



Earthing System



Lightning Protection System



Solar System



Exothermic Welding System



Cathodic Protection System





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Exothermic Welding System

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Cathodic Protection System

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Tavan Gostaran Zino



Tavan Gostaran Zino Co. has been established as a specialized company, taking advantage of the modern sciences with the aim of designing, production (supply), and installation of the following items:

- Electrical and Instrumentation
- Earthing system
- Lightning protection
- Cathodic protection (corrosion control)
- New energies systems (Solar systems)

By relying on its 20-year experience since its establishment, human resources and knowledge of its engineers and experts, and by transferring of modern technologies and methods and their employment, **Tavan Gostaran Zino Co.** has received a considerable growth in implementing EPC work in various industries including oil, gas, petrochemical, refineries, power plants, and electricity posts.





Engineering Service Range

Earthing and Lightning Protection Systems

1. Site Survey

- 1.1. Soil study
 - 1.1.1. Soil resistivity test (Wenner Four-Electrode Method)
 - 1.1.2. Soil pH test
- 1.2. Lightning rod installation survey
- 1.3. Lightning protection level and method survey

2. Designing

Designing is done according to the documented standards and procedures in the system and relevant to the received information from section 1, as well as the existing maps in the system designing with the lowest cost and the best performance. At this point, the initial plan for the installation, running, and implementation, and the calculation tables are also suggested.

3. Post-Implementation Survey

- 1. Earth resistance system survey using 62% method, Slope method and etc.
- 2. Voltage contact detection
- 3. Voltage pitch survey
- 4. Continuity testing of ground and lightning protection systems
- 5- Leak testing







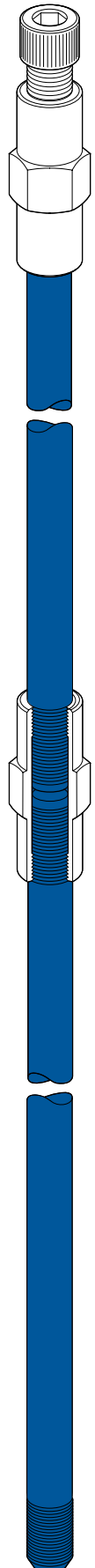
Earthing System



Copper bond Earth Rods



ZINO copper bond earth rods offer installers the most economical method of achieving a low earth resistance. Each rod has a high tensile strength, low carbon steel core. 99.95% pure copper is applied electrolytically and forms a metallurgical bond between the steel core and the copper. This combination makes the rod ideal for deep driving whilst also provides lasting resistance to corrosion. The copper is formed by a cold rolling process which ensures strength and maintains the molecularly bonded copper covering along the full length of the threads. Cold rolled threads are stronger than cut threads. The standard copper thickness is 0.25mm. Greater copper thicknesses are also available. Please contact our sales office for further information



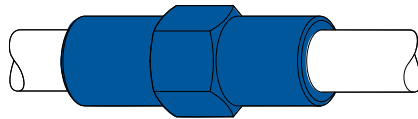
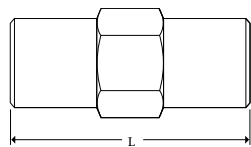
Equipment	Nominal Size	Actual Size	L (mm)	Part No.
Two side Threaded Earth Rod	16	14.2	1200	ZBR 112 A
Two side Threaded Earth Rod			1500	ZBR 115 A
Two side Threaded Earth Rod			2000	ZBR 120 A
One side Threaded and One side flat Earth Rod			1200	ZBR 112 B
One side Threaded and One side flat Earth Rod			1500	ZBR 115 B
One side Threaded and One side flat Earth Rod			2000	ZBR 120 B
One side Threaded and One side Sharp Earth Rod			1200	ZBR 112 C
One side Threaded and One side Sharp Earth Rod			1500	ZBR 115 C
One side Threaded and One side Sharp Earth Rod			2000	ZBR 120 C
Two side Threaded Earth Rod	20	17.2	1200	ZBR 212 A
Two side Threaded Earth Rod			1500	ZBR 215 A
Two side Threaded Earth Rod			2000	ZBR 220 A
One side Threaded and One side flat Earth Rod			1200	ZBR 212 B
One side Threaded and One side flat Earth Rod			1500	ZBR 215 B
One side Threaded and One side flat Earth Rod			2000	ZBR 220 B
One side Threaded and One side Sharp Earth Rod			1200	ZBR 212 C
One side Threaded and One side Sharp Earth Rod			1500	ZBR 215 C
One side Threaded and One side Sharp Earth Rod			2000	ZBR 220 C



Threaded Couplings

These Zino high strength couplings are used for joining copper bond threaded earth rods together. They facilitate deep driving and ensure continual contact between the rods both during and after installation. The coupling also protects the earth rod threads during installation with the threaded driving head. There is a lead-in for ease of assembly and a hex on the outside for grip and keeping the coupling tight when driving into the ground. All Zino couplings are manufactured from a high copper content alloy ensuring excellent corrosion resistance

Equipment	Nominal Size	L (mm)	Part No.
Threaded Coupling	16	40	ZBRC 16
Threaded Coupling	20	40	ZBRC 20

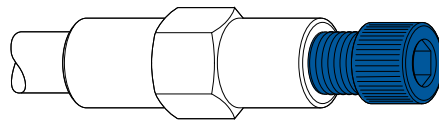
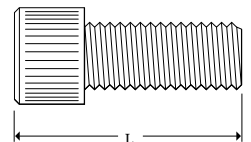


made of brass

Threaded Driving Heads

These Zino reusable threaded driving heads are suitable for driving copper bond threaded earth rods by hand or with a power hammer. The driving head screws into the threaded coupling to allow deep driving of the earth rods.

Equipment	Nominal Size	L (mm)	Part No.
Threaded Driving Head	16	40	ZBRH 16
Threaded Driving Head	20	40	ZBRH 20



made of steel

Special Driving Heads

These special driving heads enable copper bond to be driven in to the ground

Equipment	Nominal Size	L (mm)	Part No.
Non Threaded Driving Head	16	35	ZRSH 16
Non Threaded Driving Head	20	35	ZRSH 20



made of steel

Driving Spikes

These driving spikes enable copper bond earth rods to be driven easily into the ground

Equipment	Nominal Size	L (mm)	Part No.
Threaded Driving Spike	16	35	ZBRS 16
Threaded Driving Spike	20	35	ZBRS 20



made of steel



Solid copper earth rods



made of copper

These earth rods are designed for use where extremely high corrosion resistance and exceptionally long life are required. Solid copper earth rods are produced from solid copper bar and are internally threaded for jointing. When deep driving a solid copper earth rod the usual practice is to insert the rod into a bore hole and backfill with either Low Resistance Earthing Compound or Bentonite.

Equipment	Nominal Size	Actual Size	L (mm)	Part No.
Earth Rod two side threaded	16	16	1200	ZCR 112
Earth Rod two side threaded			1500	ZCR 115
Earth Rod two side threaded			2000	ZCR 120
Earth Rod two side threaded			3000	ZCR 130
Earth Rod two side threaded	20	20	1200	ZCR 212
Earth Rod two side threaded			1500	ZCR 215
Earth Rod two side threaded			2000	ZCR 220
Earth Rod two side threaded			3000	ZCR 230

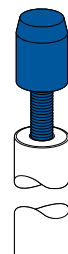
Driving Heads

The driving head protects the internal thread and the top of the solid copper earth rod from damage when being driven into the ground.

Equipment	Nominal Size	Actual Size	L (mm)	Part No.
Threaded Driving Head	16	16	30	ZCRH 16
Threaded Driving Head	20	20	30	ZCRH 20



made of steel



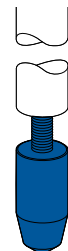
Driving Spikes

These driving spikes enable solid copper earth rods to be driven easily into the ground

Equipment	Nominal Size	Actual Size	L (mm)	Part No.
Threaded Driving Spike	16	16	30	ZCRS 16
Threaded Driving Spike	20	20	30	ZCRS 20



made of steel



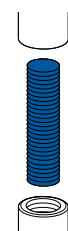
Coupling Dowels

The stainless steel coupling dowel is used for joining solid copper earth rods together

Equipment	Nominal Size	Actual Size	L (mm)	Part No.
Coupling Dowel	16	16	40	ZCRC 16
Coupling Dowel	20	20	40	ZCRC 20



made of stainless steel





Stainless Steel Earth Rods



made of stainless steel

These earth rods are designed for use where extremely high corrosion resistance and exceptionally long life are required. stainless steel earth rods are produced from stainless steel bar and are internally threaded for jointing. When deep driving a stainless steel earth rod the usual practice is to insert the rod into a bore hole and backfill with either Low-Resistance Earthing Compound or Bentonite.

Equipment	Nominal Size	Actual Size	L (mm)	Part No.
Earth Rod two side threaded	16	16	1200	ZSR 112
Earth Rod two side threaded			1500	ZSR 115
Earth Rod two side threaded			2000	ZSR 120
Earth Rod two side threaded			3000	ZSR 130
Earth Rod two side threaded	20	20	1200	ZSR 212
Earth Rod two side threaded			1500	ZSR 215
Earth Rod two side threaded			2000	ZSR 220
Earth Rod two side threaded			3000	ZSR 230

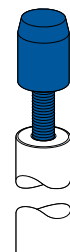
Driving Heads

The driving head protects the internal thread and the top of the stainless steel earth rod from damage when being driven into the ground.

Equipment	Nominal Size	Actual Size	L (mm)	Part No.
Threaded Driving Head	16	16	30	ZSRH 16
Threaded Driving Head	20	20	30	ZSRH 20



made of steel



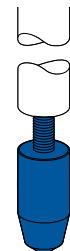
Driving Spikes

These driving spikes enable stainless steel earth rods to be driven easily into the ground.

Equipment	Nominal Size	Actual Size	L (mm)	Part No.
Threaded Driving Spike	16	16	30	ZSRS 16
Threaded Driving Spike	20	20	30	ZSRS 20



made of steel



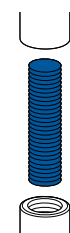
Coupling Dowels

The phosphor bronze coupling dowel is used for joining solid copper earth rods together

Equipment	Nominal Size	Actual Size	L (mm)	Part No.
Coupling Dowel	16	16	40	ZSRC 16
Coupling Dowel	20	20	40	ZSRC 20



made of stainless steel



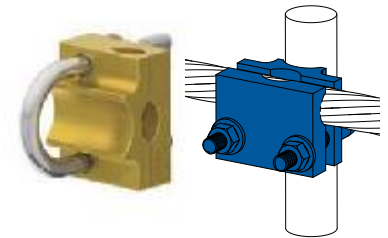


Earthing clamp connection to rod

U Bolt Clamp (wire to rod)

This versatile range of 'U' bolt clamps can be used to connect stranded cables to earth rods, reinforcing bars (rebar), hand rails etc. Double Plate Type for Vertical Stranded Cables Used to connect stranded cables in a vertical and horizontal position on the rod

Rod Diameter	Wire Size	Part No.
16-20	70-185	ZUC 185
16-20	240-400	ZUC 400

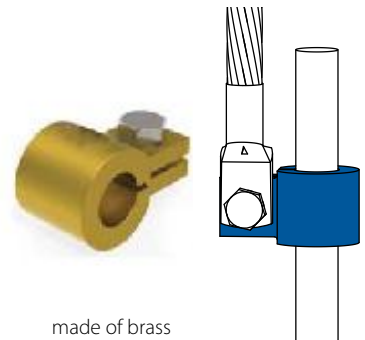


made of brass

Split Connector Clamps

Split connector clamps are used to connect cable lugs on to earth rods. The clamps are designed to suit our full range of earth rods.

Rod Diameter	Wire Size	Part No.
16	16-185	ZLC 16
20	16-185	ZLC 20

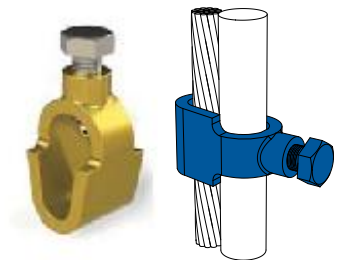


made of brass

Earth rod to Wire Clamp

These clamps are used for joining earth rods to different sizes of copper Conductor. The clamps have a high resistance to corrosion and are mechanically strong to ensure a lasting connection

Rod Diameter	Wire Size	Part No.
16	16-70	ZAC 1670
20	35-120	ZAC 2120
25	70-185	ZAC 2185

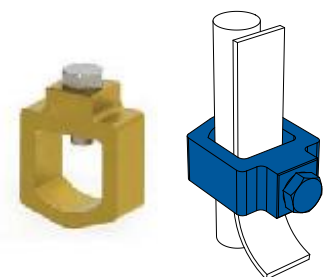


made of brass

Earth rod to Tape Clamp

These clamps are used for joining earth rods to different sizes of copper tape. The clamps have a high resistance to corrosion and are mechanically strong to ensure a lasting connection

Rod Diameter	Tape Size	Part No.
16-20	20x3	ZBC 203
	30x3	ZBC 303
	20x5	ZBC 205
	30x5	ZBC 305

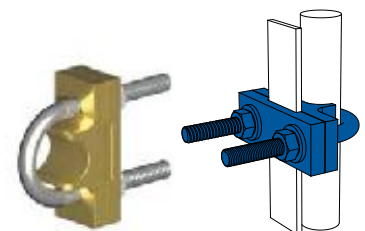


made of brass

U Bolt Clamp (Tape to rod)

Double Plate Type for Vertical Flat Tapes Used to connect vertical position on the rod.

Rod Diameter	Tape Size	Part No.
16-20	20x3	ZUT 203
	25x3	ZUT 253
	30x3	ZUT 303
	30x5	ZUT 305



made of brass

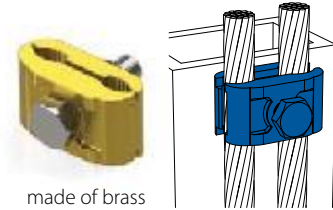


Conection to Structure

Wire to Structure Clamp

These clamps are used for bonding two copper conductors on to steel Surfaces.

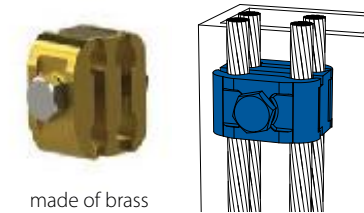
Wire Size	Bolt Size	Part No.
35-185	M10	ZSC 1185
240-300	M12	ZSC 1300



Double Wire to Structure Clamp

These clamps are used for bonding four copper conductors on to steel Surfaces.

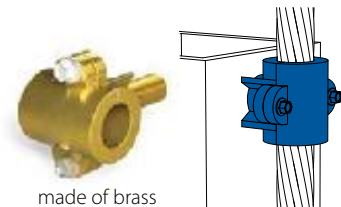
Wire Size	Bolt Size	Part No.
35-185	M10	ZSC 2185
240-300	M12	ZSC 2300



Wire to structure Holder

These clamp used for holder of copper conductor on to steel Surfaces.

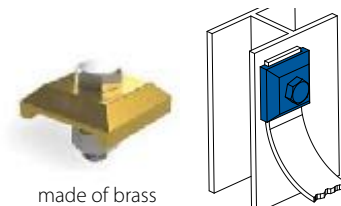
Wire Size	Bolt Size	Part No.
70-120	M10	ZWH 120
150-240	M12	ZWH 240



Tape to structure Holder

These clamps are used for holder of tape on to steel Surfaces.

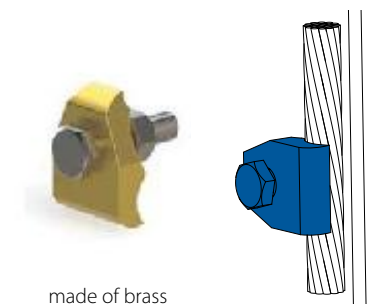
Tape Size	Bolt Size	Part No.
25x3	M10	ZHT 253



Tower Clamp

Tower earth clamps are used for bonding copper conductors on to steel surfaces. These single-plate tower earth clamps are used for bonding and aluminium conductor onto steel surfaces. The clamp is fixed by drilling a hole in the steelwork and securing with the set screw provided

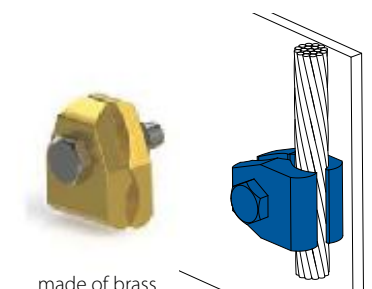
Wire Size	Bolt Size	Part No.
35-70	M 8	ZCS 1070
95-185	M10	ZCS 1185



Double Tower Clamp

The double-plate design provides a robust fixing in areas where cladding may be installed or where the complete clamp will be covered by concrete. The clamp is fixed by drilling a hole in the steelwork and securing with the set screw provided

Wire Size	Bolt Size	Part No.
35-70	M 8	ZCS 2070
95-185	M10	ZCS 2185





Cable to structure Holder

These clamps used for holder of cable on to steel surfaces

Cable Size Diameter	Bolt Size	Part No.
16	M10	ZCH 16
20	M10	ZCH 20
22	M10	ZCH 22
24	M10	ZCH 24
28	M10	ZCH 28
30	M10	ZCH 30
36	M10	ZCH 36
40	M10	ZCH 40



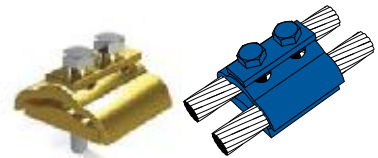
made of steel & PVC

Connectors to connectors clamp

Parallel wire clamp

Zino Parallel Groove Clamps, for stranded copper cable connections, are manufactured from high-strength, corrosion-resistant copper alloy and assembled with two stainless steel set screws.

Wire Size	Bolt Size	Part No.
35-70	M6	ZPC 70
95-185	M8	ZPC 185
240-300	M10	ZPC 300

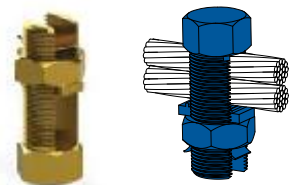


made of brass

Split Bolt Connectors

The high strength split bolt connectors will accept a wide range of stranded copper conductors. No specialist tools are required for installation.

Wire Size	Part No.
16-35	ZSB 35
50-70	ZSB 70
95-120	ZSB 120
150-185	ZSB 185



made of brass

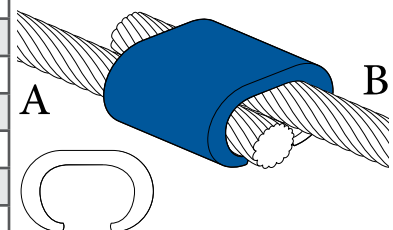
'C' Crimp Connectors

These range-tracking 'C' Crimp Connectors are specifically designed for tap and parallel connections of stranded copper cables in earthing application.

Run	Tap	Part No.	Run	Tap	Part No.
10	10	ZCC 1010	70	70	ZCC 7070
16	10	ZCC 1610	95	10	ZCC 9510
16	16	ZCC 1616	95	16-35	ZCC 9535
25	10-25	ZCC 2525	95	50-70	ZCC 9570
35	10	ZCC 3510	95	95	ZCC 9595
35	16-25	ZCC 3525	120	10-25	ZCC 12025
35	35	ZCC 3535	120	35-50	ZCC 12050
50	10-25	ZCC 5025	120	70-95	ZCC 12095
50	35	ZCC 5035	120	120	ZCC 120120
50	50	ZCC 5050	150	10-35	ZCC 15035
70	10	ZCC 7010	150	50-95	ZCC 15095
70	16-25	ZCC 7025	150	120	ZCC 150120
70	35-50	ZCC 7050	150	150	ZCC 150150



made of copper



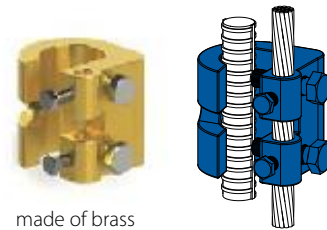


High Concrete earthing conection

Wire to rebar Clamp

High strength copper alloy rebar clamp for bonding to rein forcing bars steampipes, handrails etc.

Wire Size	armator Size	Part No.
35	18-35	ZRB 3535
50	18-35	ZRB 5035
70	18-35	ZRB 7035



made of brass

Earth bonding point

These Zino earth bonding points are installed to provide a convenient earth system connection point in concrete structures. When cast into concrete they connect the rebar to the earthing or lightning protection system

No. Holes	Hole Size	Plate Size	L	Part No.
1	M10	38x38	75	ZBP 100
2		70x35		ZBP 200
4		65x65		ZBP 400

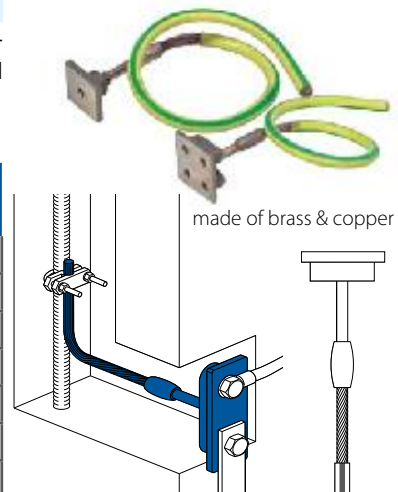


made of brass

Earth Bonding Points with cable tails

Earth points are available for direct connection to conductors, or with additional welded tail (single or double 70 mm² PVC insulated cable) to enable connection to internal rebar arrangement aria mechanical clamp.

No. Holes	Cable Size	Cable Length (mm)	Cable Insulated	Part No.
1	70	500	PVC	ZBP 175
2		500		ZBP 275
		1000		ZBP 271
		1500		ZBP 272
4		500		ZBP 475
		1000		ZBP 471
		1500		ZBP 472



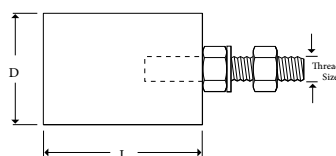
made of brass & copper

Conection to steel structures

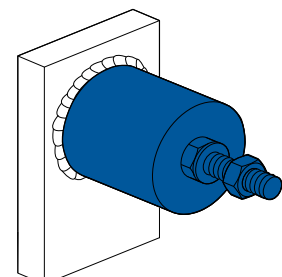
Earth Bosses

The earth boss is designed to provide an earth connection point on a steel structure. The boss is welded onto steel vessels, tanks and other structures

D (mm)	L (mm)	Thread size	Part No.
50	50	M10	ZEB 5050
50	40		ZEB 5040
50	30		ZEB 5030
38	32		ZEB 3832
40	32		ZEB 4032



made of steel or stainless steel





Compression Terminal

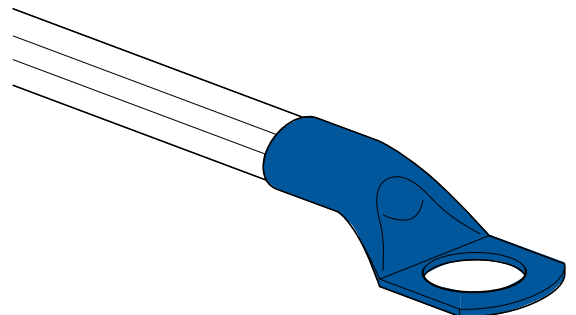
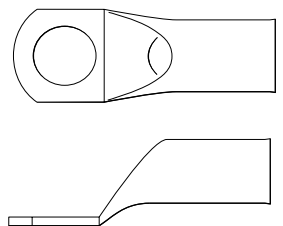
One Hole

All terminals are annealed, to avoid cracking and splitting when crimped and electroplated to combine maximum electrical conductivity with mechanical strength. An inspection hole is provided to check cable location prior to crimping.

Conductor Size (mm ²)	Hole Size (mm)	Part No.
6	6	ZCL 66
	8	ZCL 68
10	6	ZCL 106
	8	ZCL 108
16	8	ZCL 168
	10	ZCL 1610
25	8	ZCL 258
	10	ZCL 2510
35	8	ZCL 358
	10	ZCL 3510
50	8	ZCL 508
	10	ZCL 5010
70	10	ZCL 7010
	12	ZCL 7012
95	10	ZCL 9510
	12	ZCL 9512
120	10	ZCL 12010
	12	ZCL 12012
150	12	ZCL 15012
	14	ZCL 15014
185	12	ZCL 18512
	14	ZCL 18514
240	12	ZCL 24012
	14	ZCL 24014



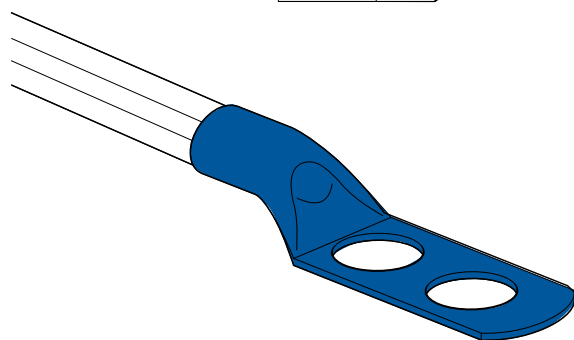
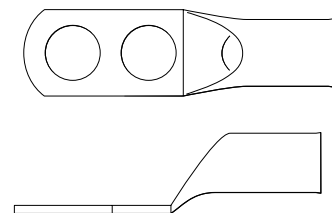
made of tinned copper





Double Hole

Conductor Size (mm ²)	Hole Size (mm)	Center to Center (mm)	Part No.
50	8	25	ZCL 508/1
		40	ZCL 508/2
	10	25	ZCL 5010/1
		40	ZCL 5010/2
70	10	25	ZCL 7010/1
		40	ZCL 7010/2
	12	25	ZCL 7012/1
		40	ZCL 7012/2
95	10	25	ZCL 9510/1
		40	ZCL 9510/2
	12	25	ZCL 9512/1
		40	ZCL 9512/2
120	10	25	ZCL 12010/1
		40	ZCL 12010/2
	12	25	ZCL 12012/1
		40	ZCL 12012/2
150	12	25	ZCL 15012/1
		40	ZCL 15012/2
	14	25	ZCL 15014/1
		40	ZCL 15014/2
185	12	25	ZCL 18512/1
		40	ZCL 18512/2
	14	25	ZCL 18514/1
		40	ZCL 18514/2
240	12	25	ZCL 24012/1
		40	ZCL 24012/2
	14	25	ZCL 24014/1
		40	ZCL 24014/2



made of tinned copper



Compression Terminal (Bimetal type)

Manufactured from a friction welded joint between high conductivity copper and aluminium to provide the ideal means of inter-connecting copper and aluminium conductors whilst avoiding bimetallic corrosion.

Conductor Size (mm ²)	Hole Size (mm)	Part No.
6	6	ZCL 66/3
	8	ZCL 68/3
10	6	ZCL 106/3
	8	ZCL 108/3
16	8	ZCL 168/3
	10	ZCL 1610/3
25	8	ZCL 258/3
	10	ZCL 2510/3
35	8	ZCL 358/3
	10	ZCL 3510/3
50	8	ZCL 508/3
	10	ZCL 5010/3
70	10	ZCL 7010/3
	12	ZCL 7012/3
95	10	ZCL 9510/3
	12	ZCL 9512/3
120	10	ZCL 12010/3
	12	ZCL 12012/3
150	12	ZCL 15012/3
	14	ZCL 15014/3
185	12	ZCL 18512/3
	14	ZCL 18514/3
240	12	ZCL 24012/3
	14	ZCL 24014/3



made of copper or aluminium

Bimetallic Washer

These washers have two sides, aluminum and copper, to protect from galvanic corrosion between copper alloy clamps and steel structures.

Shape	Dimension	Hole Dia.	Part No
Square	55x35	12	ZBW 5535
Circle	30	12	ZBW 0030



made of copper & aluminium



Accessories For Earthing Well

Solid Copper Earth Plate

Solid copper plates provide a long lasting earthing solution in places where driving earth rods might be impractical. They are often installed in conjunction with Low-Resistance Earthing Compound or Bentonite.

- solid copper earth plates offer a simple alternative style of earth electrode where high resistivity soil or rock conditions prohibit the driving of earth rods

Plate Dimension	Surface Area	Part No.
660x660x3	0.89	ZEP 663
660x660x5	0.89	ZEP 665
1000x660x3	1.33	ZEP 163
1000x660x5	1.33	ZEP 165

Solid Copper Lattice Mats

Solid copper lattice mats offer a more economical cost option to installing solid copper plates. They are often used for potential grading and are a preferred option on installations such as telecommunication towers, where touch and step potential could cause problems.

manufactured from high conductivity copper tape, lattice earth mats are design to minimize the danger of exposure it high step and touch voltages to operators in situations such as high voltage switching

Dimension	Surface Area	Part No.
660x660x3	0.31	ZLM 603
1000x660x3	0.65	ZLM 163
1000x660x5	1.33	ZLM 165

PVC Earth Inspection Housing

Manufactured from high-performance, UV stable and chemically resistant polymer with either polymer or concrete lid to suit the application.

The lightweight inspection pit with polymer lid is load rated to 5,000 Kg and is suitable for general to heavy duty use. It has a lockable lid and improved working area compared to the concrete inspection pit. The lightweight inspection pit with concrete lid is load rated to 1,200 kg and is designed for use in pedestrianized and light vehicular areas. The lid can be locked in place, if required order 2 x AS100 Allen caphead screws

Dimension	No. of Terminals	Part No.
255x255x215	--	ZPP 100
255x255x215	3	ZPP 103
255x255x215	5	ZPP 105

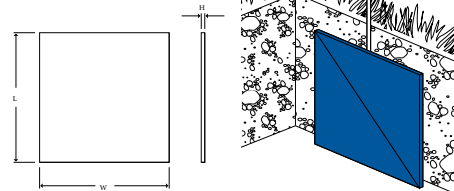
Concrete Earth Inspection Housing

The concrete earth inspection housing is load rated to 4,000 Kg and is suitable for most industrial applications. The housing can have an internal earth bar fitted diagonally across in slots provided in the base.

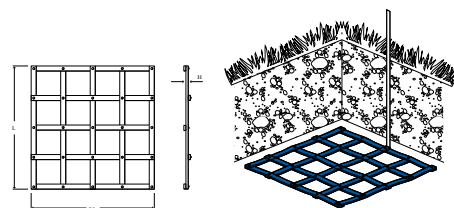
Dimension	No. of Terminals	Part No.
320x320x200	--	ZCP 300
320x320x200	3	ZCP 303
400x400x600	--	ZCP 400
400x400x600	5	ZCP 405
450x450x500	--	ZCP 450
450x450x500	5	ZCP 455



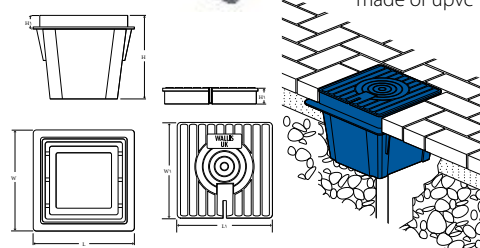
made of copper



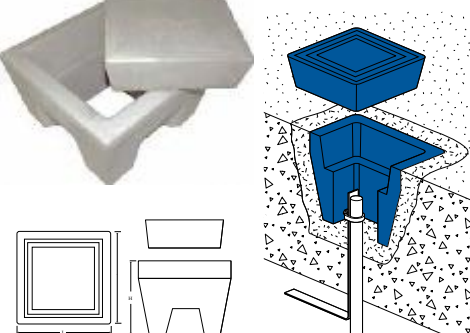
made of copper



made of upvc



made of concrete





Low Resistance earthing Compound

Low-resistance earthing compound is an electrically conductive aggregate. Our advanced range of electrodes come with a compound suitable for unique requirements of our customers; these are considered to be the ideal backfill material for an earthing system. On adding water, this compound is easily compacted and has the capability of absorbing moisture up to thirteen times its dry volume.

It improves conductivity and has a quality of long time capacity of retention or absorption of moisture, high conductivity and is non-corrosive.

Features:

- Does not dissolve in soil or water
- Does not wash away with time
- Installed dry or can be mixed with water for the formation of slurry for vertical or horizontal applications



Type	Weight (kg)	Part No
Low Resistance earthing Compound	30	ZLR 30

Bentonite

Bentonite is a moisture retaining clay used as an earth electrode back-fill to help lower soil resistivity. The clay is a sodium activated montmorillonite, which when mixed with water swells to many times its original dry volume.

Bentonite can be supplied in granular or powder form. The granular form is easier to handle as the powder can cause dust in windy conditions. Granular is the preferred option for filling trenches as the substance can be mixed in the trench. Powder is the preferred option for pouring into bore holes to ensure the mixture is a thin enough consistency to reach the bottom of the hole.

The typical expansion ratio when mixed with water is 2:1.



Type	Weight (kg)	Part No
Bentonite Granular form Non Active	30	ZGB 30
Bentonite Powder Form Active	30	ZPB 30

Earth mat

These mats are used on top of finish level and directly below the operator's normal standing position for manually operating disconnect switches.



made of steel H.D.G

Dimension	Tape size	Part No
800x500x30	30x3	ZEM 853
1000x500x30	30x3	ZEM 153



Earthing Busbar

Earth Terminals

Earth Terminals are available in a variety of sizes and specifications. Our standard earth Terminals are shown in the tables below. Special earth bars manufactured to customer requirements are also available. without bolt for cable lug.

No. of Terminals	Dimension	Disconnecting link	Part No.
3	200x50x5	--	ZDE 3
4	260x50x5	--	ZDE 4
6	320x50x5	--	ZDE 6
8	440x50x5	--	ZDE 8
10	520x50x5	--	ZDE 10
12	600x50x5	--	ZDE 12
3	275x50x5	1 No.	ZDE 31
4	320x50x5	1 No.	ZDE 41
6	400x50x5	1 No.	ZDE 61
8	520x50x5	1 No.	ZDE 81
10	600x50x5	1 No.	ZDE 101
12	675x50x5	1 No.	ZDE 121
3	350x50x5	2 No.	ZDE 32
4	395x50x5	2 No.	ZDE 42
6	470x50x5	2 No.	ZDE 62
8	590x50x5	2 No.	ZDE 82
10	670x50x5	2 No.	ZDE 102
12	750x50x5	2 No.	ZDE 122



made of copper or stainless steel

Disconnecting Link (Circuit Breaker)

The disconnecting link provides a temporary break in the earth connection to allow inspection and testing of the earth electrode.

Dimension	Part No.
120x50x5	ZDL 125
180x30x3	ZDL 183

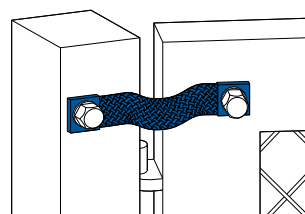
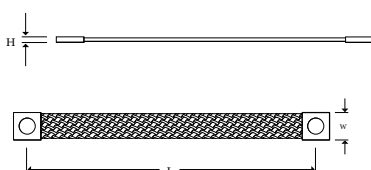


made of copper or stainless steel

Flexible Copper braid Bonds

These flexible copper braid bonds are used for bonding metal gates, doors, fences etc. Other lengths and sizes are available on request.

Dimension	Length	Part No.
20x3	200	ZFC 202
	300	ZFC 203
	400	ZFC 204
25x3	200	ZFC 252
	300	ZFC 253
	400	ZFC 254



made of copper



Temporary earthing devices

Temporary earthing devices hand-held equipment that brought and connecting points of electrical installations for earthing and it permits conductors to be earthing as well as short circuit

Zino manufacturer of an acceptable range of temporary earthing devices for 20KV up to 400KV, and maximum 40KA, 0.5 sec. short circuit current.

Temporary earthing devices as well as the matching connection points on the conductor and on the earthing system must be designed to withstand the rated short-circuit current of the respective electrical installation.





KV	KA	Equipment	part no
20	20	Temporary Earthing Device 20 KV/20 KA, included of: 1. Transparent Sheated Flexible Copper Wire, 35mm ² , 5 m L 2. Three Numbers 5-60mm Dia. Line Clamping Capacity 3. Three Numbers Earth Clamp with 30mm Claping Capacity 4. One Set Heavy Duty Insulation Stic 5.steel box cace for Item 1-4	ZTE 20/20
33	20	Temporary Earthing Device 33 KV/20 KA, included of: 1. Transparent Sheated Flexible Copper Wire, 35mm ² , 5 m L 2. Three Numbers 5-60mm Dia. Line Clamping Capacity 3. Three Numbers Earth Clamp with 30mm Claping Capacity 4. One Set Heavy Duty Insulation Stic 5.steel box cace for Item 1-4	ZTE 33/20
63	31.5	Temporary Earthing Device 63 KV/31.5 KA, included of: 1. Transparent Sheated Flexible Copper Wire, 95mm ² , 7 m L 2. Three Numbers 5-60mm Dia. Line Clamping Capacity 3. Three Numbers Earth Clamp with 30mm Claping Capacity 4. One Set Heavy Duty Insulation Stic 5.steel box cace for Item 1-4	ZTE 63/31.5
132	31.5	Temporary Earthing Device 132 KV/31.5 KA, included of: 1. Transparent Sheated Flexible Copper Wire, 95mm ² , 7 m L 2. Three Numbers 5-60mm Dia. Line Clamping Capacity 3. Three Numbers Earth Clamp with 30mm Claping Capacity 4. One Set Heavy Duty Insulation Stic 5.steel box cace for Item 1-4	ZTE 132/31.5
230	40	Temporary Earthing Device 230 KV/40 KA, included of: 1. Transparent Sheated Flexible Copper Wire, 120mm ² , 10 m L 2. Three Numbers 5-60mm Dia. Line Clamping Capacity 3. Three Numbers Earth Clamp with 30mm Claping Capacity 4. One Set Heavy Duty Insulation Stic 5.steel box cace for Item 1-4	ZTE 230/40
400	40	Temporary Earthing Device 400 KV/40 KA, included of: 1. Transparent Sheated Flexible Copper Wire, 150mm ² , 12 m L 2. Three Numbers 5-60mm Dia. Line Clamping Capacity 3. Three Numbers Earth Clamp with 30mm Claping Capacity 4. One Set Heavy Duty Insulation Stic 5.steel box cace for Item 1-4	ZTE 400/40





Copper Tapes



Bare Copper Tapes

High conductivity bare copper tape is used on both lightning protection and earthing applications. It is annealed for ease of use and has radiused edges

Dimension	Part No.
20x3	ZCT 203
25x3	ZCT 253
30x3	ZCT 303
30x5	ZCT 305
40x5	ZCT 405
50x5	ZCT 505
60x5	ZCT 605
100x5	ZCT 105



made of copper

Tinned Copper tapes

High conductivity bare tinned copper tape is used on both lightning protection and earthing applications. It is annealed for ease of use and has radiused edges

Dimension	Part No.
20x3	ZTT 203
25x3	ZTT 253
30x3	ZTT 303
30x5	ZTT 305
40x5	ZTT 405
50x5	ZTT 505
60x5	ZTT 605
100x5	ZTT 105



made of tinned copper



Cable

PVC INSULATED NON SHEATED SINGLE CORE CABLES

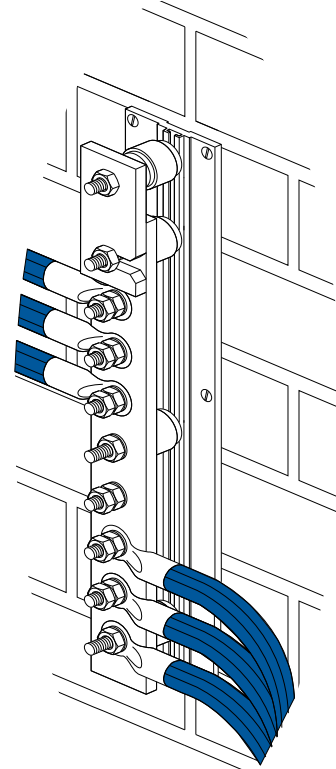
NYA, HO5V-U, HO7V-U, HO7V-R / 300 / 500 V, 450 / 750 V

These cables are used for the purpose of earthing & lighting in residential and commercial Building in surface mounted or embedded conduits. Suitable for voltages Up to 1000 AC or up to 750 to earth DC when used for fixed installation

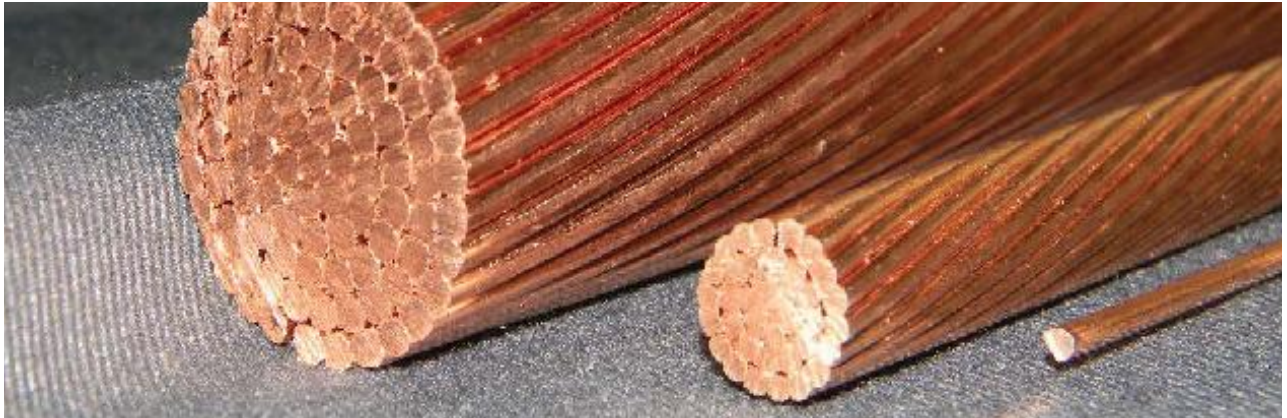
Inside applications, switchgear and control gear

Technical data:

- 1) Temperature: -25°C to +70°C
- 2) Working voltage: 300/500 V up to 1.0 mm², 450/750 V for 1.5 mm² and above
- 3) Conductor resistance: as per class 1 or 2 of IEC 60228
- 4) Test voltage: 1500 VAC for 300/500 V, 2500 VAC for 450/750 V
- 5) Flame retardant: Acc. IEC 60332-1



Size	No Standard x diameter	Insulation thickness	Approx. Overall diameter	Approx. weight	Max. d.c. resistance	Part No.
mm ²	N x dmm	mm	mm	Kg/Km	Ω/Km	
1.5	1 x 1.38	0.7	2.9	21	12.1	ZWI 1.1
1.5	7 x 0.53	0.7	3.1	22	12.1	ZWI 1.7
2.5	1 x 1.78	0.8	3.5	33	7.41	ZWI 2.1
2.5	7 x 0.67	0.8	3.7	34	7.41	ZWI 2.7
4	1 x 2.25	0.8	3.9	48	4.61	ZWI 4.1
4	7 x 0.85	0.8	4.2	51	4.61	ZWI 4.7
6	1 x 2.76	0.8	4.4	67	3.08	ZWI 6.1
6	7 x 1.04	0.8	4.8	71	3.08	ZWI 6.7
10	7 x 1.35	1.0	6.2	119	1.83	ZWI 10
16	7 x 1.7	1.0	7.2	179	1.15	ZWI 16
25	7 x 2.14	1.2	8.9	280	0.727	ZWI 25
35	7 x 2.52	1.2	10.1	375	0.524	ZWI 35
50	19 x 1.78	1.4	11.8	506	0.387	ZWI 50
70	19 x 2.14	1.4	13.6	714	0.268	ZWI 70
95	19 x 2.52	1.6	16.0	980	0.193	ZWI 95
120	37 x 2.03	1.6	17.6	1225	0.153	ZWI 120
150	37 x 2.25	1.8	19.5	1505	0.124	ZWI 150
185	37 x 2.52	2.0	21.8	1890	0.0991	ZWI 185
240	37 x 2.88	2.2	24.7	2410	0.0754	ZWI 240
300	61 x 2.52	2.4	27.6	3014	0.0601	ZWI 300



Bare stranded copper conductors

bare stranded copper conductors is used on both lightning protection and earthing systems. Available as soft drawn (copper wire that has been heat treated) and hard (copper wire that has not been annealed after drawing).

C.S.A mm ²	stranding No.* θ mm	Nominal θ mm	Maximum resistance @20c Ω /km	weight per metre Kg	Part number
6	7*1.04	3/12	3/08	0/05	ZWB 6
10	7*1.35	4/05	1/83	0/09	ZWB 10
16	7*1.70	5/1	1/15	0/15	ZWB 16
25	7*2.14	6/42	0/727	0/23	ZWB 25
35	7*2.52	7/65	0/524	0/32	ZWB 35
50	19*1.76	8/9	0/387	0/43	ZWB 50
70	19*2.14	10/7	0/268	0/62	ZWB 70
95	19*2.52	12/6	0/193	0/86	ZWB 95
120	37*2.03	14/21	0/153	1/09	ZWB 120
150	37*2.25	15/75	0/124	1/33	ZWB 150
185	37*2.52	17/64	0/099	1/67	ZWB 185
240	61*2.25	20/25	0/075	2/2	ZWB 240
300	61*252	22/68	0/06	2/76	ZWB 300
400	61*2.85	25/65	0/047	3/53	ZWB 400

stranded copper conductors Tinned Coated

C.S.A mm ²	stranding No.* θ mm	Nominal θ mm	Maximum resistance @20c Ω /km	weight per metre Kg	Part number
6	7*1.04	3/12	3/08	0/05	ZWT 6
10	7*1.35	4/05	1/83	0/09	ZWT 10
16	7*1.70	5/1	1/15	0/15	ZWT 16
25	7*2.14	6/42	0/727	0/23	ZWT 25
35	7*2.52	7/65	0/524	0/32	ZWT 35
50	19*1.76	8/9	0/387	0/43	ZWT 50
70	19*2.14	10/7	0/268	0/62	ZWT 70
95	19*2.52	12/6	0/193	0/86	ZWT 95
120	37*2.03	14/21	0/153	1/09	ZWT 120
150	37*2.25	15/75	0/124	1/33	ZWT 150
185	37*2.52	17/64	0/099	1/67	ZWT 185
240	61*2.25	20/25	0/075	2/2	ZWT 240
300	61*252	22/68	0/06	2/76	ZWT 300
400	61*2.85	25/65	0/047	3/53	ZWT 400



Lightning System



Damage Caused by Surge Voltages



Our dependency on electrical and electronic equipment continues to increase, in both our professional or private lives. Data networks in companies or emergency facilities such as hospitals and fire stations are lifelines for an essential real time information exchange. Sensitive databases, e.g. in banks or media publishers, need reliable transmission paths.

It is not only lightning strikes that pose a latent threat to these systems. More and more frequently, today's electronic aids are damaged by surge voltages caused by remote lightning discharges or switching operations in large electrical systems. During thunderstorms too, high volumes of energy are instantaneously released.

These voltage peaks can penetrate a building through all manner of conductive connections and cause enormous damage.



Discharge types

Some 90% of all lightning discharges between a cloud and the ground are negative cloud-earth strikes. The lightning begins in a negatively charged area of the cloud and spreads to the positively charged surface of the earth. Additional discharges are divided into:

- Negative earth-cloud strikes
- Positive cloud-earth strikes
- Positive earth-cloud strikes.

The most common discharges actually occur within a cloud or between different clouds.

Creation of lightning discharges

When warm, damp air masses rise, the air humidity condenses and ice crystals are formed at great heights. Storm fronts can occur when the clouds expand to heights of up to 15,000 m. The strong upwind of up to 100 kilometres per hour causes the light ice crystals to enter the higher area and the sleet particles enter the lower area. Knocks and friction cause electrical discharge.



Negative and positive charges

Studies have proved that the sleet falling down (area warmer than -15°C) has a negative charge and the ice crystals being thrown upwards (area colder than -15°C) has a positive charge. The light ice crystals are carried into the upper areas of the cloud by the upwind and the sleet falls to the central areas of the cloud. This divided the clouds into the three areas:

- Top: Positively charged zone
- Centre: Weakly negative charged zone
- Bottom: Weakly positive charged zone

This separation of charges forms a voltage in the cloud.



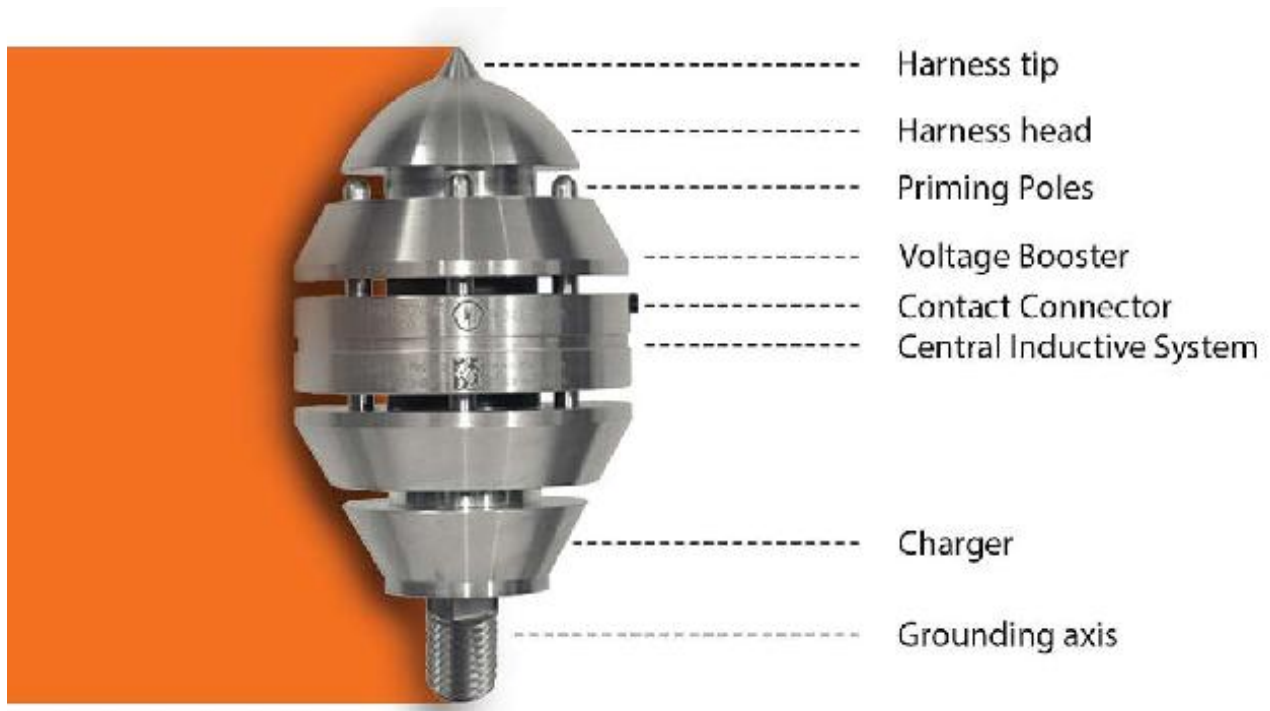
Load distribution

Typical load distribution:

- Positive at the top, negative in the centre and weakly positive at the bottom.
- Positive charges can also be found in the area near the ground.
- The field strength required to trigger lightning is dependent on the insulating ability of the air and is between 0.5 and 10 kV/cm.



Operation of the starting apparatus to lightning ESE



The action develops in three steps :

1.ESE accumulates charge :

The element called "Charger" is designed to accumulate natural ions in the "Central Inductive System" (patented). This accumulation happens as quickly and in the same proportions as the increase in power of the ambient electric field generated by an upward tracer.

2.ESE creates an electric field on a tremendous scale :

At the same time, thanks to the "Central Inductive System" and the "Voltage Boosters", ESE creates a huge electrical field the charge of which is opposed to that of the natural electric field in presence and stimulates the "Harness head".According to their quantity, the "Priming poles" multiply the efficiency of the priming.

3.Harnessing and conduction by ESE :

The priming of ESE system attracts the upward tracer and creates the "lightning strike" conditions. Then the "Harness tip" leads the lightning current through its axis toward the ground conductors..





Protection radius

The protection radius of an Early Streamer Emitter lightning rod is related to its height (h) in proportion to the surface area to protect, its efficiency and the selected protection level.

According to NFC 17-102 standard – September 2011, its calculation is made as follows

$$R_p(h^*) = \sqrt{2rh - h^2 + \Delta h(2r + \Delta h)} \quad h^* \geq 5m$$

$$R_p(h^*) = h \times R_p(5)/5 \quad 2m \leq h^* < 5m$$



$R_p(h)(m)$ stands for the protection radius at a given height h ;

- $r(m)$ 20m for the protection level I;
- 30m for the protection level II;
- 45m for the protection level III;
- 60m for the protection level IV;

$\Delta h(m)$ stands for the height of the ESE end in a horizontal plane to the farthest point of the element to protect.

$$\Delta h = \Delta = \Delta T \times 10^2$$

The experience in the field shows that Δ is equal to the efficiency obtained during the ESE evaluation tests.

The protection level is set according to numerous parameters including loss of life and economic risks, the average local lightning striking, the impact on environment, etc... To favour an ideal matching to the layout of the different premises to protect, is available with

Operation of the starting apparatus to lightning ESE

Years of experiments and numerous tests in laboratory and in real-world lightning conditions were necessary to develop this Early Streamer Emitter lightning rod.

An aluminium alloy and polymeric materials, all patented, form the major part of our lightning rod. Without any fragile priming system, we designed the most reliable and sustainable product of the market.

Called ESE, in reference to french language and to its communication abilities, our product is manufactured with utmost care in our workshop in France.

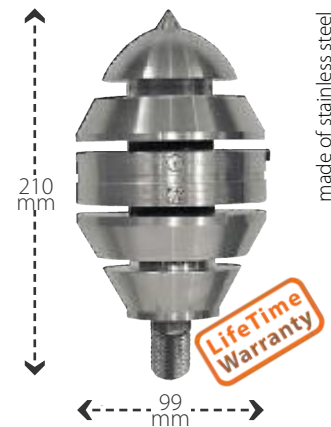




Lightning Rod ESE 1

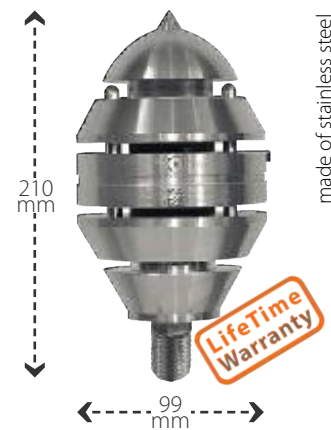
ESE 110

$\Delta t=10 \mu s$	$\Delta h(m)$	Protection Radius			
		I	II	III	IV
	2	8	11	13	15
	3	12	16	19	24
	4	17	26	26	34
	5	21	29	32	43
	10	23	36	37	48
	20	24	40	41	55
	60	30	48	59	64



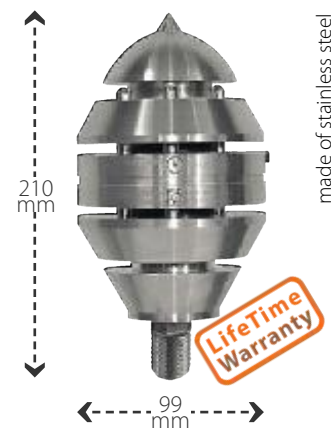
ESE 125

$\Delta t=25 \mu s$	$\Delta h(m)$	Protection Radius			
		I	II	III	IV
	2	17	19	23	26
	3	25	29	34	39
	4	34	39	46	52
	5	42	49	57	65
	10	44	51	61	69
	20	45	52	63	75
	60	45	52	65	79



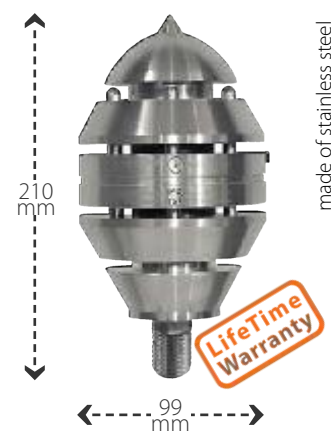
ESE 145

$\Delta t=45 \mu s$	$\Delta h(m)$	Protection Radius			
		I	II	III	IV
	2	25	28	32	36
	3	38	41	48	53
	4	51	57	65	72
	5	62	71	81	89
	10	63	72	83	92
	20	65	74	86	97
	60	66	75	90	105



ESE 160

$\Delta t=60 \mu s$	$\Delta h(m)$	Protection Radius			
		I	II	III	IV
	2	32	34	40	44
	3	48	52	59	65
	4	64	69	78	87
	5	79	86	97	107
	10	79	88	99	109
	20	80	89	102	113
	60	80	90	105	120





Lightning Rod ESE 2



ESE 210

$\Delta t=10 \mu s$	$\Delta h(m)$	Protection Radius			
		I	II	III	IV
	2	10	12	15	17
	3	16	19	23	26
	4	21	25	30	35
	5	26	31	38	43
	10	28	35	42	49
	20	30	39	49	57
	60	30	40	53	70



ESE 225

$\Delta t=25 \mu s$	$\Delta h(m)$	Protection Radius			
		I	II	III	IV
	2	17	20	23	26
	3	25	29	34	39
	4	34	39	46	52
	5	42	49	57	65
	10	44	51	61	69
	20	45	54	65	75
	60	45	55	68	85



ESE 245

$\Delta t=45 \mu s$	$\Delta h(m)$	Protection Radius			
		I	II	III	IV
	2	25	28	32	36
	3	38	42	48	54
	4	51	57	64	72
	5	63	71	81	89
	10	64	72	83	92
	20	65	74	86	97
	60	65	75	89	105



ESE 260

$\Delta t=60 \mu s$	$\Delta h(m)$	Protection Radius			
		I	II	III	IV
	2	31	35	39	43
	3	47	52	58	64
	4	63	69	78	85
	5	79	86	97	107
	10	79	88	99	109
	20	80	89	102	113
	60	80	90	104	120



Comparison of the effectiveness of protective solutions against lightning



A : ESE Rod

1. Portection area - - - - -	✓	✓	✓	✓	✓
2. Protection of open areas - - - - -	✓	✓	✓	✓	✓
3. Study - - - - -	✓	✓	✓	✓	✓
4. Implementation - - - - -	✓	✓	✓	✓	✓
5. Qualification required for implementation - - -	✓	✓	✓		
6. Aesthetic (Architecture integration) - - - - -	✓	✓	✓	✓	✓
7. Realization budget - - - - -	✓	✓	✓	✓	
8. Maintenance costs - - - - -	✓	✓	✓	✓	✓

NFC 17-102 + IEC 62305



B : Single point lightning rod

1. Portection area - - - - -	✗	✗	✗	✗	✗
2. Protection of open areas - - - - -	✗	✗	✗	✗	✗
3. Study - - - - -	✓	✓	✓		
4. Implementation - - - - -	✓	✓	✓	✓	✓
5. Qualification required for implementation - - -	✓	✓	✓	✓	✓
6. Aesthetic (Architecture integration) - - - - -	✓	✓	✓		
7. Realization budget - - - - -	✓	✓	✓	✓	✓
8. Maintenance costs - - - - -	✓	✓	✓	✓	✓

IEC 62305



C : Meshed Cage or Faraday

1. Portection area - - - - -	✗	✗	✗		
2. Protection of open areas - - - - -	✗	✗	✗	✗	✗
3. Study - - - - -	✗	✗	✗	✗	✗
4. Implementation - - - - -	✗	✗	✗	✗	✗
5. Qualification required for implementation - - -	✗	✗	✗	✗	✗
6. Aesthetic (Architecture integration) - - - - -	✗	✗	✗	✗	✗
7. Realization budget - - - - -	✗	✗	✗	✗	✗
8. Maintenance costs - - - - -	✗	✗	✗	✗	✗

IEC 62305



D : Tensioned Cables

1. Portection area - - - - -	✗	✗	✗		
2. Protection of open areas - - - - -	✓	✓	✓		
3. Study - - - - -	✗	✗	✗		
4. Implementation - - - - -	✓	✓	✓		
5. Qualification required for implementation - - -	✗	✗	✗	✗	
6. Aesthetic (Architecture integration) - - - - -	✗	✗	✗	✗	
7. Realization budget - - - - -	✗	✗	✗		
8. Maintenance costs - - - - -	✗	✗	✗		

IEC 62305



Implementation

Early Streamer Emitter lightning rods are part and parcel of a complete protection against lightning system, including also downward conductors, grounding, etc...

Before its implementation, a protection against lightning system must be the object of an in-depth study.

To provide an optimal security, this system must also be installed in compliance with the standards in force and the manufacturer's instructions.

To benefit from your product warranty, your protection against lightning system must imperatively follow those study and installation codes.

Our licensed partners (distributors, installers) are proficient in ensuring you the necessary conditions to the preservation of your warranty.



Installation Compt



ZBT

Down conductor

ZLSC

Lightning strike conter

ZTS

Test clamp



Counter

The lightning strike counter consists of a 6 digits display. Each lightning strike is recorded when it comes through by incrementing one unit (the rightmost number).

Watertight (IP65), robust and reliable, it operates without any power supply and records positive or negative lightning strikes.

The lightning strike counter displays the total number of lightning strikes having struck the Outside Protection against Lightning Installation (OPLI).

It is necessary to regularly watch over the display for a good follow-up of the installation. The lightning strike counter is essential for the good maintenance of the OPLI (cf. NFC 17-102 : a checking shall be done after each lightning strike).

This regular monitoring doesn't require a travel with Contact + Rout option. On top of that, you will be warned in real time in case of lightning strike event.).

It can be set up and works on any type of existing downward conductor (flat, round, ...) thanks to its universal fastenings. lightning strike counters are compliant with the standards in force (NFC 17-102, NF EN 50164-6).

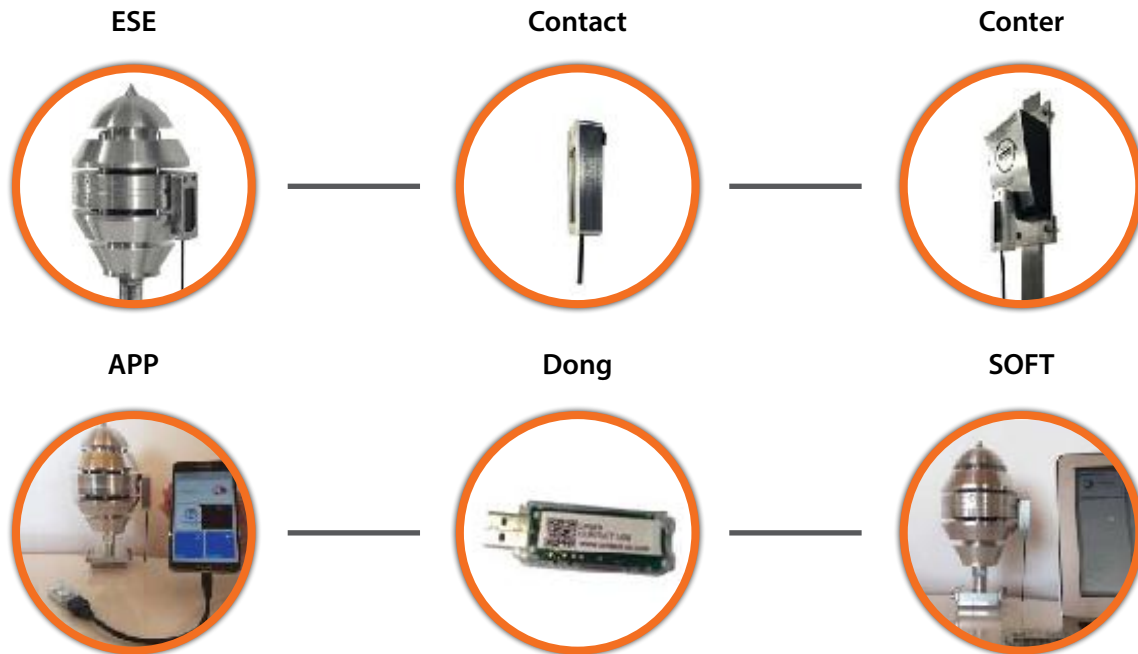


Height : 14.50 cm
Width : 5.50 cm
Depth : 5.50 cm
Weight : 0.285 kg





Contact + Dongl



An outside protection against lightning with a lightning rod must be checked every year and after each lightning strike to ensure its good working order. Source NFC 17-102 – September 2011, (art. 8.2).

Maintenance and servicing of your lightning protection installation are also necessary to preserve your manufacturer's and installer's warranties.

Contact system is an exclusive solution proposed by **LPS** to meet normative requirements, preserve your warranties and ensure your security throughout the lifetime of your lightning protection installation.



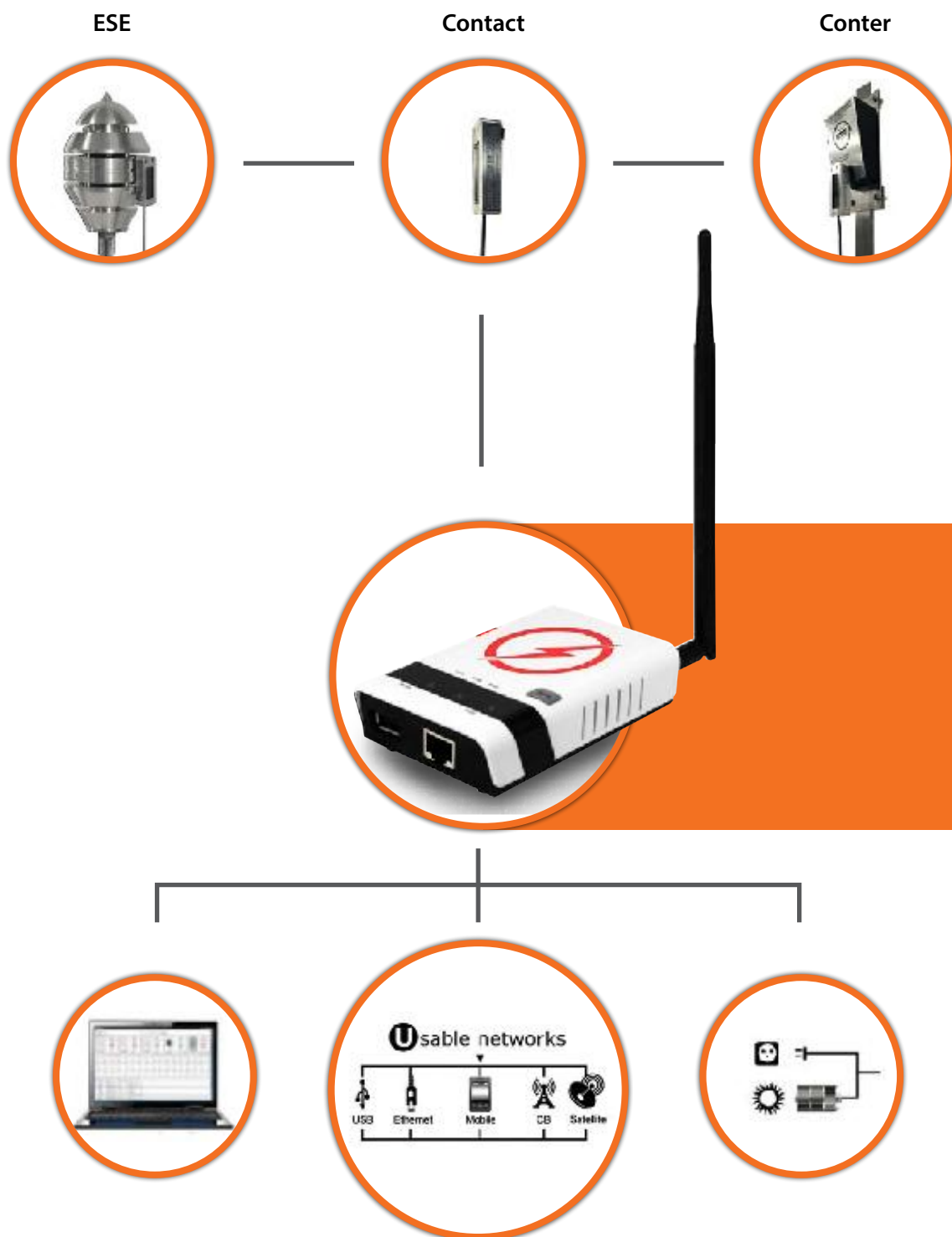


Contact + Rout

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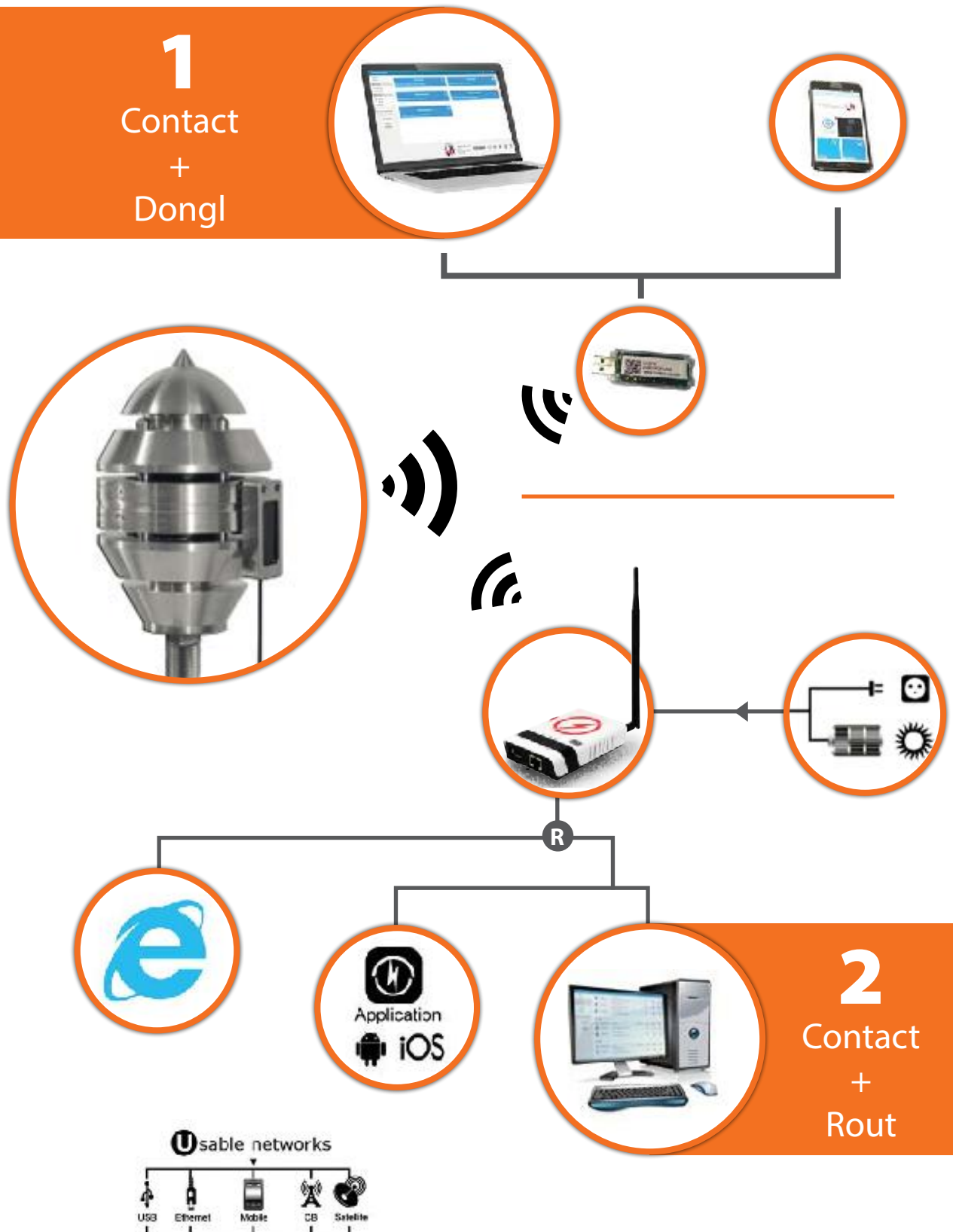




Reception of information

The content of the information you receive and the type of receipt (local or remote) depend on the choice of receiver

There is two existing receivers : **Dongl et Rout.**





Mast for Lightning

Lightning Mast

Lightning interception range of terminals stands for the protection of overhead equipment. The levels where no penetration of the roof structure is allowed to contain A. Single component system to reach the heights of protection to 6m.

Material	Mast	Base Plate	Part No.
Steel H.D.G	Up to 3 m	300x300 mm	ZLT 133
Steel H.D.G	Up to 6 m	500x500 mm	ZLT 165

Free Standing Masts

A range of free-standing lightning interception terminals for the protection of roof-mounted equipment on surfaces where no penetration of the roof structure for anchoring is allowed.

A multicomponent, stackable system with screw retention to achieve protection heights of up to 25m.

The FreeStanding Air Terminal system is designed to withstand wind speeds of up to 110kmh.

Length	Material	Part No.
6 m	Steel H.D.G	ZFS 06
8 m	Steel H.D.G	ZFS 08
10 m	Steel H.D.G	ZFS 10
12 m	Steel H.D.G	ZFS 12
15 m	Steel H.D.G	ZFS 15
20 m	Steel H.D.G	ZFS 20
25 m	Steel H.D.G	ZFS 25



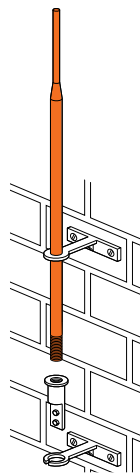
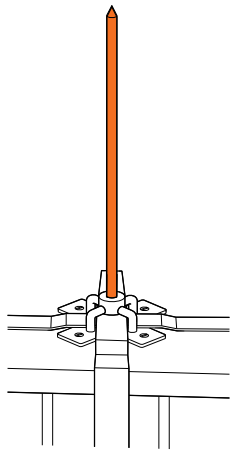


Lightning Air Rod

Single Air Rods

Air rods from an important part of the air termination network of a lightning protection system. All of our air rods are supplied with a locknut enabling the rod to be locked tight against the conductor.

Rod Diameter	Rod Length	Thread Length (mm)	Unit weight (kg)	Part No
16	300	40	0.53	ZTP 130
	500		0.85	ZTP 150
	1000		1.70	ZTP 110
	1500		2.59	ZTP 115
	2000		3.47	ZTP 120
20	300	40	0.80	ZTP 230
	500		1.34	ZTP 250
	1000		2.68	ZTP 210
	1500		4.02	ZTP 215
	2000		5.36	ZTP 220

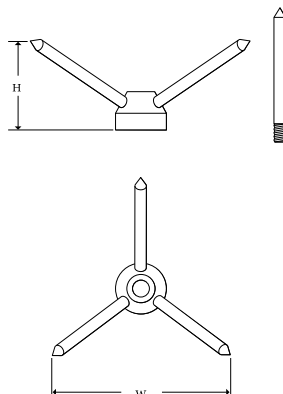
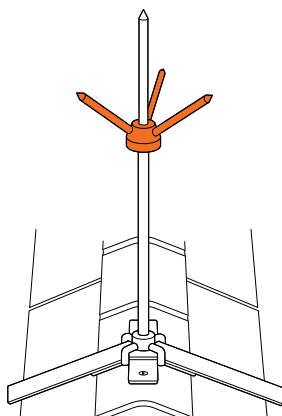


made of copper nicel chromcoted or stainless steel

MultiPoint Air Rod

Used in conjunction with the single air rods.

Air Rod Diameter	H(mm)	W(mm)	Unit weight (kg)	Part No.
16	156	72	0.30	ZMP 016
20	156	72	0.50	ZMP 020



made of copper nicel chrom coted or stainless steel



Saddles For Air Rod



Saddles for connection air rod to wire

Light duty saddles are used to support tall air rods to conductor on flat roof surfaces.

Rod Diameter	Thread size	Wire size	Part No.
16	M16	35	ZSW 135
	M16	50	ZSW 150
	M16	70	ZSW 170
	M16	95	ZSW 195
	M16	120	ZSW 112
	M16	185	ZSW 118
20	M20	35	ZSW 235
	M20	50	ZSW 250
	M20	70	ZSW 270
	M20	95	ZSW 295
	M20	120	ZSW 212
	M20	185	ZSW 218



made of brass

Saddles for connection air rod to Tape 1

Light duty saddles are used to support tall air rods to tape on flat roof surfaces.

Rod Diameter	Thread size	Tape size	Part No.
16	M16	20x3	ZST 1203
	M16	25x3	ZST 1253
	M16	30x3	ZST 1303
20	M20	20x3	ZST 2203
	M20	25x3	ZST 2253
	M20	30x3	ZST 2303



made of brass

Saddles for connection air rod to Tape 2

Light duty saddles are used to support small air rods to tape on flat roof surfaces.

Rod Diameter	Thread size	Tape size	Part No.
16	M16	20x3	ZST 3203
	M16	25x3	ZST 3253
20	M20	20x3	ZST 4203
	M20	25x3	ZST 4253



made of brass



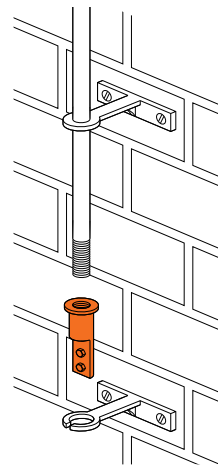
saddles for side wall



Coupling for Air rod to bracket

Enables the flat tape or cable lug to be connected to the air rod. Used in conjunction with the side mounting air rod brackets.

Rod diameter	Thread size	Part No.
16	M16	ZRC 16
20	M20	ZRC 20



made of Brass

Bracket For Coupling & Air Rod

These brackets provide a 75mm projection from the building face and are used where it is not possible to fit a saddle onto the building roof. The brackets are used in conjunction with the rod to tape coupling used to secure the flat tape to the air rod.

Rod diameter	Rod Coupler mm	Part No.
16	16	ZRH 16
20	20	ZRH 20



made of Brass

Coupling for Air rod to Mast

adopting pieces for air terminal mast and internal round or tape down conductor connection

Rod diameter	Thread size	Mast	Part No.
16	M16	2"	ZCM 016
20	M20	2"	ZCM 020



made of Brass



Down Conductors Holders



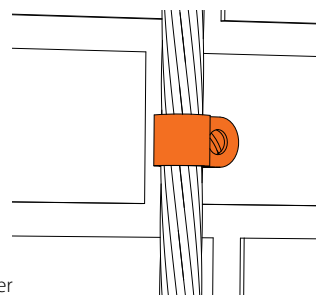
One Hole Clip

One hole conductor clips provide an easy method of fixing copper and aluminum conductors to surface.

Wire Size	Part No.
35	ZHW 35
50	ZHW 50
70	ZHW 70
95	ZHW 95
120	ZHW 120
185	ZHW 185



made of copper



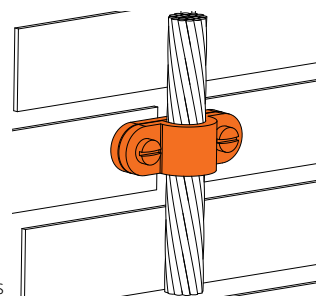
Metallic Cable Clip

Metallic cable clips secure the stranded copper conductor to the building surface.

Wire Size	Part No.
35	ZMH 35
50	ZMH 50
70	ZMH 70
95	ZMH 95
120	ZMH 120



made of brass



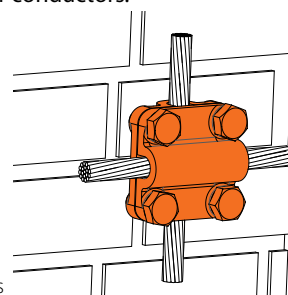
Square Conductor clamp

These four way connectors are suitable for making cross straight through or tree joints in Copper conductors.

Wire Size	Part No.
35	ZWS 35
50	ZWS 50
70	ZWS 70
95	ZWS 95
120	ZWS 120



made of brass





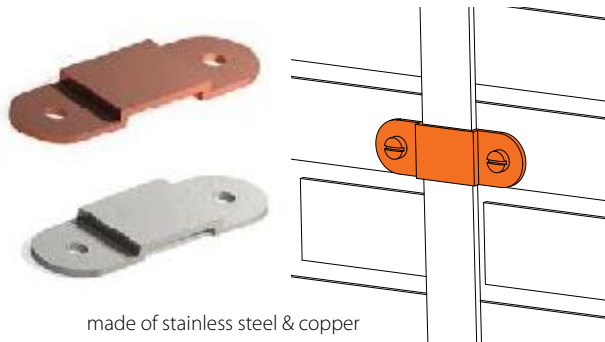
Tape Clamp



Tape Clips

Tape clips hold the flat tape conductor flush to the building surface.

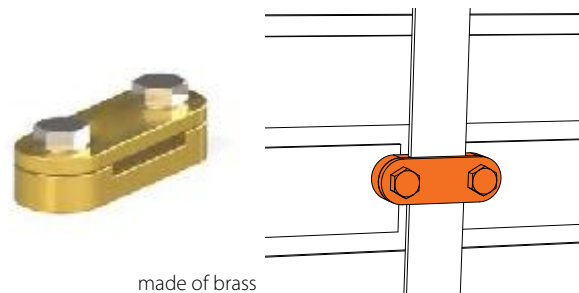
Tape Size	Material	Part No.
20x3	Copper	ZTH 253
25x3		
20x3	Stainless Steel	ZTH 253 ss
25x3		



Metallic Tape Clips

Metallic DC clips secure the flat tape conductor to the building surface.

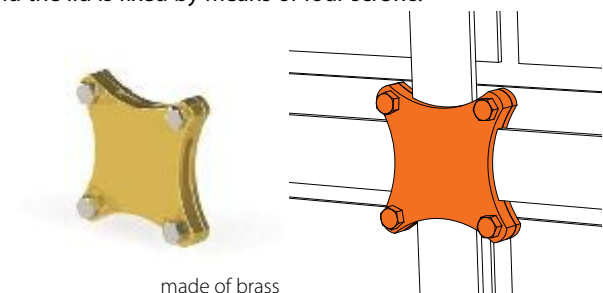
Tape Size	Part No.
20x3	ZTC 253
25x3	
30x3	ZTC 303
50x5	ZTC 505



Square Tape Clamp

These four way connectors are suitable for making cross straight through or tree joints in flat tape. The base has a countersunk hole in the middle for securing the clamp to the building surface and the lid is fixed by means of four screws.

Tape Size	Part No.
20x3	ZTX 253
25x3	
30x3	ZTX 303





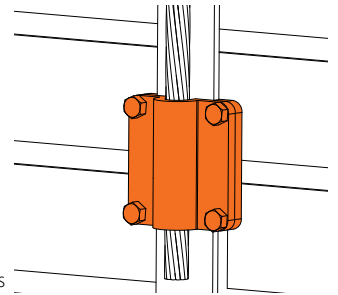
Test Clamps

cable to tape clamp

Wire Size	Tape Size	Part No.
35	20x3	ZTW 3525
	25x3	
50	20x3	ZTW 5025
	25x3	
70	20x3	ZTW 7025
	25x3	



made of brass



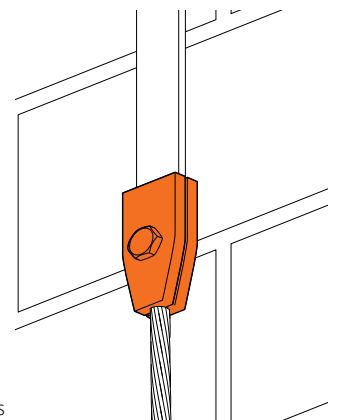
Cable To Tape Clamp

This clamp for test connecting flat tape to solide circular conductor

Wire Size	Tape Size	Part No.
50	20x3	ZTS 5025
	25x3	
	30x3	ZTS 5030
70	20x3	ZTS 7025
	25x3	
	30x3	ZTS 7030
95	20x3	ZTS 9525
	25x3	
	30x3	ZTS 9530



made of brass



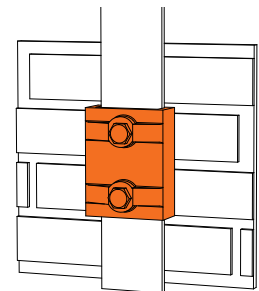
Tape To Tape Clamp

Designed to join a range of tape size in a straight through position. In many applications the clamp enables tapes to be overlapped and secured by the two set screws.

Tape Size	Part No.
20x3	ZTS 253
25x3	
30x3	ZTS 303



made of brass



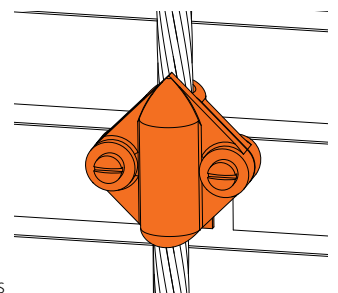
Wire To Wire Clamp

Designed to join a range of wire size in a straight through position. In many applications the clamp enables wires to be overlapped and secured by the two set screws.

Wire Size	Part No.
35	ZTS 35
50	ZTS 50
70	ZTS 70
95	ZTS 95
120	ZTS 120



made of brass





REWINDER EARTHING SYSTEM ZPT200



LIGHTNING PROTECTION FOR FLOATING ROOF TANKS

“ Minimize The Risk Of Fires Caused By Lightning “

Lightning Risks Involving Floating Roof Storage Tanks

External Floating Roof (EFRT) are extremely susceptible to not only direct lightning strikes but nearby currents as well. The shell of these structures commonly discharges current more rapidly than the floating roof.

Normally, there is little vapor, and consequently a smaller risk of internal ignition, fire and explosion; however, studies have shown that 31% of all floating roof tank fires are caused by lightning related issues.(Fig.1)

THERE ARE HUNDREDS OF ABOVE GROUND STORAGE TANK FIRES EVERY YEAR.

Rim Seal fires are the most common type of fire for floating roof tanks, especially EFRT.

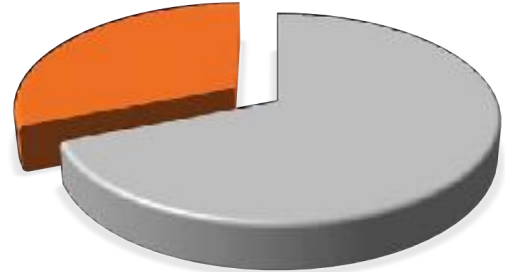
It is estimated that 95% of rim seal fires are the result of lightning strikes and 0,16% of all tanks with rim seals will experience a rim seal fire in any given year*1.(Fig.2)



Of all floating roof tank fires are caused by lightning related issues
Fig.1



31%



Of rim seal fires are the result of lightning strikes.
Fig.1



95%



CURRENT PROTECTION METHODS

Shunts –Metal strip that electrically bond to the shell wall and roof of a floating roof tank in multiple locations.

Currently, to create a roof-shell bond, the National Fire Protection Association (NFPA) 780 states that shunts must be spaced a maximum of every 3 mt around the tank perimeter.

Corrosion or by-product accumulations on the inside of the shell can create a high impedance-resistance connection between the shell and the shunts, resulting in sparking and possible ignition.

Large tanks are typically “out-of-round” by several inches, this results in shunts pulling away from the tank shell. Resulting in a loss of the necessary bonds.





RESULT OF SHUNT MALFUNCTIONS

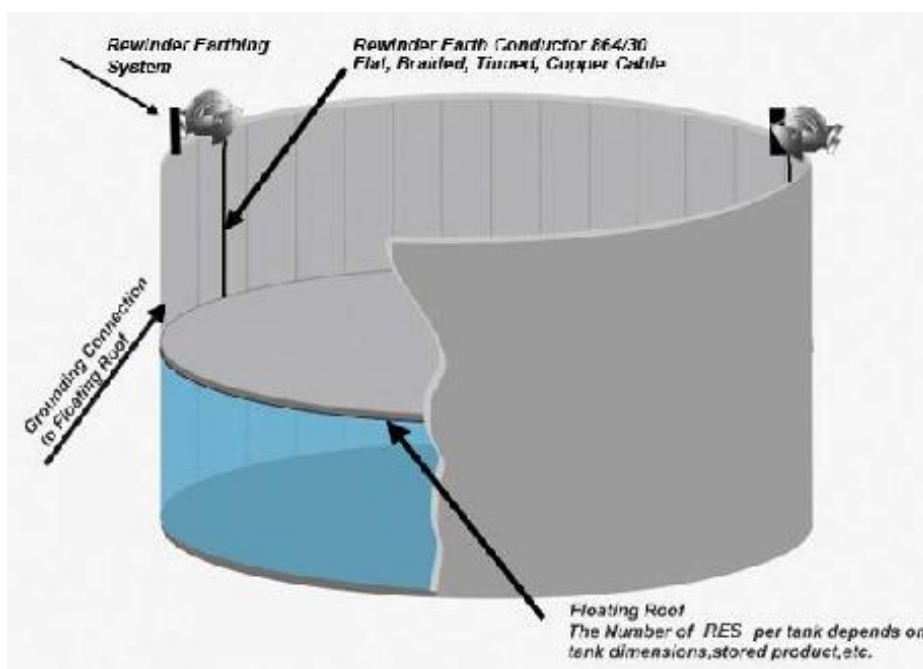
A poorly contacting rim-seal shunt on an EFRT is an example of where sparks might occur during lightning storms. If there is a non-conducting layer on the shell or the shunt, the spark will initially be an airgap spark that will break down the insulation, followed by current flow in a poorly contacting area resulting in thermal sparking.

As you can see in the chart below, shunts are used for the conduction of fast and intermediate duration of lightning-stroke current. Bypass conductors are used for conduction of the intermediate and long duration components of lightning-stroke current.*2 The long duration currents are where the most dangerous air-gap sparks may occur.



- The most effective floating roof tank grounding system on the market.
- Lowest impedance of any system
- Full-Time, Positive Connection
- Helps reduce fire risk.
- Greatly reduces shunt maintenance.
- Free Maintenance
- Easy Installation
- 5 years warranty.
- In-Service Installation
- Existing Tanks or New Tanks.
- API 545 Compliance

Shunt malfunction can result in months or years of downtime, single tank damage, damage to an entire facility, or damage to personnel. Shunts alone are too unreliable to take this chance, as testing has shown that, rather than reducing the risk of fire from lightning strikes, they may actually be increasing risk potential.



The ZPT200 uses a sleek and exceptionally rugged construction made of heavy-duty 3-4 mm 304 grade stainless steel suitable for long life in any environment. Unrivaled by anything in the industry.

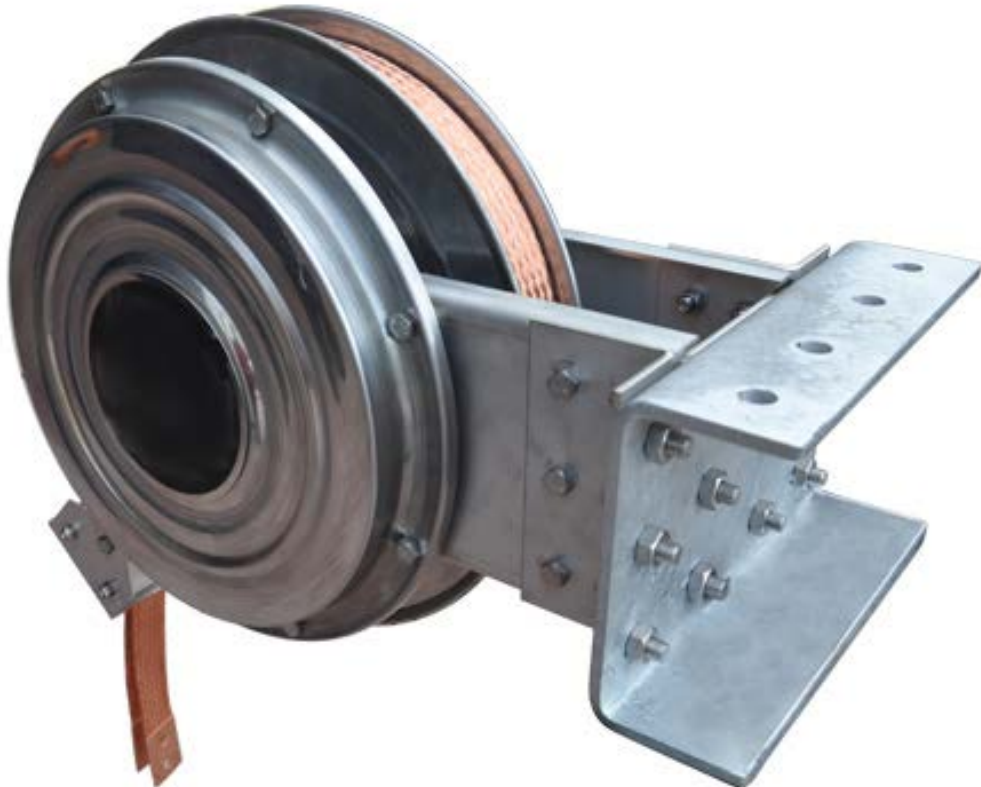
The 50 mm² bypass conductor of the RES is specially designed and manufactured with SS304 for exceptional corrosion resistance, strength and maximum durability.



ZPT200 QUANTITY SELECTION CHART



Tank Circumference (Meters)	Tank Diameter (Meters)	Quantity Of Required RES2000's
≤ 60	≤ 19,10	2
≤ 90	≤ 28,65	3
≤ 120	≤ 38,20	4
≤ 150	≤ 47,75	5
≤ 180	≤ 57,30	6
≤ 210	≤ 66,84	7
≤ 240	≤ 76,39	8
≤ 270	≤ 85,94	9
≤ 300	≤ 95,49	10
≤ 330	≤ 105,04	11
≤ 360	≤ 114,59	12
≤ 390	≤ 124,14	13
≤ 420	≤ 133,69	14
≤ 450	≤ 143,24	15
≤ 480	≤ 152,79	16
≤ 510	≤ 162,34	17
≤ 540	≤ 171,89	18
≤ 570	≤ 181,44	19
≤ 600	≤ 190,99	20

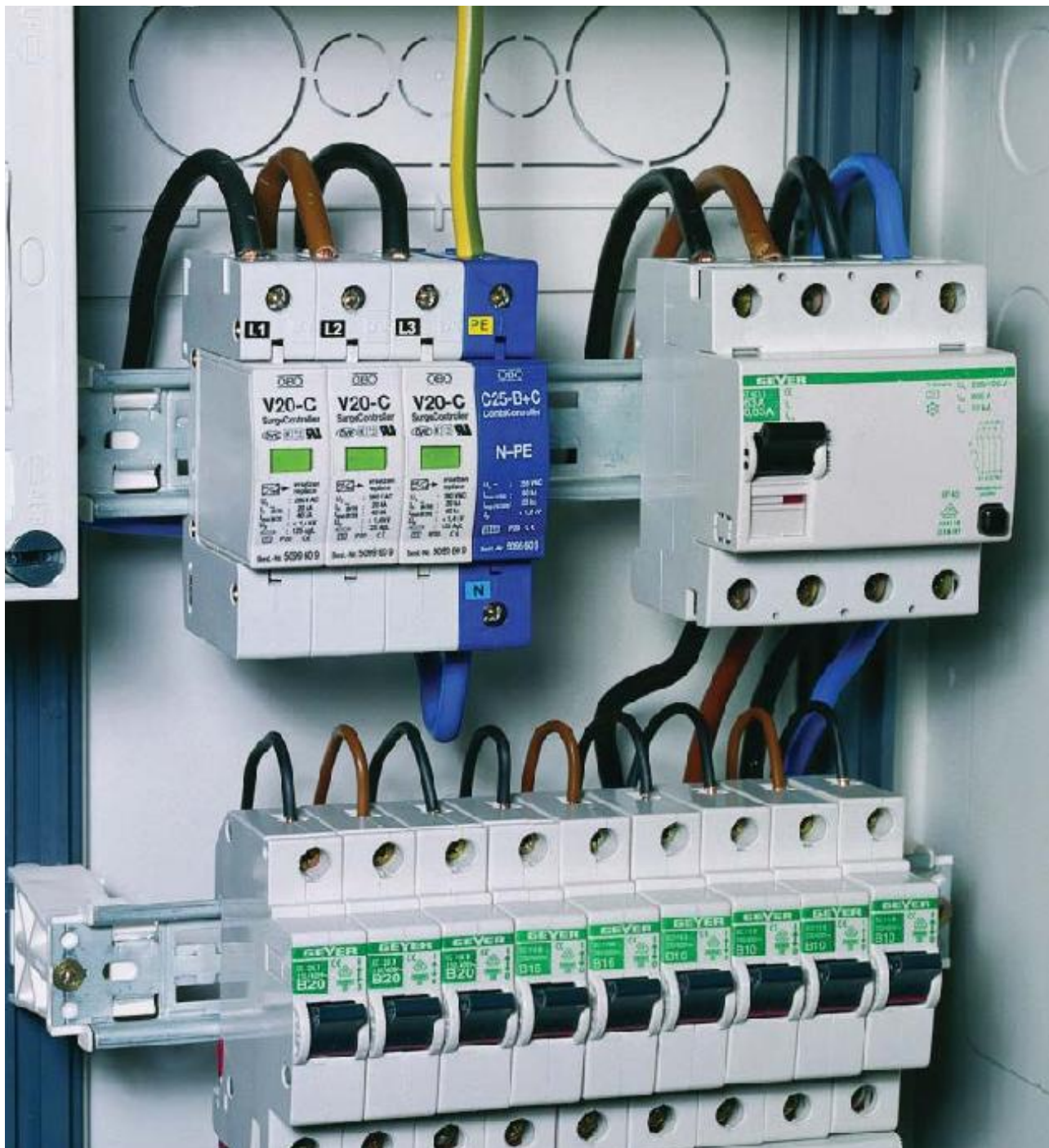




Surge arrester

A surge arrester is a device to protect electrical equipment from over-voltage transients caused by external (lightning) or internal (switching) events. Also called a surge protection device (SPD) or transient voltage surge suppressor (TVSS), this class of device is used to protect equipment in power transmission and distribution systems. (For consumer equipment protection, different products called surge protectors are used.) The energy criterion for various insulation material can be compared by impulse ratio, the surge arrester should have a low impulse ratio, so that a surge incident on the surge arrester may be bypassed, to the ground instead of passing through the apparatus.

To protect a unit of equipment from transients occurring on an attached conductor, a surge arrester is connected to the conductor just before it enters the equipment. The surge arrester is also connected to ground and functions by routing energy from an over-voltage transient to ground if one occurs, while isolating the conductor from ground at normal operating voltages. This is usually achieved through use of a varistor, which has substantially different resistances at different voltages.





What are transient surges?

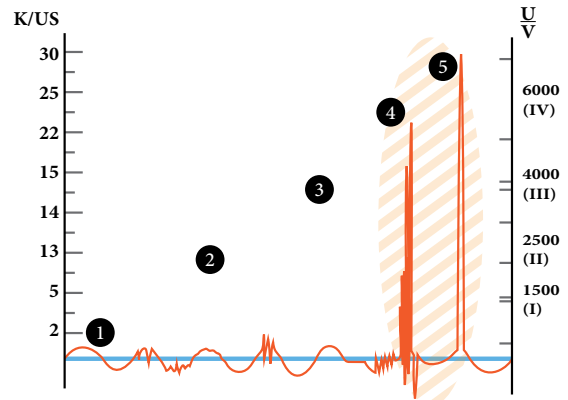
Transient surge voltages are brief voltage peaks lasting microsec-onds, which may be a multiple of the attached mains nominal volt-age.

Direct strike

The largest voltage peaks in the low voltage consumer network are caused by lightning discharges. The high energy content of lightning surges when a direct strike hits the external lightning protection system or a low voltage open wire line usually causes – without internal lightning and surge protection – total outage of the connect-ed consumers and damage to the insulation.

Delayed failures

Often, failures occur only after a time delay as the aging process of electronic components in the affected devices triggered by smaller transients causes insidious damage. A number of different protection measures are required. These depend on the exact cause and/or impact point of the light-ning discharge.

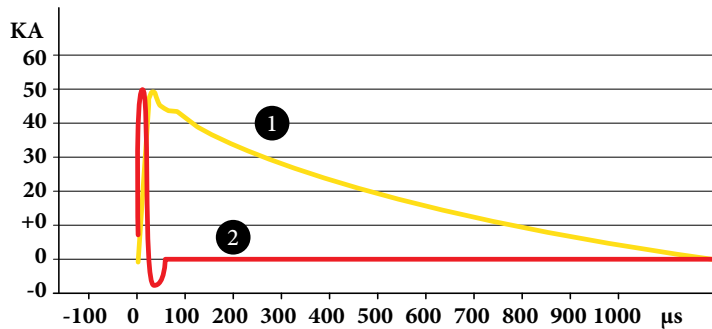


Transient surge voltages: 1 = Voltage drops/brief interruptions, 2 = Harmonic waves through slow and rapid voltage changes, 3 = Temporary voltage increases, 4 = Switching surges, 5 = Lightning surge voltages, hatched = application for surge protection devices

Induced voltage peaks and switching surge voltages

Yet induced voltage peaks in building installations and energy or data line supply cables can also reach many times the nominal operating voltage. Switching surges too, which in fact do not cause such high voltage peaks as light-ning discharges but occur much more frequently, can result in im-mediate system failure. As a rule, switching surges amount to twice to three times the operating volt-age, lightning surges on the other hand can sometimes reach 20 times the nominal voltage value and transport a high energy con-tent.

What are transient surges?



Pulse types and their characteristics: Yellow = pulse shape 1, direct lightning strike, 10/350 μs simulated lightning pulse, red = pulse shape 2, remote lightning strike or switching operation, 8/20 μs simulated lightning pulse (Surge)

Testing currents simulate poten-tial increase

High lightning currents can flow to the ground during a storm. If a building with external lightning protection receives a direct hit, a voltage drop occurs on the earthing resistor of the lightning protection equipotential bonding system, which represents a surge voltage against the distant environment. This rise in potential poses a threat to the electrical systems (e.g. volt-age supply, telephone systems, cable TV, control cables, etc.) that are routed into the building. Suitable test currents for testing different lightning and surge protectors have been defined in na-tional and international standards.

Direct lightning strike: Pulse shape 1

Lightning currents that can occur during a direct lightning strike can be imitated with the surge current of wave form 10/350 μs. The light-ning test current imitates both the fast rise and the high energy content of natural lightning. Lightning current arrestor type 1 and exter-nal lightning protection compo-nents are tested using this current.

Remote lightning strikes or switching operations: Pulse shape 2

The surges created by remote lightning strikes and switching operations are imitated with test im-pulse 8/20 μs. The energy content of this impulse is significantly lower than the lighting test current of surge current wave 10/350 μs. Surge arrestor type 2 and type 3 are impacted with this test impulse.



Causes of lightning currents

Direct lightning strike into a building

If a lightning strike hits the external lightning protection system or earthed roof structures capable of carrying lightning current (e.g. roof aerial), then the lightning energy can be arrested to the ground in advance. However, a lightning protection system on its own is not enough: Due to its impedance, the building's entire earthing system is raised to a high potential. This potential increase causes the lightning current to split over the building's earthing system and also over the power supply systems and data cables to the adjacent earthing systems (adjacent building, low-voltage transformer).

Risk:

Lightning impulse (10/350)



Direct lightning strike into a low-voltage open-wire line

A direct lightning strike into a low-voltage open wire line or data cable can couple high partial lightning currents in an adjacent building. Electrical equipment in buildings at the end of the low-voltage open wire line are at particular risk of damage caused by surges.

Risk:

Lightning impulse (10/350)



Causes of lightning currents

Switching surges in the low-voltage system

Switching surges are caused by switch on and switch off operations, by switching inductive and capacitive loads and by interrupting shortcircuit currents. Particularly when production plants, lighting systems or transformers are switched off, electrical equipment located in close proximity can be damaged.

Risk:

Lightning impulse (8/20)

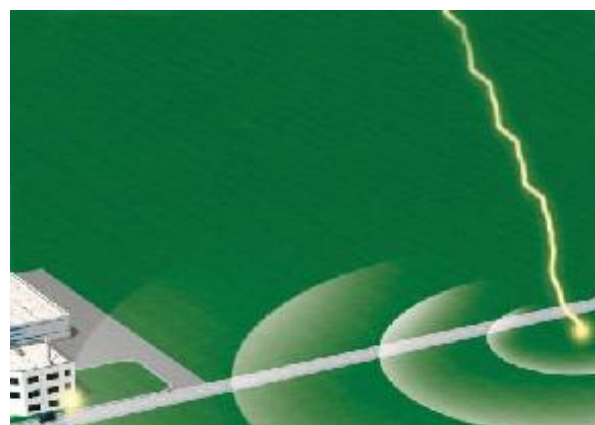


Coupling of surges through local or remote lightning strike

Even if lightning protection and surge protection measures are already installed: A local lightning strike creates additional high magnetic fields, which in turn induce high voltage peaks in line systems. Inductive or galvanic coupling can cause damage within a radius of up to 2 km around the lightning impact point.

Risk:

Lightning impulse (8/20)

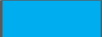




Gradual surge reduction with lightning protection zones

Lightning protection zone concept

The lightning protection zone concept described in international standard IEC 62305-4 (DIN VDE 0185 Part 4) has proved to be practical and efficient. This concept is based on the principle of gradually reducing surges to a safe level before they reach the terminal device and cause damage. In order to achieve this situation, a building's entire energy network is split into lightning protection zones (LPZ = Lightning Protection Zone). Installed at each transition from one zone to another is a surge arrester for equipotential bonding. These arrestors correspond to the requirement class in question.

Lightning protection zone		
LPZ 0 A		Unprotected zone outside the building. Direct lightning strike, no shielding against electromagnetic interference pulses LEMP (Lightning Electromagnetic Pulse)
LPZ 0 B		Through the area protected by the external lightning protection system. No shielding against LEMP.
LPZ 1		Zone inside the building. Low partial lightning energies possible.
LPZ 2		Zone inside the building. Low surges possible
LPZ 3		Zone inside the building (can also be the metal housing of a consumer). No interference pulses through LEMP or surges present.

Zone transitions and protective devices

Benefits of the lightning protection zone concept

- Minimisation of the couplings into other cable systems through arresting the energy-rich, dangerous lightning currents directly at the point the cables enter the building.
- Malfunction prevention with magnetic fields.
- Economic, well-plannable individual protection concept for new and old buildings and reconstructions.

Type classes of the surge protection devices

Zino surge protection devices are classified in accordance with DIN EN 61643-11 into three type classes type 1, type 2 and type 3 (previously B, C and D). These standards contain building regulations, requirements and tests for surge arrestors used in AC networks with nominal voltages of up to 1,000 V and nominal frequencies of between 50 and 60 Hz.

Correct selection of the arrester

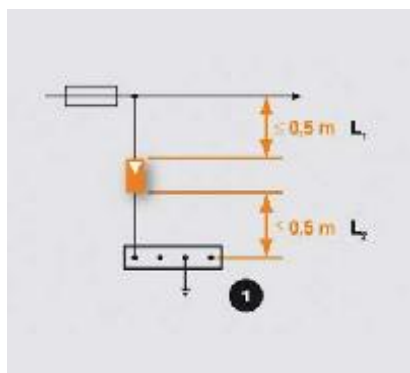
This classification enables arrestors to be matched to different requirements with regard to location, protection level and current-carrying capacity. The table below provides an overview of the zone transitions. It also shows which OBO surge protection devices can be installed in the energy supply network and their respective function.



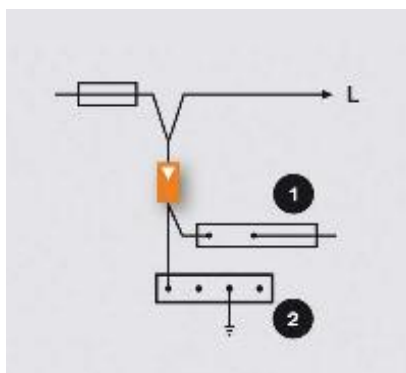
Zone transitions

Zone Transition	Protection device and device type	Product Example	Product Figure
LPZ 0 B to LPZ 1	Protection device for lightning protection equipotential bonding in accordance with DIN VDE 0185-3 for direct or close lightning strikes. • Devices: type 1 (Class I, requirements class B), e.g. MC50-B • Max. protection level according to standard: 4 kV • Installation e.g. in the main distributor/at building entry	MCD Item no.: 5096 87 9	
LPZ 1 to LPZ 2	Protection device for surge protection to DIN VDE 0100-443 for surge voltages arriving through the supply network due to remote strikes or switching operations. • Devices: type 2 (Class II, requirements class C), e.g. V20-C • Max. protection level according to standard: 2.5 kV • Installation e.g. in the power distributor, subdistributor	V20 Item no.: 5094 65 6	
LPZ 2 to LPZ 3	Protection device, designed for surge protection of portable consumers at sockets and power supplies. • Devices: type 3 (Class III, requirements class D), e.g. FineController FC-D • Max. protection level according to standard: 1.5 kV • Installation e.g. on the end consumer	FC-D Item no.: 5092 80 0	

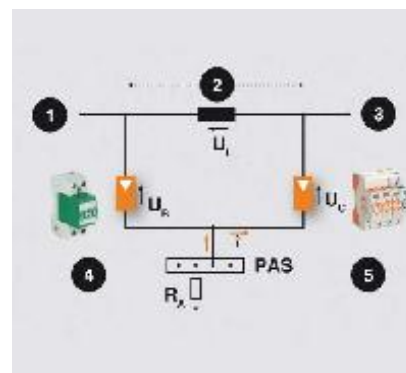
Installation instructions



Length of the feed line,
1 = Equipotential bonding rail or terminal or protective conductor rail



V wiring,
1 = Protective conductor rail,
2 = Main equipotential bonding rail or terminal



1 = Power supply,
2 = Cable length,
3 = Consumer,
4 = Response voltage 2 kV, e.g. MC 50-B VDE
5 = Response voltage 1.4 kV, e.g. V20 C

Minimum cross-sections for lightning protection equipotential bonding

The following minimum cross-sections must be observed for lightning protection equipotential bonding: for copper 16 mm², for aluminium 25 mm² and for iron 50 mm². At the lightning protection zone, transition from LPZ0 to LPZ1, all metal installations must be integrated into the equipotential bonding system. Active lines must be earthed using suitable arrestors.

Connection length, V-wiring

The connection cable to the protector is crucial for achieving an optimum protection level. In accordance with IEC installation directives, the length of the branch line to the arrestor and the length of the line from the protection device to the equipotential bonding should in each case be less than 0.5 m. If the cables are longer than 0.5 m, then V-wiring must be chosen.

Decoupling

Lightning current and surge arrestors perform a number of functions. These arrestors must be used in coordination. This coordination is guaranteed by the existing line length or special lightning current arrestors (MCD series). For example, in the protection set, type 1 and type 2 arrestors (Classes B and C) can be used adjacent to each other.

Example cable length > 5 m

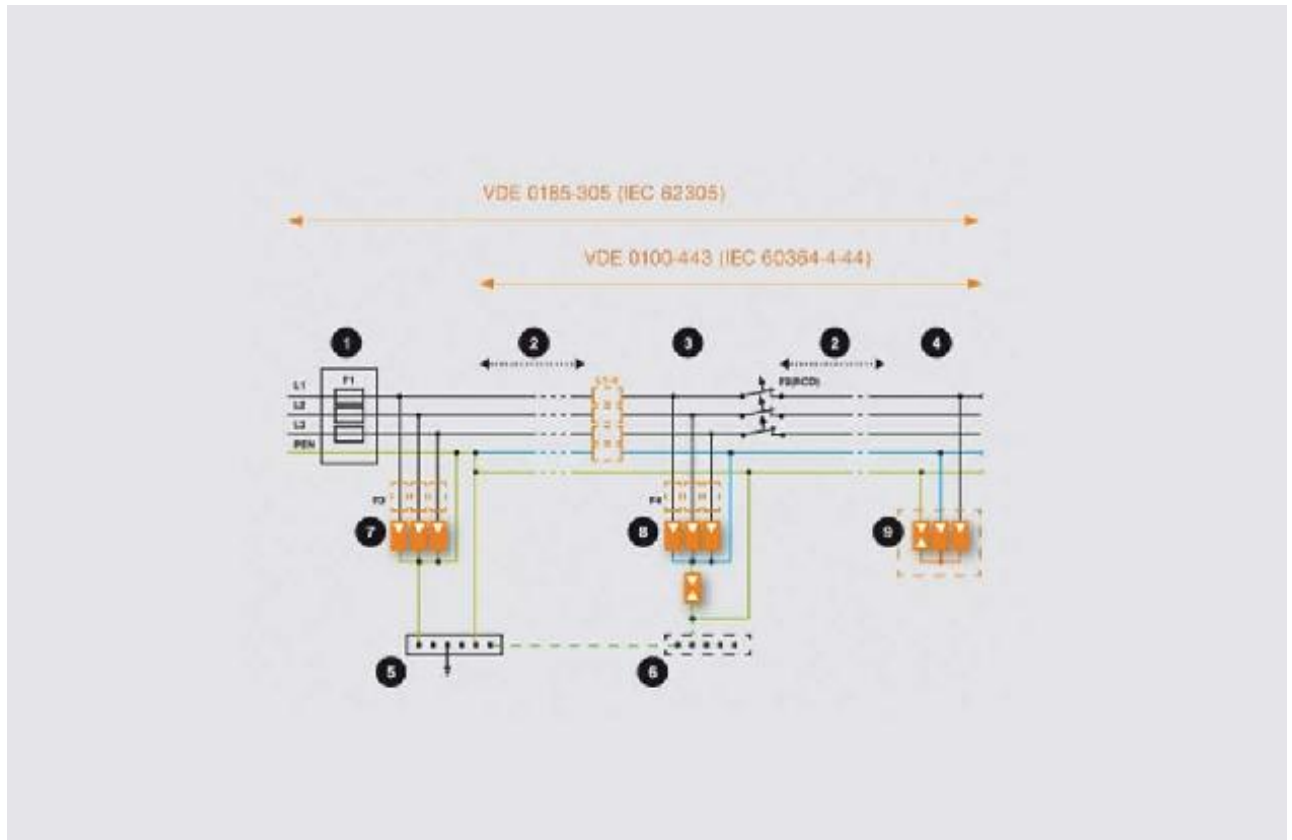
- No additional decoupling required

Example cable length < 5 m

- Use decoupling: MC 50-B VDE + LC 63 + V20-C
- Alternatively: MCD 50-B + V20-C, no additional decoupling required (e.g. protection set)



Cable networks, TN-C network system



1 = Main distributor, 2 = Cable length, 3 = Circuit distributor, e.g. subdistributor, 4 = Fine power protection, 5 = Main EBS, 6 = Local EBS, 7 = Type 1, 8 = type 2, 9 = type 3

In the TN-C-S network system, the electrical unit is supplied through the three external lines (L1, L2, L3) and the combined PEN line. Usage is described in DIN VDE 0100-534 (DIN EN 61643- 11)

Lightning current arrester Type 1

Type 1 lightning current arresters are used in the 3-pole circuit (e.g.: 3x MC 50-B). The connection is effected parallel to the external lines, which are connected to the PEN via the arrester. Following consultation with the local energy provider and in accordance with the VDN Directive, use before the main meter device is also possible.

Surge arrester, type 2

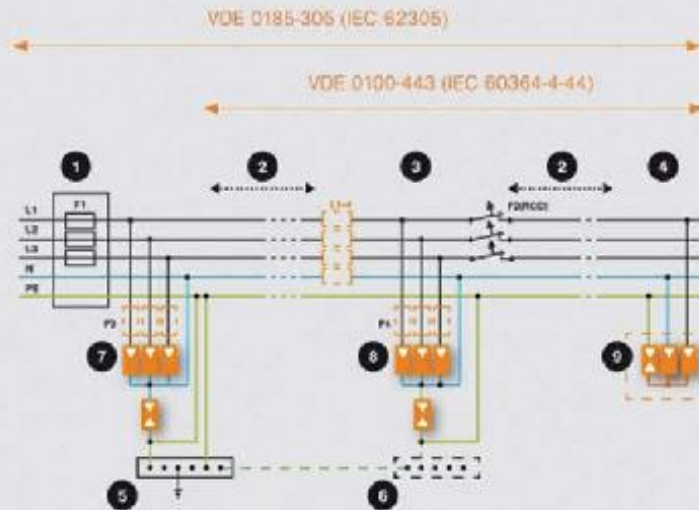
Surge arresters of type 2 are usually used after the split in the PEN line. If the split is more than 0.5 m away, the network from here onwards is 5-line. The arresters are used in the 3+1 circuit (e.g. V20-C 3+NPE). With the 3+1 circuit, the external lines (L1, L2, L3) are connected to the neutral cable (N) via arresters. The neutral cable (N) is connected to the protective earth via a collective spark gap. The arresters must be used before a residual current protective device (RCD), as it would otherwise interpret the surge current as a residual current and interrupt the power circuit.

Surge arrester, type 3

Surge arresters of type 3 are used to protect against surges in the device power circuits. These transverse surges occur primarily between L and N. A Y circuit protects the L and N lines with varistor circuits and makes the connections to the PE line through a collective spark gap (e.g. KNS-D). This protection circuit between L and N prevents surge currents from transverse voltages being conducted towards PE, the RCD thus interprets no residual current. The relevant technical data is contained on the product pages.



Cable networks, TN-S and TT network system



1 = Main distributor, 2 = Cable length, 3 = Circuit distributor, e.g. subdistributor, 4 = Fine power protection, 5 = Main EBS, 6 = Local EBS, 7 = Type 1, 8 = Type 2, 9 = Type 3

In the TN-S network system, the electrical unit is supplied through the three external lines (L1, L2, L3), the neutral cable (N) and the earth cable (PE). In the TT network, however, the electrical unit is supplied through the three external lines (L1, L2, L3), the neutral cable (N) and the earth cable (PE). Usage is described in DIN VDE 0100-534 (DIN EN 61643-11).

Lightning current arrester type 1

Type 1 lightning current arresters are used in the 3+1 circuit (e.g. 3x MC 50-B and one MC 125-B NPE). With the 3+1 circuit, the external lines (L1, L2, L3) are connected to the neutral cable (N) via arresters. The neutral cable (N) is connected to the protective earth via a collective spark gap. Following consultation with the local energy provider and in accordance with the VDN Directive, use before the main meter device is also possible.

Surge arrester, type 2

Surge arresters of type 2 are used in the 3+1 circuit (e.g. V20-C 3+NPE). With the 3+1 circuit, the external lines (L1, L2, L3) are connected to the neutral cable (N) via arresters. The neutral cable (N) is connected to the protective earth via a collective spark gap. The arresters must be used before a residual current protective device (RCD), as it would otherwise interpret the surge current as a residual current and interrupt the power circuit.

Surge arrester, type 3

Surge arresters of type 3 are used to protect against surges in the device power circuits. These transverse surges occur primarily between L and N. A Y circuit protects the L and N lines with varistor circuits and makes the connection to the PE line through a collective spark gap (e.g. KNS-D). This protection circuit between L and N prevents surge currents from transverse voltages being conducted towards PE, the RCD thus interprets no residual current. The relevant technical data is contained on the product pages.



Installation location 1

Installation in the main distributor box / combined distributor Basic protection / type 1, type 2

Initial situation	Building type	Description	Type	Item no.	Test mark	Product figure
I No external lightning protection system I Earthing cable connection 	Private building	TN-/TT Type 2 + 3 2.5 SU Secondary counter zone	V10 Compact	5093 38 0		
		TN-/TT Type 2 + 3 4 SU Secondary counter zone	V10-C 3+NPE	5093 39 1		
	Multiple dwelling/ industry, commerce	TN-/TT Type 2 4 SU Secondary counter zone	V20 3+NPE	5095 25 3	VDE	
			V20 3+NPE+FS with remote signalling	5095 33 3	VDE	
I External lightning protection system (according to DIN EN 0185 305) 	Buildings of lightning protection classes III and IV (e.g. housing, of-fices and commercial build-ings)	TN-/TT Type 1 + 2 4 SU Secondary counter zone	V50 3+NPE	5093 52 6		
			V50 3+NPE+FS with remote signalling	5093 53 3		
Outdoor connection 	Buildings of lightning protection classes I to IV (e.g. industry)	TN-C Type 1 6 SU Pre-metered or sec-ondary counter zone	MCD 50-B 3	5096 87 7		
		TN-S Type 1 8 SU Pre-metered or sec-ondary counter zone	MCD 50-B 3+1	5096 87 9		



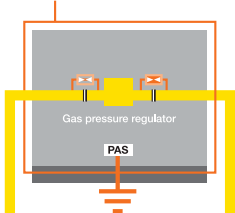
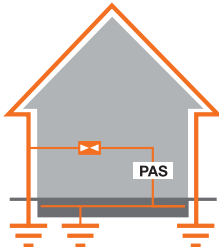
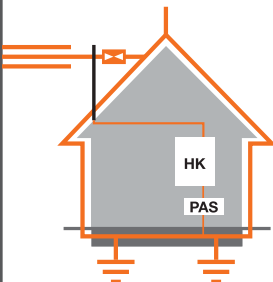
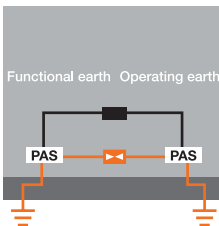
Installation location 2
Installation in the sub-distributor Medium protection / type 2 Only required if distance $\geq 10\text{m}$

Description	Type	Item no.	Product figure
TN/TT Type 2 + 3 2.5 SU	V10 Compact	5093380	
TN/TT Type 2 4 SU	V10 Compact-AS, with acoustic remote signalling	5093391	
TN/TT Type 2 4 SU	V20 3+NPE	5095253	
	V20 3+NPE+FS with remote signalling	5095333	
TN/TT Type 2 4 SU	V20 3+NPE	5095253	
	V20 3+NPE+FS with remote signalling	5095333	
TN/TT Type 2 4 SU	V20 3+NPE	5095253	
	V20 3+NPE+FS with remote signalling	5095333	

Installation location 2
Installation before the terminal
Fine protection / type 3

Description	Type	Item no.	Test mark	Product figure
Plug-in	FC-D	5092 80 0	VDE	
	FC-TV-D	5092 80 8	VDE	
	FS-SAT-D	5092 81 6	VDE	
	FC-TAE-D	5092 82 4	VDE	
	FC-ISDN-D	5092 81 2	VDE	
	FC-RJ-D	5092 82 8	VDE	
	CNS-3-D-D	5092 70 1		
Fixed installation	ÜSM-A	5092 45 1		
	ÜSM-A-2	5092 46 0		
	ÜSS 45-oRW	6117 47 3		
Series installation in distributor	V10 Compact L1/L2/ L3/N	5093 38 0		
	VF230- AC/DC	5097 65 0		
	VF230- ACFS with remote signalling	5097 85 8		



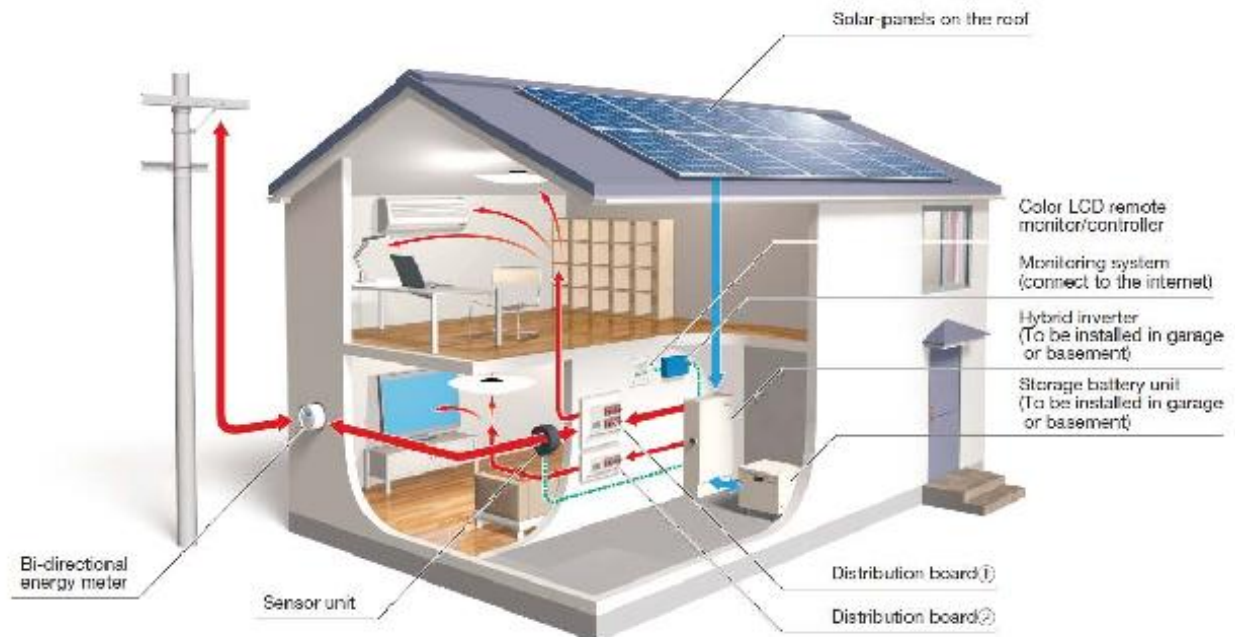
Overview				
Application	Description	Type	Item no.	Product figure
Isolating spark gaps for insulating flange 	e.g. in a gas pressure control station Particularly for Ex areas For bridging of insulating flanges or insulating threaded joints which can carry lightning currents	Type 480	5240034 5240077 5240069	
Isolating spark gaps for potential isolation 	Several earthing systems in one building, e.g. foundation earther and deep earther Connection via spark gap N electrochemical corrosion Entire earther surface is effective in the event of a direct lightning strike	Type 481	5240085	
Open-wire connection 	Roof stand spark gap for insulation Largest possible distance between the roof stand of a low voltage free cable and a lightning protection system Distance < 0.5 m: encapsulated spark gap in agreement with the power supply company	Type 482	5240050	
Coupling of earthing systems 	Several earthing systems on one building If the operation of special electronic equipment requires a separate earthing system, then this functional earth must be connected to the operating earth Prevention of dangerously high voltage differences An additional throttle is fitted to keep high-frequency voltages away from the functional earthing	Type FS-V20	5099803	



Solar System



Residential



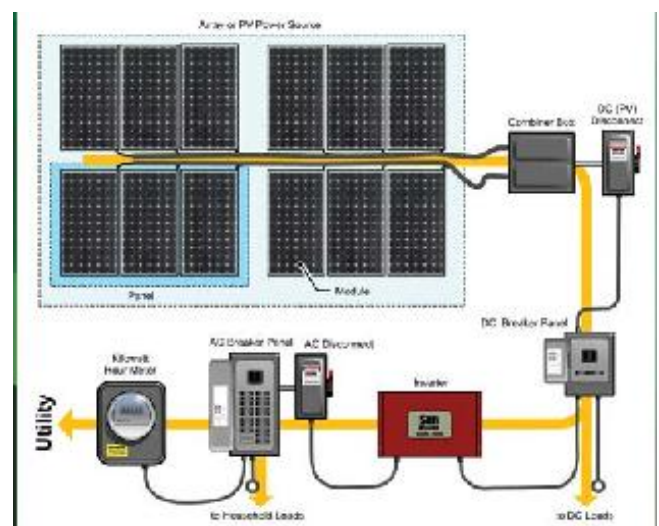
Off-grid solar energy storage system

Off-grid solar energy storage system can convert solar light into electrical energy. And the energy can be directly used by loads or stored for using at night. It is a ideal green power for without electricity, power shortage or unstable areas, such as: remote mountainous, islands, communication base stations, border posts, etc. Off-grid solar energy storage system also can be used as mobile or standby power supply. So if you want to construct your own off-grid solar energy storage system, Please contact us.

Zeno off-grid solar energy storage Kits are excellent solutions and pre-configured with major components, which simplifies your purchase source, saves overall cost and time. Zeno will provide a full range of Off-grid solar energy storage system kit to meet different electricity demand, different output power requirement. You can choice them by your loads power consumption and rated output power. The following introduction is about single phase Off-grid solar energy storage system kit.

System Features

- Available in different sizes from 500W to 8kW
- Inverter & charge controller all-in-one
- Integrated energy management system & a variety of work mode
- Frequency isolation transformer design, safe, quiet and stable
- 110V/230V optional, 50Hz/60Hz adaptive
- With electricity or Diesel generator by-pass
- VRLA-GEL battery, long deep cycle life
- External batteries, flexible configuration
- Easy installation, convenient operation
- Fast and accurate delivery, do not wait again
- Free pre-sales technical support, including customization
- One-stop after-sales service for the whole solar kit





All in One Solar LED Street Light



Solar Lighting

All in one solar street light integrates the green-energy parts solar panel, LED lamp and the battery into a single product, is with human intelligence induction system to gain the solution of low-energy, long-time, high-luminance and free maintenance. And the same time, it's convenient in the shipment and installation



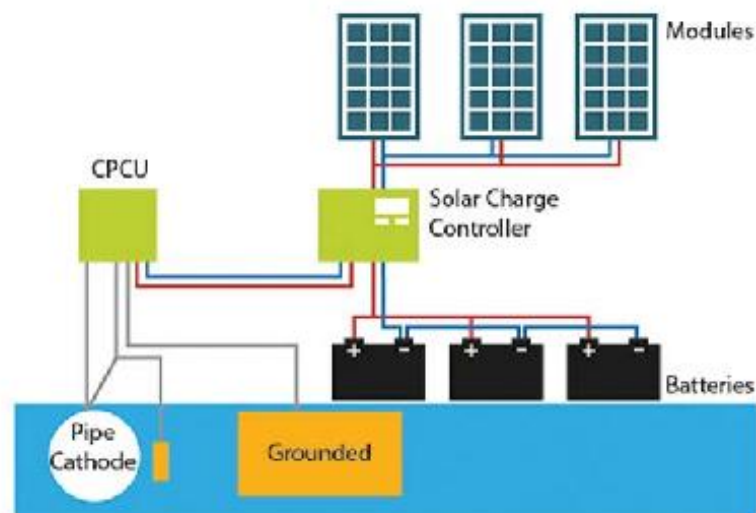


Solar Powered Cathodic Protection (SPCP)

Zino has developed a range of Solar Powered Impressed Current Cathodic Protection Systems (SPICCPs) for the protection of infrastructure in remote areas where mains power supply is not economically available. Combining the reliability of a Solar Power Supply including market-leading Batteries and Solar Panels, with the quality and robustness of a Cathodic Protection DC/DC Converter, the SPICCPs provides unrivalled performance and availability for cathodic protection requirements. Depending on size, systems are housed in ground mounted enclosures underneath solar array frames, or they can be pole mounted.

Systems are available in varying power and voltage configurations to customer requirements.

Systems utilize the CP system, which is a switch mode fully isolated DC/DC converter with a full range of features. The converter can be operated from a wide range of DC input voltages and is particularly suited to low power operations such as solar powered systems.





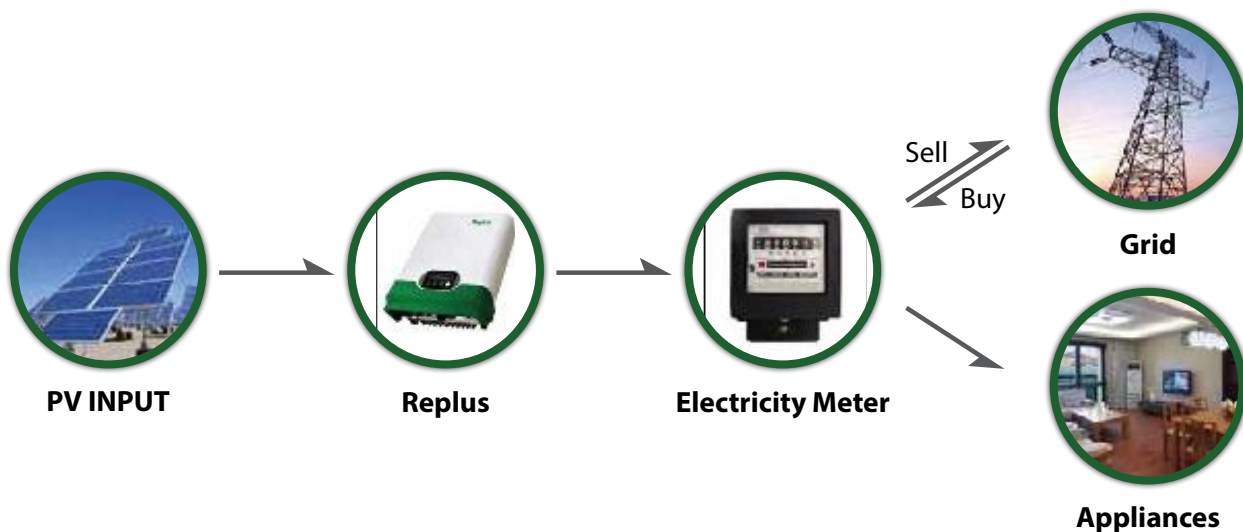
On Grid Solar System



Residential & Comercial Application

With the advent of on-grid solar kit, we can be more convenient to apply green solar energy. Because of rising electricity prices, more and more people want to own their own home solar power plant. They also gradually realize investing photovoltaic power plants, is risk-free and high return. So if you want to construct your own solar power system, Please contact us.

Zino On-grid Solar System Kits are excellent solutions for residential PV installations, it is designed to meet most roof conditions and pre-configured with major components, which simplifies your purchase source, saves overall cost and time. Our On-grid Solar Kit is especially installation-friendly due to the modular structure and several sub kit. Zino will provide a full range of on-grid solar system kit to meet different countries, different output power requirement, You can choice by your local standards and rated output power. The following introduction is about Solar Kits for Australia standard.





Industrial & Utility Scale Applicaion



PV Diesel Hybrid Applications

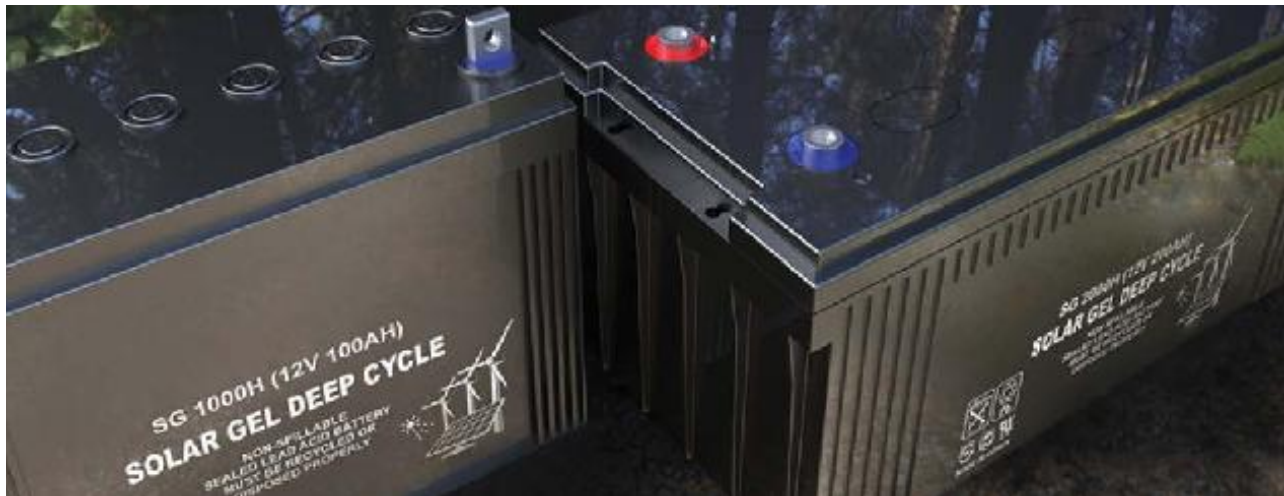
Sun saves fuel. ZINO PV-diesel solutions offer independence from rising diesel prices and reduce operating- and maintenance costs, especially in remote areas far from the utility grid.

Pure diesel power generation for industrial consumers in remote regions leads to continually increasing operating costs. Simultaneously falling PV system costs make photovoltaic diesel hybrid systems with the our Fuel Save Solution an economically attractive and environmentally friendly solution





Solar Gel Deep Cycle Battery



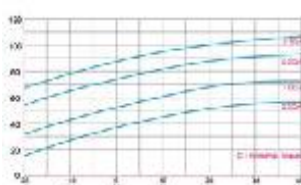
Product Descriptions

The Ultra Power of Nrwrnax Lead-Acid Battery" NEI/MAX Solar Gel(SG Series) batteries are true maintenance-free sealed batteries engineered specifically to satisfy the need for frequent deep cycles from photovoltaic (PV) and renewable energy storage applications. We are confident that our technology-intensive, long-lasting, and environmentally friendly SG Series batteries will provide stability and efficiency for your everyday renewable energy needs.

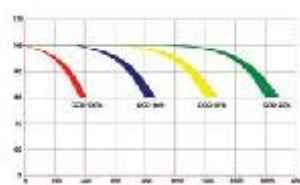
Characteristics of Our Batteries

- 01.** Long Life for Deep Cycle - High density.. anli-wirosive lead calcium aridly is used in harmony with the GEL electrolyte to reduce the sulfation effect significantly.
- 02.** Maintenance Free - NE MA Battery has . gas re-comb[ning design that doesn't need maintenance until the end of its life.
- 03.** Leak free - Gel Technology is applied to prevent leakage_ They won't spill even if the battery is tipped upside down.
- 04.** Safety - Specially designed anti-explosion filter and safety valves prevent gas leakage when overcharged'.

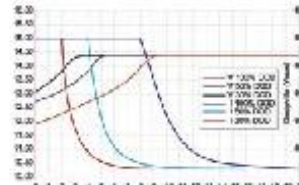
Type		Voltage (V)	Capacity (AH)				Dimension								Weight		Terminal Type	
			20HR	10HR	5HR	1HR	Length		Width		Height		T.Height		(APPROX)			
			Final V.P.C 1.75	Final V.P.C 1.75	Final V.P.C 1.75	Final V.P.C 1.75	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(Lb)	(kg)	standard	Optional
SG 800H	12	80	76	70	53	500	19.69	180	7.09	195	7.68	224	8.82	58.4	26.5	H	N	
SG 1000H	12	100	95	87	66	500	19.69	180	7.09	195	7.68	224	8.82	66.1	30.0	H	N	
SG 1200H	12	120	114	104	79	500	19.69	180	7.09	195	7.68	224	8.82	80.5	36.5	H	N	
SG 1500H	12	150	143	131	99	500	19.69	260	7.09	196	7.72	225	8.86	94.8	43.0	H	N	
SG 2000H	12	200	190	174	132	500	19.69	260	7.09	196	7.72	225	8.86	125.7	57.0	H	N	
SG 2000H	12	200	209	191	145	500	19.69	260	7.09	196	7.72	225	8.86	134.5	61.0	H	N	



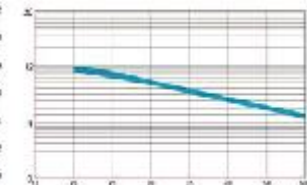
Effect of temperature on capacity



Cycle life characteristic



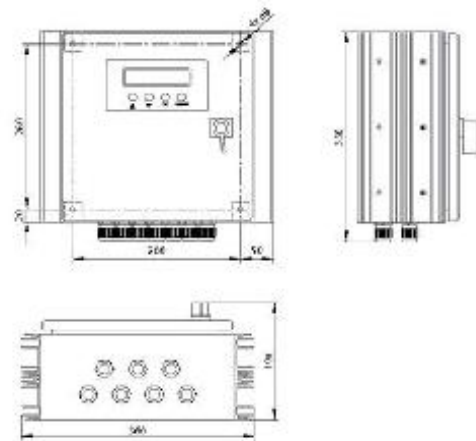
DOD % vs Recharging time curve



Floating life characteristics



Solar System Equipment



PWM & MPPT Controller

Specially designed for industrial and outdoor applications, charger controller comes with an IP 65 casing made of powder-coated steel.

This solar charge controller can be used to control system sizes of up to 8,400 Wp at three voltage levels (12 V, 24 V, 48 V). The charger is based on the technology of the PWM & MPPT. When connected in parallel, several controllers from this series can be operated via a standard DC bus in a simple solar home system or a hybrid system. This allows an output of over 20 kWp to be re.

2070		2140		4055		4110		4140			
Characterisation of the operating performance											
System voltage		12 V (24 V)			48 V						
Own consumption		14 Ma									
DC input side											
Open circuit voltage solar module		< 50 V			< 100 V						
Module current		70 A		140 A		55 A		55 A		70 A	
DC output side											
Load current		70 A		70 A		55 A		55 A		70 A	
End of charge voltage		13.7 V (27.4 V)				54.8 V					
Boost charge voltage		14.4 V (28.8 V)				57.6 V					
Equalisation charge		14.7 V (29.4 V)				58.8 V					
Reconnection voltage (SOC / LVR)		> 50 % / 12.6 V (25.2 V)				> 50 % / 50.4 V					
Deep discharge protection (SOC / LVD)		< 30 % / 11.1 V (22.2 V)				< 30 % / 44.4 V					
Operating conditions											
Ambient temperature		(-)10 ° C.....(+)60 ° C									
Fitting and construction											
Set battery type		liquid (adjustable via menu)									
Terminal (fine / single wire)		50 mm2 - AWG 1		95 mm2 - AWG 000		50 mm2 - AWG 1		70 mm2 - AWG 00		95 mm2 - AWG 000	
Degree of protection		IP 65									
Dimensions (X x Y x Z)		330 x 330 x 190 mm		360 x 330 x 190 mm		330 x 330 x 190 mm		360 x 330 x 190 mm			
Weight		10 kg									



Product features

- Hybrid controller
- State of charge determination with Steca AtonIC (SOC)
- Automatic detection of voltage
- PWM control
- Multistage charging technology
- Load disconnection depending on SOC
- Automatic load reconnection
- Temperature compensation
- Common positive grounding or negative grounding on one terminal
- Integrated data logger
- Night light function with Steca PA 15
- Integrated self test
- Monthly maintenance charge
- Integrated energy meter

Electronic protection functions

- Overcharge protection
- Deep discharge protection
- Reverse polarity protection of module, load and battery
- Reverse polarity protection by internal fuse
- Automatic electronic fuse
- Short circuit protection of load and module
- Overvoltage protection at module input
- Open circuit protection without battery
- Reverse current protection at night
- Overtemperature and overload protection
- Battery overvoltage shutdown

Displays

- Text LCD display
- ~ for operating parameters, fault messages, self test

Operation

- Simple menu-driven operation
- Programming by buttons
- Manual load switch
- Interfaces
- RJ45 interface

Options

- External temperature sensor (included)
- Alarm contact
- System monitoring via a Steca PA CAB1 Tarcom

Certificates

- Approved by the World Bank for Nepal
- Fit for use in tropical areas (DIN IEC 68 part 2-30)
- Compliant with European Standards (CE)
- Made in Germany
- Developed in Germany
- Manufactured according to ISO 9001 and ISO 14001





Solar System Equipment



Efficient

- Maximum efficiency of 98.4%

Flexible

- DC input voltage of up to 1,000 V
- Multistring capability for optimum

system design

- Optional display

Innovative

- Cutting-edge grid management functions with Integrated Plant Control
- Reactive power available 24/7 (Q on Demand 24/7)

Safe

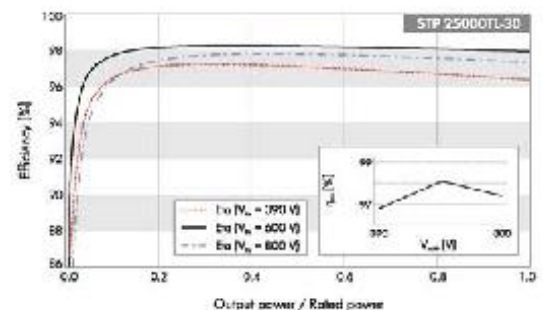
- DC surge arrester (SPD type II) can be integrated

Solar Graid-Tie Inverter

The versatile specialist for large-scale commercial plants and solar power plants. Is the ideal inverter for large-scale commercial and industrial plants. Not only does it deliver extraordinary high yields with an efficiency of 98.4%, but it also offers enormous design flexibility and compatibility

with many PV modules thanks to its multistring capabilities and wide input voltage range.

The future is now: the new inverter comes with cutting-edge grid management functions such as Integrated Plant Control, which allows the inverter to regulate reactive power at the point of common coupling. Separate controllers are no longer needed, lowering system costs. Another new feature—reactive power provision on demand (Q on Demand 24/7).



Technical Data	20000TL	25000TL
Input (DC)		
Max. DC power (@ $\cos \varphi = 1$) / DC rated power	20440 W / 20440 W	25550 W / 25550 W
Max. input voltage	1000 V	1000 V
MPP voltage range / rated input voltage	320 V to 800 V / 600 V	390 V to 800 V / 600 V
Min. input voltage / start input voltage	150 V / 188 V	150 V / 188 V
Max. input current input A / input B	33 A / 33 A	33 A / 33 A
Number of independent MPP inputs / strings per MPP input	2 / A:3; B:3	2 / A:3; B:3
output (AC)		
Rated power (@ 230 V, 50 Hz)	20000 W	25000 W
Max. AC apparent power	20000 VA	25000 VA
AC nominal voltage	3 / N / PE; 220 V / 380 V 3 / N / PE; 230 V / 400 V 3 / N / PE; 240 V / 415 V	



Technical Data		Sunny Tripower 20000TL	Sunny Tripower 25000TL
AC voltage range	180 V to 280 V		
AC grid frequency / range	50 Hz / 44 Hz to 55 Hz 60 Hz / 54 Hz to 65 Hz		
Rated power frequency / rated grid voltage	50 Hz / 230 V		
Max. output current / Rated output current	29 A / 29 A	36.2 A / 36.2 A	
Power factor at rated power / Adjustable displacement power factor	1 / 0 overexcited to 0 underexcited		
THD	≤ 3 %		
Feed-in phases / connection phases	3/3		
Efficiency			
Max. effi ciency / European Effi ciency	98.4% / 98.0%	98.3% / 98.1%	
protective devices			
DC-side disconnection device	•		
Ground fault monitoring / grid monitoring	• / •		
DC surge arrester (Type II) can be integrated	○		
DC reverse polarity protection / AC short-circuit current capability / galvanically isolated	• / • / –		
All-pole sensitive residual-current monitoring unit	•		
Protection class (according to IEC 62109-1) / overvoltage category (according to IEC 62109-1)	I / AC: III; DC: II		
General Data			
Dimensions (W / H / D)	661 / 682 / 264 mm (26.0 / 26.9 / 10.4 inch)		
Weight	61 kg (134.48 lb)		
Operating temperature range	(–)25 °C to +60 °C (–13 °F to +140 °F)		
Noise emission (typical)	51 dB(A)		
Self-consumption (at night)	1 W		
Topology / cooling concept	Transformerless / Opticool		
Degree of protection (as per IEC 60529)	IP65		
Climatic category (according to IEC 60721-3-4)	4K4H		
Maximum permissible value for relative humidity (non-condensing)	100%		
Features / function / Accessories			
DC connection / AC connection	SUNCLIX / spring-cage terminal		
Display	○		
Interface: RS485, Speedwire/Webconnect	○ / •		
Data interface: SMA Modbus / SunSpec Modbus	• / •		
Multifunction relay / Power Control Module	○ / ○		
OptiTrack Global Peak / Integrated Plant Control / Q on Demand 24/7	• / • / •		
Off-Grid capable / SMA Fuel Save Controller compatible	• / •		
Guarantee: 5 / 10 / 15 / 20 / 25 years	• / ○ / ○ / ○ / ○		
Certi ficates and permits (more available on request) * Does not apply to all national appendices of EN 50438	ANRE 30, AS 4777, BDEW 2008, C10/11:2012, CE, CEI 0-16, CEI 0-21, EN 50438*, G59/3, IEC 60068-2-x, IEC 61727, IEC 62109-1/2, IEC 62116, MEA 2013, NBR 16149, NEN EN 50438, NRS 097-2-1, PEA 2013, PPC, RD 1699/413, RD 661/2007, Res. n°7:2013, SI4777, UTE C15-712-1, VDE 0126-1-1, VDE-AR-N 4105, VFR 2014		
Type designation	STP 20000TL-30	STP 25000TL-30	



Voltaic Cell



250W+ for maximum power – standard size 165x100 cm

With an output power of 151,51Wp per square meter the PH-250P-60 EU belongs to the strongest modules of its class on the market.

High Performance at 17,6 % cell efficiency

Polycrystalline high performance cells assure a high energy conversion efficiency.

3-Busbar-Technology

Efficiency-increasing 3-Busbar-Technology for optimal power yield

German-European Production

Strictly controlled, German production rules maintain highest quality standard, European manufacturing plant (EU): Certified DIN ISO 9001:2008 and DIN ISO 14001:2004, as well as BS OHSAS 18001:2007.

25 years performance guarantee

product- and efficiency warranty of German manufacturer*

Plus power tolerance (0,0/+4,9W),

Positive tolerance (PLUS Power) ensures a high reliability of power output (DC), as well as higher module efficiency.

Anti-Reflex-Solar-Glass (Made in Germany)

Special, low-iron anti-reflective glass made of high quality German production with long-term average of 2.5% higher return than the PV modules with conventional solar glass. In addition, dust-repelling effect for higher yield in desert regions.

High-grade material

Only premium components with highest quality of noted suppliers are used. Regular controls in all stages of production ensure long-term reliability of the PH solar modules.





MECHANICAL PARAMETERS		MECHANICAL DRAWING
Solar cells	60 cells, polycrystalline 156×156mm	
Number of cells	60 (6×10)	
Dimensions LxBxW	1650×1000×42mm	
Weight	19 kg	
Front glass	Anti-reflex solar glass 3,2 mm	
Encapsulation	Ethylene-Vinylacetat (EVA)	
Backsheet	Polyester sheet multiply (PET)	
Connection material	Silicone	
Frame	Aluminium box profile, anodised	
Junction box	IP 65, mit 3 Bypass-Dioden	
Mechanical load Loading pressure	tested up to 5,4 kN/m ²	
Wind load / Snow pressure	2400Pa / 5400Pa (Snowload zone3)	
Connection wire	TÜV, 2x 1000mm,4mm ² , MC4 connector	

ELECTRICAL CHARACTERISTICS				
PERFORMANCE UNDER STANDARD TEST CONDITIONS (STC: 1000 W/m², 25°C, AM 1,5)				
Modul-Series	PH-235P-60 EU	PH-240P-60 EU	PH-245P-60 EU	PH-250P-60 EU
Maximum Power at STC (Pmax)	235 Wp	240 Wp	245 Wp	250 Wp
Short circuit current (Isc)	8,32 A	8,39 A	8,50 A	8,60 A
Open circuit voltage (Voc)	37,20 V	37,41 V	37,61 V	37,80 V
Maximum Power current (Impp)	7,80 A	7,91 A	8,03 A	8,12 A
Maximum Power voltage (Vmpp)	30,52 V	30,71 V	30,90 V	31,17 V
Cell Efficiency	16,6 %	17,0 %	17,3 %	17,6 %
Modul-Efficiency	14,2 %	14,5 %	14,8 %	15,1 %
Power toleranz	-0,0 W / + 4,9 W			
PERFORMANCE UNDER NORMAL OPERATING CELL TEMPERATURE (NOCT: 800W/m²,47+/-3°C, AM 1,5)				
Maximum Power (Pmax)	173,85 Wp	177,55 Wp	181,25 Wp	184,89 Wp
Short circuit current (Isc)	6,68 A	6,76 A	6,85 A	6,91 A
Open circuit voltage (Voc)	34,77 V	34,96 V	35,15 V	35,32 V
Maximum Power current (Impp)	6,26 A	6,34 A	6,42 A	6,48 A
Maximum Power voltage (Vmpp)	27,83 V	28,07 V	28,32 V	28,54 V
Minor reduction in efficiency under partial load conditions at 25°C, at 200 W/m², 95% (+/- 3%) of the STC efficiency (1000 W/m²) is achieved.				
THERMAL CHARACTERISTICS		PACKAGING		
Normal operating cell temperature	47°C	Palette size / -weight	170 x 80 x 120 cm, 390 kg	
Temperature coefficient Pmax (γ)	-0,43 % / K	Modules per palettes	18 pcs	
Temperature coefficient Voc (β)	-0,35 % / K	Palettes per truck	46 Paletts	
Temperature coefficient Isc (α)	0,05 % / K	Modules per truck	828 pcs	
Operating temperature	-45°C up to +80°C			
Outdoor temperature	-45°C up to +45°C			
SYSTEM INTEGRATION PARAMETERS				
System Integration	1000 V			
Reverse current	Max. External Power < Uoc			
Reverse current connection	String protection max. I < 16 A			
Panel protection	IP 65			
Application classification	IEC 61215, IEC 61730			
Marking	CE			



Portable Power Systems Plug & Play



-  **Emergency Backup for Power Outages or Rolling Blackouts**
-  **Can be Used for Camping, Tailgating, Recreation and More!**
-  **Recharge from a Renewable Power Source**
-  **Recharge Through Household AC Power**

Solar Panel Features

- Environmentally friendly photovoltaic technology
- High wattage polycrystalline panel up to 80 watts
- Foldable panel with handle make for easy portability
- Easy to use plug and play connectors
- Great for use with RVs, boats, backup power and all 12V applications

Portable Power System Features

- Separate models generate 400,800, and 1800 watts of output power
- Easily installed anywhere
- No fuel requirements
- Completely safe for indoor use
- Add a backup for stand alone systems
- Simple plug and play system
- USB port for charging handheld devices
- AC outlets operate home appliances, power tools, and home electronics
- Combine all models with solar panels (included with 1800S2 model)
- Can be recharged from utility power with built-in AC charger
- Each model contains a built-in battery. The AP1800 contains a 60Ah battery and additional battery boxes can be purchased separately to expand run times





AP400 AP800 AP1800 AP1800S2 AP 80 Watt Solar Panel

Specifications	1800	800	400
Inverter:			
Continuous Power	1800W	800W	400W
Surge power	3600W	1600W	800W
Output voltage	120 VAC		
Output waveform	Modified sine wave		
AC receptacles	4	2	2
Peak efficiency	90%		
No-load battery draw	<3W		
Transfer time	<30 ms		
AC input protection	15A	15A	10A
AC charger (built-in):			
Charger current	5A	2A	2A
Charging stages	three-stages (bulk, absorption, float)		
Solar charger (built-in):			
Input current	8 ADC maximum		
Charging stages	three-stages (bulk, absorption, float)		
Maximum input voltage	26 VDC		
5V USB:			
Type	2 ports @ 2.1A	1 port @ 750mA	1 port @ 750mA
Battery:			
Type	Deep cycle lead-acid		
Capacity	60Ah	40Ah	34Ah
Solar panel: (comes with AP1800S2)			
Peak power (Pmax)	2 X 40W		
Voltage (Vmp)	17.5 VDC		
Open circuit voltage (VOC)	21 VDC		
Current (Imp)	2 X 2.29 A		

Specifications		1800	800	400
Office Applications:				
Cell phone	5W	95 hrs	65 hrs	55 hrs
Inkjet printer	8W	60 hrs	40 hrs	34 hrs
17" LCD monitor	35W	15.5 hrs	10.5 hrs	9.2 hrs
Table lamp (40W)	40W	12 hrs	8.5 hrs	7.2 hrs
Table lamp (60W)	60W	8 hrs	5.5 hrs	4.6 hrs
Laptop	65W	7.5 hrs	5 hrs	4 hrs
Emergency Power Applications:				
Cordless phone	5W	90 hrs	65 hrs	55 hrs
Clock radio	8W	55 hrs	40 hrs	34 hrs
20" LCD TV	40W	13 hrs	9.5 hrs	8 hrs
Home Backup Power Applications:				
Home alarm system	5W	90 hrs	65 hrs	55 hrs
8.8 cu. Ft. freezer	80W	4.5 hrs	N/A	N/A
18 cu. Ft. freezer	120W	3.5 hrs	N/A	N/A
Sump pump (1/4hp)	300W	65 mins	45 mins	N/A
1/2" drill	700W	19 mins	13 mins	N/A
Microwave	1000W	20 mins	N/A	N/A
Coffee maker	1200W	10 mins	N/A	N/A
How long will it provide power?				
Laptop, inkjet printer, modem, cordless phone		Up to 10 hrs	Up to 6.5 hrs	Up to 5.5 hrs
Cordless phone, 13"TV, radio and table lamp		Up to 3.3 hrs	Up to 2 hrs	Up to 1.6 hrs
18.8 cu. ft. fridge and alarm system		Up to 3 hrs	N/A	N/A
Environmental:				
Operating temperature		32 to 104 F (0 to 40 C)		
Storage temperature		-4 to 140 F (-20 to 60 C)		
Estimated recharging time:				
Using built-in charger		14.5 hrs	24 hrs	20 hrs
Using 80W solar panel		13 hrs	11 hrs	18 hrs



Zino CATHODIC CONVERTER™

IMPRESSED CURRENT CATHODIC PROTECTION (ICCP) CONTROL

Features

- %98 super high conversion efficiency
- Ultra low heat thermal design
- Passive cooling
- Onboard surge protection
- High speed on/off control
- Low stand-by current consumption
- Low battery reset function
- Output voltage limit function
- Constant output current function
- Input reverse polarity protection
- Onboard digital LCD meter
- Optional extra surge protection
- Optional Reference Cell
- Robust and reliable
- Compact and lightweight
- Standard 2 Year warranty
- C-Tick Compliant

Zino CATHODIC CONVERTER™

The latest series is more powerful and efficient than previous Cathodic Protection Controllers, with peak power efficiencies now at 98%. **Zino CATHODIC CONVERTER™** also now features a revolutionary new ultra-low heat, high efficiency thermal design with passive cooling capacity, eliminating the need for cooling fans or bulky heatsinks, making it the most efficient, reliable, compact and lightweight Cathodic Protection Controller on the market.

The world's first MPPT Solar Charge Controller, has since been designing and manufacturing highly reliable and efficient specialised power electronics for use in Solar PV, Micro Hydro, Micro Wind and Cathodic Protection applications. AERL has now supplied literally thousands of highly efficient and reliable Cathodic Protection Controllers to satisfied customers worldwide including the Middle East, Europe, America and Australasia.

PRODUCT SPECIFICATIONS

Model Number	CP15	CP30
Maximum Anti-Corrosion Current	15A	30A
Maximum ambient air temperature	50°C	50°C
Maximum output current	15A	30A
Minimum battery input voltage—V MIN	11V	11V
Maximum battery input voltage—V MAX	60V	60V
Standby current consumption	35mA	35mA
Peak efficiency	98%	98%
Weight	1.5kg	
Dimensions (L x W x H)	240 x 160 x 90 mm	
Input/output power cable size	16mm ²	

OPTIONAL EXTRAS

Option	Description
Surge Buster	50KA Lightning Protection Module
Reference Cell Function	Accurate corrosion protection control



Exothermic Welding System



The Exothermic Weld Process

Exothermic welding is a cost efficient method of making large or small numbers of high quality electrical connections. It is a simple, self-contained system that uses the high temperature reaction of powdered copper oxide and aluminium, within a mould, to form permanent electrical connections.

Typical applications include:

- Earthing for power plants and substations
- Telecommunications
- Transmission and power distribution lines
- Cathodic protection
- Rail connections



The Exothermic weld system:

- requires no external power or heat source
- creates high quality electrical connections
- is completely portable
- can be used safely with minimum training
- is cost effective
- can be used for over 70 standard connection configurations

The Exothermic weld connection

Exothermic weld connections have several advantages:

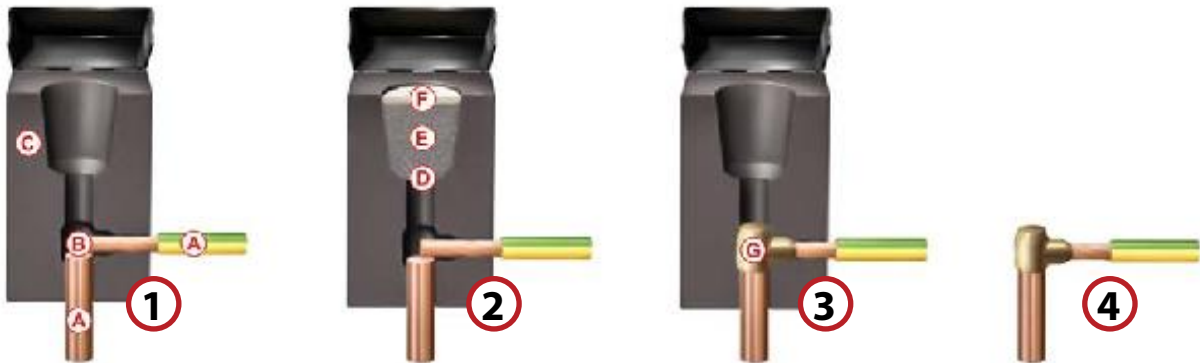
- tolerant to repeated fault currents
- highly conductive
- do not loosen
- excellent corrosion resistance

Most Exothermic weld connections have at least twice the cross-sectional area of the conductors being joined, and an equivalent or greater current carrying capacity. Corrosion resistance is exceptional because of the very high copper content (> 90%) of the alloy.



Making a Exothermic weld joint is a simple procedure as illustrated below

1. Locate the conductors (A) to be joined in the weld cavity (B) and close the mould (C).
2. Locate the steel retaining disc in the base of the crucible (D). Pour in the weld powder (E) followed by the starting powder (F). Ignite starting powder with a spark gun.
3. The resulting exothermic reaction reduces the weld powder to molten copper alloy which melts the retaining disc and flows into the weld cavity where it partially melts the conductors (G).
4. The molten copper alloy cools to leave a fusion weld of great mechanical and electrical integrity.



The Exothermic weld moulds are made of a heat-resistant semipermanent graphite

They comprises a crucible, tap hole and a weld cavity.

The high temperature thermic reaction takes place in the crucible of the moulds allowing molten copper to flow through the tap hole into the weld cavity, producing a solid joint.

They can be used for over than 70 connections under normal usage.

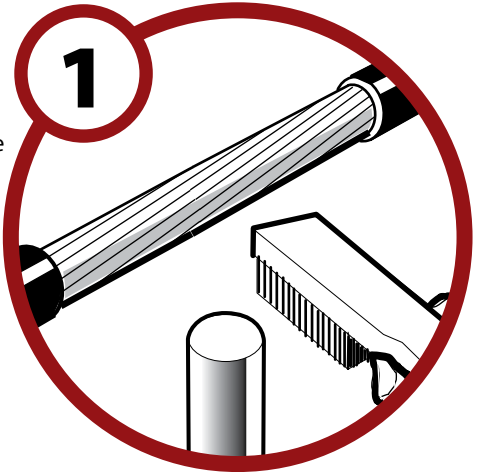
Graphite cover protects from the reaction projections.





1

Remove the isolation of the conductor on a length of 15 cm when using insulated cable. Using the cardcloth-brush, brush the cable and the rod end to remove all dust and oxydes.



Before starting the first weld preheat the graphite mould with a welding torch during at least 5 minutes. This operation is very important because moisture in moulds will cause a porous weld.



3

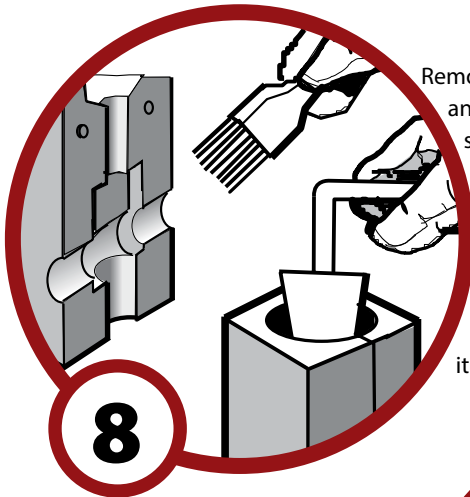
Open the mould by separating the two arms of the handle clamp. Cable must sit on top of rod. Support mould to keep it from sliding down the rod when welding. Use lock pliers or clamp on rod below mould.



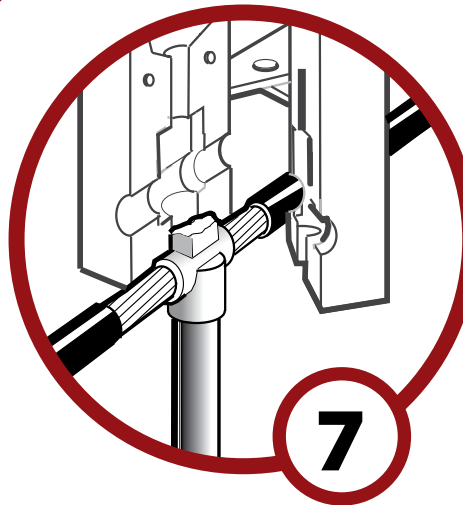
4

Close securely the mould with the handle clamp to avoid molten metal losses. Place the metallic disc, conical side to bottom, on tap hole.

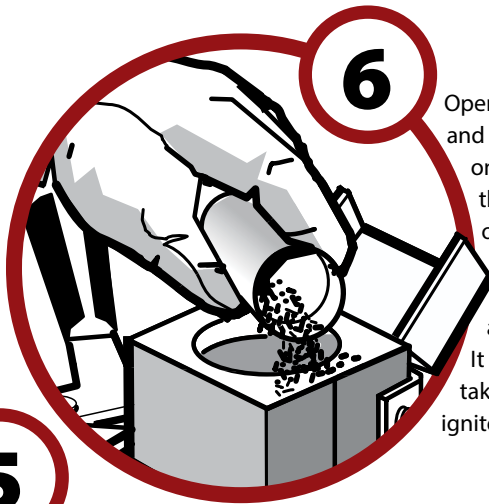




Remove slag from the crucible and tap hole with the mould scraper. Remove dust from the weld cavity, tap hole, crucible and mould cover with the mould brush. If the mould is still warm, you can go on the welding process without pre-heating it again.



Wait one minute and open completely the mould handle clamp to remove the welded connection. During this operation take care of your graphite mould.



Open black cover of the cartridge and spread all the starting powder on the welding powder and on the top edge of the mould, under open cover, for easy ignition. Close the mould cover and placing the flint ignitor from aside ignite the starting powder. It is advisable, once the ignition takes place, to pull away the flint igniter quickly to avoid its damage.



Open coloured cover of the cartridge size shown on the mould tag and pour the aluminothermic powder into the crucible.



Accessories For Exothermic Weld

Handle Clamps

They are designed to handle the moulds allowing to open and close them safely.

There are different types of handle clamps depending on the mould size and shape



Cartridges And Discs

Each plastic container holds the aluminothermic powder at one end (coloured cover) and the starting powder at the other one (black cover). Close the tap hole with the metallic disc before to dump the aluminothermic powder into the crucible.



Flint Igniter

It is designed for easy ignition starting powder is used. And replaces the standard are an excellent fit for the job.



Hard Wire Brush

It is used for cleaning the conductors before making the weld.



Mould Brush

It is recommended to safely cleaning the inner part of the mould after every weld.



Mould Scrapers

its shape fits the crucible to easy remove the slag and to check tap hole clearance after making every weld





Weld Powders

Cu-Connect Weld Metal is a high quality mixture of copper oxide and aluminium, contained inside plastic cartridges which are packed in boxes of 10 or 20 pieces depending on the powder weight. The metal retaining discs are contained in a separate bag inside each box. Each weld connection uses one disc.

The starting powder is compacted at the bottom of each cartridge with the Weld Metal on top. The starting powder is released by firmly tapping the base of the cartridge.

Cu-Connect Weld Powder is not explosive, shock sensitive or subject to spontaneous ignition.

Description	Part Number	Box Quantity
32 gr welding powder	ZWP 032	30 No.s
45 gr welding powder	ZWP 045	
65 gr welding powder	ZWP 065	
90 gr welding powder	ZWP 090	15 No.s
115 gr welding powder	ZWP 115	
150 gr welding powder	ZWP 150	
200 gr welding powder	ZWP 200	10 No.s
250 gr welding powder	ZWP 250	



Metal Discs



The disk rests on the bottom of the crucible and hold the welding powder in place until the reaction takes place. For each weld made, a new disk is required. Discs are included with the weld material.

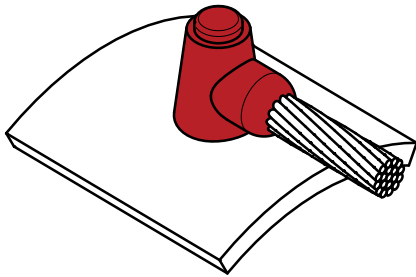
Quick Starter



A way to start weld metal is using a wick. It is also used for igniting of exothermic welding powder in smokeless moulds.



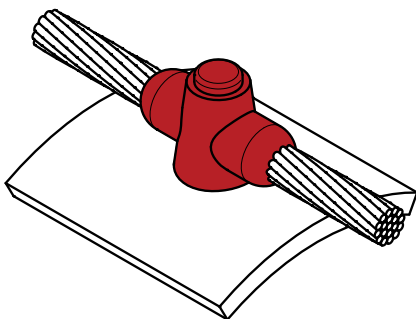
Types of connections



Cable to Steel PIPE Connection

Part No. ZCEP

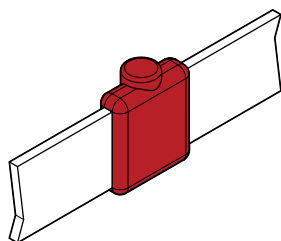
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Cable to Steel PIPE Connection Run Type

Part No. ZCPP

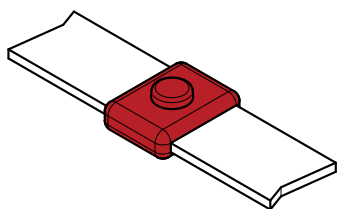
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Tape To Tape Connection - Straight Type - Vertical

Part No. ZTST-V

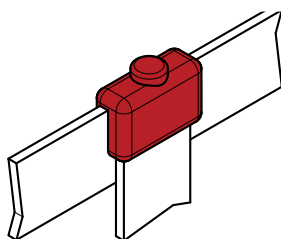
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Tape To Tape Connection - Straight Type - Horizontal

Part No. ZTST-H

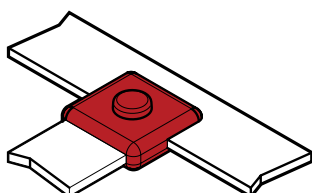
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Tape to Tape Connection - "T" Type Vertical

Part No. ZTTT-V

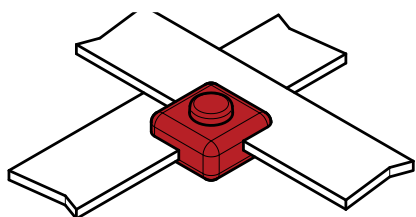
Special Custom



Tape to Tape Connection - "T" Type Horizontal

Part No. ZTTT-H

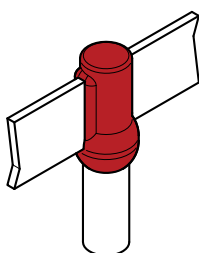
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Tape to Tape Connection - Cross Type

Part No. ZTXT

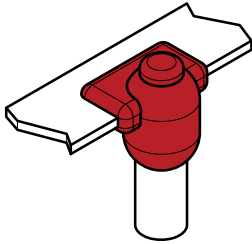
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Tape to Rod Connection - "T" Type Vertical

Part No. ZTTR-V

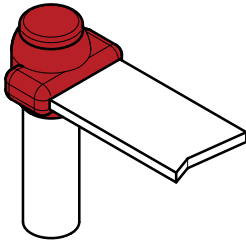
Special Custom



Tape to Rod Connection –“T” Type Horizontal

Part No. ZTTR-H

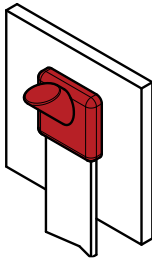
Special Custom



Tape to Rod Connection –“L” Type

Part No. ZTER

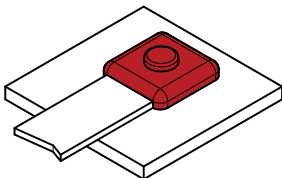
Special Custom



Tape to Steel Surface Connection - Upwards Type

Part No. ZTUS

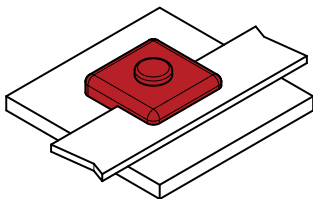
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Tape to Steel Surface connection

Part No. ZTER

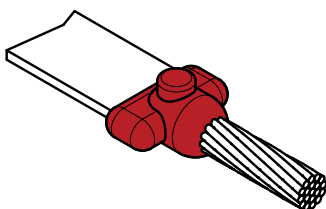
Special Custom



Tape to Steel Surface connection - Run Type

Part No. ZTRP

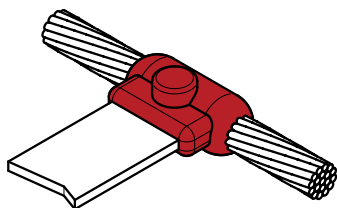
Special Custom



Cable to Tape connection - Straight Type

Part No. ZTSC

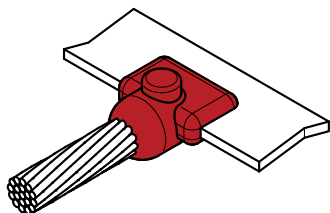
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Tape to Cable Connection - "T" Type

Part No. ZCTT

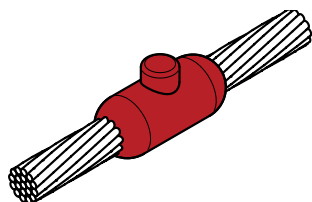
Special Custom



Cable to Tape Connection - "T" Type

Part No. ZTTC

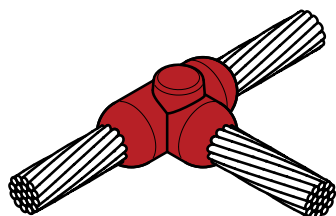
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Cable to Cable Connection Straight Type

Part No. ZCSC

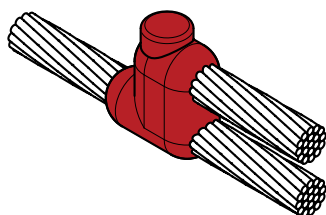
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Cable to Cable Connection - "T" Type

Part No. ZCTC

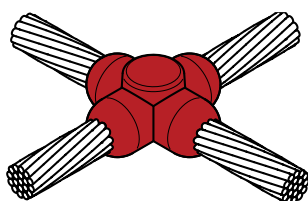
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Cable to Cable Connection - "V" Type

Part No. ZCVC

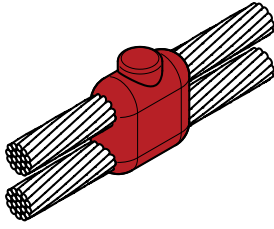
Special Custom



Cable to Cable Connection -Interapted Cross Type

Part No. ZCCC

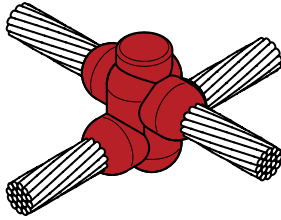
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Cable to Cable Connection - Parallel Type - Vertical

Part No. ZCPC

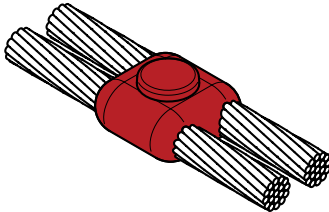
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Cable to Cable Connection - Pushing cross Type

Part No. ZCXC

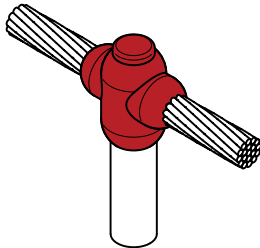
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Cable to Cable Connection - Parallel Type - Horizontal

Part No. ZCWC

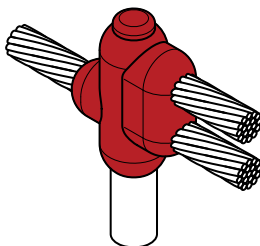
Special Custom



Cable to Rod Connection - "T" Connection

Part No. ZCTR

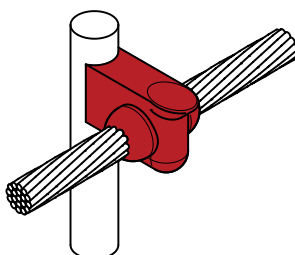
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Three Cable to Rod - "T" Connection

Part No. ZCVR

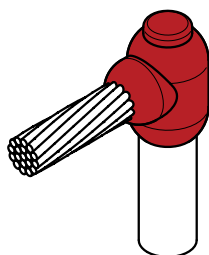
Special Custom



Cable to Rod Connection - Cross Type

Part No. ZCSR

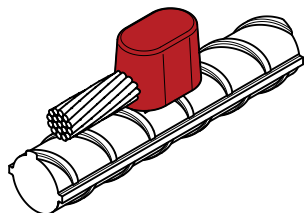
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Cable to Rod Connection - "L" Type

Part No. ZCLR

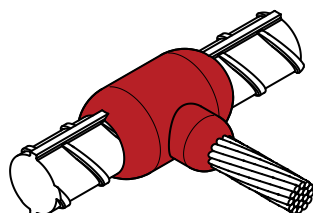
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Cable to Reinforcing Rebar Connection

Part No. ZASC

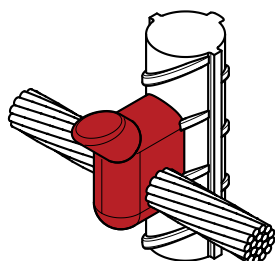
Special Custom



Cable to Reinforcing Rebar Connection - "T" Type

Part No. ZATC

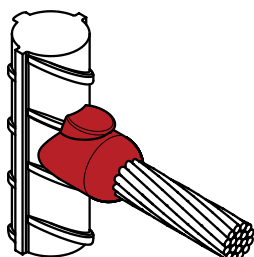
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Cable to Reinforcing Rebar Connection - Cross Type

Part No. ZAXC

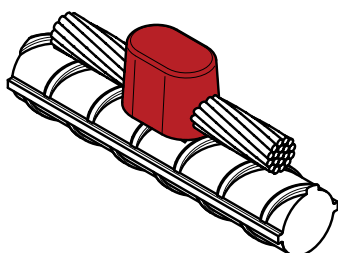
Special Custom



Cable to Reinforcing Rebar Connection - "L" Type

Part No. ZALC

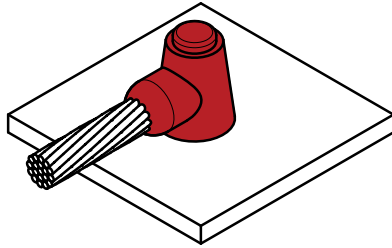
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Cable to Reinforcing Rebar Connection - Parallel Type

Part No. ZAPC

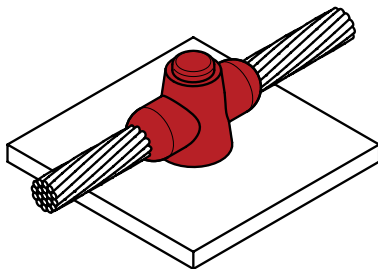
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Cable to Steel Surface Connection

Part No. ZCES

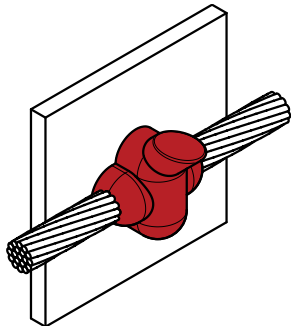
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Cable to Steel Surface Horizontal Connection - Run Type

Part No. ZCPS-H

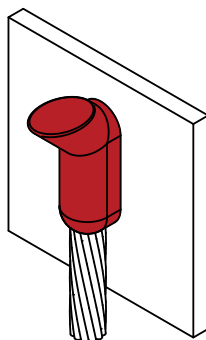
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Cable to Steel Surface Vertical Connection - Run Type

Part No. ZCPS-V

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Cable to Steel Surface Vertical Connection - Upwards Type

Part No. ZCUS

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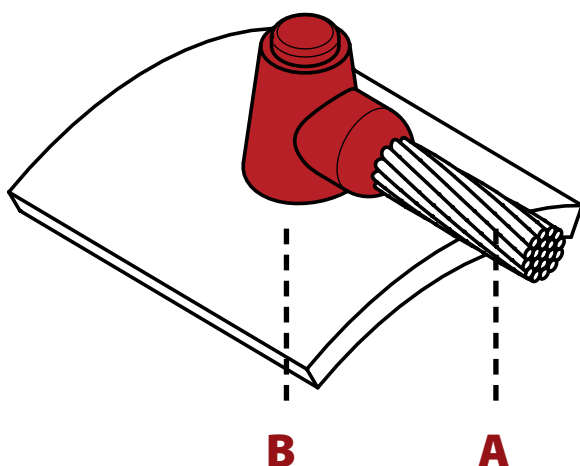


Rutin Connections Details



Zino company to easily select the appropriate connection and you need the following tables is available to you
You can use these tables, molds, powder, suitable handhold select your connection

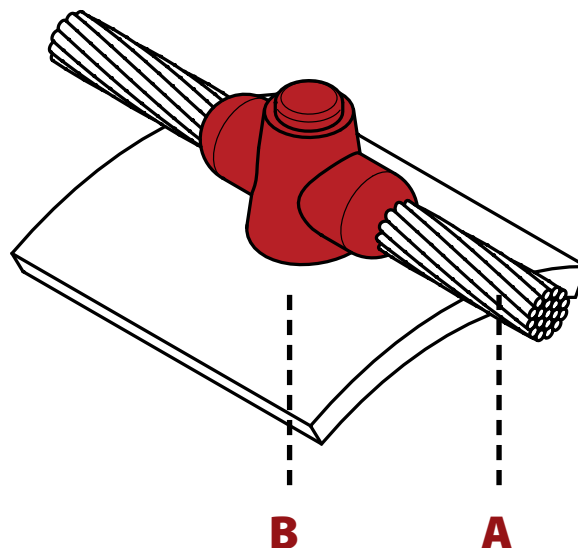
Cable to Steel PIPE Connection



A	B	Handel Clamp	Mould Type	Powder
16	PIPE Variable	ZHCS	ZCEP 16	ZWP 032
25			ZCEP 25	
35			ZCEP 35	
50			ZCEP 50	ZWP 045
70			ZCEP 70	ZWP 065
95			ZCEP 95	ZWP 115

Cable to Steel PIPE Connection Run Type

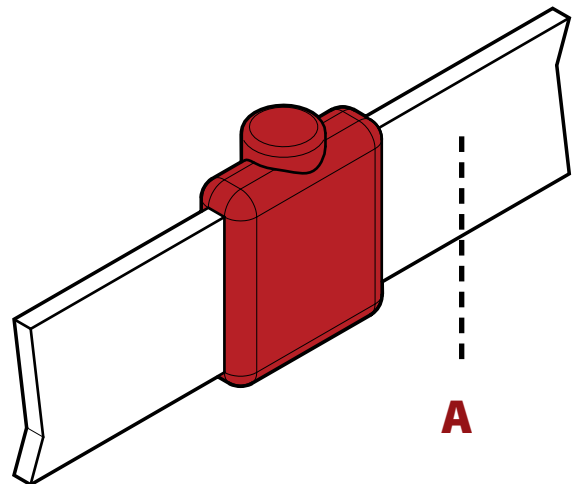
A	B	Handel Clamp	Mould Type	Powder
16	PIPE Variable	ZHC 60	ZCPP 16	ZWP 115
25			ZCPP 25	
35			ZCPP 35	
50	ZHC 80		ZCPP 50	ZWP 150
70			ZCPP 70	ZWP150
95			ZCPP 95	ZWP 150





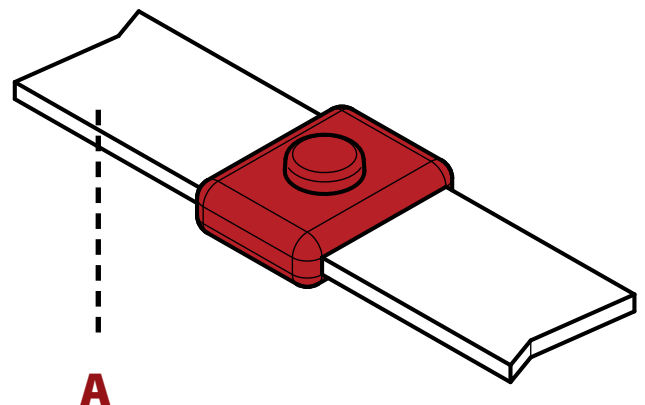
Tape To Tape Connection - Straight Type - Vertical

A	Handel Clamp	Mould Type	Powder
20x3	ZHC 80	ZTST-V 203	ZWP 065
25x3		ZTST-V 253	
25x5		ZTST-V 255	ZWP 090
30x3		ZTST-V 303	ZWP 090
30x5		ZTST-V 305	ZWP 115
40x3		ZTST-V 403	ZWP 115
40x5		ZTST-V 405	ZWP 150
40x10		ZTST-V 4010	ZWP 250



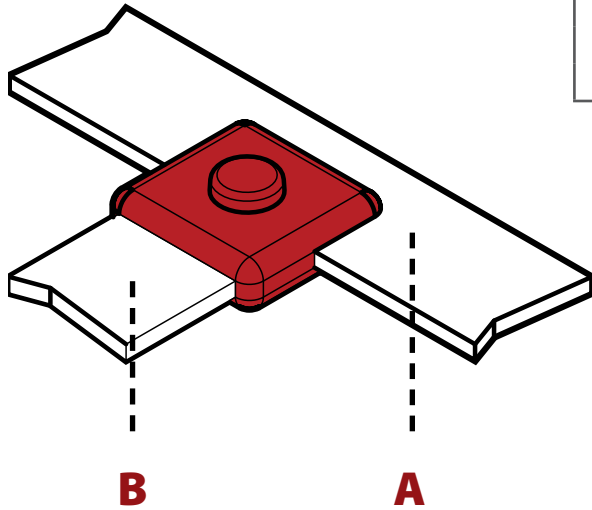
Tape To Tape Connection - Straight Type - Horizontal

A	Handel Clamp	Mould Type	Powder
20x3	ZHC 80	ZTST-H 203	ZWP 065
25x3		ZTST-H 253	
25x5		ZTST-H 255	ZWP 090
30x3		ZTST-H 303	ZWP 065
30x5		ZTST-H 305	ZWP 115
40x3		ZTST-H 403	ZWP 090
40x5		ZTST-H 405	ZWP 150
40x10		ZTST-H 4010	2 x ZWP 150



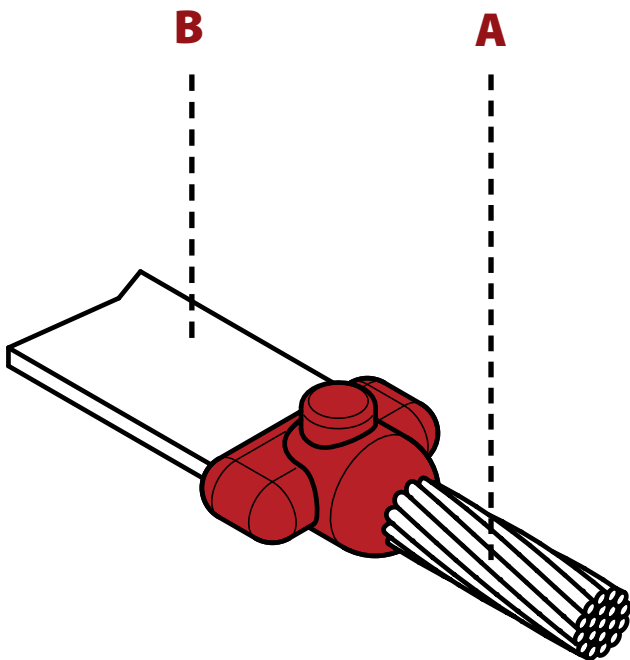


Tape to Tape Connection – "T" Type Horizontal



A	B	Handel Clamp	Mould Type	Powder
Variable Size	20x3	ZHC 80	ZTTT-H 203	ZWP 090
	25x3		ZTTT-H 253	
	25x5		ZTTT-H 255	ZWP 090
	30x3		ZTTT-H 303	
	30x5		ZTTT-H 305	ZWP 115
	40x5		ZTTT-H 405	ZWP 150

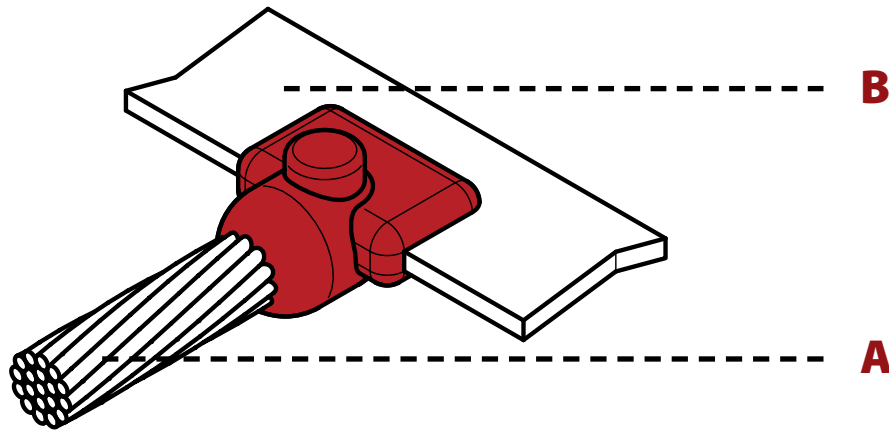
Cable to Tape connection - Straight Type



A	B	Handel Clamp	Mould Type	Powder
16	20x3	ZHC 80	ZTSC 16203	ZWP 065
25	25x3		ZTSC 16253	
35	25x5		ZTSC 35255	ZWP 090
50	30x3		ZTSC 50303	ZWP 115
70	30x5		ZTSC 70305	
95	40x5		ZTSC 95405	ZWP 150
120	25x5		ZTSC 120255	ZWP 115
	30x5		ZTSC 120305	ZWP 115
150	25x5		ZTSC 150255	ZWP 150
	30x5		ZTSC 150305	
185	25x5		ZTSC 185255	ZWP 150
	30x5		ZTSC 185305	



Cable to Tape Connection –“T” Type

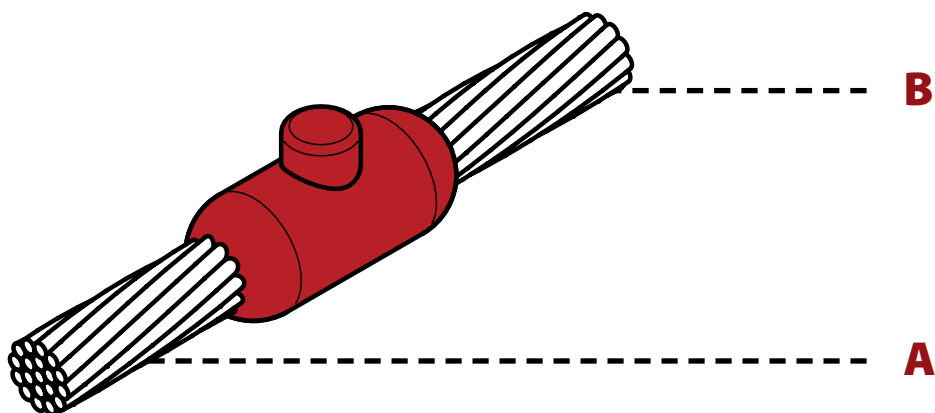


A	B	Handel Clamp	Mould Type	Powder
16	20x3	ZHC 80	ZTTC 16203	ZWP 090
	25x3		ZTTC 16253	
25	20x3	ZHC 80	ZTTC 25203	ZWP 090
	20x5		ZTTC 25205	
	25x3		ZTTC 25253	
35	20x3	ZHC 80	ZTTC 35203	ZWP 090
	20x5		ZTTC 35205	
	25x3		ZTTC 35253	
50	20x3	ZHC 80	ZTTC 50203	ZWP 090
	20x5		ZTTC 50205	
	25x3		ZTTC 50253	
	30x3		ZTTC 50303	
	40x3		ZTTC 50403	
	40x5		ZTTC 50405	
70	20x3	ZHC 80	ZTTC 70203	ZWP 090
	20x5		ZTTC 70205	
	25x3		ZTTC 70253	
	25x5		ZTTC 70255	
	30x3		ZTTC 70303	
	40x3		ZTTC 70403	
	40x5		ZTTC 70405	

A	B	Handel Clamp	Mould Type	Powder
95	20x3	ZHC 80	ZTTC 95203	ZWP 090
	25x3		ZTTC 95253	
	25x5		ZTTC 95255	
	30x3		ZTTC 95303	
	30x5		ZTTC 95305	ZWP 115
	40x5		ZTTC 95405	
120	50x5	ZHC 80	ZTTC 95505	ZWP 115
	25x3		ZTTC 120253	
	25x5		ZTTC 120255	ZWP 115
	30x5		ZTTC 120305	
	50x5		ZTTC 120505	
	25x10		ZTTC 120251	ZWP 150
	30x10		ZTTC 120301	
	40x10		ZTTC 120401	



Cable to Cable Connection Straight Type

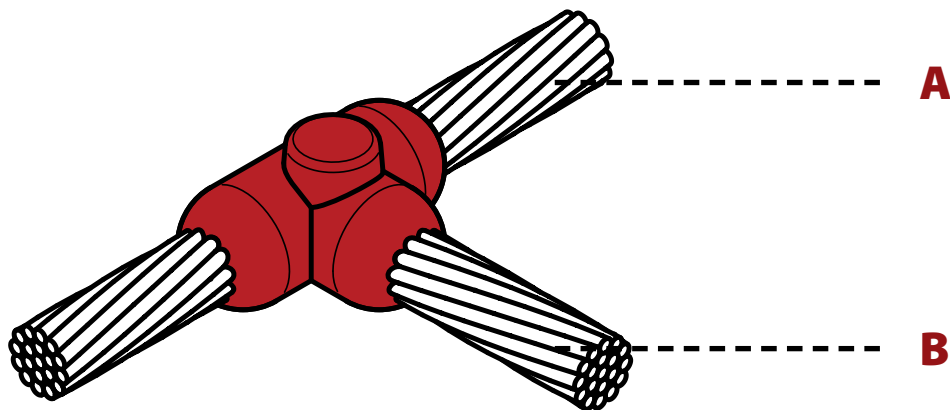


A	B	Handel Clamp	Mould Type	Powder
16	16	ZHC 60	ZCSC 1616	ZWP 032
25	16	ZHC 60	ZCSC 2516	
	25		ZCSC 2525	
35	16	ZHC 60	ZCSC 3516	ZWP 045
	25		ZCSC 3525	
	35		ZCSC 3535	
50	16	ZHC 60	ZCSC 5016	ZWP 045
	25		ZCSC 5025	
	35		ZCSC 5035	
	50		ZCSC 5050	
	70		ZCSC 5070	
70	16	ZHC 60	ZCSC 7016	ZWP 065
	25		ZCSC 7025	
	35		ZCSC 7035	
	50		ZCSC 7050	
	70		ZCSC 7070	
95	16	ZHC 80	ZCSC 9516	ZWP 065
	25		ZCSC 9525	
	35		ZCSC 9535	
	50		ZCSC 9550	
	70		ZCSC 9570	ZWP 090
	95		ZCSC 9595	
120	16	ZHC 80	ZCSC 12016	ZWP 090
	25		ZCSC 12025	
	35		ZCSC 12035	
	50		ZCSC 12050	
	70		ZCSC 12070	ZWP 115
	95		ZCSC 12095	
	120		ZCSC 120120	

A	B	Handel Clamp	Mould Type	Powder
150	50	ZHC 80	ZCSC 15050	ZWP 115
	70		ZCSC 15070	
	95		ZCSC 15095	
	120		ZCSC 150120	
	150		ZCSC 150150	
185	50	ZHC 80	ZCSC 18550	ZWP 115
	70		ZCSC 18570	
	95		ZCSC 18595	
	120		ZCSC 185120	ZWP 150
	150		ZCSC 185150	
	185		ZCSC 185185	
240	70	ZHC 80	ZCSC 24070	ZWP 150
	95		ZCSC 24095	
	120		ZCSC 240120	ZWP 200
	150		ZCSC 240150	
	185		ZCSC 240185	
	240		ZCSC 240240	



Cable to Cable Connection - "T" Type

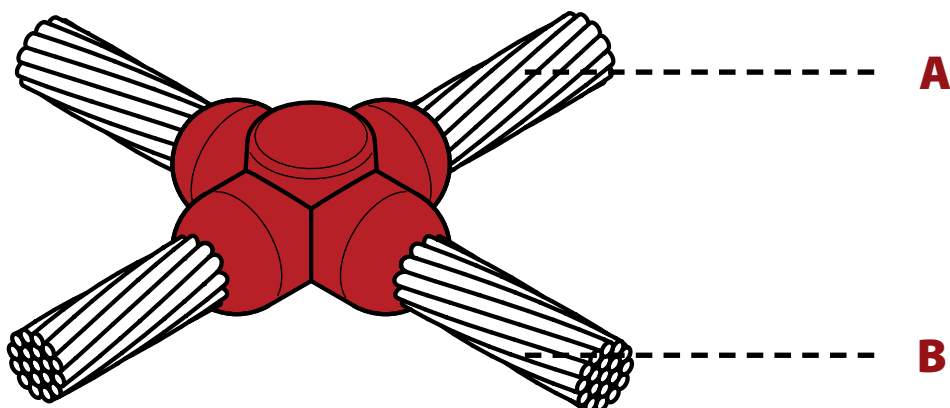


A	B	Handel Clamp	Mould Type	Powder
16	16	ZHC 60	ZCTC 1616	ZWP 045
25	16	ZHC 60	ZCTC 2516	
	25		ZCTC 2525	
35	16	ZHC 60	ZCTC 3516	ZWP 045
	25		ZCTC 3525	
	35		ZCTC 3535	
50	16	ZHC 60	ZCTC 5016	ZWP 065
	25		ZCTC 5025	
	35		ZCTC 5035	
	50		ZCTC 5050	ZWP 090
70	16	ZHC 60	ZCTC 7016	ZWP 065
	25		ZCTC 7025	
	35		ZCTC 7035	
	50		ZCTC 7050	
	70		ZCTC 7070	ZWP 090
	95		ZCTC 7095	
95	16	ZHC 60	ZCTC 9516	ZWP 090
	25		ZCTC 9525	
	35		ZCTC 9535	
	50		ZCTC 9550	
	70		ZCTC 9570	
	95		ZCTC 9595	ZWP 115
	120		ZCTC 95120	ZWP 150
120	16	ZHC 60	ZCTC 12016	ZWP 090
	25		ZCTC 12025	
	35		ZCTC 12035	
	50		ZCTC 12050	
	70		ZCTC 12070	
	95		ZCTC 12095	ZWP 115
	120	ZHC 80	ZCTC 120120	ZWP 150

A	B	Handel Clamp	Mould Type	Powder
150	16	ZHC 80	ZCTC 15016	ZWP 115
	25		ZCTC 15025	
	35		ZCTC 15035	
	50		ZCTC 15050	
	70		ZCTC 15070	ZWP 150
	95		ZCTC 15095	
	120		ZCTC 150120	
	150		ZCTC 150150	ZWP 200
	185		ZCTC 150185	
185	16	ZHC 80	ZCTC 18516	ZWP 115
	25		ZCTC 18525	
	35		ZCTC 18535	
	50		ZCTC 18550	
	70		ZCTC 18570	ZWP 150
	95		ZCTC 18595	
	120		ZCTC 185120	ZWP 200
	150		ZCTC 185150	
	185		ZCTC 185185	
240	16	ZHC 80	ZCTC 24016	ZWP 150
	25		ZCTC 24025	
	35		ZCTC 24035	
	50		ZCTC 24050	
	70		ZCTC 24070	
	95		ZCTC 24095	
	120		ZCTC 240120	ZWP 200
	150		ZCTC 240150	
	185		ZCTC 240185	ZWP 250
	240		ZCTC 240240	ZWP 150 + ZWP 150



Cable to Cable Connection -Interapted Cross Type

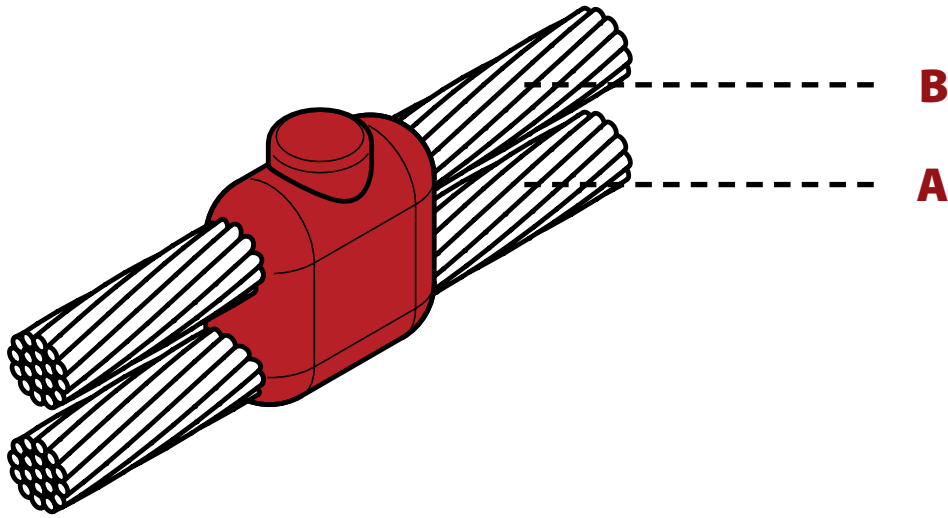


A	B	Handel Clamp	Mould Type	Powder
16	16	ZHC 60	ZCCC 1616	ZWP 045
25	16	ZHC 60	ZCCC 2516	
	25		ZCCC 2525	
35	16	ZHC 60	ZCCC 3516	ZWP 065
	25		ZCCC 35 25	
	35		ZCCC 3535	
50	16	ZHC 60	ZCCC 5016	ZWP 090
	25		ZCCC 5025	
	35		ZCCC 5035	
	50		ZCCC 5050	
70	16	ZHC 60	ZCCC 7016	ZWP 115
	25		ZCCC 7025	
	35		ZCCC 7035	
	50		ZCCC 7050	
	70		ZCCC 7070	
	95	ZHC 80	ZCCC 7095	ZWP 150
95	16	ZHC 80	ZCCC 9516	ZWP 115
	25		ZCCC 9525	
	35		ZCCC 9535	
	50		ZCCC 9550	ZWP 150
	70		ZCCC 9570	
	95		ZCCC 9595	ZWP 200
	120		ZCCC 95120	
120	16	ZHC 80	ZCCC 12016	ZWP 115
	25		ZCCC 12025	
	35		ZCCC 12035	
	50		ZCCC 12050	ZWP 150
	70		ZCCC 12070	
	95		ZCCC 12095	ZWP 200
	120		ZCCC 120120	

A	B	Handel Clamp	Mould Type	Powder
150	25	ZHC 80	ZCCC 15025	ZWP 150
	35		ZCCC 15035	
	50		ZCCC 15050	
	70		ZCCC 15070	ZWP 200
	95		ZCCC 15095	
	120		ZCCC 150120	ZWP 250
	150		ZCCC 150150	
185	185		ZCCC 150185	ZWP 250
	25	ZHC 80	ZCCC 18525	
	35		ZCCC 18535	ZWP 115
	50		ZCCC 18550	
	70		ZCCC 18570	ZWP 200
	95		ZCCC 18595	
	120		ZCCC 185120	ZWP 250
	150		ZCCC 185150	
	185		ZCCC 185185	ZWP 150 + ZWP 115
240	25	ZHC 80	ZCCC 24025	ZWP 200
	35		ZCCC 24035	
	50		ZCCC 24050	ZWP 250
	70		ZCCC 24070	
	95		ZCCC 24095	
	120		ZCCC 240120	ZWP 150 + ZWP 115
	150		ZCCC 240150	
	185		ZCCC 240185	2 x ZWP 150
	240		ZCCC 240240	



Cable to Cable Connection - Parallel Type - Vertical

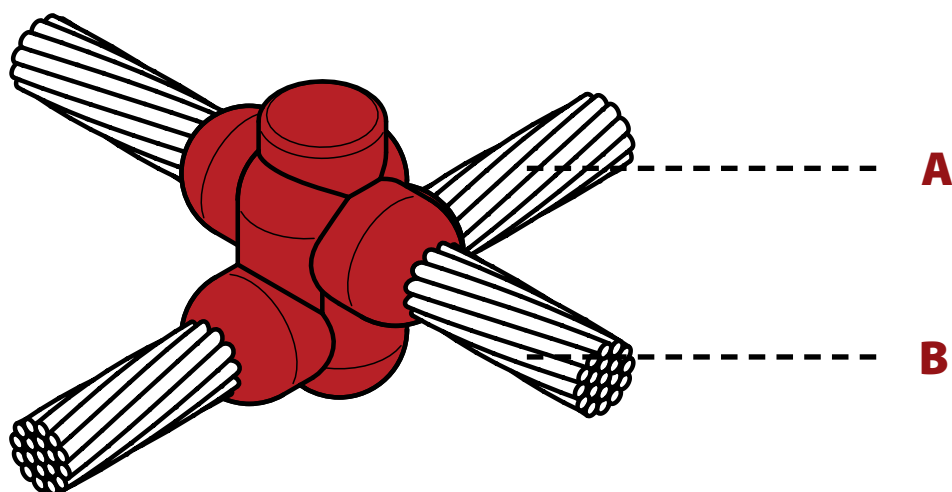


A	B	Handel Clamp	Mould Type	Powder
16	16	ZHC 60	ZCPC 1616	ZWP 065
25	16	ZHC 60	ZCPC 2516	
	25		ZCPC 2525	
35	16	ZHC 60	ZCPC 3516	ZWP 065
	25		ZCPC 3525	
	35		ZCPC 3535	
50	16	ZHC 60	ZCPC 5016	ZWP 065
	25		ZCPC 5025	
	35		ZCPC 5035	
	50	ZHC 80	ZCPC 5050	ZWP 115
70	25	ZHC 80	ZCPC 7025	ZWP 90
	35		ZCPC 7035	
	50		ZCPC 7050	ZWP 115
	70		ZCPC 7070	
95	25	ZHC 80	ZCPC 9525	ZWP 115
	35		ZCPC 9535	
	50		ZCPC 9550	
	70		ZCPC 9570	ZWP 150
	95		ZCPC 9595	
120	25	ZHC 80	ZCPC 12025	ZWP 150
	35		ZCPC 12035	
	50		ZCPC 12050	
	70		ZCPC 12070	
	95		ZCPC 12095	ZWP 200
	120		ZCPC 120120	ZWP 250

A	B	Handel Clamp	Mould Type	Powder
150	50	ZHC 80	ZCPC 15050	ZWP 150
	70		ZCPC 15070	
	95		ZCPC 15095	ZWP 200
	120		ZCPC 150120	
185	150	ZHC 80	ZCPC 150150	ZWP 250
	50		ZCPC 18550	ZWP 150
	70		ZCPC 18570	
	95		ZCPC 18595	ZWP 200
	120		ZCPC 185120	
	150		ZCPC 185150	ZWP 250
240	185		ZCPC 185185	
	70	ZHC 80	ZCPC 24070	ZWP 200
	95		ZCPC 24095	ZWP 250
	120		ZCPC 240120	
	150		ZCPC 240150	2 x ZWP 150
	185		ZCPC 240185	
	240		ZCPC 240240	



Cable to Cable Connection - Pushing cross Type

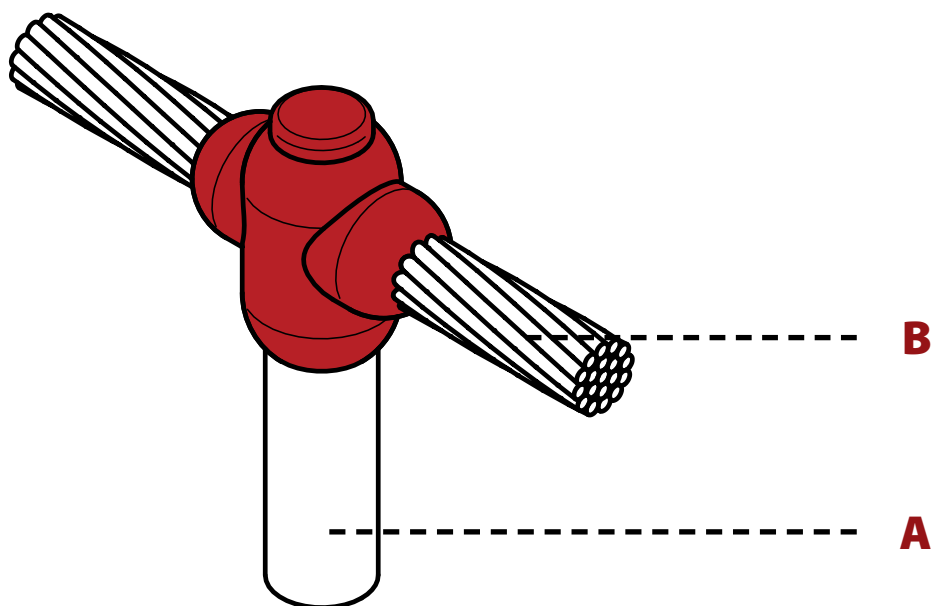


A	B	Handel Clamp	Mould Type	Powder
16	16	ZHC 80	ZCXC 1616	ZWP 115
25	16	ZHC 80	ZCXC 2516	
	25		ZCXC 2525	
35	16	ZHC 80	ZCXC 3516	ZWP 115
	25		ZCXC 3525	
	35		ZCXC 3535	
50	16	ZHC 80	ZCXC 5016	ZWP 115
	25		ZCXC 5025	
	35		ZCXC 5035	
	50		ZCXC 5050	ZWP 150
70	25	ZHC 80	ZCXC 7025	ZWP 115
	35		ZCXC 7035	ZWP 150
	50		ZCXC 7050	
	70		ZCXC 7070	
	95		ZCXC 7095	
95	25	ZHC 80	ZCXC 9525	ZWP 200
	35		ZCXC 9535	
	50		ZCXC 9550	
	70		ZCXC 9570	
	95		ZCXC 9595	
	120		ZCXC 95120	
120	25	ZHC 80	ZCXC 12025	ZWP 250
	35		ZCXC 12035	
	50		ZCXC 12050	
	70		ZCXC 12070	
	95		ZCXC 12095	
	120		ZCXC 120120	

A	B	Handel Clamp	Mould Type	Powder
150	35	ZHC 80	ZCXC 15035	ZWP 250
	50		ZCXC 15050	
	70		ZCXC 15070	
	95		ZCXC 15095	2 x ZWP 150
	120		ZCXC 150120	
	150		ZCXC 150150	
185	185	ZHC 80	ZCXC 150185	ZWP 250
	35		ZCXC 18535	
	50		ZCXC 18550	
	70		ZCXC 18570	
	95		ZCXC 18595	2 x ZWP 150
	120		ZCXC 185120	
	150		ZCXC 185150	
	185		ZCXC 185185	ZWP 115 + ZWP 200



Cable to Rod Connection –“T” Connection

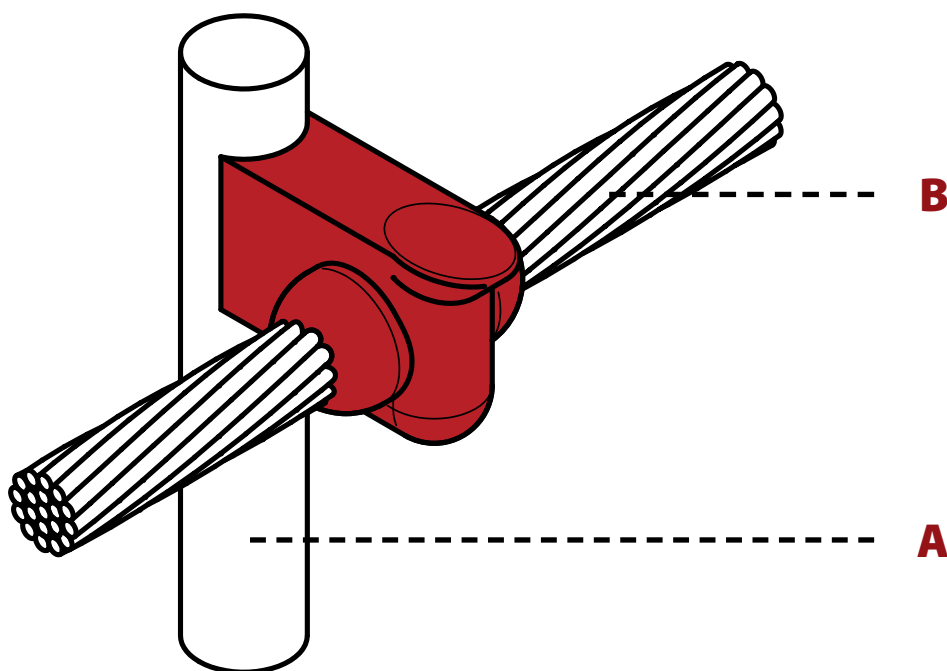


A	B	Handel Clamp	Mould Type	Powder
14.2	16	ZHC 80	ZCTR 1416	ZWP 115
	25		ZCTR 1425	
	35		ZCTR 1435	
	50		ZCTR 1450	
	70		ZCTR 1470	
	95		ZCTR 1495	
	120		ZCTR 14120	ZWP 150
	150		ZCTR 14150	ZWP 200
	185		ZCTR 14185	
	240		ZCTR 14240	
16	16	ZHC 80	ZCTR 1616	ZWP 115
	25		ZCTR 1625	
	35		ZCTR 1635	
	50		ZCTR 1650	
	70		ZCTR 1670	
	95		ZCTR 1695	
	120		ZCTR 16120	ZWP 150
	150		ZCTR 16150	ZWP 200
	185		ZCTR 16185	
	240		ZCTR 16240	

A	B	Handel Clamp	Mould Type	Powder
17.2	16	ZHC 80	ZCTR 1716	ZWP 115
	25		ZCTR 1725	
	35		ZCTR 1735	
	50		ZCTR 1750	
	70		ZCTR 1770	
	95		ZCTR 1795	
	120		ZCTR 17120	ZWP 150
	150		ZCTR 17150	ZWP 200
	185		ZCTR 17185	
	240		ZCTR 17240	ZWP 250
20	16	ZHC 80	ZCTR 2016	ZWP 115
	25		ZCTR 2025	
	35		ZCTR 2035	
	50		ZCTR 2050	
	70		ZCTR 2070	
	95		ZCTR 2095	
	120		ZCTR 20120	ZWP 150
	150		ZCTR 20150	ZWP 200
	185		ZCTR 20185	
	240		ZCTR 20240	ZWP 250



Cable to Rod Connection - Cross Type

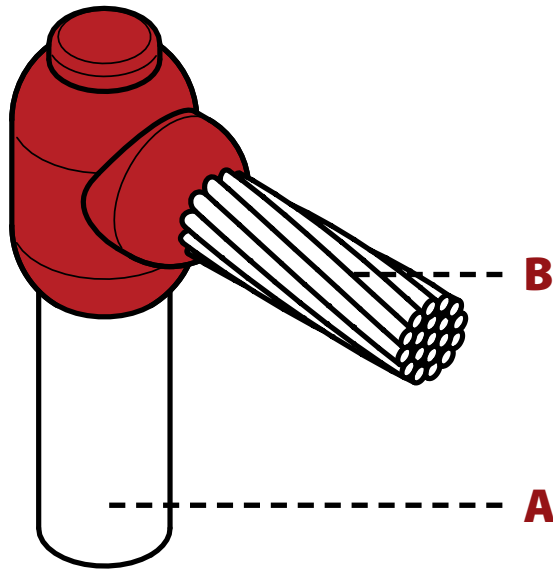


A	B	Handel Clamp	Mould Type	Powder
14.2	16	ZHC 80	ZCSR 1416	ZWP 115
	25		ZCSR 1425	
	35		ZCSR 1435	
	50		ZCSR 1450	
	70		ZCSR 1470	
	95		ZCSR 1490	
	120		ZCSR 14120	ZWP 150
	150		ZCSR 14150	ZWP 200
	185		ZCSR 14185	
	240		ZCSR 14240	
16	16	ZHC 80	ZCSR 1616	ZWP 115
	25		ZCSR 1625	
	35		ZCSR 1635	
	50		ZCSR 1650	
	70		ZCSR 1670	
	95		ZCSR 1695	
	120		ZCSR 16120	ZWP 150
	150		ZCSR 16150	ZWP 200
	185		ZCSR 16185	
	240		ZCSR 16240	

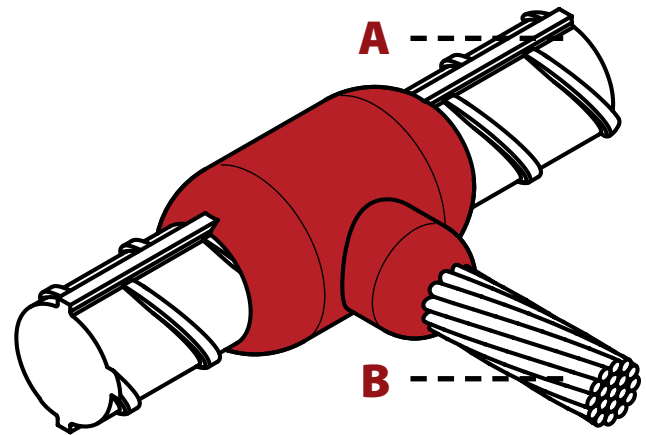
A	B	Handel Clamp	Mould Type	Powder
17.2	16	ZHC 80	ZCSR 1716	ZWP 115
	25		ZCSR 1725	
	35		ZCSR 1735	
	50		ZCSR 1750	
	70		ZCSR 1770	
	95		ZCSR 1795	
	120		ZCSR 17120	ZWP 150
	150		ZCSR 17150	ZWP 200
	185		ZCSR 17185	
	240		ZCSR 17240	ZWP 250
20	16	ZHC 80	ZCSR 2016	ZWP 115
	25		ZCSR 2025	
	35		ZCSR 2035	
	50		ZCSR 2050	
	70		ZCSR 2070	
	95		ZCSR 2095	
	120		ZCSR 20120	ZWP 150
	150		ZCSR 20150	ZWP 200
	185		ZCSR 20185	
	240		ZCSR 20240	ZWP 250



Cable to Rod Connection - "L" Type



Cable to Reinforcing Rebar Connection - "T" Type

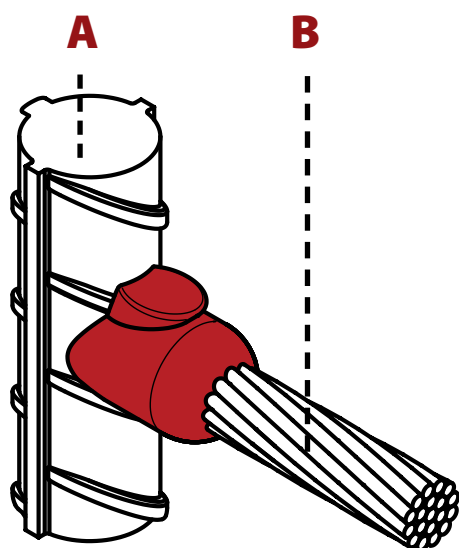


A	B	Handel Clamp	Mould Type	Powder
14.2	50	ZHC 80	ZCLR 1450	ZWP 115
	70		ZCLR 1470	
	95		ZCLR 1495	
	120		ZCLR 14120	
	150		ZCLR 14150	ZWP 150
	185		ZCLR 14185	
	240		ZCLR 14240	
16	50	ZHC 80	ZCLR 1650	ZWP 115
	70		ZCLR 1670	
	95		ZCLR 1695	
	120		ZCLR 16120	
	150		ZCLR 16150	ZWP 150
	185		ZCLR 16185	
	240		ZCLR 16240	
17.2	50	ZHC 80	ZCLR 1750	ZWP 150
	70		ZCLR 1770	
	95		ZCLR 1795	
	120		ZCLR 17120	
	150		ZCLR 17150	
	185		ZCLR 17185	
	240		ZCLR 17240	
20	50	ZHC 80	ZCLR 2050	ZWP 150
	70		ZCLR 2070	
	95		ZCLR 2095	
	120		ZCLR 20120	
	150		ZCLR 20150	
	185		ZCLR 20185	
	240		ZCLR 20240	
	240		ZCLR 20240	

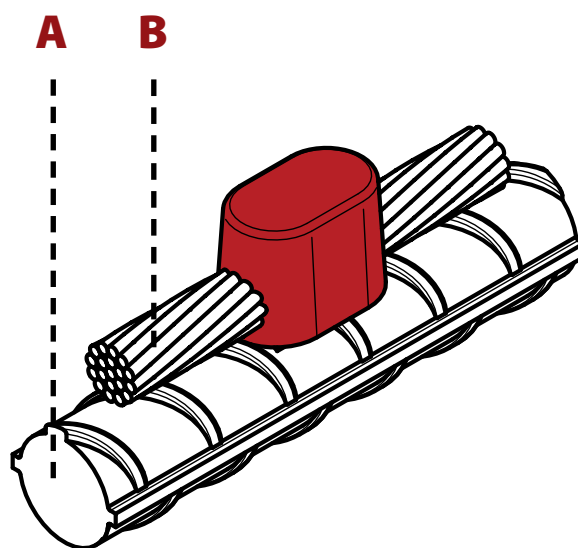
A	B	Handel Clamp	Mould Type	Powder
10	16	ZHC 80	ZATC 1016	ZWP 090
	25		ZATC 1025	
	35		ZATC 1035	
	50		ZATC 1050	ZWP 115
	70		ZATC 1070	
	95		ZATC 1095	
16	16	ZHC 80	ZATC 1616	ZWP 115
	25		ZATC 1625	ZWP 150
	35		ZATC 1635	
	50		ZATC 1650	
	70		ZATC 1670	ZWP 200
	95		ZATC 1695	
20	16	ZHC 80	ZATC 2016	ZWP 150
	25		ZATC 2025	
	35		ZATC 2035	
	50		ZATC 2050	ZWP 200
	70		ZATC 2070	
	95		ZATC 2095	
22	120	ZHC 80	ZATC 20120	ZWP 250
	16		ZATC 2216	ZWP 150
	25		ZATC 2225	
	35		ZATC 2235	ZWP 200
	50		ZATC 2250	ZWP 250
	70		ZATC 2270	2xZWP 150
	95		ZATC 2295	ZWP 150 + ZWP 200
	120		ZATC 22120	



Cable to Reinforcing Rebar Connection –“L” Type



Cable to Reinforcing Rebar Connection –Parallel Type



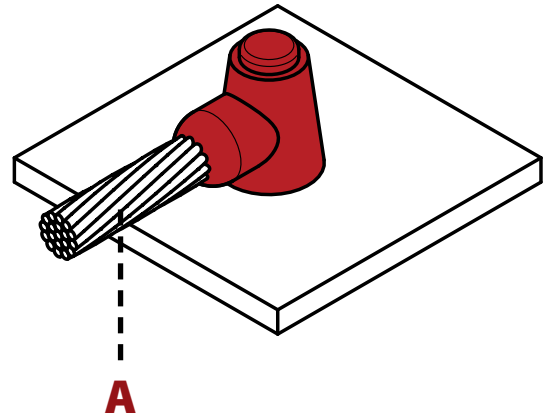
A	B	Handel Clamp	Mould Type	Powder
10	16	ZHC 80	ZALC 1016	ZWP 090
	25		ZALC 1025	
	35		ZALC 1035	
	50		ZALC 1050	ZWP 115
	70		ZALC 1070	
	95		ZALC 1095	
16	16	ZHC 80	ZALC 1616	ZWP 90
	25		ZALC 1625	ZWP 150
	35		ZALC 1635	
	50		ZALC 1650	
	70		ZALC 1670	ZWP 200
	95		ZALC 1695	
20	16	ZHC 80	ZALC 2016	ZWP 115
	25		ZALC 2025	
	35		ZALC 2035	
	50		ZALC 2050	ZWP 150
	70		ZALC 2070	
	95		ZALC 2095	ZWP 200
22	120		ZALC 20120	ZWP 250
	16	ZHC 80	ZALC 2216	ZWP 150
	25		ZALC 2225	
	35		ZALC 2235	ZWP 200
	50		ZALC 2250	ZWP 250
	70		ZALC 2270	ZWP 2x150
	95		ZALC 2295	ZWP 200 + ZWP 150
	120		ZALC 22120	

A	B	Handel Clamp	Mould Type	Powder
10	16	ZHC 60	ZAPC 1016	ZWP 065
	25		ZAPC 1025	
	35		ZAPC 1035	
	50	ZHC 80	ZAPC 1050	ZWP 115
	70		ZAPC 1070	ZWP 150
	95		ZAPC 1095	
16	16	ZHC 60	ZAPC 1616	ZWP 090
	25		ZAPC 1625	
	35		ZAPC 1635	ZWP 115
	50	ZHC 80	ZAPC 1650	ZWP 150
	70		ZAPC 1670	
	95		ZAPC 1695	ZWP 200
	120		ZAPC 16120	
	150		ZAPC 16150	
20	25	ZHC 60	ZAPC 2025	ZWP 115
	35		ZAPC 2035	
	50		ZAPC 2050	ZWP 150
	70	ZHC 80	ZAPC 2070	
	95		ZAPC 2095	ZWP 200
	120		ZAPC 20120	
	150		ZAPC 20150	
	185		ZAPC 20185	ZWP 250
	240		ZAPC 20240	2 x ZWP 150
	300		ZAPC 20300	

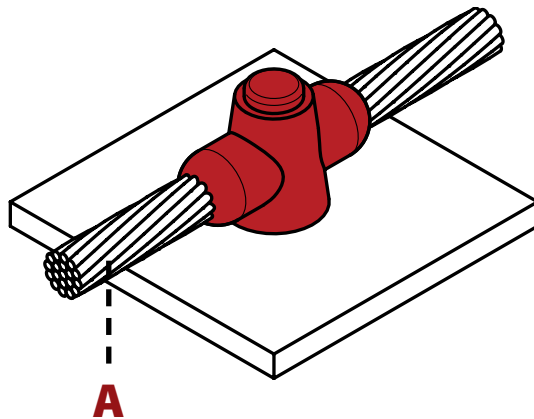


Cable to Steel Surface Connection

A	Handel Clamp	Mould Type	Powder
25	ZHC 60	ZCES 25	ZWP 65
35		ZCES 35	
50	ZHC 80	ZCES 50	ZWP 090
70		ZCES 70	
95		ZCES 95	
120		ZCES 120	ZWP 115
150		ZCES 150	
185		ZCES 185	ZWP 200
240		ZCES 240	ZWP 250



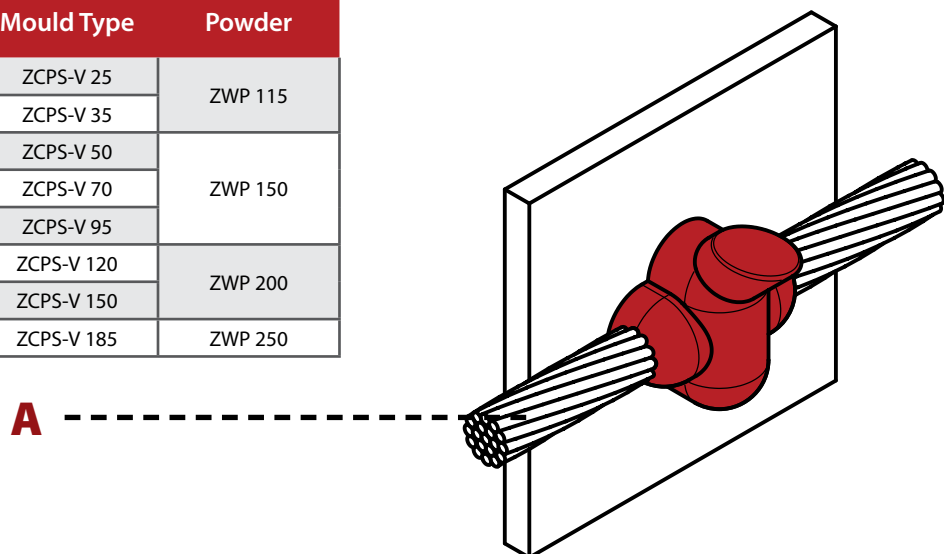
Cable to Steel Surface Horizontal Connection - Run Type



A	Handel Clamp	Mould Type	Powder
25	ZHC 60	ZCPS-H 25	ZWP 115
35		ZCPS-H 35	
50	ZHC 80	ZCPS-H 50	ZWP 150
70		ZCPS-H 70	
95		ZCPS-H 95	
120		ZCPS-H 120	ZWP 200
150		ZCPS-H 150	
185		ZCPS-H 185	ZWP 250

Cable to Steel Surface Vertical Connection - Run Type

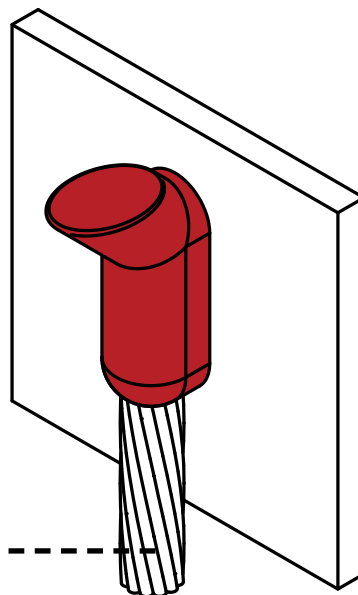
A	Handel Clamp	Mould Type	Powder
25	ZHC 60	ZCPS-V 25	ZWP 115
35		ZCPS-V 35	
50	ZHC 80	ZCPS-V 50	ZWP 150
70		ZCPS-V 70	
95		ZCPS-V 95	
120		ZCPS-V 120	ZWP 200
150		ZCPS-V 150	
185		ZCPS-V 185	ZWP 250





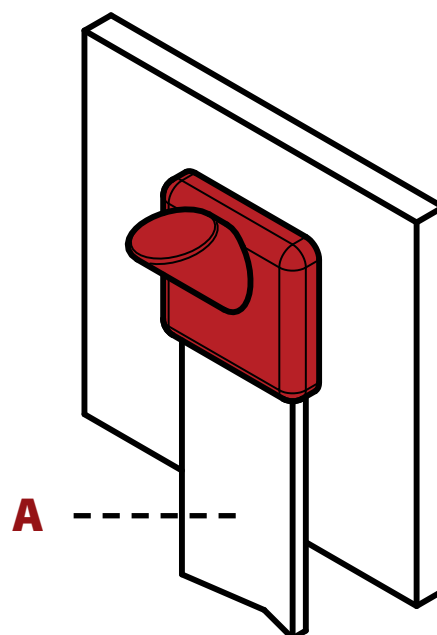
Cable to Steel Surface Vertical Connection - Upwards Type

A	Handel Clamp	Mould Type	Powder
25	ZHC 60	ZCUS 25	ZWP 65
35		ZCUS 35	
50	ZHC 80	ZCUS 50	ZWP 090
70		ZCUS 70	
95		ZCUS 95	ZWP 115
120		ZCUS 120	
150		ZCUS 150	ZWP 150
185		ZCUS 185	ZWP 200
240		ZCUS 240	ZWP 250



Tape to Steel Surface Connection - Upwards Tape

A	Handel Clamp	Mould Type	Powder
20x3	ZHC 60	ZTUS 203	ZWP 090
25x3		ZTUS 253	ZWP 090
25x5	ZHC 80	ZTUS 255	ZWP 115
30x3		ZTUS 303	
30x5		ZTUS 305	ZWP 150
40x3		ZTUS 403	
40x5		ZTUS 403	ZWP 200





Inspection of ZINOWELD Connections Visual Inspection

Photographic Guides

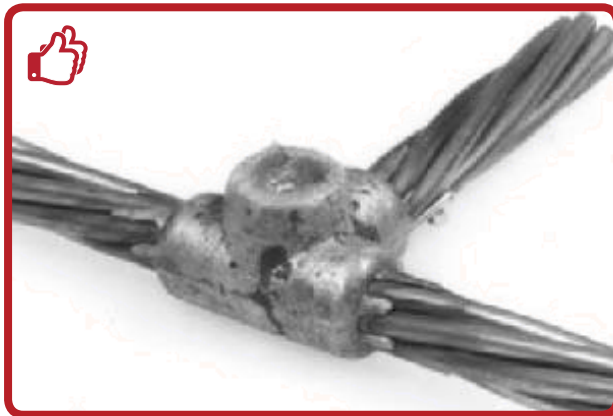
Like all electrical connections, a visual inspection is no guarantee of performance. Crimped or bolted connections cannot be inspected visually, but ZINOWELD connections can be visually inspected and provide an indication of the quality of the weld. Visual inspection is recommended as a practical minimum.

Use the photographs on the following pages as a guide to visual inspection. ZINOWELD connections are normally rated as good, acceptable or reject.

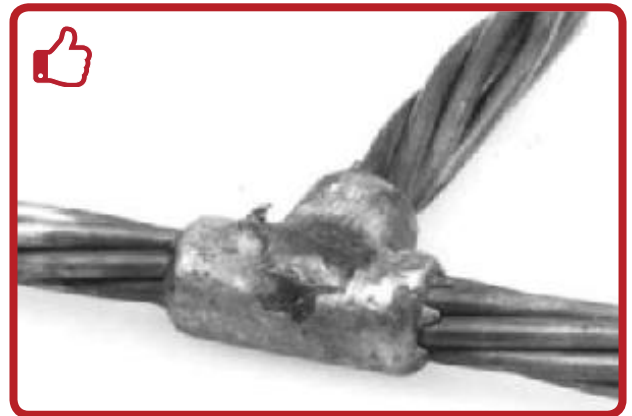
A good connection is a normal weld with only minor surface imperfections.

An acceptable connection is a less than normal weld, but a good performing weld. Imperfections indicate that 1) a new mold is required, 2) a change in procedure is necessary, or 3) the proper mold conductor and/or welding material should be used.

A reject connection shows inadequate fill or an extra high riser due to 1) use of incorrect procedure, 2) use of incorrect equipment and/or equipment worn beyond its useful life, or 3) use of incorrect material.



A solid weld with only minor surface imperfections.



Fill is lower than normal, but still sufficient.



A worn or incorrect mold was used, allowing leakage around conductor. The fill in this connection is sufficient to allow it as acceptable. Attention to mold is required prior to making next connection.



The presence of water/moisture in conductor strands or mold indicates that one or both were not properly dried. Although the riser is porous, the weld is solid. The degree of porosity is not sufficient to reject this connection.



Extreme amounts of slag on surface are caused by welding material leaking past disk or complete lack of disk. Inspect the condition of mold disk seat and check disk positioning prior to making the next connection.



Excessive water in cable strands and/or mold. Cable and mold must be dried by heating.



Light carbon traces on cable and connection are evidence of oil on cable strands. Oily cables must be cleaned with safety solvent.



Heavy carbon coating on cable and connection is evidence of large amounts of oil or grease on cable. Cable must be cleaned with safety solvent.



Fill too low. Weld cavity was not filled over cable strands. "Fins" indicate that the mold was not closed tightly due to incorrect mold, incorrectly adjusted handle clamp, or presence of foreign material in mold parting line. Before making the next connection, check the mold for each of the above.



Fill too low. Weld cavity was not filled over cable strands. Absence of leakage indicates that welding material size was incorrect (too small) or thru conductor moved.





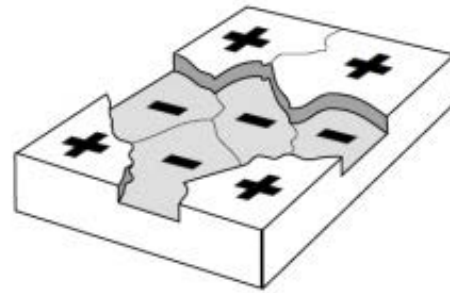
Cathodic Protection System



How Does Steel Corrode?

To understand cathodic protection, you must first understand how corrosion is caused. For corrosion to occur, three things must be present:

1. Two dissimilar metals
2. An electrolyte (water with any type of salt or salts dissolved in it)
3. A metal (conducting) path between the dissimilar metals

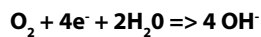


The two dissimilar metals may be totally different alloys – such as steel and aluminum – but are more likely to be microscopic or macroscopic metallurgical differences on the surface of a single piece of steel. In this case we will consider freely-corroding steel, which is non-uniform.

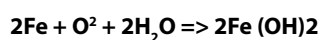
If the above conditions exist, the following reaction takes place at the more active sites: (two iron ions plus four free electrons):



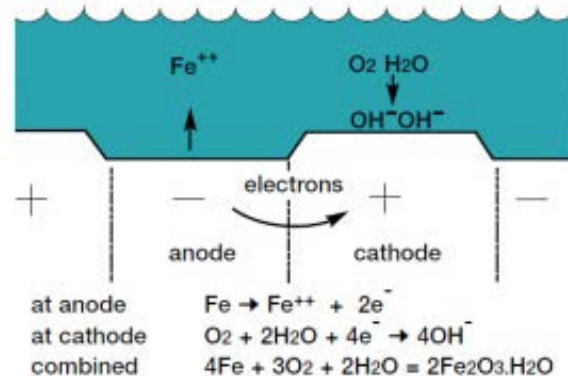
The free electrons travel through the metal path to the less active sites, where the following reaction takes place: (oxygen gas is converted to oxygen ion - by combining with the four free electrons - which combines with water to form hydroxyl ions).



Recombinations of these ions at the active surface produce the following reaction, which yields the iron-corrosion product ferrous hydroxide: (iron combining with oxygen and water to form ferrous hydroxide).



This reaction is more commonly described as 'current flow through the water from the anode (more active site) to the cathode (less active site).

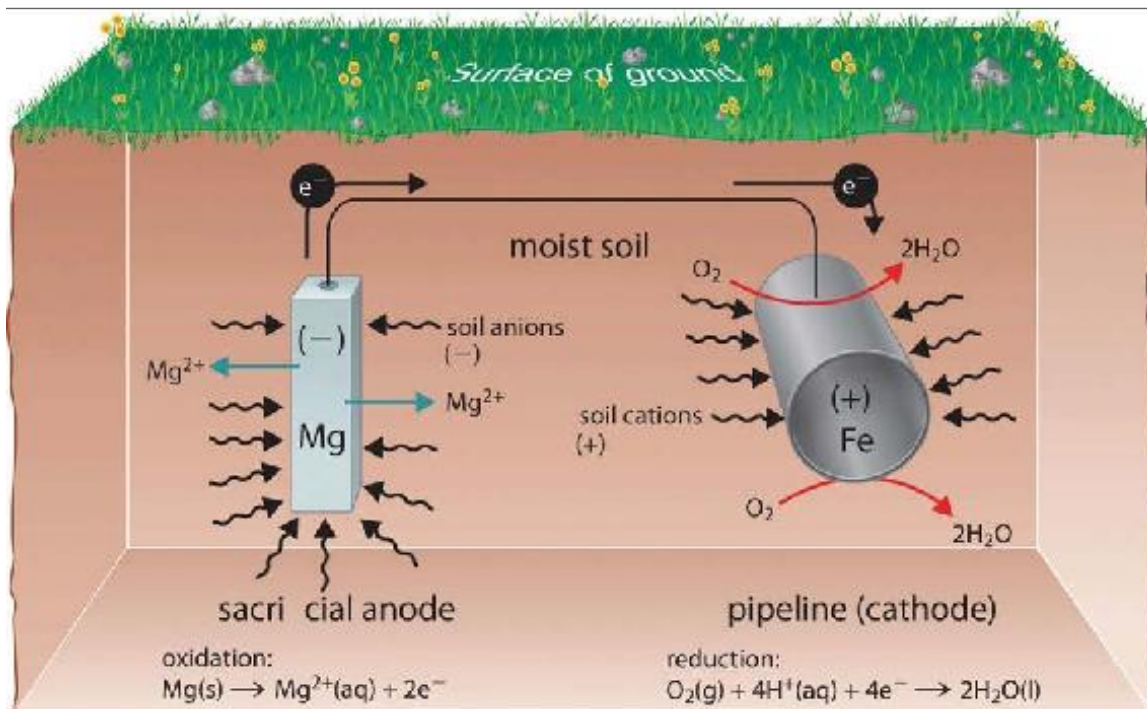




How Does Cathodic Protection Stop Corrosion?

Cathodic protection prevents corrosion by converting all of the anodic (active) sites on the metal surface to cathodic (passive) sites by supplying electrical current (or free electrons) from an alternate source.

Usually this takes the form of galvanic anodes, which are more active than steel. This practice is also referred to as a sacrificial system, since the galvanic anodes sacrifice themselves to protect the structural steel or pipeline from corrosion.



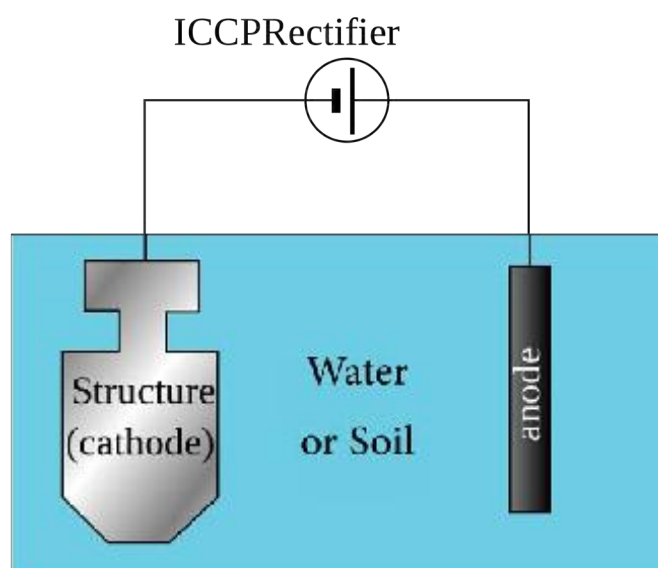
In the case of aluminum anodes, the reaction at the aluminum surface is: (four aluminum ions plus twelve free electrons)



And at the steel surface: (oxygen gas converted to oxygen ions which combine with water to form hydroxyl ions).



As long as the current (free electrons) arrives at the cathode (steel) faster than oxygen is arriving, no corrosion will occur.





Cathodic Protection Systems

SACRIFICIAL ANODE SYSTEMS

The electrical current an anode discharges is controlled by Ohm's law, which is:

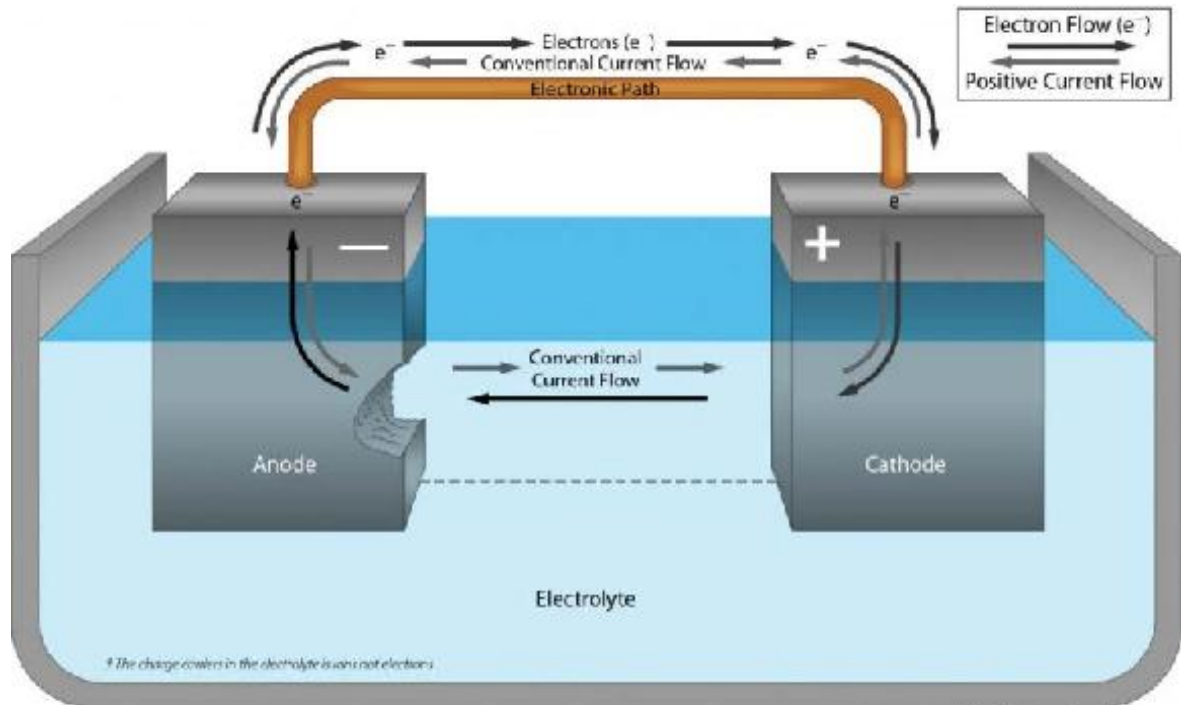


Figure courtesy of NACE International

$$I = E/R$$

I= Current flow in amps

E= Difference in potential between the anode and cathode in volts

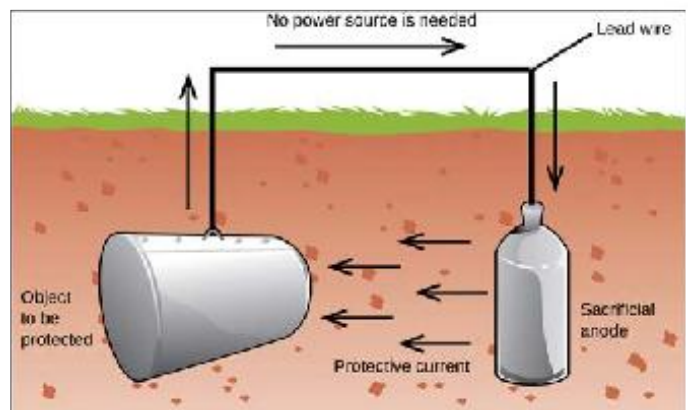
R= Total circuit resistance in ohms

Initially, current will be high because the difference in potential between the anode and cathode are high, but as the potential difference decreases due to the effect of the current flow onto the cathode, the current gradually decreases due to polarization of the cathode. The circuit resistance includes both the water path and the metal path, which includes any cable in the circuit. The dominant value here is the resistance of the anode to the seawater.

For most applications, the metal resistance is so small compared to the water resistance that it can be ignored (although this is not true for sleds or long pipelines protected from both ends). In general, long, thin anodes have lower resistance than short, fat anodes. They will discharge more current but will not last as long.

Therefore, a cathodic-protection designer must size the anodes so that they have the right shape and surface area to discharge enough current to protect the structure and enough weight to last the desired lifetime when discharging this current.

The length of the anode determines how much current the anode can produce, and consequently, how many square feet of steel can be protected. The cross section (weight) determines how long the anode can sustain this level of protection



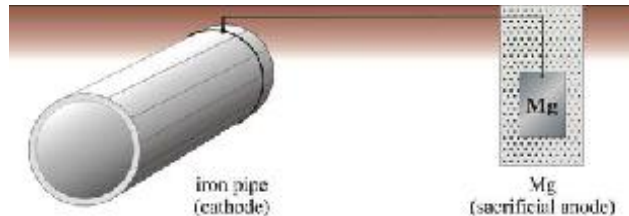


Sacrificial Anodes type

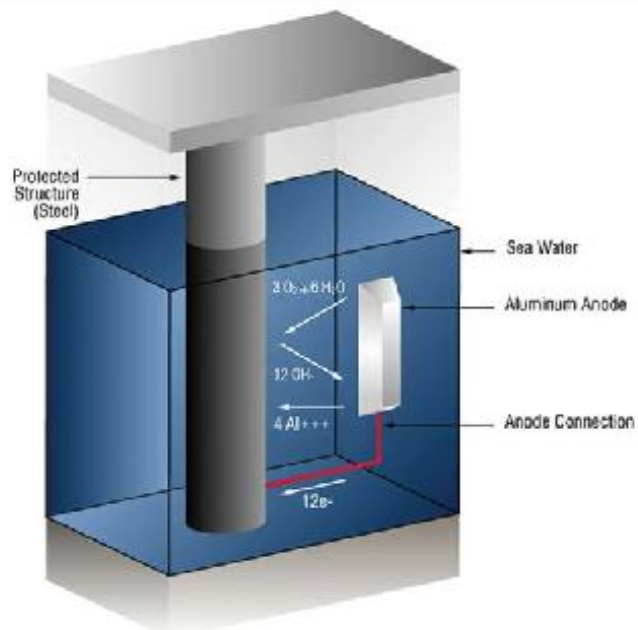
I) Magnesium: Magnesium is the most common sacrificial anode used to protect buried structures in the soil. Magnesium anodes are also used to protect domestic water heaters and reservoirs, heat exchangers, condensers and other structures that are in contact with water.

Excreted anodes are divided into two categories in terms of chemical composition and type of application:

- 1) Standard Magnesium Anode (AZ63)
- 2) High potential anemone (M1C)



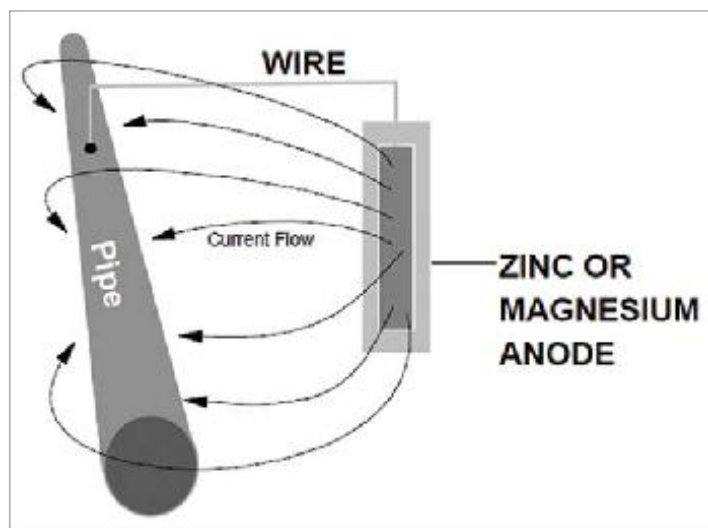
II) Aluminum Anode: The main application of these anodes is for the cathodic protection of steel structures in seawater. However, these anodes can also be used in rare cases in fresh water or soil. In order to prevent the formation of an aluminum peroxide layer on the anode surface which significantly reduces the anode function, the chemical composition of the aluminum anodes is usually utilized by an activator such as mercury or indium



III) Zinc Anode: Zinc anodes are used to protect structures immersed in fresh or salty water. Of course, these anodes are also used to protect buried structures in the soil.

Zn anodes are classified in terms of chemical composition and application type in two categories:

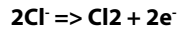
- 1) I-type alloy designed for use in seawater.
- 2) Standard type zinc alloy (Type II) formulated for use in fresh water and soil.



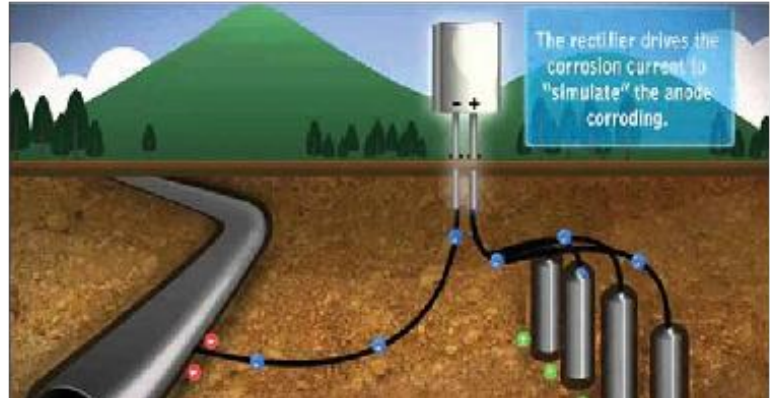


IMPRESSED CURRENT CATHODIC PROTECTION (ICCP) SYSTEMS

Due to the high currents involved in many systems (larger structures, or where electrolyte resistivity is high, galvanic anodes cannot economically deliver enough current to provide protection), it is not uncommon to use impressed-current systems that use anodes of a type (ICCP anodes) that are not easily dissolved into metallic ions. This causes an alternative reaction: the oxidation of the dissolved chloride ions.



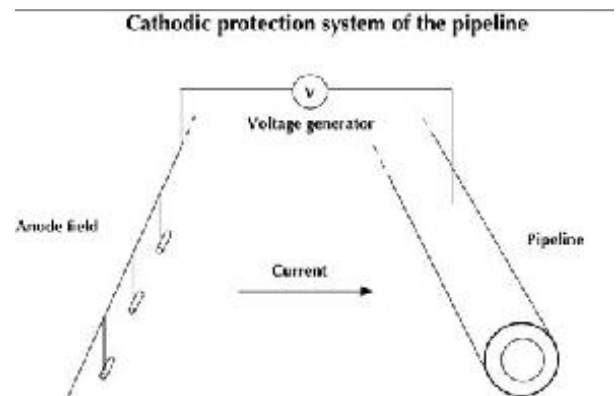
These consist of anodes connected to a DC power source, often a transformer-rectifier connected to AC power. In the absence of an AC supply, alternative power sources may be used, such as solar panels, wind power or gas powered thermoelectric generators.



ICCP Anodes Type

I) High silicon Cast Iron: The cast iron anode is probably the most used anode in flow injection systems in buried plants in the soil. The presence of high silicon and chromium in the alloy results in a sharp increase in the corrosion resistance and can guarantee the life span of the existing equipment for a long time to come.

II) Mixed Metal Oxide: The core of the anode MMO is generally selected from Titanium 1 or 2, which is activated by a complex metallic oxide coating (Ta₂O₅, IrO₂) for use and application in soil, carbon bundles, freshwater, seawater, and Also suitable concrete

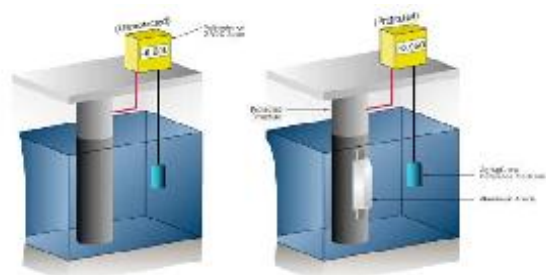


How do we know when we have enough cathodic protection?

We can verify that there's enough current by measuring the potential of the steel against a standard reference electrode, usually silver silver/chloride (Ag/AgCl sw.), but sometimes zinc (sw.).

Current flow onto any metal will shift its normal potential in the negative direction. History has shown that if steel receives enough current to shift the potential to (-) 0.800 V vs. silver / silver chloride (Ag / AgCl), the corrosion is essentially stopped.

Due to the nature of the films which form, the minimum (-0.800 V) potential is rarely optimum, so designers try to achieve a potential between (-) 0.950 V and (-) 1.000 V vs. Ag/AgCl sw.





Cathodic Protection Ground beds

Usually, according to the information obtained from the Plant and the information obtained from measuring the Soil resistivity, as well as the equipment shall be protected at site, the ground bed type will be selected.

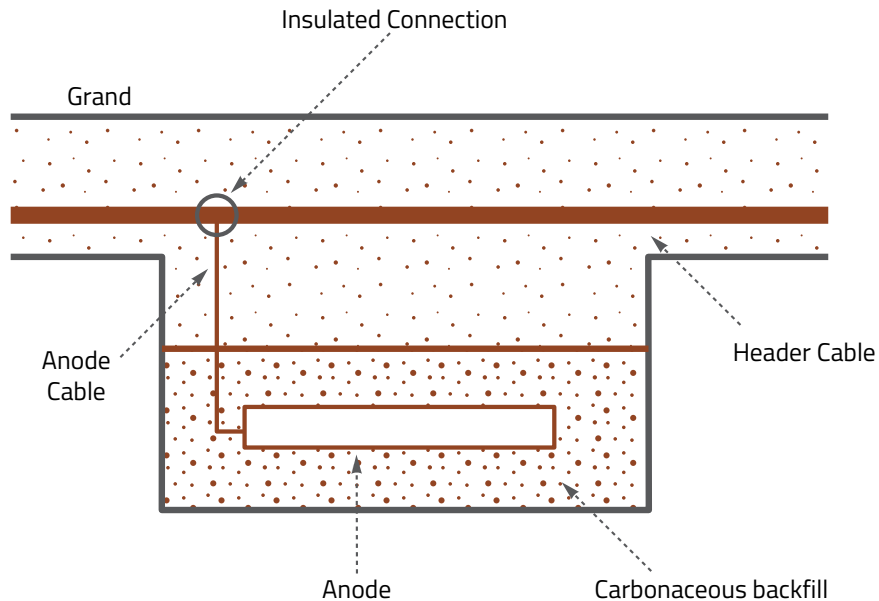
Depending on the physical shape and type of backing, the Ground beds are divided into two main categories: Shallow Ground bed and Deep well ground bed:

Shallow Ground bed

The depth of this type of GB is usually up to 5 meters. It is indicated in the following two categories:

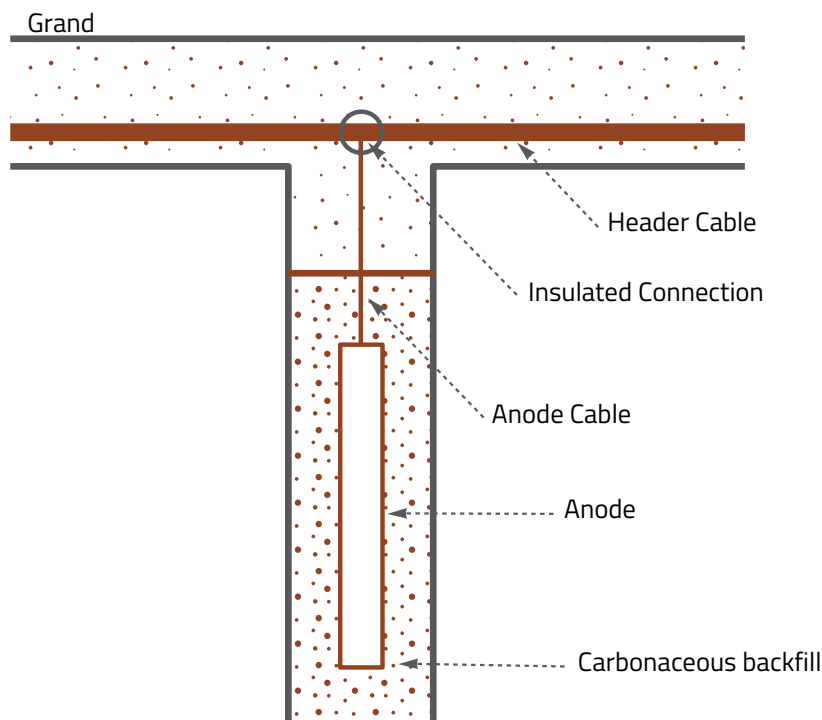
1- Horizontal Ground bed:

The anodes will be installed horizontally in Backfill, attention to Chemical interactions vent pipe shall be considered.



2- Vertical Ground bed

The anodes will be installed vertically in Backfill, attention to Chemical interactions vent pipe shall be considered.





Deep well ground bed

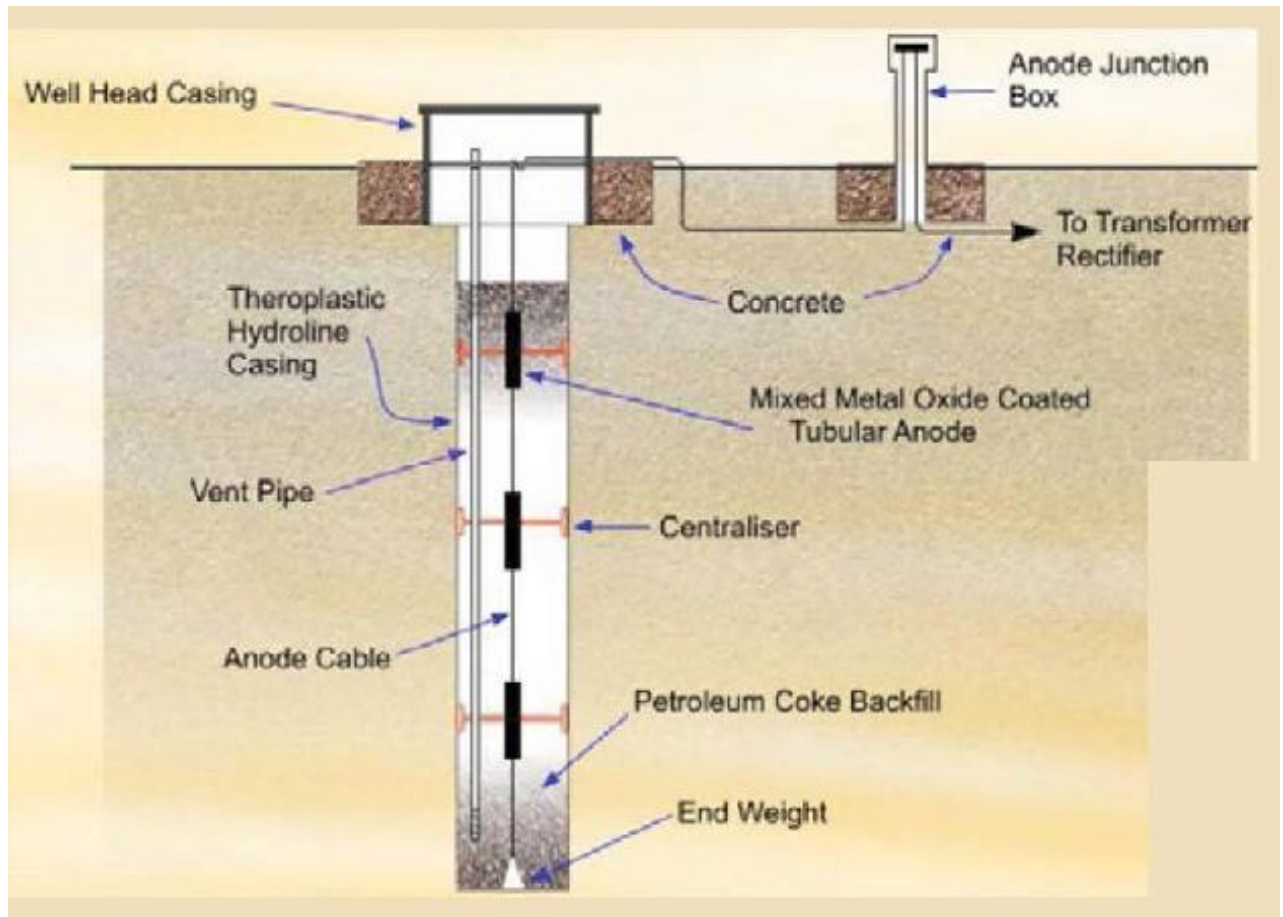
A deep well anode system consists of two zones – the active area, which extends from the bottom of the hole to the top of the coke column, and the inactive zone. Typically, the inactive area ranges from 15m to 30m and its purpose is to assure that the anodes are sufficiently remote from the structure to ensure good current distribution. The active area is where the anodes are located. Deep well ground bed have Dry and Wet type.

1- Dry Type:

In dry Deep well ground bed anodes installed in backfill.

2- Wet type:

In wet Deep well ground bed anodes installed in Water.





ICCP Equipment

Transformer Rectifier:

Transformer Rectifier is used for cathodic protection of buried pipelines across the country, storage tanks at terminals /refineries and other buried structures.

TRUs are used to prevent submerged (Soil or water) metallic structures from corrosion. All submerged Pipelines (Oil, water etc.), concrete structure of bridges/ buildings / sea ports etc. can be protected from corrosion by doing CP.

To obtain the optimum level of protection under varying conditions, it is necessary to vary the impressed current continuously so as to maintain a constant level of protective potential at the structure. This continuous monitoring and control can be achieved by providing an automatic control for the cathodic protection system.



MOD of Operation:

Auto Reference Mode

The operation of the TRUs in this mode will be fully Automatic and will be controlled by reference electrode feedback. The unit will automatically maintain reference voltage within ± 15 mv of the set value under all conditions.

Manual Mode

The DC output voltage of TRU will be controlled in 24 symmetrical steps by means of a separate Autotransformer with Coarse & Fine tapping.

CV-CC Mode

The unit will be operated in Constant Voltage or Constant Current mode.

In constant voltage mode the DC output voltage will be settable from 0 to rated value in step less manner by means of voltage adjustable pot.

In constant current mode the DC output current will be settable from 0 to rated value in step less manner by means of current adjustable pot.





Anodes

High Silicon Cast Iron Rod Anodes

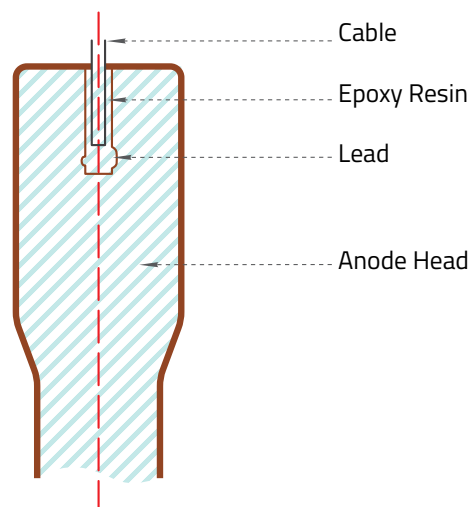
High silicon cast iron anodes have been used for more than 4 decades in the underground corrosion protection of structures. During this period of time, the anodes have proved one of the most profitable cathodic protection materials. This has led to a long demand for these products.

Solid cast anodes of solid chromium ferrosilicon can be used on soil and water. Its chemical composition (Table 1) causes the anode work effectively in saline environments, brackish water and other environments containing saline environments, brackish water and other environments containing chloride ions. The anodes also operate very well in deep well and underground applications where usually hydrogen gases are generated.

Table1: HSCI Chemical Composition		
"C" Type	"N" Type	Element
0.9-1	0.9-1	Carbon
14.25-14.75	14.25-14.75	Silicon
1.5 max	1.5 max	Manganese
0.2 max	0.2 max	Molybdenum
0.5 max	0.5 max	Copper
4.3-5	0	Chromium
Remainder	Remainder	Iron



The anodes can be installed with backfill or bare, the use of backfill improves the efficiency on applications in non-aqueous lands. The backfill increases the discharge area and decrease consumption rate.



The routine type of this Anode mention in table 2

Table 2:HSCI Routin Type							
Code	Type	Nominal Dimension (App)				Weight	
		Diameter		Length			
		In	mm	In	mm	Lb	Kg
ZIHR 260	Rod	2	51	60	1500	44	22.7
ZIHR 360	Rod	3	76	60	1500	110	49
ZIHC 2180	Canister	--	180	--	1800	--	--
ZIHC 3200	Canister	--	200	--	2000	--	--



MIXED METAL OXIDE ANODES

Mixed metal oxide (MMO) anode has become the industry standard where reliable performance and long life is paramount. With the additional advantages of light weight, variety of sizes, configurations and good electrical connectivity, MMO offers an ideal choice for the Corrosion Engineer for many varied applications.

Mixed Metal Oxide Coating has been designed for use in all cathodic protection applications. The MMO coating consists of mainly IrO₂/Ta₂O₅ and is suitable for use in soils, carbonaceous backfill, fresh and brackish water, seawater and concrete. Operating parameters are varied for each parameter and are tabled below.

The titanium substrate remains constant throughout the design life of the anode is manufactured using titanium which meets ASTM B338 Grade 1 or 2 Standards.

MMO Anode				
"C" Type	"N" Type	Nominal Dimension (App)		Weight (Kg)
		Diameter (mm)	Length (m)	
ZIMT 2505	Tubular	25	0.500	0.5
ZIMT 2510	Tubular	25	1	1
ZIMT 3205	Tubular	32	0.500	0.5
ZIMT 3210	Tubular	32	1	1
ZIMC 2180	Tubular - Canister	180	1.8	---
ZIMC 2200	Tubular - Canister	200	2	---
ZIMC 3180	Tubular - Canister	180	1.8	---
ZIMC 3200	Tubular - Canister	200	2	---

* Coil Length

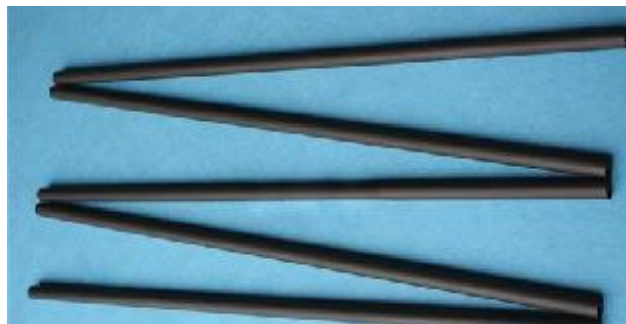




MMO Tubular Anode

MMO tubular anodes have an extremely low consumption rate. The titanium substrate remains constant throughout the design life of the anode.

The anodes are resin filled and helium tested for an effective seal of the connection. The cable end of the anode is protected with a Teflon sleeve. Tubular anodes are center connected and tested for resistance (less than 0.001 ohms). A variety of cable types and sizes are available. Several anodes may be fitted to a single cable to form a string of anodes for use in deep well ground beds.



MMO Ribbon Anode

MMO Ribbon Anode Usage for Reinforced Concrete Structures & Tank Bottoms.

MMO Anode				
"C" Type	"N" Type	Nominal Dimension (App)		Weight (Kg)
		Diameter (mm)	Length (m)	
ZIMR 0635	Ribbon	6.35	100 *	1.50



MMO Wire Anode

Tank Bottoms, Tank Internals, Pipeline Internals, Canister Anodes, Continuous Horizontal Ground beds, Discontinuous Horizontal Ground beds, Shallow Vertical Ground beds, Deep Anode Ground beds

MMO Anode				
"C" Type	"N" Type	Nominal Dimension (App)		Weight (Kg)
		Diameter (mm)	Length (m)	
ZIMW 0015	Wire	1.5	100 *	1.00
ZIMW 0030	Wire	3	100 *	3.00
ZIMP 0015	piggy bag	1.5	---	---
ZIMP 0030	piggy bag	3	---	---



MMO Mesh Anode

Anode ribbon mesh is composed of a precious metal oxide catalyst sintered to an expanded Titanium mesh substrate. The Anode Ribbon Mesh is used as a key component in the Cathodic Protection of Reinforced Concrete Structures

MMO Anode				
"C" Type	"N" Type	Nominal Dimension (App)		Weight (Kg)
		Diameter (mm)	Length (m)	
ZIMM 0010	Mesh	10	100 *	1.40
ZIMM 0013	Mesh	13	100 *	1.90
ZIMM 0015	Mesh	15	100 *	2.80
ZIMM 0020	Mesh	20	100 *	3.80





Backfill

Petroleum coke breeze is a carbon backfill which is used around impressed current anodes for underground cathodic protection applications. It is used to:

- Reduce the resistivity of the environment surrounding the anode to increase the amount of current the anode can discharge
- Extend the anode surface area, thus increasing the amount of current the anode can discharge
- Reduce consumption of the anode since the carbon becomes the part of the anode consumed before the anode itself.

While the main purpose of coke breeze backfill is to reduce the anode-to- earth circuit resistance and to increase anode service life, it also helps to eliminate gas blockage and drying tendencies.

According to IPS Standard we have product 3 type of backfill

Property	Type 1	Type 2	Type 3
Carbon content (min.)	80	90	95
Moisture Content (max.)	5	5	1
Ash Content (max.)	15	5	3
Total Sulphur Content (max.)	1	5	1
Volatile matter Content (max.)	5	5	1

Premium backfills with high carbon contents and low contact resistance values do not have to cost an arm and a leg. It is made from petroleum coke breeze, which is calcined to remove hydrocarbons and moisture.

Anode Centralizer

The anode centralizer is a nonmetallic, PVC welded assembly used to hold the anode, cable and vent pipe in the center of a deep anode cathodic protection system. The sturdy centralizer will easily slide into the borehole without sharp edges to catch on irregular surfaces. It is manufactured with holes for attaching the supplied plastic cable ties used for securing the vent pipe and the anode.



Product Benefits

- Non-metallic, will not damage the anode cable or cause electrical short
- Easy to install
- Secures anode and vent pipe
- Installs without hang-ups





Galvanic System Equipment

In this type of application the naturally occurring electrochemical potentials of different metals are used to provide protection. Sacrificial anodes are coupled to the structure under protection and conventional current flows from the anode to the structure as long as the anode is more "active" than the structure. As the current flows, all the corrosion occurs on the anode which "sacrifices" itself in order to offer protection from corrosion to the structure.

the galvanic series for common metals is shown below Table. On the active side of the drawing the metals such as zinc, aluminum and magnesium appear. These metals and their alloys are the most commonly used sacrificial anodes

Metal	Potential with respect to a Cu:CuSO ₄ reference electrode in neutral pH environment (volts)
Carbon, Graphite, Coke	+0.3
Platinum	0 to -0.1
Mill scale on Steel	-0.2
High Silicon Cast Iron	-0.2
Copper, brass, bronze	-0.2
Mild steel in concrete	-0.2
Lead	-0.5
Cast iron (not graphitized)	-0.5
Mild steel (rusted)	-0.2 to -0.5
Mild steel (clean)	-0.5 to -0.8
Commercially pure aluminium	-0.8
Aluminium alloy (5% zinc)	-1.05
Zinc	-1.1
Magnesium Alloy (6% Al, 3% Zn, 0.15% Mn)	-1.6
Commercially Pure Magnesium	-1.75

Magnesium Anode

Magnesium Anode is used for Temporary protection of buried pipelines, protection of well coated buried pipelines, and protection of small marine structures, "Hot spot" locations for buried & submerged steel structures, Protection of well coated buried pipelines, internal protection of water tanks, pipeline casing sleeves. Suitable for use in soils, mud, fresh water, brackish water and sea water.

Magnesium anodes are classified into two categories in terms of chemical composition and type of application:

- 1) Standard Magnesium Anode (AZ63)
- 2) High potential Magnesium Anode (M1C)



Code	Type	Width (mm)	Height (mm)	Length (mm)	Gross Weight (Kg)
ZSMg 0017	17 Lb	90	90	650	7.7
ZSMg 0032	32 Lb	140	140	500	14.5
ZSMg 0060	60 Lb	114		1525	27

Note:

Other size will be supply according to your order.

Element	Standard	High Potential
Aluminum (%)	5.3 - 6.7	0.01 max
Zinc (%)	2.5 - 3.5	---
Manganese (%)	0.15 - 0.7	0.5 - 1.3
Silicon (%)	0.1 max	0.05 max
Copper (%)	0.02 max	0.02 max
Nickel (%)	0.002 max	0.001 max
Iron (%)	0.003 max	0.03 max
All Others (%)	0.3 max	0.3 max
Magnesium (%)	Remainder	Remainder



Zinc Anode

Zinc has been used as a sacrificial anode material in seawater since 1824. Modern zinc anodes used for Cathodic Protection are cast from high purity zinc (99.99%) alloyed with aluminum and cadmium with limitations on the level of lead, iron and copper.

Typical applications include, submarine pipelines, ballast tanks, offshore structures, storage tank internals, quay walls, water tanks, marine applications and ships hulls.

Zinc anodes are classified in terms of chemical composition and application type in two categories:

- 1) Zinc Sea Alloys (Type I) designed for use in seawater.
- 2) Zinc standard alloy (Type II), which is formulated into fresh water and soil.

Zinc Chemical Composition

Element	Type 1	Type 2
Aluminum	0.1 – 0.5	0.005 Max
Cadmium	0.025 – 0.07	0.003 Max
Iron	0.005 Max	0.0014 Max
Lead	0.006 Max	0.003 Max
Copper	0.005 Max	0.002 Max
Other	0.1 Max	---
Zinc	Remainder	Remainder

Note:

All size will be supply according to your order.



Aluminum Anode

Aluminum alloy anodes have been formulated primarily for use in seawater. Alloys are also capable of achieving high output capacity in mud and brackish water of resistivity up to 150 Ohm.cm. Aluminum anodes have approximately three times the capacity of Zinc alloys.

Aluminum Chemical Composition

Element	Type 1	Type 2	Type 3
Zinc	0.30 – 0.05	0.30 – 6.0	2.5 – 5.75
Indium	---	---	0.015-0.040
Hg	0.30 – 0.05	0.30 – 0.05	---
Cadmium	---	---	0.002 max
Silicon	0.11-0.21	0.11-0.21	0.12 max
Iron	0.13 Max	0.13 Max	0.09 max
Copper	0.006 Max	0.006 Max	0.003 max
Other	0.02 Max	0.02 Max	0.02 max
Aluminum	Remainder	Remainder	Remainder



Al Anode					
Code	Type	L (mm)	W (mm)	H (mm)	App. Weight (Kg)
ZSAI T1140		1190	235	235	140
ZSAI T1190		1585	235	235	190
ZSAI T1200		1400	246	246	200
ZSAI T1300		2380	235	235	300
ZSAI T1310		2330	246	246	310
ZSAI T2170		1190	235	235	170
ZSAI T2235		1585	235	235	235
ZSAI T2220		1400	246	246	220
ZSAI T2330		2380	235	235	330
ZSAI T2325		2330	246	246	325
ZSAI T3018		300	75	31	1.8
ZSAI T3024		350	80	32	2.4
ZSAI T3035		500	80	32.5	3.5
ZSAI T3108		500	80	100	10.8
ZSAI T4170		1190	235	235	170
ZSAI T4230		1585	235	235	230
ZSAI T4220		1800	246	246	220
ZSAI T4330		2380	235	235	330
ZSAI T4310		2330	246	246	310
ZSAI T5018		300	75	31	1.8
ZSAI T5024		350	80	32	2.4
ZSAI T5035		500	80	32.5	3.5
ZSAI T5108		500	80	100	10.8
ZSAI T6031		300	150	26	3.1
ZSAI T6037		300	150	31	3.7
ZSAI T6065		300	150	54	6.5
ZSAI T6070		300	150	58	7
ZSAI T6075		300	150	62	7.5
ZSAI T7081		1200	50	50	8.1
ZSAI T7101		1500	50	50	10.1
ZSAI T7126		1200	62.5	62.5	12.6
ZSAI T7158		1500	62.5	62.5	15.8
Code	Type	T (mm)	L (mm)	D (mm)	App. Weight (Kg)
ZSAI T8203		78	600	498.8	203
ZSAI T8105		43	600	498.8	105
ZSAI T8094		43	550	489.3	94
ZSAI T8119		53	580	469.2	119
ZSAI T8105		53	500	478.8	105

Note:

Other size will be supply according to your order.



Backfill

This type of backfill is generally used in the case of Galvanic Cathodic Protection. A typical mixture in the case of soil with high resistivity consists of 75% powdered and hydrated gypsum (calcium sulfate), 20% bentonite clay and 5% sodium sulfate. Bentonite absorbs water, expands and makes good contact between the soil and anode, reducing groundbed resistance.

In cases in which soil has low moisture content, 75% bentonite and 25% gypsum is used. A mixture of 50% molding plaster and 50% bentonite clay works well with the zinc anodes.





Other Equipment

Boxes

The cathodic protection system, generally used below boxes:

- Positive / Negative box: connection positive and negative Cable
- Bond box: connection pipes or ... in CPS together
- Test Box: Measuring CP parameter
- Marker: To specify the pipe route, Ground bed and ...

Equipment of boxes will be considered according to Application. the CP designer can be used below equipment in boxes :

- Terminals
- Shunt
- Resistor
- Measuring Device
- Read switch
- Gland

Note that the enclosure, painting, Increase Protection (IP) and ect. of boxes Shall be specify according to area Classification. We have supply all boxes for safe or hazardous area Classification.



Boxes:



Safe Boxes

Standard	Project Specification / IPS
Material	Mild steel
Thickness	2 & 3 mm
Paint	Yes (as per request)
Input / output Cable	Pipe / Gland
Stand	Free stand / wall mounted
Terminal	Stud terminal, Modular Terminal Blocks

EX Box

Standard	Project Specification
Material	Aluminum / stainless steel
Zone	1 & 2 (IIB / IIC , T1 ~ T6)
Input / output Cable	Gland
Stand	Free stand / wall mounted
Terminal	Modular Terminal Blocks

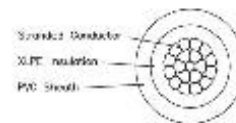


Cable

The cathodic protection cable is single core with copper conductor. Cable are rates 0.6 / 1.2 Kv (according to IEC Standard)

Isolation:

- PVC cover: polyvinyl chloride
- XLPE/PVC : cross-linked polyethylene
- HMWPE: High molecular weight polyethylene



NYY (CU/PVC/PVC)					
Part No.	Nominal cross section area of conductor (mm ²)	Insulation Thk. (mm)	Sheath Thk. (mm)	Overall Diameter (mm)	Weight (Kg/Km)
ZWP 010	1x10	1.0	1.4	8.9	165
ZWP 016	1x16	1.0	1.4	9.9	232
ZWP 025	1x25	1.2	1.4	11.6	334
ZWP 035	1x35	1.2	1.4	12.2	418
ZWP 050	1x50	1.4	1.4	13.8	574
ZWP 070	1x70	1.4	1.4	15.5	770
ZWP 095	1x95	1.6	1.5	17.7	1031
ZWP 120	1x120	1.6	1.5	19.2	1270
ZWP 150	1x150	1.8	1.6	21.3	1580
ZWP 185	1x185	2.0	1.7	23.5	1941

N2XY (CU/XLPE/PVC)					
Part No.	Nominal cross section area of conductor (mm ²)	Insulation Thk. (mm)	Sheath Thk. (mm)	Overall Diameter (mm)	Weight (Kg/Km)
ZWX 010	1x10	0.7	1.4	8.3	147
ZWX 016	1x16	0.7	1.4	9.3	211
ZWX 025	1x25	0.9	1.4	11.0	309
ZWX 035	1x35	0.9	1.4	11.6	391
ZWX 050	1x50	1.0	1.4	13.0	537
ZWX 070	1x70	1.1	1.4	14.9	732
ZWX 095	1x95	1.1	1.5	16.7	973
ZWX 120	1x120	1.2	1.5	18.4	1212
ZWX 150	1x150	1.4	1.6	20.5	1511
ZWX 185	1x185	1.6	1.6	22.5	1848

PVDF / HMWPE					
Part No.	Nominal cross section area of conductor (mm ²)	Insulation Thk. (mm)	Sheath Thk. (mm)	Overall Diameter (mm)	Weight (Kg/Km)
ZWH 006	1x6	1.0	1.65	8.42	96
ZWX 010	1x10	1.0	1.65	9.35	135
ZWX 016	1x16	1.0	1.65	10.40	197
ZWX 025	1x25	1.2	1.65	12.10	312
ZWX 035	1x35	1.2	1.65	13.20	398
ZWX 050	1x50	1.4	1.65	15.00	541



Copper-Copper Sulfate Reference Electrode (Cu/CuSO₄)

Copper sulfate reference electrodes (CSE) are the most commonly used reference electrode for measuring potentials of underground structures and also for those exposed to fresh water. CSE are not suitable for use off-shore environments or in a chloride electrolyte as the chloride ions migrate through the porous plug and contaminate the CSE.

The portable type CSE are composed of a copper rod, saturated solution of copper sulfate and a non-conducting cylinder with a porous plug at the bottom as shown in above picture.

AFIC can supply a wide range of CSE those are intended to use in soil applications and are made for portable use or for permanent installations i.e., suitable to use along the pipeline route or under the above grade storage tanks etc.



Silver chloride electrode

Silver-silver chloride (Ag-AgCl) reference electrodes are most commonly used for testing cathodic protection corrosion control system in sea water environments. The Ag-AgCl electrode is also used in concrete structures. There are two types of Ag-AgCl reference electrodes; in one type the silver electrode is exposed to seawater and in the other the electrode is immersed in a potassium chloride (KCl) solution contained in a cylinder with a porous plug.



Zinc Reference Electrode

Zinc is commonly used for onshore and offshore corrosion potential measurement. Zinc reference electrodes are not stable in carbonates or at high temperatures. For underground use, the zinc electrode is packaged in a cotton bag containing the same backfill as used around zinc anodes. In off-shore zinc electrodes used bare.



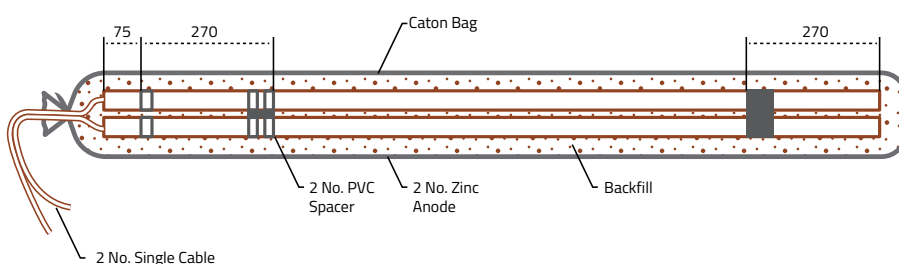


Zinc Earthing Cell

The combines two zinc reference cells, insulated from one another. One electrode would typically be connected to the protected structure, the other to an earthing device. The electrodes are surrounded by low resistivity backfill allowing large stray currents to pass between them. The enables the structure to be earthed to ground with providing a direct connection

Size Bare	2 No 35 x 35 x 1525mm c/w 12mm Dia M.S. Core Extending 25mm At One End
Size Packaged	165mm Dia x 1700mm Length
Cable	1 x 25mm ² XLPE/PVC (Black) x 5m Length (Or To Client Specification)

Zinc Composition	
Cu	0.005% max
Al	0.10 – 0.50%
Fe	0.005% max
Cd	0.025 – 0.07%
Pb	0.006% max
Others	0.10% total
Zn	Remainde



Polarization Cell

Polarization cell protects against induced AC current and ground fault current on buried pipelines. Polarization cells permit low-level voltage of cathodic protection to uniform flow and prevent hazardous voltages. Liquid Polarization cell consist of multiple plates of steel arranged, fixed and immersed in 30% KOH (Potassium Hydroxide) solution. Specially selected oil layer stop the evaporation of solution to some extend. It is advisable to verify the solution level periodically. Polarization cell is fitted in transparent body to check solution level. Normal storage of cell does not have any internal voltage and act as a grounding switch in presence of high voltage. Polarization cell works on electrochemical principle. Installed plates with large surface area polarize and allow in developing safe DC voltage suitable for cathodic protection. As the voltage increases from DC or AC voltage, the polarization film breaks and polarization cell conduct current. Specially designed polarization cells have properties to retain solution level to the maximum period with specially added floating oil. Polarization cells are designed to protect personnel and equipment from electrical disturbances. The polarization cells are rated from 5KA to 100KA AC fault capacities in 5KA steps. The other type of polarization cell is soli State device, Used in safe or hazardous area. AC fault current is 7, 10, 15, 20, 35, 50 & 70 KA





INSULATING FLANGE KITS

Flange insulation kits for metallic pipelines are available for all flange sizes, types, pressure ratings and materials. Flange insulation kits are commonly installed at each end of a pipeline to electrically isolate the pipe for other buried foreign metallic structures and plant grounding systems therefore limiting the amount of cathodic protection current required to protect the pipeline.



TYPE "E" GASKETS

Have the same outside diameter as the flanges, and are made with precision-located bolt holes. They are easy to Centre and will prevent foreign material from becoming lodged between the flange faces and "shorting out" the flange insulation. Type "E" gaskets are available in a wide variety of materials



TYPE "F" GASKETS

Are made to fit within the bolt hole circle of the flange faces. The outside diameter of the gasket is slightly larger than the inside diameter of the bolt hole circle. They are available in a wide variety of materials.



TYPE "D" GASKETS

Type "D" Are made specifically to fit into the ring groove of RTJ flanges. They are available in reinforced phenolic and other materials.



INSULATING SLEEVES AND WASHERS

Are available in complete kits, with or without a gasket. Sleeves and washer are available as separate parts or as a one-piece moulded unit. Sleeves and washers are enclosed in a strong polyethylene bag to eliminate any possibility of loss.





Cable Connecting

Splicing kit

The splicing kit will be used in onshore and marine, splicing kit suitable for plastic or rubber insulated cable 600/1000 V . There are 2way and 3way (Y or T shape) splicing kit



Pin Brazing

Pin brazing is Fast and easy connection, used to ensure a safe electrical connection to different types of steel structures. The pin brazing method is well suited for joints between pipes, connection to measuring cables, installation of sacrificial anodes, test posts and many other applications. More about the pin brazing process...

Pin Brazing Equipment

EasyBond Model MKII, Standard Pin Brazing Kit
Pin Holder, direct or threaded pins (size M8, M10 & M12)
Ferrule Holder, direct or threaded pins (size M8, M10 & M12)
Brazing Pins with Fuse Wires
Ceramic Ferrules
Cable Lugs





Cathodic Protection Engineering Services

Engineering services include system design, technical recommendations, soil analysis, water analysis, close interval potential surveys, system checkouts, troubleshooting, maintenance, personnel training, as well as recommendations for repair and cost estimates. Included in our array of installation services are deep and conventional anode installations, sacrificial anode installations, tank system installations, abandonments, and system relocation and repair.

Engineering project types include oil and gas production, all submerged pipelines, water and waste water facilities, storage facilities, offshore structures, marine facilities, as well as municipal and government facilities.

Design & Analysis Services

- Cathodic Protection Drawings & Specifications
- Economic Feasibility & Budget Estimates
- Failure Analysis
- Computer & Instrument Grounding Designs
- Research & Development

Field Services

- Current Requirement Testing
- Line Current - Natural & Applied
- Stray Current & Interference Testing
- Pipe & Cable Locating
- Electrical Short Locating
- Electrical Continuity, Isolation & Resistance Testing
- Coating Holiday Testing
- Rectifier Monitoring
- Soil & Water Analysis
- Stray Current & Interference Testing
- Underwater Surveys
- Rectifier Troubleshooting
- Cathodic Protection System Troubleshooting
- Long Term Data Acquisition
- Cathodic Protection System Maintenance





Installation Services

- Deep Anode Drilling
- Complete C.P. System Installation
- C.P. System Repair
- C.P. System Relocation
- C.P. System Abandonment



Code and Standard

- ASME Standard (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)
- ASTM
- API (American Petroleum Standard)
- BSI (British Standard Institution)
- NACE (National Association of Corrosion Engineers)
- IPS (Iranian Petroleum Standard)
- IEC (International Electrotechnical Commission)
- DNV
- Peabody



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