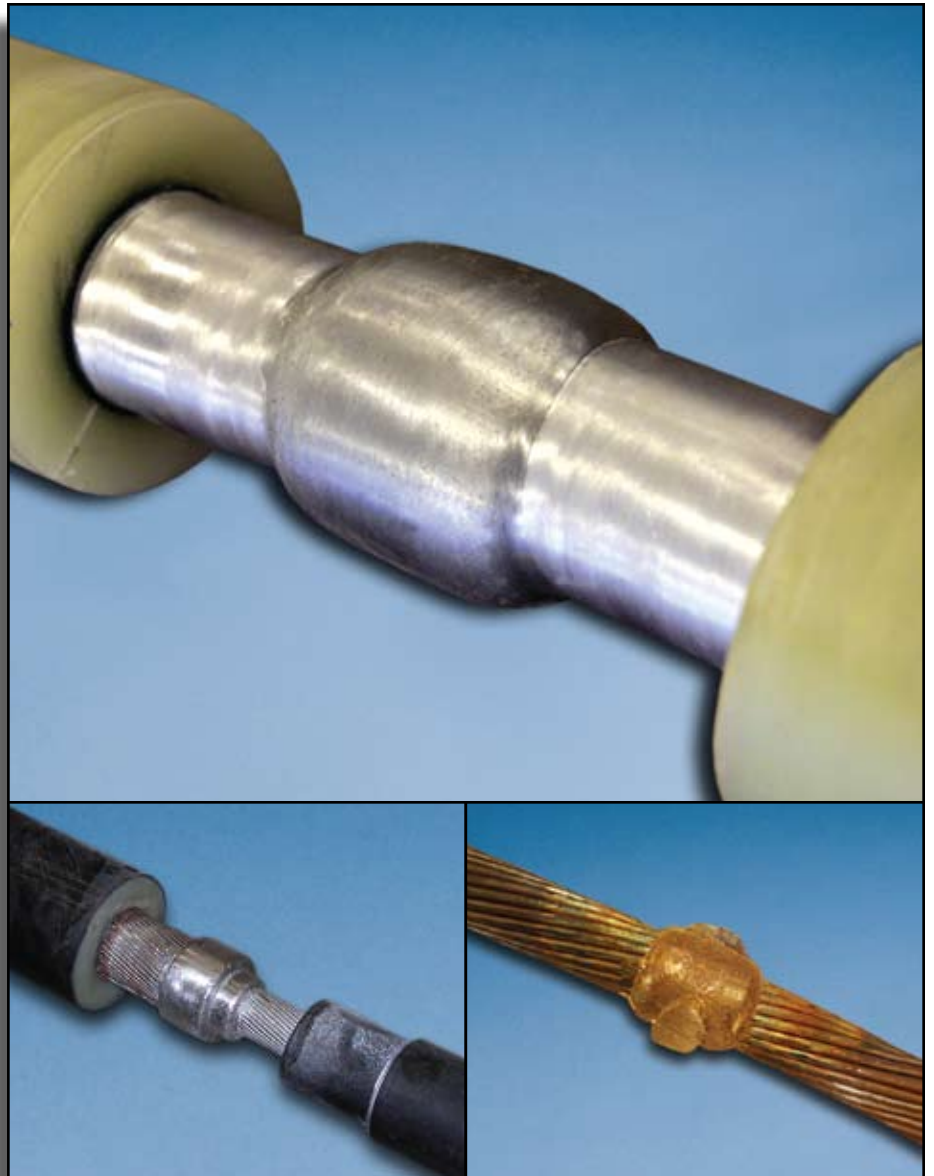


# CADWELD® Welded High-Voltage Power Connections

For Underground and Subsea Cable Splicing



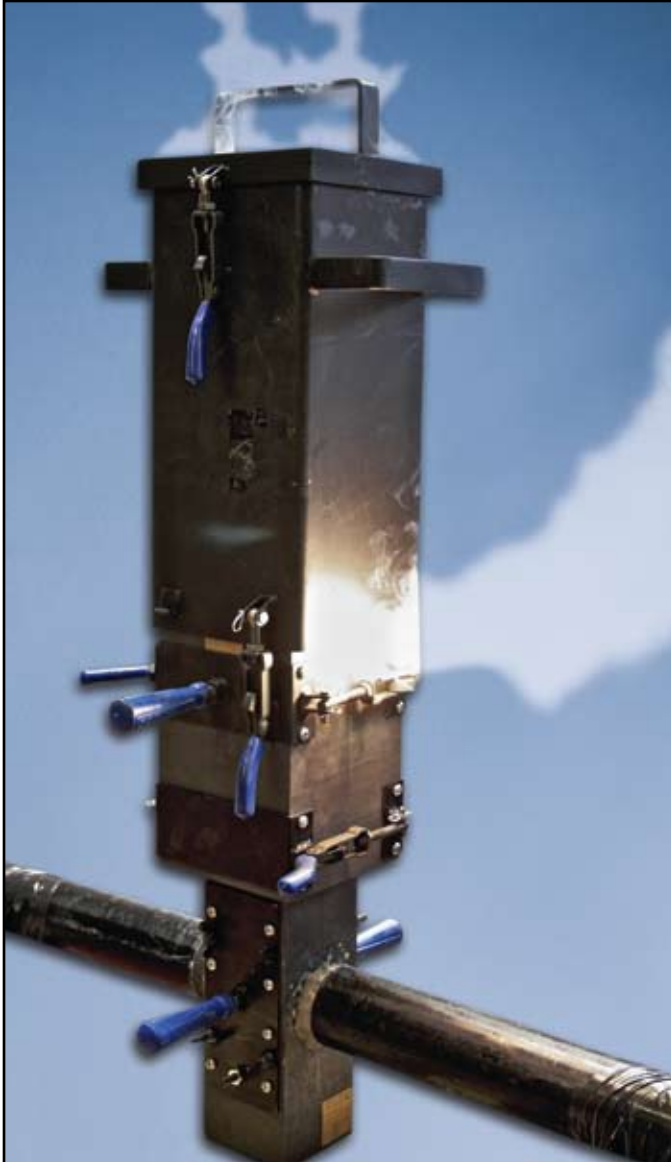
**ERICO®**

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Founded in 1903 as the Electric Railway Improvement Company, ERICO® developed the CADWELD® exothermic welding process in 1938. CADWELD connections have found industry-wide acceptance as the ultimate grounding and bonding connection. Over the years, CADWELD exothermic electrical connections have built a reputation for providing connections that are permanent and maintenance-free, with a current-carrying capacity equal to or greater than the conductors'. Many electric utility facilities worldwide use CADWELD for copper grounding and power connections.

In addition to Cu-Cu and Cu-Fe connections, an ERICO team of engineers, metallurgists and chemists developed an improved exothermic process for making high-voltage copper and aluminum power connections. CADWELD high-voltage copper and aluminum connections give you all the advantages you have come to expect from ERICO. The development of a special copper or aluminum alloy makes them perfect for high-voltage use. That means you can count on performance and cost-effectiveness.



## **BETTER THAN MECHANICAL CONNECTIONS AND LESS LABOR AND COST INTENSIVE THAN MIG OR TIG.**

CADWELD® high-voltage welds are permanent molecular bonds that cannot loosen or deteriorate, no maintenance is required and no resistance increase over time, so there is a continuous optimal electrical path. This makes CADWELD connections superior to traditional compression or mechanical connections that provide only surface contact between conductors and a less-than-perfect current path. In addition, CADWELD high-voltage welding system is easier to use and lower in labor cost, since you don't need a certified welder. Full on site training can be provided by ERICO Engineers.

## **A LOW EMISSION PROCESS**

CADWELD high-voltage welding set-up uses a unique ceramic fiber smoke filter system which prevents sparks and produces minimal smoke, but also reduces dust and other emissions to an acceptable level for exposures, even if used in unventilated small rooms and cable tunnels.

# CADWELD® HIGH-VOLTAGE WELDING PROCESS

**CADWELD® welding is a reliable method of quickly making electrical connections.**

## **OPTIMUM STANDARDIZATION:**

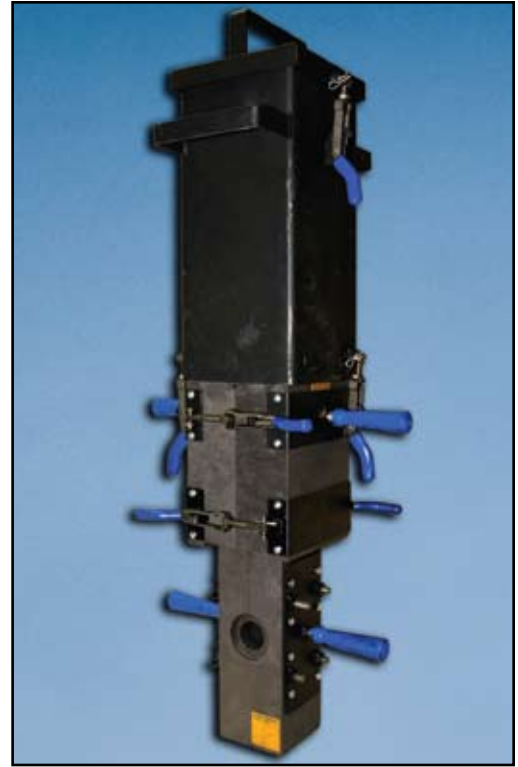
Welding equipment (crucible, smokefilter body, frames, etc.) is standardized and can be used on all connections. Only different molds and different types of welding material are needed for Copper or for Aluminum welds.

CADWELD® connections give you a single process for making all cable-to-cable, splices and terminations, tubular bus and flat bus connections.

Two different welding material options allow Cu-Cu as well as Al-Al and Al-Cu\* connections.

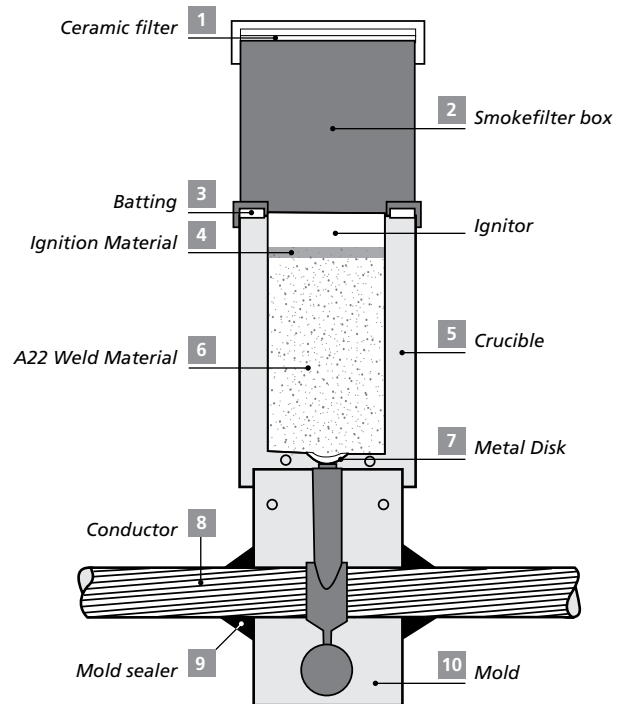
The welding material contains either copper and aluminum oxide or aluminum and calcium sulfate, both with additional ingredients.

The ignitor starts an exothermic reaction inside the crucible, producing the molten copper or molten aluminum. The molten material then flows from the crucible into the mold, welding the ends of the conductors to create the molecular bond.



## **CADWELD High-Voltage System Advantages:**

- CADWELD high-voltage welding system will weld the following materials:
  - Standard Al or Cu cable (concentric)
  - Segmented Al or Cu cable (milican)
  - Solid Al or Cu cable
- CADWELD connections can be made easily with minimal training.
- CADWELD weld is small – only 70 mm of insulation is removed from each cable end and therefore is easy to re-insulate.
- Specially designed weld profile for high-voltage applications.
- No external power or heat source required.
- Has a current carrying capacity equal to that of the conductor.
- Permanent molecular bond will not deteriorate with age, cannot loosen or corrode.
- Will withstand repeated faults, is made with lightweight equipment, has low labor cost and is time saving on jobsites.



*\*For Al-Cu connections, Copper must be tinned.*

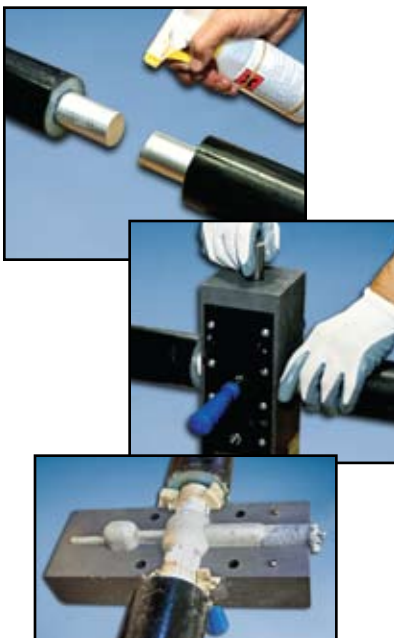
## Connection Examples:



Terminations: Copper 'Top Bolt' on Aluminum solid cable



Connection between two Aluminum cables



## Technical Information:

### Strength results

In laboratory tests, the tensile strength of CADWELD® high-voltage cable connections proved to have overall strong results. The tests show on average that the CADWELD connection provides about 75% tensile strength compared to the cable by itself. Test results vary between approx. 60% up to 90% tensile strength, whereby the breaking point is annealed cable at the edge of the CADWELD weld.

### Performance results

Like all CADWELD connections, their permanent low resistivity provides a current-carrying capacity that's greater than the conductors.

### Performance Results

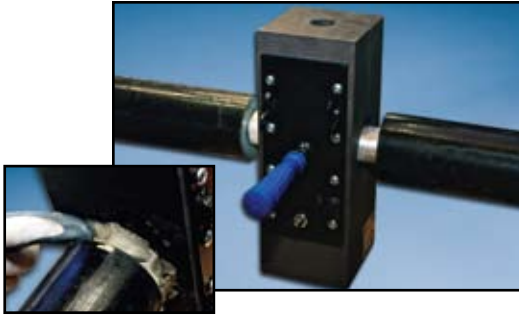
Aluminum Conductor		Resistance in $\mu\Omega$
Cable		
Cable-to-Cable Connection	A22	64.01
Cable Only		64.43

### Range of Capabilities

Conductor	Conductor Range	Connection Application
Al-cable to Al-cable or solid cable	17 mm / 56 mm diameter	<ul style="list-style-type: none"> <li>• High-, medium- and low-voltage</li> <li>• High current electrical</li> <li>• Earthing</li> </ul>
Cu-cable or Al-cable to Cu-cable	17 mm / 64 mm diameter	<ul style="list-style-type: none"> <li>• High-, medium- and low-voltage</li> <li>• High current electrical</li> <li>• Earthing</li> </ul>
Al-solid cable, -lug, busbar or flexible connections in Al-Al or Al-Cu	Customized to meet application	<ul style="list-style-type: none"> <li>• High current</li> <li>• Electrical connections for electrolysis and chemical plants</li> </ul>

\*Other cable sizes and combinations also available, please contact your ERICO engineer.

# CADWELD® WELDING EQUIPMENT



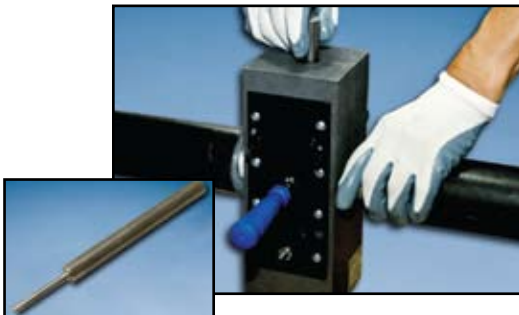
CADWELD® molds are produced from graphite blocks and can be used for 50 or more welds. Molds for Al-Al and Al-Cu are different from Cu-Cu molds. Frames are needed in order to close the mold and hold it. Mold Sealer is required around the cable on the outside of the CADWELD mold to prevent leakage of molten weldmetal.



CADWELD crucibles are included in the mold design for smaller conductor diameters. Large welds will require a separate crucible in order to accept the required amount of welding material. Frames are needed in order to close the crucible and hold it.



CADWELD high-voltage connection set-up uses a unique ceramic fiber smoke filter system which prevents sparks and produces minimal smoke. Filters can be used only once, but replacement filter sets are available for both sizes of smokefilter box.



CADWELD Gap device is a tool to correctly “gap” and center the cable ends. The tool kit provides brushes and other items which are used for easy cleaning of conductors before making connections. CADWELD Air-Dry Flux T327A is used on Al-Al and Al-Cu connections immediately after cleaning the aluminum conductors with the brush. CADWELD Air-Dry Flux must be lightly sprayed on to prevent re-oxidation.



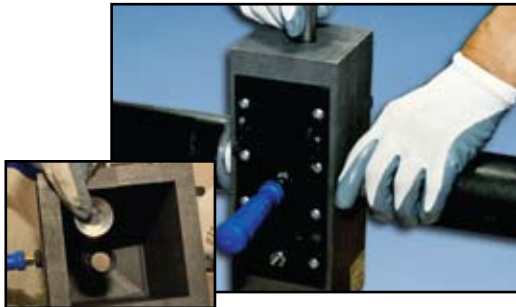
CADWELD welding material is a mixture of copper, aluminum and other ingredients. Each bag or container contains sufficient welding material for the specified connection. CADWELD welding material cannot ignite spontaneously. It can be handled and stored without danger. Adding starting material to the welding material is necessary to begin the exothermic reaction.

# EASY TO MAKE CADWELD® CONNECTIONS

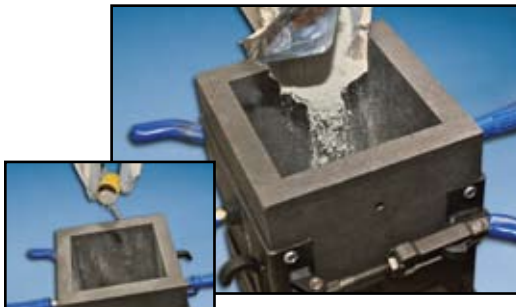
## BEFORE WELDING: READ, UNDERSTAND AND FOLLOW ALL SAFETY INSTRUCTIONS PACKAGED WITH YOUR MOLD!



- 1
  - Dry the mold and the conductors
  - Clean the conductors
  - Place cable ends in the mold



- 2
  - Correctly "gap" and center cable ends
  - Close the handles to lock the mold
  - Drop the metal disk into the mold



- 3
  - Dump the welding material into the mold
  - Sprinkle the starting material over the welding material and onto the lip of the mold  
(different for larger conductor sizes – follow instruction packaged with your mold)



- 4
  - Attach and fit the smokefilter box and ignite
  - Open the mold after approximately 5 minutes when material has solidified
  - Remove the mold from completed weld



- 5
  - A completed CADWELD® connection
  - Will not loosen or increase resistance over lifetime of installation

Detailed instructions and safety precautions are provided with every CADWELD mold. **You must read and understand all instructions before making a connection.** If you have any questions, please contact an ERICO engineer for assistance. Instruction sheets are also available for download at [www.erico.com](http://www.erico.com).

# Product Overview Aluminum A22 Welds

Cable Ø (mm) from to		Type	MOLD Frame Sealer	CRUCIBLE Type Frame		SMOKEFILTER House Set	GAP Device	TOOL KIT	Al- FLUX	Welding Material Code (Gramms)	Star- Ignitor
17.1	18.0	S1V18M	FM-102-SR	T403	-- NR --	SF-102-SR	CL-GD-3	TS-SR	T327A	300A22	Yes
18.1	19.0	S1V19M								300A22	
19.1	20.0	S1V20M								300A22	
20.1	21.0	S1V21M								300A22	
21.1	22.0	S1V22M								400A22	
22.1	23.0	S1V23M								400A22	
23.1	24.0	S1V24M								400A22	
24.1	25.0	S1V25M								400A22	
25.1	26.0	S1V26M								400A22	
26.1	27.0	S1V27M								500A22	
27.1	28.0	S1V28M			500A22						
28.1	29.0	S1V29M			500A22						
29.1	30.0	S1V30M			500A22						
30.1	31.0	S1V31M			500A22						
31.1	32.0	S1V32M			600A22						
32.1	33.0	S1V33M			700A22						
33.1	34.0	S1V34M			800A22						
34.1	35.0	S1V35M			800A22						
35.1	36.0	S1V36M			800A22						
36.1	37.0	S1V37M			800A22						
37.1	38.0	S1V38M			1000A22						
38.1	39.0	S1V39M			1000A22						
39.1	40.0	S1V40M			1000A22						
40.1	41.0	S1V41M			1000A22						
41.1	42.0	S1V42M			1100A22						
42.1	43.0	S1V43M			1100A22						
43.1	44.0	S1V44M			1100A22						
44.1	45.0	S1V45M			1200A22						
45.1	46.0	S1V46M			1200A22						
46.1	47.0	S1V47M			1300A22						
47.1	48.0	S1V48M			1300A22						
48.1	49.0	S1V49M			1400A22						
49.1	50.0	S1V50M	1400A22								
50.1	51.0	S1V51M	1400A22								
51.1	52.0	S1V52M	1400A22								
52.1	53.0	S1V53M	1400A22								
53.1	54.0	S1V54M	1700A22								
54.1	55.0	S1V55M	1900A22								
55.1	56.0	S1V56M	2000A22								
					CR-158-128-SR	SF-158-SR	CL-GD-6				
					FC-158-SR	SF-158-SR					

**Notes:**

- For Al-CU connections, copper cable or termination must be tinned
- CADWELD® A22 welds (Al-Al / Al-CU) are for indoor use only
- All A22 welds require Al-FLUX
- Standard range shown, for different sizes/combinations please contact an ERICO engineer



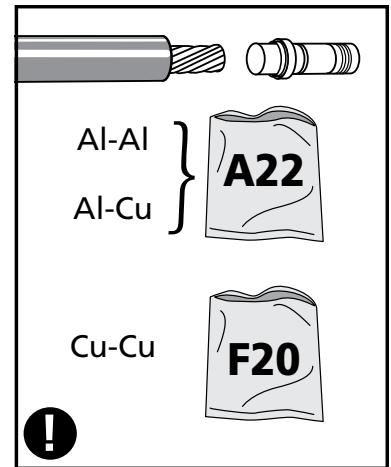
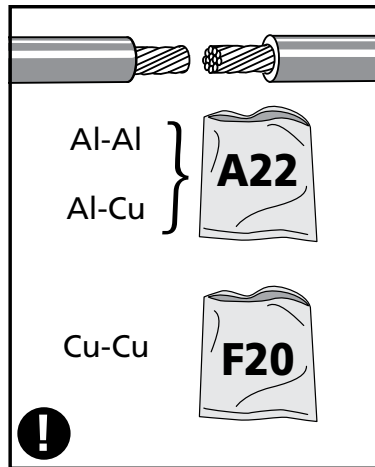
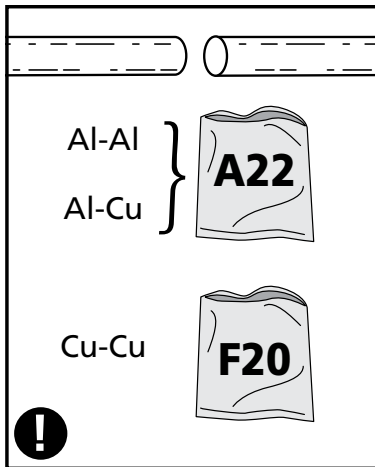
# Product Overview Copper F20 Welds

Cable Ø (mm) from to		Type	MOLD Frame Sealer	CRUCIBLE Type Frame	SMOKEFILTER House Set	GAP Device	TOOL KIT	Welding Material Code	Star- Ignitor
17.1	18.0	SS-18-SR	FM-102-SR	-- NN --	SF-102-SR	CL-GD-3	TS-SR	P98F20	Yes
18.1	19.0	SS-19-SR						P98F20	
19.1	20.0	SS-20-SR						P98F20	
20.1	21.0	SS-21-SR						P99F20	
21.1	22.0	SS-22-SR						P99F20	
22.1	23.0	SS-23-SR						P99F20	
23.1	24.0	SS-24-SR						P99F20	
24.1	25.0	SS-25-SR						P99F20	
25.1	26.0	SS-26-SR						P100F20	
26.1	27.0	SS-27-SR						P100F20	
27.1	28.0	SS-28-SR						P100F20	
28.1	29.0	SS-29-SR						P100F20	
29.1	30.0	SS-30-SR						P101F20	
30.1	31.0	SS-31-SR						P101F20	
31.1	32.0	SS-32-SR						P101F20	
32.1	33.0	SS-33-SR						P101F20	
33.1	34.0	SS-34-SR						P101F20	
34.1	35.0	SS-35-SR						P103F20	
35.1	36.0	SS-36-SR						P103F20	
36.1	37.0	SS-37-SR						P103F20	
37.1	38.0	SS-38-SR						P103F20	
38.1	39.0	SS-39-SR						P104F20	
39.1	40.0	SS-40-SR						P104F20	
40.1	41.0	SS-41-SR						P104F20	
41.1	42.0	SS-42-SR						P104F20	
42.1	43.0	SS-43-SR						P105F20	
43.1	44.0	SS-44-SR						P105F20	
44.1	45.0	SS-45-SR						P105F20	
45.1	46.0	SS-46-SR						P105F20	
46.1	47.0	SS-47-SR						P105F20	
47.1	48.0	SS-48-SR						P105F20	
48.1	49.0	SS-49-SR						P106F20	
49.1	50.0	SS-50-SR						P106F20	
50.1	51.0	SS-51-SR						P106F20	
51.1	52.0	SS-52-SR						P107F20	
52.1	53.0	SS-53-SR	P107F20						
53.1	54.0	SS-54-SR	P108F20						
54.1	55.0	SS-55-SR	P108F20						
55.1	56.0	SS-56-SR	P108F20						
56.1	57.0	SS-57-SR	P108F20						
57.1	58.0	SS-58-SR	P108F20						
58.1	59.0	SS-59-SR	P110F20						
59.1	60.0	SS-60-SR	P110F20						
60.1	61.0	SS-61-SR	P110F20						
61.1	62.0	SS-62-SR	P110F20						
62.1	63.0	SS-63-SR	P110F20						
63.1	64.0	SS-64-SR	P110F20						

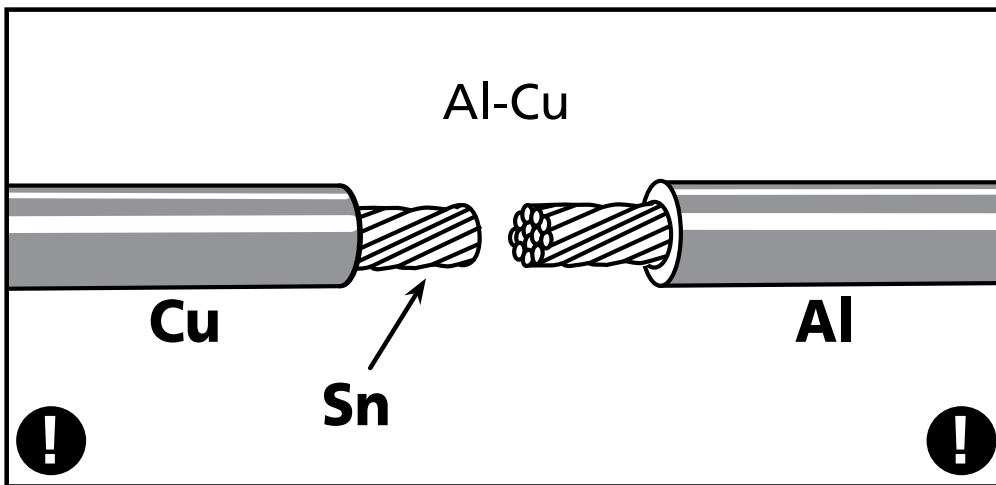
**Notes:**

- For horizontal straight splice or termination to 'Top Bolt' connections
- CADWELD® F20 molds require Mold Sealer
- Molds make approx. 60 connections/welds
- Standard range shown, for different sizes/combinations please contact an ERICO engineer

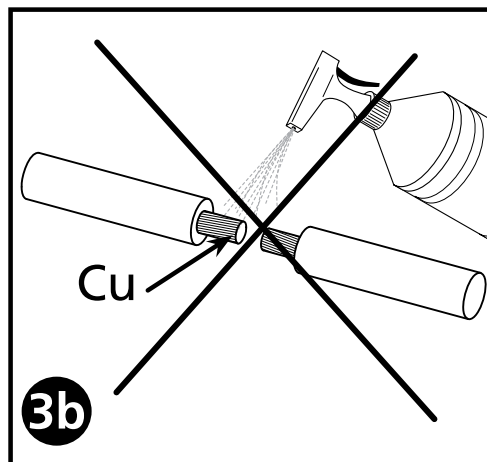
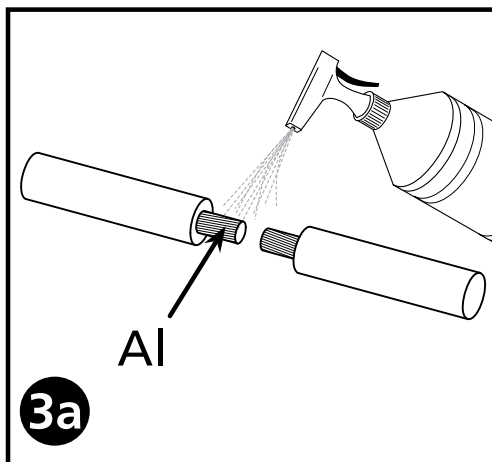
# Important Notes



ERICO® offers welding material for different conductors. Please note that any Al-Cu or Al-Al connections require CADWELD® A22 welding material. Cu-Cu connections will be processed with CADWELD F20 welding material.

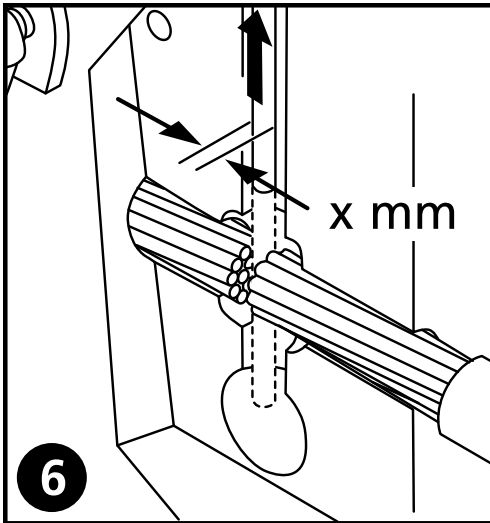


To provide a reliable connection between Al and Cu, the CADWELD welding process will require only tinned copper conductors.



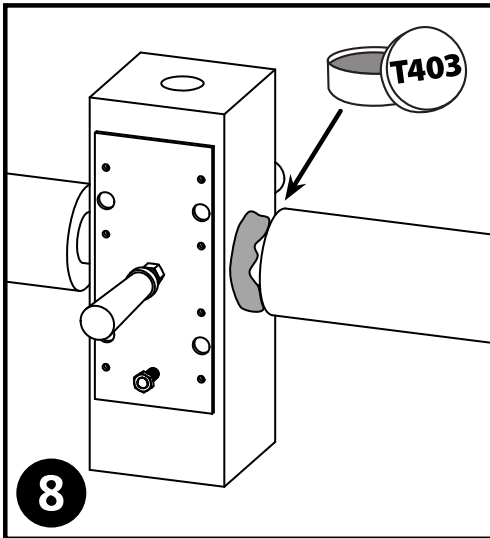
Immediately after cleaning aluminium conductors, use CADWELD Air Dry Flux T327A to prevent re-oxidation of the cleaned aluminium surface. There is no requirement to use CADWELD AIR DRY Flux on copper conductors.

**BEFORE WELDING:** Read, understand and follow all safety instructions packaged with your mold. Refer to instruction sheet IP 8067-A, which is also available at [www.erico.com](http://www.erico.com) for download.

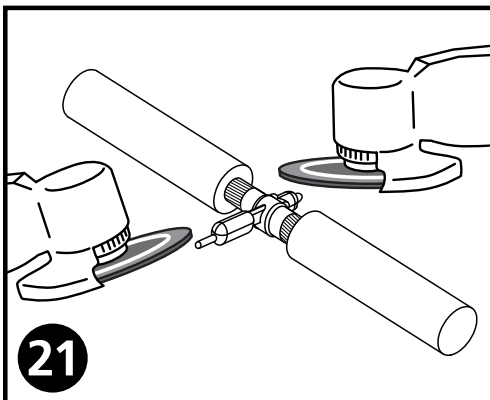


Please make sure that you maintain the correct "gap" between conductors inside the mold. This will allow the molten welding material to flow and connect the conductor. The number of the GAP Device shown on product overview pages 8 & 9 indicates the correct "gap".

If you are not sure or have additional questions, please contact an ERICO® engineer prior to any welding operation.



Apply (mold) sealer T403 between the mold and conductor to prevent leaking molten weld material.



Remove risers and overflow at the CADWELD weld once material is solidified.

**BEFORE WELDING:** Read, understand and follow all safety instructions packaged with your mold. Refer to instruction sheet IP 8067-A, which is also available at [www.erico.com](http://www.erico.com) for download.

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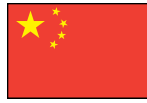


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