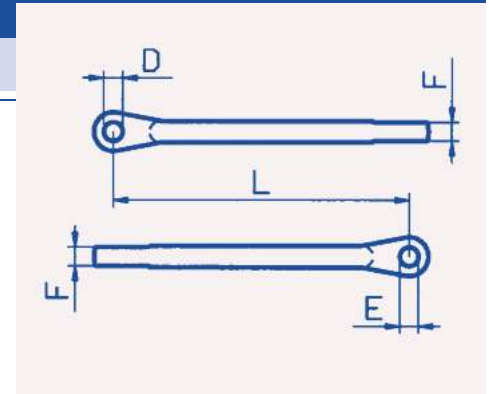
Code	U.T.S. kN	D mm	E mm	F mm	L mm	Note
2612	40	Ø14	Ø14	12	50	
26226-600	120	Ø18	Ø18	22	600	
2662-701	210	Ø22	Ø22	22	701	
2662-1029	210	Ø22	Ø22	22	1029	

Material: hot dip galvanized forged steel

## 90° Double Tongue Extension Link

Code	U.T.S. kN	D mm	E mm	F mm	L mm	Note
2622-439	210	Ø22	Ø22	22	439	

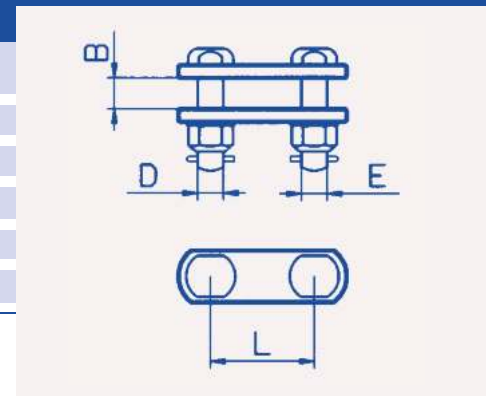
Material: hot dip galvanized forged steel



## Double Clevis Extension Link

Code	U.T.S. kN	B mm	D mm	E mm	L mm	Note
26145-80	120	24	M16	M16	80	
26166-80	210	24	M20	M20	80	
26167-70	300	24	M22	M22	70	
26171-70	360	24	1"W	1"W	70	
26182-293-M	650	32	M36	M36	293	
26179-260	1200	42	M52	M52	260	

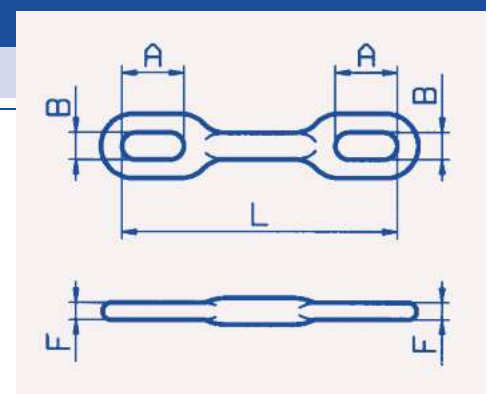
Material: hot dip galvanized steel



## Double Eye Extension Link

Code	U.T.S. kN	A mm	B mm	F mm	L mm	Note
26115	460	80	35	22	360	

Material: hot dip galvanized forged steel



## Clevis Tongue Extension Link

	Code	U.T.S. kN	B mm	C mm	D mm	F mm	L mm	Note
	2670-173-2006	120	24	M16	Ø18	22	173	
	2670-173-009	210	24	M20	Ø22	22	173	
	2670-275-009	210	24	M20	Ø22	22	275	
	2670-421-009	210	24	M20	Ø22	22	421	
	2670-433-004	210	24	Ø20	Ø22	22	433	Pin
	2670-173-1009	227	24	M20	Ø25.5 Y shape	22	173	
	2621-285-010	300	24	M22	Ø24	22	285	

Material: hot dip galvanized forged steel

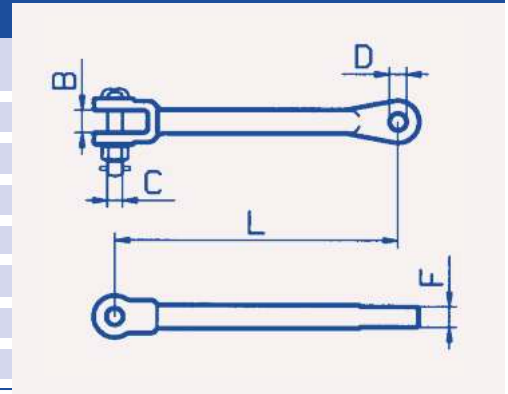
## Clevis Tongue Extension Link

	Code	U.T.S. kN	B mm	D mm	E mm	F mm	L mm	Note
	026-46-150	120	24	M16	Ø18	20	150	
	026-46-300	120	24	M16	Ø18	20	300	
	026-119-130	120	24	M20	Ø22	15	130	
	026-119-150	120	24	M20	Ø22	15	150	
	026-119-155	120	24	M20	Ø22	15	155	
	026-119-180	120	24	M20	Ø22	15	180	
	026-119-290	120	24	M20	Ø22	15	290	
	026-119-310	120	24	M20	Ø22	15	310	
	026-5-130	120	24	M20	Ø22	15	130	
	026-5-360	120	24	M20	Ø22	15	360	
	026-5-155	120	24	M20	Ø22	15	155	
	026-5-180	120	24	M20	Ø22	15	180	
	026-48-460	300	24	M22	Ø24	20	460	
	026-48-820	300	24	M22	Ø24	20	820	
	026-62-230	380	27	1"W	Ø27,5	25	230	
	026-82-210	650	32	M36	Ø38	30	210	
	026-109	890	42	M42	Ø44	40	635	

Material: hot dip galvanized steel

## 90° Clevis Tongue Extension Link

Code	U.T.S. kN	B mm	C mm	D mm	F mm	L mm	Note
2673-002	120	24	Ø16	Ø18	22	200	Pin
2673-5-006	120	24	M16	Ø18	16	200	
2673-006	120	24	M16	Ø18	22	200	
2673-300-006	120	24	M16	Ø18	22	300	
2673-275-009	210	24	M20	Ø22	22	275	
2673-4-009	210	24	M20	Ø22	22	200	
2673-300-009	227	24	M20	Ø22	22	300	
26175-010	300	24	M22	Ø24	22	300	

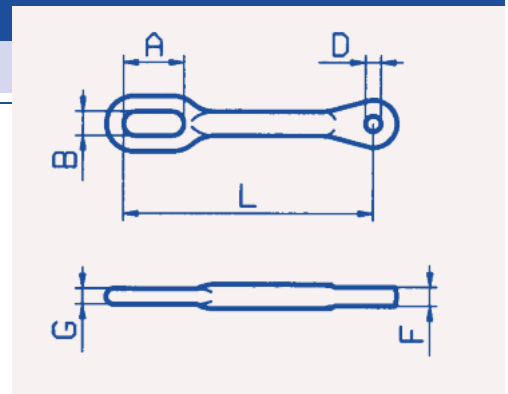


Material: hot dip galvanized forged steel

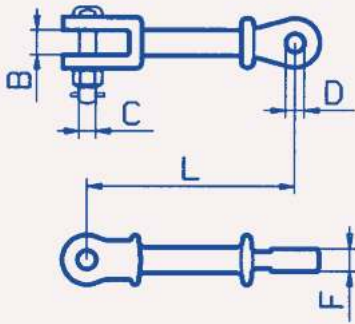
## Tongue Eye Extension Link

Code	U.T.S. kN	A mm	B mm	D mm	F mm	G mm	L mm	Note
2648-420	160	60	24	Ø18	22	18	420	

Material: hot dip galvanized forged steel



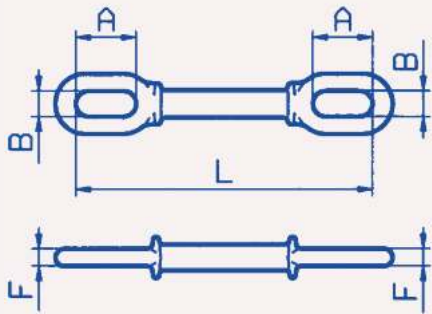
## 90° Clevis Tongue Extension Link



Code	U.T.S. kN	B mm	C mm	D mm	F mm	L mm	Note
26227-006	160	24	M16	Ø18	22	200	H.L.M.
26227-009	210	24	M20	Ø22	22	200	H.L.M.

Material: hot dip galvanized forged steel  
Hot line maintenance: both sides

## Double Eye Extension Link

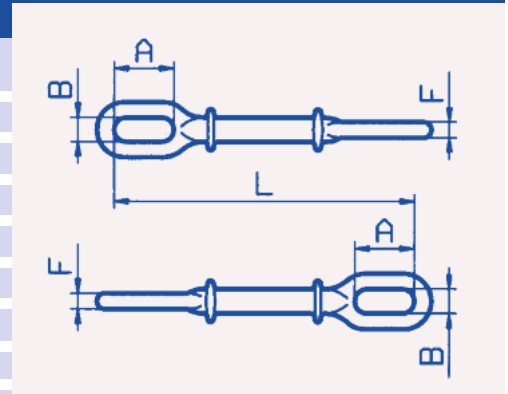


Code	U.T.S. kN	A mm	B mm	F mm	L mm	Note
2698-668	330	70	30	20	668	H.L.M.
2698-1816	330	70	30	20	1816	H.L.M.
2698-4267	330	70	30	20	4267	H.L.M.

Material: hot dip galvanized forged steel  
Hot line maintenance: both sides

## 90° Double Eye Extension Link

Code	U.T.S. kN	A mm	B mm	F mm	L mm	Note
2694-623	165	70	28	18	623	H.L.M.
2694-955	165	70	28	18	955	H.L.M.
2694-1038	165	70	28	18	1038	H.L.M.
2694-1660	165	70	28	18	1660	H.L.M.
2694-1926	165	70	28	18	1926	H.L.M.
2694-3230	165	70	28	18	3230	H.L.M.
2653-531	330	70	30	20	531	H.L.M.
2653-631	330	70	30	20	641	H.L.M.
2653-945	330	70	30	20	955	H.L.M.
2653-1028	330	70	30	20	1038	H.L.M.
2653-1916	330	70	30	20	1926	H.L.M.
2653-3220	330	70	30	20	3230	H.L.M.

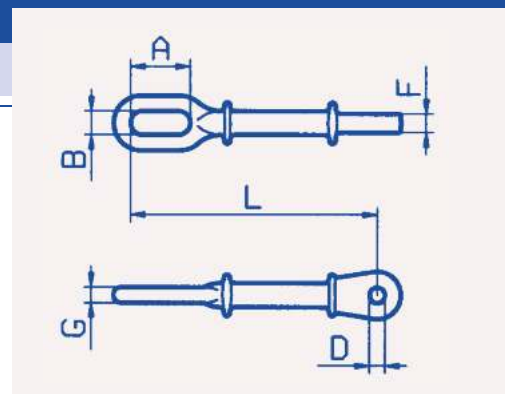


Material: hot dip galvanized forged steel  
Hot line maintenance: both sides

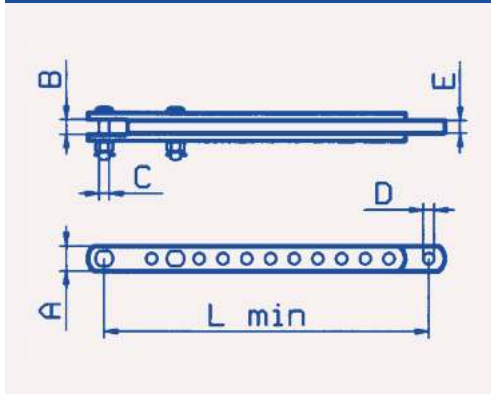
## 90° Tongue Eye Extension Link

Code	U.T.S. kN	A mm	B mm	D mm	F mm	G mm	L mm	Note
2629-343	120	70	28	Ø18	22	18	343	H.L.M.

Material: hot dip galvanized forged steel  
Hot line maintenance: both sides



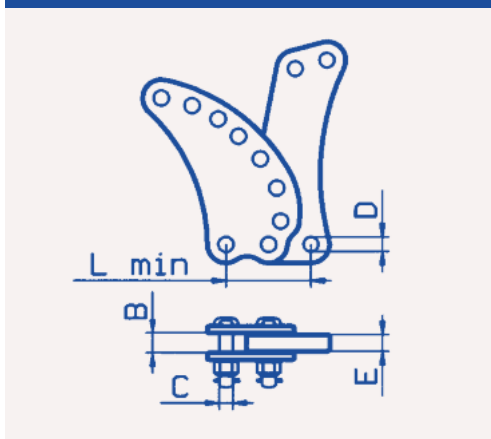
## Long Type Adjustable Extension Link



Code	Adjust. mm	U.T.S. kN	L min mm	A mm	B mm	C mm	D mm	E mm	Note
026-171	187	160	307	40	24	M16	Ø18	16	Step 12,5mm
026-100	394	120	521	40	24	M16	Ø18	20	Step 12,7mm
026-173	187	210	307	50	24	M20	Ø22	16	Step 12,5mm
026-24	382	210	534	40	24	M20	Ø22	20	Step 12,7mm
026-25	382	210	534	40	24	M20	Ø22	20	Step 25,4mm
026-28	610	380	772	70	24	1" W	Ø27,5	20	Step 25,4mm
026-164	700	600	1000	80	32	M36	Ø38	30	Step 50mm
026-165	700	600	1450	80	32	M36	Ø38	30	Step 50mm
026-174	187	300	307	50	24	M22	Ø24	20	Step 12,5mm

Material: hot dip galvanized steel

## Short Type Adjustable Extension Link



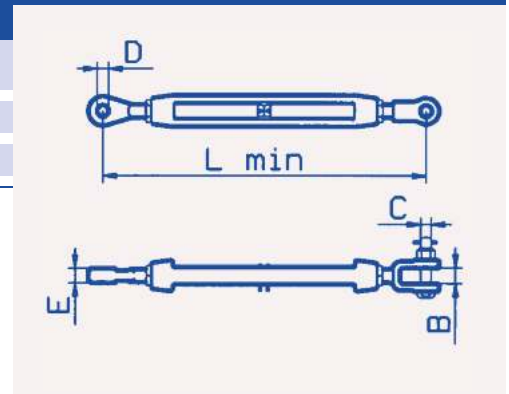
Code	Adjust. mm	U.T.S. kN	L min mm	B mm	C mm	D mm	E mm	Note
026-138	310	160	100	24	M16	Ø18	20	Step 10mm
026-162	318	120	209	24	M16	Ø18	15	Step 6mm

Material: hot dip galvanized steel

## Clevis Tongue Turnbuckle

Code	Adjust. mm	U.T.S. kN	L min mm	B mm	C mm	D mm	E mm	Note
2519M2F006	285	120	520	24	M16	Ø18	22	
2517M4F009	270	210	520	24	M20	Ø22	22	
2520M4F009	152	165	413	24	M20	Ø22	22	

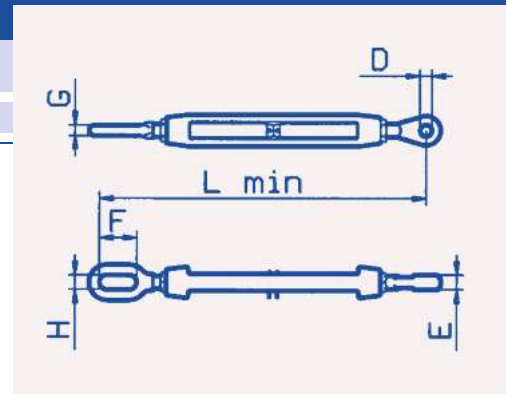
Material: hot dip galvanized forged steel



## Eye Tongue Turnbuckle

Code	Adjust. mm	U.T.S. kN	L min mm	D mm	E mm	F mm	G mm	H mm	Note
2519A5M2	285	120	550	Ø18	22	60	16	22	
2517A6M4	270	210	580	Ø22	22	60	18	24	

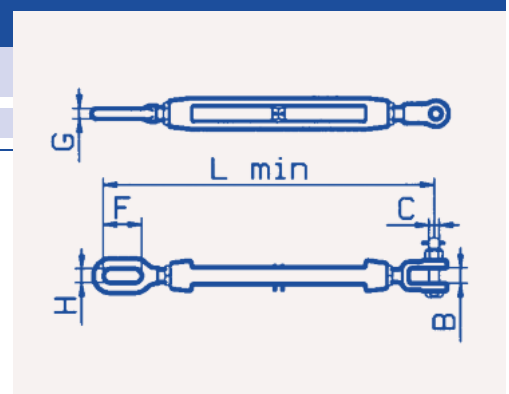
Material: hot dip galvanized forged steel



## Eye Clevis Turnbuckle

Code	Adjust. mm	U.T.S. kN	L min mm	B mm	C mm	F mm	G mm	H mm	Note
2519A5F006	285	120	550	24	M16	60	16	22	
2517A6F-009	270	210	590	24	M20	60	18	24	

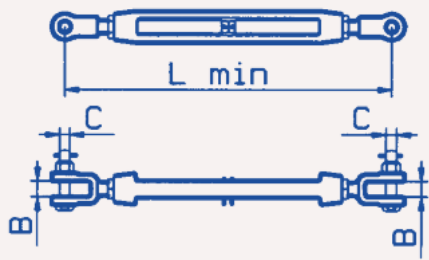
Material: hot dip galvanized forged steel







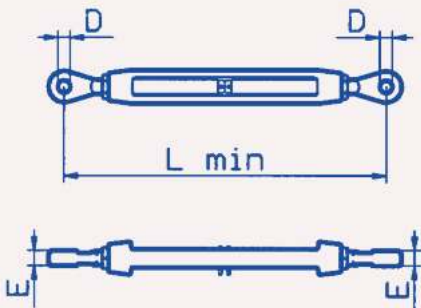
## Double Clevis Turnbuckle



Code	Adjust. mm	U.T.S. kN	L min mm	B mm	C mm	Note
2519F006F006	285	120	520	24	M16	
2517F009F009	265	210	530	24	M20	
2518F006F006	220	120	450	24	M16	

Material: hot dip galvanized forged steel

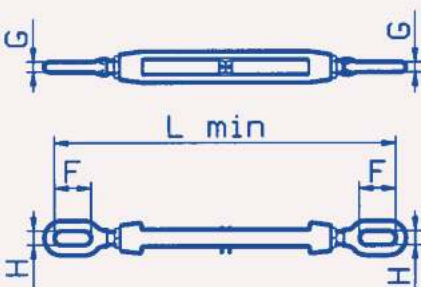
## Double Tongue Turnbuckle



Code	Adjust. mm	U.T.S. kN	L min mm	D mm	E mm	Note
2519M2M2	285	120	520	Ø18	22	
2517M4M4	270	210	510	Ø22	22	
2520M4M4	152	200	413	Ø22	22	

Material: hot dip galvanized forged steel

## Double Eye Turnbuckle



Code	Adjust. mm	U.T.S. kN	L min mm	F mm	G mm	H mm	Note
2519A5A5	285	120	580	60	16	22	
2517A6A6	270	210	650	60	18	24	

Material: hot dip galvanized forged steel



## Suspension Clamps

C



**S**alvi manufactures a complete line of quality Suspension Clamps to meet almost all transmission lines construction needs. Salvi long-term experience in fittings for transmission lines joined with its design capacity, offers best solution as regards to each clamping problem.

The complete range of Suspension Clamps covers practically all requirements of most utilities for voltages up to 132 kV, while the Corona Free Suspension Clamps series offers special performances up to 800 kV transmission lines, thanks to the accurate clamp design and to the particular U-bolt disposition.

Suspension Clamps are available for application ACAR, AAAC and ACSR. Salvi Suspension Clamps can be applied to all main conductor sizes with diameter starting from 6 up to 54 mm; special clamps are also available for very large diameters. On all our Clamps the distance between clamp rotation axis and conductor axis is reduced to the minimum to avoid undesired fatigue phenomena on conductor. In the Poly-articulated series, the clamp rotation axis passes through the conductor axis. Furthermore, all Salvi Suspension Clamps are foreseen to allow the counterweight attachment, in order to permit maximum flexibility in suspension set design.

#### **Material and Manufacture**

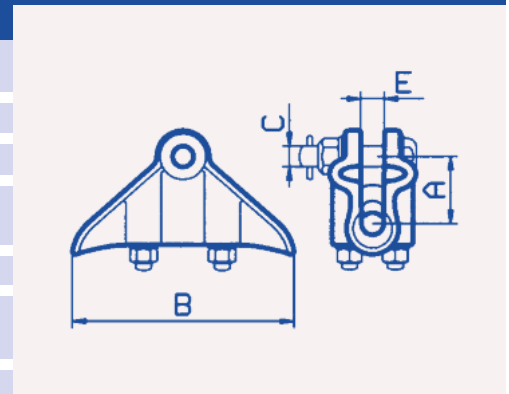
The use of aluminium based conductors is associated to the use of aluminium clamps to minimize power losses and heat build-up due to hysteresis effects associated with ferrous type clamps. Therefore Salvi manufactures its clamps by cast aluminium alloy in its own foundry. All other ferrous components are hot dip galvanized according to International Standards requirements.

#### **Mechanical Strength**

Salvi Suspension Clamps have proven field performance and have been and are continuously tested under the most strenuous conditions. Assurance of rated ultimate body strength under maximum line conditions is an important aspect of our design and quality control. The Ultimate Strength is according to customer requirements and is the load at which the failure can occur.

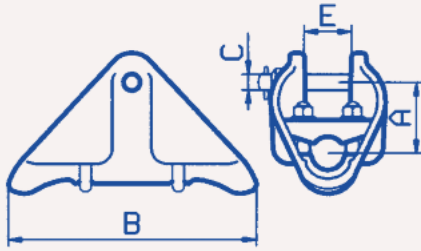
## Standard Suspension Clamp

Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	C mm	E mm	Note
1015A-002	60	Ø6	Ø17	60	170	Ø16	18	
1015A-006	60	Ø6	Ø17	60	170	M16	18	
1013A-001	24	Ø7	Ø13	50	170	Ø12	14	
1013B-001	24	Ø7	Ø13	50	170	Ø12	14	Zinc-Alum. alloy
1021A-002	60	Ø17	Ø23	65	190	Ø16	24	
1021B-002	60	Ø17	Ø23	65	190	Ø16	24	Zinc-Alum. alloy
1025A-002	60	Ø19	Ø27	65	205	Ø16	27	
1025A-006	60	Ø19	Ø27	65	205	M16	27	
1348-006	120	Ø40	Ø48	90	300	M16	50	



Note: Zinc-Aluminium alloy is used for copper conductors.

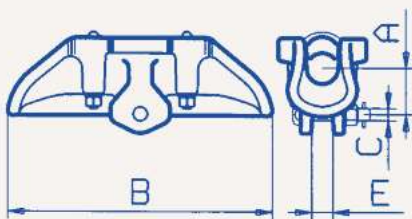
## Corona Free Suspension Clamp



Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	C mm	E mm	Note
1034R-006	105	Ø27	Ø34	90	254	M16	48	
1034R-013B	105	Ø27	Ø34	90	254	Ø16	48	Hardened and tempered pin
1044R-013B	120	Ø33	Ø41	95	340	Ø16	48	Hardened and tempered pin
1044R-006	120	Ø33	Ø41	95	340	M16	48	
1046R-006	120	Ø36	Ø48	95	300	M16	57	
1046-R-013B	80	Ø36	Ø48	95	300	Ø16	57	Hardened and tempered pin
1050R-006	120	Ø47	Ø58	100	330	M16	67	
1050R-013B	120	Ø47	Ø58	100	330	Ø16	67	Hardened and tempered pin

Material: aluminium alloy

## Corona Free Trunnion Suspension Clamp



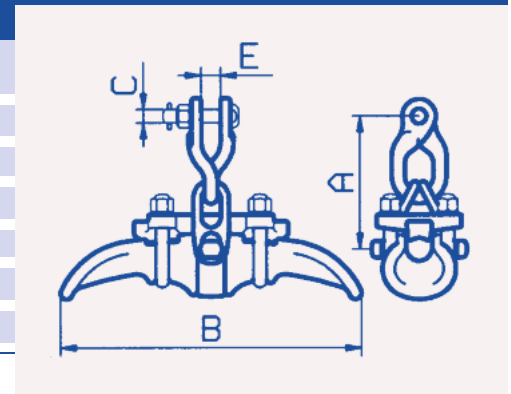
Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	C mm	E mm	Note
1140-006	90	Ø33	Ø40	60	340	M16	24	

Material: aluminium alloy

## Corona Free Poly-articulated Suspension Clamp

Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	C mm	E mm	Note
1216AG-006	60	Ø10	Ø16	155	185	M16	24	
1220AGL-006	80	Ø16	Ø20	152	230	M16	24	
1230AGL-006	115	Ø28	Ø32	172	365	M16	24	
1235AGL-006	120	Ø32	Ø35	172	365	M16	24	
1240AG-006	120	Ø35	Ø42	188	320	M16	24	
1253AG-006	120	Ø46	Ø54	188	320	M16	24	
1248AG-006	120	Ø38	Ø50,5	188	260	M16	24	

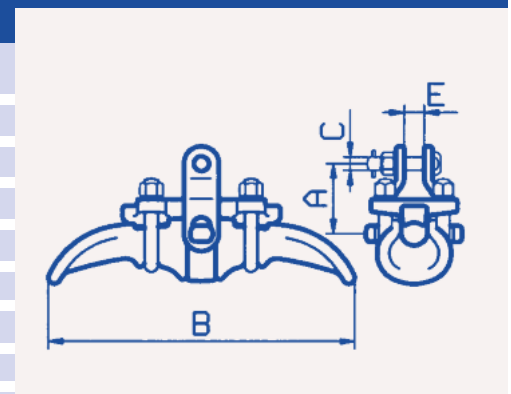
Material: aluminium alloy/hot dip galvanized steel



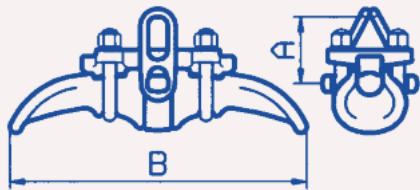
## Corona Free Poly-articulated Suspension Clamp

Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	C mm	E mm	Note
1220AFI-006	80	Ø16	Ø20	75	230	M16	24	
1230AFI-006	115	Ø28	Ø32	90	365	M16	24	
1226AF-006	120	Ø18,5	Ø27,5	75	220	M16	26	
1235AFI-006	120	Ø32	Ø35	90	365	M16	24	
1240AH-006	120	Ø35	Ø42	90	320	M16	50	
1240AF-006	120	Ø35	Ø42	100	320	M16	24	
1248AH-006	120	Ø38	Ø50,5	115	260	M16	125	
1253AF-006	120	Ø46	Ø54	100	320	M16	24	
1226AEN-006	120	Ø18,5	Ø27,5	75	220	M16	42	
1248AE-006	120	Ø38	Ø50,5	100	260	M16	50	
1248AF-006	120	Ø38	Ø50,5	100	260	M16	25	

Material: aluminium alloy/hot dip galvanized steel



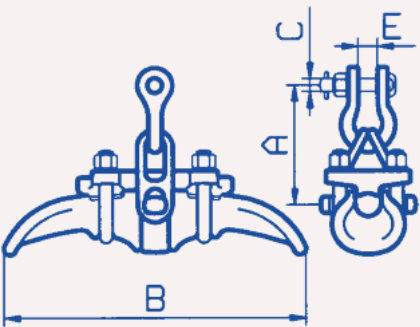
## Corona Free Poly-articulated Suspension Clamp



Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	Note
1216A	60	Ø10	Ø16	65	185	
1220AL	80	Ø16	Ø20	62	230	
1253A	120	Ø46	Ø54	101	320	
1235AL	120	Ø32	Ø35	85	365	
1240A	120	Ø35	Ø42	100	320	
1226AN	120	Ø18,5	Ø27,5	78	220	

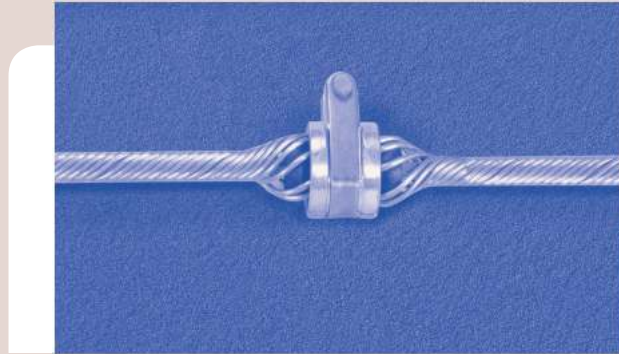
Material: aluminium alloy/hot dip galvanized steel

## Corona Free Poly-articulated Suspension Clamp



Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	C mm	E mm	Note
1216AS-006	60	Ø10	Ø16	130	185	M16	24	
1220ASL-006	80	Ø16	Ø20	127	230	M16	24	
1230ASL-006	115	Ø28	Ø32	146	365	M16	24	
1235ASL-006	120	Ø32	Ø35	147	365	M16	24	
1240AS-006	120	Ø35	Ø42	163	320	M16	24	
1253AS-006	120	Ø46	Ø54	163	320	M16	24	

Material: aluminium alloy/hot dip galvanized steel



**Preformed  
Armor Grip  
Suspension**

**D**



Preformed Armor Grip Suspension set provides an high protection to phase conductor at the suspension point being the cable enclosed in an elastomer insert.

All the elements (clamp, insert and rods) form a compact and flexible assembly which allows to:

- improve the fatigue resistance of the conductor at the suspension point due to the coiling of strands on the outer layer of the cable;
- reduce the effect of aeolian vibration due to the rods and the elastomer insert;
- control the slipping load.

Besides clamps and rods are designed to avoid Corona effects.

AGS supplied by Salvi are suitable to use with all types of conductors or cables such as ACAR, AAAC, ACSR etc. having a diameter range from 8 to 40 mm.

## Preformed Armor Grip Suspension (AGS)



<b>Technical characteristics:</b>	
Vertical breaking strenght	up to 120 kN
Slipping load	minimum 20% of conductor breaking load
<b>Materials:</b>	
Clamp body	aluminium alloy
Rods	aluminium alloy or aluminium clad steel
Remaining components	galvanized steel





Dead-end  
Clamps

E

**S**alvi has also included in its production a range of high quality bolted type Dead-end Clamps, in order to satisfy some utilities requirements. They are used where cutting of phase conductor must be avoided and full tension load is not needed.

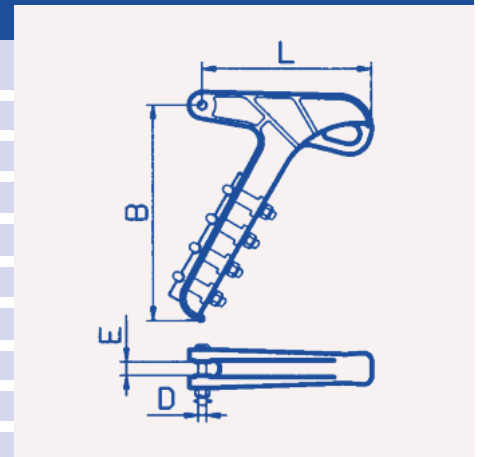
They have a minimum slipping load variable from 70% to 90% of conductor rated breaking strength.

The connection to the last fitting of the insulator string is made by means of a clevis attachment fitted with rivet or bolt.

Dead-end clamps are available for application with ACSR, ACAR and AAAC conductors (aluminium clamps) as well as with copper conductors (Zinc/Aluminium Alloy).

## U-bolt Type Strain Clamp

Code	Ø Min mm	Ø Max mm	B mm	D mm	E mm	L mm	U-Bolt N°	Note
1612A-002	5	13,5	160	Ø16	18	153	2	
1612B-002	5	13,5	160	Ø16	18	153	2	Zinc-Alum. Alloy
1616A-006	8	16	218	M16	18	165	3	
1616B-002	8	16	218	Ø16	18	165	3	Zinc-Alum. Alloy
1619RA-006	13	19,5	312	M16	20	180	4	
1619B-002	13	19,5	312	Ø16	20	180	4	Zinc-Alum. Alloy
1621RA-006	15	22	318	M16	24	200	4	
1621B-002	15	22	318	Ø16	24	200	4	Zinc-Alum. Alloy
1623RA-006	18	25	368	M16	26	210	5	
1623B-002	18	25	368	Ø16	26	210	5	Zinc-Alum. Alloy
1627A-0021	20	29	445	Ø16	26	330	5	
1635A-009	26	36	480	M20	38	340	6	



Material: Zinc-Aluminium alloy is used for copper conductors





## Compression Fittings F



**S**alvi compression fittings represent the best technical solution for conductors' full tension clamps and joints in EHV transmission lines, both from the mechanical and the electrical point of view. The conductor clamp coupling made by compression, on condition that it is carried out using Salvi Hydraulic Press and Dies, assures following advantages:

- impossibility of coupling disassembling during erection or service;
- minimum compressive stress on conductor wires at clamp mouth due to particular clamp design;
- best joint electrical conductance (in any case better than correspondent conductor length);
- best Corona behaviour thanks to the accurate finishing of pieces and to the particular shape that the compression gives to the joint.

Salvi manufactures a complete line of quality compression fittings to meet almost all transmission lines construction needs. In next pages Salvi will display its current production of compression fittings for most commonly used bimetallic and monometallic conductors (ACSR, AAC, AAAC) and earthwires. For non listed or special conductors diameter and/or stranding, and/or materials Salvi will provide directly on customer request the best technical solution. Salvi long-term experience in fittings for transmission lines joined with its design ability, offers best solution as regards to each clamping problem.

## **C**ompression Dead-end Clamp

An extruded aluminium tube of high electrical conductivity, gauged for each conductor diameter, is the key component of the Salvi Compression Dead-end Clamp. At one end of the Compression Dead-end Clamp, by means of an automatic process of electrical welding, is applied the connection for jumper terminal, which is manufactured by cast aluminium alloy in Salvi own foundry. The connection with the insulator strings is made by a steel terminal, hot dip galvanized according to International Standards requirements. Such terminal can be manufactured with various shapes suitable for different attachment types like eye, tongue and clevis. Nuts and bolts are made with hot dip galvanized steel but, on request, they can be supplied of stainless steel or aluminium alloy. The Salvi Compression Dead-end Clamp can be supplied for all conductors used in EHV transmission lines such as ACSR (Aluminium Conductor Steel Reinforced), AAC (All Aluminium Conductor), AAAC (All Aluminium Alloy Conductor), ACAR (Aluminium Conductor Alloy Reinforced), etc.

### **Mechanical Strength**

The Salvi Compression Dead-end Clamp has proven field performance and has been and is continuously tested under the most strenuous conditions. Assurance of rated ultimate body strength under maximum line conditions is an important aspect of our design and quality control. The ultimate strength of the clamp body is normally 100% of the conductor ultimate tensile strength. Slipping load is more than 95% of the conductor ultimate tensile strength. The ultimate strength is the load at which the failure can occur.

### **Electrical Strength**

A dead-end clamp has to be designed not only to meet mechanical requirements but also to satisfy electrical strength. In other words a dead-end clamp shall convey at least the same amount of current as a correspondent length of conductor. Salvi Compression Dead-end Clamp has been designed taking in account all these requirements and, to assure this, several electrical tests has been executed according to International Standard requirements. In particular all Salvi Compression Dead-end Clamp are subjected to Resistance Test and to Heating-cycle Test.

## **C**ompression Mid Span Joint

An extruded aluminium tube of high electrical conductivity, gauged for each conductor diameter, makes the Salvi Compression Joint. The Salvi Compression Joint can be supplied for all conductors used in EHV transmission line such as ACSR (Aluminium Conductor Steel Reinforced), AAC (All Aluminium Conductor), AAAC (All Aluminium Alloy Conductor), ACAR (Aluminium Conductor Alloy Reinforced), etc. In case of ACSR conductors, an inner steel splice is supplied. Such splice is hot dip galvanized according to International Standard requirements. Salvi Compression Joint is designed to be assembled on conductors by same sizes of DIES used for correspondent Compression Dead-end Clamp.

### **Mechanical Strength**

Salvi Compression Joint has the same mechanical performance as the correspondent Compression Dead-end Clamp. The ultimate strength of the splice body is normally 100% of the conductor ultimate tensile strength. Slipping load is more than 95% of the conductor ultimate tensile strength. The ultimate strength is the load at which the failure can occur.

### **Electrical Strength**

Salvi Compression Joint has the same electrical performance as the correspondent Compression Dead-end Clamp. All Salvi Compression Joint are subjected to Resistance Test and to Heating-cycle Test.

## **C**ompression Repair Sleeve

Salvi Compression Repair Sleeve are designed to restore original conductivity in damaged stranded conductors. They are made of two identical components, gauged for each conductor diameter, and these parts are fitted one into the other, allowing the assembling without cutting the conductor. The Salvi Compression Repair Sleeve is made of extruded aluminium of high electrical conductivity. They are compressed by the same die size used for dead-ends and joints.

### **Mechanical Strength**

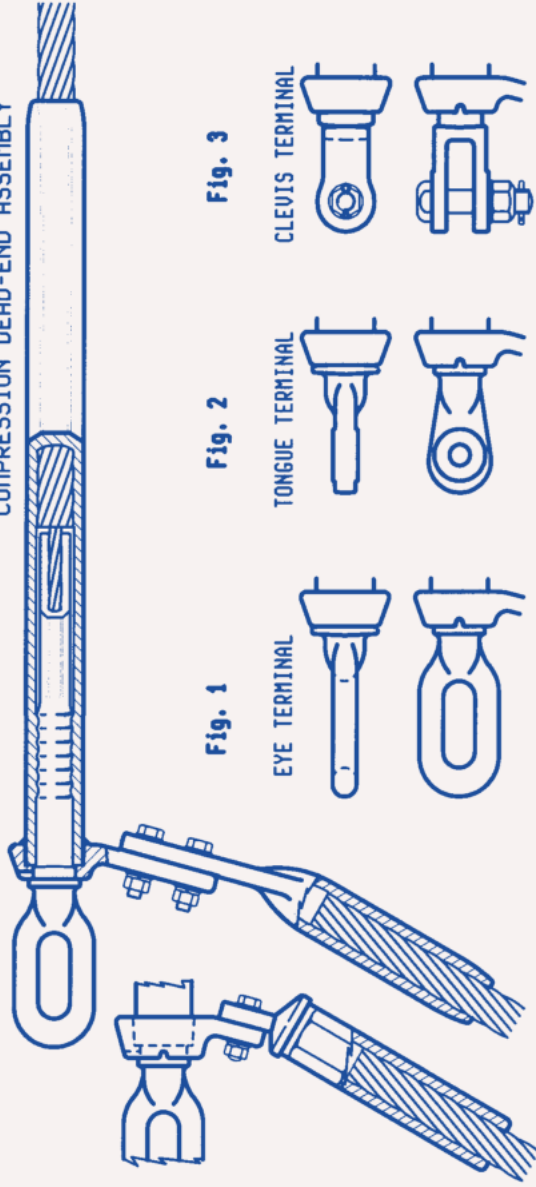
Salvi Compression Repair Sleeve can guarantee a slipping load greater than 20% of the conductor ultimate tensile strength. The ultimate strength is the load at which the failure can occur.

### **Electrical Strength**

Salvi Compression Repair Sleeve has the same electrical performance as the correspondent Compression Dead-end Clamp. All Salvi Compression Repair Sleeve are subjected to Resistance Test and to Heating-cycle Test.

# Dead-End, Mid Span Joint and Repair Sleeve for Bimetallic Conductors (ACSR)

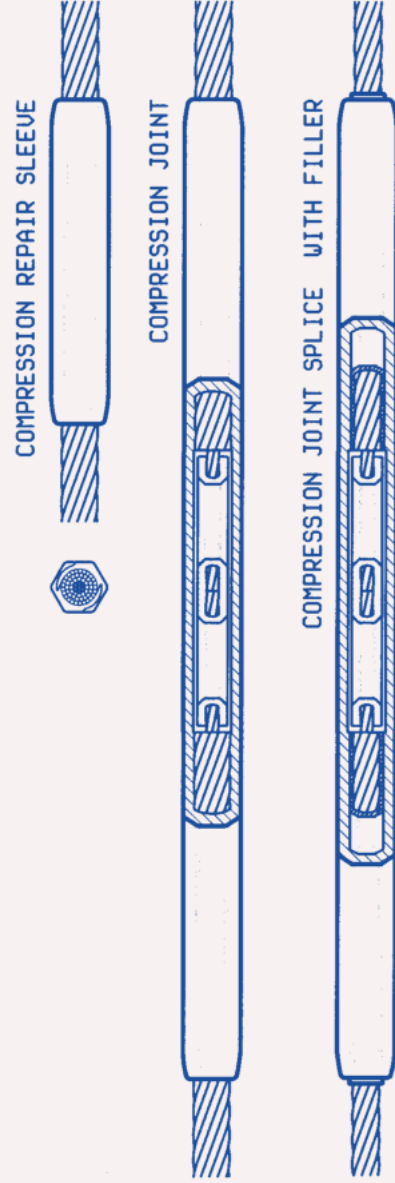
COMPRESSION DEAD-END ASSEMBLY



COMPRESSION REPAIR SLEEVE

COMPRESSION JOINT

COMPRESSION JOINT SPLICE WITH FILLER





Most common conductors fittings

Conductor Name	Conductor Diameter & Stranding				Compression Dead-End Assembly			Compression Mid-Span Joint	Compression Repair Sleeve	Filler	Compression Dies for Salvi	
	Ø overall	Aluminium n°	Steel n°	Ø	Eye Terminal Fig. 1	Tongue Terminal Fig. 2	Clevis Terminal Fig. 3				Die for Aluminium	Die for Steel
PETREL	11,70	12	2,34	7	2,34	508F221G		508F22A	578F2	•	590M046	591M022
MINORCA	12,21	12	2,44	7	2,44	508F241G		558E24A	578E2	•	590M046	591M022
LEGHORN	13,45	12	2,69	7	2,69	508E281G		558E28A	578E4	•	590M046	591M024
HORSE	13,95	12	2,79	7	2,79	508E301G		558E30A	578E6	•	590M046	591M027
AUK	14,83	8	4,05	7	2,25	508D311G		558D31A	578D11		590M038	591M020
DOTTFREL	15,40	12	3,08	7	3,08	508F201G		558F20A	578F3	•	590M055	591M029
DORKING	16,00	12	3,20	7	3,20	508F211G		558F21A	578F3	•	590M055	591M029
PARTRIDGE	16,28	26	2,57	7	2,00	508E011G	508E01NB	508E01A	578E13		590M045	591M020
TIGER	16,52	30	2,36	7	2,36	508E081G	508E08NB	558E08A	578E13		590M046	591M022
COCHIN	16,85	12	3,37	7	3,37	508G171G	508G17NL	558G17A	578G16	•	590M063	591M033
WOLF	18,13	30	2,59	7	2,59	508E181G	508E18NB	558E18A	578F14		590M046	591M027
LINNET	18,31	26	2,89	7	2,25	508E191G	508E19NB	558E19A	578E14		590M046	591M022
LYNX	19,53	30	2,79	7	2,79	508F021G	508F02NL	558F02A	578F12		590M055	591M029
PANTHER	21,48	30	3,00	7	3,00	508F161G	508F16NL	558F16A	578F13		590M055	591M029
FLICKER	21,80	24	3,58	7	2,38	508G021G	508G02NL	558G02A	578G10		590M062	591M027
HAWK	21,80	26	3,44	7	2,68	508G031G	508G03NL	558G03A	578G10		590M062	591M027
BEAR	23,45	30	3,35	7	3,35	508G111G	508G11NL	558G11A	578G15		590M063	591M033
DOVE	23,55	26	3,72	7	2,89	508G011G	508G01NL	558G01A	578G15		590M063	591M027
PEACE RIVER	24,15	48	2,90	7	2,25	508H011D		558H01A	578H04		590M067	591M025
EAGLE	24,22	30	3,46	7	3,46	508H061D		558H06A	578H04		590M068	591M033
ROOK	24,80	24	4,13	7	2,75	508H091D	508H09NL	558H09A	578H04		590M068	591M027
GROSBEEK	25,16	26	3,97	7	3,09	508H101D	508H10NL	558H10A	578H04		590M067	591M029
TEAL	25,24	30	3,61	19	2,16	508H111D	508H11NL	558H11A	578H04		590M067	591M033
EGRET	25,90	30	3,70	19	2,22	508H131D	508H13NL	558H13A	578H14		590M068	591M033
GOAT	25,97	30	3,71	7	3,71	508H131D	508H13NL	558H13A	578H14		590M068	591M033
STARLING	26,68	26	4,21	7	3,28	508H171D	508H17NL	558H17A	578H14		590M067	591M031
BISON	27,00	54	3,00	7	3,00	508K051D	508K05NL	558K05A	578K9		590M074	591M033
GAZZA	27,00	54	3,00	7	3,00	508K051D	508K05NL	558K05A	578K9		590M074	591M033
TERN	27,00	45	3,37	7	2,25	508K041D	508K04NL	558K04A	578K9		590M074	591M029
CONDOR	27,72	54	3,08	7	3,08	508K101D	508K10NL	558K10A	578K14		590M074	591M029
DRAKE	28,11	26	4,44	7	3,45	508K121D	508K12NL	558K12A	578K14		590M074	591M033
ZEBRA	28,62	54	3,18	7	3,18	508K141D	508K14NL	558K14A	578K14		590M075	591M033
CANARY	29,52	54	3,28	7	3,28	508L051D	508L05NL	558L05A	578L20		590M083	591M039
RAIL	29,58	45	3,70	7	2,47	508L061D	508L06NL	558L06A	578L20		590M083	591M027
CARDINAL	30,42	54	3,38	7	3,38	508L011D	508L01NL	558L01A	578L10		590M082	591M039
CURLEW	31,68	54	3,52	7	3,52	508L121D	508L12NL	558L12A	578L10		590M083	591M039
BULFJAY	31,96	45	3,99	7	2,66	508L261D	508L26NL	558L26A	578L10		590M083	591M027
SCISSORTAIL	33,90	42	4,42	7	2,46	508N121D		558N12A	578N7		590M092	591M022
BITTERN	34,16	45	4,27	7	2,85	508N111D	508N11NC	558N11A	578N7		590M093	591M027
PHEASANT	35,10	54	3,90	19	2,34	508N061D	508N06NC	558N06A	578N15		590M093	591M039

# Dead-End, Mid Span Joint and Repair Sleeve for Monometallic Conductors (AAC, AAAC)

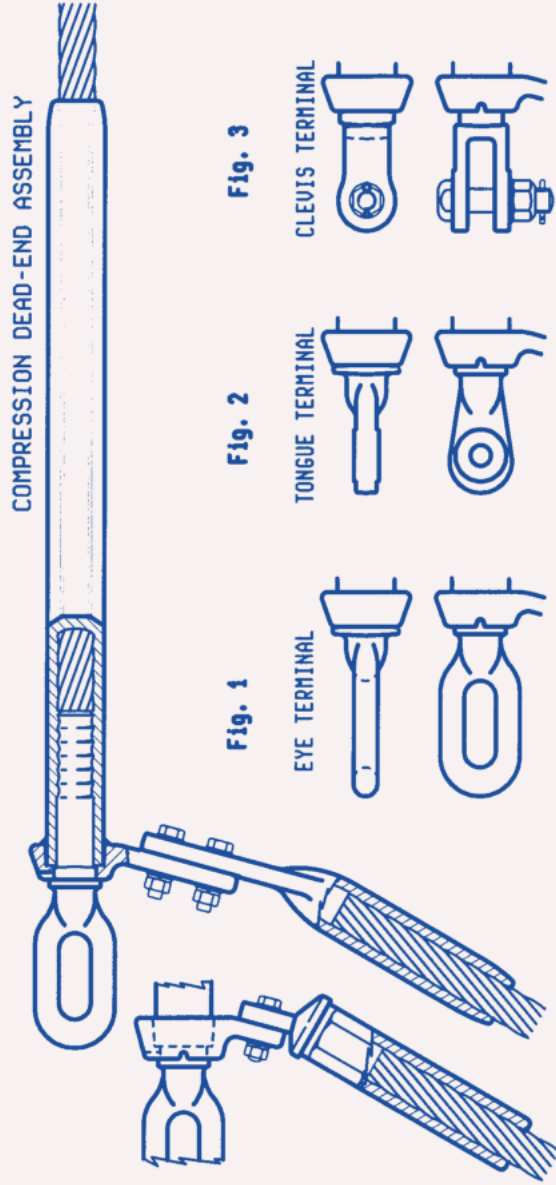


Fig. 1

EYE TERMINAL



Fig. 2

TONGUE TERMINAL

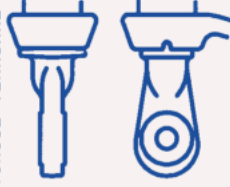
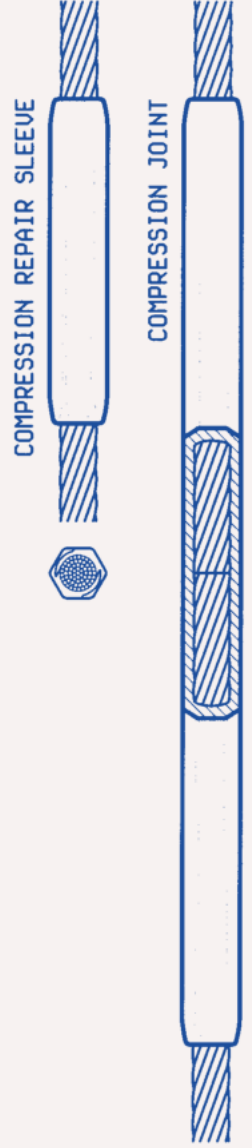
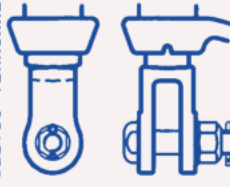


Fig. 3

CLEVIS TERMINAL



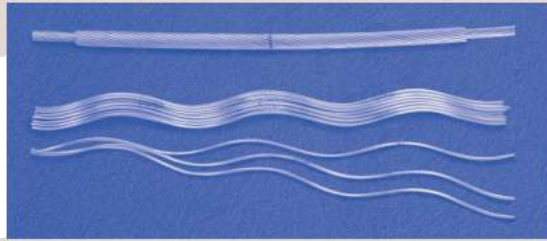


AAC

Conductor Name	Conductor Diameter & Stranding		Compression Dead-End Assembly		Compression Mid Span Joint	Compression Repair Sleeve	Compression Dies for Salvi Hydraulic Press
	Ø overall	Aluminium n° Ø	Eye Terminal Fig. 1	Tongue Terminal Fig. 2			
TULIP	16,90	19	508E02PG		558E10	578E13	590M046
300mm <sup>2</sup>	22,50	61	508G03PG	508G03RG	558G11	578G14	590M062
ORGHID	23,31	37	508H01PD		558H14	578H04	590M069
ARBUTUS	26,07	37	508K07PD		558I124	578I114	590M068
MAGNOLIA	28,55	37	508L01PD	508L01RH	558L14	578L16	590M083
NARCISSUS	33,02	61	508N01PD	508N01RH	558N10	578N7	590M092
	36,00	61	508P01PD		558P10	578P8	590M103
COREOPSIS	36,90	61	508P02PD	508P02RG	558P11	578P8	590M099

AAAC

Conductor Name	Conductor Diameter & Stranding		Compression Dead-End Assembly		Compression Mid Span Joint	Compression Repair Sleeve	Compression Dies for Salvi Hydraulic Press
	Ø overall	Aluminium n° Ø	Eye Terminal Fig. 1	Tongue Terminal Fig. 2			
	15,75	37	508T03PG	508T03RH	558T13	578T3	590M054
	16,45	37	508F04PG		558F14	578F3	590M035
ASH	17,40	19	508G04PG	508G04RH	558G12	578G5	590M062
180	17,50	37	508G04PG	508G04RH	558G12	578G5	590M062
	18,20	37	508G04PG	508G04RH	558G12	578G5	590M063
	18,90	37	508G05PG	508G05RH	558G13	578G5	590M063
DARIEN	21,80	19	508K05PD		558K21	578K0	590M075
GREELEY	28,14	37	508N03PD		558N15	578N13	590M093
YEW	28,42	37	508P03PD	508P03RG	558P12	578P0	590M099
ASTER 570	31,05	61	508P06PD		558P18	578P0	590M099



Accessories G





Our production is not limited to main fittings only. This section covers a wide range of accessories needed for a transmission line. All the steel components are hot dip galvanized in accordance with International Standards requirements.

### **P**arallel Groove Clamps

Salvi manufactures Parallel Groove Clamps to connect two equal diameter conductors.

The two elements of these clamps are made of cast aluminium alloy or galvanized forged steel, according to the earthwire (alumoweld or galvanized steel).

### **E**arthing Clamps

Salvi Earthing Clamps are able to ground different sizes of conductor or earth wires. The grounding could be done on both single and double earthwire.

Salvi Earthing Clamps are made of galvanized forged steel.

### **R**igid Spacers

Rigid Spacers are designed to maintain specified sub-conductor spacing within the prescribed geometry, in all working conditions. Thus they are able to resist the forces caused by transient conditions such as short circuit and the particular design makes them free from unacceptable level of Corona and Radio Interference. In addition, our Rigid Spacers are suitable to house counterweights and can be used in all situations that require a counterweight jumper loop.

The Rigid Spacers are made of cast aluminium alloy.

### **A**rmor Rods

Armor Rods are used to reinforce and protect the conductor at the suspension point where it is subjected to both static and dynamic forces.

Design of armor rod set is characterized by some significant parameters: diameter, length and quantity of rods. Salvi has its own software, developed in collaboration with Poytechnic of Milan, by which the length of rods can be optimized when Customer Specifications do not require a specific length.

Moreover the armor rods supplied by us are designed for a proper coupling with our suspension clamps and our vibration dampers. It has to be noted that:

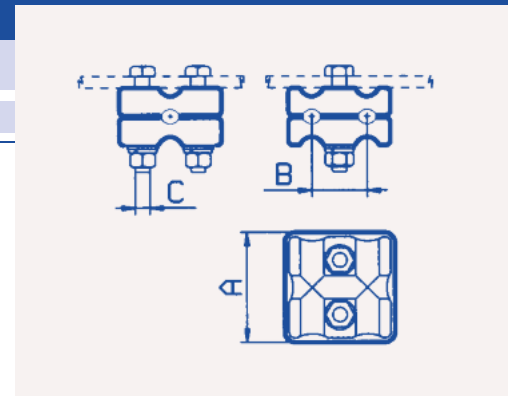
- our suspension clamps for conductors with armor rods have an housing with appropriate dimensions and shapes;
- clamps of our vibration dampers are designed for direct installation on conductor or on the armor rod set as the case may be.

The shape of rod ends is based on the voltage of the line in order to avoid Corona effects (rounded or parrot-bill ends). The material shall be aluminium alloy, aluminium clad steel or galvanized steel depending upon the outer layer of the cable to be protected.

## Parallel Groove Clamp

Code	Ø Min mm	Ø Max mm	A mm	B mm	C mm	Note
7351	10	17	70	38	M10	
7353	17	24	75	40	M10	

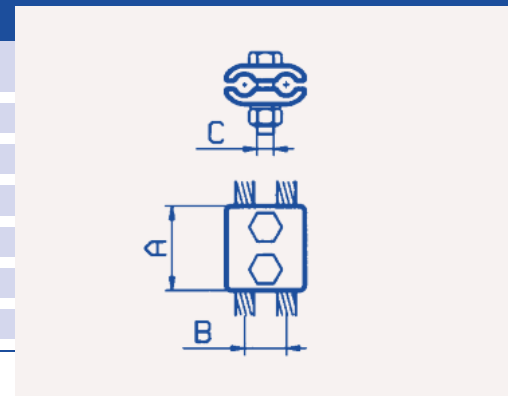
Material: aluminium alloy



## Parallel Groove Clamp

Code	Ø Min mm	Ø Max mm	A mm	B mm	C mm	Note
7734A2	9	12	80	27	M12	
7735A2	12	15	80	30	M12	
7736A2	15	18	80	34	M12	
7737A2	17	21	80	38	M12	
7738A2	21	24	80	42	M12	
7739A2	24	27	100	45	M14	
7740A2	27	30	100	48	M14	

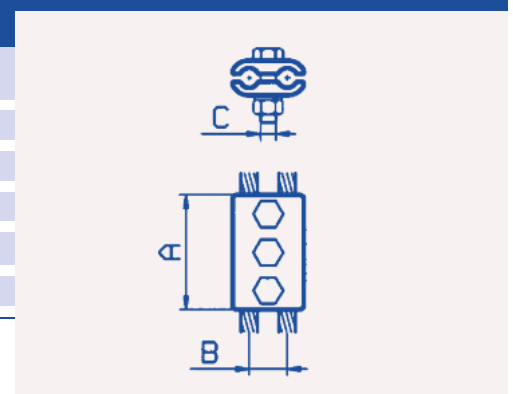
Material: aluminium alloy



## Parallel Groove Clamp

Code	Ø Min mm	Ø Max mm	A mm	B mm	C mm	Note
7735A3	12	15	120	30	M12	
7736A3	15	18	120	34	M12	
7737A3	17	21	120	38	M12	
7738A3	21	24	120	42	M12	
7739A3	24	27	150	45	M14	
7740A3	27	30	150	48	M14	

Material: aluminium alloy



G.2

### Two Bundle Rigid Spacer

	Code	Ø Min mm	Ø Max mm	A mm	B mm	Note
	3863B2038030	28	30	200	120	
	3863B2038034	32	34	200	120	

Material: aluminium alloy

### Two Bundle Rigid Spacer

	Code	Ø Min mm	Ø Max mm	A mm	B mm	Note
	3861B2561031	29	31	250	50	
	3861B3561028	26	28	354	50	
	3861B4061028	26	28	400	50	
	3861B4561032	30	32	450	50	
	3861B4561028	26	28	457	50	
	3866B4517044A	42	44	457	75	

Material: aluminium alloy

### Three Bundle Rigid Spacer

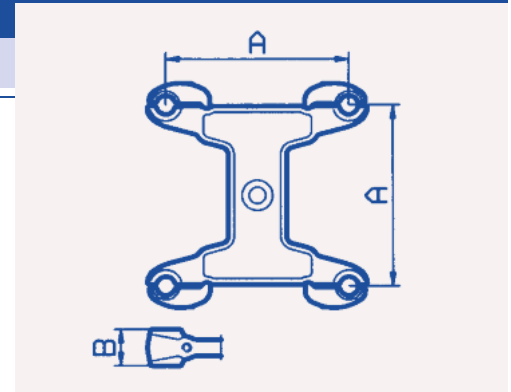
	Code	Ø Min mm	Ø Max mm	A mm	B mm	Note
	3830T4011028	26	28	400	50	
	3830T4551032	30	32	450	60	

Material: aluminium alloy

## Four Bundle Jumper Rigid Spacer

Code	Ø Min mm	Ø Max mm	A mm	B mm	Note
3865Q2561026	24	26	250	50	

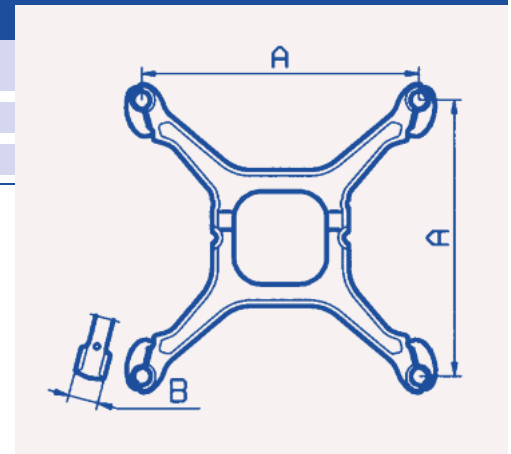
Material: aluminium alloy



## Four Bundle Jumper Rigid Spacer

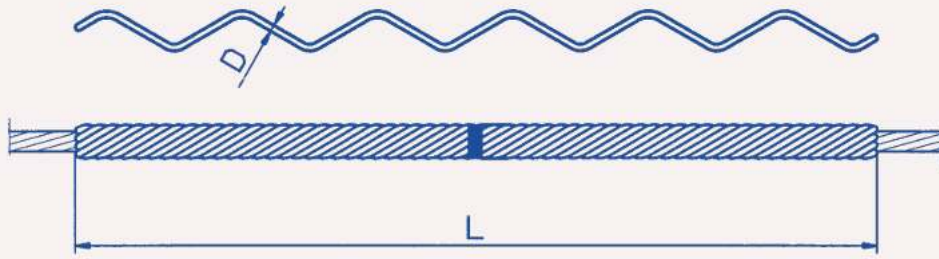
Code	Ø Min mm	Ø Max mm	A mm	B mm	Note
3865Q4557028	26	28	450	50	
3865QS4557028	26	28	457	50	
3865Q4561032	30	32	457	50	

Material: aluminium alloy

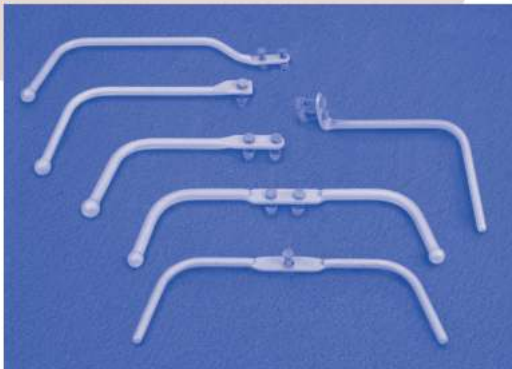
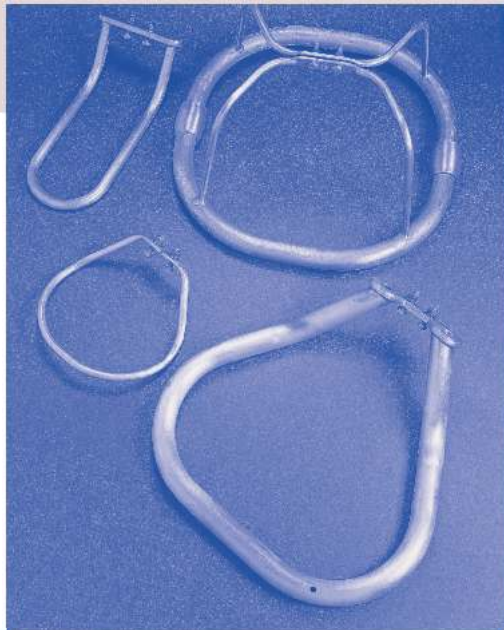


G.3

## Armor Rods



Dimensions of rods (diameter  $D$  and length  $L$ ) are calculated in accordance with conductor diameter.



Arcing  
Protections and Corona Rings H

**T**his section covers Arcing Protections (Arcing horns and Rackets) and Corona Rings normally used in medium and high voltage transmission lines. Many other types, not indicated here, are currently manufactured according to particular customer requirements or to secure high Corona free voltage levels.

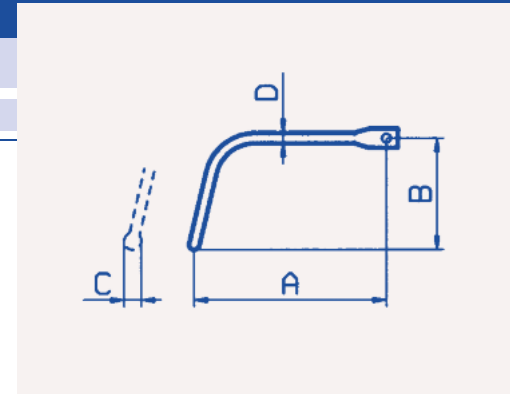
#### **Material and Manufacture**

Salvi Protections and Corona Rings are made of hot dip galvanized rolled steel round bars (arcing horns and rackets) and exterior and interior hot dip galvanized seamless steel tube. Corona Rings made of aluminium could be provided upon request.

## Arcing Horn

Code	A mm	B mm	C mm	D mm	Note
411C17	300	172	Ø27	Ø16	
411C18	300	120	Ø27	Ø16	

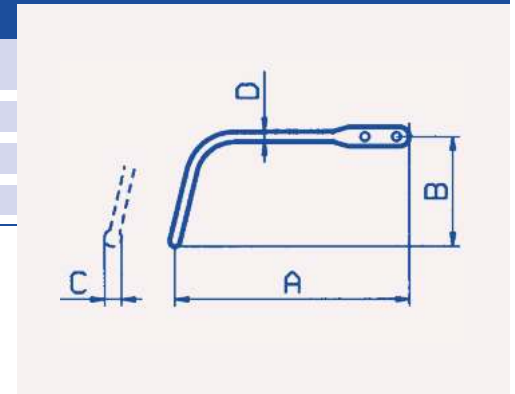
Material: galvanized steel rod



## Arcing Horn

Code	A mm	B mm	C mm	D mm	Note
411A136	375	172	Ø27	Ø16	
411A149	300	240	Ø27	Ø16	
411A166	300	125	Ø27	Ø20	
411A155	375	200	Ø40	Ø28	

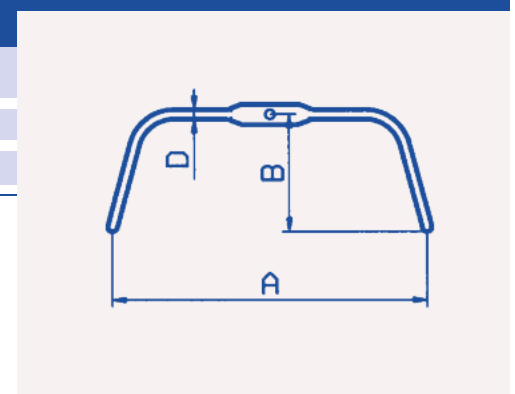
Material: galvanized steel rod



## Arcing Horn

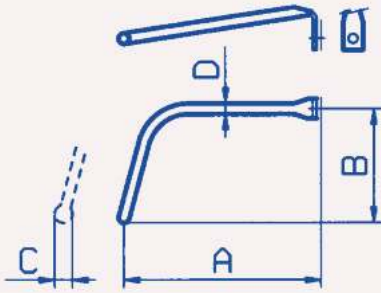
Code	A mm	B mm	D mm	Note
411Q01	500	174	Ø14	
411Q51	552	89	Ø16	
411Q52	552	89	Ø22	

Material: galvanized steel rod





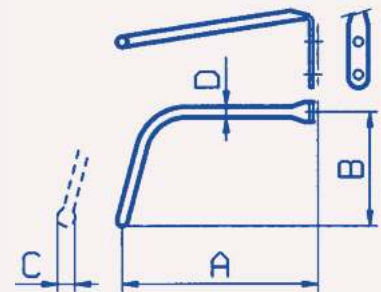
## Arcing Horn



Code	A mm	B mm	C mm	D mm	Note
411P03	300	172	Ø27	Ø16	
411P37	300	172	-	Ø16	

Material: galvanized steel rod

## Arcing Horn



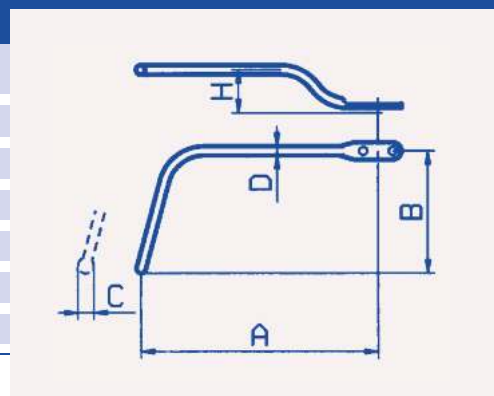
Code	A mm	B mm	C mm	D mm	Note
411D32	250	125	Ø27	Ø16	
411D31	250	205	Ø27	Ø16	
411D34	300	135	Ø27	Ø16	
411D40	300	172	Ø27	Ø16	
411D33	300	210	Ø27	Ø16	
411D191	350	480	Ø27	Ø16	
411D92	375	217	-	Ø16	
411D193	252	350	Ø40	Ø20	
411D35	375	217	Ø32	Ø20	
411D155	300	210	Ø40	Ø25	
411D138	375	177	Ø40	Ø25	
411D182	600	300	-	Ø25	
411D192	740	651	Ø40	Ø25	

Material: galvanized steel rod

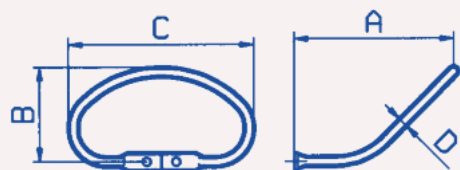
## Arcing Horn

Code	A mm	B mm	C mm	D mm	H mm	Note
411B108	590	235	-	Ø16	70	
411B40	465	210	Ø27	Ø16	70	
411B44	540	215	Ø32	Ø20	70	
411B110	500	437	Ø40	Ø25	70	
411B75	500	225	Ø40	Ø20	70	
411B94	550	225	Ø40	Ø25	70	
411B109	590	160	Ø40	Ø25	70	

Material: galvanized steel rod



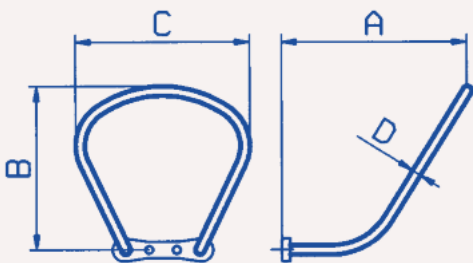
## Arcing Racket



Code	A mm	B mm	C mm	D mm	Note
411M177	242	185	316	Ø16	
411M188	252	300	316	Ø16	
411L45-16	272	160	316	Ø16	
411M184	272	260	316	Ø16	
411M186	252	300	320	Ø20	
411M187	252	385	320	Ø20	
411L45-20	270	160	320	Ø20	
411M155	390	210	320	Ø20	

Material: galvanized steel rod

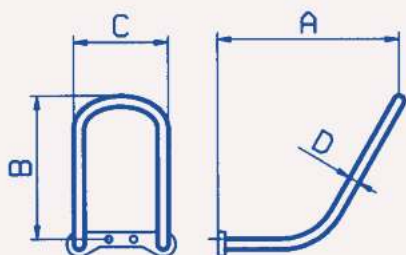
## Arcing Racket



Code	A mm	B mm	C mm	D mm	Note
411M190	287	350	600	Ø20	
411M175	365	240	600	Ø20	
411M168	580	930	320	Ø20	
411M167	583	937	322	Ø22	
411M178	292	332	325	Ø25	
411M181	292	387	325	Ø25	
411M173	317	700	325	Ø25	
411M92-3	339	302	325	Ø25	
411M160	367	230	325	Ø25	

Material: galvanized steel rod

## Arcing Racket

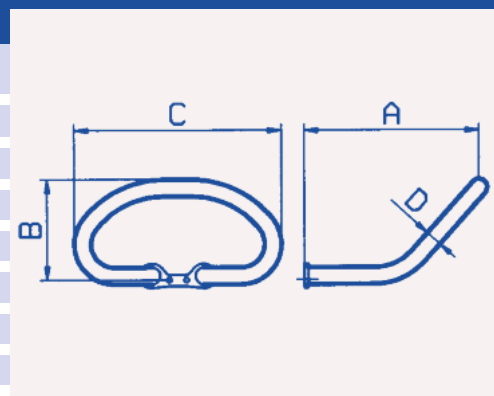


Code	A mm	B mm	C mm	D mm	Note
411M161	292	180	195	Ø25	
411M158	341	250	195	Ø25	
411M166	368	290	195	Ø25	
411M125	292	190	198	Ø28	
411M131	368	290	198	Ø28	

Material: galvanized steel rod

## Corona Ring

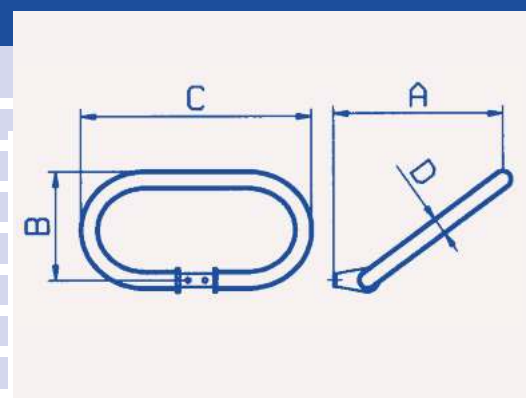
Code	A mm	B mm	C mm	D mm	Note
413M74	343	300	337	Ø42,4	
413M74-1	337	300	337	Ø42,4	
413M71	479	1097	337	Ø42,4	
413M59	490	185	328	Ø48,3	
413G22-4-1	506	292	600	Ø48,3	
413G85	368	292	378	Ø48,3	
413G70	506	320	600	Ø48,3	
413G86	315	325	500	Ø48,3	
413G84	326	350	500	Ø48,3	
413G53-4	541	375	600	Ø48,3	
413G72	646	848	600	Ø48,3	
413G76	676	1823	600	Ø48,3	



Material: galvanized steel tube

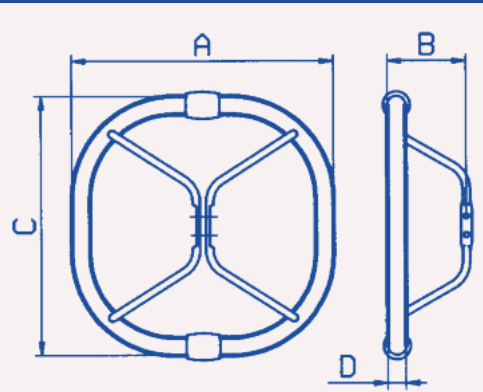
## Corona Ring

Code	A mm	B mm	C mm	D mm	Note
433M12-3	476	315	700	Ø48,3	
433M31	675	315	1000	Ø48,3	
433M34	569	330	900	Ø48,3	
433M32	436	360	700	Ø48,3	
433M16-1	491	450	1000	Ø48,3	
433M29	491	450	1050	Ø48,3	
433M30	541	450	1000	Ø48,3	
433M04-3	451	520	900	Ø48,3	
433M24	650	230	600	Ø60,3	
434M01	276	300	930	Ø48	Aluminium alloy



Material: galvanized steel tube

## Corona Ring



Code	A mm	B mm	C mm	D mm	Note
433A130	648	193	648	Ø48,3	Two pieces
433A109	700	210	700	Ø48,3	Two pieces
433B123	698	215	1048	Ø48,3	Two pieces
433B103	800	285	1200	Ø48,3	Two pieces
433A117	648	317	648	Ø48,3	Two pieces
433A131	798	400	798	Ø48,3	Two pieces
433B118	648	471	1048	Ø48,3	Two pieces
433A136	648	483	648	Ø48,3	Two pieces
433A135	698	488	698	Ø48,3	Two pieces
433A132	698	560	698	Ø48,3	Two pieces

Material: galvanized steel tube and aluminium sleeves



Counterweight  
Devices J

Other than the accessories described in section G, sometimes when a Jumper need to be counterweighted, it is necessary to provide an appropriate Counterweight Assembly. In designing such a device, Salvi is always taking into account the weight necessity as well as the electrical behaviour in the Jumper loop arrangement such as the compliance with the minimum electrical clearances required.

In this section some types of Counterweights and Counterweights Assemblies have been included, anyway Salvi is always available to design different types of Counterweights devices according to Customer's requirements.

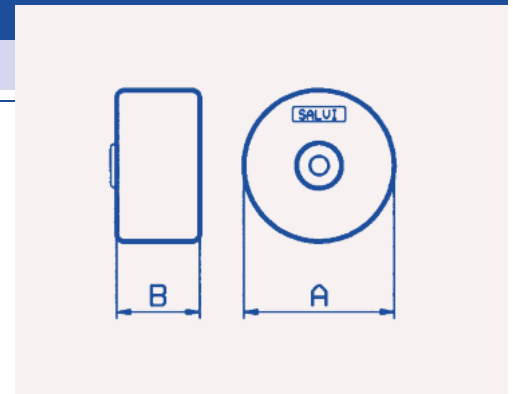
#### **Material and Manufacture**

The counterweight are made of galvanized cast iron and they are hot dip galvanized according to International Standards requirements.

## Counterweight

Code	A mm	B mm	Weight Kg	Note
3708	200	110	25	

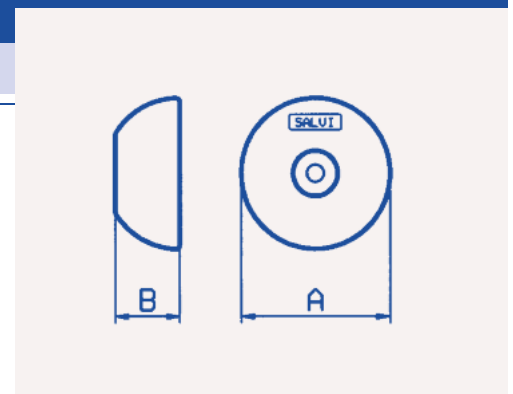
Material: galvanized cast iron



## Counterweight

Code	A mm	B mm	Weight Kg	Note
3716	200	87,5	12,5	

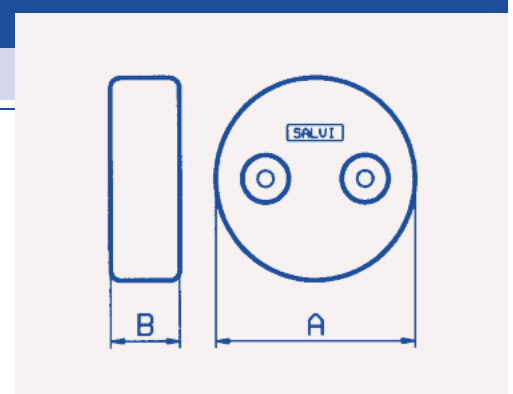
Material: galvanized cast iron



## Counterweight

Code	A mm	B mm	Weight Kg	Note
3739	300	104	50	

Material: galvanized cast iron

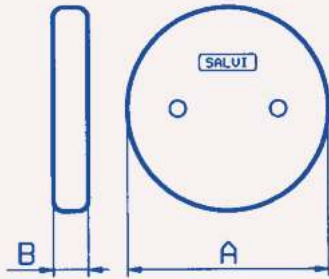






J.1

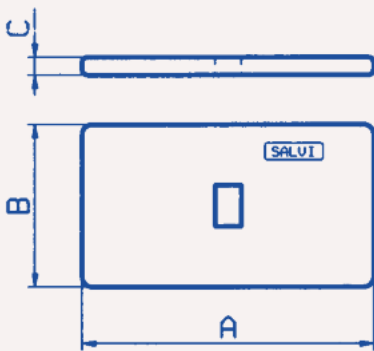
## Counterweight



Code	A mm	B mm	Weight Kg	Note
3739-25	300	50	25	

Material: galvanized cast iron

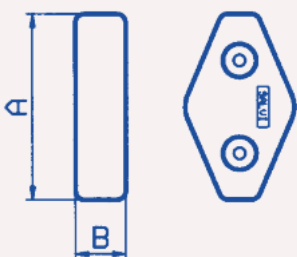
## Counterweight



Code	A mm	B mm	C mm	Weight Kg	Note
3734A	450	200	40	25	
3735-1	620	280	40	50	
3751	585	330	36	50	

Material: galvanized cast iron

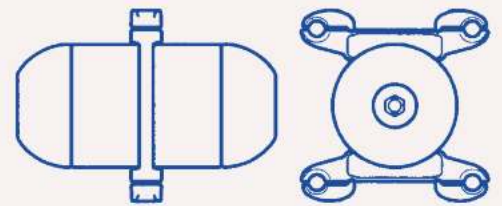
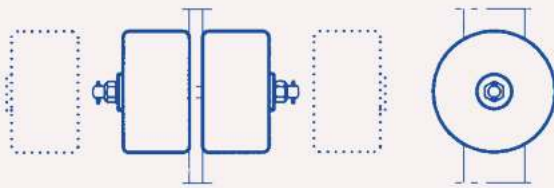
## Counterweight



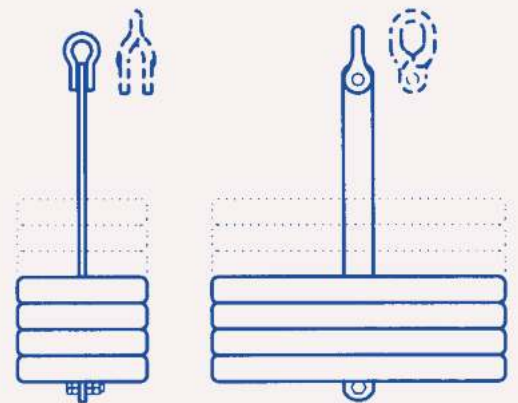
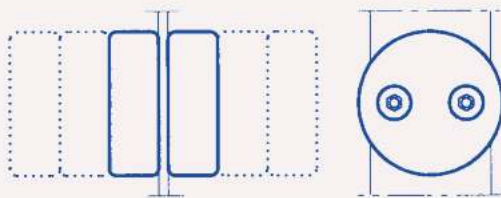
Code	A mm	B mm	Weight Kg	Note
3749	320	87	25	
3750	315	120	35	

Material: galvanized cast iron

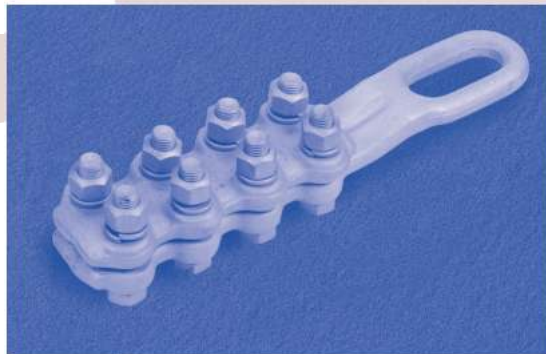
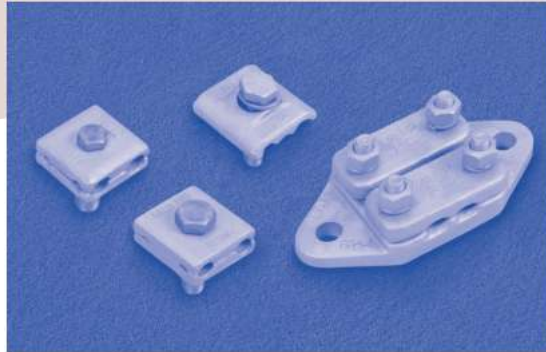
## Counterweight set



## Counterweight set







This section covers all the components for earthwire suspension and tension sets like suspension clamps, tension clamps (both compression and bolted type), attachments to the tower structure, parallel groove and earthing clamps.

These items are Salvi standard production and can be applied to T/L of any voltage.

### **S**uspension Clamps

Are available for application with galvanized steel as well as with aluminium based earthwires.

They are composed by a clamp body, a keeper and two tightening U-bolts. Clamp and keeper shall be in cast aluminium or drop forged steel depending upon earthwire material.

Three different ways of mounting are foreseen :

- directly on the support foreseen on the tower tip;
- on two supports supplied by us;
- supported by means of a shackle.

### **C**ompression Dead End and Joints

Our compression fittings, suitable for galvanized steel or alumoweld earthwires, withstand minimum 95% of conductor nominal breaking strength.

Dead ends are drop forged and can be supplied, as the joints, either in stainless or in galvanized steel.

The shape of the terminal is suitable for any type of tower attachment and allows the cable to cross through easily. The assembly on the earthwire shall be done in the same way as the compression fittings for phase conductors.

### **B**olted Type Tension Clamps

They are suitable for galvanized steel or alumoweld earthwires.

Depending upon the earthwire diameter and composition, they have a minimum slipping strength variable from 70 to 90% of the earthwire breaking strength.

Body and keeper are made of galvanized drop forged steel and the tightening is assured by means of a variable number of bolts, according to the clamp size.

### **P**arallel Groove Clamps

Two different types of Connectors are available:

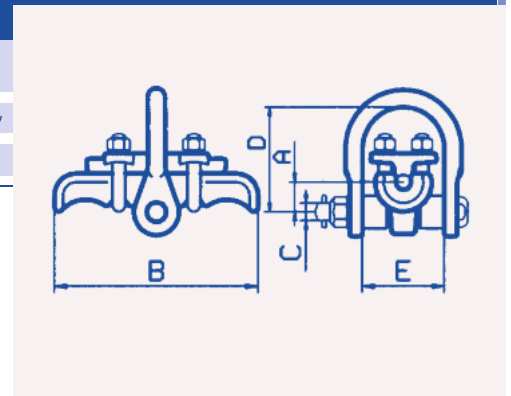
- parallel groove clamps;
- earthing clamps.

Components are made of galvanized forged steel and supplied with bolts, nuts and spring washers.

## Suspension Clamp

Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	C mm	D mm	E mm	Note
1113LAC-006	70	Ø7	Ø14	27	190	M16	98	77	
1119AC-006	70	Ø13	Ø20	27	215	M16	98	77	Alum. alloy
1110-066	70	Ø7	Ø14,5	13	140	Ø14	80	55	Pin

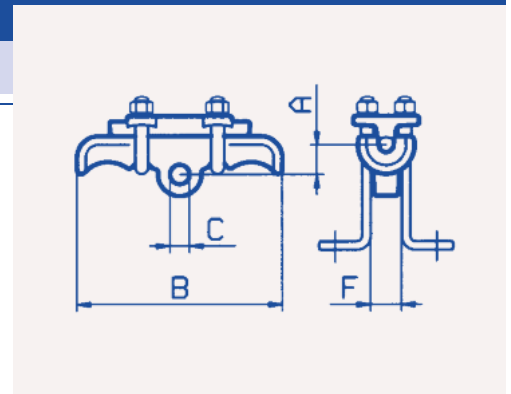
Material: hot dip galvanized forged steel



## Suspension Clamp

Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	C mm	F mm	Note
1113LB	70	Ø7	Ø14	27	190	Ø18	28	

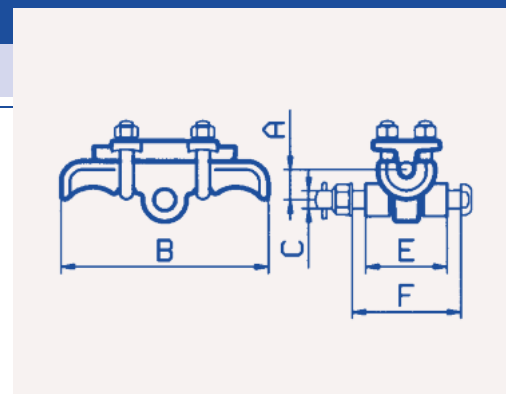
Material: hot dip galvanized forged steel



## Suspension Clamp

Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	C mm	E mm	F mm	Note
1113LA-006	70	Ø7	Ø14	27	190	M16	75	105	

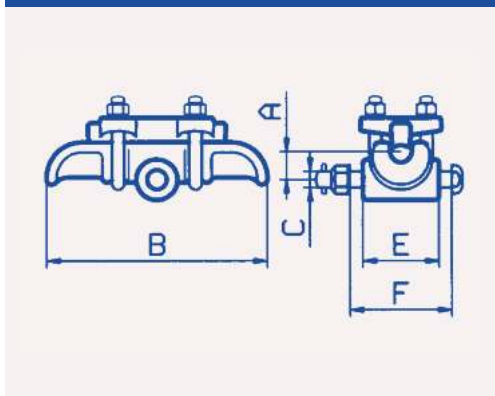
Material: hot dip galvanized forged steel





K.1

## Suspension Clamp



Code	U.T.S. kN	ØMin mm	ØMax mm	A mm	B mm	C mm	E mm	F mm	Note
1119A-006	70	Ø13	Ø20	27	215	M16	77	98	With bush

Material: aluminium alloy, hot dip galvanized steel

# Dead-End and Mid Span Joint for Earthwires

DEAD END



DEAD END



COMPRESSION MIDDLE SPAN JOINT







**GSW**

Conductor Name	Conductor Diameter & Stranding		Compression Dead-End Assembly			Compression Dies for SALVI Hydraulic Press
	Ø overall	Stranding n°	Long Eye Terminal Galvanized Steel	Compression Dead-End Fig. 1 Stainless Steel	Tongue Terminal Dead-End Fig. 2 Stainless Steel	
5/16" EHS	7,92	7		72831B-4		56219-4
	8,30	7		72831B-4	72836-12	56223-2
	8,40	7		72831B-5	72836-12	56223-2
	9,00	7		72831B-7	72836-11	56223-4
	9,14	7		72831B-7	72836-11	56223-4
3/8" EHS	9,52	7	72831-2S	72831-2	72836-2S	56227-2
	9,6	7	72831-2S	72831-2	72836-2S	56227-2
GSW 55mm <sup>2</sup>	9,75	7	72831-3S	72831-3	72836-3S	56227-3
	10	19		72831-4	72836-4	56227-4
	10,5	7		72831-5	72836-5	56233-2
70	11	19	72831-7-C20	72831-7	72836-7	56233-4
	11,05	19	72831-7-C20	72831-7	72836-7	56233-4
72	11,5	19		72831-9	72836-9	56233-6
	13,2	19		72841-7		56237-7
	13,5	19		72841-8		56242-2

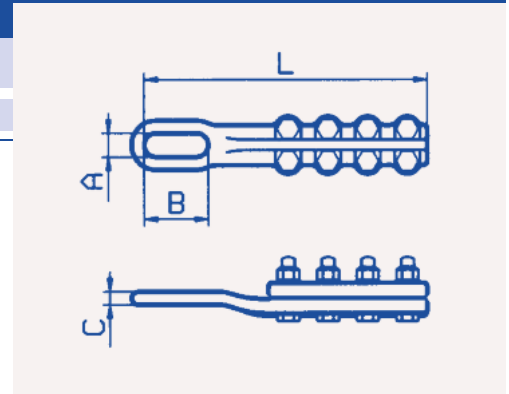
**AWG**

Conductor Name	Conductor Diameter & Stranding		Compression Dead-End Assembly			Compression Dies for SALVI Hydraulic Press
	Ø overall	Stranding n°	Long Eye Terminal Galvanized Steel	Compression Dead-End Fig. 1 Stainless Steel	Tongue Terminal Dead-End Fig. 2 Stainless Steel	
7 N°9	7,94	7		72831B-4	72836B-14	56219-4
	8,71	7		72831B-6	72836B-12	56223-3
	9,78	7	72831-3S	72831-3	72836-3	56227-3
	11,00	7	72831-7-C20	72831-7	72836-7	56233-4
	12,34	7	72841-3S	72841-3	72836-20	56237-3

## Bolted Strain Clamp

Code	U.T.S. kN	Ø Max mm	Ø Max mm	A mm	B mm	C mm	L mm	Note
713G	100	6	9,5	30	60	14	270	
715G	150	9,5	12,5	30	80	16	357	

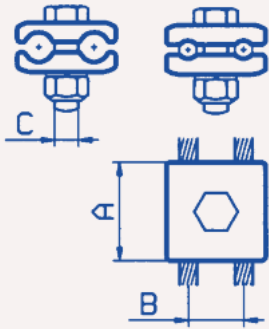
Material: hot dip galvanized forged steel





K.4

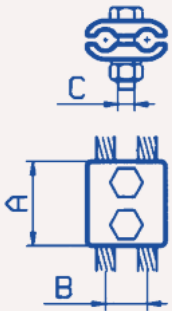
## Parallel Groove Clamp



Code	Ø Min cable mm	Ø Max cable mm	A mm	B mm	C mm	Note
7715	6	15	50	28	M12	
7718M	6	16	58	36	M18	
7718M1	6	16	58	36	M16	

Material: hot dip galvanized forged steel

## Parallel Groove Clamp



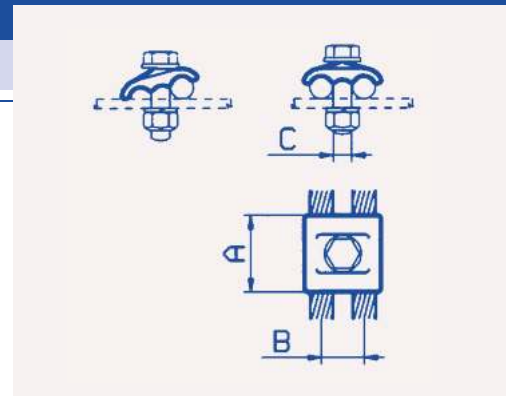
Code	Ø Min cable mm	Ø Max cable mm	A mm	B mm	C mm	Note
7712	9,15	12,5	50	25	M10	
7725Z2	16	25	80	44	M12	

Material: hot dip galvanized forged steel

## Earthing Clamp

Code	Ø Min cable mm	Ø Max cable mm	A mm	B mm	C mm	Note
7314	6	15	50	28	M12	

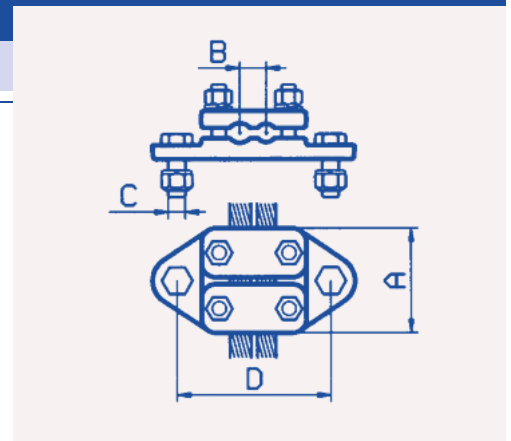
Material: hot dip galvanized forged steel



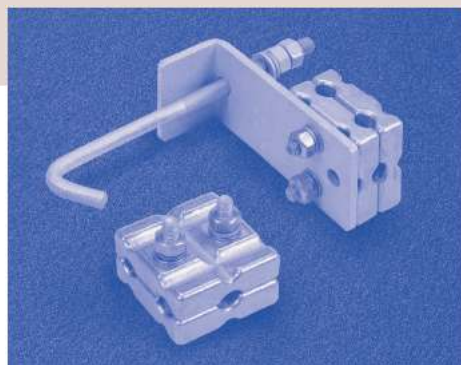
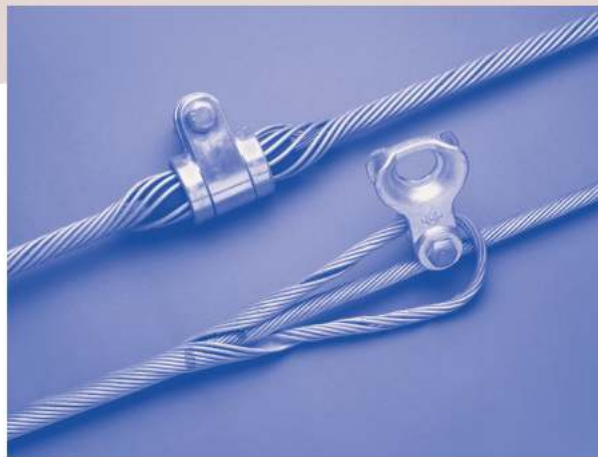
## Earthing Clamp

Code	Ø Min cable mm	Ø Max cable mm	A mm	B mm	C mm	D mm	Note
7342	7	14	75	18	M12	110	

Material: hot dip galvanized forged steel









## Preformed Armor Grip Suspension (AGS)



Technical characteristics:	
Vertical breaking strenght	up to 80 kN
Slipping load	minimum 20% of OPGW breaking load
Materials:	
Clamp body	aluminium alloy
Rods	aluminium alloy or aluminium clad steel
Remaining components	galvanized steel

Preformed type suspension set provides an high protection to the cable and to optical fibers at the suspension point being the cable enclosed in an elastomer insert.

All the elements (clamp, insert and rods) form a compact and flexible assembly which allows to:

- improve the fatigue resistance of OPGW at the suspension point due to the coiling of strands on the outer layer of the cable;
- reduce the effect of aeolian vibration due to the rods and the elastomer insert;
- control the slipping load.





## Preformed Dead-end Set



Preformed dead-end set for OPGW offers the advantage to provide a constant radial gripping force on the cable which consent to prevent any damage to the cable itself and optic fibers as well.

Dead-end set consist of:

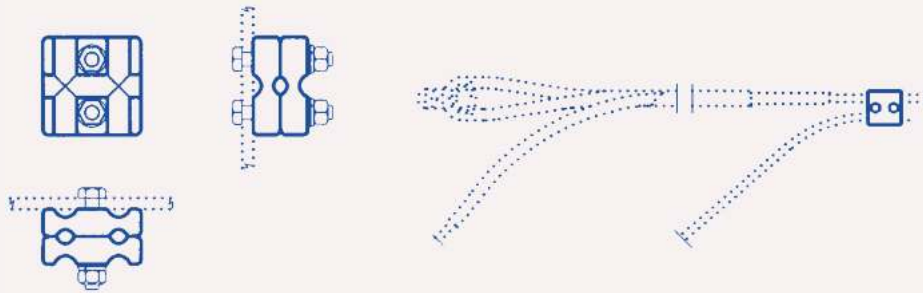
- preformed reinforcing rods (internal set installed directly on the conductor);
- preformed dead-end (external gripping set);
- thimble clevis.

The torsional effects caused to the cable by axial tension and temperature changes are relieved by using lay direction of dead-end rods opposite to that of reinforcing rods.

Preformed dead-end gripping load is at least 90% of OPGW nominal breaking strength.

Material of preformed accessories is compatible with the outer layer of the cable where they are applied and could be of aluminium alloy or aluclad steel.

## Parallel Groove Clamp



The design of this clamp has been executed in cast aluminium with the aim of standardising its use for different scopes so to reduce spares and possibility of shortages during installation activities.

The same piece in fact can be used as:

- Parallel Groove Clamp to derive a grounding cable from the earthwire;
- Grounding Clamp to attach above grounding cable to tower structure;
- Down-lead Clamp as explained in next paragraph.

## Down-lead Clamp

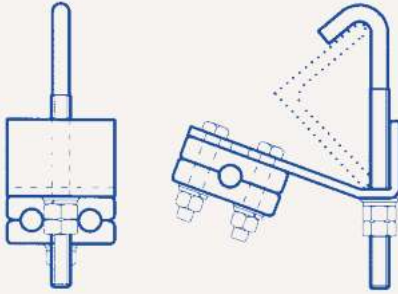


Fig. 1

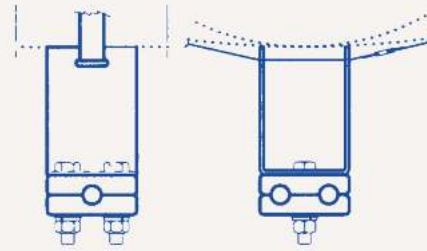


Fig. 2

Our down-lead clamp shown in fig. 1 offers the advantage of an easy and fast installation since it does not require any bolting to tower structure. This will consent also to avoid drilling of steel members and relevant galvanising touch-up eliminating any possibility of corrosion problems.

The Down-lead calmp shown in fig. 2 is suitable for all concrete, steel or wooden poles having a round or polygonal section.

Down-lead clamps can be attached to all steel sections of any thickness and OPGW is fixed by the same Parallel Groove Clamp as described in the previous paragraph.

The material is galvanised steel except the Parallel Groove Clamp which is cast aluminium.



# Typical T/L Assemblies

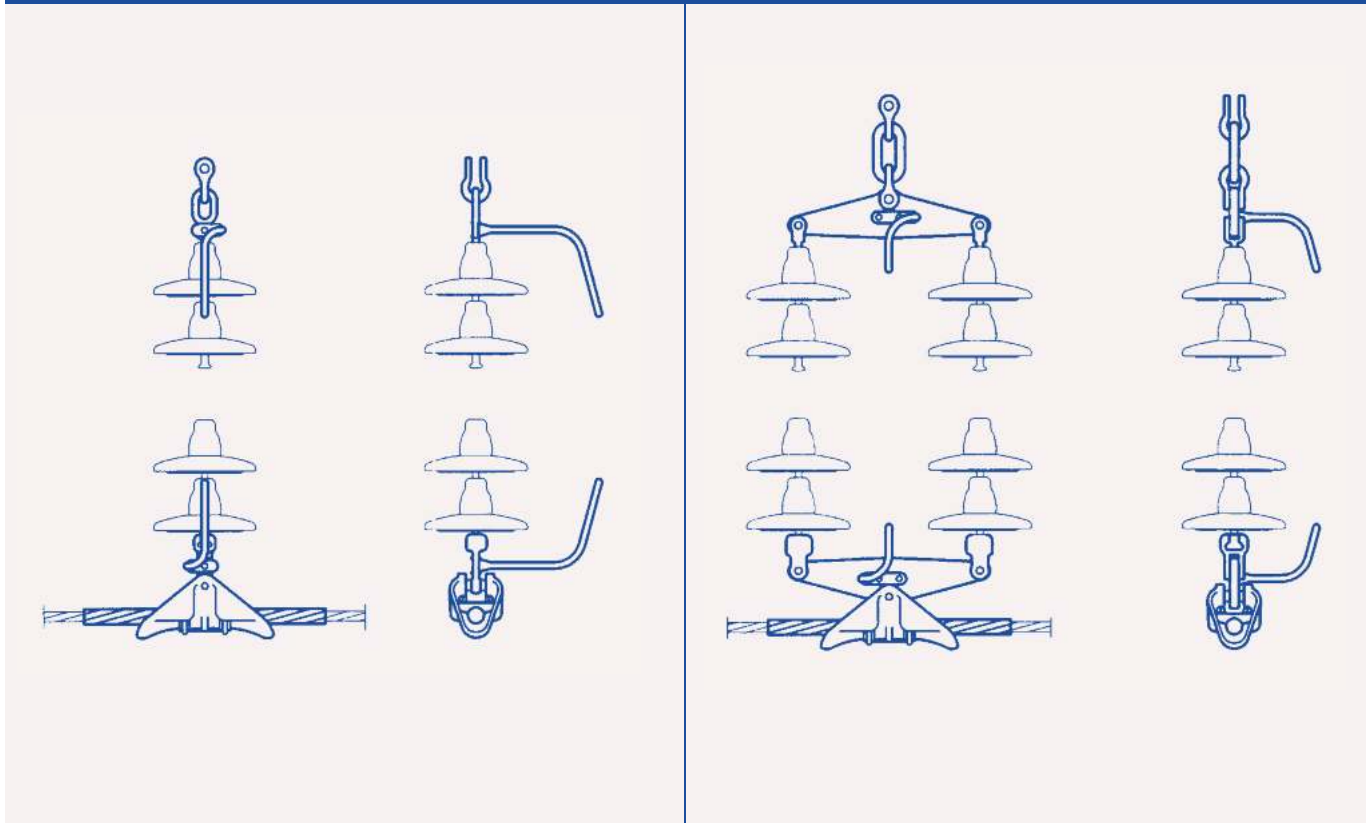
M



In this section some typical insulator assemblies have been included to show some possible configurations of single and bundle conductor insulator strings from 66kV to 500 kV transmission lines.

Salvi experience in designing EHV insulator sets, joined with its technical skill, are always made available to all customers in order to provide the right solution to each demand.

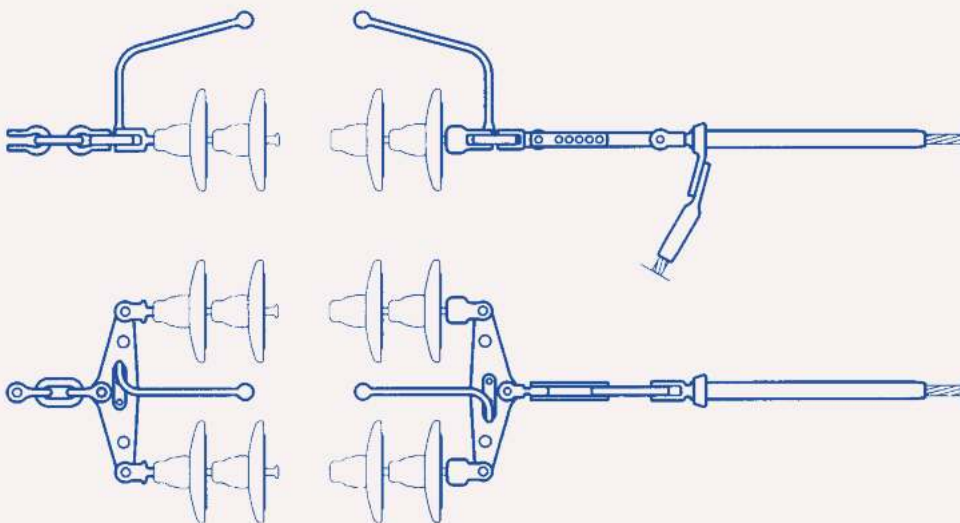
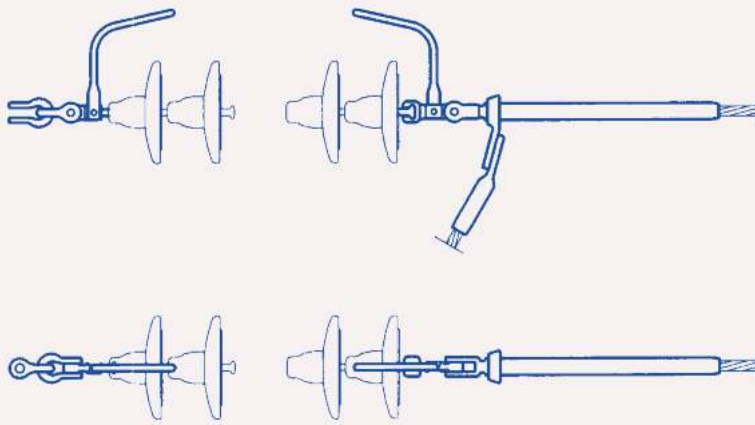
## Suspension Sets for Single Conductor



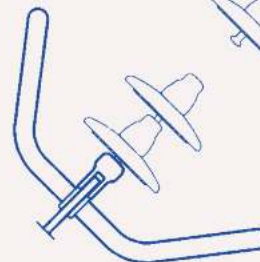
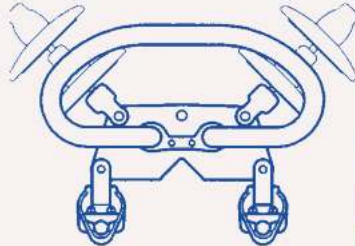
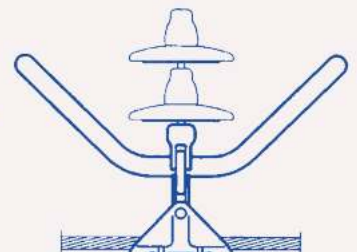
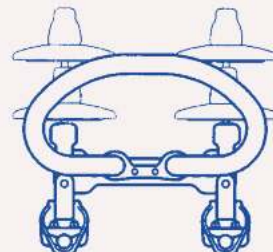
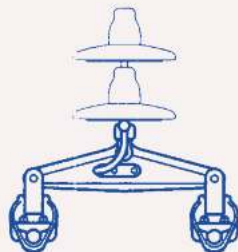
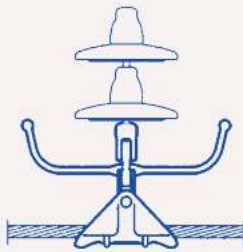
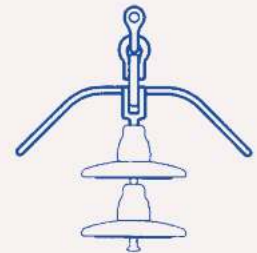
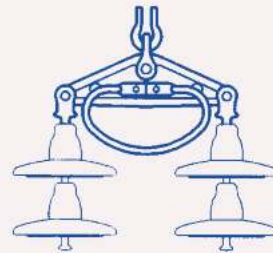


M.1

## Tension Sets for Single Conductors

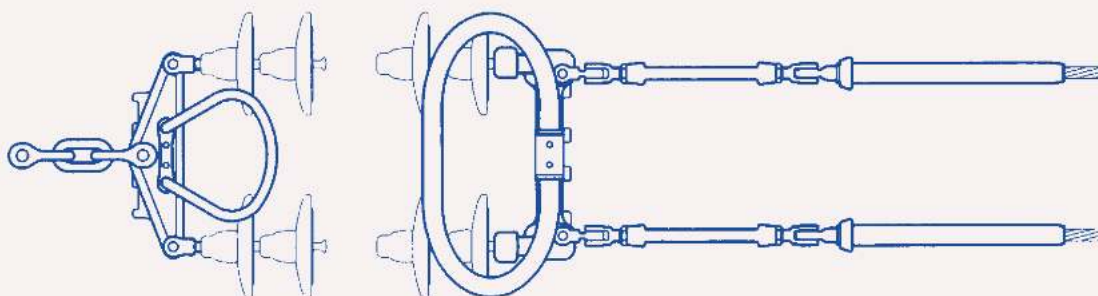
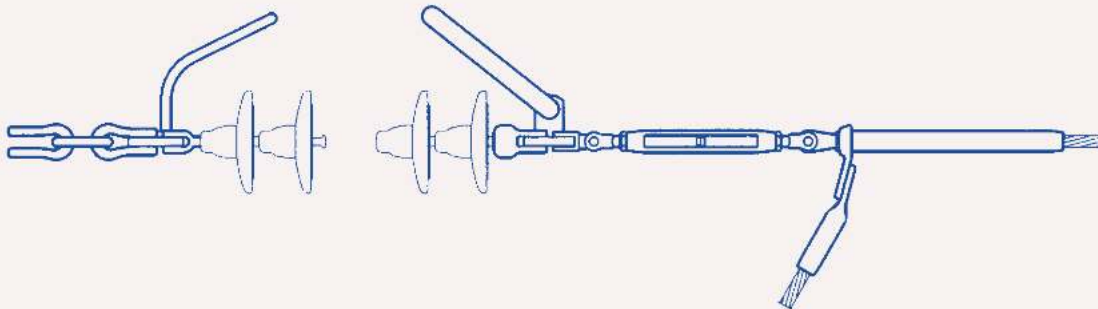
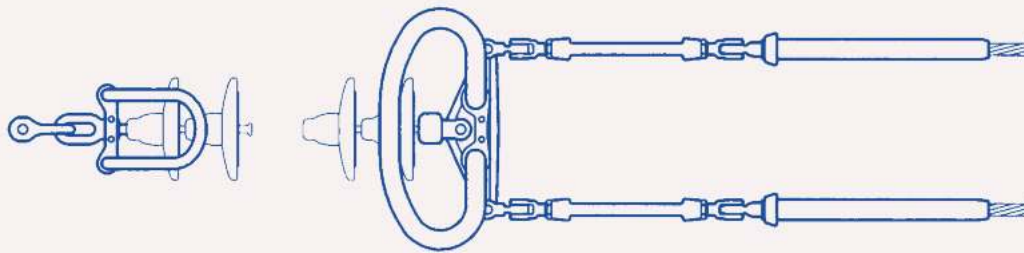
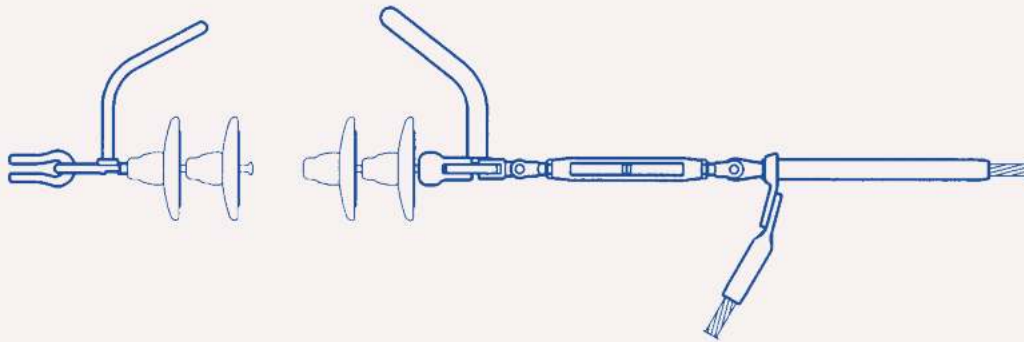


## Suspension Sets for Two Bundle Conductors

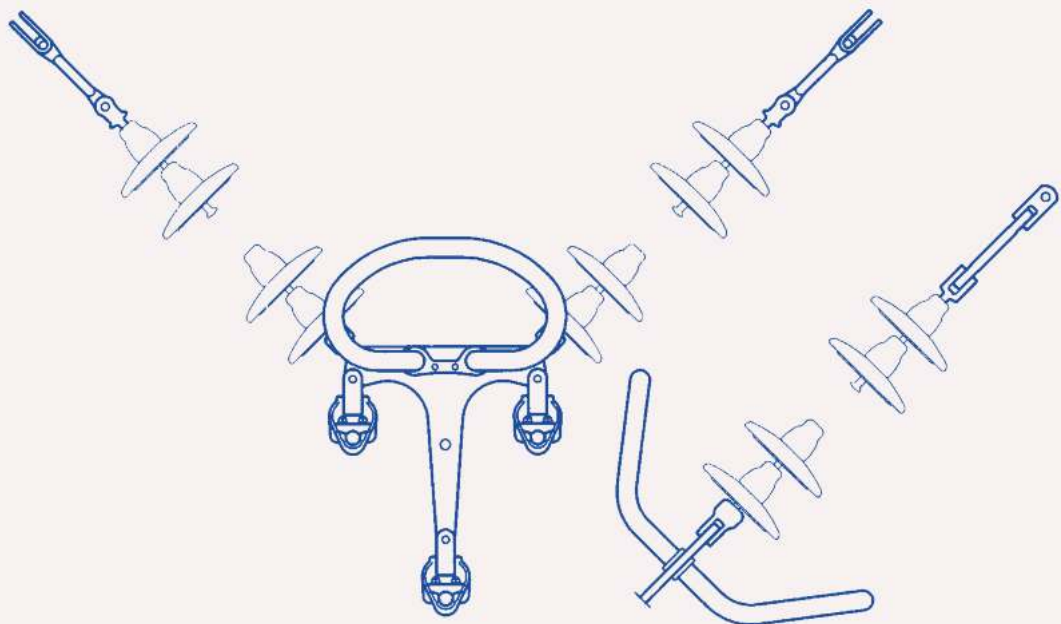
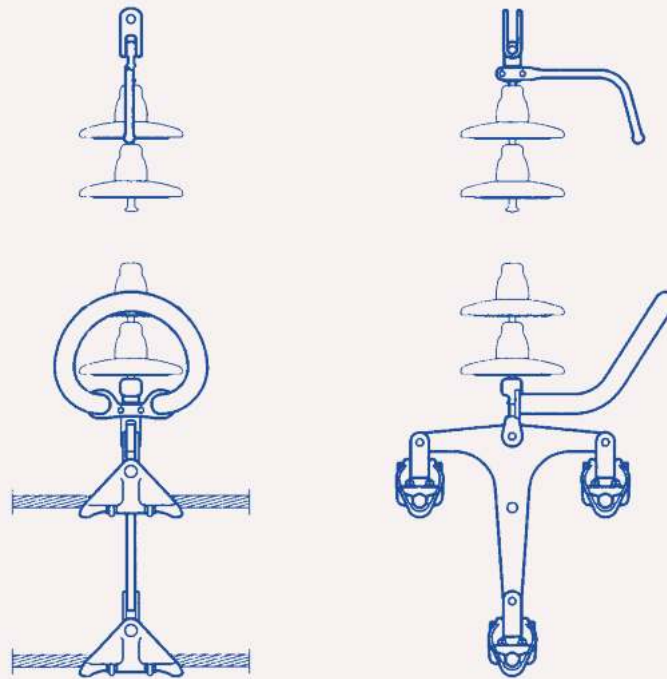




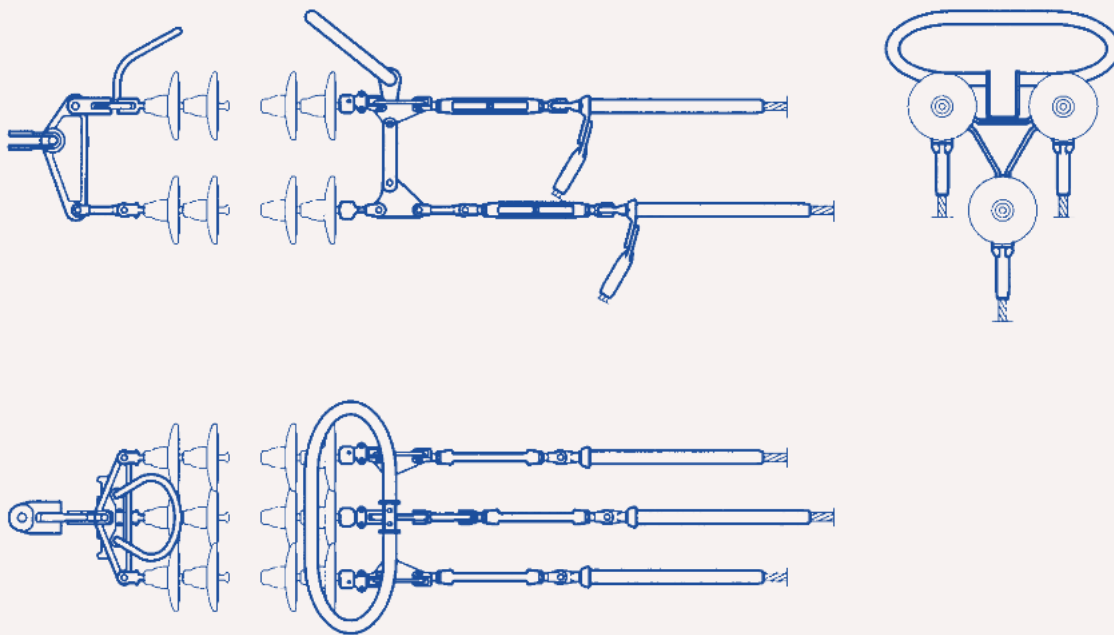
## Tension Sets for Two Bundle Conductors



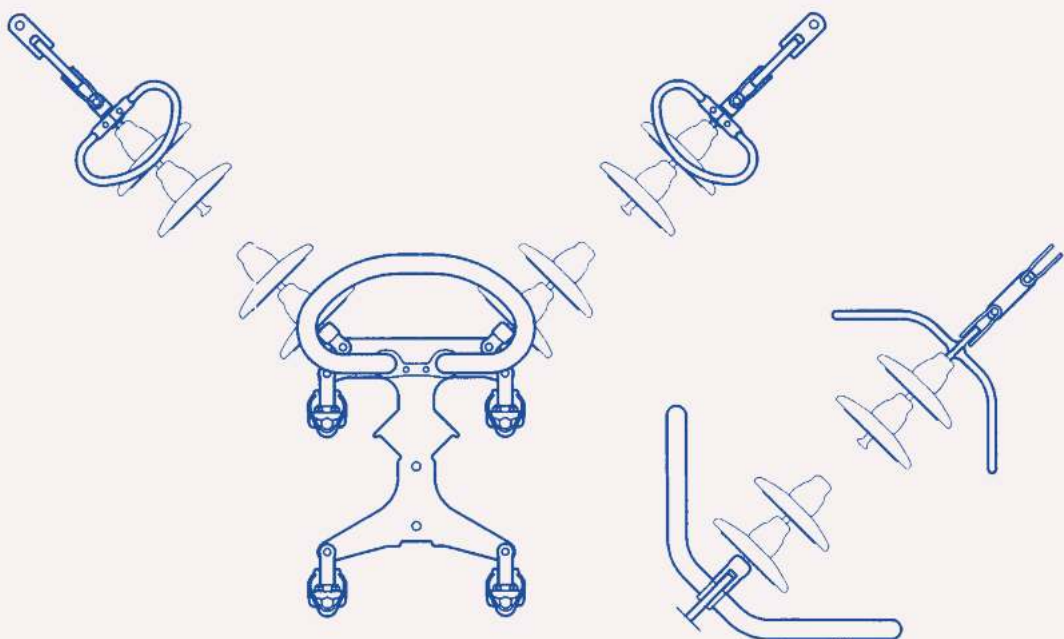
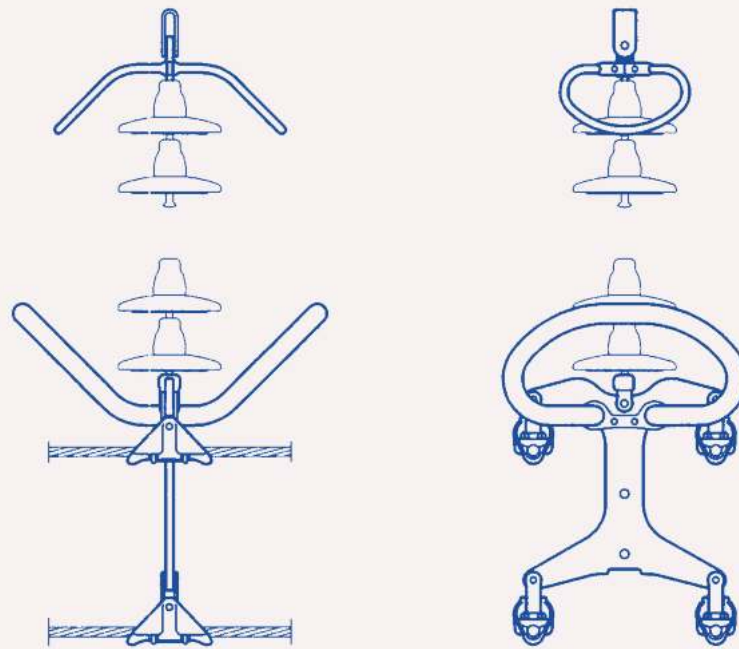
## Suspension Sets for Three Bundle Conductors



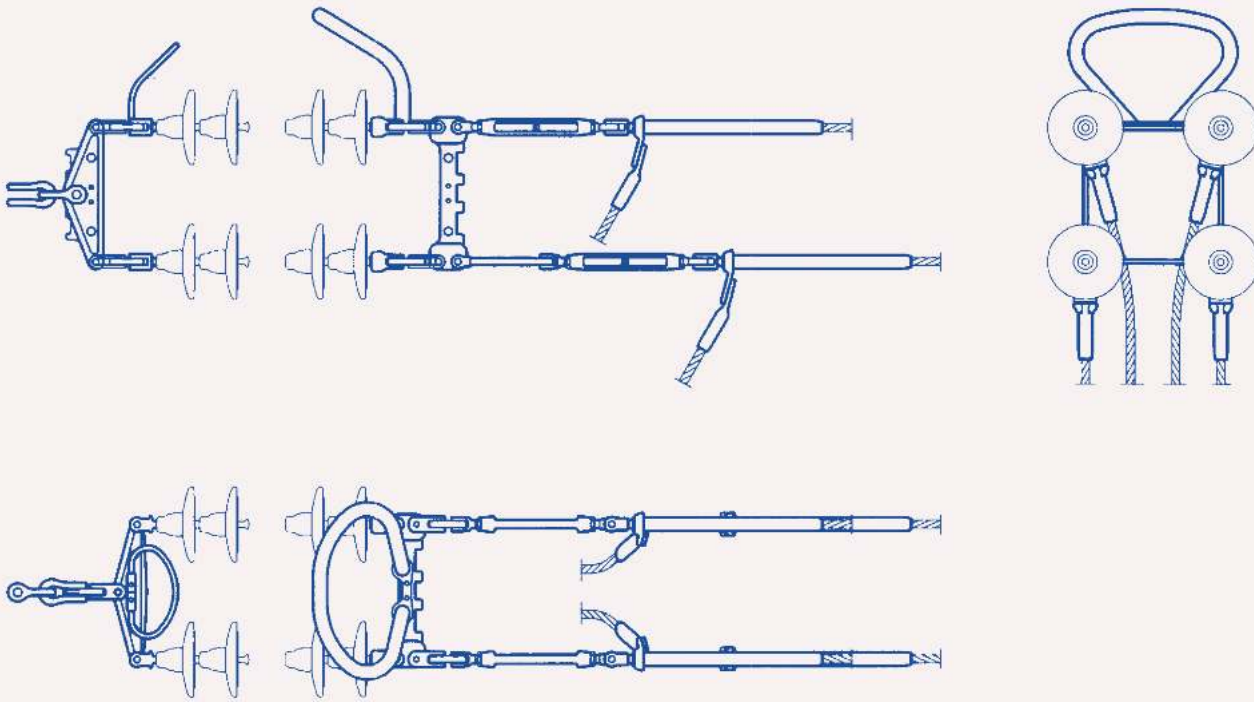
## Tension Sets for Three Bundle Conductors



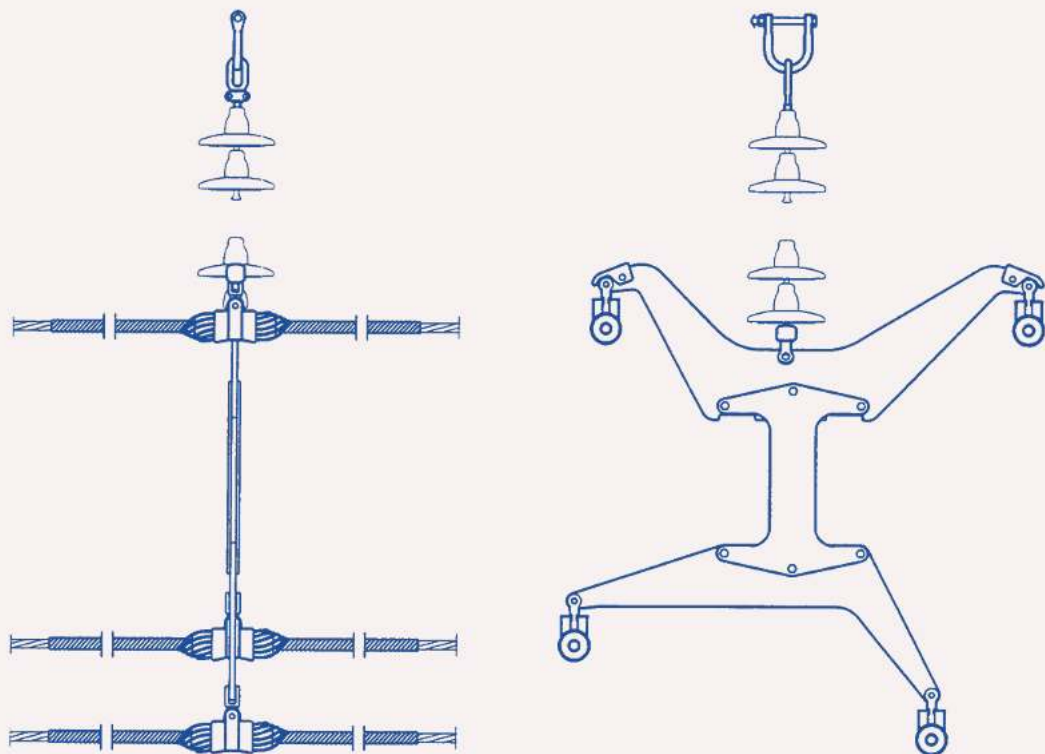
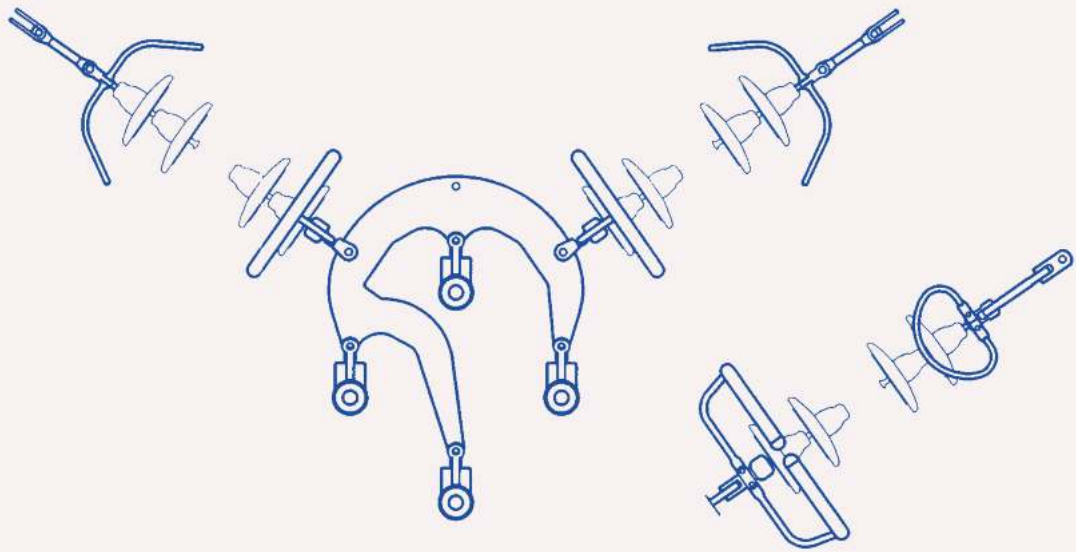
## Suspension Sets for Four Bundle Conductors



## Tension Sets for Four Bundle Conductors



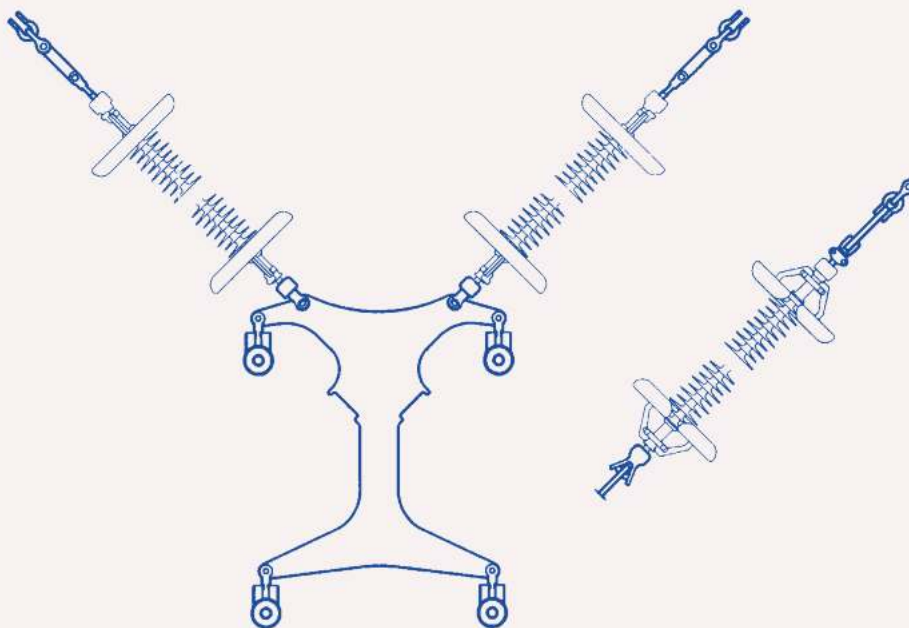
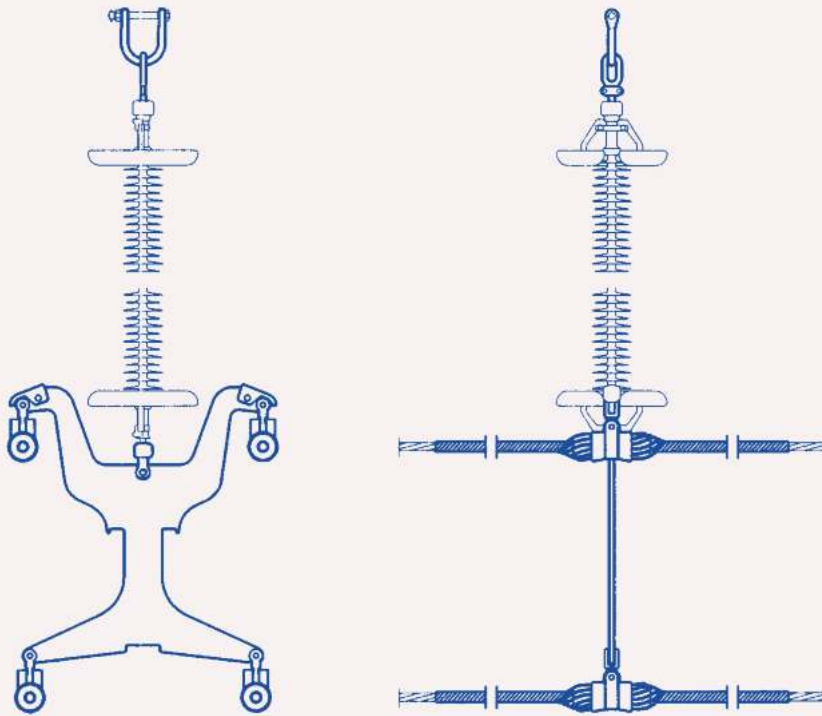
## Special Bundle Sets



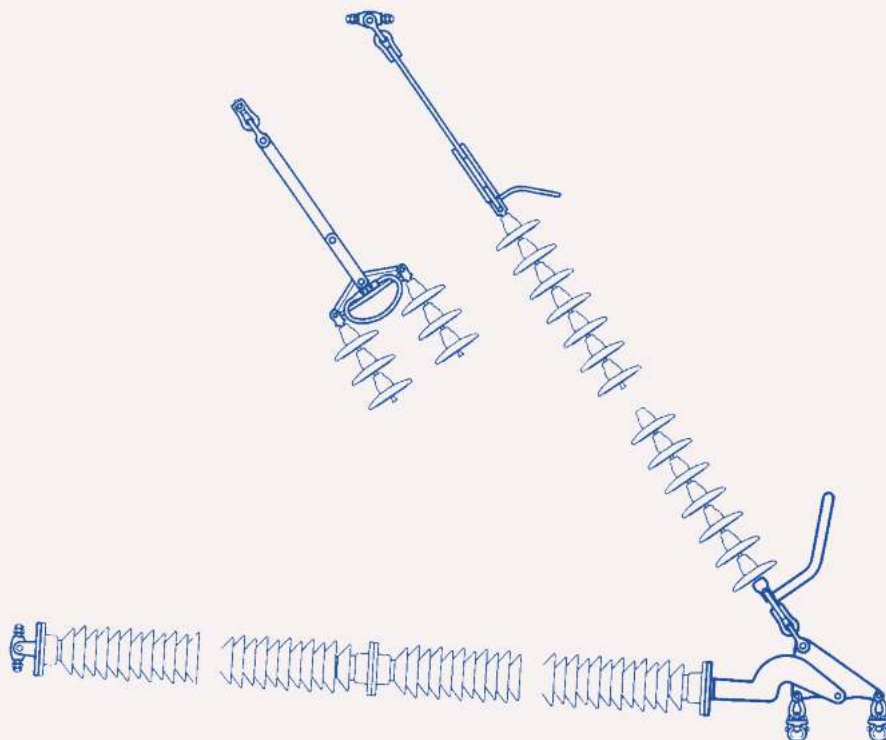
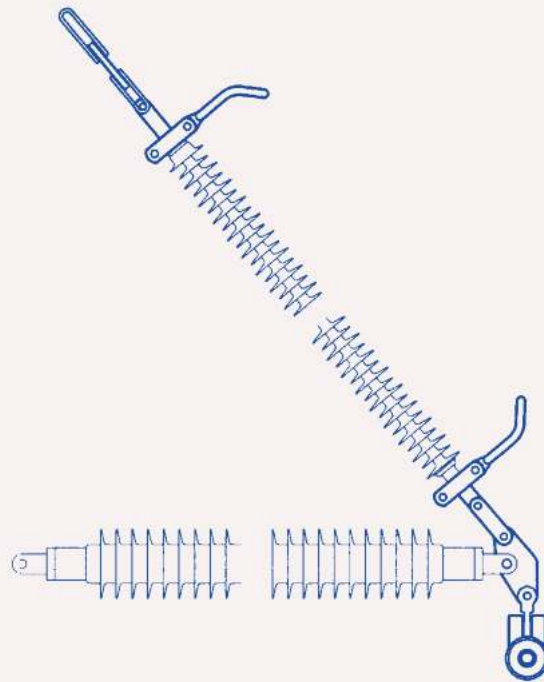


M.5

## Special Bundle Sets



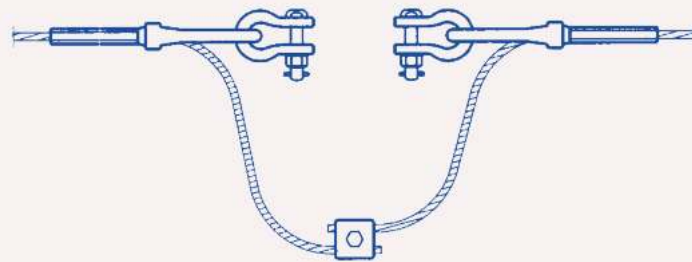
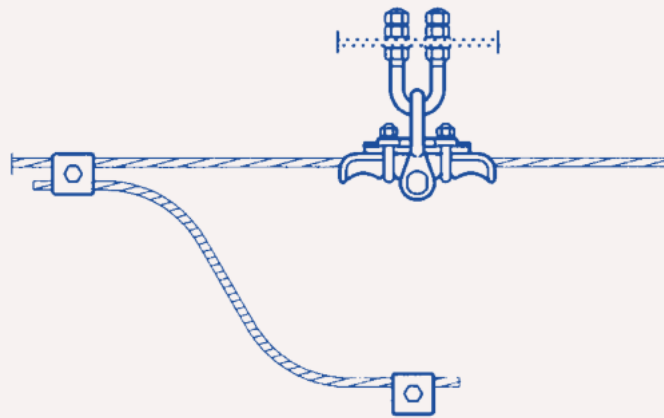
## Special Bundle Sets



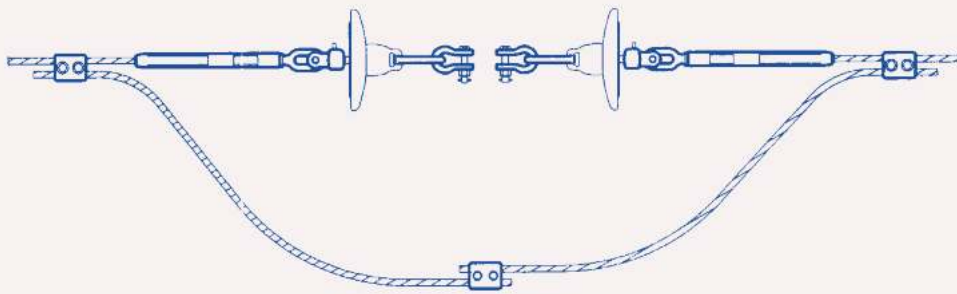
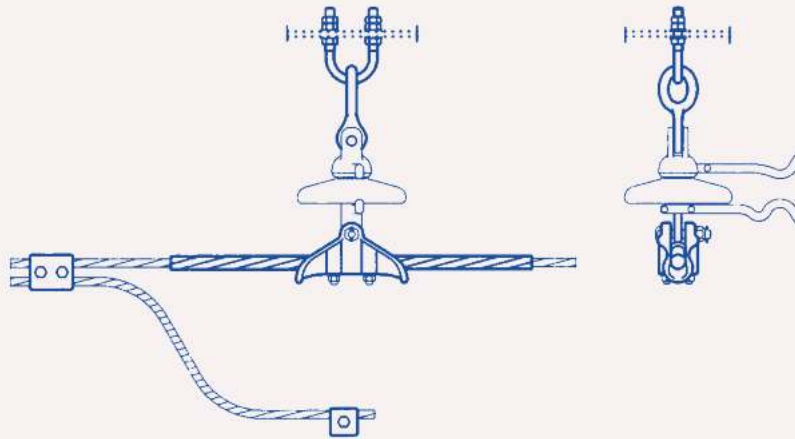




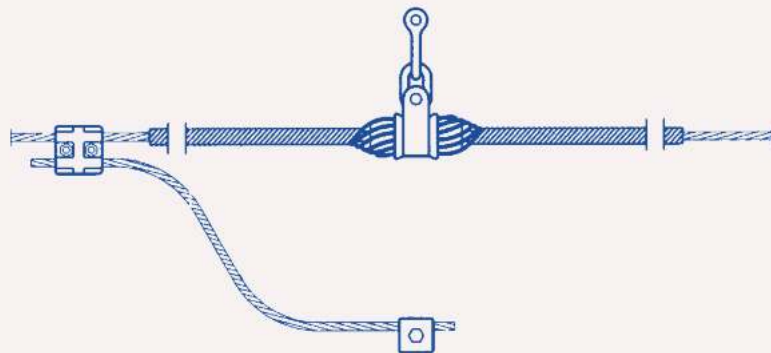
## Suspension & Tension Sets for Earthwire



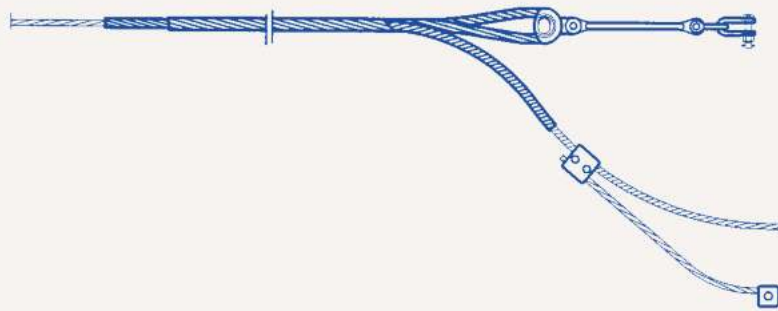
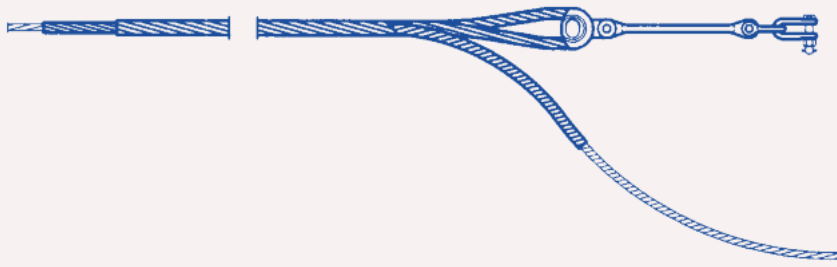
# Insulated Suspension & Tension Sets for Earthwire

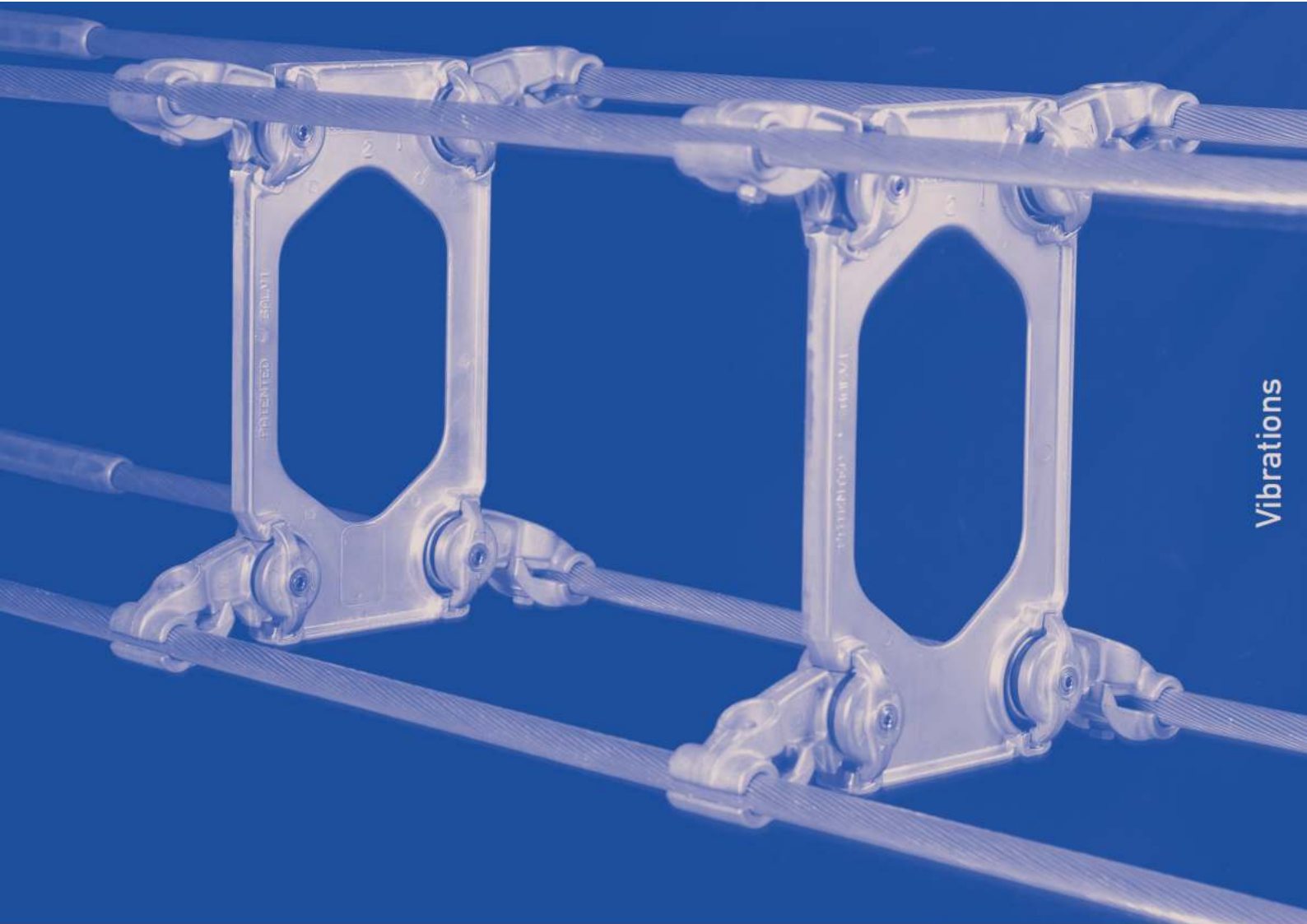


## Suspension Sets for OPGW



## Tension Sets for OPGW





Vibrations



Damping  
Phenomena  
& Damping  
Systems

## The Phenomena

The integrity of the conductors, a fundamental issue of overhead lines, must be safeguarded from damages caused by several mechanical phenomena, among which the most important are the vibrations induced by the wind: the aeolian vibrations and the subspan galloping oscillations.

The **aeolian vibrations** occur on every single cable (conductor, sub conductor or ground wire) generally at a frequency of 3 to 200 Hz and with a maximum value of vibration corresponding to the same diameter of the cable. As we are dealing with vibrations caused by vortex shedding, the phenomenon is caused by moderate winds in a range of velocity of 3 to 36 km/hour: below the lower limit, the turbulence is high and the energy introduced by the wind is limited while over the higher limit the energy dissipated by the conductor is higher than the one induced by the wind.

The phenomenon is then influenced by both the line characteristics (type of cable, cable tensile loads, cable self-damping, span length, type of suspension clamp, other devices attached to cable) and by environmental factors (ground conditions, wind direction).

The aeolian vibrations cause, as a consequence, the bending strain of the conductor: when the intensity exceeds the stress limit of the conductor, the breakage of the cable strands at the suspension clamp or at the damper/spacer clamp location is formed. The aeolian vibrations influence both single as well as bundle lines and occur generally during the whole life of the lines.

The **sub-span oscillations** occur only on bundle lines, generally at a frequency lower than 3 Hz and with an even higher amplitude of vibrations. These vibrations are caused by instability phenomenon which is produced by the upstream on the downstream conductors. The latter move on the upstream conductors introducing energy in the system and producing wide displacements. This may lead to a collision of the conductors. The instability requires average/high wind velocities (from about 20/30 km per hour to about 70/80 km per hour), with the direction of the wind limited to an angle of  $-45^\circ$  and  $+45^\circ$  relative to the direction of the transmission line.

Considering the low accumulation of strain cycles caused by the low frequency and by the rare occurrence of the phenomenon, the sub-span oscillations rarely cause the breaking of the conductor.

It can nevertheless produce wear by the clashing of the conductors and damage to the spacers, considering the amplitudes and forces involved. Besides above mentioned phenomena, loads due to ice shedding, short circuit and environmental phenomena must also be taken into consideration.

## The Damping Systems

The above described phenomena can be kept under control by using a damping system which consists of dampers or spacer dampers which maintain, for single conductor lines, the cable vibrations below acceptable limits and which guarantee, for the bundle lines, the specified spacing ensuring a suitable stiffness and damping. The choice of a damping system must be based on a careful analysis of its performance. This is decisive for the life of such an important component as the conductor.

On the other hand the complex types of phenomena to overcome exclude the fact that the supply of a damping system of a line may be interpreted as a simple supplying of accessories. In fact, it is indispensable that the analysis is specific, studied accurately and globally, starting from the design stage to the field testing on site. A new project must be conducted for every line because the performance of a damping system is tightly related to the characteristics of the line itself: in fact, the whole system, line and damping, has to undergo an evaluation.

The project must then be global so that the requirements of the client are indisputably fulfilled. Salvi works with experience and professionalism to supply, above all, a complete project rather than simply a product of high performance.

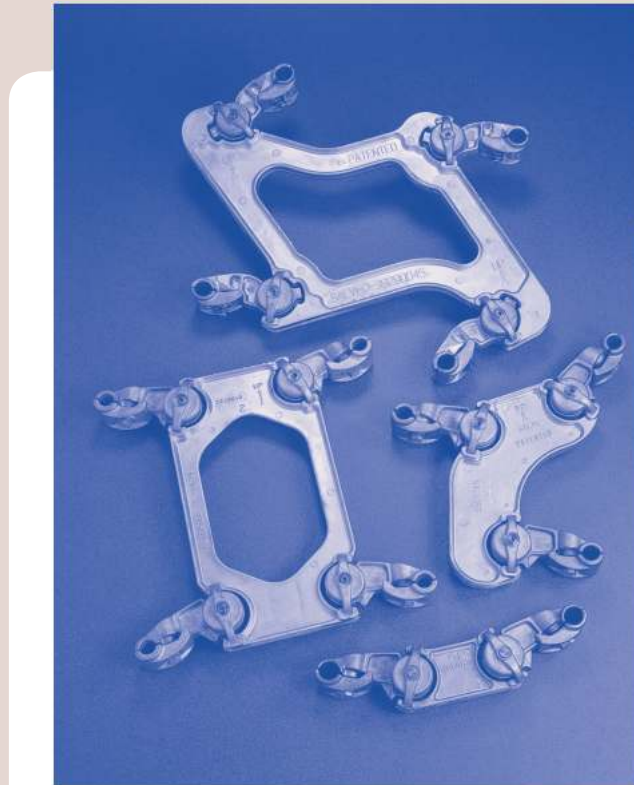
The analytical verification of the system behaviour to the aeolian vibrations and to the sub span oscillations (damping study) is made on every line, using computerized programmes, able to simulate the behaviour of the single and bundle conductor in the whole range of frequencies involved. Such programmes have been thoroughly experimented and updated with the introduction of the results of the most recent research made in this field.

The design of all the dampers and the spacer dampers, directly carried out by Salvi, has brought about the development of a range of excellent products, consolidated by experience and up to international standards. Each product is then studied to meet the specific client's requirements. Its good performance is ensured by the fact that it is entirely manufactured by Salvi and undergoes a very strict control plan.

Lastly, Salvi can carry out, on demand, every kind of experimental and field tests which are considered necessary to fulfil the specifications. All the above described actions are carried out under the supervision of our technical staff whom, apart from being highly professional, have a close and qualified cooperation with the Faculty of Engineering of the Polytechnic of Milano.







## Spacer Dampers

N

**T**he Spacer Damper is a complex product which can be described briefly by listing some of its fundamental requirements:

- maintain the spacing of the sub conductors within the prescribed geometry, in all working conditions;
- dissipate the energy introduced into the conductor thus guaranteeing low values of bending strains at the suspension and the spacer clamps;
- resist the short circuit current regaining, after the phenomenon, the spacing required;
- resist all mechanical loads caused by installation and servicing free from unacceptable level of Corona and Radio Interference.

Apart from fulfilling the above listed requirements, Salvi has achieved during the years of research and experimenting two general objectives:

- ensure product performance of a high level;
- guarantee that this performance is linked with other important factors such as reproducibility of manufacturing, durability and cost.

### **Main features of Salvi' s Spacer Dampers**

Our Spacer Dampers are designed to guarantee, in every situation, that the conductor bending strains at the suspension and the spacer clamps do not exceed even the strictest limits imposed by the client's requirements. Such result is obtained through the improvement of some parameters that are fundamental for the Spacers Dampers:

- the characteristics of the elastomer. Energy absorption and dissipation are controlled by a set of elastomeric elements having chemical and physical characteristics as well as a geometry purposely designed for our spacer dampers;
- the design of the hinge. Studied to be manufactured in a reliable and highly reproducible way
- the distribution of the masses (central frame and clamps ). Guarantees that the elastomer of the hinge is always able to function adequately;
- the inclination of the clamps. Optimized to face both aeolian vibrations and subspan oscillations.

Furthermore :

- materials have been chosen carefully according to the performance requirements and the coupling compatibility;
- every detail has been engineered to allow the required movement and resistance, with a high safety level, both for the static and the dynamic loads;
- the spacer dampers are entirely manufactured by us and the adopted productive processes permits us to ensure a high reliability and productivity;
- the quality is guaranteed by the company Quality System, ISO 9001: 2000 certificate;
- our laboratory is perfectly equipped for all kinds of tests;
- technological processes and suitable machinery assure competitive prices to all our products.

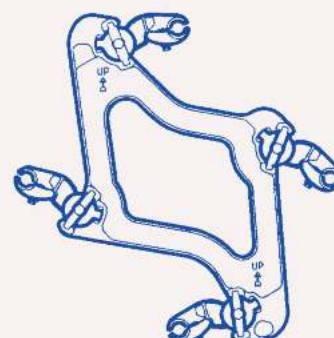
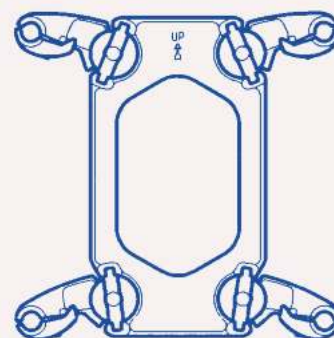
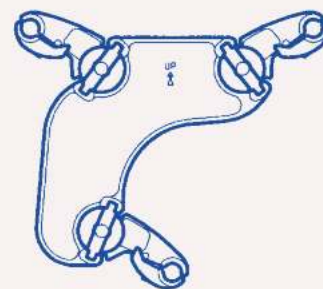
### **Production range**

All kinds of bundles (twin, three, four and diamond bundle) are included for every conductor and spacing. Our design, being of a modular type, allows to get low costs and high production volumes. In fact all the configurations are based on the same hinge design and differ on the central body only.

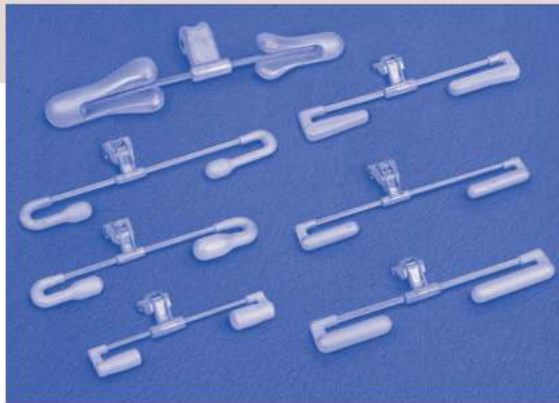
Furthermore, our spacer dampers can be personalised to satisfy specific requirements related to clamping and locking systems.

## Spacer Damper

<b>Spacer Damper type</b>	<ul style="list-style-type: none"> <li>• Single-hinge design</li> </ul>
<b>Bundle</b>	<ul style="list-style-type: none"> <li>• Two, three, four and diamond configurations</li> </ul>
<b>Conductor spacing</b>	<ul style="list-style-type: none"> <li>• 400, 450, 457, 500, 570 and 600 mm</li> <li>• Special spacing on request</li> </ul>
<b>Conductor type</b>	<ul style="list-style-type: none"> <li>• Suitable for all conductor constructions and materials</li> <li>• Clamps groove designed to accommodate all conductors in the range from 20 up to 34 mm with or without rubber liner</li> </ul>
<b>Vibration behaviour</b>	<ul style="list-style-type: none"> <li>• Analytically determined (damping study)</li> </ul>
<b>Spacing system</b>	<ul style="list-style-type: none"> <li>• Non uniform, based on computer analysis and experience</li> </ul>
<b>Damping mechanism</b>	<ul style="list-style-type: none"> <li>• Elastomeric</li> </ul>
<b>Type of conductor clamp</b>	<ul style="list-style-type: none"> <li>• Cantilever bolted type clamp</li> <li>• Hinge type</li> </ul>
<b>Bolts</b>	<ul style="list-style-type: none"> <li>• Galvanized steel</li> <li>• Stainless steel</li> <li>• Break Away</li> </ul>
<b>Means of energy retention</b>	<ul style="list-style-type: none"> <li>• Belleville</li> <li>• Spring Washers</li> </ul>
<b>Control Plan</b>	<ul style="list-style-type: none"> <li>• ND tests</li> <li>• Corrosion protection tests</li> <li>• Clamp slip tests</li> <li>• Bolt tightening tests</li> <li>• Simulated short-circuit test</li> <li>• Characterization of elastic and damping properties</li> <li>• Flexibility tests</li> <li>• Fatigue tests</li> <li>• Elastomers characterization</li> <li>• Corona &amp; RIV test.</li> </ul>
<b>Field tests</b>	<ul style="list-style-type: none"> <li>• Achievable with our own devices</li> </ul>







## Vibration Dampers

0

**T**he vibration damper is the most widely used system for limiting the aeolian vibrations of overhead cables. A damper is basically a dissipating machine which transforms the kinetic energy of the vibrating cable into heat in the messenger cable, the heat caused by inter-strand friction of the messenger cable strands.

It would therefore seem that we are dealing with a very simple product: on the contrary a damper (or a system of dampers) is effective only when it responds to the solicitation of the wind in terms of the following three factors: intensity, phase and frequency. Should the opposite take place, its application may be not only unsatisfactory but harmful.

### **Main features of Salvi' s Vibration Dampers**

Over the years, Salvi has set up accurate calculating programmes and experimental testing methods that allow the design and the carrying out of complex and complete projects. Our dampers cannot be simply defined as products that have a cable and two masses. Every damper works like a system with four resonance frequencies, in which the damper, the two different masses and the two different lengths of the messenger cable are the result of an accurate design with the purpose of supplying the damping required for every possible frequency that occurs in the phenomena range.

Such result is obtained through the improvement of some parameters that are fundamental for the vibration dampers :

- characteristic of the messenger cable. Our messenger cables are not simple cables commonly traceable on the market. They are cable suitably designed and manufactured to obtain the highest hysteretical characteristic. The two different lengths of the messenger cable are accurately defined to obtain a 4 resonance system;
- design of weights. Mass and moment of inertia of the weights are such that best dynamic performances are always guaranteed. Moreover the relevant shape is designed to assure that RIV and Corona levels are kept within acceptable limits;
- clamps design. The alluminum alloy clamps have sufficient width to prevent conductor damages and the tightening is sufficient to avoid the slipping of the conductor

Furthermore:

- our actual line of products foresees forged hot dip galvanised counterweights crimped on the messenger cable. Vibration dampers with zamak counterweights can be supplied on request;
- the strands of the messenger cable are galvanised. Stainless steel messenger cables can be supplied on request;
- the vibration dampers are entirely manufactured by us and the adopted productive processes permits us to ensure a high reliability and productivity;
- the quality is guaranteed by the company Quality System, ISO 9001: 2001 certificate;
- our laboratory is perfectly equipped for all kinds of tests;
- technological processes and suitable machinery assure competitive prices to all our products.

## **Performances**

Several times the maximum limit of the vibrations amplitude (safe limit below which fatigue is not likely to occur) is specifically required by Customer's Specifications. However Salvi has decided to use always in its damping studies the safest limit defined by International Standards and/or International common practice:

- $\pm 75$  microstrains for aluminium and aluminium alloy strands
- $\pm 150$  microstrains for steel strands.

This avoids the risk that high amplitudes could cause sooner or later fatigue failure on the strands.

## **Production range**

Our design being of a modular type, allows to obtain low costs, high production levels and mainly to realise several types of dampers suitable for each specific need. In fact our production range includes about 20 different types of dampers that can be grouped in two main families:

### **Phase Conductor Vibration Dampers**

They could be diversified for:

- Dynamic performance
- Diameter and tension of the conductor
- Voltage of the line

### **Earthwire Vibration Dampers**

They could be diversified for:

- Dynamic performance
- Type of cable (OPGW / standard earth wire)
- Diameter and tension of the cable

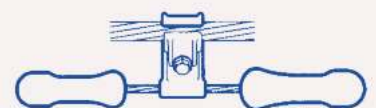
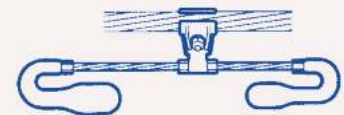
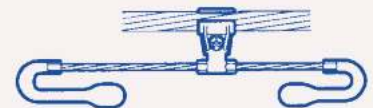
Furthermore, our vibration dampers can be personalised to satisfy specific requirements related to locking systems.



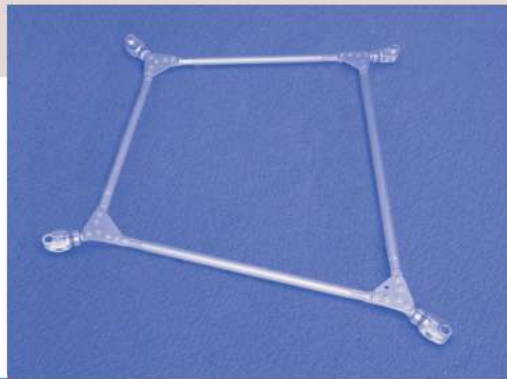


## Vibration Damper

<b>Vibration Damper type</b>	<ul style="list-style-type: none"> <li>• Four resonances</li> </ul>
<b>Conductor type</b>	<ul style="list-style-type: none"> <li>• Suitable for all conductor/earthwire/O'PGW constructions and materials</li> <li>• Clamps seat designed to accomodate all conductors in the range from 7 up to 56 mm</li> </ul>
<b>Vibration behaviour</b>	<ul style="list-style-type: none"> <li>• Analytically determined (damping study)</li> </ul>
<b>Location on the cable</b>	<ul style="list-style-type: none"> <li>• Based on computer analysis and experience</li> </ul>
<b>Damping mechanism</b>	<ul style="list-style-type: none"> <li>• Messenger cable</li> </ul>
<b>Type of clamp</b>	<ul style="list-style-type: none"> <li>• Bolted type clamp</li> </ul>
<b>Bolts</b>	<ul style="list-style-type: none"> <li>• Galvanized steel</li> <li>• Stainless steel</li> <li>• Break Away</li> </ul>
<b>Means of energy retention</b>	<ul style="list-style-type: none"> <li>• Belleville</li> <li>• Spring Washers</li> </ul>
<b>Control Plan</b>	<ul style="list-style-type: none"> <li>• ND tests</li> <li>• Corrosion protection tests</li> <li>• Clamp slip tests</li> <li>• Bolt tightening tests</li> <li>• Clamp and mass attachment verification</li> <li>• Characterization of damping properties</li> <li>• Fatigue tests</li> <li>• Corona &amp; RIV test</li> </ul>
<b>Field tests</b>	<ul style="list-style-type: none"> <li>• Achievable with our own devices</li> </ul>

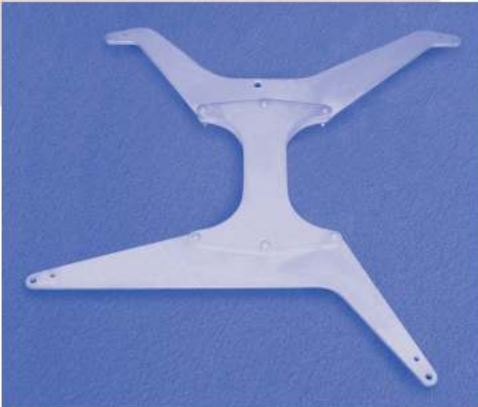






Expanded  
Bundle T/L  
Products

P



**T**echnology of High Surge Impedance Loading Line (HSIL) was originated in Russia and from 1992 it has been operationally developed in Brasil where it is known as Linhas de Transmissao com Potencia Natural Elevada (LPNE).

All the overhead bundle power lines are affected by the same problem: energised phase conductors generate electrical fields that produce undesired effects during power transmission. The principle on which a HSIL line consists basically in the re-positioning of sub-conductors of the same phase so that interference among themselves is considerably reduced. The effects of the electric field are practically minimised by positioning each sub-conductor in an asymmetric and appropriate configuration.

This technology offers several advantages:

- increase of natural power (nominal value at generation point) of the line and consequently increase of the power transmission capacity;
- remarkable reduction of voltage losses that consents to reduce the compensation equipments in the substations;
- economical optimisation of line design. Against a moderate increase of construction cost, considerable increases of power transmission capacity can be achieved and a final cost of a MW/Km is always lower than same cost in a traditional line configuration.

In Brasil a very simple technique called “Expanded Bundle” (or LPNE-FEX) has been developed, that consist in increasing the distance between sub-conductors obtaining a spacing of 1,000 – 1,400 mm symmetric or asymmetric. This technique allows to carry out more simple studies and tests than LPNE and consequently it is less expensive.

“Expanded Bundle” system offers the advantage that standard tower types can be used and therefore this technology can be employed in new projects as well as on re-furbishing of existing lines.

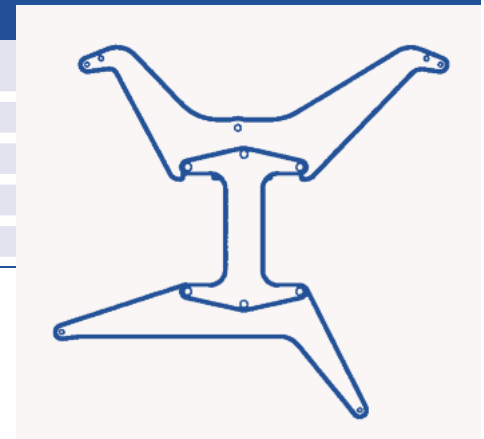
Development of design of expanded bundle lines in Brasil was limited at the beginning by the necessity to solve some problems relevant to insulators strings and to damping system:

- design of hardware suitable for quad bundle spacing much higher than traditional one (400/457 mm or 600 mm maximum) and sometimes with asymmetric configuration;
- study of dynamic behaviour of the line;
- design of spacers adequate to this particular need for both geometry and performances.

Salvi has actively participated to the development of all the brasilian projects executed starting since 1996.

## Spacing Yoke

<b>Insulator set type</b>	<b>Single "I" suspension set</b>
<b>Hot line maintenance</b>	<b>According to customer requirements</b>
<b>Bundle conductors type</b>	<b>Four "Expanded" bundle conductors</b>
<b>Material</b>	<b>Galvanized cut flame steel</b>
<b>Note</b>	<b>Integral o bolted type - Spacings to design</b>



Design of hardware for expanded bundle has many complex aspects. More significant topics regard:

- verification of electrical behaviour of the insulator strings;
- implementation of the design of a Spacing Yoke where the four suspension clamps of the insulator string must be fixed.

As far as the electrical characteristics are concerned, all the tests directed by International Standards and Brazilian Standards as well, have been conducted in laboratory with satisfactory results.

For the Spacing Yoke Salvi has developed a particular solution that:

- guarantees the mechanical loads and the necessary longitudinal rigidity;
- avoids the use of steel sections assembly;
- avoids welded connections;

Our solution could be integral (single piece) or bolted depending upon the conductor spacing required.

## Expanded Bundle Damping System.

A dynamic analysis suitable to reproduce the behaviour of an expanded bundle represents a new and different problem with respect to that relevant to the traditional bundles.

As a matter of fact for the standard bundles the sub-span motions are characterised by a flutter type instability phenomenon that can be approached taking into account a constant wind. In fact the relative motions between the subspan conductors due to turbulence are small: the turbulence effects can be neglected.

On the contrary on expanded bundle the turbulence induced motions becomes important due to much more longer subspans. The conductor motion due to turbulence could excite relative motions among the conductors at a frequency lower than in standard bundle and the spacing could be reduced (clashing risk).

Consequently a new mathematical model has been set up, in co-operation with Politechnic of Milano, and a new software for the calculation of expanded bundle has been developed in order to simulate the dynamic behaviour of the bundle and to define the number and the position of the spacer dampers needed along a span to avoid unstable bundle motions with high amplitude of vibrations of sub-conductors.

A traditional simulation of the dynamic behaviour of the expanded bundle to the aeolian vibrations shall also be done to optimise number and position of the vibration dampers.

In conclusion a damping system for quad expanded bundle lines is formed by:

- **flexible spacer dampers.** Spacers are designed to be flexible with respect to the aeolian vibrations. This means that spacer dampers do not alter the aeolian vibrations behaviour and they do not require any vibration dampers in their vicinity since such vibrations are controlled by the dampers installed close to the insulator strings. Quantity and positioning of flexible spacer dampers is such that contact between sub-conductors is absolutely avoided;
- **vibration dampers.** They are of traditional type, treated according to the usual standards.

## Flexible Spacer Damper

<b>Spacer type</b>	<ul style="list-style-type: none"> <li>• Bundle flexible design</li> </ul>	
<b>Bundle</b>	<ul style="list-style-type: none"> <li>• Four expanded symmetric or asymmetric</li> </ul>	
<b>Conductor spacing</b>	<ul style="list-style-type: none"> <li>• 800, 1.100, 1.200 mm symmetric</li> <li>• 900, 1.500 mm asymmetric</li> <li>• Special spacing on request</li> </ul>	
<b>Conductor type</b>	<ul style="list-style-type: none"> <li>• Suitable for all conductor constructions and materials</li> <li>• Clamps groove designed to accommodate all conductors in the range from 22 up to 34 mm</li> </ul>	
<b>Vibration behaviour</b>	<ul style="list-style-type: none"> <li>• Analytically determined (damping study)</li> </ul>	
<b>Spacing system</b>	<ul style="list-style-type: none"> <li>• Non uniform, based on computer analysis and experience</li> </ul>	
<b>Damping mechanism</b>	<ul style="list-style-type: none"> <li>• Elastomeric</li> </ul>	
<b>Type of conductor clamp</b>	<ul style="list-style-type: none"> <li>• Bolted type clamp</li> </ul>	
<b>Bolts</b>	<ul style="list-style-type: none"> <li>• Galvanized steel</li> <li>• Stainless steel</li> <li>• Break Away</li> </ul>	
<b>Means of energy retention</b>	<ul style="list-style-type: none"> <li>• Belleville</li> <li>• Spring Washers</li> </ul>	
<b>Control Plan</b>	<ul style="list-style-type: none"> <li>• ND tests</li> <li>• Corrosion protection tests</li> <li>• Clamp slip tests</li> <li>• Bolt tightening tests</li> <li>• Simulated short-circuit test</li> <li>• Characterization of elastic and damping properties</li> <li>• Flexibility tests</li> <li>• Fatigue tests</li> <li>• Elastomers characterization</li> <li>• Corona &amp; RIV test</li> </ul>	
<b>Field tests</b>	<ul style="list-style-type: none"> <li>• Achievable with our own devices</li> </ul>	







T/L  
Accessories

Q



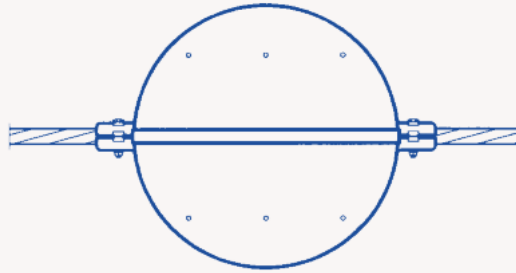
Ⓐ All the accessories included in this section, particularly warning lights and spheres, are installed onto the cable (phase conductor or earthwire) altering considerably the vibration behaviour of the span involved.

Damping study carried out for a “standard” average span can not be applied to spans equipped with these devices and a separate study shall be executed in order to get the right situation for each case.

In fact in most cases additional vibration dampers must be installed near to each device.

Salvi has the resources and the necessary experience to perform these studies and consequently to supply, as usual, a complete analysis of various phenomena and not only the simple products.

## Spherical Day Marker



Spheres can be fitted onto phase conductors or onto any kind of earthwires.

The structure material is coloured ABS which offers an excellent ageing.

Bolts, nuts and washers are of stainless steel.

Our standard consists of two sizes ( $\varnothing$  500 and  $\varnothing$  610 mm) and three colours (Red, Orange and White) or any combination of two of these colours. Draining holes are foreseen.

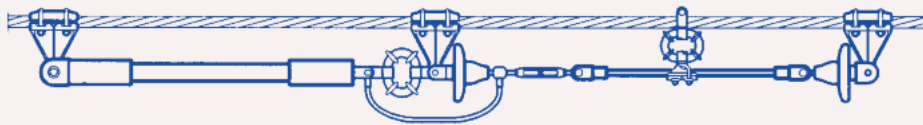
Particular arrangements could also be satisfied upon request:

- different sizes and colours;
- protective rods to be installed between conductor and sphere attachment clamp.



Q.2

## Night Warning Light



Warning Lights are suitable for T/L with a nominal voltage from 30kV to 500kV.

The neon lamp tube characteristics are in accordance with International Civil Aviation Organisation (ICAO) Standards, Annex 14:

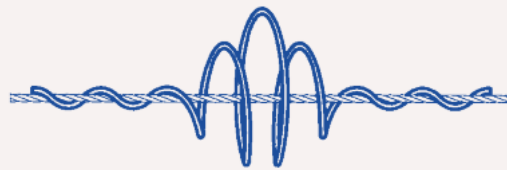
- light colour: aviation orange
- luminous brilliancy: over 10 candelas

The rated lifes are:

- lamp: about 100,000 hours
- complete device: about 10 years

The Radio Interference Level is  $< \mu$  2500

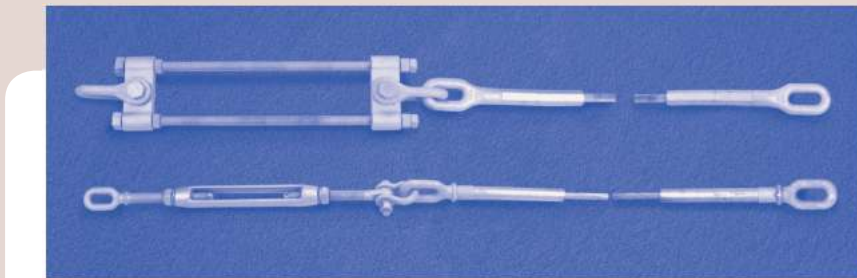
## Bird Flight Diverter



The Diverter is designed to warn birds against overhead transmission line cables by increasing the visibility of the line and consequently preventing birds from scratching.

Diverter are made of polymeric core with some spirals at both ends to grip onto the cable and some larger spirals in the middle. They are available in Red or White colour.





Guy Tower  
Accessories

R



**M**ore than 80 years of experience in design and manufacture of products for high voltage T/L has allowed us to finalise a series of components to be used in the construction of Guy Towers for power lines with latticed steel crossarm or with cross rope.

In this section some of these accessories are briefly described: the range of different supporting structures is in fact so wide to enable us to include a full and detailed description. However Salvi is capable to design and manufacture all the components necessary for each type of project needed.

This section is divided in two parts :

- accessories for connection of the two poles in the “cross rope” arrangement;
- accessories for anchoring to ground all types of guy towers and any other type of structure.

### **Cross rope guy towers accessories**

They are mainly constituted by :

- accessories for anchoring the ropes (cross and spacer) to the pole. Each end is formed by an eye terminal and by a hanging shackle, if required. The eye terminal is made by hot dip galvanised forged steel. Due to the performances required and the high loads involved, the quality of the product (design, raw materials and manufacturing) is mandatory;
- accessories for attaching the insulator strings to the cross rope. The shape is similar to conductor suspension clamps installed twisted by 180° but the design is quite specific due to the different use. The material is hot dip galvanised forged steel due to the high loads.

### **Compressed anchor devices**

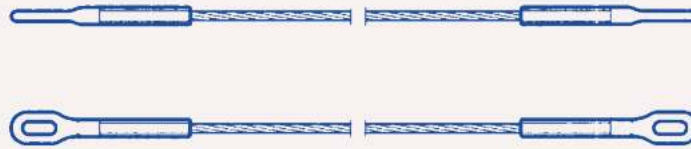
This kind of devices are designed for use on Guy Towers, Antennas, Communications and other types of Guyed Structures.

Our experience in design of hardware for T/L has led to a realisation of Anchor Devices with very specific technical characteristic and very high mechanical performances.

We have developed an innovative design that utilises the compression technique to connect tower and cable to the ground providing several advantages to its user:

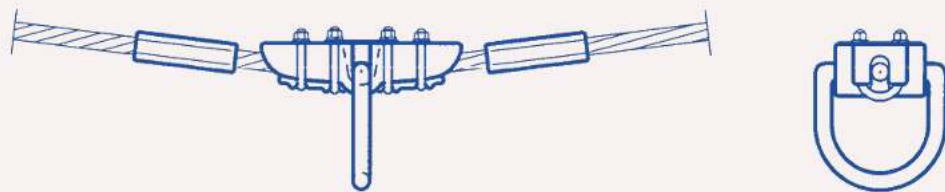
- compression gripping principle more effective than simple surface friction (used in preformed solution). In fact it allows to install this type of anchor devices for loads from 20 up to 65 ton;
- ample possibility of suitable setting due to the use of adjustable components with wide range of employment and more precision than normally used U-Bolt;
- fast assembly timing;
- flexibility. The same element can be used for different diameter/stranding cables while preformed devices need a specific sizing for each cable diameter and formation);
- possibility to operate in the yard or at site;
- short supply time.

## Rope Eye Terminal



Material: hot dip galvanized forged steel

## Inverted Suspension Clamp

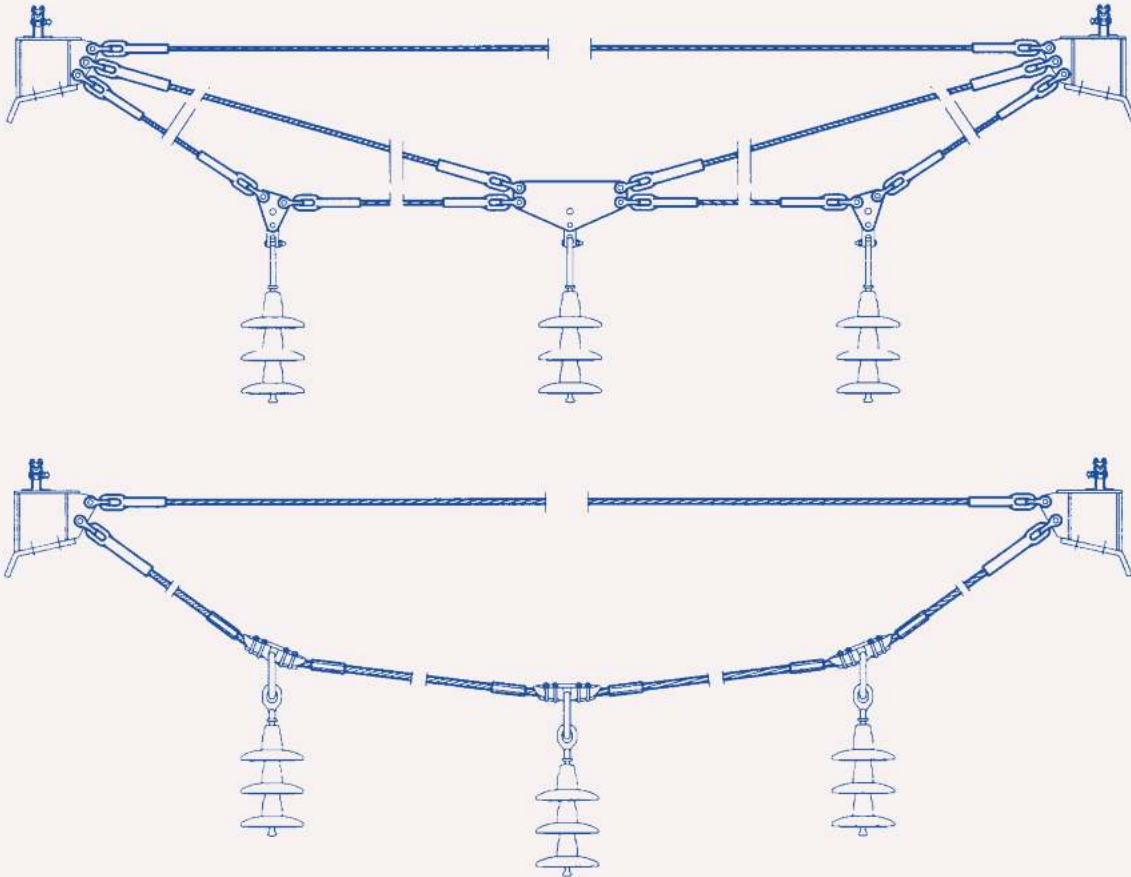


Material: hot dip galvanized forged steel



R.1

## Suspension Rope String Attachment

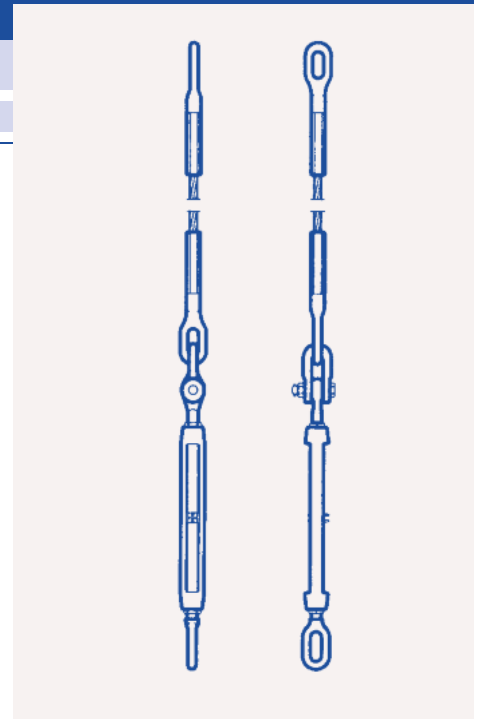


Typical configurations of Suspension Assemblies on Cross Rope Guy Tower.

## Compressed Anchor Device

Code	Strenght rating kg	Adjust. mm	Strand size		Note
			from	to	
025-9-10	10.000	152	13	16	
025-8-10	20.000	152	15	18,5	

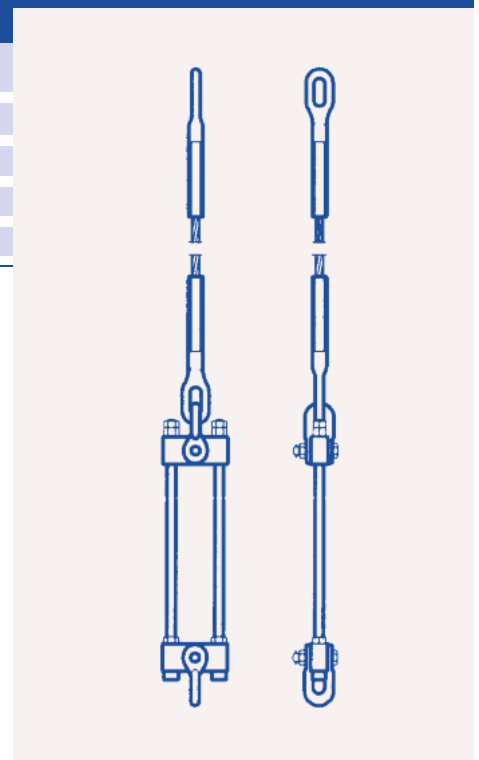
Material: hot dip galvanized forged steel



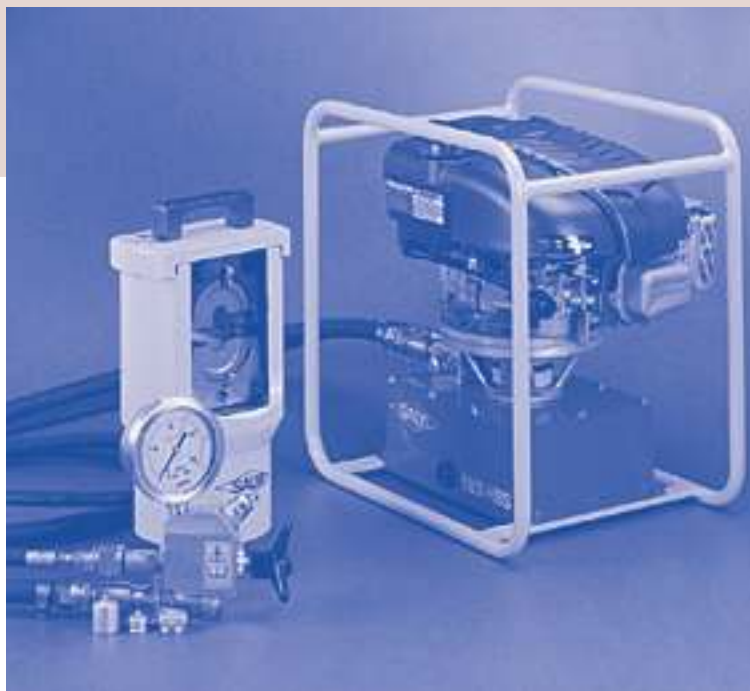
## Compressed Anchor Device

Code	Strenght rating kg	Adjust. mm	Strand size		Note
			from	to	
025-6-30	30.000	300	18,5	21,5	
025-5-40	40.000	400	21,5	25	
025-3-50	50.000	600	20,5	22,5	
025-4-55	55.000	600	20,5	22,5	
025-2-65	65.000	600	24	26	

Material: hot dip galvanized forged steel







Hydraulic  
Presses

S

**S**alvi has been manufacturing compression jointing equipment since 1950. The company's largest range of products is the result of specific re-designing to meet growing user requirements in terms of flexibility, practicality of use and transportability. In line with the 59 series, the latest generation products include all technical features of the entire previous range, in two presses: type 59M (70 ton capacity) and 59R (100 ton capacity). This arrangement offers a considerable advantage to users in terms of procurement and management of equipment and spares, while maintaining full interchangeability with previous models.

The presses can be supplied in three configurations:

- with power driven pump: hydraulic pump, electric motor or gasoline engine, regulator and connecting hoses with quick couplers;
- with manual pump: lever-operated hydraulic pump, pressure-gauge and hose with quick couplers;
- press only: without accessories.

The power-driven sets are fitted with control valves designed and manufactured exclusively by Salvi. The pumps are physically separate from the press units, and are connected via flexible pressure-hoses of various lengths, fitted with quick couplers.

#### Main Features

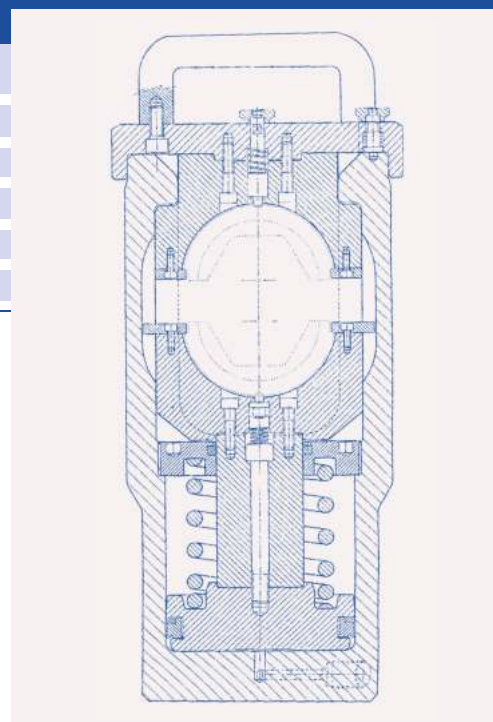
- **Compact dimensions and low weight**, allow easy transportation also to areas of difficult access and awkward working places.
- **Flexibility in use** thanks to the use of a choice of pump units separate from the press that allows the use also in adverse environmental conditions
- **Practicality in use** through the simplicity of compression operations and the ease of fitting dies.
- **Minimal maintenance** due to the simple design and high quality of material and construction.

#### Construction

- **The press body** is a forged alloy steel monobloc. All areas subject to wear are submitted to a special thermal surface-hardening treatment.
- **The high-pressure cylinder**, inside the body, is grounded and hard chromium plated, ensuring a precise and long-lasting fit.
- **The top and bottom die seats** are in high-tensile steel, and like the body, are subjected to thermal surface hardening treatment.
- **The high-pressure gasket** is designed specifically to withstand heavy-duty operations and work reliability in contact with mineral oils.
- **The return spring** is made of special steel to ensure unaltered long-term performance.
- **Connections** are achieved using oil-tight quick couplers throughout.
- **The running test** consists of a trial operation of 1,000 cycles at maximum pressure, thus guaranteeing the supply of defect-free products.

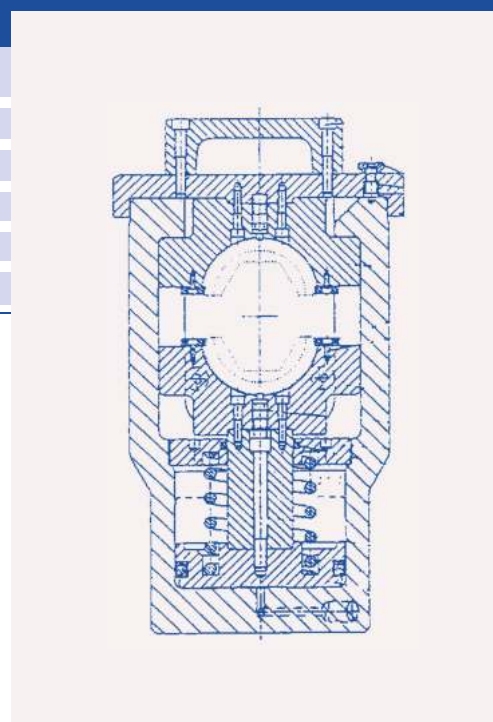
## 59.M

Technical specifications		Note
Maximum compression force	70 ton	
Maximum oil pressure	750 bar	
Oil type	AWS 32	
Maximum hexagon	52 mm	
Weight press	27 kg	
Weight die	2÷3 kg	



## 59.R

Technical specifications		Note
Maximum compression force	100 ton	
Maximum oil pressure	750 bar	
Oil type	AWS 32	
Maximum hexagon	62 mm	
Weight press	42,2 kg	
Weight die	2÷3 kg	







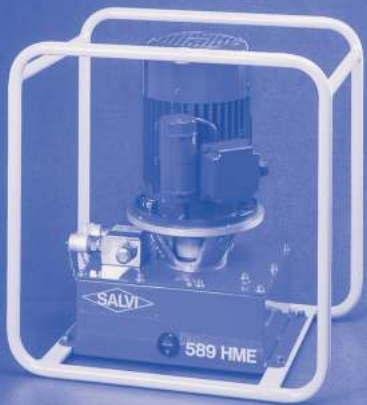
S.2

## 589HBS-R Hydraulic Pump with Gasoline Engine



Drive	4-stroke gasoline engine
Power	5 HP at 3,000 rpm
Max. oil pressure	750 bar
Cooling	air
Fuel	gasoline
Oil tank capacity	5.5 litres
Weight	45 kg
Frame	supplied complete
Overall dimension	50x51x36 cm
Packaging	wooden crate 75x61x45 cm

## 589HME-R Hydraulic Pump with Electric Motor



Drive	Electric motor, 2 or 3 phase, 50 Hz
Power	2,2 kW
Max. oil pressure	750 bar
Power supply	220 or 380 V
Oil tank capacity	5.5 litres
Weight	50 kg
Frame	supplied complete
Overall dimension	50x51x36 cm
Packaging	wooden crate 75x61x45 cm

## 588P80 Manual Hydraulic Pump



Drive	Manual 2-stage
Max. oil pressure	750 bar
Oil tank capacity	2.25 litres
Weight	13 kg
Frame	supplied complete
Overall dimension	61x20x20 cm
Packaging	71x25x25 cm

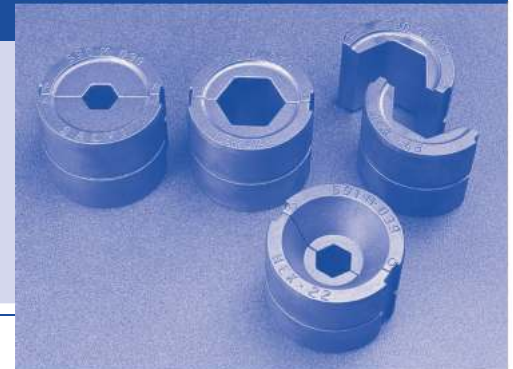
## AE0126, AE0129 Flexible hoses and couplers

Connections between pump unit and press are achieved through flexible hoses. The power-driven pump units feature a high-pressure oil feed hose and a separate low-pressure return hose. The manual pump units utilise a single hose which serves as both feed and return pipe. The high-pressure hoses feature multiple metal-core construction with synthetic rubber coating. Low-pressure hoses are in standard universal hydraulic hose. Connection hoses are available in standard lengths of 3 or 6 meters. Longer lengths are available on specific order, or can be made up by joining together standard hoses. All connections between pump and hose, and between hose and press, are achieved with standard threaded quick couplers. The couplers are provided with caps for protection when disconnected.



## 590M, 591M Dies

Manufactured in high-tensile steel, the inner faces of these dies are specifically shaped to ensure the optimum compression of steel and aluminium-alloy fittings. The outside form is designed to guarantee maximum mechanical strengths and easy fitting in the die seats. Each die is marked with an identification code number. Dies for the new 59.R press can also be used in previous press models, and vice-versa.



## HV2S-R-R Control valve

This control valve is fitted to power-driven pump units to control oil flow from pump to press during pressuring and vice-versa during drain. It includes a pressure-gauge for the monitoring of oil working pressure, and a suitably-calibrated safety valve. All parts of this Salvi designed unit are machined to the highest tolerances and accurately assembled.







Engineering  
& Laboratory

Index of Sections

## **E**ngineering & Laboratory

The entire Salvi production is subject to a systematic contribution of our R & D Department as well as of our Laboratories.

For this reason our engineering staff and our equipment allows also to :

- execute special design and/or services not tied up with material supply;
- develop projects where engineering has a predominant role either under the technical or economical point of view, compared to that of material supply.

We are listing some of more significant examples of services which could be made available:



- development of new products. We have contributed to the study of compact towers, insulated towers and six conductor expanded bundle lines;
- co-operation in preparing new technical specifications or revising existing ones;
- analysis of damages relevant to components supplied by others;
- mechanical testing on phase conductors;
- training of our Customer's Staff;
- execution of damping study for bundle conductor power lines;
- assistance during the execution of electrical tests.

As far as the execution of designs having an high technological content is concerned, we have a wide experience in :

- long span crossings (rivers, lakes, valleys etc);
- bridges;
- rope structures (antennas, stadiums, special structures as British Airways London Eye);

where we are also availing ourselves of a strict co-operation of most qualified Research Centres and Universities.



A. SALVI & C. S.P.A. VIA COSENZ, 32 - 20157 MILANO (ITALY)  
TEL. +39 02 3767 151 FAX +39 02 3767 15222 [www.salvi.eu](http://www.salvi.eu) - [salvi@salvi.eu](mailto:salvi@salvi.eu)