

thermOweld®

PRODUCT CATALOGUE

GROUNDING | LIGHTNING PROTECTION | CATHODIC PROTECTION | ENERGY



TECHNICAL INFORMATION

THE THERMOWELD® PROCESS

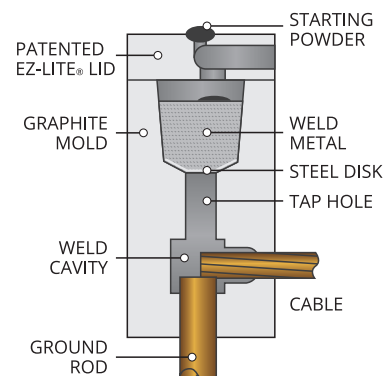
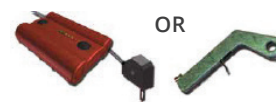
The thermOweld® permanent-connection process has been engineered to be an easy and efficient field welding system. No outside power, bulky gas tanks or other equipment associated with welding are required with the thermOweld® system. Any field installer or contractor can use our high-grade graphite molds designed and produced in thermOweld's world-class volume CNC manufacturing operations.

Incorporating our EZ Lite® mold lid (see page 10), ignition is done safely from the top of the mold with limited exhaust emanating from the side vent. This innovation from thermOweld®, combined with other unique features, make even tight field installations possible. For indoor connections where desired, thermOweld® offers low-emissions molds as well. Contractors worldwide demand thermOweld® for ease of use and the safest operation.

Using thermOweld's superior weld metal (see page 132), a high-temperature reaction between special formulations of copper oxide and aluminum occurs in the mold crucible. Upon reaching critical temperature, the resulting molten copper drops into the weld cavity, instantly creating a high-temperature molecular bond with the conductor. This weld connection cools rapidly and the mold can be removed for the next connection with thermOweld's special off-set handle clamps (page 136). The thermOweld® process creates a superior connection without the excessive applied heat of brazing, arc welding or soldering. This is important especially for welding insulated cables or to thin-wall pipe.



thermOweld® - EZ Lite® Mold



It's easy to see why thermOweld® is The Contractor's Choice worldwide!

The thermOweld® process creates a permanent, homogenous and molecular bond that cannot loosen or corrode. Compared to compression connectors, split bolts, crimp connectors, brazing and other connections, the thermOweld® connection is clearly superior. In fact, a thermOweld® connection will also withstand more current than the conductor itself.

The thermOweld® process has been used to weld materials other than copper for electrical purposes, shown here.

Stainless Steel	Galvanized Steel*	Columbium
Copperweld®	Silicon Bronze	Plain Steel
Nichrome V	Copper-Clad Steel	Everdur®
Kama	Brass	Chromax
Steel Rail	Bronze	Cast Iron
Cor-Ten®	Niobium	Monel

*When welding to galvanized steel it is recommended to resurface exposed bare steel.

It's easy to see why thermOweld® is The Contractor's Choice worldwide!

STANDARDS	COUNTRY	DESCRIPTION
IEEE: 80-1986	USA, Australia, Asia, Europe, Latin America	Guide for Safety in AC Substation Grounding
IEEE: 837	USA, Australia, Asia, Latin America	Standard for Qualifying Permanent Connections used in Substation Grounding
IEEE: 81-1983	USA, Australia, Asia	Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potential of a Ground System
IEEE: 998-1996	USA, Australia, Asia	Guide for Direct Lightning Strike Shielding of Substations
UL-96	USA	Lightning Protection Components
UL 467	USA, Australia, Asia	Grounding and Bonding Equipment
NFPA 780	USA, Australia, Asia	Lightning Protection
NEC-250	USA, Canada	Grounding and Bonding National Electrical Code
TIA-607-B -2	Global	Telecom Grounding Bars and Products
IEC/TS 60479-1	Europe, Brazil	Effects of Current passing through human beings & livestock
EN62305-3: 2011	Europe	Protection against Lightning, Physical damage to structure and life hazard
ANCE NMX-J-549-2005	Latin America	Lightning Protection

TECHNICAL INFORMATION

THERMOWELD® EXOTHERMIC MOLDS

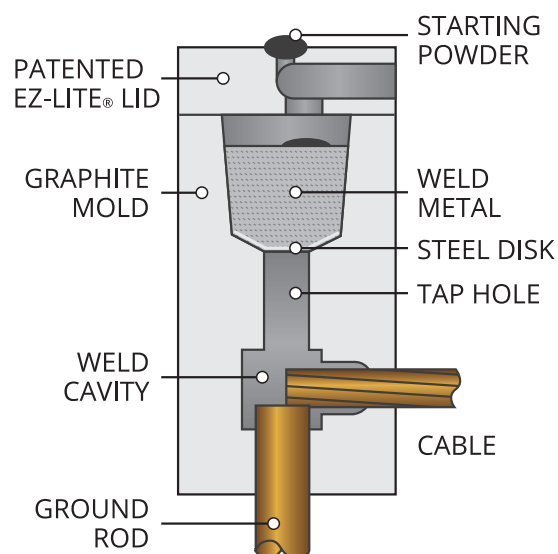
thermOweld® is a process of welding copper to copper, copper to steel and copper to ductile iron. The exothermic reaction takes place in a semi-permanent graphite mold with a special formula of copper oxide and aluminium.

thermOweld® connections are solid copper molecular bonds that do not loosen or corrode throughout the life of the host structure. These bonds are the superior connection method for the most reliable and highest longevity of grounding, lightning protection, cathodic protection and other critical infrastructure systems.

Standard Molds – thermOweld® standard molds are given in the tables on the pages in this catalogue and are used with new clean AWG and Metric wire and cable. A standard mold is not for use in “heavy-duty” applications; see Heavy Duty Molds.

Heavy Duty Molds – thermOweld® heavy-duty molds are given in the tables on the pages in this catalogue (with an H suffix) and are employed for use with reused or reclaimed and heavily oxidized AWG and Metric wire and cable. In these cases a “heavy-duty” mold is recommended as it accepts this larger wire diameter and utilizes a larger weld metal cartridge size. The resulting connection is larger than a standard mold connection. Note that the grounding engineer may determine that the calculated theoretical ground fault current level may be abnormally high and therefore would prefer the larger mass of a heavy-duty mold connection.

thermOweld® has designed and produced over 15,000 unique molds to meet application needs worldwide. We have solved many applications with unique and customized molds, utilizing our CAD engineering and specialized CNC machining capabilities. If you don't see what you need in this comprehensive catalogue, contact us. We are ready to support you quickly!



SINGLE SHOTS

thermOweld® single shot molds are an economical way to make cable connections onto the top of a ground rod or rebar. The single shot is a disposable single use ceramic mold that comes complete with everything required except the flint ignitor. This innovative process eliminates the need for a mold, handle clamps, and frames.



SUPERIOR WELD METAL

thermOweld® weld metal is packaged in moisture resistant plastic cartridges that have tight fitting caps. These cartridges and the necessary steel discs are then packaged in boxes that are shrink wrapped. Shrink wrapping ensures the weld metal will arrive in good condition, always dry, and ready for a positive ignition every time.

All weld metal is eligible for thermOweld's SDS (Same Day Service) shipment. Our SDS program is just like having it on your shelf.



TECHNICAL INFORMATION

THE MOLECULAR BOND

The thermOweld® connection is a molecular weld. The weld has the same melting point as copper. This factor, along with the increased cross sectional area of the connection and insure the following:

- thermOweld® connections are not effected by a high current surge. Tests have shown that the electrical conductor will melt before the thermOweld® connection, when subjected to high short circuit current. Consult IEEE Standard 837.
- thermOweld® connections will not loosen or corrode at the point of weld. There are no contact surfaces or mechanical pressures involved.
- thermOweld® connections have a current-carrying capacity equal to or greater than that of the conductors.

THE EZ LITE® MOLD

- Makes all thermOweld® molds EZ to ignite.
- Lights from the top at any angle.
- Reduces emissions by 50% or more.
- Reduces splatter.
- Keeps the handle clamps clean and prolongs life.
- Added Safety - The EZ Lite® Lid points the exhaust away from the user.



INSTALLATION IS EASY!

MAKING A THERMOWELD® CONNECTION

1



Position cleaned conductors in mold.

2



Place metal disc in bottom of mold crucible.

3



Pour powder into crucible.

4



Place a small amount of starting powder in the ignition pocket.

5



Ignite the starting powder with the Flint Ignitor.

6



Remove weld and clean mold before making next connection.



PIPE & PLATE INSTALLATIONS ARE EASY!

**MAKING A THERMOWELD® CABLE TO
STEEL OR CAST IRON CONNECTION**

1



Clean pipe before making weld.

2



Position conductor and mold onto pipe.

3



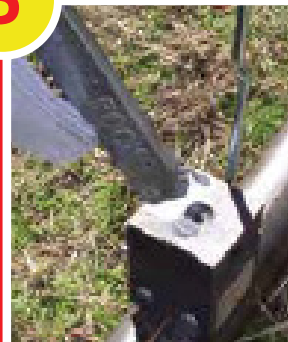
Place metal disc in bottom of mold.

4



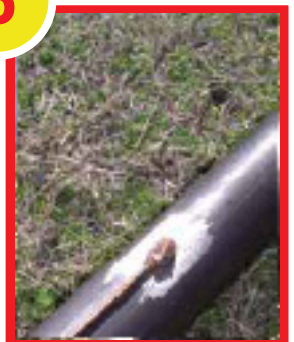
Pour weld metal into mold.

5



Close lid and place starting powder on top. Ignite starting powder with Flint Ignitor.

6



Remove and clean mold before making next connection.

TECHNICAL INFORMATION

GROUND RODS

SIZE	MATERIAL	TYPE	BODY DIAMETER	THREAD SIZE
1/2"	Copperclad	Sectional	.505"	9/16"
	Copperclad	Plain	.475"	
	Steel*	Plain	.500"	
5/8"	Copperclad	Sectional	.563"	5/8"
	Copperclad	Plain	.563"	
	Steel*	Plain	.625"	
3/4"	Copperclad	Sectional	.682"	3/4"
	Copperclad	Plain	.682"	
	Steel*	Plain	.750"	
1"	Copperclad	Sectional	.914"	1"
	Copperclad	Plain	.914"	
	Steel*	Plain	1.00"	

* Plain Steel, Stainless Steel, Stainless Clad Rods or Galvanized Steel

STEEL PIPE SIZES

Standard Weight
(Schedule 40)

ASTM A53-92-B
ANSI/ASME
B36.10M-1985

NORMAL SIZE	O.D.	WALL THICKNESS
1"	1.315"	.133"
1 1/4"	1.660"	.140"
1 1/2"	1.900"	.145"
2"	2.375"	.154"
2 1/2"	2.875"	.203"
3"	3.500"	.216"
3 1/2"	4.000"	.226"
4"	4.500"	.237"
5"	5.563"	.258"
6"	6.625"	.280"
8"	8.625"	.322"
10"	10.750"	.365"

RECTANGULAR COPPER BUSBAR

THICKNESS INCHES	WIDTH INCHES	CIRCULAR MIL SIZE	WEIGHT LBS. PER FOOT
1/8"	1"	159,200	.484
	1 1/2"	238,700	.726
	2"	318,300	.969
3/16"	1"	238,700	.727
	2"	477,500	1.45
1/4"	1"	318,300	.969
	1 1/2"	477,500	1.45
	2"	636,600	1.94
	3"	954,900	2.91
	4"	1,273,000	3.88
3/8"	1"	477,500	1.45
	1 1/2"	716,200	2.18
	2"	954,900	2.91
	3"	1,432,000	4.36
	4"	1,910,000	5.81
1/2"	2"	1,273,000	3.88
	3"	1,910,000	5.81
	4"	2,546,000	7.75

USEFUL CONVERSIONS

AREA

Sq.Inches x 1273 = kcmil
Sq.Millimeters x 1.974 = kcmil
kcmil x .5067 = Square Millimeters

DENSITY

Copper:
.323 lb/in³

Steel:
.283 lb/in³

TECHNICAL INFORMATION

CONCRETE REINFORCING BARS

US Imperial Sizes (Nominal Dimensions)

REBAR SIZES	DIAMETER	AREA - SQ.
3	.375"	.11"
4	.500"	.20"
5	.625"	.31"
6	.750"	.44"
7	.875"	.60"
8	1.000"	.79"
9	1.128"	1.00"
10	1.270"	1.27"
11	1.410"	1.56"
14	1.693"	2.25"
18	2.257"	4.00"

COPPER-CLAD STEEL CONDUCTORS

CABLE STRANDING	CONDUCTOR DIAMETER	SIZE IN CIRCULAR MILS
3/#10 CW	.220"	31,150
3/#9 CW	.247"	38,280
3/#8 CW	.277"	49,530
7/#10 CW	.306"	72,680
3/#7 CW	.311"	78,750
7/#9 CW	.343"	91,650
3/#6 CW	.349"	99,310
7/#8 CW	.385"	115,600
3/#5 CW	.392"	99,310
7/#7 CW	.433"	145,700
7/#6 CW	.486"	183,800
7/#5 CW	.546"	231,700
19/#9 CW	.572"	248,800
7/#4 CW	.613"	292,200
19/#8 CW	.642"	313,700
19/#7 CW	.721"	395,500
37/#9 CW	.801"	484,400
19/#6 CW	.810"	498,800
37/#8 CW	.899"	610,900
19/#5 CW	.910"	628,900
37/#7 CW	1.010"	770,300



TECHNICAL INFORMATION

METRIC TO IMPERIAL CABLE CONVERSION CHART

CROSS SECTIONAL AREA (MM ²)	CONDUCTOR DIAMETER		SIZE A.W.G.	CONDUCTOR DIAMETER	
	INCHES	MM		INCHES	MM
2.0 Concentric	.071	1.8	#14 Concentric	.0726	1.84
3.5 Concentric	.095	2.4	#12 Concentric	.0915	2.3
4 Solid	.0984	2.5	#10 Solid	.102	2.6
6 Solid	.122	3.1	#8 Solid	.128	3.25
5.5 Concentric	.118	3.0	#10 Concentric	.116	2.95
8.0 Concentric	.142	3.6	#8 Concentric	.146	3.7
10 Solid	.150	3.8	#6 Solid	.162	4.1
10 Concentric	.162	4.2	#7 Concentric	.164	4.2
14 Concentric	.189	4.8	#6 Concentric	.184	4.7
16 Solid	.177	4.5	#4 Solid	.204	5.2
16 Concentric	.204	5.2	#5 Concentric	.205	5.2
22 Concentric	.236	6.0	#4 Concentric	.232	5.9
25 Solid	.220	5.6	#3 Solid	.229	5.8
25 Concentric	.260	6.4	#3 Concentric	.260	6.6
30 Concentric	.276	6.9	#2 Concentric	.292	7.4
35 Solid	.264	6.7	#2 Solid	.258	6.6
35 Concentric	.305	7.7	#2 Concentric	.292	7.4
38 Concentric	.315	7.8	#2 Concentric	.292	7.4
40 Concentric	.331	8.4	#1 Concentric	.332	8.4
50 Solid	.315	8.0	1/0 Solid	.325	8.3
50 Concentric	.354	9.0	1/0 Concentric	.373	9.5
55 Concentric	.378	9.6	1/0 Concentric	.373	9.5
60 Concentric	.394	10.0	2/0 Concentric	.419	10.6
70 Solid	.394	10.0	3/0 Solid	.410	10.4
70 Concentric	.430	10.9	2/0 Concentric	.419	10.6
80 Concentric	.453	11.5	3/0 Concentric	.470	12.0
95 Concentric	.505	12.6	4/0 Concentric	.528	13.4
100 Concentric	.512	13.0	4/0 Concentric	.528	13.4
120 Concentric	.567	14.2	250 MCM	.575	14.6
125 Concentric	.571	14.5	250 MCM	.575	14.6
150 Concentric	.634	16.1	300 MCM	.630	16.0
185 Concentric	.700	17.7	350 MCM	.681	17.3
200 Concentric	.717	18.2	400 MCM	.728	18.5
240 Concentric	.801	20.3	500 MCM	.813	20.7
250 Concentric	.815	20.7	500 MCM	.813	20.7
300 Concentric	.891	22.5	600 MCM	.893	22.7
325 Concentric	.922	23.4	700 MCM	.964	24.5
400 Concentric	1.03	26.2	800 MCM	1.031	26.2
500 Concentric	1.13	28.8	1000 MCM	1.152	29.3
600 Concentric	1.26	31.9	1200 MCM	1.263	32.1
625 Concentric	1.29	32.8	1250 MCM	1.289	32.7
725 Concentric	1.39	35.2	1400 MCM	1.364	34.6
800 Concentric	1.45	36.8	1600 MCM	1.459	37.1
850 Concentric	1.48	37.6	1700 MCM	1.506	38.2
1000 Concentric	1.64	41.6	2000 MCM	1.632	41.5


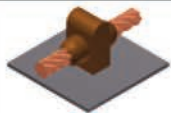



















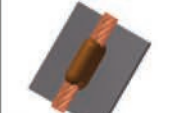
























SELECTOR CHART

CABLE TO CABLE CONNECTIONS

 <p>CC-1 SPLICE / HORIZONTAL Pages: 33, 85, 105, 217</p>	 <p>CC-12 SPLICE / HORIZONTAL 3/4" TO 5" CLEARANCE BEHIND CABLE</p>	 <p>CC-2 TEE / HORIZONTAL Pages: 34, 35, 86, 87, 88, 106, 218</p>	 <p>CC-3 TEE / VERTICAL TAP DOWN</p>	 <p>CC-4 CROSS (X) / HORIZONTAL TAP CABLE CUT Pages: 36, 37, 89, 107, 219</p>	 <p>CC-5 SPLICE / VERTICAL</p>
 <p>CC-6 PARALLEL TAP / HORIZONTAL (STACKED) Pages: 38, 85, 220</p>	 <p>CC-7 PARALLEL / HORIZONTAL RUN & TAP (STACKED) Pages: 39, 90, 221</p>	 <p>CC-8 HORIZONTAL / WYE (Y) LEFT HAND MOLD</p>	 <p>CC-9 HORIZONTAL / WYE (Y) RIGHT HAND MOLD</p>	 <p>CC-11 CROSS (X) / HORIZONTAL (UNCUT) Pages: 41, 91, 220</p>	 <p>CC-13 PARALLEL TAP / HORIZONTAL (SIDE-BY-SIDE)</p>
 <p>CC-14 PARALLEL / HORIZONTAL RUN & TAP (SIDE-BY-SIDE) Pages: 33, 198, 217</p>	 <p>CC-15 HORIZONTAL / WYE (Y) LEFT HAND MOLD 3/4" TO 5" CLEARANCE BEHIND CABLE</p>	 <p>CC-16 HORIZONTAL / WYE (Y) RIGHT HAND MOLD 3/4" TO 5" CLEARANCE BEHIND CABLE</p>	 <p>CC-17 VERTICAL / WYE (Y) TAP UP</p>	 <p>CC-18 VERTICAL / WYE (Y) TAP DOWN</p>	 <p>CC-19 HORIZONTAL / WYE (Y) TAP UP</p>
 <p>CC-20 HORIZONTAL / WYE (Y) TAP DOWN</p>	 <p>CC-21 CROSS (X) / HORIZONTAL TAP CABLE CUT</p>	 <p>CC-22 CROSS (X) / VERTICAL TAP CABLE CUT</p>	 <p>CC-23 CROSS (X) / VERTICAL (UNCUT)</p>	 <p>CC-24 TEE / HORIZONTAL TAP</p>	 <p>CC-25 TEE / VERTICAL TAP UP</p>
 <p>CC-26 ELL / HORIZONTAL</p>	 <p>CC-27 ELL / TAP DOWN</p>	 <p>CC-28 ELL / TAP UP</p>	 <p>CC-31 PARALLEL / VERTICAL TAP UP (SIDE-BY-SIDE)</p>	 <p>CC-32 PARALLEL / VERTICAL TAP UP (SIDE-BY-SIDE) 3/4" TO 5" CLEARANCE BEHIND CABLE</p>	 <p>CC-33 PARALLEL / VERTICAL TAP DOWN (SIDE-BY-SIDE)</p>
 <p>CC-34 PARALLEL / VERTICAL RUN & TAP (SIDE-BY-SIDE) Page: 40</p>	 <p>CC-29 DEAD END / HORIZONTAL (STACKED)</p>	 <p>CC-30 DEAD END / HORIZONTAL (SIDE-BY-SIDE)</p>	 <p>CC-35 DEAD END / VERTICAL (SIDE-BY-SIDE)</p>	 <p>CC-36 DEAD END / VERTICAL (SIDE-BY-SIDE)</p>	 <p>CC-37 SPLICE / HORIZONTAL MULTIPLE TAPS (SIDE-BY-SIDE)</p>
 <p>CC-38 SPLICE / VERTICAL MULTIPLE TAPS UP (SIDE-BY-SIDE)</p>	 <p>CC-39 SPLICE / VERTICAL MULTIPLE TAPS DOWN (SIDE-BY-SIDE)</p>	 <p>CC-40 TEE / HORIZONTAL TWO OR MORE TAP CABLES</p>	 <p>CC-41 TEE / HORIZONTAL TWO OR MORE RUN CABLES</p>	 <p>CC-42 TEE / HORIZONTAL TWO OR MORE RUN CABLES TWO OR MORE TAP CABLES</p>	 <p>CC-43 TEE / HORIZONTAL TWO OR MORE RUN CABLES TWO OR MORE TAP CABLES 3/4" TO 5" CLEARANCE BEHIND CABLE</p>
 <p>CC-44 TEE / VERTICAL TWO OR MORE RUN CABLES TWO OR MORE TAP CABLES</p>	 <p>CC-45 TEE / VERTICAL TWO OR MORE RUN CABLES TWO OR MORE TAP CABLES</p>	 <p>CC-46 CROSS (X) / HORIZONTAL TWO OR MORE RUN CABLES TWO OR MORE TAP CABLES</p>	 <p>CC-47 TEE / HORIZONTAL TWO OR MORE RUN CABLES</p>	 <p>CC-48 PARALLEL / HORIZONTAL RUN & TAP (SIDE BY SIDE)</p>	 <p>CC-49 PARALLEL / HORIZONTAL RUN & TAP (SIDE BY SIDE)</p>
 <p>CC-50 TEE / VERTICAL TWO OR MORE RUN CABLES</p>					















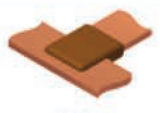




















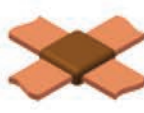






SELECTOR CHART

CABLE TO STEEL OR CAST IRON CONNECTIONS

 <p>CS-1 HORIZONTAL CABLE THRU HORIZONTAL STEEL CABLE OFF SURFACE Pages: 53, 95, 113, 227</p>	 <p>CS-2 HORIZONTAL CABLE THRU HORIZONTAL STEEL CABLE OFF SURFACE Pages: 54, 96, 114, 228</p>	 <p>CS-42 HORIZONTAL CABLE THRU HORIZONTAL CAST IRON CABLE OFF SURFACE</p>	 <p>CS-3 VERTICAL CABLE 45° DOWN VERTICAL STEEL CABLE OFF SURFACE Pages: 55, 56, 97, 115, 212, 229</p>	 <p>CS-3 VERTICAL CABLE 45° DOWN VERTICAL STEEL PIPE CABLE OFF SURFACE</p>	 <p>CS-28 VERTICAL CABLE 45° DOWN VERTICAL CAST IRON CABLE OFF SURFACE</p>
 <p>CS-22 HORIZONTAL CABLE THRU VERTICAL STEEL</p>	 <p>CS-4 VERTICAL CABLE THRU VERTICAL STEEL CABLE OFF SURFACE Pages: 59, 100, 118</p>	 <p>CS-46 VERTICAL CABLE THRU VERTICAL CAST IRON CABLE OFF SURFACE</p>	 <p>CS-5 HORIZONTAL CABLE THRU HORIZONTAL CAST IRON CABLE ON SURFACE Page: 59</p>	 <p>CS-8 HORIZONTAL CABLE THRU HORIZONTAL CAST IRON CABLE ON SURFACE Pages: 53, 95, 113, 227</p>	
 <p>CS-6 HORIZONTAL CABLE THRU VERTICAL STEEL CABLE OFF SURFACE Pages: 60, 98, 117</p>	 <p>CS-43 HORIZONTAL CABLE THRU VERTICAL CAST IRON CABLE OFF SURFACE</p>	 <p>CS-7 VERTICAL CABLE UP VERTICAL STEEL CABLE ON SURFACE Pages: 61, 99, 118, 230</p>	 <p>CS-30 VERTICAL CABLE UP VERTICAL CAST IRON CABLE ON SURFACE</p>	 <p>CS-9 HORIZONTAL CABLE THRU HORIZONTAL STEEL CABLE ON SURFACE Pages: 54, 96, 114, 228</p>	 <p>CS-11 HORIZONTAL CABLE THRU HORIZONTAL CAST IRON CABLE ON SURFACE</p>
 <p>CS-18 HORIZONTAL CABLE THRU VERTICAL STEEL CABLE ON SURFACE SPECIFY RIGHT OR LEFT HAND MOLD Pages: 60, 100, 116</p>	 <p>CS-21 HORIZONTAL CABLE THRU VERTICAL CAST IRON CABLE ON SURFACE SPECIFY RIGHT OR LEFT HAND MOLD</p>	 <p>CS-12 VERTICAL CABLE DOWN 45° STEEL CABLE ON SURFACE</p>	 <p>CS-13 HORIZONTAL CABLE THRU 45° STEEL CABLE ON SURFACE</p>	 <p>CS-14 VERTICAL CABLE THRU 45° STEEL CABLE ON SURFACE</p>	 <p>CS-15 HORIZONTAL CABLE THRU 45° STEEL CABLE ON SURFACE</p>
 <p>CS-16 HORIZONTAL CABLE THRU HORIZONTAL STEEL PIPE CABLE OFF SURFACE</p>	 <p>CS-24 VERTICAL CABLE UP VERTICAL STEEL CABLE OFF SURFACE</p>	 <p>CS-23 VERTICAL CABLE DOWN VERTICAL STEEL CABLE OFF SURFACE Pages: 57, 58, 99, 206, 229</p>	 <p>CS-45 VERTICAL CABLE DOWN VERTICAL CAST IRON CABLE OFF SURFACE</p>	 <p>CS-25 VERTICAL CABLE DOWN VERTICAL STEEL CABLE ON SURFACE</p>	
 <p>CS-29 VERTICAL CABLE DOWN VERTICAL CAST IRON CABLE ON SURFACE</p>	 <p>CS-26 VERTICAL CABLE THRU VERTICAL STEEL CABLE ON SURFACE</p>	 <p>CS-27 HORIZONTAL CABLE THRU VERTICAL STEEL CABLE ON SURFACE Pages: 98, 117, 230</p>	 <p>CS-31 HORIZONTAL CABLE THRU VERTICAL STEEL CABLE OFF SURFACE SPECIFY RIGHT OR LEFT HAND MOLD</p>	 <p>CS-32 FOR CATHODIC PROTECTION HORIZONTAL CABLE THRU HORIZONTAL STEEL PIPE CABLE ON SURFACE Pages: 231, 232</p>	 <p>CS-33 FOR CATHODIC PROTECTION HORIZONTAL CABLE THRU HORIZONTAL CAST IRON PIPE CABLE ON SURFACE Pages: 233</p>
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 <p>CS-47 VERTICAL CABLE 45° UP VERTICAL STEEL CABLE OFF SURFACE</p>	 <p>CS-48 FOR CATHODIC PROTECTION HORIZONTAL CABLE (FORMED) THRU HORIZONTAL STEEL PIPE CABLE ON SURFACE</p>	 <p>CS-49 FOR CATHODIC PROTECTION HORIZONTAL CABLE (FORMED) THRU HORIZONTAL CAST IRON PIPE CABLE ON SURFACE</p>	 <p>CS-50 FOR CATHODIC PROTECTION HORIZONTAL CABLE THRU VERTICAL STEEL PIPE CABLE ON SURFACE SPECIFY RIGHT OR LEFT HAND MOLD</p>	 <p>CS-51 FOR CATHODIC PROTECTION HORIZONTAL CABLE THRU VERTICAL CAST IRON PIPE CABLE ON SURFACE SPECIFY RIGHT OR LEFT HAND MOLD</p>	 <p>CS-52 VERTICAL CABLE THRU HORIZONTAL STEEL</p>


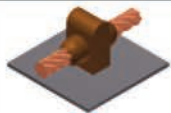



















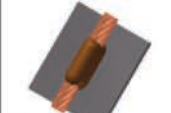
























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BUS BAR TO BUS BAR CONNECTIONS

 BB-1 HORIZONTAL SPLICE BARS ON EDGE Pages: 71, 247	 BB-28 HORIZONTAL SPLICE BARS ON EDGE 3/4" TO 5" CLEARANCE BEHIND BAR	 BB-2 ELL / TAP DOWN Pages: 72, 249	 BB-3 VERTICAL TEE / TAP DOWN BARS LAPPED Pages: 72, 248	 BB-8 VERTICAL TEE / TAP DOWN BARS LAPPED 3/4" TO 5" CLEARANCE BEHIND BAR	 BB-5 PARALLEL / BARS ON EDGE
 BB-4 VERTICAL TEE / TAP UP	 BB-11 VERTICAL TEE / TAP UP 3/4" TO 5" CLEARANCE BEHIND BAR	 BB-6 HORIZONTAL TEE BARS ON EDGE	 BB-16 HORIZONTAL TEE BARS ON EDGE 3/4" TO 5" CLEARANCE BEHIND BAR	 BB-7 HORIZONTAL SPLICE BARS FLAT Page: 247	 BB-9 VERTICAL TEE / TAP DOWN MULTIPLE BARS
 BB-12 VERTICAL TEE / TAP DOWN	 BB-13 HORIZONTAL TEE BARS ON EDGE MULTIPLE BARS	 BB-14 HORIZONTAL TEE BARS FLAT Page: 248	 BB-17 VERTICAL TEE TAP HORIZONTAL	 BB-18 VERTICAL TEE TAP HORIZONTAL RIGHT HAND 3/4" TO 5" CLEARANCE BEHIND BAR	 BB-19 VERTICAL TEE TAP HORIZONTAL LEFT HAND 3/4" TO 5" CLEARANCE BEHIND BAR
 BB-15 HORIZONTAL TEE BARS FLAT MULTIPLE BARS	 BB-20 VERTICAL ELL / TAP UP	 BB-21 HORIZONTAL ELL BARS ON EDGE	 BB-22 HORIZONTAL ELL BARS FLAT	 BB-23 HORIZONTAL ELL BARS FLAT MULTIPLE BARS	 BB-24 VERTICAL ELL / TAP DOWN MULTIPLE BARS
 BB-25 VERTICAL ELL / TAP UP MULTIPLE BARS	 BB-26 HORIZONTAL ELL BARS ON EDGE MULTIPLE BARS	 BB-27 VERTICAL SPLICE	 BB-29 VERTICAL SPLICE 3/4" TO 5" CLEARANCE BEHIND BAR	 BB-30 HORIZONTAL SPLICE BARS ON EDGE MULTIPLE BARS	 BB-31 HORIZONTAL SPLICE BARS FLAT MULTIPLE BARS
 BB-32 VERTICAL SPLICE MULTIPLE BARS	 BB-33 VERTICAL ELL / DOWN BARS FLAT	 BB-34 HORIZONTAL SPLICE BARS FLAT MULTIPLE BARS	 BB-35 HORIZONTAL SPLICE BARS ON EDGE MULTIPLE BARS	 BB-36 HORIZONTAL SPLICE BARS FLAT MULTIPLE BARS	 BB-38 VERTICAL SPLICE MULTIPLE BARS
 BB-39 VERTICAL SPLICE BARS FLAT MULTIPLE BARS	 BB-40 HORIZONTAL CROSS TAP CUT, BARS FLAT Page: 249	 BB-41 HORIZONTAL CROSS BARS UNCUT, BARS FLAT Page: 249	 BB-42 HORIZONTAL CROSS TAP CUT BARS ON EDGE	 BB-43 VERTICAL CROSS BARS UNCUT	 BB-44 HORIZONTAL BUTTON WELD FOR COPPER STRIP ONLY
 BB-45 VERTICAL BUTTON WELD FOR COPPER STRIP ONLY	 BB-46 HORIZONTAL BUTTON WELD CROSS FOR COPPER STRIP ONLY Page: 212				

SELECTOR CHART

CABLE TO GROUND ROD OR ROD CONNECTIONS

 <p>CS-1 HORIZONTAL CABLE THRU HORIZONTAL STEEL CABLE OFF SURFACE Pages: 53, 95, 113, 227</p>	 <p>CS-2 HORIZONTAL CABLE THRU HORIZONTAL STEEL CABLE OFF SURFACE Pages: 54, 96, 114, 228</p>	 <p>CS-42 HORIZONTAL CABLE THRU HORIZONTAL CAST IRON CABLE OFF SURFACE</p>	 <p>CS-3 VERTICAL CABLE 45° DOWN VERTICAL STEEL CABLE OFF SURFACE Pages: 55, 56, 97, 115, 212, 229</p>	 <p>CS-3 VERTICAL CABLE 45° DOWN VERTICAL STEEL PIPE CABLE OFF SURFACE</p>	 <p>CS-28 VERTICAL CABLE 45° DOWN VERTICAL CAST IRON CABLE OFF SURFACE</p>
 <p>CS-22 HORIZONTAL CABLE THRU VERTICAL STEEL</p>	 <p>CS-4 VERTICAL CABLE THRU VERTICAL STEEL CABLE OFF SURFACE Pages: 59, 100, 118</p>	 <p>CS-46 VERTICAL CABLE THRU VERTICAL CAST IRON CABLE OFF SURFACE</p>	 <p>CS-5 HORIZONTAL CABLE THRU HORIZONTAL CAST IRON CABLE ON SURFACE Page: 59</p>	 <p>CS-8 HORIZONTAL CABLE THRU HORIZONTAL CAST IRON CABLE ON SURFACE Pages: 53, 95, 113, 227</p>	
 <p>CS-6 HORIZONTAL CABLE THRU VERTICAL STEEL CABLE OFF SURFACE Pages: 60, 98, 117</p>	 <p>CS-43 HORIZONTAL CABLE THRU VERTICAL CAST IRON CABLE OFF SURFACE</p>	 <p>CS-7 VERTICAL CABLE UP VERTICAL STEEL CABLE ON SURFACE Pages: 61, 99, 118, 230</p>	 <p>CS-30 VERTICAL CABLE UP VERTICAL CAST IRON CABLE ON SURFACE</p>	 <p>CS-9 HORIZONTAL CABLE THRU HORIZONTAL STEEL CABLE ON SURFACE Pages: 54, 96, 114, 228</p>	 <p>CS-11 HORIZONTAL CABLE THRU HORIZONTAL CAST IRON CABLE ON SURFACE</p>
 <p>CS-18 HORIZONTAL CABLE THRU VERTICAL STEEL CABLE ON SURFACE SPECIFY RIGHT OR LEFT HAND MOLD Pages: 60, 100, 116</p>	 <p>CS-21 HORIZONTAL CABLE THRU VERTICAL CAST IRON CABLE ON SURFACE SPECIFY RIGHT OR LEFT HAND MOLD</p>	 <p>CS-12 VERTICAL CABLE DOWN 45° STEEL CABLE ON SURFACE</p>	 <p>CS-13 HORIZONTAL CABLE THRU 45° STEEL CABLE ON SURFACE</p>	 <p>CS-14 VERTICAL CABLE THRU 45° STEEL CABLE ON SURFACE</p>	 <p>CS-15 HORIZONTAL CABLE THRU 45° STEEL CABLE ON SURFACE</p>
 <p>CS-16 HORIZONTAL CABLE THRU HORIZONTAL STEEL PIPE CABLE OFF SURFACE</p>	 <p>CS-24 VERTICAL CABLE UP VERTICAL STEEL CABLE OFF SURFACE</p>	 <p>CS-23 VERTICAL CABLE DOWN VERTICAL STEEL CABLE OFF SURFACE Pages: 57, 58, 99, 206, 229</p>	 <p>CS-45 VERTICAL CABLE DOWN VERTICAL CAST IRON CABLE OFF SURFACE</p>	 <p>CS-25 VERTICAL CABLE DOWN VERTICAL STEEL CABLE ON SURFACE</p>	
 <p>CS-29 VERTICAL CABLE DOWN VERTICAL CAST IRON CABLE ON SURFACE</p>	 <p>CS-26 VERTICAL CABLE THRU VERTICAL STEEL CABLE ON SURFACE</p>	 <p>CS-27 HORIZONTAL CABLE THRU VERTICAL STEEL CABLE ON SURFACE Pages: 98, 117, 230</p>	 <p>CS-31 HORIZONTAL CABLE THRU VERTICAL STEEL CABLE OFF SURFACE SPECIFY RIGHT OR LEFT HAND MOLD</p>	 <p>CS-32 FOR CATHODIC PROTECTION HORIZONTAL CABLE THRU HORIZONTAL STEEL PIPE CABLE ON SURFACE Pages: 231, 232</p>	 <p>CS-33 FOR CATHODIC PROTECTION HORIZONTAL CABLE THRU HORIZONTAL CAST IRON PIPE CABLE ON SURFACE Pages: 233</p>
 <p>CS-34 FOR CATHODIC PROTECTION HORIZONTAL CABLE THRU HORIZONTAL STEEL PIPE CABLE ON SURFACE Pages: 234, 235</p>	 <p>CS-35 FOR CATHODIC PROTECTION HORIZONTAL CABLE THRU HORIZONTAL CAST IRON PIPE CABLE ON SURFACE Pages: 236</p>	 <p>CS-36 FOR CATHODIC PROTECTION VERTICAL CABLE 45° DOWN VERTICAL STEEL PIPE CABLE OFF SURFACE Pages: 237, 238</p>	 <p>CS-37 FOR CATHODIC PROTECTION VERTICAL CABLE 45° DOWN VERTICAL CAST IRON PIPE CABLE OFF SURFACE Pages: 239</p>	 <p>CS-38 FOR CATHODIC PROTECTION VERTICAL CABLE UP VERTICAL STEEL PIPE CABLE ON SURFACE</p>	 <p>CS-39 FOR CATHODIC PROTECTION VERTICAL CABLE UP VERTICAL CAST IRON PIPE CABLE ON SURFACE</p>
 <p>CS-47 VERTICAL CABLE 45° UP VERTICAL STEEL CABLE OFF SURFACE</p>	 <p>CS-48 FOR CATHODIC PROTECTION HORIZONTAL CABLE (FORMED) THRU HORIZONTAL STEEL PIPE CABLE ON SURFACE</p>	 <p>CS-49 FOR CATHODIC PROTECTION HORIZONTAL CABLE (FORMED) THRU HORIZONTAL CAST IRON PIPE CABLE ON SURFACE</p>	 <p>CS-50 FOR CATHODIC PROTECTION HORIZONTAL CABLE THRU VERTICAL STEEL PIPE CABLE ON SURFACE SPECIFY RIGHT OR LEFT HAND MOLD</p>	 <p>CS-51 FOR CATHODIC PROTECTION HORIZONTAL CABLE THRU VERTICAL CAST IRON PIPE CABLE ON SURFACE SPECIFY RIGHT OR LEFT HAND MOLD</p>	 <p>CS-52 VERTICAL CABLE THRU HORIZONTAL STEEL</p>


































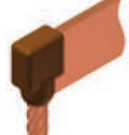


SELECTOR CHART

BUS BAR TO BUS BAR CONNECTIONS

 <p>CR-1 HORIZONTAL CABLE DEAD END VERTICAL GROUND ROD Pages: 42, 43, 92, 108, 222</p>	 <p>CR-2 HORIZONTAL CABLE THRU VERTICAL GROUND ROD Pages: 44, 45, 93, 109, 223</p>	 <p>CR-3 HORIZONTAL CABLE THRU VERTICAL GROUND ROD Pages: 46, 94, 110, 224</p>	 <p>CR-4 HORIZONTAL CABLE CROSS VERTICAL GROUND ROD</p>	 <p>CR-5 VERTICAL CABLE UP VERTICAL GRD ROD DOWN</p>	 <p>CR-6 VERTICAL CABLE DOWN VERTICAL GRD ROD UP</p>
 <p>CR-7 HORIZONTAL CABLE HORIZONTAL GRD ROD</p>	 <p>CR-8 HORIZONTAL CABLE THRU HORIZONTAL GRD ROD</p>	 <p>CR-9 HORIZONTAL CABLE THRU HORIZONTAL GRD ROD UP</p>	 <p>CR-11 HORIZONTAL CABLE CROSS (UNCUT) VERTICAL GROUND ROD</p>	 <p>CR-12 VERTICAL CABLE THRU UP HORIZONTAL GRD ROD</p>	 <p>CR-13 HORIZONTAL CABLE HORIZONTAL GRD ROD THRU</p>
 <p>CR-14 VERTICAL CABLE UP HORIZONTAL GRD ROD THRU</p>	 <p>CR-15 VERTICAL CABLE DOWN HORIZONTAL GRD ROD THRU</p>	 <p>CR-16 HORIZONTAL CABLE VERTICAL GRD ROD THRU</p>	 <p>CR-17 HORIZONTAL PARALLEL CABLE (STACKED) VERTICAL GROUND ROD Page: 47</p>	 <p>CR-18 VERTICAL CABLE UP VERTICAL GRD ROD THRU Pages: 49, 111</p>	
 <p>CR-19 VERTICAL CABLE THRU VERTICAL GRD ROD THRU</p>	 <p>CR-20 VERTICAL CABLE DOWN VERTICAL GRD ROD THRU</p>	 <p>CR-21 HORIZONTAL CABLE HORIZONTAL GRD ROD THRU (STACKED)</p>	 <p>CR-22 HORIZONTAL CABLE THRU HORIZONTAL GRD ROD THRU (STACKED)</p>	 <p>CR-23 HORIZONTAL CABLE THRU HORIZONTAL GRD ROD THRU (SIDE-BY-SIDE)</p>	 <p>CR-24 HORIZONTAL PARALLEL CABLE THRU (STACKED) VERTICAL GROUND ROD Page: 48</p>
 <p>CR-25 HORIZONTAL CABLE TEE HORIZONTAL GRD ROD</p>	 <p>CR-26 HORIZONTAL CABLE THRU HORIZONTAL GRD ROD THRU</p>	 <p>CR-28 HORIZONTAL CABLE HORIZONTAL CHEMICAL GROUND ROD</p>	 <p>CR-33 HORIZONTAL CABLE THRU HORIZONTAL CHEMICAL GROUND ROD</p>	 <p>CR-34 VERTICAL CABLES UP VERTICAL GRD ROD DOWN</p>	 <p>CR-35 VERTICAL CABLE 45° DOWN VERTICAL GRD ROD THRU</p>
 <p>CR-36 VERTICAL CABLE 45° UP VERTICAL GRD ROD DOWN Page: 112</p>	 <p>CR-37 VERTICAL CABLE 45° DOWN VERTICAL CHEMICAL GROUND ROD</p>	 <p>CR-38 VERTICAL CABLE DOWN HORIZONTAL GRD ROD</p>	 <p>CR-39 HORIZONTAL CABLE - TEE HORIZONTAL CHEMICAL GROUND ROD</p>	 <p>CR-40 VERTICAL CABLES DOWN VERTICAL GROUND ROD UP</p>	 <p>CR-41 VERTICAL CABLES 45° UP VERTICAL GROUND ROD</p>

SELECTOR CHART

CABLE TO LUG OR BUS BAR CONNECTIONS

 CB-1 HORIZONTAL CABLE HORIZONTAL LUG OR BAR Pages: 62, 101, 119, 206, 212, 244	 CB-2 VERTICAL CABLE UP HORIZONTAL BAR ON EDGE OVER 5" CLEARANCE BEHIND BAR Page: 65	 CB-6 VERTICAL CABLE UP HORIZONTAL BAR ON EDGE 3/4" TO 5" CLEARANCE BEHIND BAR Page: 66	 CB-3 VERTICAL CABLE DOWN HORIZONTAL BAR ON EDGE OVER 5" CLEARANCE BEHIND BAR Page: 67	 CB-7 VERTICAL CABLE DOWN HORIZONTAL BAR ON EDGE 3/4" TO 5" CLEARANCE BEHIND BAR Page: 68	 CB-4 HORIZONTAL CABLE HORIZONTAL BAR Pages 64, 245
 CB-5 HORIZONTAL CABLE THRU HORIZONTAL BAR Pages: 70, 246	 CB-8 HORIZONTAL CABLE HORIZONTAL BAR ON EDGE	 CB-9 VERTICAL CABLE DOWN VERTICAL BAR UP	 CB-11 VERTICAL CABLE UP VERTICAL BAR DOWN	 CB-12 MULTIPLE HORIZONTAL CABLES HORIZONTAL LUGS OR BARS	 CB-13 MULTIPLE HORIZONTAL CABLES MULTIPLE HORIZONTAL LUGS OR BARS
 CB-14 HORIZONTAL CABLE MULTIPLE HORIZONTAL LUGS OR BARS	 CB-15 HORIZONTAL CABLE VERTICAL BAR UP	 CB-16 VERTICAL CABLE UP HORIZONTAL BAR ON EDGE	 CB-17 VERTICAL CABLE DOWN HORIZONTAL BAR ON EDGE	 CB-18 HORIZONTAL CABLE VERTICAL BAR UP	 CB-19 HORIZONTAL CABLE VERTICAL BAR DOWN
 CB-20 HORIZONTAL CABLE VERTICAL BAR UP	 CB-21 HORIZONTAL CABLE VERTICAL BAR DOWN	 CB-22 HORIZONTAL CABLE HORIZONTAL BAR	 CB-23 VERTICAL CABLE UP HORIZONTAL BAR	 CB-24 VERTICAL CABLE DOWN HORIZONTAL BAR	 CB-25 HORIZONTAL CABLE HORIZONTAL BAR ON EDGE
 CB-26 HORIZONTAL CABLE THRU HORIZONTAL BAR ON EDGE	 CB-27 HORIZONTAL CABLE VERTICAL BAR UP	 CB-28 VERTICAL CABLE DOWN HORIZONTAL BAR ON EDGE	 CB-29 VERTICAL CABLE THRU HORIZONTAL BAR ON EDGE Page: 69	 CB-30 HORIZONTAL CABLE THRU VERTICAL BAR UP	 CB-31 HORIZONTAL CABLE THRU VERTICAL BAR DOWN
 CB-32 VERTICAL CABLE THRU HORIZONTAL BAR ON EDGE	 CB-33 HORIZONTAL CABLE HORIZONTAL LUG Pages: 63, 101, 244	 CB-34 HORIZONTAL CABLE HORIZONTAL COPPER STRIP THRU Page: 212	 CB-35 HORIZONTAL CABLE THRU HORIZONTAL COPPER STRIP THRU	 CB-36 VERTICAL CABLE DOWN HORIZONTAL BAR ON EDGE	 CB-37 HORIZONTAL CABLE HORIZONTAL BAR
 CB-38 VERTICAL CABLE DOWN HORIZONTAL BAR					

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CABLE TO REBAR CONNECTIONS

 CRE-1 PARALLEL / HORIZONTAL CABLE HORIZONTAL REBAR THRU Pages: 75, 255	 CRE-2 HORIZONTAL CABLE HORIZONTAL REBAR THRU Page: 76	 CRE-3 HORIZONTAL CABLE THRU VERTICAL REBAR THRU Pages: 77, 256	 CRE-4 HORIZONTAL CABLE THRU HORIZONTAL REBAR THRU Page: 78	 CRE-5 VERTICAL CABLE THRU HORIZONTAL REBAR THRU	 CRE-6 HORIZONTAL CABLE VERTICAL REBAR THRU Pages: 79, 257
 CRE-7 SPLICE / VERTICAL CABLE UP VERTICAL REBAR DOWN	 CRE-8 SPLICE / VERTICAL CABLE DOWN VERTICAL REBAR UP	 CRE-9 SPLICE / HORIZONTAL CABLE HORIZONTAL REBAR	 CRE-11 HORIZONTAL CABLE THRU HORIZONTAL REBAR	 CRE-12 VERTICAL CABLE THRU HORIZONTAL REBAR	 CRE-13 VERTICAL CABLE UP HORIZONTAL REBAR THRU
 CRE-14 VERTICAL CABLE DOWN HORIZONTAL REBAR THRU	 CRE-15 HORIZONTAL CABLE THRU VERTICAL REBAR UP	 CRE-16 HORIZONTAL CABLE THRU VERTICAL REBAR DOWN Page: 80, 94	 CRE-17 PARALLEL / HORIZONTAL CABLE THRU (STACKED) HORIZONTAL REBAR THRU	 CRE-18 PARALLEL / VERTICAL CABLE DOWN VERTICAL REBAR THRU	 CRE-19 PARALLEL / VERTICAL CABLE UP VERTICAL REBAR THRU
 CRE-20 PARALLEL / VERTICAL CABLE THRU VERTICAL REBAR THRU	 CRE-21 HORIZONTAL CABLE VERTICAL REBAR DOWN Page: 80	 CRE-25 HORIZONTAL CABLE TEE VERTICAL REBAR DOWN Page: 80	 CRE-35 VERTICAL CABLE 45° DOWN VERTICAL REBAR THRU		

BUS BAR TO REBAR CONNECTIONS

 BRE-3 HORIZONTAL BAR THRU BAR ON EDGE VERTICAL REBAR THRU	 BRE-4 HORIZONTAL BAR THRU HORIZONTAL REBAR THRU	 BRE-5 HORIZONTAL BAR HORIZONTAL REBAR THRU	 BRE-6 HORIZONTAL BAR BAR ON EDGE HORIZONTAL REBAR THRU	 BRE-7 VERTICAL BAR THRU HORIZONTAL REBAR THRU	 BRE-8 HORIZONTAL BAR BAR ON EDGE VERTICAL REBAR THRU Page: 257
 BRE-13 HORIZONTAL BAR FLAT HORIZONTAL REBAR	 BRE-15 VERTICAL BAR DOWN HORIZONTAL REBAR THRU	 BRE-16 HORIZONTAL BAR FLAT VERTICAL REBAR THRU	 BRE-17 HORIZONTAL BAR THRU BAR ON EDGE HORIZONTAL REBAR THRU	 BRE-18 VERTICAL BAR DOWN VERTICAL REBAR THRU	 BRE-20 VERTICAL BAR UP BAR ON EDGE VERTICAL REBAR THRU


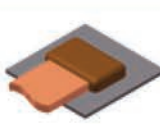
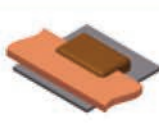


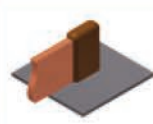



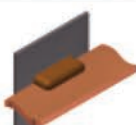



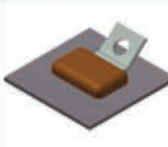





ROD TO REBAR CONNECTIONS / REBAR TO REBAR CONNECTIONS

(NOTE: RE WELD TYPES ARE FOR ELECTRICAL CONTINUITY ONLY AND ARE NOT TO BE USED FOR STRUCTURAL PURPOSES.)






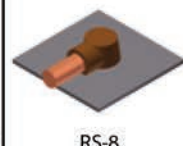



 RE-1 SPLICE / HORIZONTAL	 RE-2 SPLICE / VERTICAL	 RE-3 PARALLEL / VERTICAL RUN & TAP (SIDE-BY-SIDE)	 RE-7 PARALLEL / HORIZONTAL RUN & TAP (STACKED)	 RRE-1 HORIZONTAL ROD HORIZONTAL REBAR	 RRE-16 HORIZONTAL ROD VERTICAL REBAR THRU
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SELECTOR CHART

LUG OR BUS BAR TO STEEL CONNECTIONS












 <p>BS-1 VERTICAL BAR DOWN VERTICAL STEEL Pages: 73, 250</p>	 <p>BS-2 HORIZONTAL BAR HORIZONTAL STEEL Pages: 73, 250</p>	 <p>BS-3 HORIZONTAL BAR THRU HORIZONTAL STEEL Pages: 74, 251</p>	 <p>BS-4 HORIZONTAL BAR THRU BAR ON EDGE VERTICAL STEEL Page: 74</p>	 <p>BS-5 VERTICAL BAR THRU VERTICAL STEEL Page: 74</p>	 <p>BS-6 HORIZONTAL BAR BAR ON EDGE HORIZONTAL STEEL</p>
 <p>BS-7 HORIZONTAL BAR THRU BAR ON EDGE HORIZONTAL STEEL</p>	 <p>BS-8 VERTICAL BAR DOWN BAR ON EDGE VERTICAL STEEL</p>	 <p>BS-9 HORIZONTAL BAR BAR ON EDGE VERTICAL STEEL</p>	 <p>BS-11 HORIZONTAL BAR THRU BAR ON EDGE VERTICAL STEEL</p>	 <p>BS-12 VERTICAL BAR THRU BAR ON EDGE VERTICAL STEEL</p>	 <p>BS-13 HORIZONTAL BAR BAR ON EDGE VERTICAL STEEL</p>
 <p>BS-14 VERTICAL BAR UP VERTICAL STEEL</p>	 <p>BS-15 HORIZONTAL 45° LUG HORIZONTAL STEEL</p>	 <p>BS-16 VERTICAL 45° LUG VERTICAL STEEL</p>	 <p>BS-17 HORIZONTAL 45° LUG LUG ON EDGE VERTICAL STEEL</p>	 <p>BS-18 HORIZONTAL BAR HORIZONTAL STEEL</p>	 <p>BS-19 HORIZONTAL BAR BAR ON EDGE VERTICAL STEEL</p>
 <p>BS-20 VERTICAL BAR UP BAR ON EDGE VERTICAL STEEL</p>					

THREADED STUD OR ROD TO STEEL CONNECTIONS
















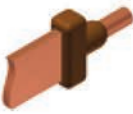



 <p>RS-1 HORIZONTAL STUD VERTICAL STEEL Pages: 52</p>	 <p>RS-2 VERTICAL STUD HORIZONTAL STEEL Pages: 52</p>	 <p>RS-5 VERTICAL ROD THRU VERTICAL STEEL ROD OFF SURFACE</p>	 <p>RS-6 HORIZONTAL ROD VERTICAL STEEL</p>	 <p>RS-7 VERTICAL ROD UP VERTICAL STEEL ROD ON SURFACE</p>	 <p>RS-8 HORIZONTAL ROD HORIZONTAL STEEL ROD ON SURFACE</p>
 <p>RS-9 HORIZONTAL ROD THRU HORIZONTAL STEEL ROD OFF SURFACE</p>	 <p>RS-11 HORIZONTAL ROD HORIZONTAL STEEL ROD OFF SURFACE</p>	 <p>RS-23 VERTICAL ROD DOWN VERTICAL STEEL ROD OFF SURFACE</p>			

SELECTOR CHART

GROUND ROD TO GROUND ROD CONNECTIONS

 RR-1 SPLICE / VERTICAL Pages: 52, 224	 RR-2 SPLICE / HORIZONTAL	 RR-3 HORIZONTAL ROD VERTICAL ROD THRU	 RR-4 HORIZONTAL ROD VERTICAL ROD DOWN	 RR-5 HORIZONTAL ROD THRU VERTICAL ROD THRU	 RR-6 HORIZONTAL ROD THRU VERTICAL ROD UP
 RR-7 PARALLEL / HORIZONTAL (STACKED)	 RR-13 HORIZONTAL ROD VERTICAL ROD	 RR-14 CROSS (X) / HORIZONTAL (UNCUT)	 RR-15 TEE / HORIZONTAL	 RR-16 ELL / HORIZONTAL	

BUS BAR TO GROUND ROD CONNECTIONS

 BR-1 HORIZONTAL BAR THRU VERTICAL ROD Page: 252	 BR-2 HORIZONTAL BAR THRU BAR ON EDGE VERTICAL ROD Page: 253	 BR-3 HORIZONTAL BAR THRU BAR ON EDGE (UNCUT) VERTICAL ROD THRU Page: 254	 BR-4 HORIZONTAL BAR THRU HORIZONTAL ROD	 BR-5 HORIZONTAL BAR HORIZONTAL ROD THRU	 BR-6 HORIZONTAL BAR THRU BAR ON EDGE VERTICAL ROD UP
 BR-7 HORIZONTAL BAR THRU VERTICAL ROD Page: 254	 BR-8 HORIZONTAL BAR BAR ON EDGE VERTICAL ROD THRU	 BR-9 HORIZONTAL BAR THRU BAR ON EDGE VERTICAL ROD	 BR-11 VERTICAL SPLICE / BAR UP VERTICAL ROD	 BR-12 HORIZONTAL BAR BAR ON EDGE VERTICAL ROD	 BR-13 HORIZONTAL BAR HORIZONTAL ROD
 BR-14 VERTICAL BAR UP HORIZONTAL ROD	 BR-15 VERTICAL BAR DOWN HORIZONTAL ROD	 BR-16 HORIZONTAL LUG OR BAR HORIZONTAL ROD	 BR-17 HORIZONTAL BAR BAR ON EDGE HORIZONTAL ROD	 BR-18 HORIZONTAL BAR THRU VERTICAL ROD THRU	 BR-19 HORIZONTAL BAR THRU BAR ON EDGE VERTICAL ROD UP 3/4" TO 5" CLEARANCE BEHIND BAR
 BR-25 HORIZONTAL BAR VERTICAL ROD					

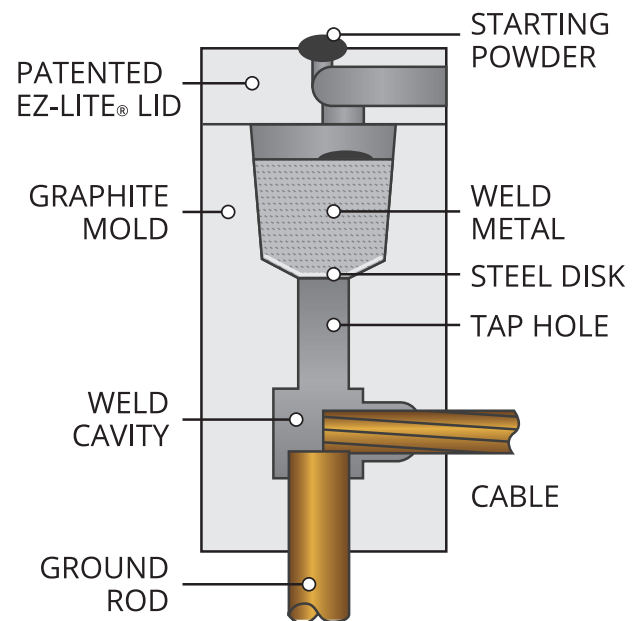
TECHNICAL INFORMATION

THERMOWELD® PROVIDES HIGH QUALITY PRODUCTS TO THE ELECTRIC, UTILITY, TELECOM, AND CATHODIC MARKETS.

The thermOweld® process is a simple way of welding copper to copper and copper to steel. The reaction takes place in a semi-permanent graphite mold and uses high temperature reactions of copper oxide and aluminum.

The thermOweld® connections are solid molecular bonds; they will not loosen or corrode throughout the life of the weld.

**IF YOU NEED IT,
WE CAN MAKE IT**



FEATURES

- All thermOweld® molds come with our EZ Lite® lid.
- Added Safety - EZ Lite® Lid redirects exhaust away from the user.
- The average life of a mold is 50 plus welds - depending on the care and treatment it receives.
- EZ to ignite with the top ignition hole.
- EZ Lite® Lid extends the life of handles and framework of mold.
- Reduces emission by more than 50% compared to the standard lid.






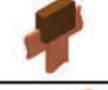

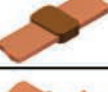
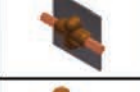

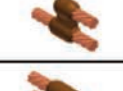
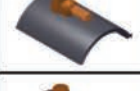
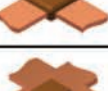


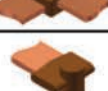
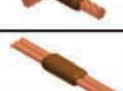

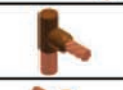

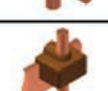
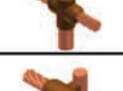








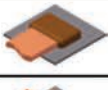
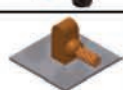

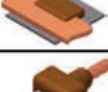
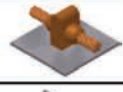

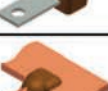
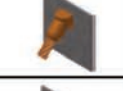






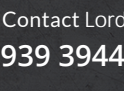


thermOweld[®]

MOLDS FOR USE WITH METRIC CONDUCTORS

SELECTOR CHART

MOLDS - METRIC

Weld Type		Page #	Weld Type		Page #	Weld Type		Page #
	BB-1	247		CB-5	246		CS-8	227
	BB-2	249		CB-33	244		CS-9	228
	BB-3	248		CC-1	217		CS-23	229
	BB-7	247		CC-2	218		CS-27	230
	BB-14	248		CC-4	219		CS-32	231-232
	BB-40	249		CC-6	220		CS-33	233
	BB-41	249		CC-7	221		CS-34	234-235
	BR-1	252		CC-11	220		CS-35	236
	BR-2	253		CC-14	217		CS-36	237-238
	BR-3	254		CR-1	222		CS-37	239
	BR-7	254		CR-2	223		RR-1	224
	BRE-8	257		CR-3	224		Single Shots	225-226
	BS-1	250		CRE-1	255		CP Kit	240
	BS-2	250		CRE-3	256		thermo-cap	241
	BS-3	251		CRE-6	257		Magnetic Mold Support	243
	CB-1	244		CS-1	227		CP Weld Metal	242
	CB-4	245		CS-2	228			
				CS-3	229			
				CS-7	230			

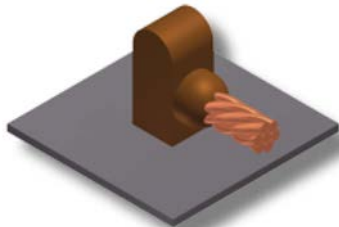
TECHNICAL INFORMATION

MOLDS - METRIC

CS-1 TYPE MOLDS

Horizontal Cable to Horizontal Steel Surface For Metric Conductors

Note that the cable is OFF the surface



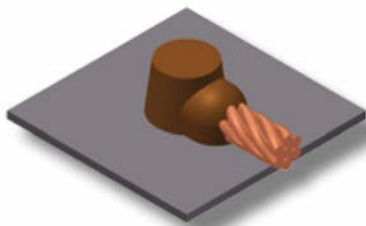
MOLDS FOR METRIC CONDUCTORS

CABLE SIZE (MM ²)	MOLD #	PRICE KEY	WELD METAL	HANDLE CLAMPS	LEAD TIME
8mm Ø	M-4527	4	90	B-106	2
50	M-3419	4	90	B-106	2
10mm Ø	M-4529	4	90	B-106	4
70	M-3421	4	90	B-106	2
95	M-3423	4	115	B-106	2
120	M-3424	4	115	B-106	2
150	M-3425	4	150	B-106	2
185	M-3426	4	200	B-106	4
240	M-3427	4	200	B-106	2
300	M-3428	4	250	B-106	4

CS-8 TYPE MOLDS

Horizontal Cable to Horizontal Steel Surface For Metric Conductors

Note that the cable is ON the surface



MOLDS FOR METRIC CONDUCTORS

CABLE SIZE (MM ²)	MOLD #	PRICE KEY	WELD METAL	HANDLE CLAMPS	LEAD TIME
10	M-10792	3†	45	Included	4
16	M-10264	3†	45	Included	4
25	M-3479	3†	45	Included	2
30	M-4530	3†	45	Included	4
35	M-3480	3†	45	Included	2
8mm Ø	M-4534	3†	45	Included	4
50	M-3480	3†	45	Included	2
10mm Ø	M-4536	3†	65	Included	4
70	M-3483	3†	65	Included	2
95	M-3485	4	90	Included	2
120	M-3486	4	115	B-106	2
150	M-3487	4	150	B-106	4
185	M-3488	4	200	B-106	2
240	M-3489	4	200	B-106	2
300	M-3490	4	250	B-106	4

For sizes not listed, contact thermOweld®.

- For heavy duty connections, contact thermOweld®.
- For expedited service, contact thermOweld®.
- To order weld metal for use with EZ Lite Remote® insert TW before and EZ after weld metal number.
- Required Tools:
Handle Clamps w/Flint Ignitor (see chart for correct handles)
†~Sold complete with frame
38-0309-00 ~ Flint Ignitor or 38-EZLT-RU EZ Lite Remote®
- Other recommended accessories:
40-0319-01 ~ Mold Cleaner for cartridge sizes #15-65 (Price Key 3 Molds Only)
38-3922-00 ~ Mold Cleaning Brush
38-0135-00 ~ Cable Cleaning Brush
38-0101-00 ~ Rasp
38-4129-00 ~ Packing Material for 50mm² & Larger Molds (CS-8 Molds Only)

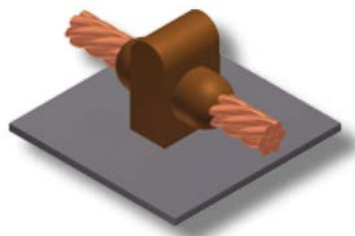
TECHNICAL INFORMATION

MOLDS - METRIC

CS-2 TYPE MOLDS

Horizontal Thru Cable to Horizontal Steel Surface For Metric Conductors

Note that the cable is OFF the surface



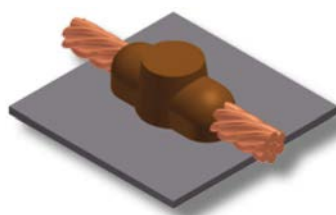
MOLDS FOR METRIC CONDUCTORS

CABLE SIZE (MM ²)	MOLD #	PRICE KEY	WELD METAL	HANDLE CLAMPS	LEAD TIME
8mm Ø	M-4537	4	90	B-106	2
50	M-4538	4	90	B-106	2
10mm Ø	M-4551	4	115	B-106	4
70	M-4552	4	115	B-106	2
95	M-4560	4	115	B-106	2
120	M-4585	4	150	B-106	2
150	M-4592	4	200	B-106	4
185	M-4602	4	250	B-106	4
240	M-4617	5	2-150	B-107	4
300	M-4622	5	2-200	B-107	4

CS-9 TYPE MOLDS

Horizontal Thru Cable to Horizontal Steel Surface For Metric Conductors

Note that the cable is ON the surface



MOLDS FOR METRIC CONDUCTORS

CABLE SIZE (MM ²)	MOLD #	PRICE KEY	WELD METAL	HANDLE CLAMPS	LEAD TIME
10	M-10793	3†	45	Included	4
16	M10794	3†	45	Included	4
25	M-3496	3†	45	Included	2
30	M-4638	3†	45	Included	4
35	M-3497	3†	45	Included	4
8mm Ø	M-4641	4	90	B-106	4
50	M-3498	4	90	B-106	2
10mm Ø	M-4653	4	115	B-106	4
70	M-3500	4	115	B-106	2
95	M-3502	4	115	B-106	2
120	M-3503	4	150	B-106	4
150	M-3504	4	200	B-106	4
185	M-3505	4	250	B-106	4
240	M-3506	5	2-150	B-107	4
300	USE TYPE CS-2				

For sizes not listed, contact thermOweld®.

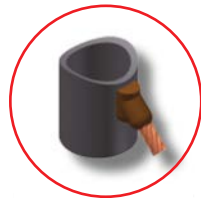
- For heavy duty connections, contact thermOweld®.
- For expedited service, contact thermOweld®.
- To order weld metal for use with EZ Lite Remote® insert TW before and EZ after weld metal number.
- Required Tools:
Handle Clamps w/Flint Ignitor (see chart for correct handles)
†~Sold complete with frame
38-0309-00 ~ Flint Ignitor or 38-EZLT-RU EZ Lite Remote®
- Other recommended accessories:
40-0319-01 ~ Mold Cleaner for cartridge sizes #15-65 (Price Key 3 Molds Only)
38-3922-00 ~ Mold Cleaning Brush
38-0135-00 ~ Cable Cleaning Brush
38-0101-00 ~ Rasp
38-4129-00 ~ Packing Material for 50mm² & Larger Molds (CS-8 Molds Only)

TECHNICAL INFORMATION

MOLDS - METRIC

CS-3 TYPE MOLDS

Angular Cable Drop to Vertical Steel Surface For Metric Conductors



For connections to pipe,
contact thermOweld

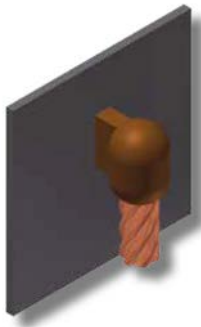
MOLDS FOR METRIC CONDUCTORS

CABLE SIZE (MM ²)	MOLD #	PRICE KEY	WELD METAL	HANDLE CLAMPS	LEAD TIME
10	M-10795	4	45	B-106	4
16	M-10796	4	45	B-106	4
25	M-3445	4	45	B-106	2
30	M-4670	4	45	B-106	4
35	M-3446	4	45	B-106	2
8mm Ø	M-4672	4	90	B-106	2
50	M-3447	4	90	B-106	2
10mm Ø	M-4691	4	115	B-106	2
70	M-3449	4	90	B-106	2
95	M-3451	4	115	B-106	2
120	M-3452	4	115	B-106	2
150	M-3453	4	115	B-106	4
185	M-3454	4	200	B-106	2
240	M-3455	4	200	B-106	2
300	M-3456	4	250	B-106	4

CS-23 TYPE MOLDS

Vertical Cable Drop to Vertical Steel Surface For Copper-Clad Steel Conductors

Note that the cable is OFF the surface



MOLDS FOR METRIC CONDUCTORS

CABLE SIZE (MM ²)	MOLD #	PRICE KEY	WELD METAL	HANDLE CLAMPS	LEAD TIME
10	M-3070	4	45	B-106	4
16	M-10797	4	65	B-106	4
25	M-4679	4	65	B-106	2
30	M-10798	4	65	B-106	2
35	M-4114	4	65	B-106	2
8mm Ø	M-10799	4	65	B-106	4
50	M-3140	4	115	B-106	2
70	M-4678	4	115	B-106	2
95	M-4601	4	150	B-106	2
120	M-3747	4	200	B-106	2
150	M-3080	4	200	B-106	4
185	M-9823	4	250	B-106	2
240	M-10800	17	2-150	B-106	4
300	M-10801	17	2-150	B-106	4

For sizes not listed, contact thermOweld®.

- For heavy duty connections, contact thermOweld®.
- For molds with wear plates, see page 135.
- For expedited service, contact thermOweld®.
- To order weld metal for use with EZ Lite Remote® insert TW before and EZ after weld metal number.
- Required Tools;
Handle Clamps w/ Flint Ignitor (see chart for correct handles)
- 38-0309-00 ~ Flint Ignitor or 38-EZLT-RU EZ Lite Remote®
- Other recommended accessories;
40-4431-00 ~ Magnetic Handle Clamp w/ B-106
Handles 38-3922-00 ~ Mold Cleaning Brush
38-0135-00 ~ Cable Cleaning Brush
38-0101-00 ~ Rasp

TECHNICAL INFORMATION

MOLDS - METRIC

CS-2 TYPE MOLDS

Cathodic Protection
Horizontal Cable to Horizontal
Steel Pipe For Metric Conductors



MOLDS FOR METRIC CONDUCTORS						
CABLE SIZE (MM ²)	PIPE DIA. IN MM	MOLD #	PRICE KEY	WELD METAL	HANDLE CLAMPS	LEAD TIME
2.5, 4 & 6	up to 125	M-4146†	3†	15CP	Included Optional: Magnetic Molds Support, Catalogue Number 40-7202-00	2
2.5, 4 & 6	over 125	M-4147†	3†	15CP		2
10	up to 125	M-4148	3†	15CP		2
	over 125	M-4149	3†	15CP		2
16	up to 125	M-4146	3†	15CP		2
	over 125	M-4147	3†	15CP		2
25	up to 70	M-4152	3†	25CP		2
	70 to 165	M-4153	3†	25CP		2
	over 165	M-4154	3†	25CP		2
30	up to 70	M-2833	3†	32CP		4
	70 to 165	M-2834	3†	32CP		4
	165 to 250	M-2835	3†	32CP		4
	over 250	M-2836	3†	32CP		4
35	up to 70	M-4155	3†	32CP		2
	70 to 165	M-4156	3†	32CP		2
	165 to 250	M-4157	3†	32CP		2
	over 250	M-4158	3†	32CP		2
50	up to 70	M-4159	3†	45CP		4
	70 to 165	M-4160	3†	45CP		2
	165 to 250	M-4161	3†	45CP		2
	over 250	M-4162	3†	45CP		2
70	up to 70	M-4163	3†	65CP		2
	70 to 165	M-4164	3†	65CP		2
	165 to 250	M-4165	3†	65CP		2
	over 250	M-4166	3†	65CP		2

† 38-4590 Sleeve/Weld Req'd

APPLICATION NOTES.

When specifying and applying thermOweld® products for cathodic protection of buried piping systems, it is the specifier and buyer's responsibility to respect the following ASME guidelines in conjunction with ASTM, NACE and applicable country, state, municipality and local guidelines:

ASME B31.8-2000, "Gas Transmission and Distribution Piping Systems"

862.115 Para (b)1 (steel pipe) 15 grams maximum weld metal cartridge

ASME B31.8-2000, "Gas Transmission and Distribution Piping Systems"

862.223 Para (a) (ductile/cast iron pipe) 32 grams maximum weld metal cartridge

For sizes not listed, contact thermOweld®.

- For heavy duty connections, contact thermOweld®.
- For expedited service, contact thermOweld®.
- To order weld metal for use with EZ Lite Remote® insert TW before and EZ after weld metal number.
- Required Tools:
Handle Clamps w/Flint Ignitor (see chart for correct handles)
†~Sold complete with frame
38-0309-00 ~ Flint Ignitor or 38-EZLT-RU EZ Lite Remote®
- Other recommended accessories:
40-0319-01 ~ Mold Cleaner for cartridge sizes #15-65 (Price Key 3 Molds Only)
38-3922-00 ~ Mold Cleaning Brush
38-0135-00 ~ Cable Cleaning Brush
38-0101-00 ~ Rasp
38-4129-00 ~ Packing Material for 50mm² & Larger Molds (CS-8 Molds Only)

TECHNICAL INFORMATION

MOLDS - METRIC

CS-34 TYPE MOLDS

**Cathodic Protection
Horizontal Thru Cable to
Horizontal Steel Pipe For
Metric Conductors**



MOLDS FOR METRIC CONDUCTORS						
CABLE SIZE (MM²)	PIPE DIA. IN MM	MOLD #	PRICE KEY	WELD METAL	HANDLE CLAMPS	LEAD TIME
2.5, 4 & 6	up to 105	M-4167‡	3†	25CP	Included Optional: Magnetic Molds Support, Catalogue Number 40-7202-00, See Page 136	2
2.5, 4 & 6	over 1105	M-4168‡	3†	25CP		2
10	up to 105	M-10806	3†	25CP		4
	over 105	M-10807	3†	25CP		4
16	up to 105	M-10808	3†	25CP		4
	over 105	M-10809	3†	25CP		2
25	up to 70	M-4173	3†	32CP		4
	70 to 165	M-4174	3†	32CP		4
	over 165	M-4175	3†	32CP		2
35	up to 70	M-4176	3†	45CP		2
	70 to 165	M-4177	3†	45CP		2
	165 to 250	M-4178	3†	45CP		2
	over 250	M-4179	3†	45CP		2
50	up to 70	M-4180	3†	65CP		4
	70 to 165	M-4181	3†	65CP		4
	165 to 250	M-4182	3†	65CP	4	
	over 250	M-4183	3†	65CP	2	
‡ (2) 38-4590 Sleeve/Weld Req'd						

For sizes not listed, contact thermOweld®.

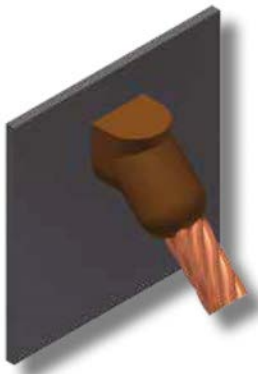
- Molds listed are for concentric stranded cable. Add suffix "-S" to mold number for solid conductors.
- For expedited service, contact thermOweld®.
- To order weld metal for use with EZ Lite Remote® insert TW before and EZ after weld metal number.
- Required Tools:
Handle Clamps w/Flint Ignitor (see chart for correct handles)
†~Sold complete with frame. If frame not requiredm specify MOLD NUMBER followed by the suffix "-G"
38-0309-00 ~ Flint Ignitor or 38-EZLT-RU EZ Lite Remote®
- Other recommended accessories:
40-0319-01 ~ Mold Cleaner for cartridge sizes #15-6538-3922-00 ~ Mold Cleaning Brush
38-0135-00 ~ Cable Cleaning Brush
38-0101-00 ~ Rasp
38-4129-00 ~ Packing Material for 1/0 & Larger Molds

TECHNICAL INFORMATION

MOLDS - METRIC

CS-36 TYPE MOLDS

**Cathodic Protection
Angular Cable Drop to Vertical Steel
Surface For Metric Conductors**



For connections to pipe,
contact thermOweld

MOLDS FOR METRIC CONDUCTORS

CABLE SIZE (MM ²)	MOLD #	PRICE KEY	WELD METAL	HANDLE CLAMPS	LEAD TIME
10	M-10721	18†	15CP	40-4565-00	2
16	M-10722	18†	25CP	40-4565-00	2
25	M-4274	18†	32CP	40-4565-00	2
30	M-10723	18†	32CP	40-4565-00	4
35	M-9878	18†	32CP	45-4565-00	2
50	M-10724	18†	65CP	40-4565-00	4
70	M-10725	18†	65CP	40-4565-00	4

For sizes not listed, contact thermOweld®.

- For expedited service, contact thermOweld®.
- To order weld metal for use with EZ Lite Remote® insert TW before and EZ after weld metal number.
- Required Tools:
Handle Clamps w/Flint Ignitor (see chart for correct handles)
†~Sold complete with frame. If frame not required, specify MOLD NUMBER (followed by suffix "-G"
38-0309-00 ~ Flint Ignitor or 38-EZLT-RU EZ Lite Remote®
- Other recommended accessories:
40-0319-01 ~ Mold Cleaner for cartridge sizes #15-65 (Price Key 3 Molds Only)
38-3922-00 ~ Mold Cleaning Brush
38-0135-00 ~ Cable Cleaning Brush
38-0101-00 ~ Rasp
38-4129-00 ~ Packing Material for 50mm² & Larger Molds

WELDING TO HORIZONTAL PIPE.

To weld to 4" to 24" horizontal pipe, add pipe size to mold number. Example: To weld #1 str cable to 6" horizontal pipe, the mold number would be M-163-6. To weld to pipe 30" and larger, use flat surface mold.

thermOweld®

PRODUCT CATALOGUE

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