# ALUICE Galvanic Aluminum Anodes by ICE

**Aluminum anodes have long been used in the fight against corrosion. Applications for aluminum anodes include ship hulls, tank interiors, offshore structures, submerged pipelines, piers, pilings, etc. ALUICE aluminium anodes are designed for optimum performance under a variety of environmental conditions and temperature ranges. Cast in a variety of sizes and weights, ALUICE anodes provide maximum performance in seawater and brackish environments.**

## Typical Chemical Composition

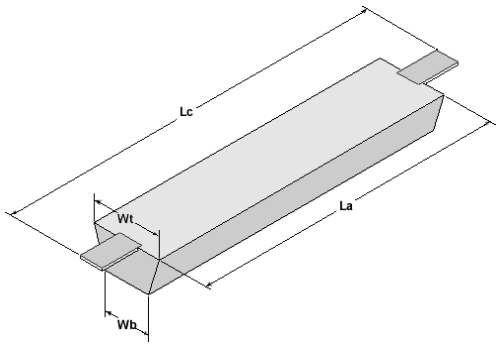
| Element | Percentage |
|---|---|
| Indium (In) | 0.016 to 0.04% |
| Zinc (Zn) | 2.75 to 6.00% |
| Silicon (Si) | 0.21% Maximum |
| Copper (Cu) | 0.005% Maximum |
| Iron (Fe) | 0.15% Maximum |
| Cadmium (Cd) | 0.002% Maximum |
| Others, each | 0.02% Maximum |
| Others, total | 0.05% Maximum |
| Aluminum | Remainder |

## Performance Characteristics

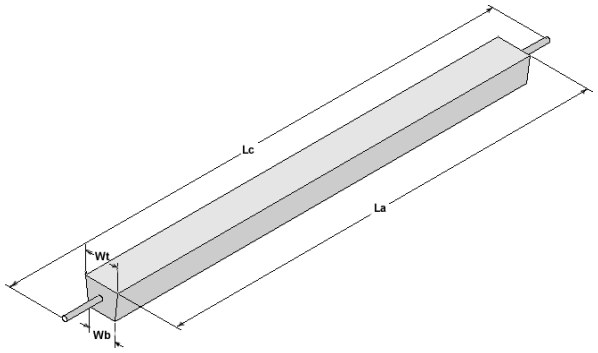
| | |
|---|---|
| Anode Capacity | 1150 amp hours per pound (Minimum) |
| Potential (Calomel) | 1.080 volts (Minimum) |
| Consumption Rate | 7.6 pounds per amp year |

## Available Sizes

ALUICE anodes are available in the shapes and sizes shown on the following drawings and charts. Other sizes and shapes may be available that are not shown in this information. If you do not see a particular anode you require, please contact ICE for assistance.

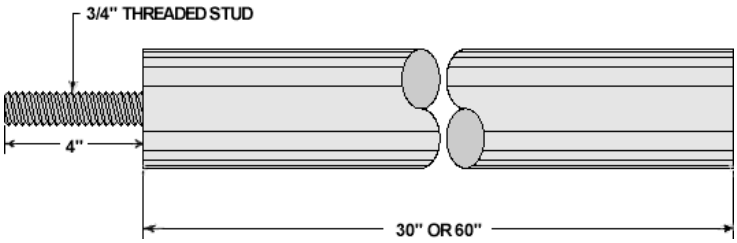



| Anode Number | Weight (lbs) | | Length (in) | | Width (in) | | Height | Core Dimensions (in) |
|---|---|---|---|---|---|---|---|---|
| | Alum. | Core | La | Lc | Wb | Wt | H (in) | |
| **10FM** | 9 | 1 | 12 | 16 | 3½ | 3½ | 2½ | 3/16 x1¼ |
| **20FM** | 18 | 2 | 20 | 25 | 3 | 4½ | 2½ | 3/16 x1½ |
| **29FM** | 26 | 3 | 24 | 29 | 4½ | 5½ | 2½ | 1/4" x 1½ |
| **37FM** | 34 | 3 | 36 | 41 | 3 | 5 | 2½ | 3/16 x1½ |
| **94FM** | 87 | 7 | 54½ | 62 | 4 | 4½ | 3¾ | 1/4" x 1½ |
| **110FM** | 101 | 9 | 77 | 84 | 4 | 4½ | 3 3/8 | 1/4" x 1½ |
| **144FM** | 135 | 9 | 72 | 84 | 7 | 8 | 3 | 1/4" x 1½ |
| **270FM** | 245 | 25 | 90 | 102 | 6¾ | 7¼ | 4 | 1/4" x 2½ |



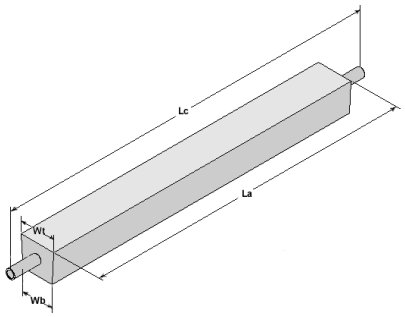

| Anode Number | Weight (lbs) | | Length (in) | | Width (in) | | Height | Core Dimensions (in) |
|---|---|---|---|---|---|---|---|---|
| | Alum. | Core | La | Lc | Wb | Wt | H (in) | |
| **26RT** | 22 | 4 | 60 | 72 | 2 | 2 | 2 | 1/2 |
| **39RT** | 35 | 4 | 60 | 72 | 2 | 2½ | 2¾ | 1/2 |
| **89RT** | 80 | 9 | 86 | 98 | 2½ | 3½ | 3¼ | 5/8 |
| **120RT** | 111 | 9 | 64 | 75 | 4 | 5 | 4 | 3/4 |
| **145RT** | 134 | 11 | 77 | 88 | 4 | 5 | 4 | 3/4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **157RT** | 150 | 7 | 60 | 72 | 4¾ | 5¼ | 5½ | 3/4 |
| **278RT** | 263 | 15 | 51 | 73 | 6¾ | 7¼ | 6½ | 1 |

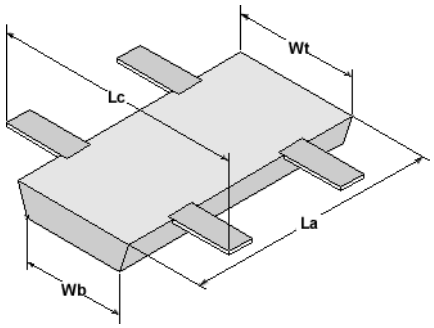



**Heater Treaters Aluminum Anodes**
(also available in 3/8" eyebolt)

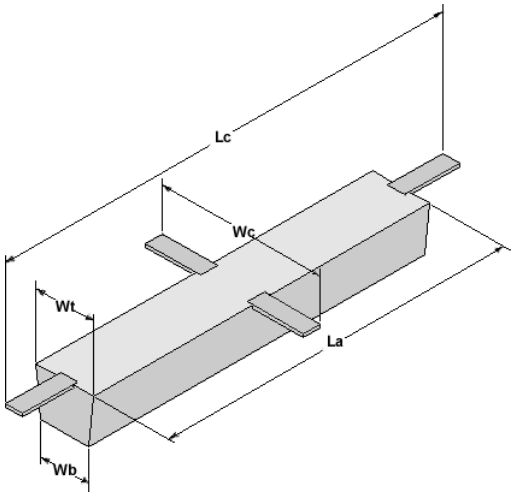
| Aluminum Length (in) | Weight (lbs) | |
|---|---|---|
| | Aluminum | Gross |
| 30" | 20.7 | 22.5 |
| 60" | 39.4 | 41.2 |



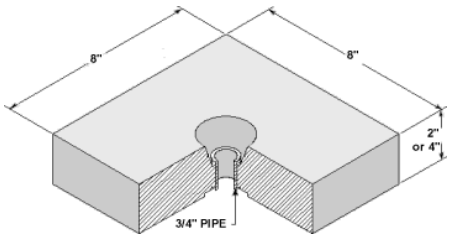

| Anode Number | Weight (lbs) | | Length (in) | | Width (in) | | Height | Core Dimensions (in) |
|---|---|---|---|---|---|---|---|---|
| | Alum. | Core | La | Lc | Wb | Wt | H (in) | |
| **205PT** | 175 | 30 | 24 | 48 | 8 | 9 | 9½ | 3" Sch40 |
| **290PT** | 244 | 46 | 29½ | 53½ | 9 | 10½ | 9½ | 3" Sch80 |
| **320PT** | 287 | 33 | 68 | 80 | 6¾ | 7½ | 6½ | 2" Sch80 |
| **351PT** | 313 | 38 | 77 | 90 | 6¾ | 7½ | 6½ | 2" Sch80 |
| **375PT** | 325 | 50 | 96 | 120 | 5¾ | 6¾ | 6½ | 2" Sch80 |
| **473PT** | 425 | 48 | 100 | 114 | 6¾ | 7½ | 6½ | 2" Sch80 |
| **575PT** | 470 | 105 | 72 | 84 | 8 | 9 | 9½ | 4" Sch80 |
| **668PT** | 548 | 120 | 84 | 96 | 8 | 9 | 9½ | 4" Sch80 |
| **875PT** | 725 | 150 | 96 | 120 | 9 | 10½ | 9½ | 4" Sch80 |

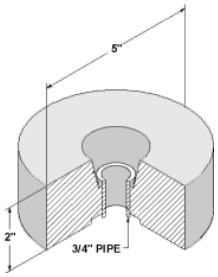



| Anode Number | Weight (lbs) | | Length (in) | | Width (in) | | Height | Core Dimensions (in) |
|---|---|---|---|---|---|---|---|---|
| | Alum. | Core | La | Lc | Wb | Wt | H (in) | |
| **11FM** | 9 | 2 | 12 | 12 | 5 | 6 | 1½ | 3/16 x1¼ |
| **40FM** | 35 | 5 | 18 | 17 | 9 | 9 | 2¼ | 1/4 x 2 |
| **61FM** | 56 | 5 | 18 | 17 | 9 | 9 | 3 5/8 | 1/4 x 2 |
| **80FM** | 76 | 4 | 48 | 10 | 4 | 4 | 4 | 1/4" x 1½ |
| **95FM** | 91 | 4 | 72 | 13¾ | 7 | 7¾ | 2 | 1/4" x 1½ |
| **144FM** | 140 | 4 | 72 | 14 | 7 | 8 | 3 | 1/4" x 1½ |
| **284FM** | 280 | 4 | 72 | 14 | 7 | 8 | 6 | 1/4" x 2½ |




| Anode Number | Weight (lbs) | | Length (in) | | Width (in) | | | Height | Core Dimensions (in) |
|---|---|---|---|---|---|---|---|---|---|
| | Alum. | Core | La | Lc | Wb | Wt | Wc | H (in) | |
| **158FM** | 140 | 18 | 40 | 52 | 5¾ | 6¾ | 18¾ | 5½ | 3/8 x 2 |
| **237FM** | 212 | 25 | 60 | 68 | 5¾ | 6¾ | 12¾ | 6 | 1/2 x 2 |

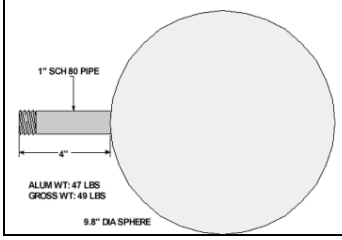


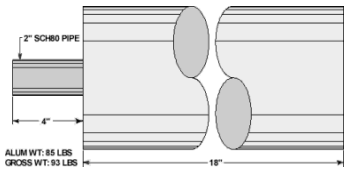

**Aluminum Condenser Anodes**

| Dimensions (in) | Weight (lbs) | |
|---|---|---|
| | Aluminum | Gross |
| 8" x 8" x 2" | 12.5 | 12.7 |
| 8" x 8" x 4" | 23 | 23.2 |
| 5" diameter x 2" | 3.5 | 3.7 |

**9.8" Dia. Sphere Aluminum Anode**

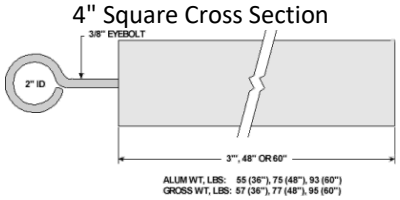



**8" Dia. x 18" Cylinder Aluminum Anode**




**Eyebolt Aluminum Anode**

4" Square Cross Section





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**Single core cables, with stranded circular copper conductor, PVC insulated and XLPE sheathed (XLPE/PVC)**

***Description***

- Soft annealed stranded copper, insulated with PVC compound covered with a layer of XLPE compound to form the overall jacket.
- Cable are according to IEC 60502 or BS 5467

***Application***

- For outdoor and indoor installation in damp and wet locations.
- They are normally used for cathodic protection, power distribution and urban networks, in industrial plants, as well as in thermo power and hydropower stations

| Egytech - code | Nominal cross sectional area | Max. Conductor resistance | | Current rating | | | | | | Approx. overall diameter | Approx. weight |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | DC at 20 °C | AC at 90 °C | Laid in ground | | | Laid in free air | | | | |
| | mm² | Ω/km | Ω/km | A | A | A | A | A | A | mm | kg/km |
| a - Copper conductors | | | | | | | | | | | |
| CX1-T101-U08 | 4 | 4.6100 | 5.8800 | 55 | 51 | 40 | 53 | 47 | 40 | 6.8 | 80 |
| CX1-T101-U09 | 6 | 3.0800 | 3.9300 | 68 | 65 | 53 | 65 | 59 | 53 | 7.3 | 102 |
| CX1-T101-U10 | 10 | 1.8300 | 2.3300 | 98 | 86 | 68 | 84 | 79 | 68 | 8.3 | 150 |
| CX1-T101-U11 | 16 | 1.1500 | 1.4700 | 116 | 111 | 87 | 116 | 110 | 95 | 9.3 | 210 |
| CX1-T101-U12 | 25 | 0.7270 | 0.9270 | 150 | 142 | 110 | 143 | 137 | 121 | 11.0 | 315 |
| CX1-T101-U13 | 35 | 0.5240 | 0.6690 | 179 | 172 | 137 | 179 | 173 | 152 | 12.1 | 410 |
| CX1-T101-U14 | 50 | 0.3870 | 0.4940 | 210 | 200 | 163 | 221 | 210 | 184 | 13.8 | 555 |
| CX1-T101-U15 | 70 | 0.2680 | 0.3430 | 263 | 247 | 200 | 278 | 268 | 236 | 15.7 | 760 |
| CX1-T101-U16 | 95 | 0.1930 | 0.2480 | 310 | 294 | 242 | 347 | 336 | 289 | 17.7 | 1015 |
| CX1-T101-U17 | 120 | 0.1530 | 0.1970 | 357 | 336 | 273 | 404 | 394 | 341 | 19.6 | 1280 |
| CX1-T101-U18 | 150 | 0.1240 | 0.1600 | 394 | 373 | 310 | 457 | 446 | 389 | 21.8 | 1570 |
| CX1-T101-U19 | 185 | 0.0991 | 0.1290 | 452 | 425 | 352 | 530 | 520 | 441 | 23.9 | 1920 |
| CX1-T101-U20 | 240 | 0.0754 | 0.0990 | 520 | 488 | 404 | 651 | 641 | 536 | 27.1 | 2530 |
| CX1-T101-U30 | 300 | 0.0601 | 0.0810 | 588 | 546 | 457 | 824 | 756 | 620 | 29.7 | 3105 |
| CX1-T101-U40 | 400 | 0.0470 | 0.0638 | 672 | 620 | 515 | 893 | 872 | 714 | 33.9 | 4135 |
| CX1-T101-U50 | 500 | 0.0366 | 0.0517 | 761 | 693 | 572 | 1008 | 987 | 814 | 37.4 | 5110 |
| CX1-T101-U60 | 630 | 0.0283 | 0.0425 | 872 | 777 | 651 | 1155 | 1134 | 956 | 41.9 | 6455 |
| CX1-T101-U70 | 800 | 0.0221 | 0.0292 | 957 | 861 | 735 | 1313 | 1292 | 1092 | 46.8 | 8260 |
| CX1-T101-U80 | 1000 | 0.0176 | 0.0234 | 1082 | 935 | 798 | 1449 | 1428 | 1208 | 51.5 | 10075 |

# FERROICE ANODES

***Introduction***

FERROICE anodes are designed for the effective protection of steel structures and pipelines from corrosion by the impressed current method. They are manufactured from high silicon cast iron alloy, one of the most important anode materials used by the corrosion engineer to protect steel in a variety of situations.

The highly quality of FERROICE anodes is achieved through manufacture by semi-automated plant using induction electric melting which ensures that there is no contamination of the metal and that the critical constituents are well mixed in the finished component. Anodes are manufactured either by chill casting or by conventional sand casting methods according to specification. The excellent corrosion resistance and other desirable properties resulting from these production methods have led to the acceptance of FERROICE anodes internationally for Cathodic protection systems.

***Specification***

**Composition**

The manufacture of FERROICE anodes is based on the following internationally recognized standards for corrosion resistant silicon iron castings: BS 1591 & ASTM A518. Typical analysis of FERROICE main elements are:

| | FERROICE | FERROICE C |
|---|---|---|
| Silicon | 14.50% | 14.50% |
| Manganese | 0.75% | 0.75% |
| Carbon | 0.85% | 0.95% |
| Chromium | - | 4.50% |
| Iron | Balance | Balance |

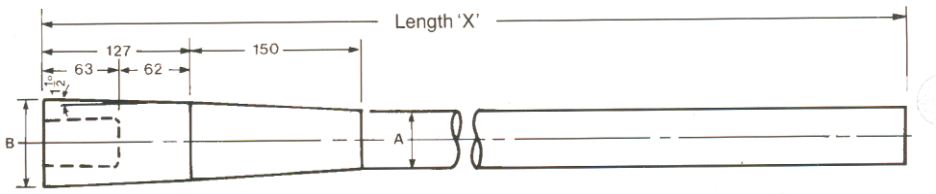
**Mechanical and Electrical Properties**

FERROICE materials are dense and homogenous ensuring that the anodes properties are uniform throughout their length. The finished product has inherently low ductility, requiring careful handling and the avoidance of mechanical or thermal shock.

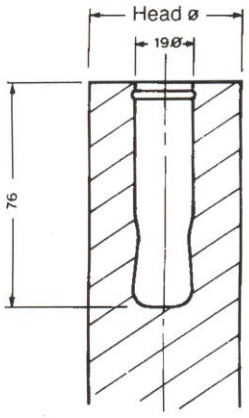
| | | |
|---|---|---|
| Tensile strength | 103 | N/mm² |
| Compressive strength | 689 | N/ mm² |
| Brinell hardness | 520 | HB |
| Density | 7.0 | g/cm² |
| Melting point | 1300 | ºC |
| Specific resistance | 72 | Microhms/cm³ at 20ºC |
| Coefficient of linear expansion | 1.86 × 10-5 | Per ºC (0-100ºC) |

**Corrosion Resistance**
The cast surface of FERROICE anodes is readily and continually oxidized with a thin film of silica, which adheres to the passive surface, retarding the rate of corrosion of the material. The exception to this situation occurs when chlorine and other gases in the halogen family can be generated in contact with the anode material such as in seawater applications. In such cases, FERROICE C is utilized, the chromium content counteracting the action of the chlorine on the anode surface and providing a more passive.

***Anode Types***
FERROICE anodes are cast in several shapes and sizes to meet a variety of requirements, the most common and used type of anode is the **Single-Headed Anode**.




| Anode Dia. 'A' mm | Head Dia. 'B' mm | Overall Length 'X' mm | Weight Kg |
|---|---|---|---|
| 75 | 100 | 900 | 32 |
| 75 | 100 | 1200 | 41 |
| 75 | 100 | 1500 | 50 |
| 75 | 100 | 1524 | 51 |
| 65 | 90 | 900 | 23 |
| 65 | 90 | 1200 | 30 |
| 65 | 90 | 1500 | 36.5 |
| 50 | 75 | 900 | 13 |
| 50 | 75 | 1200 | 18 |
| 50 | 75 | 1500 | 21 |
| 40 | 65 | 900 | 11 |
| 40 | 65 | 1200 | 13 |
| 40 | 65 | 1500 | 14 |
| 25 | 50 | 300 | 2 |
| 25 | 50 | 600 | 3 |




***Anode Cable Connections***
**Cable Connections**
Several choices for cable connection are available as standard with FERROICE anodes but the most common used type of cable connection is the **Lead Caulked Connection.**

**Cables**
FERROICE anodes can be supplied complete with cables connected Various sizes and types of cables can be supplied, standard sizes are with insulation to suit all environments. Examples of insulation materials available are:
Polyvinyl Chloride (PVC)
Cross Linked Polyethylene (XLPE)

**Anode Caps**
FERROICE anode caps may be factory fitted to cabled anodes. They are designed to counteract 'end effect' when single end anode connections are specified. The caps have a highly protective polymeric lining capable of withstanding corrosive environmental conditions including chlorine and sulphate attack. They are manufactured from cross-linked polyethylene and shrink fitted over the end of the anode.

**CANISTERED ANODES**
ICE Produces the same anodes as canistered anodes. Canister is manufactured usually to the 8"x84" dimension and is fabricated from galvanized spirally wound steel. We also manufacture any canister dimensions that would meet the client needs. Canister is filled with Metallurgical coke or Petroleum coke breeze in accordance with client choice.

***Applications***
Cathodic protection has been used successfully on many types of structure in contact with soils and liquids. The following are examples of structures protected with FERROICE anodes.

**Buried Structures**
- Pipelines (gas, oil, water, drainage)
- Underground cable conduits
- Underground tanks
- Piling structures and foundations

**Non- Buried Structures**
- Jetties
- Interior of tanks and vessels
- Fresh water and sea water tanks

**Water and Sewage Treatment Plants**
- Internal surfaces of water and chemical pipeline
- Water tanks
- Water condensers and heat exchangers
- Outfall pipelines


| | |
|---|---|
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# Flange Insulation Gaskets, Sleeves, Washers, Materials, Kits, by ICE

## Background

**Flange insulation products** manufactured by ICE are used throughout the world in all types of piping and pipeline systems to isolate and block the flow of electric currents, and to control the flow of cathodic protection and electrolytic currents.

**Flange insulation gaskets** are available in all sizes, pressure ratings and virtually all suitable materials. Related insulating sleeve and washer kits are also available in all sizes and materials, and may be purchased with or without a gasket.

**Complete flange insulation solutions** for specialized fluids, extreme temperatures, unusual environments and other individualized applications is available on special order. Included are flange insulation kits for large diameter flanges or for flanges with special bolt hole configurations.

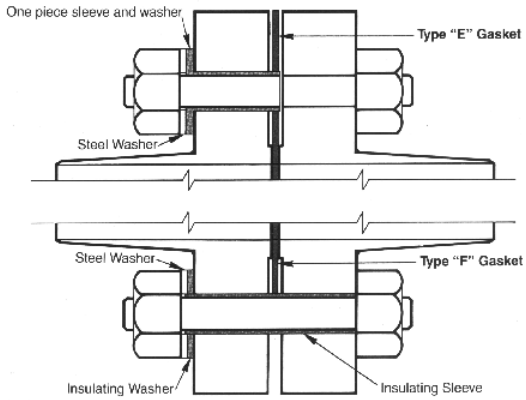
## ICE Flange Insulation Gaskets, Sleeves & Washers

- **Type "E" Gaskets** have the same outside diameter as the flanges, and are made with precision-located bolt holes. They are easy to center and will prevent foreign material from becoming lodged between the flange faces and "shorting out" the flange insulation. Type "E" gaskets are available in any of the materials described on this data sheet.

- **Type "F" Gaskets** are made to fit within the bolthole circle of the flange faces. The outside diameter of the gasket is slightly larger than the inside diameter of the bolthole circle. They are available in any of the materials described this data sheet.

- **Insulating Sleeves and Washers** are available in complete kits, with or without a gasket. Sleeves and washers are available as separate parts or as a one-piece molded unit.

- **Type "D" Gaskets** are made specifically to fit into the ring groove of RTJ flanges. They are available in reinforced phenolic and other materials. Note: an improved method of sealing RTJ flanges is with either a Type "E" or Type "F".




## Gasket Materials

**Neoprene Faced Phenolic** gaskets have long been used as a standard insulating gasket in the gas and oil industries because the soft neoprene rubber provides good sealing qualities. In these gaskets, neoprene sheets are factory applied to both sides of a laminated phenolic sheet to give good sealing qualities and high electrical resistance. The temperature limitation of these gaskets is approximately +175°F (+80°C).

**Plain Phenolic** gaskets are manufactured from laminated phenolic material to provide insulation between the flange faces. It is difficult to obtain an effective seal unless standard 1/16" (1.59 mm) service gaskets are used with them. They are less expensive than faced gaskets and can be used with temperatures to +125°C.

## Material Specifications

All materials are selected to provide quality products that will assure long-term effective sealing and electrical insulation of flanged joints. Several gaskets are made with combinations of materials to take advantage of the best characteristics of each. The following table lists some of the more important characteristics.

| Test Parameter | ASTM Test Method | Neoprene faced Phenolic* | Plain Phenolic |
|---|---|---|---|
| Dielectric Strength, Volts/mil | D229 | 500 | 500 |
| Compressive Strength, Lbs/sq.in. | D229 | 24,000 | 24,000 |
| Flexural Strength, Lbs/sq.in. | D229 | 22,500 | 22,500 |
| Impact Strength IZOD, Ft-Lb./in. of Notch | D732 | 1.2 | 1.2 |
| Rockwell Hard-ness Scale "M" | D229 | 85 | 85 |
| Shear Strength Lbs/sq.in. | D229 | 10,000 | 10,000 |
| Tensile Strength Lbs/sq.in. | D229 | 25,000 | 25,000 |
| Water Absorption % (1/8" thick) | D229 | 1.6 | 1.6 |
| Recommended Max Temp for Cont. Use | --- | 175°F**80°C | 225°F 230°C |
| Recommended Min Temp. For Cont. Use | --- | -65°F -55°C | -65°F -55°C |

*These values apply to the core material-neoprene facing for sealing purposes only.
**This value applies to neoprene material only, other values based on core material.

## Recommended Installation Procedure

1. Type "E" gaskets will prevent foreign material from making electrical contact between flanges. However, if Type "F" or "D" gaskets are used, the outside of the flange should be taped to keep out foreign material.
2. The inside diameter of the gasket is made slightly smaller than the inside diameter of the flange. Care should be taken to see that the gasket is properly centered over the bore to prevent build-up of foreign material between the flange faces when pigging.
3. Single washer insulating sets are recommended for buried flanges, and should be installed on the unprotected side of the flange to provide cathodic protection for the studs and nuts. Double washers may be used for above ground flanges for ease in testing.
4. In a safe area insert the bolt sleeves on the bolt. Use a heater or a flame torch to perform the shrinkage operation on top of the bolt.
5. Use alignment pins whenever possible to assure proper alignment of flanges and gasket. Pins should be a minimum of 3/32" (2.38 mm) larger than the bolt.
6. Follow project flange tightening procedure.

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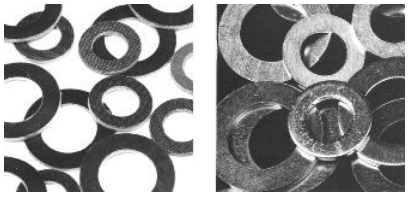
## Sleeves and Washers

### Insulating Washers



Standard insulating washers are made of high strength phenolic and provide tough, positive insulation at temperatures to +300°F (+150°C). They are available for bolt sizes from ½" (12.7 mm) through 3 ½" (88.9 mm) and are made to fit over the insulating sleeves.

### Specifications

| | |
|---|---|
| **Thickness** | 1/8" (3.2 mm) |
| **Dielectric Strength** | 500 V/mil |
| **Compressive Strength** | 26,000 ICE |
| **Water Absorption** | 1.0% Max |
| **Maximum Operating Temperature** | +300°F (+150°C) |
| **High temperature washers** | +450°F (+230°C) |

### Insulating Sleeves

Insulating sleeves are available in phenolic or heat shrinkable sleeves. They are through 31/2" (88.9 mm) and are designed to fit easily over the flange bolts, and may be used with standard size bolts and boltholes even with some misalignment. Insulating sleeves have a standard wall thickness of 1/32" (0.79 mm) and are used with separate insulating washers. They are available for standard American bolt sizes from ½" (12.7 mm) to 3 ½" (88.9 mm), as well as metric bolt sizes from 12 mm and larger.

### Specifications

| Material | Shrinkable Sleeve | Phenolic |
|---|---|---|
| Dielectric strength, Volts/mil | 4000 | 400 |
| Maximum operating temperature | 300°F (150°C) | 230°F (110°C) |

## Steel Washers

Steel washers are designed to fit over the insulating sleeve or retainer ring on the one-piece sleeves and washers. The outside diameter is sized to fit within the bolt facing on ANSI standard flanges. They are of 1/8" (3.2 mm) thick plated hot-rolled steel.

---

## Flange Insulation Kits

**Flange insulation kits** are available for all flange sizes, types, pressure ratings and materials. Each kit is individually and securely packed in a cardboard box, which is clearly labeled as to its contents for convenience in warehousing and field use.

Sleeves and washers are enclosed in a strong polyethylene bag to eliminate any possibility of loss. Very large diameter gaskets are packaged separately from the sleeves and washers for convenience in storing and handling.

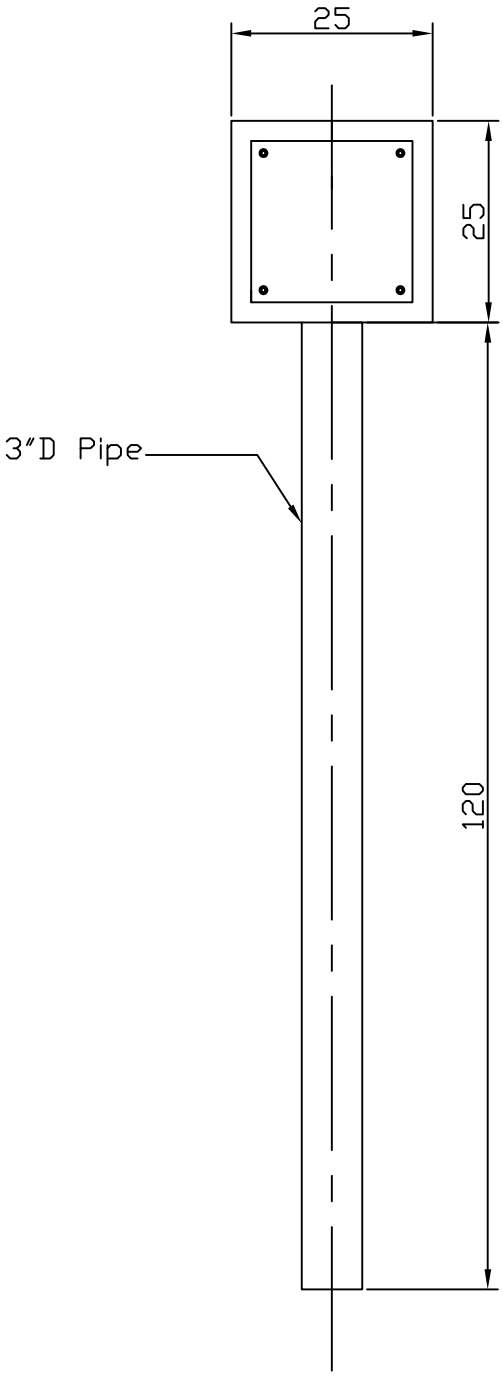
Unless otherwise specified flange insulation kits will consist of the following:

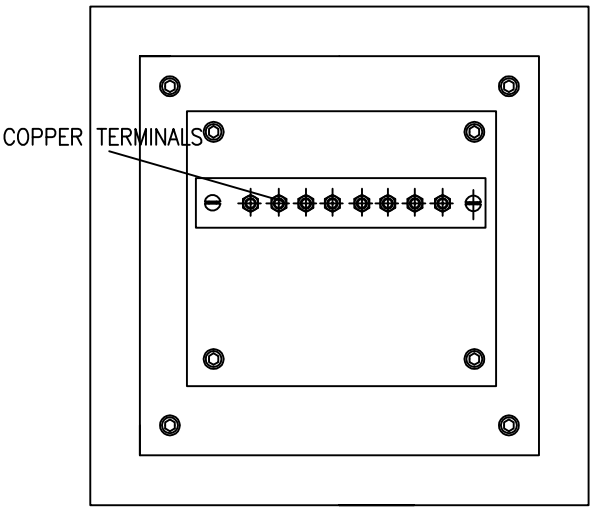
- One 1/8" thick galvanized steel washer for each bolt.
- One insulating washer for each bolt.
- One full length-insulating sleeve for each bolt.
- One Type "E" ICE gasket, phenolic retainer/nitrile sealing element.

## Warranty

All ICE products are warranted against failure caused by manufacturing defects for a period of one year. Any product found to be so defective and returned within one year from date of shipment would be replaced without charge.


| ICE | ice_co@link.net |
|---|---|
| **Phone:** +20123233343/+20224701072<br>**Fax:** +20224707286 | **MAIN OFFICE**<br>1 ABDELMONEM RIYAD BUILDINGS, EL-DAGHT EL-ALY ST, NASR CITY, CAIRO, EGYPT<br>**UAE OFFICE**<br>ABU DHABI COMMERCIAL CENTER WEST WING, 1ST FLOOR ABU-DHABI, UAE |




JUNCTION BOX CONNECTION

INTERNATIONAL CONSULTANT ENGINEERS

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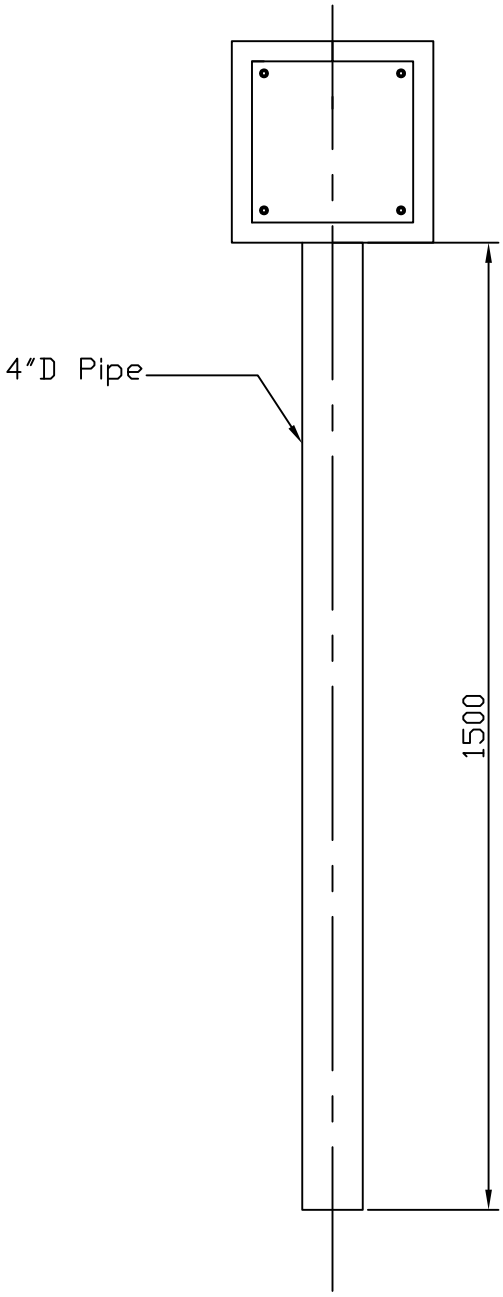
www.ice-corrosion.com

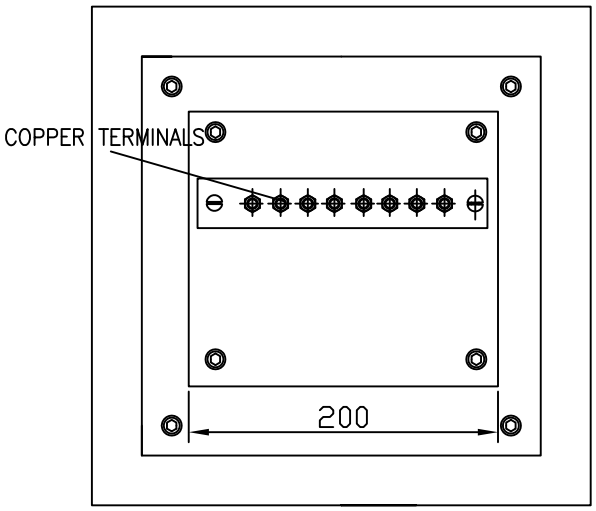
# JUNCTION BOX

PROPOSAL

SH. 1 OF 1

JUNCTION BOX IS OF HOT DIP GALVANISED CONSTRUCTION TO IP55




JUNCTION BOX CONNECTION

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# JUNCTION BOX

PROPOSAL

SH. 1 OF 1

INTERNATIONAL CONSULTANT ENGINEERS

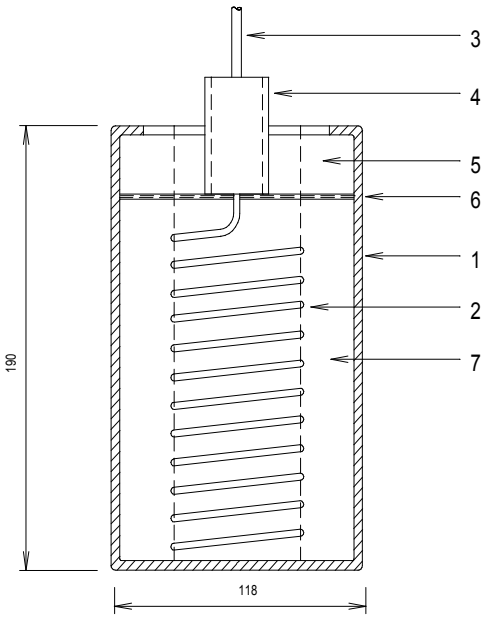
# Permanent Reference Cells

## Permanent Copper/Copper Sulphate Reference Electrodes - Minipot

**ICEI** have designed this compact Permanent Copper/Copper Sulphate Reference Electrode for permanent installation in soil along pipelines and beneath storage tank bases where access is limited.

Each reference electrode comprises a kiln fired terracotta body to give maximum porosity and contains a 2.5m spirally wound high purity copper rod embedded in pure copper sulphate granulated crystals

Standard cable tails are 10m of 6mm² XLPE/PVC red single core cable.




**Options:**

Alternative cable tails available to suit customer requirements.
For high resistivity applications electrodes can be supplied pre-packed in a gypsum / bentonite / sodium sulphate backfill.
Where specified electrodes can be supplied with the copper/ copper sulphate in a gel form.

**Specification**

| | |
|---|---|
| Diameter | 118mm |
| Height | 190mm |
| Weight | 3kg excluding cable |
| Packing | Pre-formed polystyrene for protection.<br>Overall packed dimensions: 160 x 180 x 250mm |



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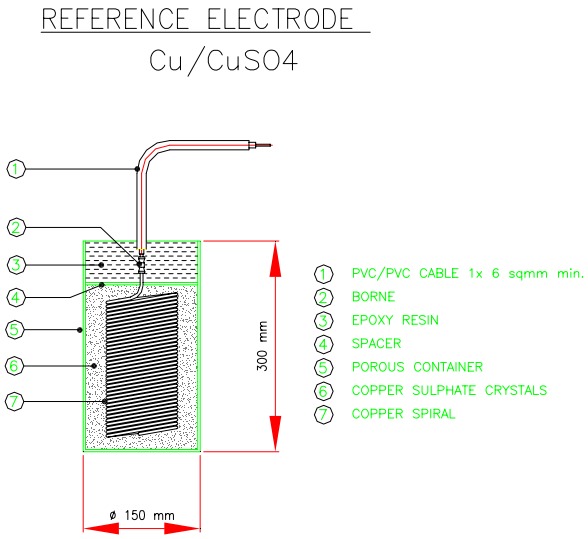
# Permanent Reference Cells

## Permanent Copper/Copper Sulphate Reference Electrodes

**ICE** has designed this Permanent Copper/Copper Sulphate Reference Electrode for permanent installation in soil environments along pipelines and beneath storage tank bases.

Each reference electrode comprises a kiln fired terracotta body to give maximum porosity and contains a 3.3m spirally wound high purity copper rod embedded in pure copper sulphate granulated crystals

Standard cable tails are 3m of 4mm² XLPE/PVC black single core cable.




**Options:**

Alternative cable tails available to suit customer requirements.
For high resistivity applications electrodes can be supplied pre-packed in a gypsum / bentonite / sodium sulphate backfill.
Where specified, electrodes can be supplied with the copper/ copper sulphate in a gel form.

**Specification**

| | |
|---|---|
| Diameter | 150mm |
| Height | 300mm |
| Weight | 10kg excluding cable |
| Packing | Pre-formed polystyrene for protection.<br>Overall packed dimensions: 230 x 230 x 380mm |



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*website: www.ice-corrosion.com*

# Portable Reference Cells

## Portable Copper/Copper Sulphate Reference Electrodes

**ICE** has designed a series of portable Copper/Copper Sulphate Reference Electrode for soil/water environments along pipelines and other buried structures.

A range of hand held Reference Electrodes (half cells) is available for use with portable high impedance voltmeters.

It comprises a coated acrylic body with window for solution level monitoring, hardwood plug and high purity copper rod.
Supplied with first fill of Copper Sulphate crystals requiring only the addition of pure water to activate.
Standard cable tails are 5m of 2.5mm² flexible single core insulated cable.
The electrode can also be supplied with enclosed terminal/cable connection.

**Options:**

Alternative cable tails available to suit customer requirements.



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# Royston Handy Cap

## *Corrosion Protection for Exothermic Grounding Connection*

### Introduction

The Royston Handy Cap is a prefabricated assembly specifically Designed for Cathodic Protection leads to pipes and tanks. When pressed by hand into position over the anode lead wire Weld it forms a thick, highly resistant electrical insulation seal over the weld, the end of the lead wire and the surrounding area of the pipe or tank.

### Usage

The Royston Handy Cap is easily applied and economical. They may be used on all anode lead wire and test wire weld areas. Royston Handy Cap is especially useful for welds on mill coated pipe where only a small part of the coating has been removed permit installation of the thermite grounding connection.

### Typical Properties

*Construction:* Molded plastic cap filled with corrosion resistant compound on a base of thick elastomeric tape.

*Dimension:*

| | |
|---|---|
| Overall | 4” × 4” |
| Plastic Sheet | 2-3/4 × 4” (serrated) |
| Sheet thickness | 10 mils |
| Plastic Dome | 1-5/8” diameter/ 0.8” height |
| Tape Thickness | 125 mils |

*Weight:* 2.1 ±0.4 oz

*Application Temperature*: -20°F to 120°F

*Service Temperature*: -40°F to 185°F

*Shelf Life*: At least one year

# Cable Splicing Kits

## CATHODIC PROTECTION JOINT CPJ RANGE

The CPJ range of compact branch cable splice kits is designed for unarmoured cables up to 1 kV rating. The main application is the jointing of single core anode cable to a d.c. feeder cable in groundbeds for the cathodic protection of buried structures.

| Max. Cable Size Single Core (mm²) | Max. Branch Single Core (mm²) | Basic Kit – No Connector | Kit with Split-Bolt Line-Tap | |
|---|---|---|---|---|
| | | Part Number | Part Number | Kit Includes |
| 120 | 95 | CPJ | CPJ+C | Joint + 1 x MC3/4 |

Cables are connected together using split bolt or line tap connectors:

### Service Branch Type - MC3 Range - Uncut Main

| Main Cable | Branch to max 6mm² | 10mm² | 16mm² | 35mm² | 70mm² | 95 - 120mm² |
|---|---|---|---|---|---|---|
| 1.5 - 6mm² | MC3 | MC3/0 | MC3/1 | MC3/2 | MC3/3 | MC3/4 |
| 10mm² | MC3/0 | MC3/0 | MC3/1 | MC3/2 | MC3/3 | MC3/4 |
| 16mm² | MC3/1 | MC3/1 | MC3/1 | MC3/2 | MC3/3 | MC3/4 |
| 25 - 35mm² | MC3/2 | MC3/2 | MC3/2 | MC3/2 | MC3/3 | MC3/4 |
| 50 - 70mm² | MC3/3 | MC3/3 | MC3/3 | MC3/3 | MC3/3 | MC3/4 |
| 95 - 120mm² | MC3/4 | MC3/4 | MC3/4 | MC3/4 | MC3/4 | MC3/4 |

### CTL two-part resin

### Features

- Two part Polyurethane resin in hermetically-sealed plastic-film pouches, protected in aluminium foil.
- Mixing is carried out in sealed conditions, transparent pack ensures visibility. Clean – no need for skin contact but safety gloves are provided.
- Clear mixing instructions on every pack.
- Controlled curing temperature designed to be compatible with PVC, XLPE, EPR, polythene and PILC cables.
- Full health and safety labelling.
- Batch number and use-by date on every pack.
- Meets requirements of BS 6910 and CENELEC HD623 S1.



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# Cable Splicing Kits

**Mixed properties**
Packs designed to contain factory pre-arranged quantities of resin and hardener

| | |
|---|---|
| **Specific gravity** | 1.40 Resin, 1.22 Hardener |
| **(Density) g/ml** | 1.36 Mixed system |
| **Colour** | Cream (Standard) |
| **Gel Time** | 20-30 minutes at 210C for 200g mass |
| **Peak Exotherm** | 54-750C depending on volume and ambient temperature, in compliance with BS 6910 |
| **Complete cure time** | at 230C – 24 hours |
| **Shelf Life** | at 800C – 1 hour |
| **Operating temp.** | 24 months when stored 5 – 150C, in compliance with BS 6910<br>-400C to + 1000C continuous, for cured product |
| **Thermal Conductivity** | >0.4w/mK |
| **Tensile Strength** | 45 MPa |
| **Electrical Strength** | 20kV/mm |

Each pack contains mixing instructions and carries health and safety warnings in accordance with BS 6910.



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# WELDERS and MOLDS

**CADWELD WELDERS AND MOLDS**

When making a CADWELD connection, an accurate control of the CADWELD process is accomplished by using a semi-permanent graphite mold. Control is exercised over the direction and speed of the molten CADWELD weld metal flow and final shape. The graphite used in a CADWELD mold is a high temperature type that lasts for an average of 50 to 100 CADWELD connections under normal usage.

Welder Price **CAT, CAP** and **CAN** are split and use the new Mini E-Z Change handle.*

Welder Price **CAA** is a solid block with a hold-down handle.*

* Welder Part No. includes mold frame. If mold only (less frame) is required, order—Welder Part No.—"M".

# WELD METAL

CADWELD weld metal is a mixture of copper oxide and aluminum, packaged by size in plastic tubes. Each tube contains the starting powder at the bottom of the plastic tube, with the weld metal on top. These containers are packaged, with metal disks, in polyethylene boxes. The welding metal cannot ignite spontaneously. They can be handled and stored without danger and can be shipped with no special packaging or marking.

Two types of CADWELD weld metal are used for cathodic protection connections:

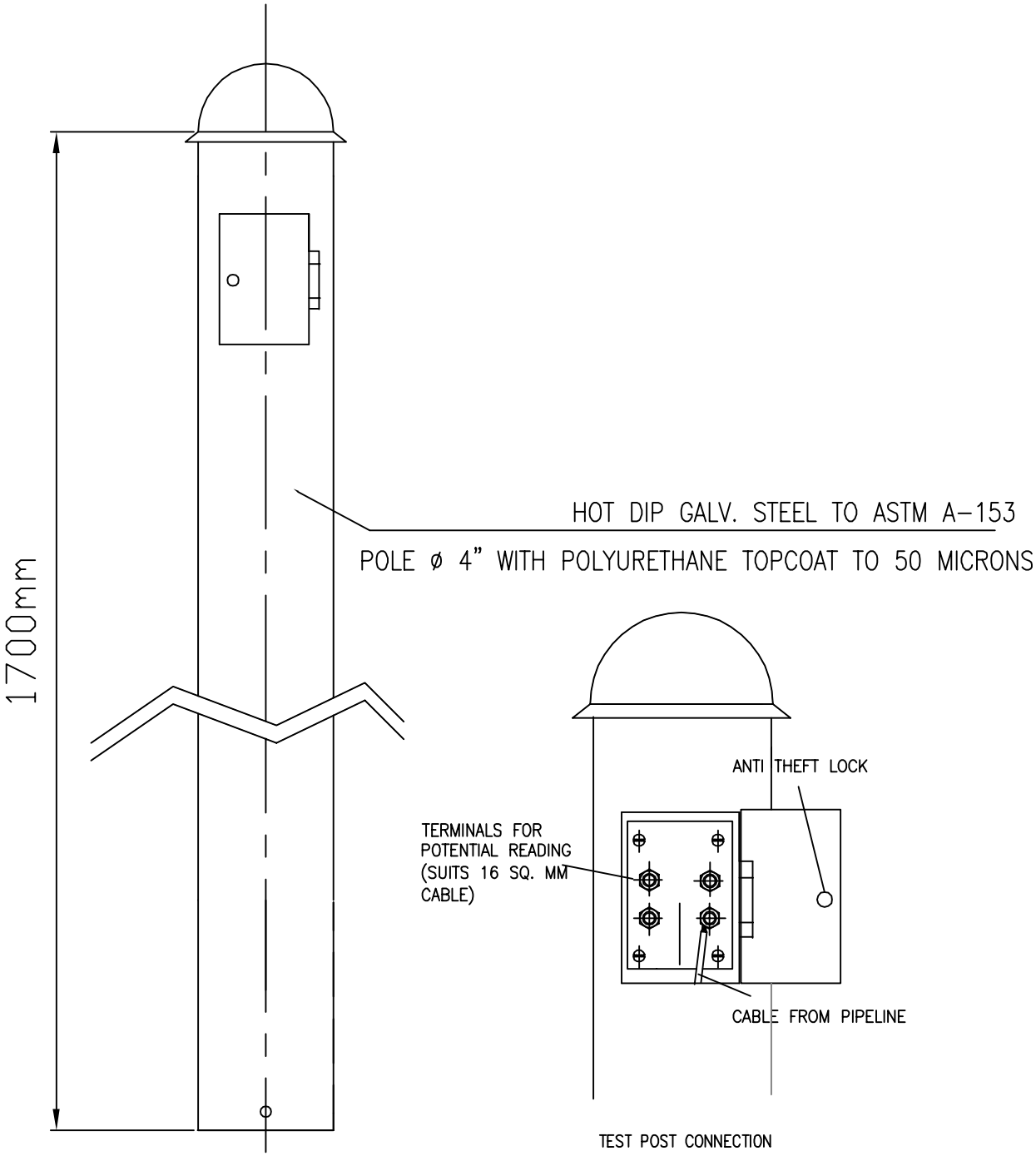
1. F-33 alloy is used for all connections of cable to cable and cable to steel or stainless steel pipe. The F-33 weld metal containers have green caps.
2. XF-19 alloy is used for all connections to cast iron. XF-19 weld metal containers have orange caps.

NOTE: For DUCTILE IRON, see page 8.


| Size* | Packed per Box** | Std. Pkg. |
|---|---|---|
| CA15 | 20 | 100 |
| CA25 | 20 | 100 |
| CA32 | 20 | 100 |
| CA45 | 20 | 100 |
| CA65 | 20 | 100 |

* XF-19 Alloy packed in same quantities. XF-19 Alloy not available in 15 size.
** Disks are included.

ERICO ELECTRICAL PRODUCTS

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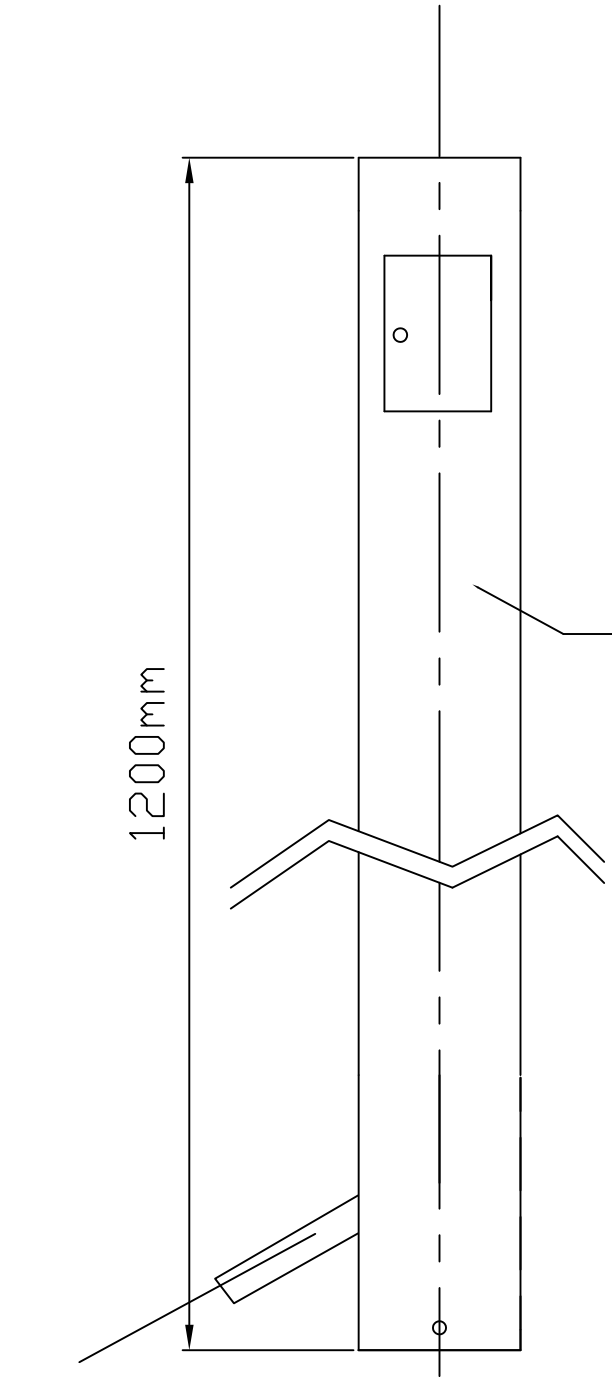
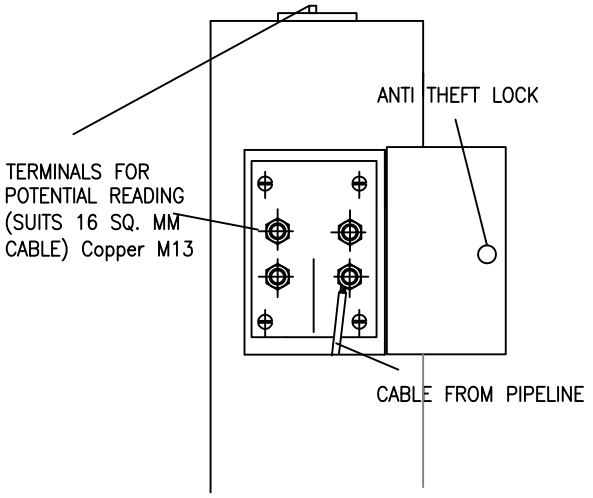
# 4" TEST POST

PROPOSAL | SH. 1 OF 1




TEST POST CONNECTION

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# 4" TEST POST

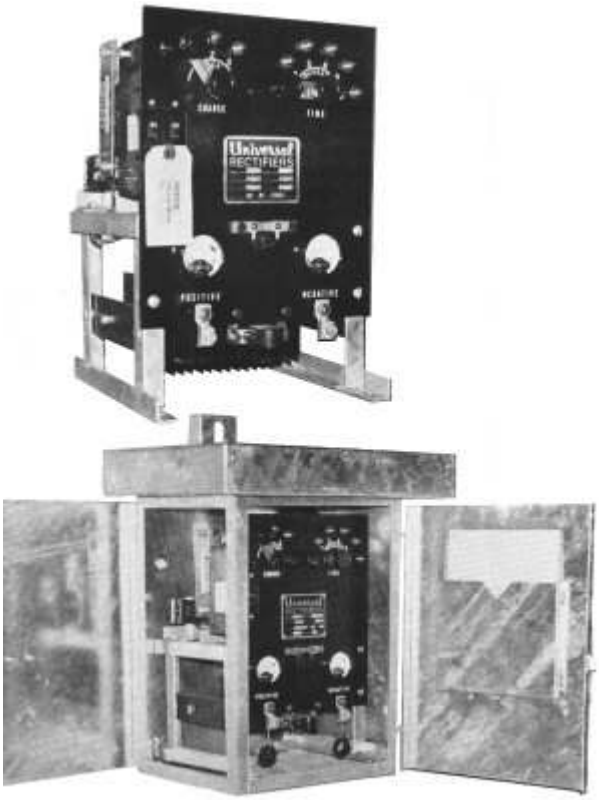
PROPOSAL

SH. 1 OF 1

# Cathodic Protection Rectifiers

INTERNATIONAL CONSULTANT ENGINEERS

## Air Cooled Oil Immersed

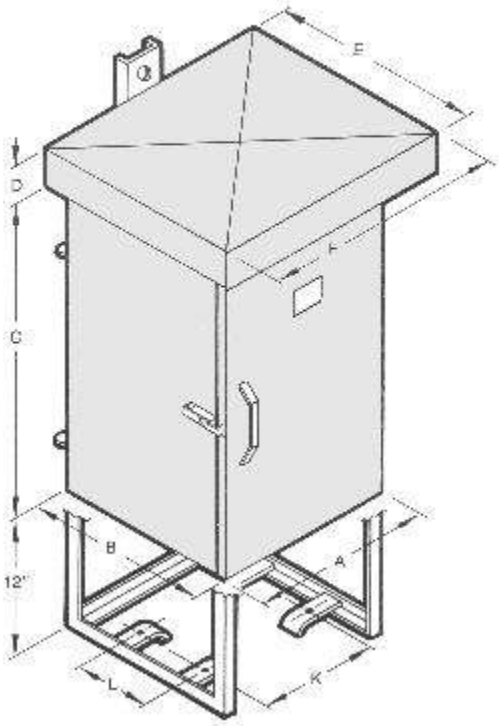


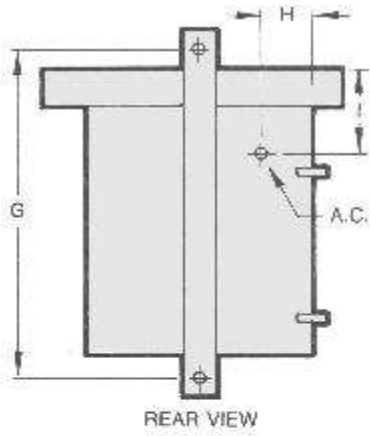

### The Air Cooled Standard Line

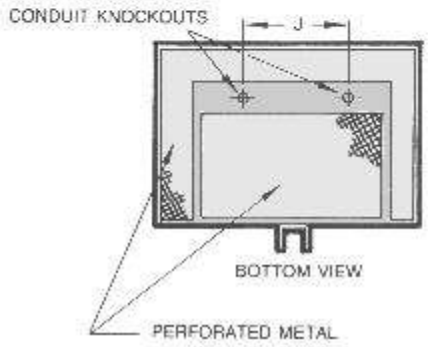
The Standard Line cathodic protection rectifiers are recognized as the leader in quality and workmanship. Many years of field-proven service have led to the design of these rectifiers. Conservative ratings, controlled manufacturing techniques, plus many extra features ensure long and trouble-free operation.

### Standard features:

- 11-gauge hot dipped galvanized case.
- Front & side opening doors.
- Heavy-duty draw-pull latch.
- Slide-out racks.
- Heavy-duty transformer with 15% over design for reserve capacity.
- 18-step voltage control taps.
- Engraved Bakelite panel.
- Quick-change heavy duty knobs for changing tap link bars.
- Minimum 5/16" diameter soldered tap changing studs.
- Accessible shunt, plainly marked.
- Heinemann magnetic circuit breaker.
- Hoyt Model 17-3 meters
- Tri-amp high density selenium.
- Syntron avalanche silicon diodes protected by surge suppressors and current limiting fuses.
- All electrical connections double nutted or soldered.
- Multi-strand high temperature extra flexible wire.
- Terminal block for AC input wires.
- Primary tap change panel for dual input voltages.
- Dead front panel supplied on all units over 60 Volts D.C.



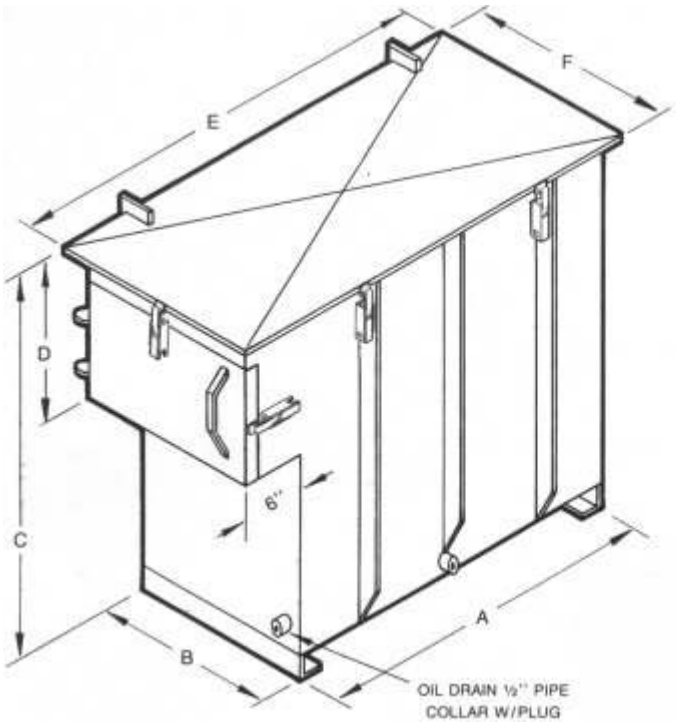



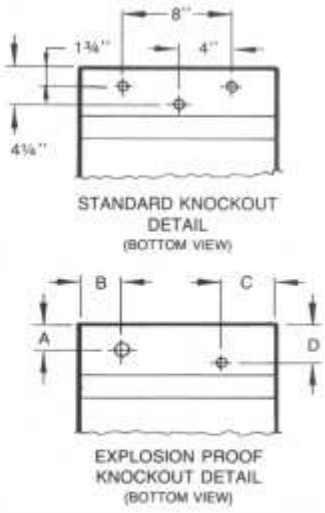




| Case Size | Dimensions (inches) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L |
| A | 14 | 12 | 20 | 3 | 15 | 20 | 16.25 | 3 | 7.5 | 6 | 9.25 | 5.5 |
| B | 17 | 15 | 24 | 3.5 | 18 | 23 | 32 | 3 | 9 | 8 | 12.5 | 8.5 |
| C | 22 | 21 | 24 | 3.5 | 24 | 28 | 32 | 3 | 9 | 10 | 17.5 | 14 |
| D | 28 | 22 | 23 | 3.5 | 25 | 34 | 32 | 3 | 9 | 12 | 23.5 | 15 |
| E | 34 | 28 | 27 | 5 | 33 | 44 | 35 | 3 | 9 | 10 | 29.5 | 20 |

## The Oil Cooled Line

The oil-cooled rectifier is a heavy-duty, rugged rectifier designed to operate under severe conditions. The cabinet is constructed of minimum 11-gauge material reinforced with external fins for added strength and cooling. All units are equipped with hinged lid, lid brace and heavy-duty draw pull latches as standard features.

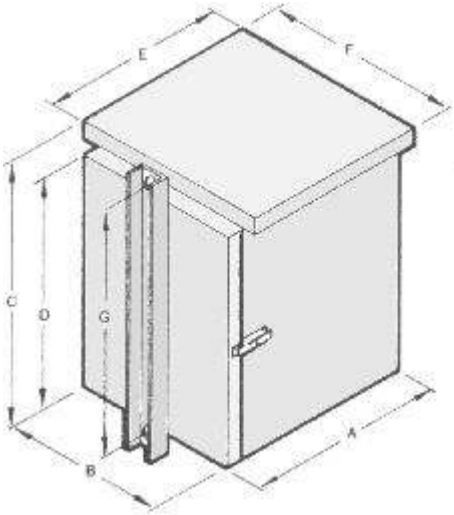


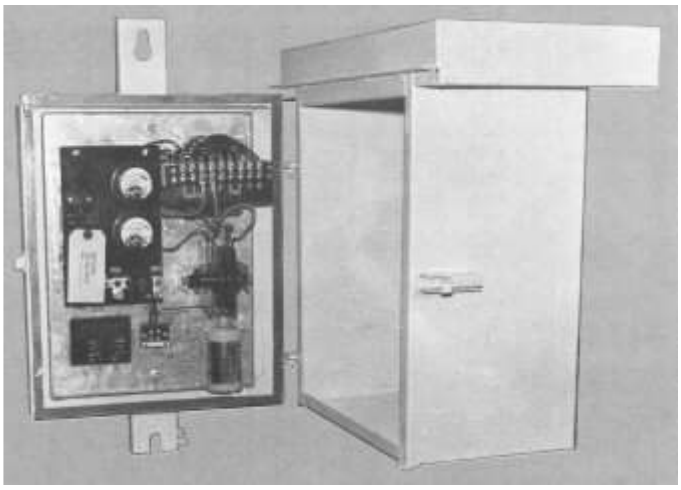




| Case Size | Oil Gal Capacity | Case Dimensions | | | | | | Knockout Detail | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | A | B | C | D |
| **MAO** | 20 | 18 | 15 | 24.5 | 24 | 26.75 | 17.75 | 3 | 1.75 | 4 | 4.25 |
| **AO** | 55 | 30 | 18.25 | 34 | 24 | 39.75 | 22 | 3 | 1.75 | 4 | 4.25 |
| **BO** | 110 | 36 | 21 | 46 | 24 | 46 | 25 | 3 | 3 | 4.5 | 4.25 |
| **CO** | 170 | 48 | 21 | 52 | 24 | 58.25 | 25 | 3 | 3 | 4.5 | 4.25 |
| **DO** | 213 | 60 | 21 | 52 | 24 | 70.25 | 25 | 3 | 3 | 4.5 | 4.25 |
| **EO** | 300 | 72 | 21 | 52 | 24 | 82.25 | 25 | 3 | 3 | 4.5 | 4.25 |
| **FO** | 465 | 84 | 30.5 | 52.5 | 24 | 93.5 | 34 | 3 | 3 | 4.5 | 4.25 |
| **GO** | 600 | 84 | 30.5 | 64.5 | 24 | 93.5 | 34 | 3 | 3 | 4.5 | 5.25 |

## The Air Cooled SW Series

The "SW" Series rectifier is an alternative to the standard line. The "SW" rectifier features a lift-off design case, which permits unlimited accessibility for routine maintenance and inspection. Simplified design reduces manufacturing costs, which provides an economical rectifier ideally suited to most applications. Rectifier components are mounted on an 11-gauge chassis panel for easy removal.



| Case Size | Dimensions (inches) | | | | | | |
|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G |
| UT | 8.75 | 12 | 19 | 17 | 11 | 16 | 20 |
| SW1 | 12 | 15 | 22 | 18.5 | 12 | 20 | 25 |
| SW2 | 14 | 17 | 25 | 22 | 14.5 | 22 | 28 |
| SW3 | 14 | 20 | 23 | 28 | 25.5 | 25 | 31 |

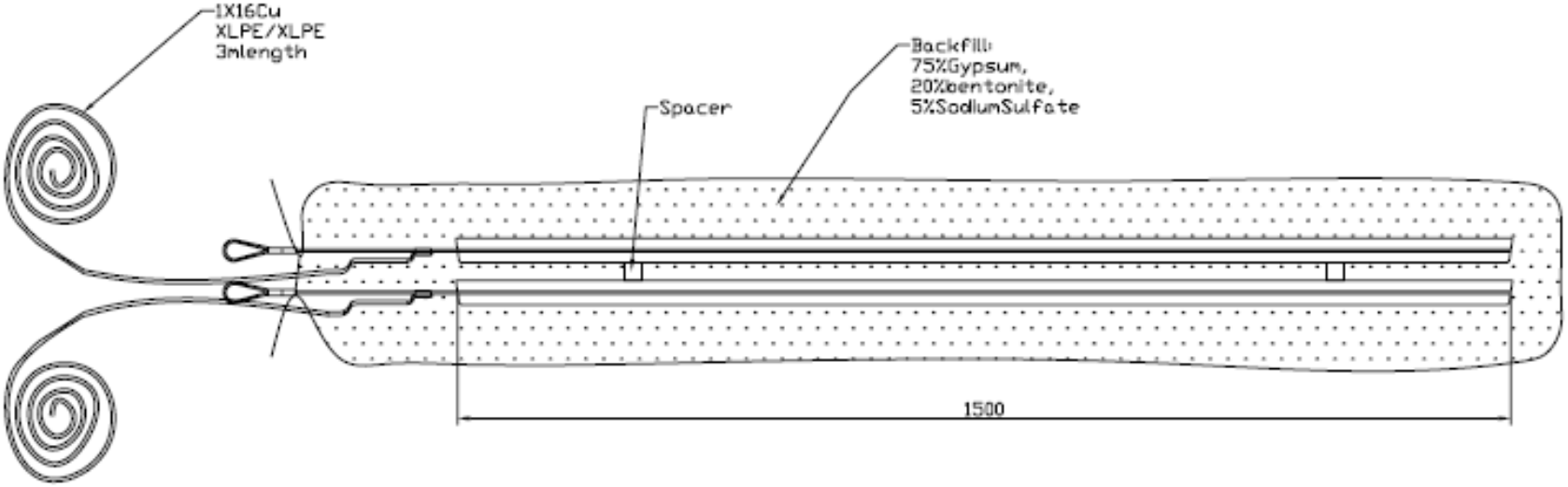
## Rectifier Ordering Guide

Configure an 8-position model number like **A S A E 20 20 A BCF**.
Positions from left to right are as follows:

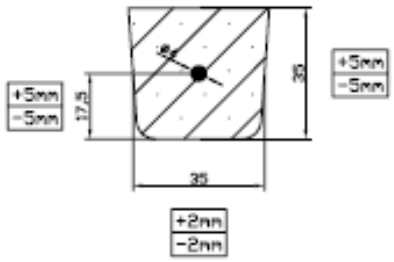
| Position #1: Model | |
|---|---|
| **A** = Standard line, Air cooled<br>**O** = Standard line, Oil immersed<br>**S** = Swing Out Series<br>**U** = Utility Series | **G** = Gas Station<br>**E** = ES<br>**P** = Proline |
| **Position #2: Type** | |
| **S** = Standard Rectifier (Manual taps)<br>**C** = Constant Current (Reactor style)<br>**D** = Constant Current (Solid state)<br>**E** = Constant Voltage (Solid state) | **P** = Constant potential (solid state)<br>**I** = Constant potential ir free (solid state)<br>**M** = Multiple modes (solid state)<br>**V** = Variac control |
| **Position #3: Cooling** | |
| **A** = Air Cooled<br>**O** = Oil Immersed | **X** = Oil immersed, explosion-proof |
| **Position #4: Stack Type** | |
| **E** = Selenium<br>**I** = Silicon | **C** = Selenium, Center Tap<br>**S** = Silicon, Center Tap |
| **Position #5: DC Volts** | |
| List Max. DC Volts Desired | |
| **Position #6: DC Amps** | |

| List Max. DC Amps Desired | |
|---|---|
| **Position #7: AC Input** | |
| **A** = 115/230, single-phase<br>**B** = 230/460, single-phase<br>**C** = 230/460 three-phase | **D** = 208, three-phase<br>**E** = 115/480, single-phase<br>**F** = Specify |
| **Position #8: Special Features** | |
| **A** = Dual input wired for low voltage<br>**B** = Dual input wired for high voltage<br>**C** = AC and DC arrestors<br>**D** = DC arrestor<br>**E** = AC arrestor<br>**F** = Filter choke<br>**G** = Communications filter<br>**H** = Meter switches<br>**I** = Base mounting<br>**J** = Pilot light | **K** = DC failure light<br>**M** = DC fuse<br>**R** = 115 VAC convenience outlet<br>**N** = Painted (Galv. std. on most models)<br>**O** = Aluminum cabinet<br>**T** = Anodized aluminum cabinet<br>**U** = Anodized aluminum with clear coat<br>**P** = Other than standard taps<br>**S** = Multiple circuits (qty.)<br>**Q** = Other, specify |


| **ICE** | ice_co@link.net<br>www.ice-corrosion.com |
|---|---|
| **Phone:** +20224701072<br>+2012-3233343<br>**Fax:** +2023707286 | **MAIN BRANCH**<br>1 ABDELMONEM RIYAD BUILDINGS,<br>EL-DAGHT EL-ALY ST, NASR CITY,<br>CAIRO, EGYPT<br><br>**UAE BRANCH**<br>ABUDHABI COMMERCIAL CENTER<br>WESTERN TOWER, 1ST FLOOR<br>ABU DHABI, EMIRATES |




Scale 1:5
Cross section




| Specification | US Mil Spec 18001 K |
|---|---|
| Cu | 0,005 max |
| Al | 0,10 - 0,50 |
| Fe | 0,005 max |
| Cd | 0,025 - 0,07 |
| Pb | 0,006 max |
| Others (Total) | 0,100 max |
| Zn | Remainder |

REFERENCE DRAWINGS

NOTES:
1.Net Weight@4.4Kg
2.Total Net Length:1500mm
3.Tolerance:
Net weight: ±3%
Total length: ±25mm
Straightness: ±6mm/m
4.Insert: Galvanized Ø 4.0mm
multistranded steel wire rope.
5.Alloy chemical Spec: USMIL 18001K
6.Centraliser to be attached on
site prior to installation.

| REV. | DATE | ISSUE | BY | CH. | AP. |
|---|---|---|---|---|---|
| 0 | 11/10/06 | APPROVAL | M.T. | M.H. | S.H. |

DUAL ZINC EARTHING
ELECTRODE

1 ABDEL-MONE'M RIYAD BGS
NASR CITY, ZONE 8, CAIRO,
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TEL: +202-121616824
E-MAIL: ice_co@link.net
www.ice-corrosion.com

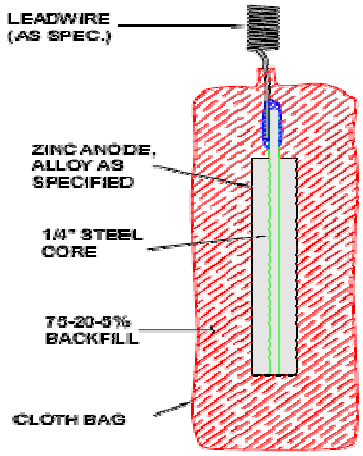
| SCALE | DRAWING NO. | REV. |
|---|---|---|
| NTS | D-45-4-1006 | 0 |

# Prepackaged Zinc Anodes

## Zinc Sacrificial Anodes for Cathodic Protection of Buried Structures

**Chemical analysis:**
Anodes shall conform to ASTM B 418, and shall be a pre-packaged zinc alloy ingot of the following chemical composition:

ASTM-B-418 TYPE II (Soil resistivity <1000ohm-cm)
Fe 0.0014% Max.
Pb 0.003% Max.
Cu 0.002% Max.
Al 0.005% Max.
Cd 0.003% Max.
Zn Remainder




**Anode Potential:** -1.10 Volts

**Ampere hours / Kg**: 780 (min.)

**Anode Weight:**

Standard weight is 13.2 Kg from single anode, however any weight or size can be prepared upon request.

**Anode Size:**

Any size is available upon request, however the standard size is 35x35mm x 1500mm length

**Anode Backfill:**

Each zinc anode shall be prepackaged in a permeable cloth bag with a backfill of the following composition:
1. Gypsum 75%
2. Powdered Bentonite 20%
3. Anhydrous Sodium Sulfate 5%

**Steel Core:**

Anode shall be cast full length with a galvanized 6mm diameter steel core which shall be exposed at one end for connection of the anode lead wire.



1 Abdel Mon'em Riyad Bldg,El-Daght El Aly St.,8Th District,Nasr City, CAIRO, EGYPT.
Tel: 202-24701072/0121616824
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*e-mail: ice_co@link.net*
*website: www.ice-corrosion.com*

INTERNATIONAL CONSULTANT ENGINEERS

# Prepackaged Zinc Anodes

**Anode Lead Wire:**

Anode lead wire shall be 4 $mm^2$ XLPE/PVC stranded copper wire with XLPE/PVC insulation. Wire shall be attached to the steel core with a copper crimp type mechanical connection and silver solder.

**Installation:**

Zinc soil anodes can be vertically or horizontally installed in native soils and should be wetted before burial.

The anode cable can either be connected directly to the structure or through a cathodic protection test station.

Typical cable-to-structure connection methods include welding or mechanical attachment.

**Other zinc uses:**

Zinc anodes are popularly used as grounding cells and in low resistance soils where driving potential isn't a major factor in a system design.

**Limitations:**

Zinc is not recommended in environments where the pH is over 8, or where the temperature of the electrolyte is over 120 degrees F(50° C).



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# ZINCOICE
# Zinc Marine Anodes by ICE

**Cathodic Protection for Marine and Soil Applications**

## ICE Corrosion - An Industry Pioneer

### Experience

**ICE Corrosion** has many years of experience in the application of galvanic anodes.

### Quality Control

Our quality assurance system assures you of the consistent composition and rigid adherence to specifications that you'd expect only from ICE. Qualified technicians regularly monitor the quality of all anodes that we handle.

## ZINCOICE - The Industry Standard

### Composition

ZINCOICE alloy has become the worldwide Standard for protecting steel from corrosion in seawater and saline mud. It was adopted by the U.S. government, with minor modifications, as MIL-A-18001H and is also covered by ASTM-B-418-73, Type 1.

### Galvanic Efficiency

ZINCOICE anodes operate at a nominal 95% galvanic efficiency in seawater. Galvanic efficiency relates directly to the anode's service life. Some commercial anodes develop dense corrosion products with high electrical resistance on their surface, which restrict current flow. In some cases, the anode's productive life ends before all of the available anode material is consumed.

ZINCOICE anodes, however, resist the formation of hard, dense corrosion products and continue producing protective current until they are completely consumed. This longer service life means fewer replacements and reduced overall operating costs.

## Proven Applications

ZINCOICE anodes are effective, economical corrosion fighters in applications where temperature exposures are limited up to about 120ºF. Typical uses in seawater or saline mud include:

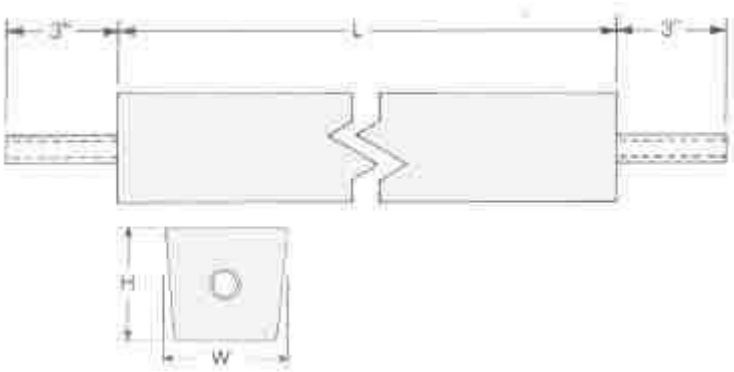
- Hulls of ships, barges, tugs and boats
- Ballast tanks of tankers, ore carriers and freighters
- Bulkheads
- Piers and pilings
- Submarine pipelines
- Heat exchangers
- Traveling screens
- Low resistivity soil

This data sheet contains mechanical specifications on a wide variety of ZINCOICE zinc anodes. All dimensions and weights are nominal. For further information, or to discuss your specific requirements, please contact ICE Corrosion Control Company.

# Pier and Piling Anodes: Z Series

Several different galvanized and carbon steel steel cores are available in this anode series. When ordering, specify which of the following cores is desired.

- **Type "E" -** 1/2" diameter eyebolt in anodes weighing up to 200 lbs; 3/4" over 200 lbs.
- **Type "P" -** 3/4" standard pipe in anodes weighing less than 250 lbs; 1" pipe 250 lbs and up.
- **Type "R" -** 1/2" diameter rod.

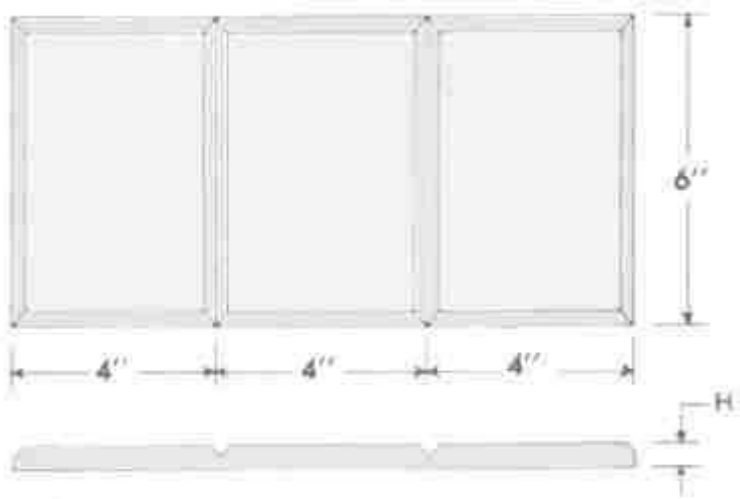


| Anode | Pounds | W | H | L | Core Type | Current Amp-Yrs |
|---|---|---|---|---|---|---|
| **Z-50** | 50 | 2" | 2" | 48" | E, R | 2 |
| **Z-100** | 100 | 3" | 3" | 44" | E, P, R | 4 |
| **Z-150** | 150 | 4" | 4" | 36" | E, P, R | 6 |
| **Z-250** | 250 | 9" | 9" | 12" | E, P, R | 10 |
| **Z-250A*** | 250 | 4" | 4" | 60" | E, P, R | 10 |
| **Z-350** | 375 | 7" | 7" | 30" | E, P, R | 15 |
| **Z-500** | 500 | 9" | 9" | 24" | E, P, R | 20 |

*Pipe core for this anode is 3/4" standard pipe.

# Hi-Amp Cast Plates

Solid hull anodes are available without cast-in mounting strips.

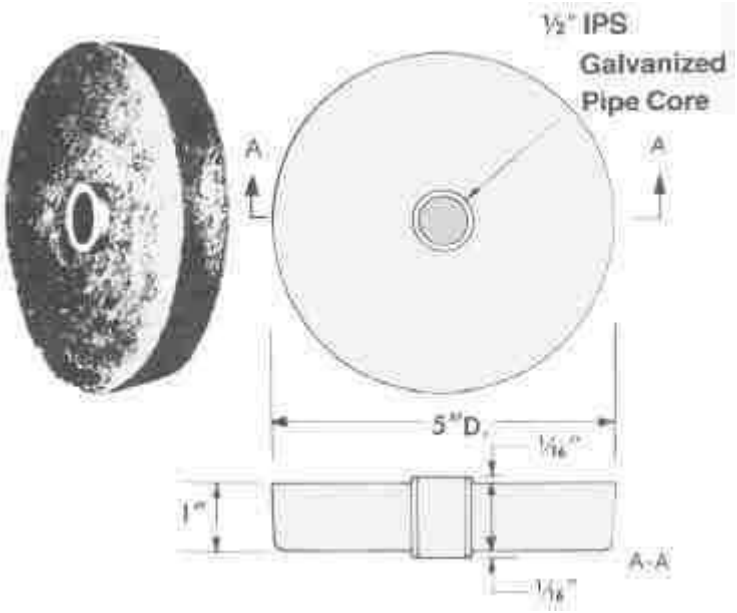



| Anode | Pounds | W | H | L | Current Amp-Yrs |
|---|---|---|---|---|---|
| **M-23** | 22 | 6" | 12" | 1 1/4" | 1 |
| **M-19** | 19 | 6" | 12" | 1" | 0.75 |
| **M-10** | 10 | 6" | 12" | 1/2" | 0.5 |

# Condenser Anodes: CZ Series

These circular anodes conform to the latest modification of MIL-A-18001 and are available with either of the following core configurations:

- **Type "A" -** one 1/2" IPS galvanized steel pipe.
- **Type "B" -** two 1/2" IPS galvanized steel pipes on 3 1/2" centers (not shown).




| Anode | Lbs | Dia. | Core Type |
|---|---|---|---|
| **CZ-2** | 1 | 2" | A |
| **CZ-3** | 2 | 3" | A |
| **CZ-4** | 3 | 4" | A |
| **CZ-5** | 5 | 5" | A |
| **CZ-6** | 7 | 6" | A |
| **CZ-9** | 16 | 9" | B |
| **CZ-11** | 24 | 11" | B |

# Custom Line

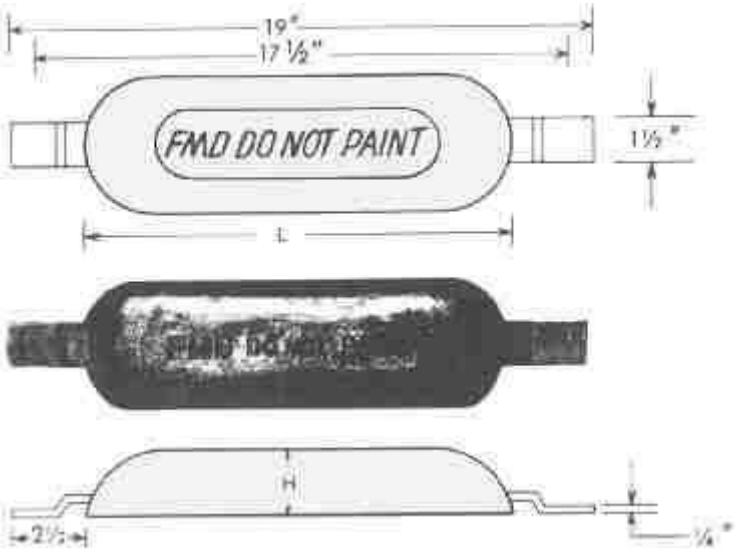
For special requirements, ZINCOICE anodes for ballast tanks, piers and pilings can be furnished with a wide variety of cores and to the range of dimensions shown in the accompanying table.

| Cross Section | Lengths | Nominal Weight (lbs/in) |
|---|---|---|
| 1.4" x 1.4" | 6" - 60" | 0.5 |
| 2" x 2" | 6" - 60" | 1.0 |
| 2 1/2" x 2 1/2" | 6" - 60" | 1.5 |
| 3" x 3" | 6" - 60" | 2.3 |
| 4" x 4" | 6" - 60" | 4.2 |
| 5" x 5" | 6" - 48" | 6.5 |
| 7" x 7" | 6" - 36" | 12.8 |
| 9" x 9" | 6" - 24" | 21.0 |
| 9" x 10" | 6" - 24" | 23.4 |
| 10" x 10" | 6" - 24" | 26.0 |

# Hull Anodes

## LL-26 Hull Anode

Contains single galvanized steel longitudinal strap. Can be bolted or welded to hull. Particularly suited for smaller ships, coastal vessels, harbor tugs, etc. ICE can add a mounting hole to each mounting strap.




| Anode | Lbs | W | H | L | Amp-yrs |
|---|---|---|---|---|---|
| **LL-26** | 26 | 4 1/2" | 2 1/4" | 14" | 1 |

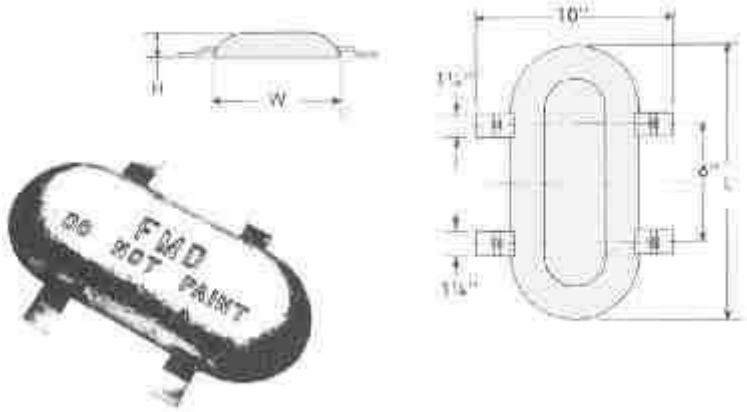
## LL-48 Hull Anode

Contains single longitudinal galvanized strap for welding to hull. Particularly suited for major ships, 10,000 DWT and upward. ICE can add a mounting hole to each mounting strap.


| Anode | Lbs | W | H | L | Amp-yrs |
|---|---|---|---|---|---|
| **LL-48** | 48 | 4 1/2" | 2 1/4" | 24" | 2 |

## Tapered M-24 Hull Anode

Contains two cast-in galvanized steel mounting straps. ICE can add a mounting hole to each mounting strap.



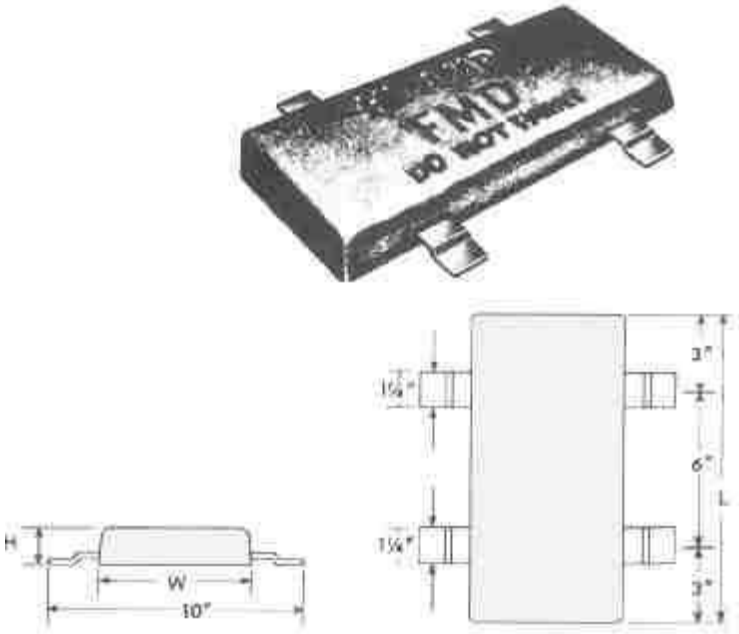

| Anode | Lbs | W | H | L | Amp-yrs |
|---|---|---|---|---|---|
| **Tapered M-24** | 22.5 | 6 1/2" | 1 1/4"" | 14" | 1 |

# Military Anodes

The military anodes shown here conform to the latest modification of mil spec MIL-A-18001.

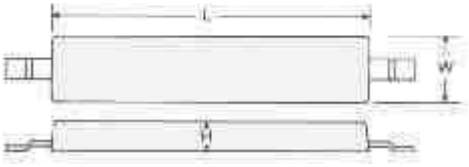
Anodes in this series contain two cast-in galvanized steel mounting straps (brass mounting straps are also available) or two cast-in cored holes on 6" centers

ICE can add a mounting hole to each mounting strap.




| Anode | Lbs | W | L | H | Amp-yrs |
|---|---|---|---|---|---|
| **M-24** | 22 | 6" | 12" | 1 1/4" | 1 |
| **M-23-C** | 22 | 6" | 12" | 1 1/4" | 1 |
| **M-47** | 42 | 6" | 12" | 2 1/2" | 2 |
| **M-47-C** | 39 | 6" | 12" | 2 1/2" | 2 |

The military anodes below contain a single cast-in galvanized steel mounting strap measuring 3/16" x 1 1/4" x 16". ICE can add a mounting hole to each mounting strap.





| Anode | Lbs | W | L | H | Amp-yrs |
|---|---|---|---|---|---|
| **M-12** | 11 | 3" | 12" | 1 1/4" | 0.5 |
| **M-21** | 21 | 3" | 12" | 2 1/2" | 1.0 |

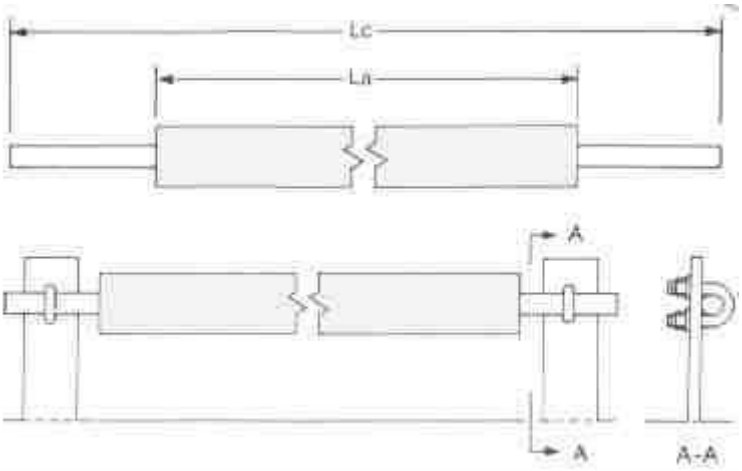
A teardrop-shaped military anode containing a single. Cast-in galvanized steel straps. ICE can add mounting holes, such as two 3/8" diameter holes on 11" centers.

| Anode | Lbs | W | L | H | Amp-yrs |
|---|---|---|---|---|---|
| **M-6** | 5 | 3" | 9" | 1 1/4" | 0.25 |

# Ballast Tank Anodes

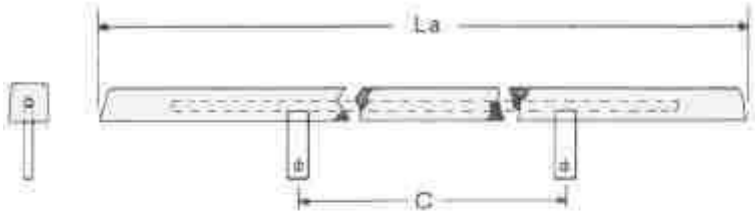
## TZ Series

Anodes contain 1/2" diameter straight electrogalvanized steel core rod for direct welding or assembly to two flat bards with "U" bolts as shown.

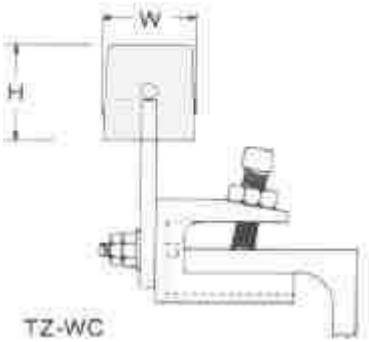


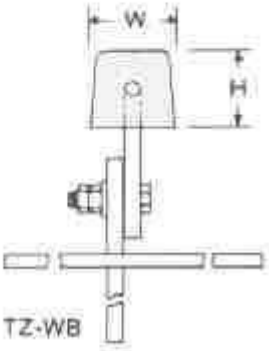
| Anode | Lbs | W | H | La | Lc | Amp-yrs |
|---|---|---|---|---|---|---|
| **TZ-27** | 27 | 1.4" | 1.4" | 48" | 60" | 1 |
| **TZ-50** | 50 | 2" | 2" | 48" | 60" | 1 |
| **TZ-60** | 60 | 2" | 2" | 60" | 72" | 2.25 |
| **TZ-70** | 70 | 2 1/2" | 2 1/2" | 48" | 60" | 2.5 |
| **TZ-100** | 100 | 2 1/2" | 2 1/2" | 60" | 72" | 4 |

## TZW Series



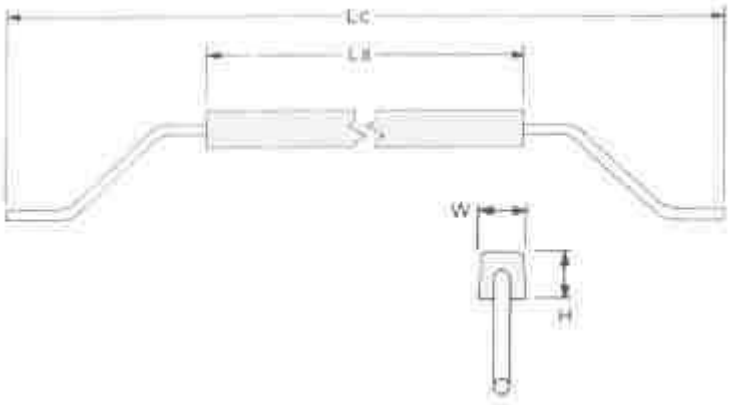

The core consists of two steel flat bars welded to a mild steel rod. Anodes can be clamped, welded or bolted to a ballast tank structure.




| Clamp Type | Bolt Type | Lbs | W | H | La | C | Amp-yrs |
|---|---|---|---|---|---|---|---|
| TZ-27-WC | TZ-27WB | 27 | 1.4" | 1.4" | 48" | 24" | 1 |
| TZ-50-WC | TZ-50WB | 50 | 2" | 2" | 48" | 24" | 2 |
| TZ-60-WC | TZ-60WB | 60 | 2" | 2" | 60" | 36" | 2.25 |
| TZ-70-WC | TZ-70WB | 70 | 2 1/2" | 2 1/2" | 48" | 24" | 2.5 |
| - | TZ-100WB | 70 | 2 1/2" | 2 1/2" | 60" | 36" | 4 |

## BTZ Series



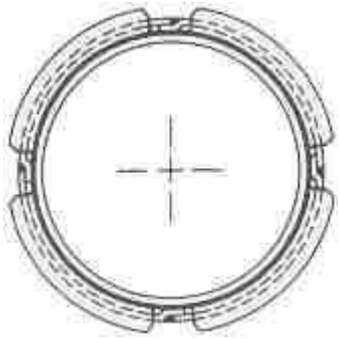

Contains 1/2" diameter bent steel core rod on sizes up to 50 lbs for direct welding to structure. Anodes over 50 lbs have 5/8" diameter core rod. Use TZW series anodes where excessive vibration is anticipated.

| Anode | Lbs | W | H | La | Lc | Amp-yrs |
|---|---|---|---|---|---|---|
| **BTZ-27** | 27 | 1.4" | 1.4" | 48" | 69" | 1 |
| **BTZ-50** | 50 | 2" | 2" | 48" | 69" | 2 |
| **BTZ-60** | 60 | 2" | 2" | 60" | 81" | 2.25 |
| **BTZ-70** | 70 | 2 1/2" | 2 1/2" | 48" | 69" | 2.5 |
| **BTZ-100** | 100 | 2 1/2" | 2 1/2" | 60" | 81" | 4 |

# Bracelet Anodes

**Typical Bracelet Configurations**

| Number of Segments | Nom. Pipe Diameter |
|---|---|
| 4 | 20" - 36" |
| 4 or 6 | 30" - 36" |
| 6 | 30" - 54" |
| 6 or 8 | 40" - 54" |
| 8 | 40" - 72" |



As a pioneer in this industry, we have a large selection of segment molds available to assure rapid delivery of bracelets for virtually all common pipe diameters.


| | |
|---|---|
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| **Phone:** +2012-3233343<br>**Fax:** +202-6707286 | **MAIN OFFICE**<br>Villa 67, El-Nargess 3, New Cairo, Egypt<br>**FACTORY**<br>119, New Cairo Industrial Zone, Egypt |

INTERNATIONAL CONSULTANT ENGINEERS

# METALLURGICAL COKE BREEZE

| ELEMENT | UNIT | ICE SPECS |
|---|---|---|
| FIXED CARBON: | mass % | 83-90 |
| SULPHUR: | mass % | 1-2 % max |
| ASH: | mass % | 8 % max |
| VOLATILES: | mass % | 0.8 % max |
| MOISTURE: | mass % | 0.15 % max |
| BULK DENSITY: | $kg/m^3$ | 1000 max |
| RESISTIVITY: | Ohm Cm | 35 |
| POROSITY | % | 50-70 |
| PARTICLE SIZE | | |

| | |
|---|---|
| >12 | %1.5 |
| 12-6 | %17 |
| 6-3 | %28 |
| 3-1 | >40% |
| 1-0.07 | 1.5% |

General Manager

PP

H. Ahmed

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**www.ice-corrosion.com**

# TECHNICAL DATA SHEET

1. Goods Description

   Hi-potential Magnesium Anode

2. Alloy Chemical Composition (%)

| Mg | Al | Zn | Mn Max. | Si Max. | Cu Max. | Ni Max | Fe Max. | Imp. Each Max. | Imp. Total Max. |
|---|---|---|---|---|---|---|---|---|---|
| Bal. | <0.01 | --- | 0.50 – 1.30 | 0.05 | 0.02 | 0.001 | 0.03 | 0.05 | 0.30 |

3. Electrochemical Properties

| Open-Circuit Potential (V respect to Cu/CuSO4) | Actual Capacity (A-Hr/Kg) | Current Efficiency (%) |
|---|---|---|
| -1.7 to 1.75 | 1230min. | 50min. |

- Closed circuit potential -1580 to -1620 mV (vs Cu/CuSO4)



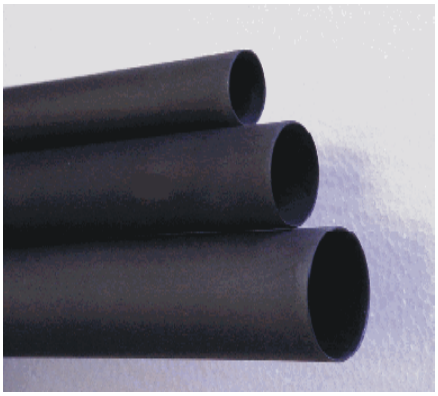
4. Backfill
   a) Gypsum 75%
   b) Bentonite 20%
   c) Sodium sulphate 5%

5. Core Material: Galvanized steel 3mm diameter

6. Cable tail: 3m, 1x6mm2 Cu/PVC, 600/1000V, red color

---END---

# Mixed Metal Anodes



Tubular anodes are manufactured using titanium which meets ASTM B338 grade 1 or 2 standards.

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 centre connected and tested for resistance (less than .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 deepwell groundbeds.

| Environment | Anode Size (mm) | Current Output (amps) | Life (Years) |
|---|---|---|---|
| Petroleum Coke | 19 x 1200 | 7 | 20 |
| Soil | 25 x 500 | 4 | 20 |
| Freshwater | 25 x 1000 | 8 | 20 |
| | 25 x 1200 | 9.6 | 20 |
| | 25 x 1500 | 12 | 20 |
| | 32 x 1200 | 12 | 20 |
| Seawater | 19 x 1200 | 45 | 20 |
| | 25 x 500 | 25 | 20 |
| | 25 x 1000 | 50 | 20 |
| | 25 x 1200 | 60 | 20 |
| | 25 x 1500 | 75 | 20 |
| | 32 x 1200 | 75 | 20 |

Anode life can be extended up to 30 years or more by increasing the thickness of the MMO coating.