Harger Lightning & Grounding

Master Equipment Catalog

Since its beginning in 1960, Harger Lightning & Grounding has become a leader in the grounding and lightning protection industries. Founded on the principles of honesty, integrity and technical expertise, Harger has been able to provide grounding solutions and lightning protection equipment for many satisfied customers.

Harger Lightning & Grounding has built its reputation on providing a broad line of quality products at a competitive price, coupled with extraordinary service.

We have experience in all facets of these markets including engineering, systems design, product manufacturing and installation. We have the staff and facilities to handle your special requirements. Our complete engineering and manufacturing facilities have the capacity to produce special items as well as modify our standard component line. Let us know the application and we can provide the necessary equipment.

In order to meet the rigorous demands of our markets, Harger maintains an extensive inventory to ensure prompt deliveries to our customers, domestically and worldwide. Located near Chicago, Illinois, Harger is centrally located to serve the needs of customers from coast to coast.

Information changes after the catalog is printed.
For the most up to date information,
please go to our website at
www.harger.com

Our catalog drawings & details are available on our CD version of this catalog. Please contact us to request a Catalog CD.

Mission Statement

Our mission is to provide the ***best*** grounding and lightning protection equipment in the world. We will accomplish this by providing the most accurate engineering designs available and supplying the highest quality materials.

We will strive to offer the ultimate in customer service, making every customer our first priority. We will continue to grow our company in a controlled, responsible and profitable manner. We will create a stable work environment for our team members that fosters creativity, rewards innovation and self-motivation, and promotes a high feeling of self-worth.

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UL Definitions

96: UL standard for lightning protection components
50H2: Harger's number for lightning protection (assigned by UL)

467: UL standard for grounding components. Includes requirements for direct burial.
2S01: Harger's number for grounding (assigned by UL)

468: UL listing for lugs
ZMVV: Harger's listing for lugs (assigned by UL)

Section 1.1

Ground Conductors

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Stranded Copper Conductors

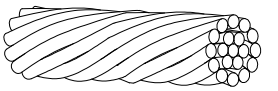
Concentric Lay Soft-Drawn Bare Copper

Part No.	Size (AWG)	No. of Strands	CM Area	Approx. Wt. lbs./M ft.
8-7	8	7	16,510	51
6-7	6	7	26,240	81
4-7	4	7	41,740	127
2-7	2	7	66,360	204
1/0-19	1/0	19	105,600	325
2/0-7	2/0	7	133,100	410
2/0-19	2/0	19	133,100	410
3/0-19	3/0	19	167,800	518
4/0-7	4/0	7	211,600	653
4/0-19	4/0	19	211,600	653

• Contact factory for reel sizes/put ups.



7 Strand Concentric

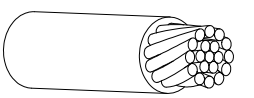


19 Strand Concentric

Green Insulated Conductors

Part No.	Size (AWG)	No. of Strands	Jacket Type	CM Area	Approx. Wt. lbs./M ft.
67G	6	7	THW	26,240	105
6-19G	6	19	THHN	26,240	98
47G	4	7	THW	41,740	160
4-19G	4	19	THHN	41,740	157
27G	2	7	THW	66,360	245
2-19G	2	19	THHN	66,360	240
1/019G	1/0	19	THHN	105,600	372
2/019G	2/0	19	THHN	133,100	462
4/019G	4/0	19	THHN	211,600	716

• Contact factory for reel sizes/put ups.

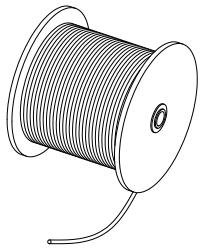


19 Strand Insulated

NOTES:
- Green Insulated conductor carries a THW or THHN rating. Other colors available upon request.
- Sizes up to 1000 MCM are available. Please contact the factory for special requests.
- Harger offers standard reel sizes, however we will cut to specified lengths.
- Bare Stranded conductor shall meet the requirements of ASTM B-8.
- Stranded copper conductors available tinned. Please add suffix T to part number.

Solid Copper Conductors

Solid Single Soft-Drawn Bare Copper

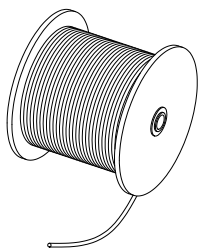


Part No.	Size (AWG)	Diameter	CM Area	Approx. Wt. lbs./M ft.
10	10	.101	10,380	31-1/2
8	8	.128	16,510	50
6	6	.162	26,240	80
4	4	.204	41,470	126
2	2	.257	66,360	201

• Contact factory for reel sizes/put ups.

Solid Tinned Copper Conductors

Solid Single Soft-Drawn Bare Tinned Copper



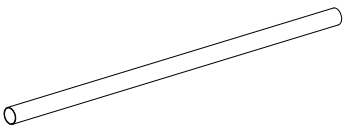
Part No.	Size (AWG)	Diameter	CM Area	Approx. Wt. lbs./M ft.
8T	8	.128	16,510	50
6T	6	.162	26,240	80
4T	4	.204	41,470	126
2T*	2	.257	66,360	201

*2T can be ordered as stock items #2T-250 (250' standard reel) and #2T-500 (500' standard reel).
• Contact factory for reel sizes/put ups.

NOTES:
- Other sizes are available. Please contact factory for special requests.
- Solid soft-drawn conductors shall meet the requirements of ASTM B-3.
- Tinned Copper conductors shall meet the requirements of ASTM B-33.

Solid Copperweld Conductors

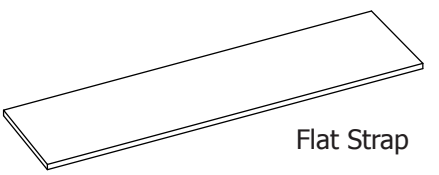
#6 Solid Copperweld LC 30% Dead Soft Annealed



Part No.	Size (AWG)	Diameter	CM Area	Approx. Wt. lbs./M ft.
6CW3D	6	.162	26,240	80

- Contact factory for reel sizes/put ups.

Copper Flat Strap Conductors



Flat Strap

Part No.	Width (Inches)	Thickness (Inches)	Actual Gauge	X-Sectional Area (in.^{2})	Approx. Wt. lbs./M ft.
CUFS58064	.625	.064	14	.0400	154
CUFS1032	1	.032	20	.0320	124
CUFS1516	1.5	.016	26	.0239	93
CUFS15032	1.5	.032	20	.0480	185-1/2
CUFS2016	2	.016	26	.0318	123-1/2
CUFS2032	2	.032	20	.0640	247-1/2
CUFS2064	2	.064	14	.1280	495
CUFS3016	3	.016	26	.0478	186
CUFS3032	3	.032	20	.0960	371
CUFS4016	4	.016	26	.0640	247-1/2
CUFS6016	6	.016	26	.0956	372

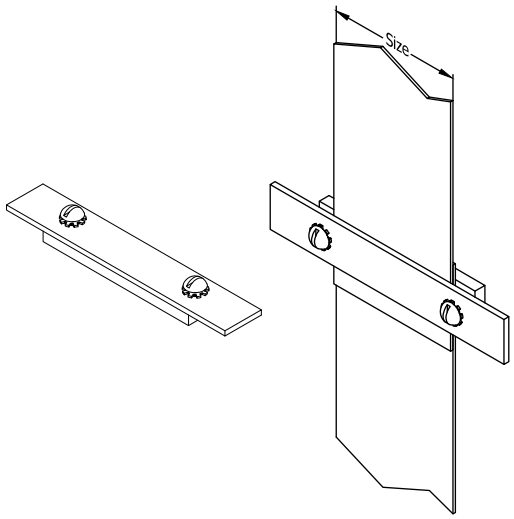
- Contact factory for reel sizes/put ups.

NOTES:
- Most Bare Copper Flat Strap conductors are available tinned. Please add suffix T to part number.
- Other sizes of conductors are available. Please contact factory for more information.

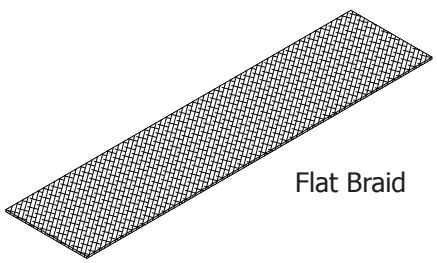
Copper Flat Strap Clamps

Part No.	Strap Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
FSC2	2"	1/2	10	5
FSC3	3"	3/4	10	7-1/2
FSC4	4"	1	10	10
FSC6	6"	1-1/4	10	12-1/2

- Used for making connection to flat strap or flat braid.
- Copper "sandwich" clamps complete with stainless steel hardware. The top is 1/8" thick and the bottom is 1/4" thick.
- Ends are designed to allow for exothermically welding conductors to clamp.



Tinned Copper Flat Braid Conductors

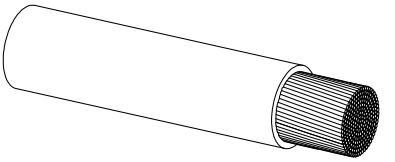

Flat Braid

Part No.	Width (Inches)	Thickness (Inches)	Actual Gauge	Nominal Circ. Mils	Approx. lbs./M ft.
CUFB14030	.25	.030	14	4,200	16
CUFB12094	.50	.094	6	24,120	84
CUFB58062	.625	.062	4	36,000	121
CUFB34062	.75	.062	6	24,120	85
CUFB1062	1	.062	4	38,592	135
CUFB15125	1.5	.125	2/0	120,600	420

- Contact factory for reel sizes/put ups.

NOTES:
- Width and thickness on flat braid items are nominal size (not exact).
- Other sizes of conductors are available. Please contact factory for more information.

Black Insulated Welding Cable



Part No.	Size (AWG)	Voltage Rating	Approx. lbs./M ft.
2WC	2	600V	302
2/0WC	2/0	600V	578
4/0WC	4/0	600V	858

- Contact factory for reel sizes/put ups.

NOTES:
- Rope stranded copper conductor, vinyl separator, insulated with oil and water resistant thermoplastic rubber compound (TPE).
- For connections for electrode holder and grounding clamp to arc welder, bus, welding box or transformer.
- Also suitable for certain 600-volt applications such as battery leads and jumper cables.

Section 1.2

Ground Electrodes & Accessories

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Copper Clad Steel Ground Rods

Part No.	Size	Approx. Each Wt. (lbs.)	Standard Bundle	Approx. Wt. lbs./Bundle	UL Mark	With UPC Label
1208UPC	1/2" x 8'	6	5	30	Yes	Yes
1210	1/2" x 10'	7	5	35	Yes	No
588	5/8" x 8'	7	5	35	Yes	No
588RUS	5/8" x 8'	7	5	35	Yes	No
588UPC	5/8" x 8'	7	5	35	Yes	Yes
5810	5/8" x 10'	9	5	45	Yes	No
5810UPC	5/8" x 10'	9	5	45	Yes	Yes
348	3/4" x 8'	11	5	55	Yes	No
3410	3/4" x 10'	13	5	65	Yes	No
3412	3/4" x 12'	15	5	75	Yes	No
110	1" x 10'	23	3	69	Yes	No



• For more information refer to Ground Rod table on page 335.

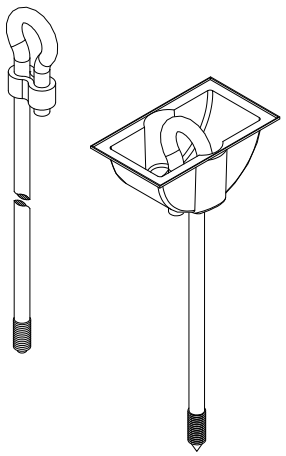
Listed 467

TECHNICAL NOTES:

- **NEC 2011 Article 250.53(G) (Summarized)**
  The electrode shall be installed so that 8' of length is in contact with the soil. It shall be driven to a depth of not less than 8' except where rock bottom is encountered. In the case of bedrock, the electrode shall be driven at an angle not to exceed 45 degrees from the vertical or shall be buried in a trench that is at least 2-1/2' deep.
- **UL 467 6.9.2.3 (Summarized)**
  A solid rod electrode of copper or other suitable non-ferrous metal, or a solid rod electrode of iron or steel with a copper or other suitable non-ferrous metal or stainless steel jacket, shall have a diameter not less than 1/2" thick.
- **UL 467 6.9.2.6 (Summarized)**
  The copper jacket shall not be less than .010" thick at any point.
- **RUS** (Rural Utilities Service) ground rods have a 13 mil copper plating thickness.

Tie Down Ground Rods

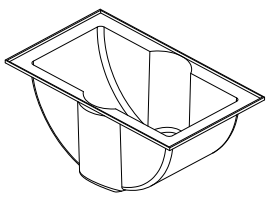
Part No.	Rod Size	Thread Size	Approx. Each Wt. (lbs.)	Standard Bundle	Approx. Wt. lbs./Bundle
3410TD	3/4" x 10'	3/4-10 (1.5" long)	14	5	70
348TD	3/4" x 8'	3/4-10 (1.5" long)	11	5	55
588TD	5/8" x 8'	5/8-11 (1.5" long)	7-1/2	5	37-1/2
586TD	5/8" x 6'	5/8-11 (1.5" long)	6	5	30



- Copper Clad Aircraft Tie Down Ground Rods are manufactured of high strength C1018 cold drawn steel with 0.010" thick copper plating.
- Threads are cold-rolled to provide superior strength.
- Use plastic mold #TDGRDM (sold separately) during installation.
- See page 22 for tool for driving tie down ground rods (34TDDRIVER).

Tie Down Plastic Mold

Part No.	Approx. Each Wt. (lbs.)
TDGRDM	1/4



Solid Copper Ground Rods

Part No.	Size	Approx. Each Wt. (lbs.)	Standard Bundle	Approx. Wt. lbs./Bundle	UL Mark
588C	5/8" x 8'	10	5	50	Yes
5810C	5/8" x 10'	12	5	60	Yes
348C	3/4" x 8'	15	5	75	Yes
3410C	3/4" x 10'	18	5	90	Yes
110C	1" x 10'	31	3	93	Yes



Listed 467

- All rods are full diameter.
- Manufactured from alloy 110 electrolytic tough pitch hard temper copper bar. Meets ASTM B 133 & ASTM B 187.
- For more information refer to Ground Rod table on page 335.

APPLICATION NOTES:

- Solid copper ground electrodes are used when better conductivity and corrosion resistance is preferred.
- Due to softness of solid copper, care must be taken when driving electrode.

Stainless Steel Ground Rods

Part No.	Size	Approx. Each Wt. (lbs.)	Standard Bundle	Approx. Wt. lbs./Bundle	UL Mark
1210SS3	1/2" x 10'	7	5	35	Yes
588SS3	5/8" x 8'	9	5	45	Yes
5810SS3	5/8" x 10'	11	5	55	Yes
3410SS3	3/4" x 10'	15	5	75	Yes



Listed 467

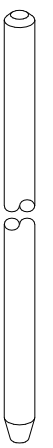
- All rods are full diameter.
- Made from Solid 304 Stainless Steel.
- For more information refer to Ground Rod table on page 335.

TECHNICAL NOTES:

- **UL 467 6.9.2.3 (Summarized)**
  A solid rod electrode of copper or other suitable non-ferrous metal, or a solid rod electrode of iron or steel with a copper or other suitable non-ferrous metal or stainless steel jacket, shall have a diameter not less than 1/2" thick.
- **UL 467 6.9.2.5 (Summarized)**
  The stainless steel jacket mentioned in 9.2.3 shall not be less than .015 inches thick at any point.
- **UL 467 6.9.2.8 (Summarized)**
  The stainless steel jacket mentioned above on a stainless steel rod, shall be formed of an austenitic stainless steel of the 18% chromium, 8% nickel type.
- Stainless steel ground rods are used in corrosive soil conditions.

Galvanized Steel Ground Rods

Part No.	Size	Approx. Each Wt. (lbs.)	Standard Bundle	Approx. Wt. lbs./Bundle	With UPC Label
588G	5/8" x 8'	8	5	40	No
588GUPC	5/8" x 8'	8	5	40	Yes
5810G	5/8" x 10'	10	5	50	No
5810GUPC	5/8" x 10'	10	5	50	Yes
348G	3/4" x 8'	12	5	60	No
3410G	3/4" x 10'	15	5	75	No
126G	1/2" x 6'	4	5	20	No
126GUPC	1/2" x 6'	4	5	20	Yes
128G	1/2" x 8'	6	5	30	No
128GUPC	1/2" x 8'	6	5	30	Yes



- All rods are full diameter.
- For more information refer to Ground Rod table on page 335.

NOTES:

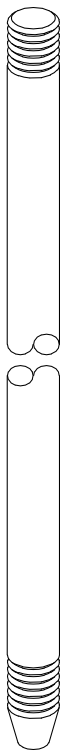
- Manufactured from zinc coated high strength steel.
- Meets requirements of NEMA GR-1.
- Preferred electrode when primary concern is cathodic protection to structure.
- Non UL listed.

Sectional Ground Rods

Sectional Copper Clad Steel Ground Rods

Part No.	Size	Approx. Each Wt. (lbs.)	Standard Bundle	Approx. Wt. lbs./Bundle	UL Mark
S582	5/8" x 2'	2	5	10	No
S583	5/8" x 3'	3	5	15	No
S585	5/8" x 5'	5	5	25	No
S588	5/8" x 8'	7	5	35	Yes
S5810	5/8" x 10'	9	5	45	Yes
S348	3/4" x 8'	11	5	55	Yes
S3410	3/4" x 10'	13	5	65	Yes
S110	1" x 10'	23	3	69	Yes

• All rods are full diameter.
• For more information refer to Ground Rod table on page 335.



Listed 467

Sectional Solid Copper Ground Rods

Part No.	Size	Approx. Each Wt. (lbs.)	Standard Bundle	Approx. Wt. lbs./Bundle	UL Mark
S582C	5/8" x 2'	3	5	15	No
S583C	5/8" x 3'	4	5	20	No
S585C	5/8" x 5'	6	5	30	No
S345C	3/4" x 5'	9	5	45	No
S15C	1" x 5'	16	3	48	No

• All rods are full diameter.

Sectional Stainless Steel Ground Rods

Part No.	Size	Approx. Each Wt. (lbs.)	Standard Bundle	Approx. Wt. lbs./Bundle	UL Mark
S585SS3	5/8" x 5'	6	5	30	No
S588SS3	5/8" x 8'	9	5	45	Yes
S5810SS3	5/8" x 10'	11	5	55	Yes
S3410SS3	3/4" x 10'	15	5	75	Yes

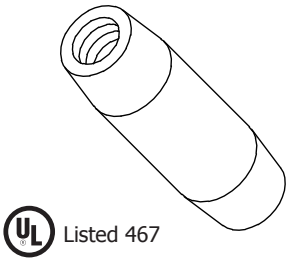
• All rods are full diameter.
• Made from Solid 304 Stainless Steel.

Sectional Stainless Steel Ground Rods Notes:
SS-3 = Type 304 Stainless Steel - Non-ferrous UL listed.
Other sizes available.
Contact factory for details.

APPLICATION NOTES:
- Sectional ground rods are used to help reduce ground resistance in poor soils such as sand and gravel.
- Doubling ground rod length theoretically reduces resistance 40%.

Ground Rod Couplers

Part No.	Ground Rod Size	Material	Box Qty.	Approx. Box Wt. (lbs.)
GRC12	1/2"	Bronze	5	2-1/2
GRC12SS	1/2"	Stainless Steel	5	2-1/2
GRC58	5/8"	Bronze	5	2-1/2
GRC58SS	5/8"	Stainless Steel	5	2-1/2
GRC34	3/4"	Bronze	5	2-1/2
GRC34SS	3/4"	Stainless Steel	5	2-1/2
GRC1	1"	Bronze	5	5
GRC1SS	1"	Stainless Steel	5	5



Listed 467

- Corrosion resistant silicon bronze threaded ground rod coupler for sectional ground rods.
- Also available in stainless steel. Stainless steel couplers are not UL Listed.

Part No.	Ground Rod Size	Box Qty.	Approx. Box Wt. (lbs.)
GRCC58	5/8"	5	2-1/2
GRCC34	3/4"	5	2-1/2



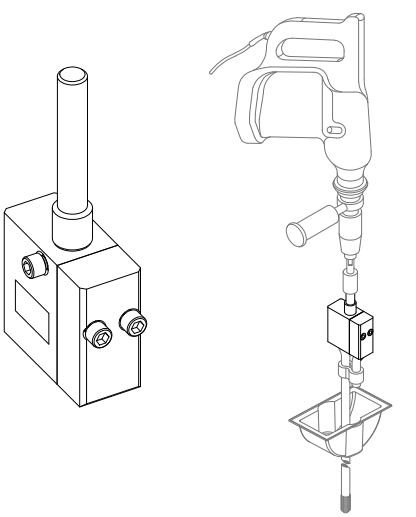
Listed 467

- Corrosion resistant bronze ground rod compression coupler for use on non-sectional copper clad ground rods.

Tie Down Ground Rod Driver

Part No.	Description	Qty.	Approx. Each Wt. (lbs.)
34TDDRIVER	3/4" Ground Rod Driver	EA	11

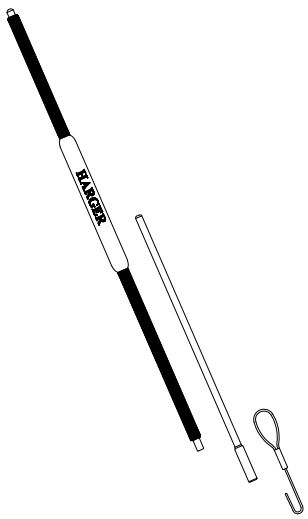
- For driving 3/4" tie down ground rods, #3410TD (see page 19), without deforming the eye loop.
- Manufactured from tool hardened shock resistant steel.
- 3-piece design allows operator to remove tool in case of a jam.
- Driving hammer and 3/4" ground rod drive bit not included.



Ground Rod Driver

Part No.	Description	Ground Rod Size	Qty.	Approx. Each Wt. (lbs.)
GRD58	Driver & 5/8" Insert	1/2" & 5/8"	EA	23
GRD34I	Replacement Insert	3/4"	EA	6

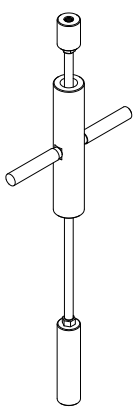
- Drives ground rods from ground level without the need for a ladder or sledge hammer.
- 3/4" insert is interchangeable with driver body.
- Insert prevents driver from slipping off ground rod near ground level.
- Insert prevents "mushrooming" top of ground rod.

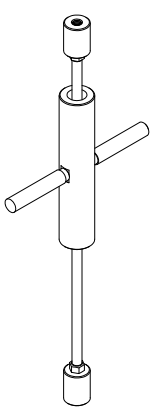


Ground Rod Drivers

Part No.	Description	Qty.	Approx. Each Wt. (lbs.)
SMGRD58U	5/8" Ground Rod Driver	EA	16
SMGRD58USHGR	5/8" Ground Rod Driver	EA	14

- SMGRD58U - Ground rod driver with slide hammer. One end is threaded for use with threaded 5/8" ground rods and the other end is for use with tapered 5/8" copper clad steel ground rods.
- SMGRD58USHGR - Ground rod driver with slide hammer, connects to ground rods with 5/8" threads on both ends.
  - Used to install or remove threaded ground rods.

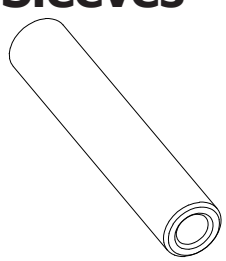

SMGRD58U


SMGRD58USHGR

Drive Sleeves

Part No.	Ground Rod Size	Qty.	Approx. Each Wt. (lbs.)
GRDS58	5/8"	EA	2
GRDS34	3/4"	EA	3

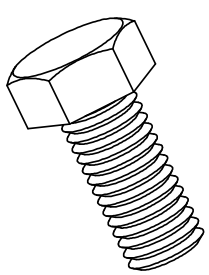
- For Copper Clad Steel ground rods.



- Prevents "mushrooming" top of ground rod while driving rod.

Drive Studs

Part No.	Ground Rod Size	Box Qty.	Approx. Box Wt. (lbs.)
GDS12	1/2"	5	2-1/2
GDS58	5/8"	5	2-1/2
GDS34	3/4"	5	2-1/2
GDS1	1"	3	3

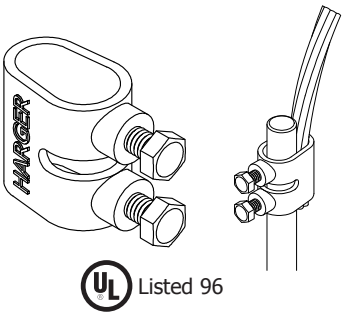


- High strength alloy driving stud prevents damage to the coupler or ground rod threads when driving ground rods.

Ground Rod Clamps

Universal Ground Rod Clamp - Heavy Duty

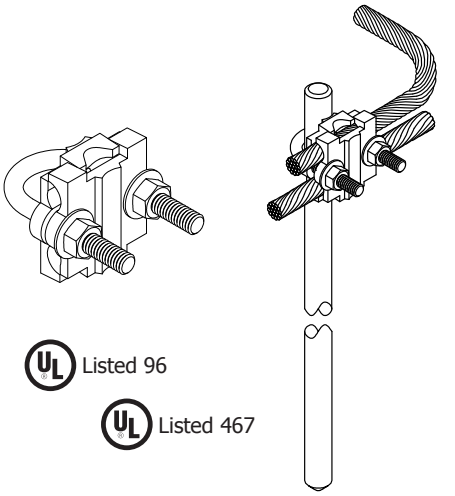
Part No.	Ground Rod Size	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
302U	1/2"	#6 Sol. - 350 MCM	5	5
	5/8"	#6 Sol. - 350 MCM		
	3/4"	#2 Sol. - 250 MCM		



UL Listed 96

- Heavy duty bronze ground rod clamps.
- Provides over 1-1/2 inches of contact area with cables and ground rod.
- Two stainless steel cap screws secure the cable to the ground electrode for a positive electrical connection.

Part No.	Ground Rod Size	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
305	Up thru 1"	#6 - 500 MCM	5	3



UL Listed 96

UL Listed 467

- Bronze ground rod clamp features a stainless steel "U" bolt for strength and corrosion resistance.
- Provides over 1-1/2" of contact between the ground electrode and conductors.
- Accommodates two horizontal conductors thru 250 MCM.
- Accommodates one vertical conductor up to 500 MCM.
- Fits all ground rods through 1" diameter. Ideal for connecting down conductors to ground loop conductors.

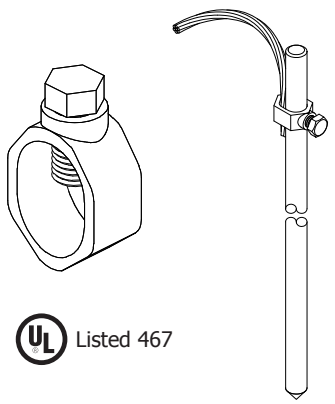
APPLICATION NOTES:

- Ground Rod Clamps for lightning protection systems require 1-1/2" of surface contact between conductor and ground rod.

Ground Rod Clamps

Part No.	Ground Rod Size	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)	UL Mark
300LD	1/2"	10 Sol. - #2 Str.	10	2	Yes
301LD	5/8"	10 Sol. - #2 Str.	10	2	Yes
302LD	3/4"	10 Sol. - #2 Str.	10	2	Yes
303LD	1"	8 Sol. - 4/0	10	6	Yes

- Light duty ground rod clamp.
- Bronze cap screw secures the cable to the ground electrode.
- Commonly called acorn or tear drop clamp.



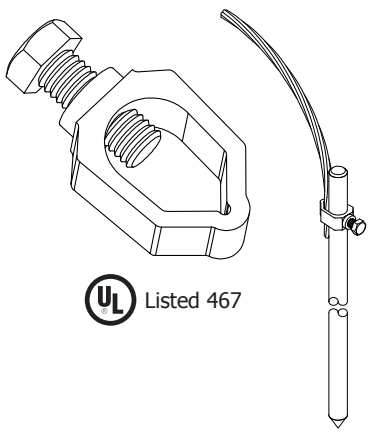
Listed 467

Universal Ground Rod Clamp - Light Duty

Part No.	Ground Rod Size	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)	UL Listed*
302UGRC	3/8"	1/0 - 10 Sol.	10	2	No
	1/2"	1/0 - 10 Sol.	10	2	Yes
	5/8"	1/0 - 10 Sol.	10	2	Yes
	3/4"	1/0 - 8 Sol.	10	2	Yes

- Light duty ground rod clamp for securing cable to ground rod.
- Eliminates the need to inventory assorted different-size clamps.
- Replaces a wide range of products made for economy, standard duty, heavy duty and extra heavy duty applications.
- Made from corrosion resistant silicon bronze.
- Accommodates 3/8" to 3/4" ground rods and #10 Solid to 1/0 Stranded conductor.
- Tested to 300 inch-pounds.

* UL and CSA listed for Direct Burial.



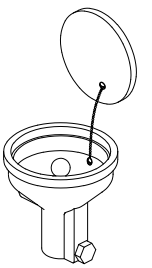
Listed 467

APPLICATION NOTES:

- Ground Rod Clamps for lightning protection systems require 1-1/2" of surface contact between conductor and ground rod.
- Light duty series (300LD, 301LD, 302LD & 302UGRC) acceptable for electrical grounding, but not lightning protection.

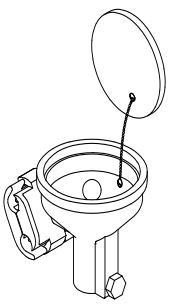
Ground Receptacles

Part No.	Ground Rod Size	Conductor Type	Qty.	Approx. Each Wt. (lbs.)
350-4SS	1/2"	Set Screw	EA	2
350-5SS	5/8"	Set Screw	EA	2
350-6SS	3/4"	Set Screw	EA	2
350-4T	1/2"	Threaded	EA	2
350-5T	5/8"	Threaded	EA	2
350-6T	3/4"	Threaded	EA	2



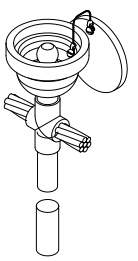
- 350 Series heavy duty bronze floor receptacle features a flush mount cover attached to the main body via a stainless steel ball chain.
- Brass ball stud located inside the receptacle provides the termination point for ground clamps.
- Brass ball stud is removable. Uses 1/2" stud #BBSTUD12.
- Receptacle top is 3" in diameter, height is 3-1/2" tall.

Part No.	Ground Rod Size	Conductor Type	Qty.	Approx. Each Wt. (lbs.)
351-4SS	1/2"	Set Screw	EA	2
351-5SS	5/8"	Set Screw	EA	2
351-6SS	3/4"	Set Screw	EA	2
351-4T	1/2"	Threaded	EA	2
351-5T	5/8"	Threaded	EA	2
351-6T	3/4"	Threaded	EA	2



- Similar to 350 Series except features a bronze dual cable connector.
- Accepts all conductors up to 4/0.
- Brass ball stud is removable. Uses 1/2" stud #BBSTUD12.
- Receptacle top is 3" in diameter, height is 3-1/2" tall.

Part No.	Qty.	Approx. Each Wt. (lbs.)
SGRX	EA	1-1/4

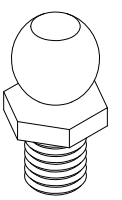


- Ground receptacle designed to be exothermically connected to a ground rod. **See page 320 for mold styles.**
- Brass ball stud is removable. Uses 1/2" stud #BBSTUD12.

APPLICATION NOTES:
- Ground Receptacles are used when temporary grounds must be established.
- Used for grounding aircrafts during refueling.
- 351 Series accept ground loop conductors; important when establishing an equipotential ground plane.

Brass Ball Studs

Part No.	Thread Size	Qty.	Approx. Each Wt. (lbs.)
BBSTUD14	1/4"	EA	1/2
BBSTUD38	3/8"	EA	1/2
BBSTUD12	1/2"	EA	1/2

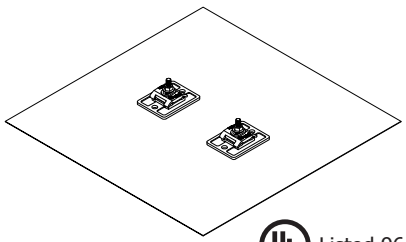


- Used as replacement studs for ground receptacles.
- Can also be mounted on ground bars.
- Brass Ball Stud: 3/4" in diameter, 1-1/2" total length.

Copper Ground Plates

Part No.	Ground Plate Size	Thickness (Inches)	Approx. Each Wt. (lbs.)
335	18" x 18"	.032	6
336	24" x 24"	.032	9

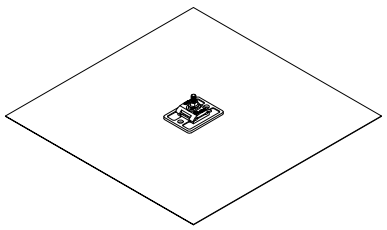
- Copper Ground Plate features two dual cable connectors for a secure electrical connection.



Listed 96

Part No.	Ground Plate Size	Thickness (Inches)	Approx. Each Wt. (lbs.)
335-1	18" x 18"	.032	5
336-1	24" x 24"	.032	8

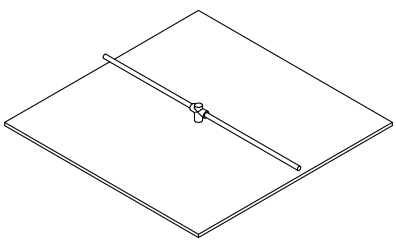
- Same as above except only has a single cable connector.



Listed 96

Part No.	Ground Plate Size	Conductor (AWG)	Approx. Each Wt. (lbs.)
GP18182T	18" x 18"	2T	4
GP18184/0	18" x 18"	4/0	4-1/2
GP24242T	24" x 24"	2T	6-1/2
GP24244/0	24" x 24"	4/0	7

- Copper Ground Plate features an 18" or 24" (depending on the size of the plate) copper conductor exothermically welded to the plate.
- Thickness is .032 inches.



Other sizes and thicknesses are available. Please contact factory for more information.

TECHNICAL NOTES:

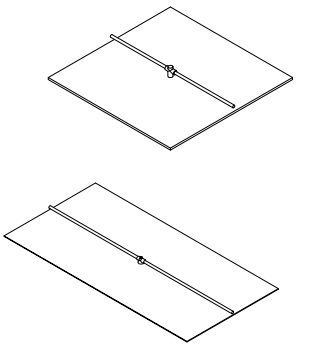
- **NEC 2011 Article 250.52(A)(7) (Summarized)**
  Each plate electrode shall expose not less than 0.186 m^2 (2 ft^2) of surface to exterior soil. Electrodes of non-ferrous metal shall be at least 1.5 mm (0.06 in.) in thickness.
- **NEC 2011 Article 250.53 (A)**
  Rod, Pipe, and Plate Electrodes. Where practicable, rod, pipe and plate electrodes shall be embedded below permanent moisture level. Rod, pipe and plate electrodes shall be free from nonconductive coatings such as paint or enamel.

APPLICATION NOTES:

- Copper Ground Plates are used in areas having little or no top soil.
- Can also be used to enhance ground grid systems.
- Can be used in conjunction with earth enhancement material such as Ultrafill.

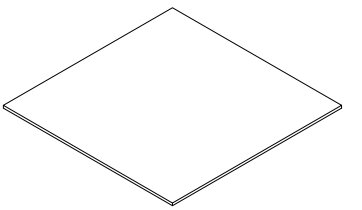
NEC Compliant Copper Ground Plates

Part No.	Ground Plate Size	Conductor (AWG)	Approx. Each Wt. (lbs.)
GP06212122T	12" x 12"	2T	3-1/2
GP06212124/0	12" x 12"	4/0	3-1/2
GP06212242T	12" x 24"	2T	6-1/2
GP06212244/0	12" x 24"	4/0	7



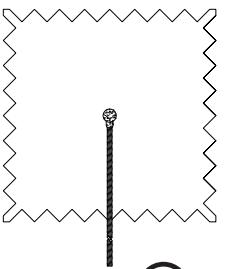
- Copper Ground Plate features a 12" or 24" (depending on the size of the plate) copper conductor exothermically welded to the plate.
- Meets grounding requirements of the National Electrical Code.
- Thickness is .062 inches.

Part No.	Ground Plate Size	Thickness (Inches)	Approx. Each Wt. (lbs.)
GP141818	18" x 18"	.25	27
GP142424N	24" x 24"	.25	47



- 1/4" thick bare copper ground plate.
- Field connection required.
- Meets grounding requirements of the National Electrical Code.

Part No.	Ground Plate Size	Conductor (AWG)	Approx. Each Wt. (lbs.)
GP142424JDP	24" x 24"	4/0	52-1/2



Listed 96

- 1/4" x 24" x 24" ground plate with zig-zag sheared edges provides 66% more edge surface area than conventional ground plates.
- 5' long 4/0-7 strand tail exothermically welded to center of plate.
- Meets grounding requirements of the National Electrical Code.
- Thickness is .25 inches.

Other sizes and thicknesses are available. Please contact factory for more information.

TECHNICAL NOTES:

- **NEC 2011 Article 250.52(A)(7) (Summarized)**
  Each plate electrode shall expose not less than 0.186 m^2 (2 ft^2) of surface to exterior soil. Electrodes of non-ferrous metal shall be at least 1.5 mm (0.06 in.) in thickness.
- **NEC 2011 Article 250.53 (A)**
  Rod, Pipe, and Plate Electrodes. Where practicable, rod, pipe and plate electrodes shall be embedded below permanent moisture level. Rod, pipe and plate electrodes shall be free from nonconductive coatings such as paint or enamel.

APPLICATION NOTES:

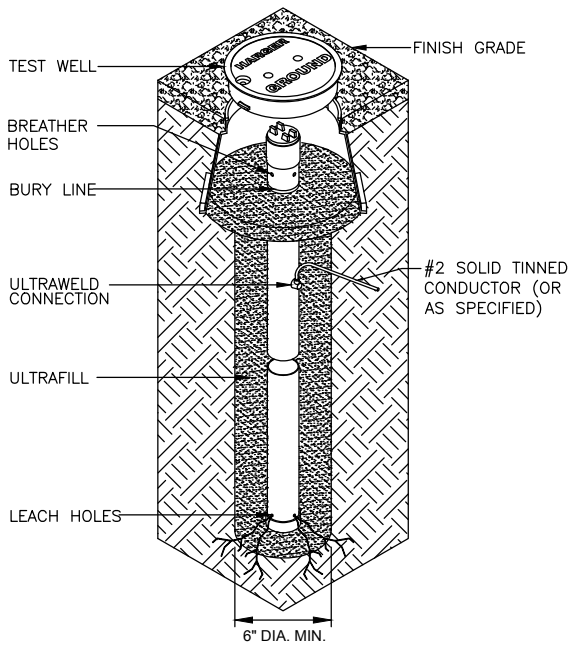
- Copper Ground Plates are used in areas having little or no top soil.
- Can also be used to enhance ground grid systems.
- Can be used in conjunction with earth enhancement material such as Ultrafill.

Enhanced Ground Rods

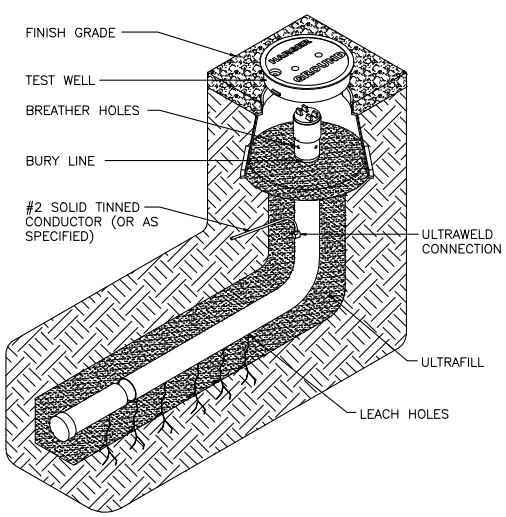
What is an Enhanced Ground Rod?

Simply put, an Enhanced Ground Rod is a conductive hollow tube ground rod, usually manufactured from 300 stainless steel or copper. They contain special hygroscopic, electrolytic salts. These salts form a saline solution by absorbing moisture out of the atmosphere. This saline solution leaches out of the bottom of the rod, which gradually lowers resistivity of the surrounding soil, forming "electrolytic roots" over time.

The salt mixture is critical. Harger utilizes a special combination of Magnesium Sulfate and Calcium Chloride. Calcium Chloride is an "active" salt, which continually draws moisture out of the air and forms the solution. Many other providers of this type of electrode utilize salts such as sodium chloride, some even use common water softener pellets. These salts do not draw moisture out of the air, they must be activated by adding water. This may lower resistivity initially, however, unless water is continually added, the salts dry out over time and resistivity of the electrode goes back up.



Vertical



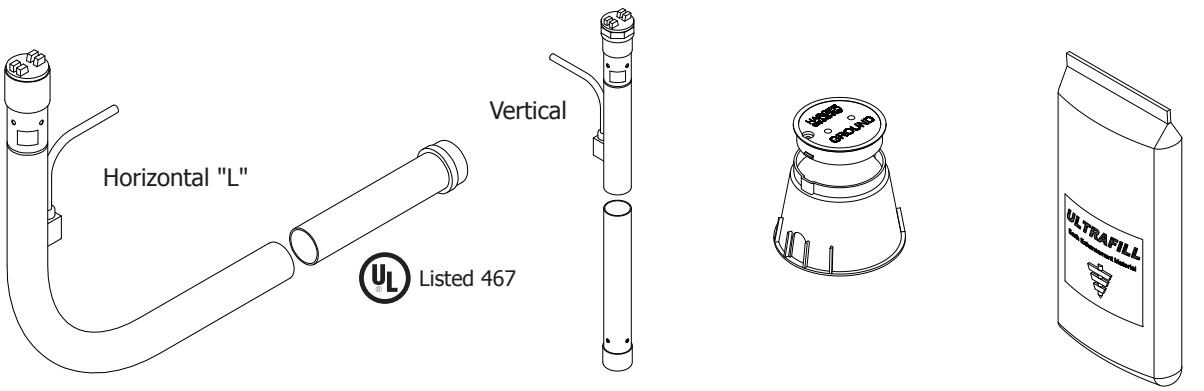
Horizontal

To increase the efficacy of the Enhanced Ground Rod, a very low resistance ground enhancement material is placed around the rod. Harger proudly uses Ultrafill; an ultra-low resistance carbon based material.

Harger exothermically attaches a conductor of your choice to the enhanced ground rod. This conductor is called the tail. The tail direction is very important. Harger provides a design which allows the current, either lightning or electrical fault, to maintain a downward sloping path to ground. Most manufacturers utilize a design which forces lightning to go "uphill" before reaching the ground rod. Some manufactures claim a superior "x" design. Although at first this sounds good, it causes the contractor to make twice as many connections, thus increasing the cost of installation.

Harger offers two basic styles, vertical and horizontal (L-shaped). We also offer a variety of lengths, sectionals and different kits to meet your specific requirements.

Enhanced Ground Rod Numbering System



EGR SS 10 L W G 2T

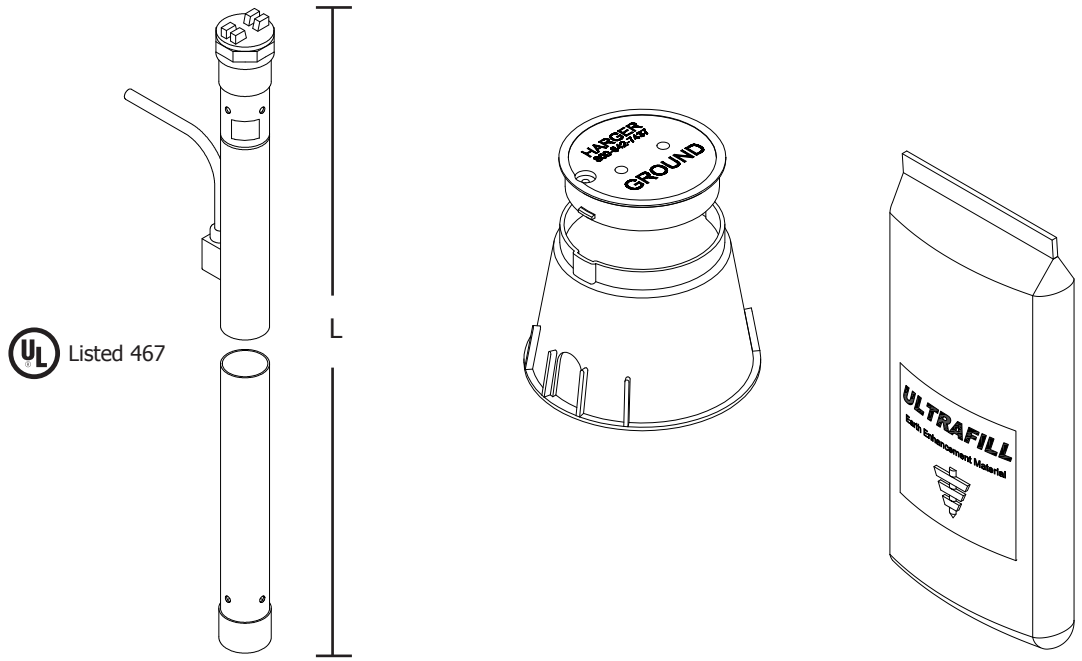
- **EGR** — Enhanced Ground Rod
- **SS** — Material: Copper - Leave Blank; Stainless Steel - Add SS
- **10** — Length (ft.)
- **L** — Style: Vertical - Leave Blank; Horizontal - Add L
- **W** — Inspection Well: Include in Kit - Add W; None Required - Leave Blank
- **G** — Ultrafill Ground Material: Include in Kit - Add G; None Required - Leave Blank
- **2T** — Conductor Type: To specify type and wire code

The Enhanced Ground Rod Numbering System allows you to customize the product to meet your specific needs. In the above example, the product specified is a stainless steel, 10' long, L-shaped ground rod that includes an inspection well and 2 - 50 pound bags of Ultrafill with a #2 solid tinned 5' tail exothermically welded to the rod. The part number is **EGRSS10LWG2T.**

TECHNICAL NOTES:

- **UL 467 6.9.3.1 (Summarized)**
  A hollow-tube, chemically-charged-rod electrode shall:
  a) Be constructed of copper or an equivalent material resistant to the corrosive effects of moist soil;
  b) Have an internal diameter not less than 2 inches and a wall thickness not less than .080 inch; and
  c) If the means of installation is not obvious, be accompanied by adequate installation instructions.
- **UL 467 6.9.3.2 (Summarized)**
  The chemical charge within the rod electrode described in 9.3.1 shall be a substance that does not cause the electrode to corrode at a faster rate than an electrode constructed of 3/4 inch trade size rigid ferrous metal conduit.
- **UL 467 6.9.3.3 (Summarized)**
  With reference to 9.3.2, a chemical charge of 60 percent sodium chloride and 40 percent calcium chloride may be used if the total weight of the charge is less than 11 pounds.

Copper Vertical Enhanced Ground Rod Kits

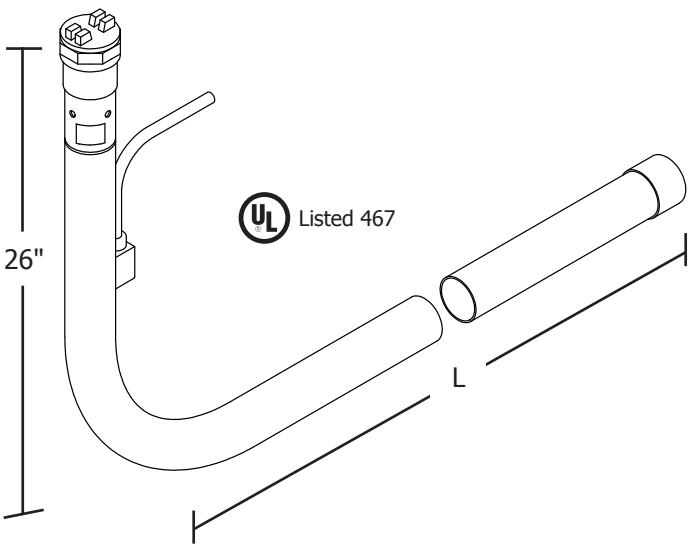


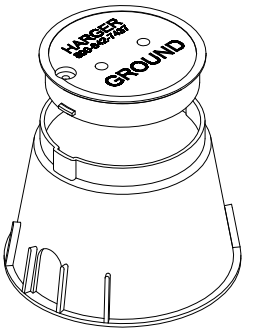
Part No.	Length	Inspection Well	Ultrafill 50# Bag	Tail (Conductor) Type (AWG)	Approx. Shipping Wt. (lbs.)
EGR5WG4/0*	5'	Yes	1	5' - 4/0 Stranded	80
EGR8WG2T	8'	Yes	2	5' - #2 Solid Tinned	135
EGR8WG2/0	8'	Yes	2	5' - 2/0 Stranded	140
EGR8WG4/0	8'	Yes	2	5' - 4/0 Stranded	145
EGR10WG2T	10'	Yes	2	5' - #2 Solid Tinned	185
EGR10WG2/0	10'	Yes	2	5' - 2/0 Stranded	190
EGR10WG4/0	10'	Yes	2	5' - 4/0 Stranded	195
EGR20WG2T	20'	Yes	4	5' - #2 Solid Tinned	320
EGR20WG2/0	20'	Yes	4	5' - 2/0 Stranded	325
EGR20WG4/0	20'	Yes	4	5' - 4/0 Stranded	330

• Other sizes and conductor types available. Contact the factory for details.
* 5' enhanced ground rods are not UL listed.

APPLICATION NOTES:
- Enhanced grounds are used in high resistivity soil conditions and when low resistance ground electrode systems are critical.
- Conductor is welded 18" down from the top.
- Outside diameter of copper tube is 2-1/8".

Copper Horizontal L-shaped Enhanced Ground Rod Kits





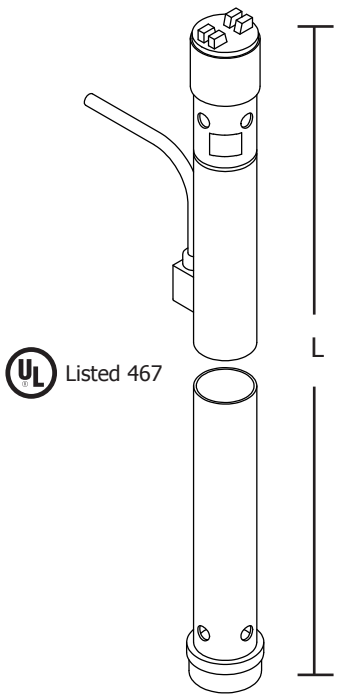


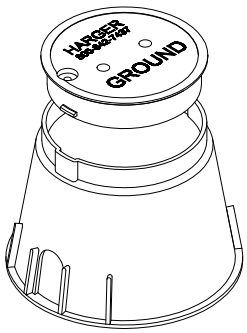
Part No.	Dims H* x L*	Inspection Well	Ultrafill 50# Bag	Tail (Conductor) Type (AWG)	Approx. Shipping Wt. (lbs.)
EGR8LWG2T	2' x 8'	Yes	2	5' - #2 Solid Tinned	150
EGR8LWG2/0	2' x 8'	Yes	2	5' - 2/0 Stranded	155
EGR8LWG4/0	2' x 8'	Yes	2	5' - 4/0 Stranded	160
EGR10LWG2T	2' x 10'	Yes	2	5' - #2 Solid Tinned	205
EGR10LWG2/0	2' x 10'	Yes	2	5' - 2/0 Stranded	210
EGR10LWG4/0	2' x 10'	Yes	2	5' - 4/0 Stranded	215
EGR20LWG2T	2' x 20'	Yes	4	5' - #2 Solid Tinned	340
EGR20LWG2/0	2' x 20'	Yes	4	5' - 2/0 Stranded	345
EGR20LWG4/0	2' x 20'	Yes	4	5' - 4/0 Stranded	350

• Other sizes and conductor types available. Contact the factory for details.
* Nominal dimensions.

APPLICATION NOTES:
- Enhanced grounds are used in high resistivity soil conditions and when low resistance ground electrode systems are critical.
- L-shaped enhanced ground rods are used when proper depth cannot be achieved due to physical conditions such as bedrock.
- Conductor is welded 11" down from the top.
- Outside diameter of copper tube is 2-1/8".

Stainless Steel Vertical Enhanced Ground Rod Kits







Part No.	Length	Inspection Well	Ultrafill 50# Bag	Tail (Conductor) Type (AWG)	Approx. Shipping Wt. (lbs.)
EGRSS5WG4/0*	5'	Yes	1	5' - 4/0 Stranded	80
EGRSS8WG2T	8'	Yes	2	5' - #2 Solid Tinned	135
EGRSS8WG2/0	8'	Yes	2	5' - 2/0 Stranded	140
EGRSS8WG4/0	8'	Yes	2	5' - 4/0 Stranded	145
EGRSS10WG2T	10'	Yes	2	5' - #2 Solid Tinned	185
EGRSS10WG2/0	10'	Yes	2	5' - 2/0 Stranded	190
EGRSS10WG4/0	10'	Yes	2	5' - 4/0 Stranded	195
EGRSS20WG2T	20'	Yes	4	5' - #2 Solid Tinned	320
EGRSS20WG2/0	20'	Yes	4	5' - 2/0 Stranded	325
EGRSS20WG4/0	20'	Yes	4	5' - 4/0 Stranded	330

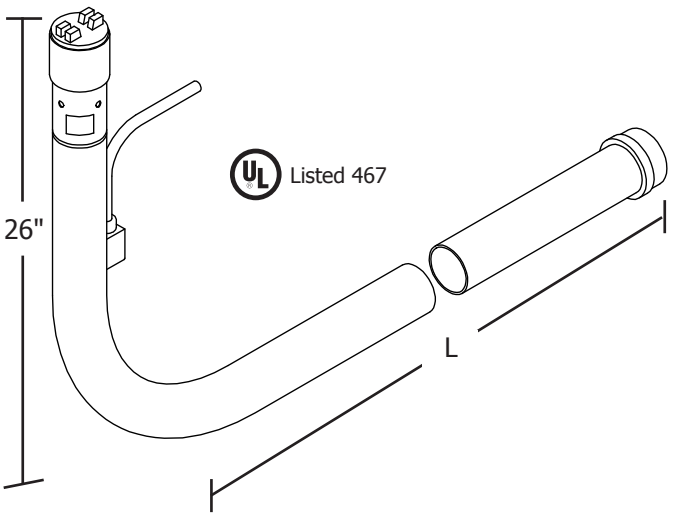
- Manufactured from corrosion resistant 300 series stainless steel.
- Other sizes and conductor types available. Contact the factory for details.

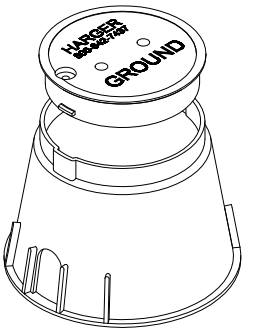
* 5' enhanced ground rods are not UL listed.

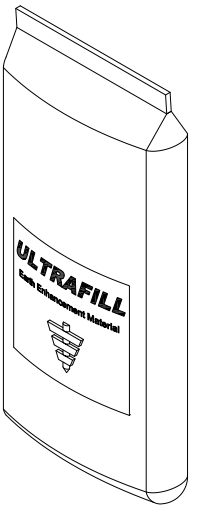
APPLICATION NOTES:

- Enhanced grounds are used in high resistivity soil conditions and when low resistance ground electrode systems are critical.
- Excellent for corrosive soils or cathodic protection applications.
- Conductor is welded 18" down from the top.
- Outside diameter of stainless steel tube is 2-3/8".

Stainless Steel Horizontal L-shaped Enhanced Ground Rod Kits







Part No.	Dims. H* x L*	Inspection Well	Ultrafill 50# Bag	Tail (Conductor) Type (AWG)	Approx. Shipping Wt. (lbs.)
EGRSS8LWG2T	2' x 8'	Yes	2	5' - #2 Solid Tinned	150
EGRSS8LWG2/0	2' x 8'	Yes	2	5' - 2/0 Stranded	155
EGRSS8LWG4/0	2' x 8'	Yes	2	5' - 4/0 Stranded	160
EGRSS10LWG2T	2' x 10'	Yes	2	5' - #2 Solid Tinned	205
EGRSS10LWG2/0	2' x 10'	Yes	2	5' - 2/0 Stranded	210
EGRSS10LWG4/0	2' x 10'	Yes	2	5' - 4/0 Stranded	215
EGRSS20LWG2T	2' x 20'	Yes	4	5' - #2 Solid Tinned	340
EGRSS20LWG2/0	2' x 20'	Yes	4	5' - 2/0 Stranded	345
EGRSS20LWG4/0	2' x 20'	Yes	4	5' - 4/0 Stranded	350

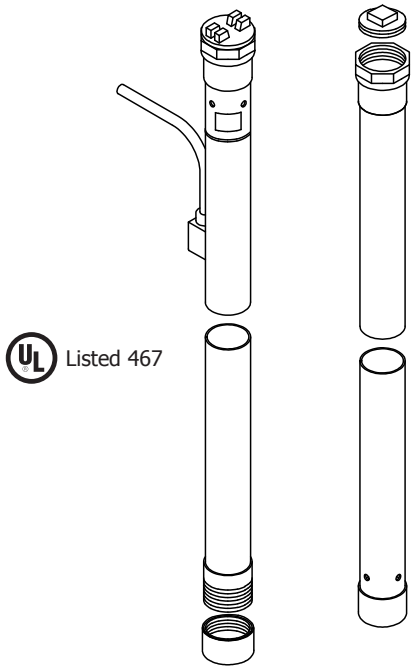
- Manufactured from corrosion resistant 300 series stainless steel.
- Other sizes and conductor types available. Contact the factory for details.

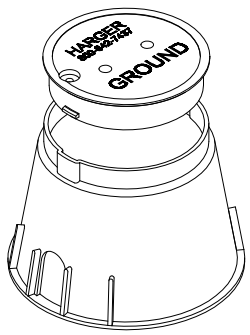
* Nominal Dimensions

APPLICATION NOTES:

- Enhanced grounds are used in high resistivity soil conditions and when low resistance ground electrode systems are critical.
- L-shaped enhanced ground rods are used when proper depth cannot be achieved due to physical conditions such as bedrock.
- Excellent for corrosive soils or cathodic protection applications.
- Conductor is welded 11" down from the top.
- Outside diameter of stainless steel tube is 2-3/8".

Copper Sectional Enhanced Ground Rod Kits







Part No.	Overall Length	Section Length	Inspection Well	Ultrafill 50# Bag	Tail (Conductor) Type (AWG)	Approx. Shipping Wt. (lbs.)
SEGR10WG2T	10'	5'	Yes	2	5' - #2 Solid Tinned	185
SEGR10WG2/0	10'	5'	Yes	2	5' - 2/0 Stranded	190
SEGR10WG4/0	10'	5'	Yes	2	5' - 4/0 Stranded	195
SEGR20WG2T	20'	10'	Yes	4	5' - #2 Solid Tinned	320
SEGR20WG2/0	20'	10'	Yes	4	5' - 2/0 Stranded	325
SEGR20WG4/0	20'	10'	Yes	4	5' - 4/0 Stranded	330
SEGR30WG2T	30'	15'	Yes	6	5' - #2 Solid Tinned	450
SEGR30WG2/0	30'	15'	Yes	6	5' - 2/0 Stranded	455
SEGR30WG4/0	30'	15'	Yes	6	5' - 4/0 Stranded	460
SEGR40WG2T	40'	20'	Yes	8	5' - #2 Solid Tinned	585
SEGR40WG2/0	40'	20'	Yes	8	5' - 2/0 Stranded	590
SEGR40WG4/0	40'	20'	Yes	8	5' - 4/0 Stranded	595

• Other size conductors available. Contact the factory for details.

APPLICATION NOTES:
- Used where there are vertical height restrictions or when lengths greater than 20' are desired.
- Conductor is welded 18" down from the top.
- Outside diameter of copper tube is 2-1/8".

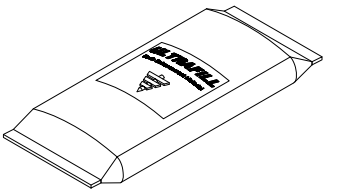
Ultrafill - Earth (Ground) Enhancement Material

Ultrafill is a low resistance carbon based backfill material, which dramatically lowers ground system resistance in difficult soil situations. Ultrafill contains no bentonite or concrete components, which, in very dry conditions, can cause shrinkage around the ground electrode, thus rendering it ineffective.

Ultrafill is ideal for use in rocky soil, sand, gravel or any other high resistance soil conditions. It is also the ideal backfill material for use around enhanced ground rods and ground grid systems.

Ultrafill is easy to use, safe and effective. Unlike other backfill products, Ultrafill is relatively dust free and does not require mixing in water prior to installation.

Ultrafill may be either used in a horzontal trench or grid, or in vertical applications. Ultrafill is available in 25 and 50 pound coated woven polypropylene bags.

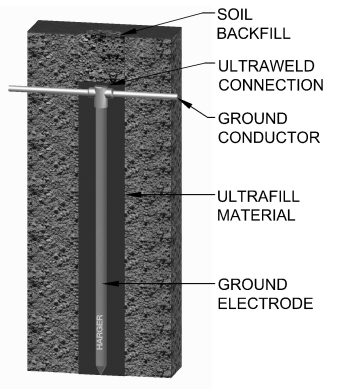


Part No.	Approx. Wt.
ULTRAFILL25	25 lbs.
ULTRAFILL	50 lbs.

Installation Instructions

Vertical Applications:

Auger hole to required depth. Insert electrode in center of hole. Pour Ultrafill to proper depth. The chart located to the right will help determine how much Ultrafill will be required.

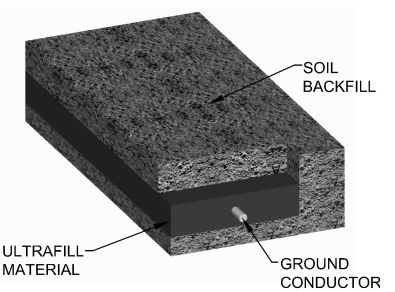


Pounds of Ultrafill Required Per Foot		
Hole Size	5/8" Ground Rod	2" EGR
4"	3.5	2.7
6"	8.1	7.3
8"	14.5	13.6
10"	22.6	21.8
12"	32.6	31.8

For example, placing a 5/8" x 10' ground rod in a 4" hole would require 35 pounds of Ultrafill. (3.5 x 10 = 35 pounds)

Horizontal Applications:

Pour enough Ultrafill to cover bottom of trench. Place the ground electrode into trench. Pour in additional Ultrafill to cover electrode to the desired depth.



Pounds of Ultrafill Required Per Foot				
Trench Width	Thickness of Ultrafill (Inches)			
	1"	2"	3"	4"
4"	1.2	2.3	3.5	4.6
6"	1.7	3.5	5.2	6.9
8"	2.3	4.6	6.9	9.3
10"	2.5	5.8	8.7	11.6
12"	3.5	6.9	10.4	13.9

For example, using 2" of material in a 6" wide by 10' long trench would require 35 pounds of Ultrafill. (3.5 x 10 = 35 pounds)

Liquid Mixing Instructions:

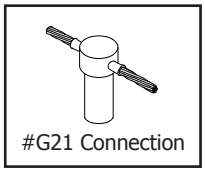
To mix Ultrafill into a slurry for pumping applications, use the following formula:

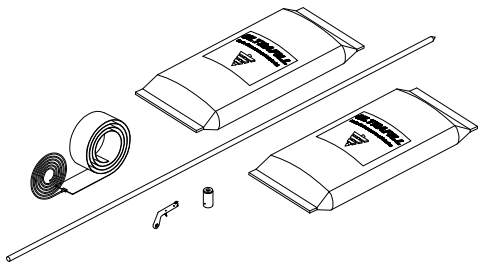
6 parts water
1 part bentonite
1 part Ultrafill.

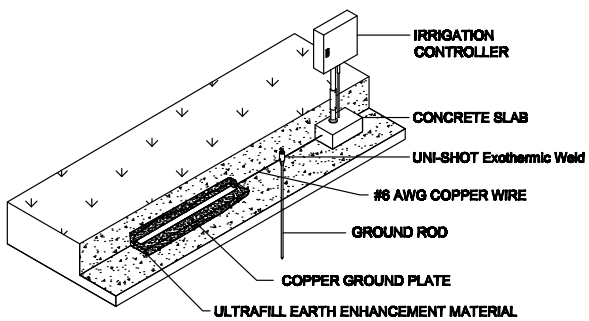
Irrigation Grounding Kits

Part No.	Approx. Wt.
IRRGRDKIT1	117 lbs.

- For grounding and lightning protection of golf course irrigation systems.
- **Kit includes:**
  (1) 5/8" x 8' ground rod
  (2) 50 lb. bags of Ultrafill earth enhancement material
  (1) Flint igniter
  (1) #G21-588 Uni-shot exothermic weld metal
  (1) 8' copper plate with a 25' tail of #6 AWG wire

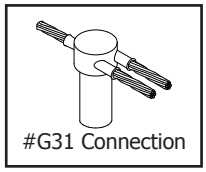

#G21 Connection

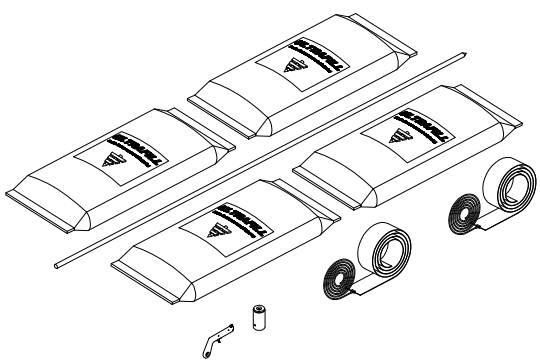


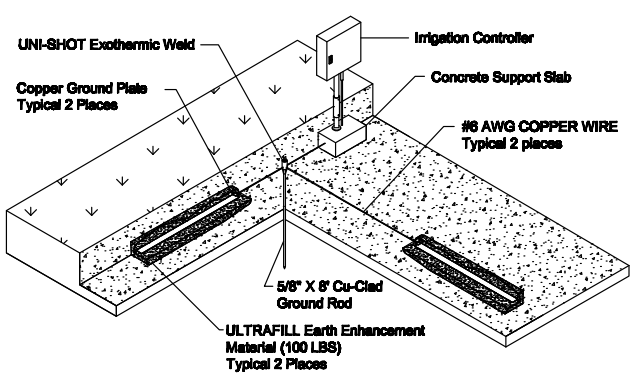


Part No.	Approx. Wt.
IRRGRDKIT2	227 lbs.

- For grounding and lightning protection of golf course irrigation systems.
- Used when connecting two kits to single irrigation controller.
- **Kit includes:**
  (1) 5/8" x 8' ground rod
  (4) 50 lb. bags of Ultrafill earth enhancement material
  (1) Flint igniter
  (1) #G31-588 Uni-shot exothermic weld metal
  (2) 8' copper plate with a 25' tail of #6 AWG wire


#G31 Connection

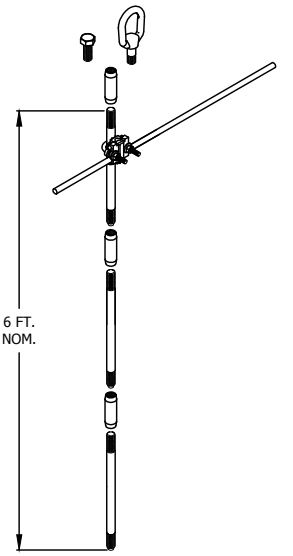




Mobile Ground Stake Kits

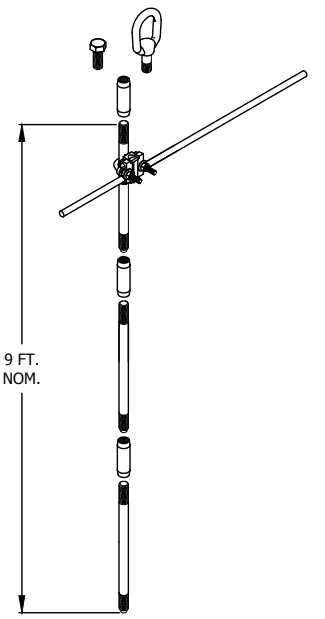
Part No.	Approx. Each Wt. (lbs.)
MOBGRDSTK582	14

- Consists of three 5/8" x 2' copper clad sectional ground rods, thus achieving an overall depth of 6'.
- Also contains three 5/8" ground rod couplers, one 5/8" drive stud, one u-bolt ground rod clamp and one 5/8" eyelet.



Part No.	Approx. Each Wt. (lbs.)
MOBGRDSTK583	20

- Consists of three 5/8" x 3' copper clad sectional ground rods, thus achieving an overall depth of 9'.
- Also contains three 5/8" ground rod couplers, one 5/8" drive stud, one u-bolt ground rod clamp and one 5/8" eyelet.



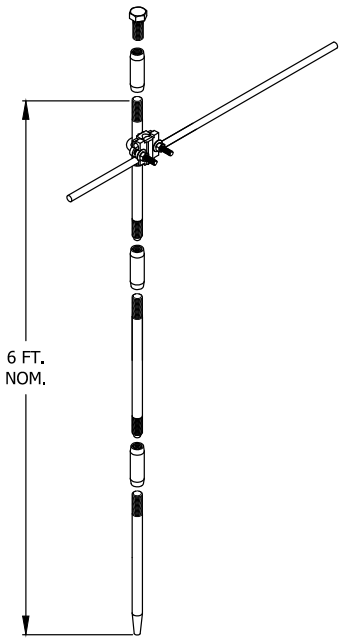
APPLICATION NOTES:

- Mobile ground stakes provide temporary grounds for military communications vehicles, tanks, COWs (Cell-site On Wheels), etc. Usually a ground loop is installed around the vehicle to help provide an equipotential ground plane. Eyelet provides for easy means of removal.

Mobile Ground Stake Kits

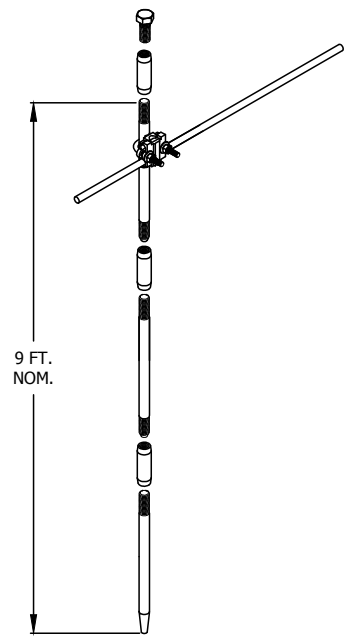
Part No.	Approx. Each Wt. (lbs.)
582GTEKIT	13-1/4

- NSN 5975-01-497-0438
- Consists of three 5/8" x 2' copper clad sectional ground rods, thus achieving an overall depth of 6'.
- Also contains three 5/8" ground rod couplers, one 5/8" drive stud and one u-bolt ground rod clamp.
- Bottom rod has tappered end to facilitate driving.



Part No.	Approx. Each Wt. (lbs.)
583GTEKIT	19-1/4

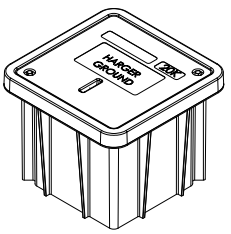
- NSN 5975-01-497-1496
- Consists of three 5/8" x 3' copper clad sectional ground rods, thus achieving an overall depth of 9'.
- Also contains three 5/8" ground rod couplers, one 5/8" drive stud and one u-bolt ground rod clamp.
- Bottom rod has tappered end to facilitate driving.



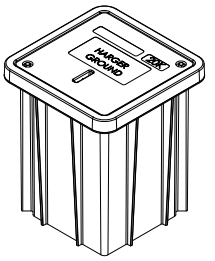
APPLICATION NOTES:

- Mobile ground stakes provide temporary grounds for military communications vehicles, tanks, COWs (Cell-site On Wheels), etc. Usually a ground loop is installed around the vehicle to help provide an equipotential ground plane. Eyelet provides for easy means of removal.

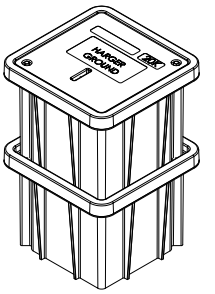
Ground Access Wells



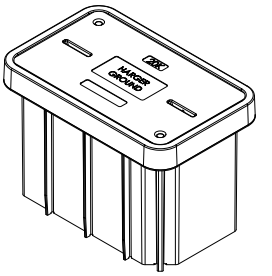
GAW121212HD



GAW121218HD



GAW121224HD*



GAW132418HD

Light Weight Polymer Concrete

Part No.	Dimensions	Approx. Each Wt. (lbs.)
GAW121212HD	12" x 12" x 12" deep	52
GAW121218HD	12" x 12" x 18" deep	57
GAW121224HD*	12" x 12" x 24" deep	67
GAW132418HD	13" x 24" x 18" deep	97-1/2

- Lid & Grade Ring manufactured from 20,000 PSI high density polymer concrete.
- Body manufactured from sheet molding compound for exceptional toughness and reduced weight.
- Comes with 20,000# rated covers.
- Suitable for installation and use through a temperature range of -40°C to +90°C.
- Gray color.

* GAW121224HD is a two piece stackable, each 12" high.

ASTM C-857 Specifications

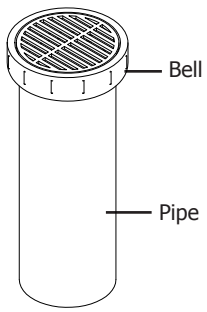
Cover Type	Cover Ratings	Live Load	30% Safety	Test Load	Test Area
Heavy Duty	10 Ton GVW (20,000#)	8,000#	10,400#	22,568#	10" x 10"
20,000# boxes and covers may be placed in locations that may see occasional non-deliberate heavy vehicles.					
Covers exceed their rating by at least 20% and exceed ASTM test loads. No polymer concrete box or cover should be placed in a full traffic, H-20, application. Meets W.U.C. 3.6.					

- GVW = Gross Vehicle Weight

Ground Access Wells

Tile Well with Grated Cover

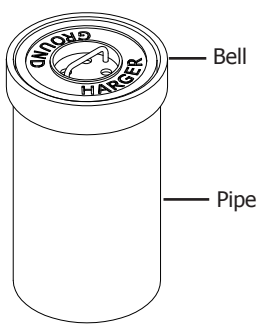
Part No.	Nominal Size	Length	Bell I.D. Minimum	Pipe I.D. (Approx.)	Cover Type	Approx. Each Wt. (lbs.)
358T	8"	24"	10-1/2"	8"	Cast Iron Grated	57
360T	10"	24"	12-3/4"	10"	Cast Iron Grated	83
362T	12"	24"	15-1/8"	12"	Cast Iron Grated	140
368T	18"	24"	22-1/4"	18"	Cast Iron Grated	222



- Available in 8", 10", 12" and 18" diameters.
- Diameter is measured on inside diameter of access well bottom.
- Must be shipped by truck only.

Tile Well with Concrete Cover

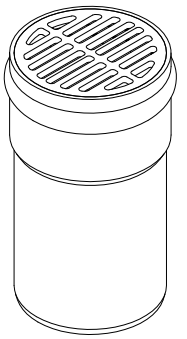
Part No.	Nominal Size	Length	Bell I.D. Minimum	Pipe I.D. (Approx.)	Cover Type	Approx. Each Wt. (lbs.)
358TC	8"	24"	10-1/2"	8"	Concrete	70
360TC	10"	24"	12-3/4"	10"	Concrete	97
362TC	12"	24"	15-1/8"	12"	Concrete	151



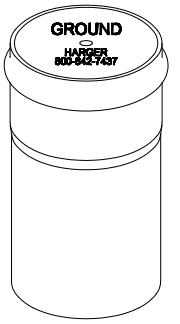
- Available in 8", 10" and 12" diameters.
- Diameter is measured on inside diameter of access well bottom.
- Must be shipped by truck only.

APPLICATION NOTES:
- Provides ready access to ground electrode for testing and inspection purposes.
- To prevent displacement by frost, the access well must be longer than the frost line is deep.

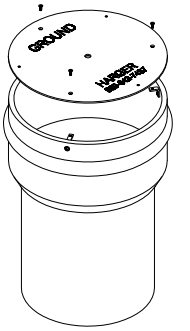
Ground Access Wells



360PBG



360PBS



360PBSTP

PVC Belled Hub Wells with Cover

Part No.	Diameter	Length	Cover Type	Approx. Each Wt. (lbs.)
360PBG	10"	24"	Cast Iron Grated	20
360PBS	10"	24"	Flat Steel	19
360PBSTP	10"	24"	Tamper Resistant	27
362PBG	12"	24"	Cast Iron Grated	28
362PBS	12"	24"	Flat Steel	26
362PBSTP	12"	24"	Tamper Resistant	28
368PBG	18"	24"	Cast Iron Grated	71
368PBS	18"	24"	Flat Steel	58
368PBSTP	18"	24"	Tamper Resistant	58

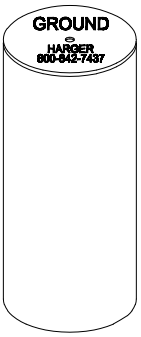
- Available in 10", 12" and 18" diameters.
- Schedule 40 PVC wells feature a belled hub.
- Flat steel covers are 3/16" thick commercial grade steel with a zinc/ultraseal coating.
- Other lids available. See page 45.

APPLICATION NOTES:
- Provides ready access to ground electrode for testing and inspection purposes.
- To prevent displacement by frost, the access well must be longer than the frost line is deep.

Ground Access Wells

PVC Well with Cover

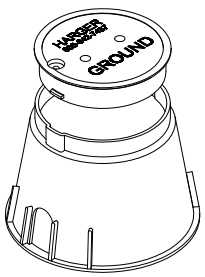
Part No.	Diameter	Length	Cover Type	Approx. Each Wt. (lbs.)
358PP	8"	24"	Plastic	12
358PS	8"	24"	Flat Steel	14
360PP	10"	24"	Plastic	15
360PS	10"	24"	Flat Steel	19
362PS	12"	24"	Flat Steel	22



- Schedule 40 PVC well.
- Steel covers are 3/16" thick commercial grade steel with a zinc/ultraseal coating.
- Plastic covers are manufactured from High Density Polyethylene.

HDPE Well with Cover

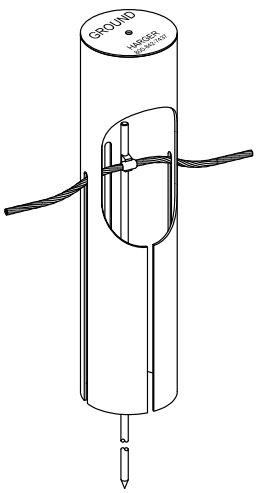
Part No.	Diameter	Length	Cover Type	Approx. Each Wt. (lbs.)
GAW910	9"	10-1/4"	HDPE	4-1/2



- Molded High Density Polyethylene well features a 9" diameter "twist lock" cover with locking bolt.
- Static vertical load rating = 350 PSF.
- 2 knock outs (mouse holes) allow for routing conductor to the inside.
- For use in non-vehicular traffic areas.

PVC Slotted Well with Cover

Part No.	Diameter	Length	Cover Type	Approx. Each Wt. (lbs.)
358P42	8"	42"	Flat Steel	19
358PP42	8"	42"	Plastic	17
360P42	10"	42"	Flat Steel	30
360PP42	10"	42"	Plastic	26



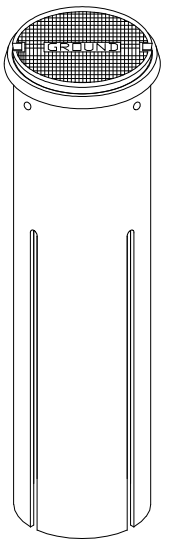
- Schedule 40 PVC well.
- Steel covers are 3/16" thick commercial grade steel with a zinc/ultraseal coating.
- Plastic covers are manufactured from High Density Polyethylene.
- Four 27" slots allow for ground electrode connections to be made before installation of test well.

APPLICATION NOTES:
- Provides ready access to ground electrode for testing and inspection purposes.
- To prevent displacement by frost, the access well must be longer than the frost line is deep.

Ground Access Wells

Access Well with 10" Cast Iron Cover

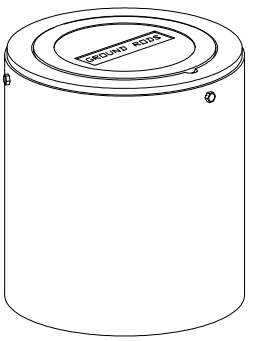
Part No.	Diameter	Length	Cover Type	Approx. Each Wt. (lbs.)
360P36CILS80	10"	36"	Cast Iron	61
360P36CILS80TP	10"	36"	Tamper Resistant	61
360P42CILS80	10"	42"	Cast Iron	67
360P42CILS80TP	10"	42"	Tamper Resistant	67



- 10" diameter Schedule 80 PVC well.
- Available in 36" and 42" lengths.
- Four 27" slots allow for ground electrode connections to be made before installation of test well.
- Cast iron cover fits into cast iron ring for extra support.
- For use in traffic areas.

Access Well with 12" Cast Iron Cover

Part No.	Diameter	Length	Cover Type	Approx. Each Wt. (lbs.)
362PS12CILS80	12"	12"	Cast Iron	42
362PS24CILS80	12"	24"	Cast Iron	61
362PS30CILS80	12"	30"	Cast Iron	68



- 12" diameter Schedule 80 PVC well.
- Available in 12", 24" and 30" lengths.
- Cast iron cover fits into cast iron ring for extra support.
- For use in traffic areas.

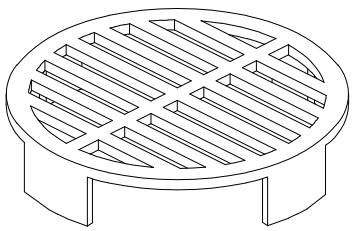
APPLICATION NOTES:
- Provides ready access to ground electrode for testing and inspection purposes.
- To prevent displacement by frost, the access well must be longer than the frost line is deep.

Ground Access Well Covers

Ground access well covers are available in cast iron grated, flat steel, plastic and concrete.

Cast Iron Grated Covers

Part No.	Diameter	Fits Test Well	Approx. Each Wt. (lbs.)
10PBG	10-1/4"	358T & 360PBG	7
12PBG	12-1/2"	360T & 362PBG	10
12TG	14-3/4"	362T	18
18PBG	18-3/8"	368PBG	29
18TG	22"	368T	36



Flat Steel Covers

Part No.	Diameter	Fits Test Well	Approx. Each Wt. (lbs.)
8PS	8-5/8"	358PS & 358P42	3
10PS	10-5/8"	360PS & 360P42	5
10PBS	11-1/4"	360PBS	6
12PBS	13-1/4"	362PBS	7
12PS	12-3/4"	362PS	8
18PBS	19-7/8"	368PBS	16

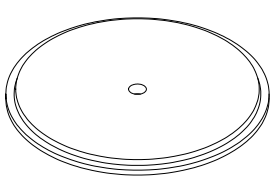
- Manufactured from 3/16" commercial grade steel with a zinc/ultraseal coating.



Plastic Covers

Part No.	Diameter	Fits Test Well	Approx. Each Wt. (lbs.)
6PP	6-5/8"	356PP	1
8PP	8-5/8"	358PP & 358PP42	1
10PP	10-3/4"	360PP & 360PP42	2

- Manufactured from High Density Polyethylene.


Inverted View of Cover

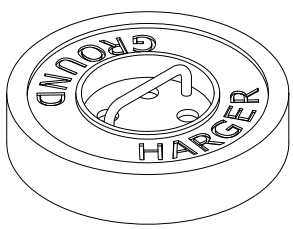


Top View of Cover

Concrete Covers

Part No.	Diameter	Fits Test Well	Approx. Each Wt. (lbs.)
8CC	10-7/8" x 2"	358TC	16
10CC	12-1/2" x 2"	360TC	24
12CC	14-3/4" x 2-3/4"	362TC	29

- Specifically made for Tile Access Wells.



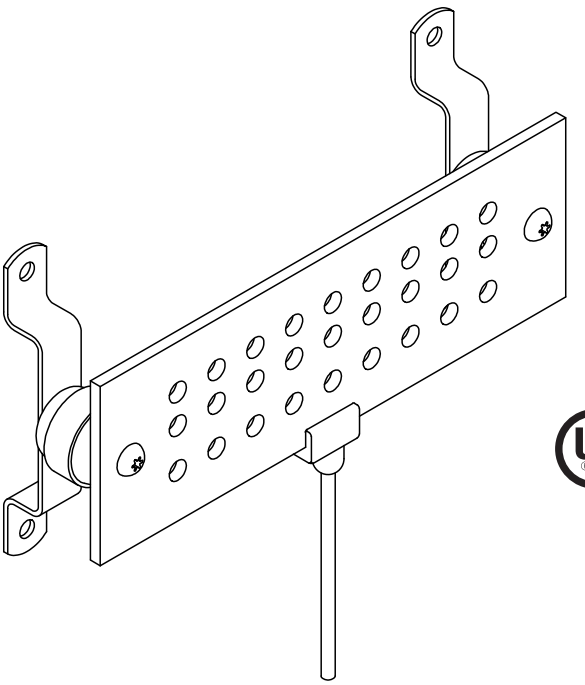
Section 1.3

Ground Bars & Accessories

Index

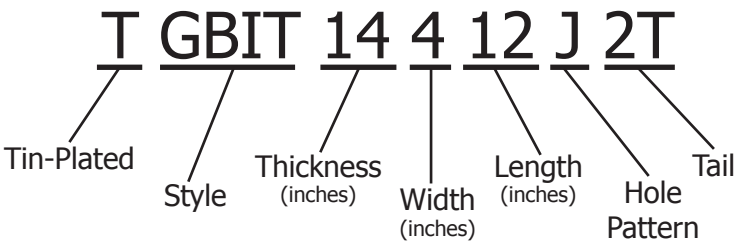
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1.3.4	Custom Ground Bars Design Sheet	53
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Harger Ground Bar Numbering System



Listed 467

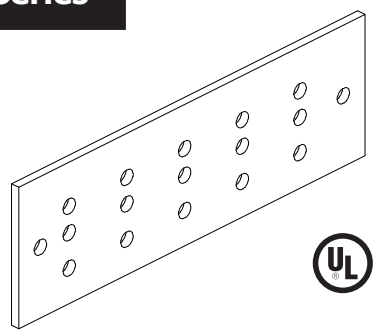
Simply follow the steps outlined below to specify the style and size of the ground bar you need. The following example is a ground bar with wall mounting brackets, insulators, and an exothermically welded tail. The ground bar is tin plated 1/4" thick, 4" wide and 12" long. It has a hole pattern "J" with a No. 2 AWG solid tinned tail.



1. **Style:** GB - Plain ground bar.
   GBA - Ground bar with stainless steel angle adapters.
   GBI - Ground bar with wall mounting brackets and insulators.
   HDGBI - Ground bar with heavy duty wall mounting brackets and insulators.
   GBIT - Ground bar with wall mounting brackets, insulators and a 25' exothermically welded tail.
   GBT - Ground bar with tail only.
   GBS - Ground bar with standoff insulators only.
   GBB - Ground bar with brackets only.
   BGB - Bent ground bar.
   GBIP - Ground bar with insulators, wall mounting brackets and plexiglass cover.
   GBIA - Ground bar with insulators and stainless steel angle adapters.
   GBU - Ground bar with insulators, wall mounting brackets and zinc plated malleable beam clamps.
2. **Size:** Thickness, width, length in inches.
3. **Hole Pattern:** See Pages 51-52 to specify hole pattern.
4. **Tail:** Specify American Wire Gauge (AWG) size and stranding required. 25' length is standard unless otherwise requested.
5. **T:** Prefix designates electro-tin plated ground bar.

Ground Bar Styles

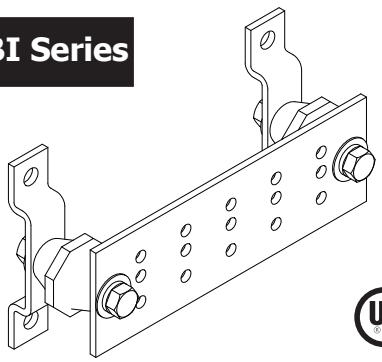
GB Series



Listed 467

Plain **G**round **B**ar

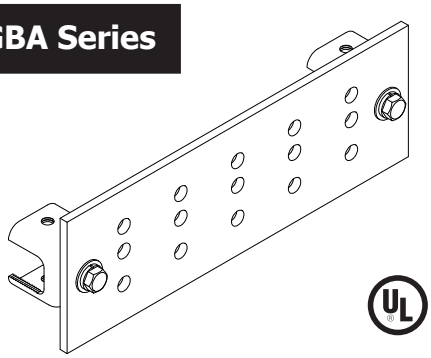
HDGBI Series



Listed 467

Heavy **D**uty **G**round Bar with Heavy Duty Wall Mounting **B**rackets and **I**nsulators

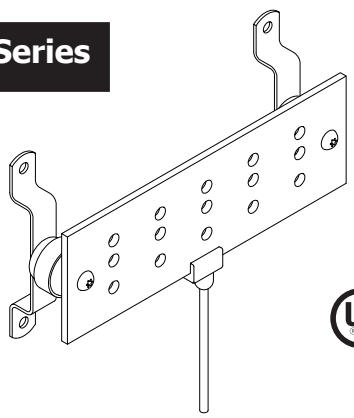
GBA Series



Listed 467

Ground **B**ar with Stainless Steel Angle **A**dapters

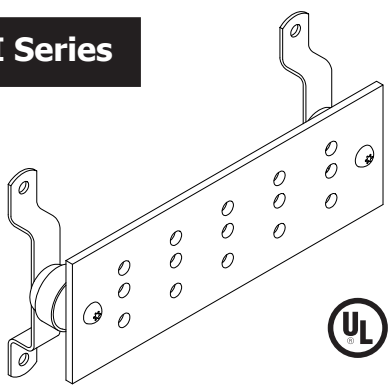
GBIT Series



Listed 467

Ground Bar with Wall Mounting **B**rackets, **I**nsulators and a 25' Exothermically Welded **T**ail

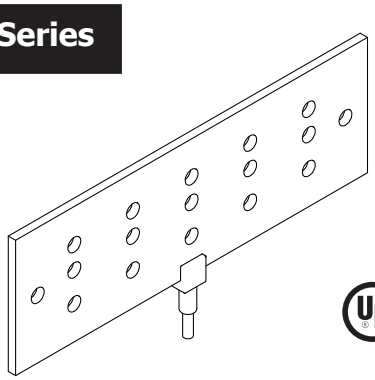
GBI Series



Listed 467

Ground Bar with Wall Mounting **B**rackets and **I**nsulators

GBT Series

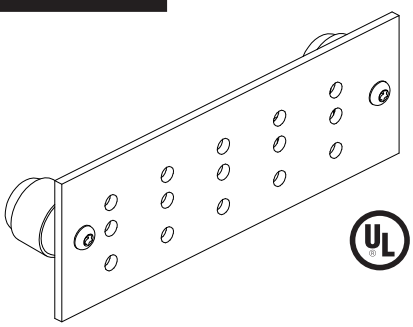


Listed 467

Ground **B**ar with a 25' Exothermically Welded **T**ail

Ground Bar Styles

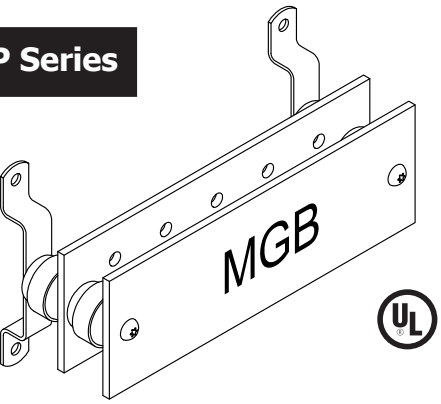
GBS Series



Listed 467

Ground **B**ar with **S**tandoff Insulators Only

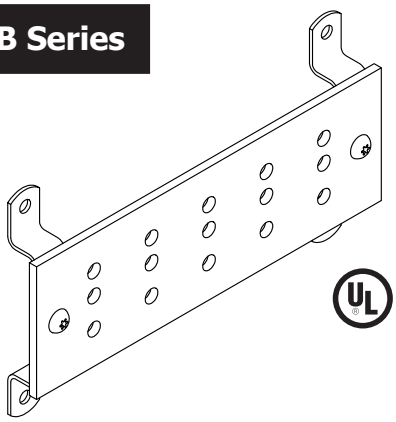
GBIP Series



Listed 467

Ground **B**ar with **I**nsulators, Wall Mounting Brackets and **P**lexiglass Cover

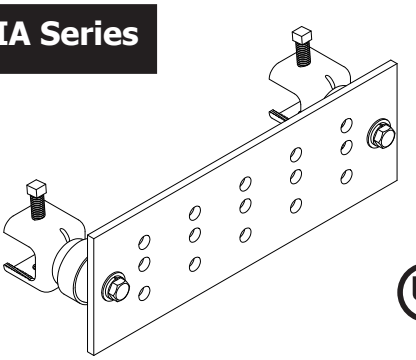
GBB Series



Listed 467

Ground **B**ar with **B**rackets Only

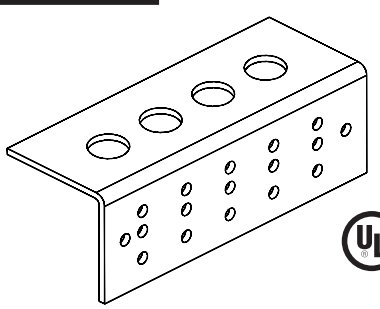
GBIA Series



Listed 467

Ground Bar with **I**nsulators and Stainless Steel Angle **A**dapters

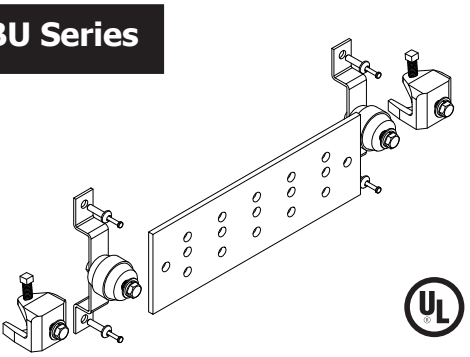
BGB Series



Listed 467

Bent **G**round **B**ar

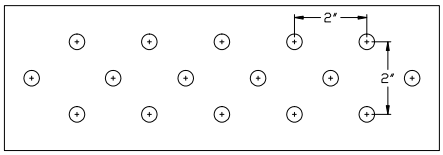
GBU Series



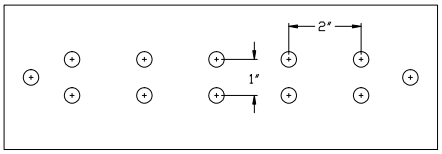
Listed 467

Ground **B**ar **U**niversal with Insulators, Brackets and Zinc Plated Malleable Beam Clamp

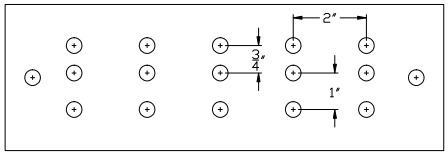
Ground Bar Hole Patterns



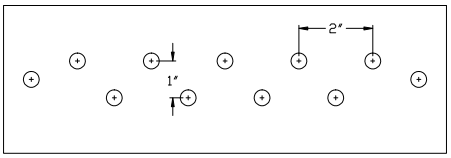
" A "



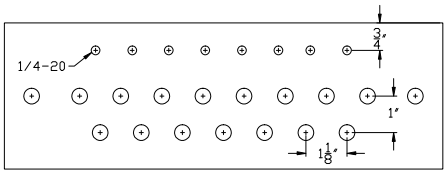
" B "



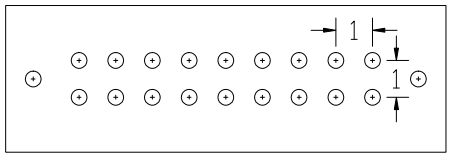
" C "



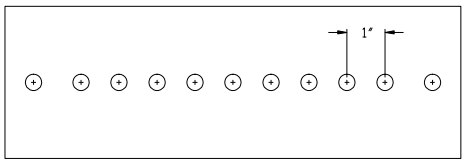
" D "



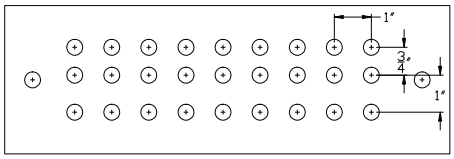
" F "



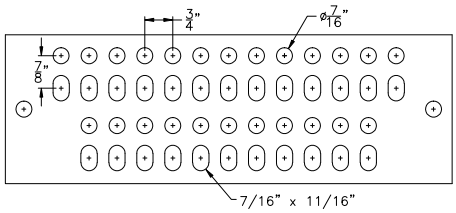
" G "



" H "



" J "

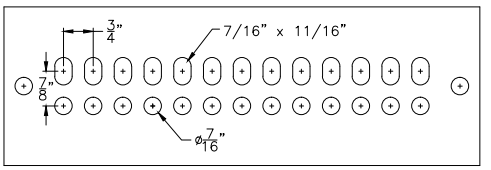


" M "

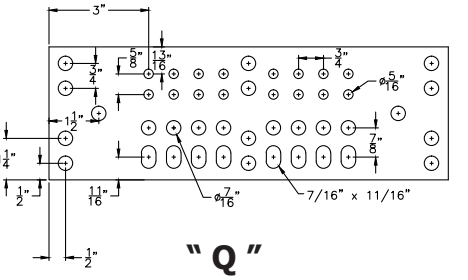
NOTES:

- All holes are 7/16" unless specified differently. To order threaded holes, specify hole size. The standard tapped hole size is 1/4-20 unless specified differently. Add suffix T to part number for tapped hole.
- Slotted hole patterns accommodate "B" and "C" spaced two hole lugs (3/4" and 1" on center).
- Above bar patterns represent a 12" ground bar.
- All bars are available with electro-tin plating. Add prefix T to part number.

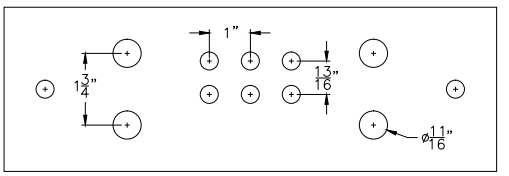
Ground Bar Hole Patterns



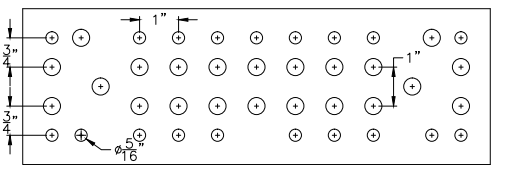
" P "



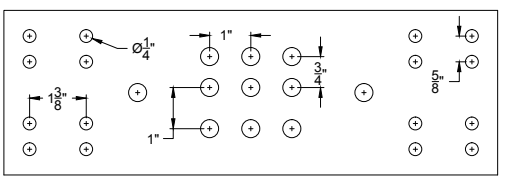
" Q "



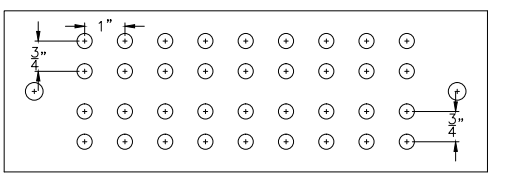
" R "



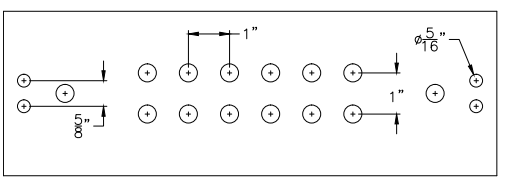
" T "



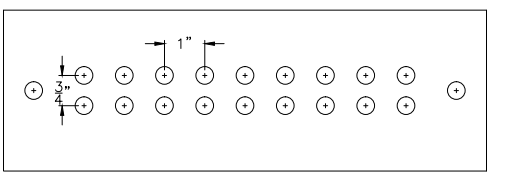
" V "



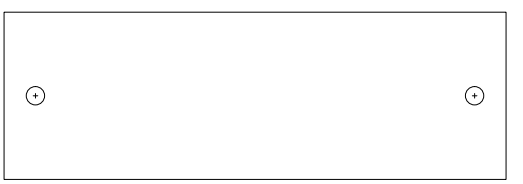
" W "



" X "



" Z "

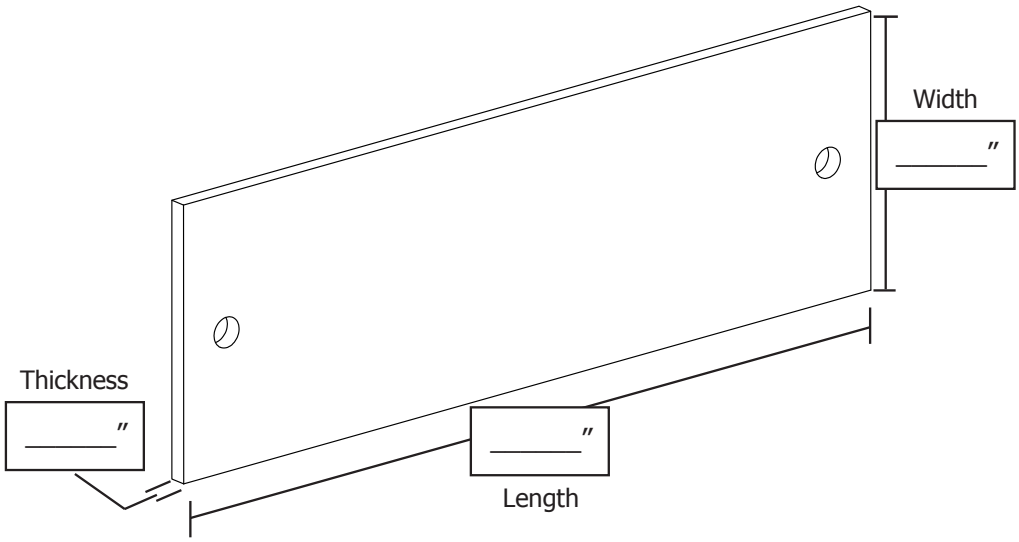


" N "

NOTES:

- All holes are 7/16" unless specified differently. To order threaded holes, specify hole size. The standard tapped hole size is 1/4-20 unless specified differently. Add suffix T to part number for tapped hole.
- Slotted hole patterns accommodate "B" and "C" spaced two hole lugs (3/4" and 1" on center).
- Above bar patterns represent a 12" ground bar.
- All bars are available with electro-tin plating. Add prefix T to part number.

Custom Ground Bar Design Sheet



Thickness:_____ Width:_____ Length: _____

Tamper Resistant Hardware: Y or N Part# _____

Plating: Y or N Type:_____

Holes: Punched Tapped Combo

Size Punched:_____ Size Tapped: _____

Exothermically Welded Tail: Y or N Size: _____

Stranded Solid Bare Tinned Insulated

Length:_____ (Show location of weld on bar.)

Standoff: Y or N Dim. Bar: _____

Type: Insulator_____ Nylon All-Thread _____

Plastic Cover: Y or N

Thickness:_____ Width:_____ Length: _____

Lettering: Y or N Size:_____ Color: _____

Text Shall Read Exactly as Follows:

_____

_____

(Note: Show Cover Layout on a Separate Sheet.)

Other Options:_____

_____

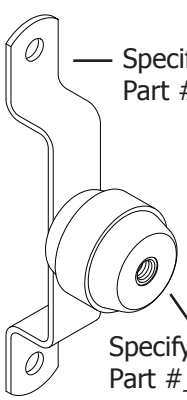
Bar Engraving / Etching: Y or N

Text Shall Read Exactly as Follows:

_____

_____

Simply fill out your requirements, submit the sheet to our factory and we will produce your custom ground bar in a timely fashion.



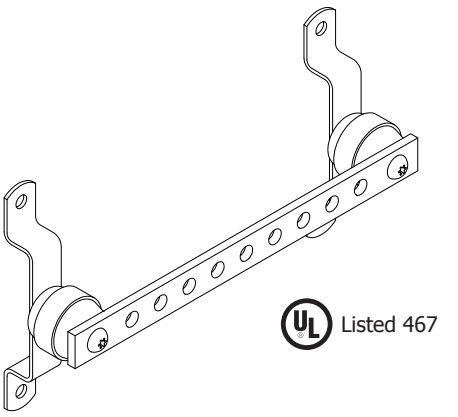
Insulators & Brackets can be found on pages 73 - 75.

GBI Ground Bars

"H" Pattern

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI1416H	1/4" x 1" x 6"	H	3	2
GBI14112H	1/4" x 1" x 12"	H	9	3
GBI14116H	1/4" x 1" x 16"	H	13	4

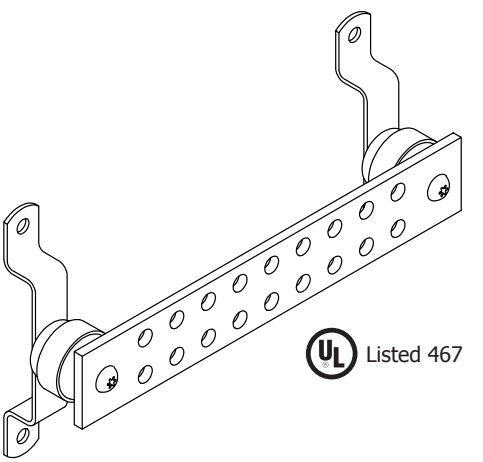
- Mounting holes not included in total No. of Holes.
- Accommodates one hole lugs using 3/8" hardware.
- 12" bar pictured. Holes are 7/16" diameter.



"G" Pattern

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI1426G	1/4" x 2" x 6"	G	6	2
GBI14212G	1/4" x 2" x 12"	G	18	3
GBI14216G	1/4" x 2" x 16"	G	26	4

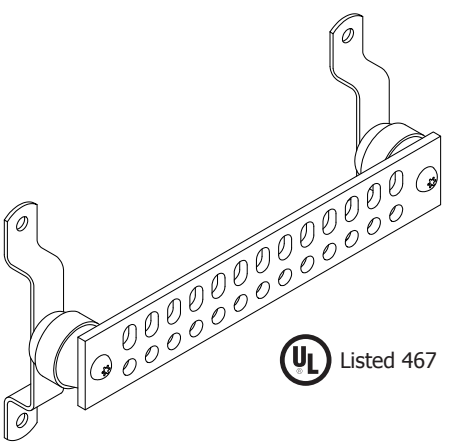
- Mounting holes not included in total No. of Holes.
- Accommodates "C" spaced two hole lugs (1" on center).
- 12" bar pictured. Holes are 7/16" diameter.



"P" Pattern

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI1426P	1/4" x 2" x 6"	P	10	2
GBI14212P	1/4" x 2" x 12"	P	26	3
GBI14216P	1/4" x 2" x 16"	P	34	4

- Mounting holes not included in total No. of Holes.
- Accommodates "B" and "C" spaced two hole lugs (3/4" and 1" on center).
- 12" bar pictured. Holes are 7/16" diameter and slots are 7/16" x 11/16".



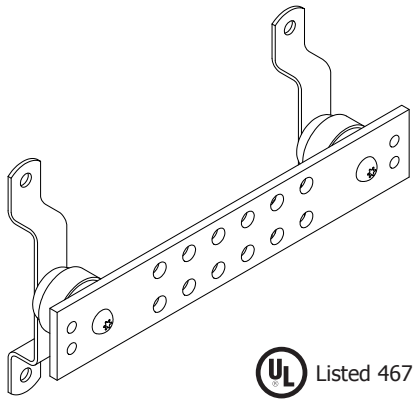
NOTES:
- Manufactured from electrolytic tough pitch copper alloy 110.
- Bars available electro-tin plated. When ordering, add prefix T to part number.
- Other sizes available. Please contact factory for more information.

GBI Ground Bars

"X" Pattern

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI1426X	1/4" x 2" x 6"	X	6	2
GBI14212X	1/4" x 2" x 12"	X	16	3
GBI14216X	1/4" x 2" x 16"	X	24	4
GBI14220X	1/4" x 2" x 20"	X	32	5
GBI14224X	1/4" x 2" x 24"	X	40	6

- Mounting holes not included in total No. of Holes.
- Accommodates "A" and "C" spaced two hole lugs (5/8" and 1" on center).
- 12" bar pictured. Holes are 5/16" and 7/16" diameter.

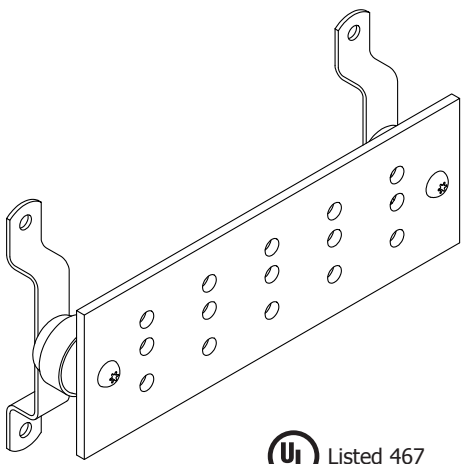


Listed 467

"C" Pattern

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI1446C	1/4" x 4" x 6"	C	6	3
GBI14412C	1/4" x 4" x 12"	C	15	5
GBI14416C	1/4" x 4" x 16"	C	21	7
GBI14420C	1/4" x 4" x 20"	C	27	8
GBI14424C	1/4" x 4" x 24"	C	33	9

- Mounting holes not included in total No. of Holes.
- Accommodates "B", "C" and "D" spaced two hole lugs (3/4", 1" and 1-3/4" on center).
- 12" bar pictured. Holes are 7/16" diameter.



Listed 467

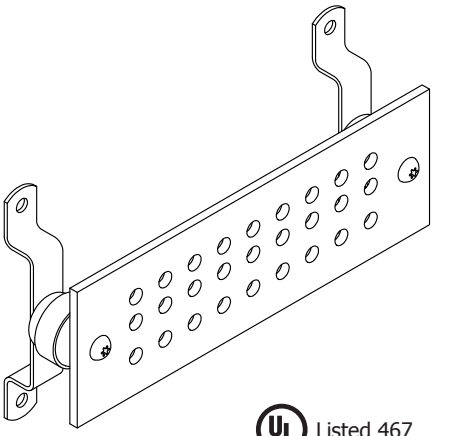
NOTES:
- Manufactured from electrolytic tough pitch copper alloy 110.
- Bars available electro-tin plated. When ordering, add prefix T to part number.
- Other sizes available. Please contact factory for more information.

GBI Ground Bars

"J" Pattern

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI1446J	1/4" x 4" x 6"	J	9	3
GBI14412J	1/4" x 4" x 12"	J	27	5
GBI14416J	1/4" x 4" x 16"	J	39	7
GBI14420J	1/4" x 4" x 20"	J	51	8
GBI14424J	1/4" x 4" x 24"	J	63	9

- Mounting holes not included in total No. of Holes.
- Accommodates "B", "C" and "D" spaced two hole lugs (3/4", 1" and 1-3/4" on center).
- 12" bar pictured. Holes are 7/16" diameter.

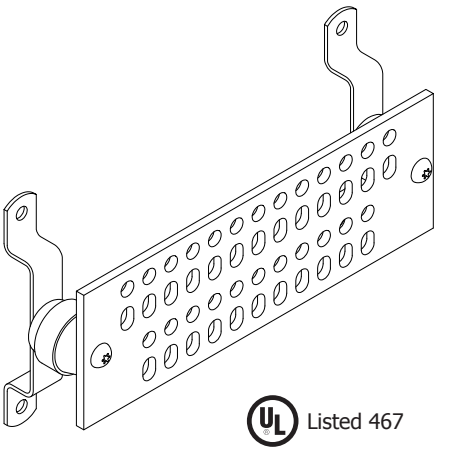


Listed 467

"M" Pattern

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI1446M	1/4" x 4" x 6"	M	16	3
GBI14412M	1/4" x 4" x 12"	M	48	5
GBI14416M	1/4" x 4" x 16"	M	68	7
GBI14420M	1/4" x 4" x 20"	M	88	8
GBI14424M	1/4" x 4" x 24"	M	112	9

- Mounting holes not included in total No. of Holes.
- Accommodates "B" and "C" spaced two hole lugs (3/4" and 1" on center).
- 12" bar pictured. Holes are 7/16" diameter and slots are 7/16" x 11/16".



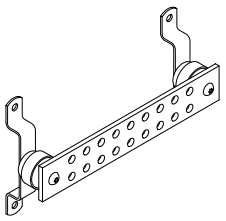
Listed 467

NOTES:
- Manufactured from electrolytic tough pitch copper alloy 110.
- Bars available electro-tin plated. When ordering, add prefix T to part number.
- Other sizes available. Please contact factory for more information.

GBI Ground Bar Kits

2" Kits

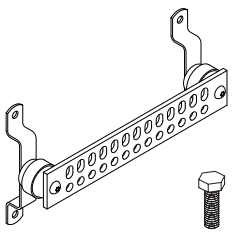
Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI14210GKT*	1/4" x 2" x 10"	G	14	5-1/2
GBI14212GKT*	1/4" x 2" x 12"	G	18	6



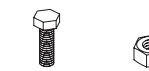
Listed 467

• Refer to page 54.

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI14210PKT*	1/4" x 2" x 10"	P	20	5-1/2
GBI14212PKT*	1/4" x 2" x 12"	P	26	6



Listed 467



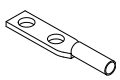
cap screw



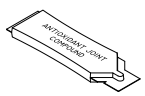
hex nut



lock washer



compression lug



antioxidant

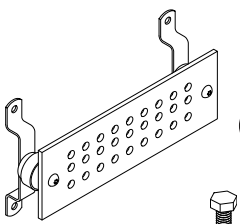
• Refer to page 54.

***Kit Includes:**

(1) Grounding busbar with brackets & insulators
(3) GECLB62C: #6 compression lug
(2) GECLB22C: #2 compression lug
(2) GECLB22CS: #2 compression lug
(1) GECLB2/02C: 2/0 compression lug
(1) GECLB4/02C: 4/0 compression lug
(18) CS68S: 3/8"-16x1" SS hex head cap screw
(18) LW6S: 3/8"-16 SS lock washer
(18) N616S: 3/8"-16 SS hex nut
(1) HCAJC1/2: 1/2 oz. tube of antioxidant

4" Kits

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI14412JKT*	1/4" x 4" x 12"	J	27	8
GBI14420JKT*	1/4" x 4" x 20"	J	51	10



Listed 467



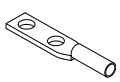
cap screw



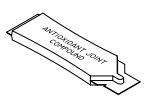
hex nut



lock washer



compression lug



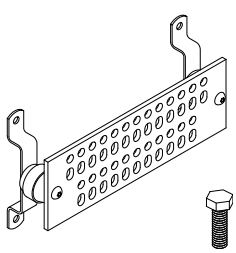
antioxidant

• Refer to page 56.

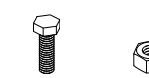
***Kit Includes:**

(1) Grounding busbar with brackets & insulators
(4) GECLB62C: #6 compression lug
(3) GECLB22C: #2 compression lug
(3) GECLB22CS: #2 compression lug
(1) GECLB2/02C: 2/0 compression lug
(1) GECLB4/02C: 4/0 compression lug
(24) CS68S: 3/8"-16x1" SS hex head cap screw
(24) LW6S: 3/8"-16 SS lock washer
(24) N616S: 3/8"-16 SS hex nut
(1) HCAJC1/2: 1/2 oz. tube of antioxidant

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBI14412MKT*	1/4" x 4" x 12"	M	48	8
GBI14420MKT*	1/4" x 4" x 20"	M	88	11



Listed 467



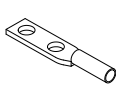
cap screw



hex nut



lock washer



compression lug



antioxidant

• Refer to page 56.

***Kit Includes:**

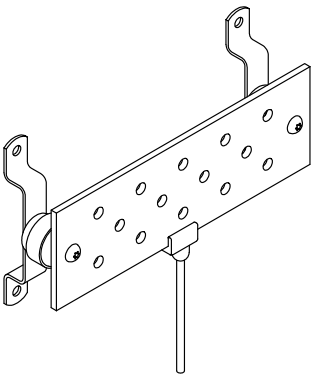
(1) Grounding busbar with brackets & insulators
(8) GECLB62C: #6 compression lug
(6) GECLB22C: #2 compression lug
(6) GECLB22CS: #2 compression lug
(1) GECLB2/02C: 2/0 compression lug
(1) GECLB4/02C: 4/0 compression lug
(44) CS68S: 3/8"-16x1" SS hex head cap screw
(44) LW6S: 3/8"-16 SS lock washer
(44) N616S: 3/8"-16 SS hex nut
(1) HCAJC1/2: 1/2 oz. tube of antioxidant

GBIT Ground Bars

"A" Pattern

Part No.	Bar Size	Hole Pattern	Conductor Type (AWG)	No. of Holes	Approx. Each Wt. (lbs.)
GBIT14412A2T	1/4" x 4" x 12"	A	2T	14	13
GBIT14416A2T	1/4" x 4" x 16"	A	2T	20	15
GBIT14420A2T	1/4" x 4" x 20"	A	2T	26	16
GBIT14424A2T	1/4" x 4" x 24"	A	2T	32	17

- Mounting holes not included in total No. of Holes.
- 12" bar pictured. Holes are 7/16" diameter.

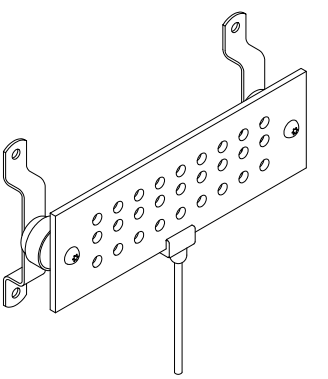


Listed 467

"J" Pattern

Part No.	Bar Size	Hole Pattern	Conductor Type (AWG)	No. of Holes	Approx. Each Wt. (lbs.)
GBIT1446J2T	1/4" x 4" x 6"	J	2T	9	11
GBIT14412J2T	1/4" x 4" x 12"	J	2T	27	13
GBIT14416J2T	1/4" x 4" x 16"	J	2T	39	15
GBIT14420J2T	1/4" x 4" x 20"	J	2T	51	16
GBIT14424J2T	1/4" x 4" x 24"	J	2T	63	17

- Mounting holes not included in total No. of Holes.
- Accommodates "B", "C" and "D" spaced two hole lugs (3/4", 1" and 1-3/4" on center).
- 12" bar pictured. Holes are 7/16" diameter.



Listed 467

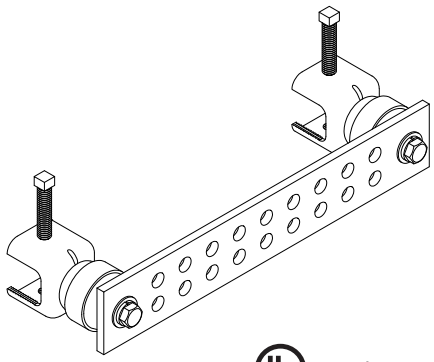
NOTES:
- Manufactured from electrolytic tough pitch copper alloy 110.
- Comes with a 25' exothermically welded tail.
- Bars available electro-tin plated. When ordering, add prefix T to part number.
- Other sizes available. Please contact factory for more information.

GBIA Ground Bars

"Z" Pattern

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBIA1426Z	1/4" x 2" x 6"	Z	6	2
GBIA14212Z	1/4" x 2" x 12"	Z	18	3
GBIA14216Z	1/4" x 2" x 16"	Z	26	4
GBIA14220Z	1/4" x 2" x 20"	Z	34	5

- Mounting holes not included in total No. of Holes.
- Accommodates "B" spaced two hole lugs (3/4" on center).
- 12" bar pictured. Holes are 7/16" diameter.

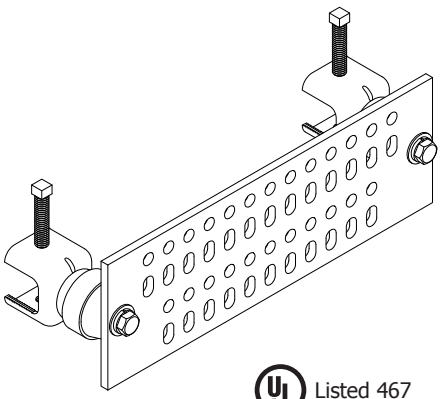


Listed 467

"M" Pattern

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBIA14412M	1/4" x 4" x 12"	M	48	5
GBIA14416M	1/4" x 4" x 16"	M	70	7
GBIA14420M	1/4" x 4" x 20"	M	88	8
GBIA14424M	1/4" x 4" x 24"	M	106	9

- Mounting holes not included in total No. of Holes.
- Accommodates "B" and "C" spaced two hole lugs (3/4" and 1" on center).
- 12" bar pictured. Holes are 7/16" diameter and slots are 7/16" x 11/16".



Listed 467

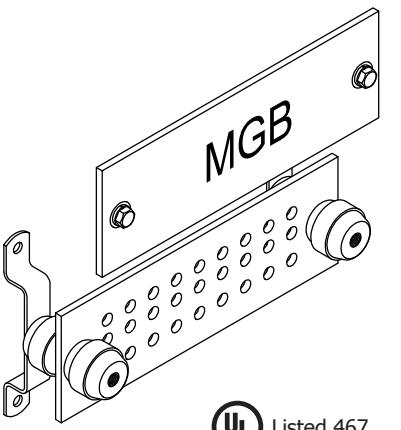
NOTES:
- Manufactured from electrolytic tough pitch copper alloy 110.
- Bars available electro-tin plated. When ordering, add prefix T to part number.
- Ground Bar with insulators and stainless steel angle adapters.
- Other sizes available. Please contact factory for more information.

GBIP Ground Bars

"J" Pattern

Part No.	Bar Size	Hole Pattern	No. of Holes	Approx. Each Wt. (lbs.)
GBIP1446JMGB	1/4" x 4" x 6"	J	9	5
GBIP14412JMGB	1/4" x 4" x 12"	J	27	7
GBIP14416JMGB	1/4" x 4" x 16"	J	39	9
GBIP14420JMGB	1/4" x 4" x 20"	J	51	11

- Mounting holes not included in total No. of Holes.
- Accommodates "B", "C" and "D" spaced two hole lugs (3/4", 1" and 1-3/4" on center).
- 12" bar pictured. Holes are 7/16" diameter.
- Plexiglass cover with MGB lettering. Other lettering available.

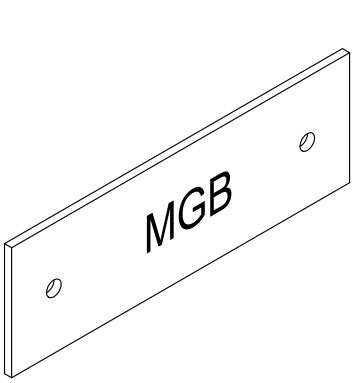


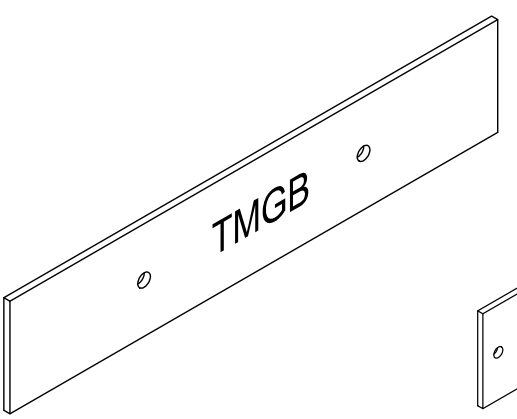
Listed 467

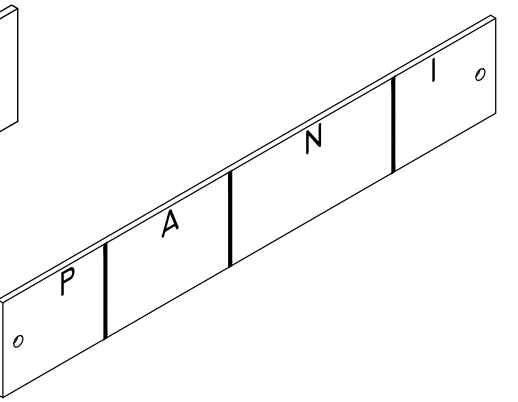
NOTES:
- Manufactured from electrolytic tough pitch copper alloy 110.
- Other sizes available. Please contact factory for more information.

Plexiglass Covers

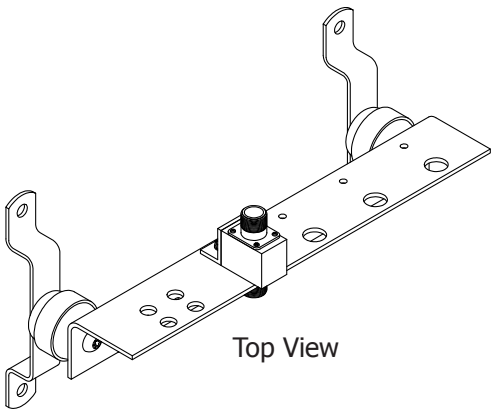
All ground bars are available with lettered plexiglass covers.
Minimum lettering height is 3/8". Lettering available in several different colors.
Standard cover thickness is 1/4". Other thicknesses available.
Please contact our factory with your special needs.



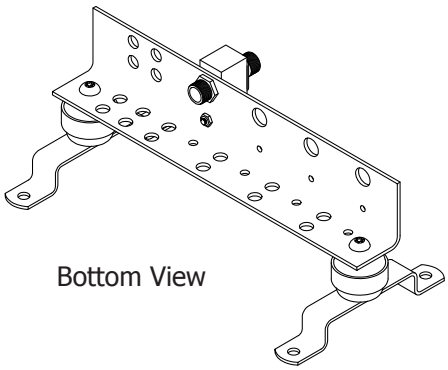




BGB Ground Bars



Top View

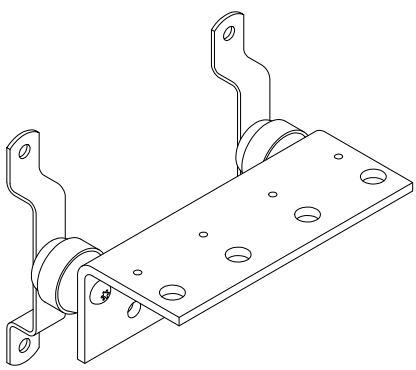


Bottom View

Part No.	Bar Size	No. of Arrestors	Approx. Each Wt. (lbs.)
BGBI1848.75TEL	1/8" x 4" x 8-3/4"	2	2-1/2
BGBI18413.25TEL	1/8" x 4" x 13-1/4"	4	3-1/2
BGBI18417.75TEL	1/8" x 4" x 17-3/4"	6	4
BGBI18428TEL	1/8" x 4" x 28"	8	5-1/2

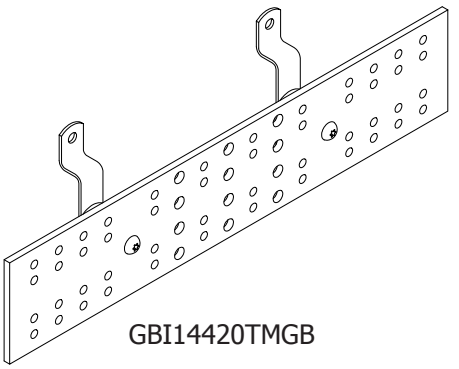
- Manufactured from electrolytic tough pitch copper alloy 110.
- Accommodates "B" spaced two hole lugs (3/4" on center).
- Accepts bulkhead style surge arrestors with N female connectors.
- Can be mounted vertically or horizontally.
- Other sizes/styles available. Please contact factory for more information.
- Surge arrestors not included.

BGBI1468ISB4FAA2



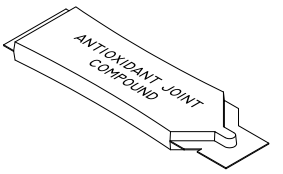
- 1/4" x 6" x 8" electrolytic tough pitch copper alloy 110.
- Accommodates "C" spaced two hole lugs (1" on center).
- Accepts 4 bulkhead style surge arrestors with N female connectors.
- Can be mounted vertically or horizontally.
- Other sizes/styles available. Please contact factory for more information.
- Approximate weight is 5 pounds.

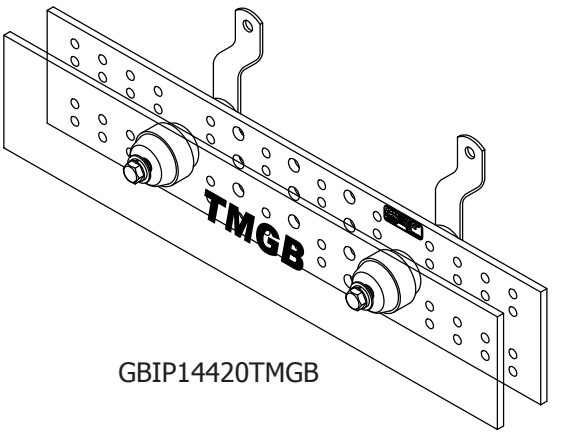
TIA-607 Style Telecommunications Main Grounding Busbars



GBI14420TMGB

Listed 467





GBIP14420TMGB

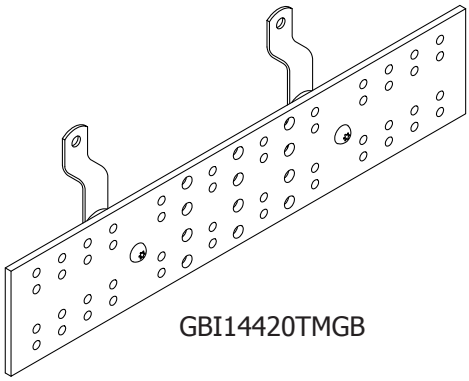
TMGB Busbars

Part No.	Bar Size	Material	Plexiglass Cover	No. of 5/16" Hole Sets	No. of 7/16" Hole Sets	Approx. Each Wt. (lbs.)
GBI14412TMGB	1/4" x 4" x 12"	Copper	No	12	6	6-1/2
GBIP14412TMGB*	1/4" x 4" x 12"	Copper	Yes	12	6	7
TGBI14412TMGB	1/4" x 4" x 12"	Electro Tin Plated	No	12	6	6-1/2
TGBIP14412TMGB*	1/4" x 4" x 12"	Electro Tin Plated	Yes	12	6	7
GBI14420TMGB	1/4" x 4" x 20"	Copper	No	24	6	9
GBIP14420TMGB*	1/4" x 4" x 20"	Copper	Yes	24	6	9-1/2
TGBI14420TMGB	1/4" x 4" x 20"	Electro Tin Plated	No	24	6	9
TGBIP14420TMGB*	1/4" x 4" x 20"	Electro Tin Plated	Yes	24	6	9-1/2
GBI14424TMGB	1/4" x 4" x 24"	Copper	No	28	10	10-1/2
GBIP14424TMGB*	1/4" x 4" x 24"	Copper	Yes	28	10	11
TGBI14424TMGB	1/4" x 4" x 24"	Electro Tin Plated	No	28	10	10-1/2
TGBIP14424TMGB*	1/4" x 4" x 24"	Electro Tin Plated	Yes	28	10	11

*TMGB is standard lettering in black with a minimum lettering height of 3/8". Other sizes available. Please contact factory for more information. See page 60 for plexiglass covers.

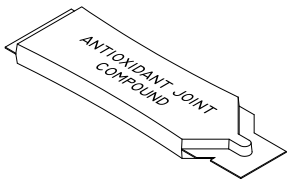
- 1/4" thick x 4" wide electrolytic tough pitch copper alloy 110.
- Includes 1-1/2" insulators and 1" offset stainless steel mounting brackets.
- Includes one 1/2 oz. tube of antioxidant (#HCAJC1/2).
- 5/16" hole sets 5/8" on centers. Accommodates "A" spaced two hole compression lugs.
- 7/16" holes sets 1" on centers. Accommodates "C" spaced two hole compression lugs.
- Other sizes available. Please contact factory for more information.
- Meets "BICSI" and EIA/TIA 607 standards.

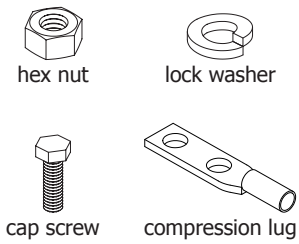
TIA-607 Style Telecommunications Main Grounding Busbar Kits



GBI14420TMGB

Listed 467





TMGB Busbar Kits

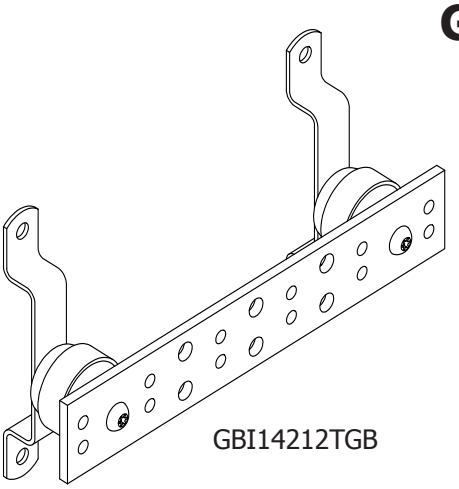
Part No.	Bar Size	Material	No. of 5/16" Hole Sets	No. of 7/16" Hole Sets	Approx. Each Wt. (lbs.)
GBI14412TMGBKT	1/4" x 4" x 12"	Copper	12	6	8
TGBI14412TMGBKT	1/4" x 4" x 12"	Electro Tin Plated	12	6	8
GBI14420TMGBKT	1/4" x 4" x 20"	Copper	24	6	11
TGBI14420TMGBKT	1/4" x 4" x 20"	Electro Tin Plated	24	6	11
GBI14424TMGBKT	1/4" x 4" x 24"	Copper	28	10	12
TGBI14424TMGBKT	1/4" x 4" x 24"	Electro Tin Plated	28	10	12

Kit Includes:

(1) Ground bar with brackets and insulators
(6) GECLB62A: #6 compression lug
(1) GECLB22C: #2 compression lug
(1) GECLB1/02C: 1/0 compression lug
(1) GECLB2/02C: 2/0 compression lug
(1) GECLB3/02C: 3/0 compression lug
(1) GECLB4/02C: 4/0 compression lug
(12) CS46S: 1/4"-20 x 3/4" SS hex head cap screw
(12) LW4S: 1/4"-20 SS lock washer
(12) N420S: 1/4"-20 SS hex nut
(6) CS68S: 3/8"-16 x 1" SS hex head cap screw
(6) LW6S: 3/8"-16 SS lock washer
(6) N616S: 3/8"-16 SS hex nut

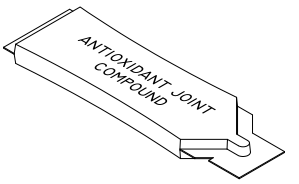
- Other sizes available. Please contact factory for more information.
- Includes one 1/2 oz. tube of antioxidant (#HCAJC1/2).
- Meets "BICSI" and EIA/TIA 607 standards.

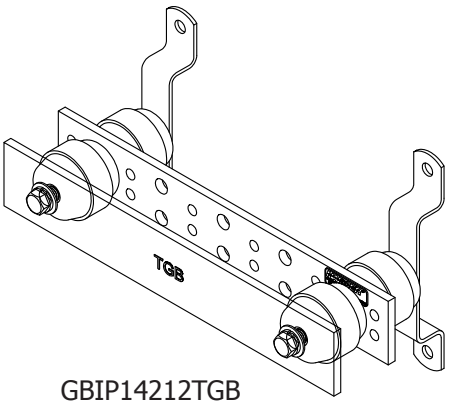
TIA-607 Style Telecommunications Grounding Busbars



GBI14212TGB

Listed 467





GBIP14212TGB

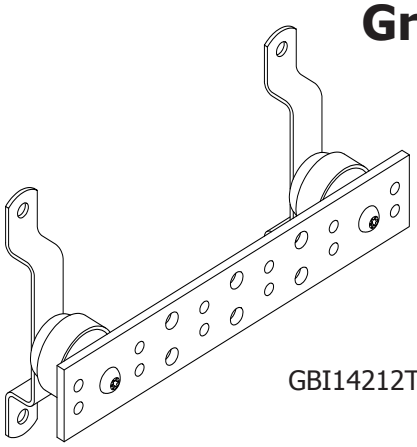
TGB Busbars

Part No.	Bar Size	Material	Plexiglass Cover	No. of 5/16" Hole Sets	No. of 7/16" Hole Sets	Approx. Each Wt. (lbs.)
GBI1426TGB	1/4" x 2" x 6"	Copper	No	2	2	1-1/2
GBIP1426TGB*	1/4" x 2" x 6"	Copper	Yes	2	2	2
TGBI1426TGB	1/4" x 2" x 6"	Electro Tin Plated	No	2	2	1-1/2
TGBIP1426TGB*	1/4" x 2" x 6"	Electro Tin Plated	Yes	2	2	2
GBI14210TGB	1/4" x 2" x 10"	Copper	No	4	3	3
GBIP14210TGB*	1/4" x 2" x 10"	Copper	Yes	4	3	3-1/2
TGBI14210TGB	1/4" x 2" x 10"	Electro Tin Plated	No	4	3	3
TGBIP14210TGB*	1/4" x 2" x 10"	Electro Tin Plated	Yes	4	3	3-1/2
GBI14212TGB	1/4" x 2" x 12"	Copper	No	6	3	4
GBIP14212TGB*	1/4" x 2" x 12"	Copper	Yes	6	3	4-1/2
TGBI14212TGB	1/4" x 2" x 12"	Electro Tin Plated	No	6	3	4
TGBIP14212TGB*	1/4" x 2" x 12"	Electro Tin Plated	Yes	6	3	4-1/2

*TGB is standard lettering in black with a minimum lettering height of 3/8". Other sizes available. Please contact factory for more information. See page 60 for plexiglass cover.

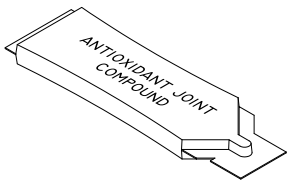
- 1/4" thick x 4" wide electrolytic tough pitch copper alloy 110.
- Includes 1-1/2" insulators and 1" offset stainless steel mounting brackets.
- Includes one 1/2 oz. tube of antioxidant (#HCAJC1/2).
- 5/16" hole sets 5/8" on centers. Accommodates "A" spaced two hole compression lugs.
- 7/16" hole sets 1" on centers. Accommodates "C" spaced two hole compression lugs.
- Other sizes available. Please contact factory for more information.
- Meets "BICSI" and EIA/TIA 607 standards.

TIA-607 Style Telecommunications Grounding Busbar Kits



GBI14212TGB

Listed 467





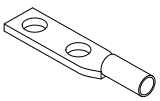
hex nut



lock washer



cap screw



compression lug

TGB Busbar Kits

Part No.	Bar Size	Material	No. of 5/16" Hole Sets	No. of 7/16" Hole Sets	Approx. Each Wt. (lbs.)
GBI1426TGBKT	1/4" x 2" x 6"	Copper	2	2	3
TGBI1426TGBKT	1/4" x 2" x 6"	Electro Tin Plated	2	2	3
GBI14210TGBKT	1/4" x 2" x 10"	Copper	4	3	4-1/2
TGBI14210TGBKT	1/4" x 2" x 10"	Electro Tin Plated	4	3	4-1/2
GBI14212TGBKT	1/4" x 2" x 12"	Copper	6	3	5
TGBI14212TGBKT	1/4" x 2" x 12"	Electro Tin Plated	6	3	5

Kit Includes:

(1) Ground bar with brackets and insulators
(6) GECLB62A: #6 compression lug
(1) GECLB22C: #2 compression lug
(1) GECLB1/02C: 1/0 compression lug
(1) GECLB2/02C: 2/0 compression lug
(1) GECLB3/02C: 3/0 compression lug
(12) CS46S: 1/4"-20 x 3/4" SS hex head cap screw
(12) LW4S: 1/4"-20 SS lock washer
(12) N420S: 1/4"-20 SS hex nut
(6) CS68S: 3/8"-16 x 1" SS hex head cap screw
(6) LW6S: 3/8"-16 SS lock washer
(6) N616S: 3/8"-16 SS hex nut

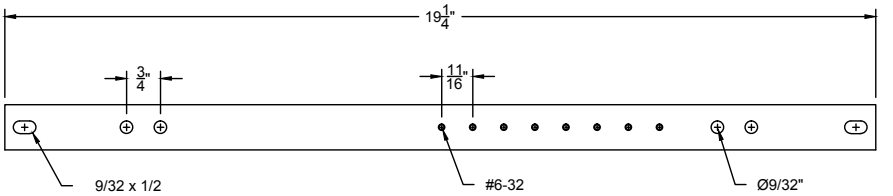
- Other sizes available. Please contact factory for more information.
- Includes one 1/2 oz. tube of antioxidant (#HCAJC1/2).
- Meets "BICSI" and EIA/TIA 607 standards.

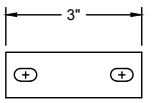
Telecommunications Equipment Rack Grounding Busbars & Kits

Telecommunications Equipment Rack Grounding Busbars are available as bar only or in kit form. All bars are manufactured from 1/4" electrolytic tough pitch copper alloy 110. Designed to fit 19", 23" and 35" equipment racks.

RGBH14119.25 Pictured

Listed 467





Bar Splice Plate

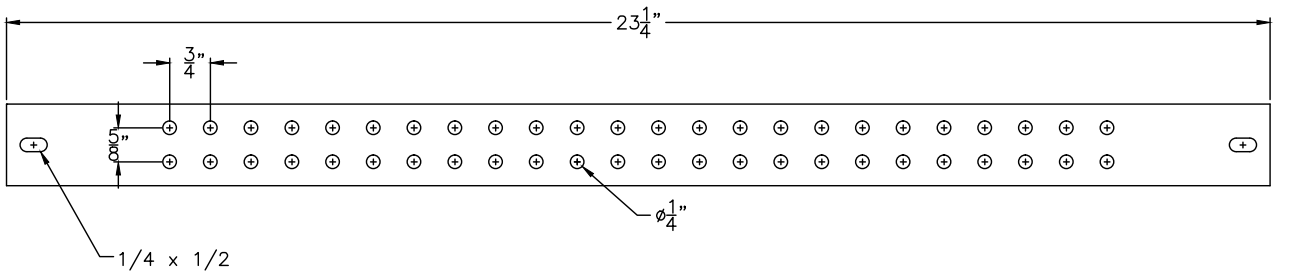
Horizontal Bars Only

Part No.	Bar Size	Approx. Each Wt. (lbs.)
RGBH14119.25	1/4" x 1" x 19-1/4"	2
RGBH14123.25	1/4" x 1" x 23-1/4"	3
RGBH14135.25	1/4" x 1" x 35-1/4"	4

- Above bars include 3" bar splice plate.

RGBH141.523.25A Pictured

Listed 467



Horizontal Bars Only

Part No.	Bar Size	Approx. Each Wt. (lbs.)
RGBH141.519.25A	1/4" x 1-1/2" x 19-1/4"	3
RGBH141.523.25A	1/4" x 1-1/2" x 23-1/4"	4
RGBH141.535.25A	1/4" x 1-1/2" x 35-1/4"	5

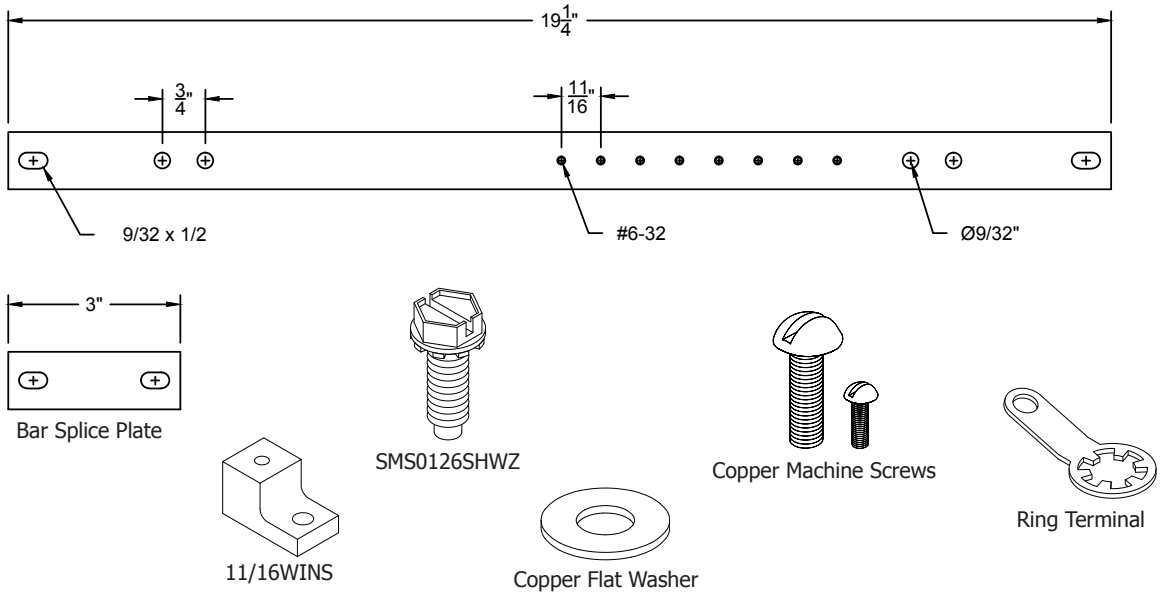
- Accommodates "A" spaced two hole lugs.

Telecommunications Equipment Rack Grounding Busbars & Kits

Telecommunications Equipment Rack Grounding Busbars are available as bar only or in kit form. All bars are manufactured from 1/4" electrolytic tough pitch copper alloy 110. Designed to fit 19", 23" and 35" equipment racks.

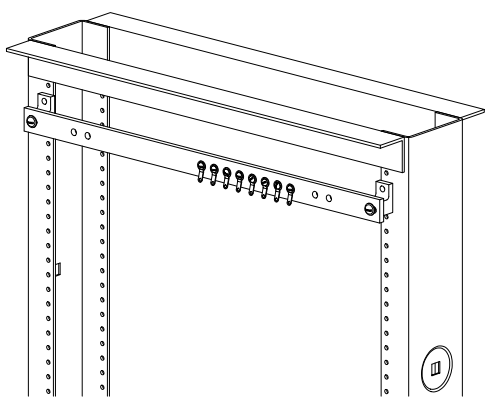
RGBHKIT14119.25 Pictured

Listed 467



Horizontal Kits

Part No.	Bar Size	Approx. Each Wt. (lbs.)
RGBHKIT14119.25	1/4" x 1" x 19-1/4"	1-3/4
RGBHKIT14123.25	1/4" x 1" x 23-1/4"	4
RGBHKIT14135.25	1/4" x 1" x 35-1/4"	5



Kit Includes:

(1) 1/4" electrolytic tough pitch copper alloy 110 ground bar
(1) 3" bar splice plate with 2 slotted holes
(2) 11/16WINS: white delrin insulator
(2) SMS0126SHWZ: 12-24 x 5/8" hex washer head thread forming screw
(2) #12-24 x 3/4" copper flashed brass screw
(2) #12 copper flat washer
(8) #6-32 x 1/4" copper flashed brass screw
(8) #6 ring terminal

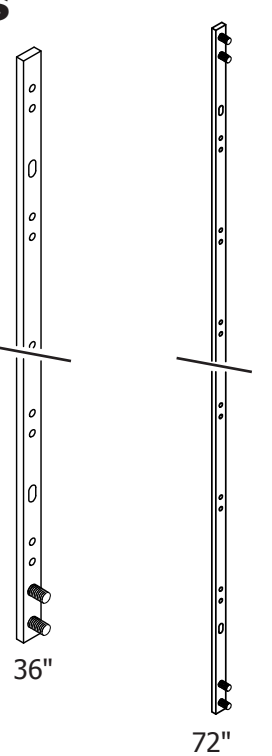
Telecommunications Equipment Rack Grounding Busbars & Kits

Vertical Bars

Part No.	Bar Size	Approx. Each Wt. (lbs.)
RGBV145836A	1/4" x 5/8" x 36"	2
RGBV145872A	1/4" x 5/8" x 72"	4

Listed 467

- Manufactured from electrolytic tough pitch copper alloy 110.
- Accommodates one hole lug or two hole "A" spaced lugs (5/8" on center).
- Elongated mounting holes.
- 36" bar has 2 PEM studs 1" on center at one end for ground conductor connection.
- 72" bar has 4 PEM studs (two at each end) 1" on center for ground conductor connections.

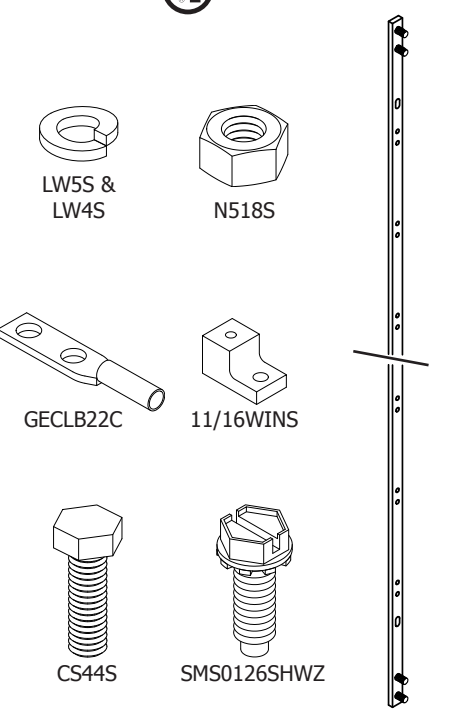


Vertical Kits

Part No.	Bar Size	Approx. Each Wt. (lbs.)
RGBVKIT145836A	1/4" x 5/8" x 36"	3-1/2
RGBVKIT145872A	1/4" x 5/8" x 72"	7

Listed 467

- Manufactured from electrolytic tough pitch copper alloy 110.
- Accommodates one or two hole "A" spaced compression lugs (5/8" on center).
- Elongated mounting holes.
- 36" bar has 2 PEM studs 1" on center at one end for ground conductor connection.
- 72" bar has 4 PEM studs (two at each end) 1" on center for ground conductor connections.

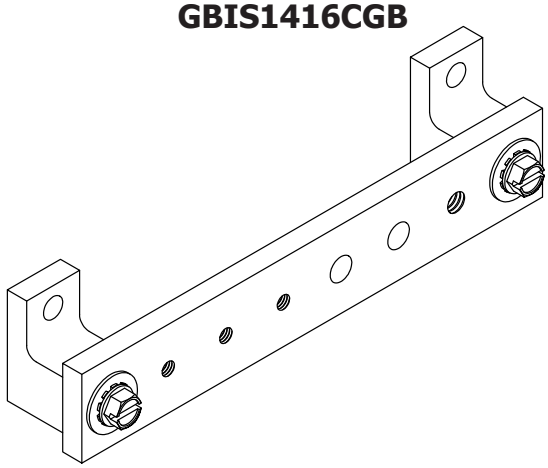


Kit Includes:

(1) Vertical Equipment Rack Grounding Busbar
(8) CS44S: 1/4"-20 x 1/2" stainless steel hex head cap screw
(3) 11/16WINS: white delrin insulator
(4) LW5S: 5/16" stainless steel lock washer
(8) LW4S: 1/4" stainless steel lock washer
(3) SMS0126SHWZ: #12-24 x 5/8" hex washer head thread forming screw
(4) N518S: 5/16"-18 stainless steel hex nut
(1) GECLB22C: two hole long barrel compression lug

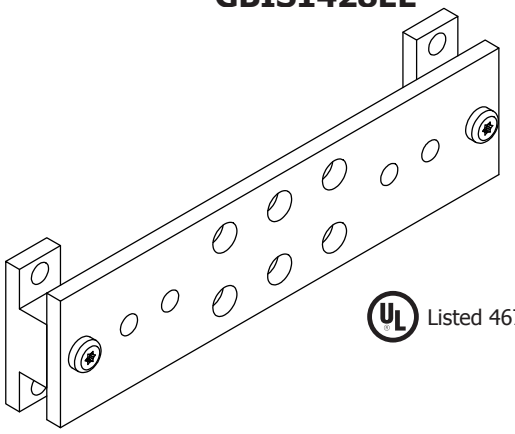
Telco Ground Bars

GBIS1416CGB



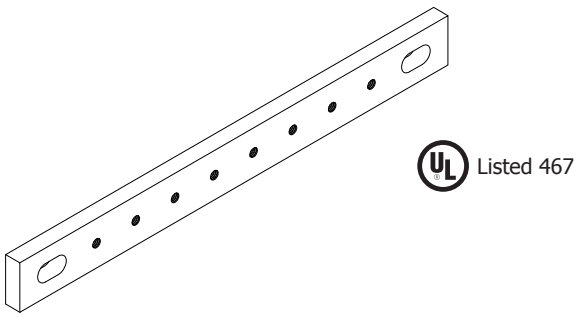
- 1/4" x 1" x 6" electrolytic tough pitch copper alloy 110 bar.
- (3) 10-32 tapped holes designed to fit one hole lugs.
- (2) .281 punched holes designed to fit one hole lugs.
- (1) 1/4-20 tapped hole designed to fit one hole lugs.
- Pre-assembled with two #11/16WINS insulators and screws.
- Approximate weight is 1/2 pound.

GBIS1428EE



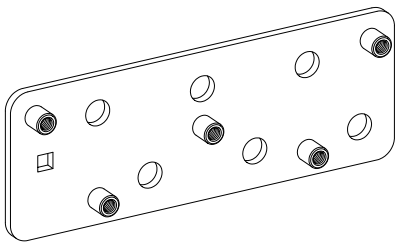
- 1/4" x 2" x 8" electrolytic tough pitch copper alloy 110 bar.
- (6) .438 punched holes designed to fit two hole lugs with 1" on center spacing.
- (4) .313 punched holes designed to fit one hole lugs.
- Pre-assembled with two #7/8WINS and pan head torx screws.
- Approximate weight is 1-1/4 pounds.

GB14.757.5GBE



- 1/4" x 3/4" x 7-1/2" electrolytic tough pitch copper alloy 110 bar.
- (8) 6-32 tapped holes designed to fit one hole lugs.
- (2) .281 x 1/2" slots, 6-3/8" on-center for mounting.
- Approximate weight is 1/2 pound.

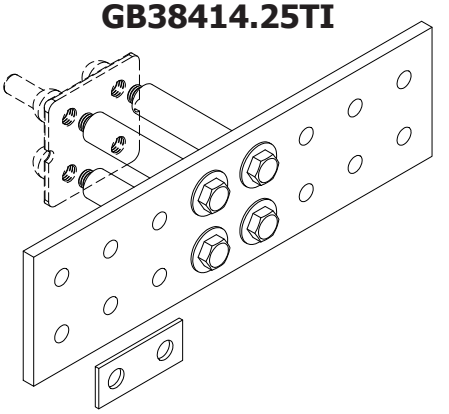
TGB1825.5CCS



- 1/8” x 2” x 5-1/2” electrolytic tough copper alloy 110 bar.
- (6) 11-32 holes used with 5/16” hardware.
- (5) 10-32 clinch nuts.
- Approximate weight is 1/2 pound.

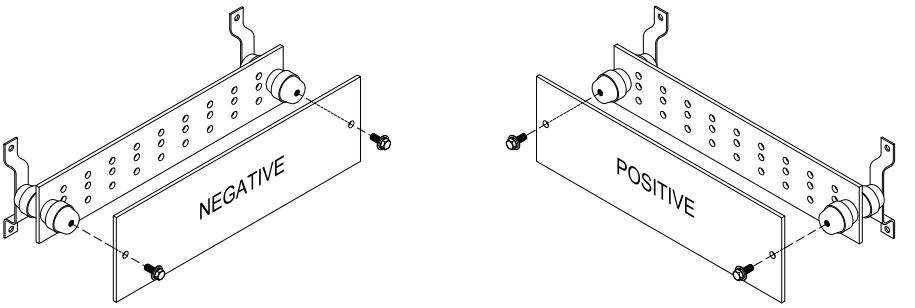
Telco Ground Bars

GB38414.25TI



- 3/8" x 4" x 14-1/4" electrolytic tough pitch copper alloy 110 bar.
- 8 sets of 1/2" diameter holes 1-3/4" on center; which accommodates "D" spaced two hole compression lugs.
- Comes with sandwich plate for attaching copper braid or flat strap.
- Includes silicon bronze bolts and copper spacers.
- Designed to be used in conjunction with exothermic ground plate XGP3.25/3.254/0 (not included). See page 316 for ground plates.
- Approximate weight is 7-1/2 pounds.

BATTERYCONNKIT

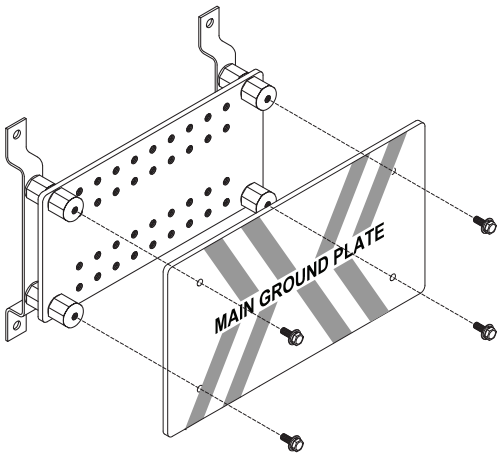


- (2) 1/4" x 4" x 20" electrolytic tough pitch copper alloy 110 bars.
- Each bar has (27) 7/16" punched holes designed to accommodate "B" and "C" spaced two hole lugs (3/4" and 1" on center).
- Each bar comes with a 1/4" thick plexiglass cover with 1" high red lettering.
- Approximate weight for complete kit is 18 pounds.

FAA Style Ground Bars

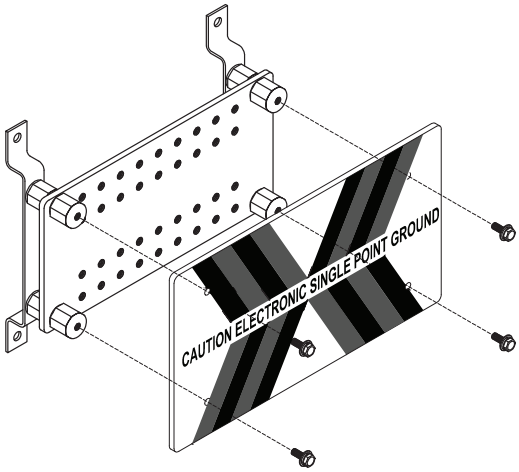
GBIP14612MGPFAA3
Main Ground Plate

1/2" high black lettering and green & clear striping are applied to plexiglass cover.



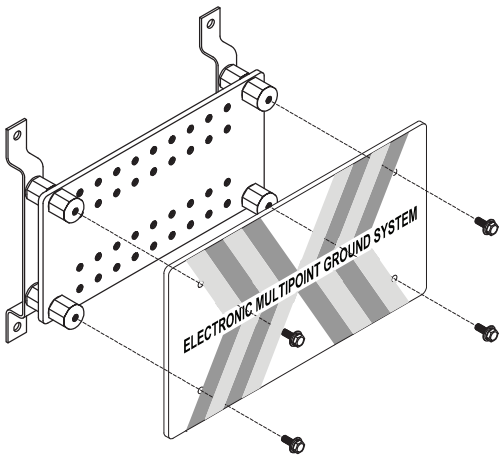
GBIP14612CESPGFAA
Caution Electronic Single Point Ground

1/2" high black lettering and green & yellow striping are applied to plexiglass cover.



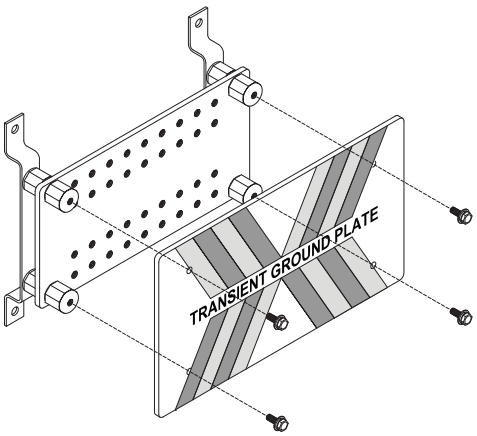
GBIP14612EMGSFAA
Electronic Multipoint Ground System

1/2" high black lettering and green & orange striping are applied to plexiglass cover.



GBIP14612TGPFAA
Transient Ground Plate

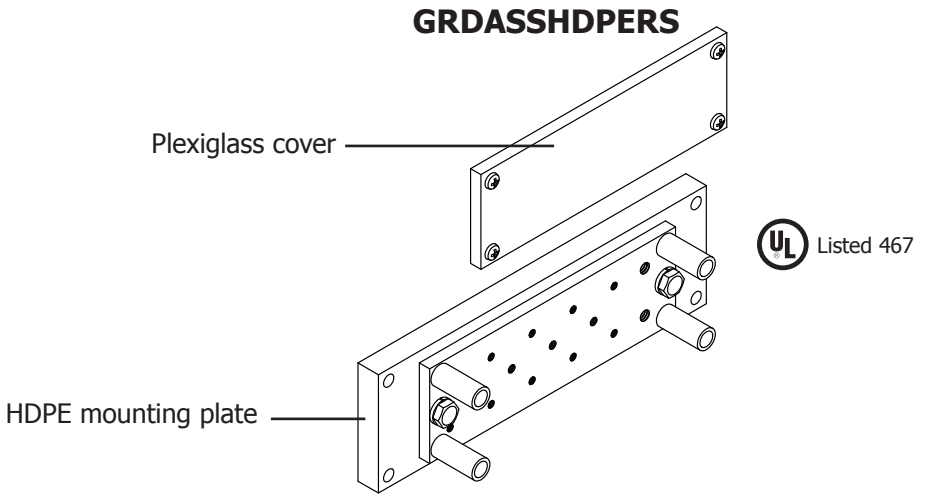
1/2" high black lettering and green & red striping are applied to plexiglass cover.



- 1/4" x 6" x 12" electrolytic tough pitch copper alloy 110 bar.
- Includes insulators, mounting brackets and plexiglass covers (ships partially assembled).
- 18 sets of 3/8-16 tapped holes 1" on center.
- Approximate weight is 8 pounds.

FAA Style Ground Bars

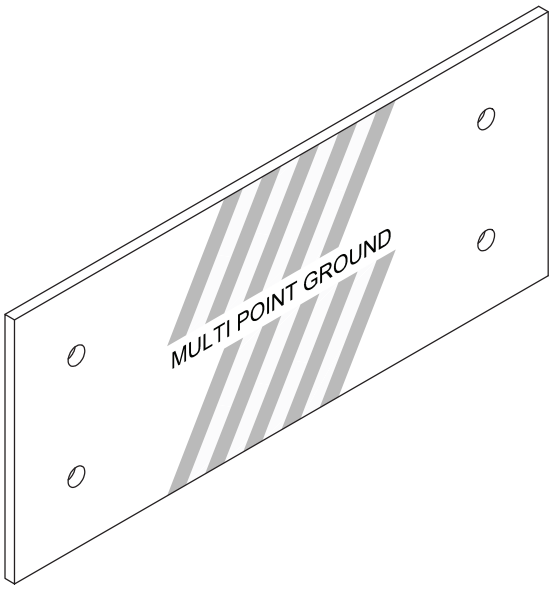
GRDASSHDPERS

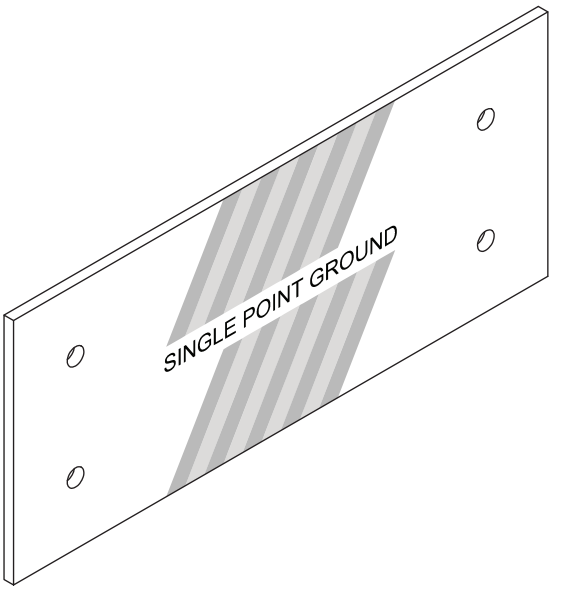


- 1/4" x 2" x 6" electrolytic tough pitch copper alloy 110 bar.
- (10) 8-32 tapped holes, (4) 10-32 tapped holes and (2) 1/4-20 tapped holes.
- 1/4" thick plexiglass cover.
- 1/2" x 2.5" x 8" HDPE mounting plate.
- Approximate weight is 5 pounds.

FAA Style Plexiglass Covers

All ground bars are available with lettered plexiglass covers.
Minimum lettering height is 3/8". Lettering available in several different colors.
Standard cover thickness is 1/4". Other thicknesses available.
Please contact our factory with your special needs.

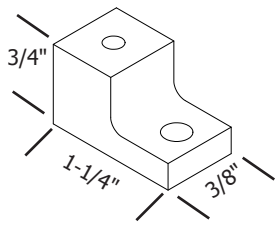




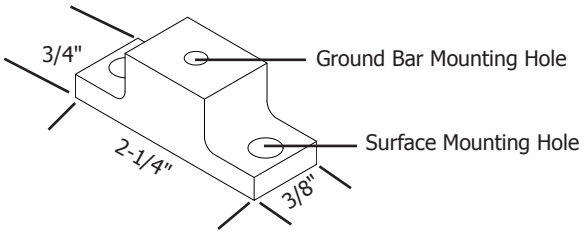
Standoff Insulators - White

Manufactured from Delrin material.

11/16WINS



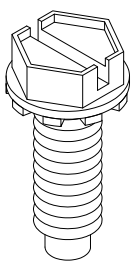
7/8WINS

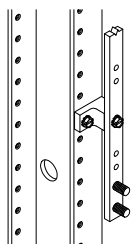


Part No.	Box Qty.	Approx. Box Wt. (lbs.)
11/16WINS	50	1-1/4
7/8WINS	20	1-1/4

- For use with 1" wide or less ground bars.
- Surface mounting hole 1/4" in diameter.
- Ground bar mounting hole 1/8" in diameter (self-tapping).

Thread Forming Screw

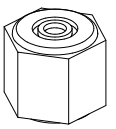




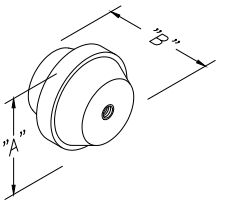
Part No.	Box Qty.	Approx. Box Wt. (lbs.)
SMS0126SHWZ-50	50	1

- #12-24 x 5/8" zinc plated thread forming hex washer head screw with external washer.
- Used with white standoff insulators (11/16WINS & 7/8WINS).
- Removes paint on a 12-24 threaded rack hole.

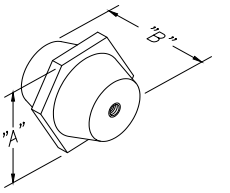
Standoff Insulators - Red



Hexagon



Round



Octagon

Manufactured from glass reinforced thermoset polyester.

Part No.	"A"	"B"	Shape	Thread Size	Voltage Rating	Tensile Strength (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
1100A1	1"	1"	Hex	1/4 - 20 x 1/4 AL	600	1200	25	1-1/2
4150S2	2"	1-1/2"	Oct	1/4 - 20 x 1/2 STL	1500	3000 - 4500	20	4-1/2
R4150S3	1-3/4"	1-1/2"	Round	5/16 - 18 x 1/2 STL	1500	2500 - 2700	20	5-1/2
R4150A4	1-3/4"	1-7/8"	Round	3/8 - 16 x 3/8 AL	2000	2500 - 2700	20	5-1/2
R4200S5	1-3/4"	2"	Round	3/8 - 16 x 5/8 STL	2500	2500 - 2700	20	6-3/4
4200S6	2"	2"	Oct	1/2 - 13 x 5/8 STL	2500	3000 - 4500	20	8
5250A5	2-1/2"	2-1/2"	Oct	3/8 - 16 x 5/8 AL	3200	5000 - 5700	10	4-1/2
5263A8	2-1/2"	2-5/8"	Oct	5/8 - 11 x 3/4 AL	3400	5000 - 5700	10	4-3/4

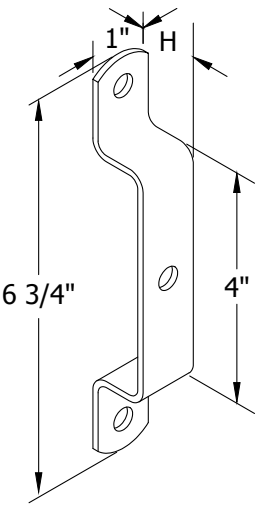
Other sizes available. Contact our factory for special requests.

Mounting Brackets

Wall Mount

Part No.	Mounting Hole Size	"H"	Material	Heavy Duty	Box Qty.	Approx. Box Wt. (lbs.)
WBKT1	7/16"	1"	SS	No	10	3
WBKT1HD	5/8"	1"	Z/P Steel	Yes	10	8
WBKT1HDS	5/8"	1"	SS	Yes	10	8
WBKT2	7/16"	2"	SS	No	10	4
WBKT3	7/16"	3"	SS	No	10	4
WBKT4	7/16"	4"	SS	No	10	5

- Manufactured from 304 series stainless steel or zinc plated steel.
- Special brackets available upon request.



WBKT1

NOTES:
- See Section 1.12 on page 141 for hardware.

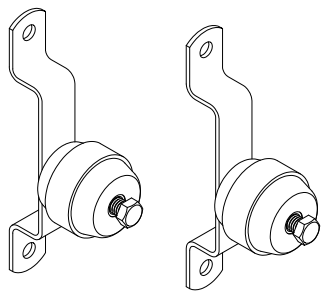
Mounting Brackets

Wall Mount Kit

Part No.	Mounting Hole Size	"H"	Material	Heavy Duty	Box Qty.	Approx. Box Wt. (lbs.)
WBKT1KIT	7/16"	1"	SS	No	5	5

- Manufactured from 304 series stainless steel or zinc plated steel.
- Special brackets available upon request.

Kit Includes:
(2) WBKT1: stainless steel ground bar bracket
(2) R4150A4: round insulator
(2) CS66S: 3/8"-16 x 3/4" stainless steel hex head cap screw
(2) W6S: 3/8" stainless steel flat washer
(2) LW6S: 3/8" stainless steel split lock washer



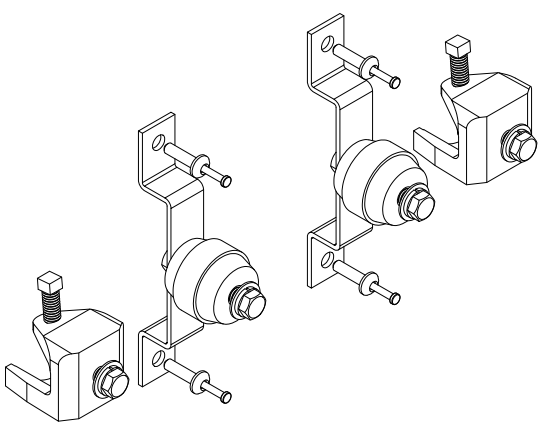
WBKT1KIT

Universal Busbar Mounting Kit

Part No.	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GBUKIT	2-1/4	10	22-1/2

- Provides material for either a Shelter or a Tower mount.

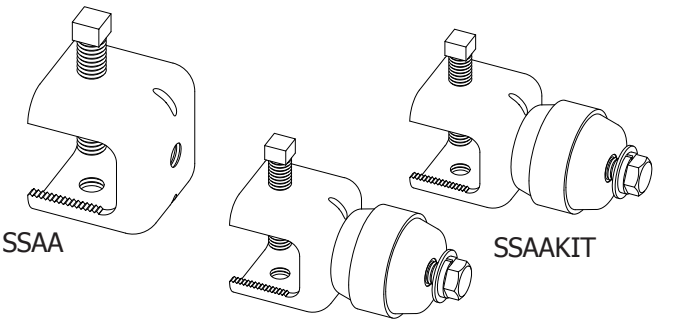
Kit Includes:
(2) WBKT1: stainless steel ground bar bracket (Shelter)
(2) MBC3816: Malleable iron angle adapters (Tower)
  • Will accommodate up to 7/8" thick material.
(2) R4150A4: round insulator
(4) 280: 1/4" x 1" drive pin
(2) CS65S: 3/8"-16 x 5/8" stainless steel hex head cap screw
(2) CS66S: 3/8"-16 x 3/4" staniless steel hex head cap screw
(4) W6S: 3/8" stainless steel flat washer
(4) LW6S: 3/8" stainless steel split lock washer



Stainless Steel Angle Adapters

Part No.	Box Qty.	Approx. Box Wt. (lbs.)
SSAA	10	5
SSAAKIT	5	8

- Manufactured from 304 series stainless steel.
- SSAAKIT includes two assemblies (pictured). 3/8" stainless steel hardware fastens kit to ground bar.
- SSAAKIT also includes R4150A4 insulators.
- Will accommodate up to 1" thick material.



"Do Not Disconnect" Tag

Part No.	Material	Box Qty.	Approx. Each Wt. (lbs.)
GRNTAGDND	Brass	EA	1/4

- Used in Data Center and In-Building Telecommunications Grounding Systems to mark both ends of grounding/bonding conductors.
- 2" diameter brass tag with 1/2" high black filled lettering.
- Made from corrosion resistant brass.
- Has a round hole for mounting, screwing or wire tying into position.



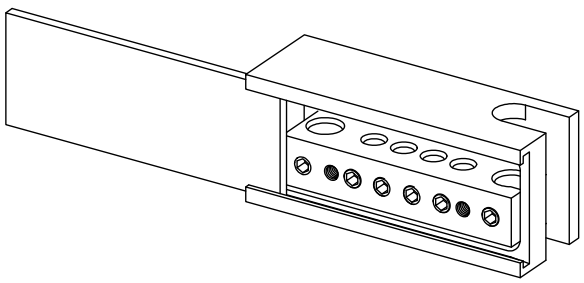
Network Building Ground Tag

Part No.	Material	Box Qty.	Approx. Box Wt. (lbs.)
GRNTAG607PK10	Plastic	10	1/2

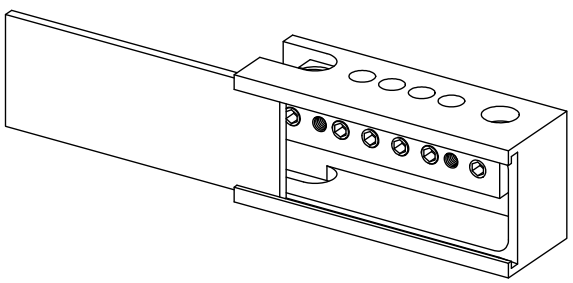
- Dimensions are 2.125" x 3.75".
- Yellow tag with green text.
- Tag is UV Resistant.



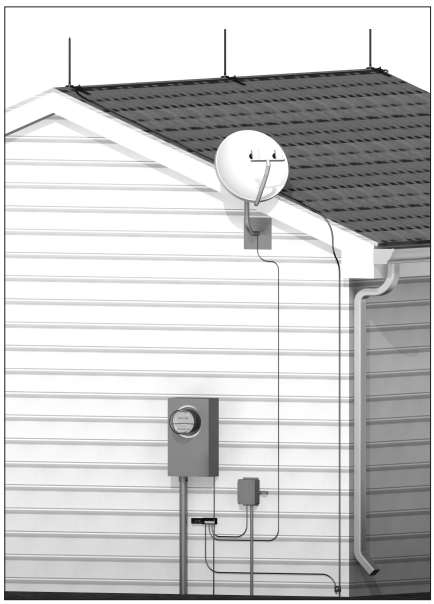
Intersystem Bonding Connection



Top View



Bottom View



Part No.	Box Qty.	Approx. Each Wt. (lbs.)
IBTD	EA	3/4

- **I**ntersystem **B**onding **T**ermination **D**evice
- Accepts one 6-1 AWG grounding electrode conductor, four 14-4 AWG bonding conductors and one Class I copper lightning conductor.
- Plastic case, brass terminal with stainless steel hardware.
- Mounting hardware included.
- Slide in, snap fit lid design for easy installation and inspection.

TECHNICAL NOTES: (Summarized)

An external accessible intersystem bonding termination for connecting intersystem bonding and grounding conductors at the service equipment and at the disconnecting means for any additional buildings or structures.*

* NEC 2011 Article 250.94 Bonding For Other Systems

Section 1.4

Ground Bus Systems

Index

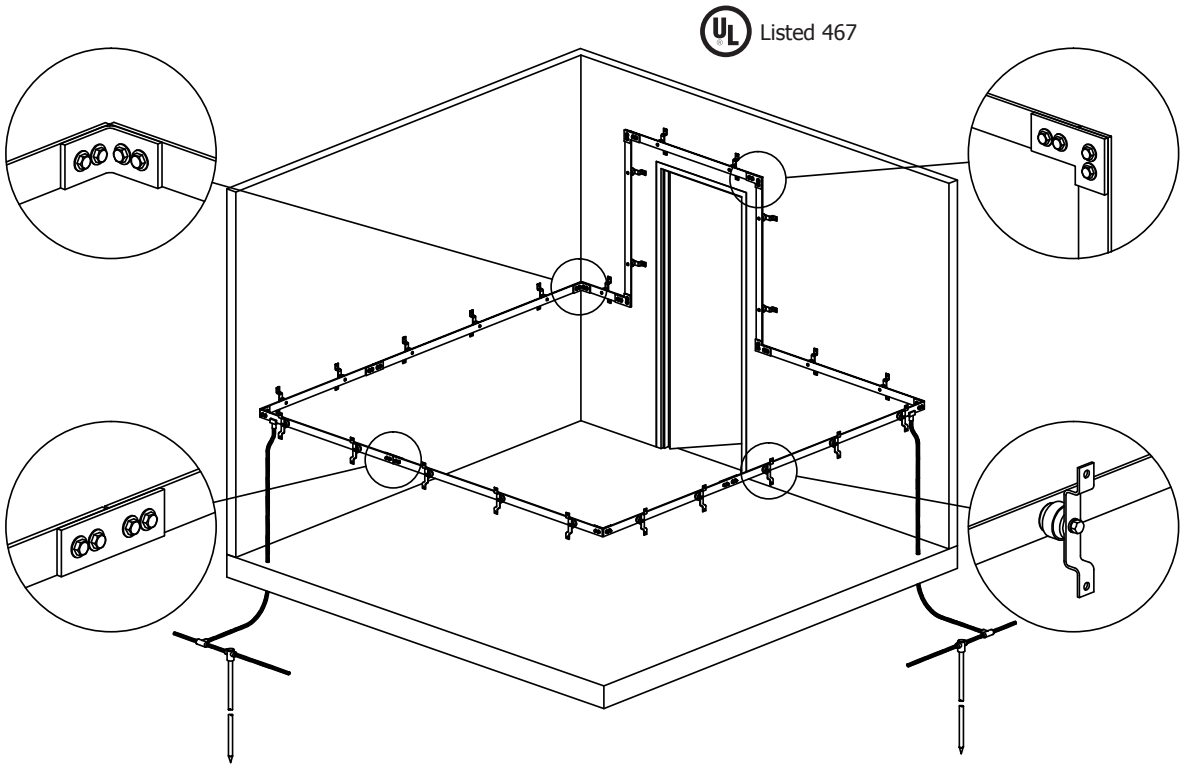
Description		Page
1.4.1	Introduction	80
1.4.2	Ground Bus Numbering System	80
1.4.3	Copper Ground Busbars	81
1.4.4	Ground Bus Sizes	81
1.4.5	Elbows & Splicers with Kits	82
1.4.6	"Sandwich" Style Elbows & Splicers	83
1.4.7	Insulators & Mounting Brackets	84
1.4.8	Static Ground Kits	85

Introduction

Custom Ground Bus Systems

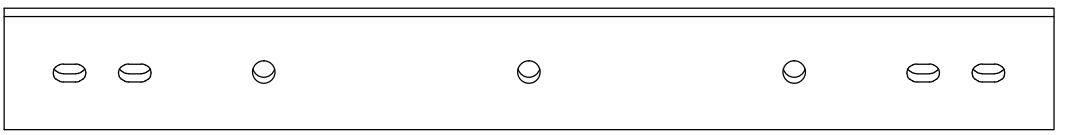
Harger Ground Bus Systems offer flexibility, ease of design and superior installation characteristics. A variety of elbows, insulators, splice plates and bars ensure that custom design specifications are met. Harger's technical support staff stands ready to assist you with your design criteria.

Some examples of Ground Bus System applications are: clean rooms for chemical storage, ammunitions, paints & inks, testing laboratories and pharmaceuticals.



Ground Bus Numbering System

Simply follow the example outlined below to specify the type and size of the ground bus you need.
The following example is a copper ground bus that is 1/4" thick, 2" wide and 12' long utilizing hole pattern "K".



CB 14 2 144 K

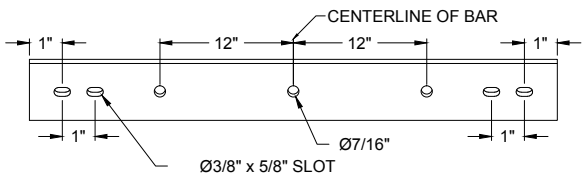
Listed 467

- CB — Material (CB = copper bar, AB = aluminum bar)
- 14 — Thickness (in.)
- 2 — Width (in.)
- 144 — Length (in.)
- K — Hole Pattern

Copper Ground Busbars

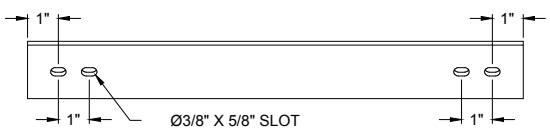
Part No.	Thickness	Width	Length	Hole Pattern	Approx Each Wt. (lbs.)
CB141144K CB141144S CB141144N	1/4"	1"	144"	K S N	12
CB141.5144K CB141.5144S CB141.5144N	1/4"	1-1/2"	144"	K S N	18
CB142144K CB142144S CB142144N	1/4"	2"	144"	K S N	24

• Other sizes available. Please contact factory for more information.

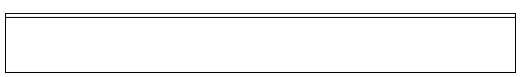


"K"

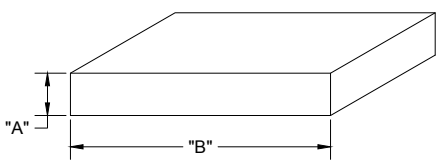
These hole patterns are offered as standard part numbers. However, Harger stands ready to custom design any hole pattern you require.



"S"



"N"



Ground Bus Sizes

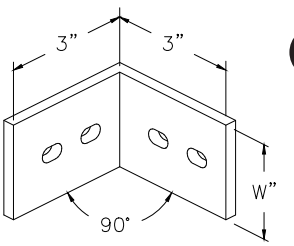
DIMEN. "A" INCHES	DIMEN. "B" INCHES	DIMEN. "A" INCHES	DIMEN. "B" INCHES	DIMEN. "A" INCHES	DIMEN. "B" INCHES	DIMEN. "A" INCHES	DIMEN. "B" INCHES
1/8	3/8	1/4	1	3/8	1-1/2	1/2	4
1/8	1/2	1/4	1-1/4	3/8	2	1/2	5
1/8	5/8	1/4	1-1/2	3/8	2-1/2	1/2	6
1/8	3/4	1/4	1-3/4	3/8	3	1/2	8
1/8	7/8	1/4	2	3/8	3-1/2	3/4	1
1/8	1	1/4	2-1/2	3/8	4	3/4	1-1/4
1/8	1-1/4	1/4	3	3/8	5	3/4	1-1/2
1/8	1-1/2	1/4	3-1/2	3/8	6	3/4	2
1/8	1-3/4	1/4	4	1/2	3/4	3/4	2-1/2
1/8	2	1/4	5	1/2	1	3/4	3
1/8	2-1/2	1/4	6	1/2	1-1/4	3/4	3-1/2
1/8	3	1/4	8	1/2	1-1/2	3/4	4
1/8	4	3/8	1/2	1/2	1-3/4	3/4	5
1/8	6	3/8	5/8	1/2	2	3/4	6
1/4	1/2	3/8	3/4	1/2	2-1/2	3/4	7-3/4
1/4	5/8	3/8	1	1/2	3	3/4	8
1/4	3/4	3/8	1-1/4	1/2	3-1/2		

Maximum length per bar is 12'-0". Bus is available in both copper and aluminum.

Elbows & Splicers with Kits

90° Elbows

Part No.	Kit*	Thickness	Width	Approx. Each Wt. (lbs.)
CU141EL90	No	1/4"	1"	1/2
CU141EL90KIT	Yes	1/4"	1"	3/4
CU141.5EL90	No	1/4"	1-1/2"	3/4
CU141.5EL90KIT	Yes	1/4"	1-1/2"	1
CU142EL90	No	1/4"	2"	1
CU142EL90KIT	Yes	1/4"	2"	1-1/4

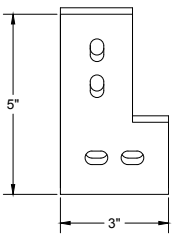


Listed 467

90° Elbows

Part No.	Kit*	Thickness	Dims.	Approx. Each Wt. (lbs.)
CU1435EL90FL	No	1/4"	3" x 5"	1
CU1435EL90FLKIT	Yes	1/4"	3" x 5"	1-1/4

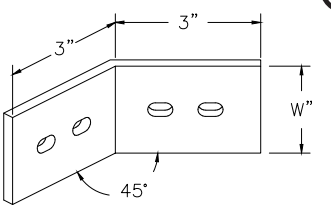
• Used for 1/4" x 2" bar stock.



Listed 467

45° Elbows

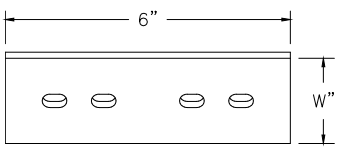
Part No.	Kit*	Thickness	Width	Approx. Each Wt. (lbs.)
CU141EL45	No	1/4"	1"	1/2
CU141EL45KIT	Yes	1/4"	1"	3/4
CU141.5EL45	No	1/4"	1-1/2"	3/4
CU141.5EL45KIT	Yes	1/4"	1-1/2"	1
CU142EL45	No	1/4"	2"	1
CU142EL45KIT	Yes	1/4"	2"	1-1/4



Listed 467

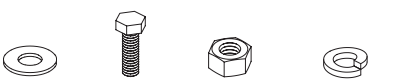
Splice Plates

Part No.	Kit*	Thickness	Width	Approx. Each Wt. (lbs.)
CU141SPL	No	1/4"	1"	1/2
CU141SPLKIT	Yes	1/4"	1"	3/4
CU141.5SPL	No	1/4"	1-1/2"	3/4
CU141.5SPLKIT	Yes	1/4"	1-1/2"	1
CU142SPL	No	1/4"	2"	1
CU142SPLKIT	Yes	1/4"	2"	1-1/4



Listed 467

***Kit Includes:**
(1) Elbow or Splice Plate
(4) CS68S: 3/8"-16x1" SS hex head cap screw
(8) W6S: 3/8"-18 SS flat washer
(4) LW6S: 3/8"-16 SS lock washer
(4) N616S: 3/8"-16 SS hex nut

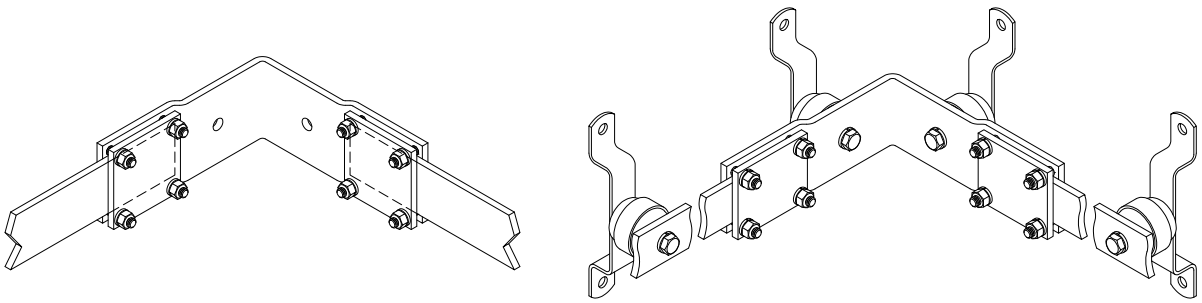


NOTES:
- Slotted hole size is 3/8" x 5/8" spaced 1" on center.
- Other sizes available. Please contact factory for more information.

"Sandwich" Style Elbow & Splicers

No Drilling Required

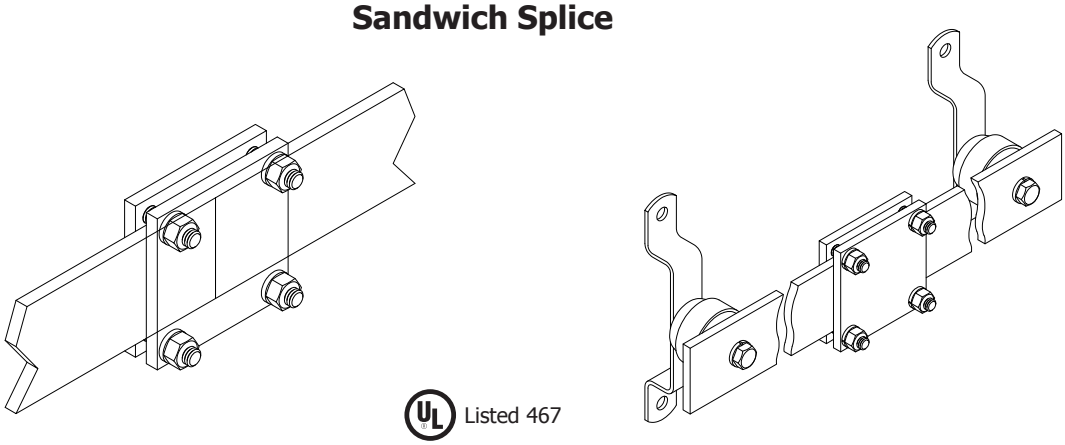
90° Sandwich Splice



Listed 467

Part No.	Thickness	Fits Bar Width	Interior or Exterior Bend	Approx. Each Wt. (lbs.)
SSCUEL90141INT	1/4"	1"	Interior	4
SSCUEL90141EXT	1/4"	1"	Exterior	4
SSCUEL90141.5INT	1/4"	1-1/2"	Interior	5
SSCUEL90141.5EXT	1/4"	1-1/2"	Exterior	5
SSCUEL90142INT	1/4"	2"	Interior	6
SSCUEL90142EXT	1/4"	2"	Exterior	6

Sandwich Splice



Listed 467

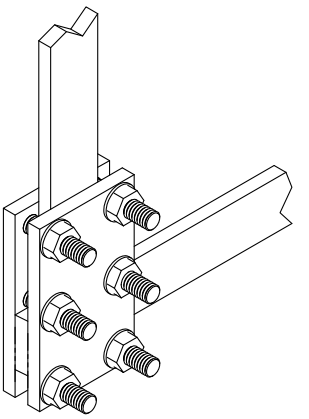
Part No.	Thickness	Fits Bar Width	Approx. Each Wt. (lbs.)
SSCUPL141	1/4"	1"	1/2
SSCUPL141.5	1/4"	1-1/2"	1
SSCUPL142	1/4"	2"	1

Other sizes available. Please contact factory for more information.

"Sandwich" Style Elbows & Splicers

No Drilling Required

Splice Plates



Listed 467

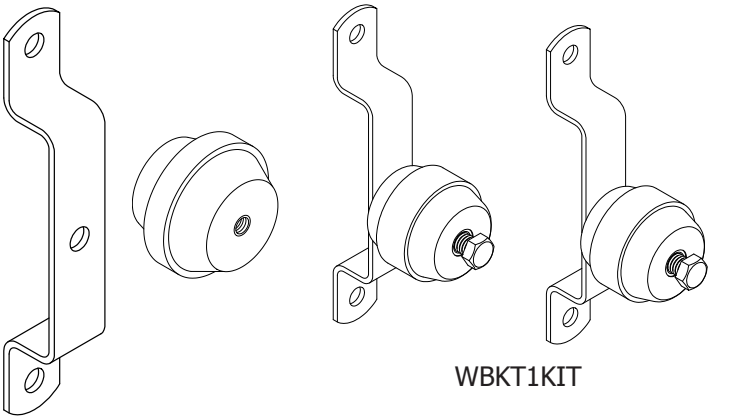
Part No.	Thickness	Fits Bar Width	Approx. Each Wt. (lbs.)
SSCUPLHV141	1/4"	1"	1/2
SSCUPLHV141.5	1/4"	1-1/2"	1
SSCUPLHV142	1/4"	2"	1-1/2

Other sizes available. Please contact factory for more information.

Insulators & Mounting Brackets

Stand-off insulators, mounting brackets and hardware are all provided by Harger. Insulators and mounting brackets are found on pages 74 & 75.
The hardware is in Section 1.12, page 141.

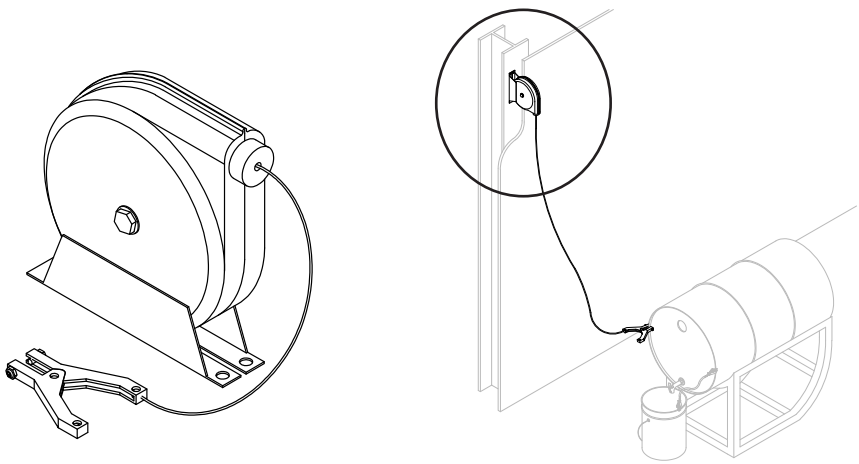
To provide proper support, bars should be mounted every 2 to 4 feet.



WBKT1KIT

Static Ground Kits

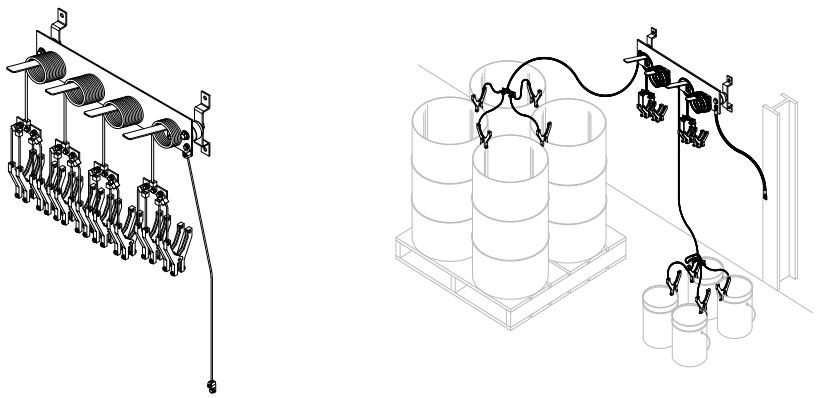
Static Ground Reel 20' with Clamp



Part No.	Approx. Each Wt. (lbs.)
SGR20	15

- Static ground reel with 20' retractable 3/32" diameter galvanized steel bonding conductor.
- Includes die cast aluminum plier-type clamp with two stainless steel points.
- Approximate 1" maximum jaw opening.

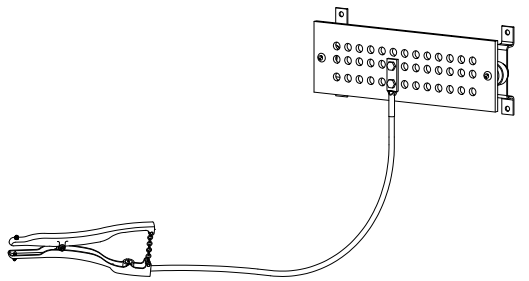
Barrel Grounding Assembly



Part No.	Approx. Each Wt. (lbs.)
ABBOTTBG	30

- Static ground assembly bonds up to 16 barrels or pails.
- Comes with 4 Quad Leads:
  - 3 leads with 10' coils.
  - 1 lead with 5' coil.
- Bars manufactured from 304 stainless steel.

Static Ground Kits

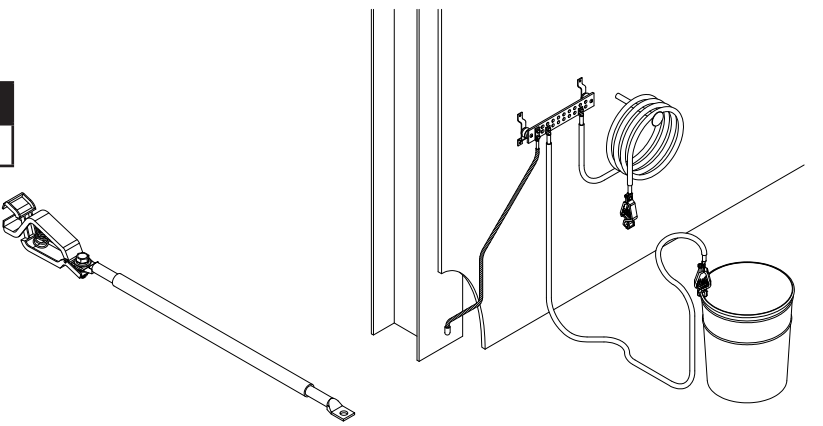


Harger manufactures a variety of static ground kits. Please contact factory for more information.

Pail Ground Strap

Part No.	Approx. Each Wt. (lbs.)
GJ2/0WC120BEMA	7

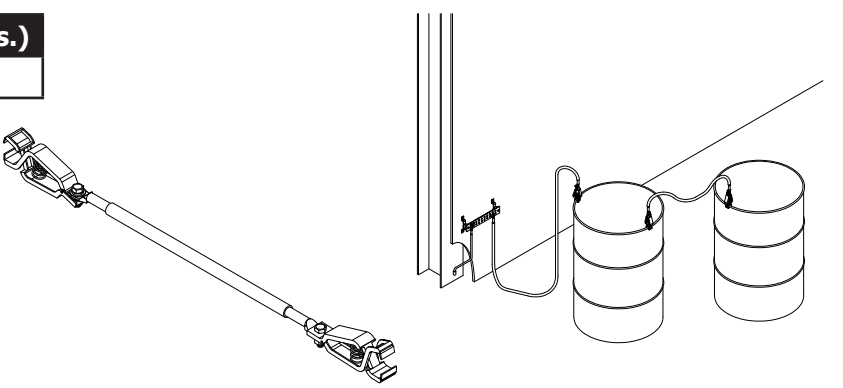
- 10' long, temporary static bond strap manufactured from 2/0 superflexible, insulated conductor.
- Comes with a 200 Amp copper ground clamp with 1-5/8" maximum jaw opening and a compression lug for 3/8" hardware.



Barrel Bond Strap

Part No.	Approx. Each Wt. (lbs.)
GJ4/0WC36CE	5-1/4

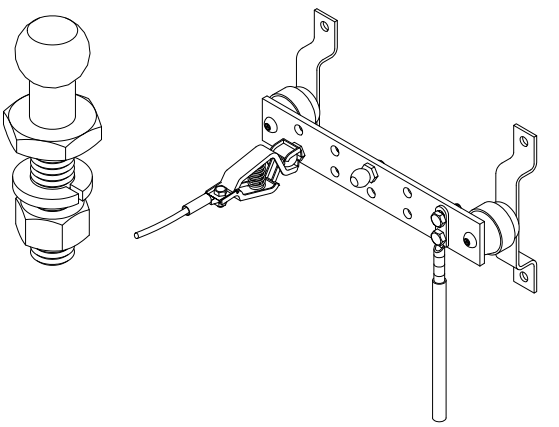
- 36" long, temporary static bond strap manufactured from 4/0 superflexible, insulated conductor.
- Comes with two 200 Amp copper ground clamps with 1-5/8" maximum jaw opening.



Brass Ground Stud

Part No.	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GRDSTD1.25	1/4	25	6-1/4

- Can be attached to ground bar or to steel frame of tank cars or trucks.
- 1-1/4" long 3/8-16 threaded stud with nut and lock washer.
- Used for static grounding.



Section 1.5

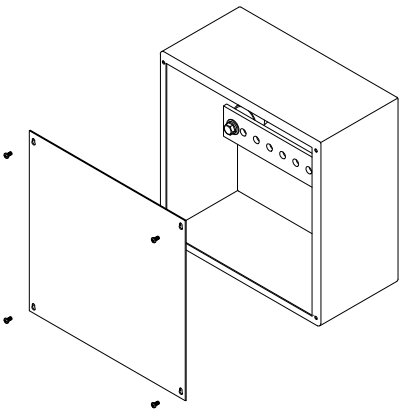
Ground Boxes

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NEMA Type 1 Steel Enclosures

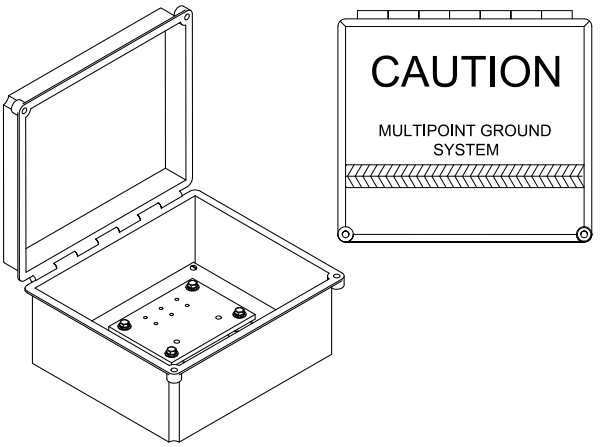
Part No.	Size H	Size W	Size D	Bar Width	Number of Holes	Approx. Each Wt. (lbs.)
GBX886	8"	8"	6"	2"	3	7
GBX10106	10"	10"	6"	2"	6	10
GBX12126	12"	12"	6"	2"	8	19
GBX18186	18"	18"	6"	4"	13	20
GBX24246	24"	24"	6"	4"	19	34



- NEMA Type 1 gray steel boxes with screw cover.
- Standard bar has "H" hole pattern (see page 51).
- "H" hole pattern is a single row of 7/16" holes spaced every 1 inch.
- Two 3/8" x 1-7/8" insulators.
- Other sizes and types available. Please contact factory for more information.

NEMA Type 4 Fiberglass Enclosures

Part No.	Size H	Size W	Size D	Number of Holes	Approx. Each Wt. (lbs.)
ES240	12"	10"	6"	8	22



- 3/8" x 4" x 6" copper ground bar with 3 sets of 1/4" holes spaced 1" on center.
- 3/4" x 9-1/2" x 11-1/2" white plywood backing panel.
- Four 3/8" x 1-1/2" insulators.
- Front cover stenciled with 1" high black letters and 3/8" high black letters.
- Striping is 1/2" high green and orange.
- Other sizes and types available. Please contact factory for more information.

Section 1.6

UL Listed
Supplementary Bonding Grids

(also known as Signal Reference Grids)

&
Prefabricated Copper Ground Mesh

Index

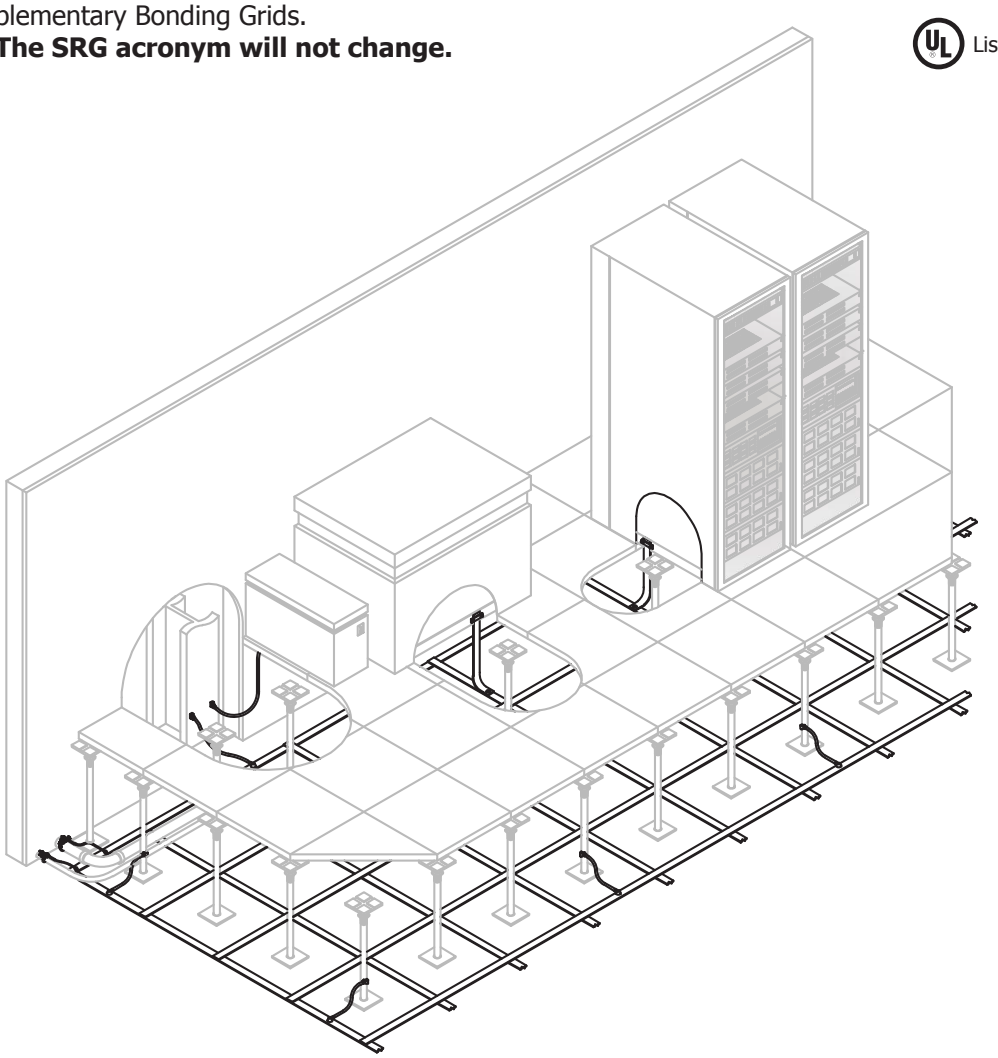
Description		Page
1.6.1	Supplementary Bonding Grids	90
1.6.2	Flat Strip Supplementary Bonding Grids	91
1.6.3	Supplementary Bonding Grid (SRG) Numbering System	91
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Supplementary Bonding Grids

Today's electronic environments require specialized grounding applications. Understanding higher frequency grounds, equipotential ground planes and supplementary bonding subsystems are imperative to protecting sophisticated equipment systems. Harger offers the knowledge and products required to protect these delicate systems. Signal Reference Grids (SRG) are also known as Supplementary Bonding Grids.

Note: The SRG acronym will not change.

Listed 467



DEFINITIONS*:

- **Equipotential Plane:** A grid, sheet, mass, or masses of conducting material which, when bonded together, offers a negligible impedance to current flow. (Serves as signal reference subsystem for new facilities.)
- **Higher Frequency Ground:** The interconnected metallic network intended to serve as a common reference for currents and voltages at frequencies above 30 kHz and in some cases above 300 kHz. Pulse and digital signals with rise and fall times of less than 1 microsecond are classified as higher frequency signals.
- **Signal Reference Subsystem:** A conductive sheet or cable network/mesh providing an equipotential reference for C-E equipments to minimize interference and noise.

*Military Handbook 419A

Flat Strip Supplementary Bonding Grids

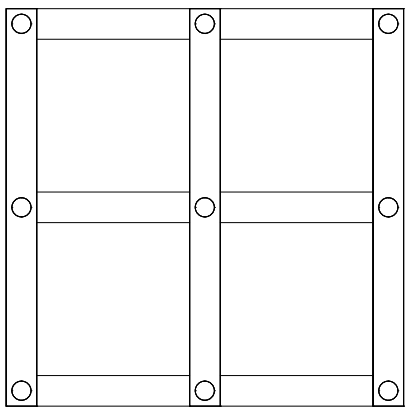
Harger's Flat Strip Supplementary Bonding Grids are manufactured from 2" wide x 26 gauge soft copper strip. They are welded together forming a 2' x 2' pattern. Rolls of SRG range from 2' to 18' wide and the weight per roll is usually limited to a maximum of 250 pounds. The following page offers a design guide to help determine what part numbers are required for the flat strip system. Signal Reference Grids (SRG) are also known as Mesh-BN's, System Reference Potential Planes (SRPP) and Supplementary Bonding Grids.
Note: The SRG acronym will not change.

APPLICATION NOTES:

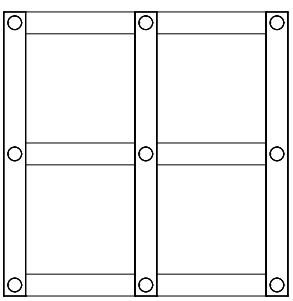
The grid lies directly on the subfloor that supports the raised floor. It may or may not be glued or fastened down. "Power and data cables lay on the grid. The advantage of this geometry is that, due to decreased open loop area, the coupling of radiated energy from far-field phenomena into the cables is minimized when they are very close to the copper strips that form the signal reference grid. The higher capacitance between the cables and the signal reference grid also increases the protected circuit's noise immunity to electric fields. Minimum spacing between the cables and the signal reference grid also reduces susceptibility to magnetic fields. Both of these are near-field effects.
A possible disadvantage of this form of signal reference grid is the requirement for longer bonding straps as compared to the raised floor-based signal reference. Two bonding straps (of different lengths) to each piece of equipment substantially reduces the impedance of the strap."*

*2005 IEEE Std. 1100

Listed 467



Supplementary Bonding Grid (SRG) Numbering System



Example

SRG 12 46 24

- SRG Mesh
- Width (in feet)
- Length (in feet)
- O.C. Spacing (in inches)

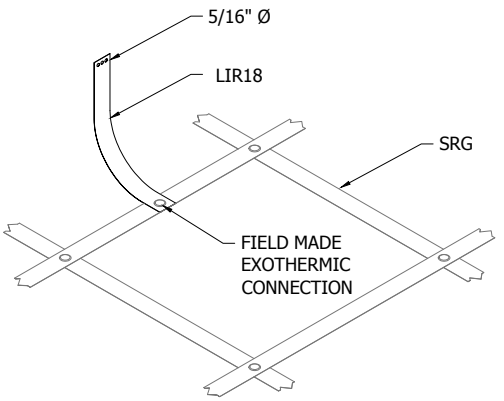
NOTES:
- 2" x .016" Copper Strip is used unless specified otherwise.
- Meets requirements of 2005 IEEE Std. 1100.

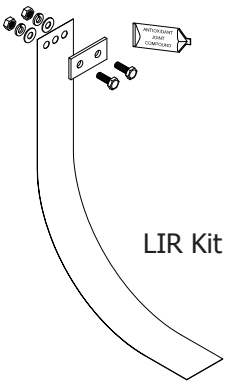
Standard SRG Sizes

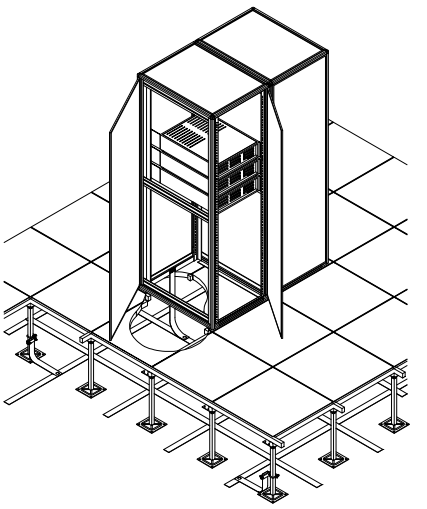
Part No.	Description	Approx. Each Wt. (lbs.)
SRG105024	10' x 50', 24" O.C. Spacing	90
SRG125024	12' x 50', 24" O.C. Spacing	98

• Commonly stocked.

Low Impedance Risers







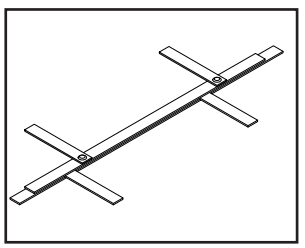
Part No.	Material	Length	Riser or Kit
LIR18	2" x .016" Flat Copper	18"	Riser
LIR18KIT	2" x .016" Flat Copper	18"	Kit
LIR24	2" x .016" Flat Copper	24"	Riser
LIR24KIT	2" x .016" Flat Copper	24"	Kit
LIR36	2" x .016" Flat Copper	36"	Riser
LIR36KIT	2" x .016" Flat Copper	36"	Kit
LIR72	2" x .016" Flat Copper	72"	Riser
LIR72KIT	2" x .016" Flat Copper	72"	Kit

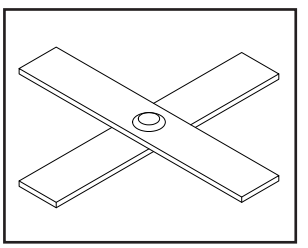
- Kit includes all necessary hardware.
- Use mold SRG2016K to weld LIR to SRG.

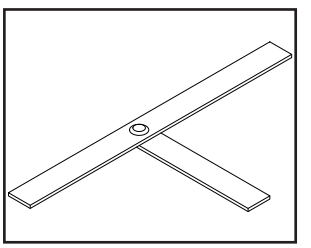
SRG to SRG Connections

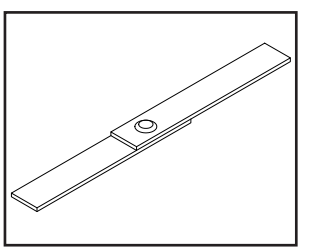
Mold Part No.	Flat Strip	Weld Metal		Handle Clamp
		UltraShot	NUWTUBE	
SRG2016K	2" x .016"	US32	NUWTUBE32	MH1

- The Ultraweld SRG mold and weld metal are used to exothermically weld adjacent SRG mats together in the field.
- The SRG mold can be used to make all required strip to strip connections.
- For low smoke requirements, a USSXKIT (page 276) is required to convert standard UltraShot molds into low smoke-no flame molds using UltraShot weld metal only.


Adjacent SRG Mats Welded Together

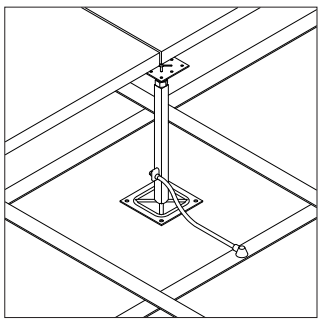

Cross


Tee


Splice

SRG Bonding

Pedestal Bonding to SRG
Connect pedestals per specification, typically every 6th in each direction, to the SRG using #6 AWG 7 strand copper cable. The cable should take the shortest path between the pedestal and the SRG. The length of the wire should not exceed 2 feet. The bond wire can either be exothermically welded to the pedestal (preferred method) or mechanically attached using a UL Listed Pedestal Ground Clamp (see page 94).

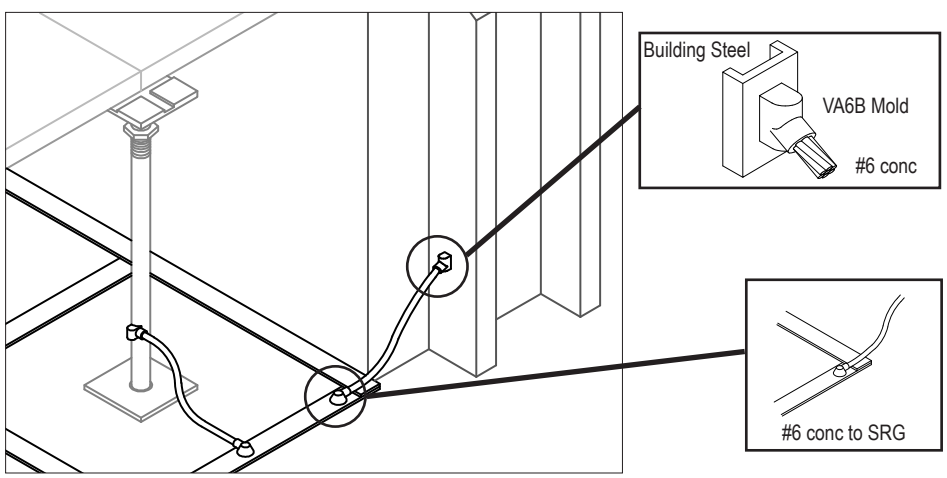


Exothermically Welded Pedestal Connections

Mold Part No.	Connection	Weld Metal		Handle Clamp
		UltraShot	NUWTUBE	
VHO61SQMX	#6 Conc. to 1" Sq. Pedestal	US25	NUWTUBE25	MH4
BCF61.5016B	#6 Conc. to SRG	US25	NUWTUBE25	MH1

- For low smoke requirements, a USSXKIT (page 276) is required to convert standard UltraShot molds into low smoke-no flame molds using UltraShot weld metal only.

Exothermic Connections for Bonding to Building Steel
All columns within and at perimeter of the computer room shall be bonded to the SRG using a concentric stranded copper conductor. #6 AWG 7 strand copper is the most common conductor used for this application. The cable should take the shortest path between the building steel and the Supplementary Bonding Grid.



Mold Part No.	Connection	Weld Metal		Handle Clamp
		UltraShot	NUWTUBE	
VA6B	#6 Conc. to Building Steel	US45	NUWTUBE45	MH1
VA4B	#4 Conc. to Building Steel	US45	NUWTUBE45	MH1
VA2B	#2 Conc. to Building Steel	US45	NUWTUBE45	MH1
BCF61.5016B	#6 Conc. to SRG	US25	NUWTUBE25	MH1
BCF41.5016B	#4 Conc. to SRG	US32	NUWTUBE32	MH1
BCF21.5016B	#2 Conc. to SRG	US32	NUWTUBE32	MH1

- For low smoke requirements, a USSXKIT (page 276) is required to convert standard UltraShot molds into low smoke-no flame molds using UltraShot weld metal only.

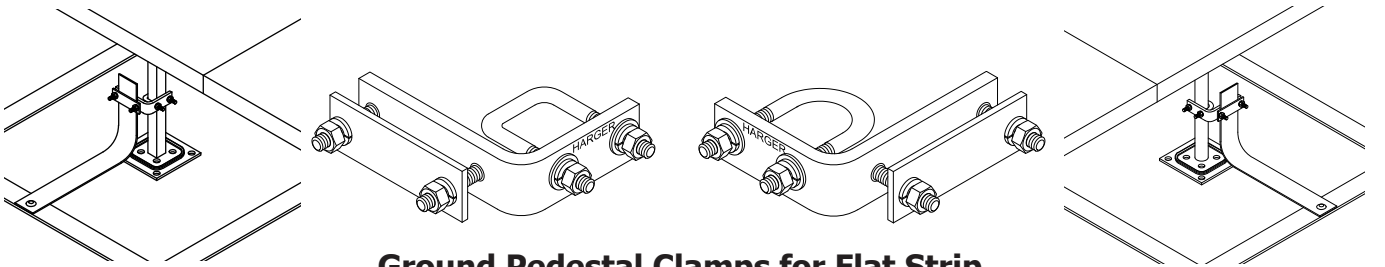
Round-wire Supplementary Bonding Grid

"A Signal Reference Grid may also be economically fabricated from standard, bare round-wire joined together via welding, brazing, compression or a suitable grounding clamp arrangement at each of the crossing points". (2005 IEEE Std. 1100)

Harger offers a variety of ground pedestal clamps and conductors to achieve these objectives. Conductors can be found in Section 1.1, page 11. Signal Reference Grids (SRG) are also known as Supplementary Bonding Grids.

Note: The SRG acronym will not change.

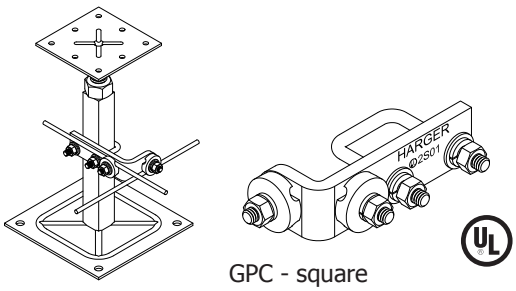
Ground Pedestal Clamps & Bonding Clamps



Ground Pedestal Clamps for Flat Strip

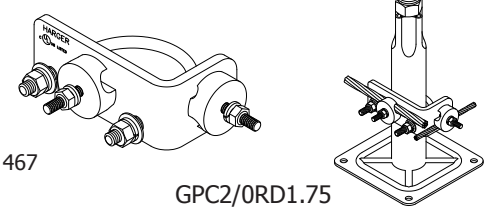
Part No.	U-Bolt Type	Pedestal Size	Conductor Size	Box Qty.	Approx. Box Wt. (lbs.)
GPC2FSSQ	Square	1"	2" Flat Strip	5	4
GPC2FSRD	Round	1"	2" Flat Strip	5	4

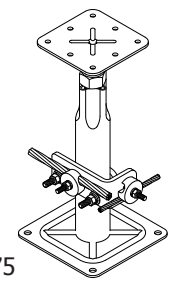
- Electro-tin plated copper.
- Includes stainless steel hardware.



GPC - square

Listed 467



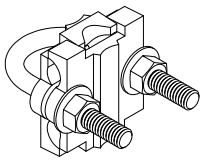


GPC2/0RD1.75

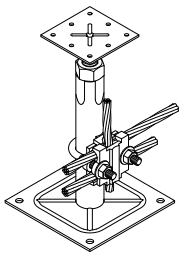
Part No.	U-Bolt Type	Pedestal Size	Conductor Size (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
GPC6SQ	Square	1" (1-1/8" OD)	#6	5	3-1/2
GPC6RD	Round	1" (1-1/8" OD)	#6	5	3-1/2
GPC4SQ	Square	1" (1-1/8" OD)	#4	5	3-1/2
GPC4RD	Round	1" (1-1/8" OD)	#4	5	3-1/2
GPC2SQ	Square	1" (1-1/8" OD)	#2	5	3-1/2
GPC2RD	Round	1" (1-1/8" OD)	#2	5	3-1/2
GPC2/0RD1.75	Round	1-1/8" - 1-3/4"	2/0 & #6	5	7-1/2

- Accommodates cross runs without adding an additional connector. Accommodates 4 conductors in total.
- Electro-tin plated copper.
- Includes stainless steel hardware.
- Other sizes available. Please contact factory for more information.

Ground Pedestal Clamps & Bonding Clamps

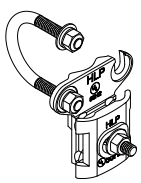


Listed 96
Listed 467

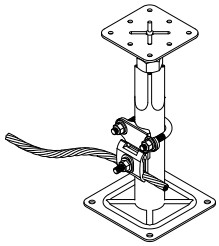


Part No.	Material	Pedestal Diameter Range	Pipe Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPC.5/.75	Tinned Bronze	.5" - 1"	.375" - 1"	5	2-1/2

- Electro-tin plated bronze includes stainless steel hardware.
- Accommodates 3 conductors from #6 AWG up to 4/0, with a maximum single conductor of 500 MCM or two conductors of 250 MCM.
- Fits both round and square pedestal legs up to 1" outside diameter.

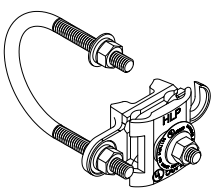


Listed 96
Listed 467

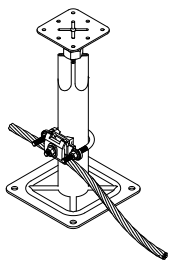


Part No.	Material	Pedestal Diameter Range	Pipe Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPC1/1.25	Tinned Bronze	1" - 1.625"	.75" - 1.7"	5	3

- Electro-tin plated bronze includes stainless steel hardware.
- Accommodates 2 conductors from #6 AWG up to 250 MCM.
- Fits round pedestal outside diameter range .75" - 1.7".



Listed 96
Listed 467



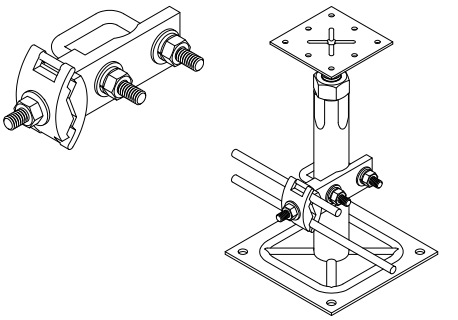
Part No.	Material	Pedestal Diameter Range	Pipe Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPC1.5/2	Tinned Bronze	1.5" - 2.375"	1" - 2.4"	5	3-3/4

- Electro-tin plated bronze includes stainless steel hardware.
- Accommodates 2 conductors from #6 AWG up to 250 MCM.
- Fits round pedestal outside diameter range 1" - 2.4".

Ground Pedestal Clamps & Bonding Clamps

Part No.	Conductor Size (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
GP1MCI	#6 Sol. thru 2/0 Str.	5	2-1/2
TGP1MCI	#6 Sol. thru 2/0 Str.	5	2-1/2

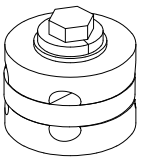
- Heavy duty bronze clamp includes stainless steel hardware.
- Available electro-tin plated. When ordering, add prefix T to part number.
- Fits both round and square pedestal legs up to 1-1/8" outside diameter.



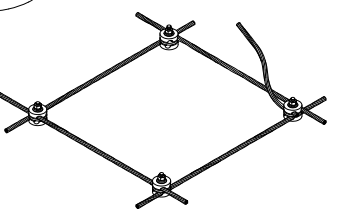
Computer Room Ground Clamps

Part No.	Conductor Size (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
CRGC6	#6	25	4
CRGC4	#4	10	5
CRGC2	#2	10	5

- Used when welded connections are not feasible.
- Unique design allows clamps to form connections at most any angle.
- Specific uses include fabrication under an existing computer room floor.
- Electro-tin plated brass.



Listed 467



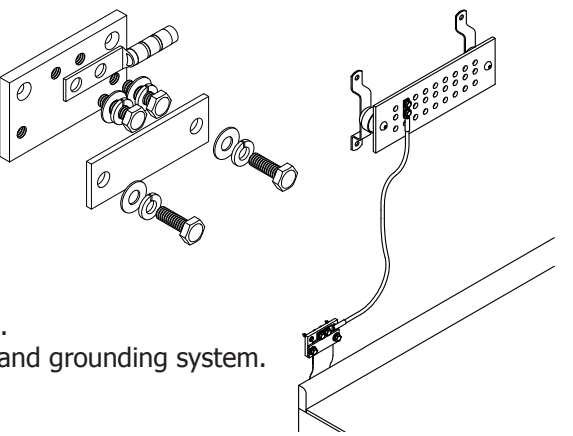
Static Floor Bonding Clamp Kit

Part No.	Box Qty.	Approx. Box Wt. (lbs.)
SFBC3KIT	1	1-1/4

Kit Includes:

(4) CS44S: 1/4"-20 x 1/2" SS hex head cap screw
(4) LW4S: 1/4"-20 SS lock washer
(4) W4S: 1/4"-20 SS flat washer
(1) GECLB62A: #6 compression lug

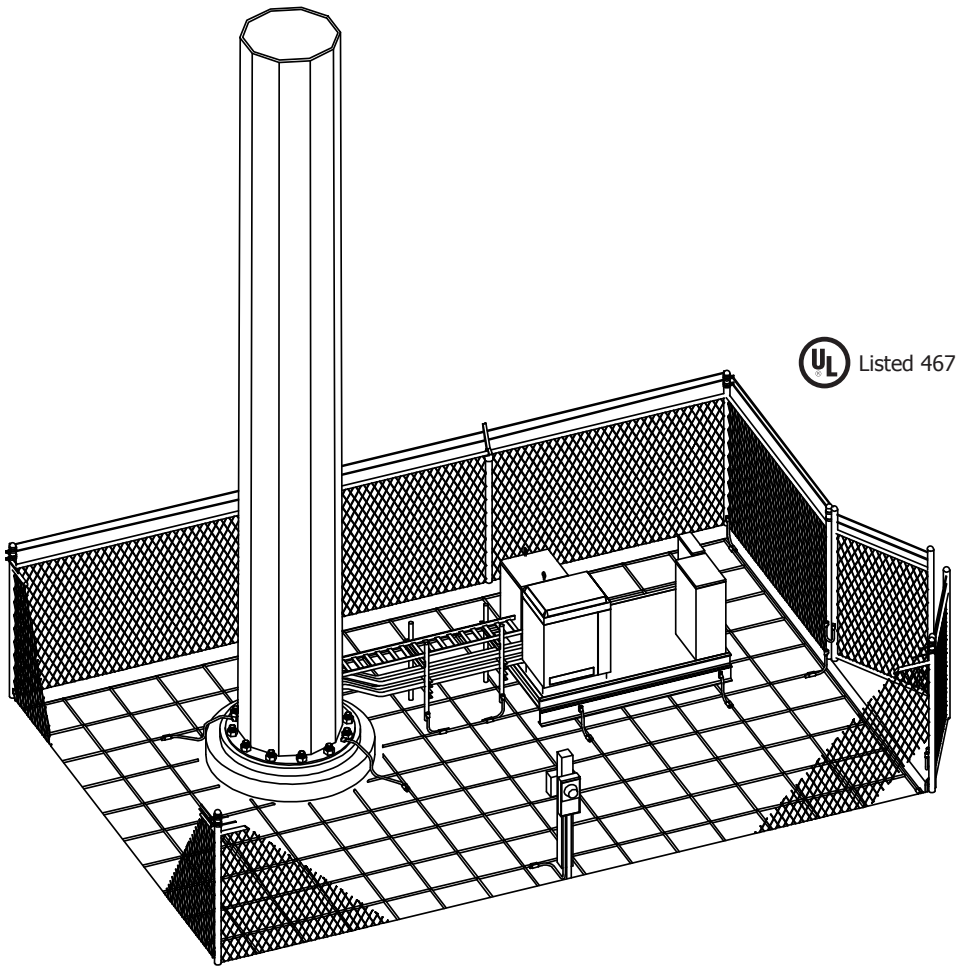
- Manufactured from 110 copper alloy.
- Two piece design sandwiches firmly secures the ground strap.
- Wall mounting hardware, ground bar and conductor not included.
- Bonds static flooring system to the telecommunications bonding and grounding system.



UL Listed Prefabricated Copper Ground Mesh

Prefabricated wire mesh is a simple cost effective method of enhancing ground systems. Applications include improving the ground plane at telecommunications and radio transmitting/ receiving facilities and reducing step and touch potentials at power plants and substations. Mesh is also used where ground rods are impossible to drive or are ineffective because of soil conditions.

Wire mesh is manufactured from solid copper or copper clad steel wire, ranging from #10 AWG to #4 AWG. Normal spacing between conductors is 4", 6", 8", 12", 24" and 48". All joints are silver brazed ensuring excellent electrical continuity, corrosion resistance and superior strength.



Standard Mat Sizes

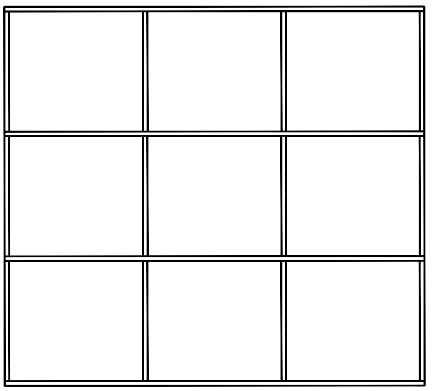
Part No.	Width (ft.)	Length (ft.)	Conductor Size/Type (AWG)	Conductor Spacing (in.)	Approx. Each Wt. (lbs.)
GM125066	12	50	6	6	214
GM1250612	12	50	6	12	117
GM1250624	12	50	6	24	69

• Other sizes available. Please contact factory for more information.

UL Listed Prefabricated Copper Ground Mesh

Harger prefabricated wire mesh can be supplied with no overhang, overlapping ends or butt splice ends.

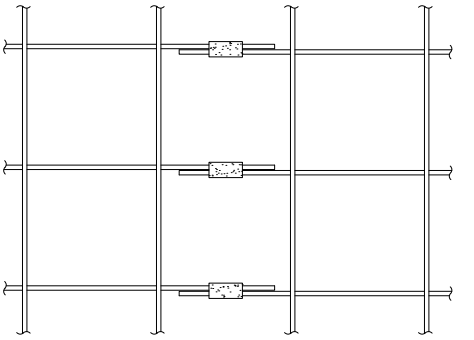
Listed 467



No Overhang

The overlapping end configuration is designed to allow for side by side connections of adjoining mats. This type of connection provides the easiest method of joining two mesh sections. Adding 2" to one half the conductor spacing provides the overlapping ends. For example, if the mesh size is 6" square, the overlapping end length is 5".

Listed 467



"Overlapping" ends

Mesh Net Weight in Pounds per Square Foot

Wire Type	Mesh Cell Size						
	4" x 4"	6" x 6"	8" x 8"	12" x 12"	24" x 24"	24" x 48"	48" x 48"
#10 Cu	0.199	0.132	0.099	0.067	0.034	0.027	0.019
8CW3D	0.257	0.171	0.129	0.087	0.045	0.035	0.024
#8 Cu	0.312	0.208	0.157	0.106	0.055	0.042	0.030
6CW3D	0.451	0.301	0.227	0.153	0.080	0.061	0.043
#6 Cu	0.491	0.328	0.248	0.167	0.087	0.067	0.047
#4 Cu	0.775	0.519	0.392	0.265	0.138	0.106	0.075

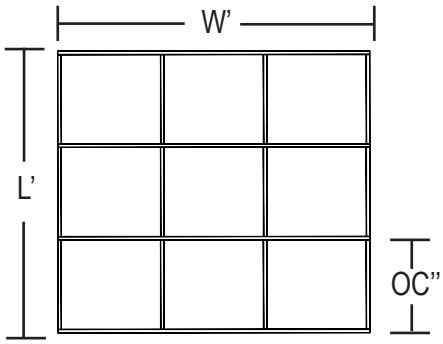
You need to first do the calculation for the net weight in order to calculate the gross shipping weight.

To Calculate Net Weight: Net Weight = Width (ft.) x Length (ft.) x Table Value (lb/ft^2)

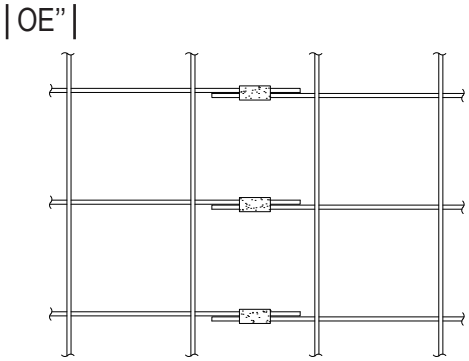
To Calculate Gross Shipping Weight: Gross Weight = Net Weight + [3.38 x (Mesh Width (ft.) + 1 (ft.))]

Example: 10' x 100', #6 Cu Wire Type, 6" x 6" Cell Size, from table 0.328 (lb/ft^2)
Net Weight = 10 x 100 x 0.328 = 328 lbs.
Gross Weight = 328 + [3.38 x (10 + 1)] = 365 lbs.

Copper Ground Mesh Worksheet



No Overhang



Overlapping ends

Example

GM 12 46 6 24 OE1

- GM — Ground Mesh
- 12 — Width (ft.)
- 46 — Length (ft.)
- 6 — Conductor Size/Type
- 24 — O.C. Spacing (in.)
- OE1 — End Type

Standard Mesh Configurations

Wire Size: #4, #6, #8, #10 AWG Solid Conductor

Wire Type: Pure copper or copper clad (30% conductivity)

Mesh Size: 4" square through 48" square in 4" and 6" increments

Conductors

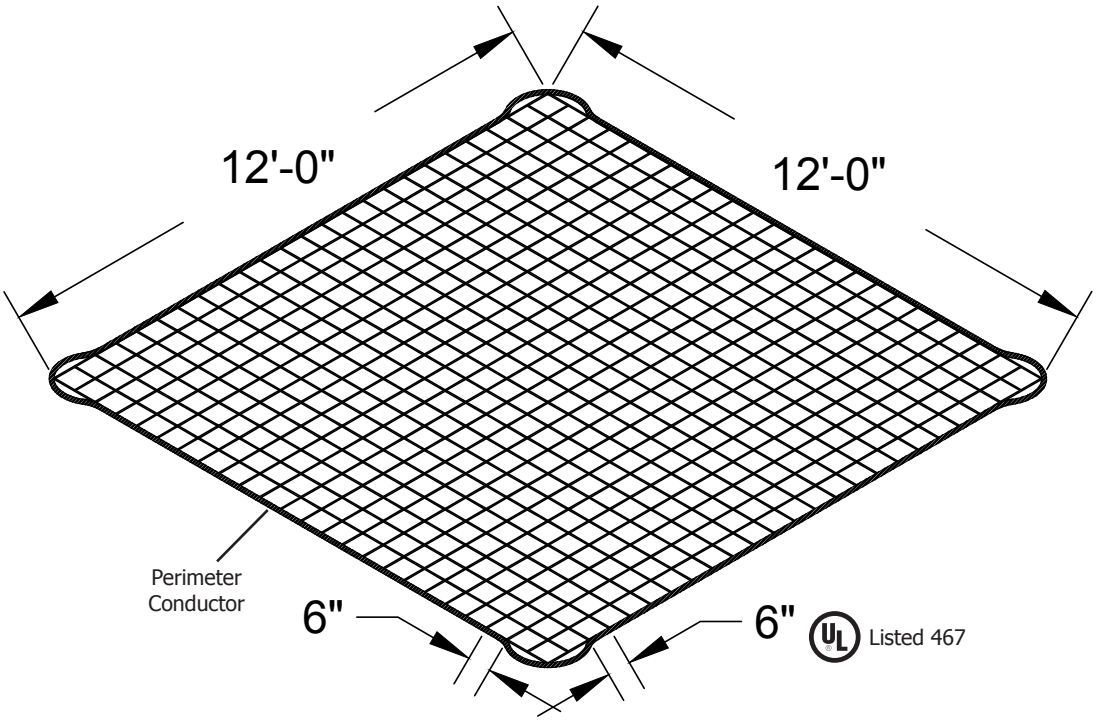
Part No.	Type
4	Solid Copper
6	Solid Copper
6CW3D	Copper Clad 30% Conductivity
8	Solid Copper
8CW3D	Copper Clad 30% Conductivity
10	Solid Copper

End Type	Description
OE1	Overlapping End, Overhang 1 End
OE2	Overlapping End, Overhang 2 Ends

DON'T COUNT THE OVERHANG FOR TOTAL LENGTH/WIDTH

NOTES:
- Overlapping ends are equal to 1/2 the O.C. spacing plus 2" unless specified otherwise.
- 40% DSA conductor available. Please contact factory for more information.

Copper Ground Mesh



Part No.	Perimeter Conductor (AWG)	Approx. Each Wt. (lbs.)
GM121266	None	50
GM121266P2T	2T	60
GM121266SPR12	4/0-19T	81

- 12' x 12' prefabricated wire grounding mesh with 6" squares made from #6 AWG solid copper.
- Available with a tinned perimeter conductor exothermically welded to mesh.
- Mesh is silver brazed at all crossovers using a 15% or 35% silver brazing alloy and a non-corrosive flux.

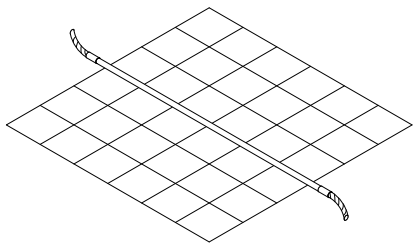
APPLICATION NOTES:

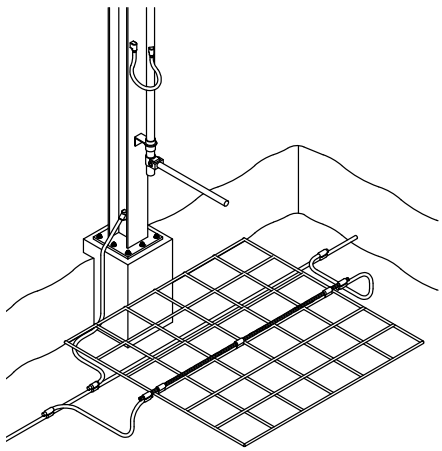
- For enhancing external grounding systems at radio, paging, cellular, etc. transmitting/receiving facilities.
- If strategically placed, mesh can be used as a safety adjunct to reduce dangerous step and touch potentials.
- Perimeter conductor makes for easy attachment to ground conductors.

Personnel Safety Mats

Harger personnel safety mats are designed to protect against "touch potentials" under fault conditions. Listed below are standard mat configurations, however mats can be customized by utilizing the personnel safety mat numbering system. The following example is a safety mat that is 6' wide x 6' long made up of #6 solid copper conductor. Conductors are spaced every 12" and the mat has a 1/0 AWG solid center wire.

UL Listed 467





Personnel Safety Mat Numbering System

PSM 6 6 6 12 C1/0S

- PSM — Personnel Safety Mat
- 6 — Width (ft.)
- 6 — Length (ft.)
- 6 — Conductor Size/Type
- 12 — Conductor Spacing (in.) (Mesh Size)
- C1/0S — Optional Center Wire

Standard Mat Configurations

Mat Size:	4' x 4', 4' x 6', 6' x 6', 6' x 8'
Wire Size:	#4, #6, #8 AWG Solid Conductor
Wire Type:	Pure copper or copper clad steel (30% conductivity)
Mesh Size:	2" square through 12" square in 2" increments
Center Wire:	Optional - See Page 11, Section 1.1 for conductors available. Comes with standard 6" overhang on both sides of mat.

Conductors

Part No.	Type
4	Solid Copper
6	Solid Copper
6CW3D	Copper Clad 30% Conductivity
8	Solid Copper
8CW3D	Copper Clad 30% Conductivity

Standard Mat Sizes

Part No.	Width (ft.)	Length (ft.)	Conductor Size/Type (AWG)	Conductor Spacing (in.)	Optional Center Wire	Approx. Each Wt. (lbs.)
PSM4666C1/0S	4	6	6	6	1/0 Sol.	11
PSM4644C2/0	4	6	4	4	2/0	23
PSM61066C4/0S	6	10	6	6	4/0 Sol.	26

NOTES:

- 40% DSA conductor available. Please contact factory for more information.

Section 1.7

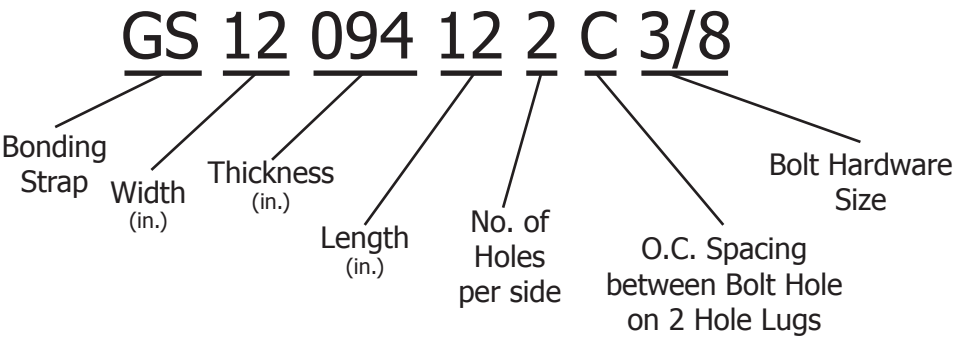
Bonding Straps/Bonding Jumpers

Index

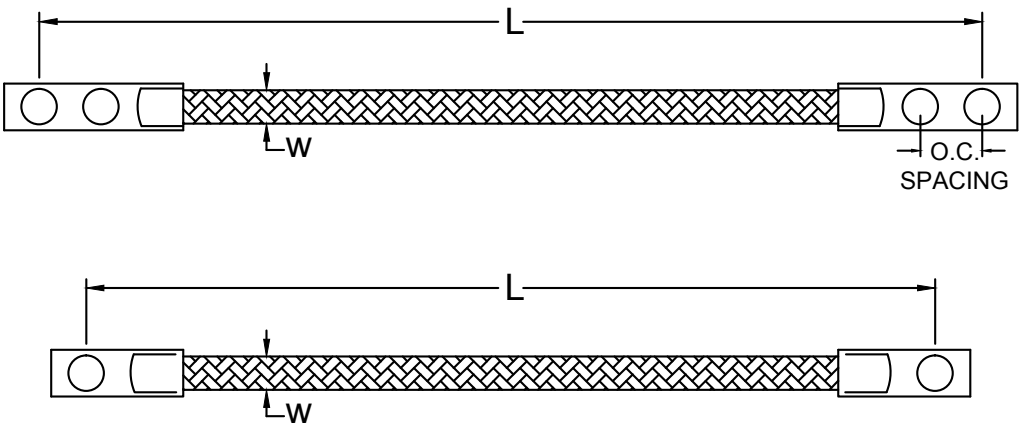
Description		Page
1.7.1	Bonding Strap Numbering System	104
1.7.2	One Hole Tinned Flat Braid Copper Bonding Straps	105
1.7.3	Two Hole Tinned Flat Braid Copper Bonding Straps	106
1.7.4	One Hole Bare Copper Braid Bonding Strap & Kit	107
1.7.5	Bonding/Grounding Straps Numbering System	108
1.7.6	Bonding/Grounding Straps	108
1.7.7	Bonding Jumper Numbering System	109
1.7.8	One Hole Bonding Jumpers & Kits	109
1.7.9	Bonding Jumper Kit	110
1.7.10	Two Hole Insulated Bonding Jumper & Kits	110

Bonding Strap Numbering System

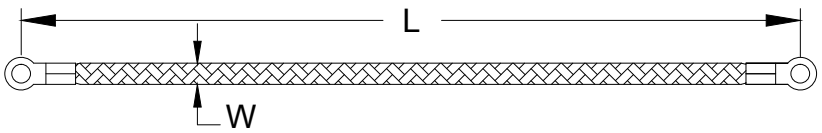
Bonding straps are constructed from flexible tinned copper flat braid. Available with one or two hole compression lugs. Harger offers a variety of lengths and styles. Customizing your own straps is simple with Harger's bonding strap numbering system. To design your own custom bonding strap simply follow the steps outlined below. The following example is a 1/2" wide, .094" thick, 12" long bonding strap using 2 hole compression lugs with 1" O.C. spacing between 3/8" bolt holes.



1. Width of braid strap
2. Thickness of braid strap
3. Length of braid strap (O.C. from lug hole)
4. Specifies one or two holes per side of strap
5. O.C. Spacing between Bolt Hole on 2 Hole Lugs
   A=5/8", B=3/4", C=1", D=1-3/4"
6. Bolt hole size

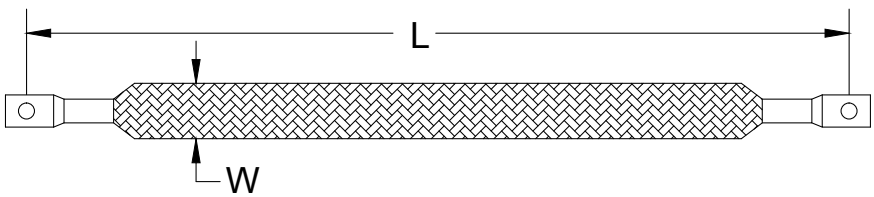


One Hole Tinned Flat Braid Copper Bonding Straps

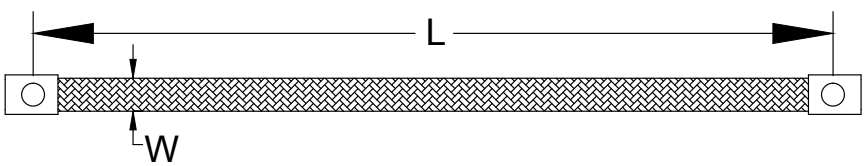


Part No.	Braid Width	Thickness	Gauge Equivalent (AWG)	Length	No. of Holes Per Side	Hardware Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GS140306R13/8	1/4"	.030"	14	6"	1	3/8"	1/2	10	5
GS1403012R13/8	1/4"	.030"	14	12"	1	3/8"	1/2	10	5
GS1403024R13/8	1/4"	.030"	14	24"	1	3/8"	1/2	10	5

• "R" indicates Ring Lug.



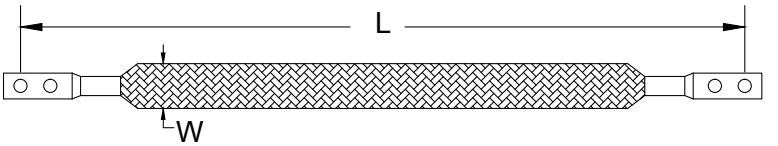
Part No.	Braid Width	Thickness	Gauge Equivalent (AWG)	Length	No. of Holes Per Side	Hardware Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GS12094613/8	1/2"	.094"	6	6"	1	3/8"	1/2	10	5
GS120941213/8	1/2"	.094"	6	12"	1	3/8"	1/2	10	5
GS120942413/8	1/2"	.094"	6	24"	1	3/8"	1/2	10	5



Part No.	Braid Width	Thickness	Gauge Equivalent (AWG)	Length	No. of Holes Per Side	Hardware Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GS5806215.188PTMW	5/8"	.062	8	15.2"	1	7/16"	1/4	10	2-1/2

APPLICATION NOTES:
- Dimensions are nominal sizes.
- See page 104 for strap dimensions.
- Other sizes available. Please contact factory for more information.

Two Hole Tinned Flat Braid Copper Bonding Straps



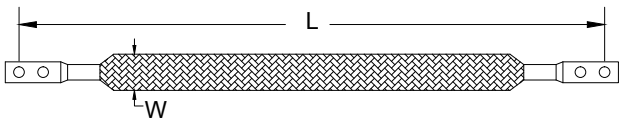
Part No.	Braid Width	Thickness	Gauge Equivalent (AWG)	Length	No. of Holes Per Side	O.C. Spacing	Hardware Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GS14030102A1/4	1/4"	.030"	14	10"	2	5/8"	1/4"	1/2	10	5
GS14030162A1/4	1/4"	.030"	14	16"	2	5/8"	1/4"	1/2	10	5
GS14030242A1/4	1/4"	.030"	14	24"	2	5/8"	1/4"	1/2	10	5

Part No.	Braid Width	Thickness	Gauge Equivalent (AWG)	Length	No. of Holes Per Side	O.C. Spacing	Hardware Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GS12094122A1/4	1/2"	.094"	6	12"	2	5/8"	1/4"	1/2	10	5
GS12094122C3/8	1/2"	.094"	6	12"	2	1"	3/8"	1/2	10	5
GS12094182A1/4	1/2"	.094"	6	18"	2	5/8"	1/4"	1/2	10	5
GS12094182C3/8	1/2"	.094"	6	18"	2	1"	3/8"	1/2	10	5
GS12094242A1/4	1/2"	.094"	6	24"	2	5/8"	1/4"	1/2	10	5
GS12094242C3/8	1/2"	.094"	6	24"	2	1"	3/8"	1/2	10	5

Part No.	Braid Width	Thickness	Gauge Equivalent (AWG)	Length	No. of Holes Per Side	O.C. Spacing	Hardware Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GS34062122A1/4	3/4"	.062"	6	12"	2	5/8"	1/4"	1/2	10	5
GS34062122C3/8	3/4"	.062"	6	12"	2	1"	3/8"	1/2	10	5
GS34062182A1/4	3/4"	.062"	6	18"	2	5/8"	1/4"	1/2	10	5
GS34062182C3/8	3/4"	.062"	6	18"	2	1"	3/8"	1/2	10	5
GS34062242A1/4	3/4"	.062"	6	24"	2	5/8"	1/4"	1/2	10	5
GS34062242C3/8	3/4"	.062"	6	24"	2	1"	3/8"	1/2	10	5
GS34062302A1/4	3/4"	.062"	6	30"	2	5/8"	1/4"	1/2	10	5
GS34062302C3/8	3/4"	.062"	6	30"	2	1"	3/8"	1/2	10	5

APPLICATION NOTES:
- Dimensions are nominal sizes.
- See page 104 for strap dimensions.
- Other sizes available. Please contact factory for more information.

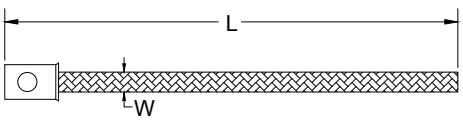
Two Hole Tinned Flat Braid Copper Bonding Straps



Part No.	Braid Width	Thickness	Gauge Equivalent (AWG)	Length	No. of Holes	O.C. Spacing	Hardware Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GS1062122A1/4	1"	.062"	4	12"	2	5/8"	1/4"	1/2	10	5
GS1062122C3/8	1"	.062"	4	12"	2	1"	3/8"	1/2	10	5
GS1062182A1/4	1"	.062"	4	18"	2	5/8"	1/4"	1/2	10	5
GS1062182C3/8	1"	.062"	4	18"	2	1"	3/8"	1/2	10	5
GS1062242A1/4	1"	.062"	4	24"	2	5/8"	1/4"	1/2	10	5
GS1062242C3/8	1"	.062"	4	24"	2	1"	3/8"	1/2	10	5

- Dimensions are nominal sizes.
- See page 104 for strap dimensions.
- Other sizes available. Please contact factory for more information.

One Hole Bare Copper Braid Bonding Strap



Part No.	Braid Width	Thickness	Gauge Equivalent (AWG)	Length	No. of Holes	Hardware Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GS58101TIE	7/16"	.070"	7	10"	1	7/16"	1/4	10	2-1/2

One Hole Bare Copper Braid Bonding Strap Kit

Part No.	Braid Width	Thickness	Length	No. of Holes	O.C. Spacing	Hardware Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GS438070BF1014KIT	7/16"	.070"	10"	1	10-1/8"	1/4"	1/4	10	2-1/2

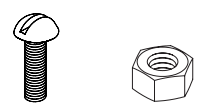
- Other sizes available. Please contact factory for more information.

Kit Includes:

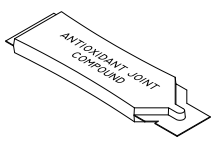
(1) GS438070BF1014: copper flat braid bonding strap
(1) HAAJC1/2: aluminum antioxidant 1/2 oz. tube
(2) N420S: 1/4"-20 x 1/2" stainless steel hex nut screw
(2) MS44S: 1/4"-20 x 1/2" stainless steel machine screw
(2) LW4S: 1/4" stainless steel split lock washer
(2) SW4S: 1/4" star lock washer

GS438070BF1014

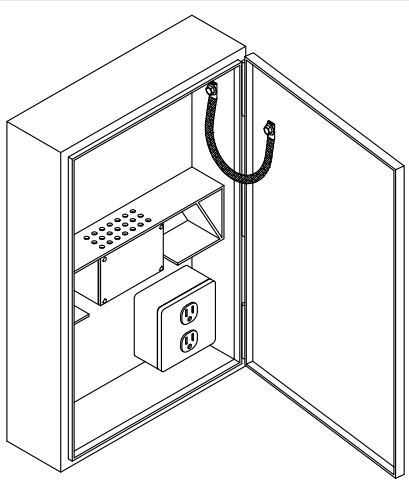




MS44S N420S SW4S LW4S



HAAJC1/2



Bonding/Grounding Straps Numbering System

BGS 1 S 12 D 3/8

- BGS — Bonding Grounding Strap
- 1 — Number of Braids
- S — Terminal Width (in.) (See Chart A Below)
- 12 — Length (in.) (including terminal)
- D — Hole O.C. Spacing (in.) (See Chart B Below)
- 3/8 — Hardware Size

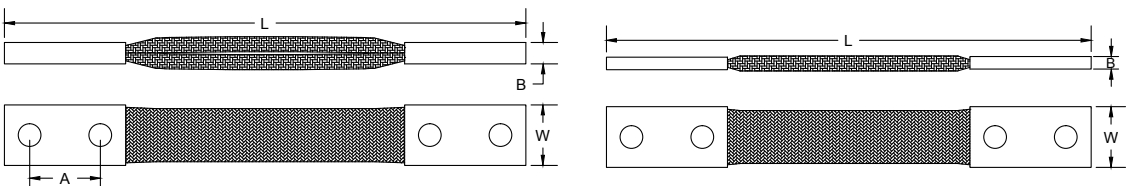
Chart A

Standard Terminal Width
R = 3/4"
S = 1"
T = 1-3/8"
U = 1-1/4"
V = 1-1/2"
W = 1-3/4"
X = 2"
Y = 2-3/8"
Z = 3"

Chart B

Hole O.C. Spacing
A = 1/2"
B = 3/4"
C = 1"
D = 1-3/4"
E = 1-1/4"
F = 1-1/2"

Bonding/Grounding Straps

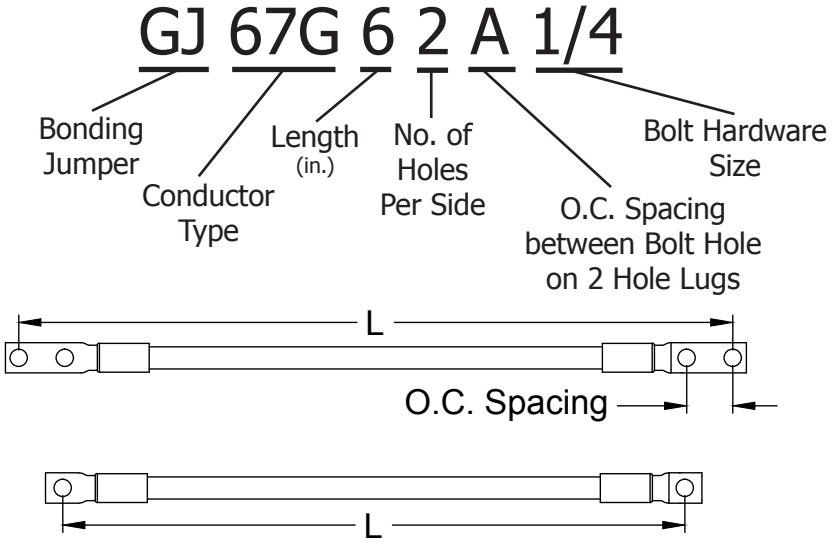


Part No.	Number of Braids	Terminal Width	Length Terminal End to End	Hole O.C. Spacing	Hardware Size	Qty.	Approx. Each Wt. (lbs.)
BGS1S12D3/8	1	1"	12"	1-3/4"	3/8"	EA	1/2
BGS1S24E3/8	1	1"	24"	1-1/4"	3/8"	EA	1
BGS2S12E1/2	2	1"	12"	1-1/4"	1/2"	EA	1
BGS1V12F1/2	1	1-1/2"	12"	1-1/2"	1/2"	EA	1/2
BGS1V18D1/2	1	1-1/2"	18"	1-3/4"	1/2"	EA	3/4

- Terminal ends come tinned as standard. Bare, silver, nickel are available.
- Braid comes tinned as a standard.
- Other sizes are available. Please contact factory for more information.

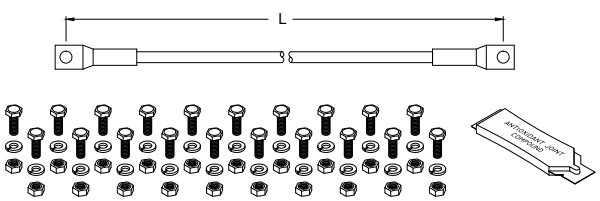
Bonding Jumper Numbering System

Bonding jumpers are constructed from round conductors, insulated or bare. Available with one or two hole compression lugs. Harger offers a variety of lengths and styles. Customizing your own jumper is simple with Harger's bonding jumper numbering system. To design your own custom bonding jumper simply follow the steps outlined below. The following example is a #6-7 AWG green conductor, 6" long with 2 hole compression lugs that have 5/8" O.C. spacing between 1/4" bolt holes.



1. Conductor type
2. Length of bonding jumper
3. Specifies one or two holes per side of jumper
4. O.C. Spacing between Bolt Hole on 2 Hole Lugs
   A=5/8", B=3/4", C=1", D=1-3/4"
5. Bolt hardware size

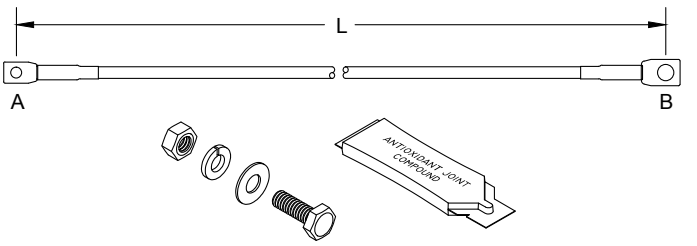
One Hole Bonding Jumpers & Kits



Part No.	Kit	Conductor Type	Length	No. of Holes Per Side	Hardware Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GJ67G1211/4	No	67G	12"	1	1/4"	1/4	10	5
GJ67G1211/4KIT5	Yes	67G	12"	1	1/4"	1-1/4	5	6-1/4
GJ67G1811/4	No	67G	18"	1	1/4"	1/4	10	5
GJ67G1811/4KIT5	Yes	67G	18"	1	1/4"	1-1/4	5	6-1/4
GJ67G2411/4	No	67G	24"	1	1/4"	1/4	10	5
GJ67G2411/4KIT5	Yes	67G	24"	1	1/4"	1-1/4	5	6-1/4

- #6 AWG x 7 Strand Green THW insulation. Kit includes all necessary hardware.
- Other sizes and types available. Please contact factory for more information.

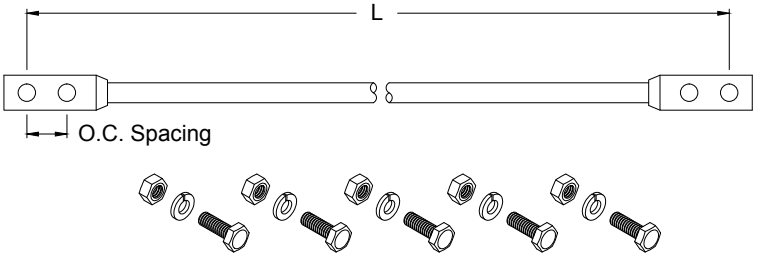
Bonding Jumper Kit



Part No.	Conductor Type	Length	No. of Holes Per Side	Hardware Size A	Hardware Size B	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GJ67G72EMSKIT	67G	73-1/4"	1	1/4"	3/8"	2	5	10

- #6 AWG x 7 strand green THW insulated.
- Bonding Jumper for 1/4" stud to ground bar or ground metal body.
- Includes 1/2 ounce antioxidant (HAAJC1/2) and 3/8" hardware.

Two Hole Insulated Bonding Jumpers & Kits



Part No.	Conductor Type	Length	No. of Holes Per Side	Hardware Size	Jumper or Kit	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GJ67G82A1/4	67G	8"	2	1/4"	Jumper	1/8	10	1-1/4
GJ67G82A1/4KIT	67G	8"	2	1/4"	Kit	1/8	10	1-1/4
GJ67G82A1/4KIT5	67G	8"	2	1/4"	Kit	3/4	5	3-3/4
GJ67G102A1/4	67G	10"	2	1/4"	Jumper	1/4	10	2-1/2
GJ67G102A1/4KIT	67G	10"	2	1/4"	Kit	1/4	10	2-1/2
GJ67G102A1/4KIT5	67G	10"	2	1/4"	Kit	1-1/4	5	6-1/4
GJ67G122A1/4	67G	12"	2	1/4"	Jumper	1/4	10	2-1/2
GJ67G122A1/4KIT	67G	12"	2	1/4"	Kit	1/4	10	2-1/2
GJ67G122A1/4KIT5	67G	12"	2	1/4"	Kit	1-1/4	5	6-1/4

- #6 AWG x 7 Strand Green THW insulation. Kit includes all necessary hardware.
- Spacing between bolt holes is 5/8" on center.
- Other sizes and types available. Please contact factory for more information.

Section 1.8

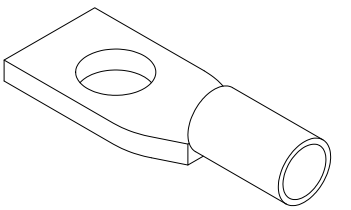
Compression Lugs, Connectors & Tools

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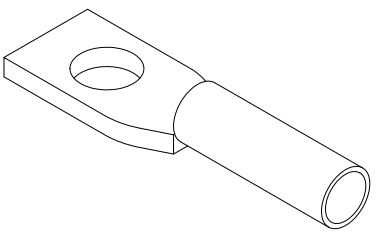
One Hole Compression Lugs

Part No.	Conductor Size (AWG)	Hardware Size	Long Barrel	Color Code	Box Qty.	Approx. Box Wt. (lbs.)
GECL6	6	1/4"	No	Blue	50	1
GECLB6	6	1/4"	Yes	Blue	50	1-1/2
GECL63/8	6	3/8"	No	Blue	50	2
GECLB63/8	6	3/8"	Yes	Blue	50	1-1/2
GECL4	4	1/4"	No	Gray	50	1-1/2
GECLB4	4	1/4"	Yes	Gray	50	2
GECL2	2	5/16"	No	Brown	50	2
GECLB2	2	5/16"	Yes	Brown	50	2
GECL23/8	2	3/8"	No	Brown	50	2
GECLB23/8	2	3/8"	Yes	Brown	50	2
GECL21/4	2	1/4"	No	Brown	50	2
GECLB21/4	2	1/4"	Yes	Brown	50	2
GECL1/0	1/0	3/8"	No	Pink	10	1/2
GECLB1/0	1/0	3/8"	Yes	Pink	10	1
GECL2/0	2/0	3/8"	No	Black	10	1
GECLB2/0	2/0	3/8"	Yes	Black	10	2
GECL4/0	4/0	1/2"	No	Purple	10	1
GECLB4/0	4/0	1/2"	Yes	Purple	10	3



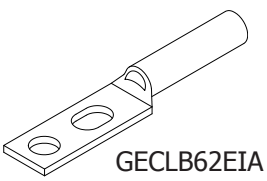
Standard Barrel

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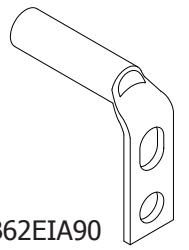


Long Barrel

Specialized Compression Lugs



GECLB62EIA



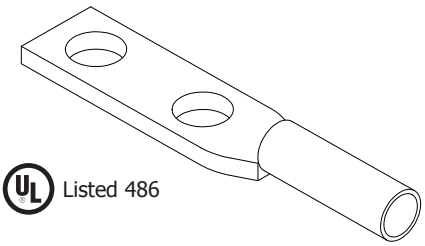
GECLB62EIA90

Part No.	Conductor Size (AWG)	Hole Spacing Range	Hardware Size	Bend Angle	Color Code	Box Qty.	Approx. Box Wt. (lbs.)
GECLB62EIA	#6 or #6 FLEX	.5" - .625"	1/4"	No Bend	Blue	50	1-1/2
GECLB62EIA90	#6 or #6 FLEX	.5" - .625"	1/4"	90°	Blue	50	1-1/2

- Designed to fit standard EIA spacing.

NOTES:
- Manufactured from electro plated tinned copper.
- For use on copper or tinned copper conductors.
- Lugs have inspection ports.
- Other sizes available. Please contact factory for more information.
- See page 148 for antioxidants.

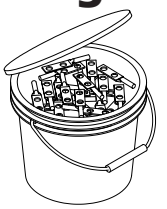
Two Hole Long Barrel Compression Lugs

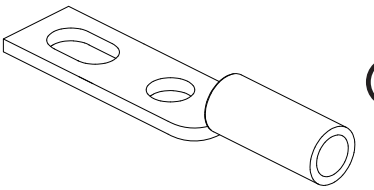


Part No.	Conductor Size (AWG)	O.C. Dim. B/T Holes	Hardware Size	Color Code	Box Qty.	Approx. Box Wt. (lbs.)
GECLB62A	6	.625"	1/4"	Blue	50	1-1/2
GECLB62B	6	.75"	3/8"	Blue	50	2
GECLB62C	6	1"	3/8"	Blue	50	2
GECLB42A	4	.625"	1/4"	Gray	25	1-1/2
GECLB42B	4	.75"	1/4"	Gray	25	1-1/2
GECLB42C	4	1"	3/8"	Gray	25	2
GECLB22A	2	.625"	1/4"	Brown	25	1-1/2
GECLB22B	2	.75"	3/8"	Brown	25	1-1/2
GECLB22BS	2 Sol.	.75"	3/8"	White	25	2
GECLB22C	2	1"	3/8"	Brown	25	2
GECLB22CS	2 Sol.	1"	3/8"	White	25	2-1/2
GECLB1/02C	1/0	1"	3/8"	Pink	10	2
GECLB1/02D	1/0	1.75"	1/2"	Pink	10	2
GECLB2/02C	2/0	1"	3/8"	Black	10	1-1/2
GECLB2/02D	2/0	1.75"	1/2"	Black	10	1-1/2
GECLB3/02C	3/0	1"	3/8"	Orange	10	2
GECLB4/02C	4/0	1"	3/8"	Purple	10	2
GECLB4/02D	4/0	1.75"	1/2"	Purple	10	2-1/2
GECLB2502C	250	1"	3/8"	Yellow	10	3
GECLB2502D	250	1.75"	1/2"	Yellow	10	4
GECLB5002C	500	1"	3/8"	Brown	10	5
GECLB5002D	500	1.75"	1/2"	Brown	10	8
GECLB7502C	750	1"	3/8"	Black	10	10
GECLB7502D	750	1.75"	1/2"	Black	10	11

- Manufactured from electro plated tinned copper.
- For use on copper or tinned copper conductors.
- Lugs have inspection ports.
- Other sizes available. Please contact factory for more information.
- For copper exothermic lugs, see pages 314-315 (SXL, OXL, BXL & JXL)
- See page 148 for antioxidants.

Slotted Long Barrel Compression Lugs





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Part No.	Conductor Size (AWG)	Hole Spacing Range	Hardware Size	Color Codes	Box Qty.	Approx. Box Wt. (lbs.)
GECLB62BC	#6 Str.	.75" to 1"	3/8"	Blue	50	2
GECLB62BC250BK	#6 Str.	.75" to 1"	3/8"	Blue	250	10
GECLB22BCS	#2 Sol.	.75" to 1"	3/8"	White	50	2
GECLB22BCS250BK	#2 Sol.	.75" to 1"	3/8"	White	250	13
GECLB22BC	#2 Str.	.75" to 1"	3/8"	Brown	50	2
GECLB22BC250BK	#2 Str.	.75" to 1"	3/8"	Brown	250	16

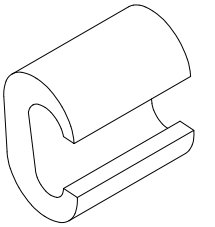
- Manufactured from electro plated tinned copper.
- For use on copper or tinned copper conductors.
- Lugs have inspection ports.
- 250 pack comes in one gallon bucket.
- See page 148 for antioxidants

C-Type Compression Taps

Connects two copper conductors together with a hydraulic crimp tool.
Please refer to the chart for the appropriate connector.

Heavy Duty C-Taps

Part No.	Conductor (AWG)		Die Index	Box Qty.	Approx. Box Wt. (lbs.)
	Run	Tap			
CT4666	#4 Stranded #6 Solid	#6 Stranded #6 Solid	BG	50	2-1/2
CT4446	#4 Stranded #6 Solid	#4 Stranded #4 Solid	BG	50	2-1/2
CT2248	#2 Stranded #2 Solid	#4 Stranded #8 Solid	C	50	6
CT2222	#2 Stranded #2 Solid	#2 Stranded #2 Solid	C	50	4
CT22/0	2/0 Stranded 1/0 Solid	#2 Stranded #8 Solid	O	10	1
CT24/0	4/0 Stranded 3/0 Solid	#2 Stranded #6 Solid	D3	10	1
CT2/02/0	2/0 Stranded 1/0 Solid	2/0 Stranded 1/0 Solid	O	10	1
CT4/02/0	4/0 Stranded 3/0 Solid	2/0 Stranded 1/0 Solid	D3	10	2
CT4/04/0	4/0 Stranded 3/0 Solid	4/0 Stranded 3/0 Solid	D3	10	2

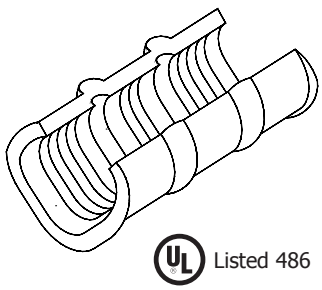


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C-Type Compression Taps

Light Duty C-Taps

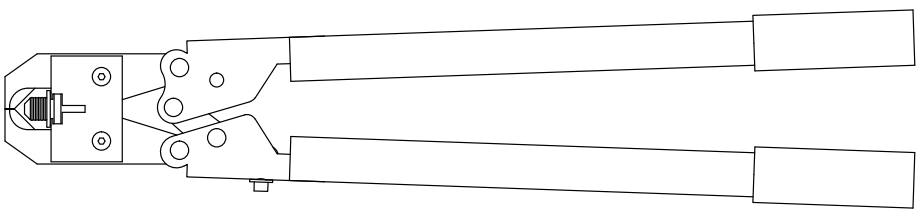
Part No.	Conductor (AWG) Run	Conductor (AWG) Tap	Color Code	Box Qty.	Approx. Box Wt. (lbs.)
CT4666LD	#6 Stranded #5, #4 AWG	#8-#6 Stranded #12 - #8 AWG	Brown	100	2
CT2248LD	#4 Stranded #3 Stranded #2 Stranded	#4 Stranded #5 Stranded #12-#6 Stranded	Pink	100	4
CT2222LD	#2 Stranded #2 Solid	#2 Str. - #2 Sol. #3 Str. - #3 Sol.	Orange	50	5
	#1 Stranded #1 Solid	#4 Str. - #4 Sol. #3 Str. - #3 Sol.			
	1/0 Stranded 1/0 Solid	#12 Str. - #12 Sol. #4 Str. - #4 Sol.			



Listed 486

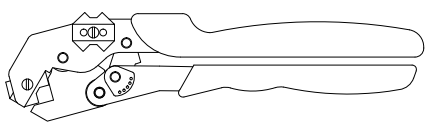
- Other sizes available. Please contact factory for more information.

Mechanical Compression Tools



Part No.	Length	Approx. Each Wt. (lbs.)
MCT	24"	5

- Dieless adjustable compression tool with steel handle.
- Works with copper conductor sizes #8 AWG through 250 MCM and aluminum conductors #8 AWG through 4/0.
- For use with compression lugs and light duty compression taps.
- Approximately 2 tons of force.



Part No.	Length	Approx. Each Wt. (lbs.)
MCT81/0	10-1/2"	3

- Handy compression tool terminates copper compression connectors in wire sizes #8 AWG through 1/0.
- Handle length facilitates two-handed crimps when necessary.
- Approximately 2 tons of force.
- Dies included.

Hydraulic Compression Tools & Dies



Part No.	Qty.	Approx. Each Wt. (lbs.)
B131LCA	EA	11.55

- Used when crimping lugs and splices up to 800 MCM, insulated terminals up to 400 MCM and c-taps up to 350 MCM.
- Hydraulic "C" head tool features a large 1.65 inch jaw opening allowing for easier insertion/removal of large size compression terminations and joints.
- Crimping head rotates 180 degrees to facilitate usage in confined spaces.
- Provides 14.6 ton crimping force.
- Used with die sets MY-C, ME-C & MC-C.
- Available in 7 die kit. Contact the factory for details.



Part No.	Qty.	Approx. Each Wt. (lbs.)
HT131LC	EA	11.55

- Used when crimping lugs and splices up to 800 MCM, insulated terminals up to 400 MCM and c-taps up to 350 MCM.
- Hydraulic "C" head tool features a large 1.65 inch jaw opening allowing for easier insertion/removal of larger size compression terminations and joints.
- Crimping head rotates 180 degrees facilitating usage in confined spaces.
- Provides 14.6 ton crimping force.
- Will accept all semicircular slotted dies common to most 12 ton tools.
- Available in 7 die kit. Contact the factory for details.

Section 1.9

Mechanicals

Terminal Lugs, Split Bolts & Pipe Clamps

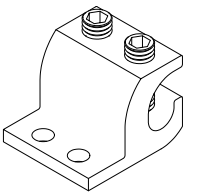
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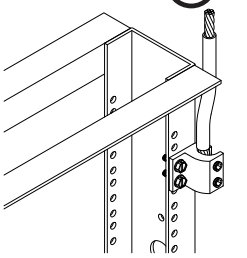
NOTE: Copper materials can consist of copper, bronze or brass. All are copper alloys.

Dual Rated Two-Hole Aluminum Lay-In Lug

Part No.	Conductor Range (AWG) Maximum	Minimum	Bolt Hole Size	O.C. Spacing	Qty.	Approx. Each Wt. (lbs.)
LI2/0142	2/0	14	1/4"	5/8"	EA	1/4



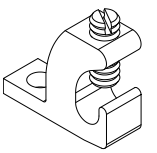
Listed 486



- Approximately 1-5/8" x 1-1/2" electro-tin plated aluminum lug allows attachment of copper or aluminum conductors to racks and cabinets.
- Includes two 3/8" x 1" hex head socket set screws. Requires a 3/16" Hex Key (not included).
- Meets ANSI J-STD-607-A two-hole mounting recommendations.
- UL Listed
- Allows grounding of racks and cabinets utilizing standard EIA/TIA hole spacing.
- Parallel mounting direction allows for better cable management.
- When using copper conductors, apply Harger #HAAJC8 Antioxidant (page 148).

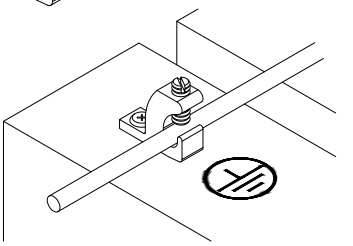
One-Hole Tinned Copper Lay-In Lug

Part No.	Conductor Range (AWG) Maximum	Minimum	Bolt Hole Size	Box Qty.	Approx. Box Wt. (lbs.)
TCLI414DB	4	14	#10	10	3/4



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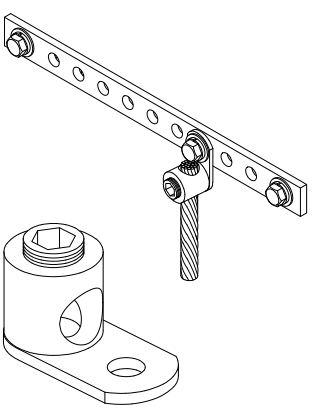
Listed 486



- Used for grounding or continuous loop bonding in applications such as pool grounding or PV array frame grounding.
- Approximately 1-1/8" x 3/8" x 7/8" electro-tin plated copper lug.
- Includes slotted stainless steel set screw.
- Tongue accepts #10 screw.
- Allows conductor to be laid in without cutting conductor.
- Corrosion resistant.
- Suitable for direct burial.

Copper Terminal Lugs

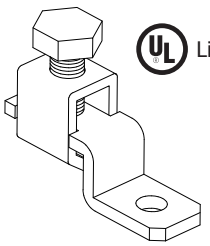
Part No.	Conductor Range (AWG) Maximum	Minimum	Bolt Hole Size	Ampere Rating	Box Qty.	Approx. Box Wt. (lbs.)
GEL1	8 Str.	14 Sol.	#8	35	100	2-1/4
GEL2	4 Str.	14 Sol.	1/4"	70	100	5-1/2
GEL3	1/0 Str.	8 Sol.	5/16"	125	50	5-1/4
GEL4	250 MCM	6 Sol.	3/8"	250	25	5



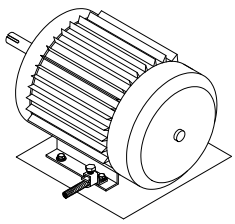
Listed 486

Copper Offset Terminal Lugs

Part No.	Conductor Range (AWG) Maximum	Minimum	Bolt Hole Size	Ampere Rating	Box Qty.	Approx. Box Wt. (lbs.)
GEOL1	10 Str.	14 Str.	#8	25	100	2-1/2
GEOL2	6 Str.	14 Str.	#8	50	100	2-1/4
GEOL3	2 Str.	8 Str.	1/4"	70	100	4
GEOL4	1/0 Str.	8 Str.	1/4"	125	25	3
GEOL5	4/0 Str.	2 Str.	3/8"	225	25	6
GEOL500MCM	500 MCM	1/0 Str.	1/2"	400	10	8

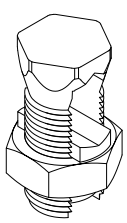


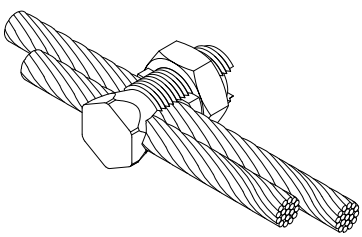
Listed 486



Copper Split Bolts

Part No.	Conductor Range for Equal Main (AWG)	Minimum Tap	Box Qty.	Approx. Box Wt. (lbs.)
GESB6	4 Sol. - 8 Sol.	16 Sol.	100	7-1/4
GESB2	2 Str. - 6 Sol.	14 Str.	50	6
GESB1/0	1/0 Str. - 4 Sol.	14 Sol.	20	3-1/4
GESB2/0	2/0 Str. - 2 Sol.	14 Str.	15	3-1/4
GESB4/0	4/0 Str. - 1/0 Sol.	10 Sol.	10	3-3/4
GESB250	250 MCM - 1/0 Str.	10 Sol.	10	3-3/4





Listed 467

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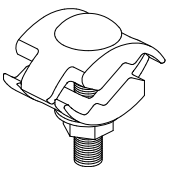
- Suitable for direct burial.

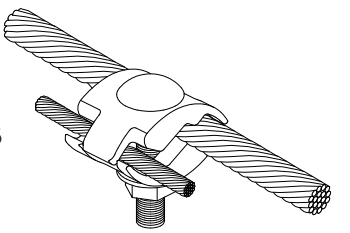
Other sizes available. Please contact the factory for more information.

Cable Connectors

1 Bolt Bonding Connectors

Part No.	Material	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
208	Copper	#6 - 4/0	10	2-1/2
208T	ETPB*	#6 - 4/0	10	2-1/2





Listed 467

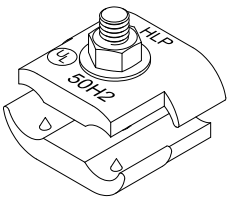
Listed 96

- Approximately 7/8" x 1-5/8" one bolt, two piece connector splices conductor up to 9/16" diameter.
- 5/16" x 1-7/8" stainless steel carriage bolts, flat washer and nut included.
- Manufactured from high conductivity copper alloy.
- Recommended installation tool - 1/2" deep socket wrench, end wrench or nut driver.
- Suitable for direct burial.

*ETPB - Electro Tin Plated Bronze.

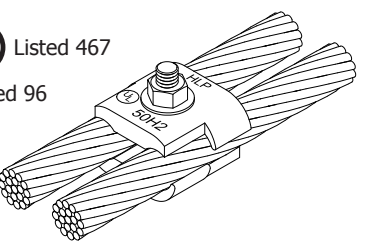
1 Bolt Parallel Connectors

Part No.	Material	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
B1BC	Copper	#6 - 250 MCM	10	4
TB1BC	ETPB*	#6 - 250 MCM	10	4



Listed 467

Listed 96



- Approximately 2" square, two piece connector provides over 1-1/2" surface contact between conductors.
- 5/16" x 1-7/8" stainless steel cap screw with flat washer and nut included.
- Manufactured from high conductivity copper alloy.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.
- Suitable for direct burial.

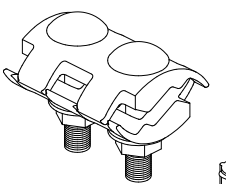
*ETPB - Electro Tin Plated Bronze.

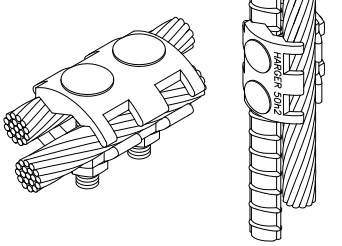
2 Bolt Parallel Connectors

Part No.	Material	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
204	Copper	#6 - 250 MCM	10	4-1/2
204T	ETPB*	#6 - 250 MCM	10	4-1/2

Listed 467

Listed 96





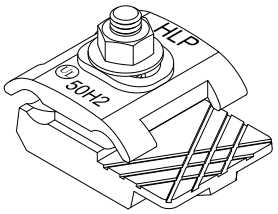
- Approximately 2" x 1-3/4" two piece connector used for splicing cables and rods.
- 5/16" x 1-7/8" stainless steel carriage bolts, flat washers and nuts included.
- Manufactured from high conductivity copper alloy.
- Recommended installation tool - 1/2" deep socket wrench, end wrench or nut driver.
- Suitable for direct burial.

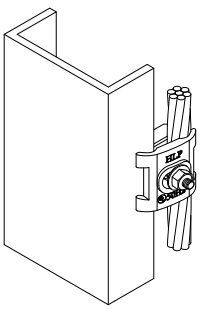
*ETPB - Electro Tin Plated Bronze.

Bonding Clamps

Listed 467
Listed 96

Cable to Flat Metal Connectors





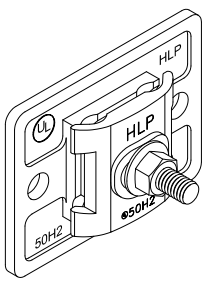
Part No.	Material	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
213	Copper	#6 - 4/0	10	4-1/2
213T	ETPB*	#6 - 4/0	10	4-1/2

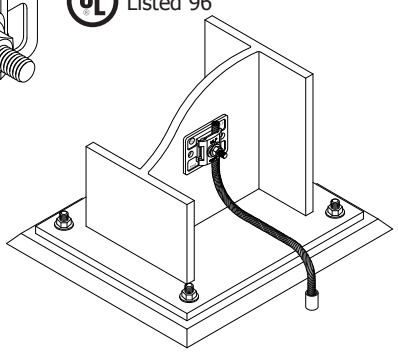
- Approximately 1-3/4" x 2" two piece, one bolt connector connects conductors through 9/16" diameter to flat metal objects up to 1/2" thickness such as steel ladders, small I-beams, channel, etc.
- 5/16" x 1-1/4" stainless steel cap screw with flat washer included.
- Manufactured from high conductivity copper alloy.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.
- Suitable for direct burial.

*ETPB - Electro Tin Plated Bronze.

Listed 467
Listed 96

Bonding Plate



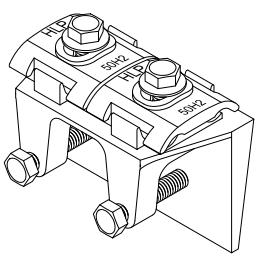


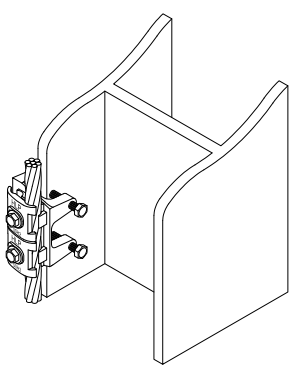
Part No.	Material	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
217	ETPB*	#6 - 4/0	5	3-1/2

- Features a pressed-in stud which ensures a flat mounting surface.
- Approximately 2-1/2" x 3-1/4" cast bonding plate provides over 8 square inches of bonding surface.
- Dual cable pressure connector accepts conductors up to 9/16" diameter.
- Two 5/16" mounting holes provide secure mounting.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.
- Suitable for direct burial.

*ETPB - Electro Tin Plated Bronze.

Flange Bonding Clamp





Part No.	Material	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
223	Copper	#6 - 4/0	10	20
223T	ETPB*	#6 - 4/0	10	20

- Approximately 3-3/4" x 2-1/2" bonding plate provides over 8 square inches of bonding surface.
- Large cable connector offers 3" of contact between the bonding plate and the cable.
- Accommodates conductors up to 9/16" diameter.
- Ideal for bonding to steel I-beams up to 1" thick.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.
- Suitable for direct burial.

*ETPB - Electro Tin Plated Bronze.

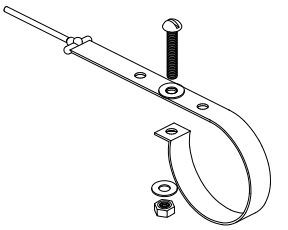
Listed 467
Listed 96

APPLICATION NOTES:

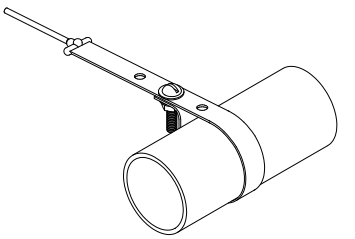
- It is imperative to properly prepare the bonding surface before applying the bonding lug or plate. All paint, rust, moisture and debris must be removed. The use of a rasp (see page 326) or grinding tool is recommended to ensure all surface oxidants have been removed. Generously coat the bonding surface with the appropriate antioxidant (see page 148), then install the bonding lug or plate.

Pipe Bonding Straps

Part No.	OD Tube Size	Conductor Size (AWG)	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
231S2-2	1-1/2" - 2-1/2"	2 Solid	1/2	25	12-1/2
231S2-4	1-1/2" - 2-1/2"	4 Solid	1/2	25	12-1/2
231S2-6	1-1/2" - 2-1/2"	6 Solid	1/2	25	12-1/2



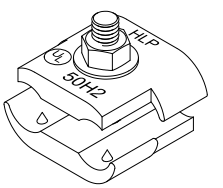
- For use in agricultural environments such as milking parlors or hog confinement facilities.
- Aids in the establishment of an equipotential ground plane thus reducing problems associated with stray voltage.
- Stainless steel bonding strap designed to fit 1-1/2" to 2-1/2" outside diameter tubing.
- Comes with a 5 foot copper conductor exothermically welded to the strap.



Cable Tray Clamps

Tinned Bronze Cable Tray Clamp

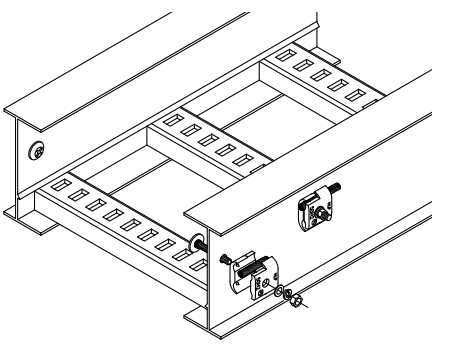
Part No.	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
TBCTC	#6 Solid through 250 MCM	10	5



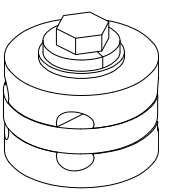
Listed 467

Listed 96

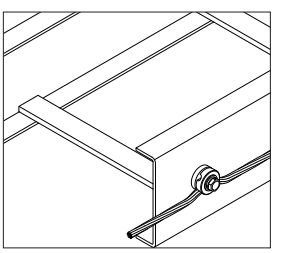
- Used for bonding galvanized steel or aluminum cable trays to the grounding electrode system.
- TBCTC can replace 3 clamps from other manufacturers due to its superior conductor range taking design.
- Electro-tin plated cast bronze.
- Two-piece connector provides a 1-1/2" linear surface contact between conductors and the clamp.
- 18-8 stainless steel ribbed neck 3/8" bolt with low profile #4 Phillips head can be driven into a 0.44" hole to prevent rotation during installation.
- Aluminum conductors should be wire brushed and used with a Zinc based antioxidant (HAAJC8 page 148).
- Recommended installation tools: 9/16" socket wrench, open-end wrench or nut driver, 7/16" drill bit, #4 Phillips screw driver and a hammer.
- Recommended torque 15 ft-lbs.
- Suitable for direct burial.



Part No.	Conductor Size (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
CRGC6	#6	25	4
CRGC4	#4	10	5



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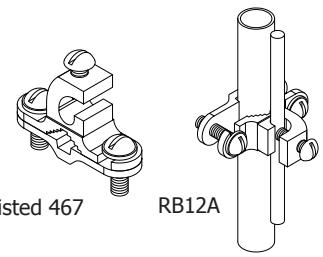


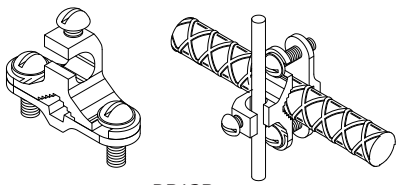
- Used for bonding galvanized steel or aluminum cable trays to the grounding electrode system.
- Used when welded connections are not feasible.
- Unique design allows clamps to form connections at most any angle.
- Electro-tin plated brass.

Rebar & Water Pipe Clamps

Part No.	Rebar Range	Pipe Range	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
RB12A	3/8" - 1"	1/2" x 1"	10 Sol. - 2 Str.	10	2-1/2
RB12B	3/8" - 1"	1/2" x 1"	10 Sol. - 2 Str.	10	2-1/2

- Manufactured from high conductivity copper alloy.
- Approved for direct burial in earth or concrete.
- Lay-in feature speeds installation.
- RB12A is for parallel mounted conductors.
- RB12B is for perpendicular mounted conductors.

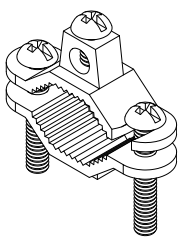

Listed 467
RB12A

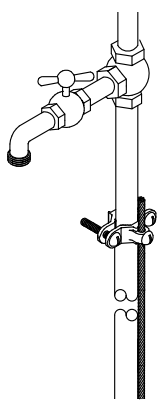

RB12B

Water Pipe Ground Clamps

Part No.	Ground Rod or Pipe Size	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
BGC4	1/2" - 1"	#10 - #2	10	3
BGC41.25-2	1-1/4" - 2"	#10 - #2	10	6
BGC42.5-4	2-1/2" - 4"	#10 - #2	10	9

- Bronze clamp has many uses such as bonding to ground rods or copper water pipes.


Listed 467



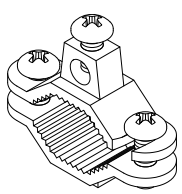
Conduit Bonding Clamps

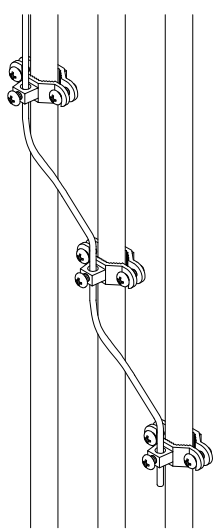
Part No.	Conduit Range	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
BGC4SCS	1/2" - 3/4"	#10 - #2	10	2-1/2
TBGC4SCS*	1/2" - 3/4"	#10 - #2	10	2-1/2
TBGC4SCSSS**	1/2" - 3/4"	#10 - #2	10	2-1/2

- Bronze clamp for bonding conduits that are flush mounted to a surface such as a wall, floor or ceiling.
- "Low Profile" design utilizes 1/4" diameter long machine screws.

* Electro tin plated bronze.

** Includes stainless steel hardware. Rated for direct burial.

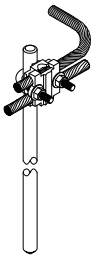

Listed 467

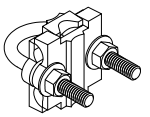


CPC Pipe Ground Clamps

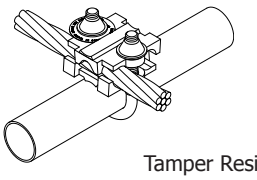
- Wide conductor range; #6 Solid through 250 MCM.
- Also used for pedestal grounding.
- Dual UL Listing (UL96 and UL467).
- Acceptable for direct burial.
- Tamper Resistant comes with break away nuts.

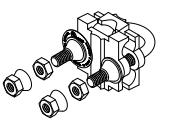
* Electro Tin Plated Bronze includes stainless steel hardware.





UL Listed 96
UL Listed 467

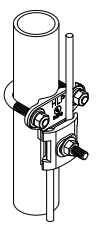


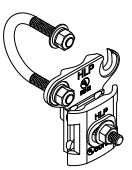


Tamper Resistant

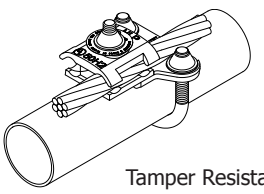
Pipe Range .5/.75

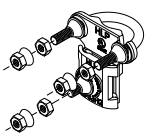
Part No.	Tamper Resistant	Material	Nominal Pipe Size Range	Pipe Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPC.5/.75	No	ETPB*	.5" - .75"	.375" - 1"	5	2-1/2
CPC.5/.75TP	Yes	ETPB*	.5" - .75"	.375" - 1"	5	2-1/2





UL Listed 96
UL Listed 467



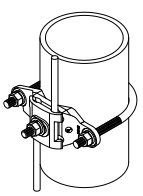


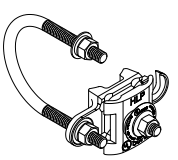
Tamper Resistant

Pipe Range 1/1.25

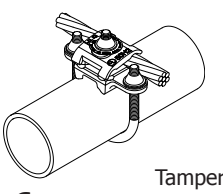
Part No.	Tamper Resistant	Material	Nominal Pipe Size Range	Pipe Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPC1/1.25	No	ETPB*	1" - 1.25"	.75" - 1.7"	5	3
CPC1/1.25TP	Yes	ETPB*	1" - 1.25"	.75" - 1.7"	5	3

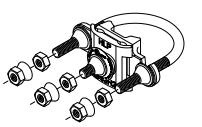
- Feature "quick connect", bi-directional design.
- Pressed stud design ensures a flush mounting surface.





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Tamper Resistant

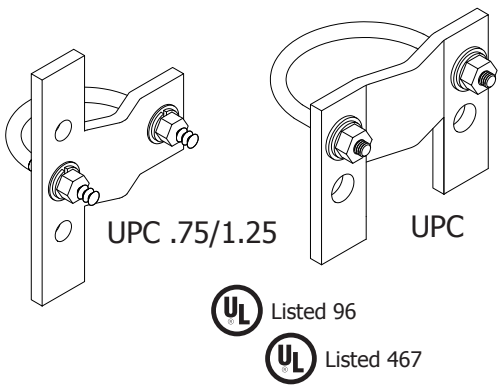
Pipe Range 1.5 through 6

Part No.	Tamper Resistant	Material	Nominal Pipe Size Range	Pipe Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPC1.5/2	No	ETPB*	1.5" - 2"	1" - 2.4"	5	3-3/4
CPC1.5/2TP	Yes	ETPB*	1.5" - 2"	1" - 2.4"	5	3-3/4
CPC2.5/3	No	ETPB*	2.5" - 3"	2.25" - 3.5"	5	5
CPC2.5/3TP	Yes	ETPB*	2.5" - 3"	2.25" - 3.5"	5	5
CPC3.5/4	No	ETPB*	3.5" - 4"	3.2" - 4.5"	5	6-1/4
CPC3.5/4TP	Yes	ETPB*	3.5" - 4"	3.2" - 4.5"	5	6-1/4
CPC5/6	No	ETPB*	5" - 6"	4.75" - 6.63"	5	8-3/4
CPC5/6TP	Yes	ETPB*	5" - 6"	4.75" - 6.63"	5	8-3/4

- Feature "quick connect", bi-directional design.
- Pressed stud design ensures a flush mounting surface.

Universal Pipe Clamps

Part No.	Material	Nominal Pipe Size	Box Qty.	Approx. Box Wt. (lbs.)
UPC.75/1.25	Tinned Copper	.75" - 1.25"	10	9
UPC1.5/2	Tinned Copper	1.5" - 2"	10	9-1/2
UPC2.5/3	Tinned Copper	2.5" - 3"	5	6
UPC3.5/4	Tinned Copper	3.5" - 4"	5	7
UPC5/6	Tinned Copper	5" - 6"	5	9

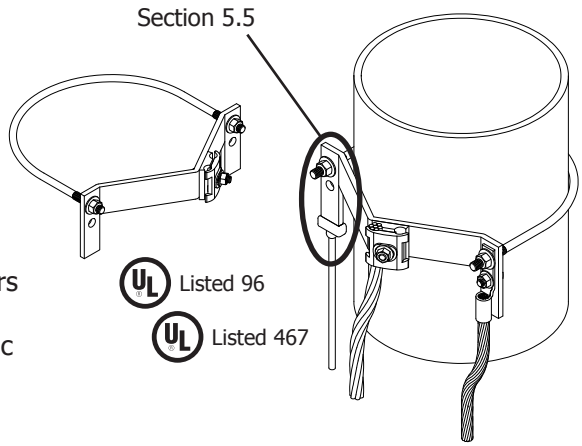


Listed 96
Listed 467

- All clamps provide 1-1/2" of contact area to ensure sufficient electrical contact for both ground fault and lightning current.
- These clamps can be connected to ground conductors via exothermic connections and/or standard compression lugs.
- Lug ends are 1/4" x 1" and have holes that are 3/8" diameter 1" on center spacing.
- The UPC.75/1.25 provides bi-directional grounding capabilities making it the perfect connection for grounding fence rail to fence post applications.
- All clamps are manufactured from highly conductive tinned copper and feature stainless steel hardware.

Part No.	Material	Nominal Pipe Size	Box Qty.	Approx. Box Wt. (lbs.)
UPC8C	Tinned Copper	8"	5	14
UPC10C	Tinned Copper	10"	5	15-1/4
UPC12C	Tinned Copper	12"	5	17-3/4

LE Style Mold
See page 297
Section 5.5



Listed 96
Listed 467

- Provides bi-directional grounding capabilities making it the perfect connection for grounding large diameter pipes.
- Clamps include mechanical connector to connect ground conductors #6 AWG thru 250 MCM.
- Clamps can also be connected to ground conductors via exothermic connections and/or standard compression lugs.
- Manufactured from highly conductive tinned copper; includes stainless steel hardware.
- Provides 1-1/2" of contact area to ensure sufficient electrical contact for both ground fault and lightning current.
- Lug ends are 1/4" x 1" and have holes that are 7/16" diameter 1" on center spacing.
- For conductors larger than 250 MCM exothermically weld to the clamp.
- Rated for Direct Burial.

LE Connection Type

Cable Size	Lug Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#2 Sol.	1/4" x 1"	LE-2S141**B**	US65	NUWTUBE65
2/0	1/4" x 1"	LE-2/0141**B**	US65	NUWTUBE65
4/0	1/4" x 1"	LE-4/0141**B**	US90	NUWTUBE90

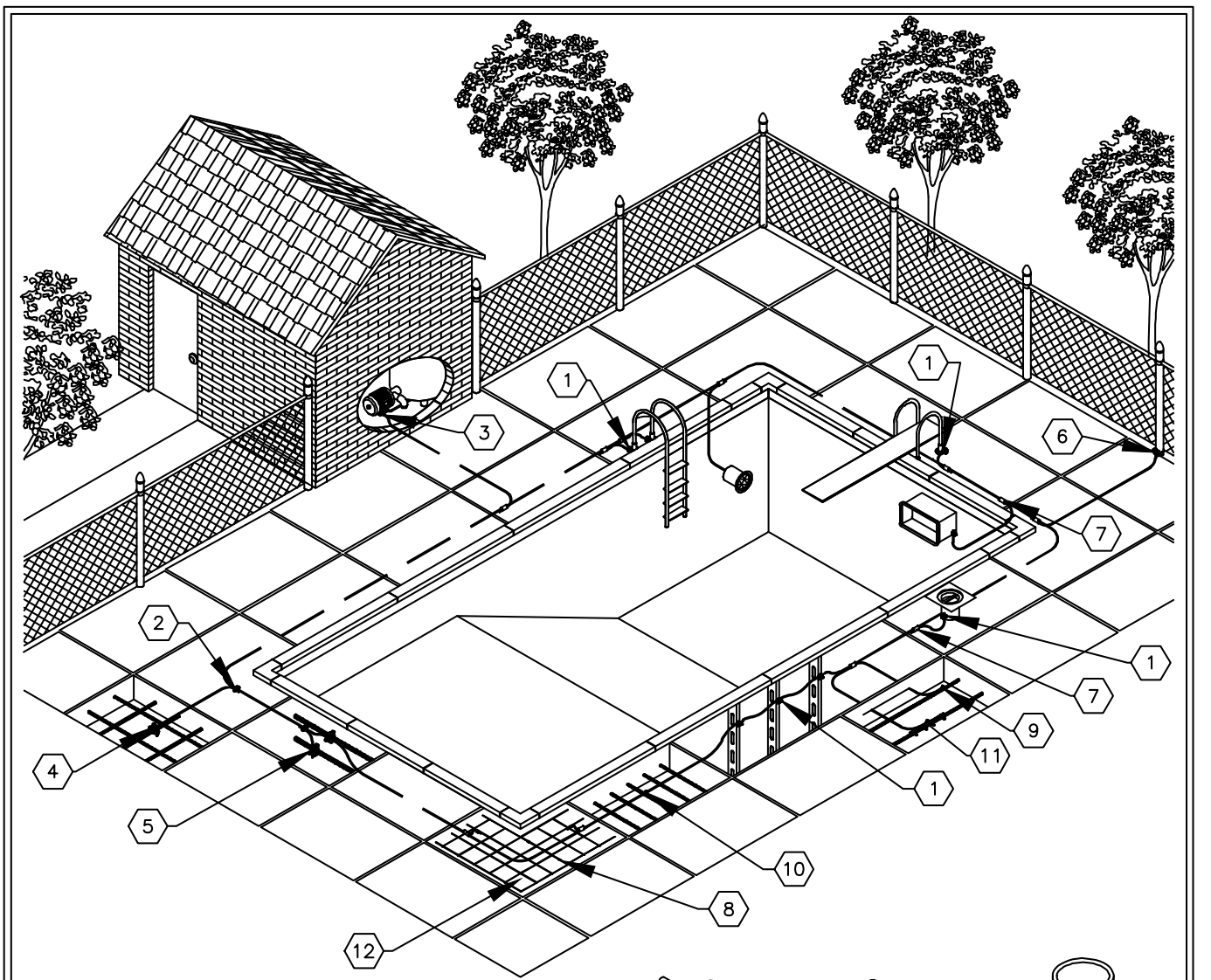
Section 1.10

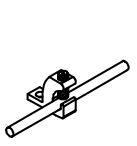
Swimming Pool Grounding

Index

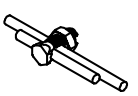
Description		Page
1.10.1	Typical Pool Grounding Layout	128
1.10.2	Pool Grounding Components	129
1.10.3	Pool Grounding Technical Notes	130

Typical Pool Grounding Layout

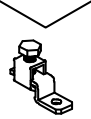




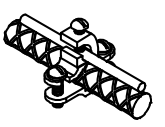
1 NO. TCLI414DB LAY-IN LUG



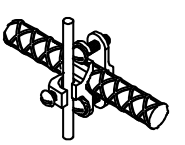
2 NO. GESB6 SPLIT BOLT CONNECTOR



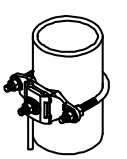
3 NO. GEOL2 OFFSET TERMINAL LUG



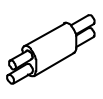
4 NO. RB12A BONDING CLAMP



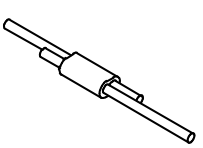
5 NO. RB12B BONDING CLAMP



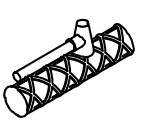
6 CPC STYLE PIPE / POST CLAMP



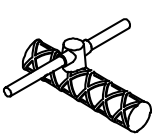
7 PT ULTRAWELD CONNECTION



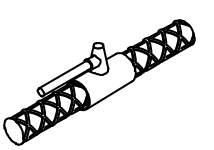
8 PS ULTRAWELD CONNECTION



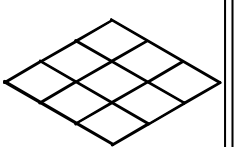
9 RP ULTRAWELD CONNECTION



10 RO ULTRAWELD CONNECTION



11 NO. RB3GA8SX5 REBAR GROUNDING ASSEMBLY

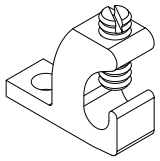


12 PREFABRICATED GROUND MESH

HARGER
LIGHTNING PROTECTION•GROUNDING•EXOTHERMIC
301 ZIEGLER DRIVE GRAYSLAKE, IL
60030 (847) 548-8700

TYPICAL POOL GROUNDING

Pool Grounding Components

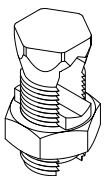


Listed 486
Listed 467

1 - One-Hole Tinned Copper Lay-In Lug

Part No.	Conductor Range (AWG)	Bolt Hole Size
TCLI414DB	4 - 14	#10

- Suitable for direct burial.
- See Page 118 for more information.



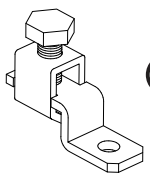
Listed 486
Listed 467

2 - Copper Split Bolt

Part No.	Conductor Range for Equal Main (AWG)	Minimum Tap
GESB6	4 Sol. - 8 Sol.	16 Sol.

- Suitable for direct burial.
- See Page 119 for more information.

Not Suitable for Direct Burial

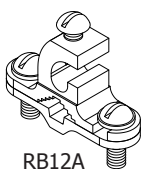


Listed 486

3 - Copper Offset Terminal Lug

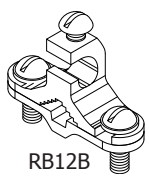
Part No.	Conductor Range (AWG)	Bolt Hole Size
GEOL2	14 Str. - 6 Str.	#8

- See Page 119 for more information.



RB12A

Listed 467

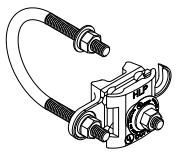


RB12B

4 & 5 - Rebar & Water Pipe Ground Clamps

Part No.	Pipe & Rebar Range	Conductor Range (AWG)
RB12A	3/8" - 1"	10 Sol. - 2 Str.
RB12B	3/8" - 1"	10 Sol. - 2 Str.

- Suitable for direct burial.
- See Page 123 for more information.



Listed 486
Listed 467

6 - CPC Pipe Clamps

Part No.	Material	Nom. Pipe Size Range	Pipe Outside Diameter
CPC1.5/2	Tinned Bronze	1.5" - 2"	1" - 2.4"
CPC2.5/3	Tinned Bronze	2.5" - 3"	2.25" - 3.5"

- Suitable for direct burial.
- Conductor Range #6 - 250 MCM.
- Other sizes available.
- See Pages 124 & 203 for more information (Grounding & LP Sections).

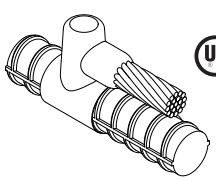


Listed 467

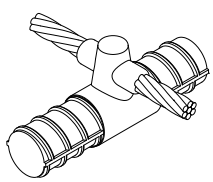
7 & 8 - Cable to Cable Ultraweld Exothermic Connection Molds

Part No.	Weld Metal		Required Handle
	UltraShot	NUWTUBE	
PT8S8SB	US25	NUWTUBE25	MH1
PS8S8SL	US25	NUWTUBE25	MH3 (Included)
PS8S6SL	US25	NUWTUBE25	MH3 (Included)

- See Page 278 for more information.



Listed 467

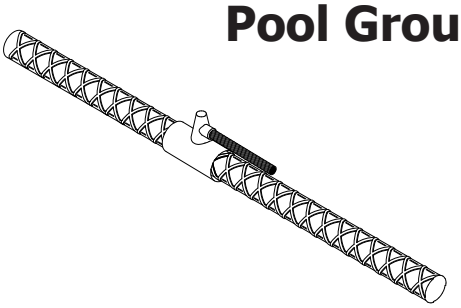


9 & 10 - Cable to Rebar Ultraweld Exothermic Connection Molds

Part No.	Weld Metal		Required Handle	Packing Mat'l No.
	UltraShot	NUWTUBE		
RP38SB	US25	NUWTUBE25	MH1	WRPSLV
RP4L8SA	US25	NUWTUBE25	Included	CERPM1
RO38SB	US65	NUWTUBE65	MH1	WRPSLV
RO48SB	US65	NUWTUBE65	MH1	WRPSLV
RO58SB	US65	NUWTUBE65	MH1	WRPSLV

- See Pages 307 & 308 for more information.

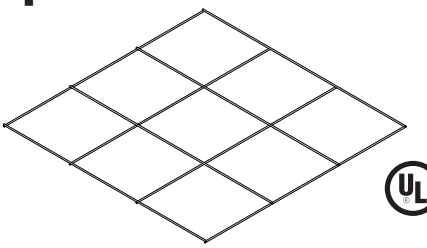
Pool Grounding Components



11 - Rebar Grounding Assembly

Part No.	Rebar Size	Conductor Type (AWG)	Conductor Length (ft.)
RB3GA8SX5	3	8 Sol.	5

- Prefabricated rebar grounding assembly with exothermically welded connection.
- Standard 24" long rebar.
- Can be wire tied or welded to rebar cage prior to concrete pour.
- See Page 196 for more information.



Listed 467

12 - UL Listed Prefabricated #8 Solid Copper Ground Mesh

Part No.	Width (ft.)	Length (ft.)	Conductor Spacing (in.)	Approx. Each Wt. (lbs.)
GM350812	3	50	12	32
GM375812	3	75	12	42
GM3100812	3	100	12	51

- Other mesh sizes and wire gauges available.
- See Page 98 & 99 for more information.

Pool Grounding & Bonding Technical Notes

TECHNICAL NOTES:

- **680.26 Equipotential Bonding* (Summarized)**

(A) Performance. The equipotential bonding required by this section shall be installed to reduce voltage gradients in the pool area.

(B) Bonded Parts. The parts specified in 680.26(B)(1) through (B)(7) shall be bonded together using solid copper conductors, insulated covered, or bare, not smaller than 8 AWG or with rigid metal conduit of brass or other identified corrosion-resistant metal. Connections to bonded parts shall be made in accordance with 250.8**. An 8 AWG or larger solid copper bonding conductor provided to reduce voltage gradients in the pool area shall not be required to be extended or attached to remote panelboards, service equipment, or electrodes.

(1) Conductive Pool Shells. Bonding to conductive pool shells shall be provided as specified in 680.26(B)(1)(a) or (B)(1)(b). Poured concrete, pneumatically applied or sprayed concrete, and concrete block with painted or plastered coatings shall all be considered conductive materials due to water permeability and porosity. Vinyl liners and fiberglass composite shells shall be considered to be nonconductive materials.

(a) *Structural Reinforcing Steel*. Unencapsulated structural reinforcing steel shall be bonded together by steel tie wires or the equivalent. Where structural reinforcing steel is encapsulated in a nonconductive compound, a copper conductor grid shall be installed in accordance with 680.26(B)(1)(b).

(b) *Copper Conductor Grid*. A copper conductor grid shall be provided and shall comply with (b)(1) through (b)(4).

(1) Be constructed of minimum 8 AWG bare solid copper conductors bonded to each other at all points of crossing. The bonding shall be in accordance with 250.8 or approved means.

(2) Conform to the contour of the pool and the pool deck.

(3) Be arranged in a 300 mm (12 in.) by 300 mm (12 in.) network of conductors in a uniformly spaced perpendicular grid pattern with a tolerance of 100 mm (4 in.).

(4) Be secured within or under the pool no more than 150 mm (6 in.) from the outer contour of the pool shell.

Pool Grounding & Bonding Technical Notes

(2) Perimeter Surfaces. The perimeter surface shall extend for 1 m (3 ft.) horizontally beyond the inside walls of the pool and shall include unpaved surfaces as well as poured concrete surfaces and other types of paving. Perimeter surfaces less than 2 m (3 ft) separated by a permanent wall or building 1.5 m (5 ft) in height or more shall require equipotential bonding on the pool side of the permanent wall or building. Bonding to perimeter surfaces shall be provided as specified in 680.26(B)(2)(a) or (2)(b) and shall be attached to the pool reinforcing steel or copper conductor grid at a minimum of four (4) points uniformly spaced around the perimeter of the pool. For nonconductive pool shells, bonding at four points shall not be required.

(a) *Structural Reinforcing Steel*. Structural reinforcing steel shall be bonded in accordance with 680.26(B)(1)(a).

(b) *Alternate Means*. Where structural reinforcing steel is not available or is encapsulated in a nonconductive compound, a copper conductor(s) shall be utilized where the following requirements are met:

(1) At least one minimum 8 AWG bare solid copper conductor shall be provided.

(2) The conductors shall follow the contour of the perimeter surface.

(3) Only listed splices shall be permitted.

(4) The required conductor shall be 450 to 600 mm (18 to 24 in.) from the inside walls of the pool.

(5) The required conductor shall be secured within or under the perimeter surface 100 to 150 mm (4 in. to 6 in.) below the subgrade.

(3) Metallic Components. All metallic parts of the pool structure, including reinforcing metal not addressed in 680.26(B)(1)(a), shall be bonded. Where reinforcing steel is encapsulated with a nonconductive compound, the reinforcing steel shall not be required to be bonded.

(4) Underwater Lighting.

(5) Metal Fittings.

(6) Electrical Equipment.

(7) Fixed Metal Parts. All fixed metal parts shall be bonded including, but not limited to, metal-sheathed cables and raceways, metal piping, metal awnings, metal fences, and metal door and window frames.

Exception No 1: Those separated from the pool by a permanent barrier that prevents contact by a person shall not be required to be bonded.

Exception No 2: Those greater than 1.5 m (5 ft.) horizontally of the inside walls of the pool shall not be required to be bonded.

Exception No 3: Those greater than 3.7 m (12 ft.) measured vertically above the maximum water level of the pool, or as measured vertically above any observation stands, towers, or platforms, or any diving structures, shall not be required to be bonded.

(C) Pool Water. An intentional bond of a minimum conductive surface area of 5600 mm^2 (9 $in.^2$) shall be installed in contact with the pool water. This bond shall be permitted to consist of parts that are required to be bonded in 680.26(B).

- **250.8 Connection of Grounding and Bonding Equipment****

(A) Permitted Methods. Equipment grounding conductors, grounding electrodes conductors, and bonding jumpers shall be connected by one of the following means:

(1) Listed pressure connectors

(2) Terminal bars

(3) Pressure connectors listed as grounding and bonding equipment

(4) Exothermic welding process

(5) Machine screw-type fasteners that engage not less than two threads or are secured with a nut

(6) Thread-forming machine screws that engage not less than two threads in the enclosure

(7) Connections that are part of a listed assembly

(8) Other listed means

(B) Methods Not Permitted. Connection devices or fittings that depend soley on solder shall not be used.

*NEC 2011 Equipotential Bonding Article 680.26

**NEC 2011 Connection of Grounding and Bonding Equipment Article 250.8

Section 1.11

Fence Grounding/Bonding Equipment

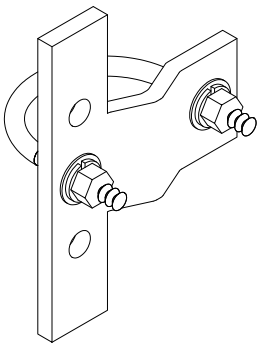
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1.11.2	Fence Clamp Assemblies	135
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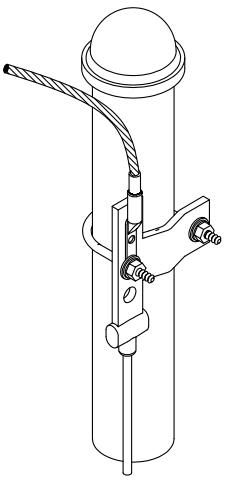
Universal Pipe Clamps

Part No.	Material	Nominal Pipe Size	Box Qty.	Approx. Box Wt. (lbs.)
UPC.75/1.25	Tinned Copper	.75" - 1.25"	10	9
UPC1.5/2	Tinned Copper	1.5" - 2"	10	9-1/2
UPC2.5/3	Tinned Copper	2.5" - 3"	5	6
UPC3.5/4	Tinned Copper	3.5" - 4"	5	7
UPC5/6	Tinned Copper	5" - 6"	5	9

- All clamps provide 1-1/2" of contact area to ensure sufficient electrical contact for both ground fault and lightning current.
- These clamps can be connected to ground conductors via exothermic connections and/or standard compression lugs.
- Lug ends are 1/4" x 1" and have holes that are 3/8" diameter 1" on center spacing.
- The UPC.75/1.25 provides bi-directional grounding capabilities making it the perfect connection for grounding fence rail to fence post applications.
- All clamps are manufactured from highly conductive tinned copper and feature stainless steel hardware.

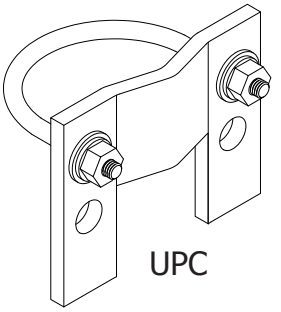


UPC .75/1.25

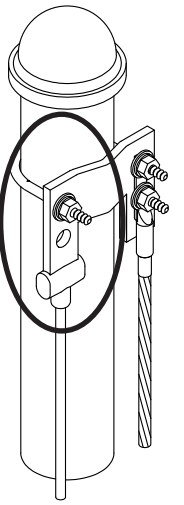


Listed 96

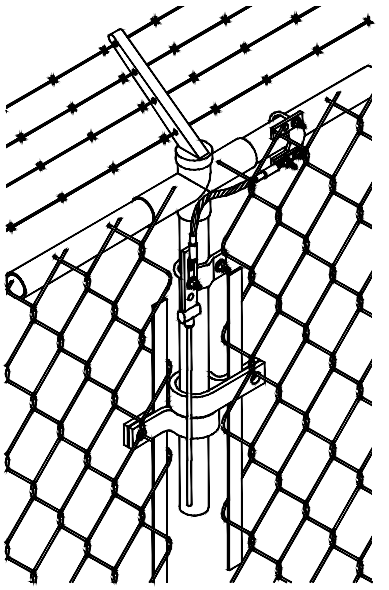
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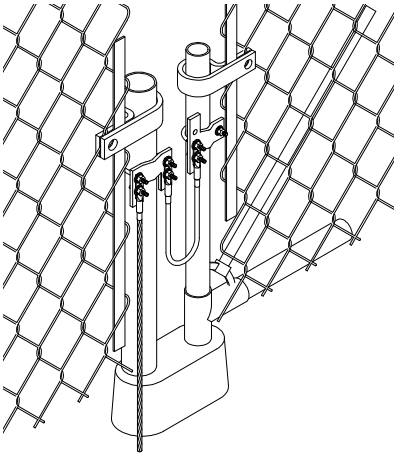


UPC



LE Style Mold
See page 297
Section 5.5

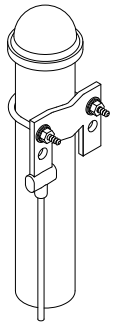




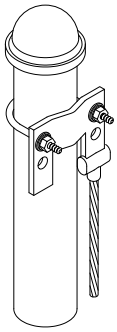
LE Connection Type

Cable Size	Lug Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#2 Sol.	1/4" x 1"	LE-2S141**B**	US65	NUWTUBE65
2/0	1/4" x 1"	LE-2/0141**B**	US65	NUWTUBE65
4/0	1/4" x 1"	LE-4/0141**B**	US90	NUWTUBE90

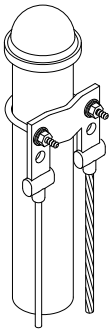
Fence Clamp Assemblies



FCAUCL2T120
3" Post
Left Ground Conductor is
#2 AWG Tinned Solid x 10' long
No Right Ground Conductor



FCAUER4/048
6" Post
Right Ground Conductor is
4/0 Concentric x 4' long
No Left Ground Conductor



FCAUBL2T48R4/036
1.5" Post
Left Ground Conductor is
#2 AWG Tinned Solid x 4' long &
Right Ground Conductor is
4/0 Concentric x 3' long

Follow the steps outlined below to specify the Fence Clamp Assembly you need.

The following **Single Wire Left** example is a **F**ence **C**lamp **A**ssembly **U**ltraweld with a nominal post size of 2.5"-3" with the left side of clamp exothermically welded to 2T AWG conductor that is 10' (120") long.

FCAU C L 2T 120

- FCAU — Fence Clamp Assembly Ultraweld
- C — Nominal Post Size (See Chart A Below)
- L — Left Side Conductor Designator
- 2T — Left Side Ground Conductor Size (See Chart B Below)
- 120 — Left Side Ground Conductor Length (in.)

The following **Double Wire** example is a **F**ence **C**lamp **A**ssembly **U**ltraweld with a nominal post size of 1.5"-2" with the left side of clamp exothermically welded to 250 MCM conductor that is 4' (48") long and the right side of clamp exothermically welded to 4/0 conductor that is 3' (36") long.

FCAU B L 25CM 48 R 4/0 36

- FCAU — Fence Clamp Assembly Ultraweld
- B — Nominal Post Size (See Chart A Below)
- L — Left Side Conductor Designator
- 25CM — Left Side Ground Conductor Size (See Chart B Below)
- 48 — Left Side Ground Conductor Length (in.)
- R — Right Side Conductor Designator
- 4/0 — Right Side Ground Conductor Size (See Chart B Below)
- 36 — Right Side Ground Conductor Length (in.)

Chart A

Nominal Post Size Codes
A = .75" - 1.25"
B = 1.5" - 2"
C = 2.5" - 3"
D = 3.5" - 4"
E = 5" - 6"

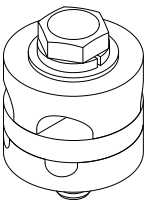
Chart B

Ground Conductor Size Codes
2 = #2 AWG Bare Solid
2T = #2 AWG Tinned Solid
2-7 = #2 AWG Bare Stranded
1/0 = 1/0 Concentric
2/0 = 2/0 Concentric
4/0 = 4/0 Concentric
25CM = 250 MCM Concentric
3CM = 300 MCM Concentric
35CM = 350 MCM Concentric

Note: 1/0 - 4/0 are supplied in standard 19 strand unless otherwise requested. 250 MCM and larger are supplied in 37 strand.

Fence Fabric Grounding Clamps

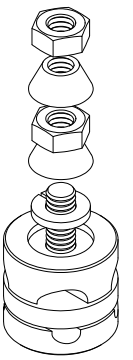
Part No.	Conductor Size (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
FGC8	#8	25	5
FGC6	#6	25	5
FGC4	#4	25	5
FGC2	#2	25	5
FGC2/0	2/0	10	3
FGC2-4/0*	#2 & 4/0	10	3



Listed 467

Tamper Resistant

Part No.	Conductor Size (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
FGC8TP	#8	25	5
FGC6TP	#6	25	5
FGC4TP	#4	25	5
FGC2TP	#2	25	5
FGC26TP	#2 & #6	25	5
FGC2/0TP	2/0	10	3
FGC2-4/0TP*	#2 & 4/0	10	3



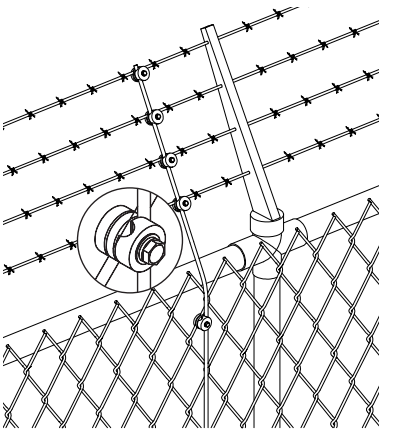
NOTES:

*Accepts a #2 AWG and/or 4/0 AWG conductor.

- Unique design allows clamp to form connections at most any angle.
- Specific uses include connection to both fence fabric and barbed wire.
- The conductor maintains a direct path to ground while connected to an object that is parallel, perpendicular or in any degree in between.
- Electro tin plated brass clamp comes complete with stainless steel hardware.
- Allows for use with most metallic surfaces including galvanized.
- Other sizes available. Please contact factory for more information.

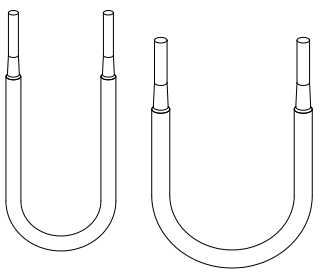
Fence Ground System

Fence grounding systems are designed to provide protection against dangerous "touch" potentials. The fence fabric ground clamp is an integral component of this personnel safety system.



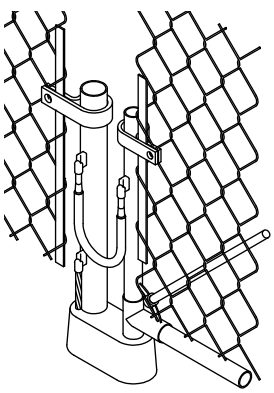
Flexible Gate Jumpers

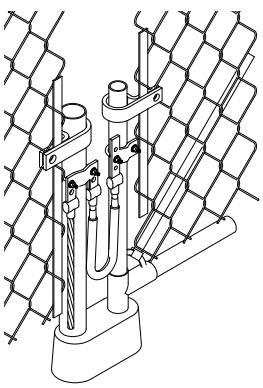
Part No.	Jumper Size	Conductor Size (AWG)	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GJX2S24	2 AWG	#2 solid	1/2	10	5
GJX2/024	2/0 AWG	2/0 concentric	1	10	10
GJX4/024	4/0 AWG	4/0 concentric	1-1/2	10	15



- Can be used with the universal pipe clamps or can be exothermically welded to the fence/gate post.
- Three sizes designed to fit either a #2 solid, 2/0 stranded or 4/0 stranded exothermic mold.
- Flex jumpers made from welding cable.
- Standard length is 24" long.
- Other lengths available. Please contact factory for more information.

Gate Jumper welded directly to posts.





Gate Jumper welded to UPC clamp.
See page 134 for UPC's.

VD (Pipe) Connection Type (Range Taking)

Cable Size	Nominal Pipe Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#2 Sol.	1-1/4" to 4" Pipe	VD-2SV1.25X4**B**	US65	NUWTUBE65
2/0	1-1/4" to 4" Pipe	VD-2/0V1.25X4**B**	US115	NUWTUBE115
4/0	1-1/4" to 4" Pipe	VD-4/0V1.25X4**B**	US150	NUWTUBE150

*See page 292 for more VD (Pipe) Connection Types.

LE Connection Type

Cable Size	Lug Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#2 Sol.	1/4" x 1"	LE-2S141**B**	US65	NUWTUBE65
2/0	1/4" x 1"	LE-2/0141**B**	US65	NUWTUBE65
4/0	1/4" x 1"	LE-4/0141**B**	US90	NUWTUBE90

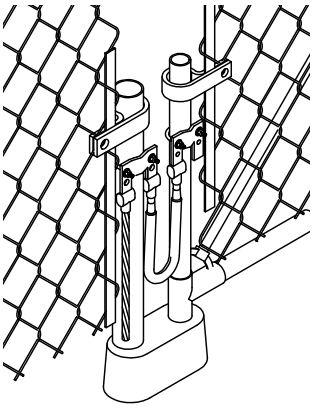
*See page 297 for more LE Connection Types.

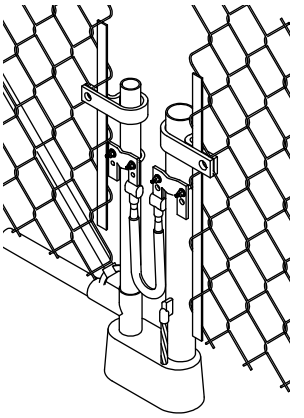
NOTE:

Thin walled pipe may be unsuitable for exothermic connections. If experiencing burn through issues with the pipe (typically with 2/0 or 4/0 conductors), adding sand inside the fence post well past the exothermic connection may solve this problem. Another solution would be to use a smaller conductor such as a #2 AWG jumper which uses a smaller size weld metal. The last solution may be to use mechanical fence clamp assembly such as the ones found in Section 1.11 on page 135.

Fence Gate Assemblies
(Exothermically Welded)

FGAUCBL4/0WC2425CM48
3" Fence Post
1.5" Gate Post
Fence Post is on the **Left**
4/0 Jumper x 2' long
250 MCM Ground Conductor x 4' long





FGAUDBR2WC18
4" Fence Post
1.5" Gate Post
Fence Post is on the **Right**
#2 AWG Jumper x 1-1/2' long
No Ground Conductor

Follow the steps outlined below to specify the Fence Gate Assembly (Exothermically Welded) you need. The following example is a **F**ence **G**ate **A**ssembly **U**ltraweld with a nominal fence post size of 2.5"-3" and a nominal gate post size of 1.5"-2" with the fence post on the left, a 4/0 AWG welding cable that is 2' (24") long and a 250 MCM ground conductor that is 4' (48") long.

FGAU C B L 4/0WC 24 25CM 48

- FGAU — Fence Gate Assembly Ultraweld
- C — Nominal Fence Post Size (See Chart A Below)
- B — Nominal Gate Post Size (See Chart A Below)
- L — Fence Post Side (L = Left or R = Right)
- 4/0WC — Flexible Jumper Size (See Chart B Below)
- 24 — Flexible Jumper Length (in.)
- 25CM — Ground** Conductor Size (See Chart C Below)
- 48 — Ground** Conductor Length (in.)

Chart A

Nominal Post Size Codes
A = .75" - 1.25"
B = 1.5" - 2"
C = 2.5" - 3"
D = 3.5" - 4"
E = 5" - 6"

Chart B

Flexible Jumper Size Codes
2WC = #2 AWG Welding Cable
2/0WC = 2/0 AWG Welding Cable
4/0WC = 4/0 AWG Welding Cable

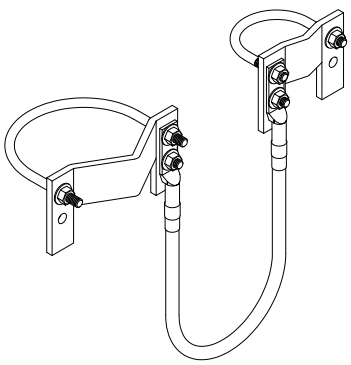
Chart C

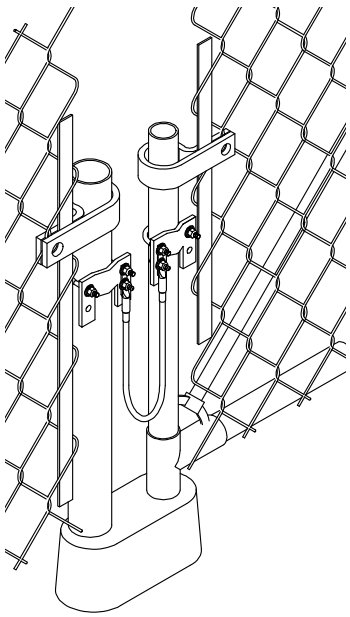
Ground Conductor Size Codes
2 = #2 AWG Bare Solid
2T = #2 AWG Tinned Solid
2-7 = #2 AWG Bare Stranded
1/0 = 1/0 Concentric
2/0 = 2/0 Concentric
4/0 = 4/0 Concentric
25CM = 250 MCM Concentric
3CM = 300 MCM Concentric
35CM = 350 MCM Concentric

Note: 1/0 - 4/0 are supplied in standard 19 strand unless otherwise requested. 250 MCM and larger are supplied in 37 strand.

****If ground conductor is not required, then leave ground conductor size and length blank.**

Fence Gate Assemblies
(Compression Lugs)





Part No.	Nominal Gate Post Size Range	Nominal Fence Post Size Range	Jumper Size (AWG)	Jumper Length	Approx. Each Wt. (lbs.)
FGA1.5/2-2.5/32WC24	1.5" - 2"	2.5" - 3"	#2	24"	2-1/2
FGA1.5/2-3.5/42WC24	1.5" - 2"	3.5" - 4"	#2	24"	3
FGA1.5/2-5/62WC24	1.5" - 2"	5" - 6"	#2	24"	3-1/2

- Integral component of a fence grounding system.
- Helps eliminate dangerous touch potential.
- Used when it is not feasible to exothermically bond to fence/gate posts.
- Flex jumper assemblies use #2 AWG Welding Cable.
- Shipped unassembled.

Section 1.12

Hardware & Accessories

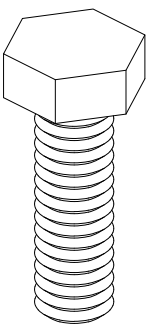
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Stainless Steel Screws

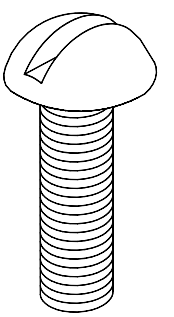
Hex Head Cap Screws

Part No.	Thread Size	Length	Box Qty.	Approx. Box Wt. (lbs.)
CS44S-100	1/4-20	1/2"	100	1-1/4
CS46S-100	1/4-20	3/4"	100	1-1/2
CS48S-100	1/4-20	1"	100	2
CS54S-100	5/16-18	1/2"	100	2
CS57S-100	5/16-18	7/8"	100	3
CS58S-100	5/16-18	1"	100	3
CS510S-100	5/16-18	1-1/4"	100	4
CS64S-100	3/8-16	1/2"	100	3
CS66S-100	3/8-16	3/4"	100	4
CS68S-100	3/8-16	1"	100	5
CS610S-100	3/8-16	1-1/4"	100	5
CS612S-100	3/8-16	1-1/2"	100	6
CS616S-100	3/8-16	2"	100	6
CS88S-100	1/2-13	1"	100	9
CS108S-100	5/8-11	1"	100	15-1/2



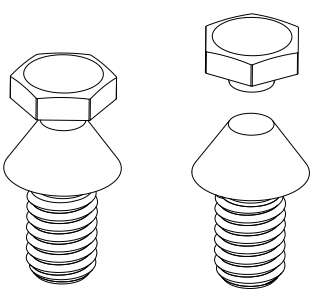
Slotted Round Head Machine Screws

Part No.	Thread Size	Length	Box Qty.	Approx. Box Wt. (lbs.)
MS103S-100	10-24	3/8"	100	1/2
MS106S-100	10-24	3/4"	100	1/2
MS108S-100	10-24	1"	100	1/2
MS44S-100	1/4-20	1/2"	100	1
MS46S-100	1/4-20	3/4"	100	1-1/4
MS48S-100	1/4-20	1"	100	1-1/2
MS412S-100	1/4-20	1-1/2"	100	2-1/4



Tamper Resistant Bolts

Part No.	Thread Size	Length	Box Qty.	Approx. Box Wt. (lbs.)
RHBOB64S-10	3/8-16	1/2"	10	1/3
RHBOB65S-10	3/8-16	5/8"	10	1/2



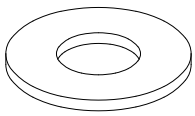
Before After

NOTES:
- Manufactured from 18-8 stainless steel.
- Other sizes available. Please contact factory for more information.

Stainless Steel Washers & Nuts

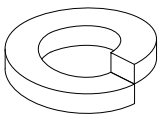
Flat Washers

Part No.	Inside Diameter	Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
W4S-100	1/4"	5/8"	100	1/2
W5S-100	5/16"	3/4"	100	1/2
W6S-100	3/8"	1"	100	1
W8S-100	1/2"	1-1/4"	100	2



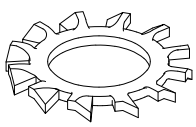
Lock Washers

Part No.	Size	Box Qty.	Approx. Box Wt. (lbs.)
LW4S-100	1/4"	100	1/2
LW5S-100	5/16"	100	1/2
LW6S-100	3/8"	100	1
LW8S-100	1/2"	100	1-1/2



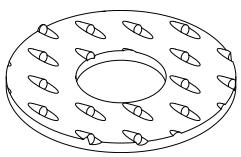
Star Washers

Part No.	Size	Box Qty.	Approx. Box Wt. (lbs.)
SW4S-100	1/4"	100	1/2
SW5S-100	5/16"	100	1/2
SW6S-100	3/8"	100	1/2
SW8S-100	1/2"	100	1/2



Dragon Tooth Washers

Part No.	Size	Box Qty.	Approx. Box Wt. (lbs.)
DTW4-100	1/4"	100	1/2
DTW6-100	3/8"	100	1/2
DTW8-100	1/2"	100	1/2

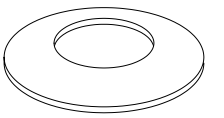


NOTES:
- Manufactured from 18-8 stainless steel.
- Sold in 100 piece packages.
- Other sizes available. Please contact factory for more information.

Stainless Steel Washers & Nuts

Belleville Washers

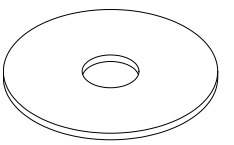
Part No.	Bolt Hole Size	Max. O.D.	Min. I.D.	Thickness	Overall Height	Load to Flat (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
BW4S-100	1/4"	0.500"	0.255"	0.038"	0.047"	376	100	1/2
BW6S-100	3/8"	0.750"	0.380"	0.040"	0.059"	392	100	1/2
BW8S-100	9/16"	1.125"	0.567"	0.038"	0.073"	268	100	1



- 301 Stainless Steel
- Maintains bolt pre-load over time.
- Allows for differential thermal expansion without loss of load.
- Provides even loading over contact area.

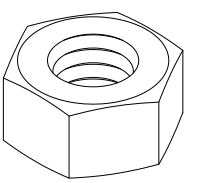
Fender Washers

Part No.	Inside Diameter	Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
FW6S-100	3/8"	1-1/4"	100	1-1/2
FW8S-100	1/2"	2"	100	2-1/2



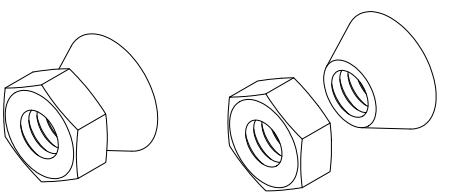
Nuts

Part No.	Thread Size	Box Qty.	Approx. Box Wt. (lbs.)
N420S-100	1/4-20	100	1
N518S-100	5/16-18	100	1-1/2
N616S-100	3/8-16	100	1-1/2
N813S-50	1/2-13	50	2



Tamper Resistant Nut

Part No.	Thread Size	Box Qty.	Approx. Box Wt. (lbs.)
N518SBON-10	5/16-18	10	1/3



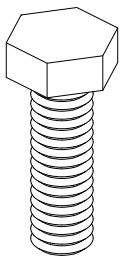
Before After

NOTES:
- Manufactured from 18-8 stainless steel.
- Other sizes available. Please contact factory for more information.

Silicon Bronze Screws, Washers & Nuts

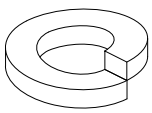
Hex Head Cap Screws

Part No.	Thread Size	Length	Box Qty.	Approx. Box Wt. (lbs.)
CS46B-100	1/4-20	3/4"	100	1-1/2
CS58B-100	5/16-18	1"	100	3
CS68B-100	3/8-16	1"	100	4-1/2



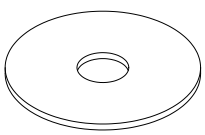
Lock Washers

Part No.	Size	Box Qty.	Approx. Box Wt. (lbs.)
LW4B-100	1/4"	100	1/2
LW5B-100	5/16"	100	1/2
LW6B-100	3/8"	100	3/4



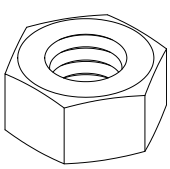
Flat Washers

Part No.	Inside Diameter	Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
W4B-100	1/4"	5/8"	100	1/4
W5B-100	5/16"	3/4"	100	1/2
W6B-100	3/8"	1"	100	3/4



Nuts

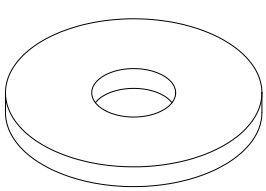
Part No.	Thread Size	Box Qty.	Approx. Box Wt. (lbs.)
N420B-100	1/4-20	100	1/2
N518B-100	5/16-18	100	1-1/2
N616B-100	3/8-16	100	1-1/2



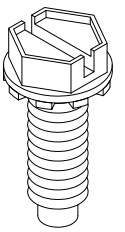
NOTES:
- Sold in 100 piece packages.
- Other sizes available. Please contact factory for more information.

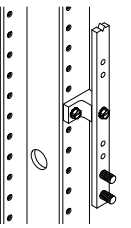
Neoprene Washers

Part No.	Size	Box Qty.	Approx. Box Wt. (lbs.)
W6R-50	3/8"	50	3/4
W6R-100	3/8"	100	1-1/2
W8R-50	1/2"	50	3/4
W8R-100	1/2"	100	1-1/2



Thread Forming Screw

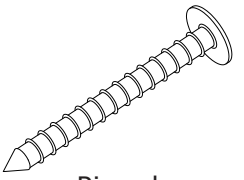




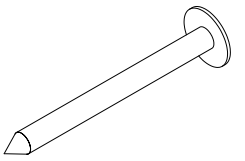
Part No.	Box Qty.	Approx. Box Wt. (lbs.)
SMS0126SHWZ-50	50	1

- #12-24 x 5/8" zinc plated thread forming hex washer head screw with external washer.
- Used with white standoff insulators (11/16WINS & 7/8WINS).
- Removes paint on a 12-24 threaded rack hole.

Nails



Ringed

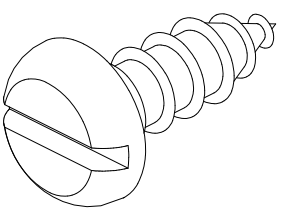


Common

Part No.	Description	Length	Diameter Head	Box Qty.	Approx. Box Wt. (lbs.)
274-100	4d Copper Ringed	1-1/2"	3/8"	100	3/4
274S-100	4d Stainless Steel Ringed	1-1/2"	5/16"	100	3/4
A274-100	4d Aluminum Common	1-5/8"	1/4"	100	1/2
275-100	6d Copper Common	2-1/8"	1/4"	100	1-1/4
277S-100	6d Stainless Steel Ringed	2"	3/8"	100	1

Sheet Metal Screws

Part No.	Description	Box Qty.	Approx. Box Wt. (lbs.)
290-100	No. 12 x 5/8" Long	100	3/4
291-100	No. 12 x 1" Long	100	1

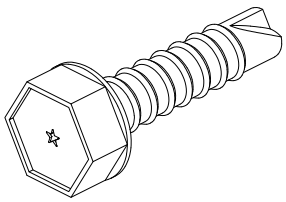


- Stainless steel pan head sheet metal screw.
- Use for fastening cable loops and/or bonding terminals to thin sheet metal surfaces.

TEK Screws

Teks / 3

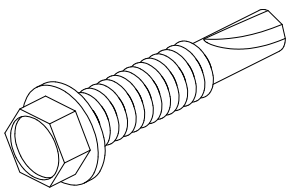
Part No.	Box Qty.	Approx. Box Wt. (lbs.)
295-25	25	1/4
295-100	100	3/4



- No. 12-14 x 3/4" long stainless steel Teks / 3 self drilling and threading screw.
- General purpose screw for use with 12 through 26 gauge steel.

Teks / 5

Part No.	Box Qty.	Approx. Box Wt. (lbs.)
296-25	25	1/2
296-100	100	1-1/4

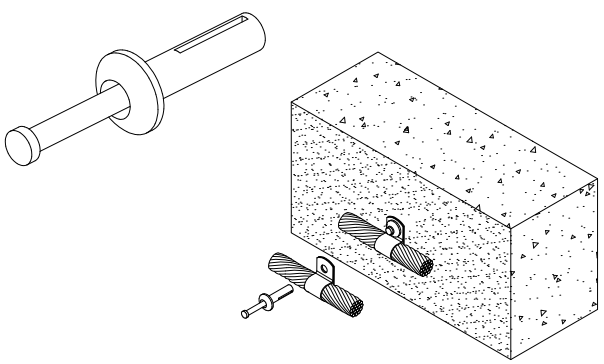


- No. 12-24 x 1-1/4" stainless steel Teks / 5 self drilling and threading screw.
- Heavy duty screw for use with 1/4” through 26 gauge steel.
- Ideal for installing bonding plates.

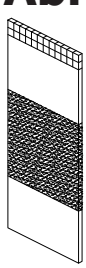
Expansion Anchors

Part No.	Description	Box Qty.	Approx. Box Wt. (lbs.)
280-25	1/4 x 1" Long	25	1/2
280-100	1/4 x 1" Long	100	2-1/4
281-25	1/4 x 1-1/2" Long	25	3/4
281-100	1/4 x 1-1/2" Long	100	2-3/4

- Has stainless steel pin and Zamac #7 body for corrosion resistant installation.
- This anchor requires a 1/4" diameter mounting hole.



Abrasive Pad & Cold Galvanizing Spray



Abrasive Pad

Part No.	Box Qty.	Unit Wt. (oz.)
3MABPAD	12	2

- Pad removes oxidation from surface when properly used. Critical step when making a low resistance connection.



Cold Galvanizing Spray

Part No.	Qty.	Unit Wt. (oz.)
CGS	EA	16

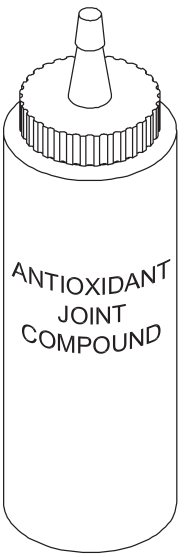
- Instant cold galvanizing spray provides protection equal to hot dip galvanizing.
- Used for touching up surfaces affected by welding.

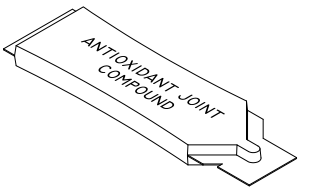
Antioxidant Joint Compound

Aluminum

Part No.	Size	Box Qty.	Approx. Box Wt. (lbs.)
HAAJC1/2	1/2 oz.	12	1/2
HAAJC8	8 oz.	12	6

- Oxide inhibiting joint compound used to improve electrical conductivity and enhance the integrity of the connection.
- Synthetic base with suspended zinc particles.
- Material is gray in color.
- Recommended for aluminum to aluminum connections, aluminum to copper connections and aluminum conduit threads.





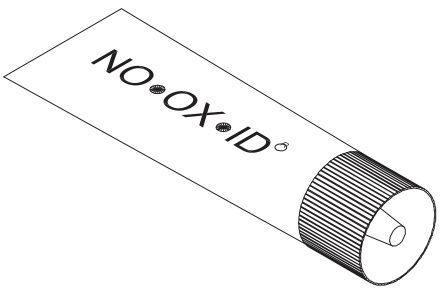
Copper

Part No.	Size	Box Qty.	Approx. Box Wt. (lbs.)
HCAJC1/2	1/2 oz.	12	1/2
HCAJC8	8 oz.	12	6

- Oxide inhibiting joint compound used to improve electrical conductivity and enhance the integrity of the connection.
- Synthetic base with suspended copper particles.
- Material is copper in color.
- Recommended for copper to copper connections, copper threads and all grounding applications.

Part No.	Qty.	Unit Wt. (oz.)
NOOXCLR	EA	8

NO•OX•ID® Antioxidant Paste
Cold applied clear antioxidant for aluminum to aluminum, aluminum to copper and copper to copper connections.



Section 2
Lightning Protection Components

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2.4	Thru-Roof/Wall Connectors, Assemblies & Accessories	187
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UL Definitions

96: UL standard for lightning protection components
50H2: Harger's number for lightning protection (assigned by UL)

467: UL standard for grounding components
2S01: Harger's number for grounding (assigned by UL)

468: UL listing for lugs
ZMVV: Harger's listing for lugs (assigned by UL)

HARGER UNIVERSITY

Lightning Protection Installation Training

- Taught by an industry expert
- Covers all installation practices
- Review NFPA 780 requirements
- Classes available monthly
- View an installed system
- Hands-on learning
- Earn CEC hours* (certain states apply)
- No charge to attend

Sign up now @ http://www.harger.com/training/lptdates.cfm

Section 2.1

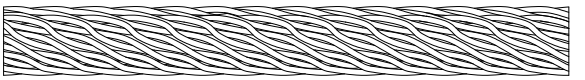
Lightning Conductors & Accessories

Index

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Class I Copper Conductors

These conductors are intended for use on structures up to and including 75' in height.



Listed 96

Part No.	No. of Strands	Strand Size	X-Sectional Area in CM	ETP*	Approx. Diameter	Approx. Wt. lbs./M ft.	Reel/Coil Size	Approx. Reel/ Coil Wt. (lbs.)
24-25COIL	24	14 AWG	98,600	No	7/16"	320	25'	8
24-50COIL	24	14 AWG	98,600	No	7/16"	320	50'	16
24-100	24	14 AWG	98,600	No	7/16"	320	100'	37
24-250	24	14 AWG	98,600	No	7/16"	320	250'	90
29-25COIL	29	16 AWG	72,500	No	3/8"	203	25'	5-1/4
29-50COIL	29	16 AWG	72,500	No	3/8"	203	50'	10-1/2
29-100	29	16 AWG	72,500	No	3/8"	203	100'	24
29-250	29	16 AWG	72,500	No	3/8"	203	250'	55
29-500	29	16 AWG	72,500	No	3/8"	203	500'	112
29T-25COIL*	29	16 AWG	72,500	Yes	3/8"	203	25'	5-1/4
29T-50COIL*	29	16 AWG	72,500	Yes	3/8"	203	50'	10-1/2
29T-100*	29	16 AWG	72,500	Yes	3/8"	203	100'	24
29T-250*	29	16 AWG	72,500	Yes	3/8"	203	250'	55
29T-500*	29	16 AWG	72,500	Yes	3/8"	203	500'	112
32-25COIL	32	16 AWG	80,000	No	7/16"	213	25'	5-1/2
32-50COIL	32	16 AWG	80,000	No	7/16"	213	50'	11
32-100	32	16 AWG	80,000	No	7/16"	213	100'	27
32-250	32	16 AWG	80,000	No	7/16"	213	250'	62
32-500	32	16 AWG	80,000	No	7/16"	213	500'	122
32T-25COIL*	32	16 AWG	80,000	Yes	7/16"	213	25'	5-1/2
32T-50COIL*	32	16 AWG	80,000	Yes	7/16"	213	50'	11
32T-100*	32	16 AWG	80,000	Yes	7/16"	213	100'	27
32T-250*	32	16 AWG	80,000	Yes	7/16"	213	250'	62
32T-500*	32	16 AWG	80,000	Yes	7/16"	213	500'	122

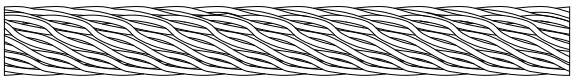
*ETP - Electro Tin Plated

TECHNICAL NOTES:

- Class I lightning conductors are manufactured using a special rope lay process. This process maximizes the surface area of the conductor while allowing greater installation flexibility.
- Class I Minimum Requirements:
  - 187 pounds per 1,000 feet.
  - Cross-sectional area of 57,400 circular mils.
  - Minimum strand size 17 AWG.
- Conductors are marked every 3' with a green ink dot for cable fastner spacing.

Class II Copper Conductors

These conductors are intended for use on structures greater than 75' in height.



Listed 96

Part No.	No. of Strands	Strand Size	X-Sectional Area in CM	ETP*	Approx. Diameter	Approx. Wt. lbs./M ft.	Reel/Coil Size	Approx. Reel/Coil Wt. (lbs.)
28-25COIL	28	14 AWG	115,000	No	1/2"	375	25'	9-1/2
28-50COIL	28	14 AWG	115,000	No	1/2"	375	50'	19
28-100	28	14 AWG	115,000	No	1/2"	375	100'	39
28-250	28	14 AWG	115,000	No	1/2"	375	250'	103
28T-25COIL*	28	14 AWG	115,000	Yes	1/2"	375	25'	9-1/2
28T-50COIL*	28	14 AWG	115,000	Yes	1/2"	375	50'	19
28T-100*	28	14 AWG	115,000	Yes	1/2"	375	100'	39
28T-250*	28	14 AWG	115,000	Yes	1/2"	375	250'	103
40-28	28	.0865	211,500	No	5/8"	660	250'	174

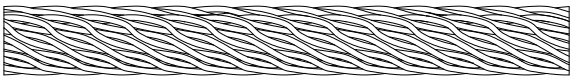
*ETP - Electro Tin Plated

TECHNICAL NOTES:

- Class II lightning conductors are manufactured using a special rope lay process. This process maximizes the surface area of the conductor while allowing greater installation flexibility.
- Class II Minimum Requirements:
  - 375 pounds per 1,000 feet.
  - Cross-sectional area of 115,000 circular mils.
  - Minimum strand size 15 AWG.
- Conductors are marked every 3' with a green ink dot for cable fastner spacing.

Class I Aluminum Conductors

These conductors are intended for use on structures up to and including 75' in height.



Listed 96

Part No.	No. of Strands	Strand Size	X-Sectional Area in CM	Approx. Diameter	Approx. Wt. lbs./M ft.	Reel/Coil Size	Approx. Reel/Coil Wt. (lbs.)
A24-25COIL	24	14 AWG	98,600	7/16"	95	25'	2-1/2
A24-50COIL	24	14 AWG	98,600	7/16"	95	50'	5
A24-100	24	14 AWG	98,600	7/16"	95	100'	13
A24-250	24	14 AWG	98,600	7/16"	95	250'	28
A24-500	24	14 AWG	98,600	7/16"	95	500'	56
A28-25COIL	28	14 AWG	115,000	1/2"	112	25'	3
A28-50COIL	28	14 AWG	115,000	1/2"	112	50'	6
A28-100	28	14 AWG	115,000	1/2"	112	100'	13
A28-250	28	14 AWG	115,000	1/2"	112	250'	33
A28-500	28	14 AWG	115,000	1/2"	112	500'	66

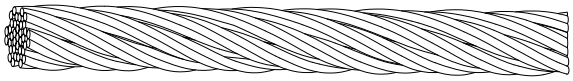
TECHNICAL NOTES:

- Class I lightning conductors are manufactured using a special rope lay process. This process maximizes the surface area of the conductor while allowing greater installation flexibility.
- Class I Minimum Requirements:
  - 95 pounds per 1,000 feet.
  - Cross-sectional area of 98,600 circular mils.
  - Minimum strand size 14 AWG.
- Conductors are marked every 3' with a green ink dot for cable fastner spacing.

Class II Aluminum Conductors

These conductors are intended for use on structures greater than 75' in height.

Listed 96



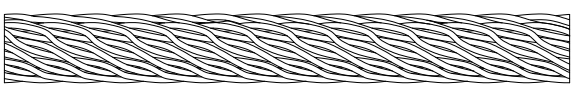
A37R (rope lay)

Part No.	No. of Strands	Strand Size	X-Sectional Area in CM	Approx. Diameter	Approx. Wt. lbs./M ft.	Reel/Coil Size	Approx. Reel/Coil Wt. (lbs.)
A37R-25COIL	37	13 AWG	192,000	19/32"	190	25'	5
A37R-50COIL	37	13 AWG	192,000	19/32"	190	50'	10
A37R-100	37	13 AWG	192,000	19/32"	190	100'	23
A37R-250	37	13 AWG	192,000	19/32"	190	250'	56
A37R-500	37	13 AWG	192,000	19/32"	190	500'	112

TECHNICAL NOTES:

- Class II Minimum Requirements:
  - 190 pounds per 1,000 feet.
  - Cross-sectional area of 192,000 circular mils.
  - Minimum strand size 13 AWG.
- Conductors are marked every 3' with a green ink dot for cable fastner spacing.

Bonding Conductors



Listed 96

Part No.	Material	No. of Strands	Strand Size	X-Sectional Area in CM	Approx. Diameter	Approx. Wt. lbs./M ft.	Reel Size	Approx. Reel Wt. (lbs.)
14	Copper	14	16 AWG	28,000	1/4"	92	100'	11-1/4
A10	Aluminum	10	14 AWG	41,100	5/16"	39	100'	6
A4	Aluminum	1	4 AWG	41,740	13/64"	39	100'	6

- A4 is a solid, single conductor.

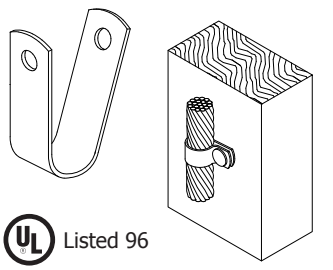
TECHNICAL NOTES:

- Class I & II Minimum Requirements:
  - Copper bonding conductors: 17 AWG, 26,240 circular mils.
  - Aluminum bonding conductors: 14 AWG, 41,100 circular mils.

Cable Clips

Part No.	Material	Fits Lightning Conductors	Fits Grounding Conductors	Box Qty.	Approx Box Wt. (lbs.)
250	Copper	28	2/0	100	1
A250	Aluminum	A28	N/A	100	1/2

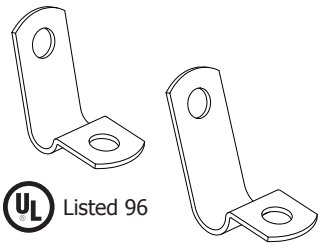
- Hole diameter is 5/32 (.156 in.)
- Use with 277S. See page 146.



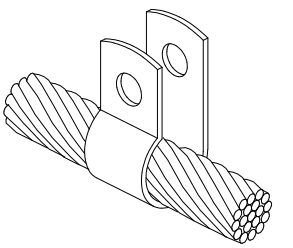
Listed 96

Pre-formed Cable Clips

Part No.	Material	Fits Lightning Conductors	Fits Grounding Conductors	Box Qty.	Approx Box Wt. (lbs.)
ACC1	Aluminum	A10	N/A	100	1/2
ACC2	Aluminum	A28 & A24	N/A	100	1/2
ACC3	Aluminum	A37	N/A	100	1/2
ACC4	Aluminum	A37R	N/A	100	1/2
CCC1	Copper	#14	2 Str., 4 Str., 2 Sol.	100	2
CCC1T	ETPC*	#14	2 Str., 4 Str., 2 Sol.	100	2
CCC2	Copper	29 & 32	1/0 Str. & 2/0 Str.	100	2-1/4
CCC2T	ETPC*	29 & 32	1/0 Str. & 2/0 Str.	100	2-1/4
CCC3	Copper	28 & 24	4/0	100	2-1/2
CCC3T	ETPC*	28 & 24	4/0	100	2-1/2
CCC4	Copper	40-28	250 MCM	50	2-3/4
CCC4T	ETPC*	40-28	250 MCM	50	2-3/4



Listed 96



- Copper cable loop fasteners manufactured from .045" x 5/8" #110 soft drawn electrolytic tough pitch copper coil.
- Aluminum cable fasteners manufactured from .051" x 5/8" 3003-0 aluminum.
- 9/32" (.280 in.) hole to accept 1/4" hardware.
- See fasteners on page 146.

* ETPC - Electro Tin Plated Copper

TECHNICAL NOTES:

- Conductors shall be fastened to the structure upon which they are placed at intervals not exceeding 0.9 m (3 ft).*
- Clips for securing copper conductors shall be cast or made from sheet copper with a minimum thickness of 0.032 inch (0.81 mm) and a minimum width of 3/8 inch (9.5 mm).**
- Aluminum clips for securing aluminum conductors shall be of cast aluminum or made from sheet aluminum with a minimum thickness of 0.051 inch (1.3 mm) thick and a minimum thickness of 1/2 inch (12.7 mm) wide.**

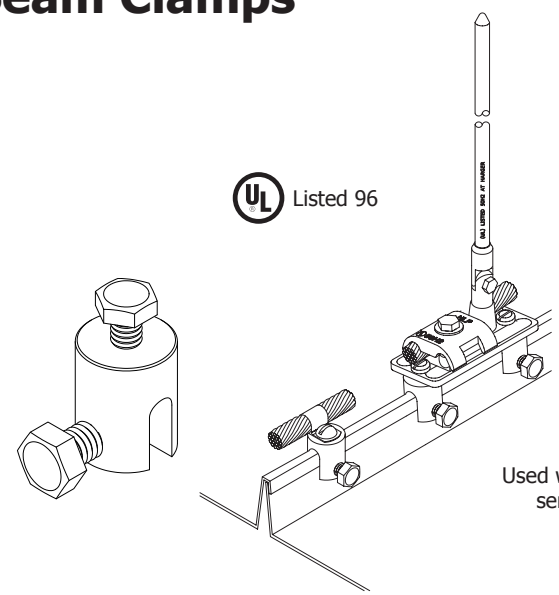
*Per NFPA 780 Conductor Fasteners Section 4.10

**UL96 Standard for Lightning Protection Components Sections 15.1 & 15.2

Standing Seam Clamps

Part No.	Material	Box Qty.	Approx Box Wt. (lbs.)
CUSC	Copper	50	6-1/2
ALSC	Aluminum	50	3-1/4

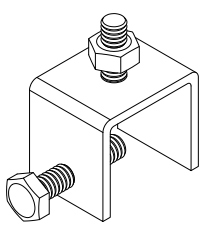
- Designed for use on standing seam roof applications.
- Can be used on seams that have widths of 1/4" or less.
- Cable clips not included. (See page 156)



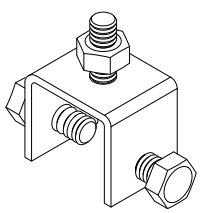
Used with #151xxI series base

Part No.	Description	Box Qty.	Approx Box Wt. (lbs.)
SSSC1	Stainless Steel - 1 Bolt	10	2
SSSC2	Stainless Steel - 2 Bolt	10	2

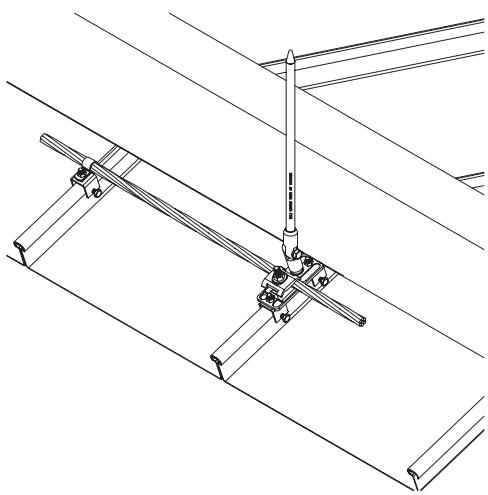
- Designed for use on standing seam roof applications.
- Can be used on seams that have widths of 1" or less
- Maximum clamp depth is 5/8".
- Cable clips not included. (See page 156)



SSSC1



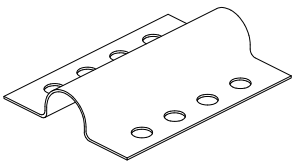
SSSC2



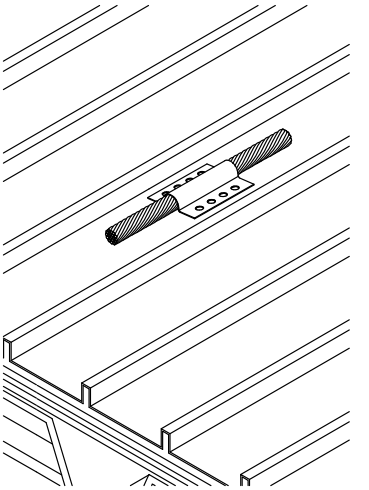
NOTE:
- Clamps can be used in conjunction with a #CCC/#ACC cable clip (See page 156) for cable fastening applications or use two clamps to secure either a #15112I or #15138I base (See page 178) to the seam.

Adhesive Cable Holders

Part No.	Material	Box Qty.	Approx Box Wt. (lbs.)
261	Stamped Copper	100	8-1/4
A261	Aluminum	100	4
261T	ETPC*	100	8-1/4



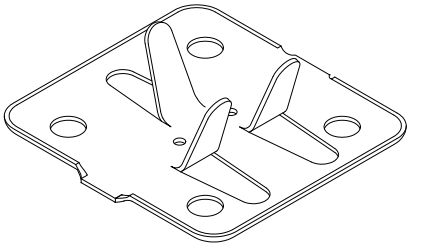
Listed 96



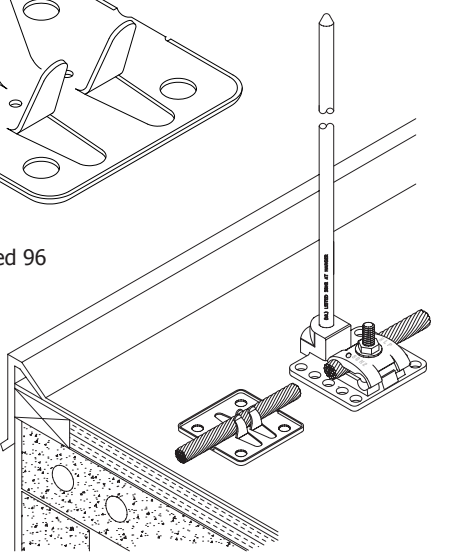
- Economical stamped copper adhesive cable holder.
- May be used with all cables thru 3/0 or up to 1/2" diameter.
- Fast installing cable holder designed to permit maximum movement of thermally expanding or contracting cables.

*ETPC - Electro Tin Plated Copper

Part No.	Material	Box Qty.	Approx Box Wt. (lbs.)
262	Stamped Copper	500	45
A262	Aluminum	500	22
262T	ETPC*	500	45



Listed 96



- Superior stamped copper cable holder secured by a surface compatible adhesive.
- Will not "roll-up" or loosen due to cable pull as will the round type.
- Use on any flat surface where a fast, secure, adhesive cable holder is required.
- Designed for use with all cables thru 4/0 or up to 9/16" diameter.
- Turned up edges for reduced puncture hazard and pooling area for increased adhesion.

*ETPC - Electro Tin Plated Copper

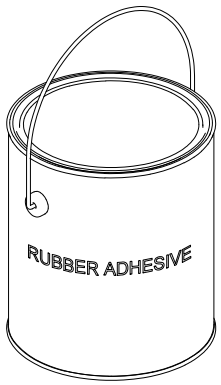
TECHNICAL NOTES:

- Conductors shall be fastened to the structure upon which they are placed at intervals not exceeding 0.9 m (3 ft).*
- Clips for securing copper conductors shall be cast or made from sheet copper with a minimum thickness of 0.032 inch (0.81 mm) and a minimum width of 3/8 inch (9.5 mm).**
- Aluminum clips for securing aluminum conductors shall be of cast aluminum or made from sheet aluminum with a minimum thickness of 0.051 inch (1.3 mm) thick and a minimum thickness of 1/2 inch (12.7 mm) wide.**

*Per NFPA 780 Conductor Fasteners Section 4.10

**UL96 Standard for Lightning Protection Components Sections 15.1 & 15.2

Adhesives



Rubber

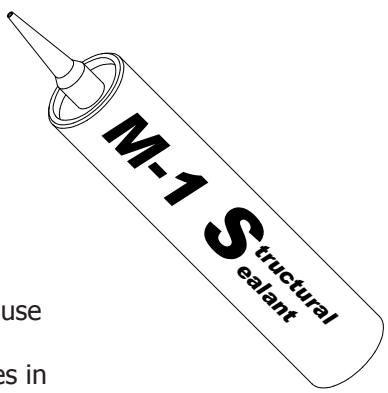
Part No.	Approx. Each Wt. (lbs.)	Box Qty.	Approx Box Wt. (lbs.)
264	10	2	20

- Fast drying rubber adhesive for bonding to rubber membrane roofing.
- Minimum application temperature is 40°F.
- Application coverage (per gallon) is 40 #CUBU or #AUBU bases or 100 #262 adhesive cable holders on smooth rubber roofing.

TECHNICAL NOTE:
- Contractor must verify adhesive compatibility with roofing contractor or manufacturer.

M-1 Structural Sealant

Part No.	Color	Box Qty.	Approx Box Wt. (lbs.)
M1-10OZ-B	Black	24	26
M1-10OZ-G	Gray	24	26
M1-10OZ-L	Limestone	24	26
M1-10OZ-W	White	24	26



- 10.1 fluid oz. cartridge
- Tough thermosetting adhesive.
- Develops 300 PSI shear strength on metal, masonry and wood. Not for use on TPO or hypolon roofs.
- Capable of 300% elongation and can accommodate dimensional changes in construction materials down to minus 20°F.
- Contains no volatile organic solvents. (No VOC's)
- Can be used in confined spaces and also to bond solvent-sensitive materials such as expanded polystyrene foam (EPS).
- Service temperature: -40°F to 200°F

APPLICATION NOTES:

Excellent for Emergency Repairs -
- Multipurpose structural sealant is designed for difficult bonding and sealing applications such as low slope commercial roofing. It bonds aggressively to EPDM, PVC, BUR, coal tar, SBS mod bit, granulated APP, many types of coated metal, metal flashing details, and FRP.
- Some Galvalume® or Kynar coated roofs may require NP1 polyurethane sealant.
- Excellent for underwater emergency repairs.
- Non-slump, self-fixturing mastic that cures to a durable bond with exposure to atmospheric moisture.

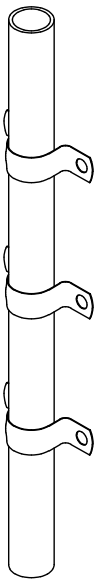
Heavy Duty Construction Adhesive -
- Tough thermosetting adhesive that can be used to permanently bond structural assemblies such as coping, metal edge, skylights.
- Capable of bonding steel deck to bar joints and metal sandwich panels to roof and wall purlins.
- Application coverage (per tube) is approximately 15 cable holders or 5 bases.
- Must be installed on a clean, free of dirt surface in temperatures not below 30°F.

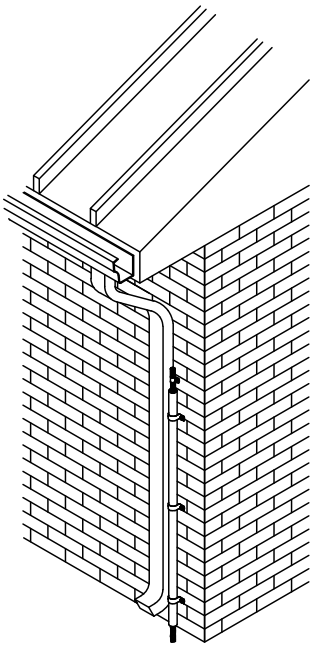
Cable Guards

PVC

Part No.	Approx. Each Wt. (lbs.)	Box Qty.	Approx Box Wt. (lbs.)
320	1-1/2	3	5

- 3/4" O.D. x 8' long PVC pipe cable guard for protecting all cables thru 4/0.
- Three galvanized fastening clips furnished for mounting with nails or screws.



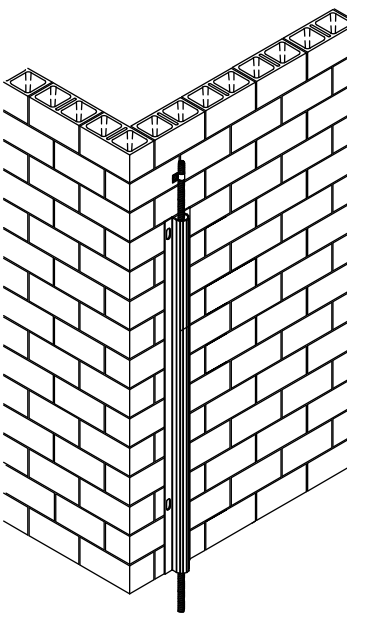


Plastic

Part No.	Color	Approx. Each Wt. (lbs.)	Box Qty.	Approx Box Wt. (lbs.)
321B	Black	1	5	5-1/2
321G	Gray	1	5	5-1/2

- 1/2" x 8' extruded thermo plastic cable guard with flanges provides concealment and protection for cables and down conductors.





TECHNICAL NOTE:

- Down conductors located in runways, driveways, school playgrounds, cattle yards, public walks, or other locations subject to physical damage or displacement shall be guarded. Metallic guards shall be bonded at each end. The down conductor shall be protected for a minimum distance of 1.8 m (6 ft.) above grade level.*

*NFPA 780 Protecting Down Conductors Sections 4.9.11, 4.9.11.1 & 4.9.11.2

Section 2.2

Air Terminals & Accessories

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NOTE: Copper materials can consist of copper, bronze or brass. All are copper alloys.

NOTE:
Air Terminals are also known as Strike Termination Devices (STD) or Lightning Rods.

Class I Copper Air Terminals

3/8" Diameter

Part No. Copper	Part No. Nickel Plated	Part No. Tin Plated	Length	Box Qty.	Approx Box Wt. (lbs.)
3810CUAT	3810CUATN	3810CUATT	10"	10	5-1/2
3812CUAT	3812CUATN	3812CUATT	12"	10	6-1/4
3816CUAT	3816CUATN	3816CUATT	16"	10	7-3/4
3818CUAT	3818CUATN	3818CUATT	18"	10	9
3824CUAT	3824CUATN	3824CUATT	24"	10	10-1/2
3836CUAT	3836CUATN	3836CUATT	36"	10	18-3/4
3848CUAT	3848CUATN	3848CUATT	48"	10	21

- Manufactured from highly conductive electrolytic tough pitch copper alloy 110.
- Conductivity greater than 99% when annealed.
- Utilizes standard 3/8" UNC threads.
- Adapters sold separately. See pages 169-171.
- Longer lengths available. Please contact factory for more information.



Listed 96

TECHNICAL NOTES:

- Class I air terminals are used on structures up to and including 75' in height.
- For longer air terminals, select an air terminal and combine with extension rods and couplers on pages 173 & 174.
- Class I Minimum Requirements:
  - Minimum diameter is 3/8" solid.
  - The tip of an air terminal shall be not less than 254 mm (10 in.) above the object or area it is to protect.*

*NFPA 780 Air Terminal Height Section 4.6.2.1

- Air terminals shall be secured against overturning or displacement by one of the following methods: (1) Attachment to the object to be protected, (2) Braces that are permanently and rigidly attached to the structure. Air terminals exceeding 600 mm (24 in.) in height shall be supported at a point not less than one-half their height.*

*NFPA 780 Air Terminal Support Sections 4.6.2.2.1 & 4.6.2.2.2

Class II Copper Air Terminals

1/2" Diameter

Part No. Copper	Part No. Nickel Plated	Part No. Tin Plated	Length	Box Qty.	Approx Box Wt. (lbs.)
1210CUAT	1210CUATN	1210CUATT	10"	10	6-12
1212CUAT	1212CUATN	1212CUATT	12"	10	7-3/4
1216CUAT	1216CUATN	1216CUATT	16"	10	10-1/2
1218CUAT	1218CUATN	1218CUATT	18"	10	11-3/4
1224CUAT	1224CUATN	1224CUATT	24"	10	15-1/2
1236CUAT	1236CUATN	1236CUATT	36"	10	23-1/4
1248CUAT	1248CUATN	1248CUATT	48"	10	31

- Manufactured from highly conductive electrolytic tough pitch copper alloy 110.
- Conductivity greater than 99% when annealed.
- Utilizes standard 1/2" UNC threads.
- Adapters sold separately. See pages 169-171.
- Longer lengths available. Please contact factory for more information.

Listed 96



5/8" Diameter

Part No. Copper	Part No. Nickel Plated	Part No. Tin Plated	Length	Box Qty.	Approx Box Wt. (lbs.)
5810CUAT	5810CUATN	5810CUATT	10"	10	9-3/4
5812CUAT	5812CUATN	5812CUATT	12"	10	11-3/4
5816CUAT	5816CUATN	5816CUATT	16"	10	15-3/4
5818CUAT	5818CUATN	5818CUATT	18"	10	17-3/4
5824CUAT	5824CUATN	5824CUATT	24"	10	23-1/2
5836CUAT	5836CUATN	5836CUATT	36"	10	35-1/4
5848CUAT	5848CUATN	5848CUATT	48"	10	47

- Utilizes standard 5/8" UNC threads.
- Longer lengths available. Please contact factory for more information.

Listed 96



TECHNICAL NOTES:

- Class II air terminals are used on structures greater than 75' in height.
- For longer air terminals, select an air terminal and combine with extension rods and couplers on pages 173 & 174.
- Class II Minumum Requirements:
  - Minimum diameter is 1/2" solid.
  - The tip of an air terminal shall be not less than 254 mm (10 in.) above the object or area is it to protect.*

*NFPA 780 Air Terminal Height Section 4.6.2.1

- Air terminals shall be secured against overturning or displacement by one of the following methods: (1) Attachment to the object to be protected, (2) Braces that are permanently and rigidly attached to the structure. Air terminals exceeding 600 mm (24 in.) in height shall be supported at a point not less than one-half their height.**

**NFPA 780 Air Terminal Support Sections 4.6.2.2.1 & 4.6.2.2.2

Class I Aluminum Air Terminals

1/2" Diameter

Part No.	Length	Box Qty.	Approx. Box Wt. (lbs.)
1210ALAT	10"	10	2-1/2
1212ALAT	12"	10	2-3/4
1216ALAT	16"	10	3-1/2
1218ALAT	18"	10	3-3/4
1224ALAT	24"	10	5
1236ALAT	36"	10	8-1/4
1248ALAT	48"	10	10

- Manufactured from highly conductive aluminum.
- Utilizes standard 1/2" UNC threads.
- Adapters sold separately. See pages 169-171.
- Longer lengths available. Please contact factory for more information.

Listed 96



Class II Aluminum Air Terminals

5/8" Diameter

Part No.	Length	Box Qty.	Approx. Box Wt. (lbs.)
5810ALAT	10"	10	3-1/2
5812ALAT	12"	10	4
5816ALAT	16"	10	5-1/4
5818ALAT	18"	10	6-3/4
5824ALAT	24"	10	8-3/4
5836ALAT	36"	10	12-3/4
5848ALAT	48"	10	17-1/2

- Manufactured from highly conductive aluminum.
- Utilizes standard 5/8" UNC threads.
- Adapters sold separately. See pages 169-171.
- Longer lengths available. Please contact factory for more information.

Listed 96



TECHNICAL NOTES:

- Class I air terminals are used on structures up to and including 75' in height. Class II air terminals are used on structures greater than 75' in height.
- For longer air terminals, select an air terminal and combine with extension rods and couplers on pages 173 & 174.
- Class I Minimum Requirements:
  - Minimum diameter is 1/2" solid.
  - The tip of an air terminal shall be not less than 254 mm (10 in.) above the object or area it is to protect.*
- Class II Minumum Requirements:
  - Minimum diameter is 5/8" solid.
  - The tip of an air terminal shall be not less than 254 mm (10 in.) above the object or area is it to protect.*

*NFPA 780 Air Terminal Height Section 4.6.2.1

- Air terminals shall be secured against overturning or displacement by one of the following methods: (1) Attachment to the object to be protected, (2) Braces that are permanently and rigidly attached to the structure. Air terminals exceeding 600 mm (24 in.) in height shall be supported at a point not less than one-half their height.**

**NFPA 780 Air Terminal Support Sections 4.6.2.2.1 & 4.6.2.2.2

Safety Tip Air Terminals - STAT

Revolutionary new air terminal designed with safety as well as efficacy in mind. The air terminal's tip consists of a sphere approximately 3/4" in diameter. The rounded tip helps minimize personnel injuries caused by accidental falls.

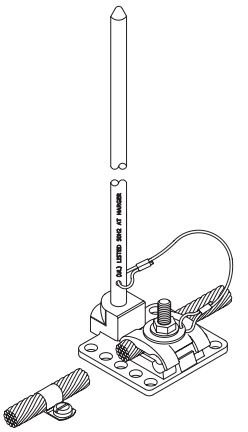
Part No.	Diameter	Length	Class	Copper/ Aluminum	Box Qty.	Approx. Box Wt. (lbs.)
3812CSTAT	3/8"	12"	I	Copper	10	7
3816CSTAT	3/8"	16"	I	Copper	10	8-1/2
3818CSTAT	3/8"	18"	I	Copper	10	9-3/4
3824CSTAT	3/8"	24"	I	Copper	10	11-1/4
1212ASTAT	1/2"	12"	I	Aluminum	10	3-1/4
1212CSTAT	1/2"	12"	II	Copper	10	8-1/2
1216ASTAT	1/2"	16"	I	Aluminum	10	4
1216CSTAT	1/2"	16"	II	Copper	10	11-1/4
1218ASTAT	1/2"	18"	I	Aluminum	10	4-1/4
1218CSTAT	1/2"	18"	II	Copper	10	12-1/2
1224ASTAT	1/2"	24"	I	Aluminum	10	5-1/2
1224CSTAT	1/2"	24"	II	Copper	10	16-1/4
5812ASTAT	5/8"	12"	II	Aluminum	10	4-1/2
5812CSTAT	5/8"	12"	II	Copper	10	12-1/2
5816ASTAT	5/8"	16"	II	Aluminum	10	5-3/4
5816CSTAT	5/8"	16"	II	Copper	10	16-1/2
5818ASTAT	5/8"	18"	II	Aluminum	10	7-1/4
5818CSTAT	5/8"	18"	II	Copper	10	18-1/2
5824ASTAT	5/8"	24"	II	Aluminum	10	9-1/4
5824CSTAT	5/8"	24"	II	Copper	10	24-1/4



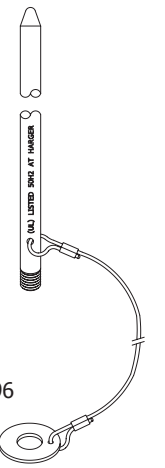
Listed 96

- Copper safety tipped air terminals available in electro plated tin (add suffix T to part number) or nickel plating (add suffix N to part number).
- Longer lengths available. Please contact factory for more information.
- 5/8" diameter STATs have standard 5/8" UNC threads.
- Adapters sold separately. See pages 169-171.
- For added safety, use with flexible adapters. See page 170.

Air Terminals with Safety Cable



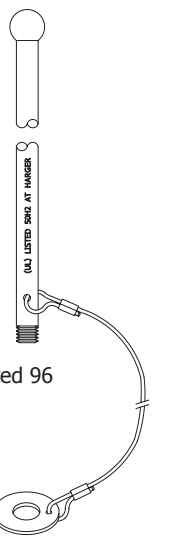
Part No.	Diameter	Length	Class	Copper/ Aluminum	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
1212CUAT-WSC36	1/2"	12"	II	Copper	3/4	10	7-1/2
1212ALAT-WSC36	1/2"	12"	I	Aluminum	1/4	10	2-1/2
1224CUAT-WSC36	1/2"	24"	II	Copper	1-1/2	10	15
5812ALAT-WSC36	5/8"	12"	II	Aluminum	1/2	10	5



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Safety Tip

Part No.	Diameter	Length	Class	Copper/ Aluminum	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
1212ASTAT-WSC36	1/2"	12"	I	Aluminum	1/4	10	2-1/2
1224CSTAT-WSC36	1/2"	24"	II	Copper	1-1/2	10	15
1224ASTAT-WSC36	1/2"	24"	I	Aluminum	1/2	10	5
3824CSTAT-WSC36	3/8"	24"	I	Copper	1-1/4	10	12-1/2



Listed 96

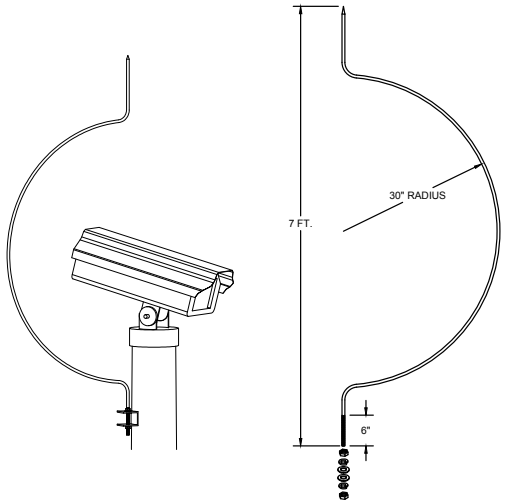
NOTES:
- Copper air terminals available in electro plated tin (add suffix T to part number) or nickel plating (add suffix N to part number).
- Comes with attached 36" safety cable.
- Cable prevents air terminal from falling off structure if air terminal detaches from base.
- Longer lengths available. Please contact factory for more information.
- Adapters sold separately. See pages 169-171.

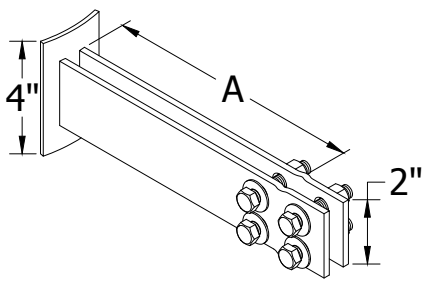
Specialty Air Terminals

Bent Copper Clad Air Terminals

Part No.	Diameter	Length	Class	Approx. Each Wt. (lbs.)
5810BCCATTSE	5/8"	7'	II	9

- For protecting security cameras mounted on poles.
- Manufactured from 5/8" x 10' copper clad ground rod.
- Thread size is 5/8" in diameter and 6" in length.
- Comes with (2) #JN1011S jam nuts, (2) LW10S lock washers and (2) W10S flat washers.
- Other sizes available. Please contact factory for more information.

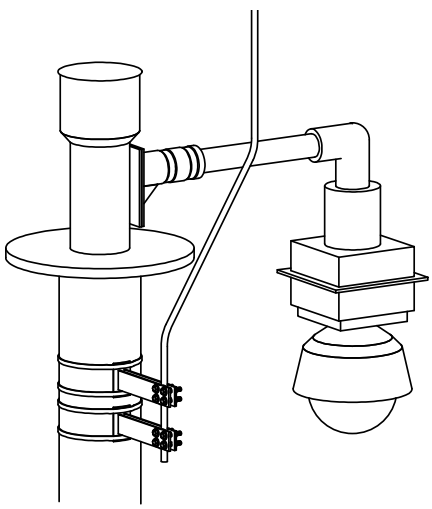




Lightning Rod Clamps

Part No.	"A"	Approx. Each Wt. (lbs.)
LRCSS3/16X8	8"	2-1/2
LRCSS3/16X12	12"	3-1/2

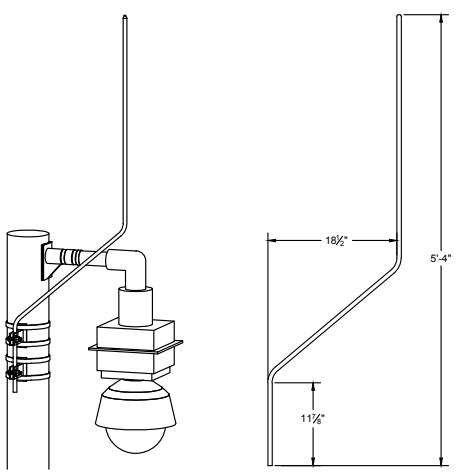
- Manufactured from 3/16" x 2" 304 stainless steel.
- Includes 3/8-16 stainless steel hardware.
- Can be mounted using stainless banding systems such as BAND-IT® by others or by welding.
- Other sizes available. Please contact factory for more information.



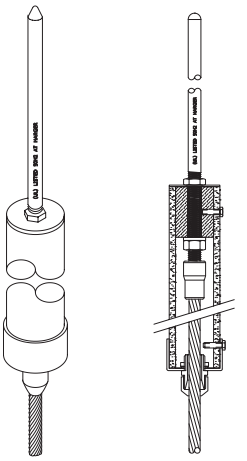
Closed Circuit TV Copper Clad Air Terminal

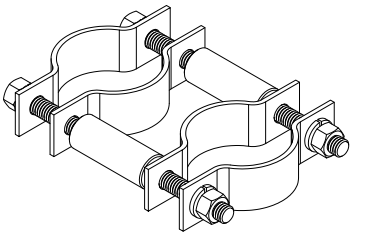
Part No.	Diameter	Length	Class	Approx. Each Wt. (lbs.)
CCTVCCAT5/8	5/8"	5'-4"	II	7

- For protecting security cameras mounted on poles.
- Manufactured from 5/8" x 8' copper clad ground rod.
- Other sizes available. Please contact factory for more information.

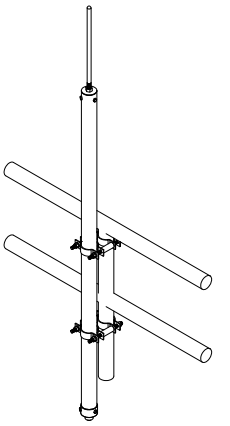


Air Terminal Assemblies





SSATMSC2
(not included)



Copper Air Terminals with Fiberglass Mast Assembly

Part No.	Fiberglass Pipe Length (ft.)	Exposed Air Terminal Length (in.) (+/-1")	Conductor Type	Exposed Conductor Length (ft.)	Approx. Each Wt. (lbs.)
CUFATM-10	14	26	32	10	43
CUFATM-50	14	26	32	50	50
CUFATM-90	14	26	32	90	60
CUFATM20-5-15*	20	60	28	15	45

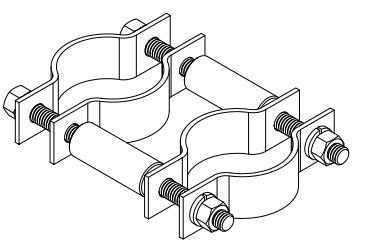
*Ships partially assembled

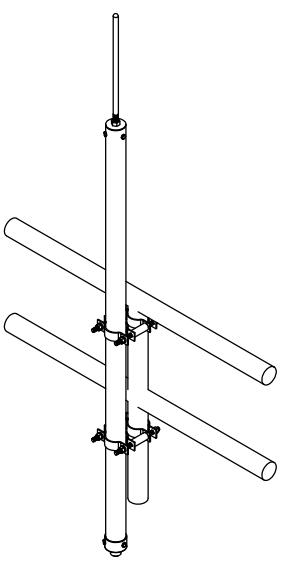
- Designed for use with towers or other structures which require long air terminal extensions.
- Protects tower lighting, antennas and miscellaneous equipment from direct lightning strikes.
- Copper braided lightning conductor is exothermically attached to the air terminal and extends past the end of the pole in various lengths.
- Mast is manufactured from heavy duty, rigid 1/4" thick fiberglass.
- Requires separate mounting assembly such as #SSATMSC2.

Air Terminal Mast Mounting Assembly

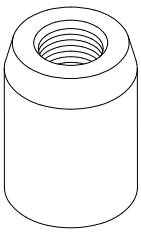
Part No.	Qty.	Approx. Each Wt. (lbs.)
SSATMSC2	EA	1-1/2

- Mounts CUFATM assembly (above) to vertical pole or tower platform.
- Mounts 2" mast to 2" OD tube.
- Manufactured from stainless steel.
- Includes 3/8" stainless steel hardware.

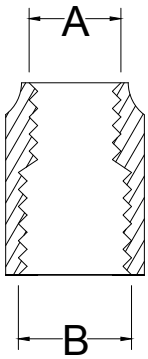


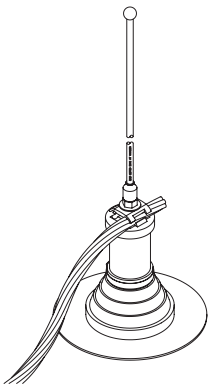


Air Terminal Adapters



Listed 96





Standard

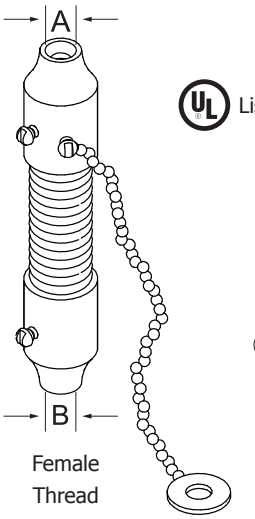
Part No.	Material	Thread Diameter		Box Qty.	Approx. Box Wt. (lbs.)
		A	B		
120	Copper	3/8"	5/8"	40	4
120N	Nickel Plated	3/8"	5/8"	40	4
120T	Tin Plated	3/8"	5/8"	40	4
121	Copper	1/2"	5/8"	40	4
121N	Nickel Plated	1/2"	5/8"	40	4
121T	Tin Plated	1/2"	5/8"	40	4
A121	Aluminum	1/2"	5/8"	40	1-1/2
122	Copper	5/8"	5/8"	40	4
122N	Nickel Plated	5/8"	5/8"	40	4
122T	Tin Plated	5/8"	5/8"	40	4
122-5/8F1/2F	Copper	5/8"	1/2"	40	4
A122	Aluminum	5/8"	5/8"	40	1-1/2
A122-5/8F1/2F	Aluminum	5/8"	1/2"	40	1-1/2
123	Copper	3/8"	3/8"	40	5
123N	Nickel Plated	3/8"	3/8"	40	5
123T	Tin Plated	3/8"	3/8"	40	5
124	Copper	3/8"	1/2"	40	4-1/4
124N	Nickel Plated	3/8"	1/2"	40	4-1/4
124T	Tin Plated	3/8"	1/2"	40	4-1/4
125	Copper	1/2"	1/2"	40	4-1/4
125N	Nickel Plated	1/2"	1/2"	40	4-1/4
125T	Tin Plated	1/2"	1/2"	40	4-1/4
A125	Aluminum	1/2"	1/2"	40	1-1/2

- Used to engage standard air terminal threads with different thread sizes found in various air terminal base assemblies. All threads are UNC.
- Other sizes available. Please contact factory for more information.

Air Terminal Adapters

Flexible Female Threads

Part No.	Material	Thread Diameter A	Thread Diameter B	Box Qty.	Approx. Box Wt. (lbs.)
126	Copper	1/2"	5/8"	10	6-1/4
A126	Aluminum	1/2"	5/8"	10	4
127	Copper	1/2"	1/2"	10	6-1/4
A127	Aluminum	1/2"	1/2"	10	4
128	Copper	5/8"	5/8"	10	6-1/4
A128	Aluminum	5/8"	5/8"	10	4

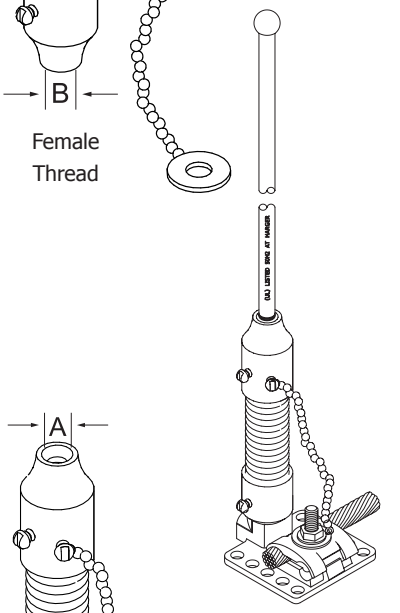


Listed 96

Female Thread

Flexible Male Threads

Part No.	Material	Thread Diameter A	Thread Diameter B	Box Qty.	Approx. Box Wt. (lbs.)
127M	Copper	1/2"	1/2"	10	6-1/2
A127M	Aluminum	1/2"	1/2"	10	4-1/4
128M	Copper	5/8"	5/8"	10	6-1/2
A128M	Aluminum	5/8"	5/8"	10	4-1/4
129M	Copper	5/8"	1/2"	10	6-1/2
A129M	Aluminum	5/8"	1/2"	10	4-1/4



Listed 96

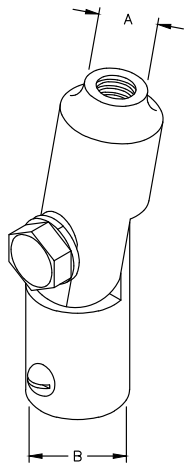
Male Thread (M)

NOTES:
- Flexible air terminal adapters are used with air terminals located underneath window washing or other mobile equipment.
- Come complete with stainless steel spring and safety chain.
- Overall length of Male thread adapter is 4-3/4".
- Overall length of Female thread adapter is 4-1/4".
- Can be used in conjunction with safety tipped air terminals. See page 165.
- Other sizes available. Please contact factory for more information.

Air Terminal Adapters

Swivel

Part No.	Material	Thread Diameter A	Thread Diameter B	Box Qty.	Approx. Box Wt. (lbs.)
133	Copper	3/8"	3/8"	10	4-1/4
133N	Nickel Plated	3/8"	3/8"	10	4-1/4
133T	Tin Plated	3/8"	3/8"	10	4-1/4
134	Copper	3/8"	1/2"	10	4
134N	Nickel Plated	3/8"	1/2"	10	4
134T	Tin Plated	3/8"	1/2"	10	4
135	Copper	3/8"	5/8"	10	3-1/2
135N	Nickel Plated	3/8"	5/8"	10	3-1/2
135T	Tin Plated	3/8"	5/8"	10	3-1/2
136	Copper	1/2"	1/2"	10	3-3/4
136N	Nickel Plated	1/2"	1/2"	10	3-3/4
136T	Tin Plated	1/2"	1/2"	10	3-3/4
A136	Aluminum	1/2"	1/2"	10	1-1/2
137	Copper	1/2"	5/8"	10	3-1/2
137N	Nickel Plated	1/2"	5/8"	10	3-1/2
137T	Tin Plated	1/2"	5/8"	10	3-1/2
A137	Aluminum	1/2"	5/8"	10	1-1/2
138	Copper	5/8"	5/8"	10	3-1/2
138N	Nickel Plated	5/8"	5/8"	10	3-1/2
138T	Tin Plated	5/8"	5/8"	10	3-1/2
A138	Aluminum	5/8"	5/8"	10	3-1/2
139	Copper	5/8"	1/2"	10	3-1/2
A139	Aluminum	5/8"	1/2"	10	3-1/2

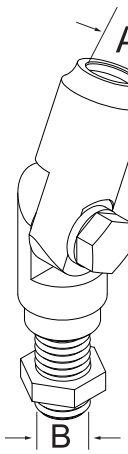


Listed 96

- Used to plumb air terminals to vertical where the bases are mounted on sloping surfaces.
- Stainless steel screws allow the adapter to be locked in any position.

Swivel - CUSM & ALSM Series

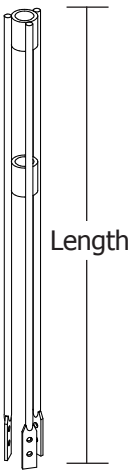
Part No.	Material	Internal Threaded Top A	Threaded Male Stud B	Box Qty.	Approx. Box Wt. (lbs.)
CUS12M	Copper	1/2"	1/2"	10	5
CUS12MT	Tin Plated	1/2"	1/2"	10	5
CUS38M	Copper	3/8"	3/8"	10	5
CUS38MT	Tin Plated	3/8"	3/8"	10	5
CUS58M	Copper	5/8"	5/8"	10	2
CUS58MT	Tin Plated	5/8"	5/8"	10	2
ALS12M	Aluminum	1/2"	1/2"	10	2
ALS58M	Aluminum	5/8"	5/8"	10	2



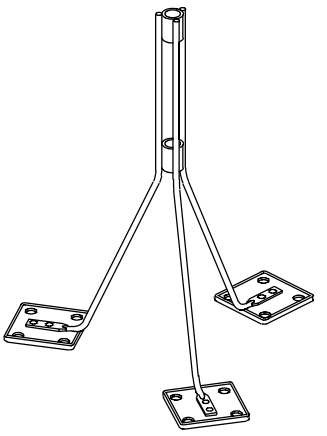
Listed 96

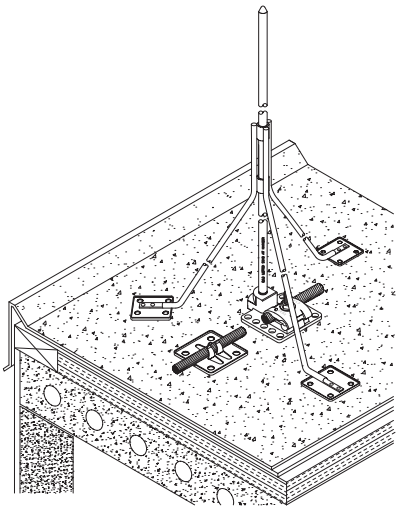
- Male thread configuration designed to fit internally threaded air terminal bases.

Air Terminal Braces



Listed 96





Part No.	Adhesive Feet Copper/Aluminum	Type	Standard Lengths	Max. Air Terminal Supported	Box Qty.	Approx. Box Wt. (lbs.)
140-18	-----	Screw Hole	18"	24"	10	12-1/2
140-18AD	Copper	Adhesive Feet	18"	24"	10	12-3/4
A140-18AD	Aluminum	Adhesive Feet	18"	24"	10	12-3/4
140-24	-----	Screw Hole	24"	36"	10	16
140-24AD	Copper	Adhesive Feet	24"	36"	10	16-1/4
A140-24AD	Aluminum	Adhesive Feet	24"	36"	10	16-1/4
140-36	-----	Screw Hole	36"	60"	10	20
140-36AD	Copper	Adhesive Feet	36"	60"	10	20-1/4
A140-36AD	Aluminum	Adhesive Feet	36"	60"	10	20-1/4
140-48	-----	Screw Hole	48"	72"	10	22
140-48AD	Copper	Adhesive Feet	48"	72"	10	22-1/4
A140-48AD	Aluminum	Adhesive Feet	48"	72"	10	22-1/4

- Galvanized steel tripod braces are used for the support of air terminals that exceed 24" in length.
- Constructed of 1/4" steel rod with welded joints and a zinc/ultraseal plating.
- Braces available with 3/16" holes for anchoring with screws or nails or with adhesive feet when mounting to roofing membranes or similar surfaces where penetrations cannot be made.
- Lengths given are prior to installation. Please take technical notes below into consideration before ordering.
- Meets UL requirements.

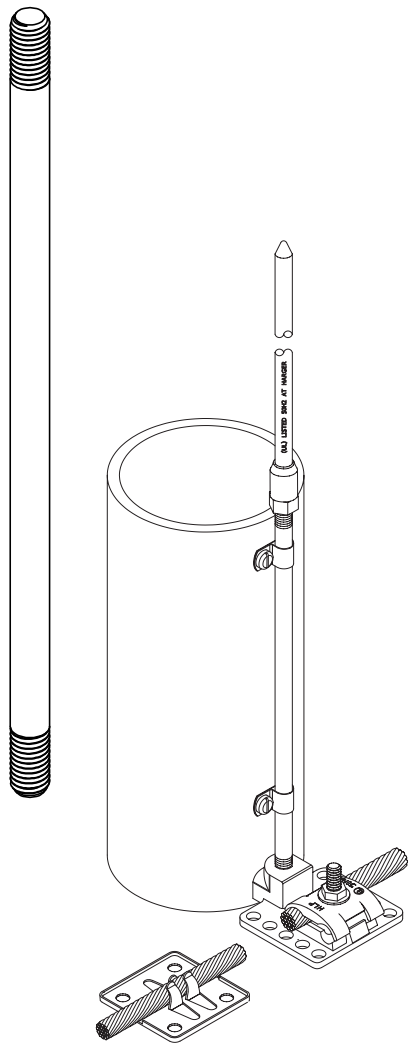
TECHNICAL NOTE:

- Air terminals shall be secured against overturning or displacement by one of the following methods: (1) Attachment to the object to be protected (2) Braces that are permanently and rigidly attached to the structure. Air terminals exceeding 24 in. (600 mm) in height shall be supported at a point not less than one-half their height.*

*NFPA 780 Air Terminal Support Sections 4.6.2.2.1 & 4.6.2.2.2

Air Terminal Extensions

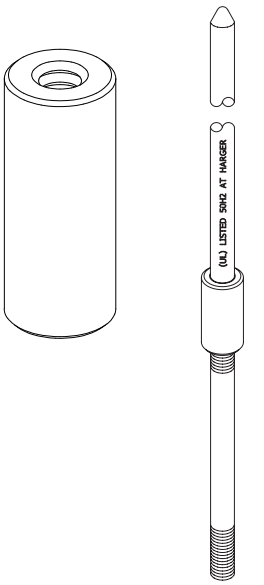
Part No.	Copper/ Aluminum	Length	Diameter	Box Qty.	Approx. Box Wt. (lbs.)
144-12	Copper	12"	3/8"	10	1/2
144-24	Copper	24"	3/8"	10	1
144-36	Copper	36"	3/8"	10	1-1/2
144-48	Copper	48"	3/8"	10	2
144-60	Copper	60"	3/8"	10	2-1/2
145-12	Copper	12"	1/2"	10	3/4
A145-12	Aluminum	12"	1/2"	10	1/4
145-24	Copper	24"	1/2"	10	1-1/2
A145-24	Aluminum	24"	1/2"	10	1/2
145-36	Copper	36"	1/2"	10	2-1/4
A145-36	Aluminum	36"	1/2"	10	3/4
145-48	Copper	48"	1/2"	10	3
A145-48	Aluminum	48"	1/2"	10	1
145-60	Copper	60"	1/2"	10	3-3/4
A145-60	Aluminum	60"	1/2"	10	1-1/4
146-12	Copper	12"	5/8"	10	1-1/4
A146-12	Aluminum	12"	5/8"	10	1/2
146-24	Copper	24"	5/8"	10	2-1/2
A146-24	Aluminum	24"	5/8"	10	1
146-36	Copper	36"	5/8"	10	3-3/4
A146-36	Aluminum	36"	5/8"	10	1-1/2
146-48	Copper	48"	5/8"	10	5
A146-48	Aluminum	48"	5/8"	10	2
146-60	Copper	60"	5/8"	10	5-1/4
A146-60	Aluminum	60"	5/8"	10	2-1/2



- Solid copper or aluminum extension rods are used to extend standard air terminals to lengths required.
- Extension rods are available in lengths up to 12 feet and have standard UNC threads at each end.
- Meets UL requirements.
- Other sizes available. Please contact factory for more information.

Extension Rod Couplers

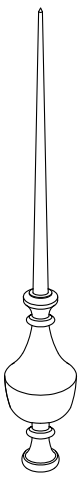
Part No.	Copper/ Aluminum	Diameter	Box Qty.	Approx. Box Wt. (lbs.)
147	Copper	3/8"	10	2-3/4
148	Copper	1/2"	10	2-1/2
A148	Aluminum	1/2"	10	1
149	Copper	5/8"	10	1-3/4
A149	Aluminum	5/8"	10	1

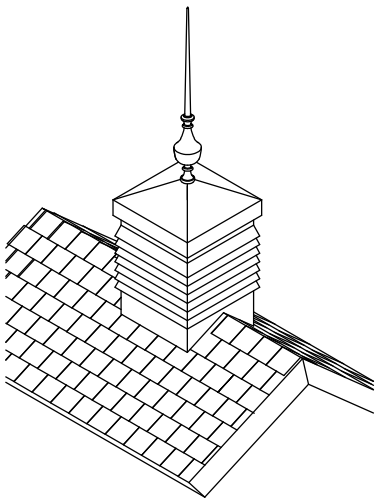


- 13/16" x 2" coupler connects air terminals to extension rods, or used to connect sections of rods together.
- All threads are UNC.
- Meets UL requirements.

Decorative Finials

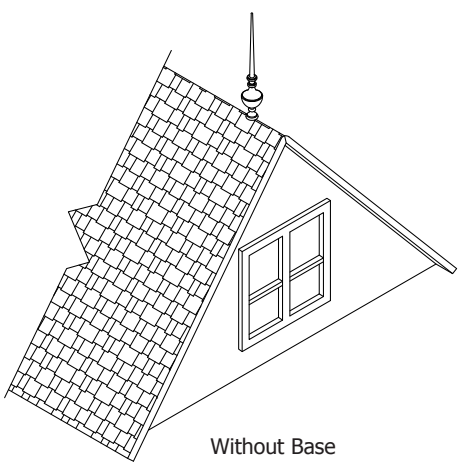
Decorative finial enhances building aesthetics while being part of a functional lightning protection system.



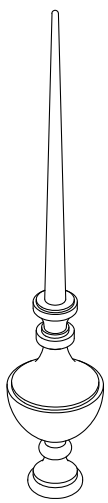


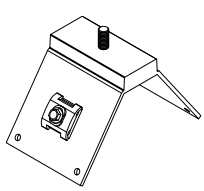
Part No.	Material	Qty.	Approx. Each Wt. (lbs.)
BF16I1/2	Copper	EA	3

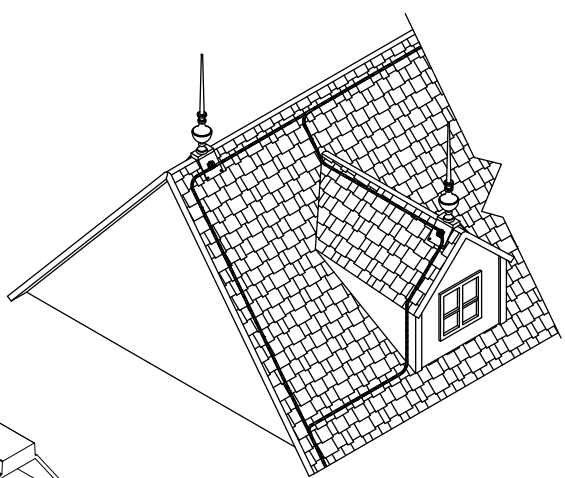
- 16" decorative finial with 1/2" diameter internal thread.
- Meets UL requirements.



Without Base







With Base

Part No.	Description	Material	Internal Thread	Qty.	Approx. Each Wt. (lbs.)
BF27I1/2	Finial	Copper	1/2"	EA	21
BF27BASE	Base	Copper	1/2"	EA	19

- 27" decorative finial with 1/2" diameter internal thread.
- Meets UL requirements.
- Base sold separately.

Section 2.3

Air Terminal Bases

Index

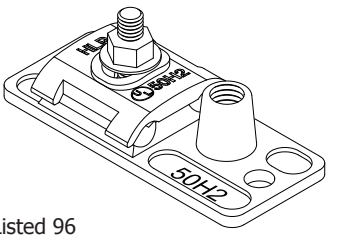
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NOTE: Copper materials can consist of copper, bronze or brass. All are copper alloys.

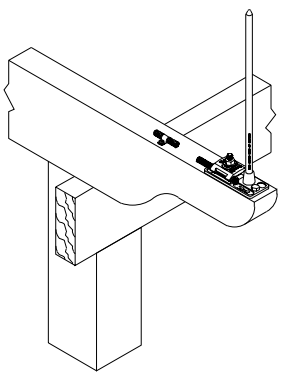
Horizontal Bases

Internally Threaded Hub Bases

Part No.	Material	Internally Threaded Hub Diameter	Box Qty.	Approx. Box Wt. (lbs.)
15138I	Copper	3/8"	5	3-3/4
15138IT	ETPB*	3/8"	5	3-3/4
15112I	Copper	1/2"	5	3-3/4
15112IT	ETPB*	1/2"	5	3-3/4
A15112I	Aluminum	1/2"	5	1-1/4



Listed 96

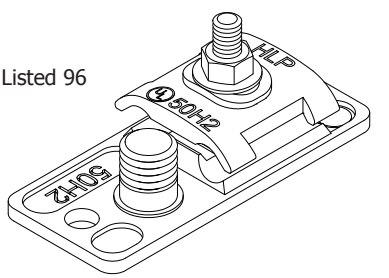


Externally Threaded Hub Bases

Part No.	Material	Externally Threaded Hub Diameter	Box Qty.	Approx. Box Wt. (lbs.)
151	Copper	5/8"	5	3-1/4
A151	Aluminum	5/8"	5	3-1/4
151T	ETPB*	5/8"	5	3-1/4

• Adapter needed. See page 169.

Listed 96



NOTES:

- 1-3/4" x 4" base is ideal for use where mounting area is very small such as on skylight frames or narrow extruded shapes.
- Accepts all Class I & Class II conductors.
- Two mounting holes are provided for secure mounting using machine or self tapping screws.

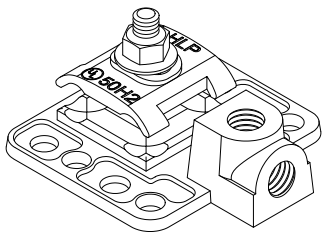
*ETPB - Electro Tin Plated Bronze

TECHNICAL NOTES:

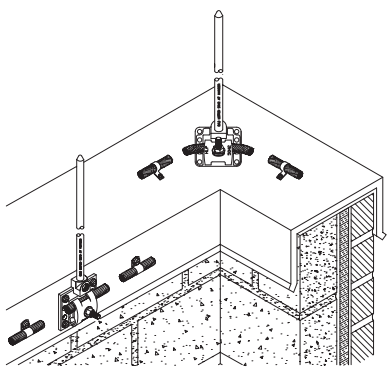
- A threaded hub provided for the attachment of the air terminal shall have at least five full threads and, if internally threaded, shall have a wall thickness of not less than 1/16 inch (1.6 mm) measured at the base of the threads.*
- Each base support shall incorporate a connector fitting for connection to the lightning conductor. The conducting cross-sectional area of the base support, between the connector and the base of the air terminal, shall be equal to or greater than that of the conductor. The conductor shall contact the base for not less than 1-1/2 inches (38 mm) on all sides of the cable.*
- At least two mounting holes that will accept a No. 10 - 24 or larger bolt or screw shall be provided in the support so that it can be permanently and rigidly fastened.*

*UL 96 Standard for Lightning Protection Components Sections 7.2, 7.4 & 7.5

Universal Bases



Listed 96



UBU Series - Horizontal & Vertical Bases

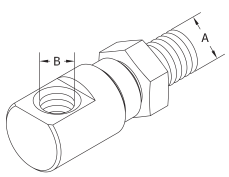
Part No.	Material	Internally Threaded Hub Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CUBU38I	Copper	3/8"	5	4-1/4
TCUBU38I	ETPB*	3/8"	5	4-1/4
CUBU12I	Copper	1/2"	5	4-1/4
TCUBU12I	ETPB*	1/2"	5	4-1/4
AUBU12I	Aluminum	1/2"	5	1-1/2
CUBU58I	Copper	5/8"	5	4-1/4
TCUBU58I	ETPB*	5/8"	5	4-1/4
AUBU58I	Aluminum	5/8"	5	1-1/2

- 2-5/8" x 3" base features a universal mounting design allowing it to be installed either horizontally or vertically.
- Utilizes a variety of mounting applications such as self tapping screws, nails or adhesives.
- Accepts all Class I & Class II conductors.

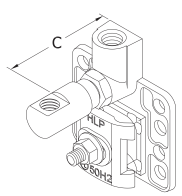
*ETPB - Electro Tin Plated Bronze

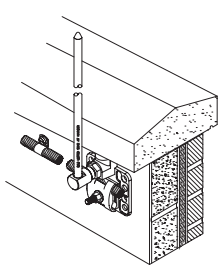
Parapet Base Extensions

Part No.	Material	Base Thread Diameter A	Air Terminal Threaded Diameter B	Offset Clearance C	Box Qty.	Approx. Box Wt. (lbs.)
BPBE2	Copper	1/2"	1/2"	2"	10	5
BPBE2-3/8	Copper	1/2"	3/8"	2"	10	5
BPBE2-3/8X3/8	Copper	3/8"	3/8"	2"	10	5
BPBE2-5/8X5/8	Copper	5/8"	5/8"	2"	10	5
BPBE3	Copper	1/2"	1/2"	3"	10	7-1/2
BPBE3-3/8	Copper	1/2"	3/8"	3"	10	7-1/2
BPBE3-3/8X3/8	Copper	3/8"	3/8"	3"	10	7-1/2
BPBE3-5/8X5/8	Copper	5/8"	5/8"	3"	10	7-1/2
APBE2	Aluminum	1/2"	1/2"	2"	10	2-1/2
APBE2-5/8	Aluminum	1/2"	5/8"	2"	10	2-1/2
APBE2-5/8X5/8	Aluminum	5/8"	5/8"	2"	10	2-1/2
APBE3	Aluminum	1/2"	1/2"	3"	10	5
APBE3-5/8X5/8	Aluminum	5/8"	5/8"	3"	10	5



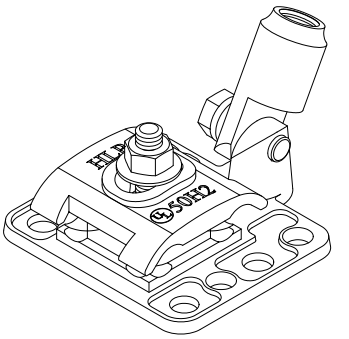
Listed 96





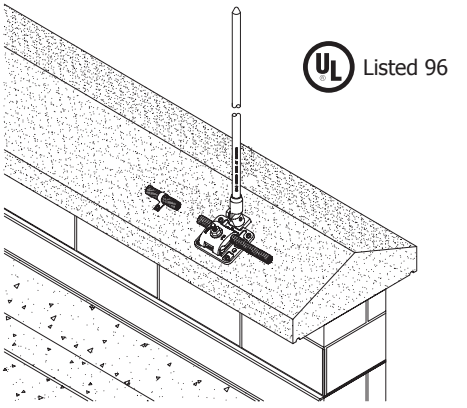
- Used when mounting air terminal bases under copings that have up to a 2" or 3" overhang.
- Provides a 2" or 3" extension (measured from inside of air terminal to parapet wall).
- Manufactured from highly conductive copper or aluminum alloys.
- Stainless steel jam nut provides for proper positioning of air terminal.
- Available electro-tin plated. When ordering, add prefix T to part number.

Swivel Bases



UBS Series with Swivel Adapter

Part No.	Material	Internally Thread Hub Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CUBS38	Copper	3/8"	5	4-1/2
TCUBS38	ETPB*	3/8"	5	4-1/2
CUBS12	Copper	1/2"	5	5-1/2
TCUBS12	ETPB*	1/2"	5	5-1/2
AUBS12	Aluminum	1/2"	5	1-1/2
CUBS58	Copper	5/8"	5	5
TCUBS58	ETPB*	5/8"	5	5
AUBS58	Aluminum	5/8"	5	5

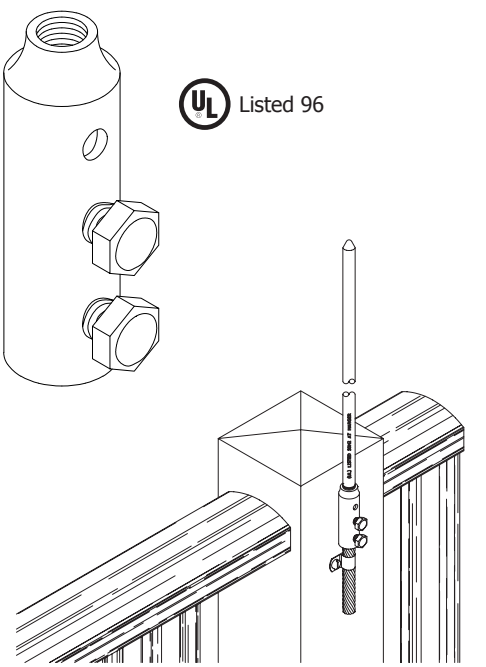


- 2-5/8" x 3" base features a swivel adapter intended for installation on angled surfaces.
- Utilizes a variety of mounting applications such as self tapping screws, nails or adhesives.
- Accepts all Class I & Class II conductors.

*ETPB - Electro Tin Plated Bronze.

Vertical Bases

Part No.	Material	Internally Threaded Hub Diameter	Box Qty.	Approx. Box Wt. (lbs.)
157	Copper	3/8"	10	2-1/2
157T	Copper*	3/8"	10	2-1/2
158	Copper	1/2"	10	2-1/2
158T	Copper*	1/2"	10	2-1/2
A158	Aluminum	1/2"	10	1-1/4
A158R	Aluminum	1/2"	10	1-1/4
158-5/8	Copper	5/8"	10	2-1/2
158-5/8T	Copper*	5/8"	10	2-1/2
A158-5/8	Aluminum	5/8"	10	1-1/4
A158R-5/8	Aluminum	5/8"	10	1-1/4



- 2-1/2" long, vertical base connector features 1/4" mounting hole and two stainless steel cap screws to assure a good electrical connection.
- For all standard cables up to 1/2" in diameter.
- #A158R and #A158R-5/8 fits aluminum cables up to 19/32" diameter.

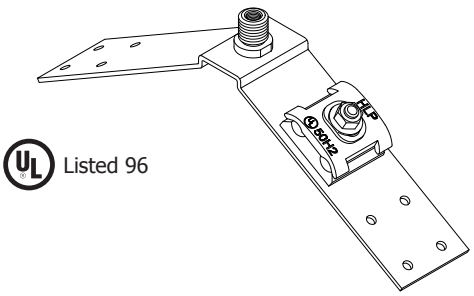
* Electro Tin Plated

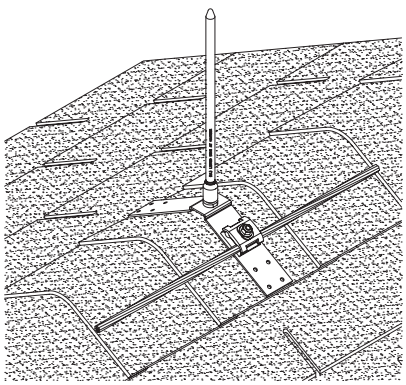
Ridge Saddle Bases

Part No.	Material	Threaded Hub Diameter		Box Qty.	Approx. Box Wt. (lbs.)
		Int.	Ext.		
160	Copper	3/8"	5/8"	10	10
160T	Copper*	3/8"	5/8"	10	10
A160	Aluminum	1/2"	N/A	10	4-1/2
A160-5/8	Aluminum	5/8"	N/A	10	4-1/2

- 2" x 12" base fits easily to most any surface.
- Accepts all Class I & Class II conductors.

*Electro Tin Plated



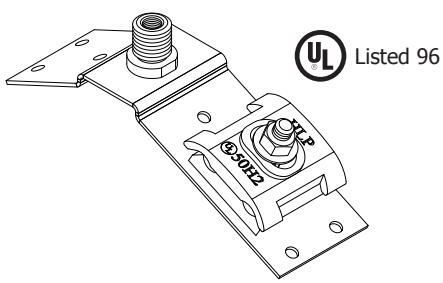


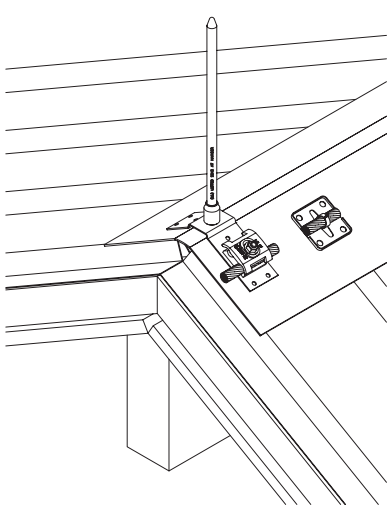
NOTE:
- See page 169 for adapters.

1/2 Ridge Saddle Bases

Part No.	Material	Threaded Hub Diameter		Box Qty.	Approx. Box Wt. (lbs.)
		Int.	Ext.		
CURS6.75	Copper	3/8"	5/8"	10	10
ALRS6.75	Aluminum	1/2"	N/A	10	5

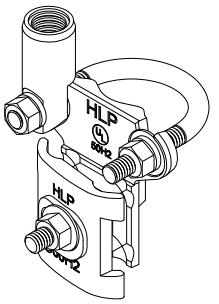
- 2" x 6-3/4" base fits easily to most any surface.
- Accepts all Class I & Class II conductors.



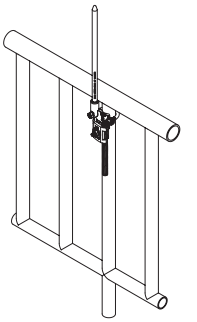


NOTE:
- See page 169 for adapters.

Pipe Railing Bases

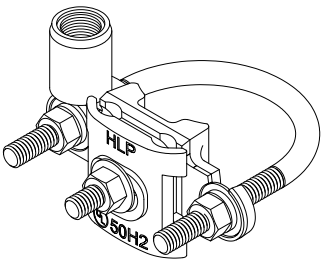


Listed 96

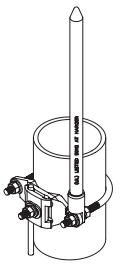


Part No.	Material	Nominal Pipe Size Range	Outside Diameter Pipe Size Range	Air Terminal Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPRB.5/1AT38	ETPB*	.5" - 1"	0.84" - 1.315"	3/8"	5	3-3/4
CPRB.5/1AT12	ETPB*	.5" - 1"	0.84" - 1.315"	1/2"	5	3-3/4
CPRB.5/1AT58	ETPB*	.5" - 1"	0.84" - 1.315"	5/8"	5	3-3/4
APRB.5/1AT12	Aluminum	.5" - 1"	0.84" - 1.315"	1/2"	5	2-1/2
APRB.5/1AT58	Aluminum	.5" - 1"	0.84" - 1.315"	5/8"	5	2-1/2

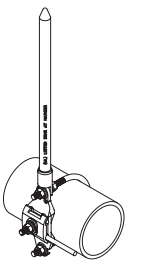
* Electro Tin Plated Bronze



Listed 96



Vertical



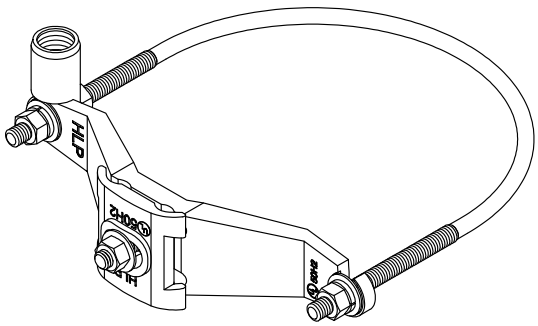
Horizontal

Part No.	Material	Nominal Pipe Size Range	Outside Diameter Pipe Size Range	Air Terminal Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPRB1.5/2AT38	ETPB*	1.25" - 2"	1.315" - 2.4"	3/8"	5	5
CPRB1.5/2AT12	ETPB*	1.25" - 2"	1.315" - 2.4"	1/2"	5	5
CPRB1.5/2AT58	ETPB*	1.25" - 2"	1.315" - 2.4"	5/8"	5	5
APRB1.5/2AT12	Aluminum	1.25" - 2"	1.315" - 2.4"	1/2"	5	2-1/2
APRB1.5/2AT58	Aluminum	1.25" - 2"	1.315" - 2.4"	5/8"	5	2-1/2
CPRB2.5/3AT38	ETPB*	2.5" - 3"	2.25" - 3.5"	3/8"	5	7-1/2
CPRB2.5/3AT12	ETPB*	2.5" - 3"	2.25" - 3.5"	1/2"	5	7-1/2
CPRB2.5/3AT58	ETPB*	2.5" - 3"	2.25" - 3.5"	5/8"	5	7-1/2
APRB2.5/3AT12	Aluminum	2.5" - 3"	2.25" - 3.5"	1/2"	5	2-1/2
APRB2.5/3AT58	Aluminum	2.5" - 3"	2.25" - 3.5"	5/8"	5	3

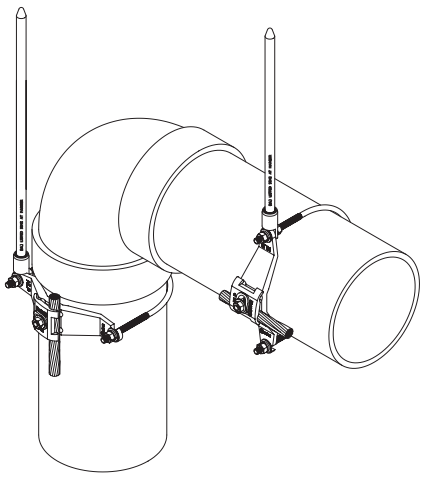
* Electro Tin Plated Bronze

NOTES:
- Swivel adapter design allows for mounting at any angle.
- Fits all main size conductors up to 9/16" diameter.
- Air terminal not included.

Pipe Railing Bases



Listed 96



Part No.	Material	Nominal Pipe Size Range	Outside Diameter Pipe Size Range	Air Terminal Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPRB3.5/4AT38	ETPB*	3.5" - 4"	3.2" - 4.5"	3/8"	5	8-3/4
CPRB3.5/4AT12	ETPB*	3.5" - 4"	3.2" - 4.5"	1/2"	5	8-3/4
CPRB3.5/4AT58	ETPB*	3.5" - 4"	3.2" - 4.5"	5/8"	5	8-3/4
APRB3.5/4AT12	Aluminum	3.5" - 4"	3.2" - 4.5"	1/2"	5	3-3/4
APRB3.5/4AT58	Aluminum	3.5" - 4"	3.2" - 4.5"	5/8"	5	4
CPRB5/6AT38	ETPB*	5" - 6"	5.63" - 6.63"	3/8"	3	6
CPRB5/6AT12	ETPB*	5" - 6"	5.63" - 6.63"	1/2"	3	6
CPRB5/6AT58	ETPB*	5" - 6"	5.63" - 6.63"	5/8"	3	6
APRB5/6AT12	Aluminum	5" - 6"	5.63" - 6.63"	1/2"	3	3-3/4
APRB5/6AT58	Aluminum	5" - 6"	5.63" - 6.63"	5/8"	3	3-3/4

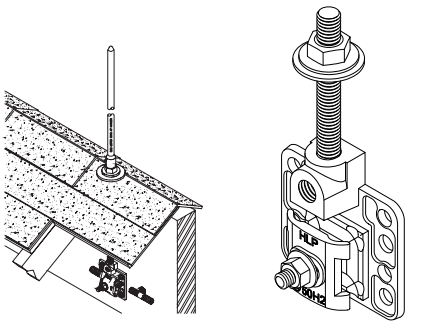
* Electro Tin Plated Bronze

NOTES:
- Swivel adapter design allows for mounting at any angle.
- Fits all main size conductors up to 9/16" diameter.
- Air terminal not included.

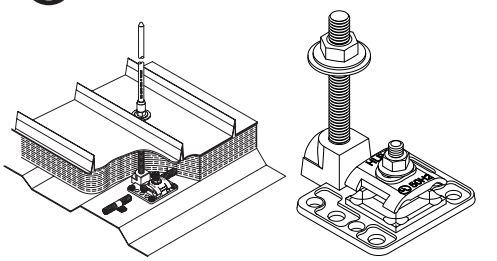
Concealed Bases

Concealed Base Assemblies

Part No.	Material	Riser Bar Length	Riser Bar Diameter	Box Qty.	Approx. Box Wt. (lbs.)
155-6	Copper	6"	3/8"	10	6-1/4
155-12	Copper	12"	3/8"	10	12-1/2
155-18	Copper	18"	3/8"	10	18-3/4
156-6	Copper	6"	1/2"	10	5-1/4
A156-6	Aluminum	6"	1/2"	10	4-1/4
156BM-6	Bi-Metal	6"	1/2"	10	7-1/2
156-12	Copper	12"	1/2"	10	10-1/4
A156-12	Aluminum	12"	1/2"	10	8-1/4
156BM-12	Bi-Metal	12"	1/2"	10	14-3/4
156-18	Copper	18"	1/2"	10	15-1/2
A156-18	Aluminum	18"	1/2"	10	12-1/4
156BM-18	Bi-Metal	18"	1/2"	10	22



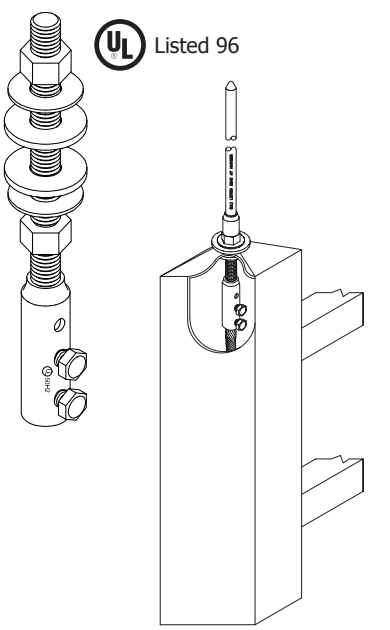
Listed 96



- Vertical concealed base assembly designed to be mounted on ridge boards or roof trusses.
- Horizontal concealed base assembly is designed for use on flat roof decks or other flat surfaces.

Concealed Base Assemblies

Part No.	Material	Riser Bar Length	Riser Bar Diameter	Box Qty.	Approx. Box Wt. (lbs.)
157-6	Copper	6"	3/8"	10	5
157-12	Copper	12"	3/8"	10	6
157-18	Copper	18"	3/8"	10	8
158-6	Copper	6"	1/2"	10	6
158BM-6	Bi-Metal	6"	1/2"	10	6
158-12	Copper	12"	1/2"	10	9
158BM-12	Bi-Metal	12"	1/2"	10	10
158-18	Copper	18"	1/2"	10	12
158BM-18	Bi-Metal	18"	1/2"	10	12
A158-6	Aluminum	6"	1/2"	10	3
A158-12	Aluminum	12"	1/2"	10	4
A158-18	Aluminum	18"	1/2"	10	6



Listed 96

- Aluminum concealed base assemblies utilize stainless steel riser bars.

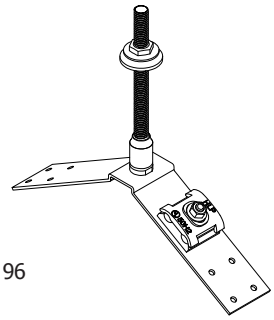
NOTES:
- Accepts all Class I and Class II conductors.
- Stainless steel jam nut and washer are provided along with a special neoprene sealing washer to assure a watertight installation.
- Bi-metal consists of stainless steel riser bar and bronze base.
- Air terminal adapters needed for these type of bases. See page 169 for adapters.
- Other lengths available. Please contact factory for more information.

Concealed Bases

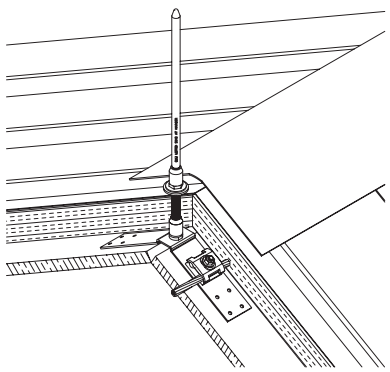
Concealed Ridge Saddle Assemblies

Part No.	Material	Riser Bar Length	Riser Bar Diameter	Box Qty.	Approx. Box Wt. (lbs.)
162-6	Copper	6"	1/2"	10	12-1/2
A162-6	Aluminum	6"	1/2"	10	8-1/2
162-12	Copper	12"	1/2"	10	5
A162-12	Aluminum	12"	1/2"	10	11-1/2
162-18	Copper	18"	1/2"	10	18
A162-18	Aluminum	18"	1/2"	10	14-1/4

- 2" x 12" concealed base assembly designed for use on pitched roof decks in the insulation space.
- Permits concealment of roof conductors where they otherwise may not be concealed because the under side of the deck is exposed.
- Accepts all Class I & Class II conductors.
- Furnished with a stainless steel washer and jam nut, as well as a neoprene washer for a complete watertight installation.



UL Listed 96

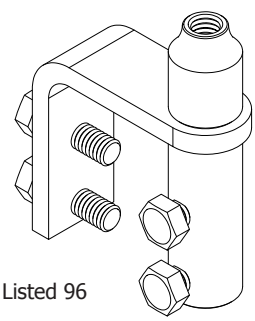


NOTES:
- Air terminal adapters needed for these type of bases. See page 169 for adapters.
- For other available riser bar lengths, please contact factory for more information.

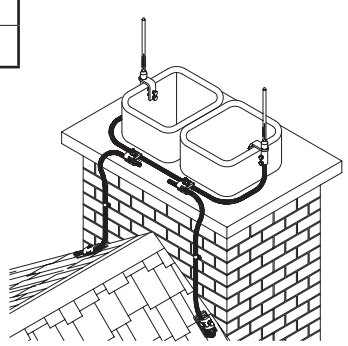
Chimney Flue Bases

Part No.	Material	Maximum Material Thickness	Class	Internally Threaded Hub Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CFB1.5	Tinned Copper	1-1/2"	I	3/8"	5	5
CFB2.25	Tinned Copper	2-1/4"	I	3/8"	5	6-1/4
AFB1-1/2	Aluminum	1"	I	1/2"	5	2
AFB1-5/8	Aluminum	1"	II	5/8"	5	2

- Accepts all Class I & Class II conductors.
- Used when protecting chimneys from direct lightning strikes.
- Other sizes available. Please contact factory for more information.



UL Listed 96

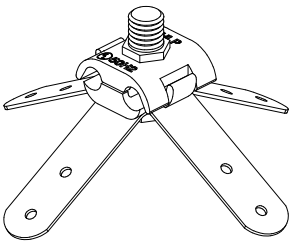


Dome Bases

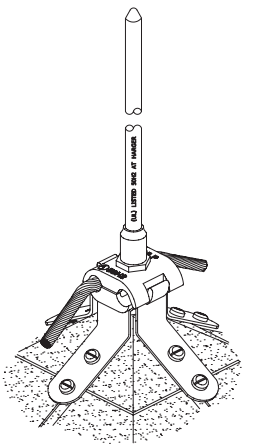
Part No.	Material	Externally Threaded Hub Diameter	Box Qty.	Approx. Box Wt. (lbs.)
164	Copper	5/8"	5	7-1/2
A164	Aluminum	5/8"	5	6

- Base features four 4" straps with two 3/16" mounting holes per strap.
- Straps manufactured from 1" wide soft temper copper or aluminum which easily forms to fit all conical shapes.
- Accepts all Class I & Class II conductors.

NOTES:
- Air terminal adapters needed for these type of bases. See page 169 for adapters.



Listed 96



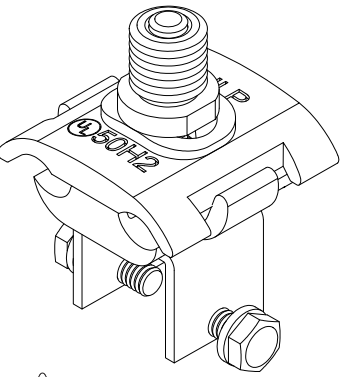
Standing Seam Bases

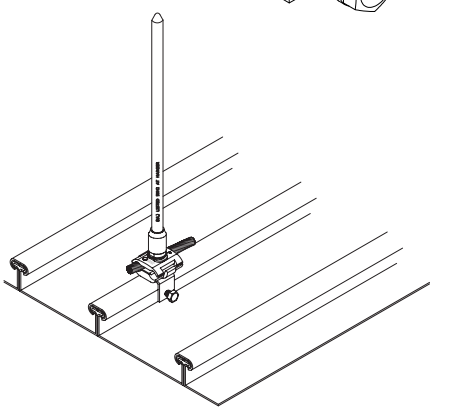
Part No.	Material	Externally Threaded Hub Diameter	Box Qty.	Approx. Box Wt. (lbs.)
BSB	Copper	5/8"	5	3-3/4
ALSB	Aluminum	5/8"	5	2-1/2

- Used to connect air terminal and conductor to a seam.
- Fits up to 1" wide seam.
- Omni directional base design allows conductor to be coursed parallel or perpendicular to seam.
- Accepts all Class I & Class II conductors.

NOTES:
- Air terminal adapters needed for these type of bases. See page 169 & 171 for adapters.

Listed 96





Section 2.4

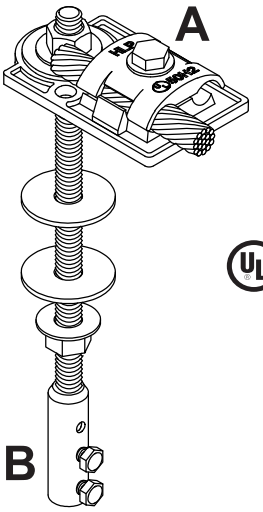
Thru-Roof/Wall Connectors, Assemblies & Accessories

Index

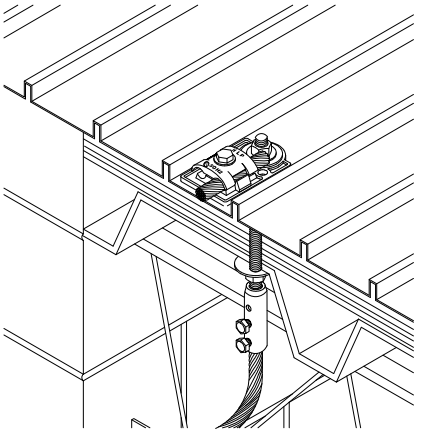
Description		Page
2.4.1	Thru-Roof/Wall Connectors	188
2.4.2	Thru-Roof/Wall Assemblies	190
2.4.3	Thru-Roof Accessories	192
2.4.4	Pitch Pockets & Roof Flashings	194

NOTE: Copper materials can consist of copper, bronze or brass. All are copper alloys.

Thru-Roof/Wall Connectors



Listed 96



Right Angle to Straight Connection

Part No.	Type of Material A	Type of Material B	Threaded Bar Length	Box Qty.	Approx. Box Wt. (lbs.)
225-6	Copper	Copper	6"	10	12-3/4
A225-6	Aluminum	Aluminum	6"	10	7-1/4
225BM-6	Aluminum	Copper	6"	10	11-1/4
225-12	Copper	Copper	12"	10	15-3/4
A225-12	Aluminum	Aluminum	12"	10	8-1/2
225BM-12	Aluminum	Copper	12"	10	13-3/4
225-18	Copper	Copper	18"	10	18-3/4
A225-18	Aluminum	Aluminum	18"	10	9-3/4
225BM-18	Aluminum	Copper	18"	10	16-1/4
A225BM-18	Copper	Aluminum	18"	10	16-1/4

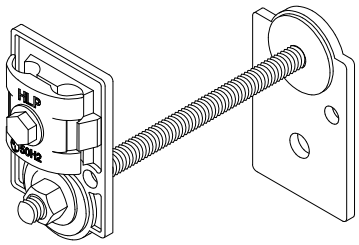
- Thru-roof or thru-wall connectors are used when making roof or wall penetrations because of the difficulty of sealing stranded lightning conductor cables.
- Features include 1/2" diameter threaded rod, neoprene sealing washers and stainless steel jam nuts to assure a watertight installation.
- Fits all main size conductors up to 9/16" diameter.
- Other configurations available. Please contact factory for more information.

TECHNICAL NOTES:

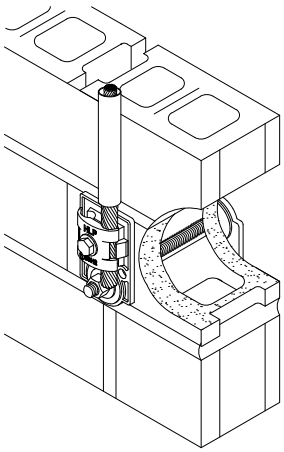
- Requirements covering exposed systems also shall apply to concealed systems, except conductors shall be permitted to be coursed under roofing materials, under roof framing, behind exterior wall facing, between wall studding, in conduit chases, or embedded directly in concrete or masonry construction.*
- Where a conductor is run in metal conduit, it shall be bonded to the conduit at the point where it enters the conduit, at the point where it emerges from the conduit, and at all locations where the conduit is not electrically continuous.*

*NFPA 780 Concealed Systems, General Sections 4.15.1.1 & 4.15.1.2

Thru-Roof/Wall Connectors



Listed 96



Right Angle to Right Angle Connection

Part No.	Type of Material Connection	Threaded Bar Length	Box Qty.	Approx. Box Wt. (lbs.)
226-6	Copper to Copper	6"	5	9
A226-6	Aluminum to Aluminum	6"	5	4-3/4
226BM-6	Copper to Aluminum	6"	5	6-3/4
226-12	Copper to Copper	12"	5	10-1/4
A226-12	Aluminum to Aluminum	12"	5	6
226BM-12	Copper to Aluminum	12"	5	8
226-18	Copper to Copper	18"	5	11-1/2
A226-18	Aluminum to Aluminum	18"	5	7-1/4
226BM-18	Copper to Aluminum	18"	5	9-1/4

- Thru-roof or thru-wall connectors are used when making roof or wall penetrations because of the difficulty of sealing stranded lightning conductor cables.
- Features include 1/2" diameter threaded rod, neoprene sealing washers and stainless steel jam nuts to assure a watertight installation.
- Fits all main size conductors up to 9/16" diameter.
- Other configurations available. Please contact factory for more information.

TECHNICAL NOTES:

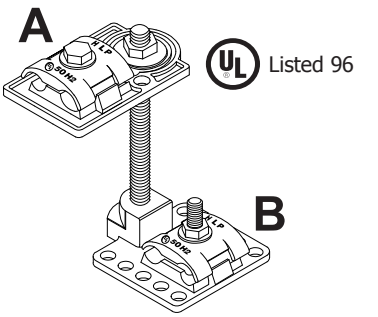
- Requirements covering exposed systems also shall apply to concealed systems, except conductors shall be permitted to be coursed under roofing materials, under roof framing, behind exterior wall facing, between wall studding, in conduit chases, or embedded directly in concrete or masonry construction.*
- Where a conductor is run in metal conduit, it shall be bonded to the conduit at the point where it enters the conduit, at the point where it emerges from the conduit, and at all locations where the conduit is not electrically continuous.*

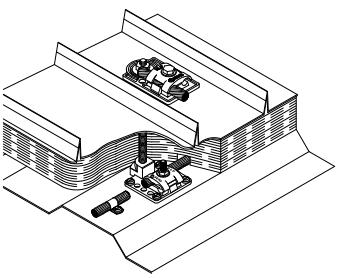
*NFPA 780 Concealed Systems, General Sections 4.15.1.1 & 4.15.1.2

Thru-Roof/Wall Connectors

Bonding Plate to Flat Surface Base Connection

Part No.	Type of Material A	Type of Material B	Threaded Bar Length	Box Qty.	Approx. Box Wt. (lbs.)
U219ATR-6	Aluminum	Aluminum	6"	5	5
U219BMTR-6	Copper	Aluminum	6"	5	8
U219TR-6	Copper	Copper	6"	5	9-1/2
U219ATR-12	Aluminum	Aluminum	12"	5	6
U219BMTR-12	Copper	Aluminum	12"	5	9
U219TR-12	Copper	Copper	12"	5	10-1/2



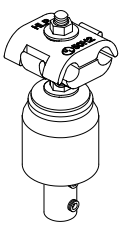


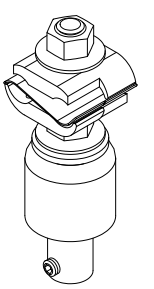
- Thru-roof or thru-wall connectors are used when making roof or wall penetrations because of the difficulty of sealing stranded lightning conductor cables.
- Features include 1/2" diameter threaded rod, neoprene sealing washers and stainless steel jam nuts to assure a watertight installation.
- Fits all main size conductors up to 9/16" diameter.
- Other sizes available. Please contact factory for more information.

Thru-Roof/Wall Assemblies

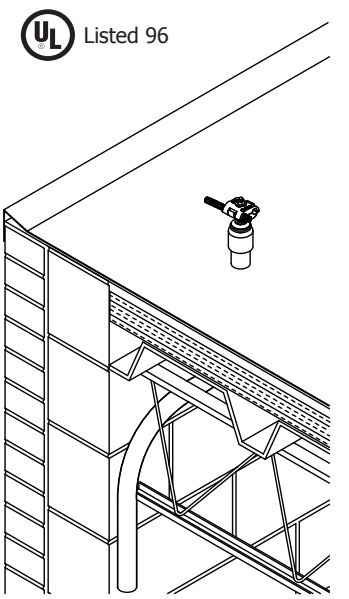
Thru-Roof Connectors

Part No.	Description	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
ATRC1	Aluminum	3/4	10	7-1/2
CTRC1	Copper	1	10	10
BMTRC1	Bi-Metal	3/4	10	7-3/4
BMTRC1U	Bi-Metal	3/4	10	7-3/4





BMTRC1U



- Economical, low profile assembly provides a water tight mechanical connection through the roof when 1" PVC conduit is used.
- Used through finished roof surfaces or when exiting above the finished roof, such as in or on top of a parapet wall.
- Used when 230 series thru-roof units are not feasible.
- #BMTRC1 thru-roof connectors provide a bi-metal connection between aluminum roof components and copper down conductors.
- #BMTRC1U thru-roof connector provides a universal connection for one aluminum and/or one copper roof component and a copper down conductor.
- Fits all main size conductors up to 9/16" diameter.
- #ATRC1 fits all main size conductors up to 19/32" diameter.

TECHNICAL NOTE:

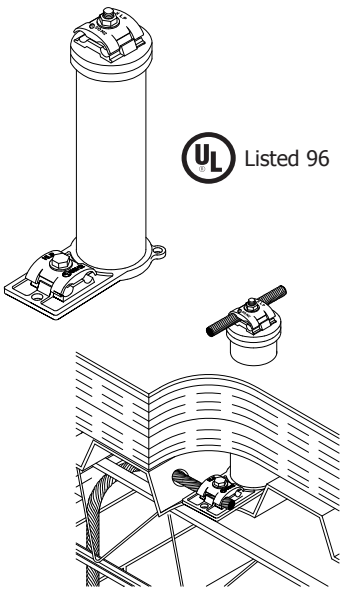
- No bend of a conductor shall form an included angle of less than 90 degrees, nor shall it have a radius of bend less than 203 mm (8 in.).*

*NFPA 780 Conductor Bends Section 4.9.5

Thru-Roof/Wall Assemblies

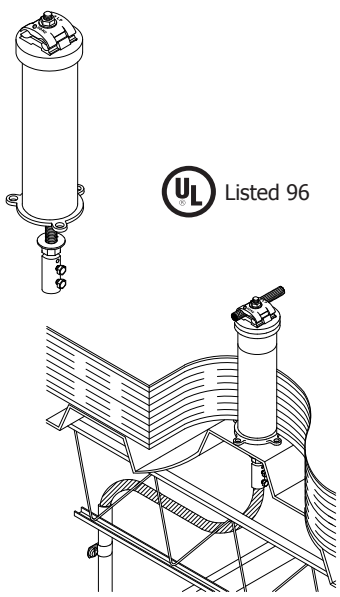
Horizontal Base Connectors

Part No.	Description	Riser Length	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
230H-12	Copper roof conductor to copper downlead cable with horizontal base connector.	12"	2-1/2	10	25
230H-18		18"	3-1/4	10	32-1/2
230H-24		24"	3-1/2	10	35
230HBM-12	Aluminum roof conductor to copper downlead cable with horizontal base connector.	12"	2	10	20
230HBM-18		18"	2-1/4	10	22-1/2
230HBM-24		24"	3	10	30



Vertical Base Connectors

Part No.	Description	Riser Length	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
230V-12	Copper roof conductor to copper downlead cable with vertical base connector.	12"	2-1/2	10	25
230V-18		18"	3-1/4	10	32-1/2
230V-24		24"	3-1/2	10	35
230VBM-12	Aluminum roof conductor to copper downlead cable with vertical base connector.	12"	1-1/2	10	15
230VBM-18		18"	2-1/4	10	22-1/2
230VBM-24		24"	2-1/2	10	25

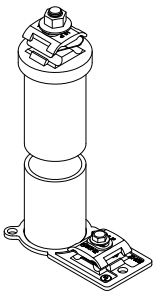


NOTES:

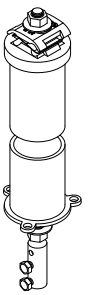
- No. 230 series thru-roof assemblies offer superior strength and are compatible with a wide range of roofing systems.
- Assemblies feature a 2-3/8" O.D. PVC tubing support.
- The support not only provides additional strength to protect against breakage, but also presents a smooth, rigid surface for the installation of various types of membrane boot flashings.
- Assemblies are available in various standard lengths with vertical connector (V) or horizontal base connector (H) for copper down conductors.
- Dual cable connector accommodates two main size conductors up to 9/16" diameter.
- Also available in aluminum and other lengths are available on special order. Please contact factory for more information.

Thru-Roof/Wall Assemblies

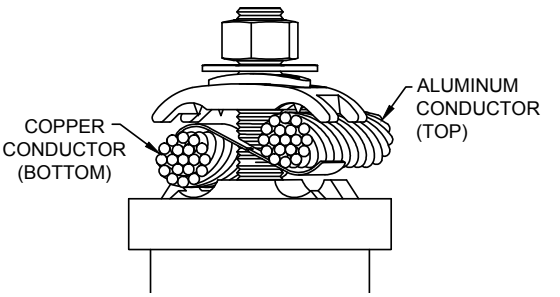
Listed 96



Horizontal



Vertical



Bi-Metal

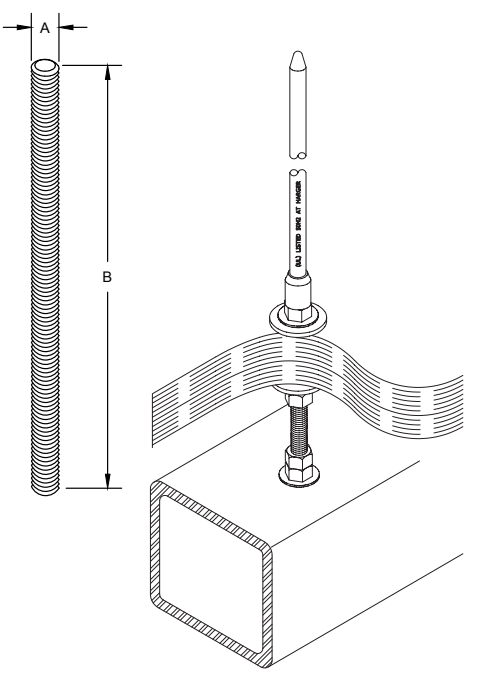
Part No.	Description	Riser Length	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
230H18BM	Horizontal	18"	2	10	20
230V18BM	Vertical	18"	2-1/2	10	25

- Aluminum or copper roof conductor to copper downlead cable with horizontal or vertical base connector.
- For more information see Notes on Page 191.

Thru-Roof Accessories

Threaded Riser Bar

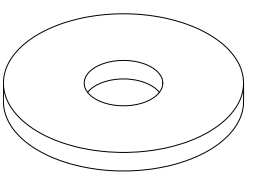
Part No.	Material	"A"	"B"	Box Qty.	Approx. Box Wt. (lbs.)
240-6	Copper	3/8"	6"	10	1-3/4
240-12	Copper	3/8"	12"	10	3-1/4
240-24	Copper	3/8"	24"	10	6-1/2
241-6	Copper	1/2"	6"	10	3-1/4
241S6	Stainless Steel	1/2"	6"	10	2-3/4
241-12	Copper	1/2"	12"	10	6-1/2
241S12	Stainless Steel	1/2"	12"	10	5-3/4
241-24	Copper	1/2"	24"	10	13
241S24	Stainless Steel	1/2"	24"	10	11-1/2



- High quality threaded riser bar can be furnished in any length up to 6 feet.
- Other lengths available. Please contact factory for more information.

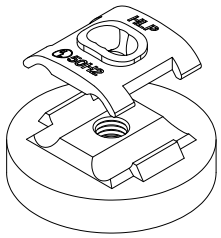
Neoprene Washers

Part No.	Size	Box Qty.	Approx. Box Wt. (lbs.)
W6R-50	3/8"	50	3/4
W6R-100	3/8"	100	1-1/2
W8R-50	1/2"	50	3/4
W8R-100	1/2"	100	1-1/2

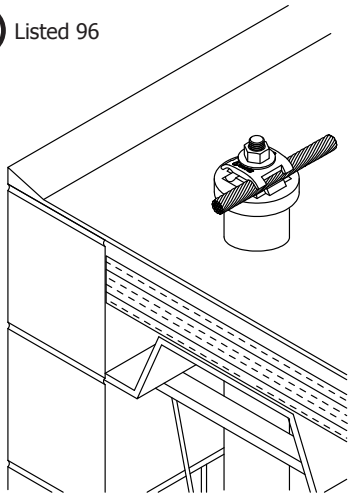


Thru-Roof Accessories

Cap & Cable Connectors



Listed 96



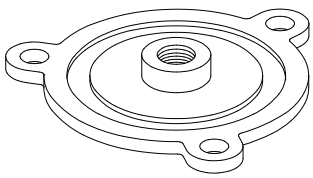
Part No.	Material	Box Qty.	Approx. Box Wt. (lbs.)
244	Copper	5	4
A244	Aluminum	5	1-1/2
244T	ETPB*	5	4

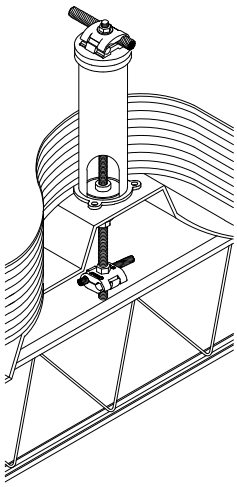
- Special fitting designed to fit standard 2" schedule 40 PVC pipe.
- Assures a watertight joint when appropriate sealant is used (See page 159).
- Rugged cable clamp accepts up to two Class II conductors.
- Center hub has 1/2" x 13 thread to fit standard 1/2" riser bars.

*ETPB - Electro Tin Plated Bronze

Base Plates

Listed 96





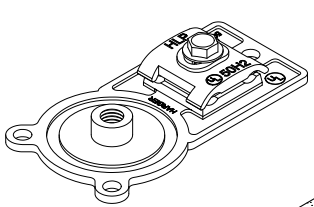
Part No.	Material	Box Qty.	Approx. Box Wt. (lbs.)
245	Copper	10	3-1/2
A245	Aluminum	10	1-1/4
245T	ETPB*	10	3-1/2

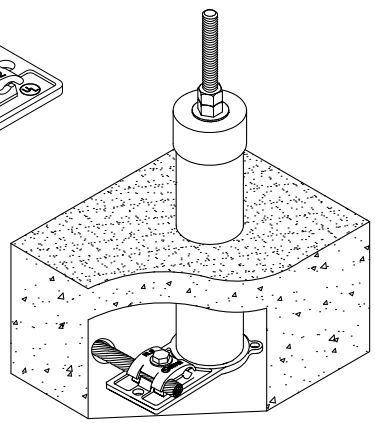
- Heavy duty base plate designed for use with standard 2" schedule 40 PVC pipe.
- Three mounting holes permit secure mounting to roof decks.
- May be used on top of or below concrete or metal roof decks.
- Center hub is threaded for 1/2" x 13 standard riser bar.
- Recessed ring is provided to seat PVC pipe and to assure a rigid assembly.
- 1/4" mounting holes.

*ETPB - Electro Tin Plated Bronze

Base Plates / Cable Connectors

Listed 96





Part No.	Material	Box Qty.	Approx. Box Wt. (lbs.)
246	Copper	10	8-1/2
A246	Aluminum	10	3-1/4
246T	ETPB*	10	8-1/2

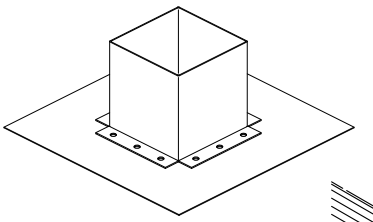
- Combination base plate and cable connector engineered to provide easy, secure mounting to any roof deck.
- Dual cable connector accommodates two main size conductors up to 9/16" diameter.
- Three mounting holes assure secure mounting.

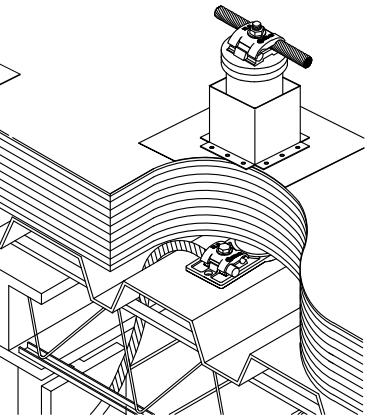
*ETPB - Electro Tin Plated Bronze

Pitch Pockets & Roof Flashings

Pitch Pockets

Part No.	Material	Approx. Each Wt. (lbs.)
227G	Galvanized Steel	1-3/4
227C	Copper	1-3/4

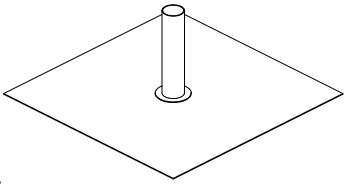


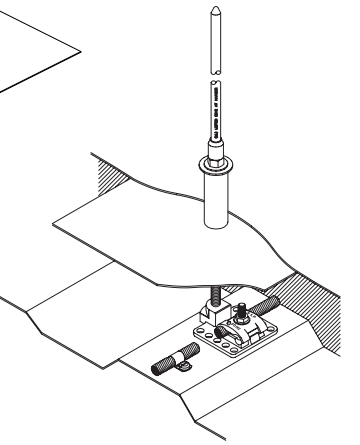


- Galvanized steel pitch pocket used on built-up roofs.
- 10" x 10" - 22 gauge flashing has a 4" square pitch reservoir 4" high.
- Pitch pocket may be used with the 230 series thru-roof assemblies or with conduits up to 4" in diameter.
  For 230 series thru-roof assemblies, see page 191.

Roof Flashings

Part No.	Material	Approx. Each Wt. (lbs.)
228G	Galvanized Steel	1-1/4
228C	Copper	1-1/4





- Galvanized steel roof flashing designed for use with the 225 or 226 thru-roof assemblies or 155, 156 or 162 concealed air terminal assemblies when penetrating flat built-up roofs.
  For 225 series thru-roof assemblies, see page 188.
  For 226 series thru-roof assemblies, see page 189.
  For 155 & 156 concealed air terminal assemblies, see page 184.
  For 162 concealed air terminal assemblies, see page 185.
- Flashing is fabricated from 22 gauge galvanized steel and is 10" x 10" with a 7/8" riser tube 4" long.

NOTE:
- Other lengths available on special order. Please contact factory for more information.

Section 2.5

Lightning Conductor Cable Connectors & Clamps

Index

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2.5.4	2 Bolt Connectors	197
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2.5.12	Sillcock Ground Connector	202
2.5.13	Strap Type Pipe Clamps	202
2.5.14	CPC & APC Pipe Clamps	203

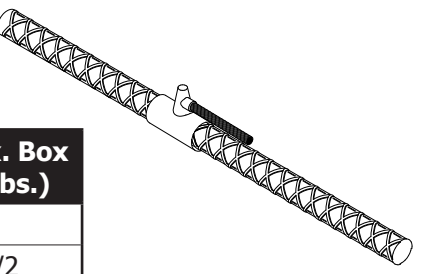
NOTE: Copper materials can consist of copper, bronze or brass. All are copper alloys.

Rebar Grounding Assemblies

Rebar Grounding Assemblies Numbering System

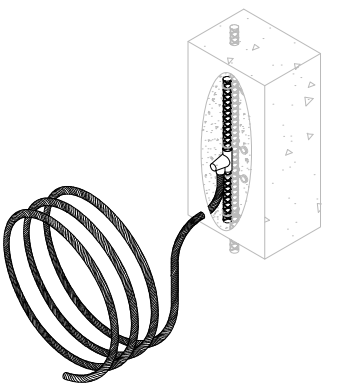
RB5GA 28 X 10

- RB5GA — Rebar Size
- 28 — Conductor Type
- X — Length of Conductor (ft.)
- 10



Part No.	Rebar Size	Conductor Type	Conductor Length (ft.)	Class	Box Qty.	Approx. Box Wt. (lbs.)
RB3GA8SX5	3	8 Sol.	5	N/A	1	1
RB4GA32X5	4	32	5	I	1	2-1/2
RB5GA2TX5	5	2T	5	N/A	1	2-1/2
RB5GA28X10	5	28	10	II	1	6-1/4
RB6GA4/0X15	6	4/0	15	N/A	1	13-1/2

- Prefabricated rebar grounding assembly.
- Standard 24" long rebar.
- Exothermically welded connection.
- Can be wire tied or welded to rebar cage prior to concrete pour.
- Conductor can be stubbed out for connection to a downlead or ground grid.
- Other sizes available. Please contact factory for more information.

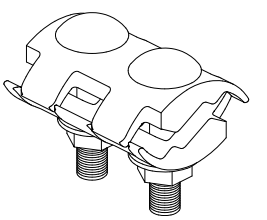


2 Bolt Parallel Connectors

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
204	Copper	II	10	4-1/2
A204	Aluminum	II	10	2-1/2
204T	ETPB*	II	10	4-1/2

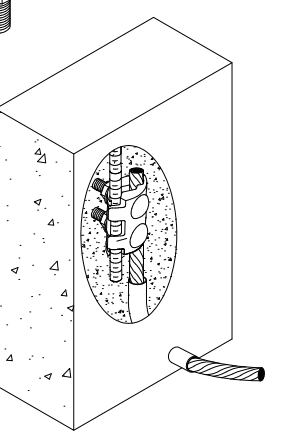
UL Listed 467

UL Listed 96



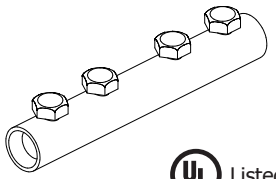
- Approximately 2" x 1-3/4" two piece connector used for splicing cables and rods.
- Accommodates all standard size Class I and Class II conductors up to 17/32" diameter.
- Accommodates ground cable sizes ranging from #6 AWG up to 250 MCM.
- 5/16" x 1-3/4" stainless steel carriage bolts, flat washers and nuts included.
- #204 manufactured from high conductivity copper alloy.
- #A204 manufactured from high conductivity aluminum alloy.
- Recommended installation tool - 1/2" deep socket wrench, end wrench or nut driver.
- #204 is suitable for direct burial.

*ETPB - Electro Tin Plated Bronze

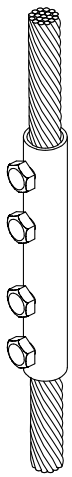


4 Bolt Connectors

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
205	Copper	II	10	4-3/4
A205R	Aluminum	II	10	2
205T	Copper*	II	10	4-3/4



Listed 96

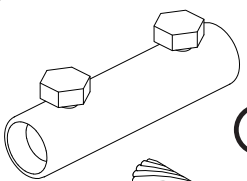


- Approximately 4" long connector provides 2" of surface contact between conductors.
- Accommodates all standard size Class I and Class II conductors up to 17/32" diameter.
- #A205R accommodates all standard size Class I and Class II conductors up to 19/32" diameter.
- Four 5/16" hex head stainless steel cap screws assure a positive electrical connection.
- #205 manufactured from high conductivity brass alloy.
- #A205R manufactured from high conductivity aluminum alloy.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

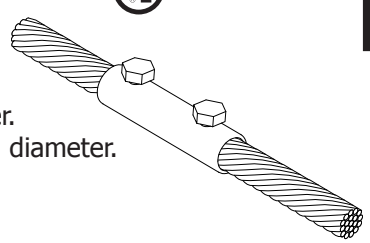
*Electro Tin Plated

2 Bolt Connectors

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
206	Copper	II	10	2-3/4
A206R	Aluminum	II	10	1-1/4
206T	Copper*	II	10	2-3/4



Listed 96

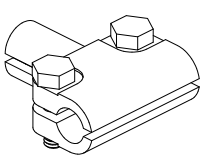


- 3" long connector provides 1-1/2" of surface contact between conductors.
- Accommodates all standard size Class I and Class II conductors up to 17/32" diameter.
- #A206R accommodates all standard size Class I and Class II conductors up to 19/32" diameter.
- Two 5/16" hex head stainless steel cap screws assure a positive electrical connection.
- #206 manufactured from high conductivity brass alloy.
- #A206R manufactured from high conductivity aluminum alloy.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

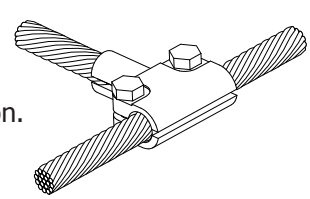
*Electro Tin Plated

"T" Connectors

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
207	Copper	II	10	5
A207	Aluminum	II	10	2
207T	ETPB*	II	10	5



Listed 96

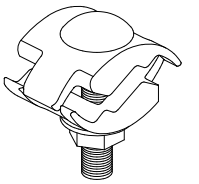


- 2" x 2-1/4" - "T" connector splices two perpendicular conductors.
- Accommodates all standard size Class I and Class II conductors up to 9/16" diameter.
- Two 5/16" x 7/8" hex head stainless steel cap screws assure a positive electrical connection.
- #207 manufactured from high conductivity copper alloy.
- #A207 manufactured from high conductivity aluminum alloy.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

*ETPB - Electro Tin Plated Bronze

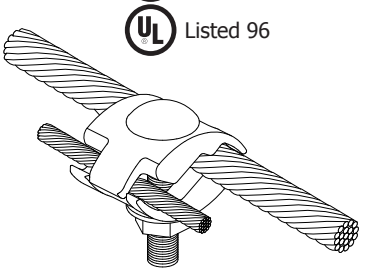
1 Bolt Bonding Connectors

Part No.	Material	Box Qty.	Approx. Box Wt. (lbs.)
208	Copper	10	2-1/2
A208	Aluminum	10	1-1/4
208T	ETPB*	10	2-1/2



Listed 467

Listed 96

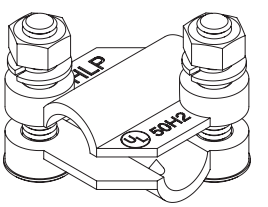


- Approximately 7/8" x 1-5/8" one bolt, two piece connector splices bonding conductor to all standard size Class I and Class II conductors up to 9/16" diameter.
- Accommodates ground cable sizes ranging from #6 AWG through 4/0.
- 5/16" x 1-3/4" stainless steel carriage bolt, flat washer and nut included.
- #208 manufactured from high conductivity copper alloy.
- #A208 manufactured from high conductivity aluminum alloy.
- Recommended installation tool - 1/2" deep socket wrench, end wrench or nut driver.
- Suitable for direct burial, except Aluminum.

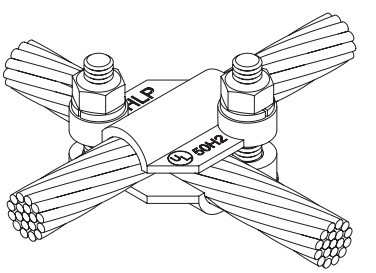
*ETPB - Electro Tin Plated Bronze

Cross Run Connectors

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
210	Copper	II	10	4-1/2
A210	Aluminum	II	10	2
210T	ETPB*	II	10	4-1/2



Listed 96



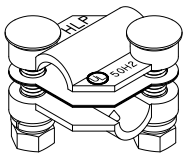
- 1-1/2" x 1-1/2" two bolt, two piece connector splices perpendicular intersecting standard Class I and Class II conductors up to 9/16" diameter.
- Two 5/16" x 1-1/2" stainless steel carriage bolts assure a positive electrical connection.
- #210 manufactured from high conductivity copper alloy.
- #A210 manufactured from high conductivity aluminum alloy.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

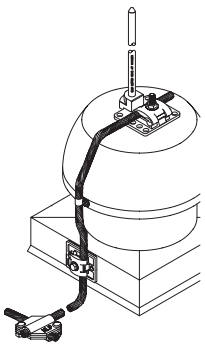
*ETPB - Electro Tin Plated Bronze

Bi-Metal Connectors

Bi-Metal 2 Bolt 2 Piece

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
210BM	Bi-Metal	II	10	2-1/2



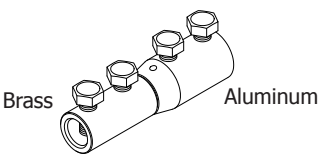


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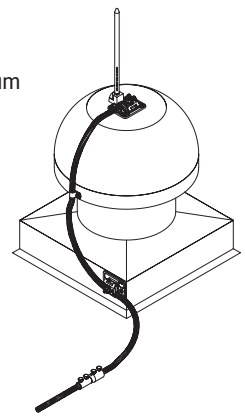
- 1-1/2" x 1-1/2" two bolt, two-piece, bi-metal connector allows splicing of aluminum and copper conductors.
- Ideal when splicing aluminum conductor off vents to main copper conductor run.
- Accepts all main size lightning conductors up to 9/16" diameter.
- Two 5/16" stainless steel carriage bolts assure a positive electrical connection.
- Manufactured from high conductivity copper and aluminum alloys.

Bi-Metal 4" Long 4 Bolt

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
211R	Bi-Metal	II	10	4-1/4



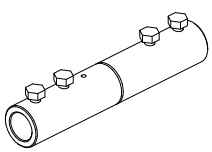
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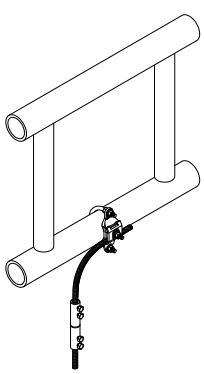
- Approximately 4" long, four bolt bi-metal connector provides a non-electrolytic connection between copper and aluminum conductors.
- Brass side accepts all main size conductors up to 17/32" diameter.
- Aluminum side accepts all main size conductors up to 19/32" diameter.
- Four 5/16" hex head stainless steel cap screws assure a positive electrical connection.
- Manufactured from high conductivity brass and aluminum alloys.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

Bi-Metal 6" Long 4 Bolt

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
211XL	Bi-Metal	II	10	7



Listed 96



- 6" long, four bolt bi-metal connector provides a non-electrolytic connection between copper and aluminum conductors.
- Accepts all main size lightning conductors up to 3/4" diameter.
- Four 5/16" x 1/2" hex head stainless steel cap screws assure a positive electrical connection.
- Manufactured from high conductivity brass and aluminum alloys.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

TECHNICAL NOTE:

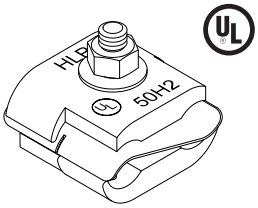
- Aluminum materials shall not be used within 460 mm (18 in.) of the point where the lightning protection system conductor comes into contact with the earth. Fittings used for the connection of aluminum down conductors to copper or copper-clad grounding equipment shall be of the bimetallic type. Bimetallic connectors shall be installed not less than 460 mm (18 in.) above earth level.*

*NFPA 780 Use of Aluminum Sections 4.5.2, 4.5.2.1 & 4.5.2.2

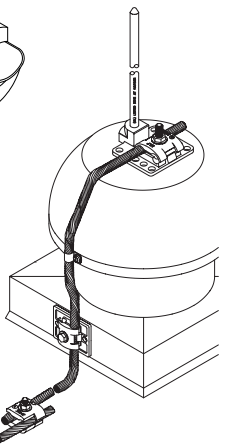
Bi-Metal Connectors

Bi-Metal 1 Bolt Parallel Connector

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
BM1BC	Bi-Metal	II	10	5-1/4



Listed 96



- 2" x 1-1/2" one bolt, three piece, bi-metal connector allows splicing of aluminum conductors to copper conductors.
- Ideal when splicing aluminum conductor off vents to main copper conductor run.
- Eliminates the need for an additional connector.
- One 5/16" x 1-1/4" stainless steel pressed bolt assures a positive electrical connection and a damage free installation when properly installed on a membrane roof.
- Bi-metal materials manufactured from copper and aluminum alloys.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

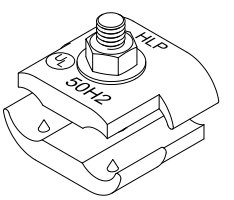
TECHNICAL NOTE:

- Aluminum materials shall not be used within 460 mm (18 in.) of the point where the lightning protection system conductor comes into contact with the earth. Fittings used for the connection of aluminum down conductors to copper or copper-clad grounding equipment shall be of the bimetallic type. Bimetallic connectors shall be installed not less than 460 mm (18 in.) above earth level.*

*NFPA 780 Use of Aluminum Sections 4.5.2, 4.5.2.1 & 4.5.2.2

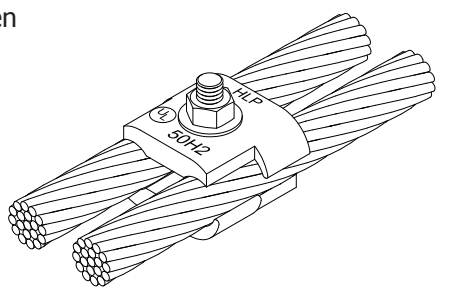
1 Bolt Parallel Connectors

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
B1BC	Copper	II	10	4
A1BC	Aluminum	II	10	1-1/2
TB1BC	ETPB*	II	10	4



Listed 467

Listed 96

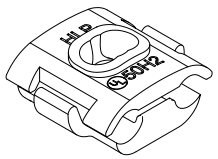


- Innovative pressed bolt design ensures a smooth flat surface; no damage when used on membrane roofs and provides greater ease of installation.
- Approximately 2" square, two piece connector provides over 1-1/2" surface contact between conductors.
- Accepts all lightning conductors and rods up to 5/8" diameter and grounding conductors ranging from #6 AWG up to 250 MCM.
- 5/16" x 1-1/4" stainless steel cap screw with flat washer included.
- #B1BC manufactured from high conductivity copper alloy.
- #A1BC manufactured from high conductivity aluminum alloy.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.
- Suitable for direct burial, except Aluminum.

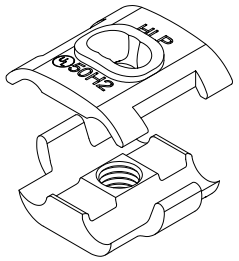
*ETPB - Electro Tin Plated Bronze

Parallel Cable Connectors

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
212-1/2	Copper	II	10	4
A212-1/2	Aluminum	II	10	1-1/2
212-1/2T	ETPB*	II	10	4

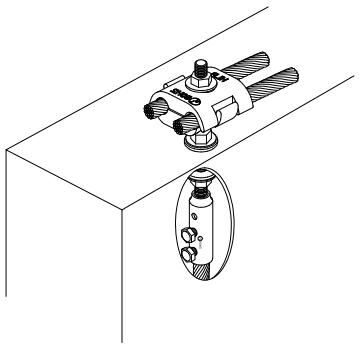


Listed 96



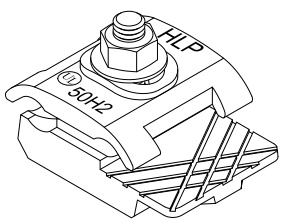
- 2" square, two piece connector provides 1-1/2" surface contact between conductors.
- Accepts all lightning conductors and rods up to 5/8" in diameter and grounding conductors ranging from #6 AWG through 4/0.
- Bottom casting is drilled and tapped 1/2-13 UNC coarse thread.
- Top piece is bored out to accept 1/2" threaded rod.
- Primary use is attaching conductors to allthread.
- No hardware provided.
- #212-1/2 manufactured from high conductivity copper alloy.
- #A212-1/2 manufactured from high conductivity aluminum alloy.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

*ETPB - Electro Tin Plated Bronze



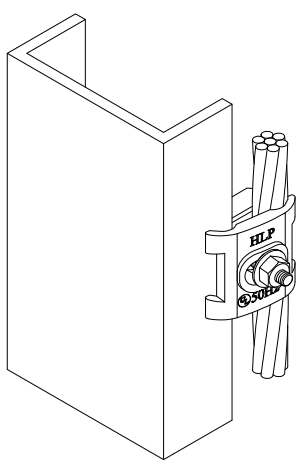
Cable to Flat Metal Connectors

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
213	Copper	II	10	4-1/2
A213	Aluminum	II	10	1-3/4
213T	ETPB*	II	10	4-1/2



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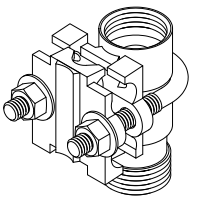


- Approximately 1-3/4" x 2" two piece, one bolt connector connects all lightning conductor cables through 9/16" diameter to flat metal objects up to 1/2" thickness such as steel ladders, small I-beams, channel, etc.
- 5/16" x 1-1/4" stainless steel cap screw with flat washer included.
- #213 manufactured from high conductivity copper alloy.
- #A213 manufactured from high conductivity aluminum alloy.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.
- Suitable for direct burial, except Aluminum.

*ETPB - Electro Tin Plated Bronze

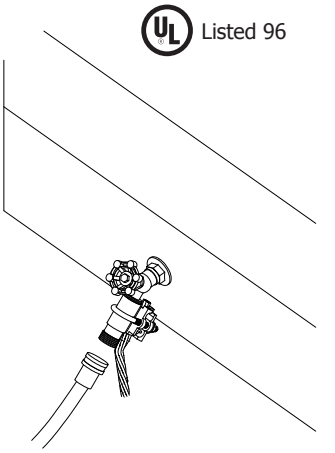
Sillcock Ground Connector

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
SCGC	Copper	II	5	4-3/4

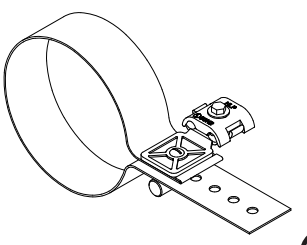


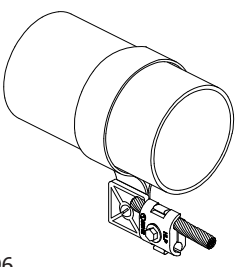
- Manufactured from cast bronze, brass and stainless steel.
- Accepts all Class I and Class II copper conductors up to 9/16" diameter.
- Allows for required bonding of water pipe system to lightning protection system.
- Mounts directly on sill cock threads.
- Recommended installation tool - channel locks, 1/2" socket wrench, end wrench or nut driver.

Listed 96



Strap Type Pipe Clamps





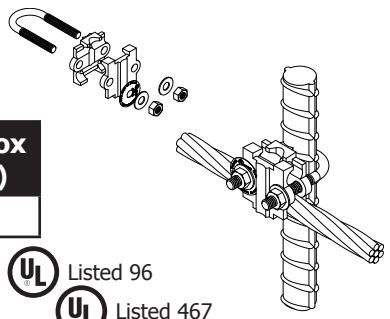
Listed 96

Part No.	Material	Nominal Pipe Size Range	Outside Diameter	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
231-4	Copper	3" - 4"	3.5" - 4.5"	2	10	20
A2314	Aluminum	3" - 4"	3.5" - 4.5"	1	10	10
231-6	Copper	4" - 6"	4.5" - 6.625"	2	10	20
A2316	Aluminum	4" - 6"	4.5" - 6.625"	1	10	10
231-8	Copper	6" - 8"	6.625" - 8.625"	3	10	30
A2318	Aluminum	6" - 8"	6.625" - 8.625"	2	10	20
231-12	Copper	8" - 12"	8.625" - 12.75"	3	10	30
A23112	Aluminum	8" - 12"	8.625" - 12.75"	2	10	20

- 2" wide electro plated tin copper strap with heavy duty bonding lug for use with all cables #6 AWG through 4/0.

CPC & APC Pipe Clamps

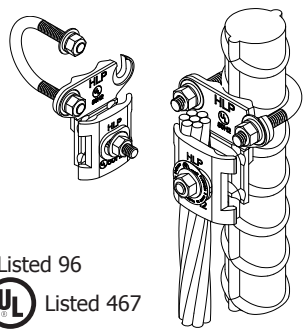
- Wide conductor range; #6 Solid through 250 MCM.
- * Electro Tin Plated Bronze includes stainless steel hardware.
- CPC series only Dual UL Listing (UL96 and UL467).
- CPC series only acceptable for direct burial.



Pipe Range .5/.75

Part No.	Material	Nominal Pipe Size Range	Pipe Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPC.5/.75	ETPB*	.5" - .75"	.375" - 1"	5	2-1/2

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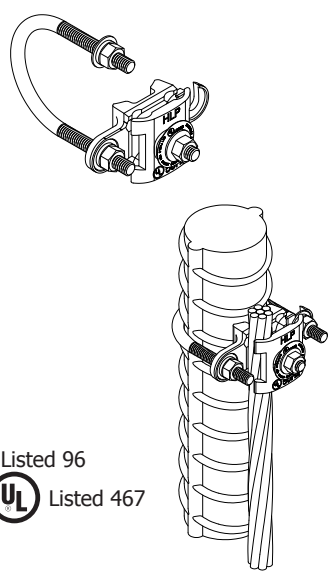


Pipe Range 1/1.25

Part No.	Material	Nominal Pipe Size Range	Pipe Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPC1/1.25	ETPB*	1" - 1.25"	.75" - 1.7"	5	3
APC1/1.25	Aluminum	1" - 1.25"	.75" - 1.7"	5	2

- Feature "quick connect", bi-directional design.
- Pressed stud design ensures a flush mounting surface.

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UL Listed 467



Pipe Range 1.5/2 - 5/6

Part No.	Material	Nominal Pipe Size Range	Pipe Outside Diameter	Box Qty.	Approx. Box Wt. (lbs.)
CPC1.5/2	ETPB*	1.5" - 2"	1" - 2.4"	5	3-3/4
APC1.5/2	Aluminum	1.5" - 2"	1" - 2.4"	5	2
CPC2.5/3	ETPB*	2.5" - 3"	2.25" - 3.5"	5	5
APC2.5/3	Aluminum	2.5" - 3"	2.25" - 3.5"	5	2-1/2
CPC3.5/4	ETPB*	3.5" - 4"	3.2" - 4.5"	5	6-1/4
APC3.5/4	Aluminum	3.5" - 4"	3.2" - 4.5"	5	3
CPC5/6	ETPB*	5" - 6"	4.75" - 6.63"	5	8-3/4
APC5/6	Aluminum	5" - 6"	4.75" - 6.63"	5	5

- Feature "quick connect", bi-directional design.
- Pressed stud design ensures a flush mounting surface.

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UL Listed 467

Section 2.6

Bonding Lugs & Plates

Index

Description		Page
2.6.1	Bonding Lugs	206
2.6.2	Bonding Plates	208

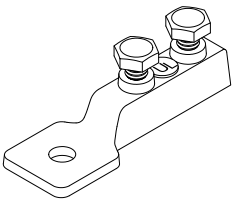
NOTE: Copper materials can consist of copper, bronze or brass. All are copper alloys.

Bonding Lugs

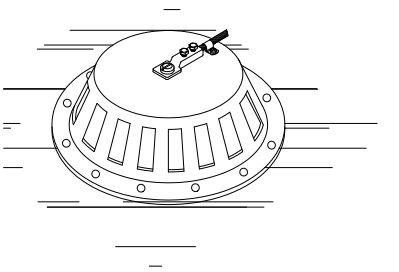
Part No.	Material	Box Qty.	Approx. Box Wt. (lbs.)
216	ETPB*	10	1-3/4
A216	Aluminum	10	1-1/2

- 2-7/8" long cast lug for use with bonding conductors size #6 AWG through #4 AWG.
- 1" x 1" tang features a 5/16" mounting hole.
- Two stainless steel bolts provide a secure connection.
- Lug has 1-1/2" of surface contact to conductor.
- Recommended installation tool - 7/16" socket wrench, end wrench or nut driver.

*ETPB - Electro Tin Plated Bronze



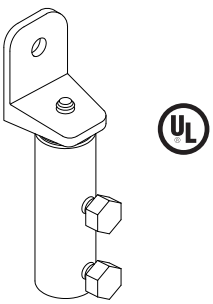
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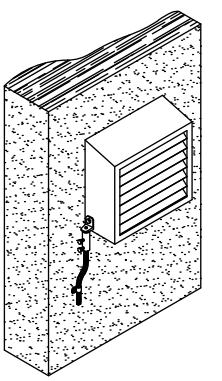
Bi-Metal

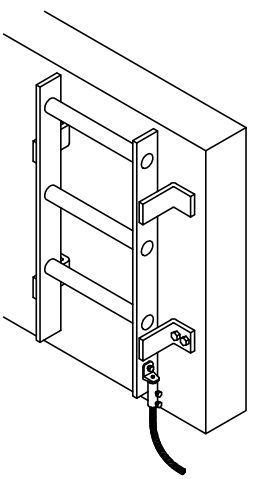
Part No.	Material	Box Qty.	Approx. Box Wt. (lbs.)
216BM	Bi-Metal	10	2-1/2

- 13/16" x 3-1/4" bi-metal secondary bonding lug allows bonding to aluminum or steel surfaces from copper cable runs.
- For secondary bonding of small metallic bodies that require an aluminum connection for compatibility such as gutters, ladders, mechanical units and drain vents.
- Two 5/16" x 3/4" stainless steel bolts assure a positive electrical connection.
- Will accommodate bonding or main size lightning conductors or #6 solid to 4/0 concentric conductors.
- Eliminates need for an additional connector.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.



Listed 96





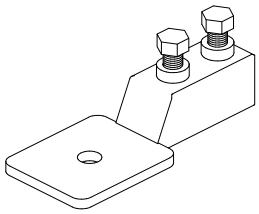
TECHNICAL NOTES:

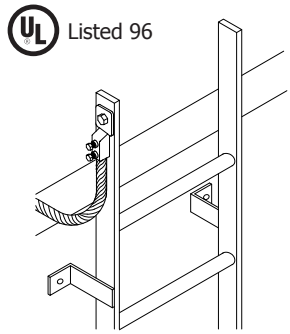
- A connector fitting shall be constructed so that a minimum of 1-1/2 inches (38 mm) of each conductor can be secured within the connector.*
- The fitting shall be provided with at least two 1/8 inch (3.2 mm) high projections on an interior surface that embed in the conductor when the connector is compressed around the conductor.*

*UL 96 Standard for Lightning Protection Components Sections 10.3 & 10.4

Bonding Lugs

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
218	Copper	II	5	3
A218	Aluminum	II	5	2-1/4
218T	ETPB*	II	5	3



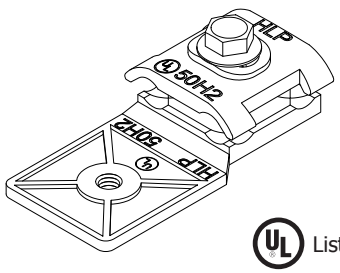


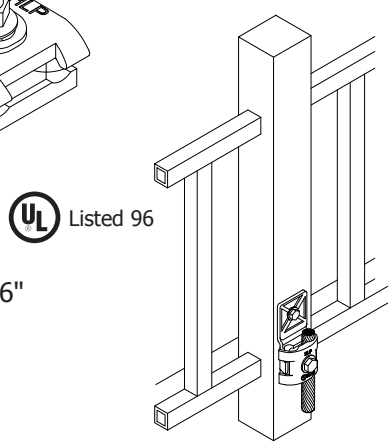
- 4-1/4" long cast lug for use with main size conductors up to 9/16" diameter.
- #A218 accommodates main size conductors up to 19/32" diameter.
- 2" x 1-3/4" tang features a 7/16" diameter mounting hole.
- Two standard steel hex head cap screws provide a secure connection.
- Lug has 1-1/2" of surface contact to conductor.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

*ETPB - Electro Tin Plated Bronze

Heavy Duty

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
222	Copper	II	10	5-1/4
A222	Aluminum	II	10	2
222T	ETPB*	II	10	5-1/4



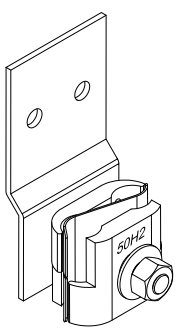


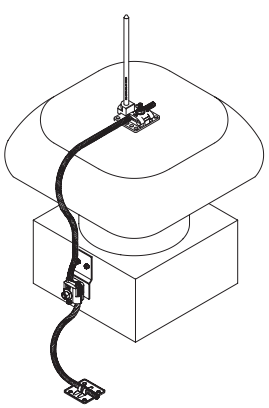
- 3-1/2" x 1-3/4" cast lug provides over 3-1/2 square inches of bonding surface.
- Dual pressure type cable connector will accept all main size conductors up to 9/16" in diameter.
- Tang features a 3/8" mounting hole.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

*ETPB - Electro Tin Plated Bronze

Bi-Metal

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
BMBL	Bi-Metal	II	10	4-1/4





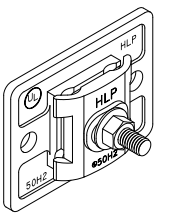
- For bonding of larger metallic bodies that require an aluminum connection for compatibility such as mechanical units, copings, rooftop cable tray and antenna frames. Recommended for vertical mounting applications.
- 2" x 4-3/16" x 0.10" aluminum base plate has over 4 square inches of surface contact.
- Bi-metallic mechanical connector provides 1-1/2" of contact length with conductors.
- 18-8 Stainless Steel Ribbed Neck 3/8" Bolt with low profile No. 4 Phillips head is pre-driven into the lug to prevent rotation during installation.

TECHNICAL NOTES:

- A connector fitting shall be constructed so that a minimum of 1-1/2 inches (38 mm) of each conductor can be secured within the connector.*
- The fitting shall be provided with at least two 1/8 inch (3.2 mm) high projections on an interior surface that embed in the conductor when the connector is compressed around the conductor.*

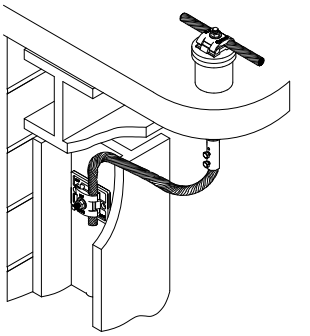
*UL 96 Standard for Lightning Protection Components Sections 10.3 & 10.4

Bonding Plates



Listed 467

Listed 96

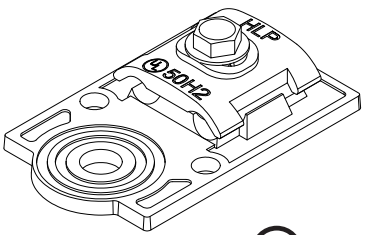


Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
217	ETPB*	II	5	3-1/2
A217	Aluminum	II	5	1-1/2

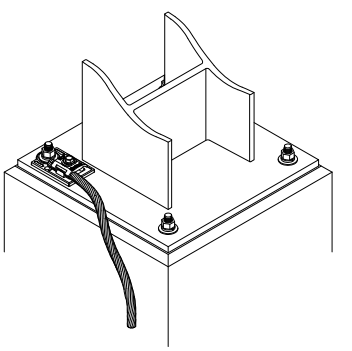
- Features a pressed-in stud; ensures flat mounting surface.
- Approximately 2-1/2" x 3-1/4" cast bonding plate provides over 8 square inches of bonding surface.
- Dual cable pressure connector accepts all main size conductors up to 9/16" diameter.
- Two 5/16" mounting holes provide secure mounting.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.
- Suitable for direct burial, except Aluminum.

*ETPB - Electro Tin Plated Bronze

Bolt Hole



Listed 96



Part No.	Material	Hole Size	Hole Type	Class	Box Qty.	Approx. Box Wt. (lbs.)
219-3/8	Copper	3/8"	Tapped	II	5	3-1/2
A219-3/8	Aluminum	3/8"	Tapped	II	5	1-1/2
219-3/8T	ETPB*	3/8"	Tapped	II	5	3-1/2
219-1/2	Copper	1/2"	Tapped	II	5	3-1/2
A219-1/2	Aluminum	1/2"	Tapped	II	5	1-1/2
219-1/2T	ETPB*	1/2"	Tapped	II	5	3-1/2
219-5/8	Copper	5/8"	Thru	II	5	3-1/2
A219-5/8	Aluminum	5/8"	Thru	II	5	1-1/2
219-5/8T	ETPB*	5/8"	Thru	II	5	3-1/2
219-1	Copper	1"	Thru	II	5	3-1/2
A219-1	Aluminum	1"	Thru	II	5	1-1/2
219-1T	ETPB*	1"	Thru	II	5	3-1/2

- 2-1/2" x 4" cast bonding plate provides over 8 square inches of bonding surface.
- Dual cable pressure connector accepts all main sized conductor up to 9/16" diameter.
- Used over anchor bolts to ground steel columns.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

*ETPB - Electro Tin Plated Bronze

TECHNICAL NOTES:

- A bonding plate shall have a minimum thickness of not less than 3/32 inch (2.4 mm). The thickness shall not be less than 5/16 inch (7.9 mm) for bosses for screw threads.*
- A Class I bonding plate shall have a minimum surface contact area of 3 square inches (19.4 cm^2).*
- A Class II bonding plate shall comply with the material and dimensional requirements for Class I bonding plates.
- A bonding plate for utilizing the steel framework as a conductor shall have a surface contact area of not less than 8 square inches (52 cm^2).*

*UL 96 Standard for Lightning Protection Components Sections 14.1, 14.2, 20.1 & 20.2

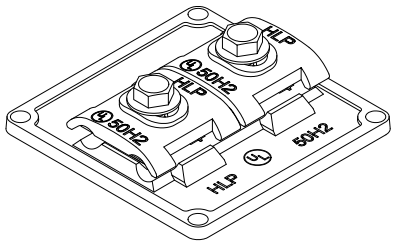
Bonding Plates

Heavy Duty

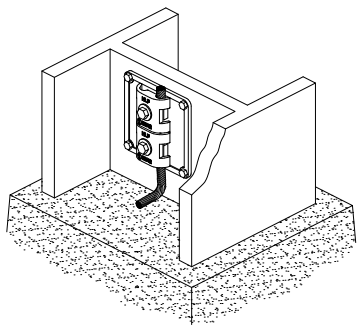
Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
220	Copper	II	10	12-1/2
220T	ETPB*	II	10	12-1/2

- 3-3/4" x 3-3/4" heavy duty bonding plate provides over 14 square inches of bonding surface.
- Large cable connector offers 3" of contact between the bonding plate and the cable.
- Accommodates all main size conductors up to 9/16" diameter.
- Will accept up to four cables.
- Four 5/16" mounting holes.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.

*ETPB - Electro Tin Plated Bronze



Listed 96

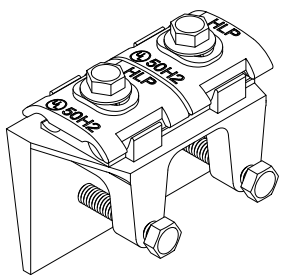


Flange

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
223	Copper	II	10	20
A223	Aluminum	II	10	8
223T	ETPB*	II	10	20

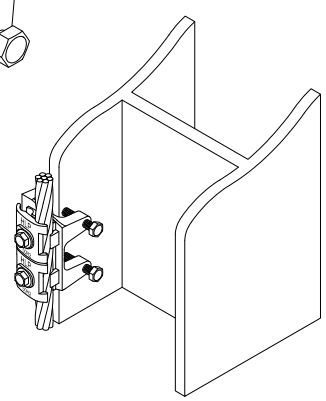
- 3-3/4" x 2-1/2" bonding plate provides over 8 square inches of bonding surface.
- Large cable connector offers 3" of contact between the bonding plate and the cable.
- Accommodates all main size conductors up to 9/16" diameter.
- Ideal for bonding to steel I-beams up to 1" thick.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.
- Suitable for direct burial, except Aluminum.

*ETPB - Electro Tin Plated Bronze



Listed 467

Listed 96



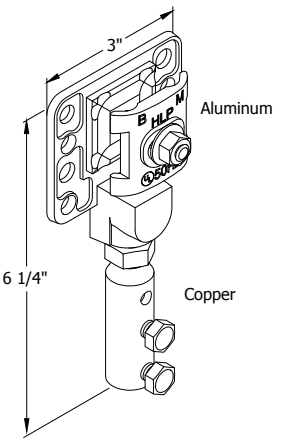
APPLICATION NOTE:

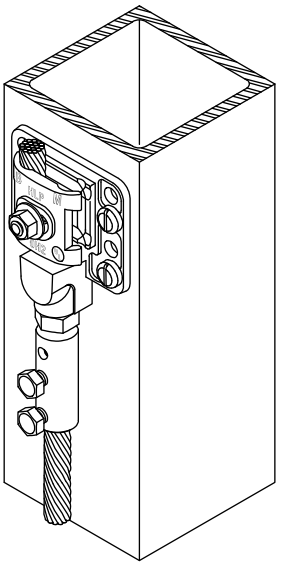
- It is imperative to properly prepare the bonding surface before applying the bonding lug or plate. All paint, rust, moisture and debris must be removed. The use of a rasp (see page 327) or grinding tool is recommended to ensure all surface oxidants have been removed. Generously coat the bonding surface with the appropriate antioxidant (see page 148), then install the bonding lug or plate.

Bonding Plates

Part No.	Material	Class	Box Qty.	Approx. Box Wt. (lbs.)
BMBP	Bi-Metal	II	5	3-3/4

- Allows copper conductors to be bonded to aluminum surfaces.
- Provides over 8 square inches of bonding surface.
- Aluminum - Dual cable pressure connector accepts all aluminum main size conductors up to 9/16" diameter.
- Copper - Dual bolt connector accepts all copper main size conductors up to 1/2" in diameter.
- Recommended installation tool - 1/2" socket wrench, end wrench or nut driver.





Listed 96

TECHNICAL NOTES:

- A bonding plate shall have a minimum thickness of not less than 3/32 inch (2.4 mm). The thickness shall not be less than 5/16 inch (7.9 mm) for bosses for screw threads.*
- A Class I bonding plate shall have a minimum surface contact area of 3 square inches (19.4 cm^2).*
- A Class II bonding plate shall comply with the material and dimensional requirements for Class I bonding plates.
- A bonding plate for utilizing the steel framework as a conductor shall have a surface contact area of not less than 8 square inches (52 cm^2).*

*UL 96 Standard for Lightning Protection Components Sections 14.1, 14.2, 20.1 & 20.2

Section 2.7

Lightning Warning System

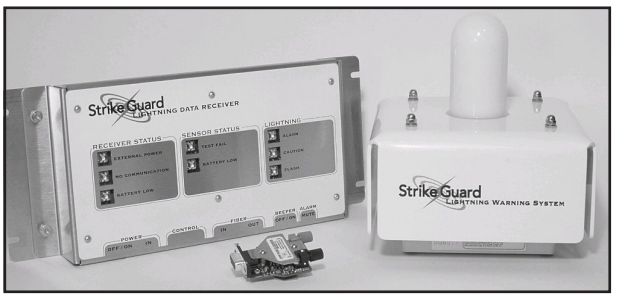
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2.7.2	WAVE Siren & Transmitter	213
2.7.3	Complete Lightning Warning System	214

Strike Guard Lightning Warning System

Strike Guard employs state-of-the-art technology to address the most demanding lightning safety and equipment protection applications.

Designed for critical industrial applications, Strike Guard monitors cloud and cloud-to-ground lightning within a user-set radius and provides relay-contact signaling at user-set lightning activity thresholds. Patented optical signal processing and proprietary optical-coincidence technology prevents false alarms.



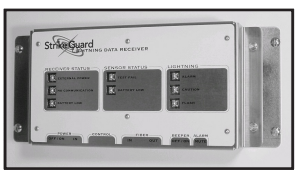
Part No. SG001 Strike Guard Components

Strike Guard sensor data are communicated via lightning-proof fiber-optic cable to an independent Lightning Data Receiver with system status and Alarm Mode indicators, relays, and PC output.

Strike Guard Delivers:

- Fully automatic alarm triggering in selectable range
- 20 mile detection radius
- No false alarms! Patented technology
- Sensor and communication self-test
- Sensor is battery powered for easy installation
- Durable fiber-optic communication with connector-less technology
- NEMA 4X enclosure
- Lightning Data Receiver with battery-back-up
- Optional, Strike View, Windows-based display software
- Strike Guard Simulation Software for training and testing

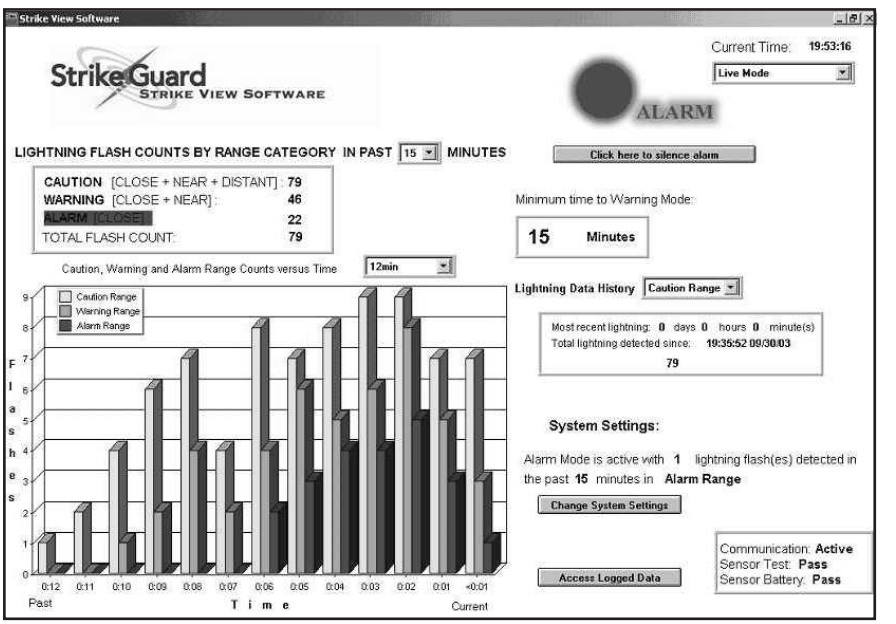
Strike Guard patented technology provides significant improvement over first-generation lightning sensors to enable automated generator activation, data back-up, and lightning evacuation plans with utmost confidence.



Lightning Data Receiver



Lightning Warning System



Part No. SG002 The optional Strike View Software for Windows® offers PC-based audible and visual alarm functions, data logging, and system monitoring.

WAVE Siren & Transmitter

WAVE employs state-of-the-art technology to address the most demanding audible and visual notification and warning applications over areas of less than an acre to hundreds of acres.

Designed for critical safety applications, the WAVE Transmitter broadcasts digitally encrypted messages to activate WAVE Siren Stations within a three mile radius. The Transmitter accepts contact-closure signaling for automated triggering during programmable hours of operation. WAVE relies on low-frequency RF communication to operate in noisy environments and over challenging terrain.

WAVE Siren Station horns are modular in design to provide audible notification specific to the desired coverage area and application. Based on coverage area and sound pressure level requirements, Siren Stations can be ordered with up to four 100 W re-entrant horn, high efficiency compression-drivers.



Part No. WAVE-SS03
Other configurations available.
Contact the factory for details.

WAVE SIREN DELIVERS:
- Automatic or manual wireless siren actuation within a three mile radius
- Secure encoded communications
- Comprehensive, automatic self-test for RF communication and system status
- Multiple compression driver mounting for greatest flexibility
- Siren Station NEMA 4X enclosure
- RF transmission test signal for Siren Station site selection
- Manual key operation or automated operation with contact-closure signal
- Programmable hours of operation for automated external control
- Solar- or AC-powered Siren Station available **Part No. SOLAR-SS**
- High capacity, battery back-up for uninterrupted operation in a lightning environment

WAVE Siren and Strike Guard combine to provide a fully automated lightning warning system. Strike Guard easily connects to the WAVE Transmitter to trigger the WAVE Siren Stations and WAVE Power Sequencers for audible lightning hazard notification and equipment protection across the golf course.

Part No. WAVE-TR01



WAVE Transmitter



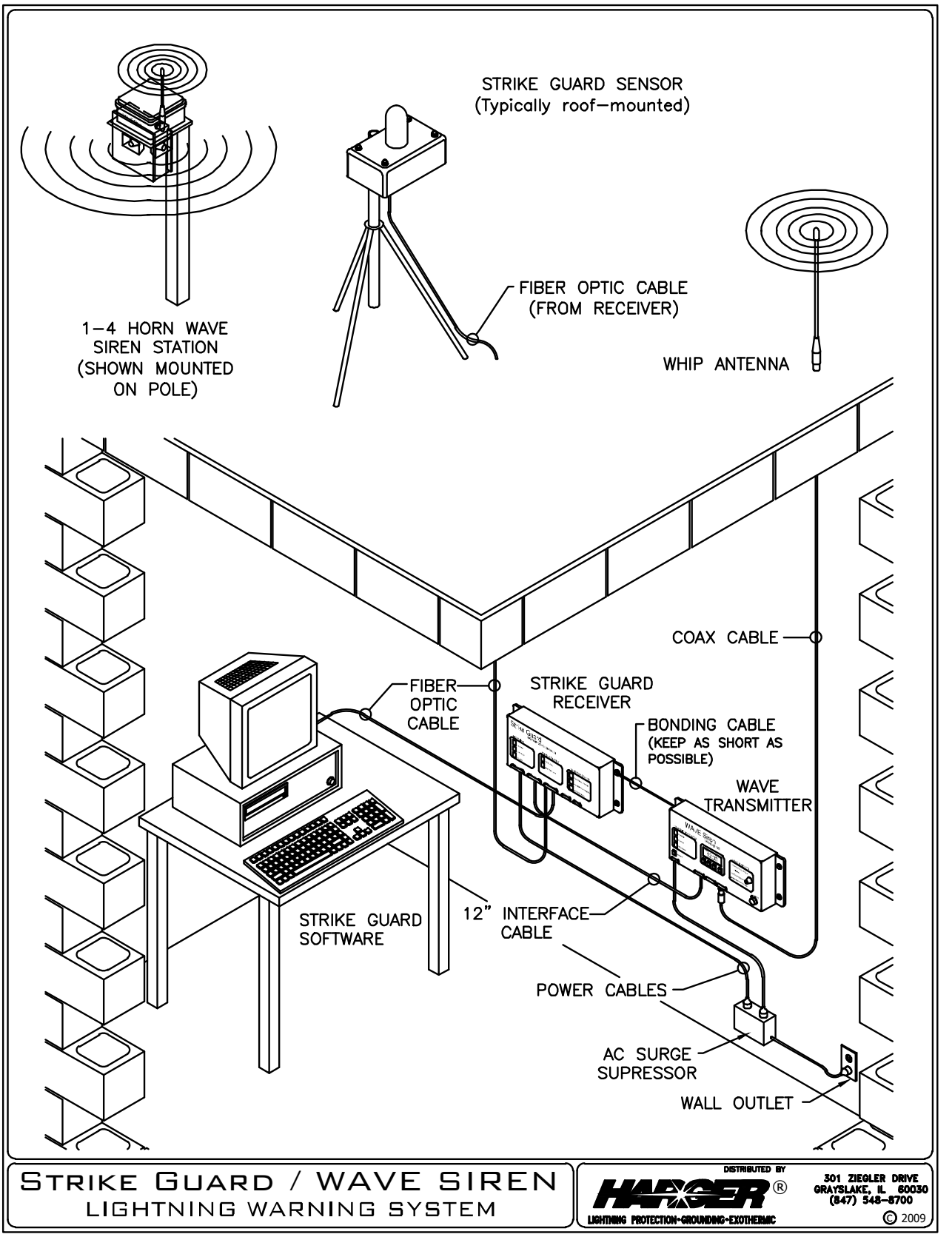
WAVE Siren

The WAVE Transmitter sends secure codes to activate an unlimited number of Siren Stations and Power Sequencers within a three mile radius.

The WAVE Transmitter offers:
1. Easy programming through front panel switches and LCD
2. Comprehensive, automatic system status monitoring
3. Manual control or automated activation from external contact-closure
4. Manual selection of desired transmission via front panel quick-select knob

The WAVE Siren Station offers:
1. Simplified installation and flexibility through modular design
2. Solar or AC power input
3. Optional strobe light to provide visual indication of conditions
4. External indicators of system status
5. Super-high sound pressure level – directional or omni-directional

Complete Lightning Warning System



Section 3
Communications Site Equipment

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Section 3.1

Wireless Communications Equipment

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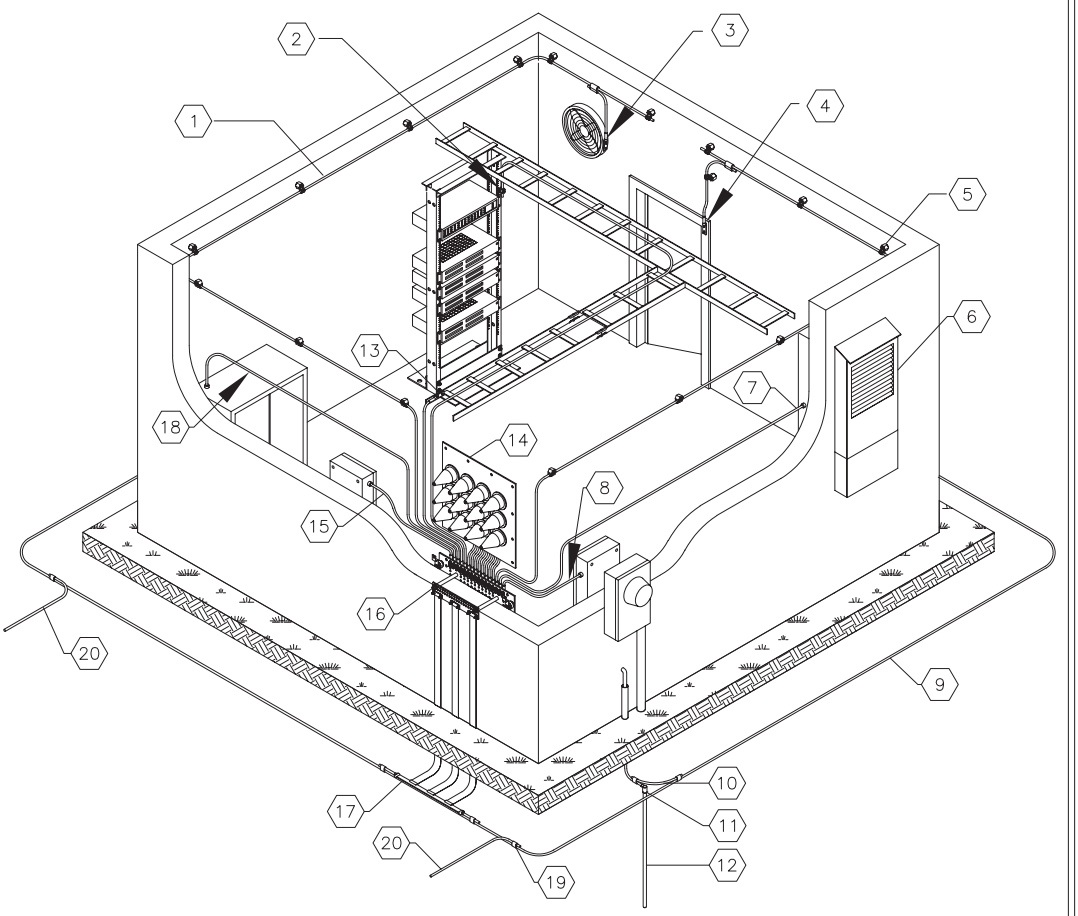
Section 3.1.1

Shelter Grounding Components

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Shelter Interior Layout



KEYED NOTES

1. NO.27G, #2AWG STRANDED, GREEN INSULATED CONDUCTOR. INTERNAL PERIMETER GROUND BUS. CONNECTED TO MGB AT ONE END. TYPICAL
2. EQUIPMENT RACK CHASSIS AND EQUIPMENT GROUND CONDUCTORS TO MGB
3. BOND EXHAUST FAN AND AIR VENTS TO INTERNAL PERIMETER GROUND BUS CONDUCTOR WITH NO. 6-7G CONDUCTOR, NO. CT2248LD TAP AND NO. GECLB62A LUG
4. BOND DOOR FRAME TO INTERNAL PERIMETER GROUND BUS CONDUCTOR WITH NO. 6-7G CONDUCTOR, NO. CT2248LD TAP AND NO. GECLB62A LUG
5. NO. HSC STYLE HALO STANDOFF CLAMP
6. HVAC UNIT
7. HVAC EQUIPMENT GROUNDING CONDUCTOR TO MGB
8. BOND AC ELECTRIC SERVICE TO MGB PER NFPA 70
9. SHELTER COUNTERPOISE GROUND LOOP. NO. 2T, SOFT-DRAWN TINNED SOLID COOPER CONDUCTOR RUN 30" MIN. OR BELOW FROST LINE.
10. BOND BETWEEN UTILITY GROUND AND SHELTER COUNTERPOISE WITH NO. 2T, SOFT-DRAWN TINNED SOLID COOPER CONDUCTOR
11. ULTRAWELD NO. GD582SB CONNECTION WITH NO. US65 OR NUWTUBE65 WELD METAL
12. NO. 5810, 5/8"X10' COPPER CLAD GROUND ROD. UTILITY SERVICE GROUND
13. BOND CABLE TRAY TO MGB
14. COAX ENTRY PORT
15. TELCO GROUND TO MGB
16. NO. EPK12, ENTRANCE PANEL KIT WITH THROUGH WALL MOUNTING OF EXTERIOR GROUND BAR AND INTERNAL (MGB) GROUND BAR.
17. THE EPK12 ENTRANCE PANEL KIT PROVIDES A GROUND STRAP (1/32" X 3") ASSEMBLY THAT IS EASILY EXOTHERMICALLY WELDED TO THE SHELTER COUNTERPOISE.
18. UPS EQUIPMENT GROUND CONDUCTOR TO MGB
19. ULTRAWELD NO. PT2S2SB CONNECTION WITH NO. US65 OR NUWTUBE65 WELD METAL OR NO. RT2S2SB WITH NO. US45 OR NUWTUBE45 WELDMETAL. TYPICAL
20. TO TOWER GROUND ELECTRODE SYSTEM

HARGER® LIGHTNING PROTECTION•GROUNDING•EXOTHERMIC
301 ZIEGLER DRIVE GRAYSLAKE, IL
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INTERIOR SHELTER LAYOUT

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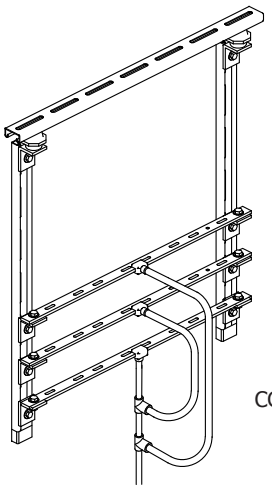
NTS

Lightning Arrestor Brackets

Ceiling Mount

Part No.	Description	Approx. Each Wt. (lbs.)
CGARRBKT04	4 Unit	18
CGARRBKT08	8 Unit	21
CGARRBKT12	12 Unit	24
CGARRBKT16	16 Unit	28

- Manufactured from 110 alloy copper bar.
- Arrestor bracket is designed to be mounted to the ceiling of a communication building where communication lines enter the building through the side wall.
- Bracket can hold 4 large flange mount lightning arrestors and comes with a 25' tail of #2 AWG solid tinned conductor for connection to an exterior ground loop.
- Bars are connected with tinned #2 AWG flexible copper conductor.
- Ships assembled.

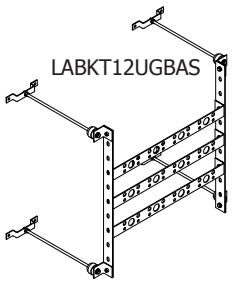


CGARRBKT12

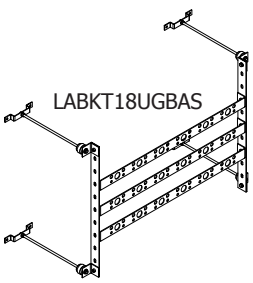
Ceiling/Wall Mounts

Part No.	Description	Configuration	Width	Approx. Each Wt. (lbs.)
LABKT12UGBAS	12 Unit	4 x 3	27"	17
LABKT18UGBAS	18 Unit	6 x 3	39"	25

- Manufactured from 1/8" thick 110 alloy copper bar.
- Accommodates bulkhead arrestors with DIN or N female connectors.
- Premounted self clinching nuts speed installation.
- Can be ceiling or wall mounted.
- Ships unassembled.



LABKT12UGBAS

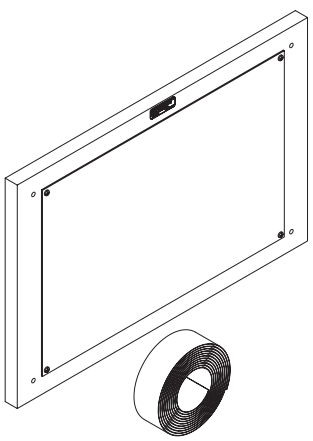


LABKT18UGBAS

Single Point Ground Window

Part No.	Approx. Each Wt. (lbs.)
CUSPGW	11

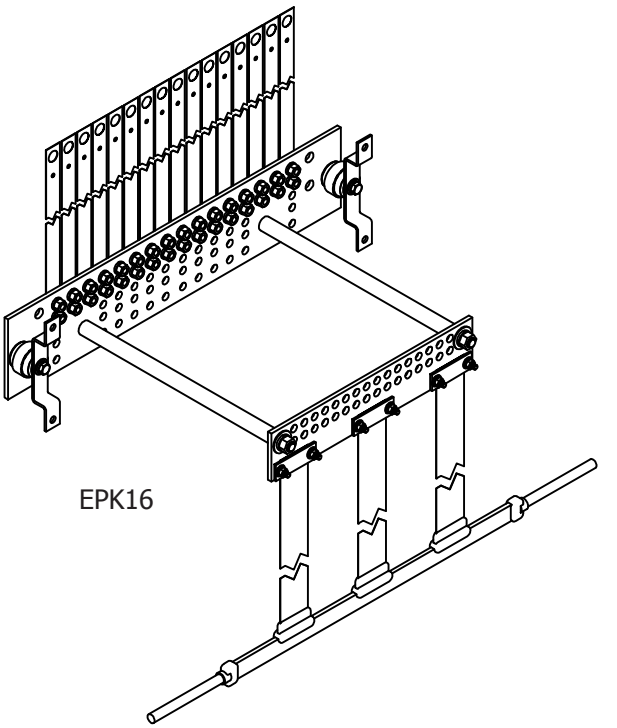
- Flexible installation solution for a single point grounding panel.
- Ground assembly has melamine backing plate with predrilled 16" on center mounting holes.
- Comes with:
  - (2) sandwich plates with hardware
  - (20ft.) 0.016" x 12" copper flat strap
  - (4) concrete lead mounting hardware
  - (14) mounting screws
  - (1) 1/2 oz. tube of HCAJC1/2 antioxidant
- Custom configuration available. Contact factory.



Entrance Panel Kits

Part No.	Description	Approx. Each Wt. (lbs.)
EPK12	12 Unit	52
EPK16	16 Unit	53
EPK24	24 Unit	71-1/2

- Complete 12, 16 and 24 unit entrance panel ground kits provide the lowest possible impedance to ground for coaxial ground shields and arrestors by utilizing robust flat ground straps.
- Unique flat ground strap assembly incorporates 3 low impedance (1/32" x 3") copper straps that are exothermically welded to a 1/4" x 1" copper bar that has #2 AWG solid tinned conductor exothermically welded at either end for easy attachment to ground ring.
- Ground strap assembly attaches to the exterior ground bar via 3 integrated sandwich type ground clamps.
- Exterior ground bar has landings (3/8" bolt holes on 3/4" centers) to accommodate up to 16 coaxial ground leads.
- Maximum wall thickness of 9".
- Longer extension bars are available.
- Ships unassembled.



EPK16

EPK12 Kit Includes:
(1) Interior ground bar
(1) Exterior ground bar
(2) Through wall mounting bars
(1) Flat ground strap assembly
(12) Surge suppression ground straps
(1) HCAJC1/2 joint compound
(24) Sets stainless steel fasteners

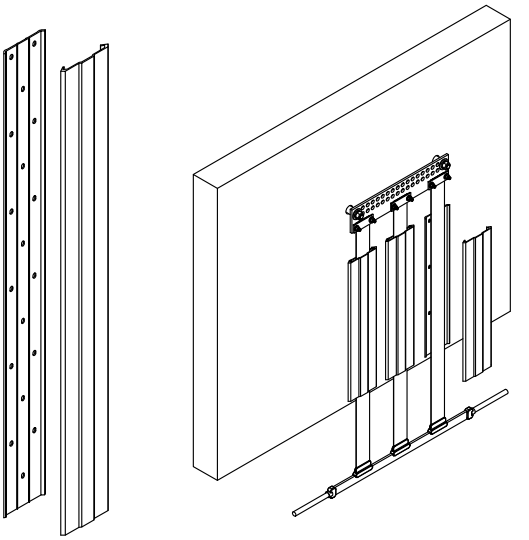
EPK16 Kit Includes:
(1) Interior ground bar
(1) Exterior ground bar
(2) Through wall mounting bars
(1) Flat ground strap assembly
(16) Surge suppression ground straps
(1) HCAJC1/2 joint compound
(32) Sets stainless steel fasteners

EPK24 Kit Includes:
(1) Interior ground bar
(1) Exterior ground bar
(2) Through wall mounting bars
(1) Flat ground strap assembly
(24) Surge suppression ground straps
(1) HCAJC1/2 joint compound
(48) Sets stainless steel fasteners

Channel Support

Part No.	Qty.	Approx. Each Wt. (lbs.)
EPKPPCST5	EA	5

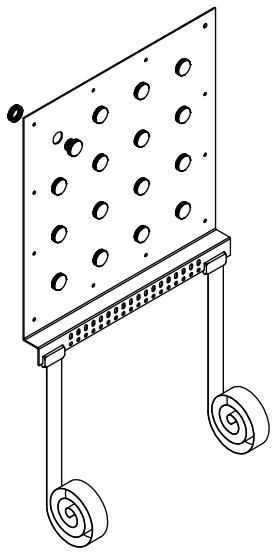
- 5' plastic protective channel supports (includes a front & back).
- Fastens flat ground strap to shelter surface and protects strap from damage.



Bulk Head Entry Panel Kits

Part No.	Description	Approx. Each Wt. (lbs.)
TCEP4X3	12 Unit	60
TCEP4X4	16 Unit	60

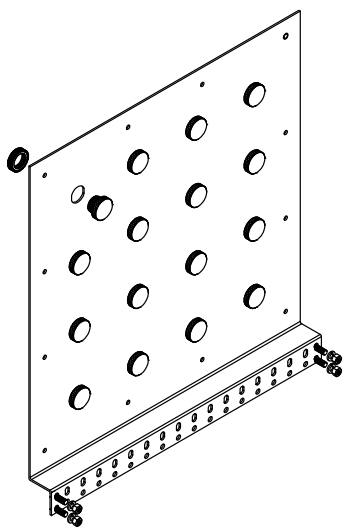
- Entrance panels can accommodate either 12 or 16 coaxial entries.
- 5/8" diameter holes accept surge arrestors.
- The entrance panel and ground bar are integral to the unit being fabricated from a single copper plate ensuring the lowest possible impedance between the entrance panel and ground bar.
- Entrance panels are made from tinned plated 110 copper alloy.
- Respectively, the panel ground bus have 12 and 16 sets of hole/slots to accommodate lugs with 3/8" holes on 3/4" to 1" centers.
- Weatherproof plugs are included to seal unused ports.
- The panel has two robust flat copper ground straps (0.032" x 2" x 10' long) exothermically welded to ground bus to provide a low impedance path to the ground grid.
- The ground straps are exothermically welded in the field to the ground grid.



TCEP4X4

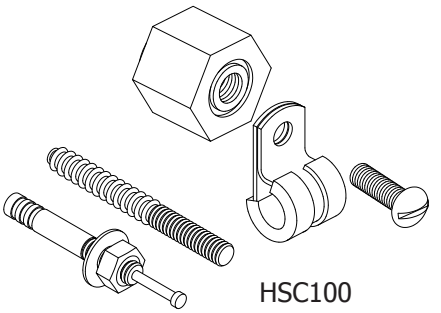
Part No.	Description	Approx. Each Wt. (lbs.)
TCEP4X4HS	16 Unit	43-1/2

- Entrance panels can accommodate either 12 or 16 coaxial entries and DIN arrestors. Contact factory for specifications.
- The entrance panel and ground bar are integral to the unit being fabricated from a single copper plate ensuring the lowest possible impedance between the entrance panel and ground bar.
- Entrance panels are made from tinned plated 110 copper alloy.
- Respectively, the panel ground bus have 12 and 16 sets of hole/slots to accommodate lugs with 3/8" holes on 3/4" to 1" centers. See page 113 for lugs.
- Weatherproof plugs are included to seal unused ports.

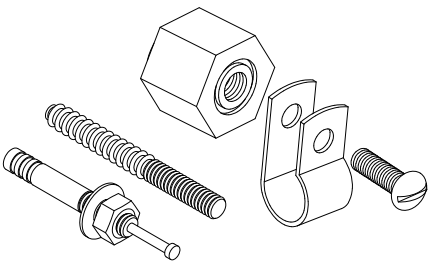


Halo Standoff Clamps

APPLICATION NOTE:
- Halo Standoff Clamps are used for mounting interior halo ground rings.



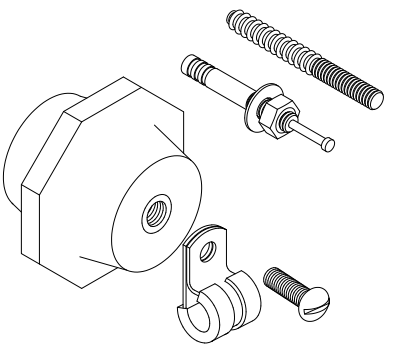
HSC100



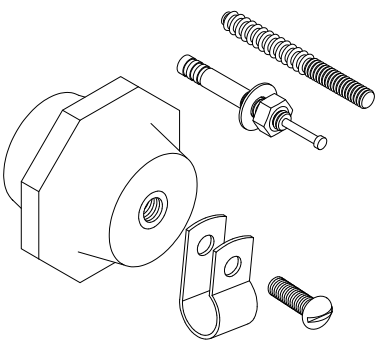
HSC100C

Part No.	Clip Style	Conductor Range	Box Qty.	Approx. Box Wt. (lbs.)
HSC100	Stainless Steel w/ Insulating Rubber Grommet	#6 AWG Insulated to #2 AWG Bare	1	1/4
HSC100C	Bare Copper	#6 AWG Insulated to 2/0 AWG Bare	1	1/4

- Will hold the halo 1" off of the wall.
- Supplied with two anchors for mounting to both masonry and stud walls.



HSC150

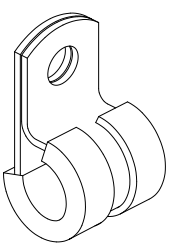


HSC150C

Part No.	Clip Style	Conductor Range	Box Qty.	Approx. Box Wt. (lbs.)
HSC150	Stainless Steel w/ Insulating Rubber Grommet	#6 AWG Insulated to #2 AWG Bare	1	1/4
HSC150C	Bare Copper	#6 AWG Insulated to 2/0 AWG Bare	1	1/4

- Will hold the halo 1-1/2" off of the wall.
- Supplied with two anchors for mounting to both masonry and stud walls.

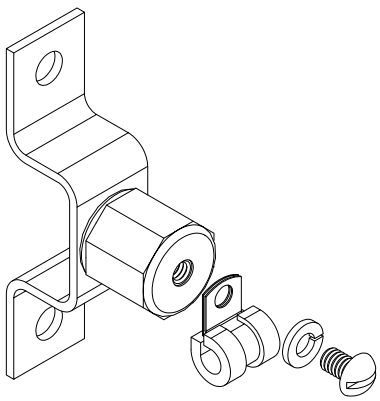
Part No.	Box Qty.	Approx. Box Wt. (lbs.)
CC5	100	1-1/2
CC7	100	1-1/2



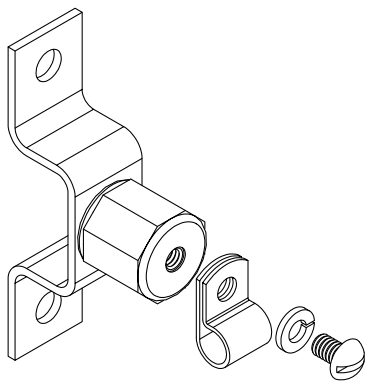
- 304 SS clip with insulating rubber grommet.
- CC5 fits conductors #6 AWG insulated through #2 AWG bare.
- CC7 fits conductors #2 AWG insulated through 2/0 AWG bare.
- CC5 and CC7 have .265" mounting hole.

Halo Standoff Clamps - R56* Compliant

APPLICATION NOTE:
- Halo Standoff Clamps are used for mounting interior halo ground rings.



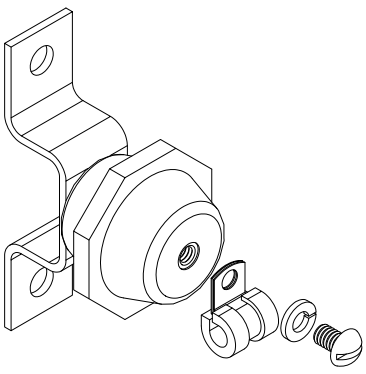
HSC100R56



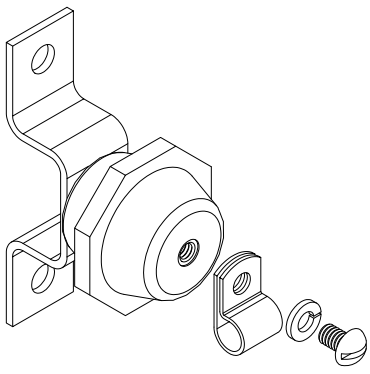
HSC100CR56

Part No.	Clip Style	Conductor Range	Box Qty.	Approx. Box Wt. (lbs.)
HSC100R56	Stainless Steel w/ Insulating Rubber Grommet	#6 AWG Insulated to #2 AWG Bare	1	1/4
HSC100CR56	Bare Copper	#6 AWG Insulated to 2/0 AWG Bare	1	1/4

- Will hold the halo 2" off of the wall.



HSC150R56



HSC150CR56

Part No.	Clip Style	Conductor Range	Box Qty.	Approx. Box Wt. (lbs.)
HSC150R56	Stainless Steel w/ Insulating Rubber Grommet	#6 AWG Insulated to #2 AWG Bare	1	1/4
HSC150CR56	Bare Copper	#6 AWG Insulated to 2/0 AWG Bare	1	1/4

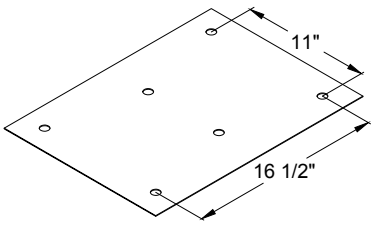
- Will hold the halo 2-1/2" off of the wall.

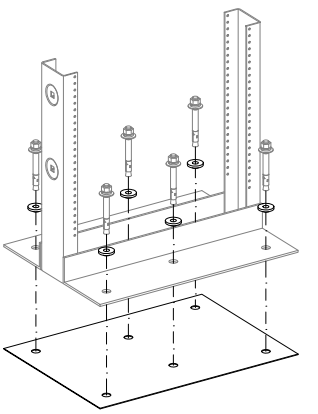
*R56 is Motorola, Inc. Standards and Guidelines for Communication Sites

Rack Isolating Pad

Part No.	Qty.	Approx. Each Wt. (lbs.)
IP0621520.5MOTO	EA	1-1/4

- Used to isolate racks from conductive flooring such as concrete and prevent multiple ground paths.
- .062" x 15" x 20-1/2" GPO-3 Phenolic Isolation Pad designed to fit Motorola equipment racks.
- Includes six isolating shoulder washers designed to accommodate 1/2" anchors.
- Other sizes and configurations available. Please contact factory for more information.





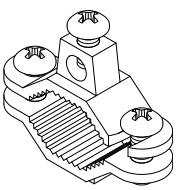
Conduit Bonding Clamps

Part No.	Conduit Range	Conductor Range (AWG)	Box Qty.	Approx. Box Wt. (lbs.)
BGC4SCS	1/2" - 3/4"	#10 - #2	10	2-1/2
TBGC4SCS*	1/2" - 3/4"	#10 - #2	10	2-1/2
TBGC4SCSSS**	1/2" - 3/4"	#10 - #2	10	2-1/2

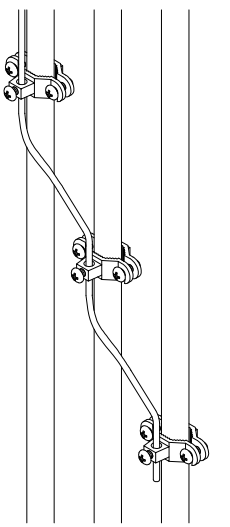
- Bronze clamp for bonding conduits that are flush mounted to a surface such as a wall, floor or ceiling.
- "Low Profile" design utilizes 1/4" diameter long machine screws.

* Electro tin plated bronze.

** Includes stainless steel hardware. Rated for direct burial.



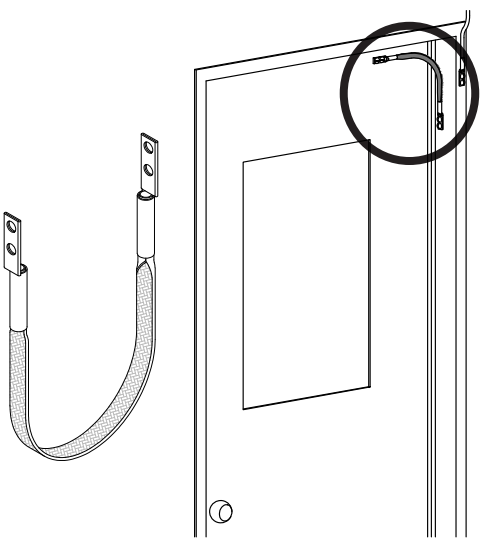
Listed 467



Door Jumpers

Part No.	Length	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GS12094122A1/4	12"	1/2	10	5
GS12094182A1/4	18"	1/2	10	5

- Door jumpers made from 1/2" x .094 flexible tinned copper flat braid.
- Two holes spaced 5/8" on center per each end.
- Braid is 4 guage equivalent.
- Dimensions are nominal size.
- Hole size is 1/4".



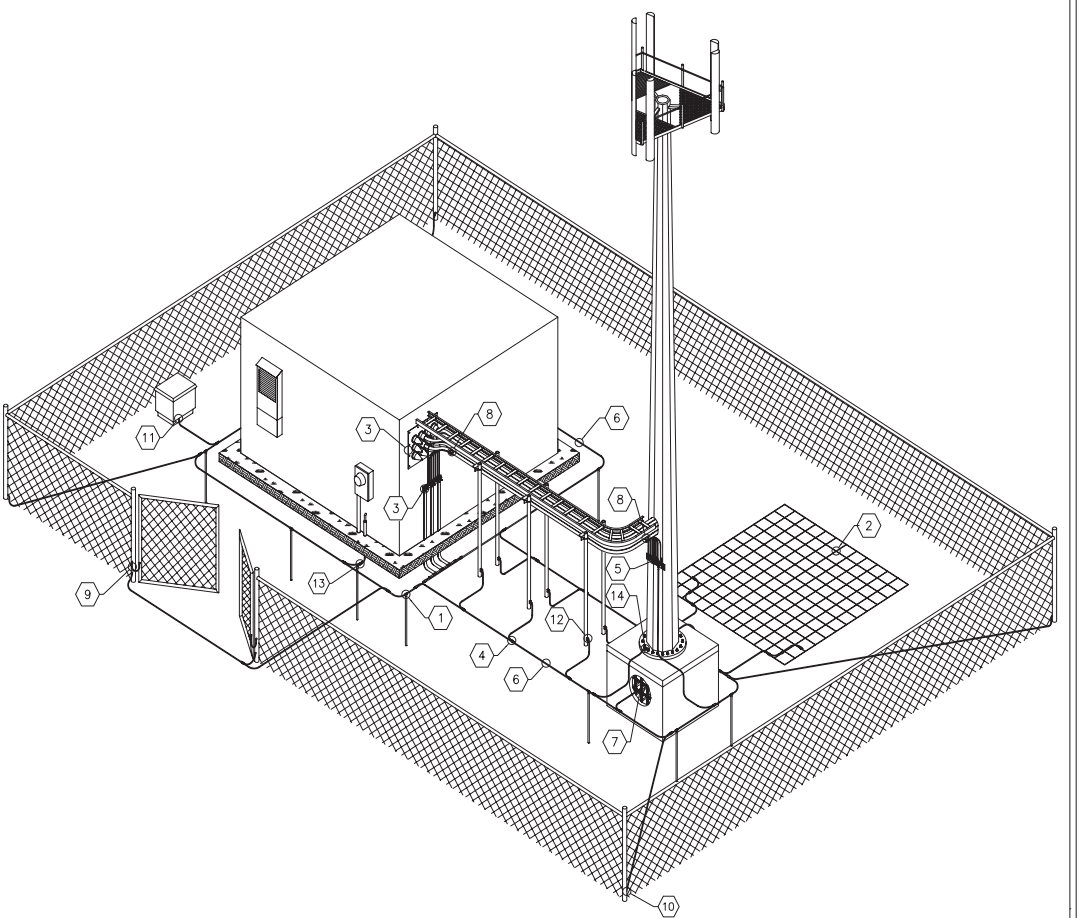
Section 3.1.2

Tower Grounding Components

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Exterior Grounding Layout



KEYED NOTES

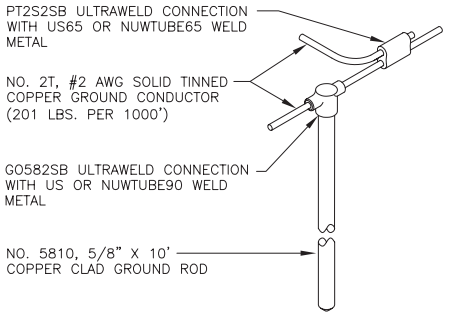
1. NO. 5810, 5/8" x 10'–0" COPPERCLAD GROUND ROD SPACED AT 16' MINIMUM WITH ULTRAWELD CONNECTION TYPE "GO582SB" (MOLD NUMBER) AND NUWTUBE90 (WELD METAL SIZE–ONE PER LOCATION) SEE DETAIL "G".
2. NO. GM121266, 12'–0" x 12'–0" GROUND MAT WITH NO. 6 AWG. SOLID BARE COPPER CONDUCTOR AT 6" O.C. EACH WAY, 24" BELOW GRADE OR FROST LINE, WHICH EVER IS LOWER. NO. 2T, #2 AWG SOLID TINNED COPPER GROUND CONDUCTOR SHALL BE ATTACHED TO THE MAT USING ULTRAWELD CONNECTION PT6S2SB (MOLD NUMBER) AND US45 OR NUWTUBEW45 (WELD METAL SIZE) AT THREE PLACES PER NO. 2T GROUND CONDUCTOR.
3. NO. EPK12, 12 UNIT ENTRANCE PANEL KIT WITH INTEGRATED 1/4"x5"x24" SOLID COPPER INTERIOR GROUND BAR WITH INSULATORS AND 1/4"x3"x14.5" EXTERIOR GROUND BAR.(INSTALL NEAR THE POINT WHERE THE COAX LINES ENTER THE SHELTER) SEE DETAIL "EPK".
4. CABLE TO CABLE CONNECTION WITH NO. PT2S2SB (MOLD NUMBER) ULTRAWELD CONNECTION WITH NO. US65 OR NUWTUBE65 (WELD METAL SIZE – ONE PER LOCATION).
5. NO. GBIA14424M, 1/4"x4"x24" SOLID COPPER TOWER GROUND BAR WITH INSULATOR AND BEAM CLAMP STANDOFFS. COAX CABLES SHALL BE GROUNDED TO TOWER AT THE TOP AND BOTTOM OF THE TOWER AND EVERY 75' OR LESS IF THE TOWER IS TALLER THAN 150". SEE DETAIL "GB".
6. NO. 2T, #2 AWG SOLID TIN COATED COPPER CONDUCTOR (201 LBS. PER 1000) LOCATED AT 2'–6" MIN. BELOW GRADE OR 6" BELOW THE FROST LINE, WHICH EVER IS LOWER.
7. "RE" OR "RP" STYLE ULTRAWELD CONNECTION BONDING REBAR IN TOWER FOOTING. *VERIFY SIZE OF REBAR PRIOR TO ORDERING.
8. BOND COAX CABLE USING NO. CGKB SERIES GROUND KIT TO EXTERIOR GROUND BARS. PART NUMBER IS SPECIFIC TO COAX SIZE. SEE COAX CABLE GROUNDING DETAIL "CGK".
9. NO. GJX2S24, FLEXIBLE BONDING JUMPER WITH ULTRAWELD CONNECTION TYPE VA2SV1.5x4B (WELD MOLD) AND US45 OR NUWTUBE45 (WELD METAL SIZE) – ONE PER GATE. SEE DETAIL "FG"
10. ULTRAWELD CONNECTION TO 3" – 4" DIA. FENCE POST TYPE VA2SV1.5x4B (MOLD NUMBER) AND US45 OR NUWTUBE45 (WELD METAL SIZE)– ONE PER LOCATION. SEE DETAIL "FG"
11. ALL CONDUCTIVE BODIES SHALL BE BONDED TO THE GROUNDING SYSTEM.
12. BOND WAVE GUIDE SUPPORTS TO EXTERIOR GROUND LOOP.
13. PROVIDE CONNECTION TO EXTERIOR POWER AND TELEPHONE GROUNDING SYSTEMS AND WATER SERVICE.
14. GROUND TOWER (2 LOCATIONS) WITH NO. HD2SA (MOLD NUMBER) ULTRAWELD CONNECTION WITH NO. US45 OR NUWTUBE45 (WELD METAL SIZE)– ONE PER LOCATION.

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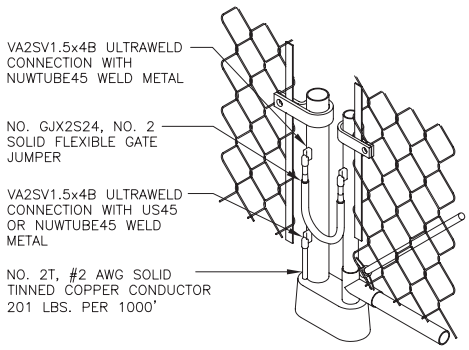
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Exterior Grounding Layout



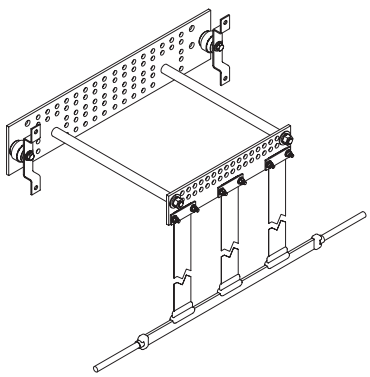
GROUND ROD DETAIL "G"

NTS



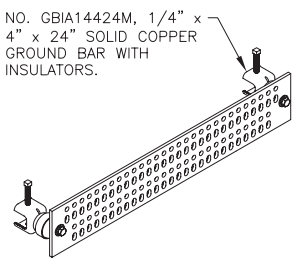
FENCE GROUNDING DETAIL "FG"

NTS



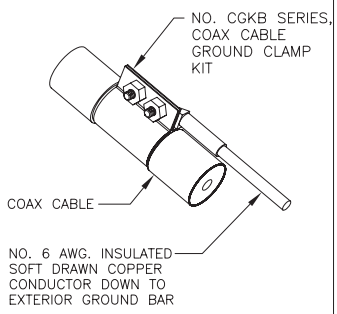
ENTRANCE PANEL DETAIL "EPK"

NTS



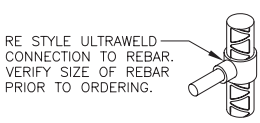
GROUND BAR DETAIL "GB"

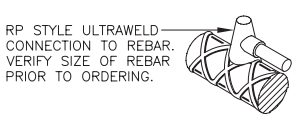
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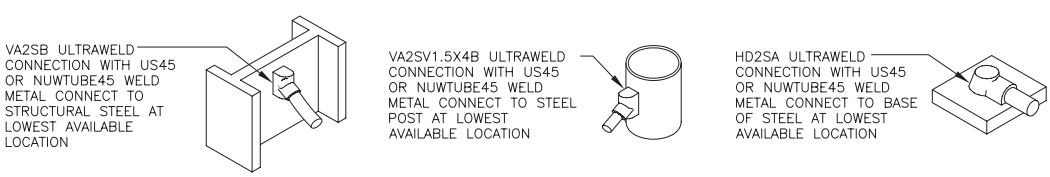


COAX GROUNDING DETAIL "CGK"

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ULTRAWELD DETAILS

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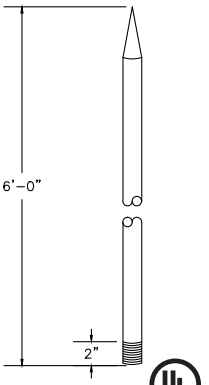
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Tower Air Terminals

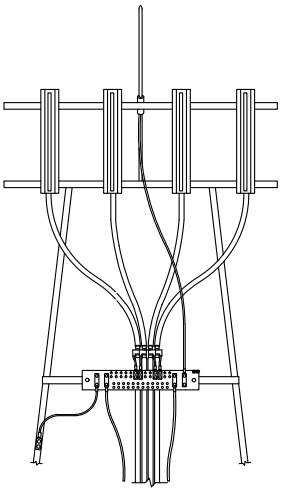
Stainless Steel

Part No.	Qty.	Approx. Each Wt. (lbs.)
586SS3AT	EA	6-1/4

- Tower air terminals are mounted on top of and on the sides of towers to help protect tower lighting, antennas, dishes, etc. from direct lightning strikes.
- 5/8" diameter x 6' long air terminal made from 304 stainless steel.
- Air terminal features 2" of 5/8"-11 UNC coarse threads and comes complete with 2 each of stainless steel jam nuts, lock washers and flat washers.



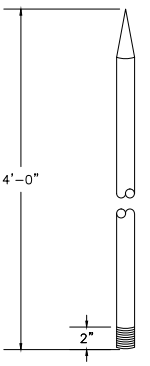
Listed 96



Solid Copper

Part No.	Qty.	Approx. Each Wt. (lbs.)
1248SCAT	EA	3-1/2

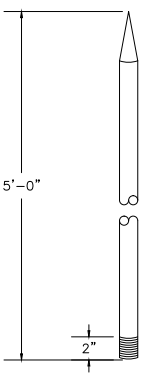
Listed 96



- Used where solid copper air terminals are preferred.
- 1/2" diameter x 4' long solid copper air terminal.
- Air terminal features 2" of 1/2"-13 UNC coarse threads and comes complete with 2 each of stainless steel jam nuts, lock washers and flat washers.

Copper Clad Steel

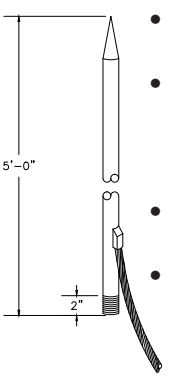
Part No.	Qty.	Approx. Each Wt. (lbs.)
585CCAT	EA	4-1/4



- 5/8" diameter x 5' long air terminal made from copper clad steel (10 mil).
- Air terminal features 2" of 5/8"-11 UNC coarse threads and comes complete with 2 each of stainless steel jam nuts, lock washers and flat washers.
- Copper clad steel provides superior strength and is less susceptible to wind shear than solid copper air terminals.

Copper Clad Steel

Part No.	Qty.	Approx. Each Wt. (lbs.)
585CCAT-2/0	EA	14-1/2



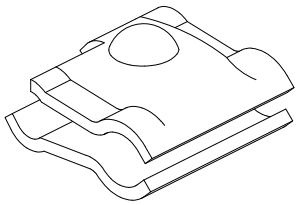
- 5/8" diameter x 5' long air terminal made from copper clad steel (10 mil).
- Air terminal features 2" of 5/8"-11 UNC coarse threads and comes complete with 2 each of stainless steel jam nuts, lock washers and flat washers.
- 25' of 2/0 AWG 19 strand copper conductor exothermically welded to air terminal.
- Tail can be exothermically welded to steel tower, ground bar or connected to a down conductor.

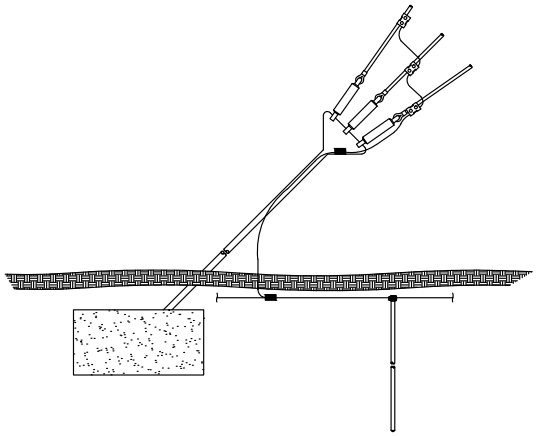
NOTE:
- Other sizes are available. Please contact factory for more information.

Guy Wire Clamps

Conductor to Guy Wire

Part No.	Box Qty.	Approx. Box Wt. (lbs.)
SSC25/875	10	3-1/4

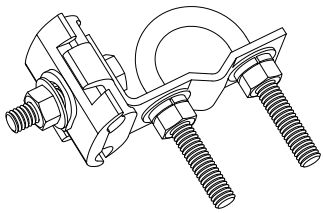


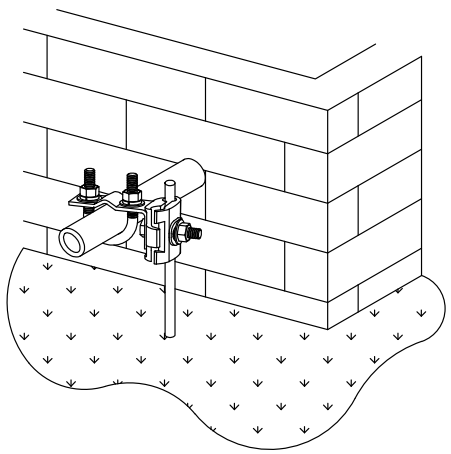


- Can be used for connecting 2 dissimilar conductors such as copper and galvanized steel.
- One bolt stainless steel clamp comes with stainless steel hardware.
- Accommodates up to 7/8" guy wire and 4/0 AWG conductor.

Conductor to Pipe or Guy Wire

Part No.	Box Qty.	Approx. Box Wt. (lbs.)
SSGC.75/1-OD	5	3-3/4
SSGC1.00/1.625-OD	5	4
SSGC1.625/2.375-OD	5	5
SSGC2.375/3.5-OD	5	5-1/2



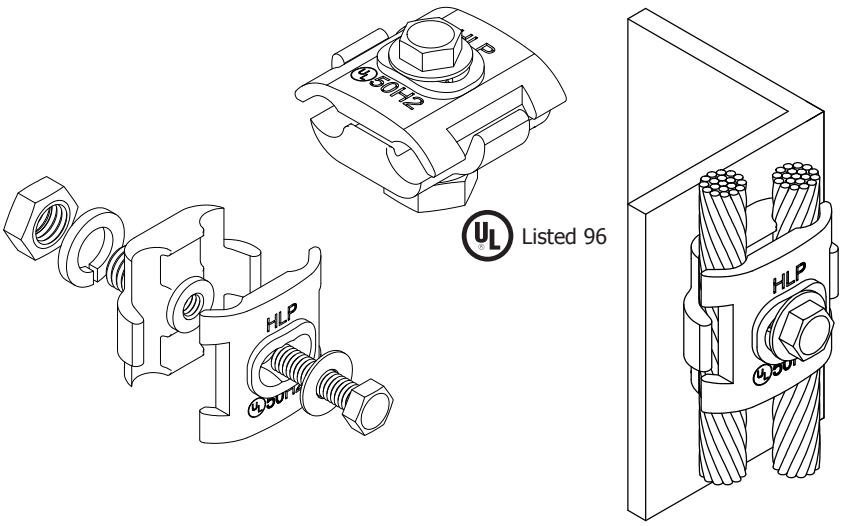


- Can be used for connecting 2 dissimilar conductors such as copper and galvanized steel.
- One bolt stainless steel clamp comes with stainless steel hardware.
- Accommodates up to 1" guy wire and 4/0 AWG conductor.

Banjo Clamp

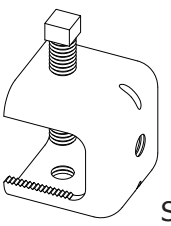
Part No.	Box Qty.	Approx. Box Wt. (lbs.)
BJC	10	4-1/4

- Tinned bronze clamp attaches lightning conductor cable to lattice towers.
- Accepts up to 4/0 AWG conductor.
- 1/2" external hub fits into most banjo brackets.

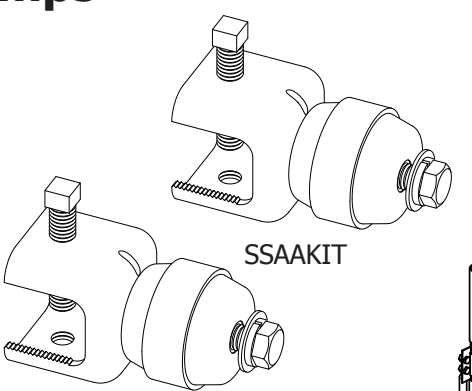


Listed 96

Beam Clamps



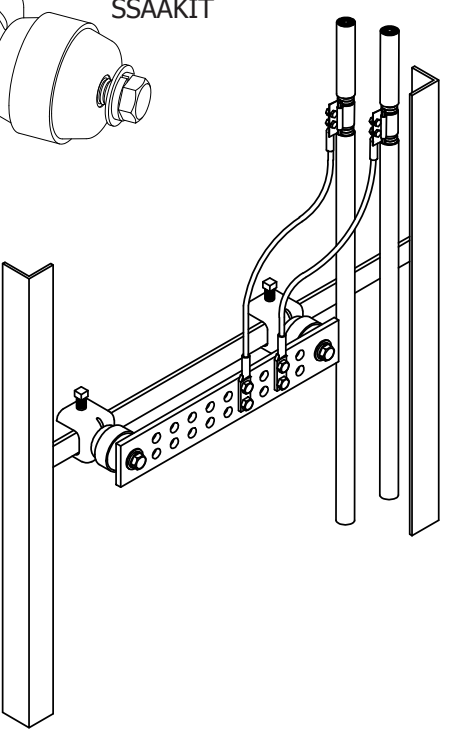
SSAA



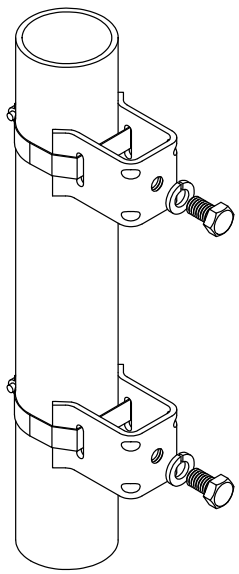
SSAAKIT

Part No.	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
SSAA	1/2	10	5
SSAAKIT	1/2	5	8

- Manufactured from 304 series stainless steel.
- SSAAKIT includes two assemblies (pictured). 3/8" stainless steel hardware fastens kit to ground bar.
- SSAAKIT also includes R4150A4 insulators.
- Will accommodate up to 1" thick material.



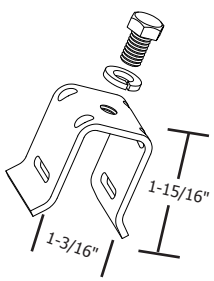
Tower Standoff for Round Members
TSO Series



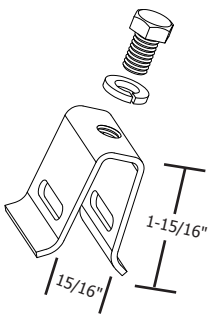
- The fast, easy and economical way to make quality attachments of ground bars and other components to round tower members.
- Manufactured from 300 series stainless steel for optimum compatibility.
- 3/8-16 x 5/8" stainless steel hex head cap screw and lock washer included.
- Available with or without stainless steel hose clamps in a variety of sizes.
- Sold as 10 pack.

Tower Standoffs

Part No.	Band Clamp Included	Pack Qty.	Approx. Box Wt. (lbs.)
TSO	No	10	2-1/2
TSOM	No	10	2



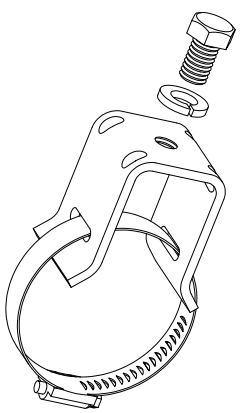
TSO



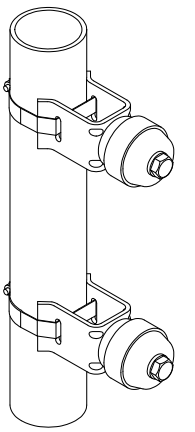
TSOM

Tower Standoff with Hose Clamp

Part No.	Band Clamp Included	Round Member Size O.D.	Pack Qty.	Approx. Box Wt. (lbs.)
TSOC.75/1.75	Yes	.75" - 1.75"	10	2-1/2
TSOC2/2.75	Yes	2" - 2.75"	10	3-1/2
TSOC3/3.75	Yes	3" - 3.75"	10	3-1/2
TSOC4/4.75	Yes	4" - 4.75"	10	4
TSOC5/5.75	Yes	5" - 5.75"	10	4
TSOC6/6.75	Yes	6" - 6.75"	10	4



Insulated Tower Standoff for Round Members
TSOINS Series

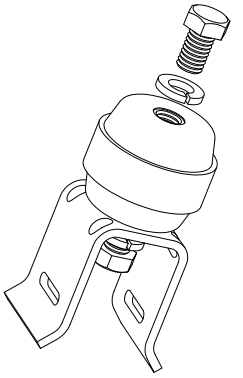


- The fast, easy and economical way to make a quality isolated coaxial ground bar mount to round tower members.
- Manufactured from 300 series stainless steel for optimum compatibility.
- 3/8" x 1-1/2" insulator with 3/8-16 x 5/8" stainless steel hex head cap screw and lock washer included.
- Available with or without stainless steel hose clamps in a variety of sizes.
- Sold as 10 pack.

Insulated Tower Standoffs

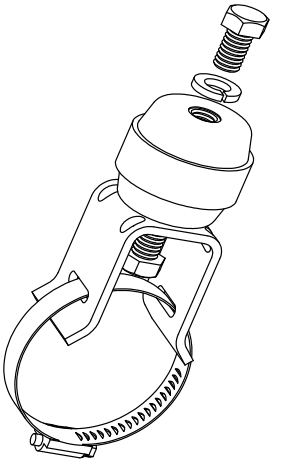
Part No.	Band Clamp Included	Pack Qty.	Approx. Box Wt. (lbs.)
TSOINS	No	10	4-3/4
TSOMINS	No	10	5

- TSOINS uses Tower Standoff TSO.
- TSOMINS uses Tower Standoff TSOM.

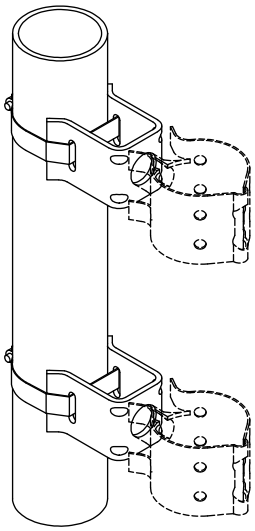


Insulated Tower Standoffs with Hose Clamp

Part No.	Band Clamp Included	Round Member Size O.D.	Pack Qty.	Approx. Box Wt. (lbs.)
TSOCINS.75/1.75	Yes	.75" - 1.75"	10	6-1/4
TSOCINS2/2.75	Yes	2" - 2.75	10	6-1/4
TSOCINS3/3.75	Yes	3" - 3.75"	10	6-1/4
TSOCINS4/4.75	Yes	4" - 4.75"	10	6-1/2
TSOCINS5/5.75	Yes	5" - 5.75"	10	6-1/2
TSOCINS6/6.75	Yes	6" - 6.75"	10	6-1/2



Tower Standoff for Snap-Ins
TSOSI Series

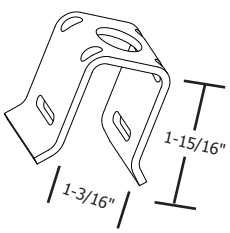


- The fast, easy and economical way to provide snap-in mounting of coaxial cables to round tower members.
- Manufactured from 300 series stainless steel for optimum compatibility.
- 3/4" hole for snap-in. Snap-In not included.
- Available with or without stainless steel hose clamps in a variety of sizes.
- Sold as 10 pack.

Tower Standoff for Snap-Ins

Part No.	Band Clamp Included	Pack Qty.	Approx. Box Wt. (lbs.)
TSOSI	No	10	2-3/4

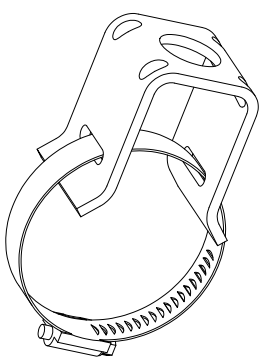
- Snap-In not included.



Tower Standoffs for Snap-Ins with Hose Clamp

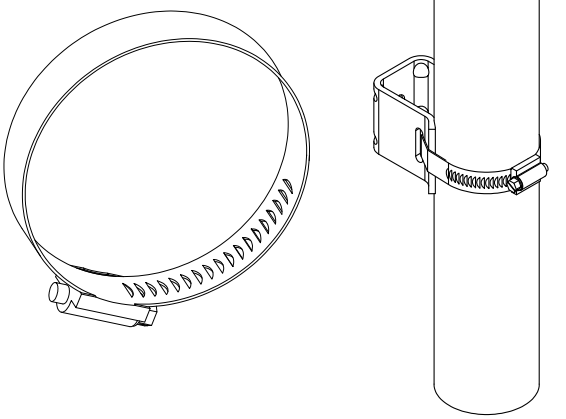
Part No.	Band Clamp Included	Round Member Size O.D.	Pack Qty.	Approx. Box Wt. (lbs.)
TSOCSI1.25/1.75	Yes	1.25" - 1.75"	10	3-1/4
TSOCSI2/2.75	Yes	2" - 2.75"	10	3-1/2
TSOCSI3/3.75	Yes	3" - 3.75"	10	3-1/2
TSOCSI4/4.75	Yes	4" - 4.75"	10	3-3/4
TSOCSI5/5.75	Yes	5" - 5.75"	10	3-3/4
TSOCSI6/6.75	Yes	6" - 6.75"	10	4

- Snap-In not included.



Band Clamps

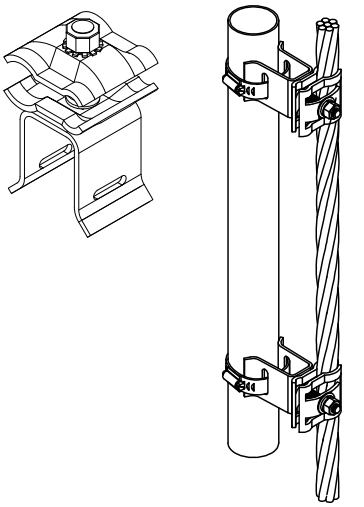
Part No.	Band Clamp Size Range	Pack Qty.	Approx. Box Wt. (lbs.)
SSBC12-50	1.06" - 2"	50	3
SSBC23-50	2.06" - 3"	50	3-1/2
SSBC34-50	3.06" - 4"	50	4-1/4
SSBC45-50	4.06" - 5"	50	5
SSBC56-50	5.06" - 6"	50	6
SSBC67-50	6.06" - 7"	50	6-3/4



- Stainless steel band clamps attach hangers to round members.
- Sold as 50 pack.

Stainless Steel Down Conductor Standoff

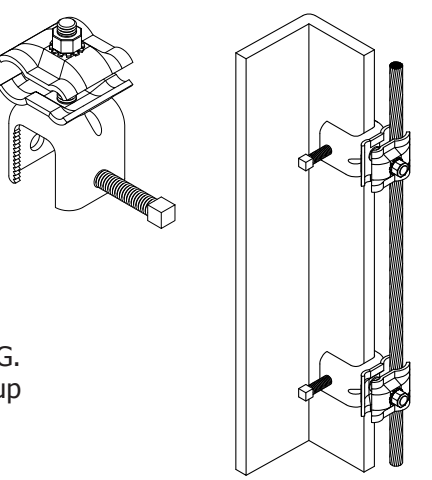
Part No.	Approx. Each Wt. (lbs.)	Pack Qty.	Approx. Box Wt. (lbs.)
SSDCSO	1/2	5	3-1/2



- Range taking down conductor cable clamp with tower standoff.
- Fast, easy and economical way to attach down conductors to round tower members.
- The small side of the clamp accommodates bare stranded conductors from #6 up to 2/0 AWG while the large side accommodates from 2/0 to 4/0 AWG.
- The small side of the clamp accommodates insulated conductors from #8 up to 2/0 AWG while the large side accommodates from #1 up to 4/0 AWG.
- Manufactured from stainless steel to allow use with any type of wire.
- Available with stainless steel band clamp. See above for sizes.
- Sold as 5 pack.

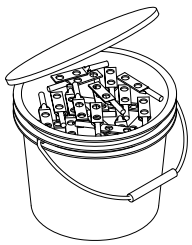
Stainless Steel Down Conductor Angle Adapter

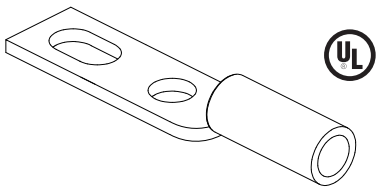
Part No.	Approx. Each Wt. (lbs.)	Pack Qty.	Approx. Box Wt. (lbs.)
SSDCAA	1/2	5	4



- Range taking down conductor cable clamp with tower standoff.
- Designed to attach to flat steel tower members.
- Fast, easy and economical way to attach down conductors to flat tower members.
- The small side of the clamp accommodates bare stranded conductors from #6 up to 2/0 AWG while the large side accommodates from 2/0 to 4/0 AWG.
- The small side of the clamp accommodates insulated conductors from #8 up to 2/0 AWG while the large side accommodates from #1 up to 4/0 AWG.
- Manufactured from stainless steel to allow use with any type of wire.
- Sold as 5 pack.

Slotted Long Barrel Compression Lugs (Telecommunications)





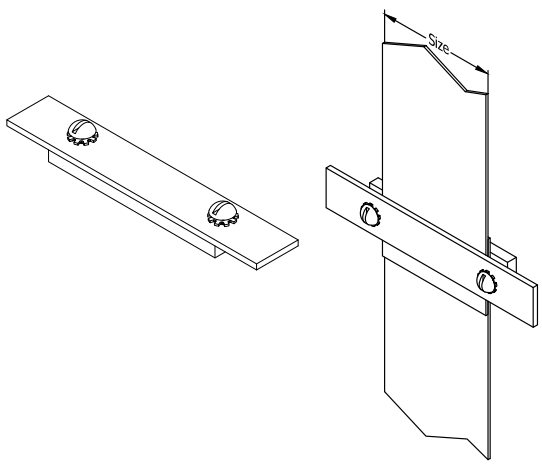
Listed 486

Part No.	Conductor Size (AWG)	Hole Spacing Range	Hardware Size	Color Codes	Box Qty.	Approx. Box Wt. (lbs.)
GECLB62BC	#6 Str.	.75" to 1"	3/8"	Blue	50	2
GECLB62BC250BK	#6 Str.	.75" to 1"	3/8"	Blue	250	10
GECLB22BCS	#2 Sol.	.75" to 1"	3/8"	White	50	2
GECLB22BCS250BK	#2 Sol.	.75" to 1"	3/8"	White	250	13
GECLB22BC	#2 Str.	.75" to 1"	3/8"	Brown	50	2
GECLB22BC250BK	#2 Str.	.75" to 1"	3/8"	Brown	250	16

- Manufactured from electro plated tinned copper.
- For use on copper or tinned copper conductors.
- Lugs have inspection ports.
- 250 pack comes in one gallon bucket.

Copper Flat Strap Clamps

Part No.	Strap Size	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
FSC2	2"	1/2	10	5
FSC3	3"	3/4	10	7-1/2
FSC4	4"	1	10	10
FSC6	6"	1-1/4	10	12-1/2



- Used for making connection to flat strap or flat braid.
- Copper "sandwich" clamps complete with stainless steel hardware. The top is 1/8" thick and the bottom is 1/4" thick.
- Ends are designed to allow for exothermically welding conductors to clamp.

Section 3.1.3

Ground Kits & Accessories

Index

Description		Page
3.1.3.1	Coax Ground Kits with Captive Hardware	240
3.1.3.2	Universal Ground Kits	241
3.1.3.3	Weather Proofing Kits	241
3.1.3.4	Lightning Arrestor Kits	242

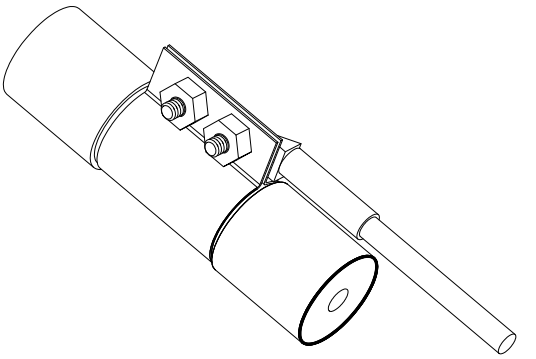
Coax Ground Kits with Captive Hardware

Part No. Green	Part No. Black	Coax Size	Approx. Each Wt. (lbs.)
N/A	CGKBB1/4-3/8	1/4 to 3/8	1-1/2
CGKB3/8-5	CGKBB3/8-5	3/8 Corrugated	1-1/2
CGKB1/2-5	CGKBB1/2-5	1/2 Corrugated	1-1/2
CGKB5/8-5	CGKBB5/8-5	5/8 Corrugated	1-1/2
CGKB7/8-5	CGKBB7/8-5	7/8 Corrugated	1-1/2
CGKB1-1/4-5	CGKBB1-1/4-5	1-1/4 Corrugated	1-1/2
CGKB1-5/8-5	CGKBB1-5/8-5	1-5/8 Corrugated	1-1/2
CGKB2-1/4-5	CGKBB2-1/4-5	2-1/4 Corrugated	1-1/2

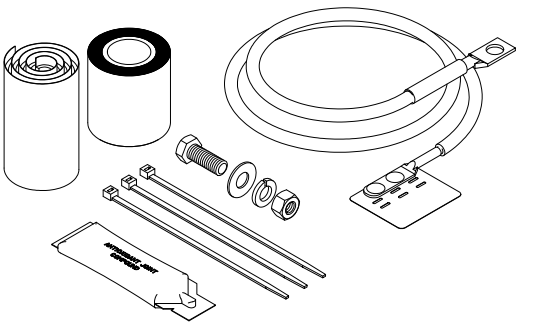
- 2-bolt coax ground kit featuring captive hardware design allows greater ease of installation while providing a functional, high quality ground.
- Designed to eliminate over tightening and damaging the coax shield.
- 5' ground conductor available in Green or Black.
- Complies with MIL-STD-188-124B.

Kit Includes:

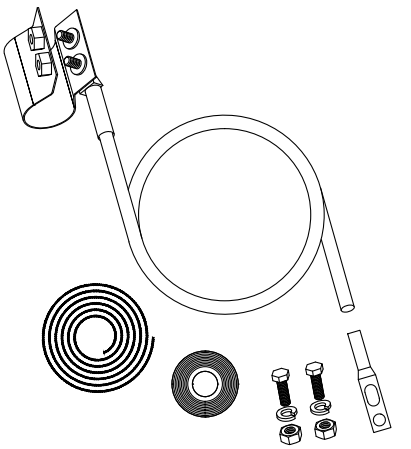
(1) Preformed copper ground strap complete with "captive" hardware
(1) 5' of #6-7 strand AWG THW ground conductor
(1) "Universal" style ground lug which accommodates 3/4" to 1" spaced holes
(2) Sets of stainless steel hardware to attach ground lug to ground bar
(1) Butyl Mastic (2-1/2" x 24")
(1) Black electrical tape (2" x 20')



Patented Design



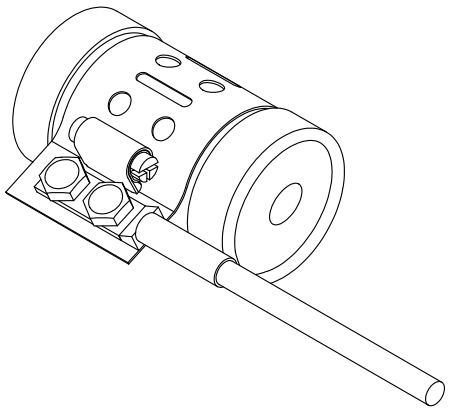
CGKBB1/4-3/8



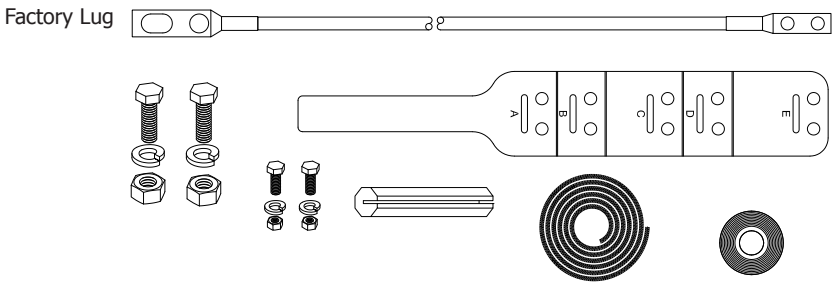
NOTE:
- Other sizes and configurations available. Please contact factory for more information.

Universal Ground Kits

Part No.	Qty.	Approx. Each Wt. (lbs.)
UGKB-5	EA	1-3/4
UGKB-5X	EA	1-3/4

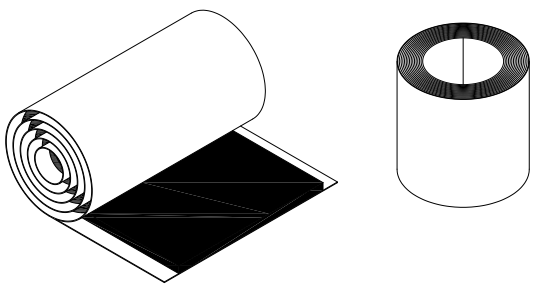


- Accommodates transmission line sizes 1/2" through 2-1/4".
- 5' of Black #6 AWG ground lead provided with special factory attached ground lugs.
- "Universal" style ground lug accommodates 3/4" to 1" spaced holes on ground bar.
- Stainless steel hardware and waterproofing materials included.
- UGKB-5X does not have the factory lug attached.
- Complies with MIL-STD-188-124B.



Weather Proofing Kits

Part No.	Rolls of Mastic	Rolls of Tape	Qty.	Approx. Each Wt. (lbs.)
WP1KIT	1	1	EA	1/2
WP3KIT	3	2	EA	1-1/2
WP5KIT	5	3	EA	2-1/2



- Used to weatherproof electrical connector junctions and grounds.
- Includes 2" x 20' premium all weather vinyl electrical tape.
- Includes 2-1/2" x 2' Butyl Mastic.

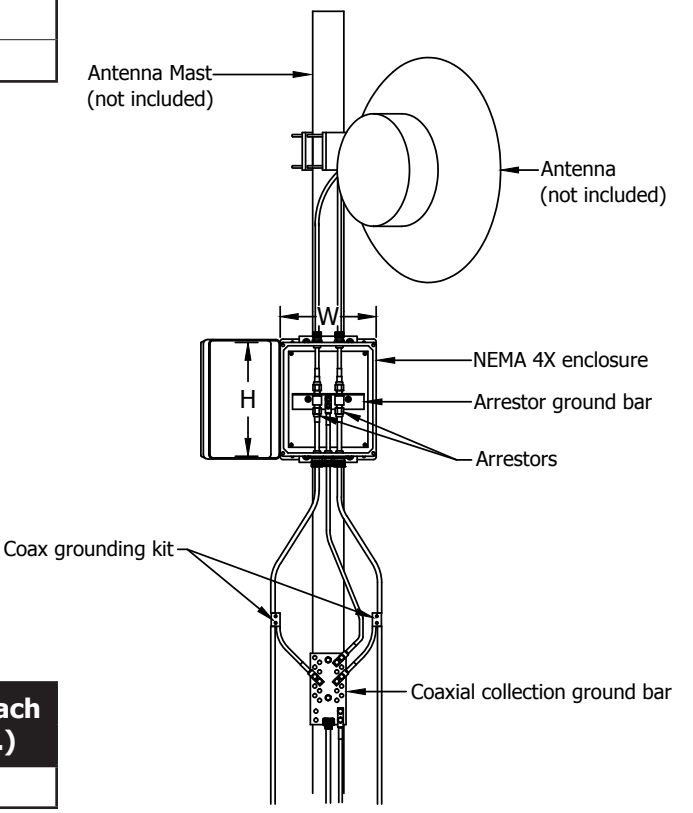
Lightning Arrestor Kits

Part No.	Size H	W	D	Approx. Each Wt. (lbs.)
LABA42A2GKCGB	12"	10"	5"	20
LABB42A2GKCGB	16"	14"	6"	20

- Enclosure provides water tight environment for both surge arrestors and connectors.
- Surge arrestors protect against lightning induced surge currents.
- Lightning arrestor ground bar design allows the addition of 2 more arrestors.
- Coax ground kits provide low impedance ground path.
- Coax ground bar provides ground point for coax lines as well as antenna mount.

Kit Includes:

(1) NEMA 4X molded fiberglass reinforced polyester enclosure
(2) Premounted bi-directional surge arrestors
(1) Lightning arrestor ground bar
(2) Coax ground kits
(1) Coax ground bar

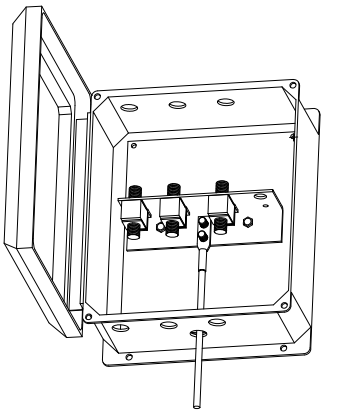


Part No.	Size H	W	D	Approx. Each Wt. (lbs.)
LAB12106XO	12"	10"	6"	20

- Enclosure provides water tight environment for both surge arrestors and connectors.
- Surge arrestors protect against lightning induced surge currents.
- Lightning arrestor ground bar design allows the addition of 1 more arrestor.
- Coax ground kits provide low impedance ground path.
- Coax ground bar provides ground point for coax lines as well as antenna mount.

Kit Includes:

(1) NEMA 4X molded fiberglass reinforced polyester enclosure
(3) Premounted bi-directional surge arrestors
(1) Lightning arrestor ground bar
(3) Coax ground kits
(1) Coax ground bar



NEMA 4X enclosure

APPLICATION NOTE:

- Lightning arrestor box kits are used in wireless rooftop communication applications such as broadband point to point, point to multi-point and other similar type systems.

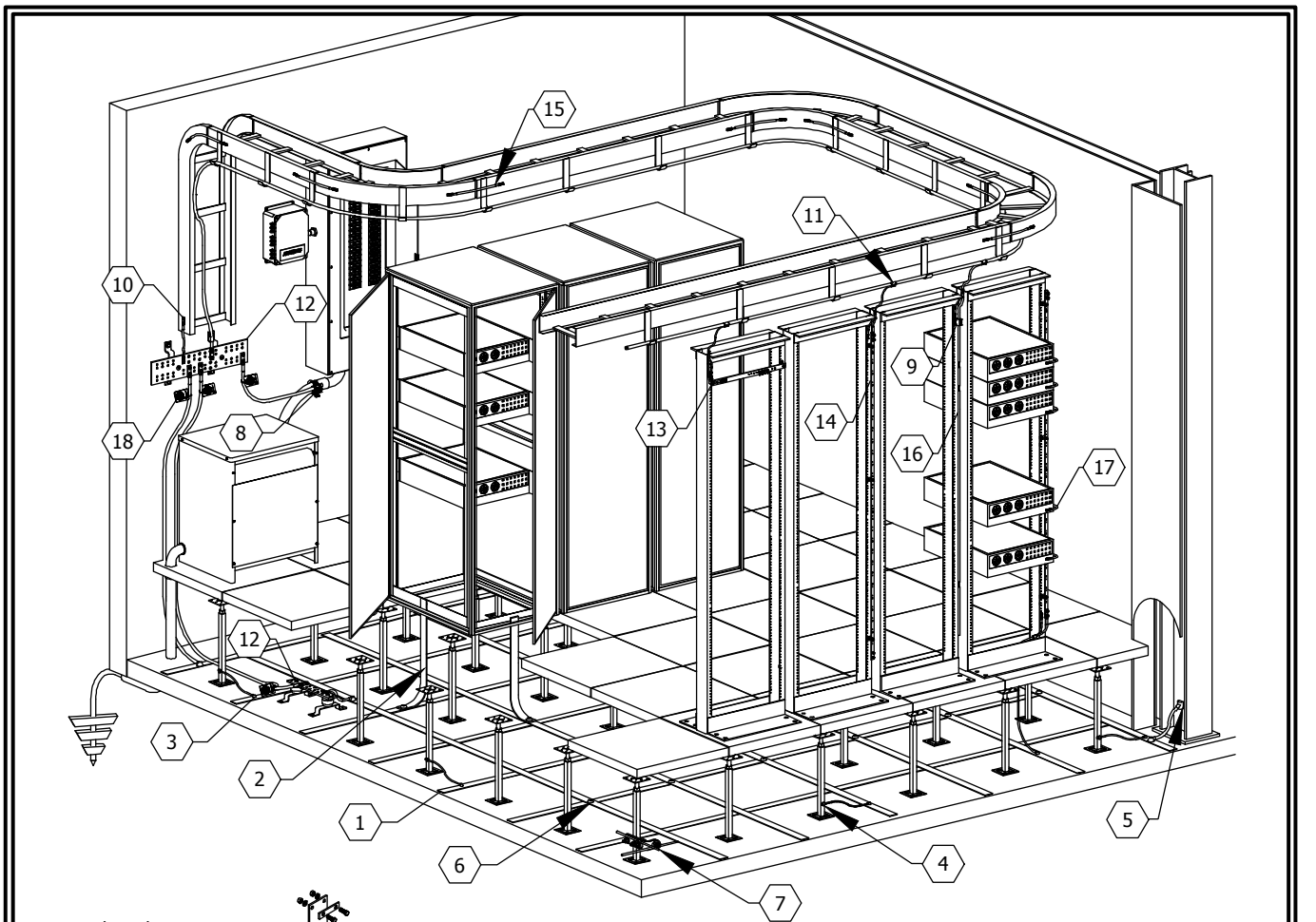
Section 3.2

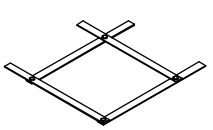
Premise Wiring/Data-Com

Index

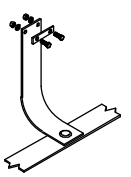
Description		Page
3.2.1	Data-Com Grounding & Bonding Applications	244
3.2.2	Data-Com Grounding & Bonding Equipment	245

Data-Com Grounding & Bonding Applications

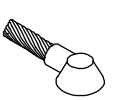




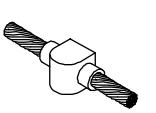
1 Signal Reference Grid



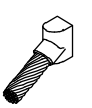
2 Low Impedance Riser



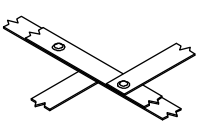
3 BCF ULTRAWELD Connection



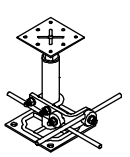
4 VHO ULTRAWELD Connection



5 VA ULTRAWELD Connection



6 SRG ULTRAWELD Connection



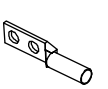
7 GPC Pedestal Clamp



8 CPC Pipe Clamp



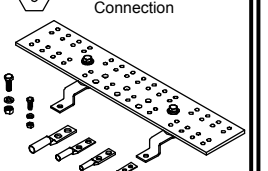
9 LI2/0142 Dual Rated Lay-In Lug



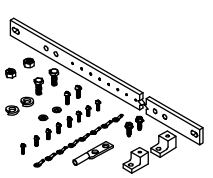
10 GECLB Compression Lug



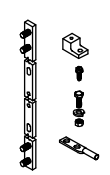
11 CT C-Tap



12 Telecommunication Ground Bar

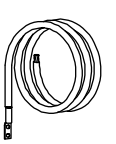


13 RGBHKIT Horizontal Rack Ground Bar

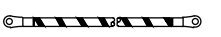


14 RGBVKIT Vertical Rack Ground Bar

15 Insulated Ground Jumper



16 RGJ Rack Ground Jumper



17 Unit Bonding Conductor



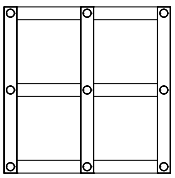
18 Network Building Ground Tag

HARGER

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Data-Com Grounding & Bonding Applications

Data-Com Grounding & Bonding Equipment

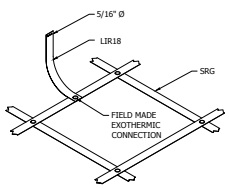


Listed 467

1 - Supplementary Bonding Grids

Part No.	Description
SRG105024	10' x 50', 24" O.C. Spacing
SRG125024	12' x 50', 24" O.C. Spacing

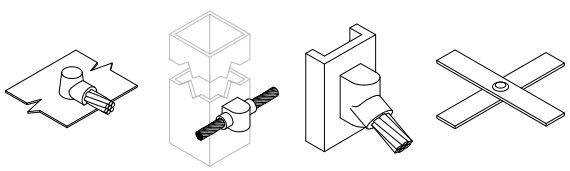
- 2" x .016" flat copper conductor
- See Pages 90 & 91 for more information.



2 - Low Impedance Risers & Kits

Part No.	Material	Length	Riser or Kit
LIR18	2" x .016" Flat Copper	18"	Riser
LIR18KIT	2" x .016" Flat Copper	18"	Kit
LIR24	2" x .016" Flat Copper	24"	Riser
LIR24KIT	2" x .016" Flat Copper	24"	Kit
LIR36	2" x .016" Flat Copper	36"	Riser
LIR36KIT	2" x .016" Flat Copper	36"	Kit
LIR72	2" x .016" Flat Copper	72"	Riser
LIR72KIT	2" x .016" Flat Copper	72"	Kit

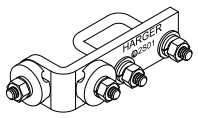
- See Page 92 for more information.



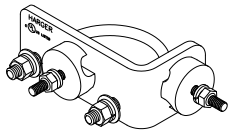
3, 4, 5, 6 - Ultraweld Connections Low Emission Exothermic Molds

Part No.	Weld Metal	Fliter	Required Handle
BCF61.5016B	US25	USSXFLR1.8	MH1
VHO61SQMX	US25	USSXFLR1.8	MH4
VA6B	US45	USSXFLR1.8	MH1
SRG2016K	US32	USSXFLR1.8	MH1

- All Low Emission Molds Require USCONTROLLER.
- See Page 276 for more information.



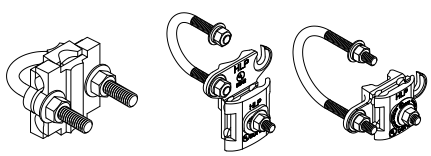
Listed 467



7 - GPC Pedestal Clamps

Part No.	U-Bolt Type	Pedestal Size	Conductor Size
GPC6SQ	Square	1" (1-1/8" OD)	#6 AWG
GPC6RD	Round	1" (1-1/8" OD)	#6 AWG
GPC4SQ	Square	1" (1-1/8" OD)	#4 AWG
GPC4RD	Round	1" (1-1/8" OD)	#4 AWG
GPC2SQ	Square	1" (1-1/8" OD)	#2 AWG
GPC2RD	Round	1" (1-1/8" OD)	#2 AWG
GPC2/0RD1.75	Round	1-1/8" - 1-3/4"	2/0 & #6 AWG

- See Page 94 for more information.



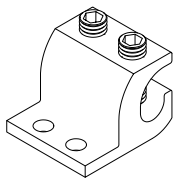
Listed 96

Listed 467

8 - Pipe Clamps

Part No.	Material	Nom. Pipe Size Range	Pipe Outside Diameter
CPC.5/.75	Tinned Bronze	.5" - .75"	.375" - 1"
CPC1/1.25	Tinned Bronze	1" - 1.25"	.75" - 1.7"
CPC1.5/2	Tinned Bronze	1.5" - 2"	1" - 2.4"
CPC2.5/3	Tinned Bronze	2.5" - 3"	2.25" - 3.5"
CPC3.5/4	Tinned Bronze	3.5" - 4"	3.2" - 4.5"
CPC5/6	Tinned Bronze	5" - 6"	4.75" - 6.63"

- See Page 124 & 203 for more information.



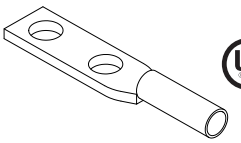
Listed 486

9 - Lay-In Lug

Part No.	LI2/0142
Size	1-5/8" x 1-1/2"
Material	Electro-tin Plated Aluminum (6061-T6)
Accepts Conductors	2/0 to #14 AWG
Includes	(2) 3/8" x 1" Hex Socket Set Screws
Requires	3/16" Hex Key (not included)
Features	Dual Rated, UL486B Listed

- See Page 118 for more information.

Data-Com Grounding & Bonding Equipment

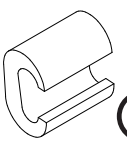


Listed 486

10 - GECLB Compression Lugs

Part No.	Cable Size	O.C. Dim. B/T Holes	Hardware Size	Color Code
GECLB62A	6	5/8"	1/4"	Blue
GECLB62C	6	1"	3/8"	Blue
GECLB22A	2	5/8"	1/4"	Brown
GECLB22C	2	1"	3/8"	Brown
GECLB1/02C	1/0	1"	3/8"	Pink
GECLB2/02C	2/0	1"	3/8"	Black
GECLB3/02C	3/0	1"	3/8"	Orange
GECLB4/02C	4/0	1"	3/8"	Purple

• See Page 113 for more information.

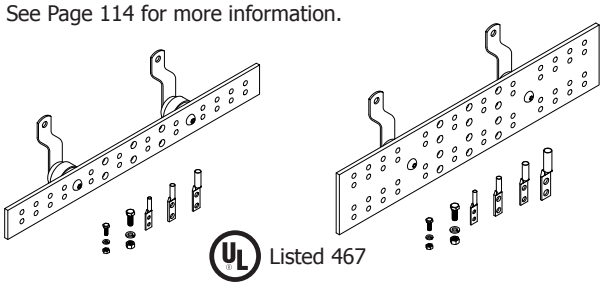


Listed 486

11 - Heavy Duty C-Taps

Part No.	Conductor Run	Conductor Tap
CT2248	#2 Stranded #2 Solid	#4 Stranded #8 Solid
CT2222	#2 Stranded #2 Solid	#2 Stranded #2 Solid

• See Page 114 for more information.

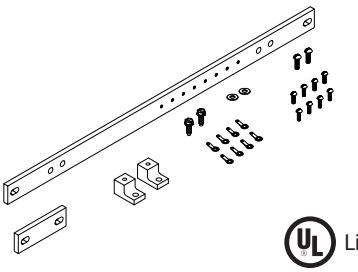


Listed 467

12 - Telecommunication Ground Bars & Kits

Part No.	Bar Size	No. of 5/16" Hole Sets	No. of 7/16" Hole Sets	Bar or Kit
GBI1426TGB	1/4" x 2" x 6"	2	2	Bar
GBI1426TGBKT	1/4" x 2" x 6"	2	2	Kit
GBI14212TGB	1/4" x 2" x 12"	6	3	Bar
GBI14212TGBKT	1/4" x 2" x 12"	6	3	Kit
GBI14412TMGB	1/4" x 4" x 12"	12	6	Bar
GBI14412TMGBKT	1/4" x 4" x 12"	12	6	Kit
GBI14420TMGB	1/4" x 4" x 20"	24	6	Bar
GBI14420TMGBKT	1/4" x 4" x 20"	24	6	Kit

• Kit includes lugs and hardware.
• See Pages 62-65 for more information.

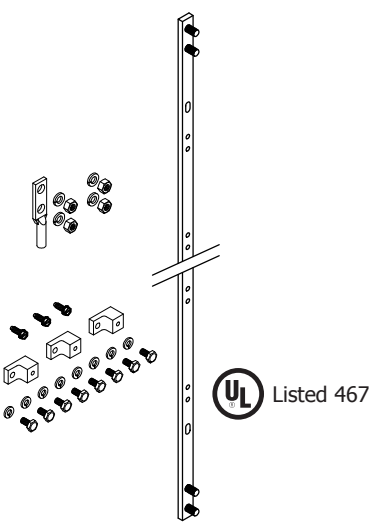


Listed 467

13 - Horizontal Rack Ground Bars & Kits

Part No.	Bar Size	Bar or Kit
RGBH14119.25	1/4" x 1" x 19-1/4"	Bar
RGBHKIT14119.25	1/4" x 1" x 19-1/4"	Kit
RGBH14123.25	1/4" x 1" x 23-1/4"	Bar
RGBHKIT14123.25	1/4" x 1" x 23-1/4"	Kit
RGBH14135.25	1/4" x 1" x 35-1/4"	Bar
RGBHKIT14135.25	1/4" x 1" x 35-1/4"	Kit

• Bar includes splice plate. Kit includes splice plate, mounting hardware and ring terminals.
• See Pages 66-67 for more information.



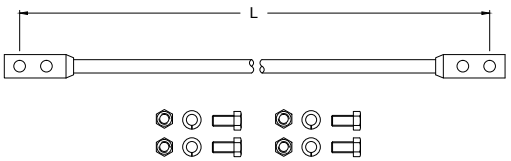
Listed 467

14 - Vertical Rack Ground Bars & Kits

Part No.	Bar Size	Bar or Kit
RGBV145836A	1/4" x 5/8" x 36"	Bar
RGBVKIT145836A	1/4" x 5/8" x 36"	Kit
RGBV145872A	1/4" x 5/8" x 72"	Bar
RGBVKIT145872A	1/4" x 5/8" x 72"	Kit

• Kit includes lug and all necessary hardware.
• See Page 68 for more information.

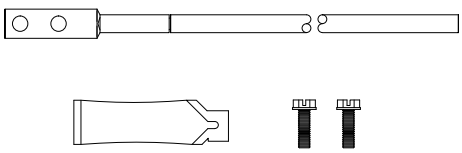
Data-Com Grounding & Bonding Equipment



15 - Insulated Ground Jumpers & Kits

Part No.	Conductor Type	Length	No. of Holes Per Side	Hole Size	Jumper or Kit
GJ67G82A1/4	67G	8"	2	1/4"	Jumper
GJ67G82A1/4KIT	67G	8"	2	1/4"	Kit
GJ67G102A1/4	67G	10"	2	1/4"	Jumper
GJ67G102A1/4KIT	67G	10"	2	1/4"	Kit
GJ67G122A1/4	67G	12"	2	1/4"	Jumper
GJ67G122A1/4KIT	67G	12"	2	1/4"	Kit

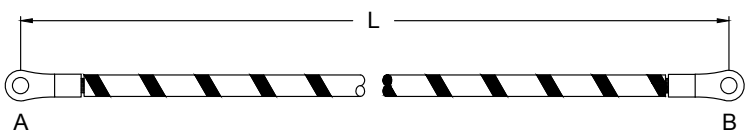
- #6 AWG x 7 Strand Green THW insulation.
- Kit includes all necessary hardware.
- See Pages 110 for more information.

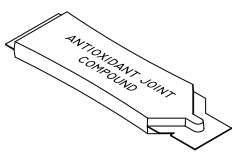


16 - Rack Bonding Jumper Kit

Part No.	RGJ67G1082AKIT
Conductor Type	#6 AWG x 7 Strand THW Green
Conductor Length	9 ft.
No. of Holes	2
Hole Size	1/4"
On Center Spacing	5/8"

- Kit includes all necessary hardware.





17 - One Hole Unit Bonding Conductor Kits

Part No.	Conductor Type	Length	No. of Holes Per Side	Hole Size A	Hole Size B	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
UBC61411/4KIT5	6MTWG/YS	14	1	1/4"	1/4"	1-1/2	5	7-1/2
UBC61411/410KIT5	6MTWG/YS	14	1	1/4"	#10	1-1/2	5	7-1/2
UBC61811/4KIT5	6MTWG/YS	18	1	1/4"	1/4"	2-1/2	5	12-1/2
UBC61811/410KIT5	6MTWG/YS	18	1	1/4"	#10	2-1/2	5	12-1/2
UBC63211/4KIT5	6MTWG/YS	32	1	1/4"	1/4"	3	5	15
UBC63211/410KIT5	6MTWG/YS	32	1	1/4"	#10	3	5	15
UBC63811/410KIT5	6MTWG/YS	38	1	1/4"	#10	3	5	15

- Conductor type is #6 MTW wire with Green insulation and yellow spiral stripe.
- Kit includes 5 jumpers and 1 antioxidant (HAAJC1/2).

18 - Network Building Ground Tag

Part No.	Material	Box Qty.	Approx. Box Wt. (lbs.)
GRNTAG607PK10	Plastic	10	1/2

- Dimensions are 2.125" x 3.75".
- Yellow tag with green text.
- Tag is UV Resistant.



Section 4
Ground Testing Equipment

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4.2	Megger® Ground Testing Equipment	255
4.3	Megger® Earth/Ground Resistance & Leakage Current Clamp Testers	257
4.4	Harger Ground Test Kits	259

An Introduction to Ground Testing by Megger®

Before performing a ground test, it is advisable to develop a working familiarity with two important concepts: how the tester accomplishes the measurement and what the operator must do to assure a proper test.

Choose the Proper Instruments

The first consideration is helpful in the selection of an instrument and the fundamental application of the test. Ground tests are frequently attempted with a variety of ohmmeters that happen to be conveniently at hand. This practice is doubly damaging because it may result in an incorrect measurement that is accepted by the operator.

Two-point measurement with a multimeter will give a loop resistance of the circuit that is defined by the arbitrary points of connection, and this will include in its path the soil between those points. But, so what? This is not necessarily an indication of the electrical condition that the ground electrode has established with the surrounding soil. Furthermore, the measurement itself can be made inaccurate by the influence of transient currents that travel in the soil from a variety of sources.

Understand the Test

To perform a ground test, a dedicated ground tester, not a generalized ohmmeter or multimeter, is requisite. The manner in which the ground tester uniquely accomplishes its purpose is diagrammed in the accompanying simplified schematic. Its operation is similar to, but in a sense opposite, that of the familiar Megger® Insulation Tester.

The instrument uses two precise measuring circuits (voltage and current), and combines the values through Ohm's Law to give the desired measurement (resistance).

The two test circuits are established through the soil by strategic placement of probes, attached via leads to their respective terminals. The current terminal, lead, and probe set up a test current of a unique, square wave frequency, apart from the harmonics of utility power, through the soil to the ground under test. It is only this current that contributes to the measurement, leaving interfering transients out. Likewise, the voltage probe enables measurement of the drop over the soil to its critical point of placement.

Both circuits are completed by connection of a second pair of terminals (or a common in the case of three-terminal testers) to the ground under test. (See Figure 1.)

Understand the Test Environment

Providing the most applicable and highest quality tester, however, is only the first part of the operator's responsibility. No ground tester can perform a successful test all by itself since a ground test is never routine. The operator's knowledge and skill must always be an essential element of a proper test.

The proper placement of the probes is critical and defies standardization of procedure. A degree of trial and error cannot be avoided, because the earth is not a defined circuit, like a piece of equipment. The experience and ability of the operator are valuable in reducing this process to an efficient level, and no instrument can substitute for this factor.

The resistance environment with which the ground electrode is surrounded, whether it be a single rod or complex grid, is determined by a critical volume of soil. This volume may be thought of as an area of electrical field influence around the electrode. It has at the same time both a fixed nature, determined by soil type, structure of the electrode, electrical demands upon it and other factors, and a variable component, determined by transient factors like moisture and temperature.

Put simply, this entire critical volume must be measured, for it is what influences the flow of fault current from the ground electrode into the earth. For the proper volume to be measured, probes must be sufficiently spaced. Only the operator's knowledge can accomplish this placement properly and efficiently. Because soil conditions are never precisely the same, there is no set method to predict spacing in advance, and no instrument design can eliminate the operator.

Space the Probes Properly

If the potential probe is too close, measurements are taken within the electrode's sphere of influence, and different readings would be obtained with other placements. Indeed, a quality tester will give an accurate measurement to that point, but it is not taking into account all the resistance that a fault current will meet.

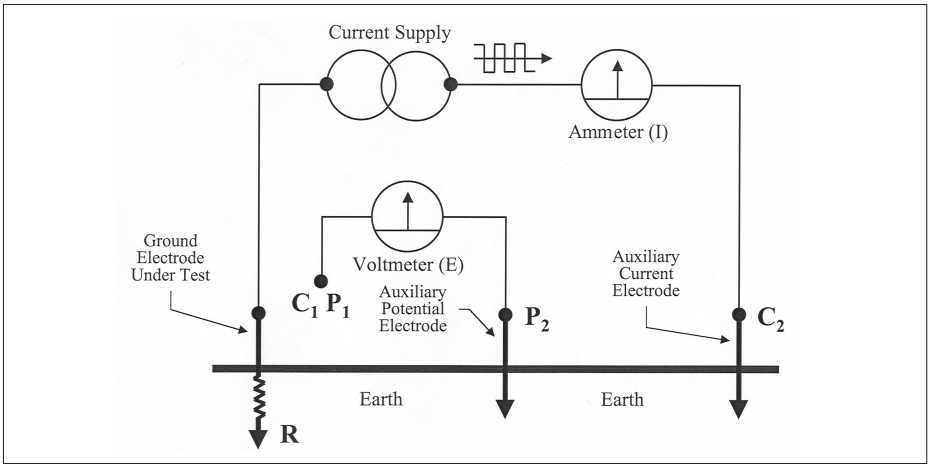


Figure 1: Simplified schematic of four-terminal instruments

This is what happens when shortcut two-point tests are made. (See Figure 2.) If the current probe is too close, its electrical field will overlap that of the ground electrode, and the potential probe will find itself making measurements in an electrical environment of conflicting influences. (See Figure 3.)

With adequate spacing, however, the potential probe will make its measurement beyond the boundary of maximum resistance exerted by the field influence of the ground electrode, in an area where additional distance does not contribute significantly to the tested electrode's resistance, and measurements will be reasonably stable. This uniformity of measurement will persist with increasing distance until the sphere of influence of the current probe is entered. This is the method that is referred to as Fall of Potential (also called the "three-point method," in reference to the three points of soil contact established by the electrode under test and the two probes). It is the method described by IEEE Standard #81 as the recognized basis for earth testing in the U.S. (See Figure 4.)

Conclusion

Simplified methods have been developed from the full Fall of Potential concept, and their descriptions are readily available in the literature. These various methods take advantage of simplifications of the calculus associated with a typical Fall of Potential graph to provide quick and easy mathematical tests that will throw out the results of tests made with inadequate setups, and accept only those results that are accurate and reliable measurements.

Familiarization is necessary for the proper conduct of earth tests, and with this familiarization, the knowledgeable operator can reduce trial and error, and indeed the work itself, to minimal levels.

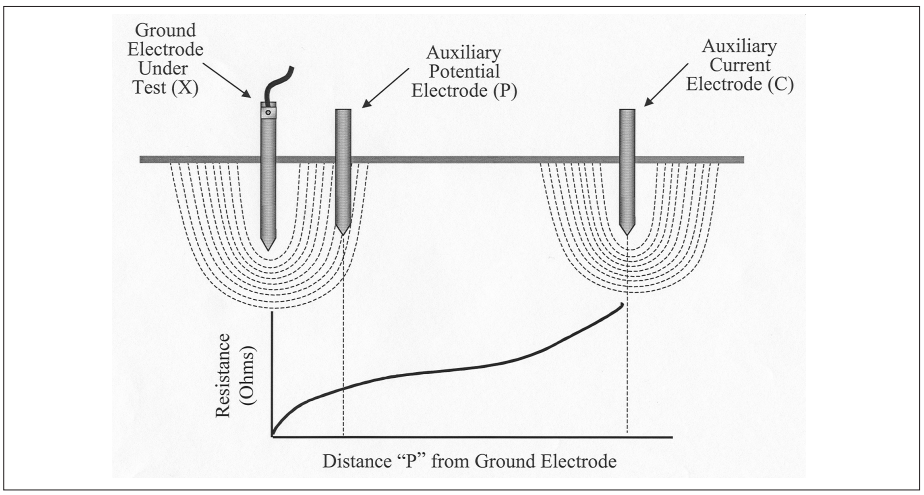


Figure 2: Insufficient spacing of potential probe

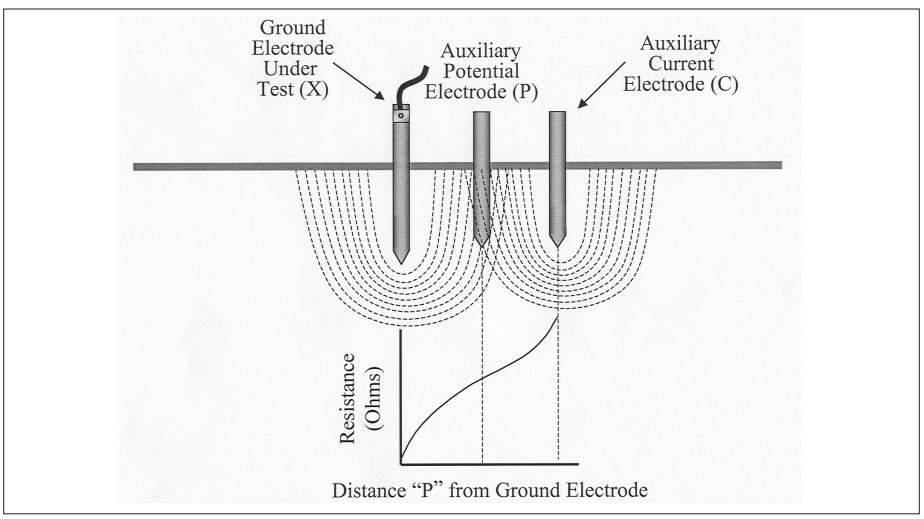


Figure 3: Insufficient spacing of current probe

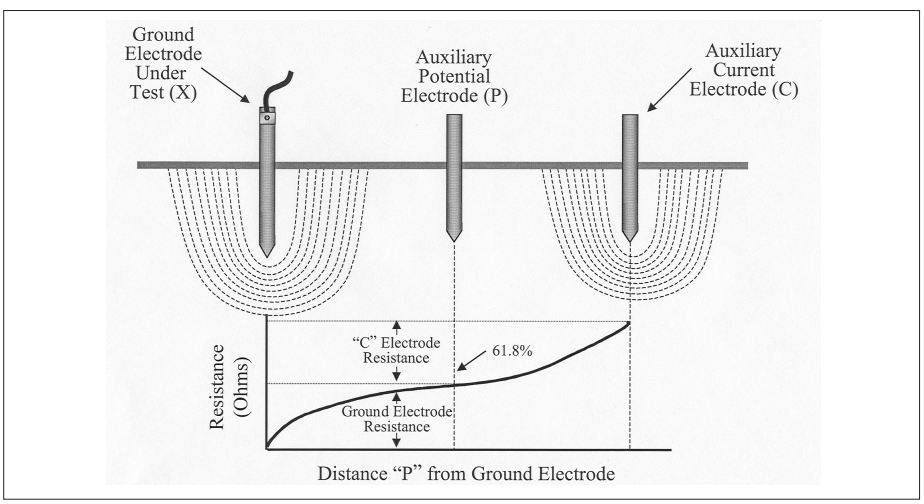


Figure 4: Correct probe spacing

TESTING LARGE SYSTEMS

Large ground systems are an important part of the protection of the electricity supply network. They ensure that fault current will enable protective devices to operate correctly. A substation must have a low ground resistance to reduce excessive voltages developing during a fault which could endanger safety of nearby people or animals.

In order to obtain a low enough value of ground resistance, ground systems may consist of an earth mat covering a large area or many interconnected rods. Suitable test techniques must be used for large systems to ensure that valid readings are obtained. This is unlike a small single electrode (i.e., a lightning conductor or domestic ground) which can be simple to test.

Fall of Potential Testing

For single electrode grounds, such as domestic grounds and lightning conductors, the influence on the surrounding soil is limited and current test spikes can be quite close (typically 30 to 60 ft.) to the electrode under test. It is usually quite easy to find a flat portion of the ground resistance curve which should be close to the resistance of the electrode.

Testing several points or drawing up a curve will help the understanding of the area around the electrode. It is always best to check results by using a different direction or a longer distance to the test spikes. This will help to eliminate errors caused by nearby buried conductors and other parts of the electrical system interfering with the results.

The Slope Method

This method enables measurement of a large ground system **without** finding the flat portion of the characteristic curve. This can reduce the test distances and, in addition, the electrical center of the ground system is not required for measurement, few calculations are necessary and the result can easily be checked giving added confidence to the test.

The Slope Method involves taking three readings at 20%, 40% and 60% to the current spike distance. The differences between these readings are used to fit to a mathematical model of the resistance characteristic. The coefficient of slope, μ, is calculated from:

$$\mu = (R_{60} - R_{40}) / (R_{40} - R_{20})$$

As with all ground testing, it is best to check the results by plotting the full characteristic and repeating the test using a different direction for the test spikes or a larger distance to the current electrode.

Large Ground Systems

The physically large areas used by ground systems such as those in substations and power stations result in large "resistance areas" and consequently large distances to the test spikes. This can typically give a value of resistance to earth of less than 0.5 Ω allowing a good path for the large prospective fault current.

The distance to the current electrode should be ten times the maximum dimension of the ground system. For a single, 6 ft. long electrode this is not usually a problem with a remote test spike at 60 ft. However, this may be impractical for a substation with a 300 ft. square ground mat. A current electrode is required approximately 3,000 ft. from the site. In cases like these, a measuring technique such as the slope method can be used. This reduces the length of cable runs and is less likely to overlap with other local ground systems which may interfere with the result.

Increase the Resolution

The Megger® DET2/2 is ideal for measuring large ground systems including substation ground mats, power station grounding and communication systems. When measuring ground resistance of less than 1 Ω, the 1 mΩ resolution allows real readings to be made without instrument errors overwhelming the results.

Using either the Fall of Potential Method or the Slope Method on large systems, means that small differences between low readings are required. The extra digit of resolution makes these variations more accurate and suitable for use with the reference tables commonly available in engineering manuals.

Noise Interference

High noise interference rejection allows ground resistance readings to be made even in the presence of induced noise. A small test signal has to be retrieved from a much larger total signal.

To remove the effect of noise from a ground test, a frequency of 128 Hz is often used. This is close enough to line frequency to give a result that can be used to make calculations of ground fault current. This frequency avoids harmonics of the standard line frequencies to allow filtering of the test signal. A filter can then remove the 50 or 60 Hz interference from the total signal.

Many ground testers can only reject noise of a single frequency. This may be acceptable in a laboratory but is inadequate for most real situations. Electrical networks contain noise consisting of the fundamental frequency of the supply and its harmonics plus high frequency noise from switching etc., and induced signals from other sources. In generic ground testers, this type of interference can cause significant measurement errors without alerting the user. Such instruments cannot reject the noise even though it is insufficient to trigger a high noise indicator.

Sometimes electrical noise may be short term and testing can be delayed until the noise has decreased, for example, a passing train when testing a railway system. However, in most cases background noise cannot be removed and so a suitable instrument specification is required.

The Megger® DET2/2 uses a sophisticated filtering system that can reject more noise than any other earth tester available. Test frequency adjustment and selectable levels of noise filtering also help to remove stray noise that could affect the reading. A high current range increases the test signal strength in comparison with the noise.

In extreme cases it may still be necessary to carry out the test when the noise has decreased. However, the DET2/2 can keep going at higher resolutions long after other earth testers have given up.

Conclusion

The latest generation of digital ground testers greatly simplify the testing of electrical ground systems. However, care is still needed interpreting the results. Error indicators can alert the user to misconnected leads or conditions that may lead to an invalid reading but simply taking one reading is not sufficient to measure the resistance of any ground electrode.

It is always best to repeat a ground test using a different direction or distance to verify the results. This may remove any errors from hidden differences in the soil and increase confidence in the results.

When selecting a ground tester, ensure that the resolution and accuracy are suitable for the application. Instrument errors can lead to unnecessary expense in the design or maintenance of ground systems or, worse still, unsafe installations.

Use a Megger® DET2/2 if testing low values (<1 Ω), or in the presence of induced noise. A high level of noise filtering is required for accurate results in real life situations.

LAZY SPIKE METHOD

Certain field conditions such as asphalt preclude the use of driven ground rods when attempting to test a ground system. In the past, the operator would have been unable to make the required test. New technology has led to the development of the "lazy spike" method of ground testing, an approach that allows for effective testing even under these types of adverse conditions.

Lazy spike takes advantage of the exceptional resistance tolerances built into the Megger® Ground Testers' current and voltage circuits in order to provide the operator with a means of dealing with the oft-encountered problem of no available soil to make contact. The "spike" (contact probe) doesn't have to break the surface in order to take a valid measurement. Suppose the test is being performed in a congested urban area, a sprawling parking lot, or an airport. Older-technology testers used to require fairly high voltages and currents in order to operate. Contact resistance with the surrounding soil posed a problem, and mandated a solidly driven probe. With recent technology, however, sensitivities have improved so that mere surface contact is frequently sufficient. And as could be expected, Megger models offer the best capabilities on the market.

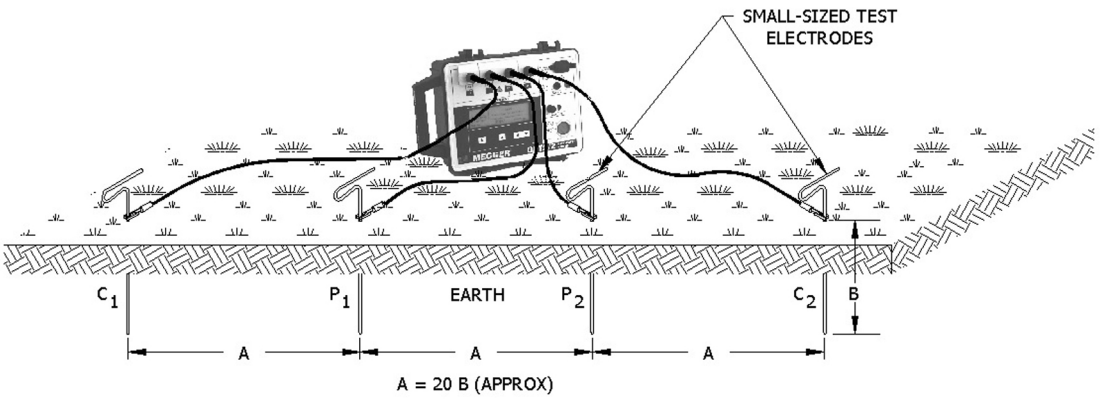
When making a measurement using the lazy spike method, simply lay the probes on the surface at the normal distances. Pouring water on the probes will improve the contact. Hook the leads to the probes and measure the resistance of the ground electrode under test.

Now, suppose you have set up to test, say, lighting grounds on an expansive mall parking lot. There is no soil surface nearby, so the contact probes are laid on the surface and wetted down. Oops! The Megger Ground Tester's convenient and indispensable warning indicators light, informing the operator that insufficient contact has been made. Is the opportunity lost? No! **Simply substitute a coiled metal chain for the straight spike, clip on the lead, and wet down the area.** Coiled metal chain provides an excellent surface contact for the conductance of electrical current, and even better, it can be infinitely varied. Just add more length, until contact resistance is brought within the tester's already broad range, and the warning indicators extinguish.

Proceed with the test! Megger's top-of-the-line capabilities are amenable to the kind of variety and flexibility that will keep you operating.

SOIL RESISTIVITY TESTING (4 point method)

The most common method utilized for measuring soil resistivity is the Four Point Method using the equally spaced Wenner Arrangement. This method is commonly referred to as the Four Pin Method. This method is the most accurate method in practice for measuring the average soil resistivity of large volumes of earth. This method utilizes a specialized ground test instrument that has a four-terminal arrangement. Small electrodes are driven into the earth, all at depth B and spaced (in a straight line) at equal distance intervals A. The test current (I) is passed between the two outer electrodes (C1 and C2) and the voltage (V) is measured between the two inner electrodes (P1 and P2). The instrument knowing the voltage and current calculates the resistance from Ohms law (V/I) and gives the resistance (R) in ohms.



Four Point Method using Equally Spaced Pin Arrangement

The average soil resistivity ρ (ohm•cm) is calculated by the following formula where R is the resistance measured in ohms, (A) is the pin spacing expressed in centimeters and (B) is the depth that the pins are inserted into the soil also expressed in centimeters and π is the constant 3.1416.

$$\rho = \frac{4 \cdot \pi \cdot A \cdot R}{1 + \frac{2A}{\sqrt{A^2 + 4B^2}} - \frac{A}{\sqrt{A^2 + B^2}}}$$

(A and B in cm)

This soil resistivity (ρ) value is an indication of the average soil resistivity to a depth which is equal to the pin separation distance (A). If the condition whereby the pin separation distance (A) is more than 20 times the pin depth (B) then the formula for resistivity above can be simplified to the following:

$$\rho = 2 \cdot \pi \cdot A \cdot R$$

(A in cm)

In practice pin separation distance A is measured in feet, so the following formula can be used to calculate the average soil resistivity when A is expressed in feet. The constant takes into account the conversion from feet to centimeters.

$$\rho = 191.5 \cdot A \cdot R$$

(A in feet)

Megger® Ground Testing Equipment

High Sensitivity Ground Resistance Tester

The Megger® DET2/2 remains the line leader with its remarkable 40 V tolerance feature and .001 resolution readings. In addition, the DET2/2 has matchless added capabilities that make it virtually undefeatable in field testing in the worst electrical environments.

The features of the DET2/2 include an interference filter (on/off) and test current control (high/low). But above all, the test current frequency is adjustable in half-Hertz increments over the full range from 105 to 160 Hz. If soil transients are affecting the measurement, a display annunciator alerts the user. The operator need only dial to a different test frequency, away from the troublesome harmonic, while observing the annunciator disappear and the reading stabilize.

When testing in extreme electrical environments around utility substations or heavy industrials, the extra capabilities of the DET2/2 will quickly prove indispensable.



The DET2/2 is ideal for testing complex systems such as encountered in larger substations or telecommunications grounding systems.

Part No.	Range Resistance	Power Source	Display	Wt.
DET2/2	0.010 Ω - 19.99 kΩ	Rechargeable Battery	Digital	11 lbs.

Testing Application	Application Examples	Resistivity	Testing Requirements	Instrument Type
Large, complex grounding systems; extreme ac interference voltage present	Large substations; switchyard	Yes	Highest accuracy and precise resolution required	4-terminal high sensitivity

• See page 259 for Ground Test Kits.

Three Terminal Ground Resistance Tester

The Three-Terminal Ground Resistance Tester is the economical choice for electrical contractors, plant electricians, telephone and CATV technicians making routine ground resistance tests on single electrodes and other simple grounding systems. The instrument is easy to use for quick measurement of resistances from 0.5 to 500 ohms.

Designed for simplicity of use, the instrument is operated by a single three-position switch to read the measurement, check the probe resistance and turn the instrument off. Measurements are displayed directly in ohms; range changing, multipliers or calibration adjustments are not necessary.



Part No.	Range Resistance	Power Source	Display	Wt.
250260	0.5 Ω - 500 Ω	4C Batteries	Analog	3 lbs.

Testing Application	Application Examples	Resistivity	Testing Requirements	Instrument Type
Simple ground system	Pole grounds; residential wiring systems	No	High resolution required	3-terminal

Megger® Ground Testing Equipment
DET4 Contractor Series



DET4TR2
Rechargeable battery



DET4TD2
Dry cell battery

The four-terminal model adds soil resisitivity measurement to ground resistance and bonding. With this added function, the tester has full capability for all measurements necessary for location, design, installation, and maintenance of a grounding system.

Features:
- IP54 rated
- 2, 3 and 4 point testing
- Resistance measurement range to 200,000 Ω
- Selectable 25 V or 50 V output
- Simple one button operation
- Hardwearing carry case
- Delivered with FREE calibration certificate

Kit includes:
- Lead and stake kit

All models have a rugged, field-ready case design that assures toughness and facilitates easy use. The large selector switch and LCD promote ease of operation and viewing, to reduce error and enhance efficiency in the field. Automatic indicators warn the operator of insufficient probe contact. The uniquely designed selector permits two-, three-, and four-terminal tests to be performed by selection alone.

All models are rated IP54 against moisture and dirt penetration, making them a match for field weather and environmental conditions that would quickly render a lesser instrument out of service. They come provided with carrying case, leads and stakes, so as to be fully ready for field use upon purchase. A variety of extra leads are available to meet unusual field challenges.

"Grounds" are considered normally "dead", when in fact they are often "live", a situation that invites accident and injury. These new instruments are provided with an additional 100 V check to enable the operator to verify safety before proceeding. For protection against arc flash/arc blast, the units are rated to IEC1010-1 CAT IV 100 V.

Measurement range is from 0.01 Ω to 20 kΩ at 2% accuracy. Noise protection of 40 V peak-to-peak is the best on the market.

Selection Guide	DET4TR2	DET4TD2
2-wire Resistance	•	•
3-wire Resistance	•	•
4-wire Resistance	•	•
Resistance Range & Accuracy	0.01 to 2000 Ω 2% ± 3 digits	0.01 to 2000 Ω 2% ± 3 digits
Earth Voltage Range	0 to 100 V	0 to 100 V
Display	Digital	Digital

Megger® Earth/Ground Resistance & Leakage Current Clamp Testers

Part No.	Description	Approx. Each Wt. (lbs.)
DET10C	Clamp-On Ground Resistance Tester	1-1/2
DET20C	Clamp-On Ground Resistance Tester	1-1/2

Description

The Megger models DET10C and 20C measure earth/ground resistance and current flow using clamp-on technology. The instruments induce a test current into the system without the need to disturb existing connections. Either unit is a useful addition to the more traditional methods of earth/ground resistance testing that may require disconnection and the use of stakes or ground rods. Simply clamp around the conductor or stake/rod and measure the resistance to ground fast and accurately.

The DET10C and 20C can also be used to measure earth/ground resistance in multiple loop installations without disconnecting the earth or ground. This allows the user to perform the test quickly and easily in total safety, with the added convenience of having a single point of measurement to read the earth/ground resistance.

Each instrument also provides a true RMS current measurement reading to better indicate potential measurement problems and provide a useful overview of the dynamics of the general earth/ground system.

The units are rugged, compact and have configurable audible alarms. They also feature auto shutdown (which is also configurable), data storage and self calibration on power-up, and are supplied with a calibration loop – all contained in a rugged carry case. The DET20C also comes with a USB interface cable and is compatible with Megger Download Manager Software (included) allowing further analysis and storage of data.

Application

The DET10C and 20C have a variety of applications including:

- Use to measure resistance and continuity of grounding loops around pads and buildings.
- Use on multi-grounded systems without disconnecting the ground rod/stake under test.
- Use to measure leakage current flowing to ground or circulating in ground systems.
- Use on cell towers, RF transmitters and telecommunications sites.
- Use to inspect and verify lightning protection systems.
- Use on a variety of consumer installations, including pools, spas, etc.

Features & Benefits



- Easy and fast clamp-on operation. No need for cables or auxiliary rods/stakes.
- Large LCD display screen that can be read in bright sunlight.
- Measures ground resistance from 0.025Ω to 1550Ω.
- Direct reading of continuity and ground loop resistance.
- Measures ground leakage or phase current from 0.2mA to 35A.
- Large jaw opening to accommodate a variety of conductors.
- Indication of high noise content that may affect readings.
- Lightweight; only 750g (1.65lbs), yet exceptionally rugged for regular field use.
- Hold function for difficult to reach installations.
- Auto-off to save on battery power.
- Configure high and low alarms with audible indication for fast field checks.
- On board storage of test results (up to 8180 records).
- Calibration check loop to insure proper operation.
- Rugged, yet lightweight storage case contains complete testing kit.
- USB interface for download of test data for later analysis (DET20C).

Included Accessories:

(1) Carrying case (DET10C & DET20C)
(1) Calibration loop (DET10C & DET20C)
(1) Battery (fitted) (DET10C & DET20C)
(1) USB interface cable (DET20C)
(1) Download Manager Software (DET20C)

Megger® Earth/Ground Resistance & Leakage Current Clamp Testers

Specifications

General Specifications:

Conductor size:	35mm Ø approx.
Battery type:	9V IEC 6 LR61 alkaline
Display type:	4 digits 9999 counts LCD
Range selection:	Automatic within function
Overload indication:	"OL" on display
Power consumption:	40 mA
Battery life:	3000 measurements approx.
Auto power down:	5 minutes approx.
Sampling time:	0.5 seconds
Operating temperature:	0 to 50° C
Storage temperature:	-20° C to 60° C
Operating humidity:	Less than 85% RH
Storage humidity:	Less than 75% RH
Dimensions:	10.8" L x 3.9" W x 1.9" H
	276mm L x 100mm W x 47mm H

Data logging capacity DET10C: 116 records
Data logging capacity DET20C: 8180 records



The DET20C being used to test a facility ground.

Electrical Specifications:

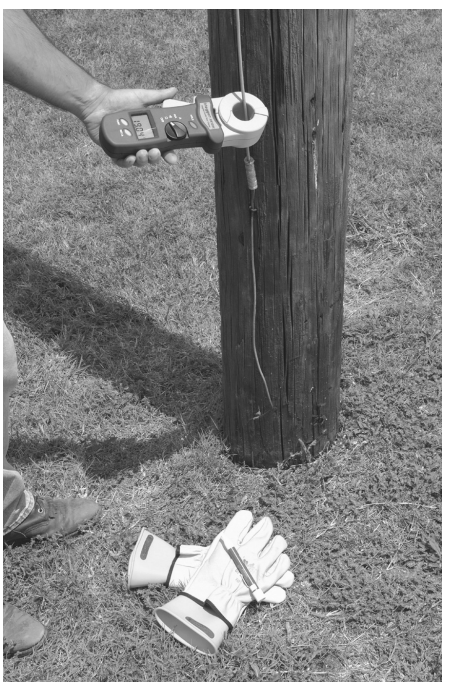
Range (2)	Resolution	Accuracy (1)
0.025 - 0.250 Ω	0.002 Ω	± 1.5% ± 0.05 Ω
0.25 - 9.999 Ω	0.02 Ω	± 1.5% ± 0.1 Ω
10 - 99.99 Ω	0.04 Ω	± 2.0% ± 0.3 Ω
100 - 199.9 Ω	0.4 Ω	± 3.0% ± 1.0 Ω
200 - 400 Ω	2 Ω	± 5.0% ± 5 Ω
400 - 600 Ω	5 Ω	± 10% ± 10 Ω
600 - 1500 Ω	20 Ω	± 20%

(1) Loop resistance non-inductive, external field <50 A/m, external electrical field <1 V/m, conductor centered in jaws.
(2) Resistance measurement frequency: 1.667 KHz

Alarm Type	Range	Resolution
High Alarm	0 - 1550 Ω	1 Ω
Low Alarm	0 - 1550 Ω	1 Ω

Leakage Current Range (3)	Resolution	Accuracy
0.200 - 1.000 mA	0.001 mA	± 2.0% ± 0.05 mA
1.00 - 10.00 mA	0.01 mA	± 2.0% ± 0.03 mA
10.0 - 100.0 mA	0.1 mA	± 2.0% ± 0.3 mA
100 - 1000 mA	1 mA	± 2.0% ± 3 mA
0.20 - 35 A	0.01 A	± 2.0% ± 0.03 A

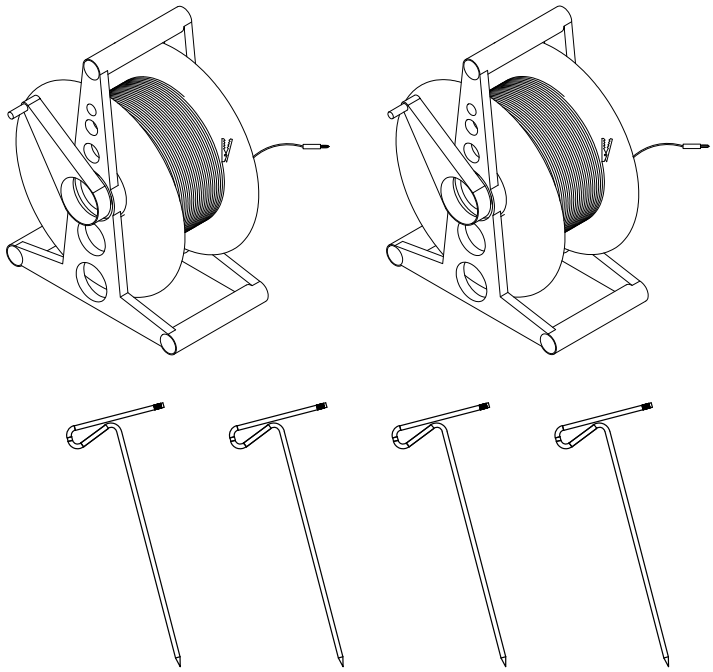
(3) Auto range, 50/60Hz, true RMS to crest factor <3.5



The DET20C being used to test a pole ground.

Harger Ground Test Kits

Accessory test kits are designed for doing three point measurements on larger sites.

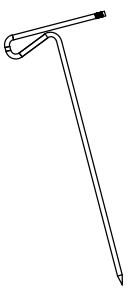


Part No.	Description	Qty.	Approx. Each Wt. (lbs.)
GTKIT300	Test Kit with 300' long test leads & 12 spikes	EA	20
GTKIT500	Test Kit with 500' long test leads & 12 spikes	EA	25

GTKIT Includes:

(2) 300' or 500' long test lead reels. Durable reel with leads made from #18 AWG (65/36) test lead wire.

(12) Test spikes. Spikes are 24" long and made of steel with a dipped zinc ultra-seal finish.



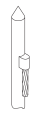
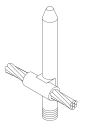
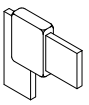
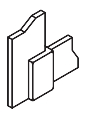
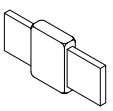
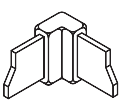
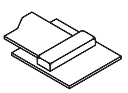
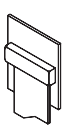
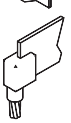
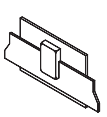
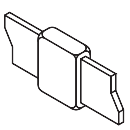
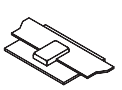
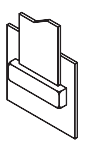
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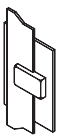
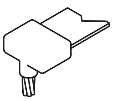
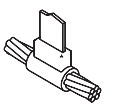
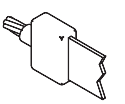
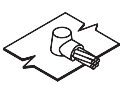
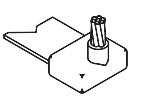
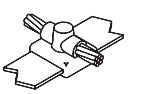
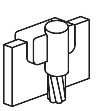
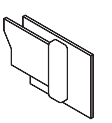
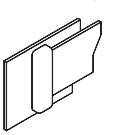
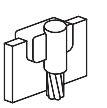
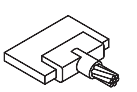
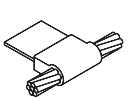
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Exothermic Connections

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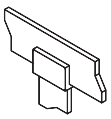
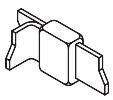
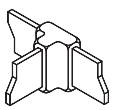
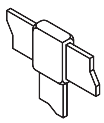
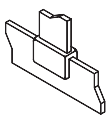
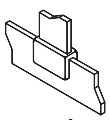
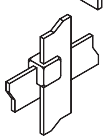
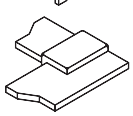
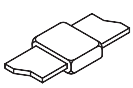
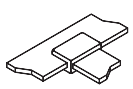
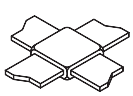
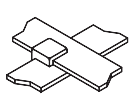
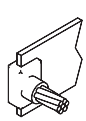
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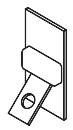
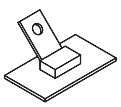
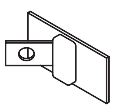
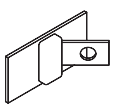
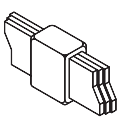
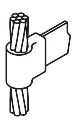
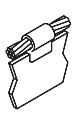
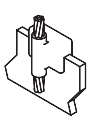
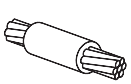
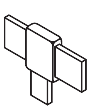
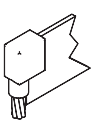
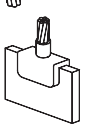
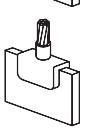
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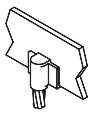
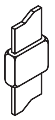
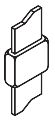
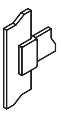
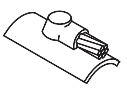
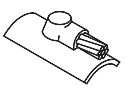
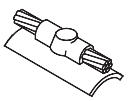
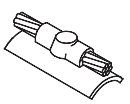
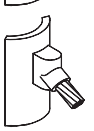
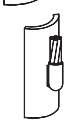
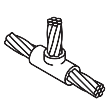
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	BCE	No	
	BCF	No	
	BCU	No	
	BCX	No	
	BD	Yes	299
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	BDW	No	
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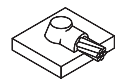
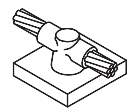
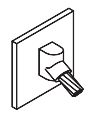
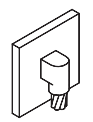
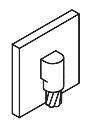
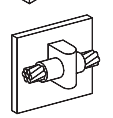
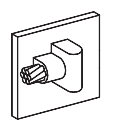
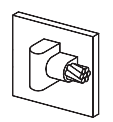
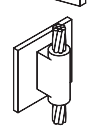
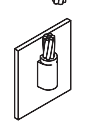
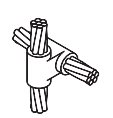
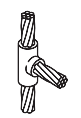
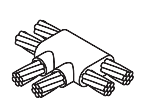
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	BHEBHT	No	
	BHEBVTD	No	
	BHEBVTT	No	
	BHEBVTU	No	
	BHEXC	No	
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	BHFBHX	No	
	BHFBHXC	No	
	BL	No	

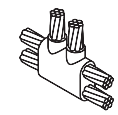
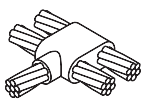
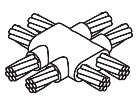
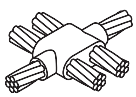
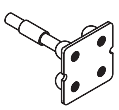
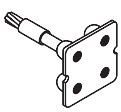
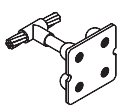
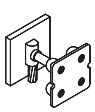
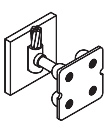
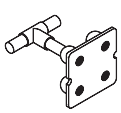
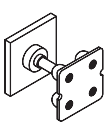
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	BLRVS	No	
	BMB	No	
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	BP	No	
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	BT	Yes	303
	BTE	No	
	BU	Yes	301
	BUW	No	

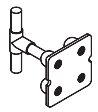
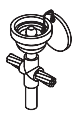
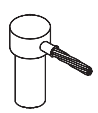
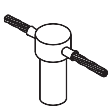
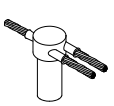
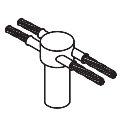
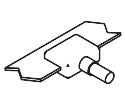
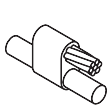
Connection Types

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	BVFBVFT	No	
	BVFBVT	No	
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	CACIHD	No	
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	CH	No	

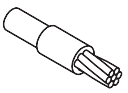
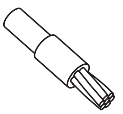
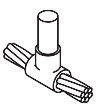
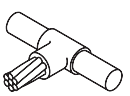
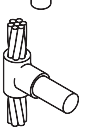
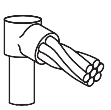
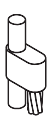
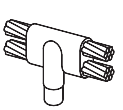
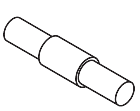
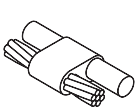
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	CIVD	No	
	CIVDO	No	
	CIVH	No	
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	CIVT	No	
	CIVU	No	
	CS	No	
	CT	No	
	DPRDT	No	

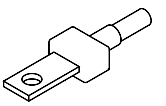
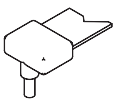
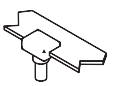
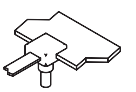
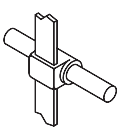
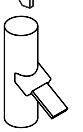
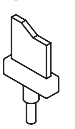
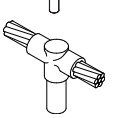
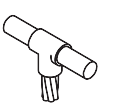
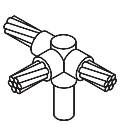
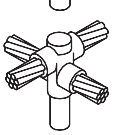
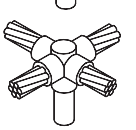
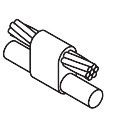
Connection Types

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	DX	No	
	DX1C	No	
	EGPBS	No	
	EGPCB	Yes	317
	EGPCT	Yes	317
	EGPCVD	No	
	EGPCVU	No	
	EGPGRT	No	
	EGPHB	No	
	EGPID	Yes	317
	EGPIO	Yes	317

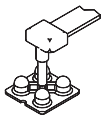
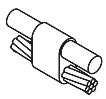
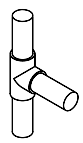
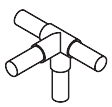
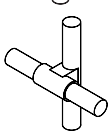
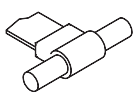
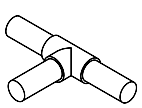
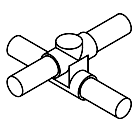
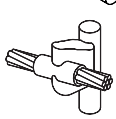
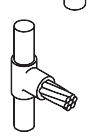
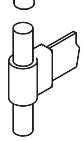
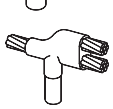
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	EGPVBS	No	
	FGRBS	Yes	320
	FGRGD	Yes	320
	FGRGO	Yes	320
	FGRIGD	Yes	320
	FGRIGO	Yes	320
	G11	Yes	312
	G21	Yes	312
	G31	Yes	312
	G41	Yes	312
	GASO	No	
	GB	No	

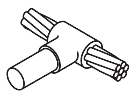
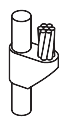
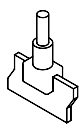
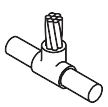
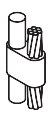
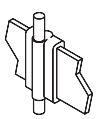
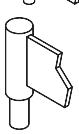
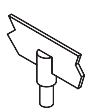
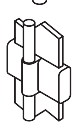
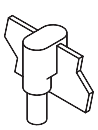
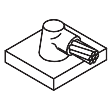
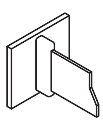
Connection Types

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	GCD	No	
	GCH	No	
	GCT	No	
	GCU	No	
	GCV	No	
	GD	Yes	282
	GE	No	
	GF	Yes	283
	GG	Yes	286
	GGH	No	
	GH	No	

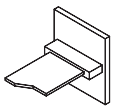
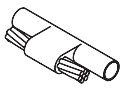
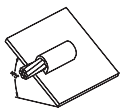
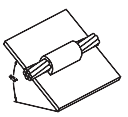
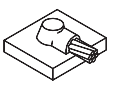
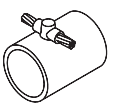
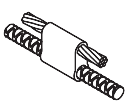
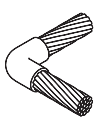
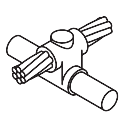
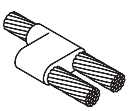
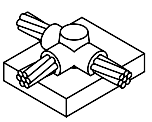
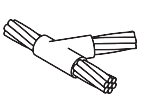
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	GHSO	No	
	GHSRT	No	
	GHVSX	No	
	GLA	No	
	GLV	No	
	GO	Yes	284
	GOC	No	
	GOT	No	
	GOXO	No	
	GOXX	No	
	GP	No	

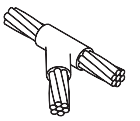
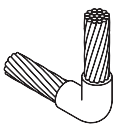
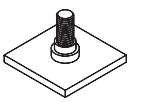
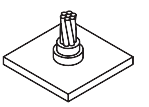
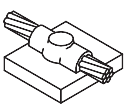
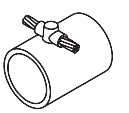
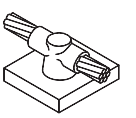
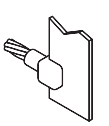
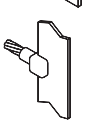
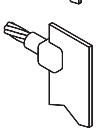
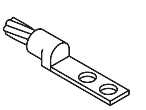
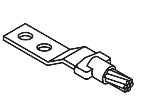
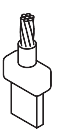
Connection Types

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	GPT	No	
	GRH90B	No	
	GRHT	No	
	GROT	No	
	GRS	No	
	GRST	No	
	GRT	No	
	GRXO	No	
	GS	Yes	285
	GSC	No	
	GSSD	No	
	GT	Yes	286

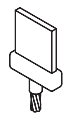
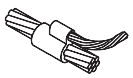
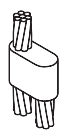
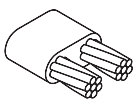
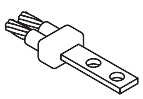
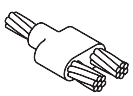
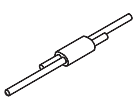
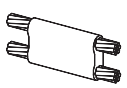
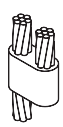
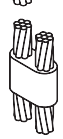
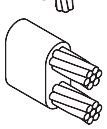
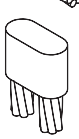
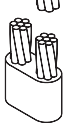
	Connection Type	Catalog Item	Page
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	GUBV	No	
	GUC	No	
	GV	No	
	GVSAS	No	
	GVSD	No	
	GVSO	No	
	GVSP	No	
	GVSS	No	
	HB	Yes	287
	HBCP	No	
	HBUVS	No	

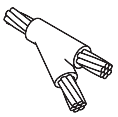
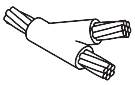
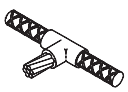
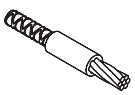
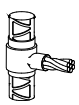
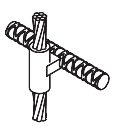
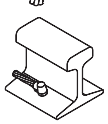
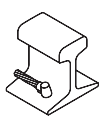
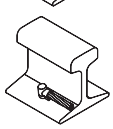
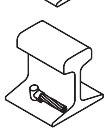
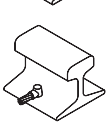
Connection Types

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	HCHP	No	
	HCLVS45	No	
	HCTVS45	No	
	HD	Yes	287
	HPHCX	No	
	HRCT	No	
	HRDHT	No	
	HRH90B	No	
	HRHCX	No	
	HRPHT	No	
	HRT	No	
	HRV30TL	No	

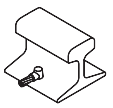
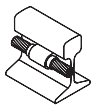
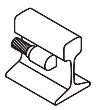
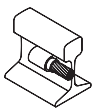
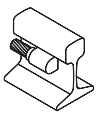
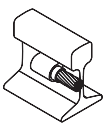
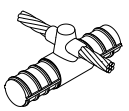
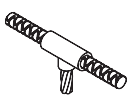
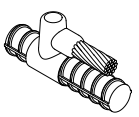
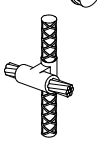
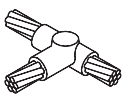
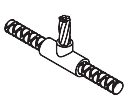
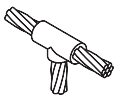
	Connection Type	Catalog Item	Page
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	HRV90B	No	
	HSVB	No	
	HSVC	No	
	HT	Yes	289
	HTCP	No	
	HU	Yes	289
	HVBB	No	
	HVBM	No	
	HVBT	No	
	LBJ	Yes	298
	LE	Yes	297
	LU	No	

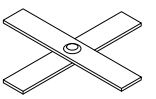
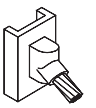
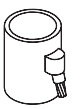
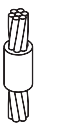
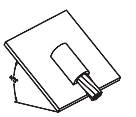
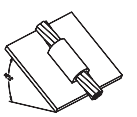
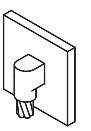
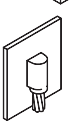
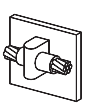
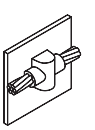
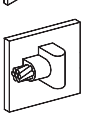
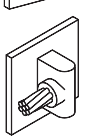
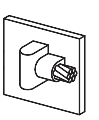
Connection Types

	Connection Type	Catalog Item	Page
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	PD	No	
	PHD	No	
	PRLE	No	
	PRPT	No	
	PS	Yes	278
	PT	Yes	278
	PU	No	
	PV	No	
	PVD	No	
	PVDD	No	
	PVDU	No	

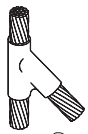
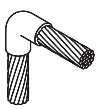
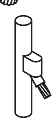
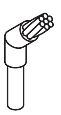
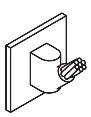
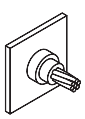
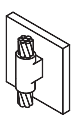
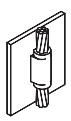
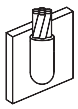
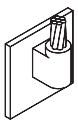
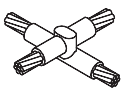
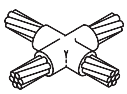
	Connection Type	Catalog Item	Page
	RATD	No	
	RATU	No	
	RB	Yes	305
	RCB	No	
	RCD	No	
	RCU	No	
	RE	Yes	306
	RHCVT	No	
	RMFPL	No	
	RMFPLB	No	
	RMFPR	No	
	RMFPRB	No	
	RMFT	No	

Connection Types

	Connection Type	Catalog Item	Page
	RMFTB	No	
	RMVH	Yes	310
	RMVL	Yes	311
	RMVR	Yes	311
	RMVLB	No	
	RMVRB	No	
	RO	Yes	307
	ROC	No	
	RP	Yes	308
	RS	Yes	309
	RT	Yes	279
	RUC	No	
	RVT	No	

	Connection Type	Catalog Item	Page
	SRG	No	
	VA	Yes	290
	VACP	No	
	VBS	No	
	VCDVS45	No	
	VCTVS45	No	
	VD	Yes	290
	VDO	No	
	VH	Yes	293
	VHO	No	
	VL	Yes	293
	VLO	No	
	VR	Yes	293

Connection Types

	Connection Type	Catalog Item	Page
	VR45DT	No	
	VRCD	No	
	VRCT	No	
	VRCU	No	
	VRH90B	No	
	VRV45T	No	
	VRVCAD	No	
	VRVCAU	No	
	VSAU	No	
	VSHB	No	
	VSHBS	No	
	VT	Yes	295
	VTO	No	
	VU	Yes	295
	VUO	No	
	XO	Yes	280
	XX	Yes	281

Exothermic Process

Exothermic Process

The Exothermic Process is an effective and safe method of welding copper to copper or copper to steel for the purpose of producing permanent electrical connections. Exothermically welded connections are produced from the energy and molten copper metal liberated from an exothermic reaction between powdered copper oxide and aluminum. The exothermic reaction takes place at a theoretical temperature of 4600°F and as a result, molten copper alloy is created and used to melt the conductors and cast the finished connection. The exothermic reaction takes place in a semi-permanent graphite mold that will last 50 or more welds if properly cared for. The process is simple and easy to implement providing an on-site means to make welded electrical connections without requiring external power, equipment or the special training usually required for brazing and welding. The process will provide a finished connection that will never corrode, loosen or increase in resistance. The finished connection also provides an ampacity that exceeds that of the conductors being joined.



UltraShot® (Drop-In)

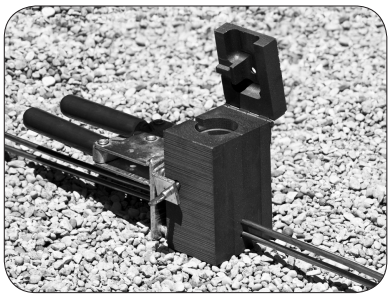


NUWTube® (Pour & Shoot)

NUWTube Pour & Shoot Process



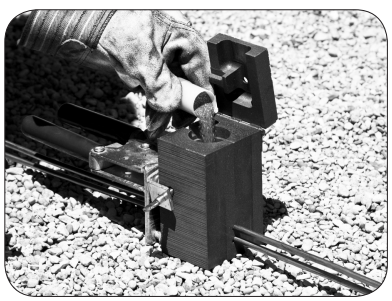
Step 1:
- Torch dry the mold before making the first connection



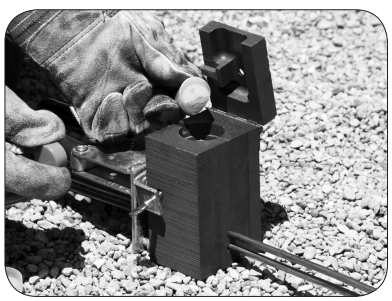
Step 2:
- Clean and dry conductors
- Insert conductor into mold
- Close handle clamp and lock mold



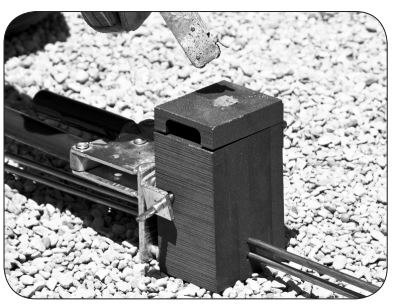
Step 3:
- Insert disk into mold



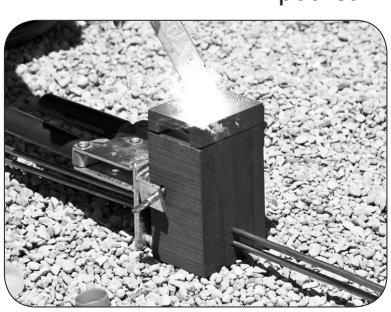
Step 4:
- Remove Clear plastic cap from NUWTube
- Pour weld metal into mold



Step 5:
- Remove Orange cap from NUWTube
- Pour 2/3 of the starting material on top of weld metal
- Close lid
- Sprinkle remaining starting powder in the lid's ignition pocket



Step 6:
- Ignite material located on top of the lid using a flint igniter (FLTIG)



Step 7:
- After the connection is complete, open the mold and remove the connection
- Remove slag and clean mold before making the next connection



Complete NUWTUBE connection

Note: When exothermic welding, always wear proper clothing, safety glasses and gloves. Harger offers Ultraweld training. Please contact the factory for more information.

UltraShot® Exothermic Process

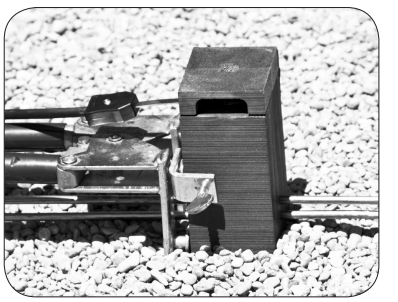
UltraShot Drop-In Process



Step 1:
- Clean and dry conductors and mold
- Insert conductors into mold



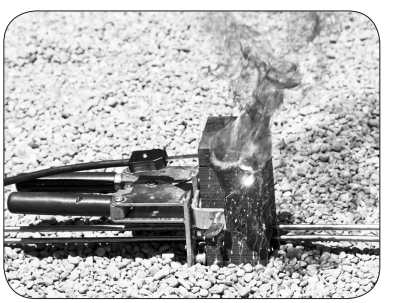
Step 2:
- Close handle clamp and lock mold
- Insert UltraShot drop-in into mold



Step 3:
- Attach cord to UltraShot igniter



Step 4:
- Push and hold both igniter buttons at the same time



Step 5:
- Reaction is made
- Open mold and remove connection
- Remove slag before next connection



A completed UltraShot connection

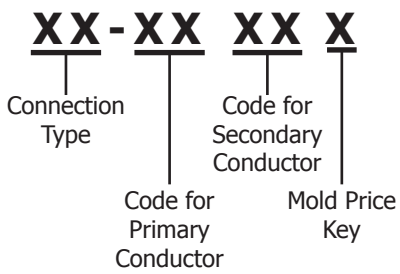
Note: When exothermic welding, always wear proper clothing, safety glasses and gloves. Harger offers UltraShot training. Please contact the factory for more information.

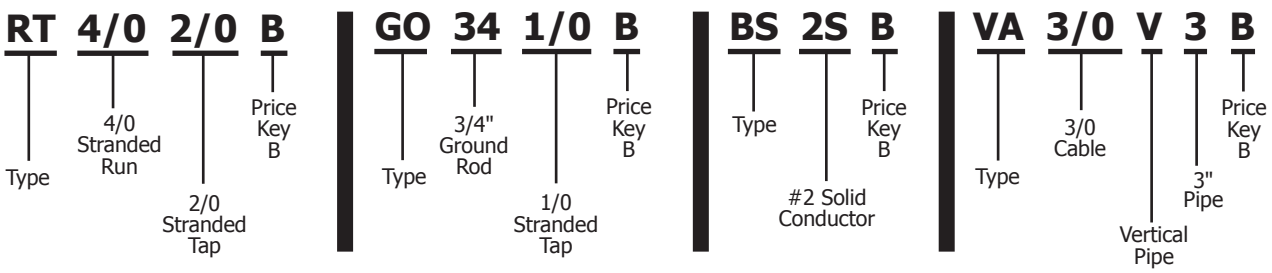
Mold Numbering System

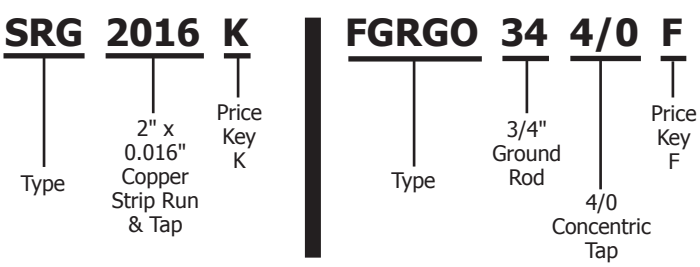
Mold Numbering System

The Part Number gives, in code, the complete information of the mold.

- Type of connection, conductor size(s) and mold price key.
- Some connection types have more than 2 characters.





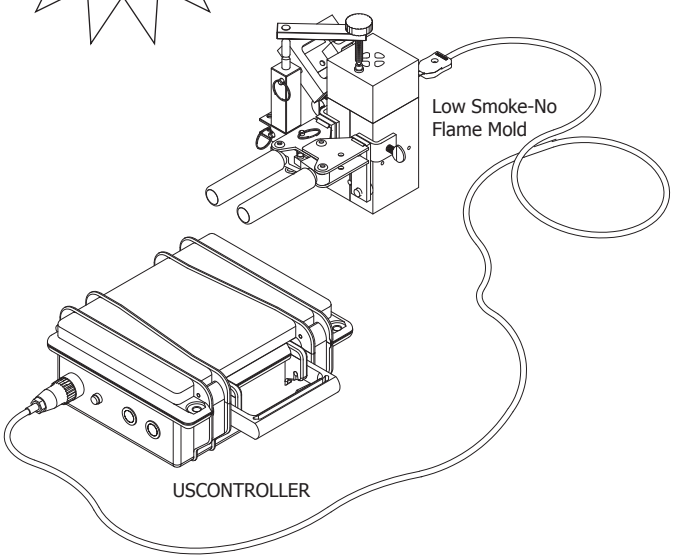


Low Smoke-No Flame System

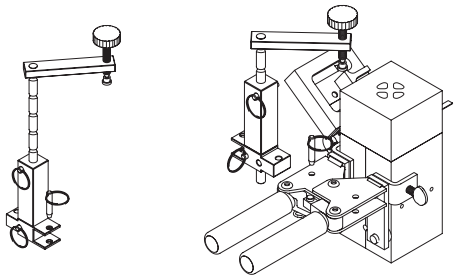
Harger Lightning & Grounding offers the industry's best Low Smoke-No Flame System for indoor applications, confined spaces, high-risk fire environments and added safety for operators. The process uses Harger's standard Ultraweld molds, standard UltraShot weld metal and standard USCONTROLLER ignition system with a consumable filter to produce a finished connection with minimal smoke emission and zero flame.

- The filter should be changed every connection to ensure the best performance.
- Ignition is accomplished with the use of a USCONTROLLER.

NEW

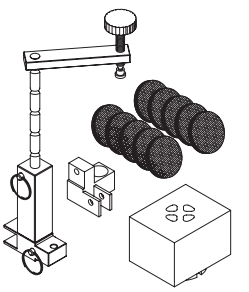


Part No.	Qty.	Approx. Each Wt. (lbs.)
USCONTROLLER	EA	11



Low Smoke-No Flame Adapter Clamp

Part No.	Qty.	Approx. Each Wt. (lbs.)
USSXADPTR	EA	4



Low Smoke-No Flame Kits

Part No.	Weld Metal Size	Approx. Each Wt. (lbs.)
USSKIT1	25 thru 115	6
USSKIT2	150 thru 300	6
USSKIT3	400	6

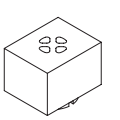
Kit Includes:
(1) Low Smoke-No Flame Adapter Clamp (USSXADPTR)
(1) Replacement Filter Housing
(10) Low Smoke-No Flame Filters



Low Smoke-No Flame Filters

Part No.	Filter Housing	Approx. Pack Wt. (lbs.)
USSXFLR1.8	SAFHB25115	1/2
USSXFLR2	SAFHB150300	1/2
USSXFLR3	SAFHC400	1/2

• Sold as 10 pack.



Replacement Filter Housing

Part No.	Weld Metal Size	Approx. Each Wt. (lbs.)
SAFHB25115	25 thru 115	1/2
SAFHB150300	150 thru 300	1/2
SAFHC400	400	3/4

BS / PB Cable to Cable

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- Molds with Price Key "**L**" SOLD WITH HANDLES.
- If Handles not required, add suffix "-X" after the Mold Part No.
- Handles for "**L**" Price Key molds DO NOT INCLUDE Flint Igniters.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds
FLTIG - Flint Igniter when Price Key is "**L**"

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



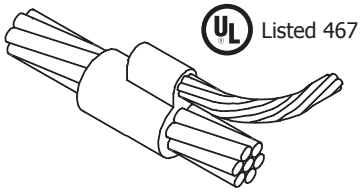
Listed 467

BS

(Butt End Splice of Horizontal Cables)

BS Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6 Sol	BS-6S**L**	US25	NUWTUBE25
#4	BS-4**L**	US25	NUWTUBE25
#2 Sol	BS-2S**L**	US32	NUWTUBE32
#2	BS-2**L**	US32	NUWTUBE32
1/0	BS-1/0**B**	US45	NUWTUBE45
2/0	BS-2/0**B**	US65	NUWTUBE65
3/0	BS-3/0**B**	US90	NUWTUBE90
4/0	BS-4/0**B**	US90	NUWTUBE90
250 MCM	BS-25CM**B**	US115	NUWTUBE115
300 MCM	BS-3CM**B**	US115	NUWTUBE115
350 MCM	BS-35CM**B**	US150	NUWTUBE150
500 MCM	BS-5CM**B**	US200	NUWTUBE200
750 MCM	BS-75CM**C**	US300	2-NUWTUBE150
1000 MCM	BS-1MM**C**	US400	2-NUWTUBE200



Listed 467

PB

(Parallel Tap of Horizontal Cables)

PB Connection Type

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
#6	#6	PB-66**B**	US25	NUWTUBE25
#4	#8 Sol	PB-48S**B**	US32	NUWTUBE32
	#6 Sol	PB-46S**B**	US32	NUWTUBE32
	#6	PB-46**B**	US32	NUWTUBE32
	#4	PB-44**B**	US32	NUWTUBE32
#2 Sol	#2 Sol	PB-2S2S**B**	US65	NUWTUBE65
#2	#8 Sol	PB-28S**B**	US32	NUWTUBE32
	#6 Sol	PB-26S**B**	US32	NUWTUBE32
	#6	PB-26**B**	US32	NUWTUBE32
	#4	PB-24**B**	US45	NUWTUBE45
	#2	PB-22**B**	US65	NUWTUBE65
1/0	#8 Sol	PB-1/08S**B**	US45	NUWTUBE45
	#6 Sol	PB-1/06S**B**	US45	NUWTUBE45
	#6	PB-1/06**B**	US45	NUWTUBE45
	#4	PB-1/04**B**	US65	NUWTUBE65
	#2 Sol	PB-1/02S**B**	US65	NUWTUBE65
	#2	PB-1/02**B**	US65	NUWTUBE65
	1/0	PB-1/01/0**B**	US90	NUWTUBE90
2/0	#8 Sol	PB-2/08S**B**	US65	NUWTUBE65
	#6 Sol	PB-2/06S**B**	US65	NUWTUBE65
	#6	PB-2/06**B**	US65	NUWTUBE65
	#4	PB-2/04**B**	US65	NUWTUBE65
	#2 Sol	PB-2/02S**B**	US90	NUWTUBE90
	#2	PB-2/02**B**	US90	NUWTUBE90
	1/0	PB-2/01/0**B**	US115	NUWTUBE115
	2/0	PB-2/02/0**B**	US115	NUWTUBE115
4/0	#8 Sol	PB-4/08S**B**	US90	NUWTUBE90
	#6 Sol	PB-4/06S**B**	US90	NUWTUBE90
	#6	PB-4/06**B**	US90	NUWTUBE90
	#4	PB-4/04**B**	US90	NUWTUBE90
	#2 Sol	PB-4/02S**B**	US115	NUWTUBE115
	#2	PB-4/02**B**	US115	NUWTUBE115
	1/0	PB-4/01/0**B**	US115	NUWTUBE115
	2/0	PB-4/02/0**B**	US115	NUWTUBE115
	4/0	PB-4/04/0**B**	US150	NUWTUBE150

Cable to Cable — PS / PT

Mold Information:

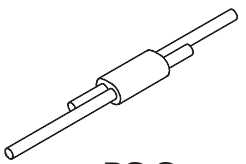
- **PS** molds listed are for solid or concentric stranded copper conductors.
- **PT** molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- Molds with Price Key "**L**" & "**M**" SOLD WITH HANDLES.
- If Handles not required, add suffix "-X" after the Mold Part No.
- Handles for "**L**" & "**M**" Price Key molds DO NOT INCLUDE Flint Igniters.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:

MH1 - Handle for "**B**" Price Key Molds
FLTIG - Flint Igniter when Price Key is "**L**" & "**M**"

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush

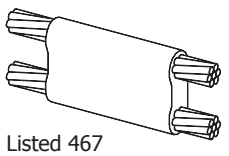


PS

(Parallel Thru Splice of Horizontal Cables)

PS Connection Type

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
#8 Sol	#8 Sol	PS-8S8S**L**	US25	NUWTUBE25
#8	#8	PS-88**L**	US25	NUWTUBE25
#6 Sol	#6 Sol	PS-6S6S**L**	US25	NUWTUBE25
#6	#6	PS-66**L**	US25	NUWTUBE25
#4 Sol	#4 Sol	PS-4S4S**M**	US32	NUWTUBE32
#4	#4	PS-44**M**	US32	NUWTUBE32
#2 Sol	#2 Sol	PS-2S2S**M**	US45	NUWTUBE45



Listed 467

PT

(Parallel Thru Splice of Horizontal Cables, Tap Conductor Over Run)

PT Connection Type

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
#6	#6	PT-66**B**	US25	NUWTUBE25
#4	#8 Sol	PT-48S**B**	US32	NUWTUBE32
	#8	PT-48**B**	US32	NUWTUBE32
	#6 Sol	PT-46S**B**	US32	NUWTUBE32
	#6	PT-46**B**	US32	NUWTUBE32
	#4	PT-44**B**	US32	NUWTUBE32

PT Connection Type continued

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	Ultraweld
#2 Sol	#2 Sol	PT-2S2S**B**	US65	NUWTUBE65
#2	#8 Sol	PT-28S**B**	US45	NUWTUBE45
	#8	PT-28**B**	US45	NUWTUBE45
	#6 Sol	PT-26S**B**	US45	NUWTUBE45
	#6	PT-26**B**	US45	NUWTUBE45
	#4	PT-24**B**	US65	NUWTUBE65
	#2 Sol	PT-22S**B**	US65	NUWTUBE65
	#2	PT-22**B**	US65	NUWTUBE65
1/0	#8 Sol	PT-1/08S**B**	US65	NUWTUBE65
	#8	PT-1/08**B**	US65	NUWTUBE65
	#6 Sol	PT-1/06S**B**	US65	NUWTUBE65
	#6	PT-1/06**B**	US65	NUWTUBE65
	#4	PT-1/04**B**	US65	NUWTUBE65
	#2 Sol	PT-1/02S**B**	US65	NUWTUBE65
	#2	PT-1/02**B**	US65	NUWTUBE65
	1/0	PT-1/01/0**B**	US90	NUWTUBE90
2/0	#8 Sol	PT-2/08S**B**	US65	NUWTUBE65
	#8	PT-2/08**B**	US65	NUWTUBE65
	#6 Sol	PT-2/06S**B**	US90	NUWTUBE90
	#6	PT-2/06**B**	US90	NUWTUBE90
	#4	PT-2/04**B**	US90	NUWTUBE90
	#2 Sol	PT-2/02S**B**	US90	NUWTUBE90
	#2	PT-2/02**B**	US90	NUWTUBE90
	1/0	PT-2/01/0**B**	US115	NUWTUBE115
	2/0	PT-2/02/0**B**	US115	NUWTUBE115
3/0	#8 Sol	PT-3/08S**B**	US90	NUWTUBE90
	#8	PT-3/08**B**	US90	NUWTUBE90
	#6 Sol	PT-3/06S**B**	US90	NUWTUBE90
	#6	PT-3/06**B**	US90	NUWTUBE90
	#4	PT-3/04**B**	US115	NUWTUBE115
	#2 Sol	PT-3/02S**B**	US115	NUWTUBE115
	#2	PT-3/02**B**	US115	NUWTUBE115
	1/0	PT-3/01/0**B**	US115	NUWTUBE115
	2/0	PT-3/02/0**B**	US150	NUWTUBE150
	3/0	PT-3/03/0**B**	US150	NUWTUBE150
4/0	#8 Sol	PT-4/08S**B**	US90	NUWTUBE90
	#8	PT-4/08**B**	US90	NUWTUBE90
	#6 Sol	PT-4/06S**B**	US90	NUWTUBE90
	#6	PT-4/06**B**	US90	NUWTUBE90
	#4	PT-4/04**B**	US150	NUWTUBE150
	#2 Sol	PT-4/02S**B**	US150	NUWTUBE150
	#2	PT-4/02**B**	US150	NUWTUBE150
	1/0	PT-4/01/0**B**	US150	NUWTUBE150
	2/0	PT-4/02/0**B**	US150	NUWTUBE150
	3/0	PT-4/03/0**B**	US200	NUWTUBE200
	4/0	PT-4/04/0**B**	US200	NUWTUBE200

RT Cable to Cable

Mold Information:

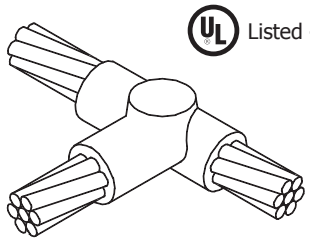
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:

MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



Listed 467

RT

(Tee of Horizontal Run & Tap Cables)

RT Connection Type

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
#6	#6	RT-66**B**	US32	NUWTUBE32
#4	#4	RT-44**B**	US32	NUWTUBE32
#2 Sol	#2 Sol	RT-2S2S**B**	US45	NUWTUBE45
#2	#6	RT-26**B**	US45	NUWTUBE45
	#4	RT-24**B**	US45	NUWTUBE45
	#2 Sol	RT-22S**B**	US45	NUWTUBE45
	#2	RT-22**B**	US45	NUWTUBE45
1/0	#6	RT-1/06**B**	US45	NUWTUBE45
	#4	RT-1/04**B**	US45	NUWTUBE45
	#2 Sol	RT-1/02S**B**	US45	NUWTUBE45
	#2	RT-1/02**B**	US45	NUWTUBE45
	1/0	RT-1/01/0**B**	US90	NUWTUBE90
2/0	#6	RT-2/06**B**	US45	NUWTUBE45
	#4	RT-2/04**B**	US45	NUWTUBE45
	#2 Sol	RT-2/02S**B**	US45	NUWTUBE45
	#2	RT-2/02**B**	US45	NUWTUBE45
	1/0	RT-2/01/0**B**	US90	NUWTUBE90
	2/0	RT-2/02/0**B**	US90	NUWTUBE90
3/0	#6	RT-3/06**B**	US45	NUWTUBE45
	#4	RT-3/04**B**	US45	NUWTUBE45
	#2 Sol	RT-3/02S**B**	US45	NUWTUBE45
	#2	RT-3/02**B**	US45	NUWTUBE45
	1/0	RT-3/01/0**B**	US90	NUWTUBE90
	2/0	RT-3/02/0**B**	US90	NUWTUBE90
	3/0	RT-3/03/0**B**	US115	NUWTUBE115
4/0	#6	RT-4/06**B**	US90	NUWTUBE90
	#4	RT-4/04**B**	US90	NUWTUBE90
	#2 Sol	RT-4/02S**B**	US90	NUWTUBE90
	#2	RT-4/02**B**	US90	NUWTUBE90
	1/0	RT-4/01/0**B**	US90	NUWTUBE90
	2/0	RT-4/02/0**B**	US90	NUWTUBE90
	3/0	RT-4/03/0**B**	US115	NUWTUBE115
	4/0	RT-4/04/0**B**	US150	NUWTUBE150
250 MCM	#2	RT-25CM2**B**	US90	NUWTUBE90
	1/0	RT-25CM1/0**B**	US90	NUWTUBE90
	2/0	RT-25CM2/0**B**	US90	NUWTUBE90
	3/0	RT-25CM3/0**B**	US150	NUWTUBE150
	4/0	RT-25CM4/0**B**	US150	NUWTUBE150
	250 MCM	RT-25CM25CM**B**	US150	NUWTUBE150

RT Connection Type continued

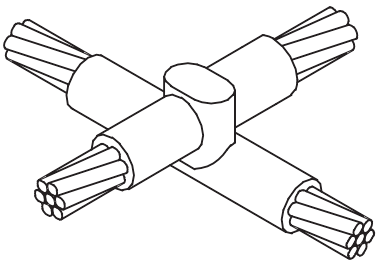
Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
300 MCM	#2	RT-3CM2**B**	US90	NUWTUBE90
	1/0	RT-3CM1/0**B**	US90	NUWTUBE90
	2/0	RT-3CM2/0**B**	US90	NUWTUBE90
	3/0	RT-3CM3/0**B**	US150	NUWTUBE150
	4/0	RT-3CM4/0**B**	US150	NUWTUBE150
	250 MCM	RT-3CM25CM**B**	US150	NUWTUBE150
	300 MCM	RT-3CM3CM**B**	US200	NUWTUBE200
350 MCM	#2	RT-35CM2**B**	US90	NUWTUBE90
	1/0	RT-35CM1/0**B**	US90	NUWTUBE90
	2/0	RT-35CM2/0**B**	US90	NUWTUBE90
	3/0	RT-35CM3/0**B**	US150	NUWTUBE150
	4/0	RT-35CM4/0**B**	US150	NUWTUBE150
	250 MCM	RT-35CM25CM**B**	US200	NUWTUBE200
	300 MCM	RT-35CM3CM**B**	US200	NUWTUBE200
	350 MCM	RT-35CM35CM**B**	US200	NUWTUBE200
500 MCM	#2	RT-5CM2**B**	US90	NUWTUBE90
	1/0	RT-5CM1/0**B**	US90	NUWTUBE90
	2/0	RT-5CM2/0**B**	US90	NUWTUBE90
	4/0	RT-5CM4/0**B**	US150	NUWTUBE150
	250 MCM	RT-5CM25CM**B**	US200	NUWTUBE200
	300 MCM	RT-5CM3CM**B**	US200	NUWTUBE200
	350 MCM	RT-5CM35CM**B**	US200	NUWTUBE200
	500 MCM	RT-5CM5CM**B**	US300	2-NUWTUBE150
750 MCM	1/0	RT-75CM1/0**B**	US150	NUWTUBE150
	2/0	RT-75CM2/0**B**	US150	NUWTUBE150
	4/0	RT-75CM4/0**B**	US150	NUWTUBE150
	250 MCM	RT-75CM25CM**B**	US200	NUWTUBE200
	300 MCM	RT-75CM3CM**B**	US200	NUWTUBE200
	350 MCM	RT-75CM35CM**B**	US250	NUWTUBE250
	500 MCM	RT-75CM5CM**C**	US400	2-NUWTUBE200
	750 MCM	RT-75CM75CM**C**	US500	2-NUWTUBE250
1000 MCM	1/0	RT-1MM1/0**B**	US150	NUWTUBE150
	2/0	RT-1MM2/0**B**	US150	NUWTUBE150
	4/0	RT-1MM4/0**B**	US150	NUWTUBE150
	250 MCM	RT-1MM25CM**B**	US200	NUWTUBE200
	300 MCM	RT-1MM3CM**B**	US200	NUWTUBE200
	350 MCM	RT-1MM35CM**B**	US250	NUWTUBE250
	500 MCM	RT-1MM5CM**C**	US400	2-NUWTUBE200
	750 MCM	RT-1MM75CM**C**	US500	2-NUWTUBE250
	1000 MCM	RT-1MM1MM**C**	US500	2-NUWTUBE250

Cable to Cable XO

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:
MH1 - Handle for "**B**" & "**Q**" Price Key Molds
MH2 - Handle for "**Z**" Price Key Molds

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



XO
(Cross of Horizontal Cables, Lapped & Not Cut)

Listed 467

Cost Effective 2-Piece Design

XO Connection Type

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
#6	#6	XO-66**B**	US45	NUWTUBE45
#4	#4	XO-44**B**	US65	NUWTUBE65
#2 Sol	#2 Sol	XO-2S2S**B**	US90	NUWTUBE90
#2	#4	XO-24**B**	US65	NUWTUBE65
	#2	XO-22**B**	US90	NUWTUBE90
1/0	#4	XO-1/04**Q**	US115	NUWTUBE115
	#2	XO-1/02**Q**	US115	NUWTUBE115
	1/0	XO-1/01/0**Q**	US150	NUWTUBE150
2/0	#2	XO-2/02**Q**	US150	NUWTUBE150
	1/0	XO-2/01/0**Q**	US200	NUWTUBE200
	2/0	XO-2/02/0**Q**	US200	NUWTUBE200
3/0	#2	XO-3/02**Q**	US150	NUWTUBE150
	1/0	XO-3/01/0**Q**	US200	NUWTUBE200
	2/0	XO-3/02/0**Q**	US200	NUWTUBE200
	3/0	XO-3/03/0**Q**	US250	NUWTUBE250
4/0	#2	XO-4/02**Q**	US150	NUWTUBE150
	1/0	XO-4/01/0**Q**	US200	NUWTUBE200
	2/0	XO-4/02/0**Q**	US200	NUWTUBE200
	3/0	XO-4/03/0**Q**	US250	NUWTUBE250
	4/0	XO-4/04/0**Q**	US250	NUWTUBE250

XO Connection Type continued

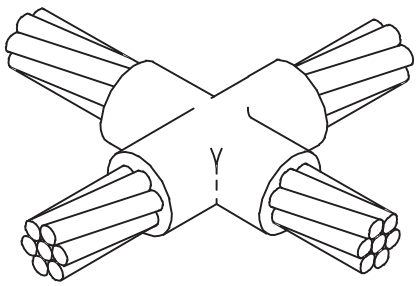
Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
250 MCM	#2	XO-25CM2**Q**	US150	NUWTUBE150
	1/0	XO-25CM1/0**Q**	US250	NUWTUBE250
	2/0	XO-25CM2/0**Q**	US250	NUWTUBE250
	3/0	XO-25CM3/0**Q**	US300	2-NUWTUBE150
	4/0	XO-25CM4/0**Q**	US300	2-NUWTUBE150
	250 MCM	XO-25CM25CM**Q**	US300	2-NUWTUBE150
300 MCM	#2	XO-3CM2**Q**	US150	NUWTUBE150
	1/0	XO-3CM1/0**Q**	US250	NUWTUBE250
	2/0	XO-3CM2/0**Q**	US250	NUWTUBE250
	3/0	XO-3CM3/0**Q**	US300	2-NUWTUBE150
	4/0	XO-3CM4/0**Q**	US300	2-NUWTUBE150
	250 MCM	XO-3CM25CM**Z**	US400	2-NUWTUBE200
	300 MCM	XO-3CM3CM**Z**	US400	2-NUWTUBE200
350 MCM	#2	XO-35CM2**Q**	US200	NUWTUBE200
	1/0	XO-35CM1/0**Q**	US250	NUWTUBE250
	2/0	XO-35CM2/0**Q**	US300	2-NUWTUBE150
	3/0	XO-35CM3/0**Z**	US400	2-NUWTUBE200
	4/0	XO-35CM4/0**Z**	US400	2-NUWTUBE200
	250 MCM	XO-35CM25CM**Z**	US500	2-NUWTUBE250
	300 MCM	XO-35CM3CM**Z**	US500	2-NUWTUBE250
	350 MCM	XO-35CM35CM**Z**	US500	2-NUWTUBE250
500 MCM	#2	XO-5CM2**Q**	US250	NUWTUBE250
	1/0	XO-5CM1/0**Q**	US300	2-NUWTUBE150
	2/0	XO-5CM2/0**Z**	US400	2-NUWTUBE200
	3/0	XO-5CM3/0**Z**	US500	2-NUWTUBE250
	4/0	XO-5CM4/0**Z**	US500	2-NUWTUBE250
	250 MCM	XO-5CM25CM**Z**	US500	2-NUWTUBE250
	300 MCM	XO-5CM3CM**Z**	US750	3-NUWTUBE250
	350 MCM	XO-5CM35CM**Z**	US750	3-NUWTUBE250
	500 MCM	XO-5CM5CM**Z**	US750	3-NUWTUBE250

XX Cable to Cable

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



XX

(Cross of Horizontal Cables, Tap Cable Cut, Cables in Same Plane)

Listed 467

XX Connection Type

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
#6	#6	XX-66**B**	US32	NUWTUBE32
#4	#4	XX-44**B**	US45	NUWTUBE45
#2 Sol	#2 Sol	XX-2S2S**B**	US65	NUWTUBE65
#2	#4	XX-24**B**	US65	NUWTUBE65
	#2	XX-22**B**	US65	NUWTUBE65
1/0	#4	XX-1/04**B**	US90	NUWTUBE90
	#2	XX-1/02**B**	US90	NUWTUBE90
	1/0	XX-1/01/0**B**	US90	NUWTUBE90
2/0	#2	XX-2/02**B**	US115	NUWTUBE115
	1/0	XX-2/01/0**B**	US115	NUWTUBE115
	2/0	XX-2/02/0**B**	US115	NUWTUBE115
3/0	#2	XX-3/02**B**	US115	NUWTUBE115
	1/0	XX-3/01/0**B**	US115	NUWTUBE115
	2/0	XX-3/02/0**B**	US150	NUWTUBE150
	3/0	XX-3/03/0**B**	US150	NUWTUBE150
4/0	#2	XX-4/02**B**	US115	NUWTUBE115
	1/0	XX-4/01/0**B**	US150	NUWTUBE150
	2/0	XX-4/02/0**B**	US150	NUWTUBE150
	3/0	XX-4/03/0**B**	US200	NUWTUBE200
	4/0	XX-4/04/0**B**	US200	NUWTUBE200
250 MCM	#2	XX-25CM2**B**	US115	NUWTUBE115
	1/0	XX-25CM1/0**B**	US150	NUWTUBE150
	2/0	XX-25CM2/0**B**	US150	NUWTUBE150
	3/0	XX-25CM3/0**B**	US200	NUWTUBE200
	4/0	XX-25CM4/0**B**	US200	NUWTUBE200
	250 MCM	XX-25CM25CM**B**	US200	NUWTUBE200

XX Connection Type continued

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
300 MCM	#2	XX-3CM2**B**	US115	NUWTUBE115
	1/0	XX-3CM1/0**B**	US150	NUWTUBE150
	2/0	XX-3CM2/0**B**	US150	NUWTUBE150
	3/0	XX-3CM3/0**B**	US200	NUWTUBE200
	4/0	XX-3CM4/0**B**	US200	NUWTUBE200
	250 MCM	XX-3CM25CM**B**	US250	NUWTUBE250
	300 MCM	XX-3CM3CM**B**	US250	NUWTUBE250
350 MCM	#2	XX-35CM2**B**	US150	NUWTUBE150
	1/0	XX-35CM1/0**B**	US200	NUWTUBE200
	2/0	XX-35CM2/0**B**	US200	NUWTUBE200
	3/0	XX-35CM3/0**B**	US200	NUWTUBE200
	4/0	XX-35CM4/0**B**	US200	NUWTUBE200
	250 MCM	XX-35CM25CM**B**	US250	NUWTUBE250
	300 MCM	XX-35CM3CM**B**	US250	NUWTUBE250
	350 MCM	XX-35CM35CM**B**	US250	NUWTUBE250
500 MCM	#2	XX-5CM2**B**	US200	NUWTUBE200
	1/0	XX-5CM1/0**B**	US250	NUWTUBE250
	2/0	XX-5CM2/0**B**	US250	NUWTUBE250
	3/0	XX-5CM3/0**C**	US300	2-NUWTUBE150
	4/0	XX-5CM4/0**C**	US300	2-NUWTUBE150
	250 MCM	XX-5CM25CM**C**	US300	2-NUWTUBE150
	300 MCM	XX-5CM3CM**C**	US400	2-NUWTUBE200
	350 MCM	XX-5CM35CM**C**	US400	2-NUWTUBE200
	500 MCM	XX-5CM5CM**C**	US500	2-NUWTUBE250

Cable to Ground Rod GD

Mold Information:

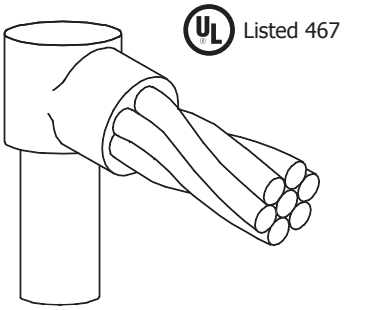
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds listed are for tapered ground rods. For threaded sectional rods, add suffix "S" after the ground rod number. i.e. 58S = 5/8" sectional ground rod.
- Molds with Price Key "**L**" SOLD WITH HANDLES.
- If Handles not required, add suffix "-X" after the Mold Part No.
- Handles for "**L**" Price Key Molds DO NOT INCLUDE Flint Igniters.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:

MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds
FLTIG - Flint Igniter when Price Key is "**L**"

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



GD

(Single Cable Dead Ended to Top of Ground Rod)

GD Connection Type

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
1/2"	#6	GD-126**L**	US25	NUWTUBE25
	#4	GD-124**L**	US25	NUWTUBE25
	#2 Sol	GD-122S**B**	US65	NUWTUBE65
	#2	GD-122**B**	US65	NUWTUBE65
	1/0	GD-121/0**B**	US90	NUWTUBE90
	2/0	GD-122/0**B**	US90	NUWTUBE90
	3/0	GD-123/0**B**	US90	NUWTUBE90
	4/0	GD-124/0**B**	US90	NUWTUBE90
	250 MCM	GD-1225CM**B**	US90	NUWTUBE90
	300 MCM	GD-123CM**B**	US90	NUWTUBE90
5/8"	#6	GD-586**L**	US32	NUWTUBE32
	#4	GD-584**L**	US32	NUWTUBE32
	#2 Sol	GD-582S**B**	US65	NUWTUBE65
	#2	GD-582**B**	US65	NUWTUBE65
	1/0	GD-581/0**B**	US90	NUWTUBE90
	2/0	GD-582/0**B**	US90	NUWTUBE90
	3/0	GD-583/0**B**	US90	NUWTUBE90
	4/0	GD-584/0**B**	US90	NUWTUBE90
	250 MCM	GD-5825CM**B**	US90	NUWTUBE90
	300 MCM	GD-583CM**B**	US115	NUWTUBE115
	350 MCM	GD-5835CM**B**	US115	NUWTUBE115
	500 MCM	GD-585CM**B**	US150	NUWTUBE150

GD Connection Type continued

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
3/4"	#6	GD-346**L**	US32	NUWTUBE32
	#4	GD-344**L**	US45	NUWTUBE45
	#2 Sol	GD-342S**B**	US90	NUWTUBE90
	#2	GD-342**B**	US90	NUWTUBE90
	1/0	GD-341/0**B**	US90	NUWTUBE90
	2/0	GD-342/0**B**	US90	NUWTUBE90
	3/0	GD-343/0**B**	US90	NUWTUBE90
	4/0	GD-344/0**B**	US90	NUWTUBE90
	250 MCM	GD-3425CM**B**	US90	NUWTUBE90
	300 MCM	GD-343CM**B**	US115	NUWTUBE115
	350 MCM	GD-3435CM**B**	US115	NUWTUBE115
	500 MCM	GD-345CM**B**	US150	NUWTUBE150
	750 MCM	GD-3475CM**B**	US250	NUWTUBE250
1"	1/0	GD-101/0**B**	US150	NUWTUBE150
	2/0	GD-102/0**B**	US150	NUWTUBE150
	3/0	GD-103/0**B**	US150	NUWTUBE150
	4/0	GD-104/0**B**	US150	NUWTUBE150
	250 MCM	GD-1025CM**B**	US150	NUWTUBE150
	300 MCM	GD-103CM**B**	US200	NUWTUBE200
	350 MCM	GD-1035CM**B**	US200	NUWTUBE200
	500 MCM	GD-105CM**B**	US200	NUWTUBE200
	750 MCM	GD-1075CM**B**	US250	NUWTUBE250
	1000 MCM	GD-101MM**C**	US300	2-NUWTUBE150

NOTES:

- Molds listed are for copper-clad steel ground rods.
- For welding to full size copper-clad steel, stainless steel, galvanized steel or solid copper ground rods, add letter "F" to ground rod size. For sectional ground rods, add letter "S" to ground rod size. See chart on page 335 for details.

GF Cable to Ground Rod

Mold Information:

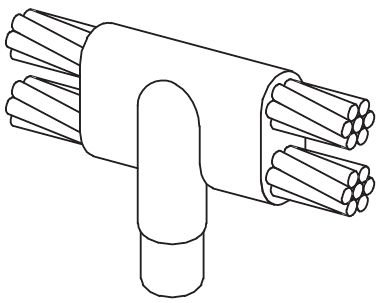
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds listed are for tapered ground rods. For threaded sectional rods, add suffix "S" after the ground rod number. i.e. 58S = 5/8" sectional ground rod.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:

MH1 - Handle for "**K**" Price Ke y Molds
MH2 - Handle for "**D**" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



GF

(Parallel Thru Horizontal Cables (Tap Over Run) to Top of Ground Rod)

GF Connection Type

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
1/2"	#6	GF-126**K**	US90	NUWTUBE90
	#4	GF-124**K**	US115	NUWTUBE115
	#2 Sol	GF-122S**K**	US115	NUWTUBE115
	#2	GF-122**K**	US115	NUWTUBE115
	1/0	GF-121/0**K**	US150	NUWTUBE150
	2/0	GF-122/0**K**	US200	NUWTUBE200
	3/0	GF-123/0**K**	US250	NUWTUBE250
	4/0	GF-124/0**K**	US250	NUWTUBE250
5/8"	#6	GF-586**K**	US90	NUWTUBE90
	#4	GF-584**K**	US115	NUWTUBE115
	#2 Sol	GF-582S**K**	US150	NUWTUBE150
	#2	GF-582**K**	US150	NUWTUBE150
	1/0	GF-581/0**K**	US200	NUWTUBE200
	2/0	GF-582/0**K**	US250	NUWTUBE250
	3/0	GF-583/0**D**	US300	2-NUWTUBE150
	4/0	GF-584/0**D**	US300	2-NUWTUBE150
	250 MCM	GF-5825CM**D**	US400	2-NUWTUBE200
	300 MCM	GF-583CM**D**	US500	2-NUWTUBE250
	350 MCM	GF-5835CM**D**	US500	2-NUWTUBE250

GF Connection Type continued

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
3/4"	#6	GF-346**K**	US90	NUWTUBE90
	#4	GF-344**K**	US115	NUWTUBE115
	#2 Sol	GF-342S**K**	US150	NUWTUBE150
	#2	GF-342**K**	US150	NUWTUBE150
	1/0	GF-341/0**K**	US200	NUWTUBE200
	2/0	GF-342/0**K**	US250	NUWTUBE250
	3/0	GF-343/0**D**	US300	2-NUWTUBE150
	4/0	GF-344/0**D**	US300	2-NUWTUBE150
	250 MCM	GF-3425CM**D**	US400	2-NUWTUBE200
	300 MCM	GF-343CM**D**	US500	2-NUWTUBE250
	350 MCM	GF-3435CM**D**	US500	2-NUWTUBE250
1"	#4	GF-104**K**	US150	NUWTUBE150
	#2	GF-102**K**	US200	NUWTUBE200
	1/0	GF-101/0**K**	US250	NUWTUBE250
	2/0	GF-102/0**D**	US300	2-NUWTUBE150
	3/0	GF-103/0**D**	US400	2-NUWTUBE200
	4/0	GF-104/0**D**	US400	2-NUWTUBE200
	250 MCM	GF-1025CM**D**	US500	2-NUWTUBE250

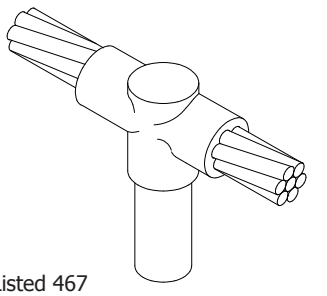
NOTES:

- Molds listed are for copper-clad steel ground rods.
- For welding to full size copper-clad steel, stainless steel, galvanized steel or solid copper ground rods, add letter "F" to ground rod size. For sectional ground rods, add letter "S" to ground rod size. See chart on page 335 for details.

Cable to Ground Rod GO

Mold Information:

- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds listed are for tapered ground rods. For threaded sectional rods, add suffix "S" after the ground rod number. i.e. 58S = 5/8" sectional ground rod.
- Molds with Price Key "**L**" and "**M**" SOLD WITH HANDLES.
- Handles for "**L**" and "**M**" Price Key Molds DO NOT INCLUDE Flint Igniters.
- If Handles not required, add suffix "-X" after the Mold Part No.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.



Listed 467

GO

(Horizontal Thru Cable to Top of Ground Rod)

Required Tools & Accessories:

MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds
FLTIG - Flint Igniter when Price Key is "**L**" or "**M**"

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush

GO Connection Type

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
1/2"	#6	GO-126**L**	US32	NUWTUBE32
	#4	GO-124**L**	US32	NUWTUBE32
	#2 Sol	GO-122S**B**	US90	NUWTUBE90
	#2	GO-122**B**	US90	NUWTUBE90
	1/0	GO-121/0**B**	US90	NUWTUBE90
	2/0	GO-122/0**B**	US90	NUWTUBE90
	3/0	GO-123/0**B**	US115	NUWTUBE115
	4/0	GO-124/0**B**	US115	NUWTUBE115
	250 MCM	GO-1225CM**B**	US150	NUWTUBE150
	300 MCM	GO-123CM**B**	US200	NUWTUBE200
5/8"	#6	GO-586**L**	US32	NUWTUBE32
	#4	GO-584**L**	US32	NUWTUBE32
	#2 Sol	GO-582S**B**	US90	NUWTUBE90
	#2	GO-582**B**	US90	NUWTUBE90
	1/0	GO-581/0**B**	US90	NUWTUBE90
	2/0	GO-582/0**B**	US115	NUWTUBE115
	3/0	GO-583/0**B**	US115	NUWTUBE115
	4/0	GO-584/0**B**	US115	NUWTUBE115
	250 MCM	GO-5825CM**B**	US150	NUWTUBE150
	300 MCM	GO-583CM**B**	US200	NUWTUBE200
	350 MCM	GO-5835CM**B**	US200	NUWTUBE200
	500 MCM	GO-585CM**B**	US250	NUWTUBE250

GO Connection Type continued

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
3/4"	#6	GO-346**L**	US45	NUWTUBE45
	#4	GO-344**M**	US65	NUWTUBE65
	#2 Sol	GO-342S**B**	US90	NUWTUBE90
	#2	GO-342**B**	US90	NUWTUBE90
	1/0	GO-341/0**B**	US115	NUWTUBE115
	2/0	GO-342/0**B**	US115	NUWTUBE115
	3/0	GO-343/0**B**	US115	NUWTUBE115
	4/0	GO-344/0**B**	US115	NUWTUBE115
	250 MCM	GO-3425CM**B**	US150	NUWTUBE150
	300 MCM	GO-343CM**B**	US200	NUWTUBE200
	350 MCM	GO-3435CM**B**	US200	NUWTUBE200
	500 MCM	GO-345CM**B**	US250	NUWTUBE250
	750 MCM	GO-3475CM**C**	US400	2-NUWTUBE200
1"	1/0	GO-101/0**B**	US150	NUWTUBE150
	2/0	GO-102/0**B**	US150	NUWTUBE150
	3/0	GO-103/0**B**	US150	NUWTUBE150
	4/0	GO-104/0**B**	US150	NUWTUBE150
	250 MCM	GO-1025CM**B**	US200	NUWTUBE200
	300 MCM	GO-103CM**B**	US200	NUWTUBE200
	350 MCM	GO-1035CM**B**	US200	NUWTUBE200
	500 MCM	GO-105CM**B**	US250	NUWTUBE250
	750 MCM	GO-1075CM**C**	US400	2-NUWTUBE200
	1000 MCM	GO-101MM**C**	US500	2-NUWTUBE250

NOTES:

- Molds listed are for copper-clad steel ground rods.
- For welding to full size copper-clad steel, stainless steel, galvanized steel or solid copper ground rods, add letter "F" to ground rod size. For sectional ground rods, add letter "S" to ground rod size. See chart on page 335 for details.

GS Cable to Ground Rod

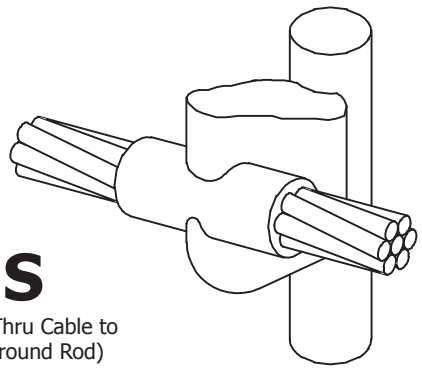
Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- If Frame not required, add suffix "-X" after the Mold Part No.
- Handles for "**R**" Price Key Molds DO NOT INCLUDE Flint Igniters.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:

MH1 - Handle for "**P**" Price Key Molds
MH2 - Handle for "**Y**" Price Key Molds
MH4 - Handle for "**R**" Price Key Molds
FLTIG - Flint Igniter when Price Key is "**R**"

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



GS

(Horizontal Thru Cable to Side of Ground Rod)

Cost Effective 2-Piece Design

GS Connection Type

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
1/2"	#6	GS-126**R**	US65	NUWTUBE65
	#4	GS-124**R**	US65	NUWTUBE65
	#2 Sol	GS-122S**R**	US65	NUWTUBE65
	#2	GS-122**R**	US65	NUWTUBE65
	1/0	GS-121/0**P**	US115	NUWTUBE115
	2/0	GS-122/0**P**	US115	NUWTUBE115
	3/0	GS-123/0**P**	US150	NUWTUBE150
	4/0	GS-124/0**P**	US150	NUWTUBE150
	250 MCM	GS-1225CM**P**	US150	NUWTUBE150
5/8"	#6	GS-586**R**	US65	NUWTUBE65
	#4	GS-584**R**	US65	NUWTUBE65
	#2 Sol	GS-582S**R**	US65	NUWTUBE65
	#2	GS-582**R**	US65	NUWTUBE65
	1/0	GS-581/0**P**	US115	NUWTUBE115
	2/0	GS-582/0**P**	US115	NUWTUBE115
	3/0	GS-583/0**P**	US150	NUWTUBE150
	4/0	GS-584/0**P**	US150	NUWTUBE150
	250 MCM	GS-5825CM**P**	US150	NUWTUBE150
	500 MCM	GS-585CM**Y**	US400	2-NUWTUBE200

GS Connection Type continued

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
3/4"	#6	GS-346**R**	US65	NUWTUBE65
	#4	GS-344**R**	US65	NUWTUBE65
	#2 Sol	GS-342S**R**	US65	NUWTUBE65
	#2	GS-342**R**	US65	NUWTUBE65
	1/0	GS-341/0**P**	US115	NUWTUBE115
	2/0	GS-342/0**P**	US115	NUWTUBE115
	3/0	GS-343/0**P**	US150	NUWTUBE150
	4/0	GS-344/0**P**	US150	NUWTUBE150
	250 MCM	GS-3425CM**P**	US200	NUWTUBE200
	500 MCM	GS-345CM**Y**	US500	2-NUWTUBE250

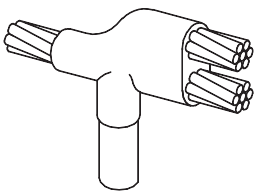
NOTES:
- Molds listed are for copper-clad steel ground rods.
- For welding to full size copper-clad steel, stainless steel, galvanized steel or solid copper ground rods, add letter "F" to ground rod size. For sectional ground rods, add letter "S" to ground rod size. See chart on page 335 for details.

Cable to Ground Rod — GT

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds listed are for tappered ground rods. For threaded sectional rods, add suffix "S" after the ground rod number. i.e. 58S = 5/8" sectional ground rod.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:
MH1 - Handle for "**K**" Price Key Molds
MH2 - Handle for "**D**" Price Key Molds

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



GT

(Horizontal Thru Cable Plus Tap Cable to Top of Ground Rod)

GT Connection Type

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
5/8"	#6	GT-586**K**	US90	NUWTUBE90
	#4	GT-584**K**	US90	NUWTUBE90
	#2 Sol	GT-582S**K**	US115	NUWTUBE115
	#2	GT-582**K**	US115	NUWTUBE115
	1/0	GT-581/0**K**	US150	NUWTUBE150
	2/0	GT-582/0**K**	US200	NUWTUBE200
	3/0	GT-583/0**K**	US250	NUWTUBE250
	4/0	GT-584/0**K**	US250	NUWTUBE250
	250 MCM	GT-5825CM**D**	US300	2-NUWTUBE150

GT Connection Type continued

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
3/4"	#6	GT-346**K**	US90	NUWTUBE90
	#4	GT-344**K**	US90	NUWTUBE90
	#2 Sol	GT-342S**K**	US115	NUWTUBE115
	#2	GT-342**K**	US115	NUWTUBE115
	1/0	GT-341/0**K**	US150	NUWTUBE150
	2/0	GT-342/0**K**	US200	NUWTUBE200
	3/0	GT-343/0**K**	US250	NUWTUBE250
	4/0	GT-344/0**K**	US250	NUWTUBE250
	250 MCM	GT-3425CM**D**	US300	2-NUWTUBE150
	300 MCM	GT-343CM**D**	US400	2-NUWTUBE200
	350 MCM	GT-3435CM**D**	US400	2-NUWTUBE200

Ground Rod to Ground Rod — GG

Mold Information:
- Molds listed are for tappered ground rods. For threaded sectional rods, add suffix "S" after the ground rod number. i.e. 58S = 5/8" sectional ground rod.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds
GRCC - Ground Rod and Cable Clamp.
See page 332 for details.

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush

GG Connection Type

Ground Rod Size	Heavy Duty Mold		
	Mold Part No.	Weld Metel	
		UltraShot	NUWTUBE
1/2"	GG-12**B**	US250	NUWTUBE250
5/8"	GG-58**C**	US300	2-NUWTUBE150
3/4"	GG-34**C**	US400	2-NUWTUBE200



GG

(Butt Splice of Vertical Ground Rods)

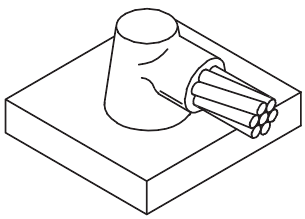
NOTES:
- Molds listed are for copper-clad steel ground rods.
- For welding to full size copper-clad steel, stainless steel, galvanized steel or solid copper ground rods, add letter "F" to ground rod size. For sectional ground rods, add letter "S" to ground rod size. See chart on page 335 for details.

HB / HD Cable to Steel Surface

Mold Information:
- **HB** mold cable is **off** the steel surface.
- **HD** mold cable is **on** the steel surface.
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds with Price Key "**A**" SOLD WITH FRAME.
- If Frame not required, add suffix "-X" after the Mold Part No.
- Frame for "**A**" Price Key Molds DO NOT INCLUDE Flint Igniters.
- Price Key is the **Bold Letter** in the Mold Part No.
- For **HB** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds
FLTIG - Flint Igniter when Price Key is "**A**"

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush
UMHDKIT - Hold Down Kit
UMMHDA - Hold Down Kit when Price Key is **"A"**



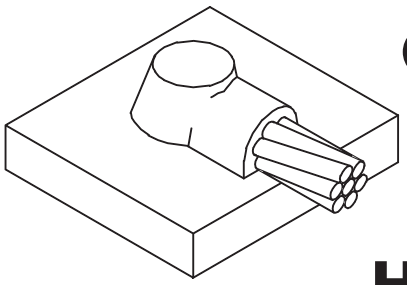
HB

Listed 467

(Horizontal Cable to Horizontal Flat Steel Surface, OFF Surface)

HB Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	HB-6**B**	US65	NUWTUBE65
#2 Sol	HB-2S**B**	US65	NUWTUBE65
#2	HB-2**B**	US65	NUWTUBE65
1/0	HB-1/0**B**	US90	NUWTUBE90
2/0	HB-2/0**B**	US90	NUWTUBE90
3/0	HB-3/0**B**	US115	NUWTUBE115
4/0	HB-4/0**B**	US115	NUWTUBE115
250 MCM	HB-25CM**B**	US115	NUWTUBE115
300 MCM	HB-3CM**B**	US150	NUWTUBE150
350 MCM	HB-35CM**B**	US200	NUWTUBE200
500 MCM	HB-5CM**B**	US200	NUWTUBE200
750 MCM	HB-75CM**C**	US300	2-NUWTUBE150
1000 MCM	HB-1MM**C**	US400	2-NUWTUBE200



Listed 467

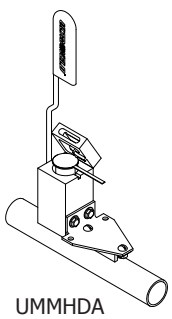
HD

(Horizontal Cable to Horizontal Flat Steel Surface, ON Surface)

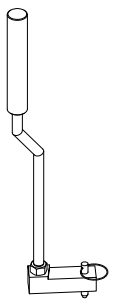
HD Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6 Sol	HD-6S**A**	US45	NUWTUBE45
#6	HD-6**A**	US45	NUWTUBE45
#4	HD-4**A**	US45	NUWTUBE45
#2 Sol	HD-2S**A**	US45	NUWTUBE45
#2	HD-2**A**	US45	NUWTUBE45
1/0	HD-1/0**B**	US90	NUWTUBE90
2/0	HD-2/0**B**	US90	NUWTUBE90
3/0	HD-3/0**B**	US115	NUWTUBE115
4/0	HD-4/0**B**	US115	NUWTUBE115
250 MCM	HD-25CM**B**	US115	NUWTUBE115
300 MCM	HD-3CM**B**	US150	NUWTUBE150
350 MCM	HD-35CM**B**	US200	NUWTUBE200
500 MCM	HD-5CM**B**	US200	NUWTUBE200
750 MCM	HD-75CM**C**	US300	2-NUWTUBE150
1000 MCM	HD-1MM**C**	US400	2-NUWTUBE200

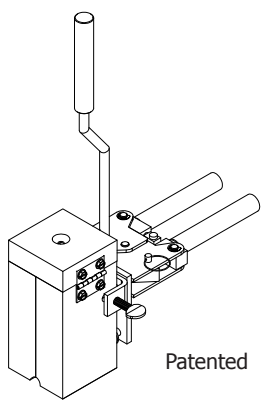
NOTE:
- For HD mold, may need Mold Sealer (MLDSLR, see page 326) on conductors 1/0 and larger.



UMMHDA



UMHDKIT



Patented

UMHDKIT with Mold & Handle

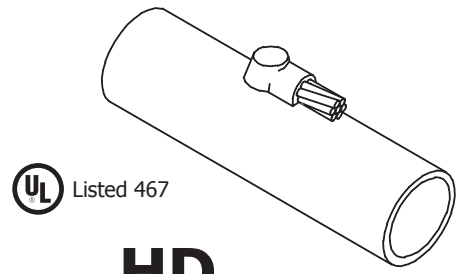
Cable to Steel Surface / Pipe — HB / HD

Mold Information:
- **HB** mold cable is **off** the pipe surface.
- **HD** mold cable is **on** the pipe surface.
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds with Price Key "**A**" SOLD WITH FRAME.
- Molds with Price Key "**A**" do not use a handle.
- Frame for "**A**" Price Key Molds DO NOT INCLUDE Flint Igniters.
- Price Key is the **Bold Letter** in the Mold Part No.
- For **HB** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
FLTIG - Flint Igniter when Price Key is "**A**"

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush
UMHDKIT - Hold Down Kit

OR
CSKITHP - Chain Support Kit for Horizontal Pipe
UMMHDA - Hold Down Kit when Price Key is **"A"**



HD

(Horizontal Cable to Top of Horizontal Steel Pipe, ON Surface)

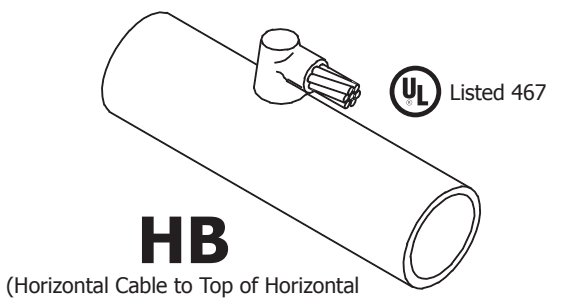
HD (Pipe) Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	HD-6**A	US45	NUWTUBE45
#4	HD-4**A	US45	NUWTUBE45
#2 Sol	HD-2S**A	US45	NUWTUBE45
#2	HD-2**A	US45	NUWTUBE45
1/0	HD-1/0**B	US90	NUWTUBE90
2/0	HD-2/0**B	US90	NUWTUBE90
3/0	HD-3/0**B	US115	NUWTUBE115
4/0	HD-4/0**B	US115	NUWTUBE115
250 MCM	HD-25CM**B	US115	NUWTUBE115

****Add Pipe Size to Mold Part No.**
See chart to the left.

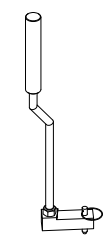
CABLE TO HORIZONTAL STEEL PIPE (HB & HD) Use Mold Part No. with Pipe Size (**) Indicator		
Cable	**Nominal Pipe Size**	**Pipe Size Indicator**
#1 and Smaller	12" and Smaller 14" and Larger	Nominal Pipe Size◇ None
1/0 thru 250	28" and Smaller 30" and Larger	Nominal Pipe Size◇ None
Example: #1/0 cable to 2-1/2" pipe = HB-1/02.5**B**		

◇ See page 334 for pipe sizes.

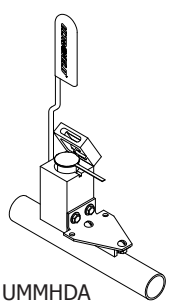


HB

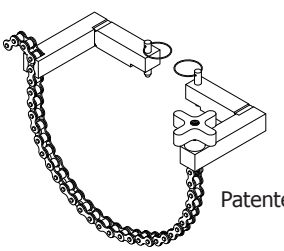
(Horizontal Cable to Top of Horizontal Steel Pipe, OFF Surface)



UMHDKIT



UMMHDA



CSKITHP

HB (Pipe) Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
1/0	HB-1/0**B	US90	NUWTUBE90
2/0	HB-2/0**B	US90	NUWTUBE90
3/0	HB-3/0**B	US115	NUWTUBE115
4/0	HB-4/0**B	US115	NUWTUBE115
250 MCM	HB-25CM**B	US115	NUWTUBE115

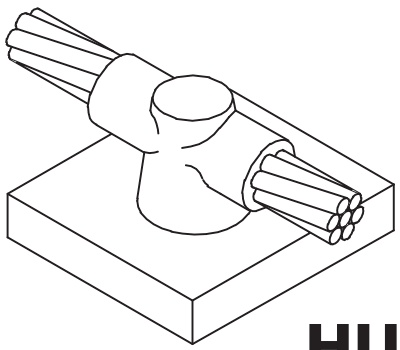
****Add Pipe Size to Mold Part No.**
See chart to the left.

HT / HU Cable to Steel Surface

Mold Information:
- **HT** mold cable is **on** the steel surface.
- **HU** mold cable is **off** the steel surface.
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds with Price Key "**A**" SOLD WITH FRAME.
- If Frame not required, add suffix "-X" after the Mold Part No.
- Price Key is the **Bold Letter** in the Mold Part No.
- For **HU** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds
FLTIG - Flint Igniter when price key is "**A**"

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush
UMHDKIT - Hold Down Kit
UMMHDA - Hold Down Kit when Price Key is **"A"**

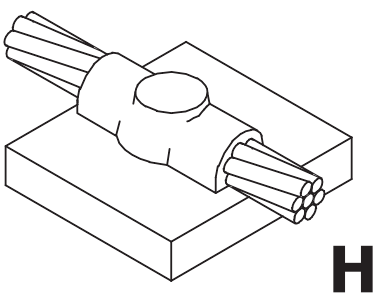


HU

(Horizontal Thru Cable to Horizontal Flat Steel Surface, OFF Surface)

HU Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
1/0	HU-1/0**B**	US90	NUWTUBE90
2/0	HU-2/0**B**	US115	NUWTUBE115
3/0	HU-3/0**B**	US115	NUWTUBE115
4/0	HU-4/0**B**	US150	NUWTUBE150
250 MCM	HU-25CM**B**	US150	NUWTUBE150
300 MCM	HU-3CM**B**	US200	NUWTUBE200
350 MCM	HU-35CM**B**	US250	NUWTUBE250
500 MCM	HU-5CM**C**	US300	2-NUWTUBE150

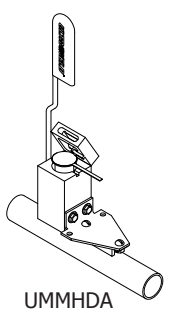


HT

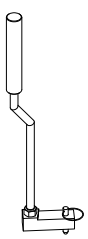
(Horizontal Thru Cable to Horizontal Flat Steel Surface, ON Surface)

HT Connection Type

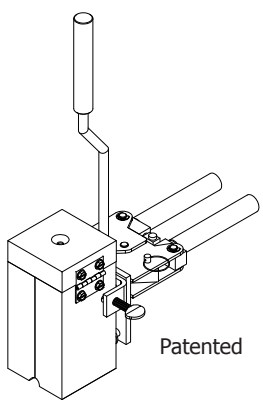
Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	HT-6**A**	US45	NUWTUBE45
#4	HT-4**A**	US45	NUWTUBE45
#2 Sol	HT-2S**A**	US45	NUWTUBE45
#2	HT-2**A**	US45	NUWTUBE45
1/0	HT-1/0**B**	US90	NUWTUBE90
2/0	HT-2/0**B**	US115	NUWTUBE115
3/0	HT-3/0**B**	US115	NUWTUBE115
4/0	HT-4/0**B**	US150	NUWTUBE150
250 MCM	HT-25CM**B**	US150	NUWTUBE150
300 MCM	HT-3CM**B**	US200	NUWTUBE200
350 MCM	HT-35CM**B**	US200	NUWTUBE200
500 MCM	HT-5CM**C**	US300	2-NUWTUBE150



UMMHDA



UMHDKIT



Patented

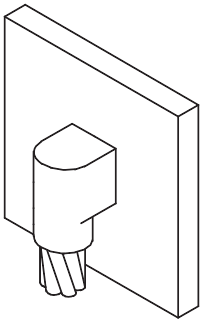
UMHDKIT with Mold & Handle

Cable to Steel Surface — VA / VD

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For **VA** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

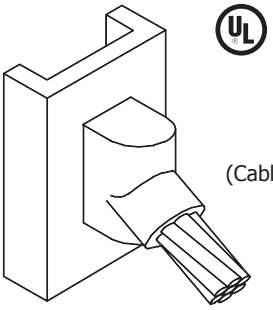
Required Tools & Accessories:
MH1 - Handle for "**B**" and "**K**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush
MSKIT - Magnetic Support Kit



VD

(Vertical Downward Cable to Vertical Flat Steel Surface)



Listed 467

VA

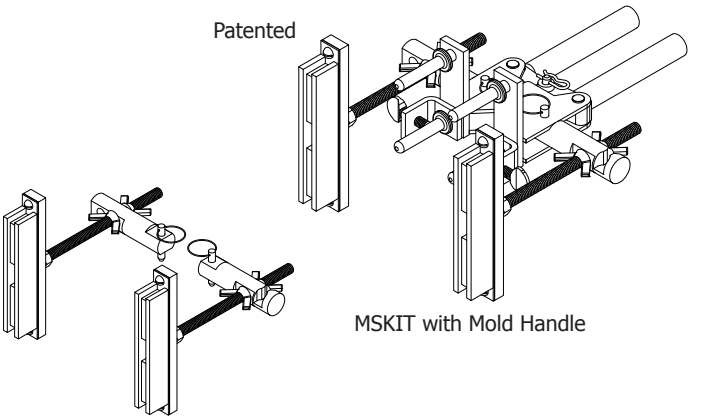
(Cable Down at 45° to Vertical Flat Steel Surface)

VD Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VD-6**B**	US45	NUWTUBE45
#4	VD-4**B**	US65	NUWTUBE65
#2 Sol	VD-2S**B**	US65	NUWTUBE65
#2	VD-2**B**	US65	NUWTUBE65
1/0	VD-1/0**B**	US115	NUWTUBE115
2/0	VD-2/0**B**	US115	NUWTUBE115
3/0	VD-3/0**B**	US150	NUWTUBE150
4/0	VD-4/0**B**	US150	NUWTUBE150
250 MCM	VD-25CM**B**	US200	NUWTUBE200
300 MCM	VD-3CM**B**	US200	NUWTUBE200
350 MCM	VD-35CM**B**	US250	NUWTUBE250
500 MCM	VD-5CM**K**	US300	2-NUWTUBE150

VA Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VA-6**B**	US45	NUWTUBE45
#4	VA-4**B**	US45	NUWTUBE45
#2 Sol	VA-2S**B**	US45	NUWTUBE45
#2	VA-2**B**	US45	NUWTUBE45
1/0	VA-1/0**B**	US90	NUWTUBE90
2/0	VA-2/0**B**	US90	NUWTUBE90
3/0	VA-3/0**B**	US115	NUWTUBE115
4/0	VA-4/0**B**	US115	NUWTUBE115
250 MCM	VA-25CM**B**	US115	NUWTUBE115
300 MCM	VA-3CM**B**	US150	NUWTUBE150
350 MCM	VA-35CM**B**	US200	NUWTUBE200
500 MCM	VA-5CM**B**	US200	NUWTUBE200
750 MCM	VA-75CM**C**	US300	2-NUWTUBE150
1000 MCM	VA-1MM**C**	US400	2-NUWTUBE200



Patented

MSKIT with Mold Handle

MSKIT

VA Cable to Steel Surface / Pipe

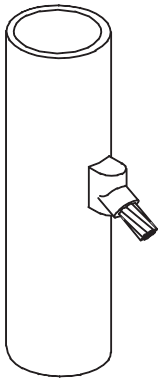
Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:

CSH1 - Chain Support Handle clamp for "**B**" Price Key Molds **OR**
MH1 - Mold Handle for "**B**" Price Key Molds **AND**
CSKIT - Chain Support Kit

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



VA

(Cable Down at 45° to Side of Vertical or Horizontal Steel Pipe)

Listed 467

VA (Pipe) Connection Type (Range Taking)

Cable Size	Nominal Pipe Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#6	1-1/2" to 4" Pipe	VA-6V1.25X4**B**	US45	NUWTUBE45
	4" to 6" Pipe	VA-6V4X6**B**	US45	NUWTUBE45
	6" to 10" Pipe	VA-6V6X10**B**	US45	NUWTUBE45
	12" to 30" Pipe	VA-6V12X30**B**	US45	NUWTUBE45
	32" Pipe or Larger	VA-6**B**	US45	NUWTUBE45
#4	1-1/2" to 4" Pipe	VA-4V1.5X4**B**	US45	NUWTUBE45
	4" to 6" Pipe	VA-4V4X6**B**	US45	NUWTUBE45
	6" to 10" Pipe	VA-4V6X10**B**	US45	NUWTUBE45
	12" to 30" Pipe	VA-4V12X30**B**	US45	NUWTUBE45
	32" Pipe or Larger	VA-4**B**	US45	NUWTUBE45
#2 Sol	1/2" to 1" Pipe	VA-2SV.5X1**B**	US45	NUWTUBE45
	1-1/2" to 4" Pipe	VA-2SV1.5X4**B**	US45	NUWTUBE45
	4" to 6" Pipe	VA-2SV4X6**B**	US45	NUWTUBE45
	6" to 10" Pipe	VA-2SV6X10**B**	US45	NUWTUBE45
	12" to 30" Pipe	VA-2SV12X30**B**	US45	NUWTUBE45
	32" Pipe or Larger	VA-2S**B**	US45	NUWTUBE45
#2	1-1/2" to 4" Pipe	VA-2V1.5X4**B**	US45	NUWTUBE45
	4" to 6" Pipe	VA-2V4X6**B**	US45	NUWTUBE45
	6" to 10" Pipe	VA-2V6X10**B**	US45	NUWTUBE45
	12" to 30" Pipe	VA-2V12X30**B**	US45	NUWTUBE45
	32" Pipe or Larger	VA-2**B**	US45	NUWTUBE45

Cable Size	Nominal Pipe Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
1/0	2" to 4" Pipe	VA-1/0V2X4**B**	US90	NUWTUBE90
	4" to 6" Pipe	VA-1/0V4X6**B**	US90	NUWTUBE90
	6" to 10" Pipe	VA-1/0V6X10**B**	US90	NUWTUBE90
	12" to 30" Pipe	VA-1/0V12X30**B**	US90	NUWTUBE90
	32" Pipe or Larger	VA-1/0**B**	US90	NUWTUBE90
2/0	2" to 4" Pipe	VA-2/0V2X4**B**	US90	NUWTUBE90
	4" to 6" Pipe	VA-2/0V4X6**B**	US90	NUWTUBE90
	6" to 10" Pipe	VA-2/0V6X10**B**	US90	NUWTUBE90
	12" to 30" Pipe	VA-2/0V12X30**B**	US90	NUWTUBE90
	32" Pipe or Larger	VA-2/0**B**	US90	NUWTUBE90
3/0	2" to 4" Pipe	VA-3/0V2X4**B**	US115	NUWTUBE115
	4" to 6" Pipe	VA-3/0V4X6**B**	US115	NUWTUBE115
	6" to 10" Pipe	VA-3/0V6X10**B**	US115	NUWTUBE115
	12" to 30" Pipe	VA-3/0V12X30**B**	US115	NUWTUBE115
	32" Pipe or Larger	VA-3/0**B**	US115	NUWTUBE115
4/0	2" to 4" Pipe	VA-4/0V2X4**B**	US115	NUWTUBE115
	4" to 6" Pipe	VA-4/0V4X6**B**	US115	NUWTUBE115
	6" to 10" Pipe	VA-4/0V6X10**B**	US115	NUWTUBE115
	12" to 30" Pipe	VA-4/0V12X30**B**	US115	NUWTUBE115
	32" Pipe or Larger	VA-4/0**B**	US115	NUWTUBE115

VA (Pipe) Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VA-6****B**	US45	NUWTUBE45
#4	VA-4****B**	US45	NUWTUBE45
#2 Sol	VA-2S****B**	US45	NUWTUBE45
#2	VA-2****B**	US45	NUWTUBE45
1/0	VA-1/0****B**	US90	NUWTUBE90
2/0	VA-2/0****B**	US90	NUWTUBE90
3/0	VA-3/0****B**	US115	NUWTUBE115
4/0	VA-4/0****B**	US115	NUWTUBE115

****Add Horizontal or Vertical Pipe Orientation and Pipe Size Indicator. See chart to the right.**

CABLE TO VERTICAL STEEL PIPE Use Mold Part No.; add "V" with Pipe Size (**) Indicator		
Cable	**Nominal Pipe Size**	**Pipe Size Indicator**
#4 thru 250	30" and Smaller	Nominal Pipe Size◊
	32" and Larger	None
Example: #2 cable to 2-1/2" pipe = VA-2V2.5**B**		
CABLE TO HORIZONTAL STEEL PIPE Use Mold Part No.; add "H" and Pipe Size (**) Indicator Example: #2/0 cable to 6" pipe = VA-2/0H6**B**		

◊ See page 334 for pipe sizes.

NOTE:

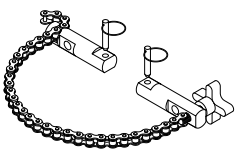
Thin walled pipe may be unsuitable for exothermic connections. If experiencing burn through issues with the pipe (typically with 2/0 or 4/0 conductors), adding sand inside the fence post well past the exothermic connection may solve this problem. Another solution would be to use a smaller conductor such as a #2 AWG jumper which uses a smaller size weld metal. The last solution may be to use mechanical fence clamp assembly such as the ones found in Section 1.11 on page 133.

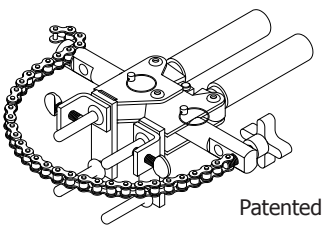
Cable to Steel Surface / Pipe — VD

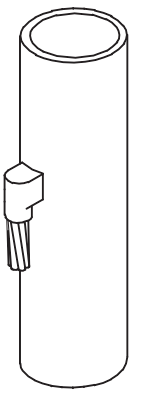
Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:
CSH1 - Chain Support Handle clamp for "**B**" Price Key Molds
OR
MH1 - Mold Handle for "**B**" Price Key Molds **AND**
CSKIT - Chain Support Kit

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush


CSKIT


Patented
CSH1



VD
(Vertical Downward Cable to Side of Vertical or Horizontal Steel Pipe)

VD (PIPE) Connection Type (Range Taking)

Cable Size	Nominal Pipe Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#2 Sol	1-1/4" to 4" Pipe	VD-2SV1.25X4**B**	US65	NUWTUBE65
#2	1-1/4" to 4" Pipe	VD-2V1.25X4**B**	US65	NUWTUBE65
1/0	1-1/4" to 4" Pipe	VD-1/0V1.25X4**B**	US115	NUWTUBE115
2/0	1-1/4" to 4" Pipe	VD-2/0V1.25X4**B**	US115	NUWTUBE115
4/0	1-1/4" to 4" Pipe	VD-4/0V1.25X4**B**	US150	NUWTUBE150

VD (Pipe) Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VD-6****B**	US45	NUWTUBE45
#4	VD-4****B**	US65	NUWTUBE65
#2 Sol	VD-2S****B**	US65	NUWTUBE65
#2	VD-2****B**	US65	NUWTUBE65
1/0	VD-1/0****B**	US115	NUWTUBE115
2/0	VD-2/0****B**	US115	NUWTUBE115
3/0	VD-3/0****B**	US150	NUWTUBE150
4/0	VD-4/0****B**	US150	NUWTUBE150
250 MCM	VD-25CM****B**	US200	NUWTUBE200

****Add Horizontal or Vertical Pipe Orientation and Pipe Size Indicator. See chart below.**

VD (FENCE POST) Connection Type (Range Taking)

Cable Size	Nominal Round Fence Post Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#2 Sol	1-1/4" to 4" Post	VD-2SV1.25X4**B**	US65	NUWTUBE65
#2	1-1/4" to 4" Post	VD-2V1.25X4**B**	US65	NUWTUBE65
1/0	1-1/4" to 4" Post	VDRFP-1/0**B**	US90	NUWTUBE90
2/0	1-1/4" to 4" Post	VDRFP-2/0**B**	US90	NUWTUBE90
4/0	1-1/4" to 4" Post	VDRFP-4/0**B**	US115	NUWTUBE115

CABLE TO VERTICAL STEEL PIPE Use Mold Part No.; add "V" with Pipe Size (**) Indicator		
Cable	**Nominal Pipe Size**	**Pipe Size Indicator**
#4 thru 250	30" and Smaller 32" and Larger	Nominal Pipe Size◇ None
Example: #2 cable to 2-1/2" pipe = VD-2V2.5**B**		
CABLE TO HORIZONTAL STEEL PIPE Use Mold Part No.; add "H" and Pipe Size (**) Indicator Example: #2/0 cable to 6" pipe = VD-2/0H6**B**		

◇ See page 334 for pipe sizes.

NOTE:
Thin walled pipe may be unsuitable for exothermic connections. If experiencing burn through issues with the pipe (typically with 2/0 or 4/0 conductors), adding sand inside the fence post well past the exothermic connection may solve this problem. Another solution would be to use a smaller conductor such as a #2 AWG jumper which uses a smaller size weld metal. The last solution may be to use mechanical fence clamp assembly such as the ones found in Section 1.11 on page 133.

VH / VL / VR Cable to Steel Surface

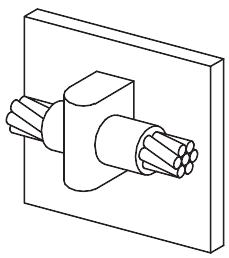
Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For **VH** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:

MH1 - Handle for "**B**" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush
MSKIT - Magnetic Support Kit

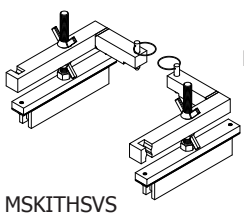


VH

(Horizontal Thru Cable to Vertical Flat Steel Surface)

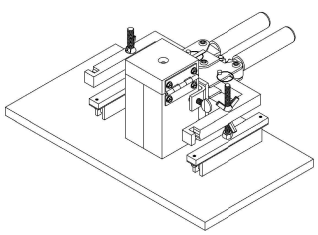
VH Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VH-6**B**	US65	NUWTUBE65
#4	VH-4**B**	US65	NUWTUBE65
#2 Sol	VH-2S**B**	US65	NUWTUBE65
#2	VH-2**B**	US65	NUWTUBE65
1/0	VH-1/0**B**	US115	NUWTUBE115
2/0	VH-2/0**B**	US115	NUWTUBE115
3/0	VH-3/0**B**	US150	NUWTUBE150
4/0	VH-4/0**B**	US150	NUWTUBE150
250 MCM	VH-25CM**B**	US150	NUWTUBE150

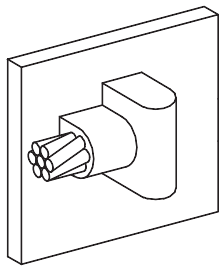


MSKITHSVS

Patented



MSKITHSVS with Mold Handle



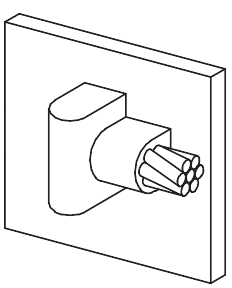
VL

(Horizontal Dead End Cable to Vertical Flat Steel Surface◇)

VL Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VL-6**B**	US45	NUWTUBE45
#4	VL-4**B**	US45	NUWTUBE45
#2 Sol	VL-2S**B**	US45	NUWTUBE45
#2	VL-2**B**	US45	NUWTUBE45
1/0	VL-1/0**B**	US90	NUWTUBE90
2/0	VL-2/0**B**	US90	NUWTUBE90
3/0	VL-3/0**B**	US115	NUWTUBE115
4/0	VL-4/0**B**	US115	NUWTUBE115
250 MCM	VL-25CM**B**	US115	NUWTUBE115
300 MCM	VL-3CM**B**	US150	NUWTUBE150
350 MCM	VL-35CM**B**	US200	NUWTUBE200
500 MCM	VL-5CM**B**	US200	NUWTUBE200

◇NOTES:
- VL is a Left Hand mold.
- To order a Right Hand mold, change the VL in the Mold Part No. to VR. Example: VR-6**B**.



VR

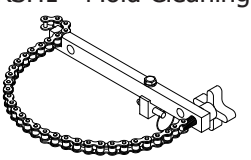
(Horizontal Dead End Cable to Vertical Flat Steel Surface◇)

Cable to Steel Surface / Pipe — VH / VL / VR

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number.
  i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For **VH** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:
For **VH** mold: MH1 - Mold Handle for "**B**" Price Key Molds **AND**
CSKITHSVM - Chain Support Kit for VH Mold
For **VL & VR** molds: MH1 - Handle for "**B**" Price Key Molds

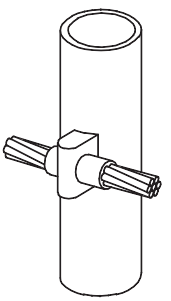
Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



CSKITHSVM
(Required for VH Mold)

VH

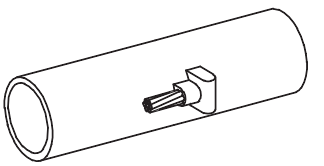
(Horizontal Thru Cable to Side of Vertical Steel Pipe)



VH (Pipe) Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VH-6**B	US65	NUWTUBE65
#4	VH-4**B	US65	NUWTUBE65
#2 Sol	VH-2S**B	US65	NUWTUBE65
#2	VH-2**B	US65	NUWTUBE65
1/0	VH-1/0**B	US115	NUWTUBE115
2/0	VH-2/0**B	US115	NUWTUBE115
3/0	VH-3/0**B	US150	NUWTUBE150
4/0	VH-4/0**B	US150	NUWTUBE150
250 MCM	VH-25CM**B	US150	NUWTUBE150

****Add Pipe Size and Vertical Pipe to Mold Part No. See chart below.**



VL

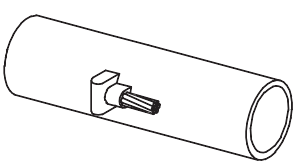
(Horizontal Dead End Cable to Side of Horizontal Steel Pipe◇)

VL (Pipe) Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VL-6**B	US45	NUWTUBE45
#4	VL-4**B	US45	NUWTUBE45
#2 Sol	VL-2S**B	US45	NUWTUBE45
#2	VL-2**B	US45	NUWTUBE45
1/0	VL-1/0**B	US90	NUWTUBE90
2/0	VL-2/0**B	US90	NUWTUBE90
3/0	VL-3/0**B	US115	NUWTUBE115
4/0	VL-4/0**B	US115	NUWTUBE115
250 MCM	VL-25CM**B	US115	NUWTUBE115

****Add Pipe Size and Horizontal Pipe to Mold Part No. See chart below.**

◇NOTES:
- VL is a Left Hand mold.
- To order a Right Hand mold, change the VL in the Mold Part No. to VR. Example: VR-6**B.



VR

(Horizontal Dead End Cable to Side of Horizontal Steel Pipe◇)

CABLE TO VERTICAL STEEL PIPE Use Mold Part No.; add "V" with Pipe Size (**) Indicator		
Cable	**Nominal Pipe Size**	**Pipe Size Indicator**
#1 and Smaller	12" and Smaller 24" and Larger	Nominal Pipe Size◇ None
1/0 thru 250	28" and Smaller 30" and Larger	Nominal Pipe Size◇ None
Example: #2 cable to 2-1/2" pipe = VH-2V2.5**B**		

◇ See page 334 for pipe sizes.

CABLE TO HORIZONTAL STEEL PIPE Use Mold Part No.; add "H" with Pipe Size (**) Indicator		
Cable	**Nominal Pipe Size**	**Pipe Size Indicator**
#1 and Smaller	12" and Smaller 14" and Larger	Nominal Pipe Size◇ None
1/0 thru 250	28" and Smaller 30" and Larger	Nominal Pipe Size◇ None
Example: #2 cable to 2-1/2" pipe = VL-2H2.5**B**		

◇ See page 334 for pipe sizes.

VT / VU Cable to Steel Surface

Mold Information:

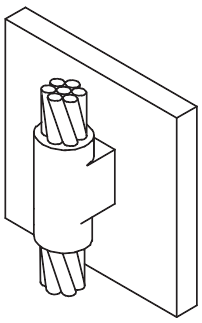
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For **VT** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:

MH1 - Handle for "**B**" and "**K**" Price Key Molds
MH2 - Handle for "**D**" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush
MSKIT - Magnetic Support Kit

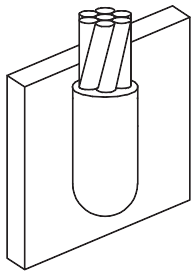


VT

(Vertical Thru Cable to Vertical Flat Steel Surface)

VT Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VT-6**B**	US90	NUWTUBE90
#4	VT-4**B**	US90	NUWTUBE90
#2 Sol	VT-2S**B**	US115	NUWTUBE115
#2	VT-2**B**	US115	NUWTUBE115
1/0	VT-1/0**K**	US200	NUWTUBE200
2/0	VT-2/0**K**	US200	NUWTUBE200
3/0	VT-3/0**K**	US250	NUWTUBE250
4/0	VT-4/0**K**	US250	NUWTUBE250
250 MCM	VT-25CM**K**	US250	NUWTUBE250

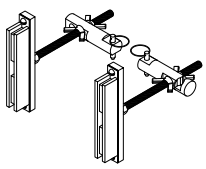


VU

(Vertical Cable Dead End to Vertical Flat Steel Surface)

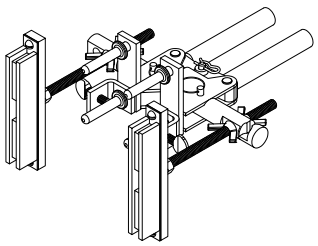
VU Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VU-6**B**	US65	NUWTUBE65
#4	VU-4**B**	US65	NUWTUBE65
#2 Sol	VU-2S**B**	US65	NUWTUBE65
#2	VU-2**B**	US65	NUWTUBE65
1/0	VU-1/0**B**	US150	NUWTUBE150
2/0	VU-2/0**B**	US150	NUWTUBE150
3/0	VU-3/0**K**	US200	NUWTUBE200
4/0	VU-4/0**K**	US200	NUWTUBE200
250 MCM	VU-25CM**K**	US200	NUWTUBE200
300 MCM	VU-3CM**K**	US250	NUWTUBE250
350 MCM	VU-35CM**D**	US300	2-NUWTUBE150
500 MCM	VU-5CM**D**	US400	2-NUWTUBE200
750 MCM	VU-75CM**D**	US500	2-NUWTUBE250



MSKIT

Patented



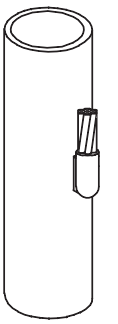
MSKIT with Mold Handle

Cable to Steel Surface / Pipe VT / VU

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For **VT** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

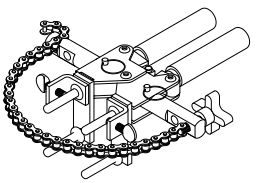
Required Tools & Accessories:
CSH1 - Chain Support Handle clamp for "**B**" and "**K**" Price Key Molds
OR
MH1 - Mold Handle for "**B**" and "**K**" Price Key Molds
AND
CSKIT - Chain Support Kit

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



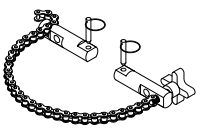
VU

(Vertical Cable Dead End to Side of Vertical or Horizontal Steel Pipe)

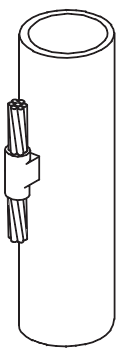


CSH1

Patented



CSKIT



VT

(Vertical Thru Cable to Side of Vertical or Horizontal Steel Pipe)

VU (Pipe) Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VU-6**B	US65	NUWTUBE65
#4	VU-4**B	US65	NUWTUBE65
#2 Sol	VU-2S**B	US65	NUWTUBE65
#2	VU-2**B	US65	NUWTUBE65
1/0	VU-1/0**B	US150	NUWTUBE150
2/0	VU-2/0**B	US150	NUWTUBE150
3/0	VU-3/0**K	US200	NUWTUBE200
4/0	VU-4/0**K	US200	NUWTUBE200
250 MCM	VU-25CM**K	US200	NUWTUBE200

****Add Pipe Size and Horizontal or Vertical Pipe to Mold Part No. See chart below.**

VT (Pipe) Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VT-6**B	US90	NUWTUBE90
#4	VT-4**B	US90	NUWTUBE90
#2 Sol	VT-2S**B	US115	NUWTUBE115
#2	VT-2**B	US115	NUWTUBE115
1/0	VT-1/0**K	US200	NUWTUBE200
2/0	VT-2/0**K	US200	NUWTUBE200
3/0	VT-3/0**K	US250	NUWTUBE250
4/0	VT-4/0**K	US250	NUWTUBE250
250 MCM	VT-25CM**K	US250	NUWTUBE250

****Add Horizontal or Vertical Pipe Orientation and Pipe Size Indicator. See chart to the right.**

CABLE TO VERTICAL STEEL PIPE Use Mold Part No.; add "V" with Pipe Size (**) Indicator		
Cable	**Nominal Pipe Size**	**Pipe Size Indicator**
#4 thru 250	28" and Smaller 30" and Larger	Nominal Pipe Size◊ None
Example: #2 cable to 2-1/2" pipe = VT-2V2.5**B**		
CABLE TO HORIZONTAL STEEL PIPE Use Mold Part No.; add "H" with Pipe Size (**) Indicator Example: #2/0 cable to 6" pipe = VT-2/0H6**B**		

◊ See page 334 for pipe sizes.

LE Cable to Lug or Busbar

Mold Information:

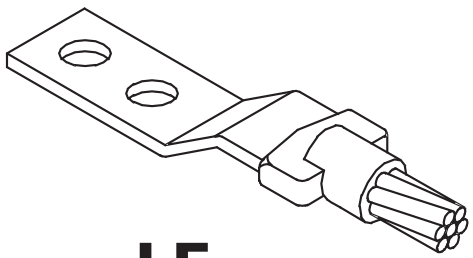
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:

MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



LE

(Butt End Splice of Horizontal Cable to Lug or Busbar)

See pages 314 & 315 for Lugs.

LE Connection Type

Cable Size	Lug Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#6	1/8 x 1	LE-6181**B**	US45	NUWTUBE45
#4	1/8 x 1	LE-4181**B**	US45	NUWTUBE45
#2 Sol	1/8 x 1	LE-2S181**B**	US45	NUWTUBE45
#2	1/8 x 1	LE-2181**B**	US45	NUWTUBE45
1/0	1/8 x 1 1/4 x 1	LE-1/0181**B** LE-1/0141**B**	US45 US65	NUWTUBE45 NUWTUBE65
2/0	1/8 x 1 1/4 x 1	LE-2/0181**B** LE-2/0141**B**	US65 US65	NUWTUBE65 NUWTUBE65
3/0	3/16 x 1 1/4 x 1	LE-3/03161**B** LE-3/0141**B**	US90 US90	NUWTUBE90 NUWTUBE90
4/0	3/16 x 1 1/4 x 1 1/4 x 1-1/4 1/4 x 1-1/2	LE-4/03161**B** LE-4/0141**B** LE-4/0141.25**B** LE-4/0141.5**B**	US90 US90 US90 US90	NUWTUBE90 NUWTUBE90 NUWTUBE90 NUWTUBE90

LE Connection Type continued

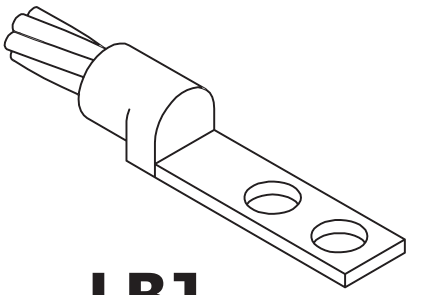
Cable Size	Lug Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
250 MCM	1/4 x 1 1/4 x 1-1/4 1/4 x 1-1/2	LE-25CM141**B** LE-25CM141.25**B** LE-25CM141.5**B**	US90 US90 US90	NUWTUBE90 NUWTUBE90 NUWTUBE90
300 MCM	1/4 x 1 1/4 x 1-1/4 1/4 x 1-1/2	LE-3CM141**B** LE-3CM141.25**B** LE-3CM141.5**B**	US90 US90 US90	NUWTUBE90 NUWTUBE90 NUWTUBE90
350 MCM	1/4 x 1 1/4 x 1-1/4 3/8 x 1	LE-35CM141**B** LE-35CM141.25**B** LE-35CM381**B**	US115 US115 US150	NUWTUBE115 NUWTUBE115 NUWTUBE150
500 MCM	1/4 x 1-1/2 1/4 x 2 3/8 x 1 3/8 x 1-1/2 3/8 x 2	LE-5CM141.5**B** LE-5CM142**B** LE-5CM381**B** LE-5CM381.5**B** LE-5CM382**C**	US200 US200 US200 US200 US300	NUWTUBE200 NUWTUBE200 NUWTUBE200 NUWTUBE200 2-NUWTUBE150
750 MCM	1/4 x 2 3/8 x 1-1/2 3/8 x 2	LE-75CM142**C** LE-75CM381.5**C** LE-75CM382**C**	US300 US300 US300	2-NUWTUBE150 2-NUWTUBE150 2-NUWTUBE150
1000 MCM	3/8 x 2 7/16 x 2 1/2 x 2	LE-1MM382**C** LE-1MM7162**C** LE-1MM122**C**	US400 US400 US500	2-NUWTUBE200 2-NUWTUBE200 2-NUWTUBE250

Cable to Lug or Busbar LBJ

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



LBJ

(Butt End Splice of Horizontal Cable to Lug Bent J)

See page 315 for Lugs.

LBJ Connection Type

Cable Size	Lug Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#6	1/8 x 1	LBJ-6181**B**	US32	NUWTUBE32
#4	1/8 x 1	LBJ-4181**B**	US32	NUWTUBE32
#2 Sol	1/8 x 1	LBJ-2S181**B**	US32	NUWTUBE32
#2	1/8 x 1	LBJ-2181**B**	US45	NUWTUBE45
1/0	1/8 x 1	LBJ-1/0181**B**	US45	NUWTUBE45
2/0	1/8 x 1 3/16 x 1	LBJ-2/0181**B** LBJ-2/03161**B**	US45 US65	NUWTUBE45 NUWTUBE65
3/0	1/8 x 1 3/16 x 1	LBJ-3/0181**B** LBJ-3/03161**B**	US65 US65	NUWTUBE65 NUWTUBE65
4/0	1/8 x 1 3/16 x 1	LBJ-4/0181**B** LBJ-4/03161**B**	US65 US65	NUWTUBE65 NUWTUBE65

BD Cable to Busbar

Mold Information:

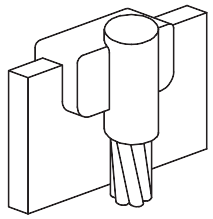
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:

MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds
MLDSLR - Mold Sealer

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



BD

(Downward Vertical Cable to Top of Horizontal Busbar with Face in Vertical Plane)

BD Connection Type

Busbar Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
1/8 x 1	1/0	BD-1811/0**B**	US90	NUWTUBE90
	2/0	BD-1812/0**B**	US90	NUWTUBE90
	4/0	BD-1814/0**B**	US115	NUWTUBE115
1/8 x 2	1/0	BD-1821/0**B**	US90	NUWTUBE90
	2/0	BD-1822/0**B**	US90	NUWTUBE90
	4/0	BD-1824/0**B**	US115	NUWTUBE115
	250 MCM	BD-18225CM**B**	US115	NUWTUBE115
	300 MCM	BD-1823CM**B**	US150	NUWTUBE150
	350 MCM	BD-18235CM**B**	US150	NUWTUBE150
1/4 x 1	1/0	BD-1411/0**B**	US115	NUWTUBE115
	2/0	BD-1412/0**B**	US115	NUWTUBE115
	4/0	BD-1414/0**B**	US150	NUWTUBE150
	250 MCM	BD-14125CM**B**	US150	NUWTUBE150
	300 MCM	BD-1413CM**B**	US200	NUWTUBE200
	350 MCM	BD-14135CM**B**	US200	NUWTUBE200
	500 MCM	BD-1415CM**B**	US250	NUWTUBE250
1/4 x 1-1/2	1/0	BD-141.51/0**B**	US115	NUWTUBE115
	2/0	BD-141.52/0**B**	US115	NUWTUBE115
	4/0	BD-141.54/0**B**	US150	NUWTUBE150
	250 MCM	BD-141.525CM**B**	US150	NUWTUBE150
	300 MCM	BD-141.53CM**B**	US200	NUWTUBE200
	350 MCM	BD-141.535CM**B**	US200	NUWTUBE200
	500 MCM	BD-141.55CM**B**	US250	NUWTUBE250
	750 MCM	BD-141.575CM**C**	US400	2-NUWTUBE200
1/4 x 2	1/0	BD-1421/0**B**	US115	NUWTUBE115
	2/0	BD-1422/0**B**	US115	NUWTUBE115
	4/0	BD-1424/0**B**	US150	NUWTUBE150
	250 MCM	BD-14225CM**B**	US150	NUWTUBE150
	300 MCM	BD-1423CM**B**	US200	NUWTUBE200
	350 MCM	BD-14235CM**B**	US200	NUWTUBE200
	500 MCM	BD-1425CM**B**	US250	NUWTUBE250
	750 MCM	BD-14275CM**C**	US400	2-NUWTUBE200
	1000 MCM	BD-1421MM**C**	US500	2-NUWTUBE250
1/4 x 3 & WIDER	1/0	BD-1431/0**B**	US115	NUWTUBE115
	2/0	BD-1432/0**B**	US115	NUWTUBE115
	4/0	BD-1434/0**B**	US150	NUWTUBE150
	250 MCM	BD-14325CM**B**	US150	NUWTUBE150
	300 MCM	BD-1433CM**B**	US200	NUWTUBE200
	350 MCM	BD-14335CM**B**	US200	NUWTUBE200
	500 MCM	BD-1435CM**B**	US250	NUWTUBE250
	750 MCM	BD-14375CM**C**	US400	2-NUWTUBE200
	1000 MCM	BD-1431MM**C**	US500	2-NUWTUBE250

BD Connection Type continued

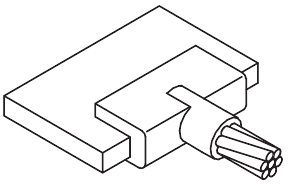
Busbar Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
3/8 x 2	1/0	BD-3821/0**B**	US115	NUWTUBE115
	2/0	BD-3822/0**B**	US115	NUWTUBE115
	4/0	BD-3824/0**B**	US150	NUWTUBE150
	250 MCM	BD-38225CM**B**	US150	NUWTUBE150
	300 MCM	BD-3823CM**B**	US200	NUWTUBE200
	350 MCM	BD-38235CM**B**	US200	NUWTUBE200
	500 MCM	BD-3825CM**B**	US250	NUWTUBE250
	750 MCM	BD-38275CM**C**	US400	2-NUWTUBE200
	1000 MCM	BD-3821MM**C**	US500	2-NUWTUBE250
3/8 x 3 & WIDER	1/0	BD-3831/0**B**	US115	NUWTUBE115
	2/0	BD-3832/0**B**	US115	NUWTUBE115
	4/0	BD-3834/0**B**	US150	NUWTUBE150
	250 MCM	BD-38325CM**B**	US150	NUWTUBE150
	300 MCM	BD-3833CM**B**	US200	NUWTUBE200
	350 MCM	BD-38335CM**B**	US200	NUWTUBE200
	500 MCM	BD-3835CM**B**	US250	NUWTUBE250
	750 MCM	BD-38375CM**C**	US400	2-NUWTUBE200
	1000 MCM	BD-3831MM**C**	US500	2-NUWTUBE250
1/2 x 2	1/0	BD-1221/0**B**	US150	NUWTUBE150
	2/0	BD-1222/0**B**	US150	NUWTUBE150
	4/0	BD-1224/0**B**	US200	NUWTUBE200
	250 MCM	BD-12225CM**B**	US200	NUWTUBE200
	300 MCM	BD-1223CM**B**	US250	NUWTUBE250
	350 MCM	BD-12235CM**B**	US250	NUWTUBE250
	500 MCM	BD-1225CM**C**	US300	2-NUWTUBE150
	750 MCM	BD-12275CM**C**	US500	2-NUWTUBE250
1/2 x 3 & WIDER	1/0	BD-1231/0**B**	US150	NUWTUBE150
	2/0	BD-1232/0**B**	US150	NUWTUBE150
	4/0	BD-1234/0**B**	US200	NUWTUBE200
	250 MCM	BD-12325CM**B**	US200	NUWTUBE200
	300 MCM	BD-1233CM**B**	US250	NUWTUBE250
	350 MCM	BD-12335CM**B**	US250	NUWTUBE250
	500 MCM	BD-1235CM**C**	US300	2-NUWTUBE150
	750 MCM	BD-12375CM**C**	US500	2-NUWTUBE250

Cable to Busbar — BE / BH

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For **BH** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush

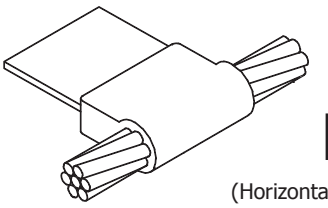


BE

(Horizontal Cable Tap to Edge of Horizontal Flat Busbar)

BE Connection Type

Bus/Lug Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
1/4 x 1-1/2 & WIDER	#6	BE-141.56**B**	US65	NUWTUBE65
	#2 Sol	BE-141.52S**B**	US65	NUWTUBE65
	#2	BE-141.52**B**	US65	NUWTUBE65
	1/0	BE-141.51/0**B**	US90	NUWTUBE90
	2/0	BE-141.52/0**B**	US90	NUWTUBE90
	3/0	BE-141.53/0**B**	US90	NUWTUBE90
	4/0	BE-141.54/0**B**	US90	NUWTUBE90
	250 MCM	BE-141.525CM**B**	US115	NUWTUBE115
	300 MCM	BE-141.53CM**B**	US115	NUWTUBE115
	350 MCM	BE-141.535CM**B**	US150	NUWTUBE150
	500 MCM	BE-141.55CM**B**	US200	NUWTUBE200
3/8 x 1-1/2 & WIDER	1/0	BE-381.51/0**B**	US90	NUWTUBE90
	2/0	BE-381.52/0**B**	US90	NUWTUBE90
	3/0	BE-381.53/0**B**	US115	NUWTUBE115
	4/0	BE-381.54/0**B**	US115	NUWTUBE115
	250 MCM	BE-381.525CM**B**	US150	NUWTUBE150
	300 MCM	BE-381.53CM**B**	US150	NUWTUBE150
	350 MCM	BE-381.535CM**B**	US200	NUWTUBE200
	500 MCM	BE-381.55CM**B**	US250	NUWTUBE250
	750 MCM	BE-381.575CM**C**	US300	2-NUWTUBE150
	1000 MCM	BE-381.51MM**C**	US400	2-NUWTUBE200
1/2 x 1-1/2 & WIDER	1/0	BE-121.51/0**B**	US115	NUWTUBE115
	2/0	BE-121.52/0**B**	US115	NUWTUBE115
	3/0	BE-121.53/0**B**	US150	NUWTUBE150
	4/0	BE-121.54/0**B**	US150	NUWTUBE150
	250 MCM	BE-121.525CM**B**	US200	NUWTUBE200
	300 MCM	BE-121.53CM**B**	US200	NUWTUBE200
	350 MCM	BE-121.535CM**B**	US250	NUWTUBE250
	500 MCM	BE-121.55CM**C**	US300	2-NUWTUBE150
	750 MCM	BE-121.575CM**C**	US400	2-NUWTUBE200
	1000 MCM	BE-121.51MM**C**	US500	2-NUWTUBE250



BH

(Horizontal Flat Busbar Tap to Horizontal Run Cable)

BH Connection Type

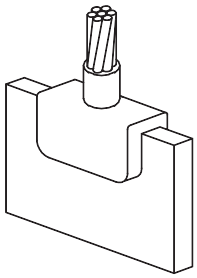
Cable Size	Bus/Lug Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
1/0	1/8 x 1 1/4 x 1	BH-1/0181**B** BH-1/0141**B**	US65 US90	NUWTUBE65 NUWTUBE90
2/0	1/8 x 1 1/4 x 1	BH-2/0181**B** BH-2/0141**B**	US90 US115	NUWTUBE90 NUWTUBE115
3/0	3/16 x 1 1/4 x 1 1/4 x 1-1/2 1/4 x 2	BH-3/03161**B** BH-3/0141**B** BH-3/0141.5**B** BH-3/0142**B**	US115 US150 US200 US250	NUWTUBE115 NUWTUBE150 NUWTUBE200 NUWTUBE250
4/0	3/16 x 1 1/4 x 1 1/4 x 1-1/2 1/4 x 2	BH-4/03161**B** BH-4/0141**B** BH-4/0141.5**B** BH-4/0142**B**	US150 US150 US200 US250	NUWTUBE150 NUWTUBE150 NUWTUBE200 NUWTUBE250
250 MCM	1/4 x 1 1/4 x 1-1/2 1/4 x 2	BH-25CM141**B** BH-25CM141.5**B** BH-25CM142**B**	US150 US200 US250	NUWTUBE150 NUWTUBE200 NUWTUBE250
300 MCM	1/4 x 1 1/4 x 1-1/2 1/4 x 2	BH-3CM141**B** BH-3CM141.5**B** BH-3CM142**C**	US200 US250 US300	NUWTUBE200 NUWTUBE250 2-NUWTUBE150
350 MCM	1/4 x 1 1/4 x 1-1/4 1/4 x 1-1/2 1/4 x 2	BH-35CM141**B** BH-35CM141.25**B** BH-35CM141.5**B** BH-35CM142**C**	US200 US250 US250 US300	NUWTUBE200 NUWTUBE250 NUWTUBE250 2-NUWTUBE150
500 MCM	1/4 x 1 1/4 x 1-1/2 1/4 x 2	BH-5CM141**B** BH-5CM141.5**C** BH-5CM142**C**	US250 US300 US400	NUWTUBE250 2-NUWTUBE150 2-NUWTUBE200
750 MCM	1/4 x 1-1/2 1/4 x 2 3/8 x 1-1/2	BH-75CM141.5**C** BH-75CM142**C** BH-75CM381.5**C**	US400 US500 US500	2-NUWTUBE200 2-NUWTUBE250 2-NUWTUBE250
1000 MCM	1/4 x 1-1/2	BH-1MM141.5**C**	US500	2-NUWTUBE250

BU Cable to Busbar

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:
MH1 - Handle for "**K**" Price Key Molds
MH2 - Handle for "**D**" Price Key Molds

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



BU

(Upward Vertical Cable Tap to Edge of Horizontal Busbar with Face in Vertical Plane)

BU Connection Type

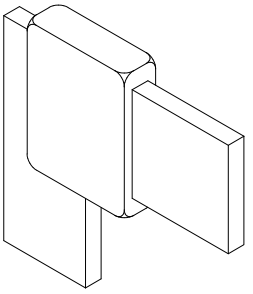
Busbar Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
1/8 x 1	1/0	BU-1811/0**K**	US115	NUWTUBE115
	2/0	BU-1812/0**K**	US115	NUWTUBE115
	4/0	BU-1814/0**K**	US115	NUWTUBE115
1/8 x 1-1/2 & WIDER	1/0	BU-181.51/0**K**	US115	NUWTUBE115
	2/0	BU-181.52/0**K**	US115	NUWTUBE115
	4/0	BU-181.54/0**K**	US115	NUWTUBE115
	250 MCM	BU-181.525CM**K**	US115	NUWTUBE115
	300 MCM	BU-181.53CM**K**	US150	NUWTUBE150
	350 MCM	BU-181.535CM**K**	US150	NUWTUBE150
1/4 x 1	1/0	BU-1411/0**K**	US150	NUWTUBE150
	2/0	BU-1412/0**K**	US150	NUWTUBE150
	4/0	BU-1414/0**K**	US150	NUWTUBE150
	250 MCM	BU-14125CM**K**	US150	NUWTUBE150
	300 MCM	BU-1413CM**K**	US200	NUWTUBE200
	350 MCM	BU-14135CM**K**	US200	NUWTUBE200
	500 MCM	BU-1415CM**K**	US300	2-NUWTUBE150
1/4 x 1-1/2 & WIDER	1/0	BU-141.51/0**K**	US150	NUWTUBE150
	2/0	BU-141.52/0**K**	US150	NUWTUBE150
	4/0	BU-141.54/0**K**	US150	NUWTUBE150
	250 MCM	BU-141.525CM**K**	US150	NUWTUBE150
	300 MCM	BU-141.53CM**K**	US200	NUWTUBE200
	350 MCM	BU-141.535CM**K**	US200	NUWTUBE200
	500 MCM	BU-141.55CM**K**	US300	2-NUWTUBE150
	750 MCM	BU-141.575CM**D**	US400	2-NUWTUBE200
3/8 x 1	1/0	BU-3811/0**K**	US150	NUWTUBE150
	2/0	BU-3812/0**K**	US150	NUWTUBE150
	4/0	BU-3814/0**K**	US150	NUWTUBE150
	250 MCM	BU-38125CM**K**	US150	NUWTUBE150
	300 MCM	BU-3813CM**K**	US200	NUWTUBE200
	350 MCM	BU-38135CM**K**	US200	NUWTUBE200
	500 MCM	BU-3815CM**K**	US250	NUWTUBE250
	750 MCM	BU-38175CM**D**	US400	2-NUWTUBE200

BU Connection Type continued

Busbar Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
3/8 x 1-1/2 & WIDER	1/0	BU-381.51/0**K**	US150	NUWTUBE150
	2/0	BU-381.52/0**K**	US150	NUWTUBE150
	4/0	BU-381.54/0**K**	US150	NUWTUBE150
	250 MCM	BU-381.525CM**K**	US150	NUWTUBE150
	300 MCM	BU-381.53CM**K**	US200	NUWTUBE200
	350 MCM	BU-381.535CM**K**	US200	NUWTUBE200
	500 MCM	BU-381.55CM**K**	US250	NUWTUBE250
	750 MCM	BU-381.575CM**D**	US400	2-NUWTUBE200
1/2 x 1	1/0	BU-1211/0**K**	US200	NUWTUBE200
	2/0	BU-1212/0**K**	US200	NUWTUBE200
	4/0	BU-1214/0**K**	US200	NUWTUBE200
	250 MCM	BU-12125CM**K**	US200	NUWTUBE200
	300 MCM	BU-1213CM**K**	US250	NUWTUBE250
	350 MCM	BU-12135CM**K**	US250	NUWTUBE250
	500 MCM	BU-1215CM**D**	US300	2-NUWTUBE150
	750 MCM	BU-12175CM**D**	US500	2-NUWTUBE250
1/2 x 1-1/2 & WIDER	1/0	BU-121.51/0**K**	US200	NUWTUBE200
	2/0	BU-121.52/0**K**	US200	NUWTUBE200
	4/0	BU-121.54/0**K**	US200	NUWTUBE200
	250 MCM	BU-121.525CM**K**	US200	NUWTUBE200
	300 MCM	BU-121.53CM**K**	US250	NUWTUBE250
	350 MCM	BU-121.535CM**K**	US250	NUWTUBE250
	500 MCM	BU-121.55CM**D**	US300	2-NUWTUBE150
	750 MCM	BU-121.575CM**D**	US500	2-NUWTUBE250

Busbar to Busbar BA / BB

Mold Information:
• Price Key is the **Bold Letter** in the Mold Part No.
Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds
Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush

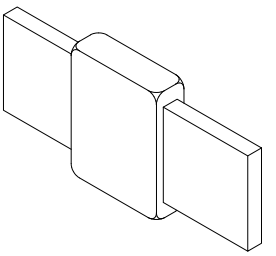


BA

(Busbar 90°, Tap Down, Run Horizontal, Busbar Face in Vertical Plane)

BA Connection Type

Busbar Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
1/8 x 1	BA-181**B**	US45	NUWTUBE45
1/8 x 2	BA-182**B**	US90	NUWTUBE90
3/16 x 1	BA-3161**B**	US65	NUWTUBE65
3/16 x 2	BA-3162**B**	US115	NUWTUBE115
1/4 x 1	BA-141**B**	US90	NUWTUBE90
1/4 x 1-1/4	BA-141.25**B**	US115	NUWTUBE115
1/4 x 1-1/2	BA-141.5**B**	US150	NUWTUBE150
1/4 x 2	BA-142**B**	US200	NUWTUBE200
1/4 x 3	BA-143**C**	US400	2-NUWTUBE200
1/4 x 4	BA-144**C**	US500	2-NUWTUBE250
3/8 x 1	BA-381**B**	US150	NUWTUBE150
3/8 x 1-1/2	BA-381.5**B**	US250	NUWTUBE250
3/8 x 2	BA-382**C**	US300	2-NUWTUBE150
3/8 x 3	BA-383**C**	US500	2-NUWTUBE250
1/2 x 1	BA-121**B**	US200	NUWTUBE200
1/2 x 2	BA-122**C**	US400	2-NUWTUBE200



BB

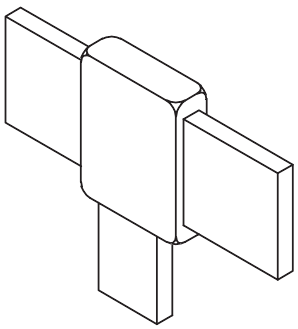
(Horizontal Busbar Butt Splice, Busbar Face in Vertical Plane)

BB Connection Type

Busbar Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
1/8 x 1	BB-181**B**	US45	NUWTUBE45
1/8 x 2	BB-182**B**	US90	NUWTUBE90
3/16 x 1	BB-3161**B**	US65	NUWTUBE65
3/16 x 2	BB-3162**B**	US115	NUWTUBE115
1/4 x 1	BB-141**B**	US90	NUWTUBE90
1/4 x 1-1/4	BB-141.25**B**	US115	NUWTUBE115
1/4 x 1-1/2	BB-141.5**B**	US150	NUWTUBE150
1/4 x 2	BB-142**B**	US200	NUWTUBE200
1/4 x 3	BB-143**C**	US400	2-NUWTUBE200
1/4 x 4	BB-144**C**	US500	2-NUWTUBE250
3/8 x 1	BB-381**B**	US150	NUWTUBE150
3/8 x 1-1/2	BB-381.5**B**	US250	NUWTUBE250
3/8 x 2	BB-382**C**	US300	2-NUWTUBE150
3/8 x 3	BB-383**C**	US500	2-NUWTUBE250
1/2 x 1	BB-121**B**	US200	NUWTUBE200
1/2 x 2	BB-122**C**	US400	2-NUWTUBE200

BT Busbar to Busbar

Mold Information:
• Price Key is the **Bold Letter** in the Mold Part No.
Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
MH2 - Handle for "**C**" Price Key Molds
Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



BT

(Busbar Tee, Tap Down, Thru Horizontal Run, Busbar Face in Vertical Plane)

BT Connection Type

Busbar Size		Mold Part No.	Weld Metal	
Bar Run	Bar Tap		UltraShot	NUWTUBE
1/8 x 1 1/8 x 2 & WIDER	1/8 x 1 1/8 x 2	BT-181181**B** BT-182182**B**	US90 US200	NUWTUBE90 NUWTUBE200
3/16 x 1 3/16 x 2 & WIDER	3/16 x 1 3/16 x 2	BT-31613161**B** BT-31623162**B**	US115 US200	NUWTUBE115 NUWTUBE200
1/4 x 1 1/4 x 1-1/4 1/4 x 1-1/2 1/4 x 2 & WIDER	1/4 x 1 1/4 x 1-1/4 1/4 x 1-1/2 1/4 x 2	BT-141141**B** BT-141.25141.25**B** BT-141.5141.5**B** BT-142142**C**	US150 US200 US250 US400	NUWTUBE150 NUWTUBE200 NUWTUBE250 2-NUWTUBE200
3/8 x 1 3/8 x 1-1/2 3/8 x 2 & WIDER	3/8 x 1 3/8 x 1-1/2 3/8 x 2	BT-381381**B** BT-381.5381.5**C** BT-382382**C**	US250 US400 US500	NUWTUBE250 2-NUWTUBE200 2-NUWTUBE250
1/2 x 1	1/2 x 1	BT-121121**C**	US300	2-NUWTUBE150

Cable to Rebar

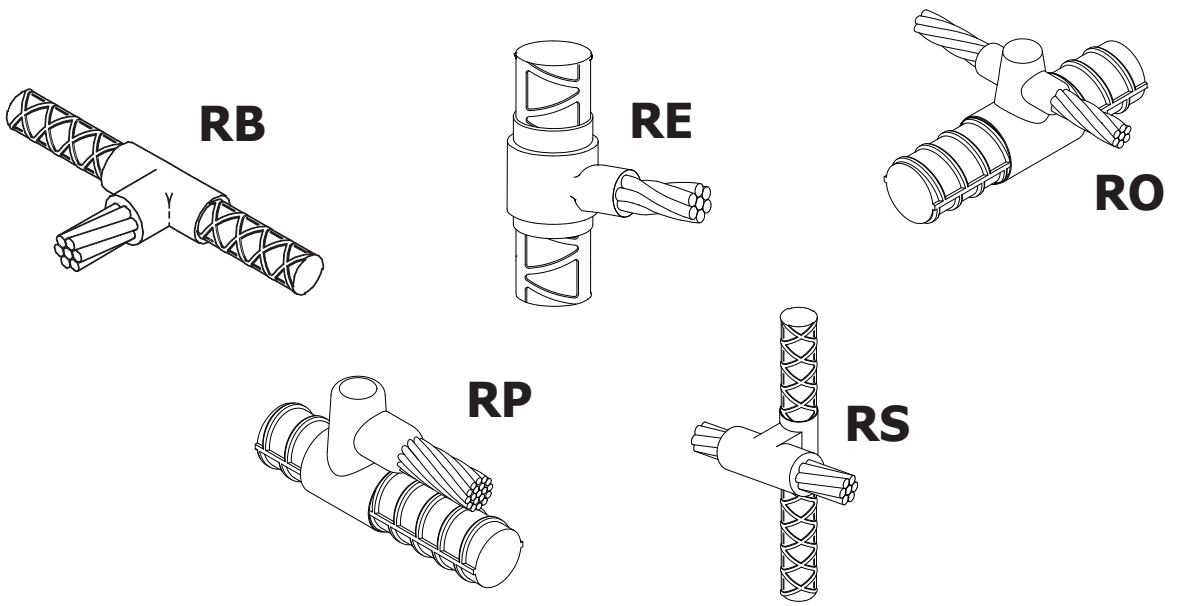
APPLICATION NOTES:

Ultraweld Connections Used for Grounding Reinforcing Bars

The Ultraweld process is ideal for providing permanent connections of grounding conductors and lightning protection conductors to rebar. Exothermically welding to the rebar ensures that the concrete encased connection will last the duration of the structure. To ensure that the connection is made properly, the mill scale must be removed from the rebar in the area of the connection. In addition to the normal materials used to make an Ultraweld connection, packing material is also required. The packing material serves as a sealant barrier between the mold and the rebar and thus prevents weld metal leakage. A piece of packing material is good for one connection.

Ultraweld Connections to Structural Reinforcing Bar

The Ultraweld process is only to be used for attaching conductors to rebar and not as a means to provide a structural welded joint of the rebar itself. The welding of ground conductors to rebar using the Ultraweld process will not be harmful if the stresses in the rebar are below its yield point. Design stresses for rebar are normally below 60% of the nominal yield strength thus Ultraweld exothermic welding process should not be detrimental under design stresses. In practice it is best to make grounding attachments to rebar in areas away from the point of maximum stress. It is best to make connections near the free end of the rebar.



RB Cable to Rebar

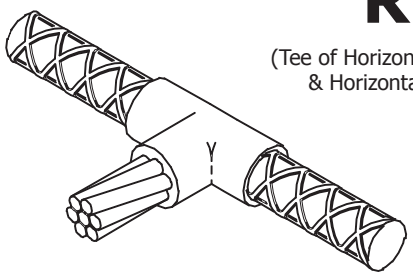
Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For information on sizes not listed, please contact the factory.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
WRPSLV - Wrap Sleeve

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush

RB

(Tee of Horizontal Thru Rebar & Horizontal Tap Cable)



Important: See Packing Material Notes.

RB Connection Type

Rebar Size	Cable Size	Mold Part No.	Packing Mat'l No.	Weld Metal	
				UltraShot	NUWTUBE
3	#6	RB-36**B**	WRPSLV	US45	NUWTUBE45
	#4	RB-34**B**	WRPSLV	US45	NUWTUBE45
	#2 Sol	RB-32S**B**	WRPSLV	US65	NUWTUBE65
	#2	RB-32**B**	WRPSLV	US65	NUWTUBE65
	1/0	RB-31/0**B**	WRPSLV	US90	NUWTUBE90
	2/0	RB-32/0**B**	WRPSLV	US90	NUWTUBE90
	3/0	RB-33/0**B**	WRPSLV	US115	NUWTUBE115
	4/0	RB-34/0**B**	WRPSLV	US115	NUWTUBE115
4	#6	RB-46**B**	WRPSLV	US45	NUWTUBE45
	#4	RB-44**B**	WRPSLV	US45	NUWTUBE45
	#2 Sol	RB-42S**B**	WRPSLV	US65	NUWTUBE65
	#2	RB-42**B**	WRPSLV	US65	NUWTUBE65
	1/0	RB-41/0**B**	WRPSLV	US90	NUWTUBE90
	2/0	RB-42/0**B**	WRPSLV	US90	NUWTUBE90
	3/0	RB-43/0**B**	WRPSLV	US115	NUWTUBE115
	4/0	RB-44/0**B**	WRPSLV	US115	NUWTUBE115
5	#6	RB-56**B**	WRPSLV	US90	NUWTUBE90
	#4	RB-54**B**	WRPSLV	US90	NUWTUBE90
	#2 Sol	RB-52S**B**	WRPSLV	US90	NUWTUBE90
	#2	RB-52**B**	WRPSLV	US90	NUWTUBE90
	1/0	RB-51/0**B**	WRPSLV	US115	NUWTUBE115
	2/0	RB-52/0**B**	WRPSLV	US115	NUWTUBE115
	3/0	RB-53/0**B**	WRPSLV	US150	NUWTUBE150
	4/0	RB-54/0**B**	WRPSLV	US150	NUWTUBE150
6	#6	RB-66**B**	WRPSLV	US90	NUWTUBE90
	#4	RB-64**B**	WRPSLV	US90	NUWTUBE90
	#2 Sol	RB-62S**B**	WRPSLV	US90	NUWTUBE90
	#2	RB-62**B**	WRPSLV	US90	NUWTUBE90
	1/0	RB-61/0**B**	WRPSLV	US115	NUWTUBE115
	2/0	RB-62/0**B**	WRPSLV	US115	NUWTUBE115
	3/0	RB-63/0**B**	WRPSLV	US150	NUWTUBE150
	4/0	RB-64/0**B**	WRPSLV	US150	NUWTUBE150

Packing Material Notes

Packing Material or Wrap Sleeve(s) are necessary when making Ultraweld connections to Rebar. The two types of material used are CERPM or WRPSLV.

CERPM Packing Material is a ceramic fiber material and can be used for one connection only. CERPM is packaged in quantities of 25 per box.

WRPSLV Copper Wrap Sleeve is wrapped around the rebar for certain connection styles. WRPSLV is packaged in quantities of 50 per box.

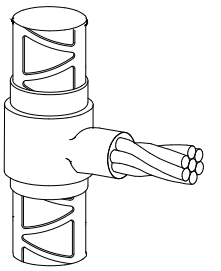
Be sure to specify Packing Material No. when ordering Mold and Weld Metal. See pages 325 & 326 for Packing Material.

Cable to Rebar RE

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:
WRPSLV or CERPM - Rebar Packing Material
CSH1 - Chain Support Handle clamp for "**B**" & **"K"** Price Key Molds
OR
MH1 - Handle for "**B**" and **"K"** Price Key Molds
**CSKIT - Chain Support Kit for #7 & Larger rebar

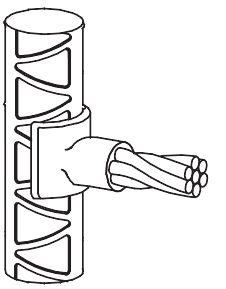
Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



RE

(Tee of Vertical Thru Rebar & Horizontal Tap Cable)

Listed 467



RE 7 & Larger

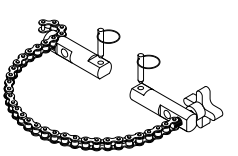
RE Connection Type

Rebar Size	Cable Size	Mold Part No.	Packing Mat'l No.	Weld Metal	
				UltraShot	NUWTUBE
3	#6	RE-36**B**	WRPSLV	US45	NUWTUBE45
	#4	RE-34**B**	WRPSLV	US65	NUWTUBE65
	#2 Sol	RE-32S**B**	WRPSLV	US65	NUWTUBE65
	#2	RE-32**B**	WRPSLV	US65	NUWTUBE65
	1/0	RE-31/0**B**	WRPSLV	US115	NUWTUBE115
	2/0	RE-32/0**B**	WRPSLV	US115	NUWTUBE115
	3/0	RE-33/0**B**	WRPSLV	US150	NUWTUBE150
	4/0	RE-34/0**B**	WRPSLV	US150	NUWTUBE150
4	#6	RE-46**B**	WRPSLV	US45	NUWTUBE45
	#4	RE-44**B**	WRPSLV	US65	NUWTUBE65
	#2 Sol	RE-42S**B**	WRPSLV	US65	NUWTUBE65
	#2	RE-42**B**	WRPSLV	US65	NUWTUBE65
	1/0	RE-41/0**B**	WRPSLV	US115	NUWTUBE115
	2/0	RE-42/0**B**	WRPSLV	US115	NUWTUBE115
	3/0	RE-43/0**B**	WRPSLV	US150	NUWTUBE150
	4/0	RE-44/0**B**	WRPSLV	US150	NUWTUBE150
5	#6	RE-56**B**	WRPSLV	US45	NUWTUBE45
	#4	RE-54**B**	WRPSLV	US65	NUWTUBE65
	#2 Sol	RE-52S**B**	WRPSLV	US65	NUWTUBE65
	#2	RE-52**B**	WRPSLV	US65	NUWTUBE65
	1/0	RE-51/0**B**	WRPSLV	US115	NUWTUBE115
	2/0	RE-52/0**B**	WRPSLV	US115	NUWTUBE115
	3/0	RE-53/0**B**	WRPSLV	US150	NUWTUBE150
	4/0	RE-54/0**B**	WRPSLV	US150	NUWTUBE150

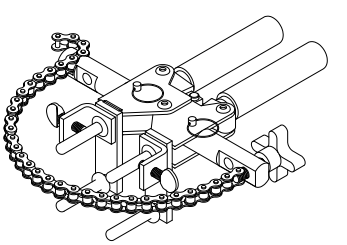
RE Connection Type continued

Rebar Size	Cable Size	Mold Part No.	Packing Mat'l No.	Weld Metal	
				UltraShot	NUWTUBE
6	#6	RE-66**B**	WRPSLV	US45	NUWTUBE45
	#4	RE-64**B**	WRPSLV	US65	NUWTUBE65
	#2 Sol	RE-62S**B**	WRPSLV	US65	NUWTUBE65
	#2	RE-62**B**	WRPSLV	US65	NUWTUBE65
	1/0	RE-61/0**B**	WRPSLV	US115	NUWTUBE115
	2/0	RE-62/0**B**	WRPSLV	US115	NUWTUBE115
	3/0	RE-63/0**B**	WRPSLV	US150	NUWTUBE150
	4/0	RE-64/0**B**	WRPSLV	US150	NUWTUBE150
7** & Larger	#6	RE-7L6**K**	CERPM3	US45	NUWTUBE45
	#4	RE-7L4**K**	CERPM3	US65	NUWTUBE65
	#2 Sol	RE-7L2S**K**	CERPM3	US65	NUWTUBE65
	#2	RE-7L2**K**	CERPM3	US65	NUWTUBE65
	1/0	RE-7L1/0**K**	CERPM3	US115	NUWTUBE115
	2/0	RE-7L2/0**K**	CERPM3	US115	NUWTUBE115
	3/0	RE-7L3/0**K**	CERPM3	US150	NUWTUBE150
	4/0	RE-7L4/0**K**	CERPM3	US150	NUWTUBE150

**Requires Chain Support Kit (#CSKIT) for welds made to #7 and Larger rebar.



CSKIT



CSH1 Patented

Important: See Packing Material Notes On Page 305.

RO Cable to Rebar

Mold Information:

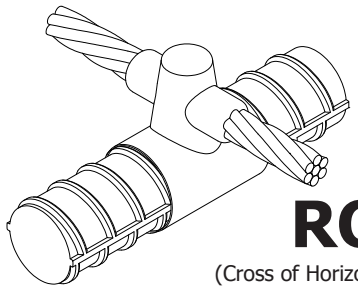
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:

MH1 - Handle for "**B**" and "**Q**" Price Key Molds
WRPSLV or CERPM - Rebar Packing Material
UMHDKIT - Hold Down Kit

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



RO

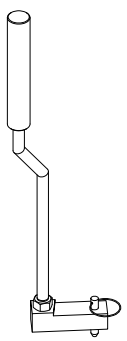
(Cross of Horizontal Cable Lapped Over Horizontal Rebar)

UL Listed 467

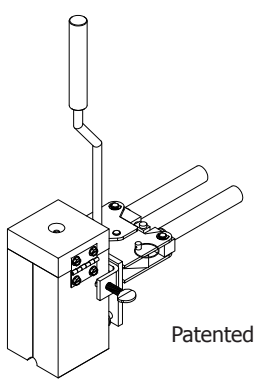
RO Connection Type

Rebar Size	Cable Size	Mold Part No.	Packing Mat'l No.	Weld Metal	
				UltraShot	NUWTUBE
3	#6	RO-36**B**	WRPSLV	US65	NUWTUBE65
	#4	RO-34**B**	WRPSLV	US65	NUWTUBE65
	#2 Sol	RO-32S**B**	WRPSLV	US90	NUWTUBE90
	#2	RO-32**B**	WRPSLV	US90	NUWTUBE90
	1/0	RO-31/0**Q**	WRPSLV	US115	NUWTUBE115
	2/0	RO-32/0**Q**	WRPSLV	US115	NUWTUBE115
	3/0	RO-33/0**Q**	WRPSLV	US150	NUWTUBE150
	4/0	RO-34/0**Q**	WRPSLV	US150	NUWTUBE150
4	#6	RO-46**B**	WRPSLV	US65	NUWTUBE65
	#4	RO-44**B**	WRPSLV	US65	NUWTUBE65
	#2 Sol	RO-42S**B**	WRPSLV	US90	NUWTUBE90
	#2	RO-42**B**	WRPSLV	US90	NUWTUBE90
	1/0	RO-41/0**Q**	WRPSLV	US115	NUWTUBE115
	2/0	RO-42/0**Q**	WRPSLV	US115	NUWTUBE115
	3/0	RO-43/0**Q**	WRPSLV	US150	NUWTUBE150
	4/0	RO-44/0**Q**	WRPSLV	US150	NUWTUBE150
5	#6	RO-56**B**	WRPSLV	US65	NUWTUBE65
	#4	RO-54**B**	WRPSLV	US65	NUWTUBE65
	#2 Sol	RO-52S**B**	WRPSLV	US90	NUWTUBE90
	#2	RO-52**B**	WRPSLV	US90	NUWTUBE90
	1/0	RO-51/0**Q**	WRPSLV	US115	NUWTUBE115
	2/0	RO-52/0**Q**	WRPSLV	US115	NUWTUBE115
	3/0	RO-53/0**Q**	WRPSLV	US150	NUWTUBE150
	4/0	RO-54/0**Q**	WRPSLV	US150	NUWTUBE150
6** & Larger	#6	RO-6L6**B**	CERPM1	US65	NUWTUBE65
	#4	RO-6L4**B**	CERPM1	US65	NUWTUBE65
	#2 Sol	RO-6L2S**B**	CERPM1	US90	NUWTUBE90
	#2	RO-6L2**B**	CERPM1	US90	NUWTUBE90
	1/0	RO-6L1/0**B**	CERPM2	US115	NUWTUBE115
	2/0	RO-6L2/0**B**	CERPM2	US115	NUWTUBE115
	3/0	RO-6L3/0**B**	CERPM2	US150	NUWTUBE150
	4/0	RO-6L4/0**B**	CERPM2	US150	NUWTUBE150

** Requires Hold Down Kit (#UMHDKIT) for welds made to #6 and Larger rebar.



UMHDKIT



Patented

UMHDKIT with Mold & Handle

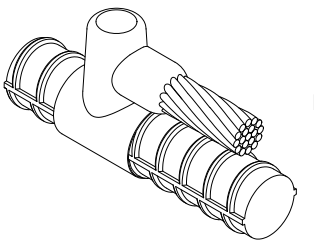
Important: See Packing Material Notes On Page 305.

Cable to Rebar — RP

Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds with Price Key "**A**" SOLD WITH FRAME.
- If Frame not required, add suffix "-X" after the Mold Part No.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds
WRPSLV or CERPM - Rebar Packing Material

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush
UMHDKIT - Hold Down Kit
UMMHDA - Hold Down Kit when Price Key is **"A"**



RP

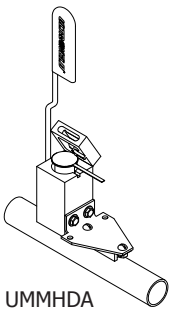
(Parallel Cable Tap of Horizontal Cable to Thru Horizontal Rebar)

Listed 467

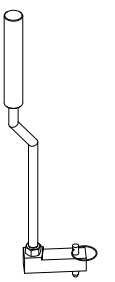
RP Connection Type

Rebar Size	Cable Size	Mold Part No.	Packing Mat'l No.	Weld Metal	
				UltraShot	NUWTUBE
3	#6	RP-36**B**	WRPSLV	US25	NUWTUBE25
	#4	RP-34**B**	WRPSLV	US32	NUWTUBE32
	#2 Sol	RP-32S**B**	WRPSLV	US45	NUWTUBE45
	#2	RP-32**B**	WRPSLV	US45	NUWTUBE45
	1/0	RP-31/0**B**	WRPSLV	US90	NUWTUBE90
	2/0	RP-32/0**B**	WRPSLV	US90	NUWTUBE90
	3/0	RP-33/0**B**	WRPSLV	US115	NUWTUBE115
	4/0	RP-34/0**B**	WRPSLV	US115	NUWTUBE115
4 & Larger	#6	RP-4L6**A**	CERPM1	US25	NUWTUBE25
	#4	RP-4L4**A**	CERPM1	US32	NUWTUBE32
	#2 Sol	RP-4L2S**A**	CERPM1	US45	NUWTUBE45
	#2	RP-4L2**A**	CERPM1	US45	NUWTUBE45
4	1/0	RP-41/0**B**	WRPSLV	US90	NUWTUBE90
	2/0	RP-42/0**B**	WRPSLV	US90	NUWTUBE90
	3/0	RP-43/0**B**	WRPSLV	US115	NUWTUBE115
	4/0	RP-44/0**B**	WRPSLV	US115	NUWTUBE115
5	1/0	RP-51/0**B**	WRPSLV	US90	NUWTUBE90
	2/0	RP-52/0**B**	WRPSLV	US90	NUWTUBE90
	3/0	RP-53/0**B**	WRPSLV	US115	NUWTUBE115
	4/0	RP-54/0**B**	WRPSLV	US115	NUWTUBE115
6** & Larger	1/0	RP-6L1/0**B**	CERPM2	US90	NUWTUBE90
	2/0	RP-6L2/0**B**	CERPM2	US90	NUWTUBE90
	3/0	RP-6L3/0**B**	CERPM2	US115	NUWTUBE115
	4/0	RP-6L4/0**B**	CERPM2	US115	NUWTUBE115

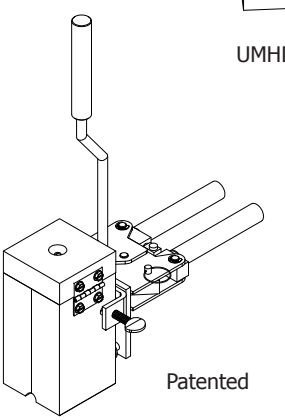
** Requires Hold Down Kit (#UMHDKIT) for welds made to #6 and Larger Rebar.



UMMHDA



UMHDKIT



Patented

UMHDKIT with Mold & Handle

Important: See Packing Material Notes On Page 305.

RS Cable to Rebar

Mold Information:

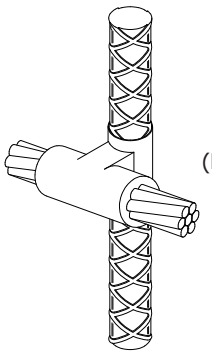
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:

MH1 - Handle for "**B**" and "**P**" Price Key Molds
WRPSLV or CERPM - Rebar Packing Material
**CSKITHSVM - Chain Support Kit for #7 and Larger rebar

Recommended Tools & Accessories:

CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush



RS

(Horizontal Thru Cable to Side of Vertical Rebar)

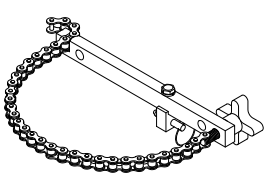
RS Connection Type

Rebar Size	Cable Size	Mold Part No.	Packing Mat'l No.	Weld Metal	
				UltraShot	NUWTUBE
3	#6	RS-36**P**	WRPSLV	US90	NUWTUBE90
	#4	RS-34**P**	WRPSLV	US90	NUWTUBE90
	#2 Sol	RS-32S**P**	WRPSLV	US90	NUWTUBE90
	#2	RS-32**P**	WRPSLV	US90	NUWTUBE90
	1/0	RS-31/0**P**	WRPSLV	US115	NUWTUBE115
	2/0	RS-32/0**P**	WRPSLV	US115	NUWTUBE115
	3/0	RS-33/0**P**	WRPSLV	US150	NUWTUBE150
	4/0	RS-34/0**P**	WRPSLV	US150	NUWTUBE150
4	#6	RS-46**P**	WRPSLV	US90	NUWTUBE90
	#4	RS-44**P**	WRPSLV	US90	NUWTUBE90
	#2 Sol	RS-42S**P**	WRPSLV	US90	NUWTUBE90
	#2	RS-42**P**	WRPSLV	US90	NUWTUBE90
	1/0	RS-41/0**P**	WRPSLV	US115	NUWTUBE115
	2/0	RS-42/0**P**	WRPSLV	US115	NUWTUBE115
	3/0	RS-43/0**P**	WRPSLV	US150	NUWTUBE150
	4/0	RS-44/0**P**	WRPSLV	US150	NUWTUBE150
5	#6	RS-56**P**	WRPSLV	US90	NUWTUBE90
	#4	RS-54**P**	WRPSLV	US90	NUWTUBE90
	#2 Sol	RS-52S**P**	WRPSLV	US90	NUWTUBE90
	#2	RS-52**P**	WRPSLV	US90	NUWTUBE90
	1/0	RS-51/0**P**	WRPSLV	US115	NUWTUBE115
	2/0	RS-52/0**P**	WRPSLV	US115	NUWTUBE115
	3/0	RS-53/0**P**	WRPSLV	US150	NUWTUBE150
	4/0	RS-54/0**P**	WRPSLV	US150	NUWTUBE150

RS Connection Type continued

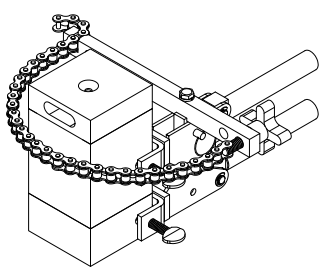
Rebar Size	Cable Size	Mold Part No.	Packing Mat'l No.	Weld Metal	
				UltraShot	NUWTUBE
6	#6	RS-66**P**	WRPSLV	US90	NUWTUBE90
	#4	RS-64**P**	WRPSLV	US90	NUWTUBE90
	#2 Sol	RS-62S**P**	WRPSLV	US90	NUWTUBE90
	#2	RS-62**P**	WRPSLV	US90	NUWTUBE90
	1/0	RS-61/0**P**	WRPSLV	US115	NUWTUBE115
	2/0	RS-62/0**P**	WRPSLV	US115	NUWTUBE115
	3/0	RS-63/0**P**	WRPSLV	US150	NUWTUBE150
	4/0	RS-64/0**P**	WRPSLV	US150	NUWTUBE150
7** & Larger	#6	RS-7L6**B**	CERPM3	US90	NUWTUBE90
	#4	RS-7L4**B**	CERPM3	US90	NUWTUBE90
	#2 Sol	RS-7L2S**B**	CERPM3	US90	NUWTUBE90
	#2	RS-7L2**B**	CERPM3	US90	NUWTUBE90
	1/0	RS-7L1/0**B**	CERPM3	US115	NUWTUBE115
	2/0	RS-7L2/0**B**	CERPM3	US115	NUWTUBE115
	3/0	RS-7L3/0**B**	CERPM3	US150	NUWTUBE150
	4/0	RS-7L4/0**B**	CERPM3	US150	NUWTUBE150

** Requires Chain Support Kit (#CSKITHSVM) for welds made to #7 and Larger rebar.



CSKITHSVM

Patented



CSKITHSVM with Mold & Handle

Important: See Packing Material Notes On Page 305.

Cable to Rail RMVH

Web Grounding Connections

- Welded grounding connections to the web of 85 lb. to 140 lb. standard rails.
- If the ampacity requirement cannot be met with a single conductor listed, then two or more smaller conductors can be used.
- Molds listed are for concentric conductors.
- Mold frame includes adjusting screws to position the mold at the neutral axis of the rail.

Mold Information:
- Molds listed are for concentric stranded cable.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:
MH1 - Handle for "**K**" Price Key Molds
RMFRMW105C - Rail Clamp
Flint Igniter (FLTIG) included with MH1

Recommended Tools & Accessories:
CCBRSH2 - Cable Cleaning Brush
MCBRSH1 - Mold Cleaning Brush
RASP - Rasp for cleaning rail

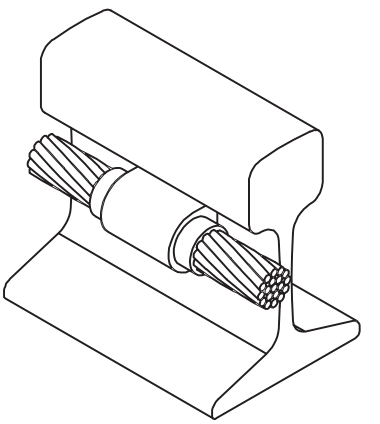
RMVH Connection Type

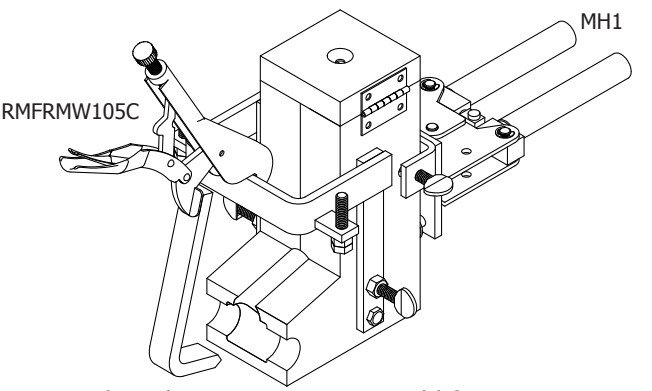
Size	Mold Part No.	Weld Metal
4 Concentric	RMVH4-WEB-**K**	NUWTUBE90R
2 Concentric	RMVH2-WEB-**K**	NUWTUBE90R
1 Concentric	RMVH1-WEB-**K**	NUWTUBE90R
1/0 Concentric	RMVH1/0-WEB-**K**	NUWTUBE115R
2/0 Concentric	RMVH2/0-WEB-**K**	NUWTUBE115R
4/0 Concentric	RMVH4/0-WEB-**K**	NUWTUBE150R

- Ultraweld exothermic materials meet requirements of AREMA 8.1.34.

RMVH

(**R**ail **M**old **V**ertical Web **H**orizontal Cable)





The adjusting screws on mold frame position conductor at neutral axis of rail where stresses are minimal.

RMVL / RMVR Cable to Rail

Web Grounding Connections

Mold Information:
- Molds listed are for concentric stranded cable.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:

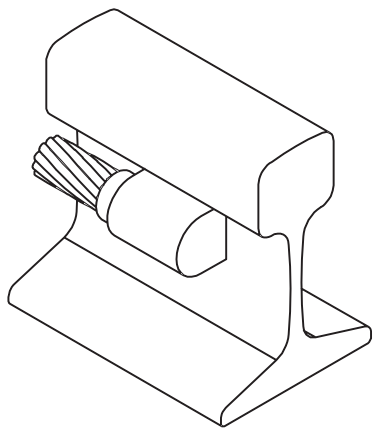
MH1 - Handle for "**K**" Price Key Molds
RMFRMW105C - Rail Clamp
Flint Igniter (FLTIG) included with MH1

Recommended Tools & Accessories:

CCBRSH2 - Cable Cleaning Brush
MCBRSH1 - Mold Cleaning Brush
RASP - Rasp for cleaning rail

RMVL

(**R**ail **M**old **V**ertical Web **L**eft Hand Mold)



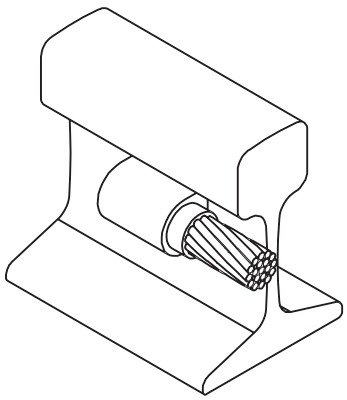
RMVL Connection Type

Size	Mold Part No.	Weld Metal
4 Concentric	RMVL4-WEB-**K**	NUWTUBE65R
2 Concentric	RMVL2-WEB-**K**	NUWTUBE65R
1 Concentric	RMVL1-WEB-**K**	NUWTUBE65R
1/0 Concentric	RMVL1/0-WEB-**K**	NUWTUBE90R
2/0 Concentric	RMVL2/0-WEB-**K**	NUWTUBE90R
4/0 Concentric	RMVL4/0-WEB-**K**	NUWTUBE115R

- Ultraweld exothermic materials meet requirements of AREMA 8.1.34.

RMVR

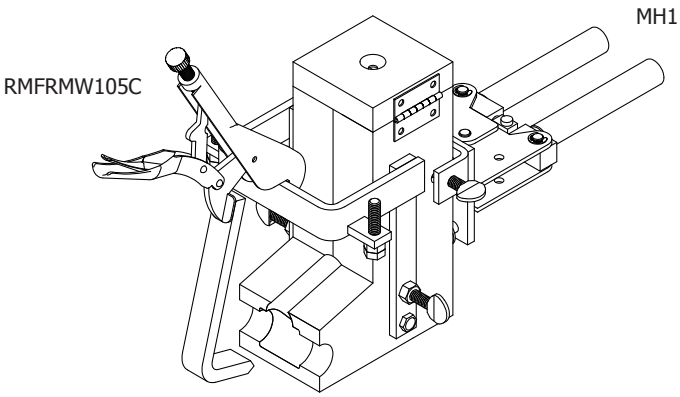
(**R**ail **M**old **V**ertical Web **R**ight Hand Mold)



RMVR Connection Type

Size	Mold Part No.	Weld Metal
4 Concentric	RMVR4-WEB-**K**	NUWTUBE65R
2 Concentric	RMVR2-WEB-**K**	NUWTUBE65R
1 Concentric	RMVR1-WEB-**K**	NUWTUBE65R
1/0 Concentric	RMVR1/0-WEB-**K**	NUWTUBE90R
2/0 Concentric	RMVR2/0-WEB-**K**	NUWTUBE90R
4/0 Concentric	RMVR4/0-WEB-**K**	NUWTUBE115R

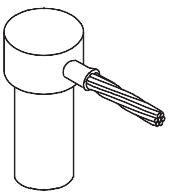
- Ultraweld exothermic materials meet requirements of AREMA 8.1.34.

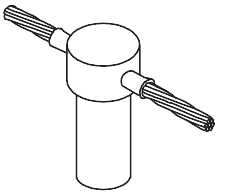


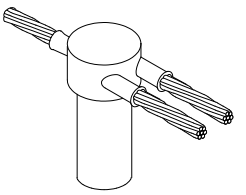
The adjusting screws on mold frame position conductor at neutral axis of rail where stresses are minimal.

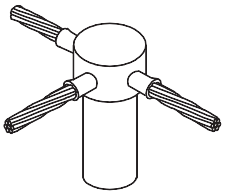
Uni-Shots - NUWTube G11 / G21 / G31 / G41

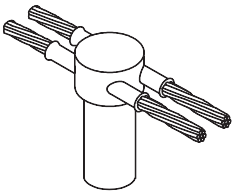
Listed 467


G11

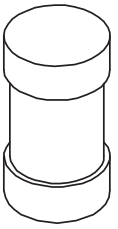

G21


G31


G31*


G41

NEW

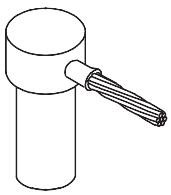

NUWTube
(Traditional)

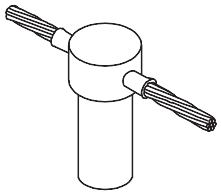
Type	Mold Part No.	Ground Rod Size	Cable Size Solid	Cable Size Stranded
G11	G11588NU	5/8"	#6, #8	#8
G11	G11584NU	5/8"	#3, #4	#4, #6
G11	G11582NU	5/8"	#1, #2	#2, #3
G11	G11581/0NU	5/8"	2/0, 1/0	1/0, #1
G11	G11582/0NU	5/8"	—	2/0
G21	G21588NU	5/8"	#6, #8	#8
G21	G21584NU	5/8"	#3, #4	#4, #6
G21	G21582NU	5/8"	#1, #2	#2, #3
G21	G21581/0NU	5/8"	2/0, 1/0	1/0, #1
G31	G31588NU	5/8"	#6, #8	#8
G31	G31584NU	5/8"	#3, #4	#4, #6
G31	G31582NU	5/8"	#1, #2	#2, #3
G31	G31581/0NU*	5/8"	2/0, 1/0	1/0, #1
G41	G41588NU	5/8"	#6, #8	#8
G41	G41584NU	5/8"	#3, #4	#4, #6
G41	G41582NU	5/8"	#1, #2	#2, #3

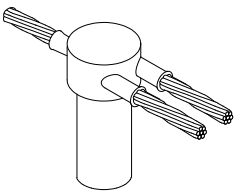
Type	Mold Part No.	Ground Rod Size	Cable Size Solid	Cable Size Stranded
G11	G11348NU	3/4"	#6, #8	#8
G11	G11344NU	3/4"	#3, #4	#4, #6
G11	G11342NU	3/4"	#1, #2	#2, #3
G11	G11341/0NU	3/4"	2/0, 1/0	1/0, #1
G11	G11342/0NU	3/4"	—	2/0
G21	G21348NU	3/4"	#6, #8	#8
G21	G21344NU	3/4"	#3, #4	#4, #6
G21	G21342NU	3/4"	#1, #2	#2, #3
G21	G21341/0NU	3/4"	2/0, 1/0	1/0, #1
G31	G31348NU	3/4"	#6, #8	#8
G31	G31344NU	3/4"	#3, #4	#4, #6
G31	G31342NU	3/4"	#1, #2	#2, #3
G31	G31341/0NU*	3/4"	2/0, 1/0	1/0, #1
G41	G41348NU	3/4"	#6, #8	#8
G41	G41344NU	3/4"	#3, #4	#4, #6
G41	G41342NU	3/4"	#1, #2	#2, #3

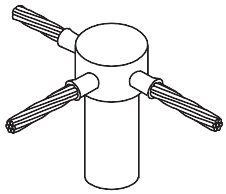
NOTES:
- Disposable single use ceramic mold provides convenience and ease of use.
- Add "F" at the end of the part number to designate use on a full size ground rod.
- Packaged 12 per box.
- Requires only a Flint Igniter (FLTIG) to make a connection. See page 325.
- No frames or handle clamps are required.

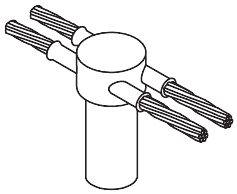
G11 / G21 / G31 / G41 Uni-Shots - UltraShot


G11


G21


G31


G31*


G41

Type	Mold Part No.	Ground Rod Size	Cable Size Solid	Stranded
G11	G11588US	5/8"	#6, #8	#8
G11	G11584US	5/8"	#3, #4	#4, #6
G11	G11582US	5/8"	#1, #2	#2, #3
G11	G11581/0US	5/8"	2/0, 1/0	1/0, #1
G11	G11582/0US	5/8"	2/0	2/0
G11	G11584/0US	5/8"	4/0	4/0
G21	G21588US	5/8"	#6, #8	#8
G21	G21584US	5/8"	#3, #4	#4, #6
G21	G21582US	5/8"	#1, #2	#2, #3
G21	G21581/0US	5/8"	2/0, 1/0	1/0, #1
G21	G21582/0US	5/8"	2/0	2/0
G21	G21584/0US	5/8"	4/0	4/0
G31	G31588US	5/8"	#6, #8	#8
G31	G31584US	5/8"	#3, #4	#4, #6
G31	G31582US	5/8"	#1, #2	#2, #3
G31	G31581/0US*	5/8"	2/0, 1/0	1/0, #1
G41	G41588US	5/8"	#6, #8	#8
G41	G41584US	5/8"	#3, #4	#4, #6
G41	G41582US	5/8"	#1, #2	#2, #3
G41PS	G41PS8US	---	#6, #8	#8

NEW

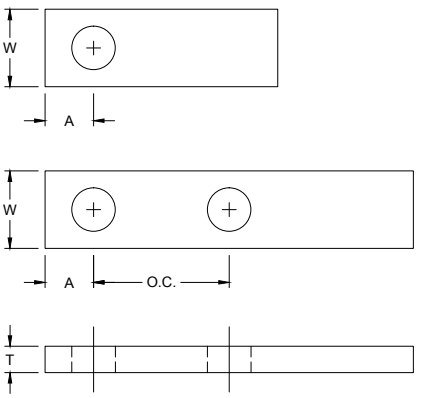


UltraShot (Electronic)

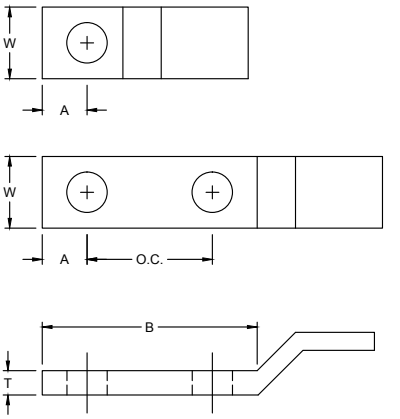
Type	Mold Part No.	Ground Rod Size	Cable Size Solid	Stranded
G11	G11348US	3/4"	#6, #8	#8
G11	G11344US	3/4"	#3, #4	#4, #6
G11	G11342US	3/4"	#1, #2	#2, #3
G11	G11341/0US	3/4"	1/0	1/0, #1
G11	G11342/0US	3/4"	2/0	2/0
G11	G11344/0US	3/4"	4/0	4/0
G21	G21348US	3/4"	#6, #8	#8
G21	G21344US	3/4"	#3, #4	#4, #6
G21	G21342US	3/4"	#1, #2	#2, #3
G21	G21341/0US	3/4"	2/0, 1/0	1/0, #1
G21	G21342/0US	3/4"	2/0	2/0
G21	G21344/0US	3/4"	4/0	4/0
G31	G31348US	3/4"	#6, #8	#8
G31	G31344US	3/4"	#3, #4	#4, #6
G31	G31342US	3/4"	#1, #2	#2, #3
G31	G31341/0US*	3/4"	2/0, 1/0	1/0, #1
G41	G41348US	3/4"	#6, #8	#8
G41	G41344US	3/4"	#3, #4	#4, #6
G41	G41342US	3/4"	#1, #2	#2, #3

NOTES: See Notes on Page 312. USCONTROLLER required to make UltraShot Uni-Shot connection. See page 322.

Tinned Copper Lugs — Straight & Offset



SXL

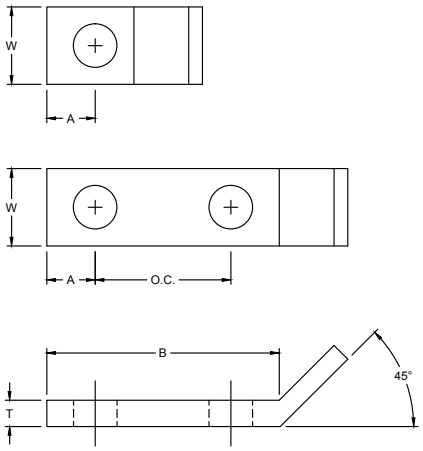


OXL

Lug Size	Straight Part No.	Offset Part No.	No. of Holes	Screw Size	O.C. Dimension	T	W	A	B
1/8 x 1	SXL-181	OXL-181	1	3/8	---	1/8	1	1/2	7/8
	SXL-1812B	OXL-1812B	2	3/8	.75	1/8	1	5/8	3
	SXL-1812C	OXL-1812C	2	1/2	1	1/8	1	5/8	3
	SXL-1812D	OXL-1812D	2	1/2	1.75	1/8	1	5/8	3
3/16 x 1	SXL-3161	OXL-3161	1	3/8	---	3/16	1	9/16	1-1/8
	SXL-31612B	OXL-31612B	2	3/8	.75	3/16	1	5/8	3
	SXL-31612C	OXL-31612C	2	1/2	1	3/16	1	5/8	3
	SXL-31612D	OXL-31612D	2	1/2	1.75	3/16	1	5/8	3
1/4 x 1	SXL-141	OXL-141	1	1/2	---	1/4	1	5/8	1-1/8
	SXL-1412B	OXL-1412B	2	3/8	.75	1/4	1	5/8	3
	SXL-1412C	OXL-1412C	2	1/2	1	1/4	1	5/8	3
	SXL-1412D	OXL-1412D	2	1/2	1.75	1/4	1	5/8	3
1/4 x 1-1/2	SXL-141.5	OXL-141.5	1	5/8	---	1/4	1-1/2	3/4	1-1/2
	SXL-141.52B	OXL-141.52B	2	3/8	.75	1/4	1-1/2	5/8	3
	SXL-141.52C	OXL-141.52C	2	1/2	1	1/4	1-1/2	5/8	3
	SXL-141.52D	OXL-141.52D	2	1/2	1.75	1/4	1-1/2	5/8	3
1/4 x 2	SXL-1422B	OXL-1422B	2	3/8	.75	1/4	2	5/8	3
	SXL-1422C	OXL-1422C	2	1/2	1	1/4	2	5/8	3
	SXL-1422D	OXL-1422D	2	1/2	1.75	1/4	2	5/8	3
3/8 x 1-1/2	SXL-381.5	OXL-381.5	1	5/8	---	3/8	1-1/2	3/4	1-1/2
	SXL-381.52B	OXL-381.52B	2	3/8	.75	3/8	1-1/2	5/8	3
	SXL-381.52C	OXL-381.52C	2	1/2	1	3/8	1-1/2	5/8	3
	SXL-381.52D	OXL-381.52D	2	1/2	1.75	3/8	1-1/2	5/8	3
3/8 x 2	SXL-382	OXL-382	1	5/8	---	3/8	2	1	2-1/8
	SXL-3822B	OXL-3822B	2	3/8	.75	3/8	2	5/8	3
	SXL-3822C	OXL-3822C	2	1/2	1	3/8	2	5/8	3
	SXL-3822D	OXL-3822D	2	1/2	1.75	3/8	2	5/8	3

For Use with LE Style Molds on Page 297.

Bent & Bent J Tinned Copper Lugs

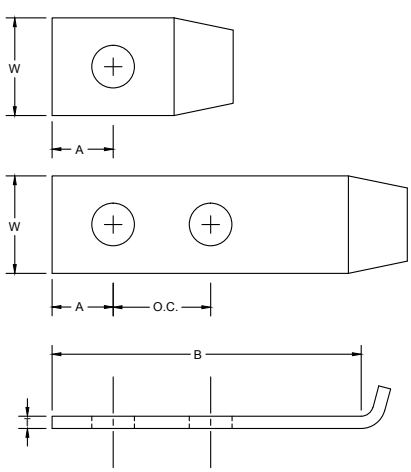


Lug Size	Bent Part No.	No. of Holes	Screw Size	O.C. Dimension	T	W	A	B
1/8 x 1	BXL-181	1	3/8	---	1/8	1	7/16	7/8
	BXL-1812B	2	3/8	.75	1/8	1	5/8	3
	BXL-1812C	2	1/2	1	1/8	1	5/8	3
	BXL-1812D	2	1/2	1.75	1/8	1	5/8	3
3/16 x 1	BXL-3161	1	1/2	---	3/16	1	5/8	1-1/4
	BXL-31612B	2	3/8	.75	3/16	1	5/8	3
	BXL-31612C	2	1/2	1	3/16	1	5/8	3
	BXL-31612D	2	1/2	1.75	3/16	1	5/8	3
1/4 x 1	BXL-141	1	1/2	---	1/4	1	5/8	1-1/4
	BXL-1412B	2	3/8	.75	1/4	1	5/8	3
	BXL-1412C	2	1/2	1	1/4	1	5/8	3
	BXL-1412D	2	1/2	1.75	1/4	1	5/8	3
1/4 x 1-1/2	BXL-141.5	1	5/8	---	1/4	1-1/2	3/4	1-1/2
	BXL-141.52B	2	3/8	.75	1/4	1-1/2	5/8	3
	BXL-141.52C	2	1/2	1	1/4	1-1/2	5/8	3
	BXL-141.52D	2	1/2	1.75	1/4	1-1/2	5/8	3

For Use with LE Style Molds on Page 297.

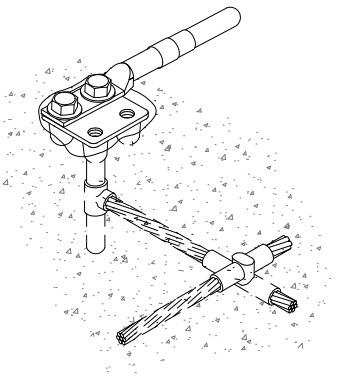
Lug Size	Bent J Part No.	No. of Holes	Screw Size	O.C. Dimension	T	W	A	B
1/8 x 1	JXL-1813/8	1	3/8	---	1/8	1	5/8	1-1/4
	JXL-181	1	1/2	---	1/8	1	5/8	1-1/4
	JXL-1812C1/4	2	1/4	1	1/8	1	5/8	3
	JXL-1812C3/8	2	3/8	1	1/8	1	5/8	3
	JXL-1812D	2	1/2	1.75	1/8	1	5/8	3
3/16 x 1	JXL-3161	1	1/2	---	3/16	1	5/8	1-1/4
	JXL-31612D	2	1/2	1.75	3/16	1	5/8	3

For Use with LBJ Style Molds on Page 298.



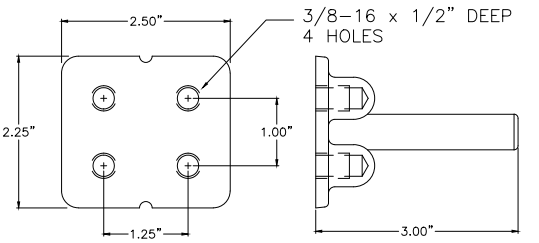
Equipment Ground Plates

APPLICATION NOTE:
Equipment ground plates are cast into concrete structures to offer convenient connection points to the ground system. The cast ground plates are made from high quality copper alloy and are easily exothermically welded to copper conductors. The resulting connection has an ampacity that surpasses that of the conductor or the stud.



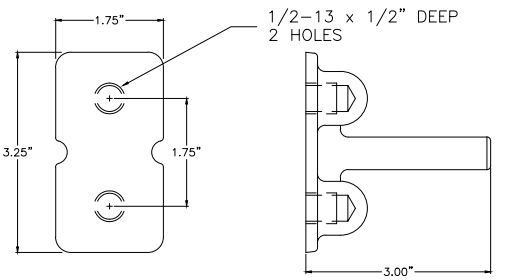
Part No.	Stud Size	Qty.	Approx. Each Wt. (lbs.)
XGP2.5/2.54/0	4/0 AWG Conc	EA	2
XGP2.5/2.55CM	500 MCM Conc	EA	2

- Stud fits mold openings for concentric strand conductor of stud size listed.



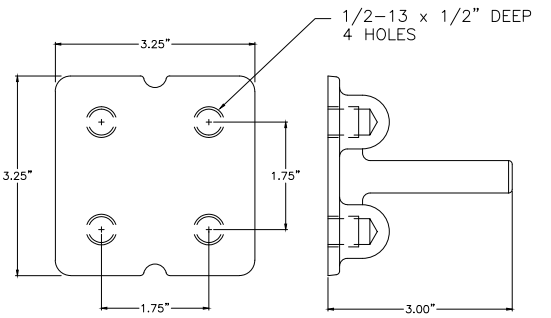
Part No.	Stud Size	Qty.	Approx. Each Wt. (lbs.)
XGP1.75/3.254/0	4/0 AWG Conc	EA	1-1/2

- NEMA hole spacing.
- Stud fits mold opening for concentric strand conductor of stud size listed.



Part No.	Stud Size	Qty.	Approx. Each Wt. (lbs.)
XGP3.25/3.254/0	4/0 AWG Conc	EA	2-1/2
XGP3.25/3.255CM	500 MCM Conc	EA	2-1/2

- NEMA hole spacing.
- Stud fits mold openings for concentric strand conductor of stud size listed.



NOTES:
- Use Ultraweld Type EGPCB or EGPCT molds to make straight splices or tee connections with ground conductors to equipment ground plates.
- Custom assemblies available. Please contact factory for more information.

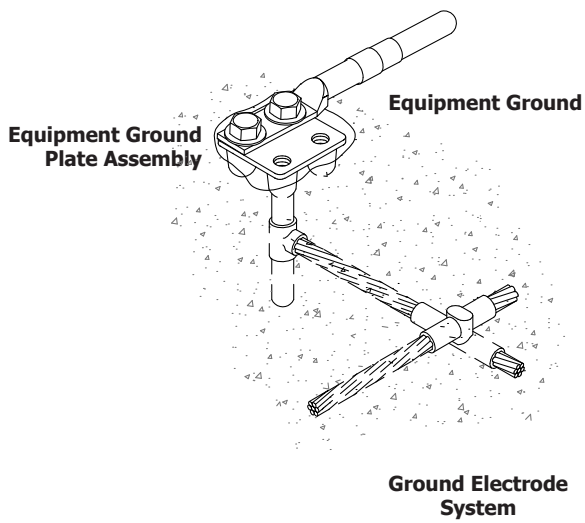
Equipment Ground Plate Molds

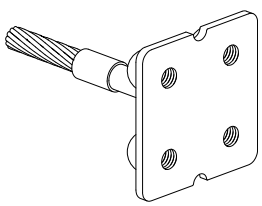
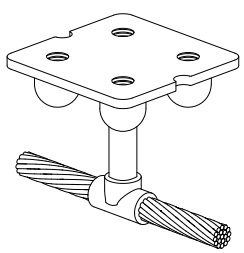
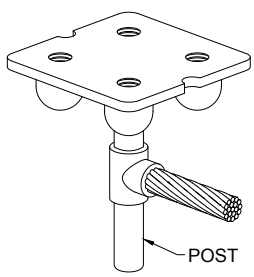
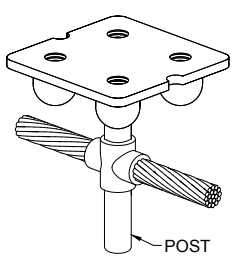
Mold Information:
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 324 for details.

Required Tools & Accessories:
MH1 - Handle for "**B**" Price Key Molds

Recommended Tools & Accessories:
CCBRSH1 - Card Cloth Brush
MCBRSH1 - Mold Cleaning Brush

Plate Stud Size	Cable	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
4/0	1/0	EGPCB4/01/0**B**	US90	NUWTUBE90
4/0	2/0	EGPCB4/02/0**B**	US90	NUWTUBE90
4/0	4/0	EGPCB4/04/0**B**	US90	NUWTUBE90
4/0	1/0	EGPCT4/01/0**B**	US115	NUWTUBE115
4/0	2/0	EGPCT4/02/0**B**	US115	NUWTUBE115
4/0	4/0	EGPCT4/04/0**B**	US150	NUWTUBE150
4/0	1/0	EGPID4/01/0**B**	US150	NUWTUBE150
4/0	2/0	EGPID4/02/0**B**	US150	NUWTUBE150
4/0	4/0	EGPID4/04/0**B**	US150	NUWTUBE150
4/0	1/0	EGPIO4/01/0**B**	US150	NUWTUBE150
4/0	2/0	EGPIO4/02/0**B**	US150	NUWTUBE150
4/0	4/0	EGPIO4/04/0**B**	US200	NUWTUBE200

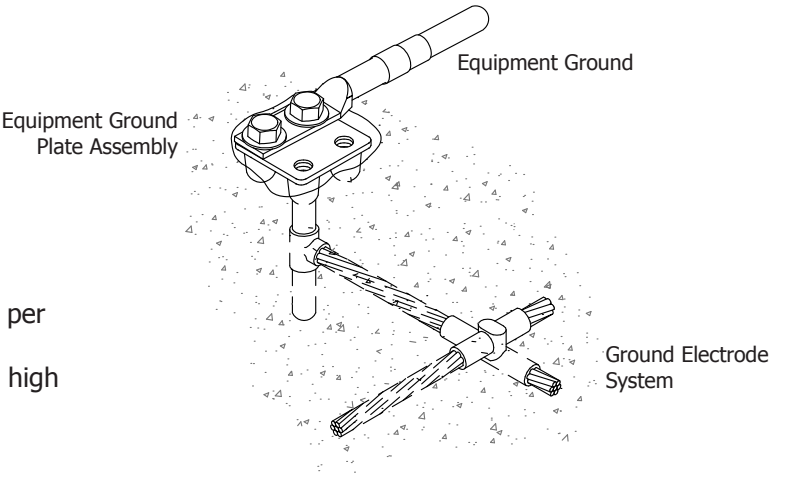


Mold Type	EGPCB	EGPCT	EGPID	EGPIO
Connection	BS	RT	GD	GO
Ground Plate Assemblies				

NOTE:
- Style EGPID and EGPIO assemblies have posts formed from the Ultraweld connection that fit into 1/2" pipe that is used for support and positioning the ground plate.

Prefabricated Equipment Ground Plate Assemblies

APPLICATION NOTE:
Equipment ground plates are cast into concrete structures to offer convenient high quality connection points to the ground system. The equipment ground plate assemblies provide ease of installation and reduce labor.



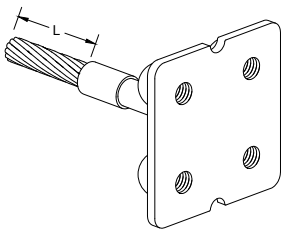
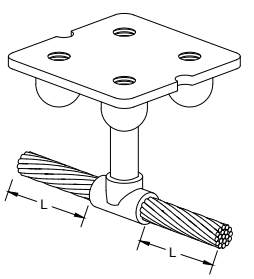
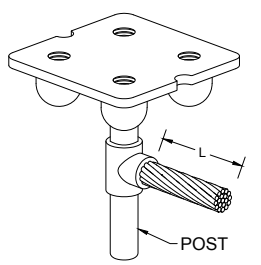
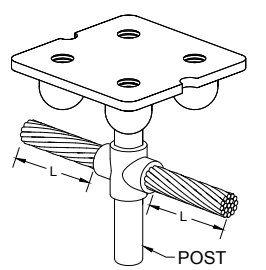
- The assembly is made to customer specifications per the part numbering system shown below.
- Equipment ground plates are manufactured from high quality cast copper alloy.
- Meets requirements of Federal Specification QQ-B-691B.2 and ASTMB584.
- The copper conductor is factory welded using the Ultraweld process.

Part Numbering System:

"XGP" + "Style" + "Ground Plate Designation Code" + "Conductor" + "X" + "Conductor Length (in.)"

XGP BS D 1/0 X 24

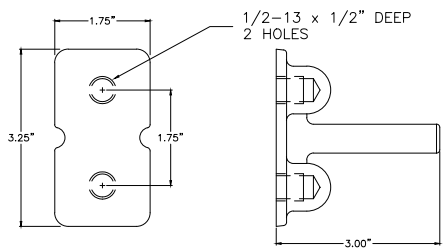
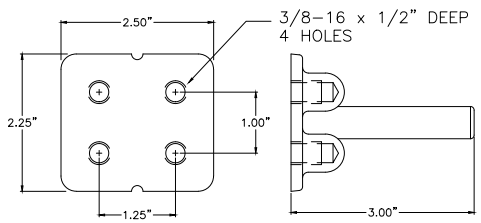
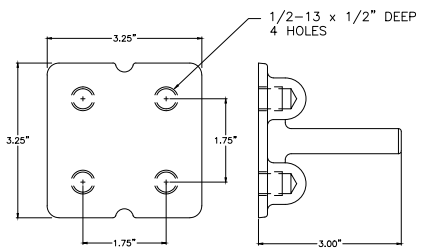
- XGP Prefix
- Style
- Ground Plate Designation Code
- Conductor
- Conductor Length (in.)

BS Style	RT Style	GD Style	GO Style
			

NOTE:
- Style GD and GO assemblies have posts formed from the Ultraweld connection that fit into 1/2" pipe that is used for support and positioning the ground plate.

Equipment Ground Plate Assemblies

Ground Plate Designation Code:

Ground Plate Code	Ground Plate Part Number	Stud Size	Ground Plate Figure
A	XGP1.75/3.254/0	4/0 AWG Conc	
B	XGP2.5/2.54/0	4/0 AWG Conc	
C	XGP2.5/2.55CM	500 MCM Conc	
D	XGP3.25/3.254/0	4/0 AWG Conc	
E	XGP3.25/3.255CM	500 MCM Conc	

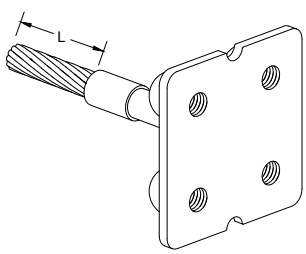
Part Numbering Example:

Part Number: **XGP BS D 1/0 X 24** is a XGP3.25/3.254/0 Equipment Ground Plate with 1/0 conductor 24" long welded with Ultraweld BS connection.

Most Common Assemblies:

Part No.	Stud Size	Qty.	Approx. Each Wt. (lbs.)
XGPBSD2/0X12	2/0-19 AWG Conc	EA	2
XGPBSD1/0X24	1/0-19 AWG Conc	EA	2

- NEMA hole spacing.
- Stud fits mold openings for concentric strand conductor of stud size listed.

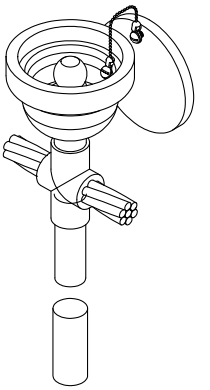


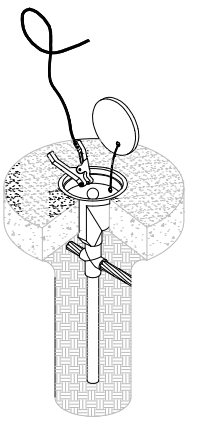
Aircraft Ground Receptacle

Part No.	Qty.	Approx. Each Wt. (lbs.)
SGRX	EA	1-1/4

- Ground receptacle designed to be exothermically connected to a ground rod.

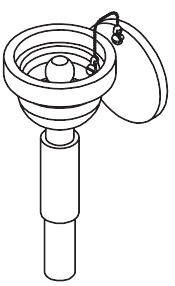
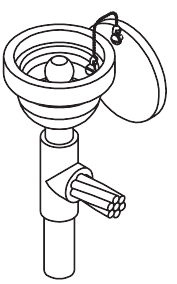
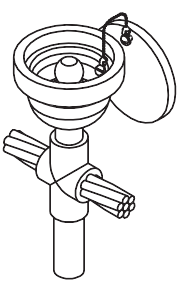
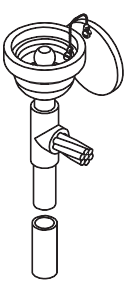
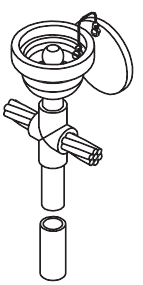
Listed 96





APPLICATION NOTES:
- Aircraft Ground Receptacles are used when temporary grounds must be established.
- Used for grounding aircrafts during refueling.
- Receptacle: top is 3" in diameter, height is 3-1/2" tall.

Mold Types for Aircraft Ground Receptacles

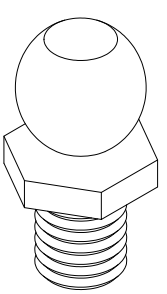
FGRBS	FGRGD	FGRGO	FGRIGD	FGRIGO
				

NOTE:
- Style FGRIGD and FGRIGO assemblies have posts formed from the Ultraweld connection that fit into 1/2" pipe that is used for support and positioning the ground plate.

Brass Ball Studs

Part No.	Thread Size	Qty.	Approx. Each Wt. (lbs.)
BBSTUD14	1/4"	EA	1/2
BBSTUD38	3/8"	EA	1/2
BBSTUD12	1/2"	EA	1/2

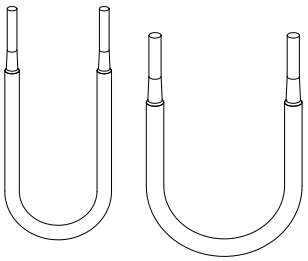
- Used as replacement studs for floor ground receptacles.
- Can also be mounted on ground bars.
- Brass Ball Stud: 3/4" in diameter, 1-1/2" total length.



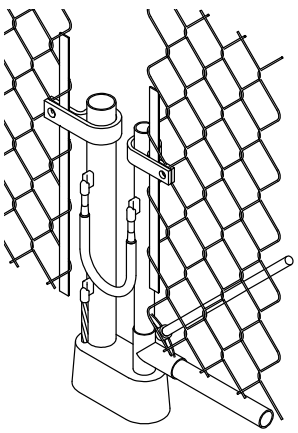
NOTE:
- Custom assemblies available. Please contact factory for more information.

Flexible Gate Jumpers

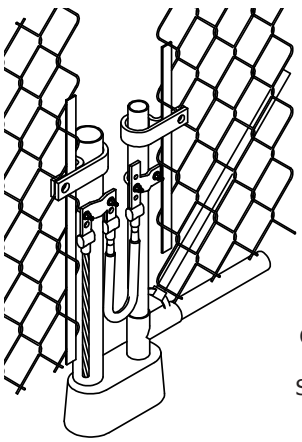
Part No.	Jumper Size	Conductor Size (AWG)	Approx. Each Wt. (lbs.)	Box Qty.	Approx. Box Wt. (lbs.)
GJX2S24	#2 AWG	#2 solid	1/2	10	5
GJX2/024	2/0 AWG	2/0 concentric	1	10	10
GJX4/024	4/0 AWG	4/0 concentric	1-1/2	10	15



- Can be used with the universal pipe clamps or can be exothermically welded to the fence/gate post themselves.
- Three sizes designed to fit either a #2 solid, 2/0 stranded or 4/0 stranded exothermic mold.
- Flex jumpers made from welding cable.
- Standard length is 24" long.
- Other lengths available. Please contact factory for more information.



Gate Jumper welded directly to posts.



Gate Jumper welded to UPC clamp.
See page 134 for UPC's.

VD (Pipe) Connection Type (Range Taking)

Cable Size	Nominal Pipe Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#2 Sol.	1-1/4" to 4" Pipe	VD-2SV1.25X4**B**	US65	NUWTUBE65
2/0	1-1/4" to 4" Pipe	VD-2/0V1.25X4**B**	US115	NUWTUBE115
4/0	1-1/4" to 4" Pipe	VD-4/0V1.25X4**B**	US150	NUWTUBE150

*See page 292 for more VD (Pipe) Connection Types.

LE Connection Type

Cable Size	Lug Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
#2 Sol.	1/4" x 1"	LE-2S141**B**	US65	NUWTUBE65
2/0	1/4" x 1"	LE-2/0141**B**	US65	NUWTUBE65
4/0	1/4" x 1"	LE-4/0141**B**	US90	NUWTUBE90

*See page 297 for more LE Connection Types.

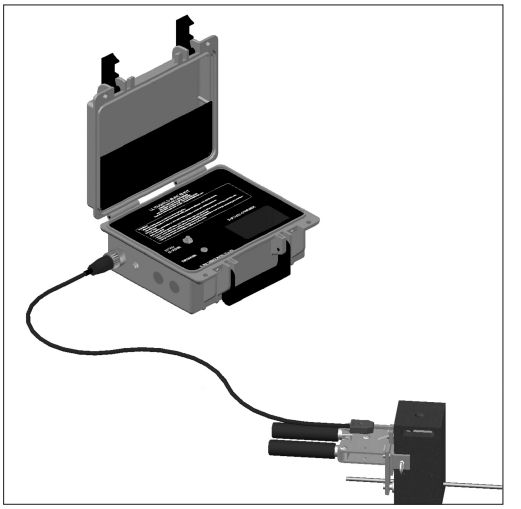
NOTE:

Thin walled pipe may be unsuitable for exothermic connections. If experiencing burn through issues with the pipe (typically with 2/0 or 4/0 conductors), adding sand inside the fence post well past the exothermic connection may solve this problem. Another solution would be to use a smaller conductor such as a #2 AWG jumper which uses a smaller size weld metal. The last solution may be to use mechanical fence clamp assembly such as the ones found in Section 1.11 on page 133.

Materials, Tools & Accessories

UltraShot Controller

Part No.	Qty.	Approx. Each Wt. (lbs.)
USCONTROLLER	EA	11



- Patented copper drop-in cartridge consumed during the reaction process.
- Rugged long lasting 12-volt rechargeable battery control unit ignites hundreds of connections on a single charge.
- Six-foot controller cord standard, 15-foot cord optional.
- Cartridge is consumed leaving no waste such as plastic or metal containers on the job site.
- Long lasting **Ultra**-reliable ignition process allows for little to no downtime on the job site.

Controller Cords

Part No.	Description	Qty	Approx. Each Wt. (lbs.)
USLEAD6	6' Controller Cord	EA	1/8
USLEAD15	15' Controller Cord	EA	1/8

- Allows for flexibility in tight spaces as well as maintaining a safe distance from the reaction.

Shoulder Strap

Part No.	Qty	Approx. Each Wt. (lbs.)
USCTRLSTRP	EA	2

- The removable, adjustable shoulder strap allows the user to transport the controller unit hands-free.



Car Charger

Part No.	Qty	Approx. Each Wt. (lbs.)
USCARCHARGER	EA	1/2

- 12 volt charger allows the Controller to be recharged on the go.

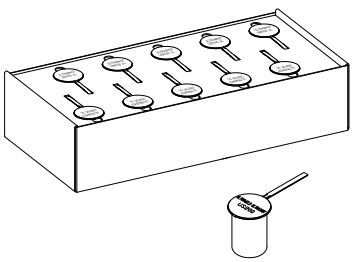


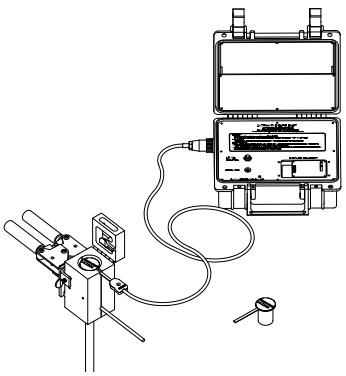
Materials, Tools & Accessories

Weld Metal

UltraShot®

- The weld metal, a mixture of copper oxide and aluminum, is packaged in individual, moisture resistant copper drop-ins.
- The copper drop-in is consumed during the reaction process.
- Each drop-in is marked with the size.
- The drop-ins are packaged in a box containing either 5 units per box (4 boxes per case), 10 units per box (5 boxes per case) or 20 units per box (10 boxes per case).



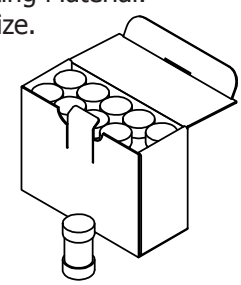


UltraShot® (Drop-In) Weld Metal

Size	Qty. Per Carton	Size	Qty. Per Carton
US25	20	US200	10
US32	20	US250	10
US45	20	US300	10
US65	20	US400	5
US90	10	US500	5
US115	10	US600	5
US150	10	US750	5

NUWTube®

- The weld metal, a mixture of copper oxide and aluminum, is packaged in individual, moisture resistant plastic tubes.
- Dual chamber design holds starting material and weld metal separately, in the same tube.
- Easy to identify with color coded caps. Clear = Weld Metal, Orange = Starting Material.
- Each cartridge is marked with the size.
- Each box also contains instructions and metal disks. One metal disk is used for each connection.

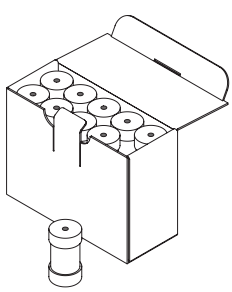


NUWTube® (Pour & Shoot) Weld Metal

Size	Qty. Per Carton	Size	Qty. Per Carton
NUWTUBE15	20	NUWTUBE90	10
NUWTUBE25	20	NUWTUBE115	10
NUWTUBE32	20	NUWTUBE150	10
NUWTUBE45	20	NUWTUBE200	10
NUWTUBE65	20	NUWTUBE250	10

Cast Iron NUWTube®

- For use on ductile iron surfaces.
- Dual chamber design holds starting material and weld metal separately, in the same tube.
- "Red Dot" on cap designates the starting material side.
- Each cartridge is marked with the size.
- Each box also contains instructions and metal disks. One metal disk is used for each connection.



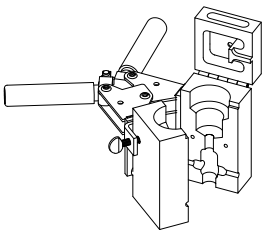
Cast Iron NUWTube® Weld Metal

Size	Qty. Per Carton
NUWTUBE25CI	20
NUWTUBE32CI	20
NUWTUBE45CI	20
NUWTUBE65CI	20
NUWTUBE90CI	10
NUWTUBE115CI	10

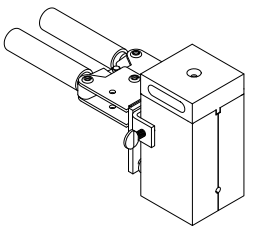
Materials, Tools & Accessories

Molds

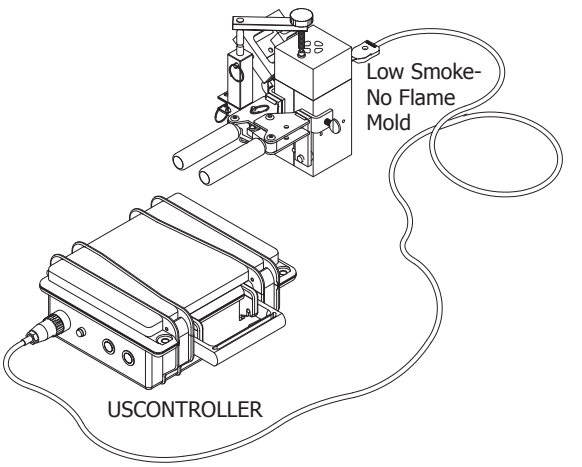
- Depending on the care and treatment of the mold, it will average 50 or more welds. Substantially more with the UltraShot process.
- The Low Smoke-No Flame process uses an integrated filter system on the mold and electric ignition of the weld metal to produce a finished connection with minimal smoke emission. Ideal for indoor and confined space working conditions. See page 276.
- For the Low Smoke-No Flame process, ignition is accomplished with the use of a USCONTROLLER.
- Mold Handle not inluded.



Open Mold

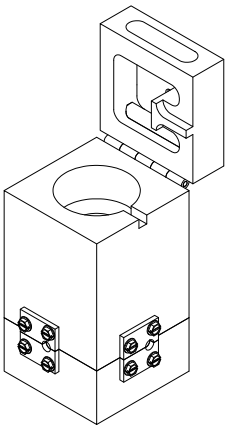


Closed Mold



Wear Plates

- Wear plates help extend the life of the mold.
- The openings of the mold get worn down due to forcing a mold shut over "out of round" conductors, the ends of conductors hitting and chipping the openings, etc.
- Wear plates can be supplied for all molds for cable sizes; #2 Solid, 1/0 AWG through 500 MCM and Copperweld cable 7/#10 through 19/#6.
- To order, add the suffix "WP" to the Ultraweld part number. Example: RT-4/04/0**B**-WP



Available Weld Type	Number of Wear Plates
BH	2
BS	2
GD	2
GO	3
GS	3
HB	1
HU	2
LE	1
PB*	3
PT*	4
RO	2
RS	2
RT	3
VA	1
VH	2
VT	2
XO	4
XX	4

*Wear plates only available on 1/0 stranded and larger or Copperweld 7/#10 and larger run and tap cables. Also available from #2 solid run and tap cables.

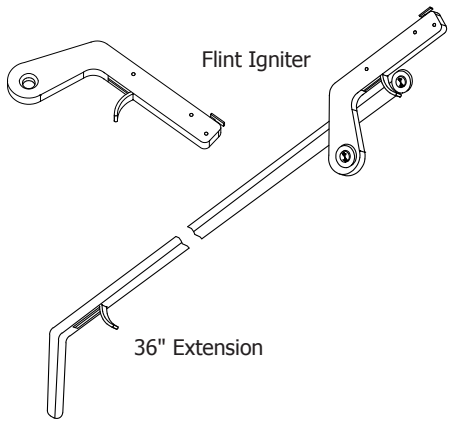
Materials, Tools & Accessories

Mold Accessories

Flint Igniters

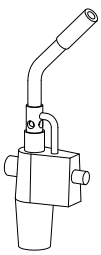
Part No.	Description	Qty.	Approx. Each Wt. (lbs.)
FLTIG	Flint Igniter	EA	1/4
FLTIGEXT	36" Extention	EA	1-1/2
RPLFLT	Replacement Flints	EA	1/8

- When making an Ultraweld connection, Flint Igniters are used to ignite the starting material.
- Flint Igniters comes with MH1 and MH2 handle clamps.
- Replacement Flints are also available.



Torch Head

Part No.	Qty.	Approx. Each Wt. (lbs.)
TRCHD	EA	1-1/4

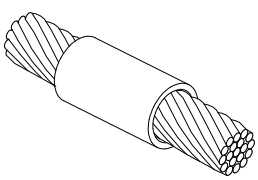


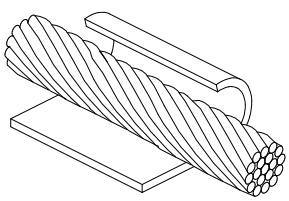
- Self-igniting Torch Head is designed to fit 14 or 16 ounce propane cylinders.
- Torches are required to remove moisture from the mold and conductors before making the Ultraweld connections.

Adapting Molds to Fit Conductors

Wrap Sleeves

Part No.	Box Qty.	Approx. Box Wt. (lbs.)
WRPSLV	50	1/2





- Wrap Sleeves can be used when welding cables smaller than indicated on mold tag.
- When the cable opening in the mold is larger than the cable, copper Wrap Sleeves are wrapped around the cable until the diameter is about the same size as the mold cable opening.
- A copper Wrap Sleeve is also used for wrapping around rebar for certain connection styles.

Adapter Sleeves

Part No.	Cable Size		Use in Mold for Stranded	Sleeve Dimensions			Box Qty.	Approx. Box Wt. (lbs.)
	Concentric Strand	Solid		O.D	I.D.	Length		
ADPSLV6	#12, 14	#10, 12, 14	#6	.156	.111	1.00	25	1/4
ADPSLV4	#7, 8, 10	#6, 8	#4	.227	.177	1.00	50	1/4
ADPSLV2A	#6	#5	#2	.292	.198	1.00	25	1/4
ADPSLV2B	#4, 5	#3, 4	#2	.287	.246	1.00	50	1/4
ADPSLV1	#4	n/a	#1	.340	.246	1.00	50	1/4
ADPSLV1/0	#2	#1	1/0	.370	.307	1.00	25	1/4
ADPSLV2/0	#1	1/0	2/0	.420	.359	1.00	25	1/4
ADPSLV3/0	1/0, #1	2/0	3/0	.452	.389	1.00	25	1/4
ADPSLV4/0	2/0, 1/0	3/0	4/0	.524	.437	1.50	50	1/4

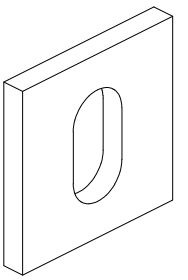
- Adapter Sleeves can be used when welding cables smaller than indicated on mold tag.
- Adapter sleeves slide over the cable to adapt smaller size cables to a larger size mold.

Materials, Tools & Accessories

Adapting Molds to Fit Conductors continued

Ceramic Rebar Packing Material

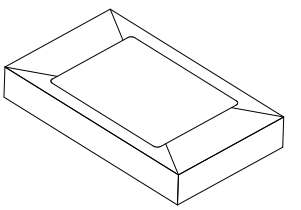
Part No.	Box Qty.	Approx. Box Wt. (lbs.)
CERPM1	25	1/4
CERPM2	25	1/4
CERPM3	25	1/4



- Packing consists of preformed ceramic batting.
- Packing is required on all rebar connections to prevent leakage.
- Some connection styles may require wrap sleeves in place of ceramic packing.

Mold Sealer

Part No.	Qty.	Approx. Each Wt. (lbs.)
MLDSLR	EA	1



- Mold Sealer is for sealing slightly worn molds to guard against leakage from large stranded conductors.
- Available in a convenient 1 pound package.

Cable & Work Surface Preparation

Cold Galvanizing Spray

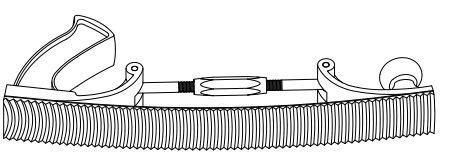
Part No.	Qty.	Unit Wt. (oz.)
CGS	EA	16



- Instant cold galvanizing spray provides protection equal to hot dip galvanizing.
- Used for touching up surfaces affected by welding.

Rasp

Part No.	Qty.	Approx. Each Wt. (lbs.)
RASP	EA	2-1/2



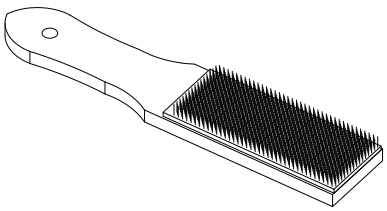
- Ideal for removing mill scale and rust from steel surfaces.

Materials, Tools & Accessories

Cable & Work Surface Preparation continued

Card Cloth Brush

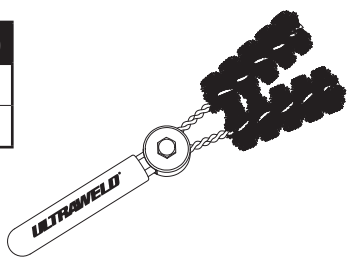
Part No.	Qty.	Approx. Each Wt. (lbs.)
CCBRSH1	EA	1/4



- The Card Cloth Brush has short, stiff, metal bristles which are generally preferred for cleaning concentric conductors and busbars, that are not heavily oxidized.

Cable Cleaning Brush

Part No.	Description	Qty.	Approx. Each Wt. (lbs.)
CCBRSH2	Cable Cleaning Brush	EA	3/4
CCBRSH2R	Replacement Brush Pair	EA	1/4

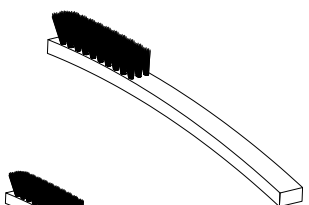


- Ideal for cleaning concentric stranded cable, especially very dirty or oxidized conductors.

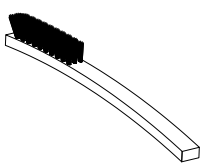
Mold Care & Use

Mold Cleaning Brushes

Part No.	Qty.	Approx. Each Wt. (lbs.)
MCBRSH1	EA	1/4
MCBRSH2	EA	1/16



MCBRSH1

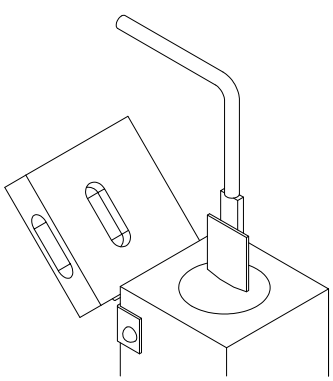


MCBRSH2

- Slag can be removed from molds by using a Mold Cleaning Brush.
- The brush is especially useful on vertical split molds.
- Consistent and proper use of the brush will aid in maintaining or exceeding the average mold life of 50 connections.

Mold Cleaning Spades

Part No.	Weld Metal Sizes	Qty.	Approx. Each Wt. (lbs.)
MCSPD25/115	25 - 115	EA	1/4
MCSPD150/400	150 and larger	EA	1/4

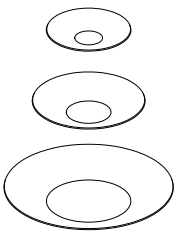


- Slag can be cleaned from the molds by using a Mold Cleaning Spade.
- The cleaning spade is especially useful on horizontally split molds.
- The cleaning spades are specifically designed to fit the mold crucible for a given range of weld metal sizes.
- Consistent and proper use of cleaning spades will aid in maintaining or exceeding the average mold life of 50 connections.

Materials, Tools & Accessories

Disks

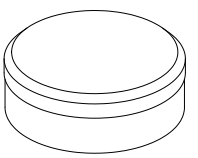
Part No.	Description	Diameter	Box Qty.	Approx. Box Wt. (lbs.)
DISK15/65	Used in molds using 15 thru 65 weld metal	3/4"	20	1/8
DISK90/115	Used in molds using 90 thru 115 weld metal	1"	10	1/8
DISK150/500	Used in molds using 150 thru 250 weld metal	1-1/2"	10	1/4



- The disk rests on the bottom of the crucible and holds the weld metal powder in place until the reaction occurs.
- A new disk is required each time a weld is made.
- Disks are included with the NUWTUBE Weld Metal.

Disk Kit

Part No.	Qty.	Approx. Each Wt. (lbs.)
DISKKIT1	EA	1/4



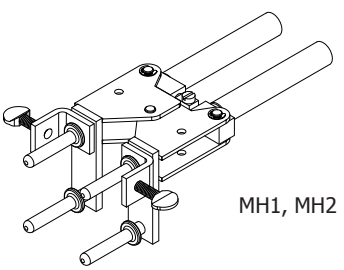
- A Disk Kit contains three sizes of steel disks; 60 small, 30 medium and 30 large.

Mold Fastening & Mounting

Mold Handle Clamps

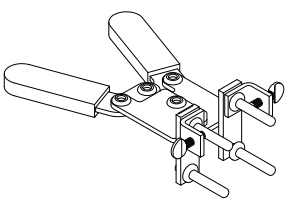
Part No.	Application	Qty.	Approx. Each Wt. (lbs.)
MH1	For All molds with B, E, K, P & Q mold price key (3" wide)	EA	2-3/4
MH2	For All molds with C, D, F, Y & Z mold price key	EA	3-1/2
MH3	For Combo molds with L & M mold price key	EA	1/4
MH4	For Combo molds with R mold price key	EA	1-1/2

- Mold Handle Clamps are required for all molds.
- Some molds are used with specialized frames.
- Handle clamps MH1 & MH2 come with a flint igniter (FLTIG).
- Handle clamps have a Zinc plated finish.

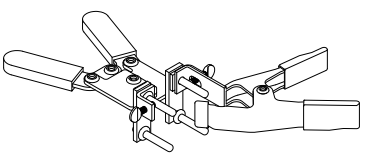


Patented

MH1, MH2



MH3



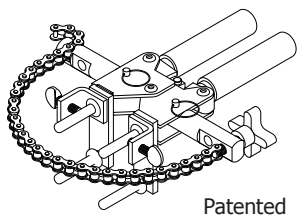
MH4

Materials, Tools & Accessories

Mold Fastening & Mounting continued

Chain Support Handle Clamps

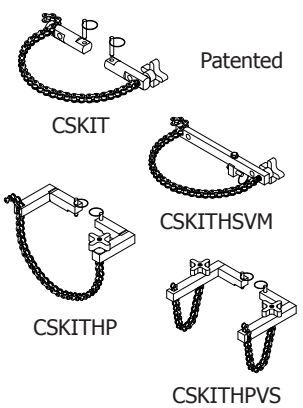
Part No.	Fits Mold Price Key	For Following Connection Types	Pipe/ Rebar	Qty.	Approx. Each Wt. (lbs.)
CSH1	B, E, K	RE, VA, VD, VT, VU	Vertical	EA	4
CSH2	C, D, F	VA, VD, VT, VU	Vertical	EA	4-1/2


Patented

- Handle clamps CSH1 & CSH2 come with MH1 & MH2 clamps respectively as well as a CSKIT and flint igniter (FLTIG).
- Chain Support Handle Clamps are used to securely hold the mold to either a vertical or horizontal pipe.
- A 20" length of chain, which fits up to 4" pipes, comes with the chain support handle clamps.
- Extra chain length is available. Please contact factory for details.

Chain Support Kits

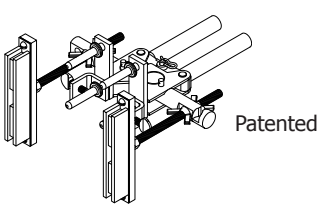
Part No.	Fits Mold Price Key	For Following Connection Types	Pipe/ Rebar	Qty.	Approx. Each Wt. (lbs.)
CSKIT	B, C, D, E, F, K	RE, VA, VD, VT, VU	Vertical	EA	2
CSKITHSVM	B, C	VH, RS	Vertical	EA	3
CSKITHP	B, C	HB, HD, HT, HU	Horizontal	EA	3-1/4
CSKITHPVS	B	HTCP, RO	Horizontal	EA	4



- These kits convert standard mold handle clamps into chain support clamps.

Magnetic Support Handle Clamps

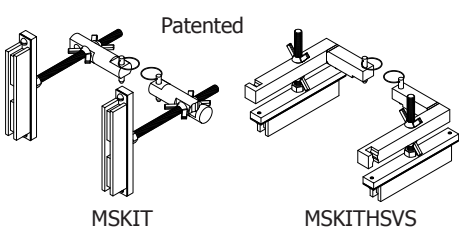
Part No.	Fits Mold Price Key	Minimum Width Requirements	Qty.	Approx. Each Wt. (lbs.)
MSHC1	B, E, K	8"	EA	6
MSHC2	C, D, F	8"	EA	6-1/2


Patented

- Handle clamps MSHC1 & MSHC2 come with MH1 & MH2 clamps respectively as well as a MSKIT and a flint igniter (FLTIG).
- Magnetic Support Handle Clamp allows mold to be securely held in place to steel surfaces.
- MSKIT converts the standard mold handle clamp into a magnetic support handle clamp.

Magnetic Support Kits

Part No.	Fits Mold Price Key	Minimum Width Requirements	Qty.	Approx. Each Wt. (lbs.)
MSKIT	B, C, D, E, F, K	8"	EA	6
MSKITHSVS	B, C, D, K	10"	EA	5



- These kits convert the standard mold handle clamp into a magnetic support handle clamp.

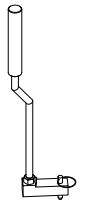
Materials, Tools & Accessories

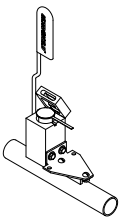
Mold Fastening & Mounting continued

Hold Down Kit

Part No.	Qty.	Approx. Each Wt. (lbs.)
UMHDKIT	EA	1-1/2
UMMHDA	EA	1/2

- UMHDKIT: Attaches easily to MH1 & MH2 handle clamps for holding mold in place.
- UMMHDA: Used for horizontal "A" molds.

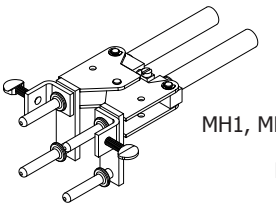

UMHDKIT


UMMHDA

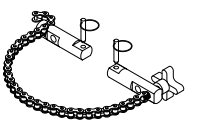
Mold Handle Clamp Kits

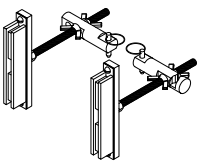
Part No.	Fits Mold Price Key	Kit Includes	Qty.	Approx. Each Wt. (lbs.)
ULTRAMH1KIT	B, E, K	MH1, CSKIT, MSKIT	EA	7
ULTRAMH2KIT	C, D, F	MH2, CSKIT, MSKIT	EA	7-1/2

- Handle clamps MH1 & MH2 come with a flint igniter. (FLTIG)
- Chain Support Handle Clamp securely holds mold to a vertical pipe.
- Magnetic Support Handle Clamp holds mold securely in place when welding to steel surfaces.


MH1, MH2

Patented

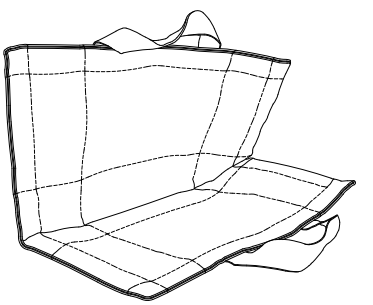

CSKIT


MSKIT

Mold Blanket

Part No.	Qty.	Approx. Each Wt. (lbs.)
ULTRAWRAP	EA	2

- Contains an inner and outer E-glass yarn with a padded non-crystalline silicate filling, finished with Kevlar®.
- Extends mold life by protecting against shock impact caused by rough handling.
- Protects exothermic welders from coming into contact with hot molds.
- Used as a protection blanket against weld splatter.

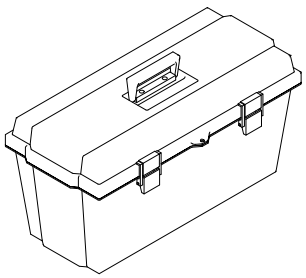


Materials, Tools & Accessories

Toolbox & Tools

Toolbox

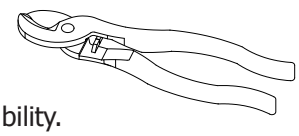
Part No.	Qty.	Approx. Each Wt. (lbs.)
TOOLBOX	EA	5-1/2



- Plastic toolbox measures 22" x 9.5" x 9.75" and includes a tray.

9" Cable Cutter

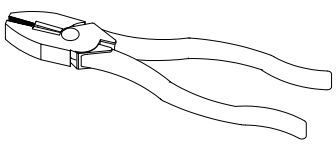
Part No.	Qty.	Approx. Each Wt. (lbs.)
CC9	EA	1/4



- Cable cutters designed for special high-leverage to give excellent cutting capability.
- The cable-gripping shear-type jaw makes clean cuts up to 2/0 soft copper cable.
- Handles are plastic-dipped for comfort and to minimize fatigue.

Lineman's Pliers

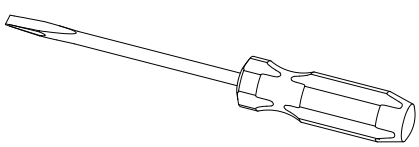
Part No.	Qty.	Approx. Each Wt. (lbs.)
LP9	EA	1-1/4



- 9" Lineman's pliers are heavy duty with non-slip cushion grips.
- Made with heat treated forged alloy steel for increased toughness and durability.
- Has a streamline head design and it's hardened side cutting edges create a clean cut and remain sharp.

Standard Slot Screwdriver

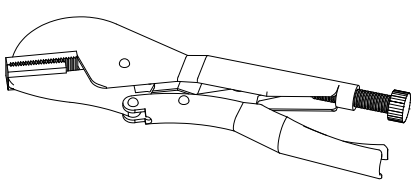
Part No.	Qty.	Approx. Each Wt. (lbs.)
SSS6	EA	1/4



- Screwdriver is 6" long with a 5/16" standard head.

Standard Vise-Grip®

Part No.	Qty.	Approx. Each Wt. (lbs.)
VG10	EA	1-1/4

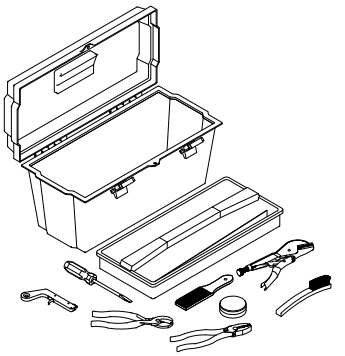


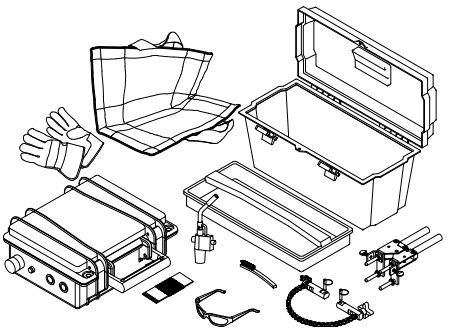
- 10" Vise-Grip® straight jaw locking pliers can be used as a pliers, adjustable wrench, pipe wrench, or clamp.
- They have a strong grip with quick release and locks on to a variety of sizes.

Materials, Tools & Accessories

Toolkits

Part No.	Qty.	Approx. Each Wt. (lbs.)
TOOLKIT	EA	10
USTOOLKIT	EA	23-1/4





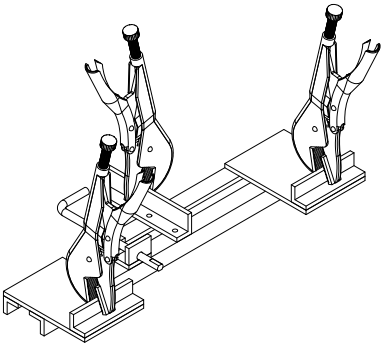
- **TOOLKIT Includes:**
  (1) TOOLBOX: 22" x 9.5" x 9.75" plastic toolbox with tray
  (1) CC9: 9" Cable Cutters
  (1) LP9: Lineman's Pliers
  (1) SSS6: 6" Screwdriver
  (1) VG10: 10" Vise-Grips
  (1) FLTIG: Flint Igniter
  (1) CCBRSH1: Card Cloth Brush
  (1) MCBRSH1: Mold Cleaning Brush
  (1) DISKKIT: Disk Kit

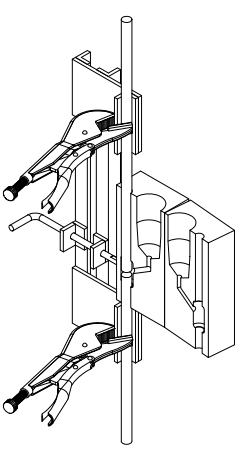
- **USTOOLKIT Includes:**
  (1) USCONTROLLER
  (1) TOOLBOX: 22" x 9.5" x 9.75" plastic toolbox with tray
  (1) MH1: Mold Handle
  (1) CSKIT: Chain Support Kit
  (1) MCBRSH2: Mold Cleaning Brush
  (1) SFTYGLS: Safety Glasses
  (1) GLOVES: Leather Palm Gloves
  (1) 3MABPAD: Abrasive Pad
  (1) ULTRAWRAP: Mold Blanket
  (1) TRCHD: Torch Head with Igniter

Ground Rod & Cable Clamp

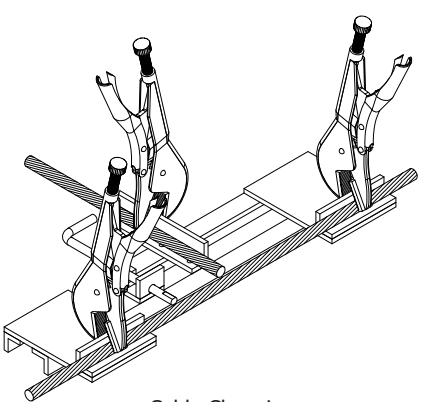
Part No.	Qty.	Approx. Each Wt. (lbs.)
GRCC	EA	18

- Clamp properly aligns and supports Ground Rods for welding type GG connections. See page 286 for details.
- Add-on third clamp (included) is used to convert into a Cable Clamping system. Thus preventing cables under tension from moving during welding and ensuring no weld metal leakage. This ensures quality connections and increases the life of the mold.





Ground Rod Clamping



Cable Clamping

Conductor Identification

Bare Class A, B, and C Concentric Stranded Conductors

Based on A.S.T.M Standard Specifications

Size in Circular mils	Size A.W.G.	Conductor Diameter	Number of Wires					Cable Code
			7	19	37	61	91	
1,000,000	1000	1.152"			.1644*	.1280	0.148	1MM
800,000	800	1.031"		.1470*	.1145	.0938		8CM
750,000	750	.998"		.1424*	.1109	.0908		75CM
700,000	700	.964"		.1375*	.1071	.0877		7CM
600,000	600	.893"		.1273	.0992	.0812		6CM
500,000	500	.813"		.1622*	.1162	.0905		5CM
400,000	400	.728"		.1451	.1040	.0810		4CM
350,000	350	.681"		.1357	.0973	.0757		35CM
300,000	300	.630"		.1257	.0900	.0701		3CM
250,000	250	.575"		.1147	.0822	.0640		25CM
211,600	4/0	.528"	.1739	.1055	.0756			4/0
167,800	3/0	.470"	.1548	.0940	.0763			3/0
133,100	2/0	.419"	.1379	.0837	.0600			2/0
105,500	1/0	.373"	.1228	.0745	.0534			1/0
83,690	1	.332"	.1093	.0664	.0467			1
66,370	2	.292"	.0974	.0591				2
52,630	3	.260"	.0867	.0526				3
41,740	4	.232"	.0772	.0469				4
26,240	6	.184"	.0612	.0372				6
16,510	8	.146"	.0486	.0295				8
10,380	10	.116"	.0385	.0234				10
6,530	12	.0915"	.0305	.0185				12
4,110	14	.0726"	.0242	.0417				14

* Class AA

Bare Solid Copper Conductors

Based on A.S.T.M Standard Specifications

Size A.W.G.	Cross Sectional Area Circular Mils	Wire Diameter	Cable Code
4/0	211,600	.4600"	4/0S
3/0	167,800	.4096"	3/0S
2/0	133,100	.3648"	2/0S
1/0	105,500	.3249"	1/0S
1	83,690	.2893"	1S
2	66,370	.2576"	2S
3	52,630	.2294"	3S
4	41,740	.2043"	4S
6	26,250	.1620"	6S
8	16,510	.1285"	8S
10	10,380	.1019"	10S
12	6,530	.0808"	12S
14	4,110	.0641"	14S

Conductor Area Conversions

Square Inches x 1273 = MCM
MCM x 7.862 x 10^{-4} = Square Inches

Square Inches x 645.2 = Square Millimeter
Square Millimeter x 1.550 x 10^{-3} = Square Inches

Square Millimeters x 1.9736 = MCM
MCM x 0.5067 = Square Millimeters

1 MCM = 1 kcmil = 1,000 circular mil

Copper-Clad Steel Conductors

Cable Code	Cable Stranding	Nominal Diameter (in.)	Cross Sectional Area (kcmil)
3/10CW	3/#10 CW	.220	31.15
3/9CW	3/#9 CW	.247	39.28
3/8CW	3/#8 CW	.277	49.53
7/10CW	7/#10 CW	.306	72.68
3/7CW	3/#7 CW	.311	62.45
7/9CW	7/#9 CW	.343	91.65
3/6CW	3/#6 CW	.349	78.75
7/8CW	7/#8 CW	.385	115.60
3/5CW	3/#5 CW	.392	99.31
7/7CW	7/#7 CW	.433	145.70
7/6CW	7/#6 CW	.486	183.80
7/5CW	7/#5 CW	.546	231.63
19/9CW	19/#9 CW	.572	248.70
7/4CW	7/#4 CW	.613	292.20
19/8CW	19/#8 CW	.642	313.70
19/7CW	19/#7 CW	.721	395.60
19/6CW	19/#6 CW	.810	498.60
19/5CW	19/#5 CW	.910	628.70

Steel Pipe Sizes

Standard Weight (Schedule 40) **ASTM A53-90-B ANSI/ASME B36.10M-1985**

Nominal Size	O.D.	Wall Thickness	Mold Code
1"	1.315"	.133"	1
1-1/4"	1.66"	.14"	1.25
1-1/2"	1.9"	.145"	1.5
2"	2.375"	.154"	2
2-1/2"	2.875"	.203"	2.5
3"	3.5"	.216"	3
3-1/2"	4"	.226"	3.5
4"	4.5"	.237"	4
5"	5.563"	.258"	5
6"	6.625"	.28"	6
8"	8.625"	.322"	8
10"	10.75"	.365"	10

Ground Rods

Nominal Size	Material	Type	Body Diameter	Thread Size	Ground Rod Code
1/2"	Copper-clad	Sectional	.505"	9/16"	12F
	Copper-clad	Plain	.50"	N/A	12F
	Steel*	Plain	.50"	N/A	12F
	Copper-clad	Plain	.475"	N/A	12
5/8"	Steel*	Plain	.625"	N/A	58F
	Copper-clad	Plain	.563"	N/A	58
	Copper-clad	Sectional	.563"	5/8"	58S**
3/4"	Steel*	Plain	.75"	N/A	34F
	Copper-clad	Plain	.682"	N/A	34
	Copper-clad	Sectional	.682"	3/4"	34S**
1"	Steel*	Plain	1.00"	N/A	10F
	Copper-clad	Plain	.914"	N/A	10
	Copper-clad	Sectional	.914"	1"	10S**

* Plain steel, stainless steel, stainless clad rods or galvanized steel.
** Add S to sectional ground rod size for connections to end of rod such as: GD, GF, GO, GT, GG

Rectangular Copper Busbar

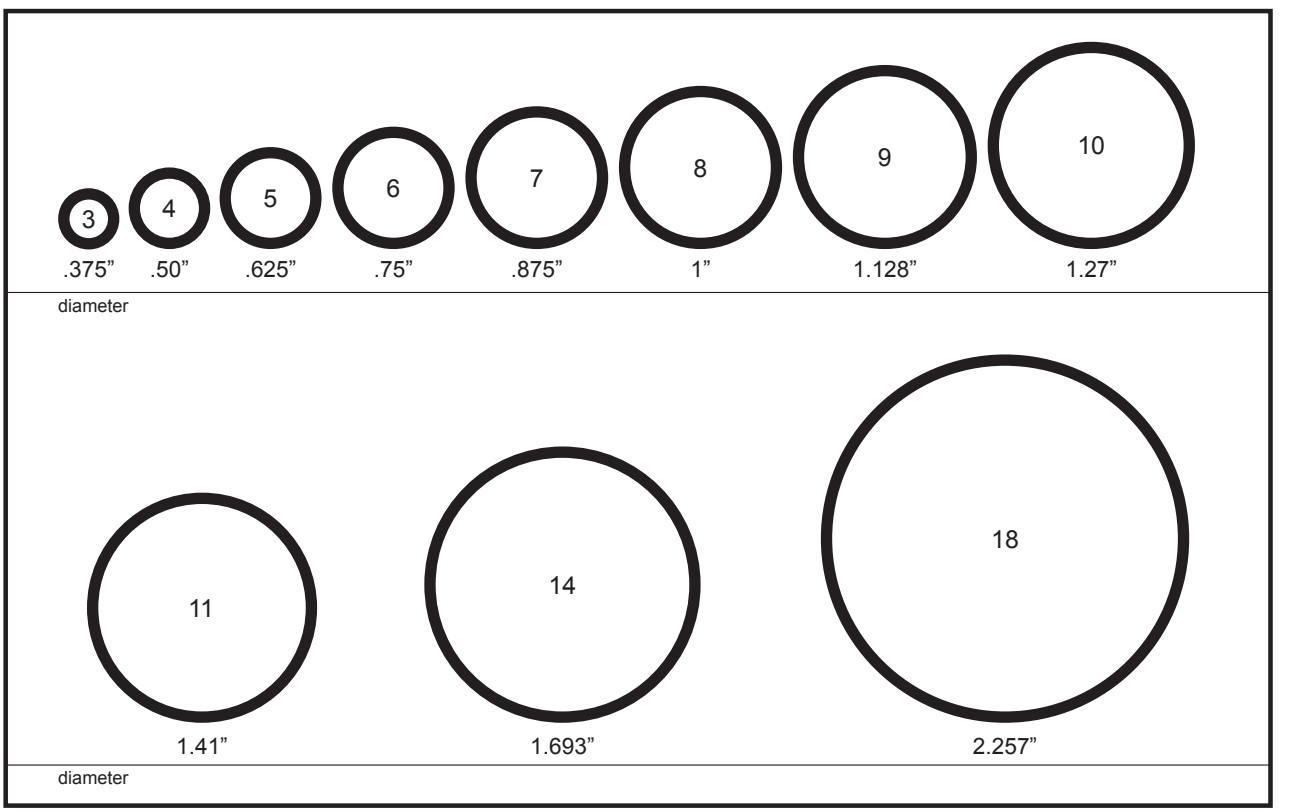
Thickness	Width	Circular Mil Size	Weight Lbs. per Foot	Busbar Code
1/8"	1"	159,200	.484	181
	1-1/2"	238,700	.726	181.5
	2"	318,300	.969	182
3/16"	1"	238,700	.727	3161
	2"	477,500	1.45	3162
1/4"	1"	318,300	.969	141
	1-1/2"	477,500	1.45	141.5
	2"	636,600	1.94	142
	3"	954,900	2.91	143
	4"	1,273,000	3.88	144
3/8"	1"	477,500	1.45	381
	1-1/2"	716,200	2.18	381.5
	2"	954,900	2.91	382
	3"	1,432,000	4.36	383
	4"	1,910,000	5.81	384
1/2"	2"	1,273,000	3.88	122
	3"	1,910,000	5.81	123
	4"	2,546,000	7.75	124

Reinforcing Bars

Rebar Sizes	Nominal Dimensions		Equivalent Copper Sizes*	Rebar Code
	Diameter Inches	Cross-sectional Area-Sq. Inches		
3	.375"	.11"	9 AWG	3
4	.50"	.20"	7	4
5	.625"	.31"	5	5
6	.75"	.44"	3	6
7	.875"	.60"	2	7
8	1"	.79"	1	8
9	1.128"	1"	1/0	9
10	1.27"	1.27"	2/0	10
11	1.41"	1.56"	3/0	11
14	1.693"	2.25"	250 MCM	14
18	2.257"	4"	450	18

* Based on 8% IACS, rounded to the next higher commercial copper size.

Rebar Size Chart



Section 6
Technical Assistance

Index

Description		Page
6.1	Lightning Risk Assessment	338
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6.3	Underwriters Laboratories Master Label Inspection Service	348
6.4	Typical Lightning Protection Drawings	349
6.5	Lightning Protection & Grounding Details	353
6.6	Wireless Communication Site LP & Grounding System Specification	364
6.7	Wireless Communication Drawings & Details	370
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6.9	Signal Reference Grid (SRG) Installation Instructions	379
6.10	Grounding & Bonding for Communications System Specification (ANSI/TIA 607-B)	381

NOTE:
Our catalog drawings & details are available on our CD version of this catalog and our website. Please contact us to request a Catalog CD.

Harger Lightning & Grounding

is pleased to present the

Lightning Risk Assessment Guide

to Aid in the Determination of the Need for Lightning Protection (per NFPA 780 2011 Edition)

For years, architects, engineers, building managers, owners, and insurance carriers have been seeking a more professional method of evaluating the need for lightning protection.

In the past, the decision to provide lightning protection was often based on gambles and guesswork by well-meaning persons, not having specialized training in lightning protection. Tragic and unnecessary losses have occurred because of this approach.

Now, by use of this guide, you may make a more accurate determination regarding the need for lightning protection. Once the need for protection has been established, loss of life and property can be avoided by the installation of an approved lightning protection system.

In those special cases where professional consultation or installation is desired, **Harger Lightning & Grounding** stands ready to be of service.

Lightning loss risk assessment involves the evaluation of various criteria to determine the risk of loss due to lightning. This guide is designed to assist in that determination. As a guide, it is not possible to cover each special design element that may render a structure more or less susceptible to lightning damage. In these special cases it is recommended the user seek professional advice. Personal and economic factors are very important and must be considered in addition to the assessment obtained by use of this guide.

The probability that a structure or object will be struck by lightning is the product of the equivalent collection area of the structure or object and the lightning flash density for the area that the structure is located.

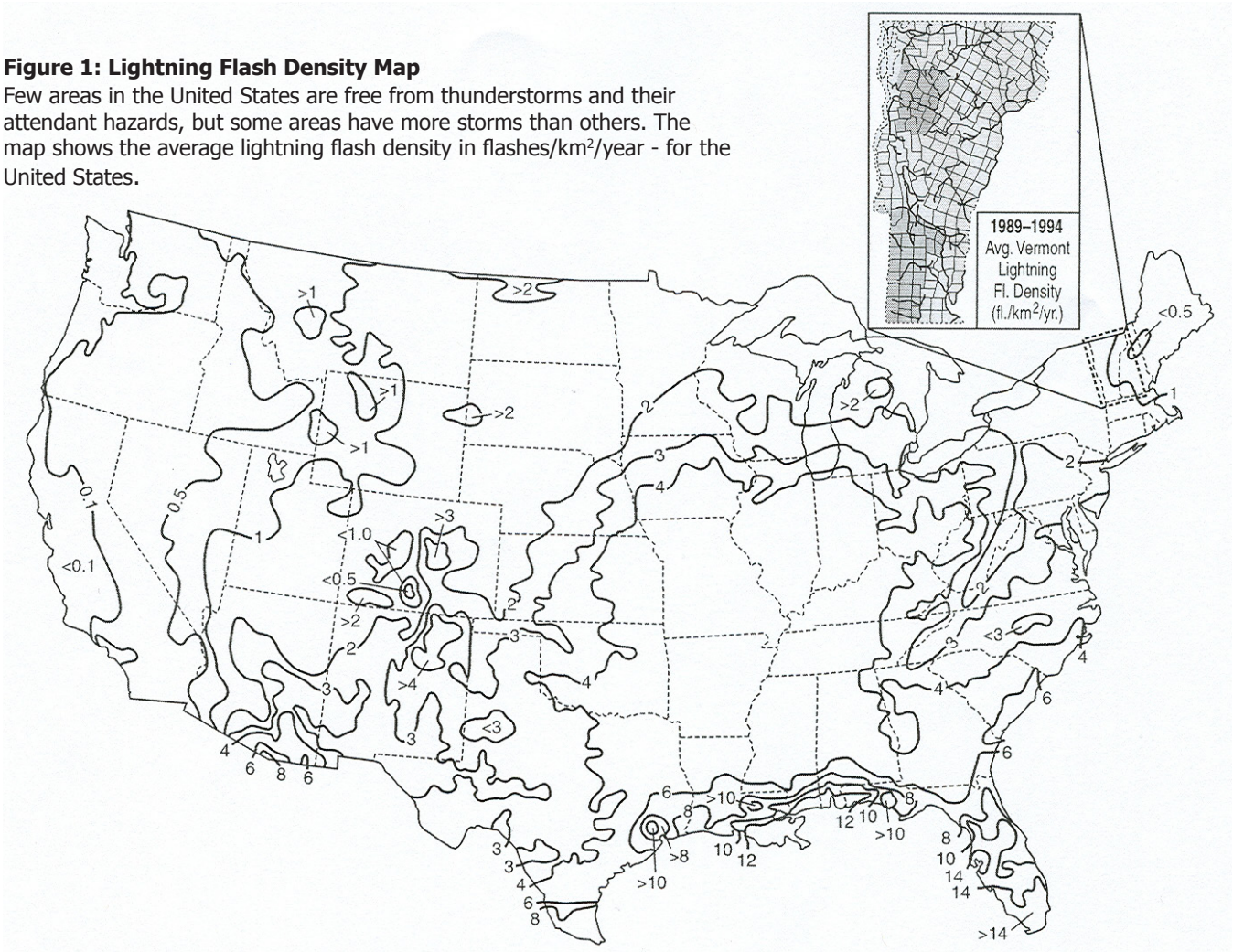
This risk assessment method is a guide that takes into account the lightning flash density and the following factors:

1. Building environment
2. Type of construction
3. Structure occupancy
4. Structure contents
5. Lightning stroke consequences

Lightning risk for a structure is the product of the lightning strike frequency and the consequence of the strike to the structure.

Lightning Flash Density (N_g) - The yearly number of flashes to ground per square kilometer, lightning flash density, is found in Figure 1.

Figure 1: Lightning Flash Density Map
Few areas in the United States are free from thunderstorms and their attendant hazards, but some areas have more storms than others. The map shows the average lightning flash density in flashes/km^2/year - for the United States.



Lightning data provided by the U.S. National Lightning Detection Network™ (Measured lightning flash density corrected for NLDN detection efficiency)

1989-1998 Average U.S. Lightning Flash Density Flashes per Square Kilometer per Year. ***(Courtesy Global Atmospherics, Inc.)***

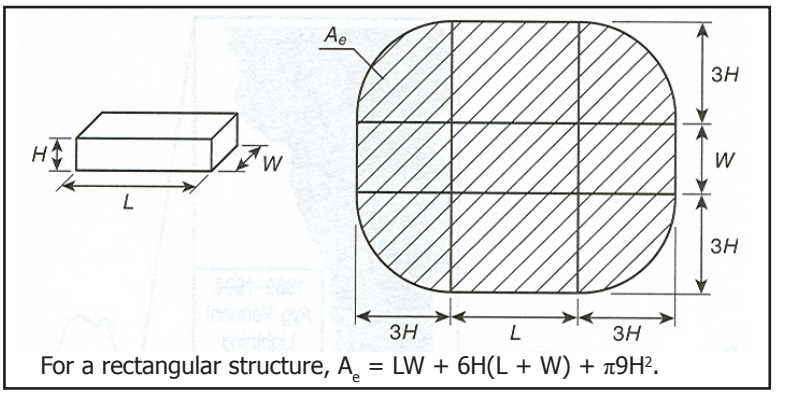
Method:
Calculate and compare the expected Lightning Strike Frequency (N_d) for the facility to the Tolerable Lightning Strike Frequency (N_c).

Step 1: Determination of Expected Lightning Strike Frequency (N_d)

$N_d = N_g \bullet A_e \bullet C_1 \bullet 10^{-6}$

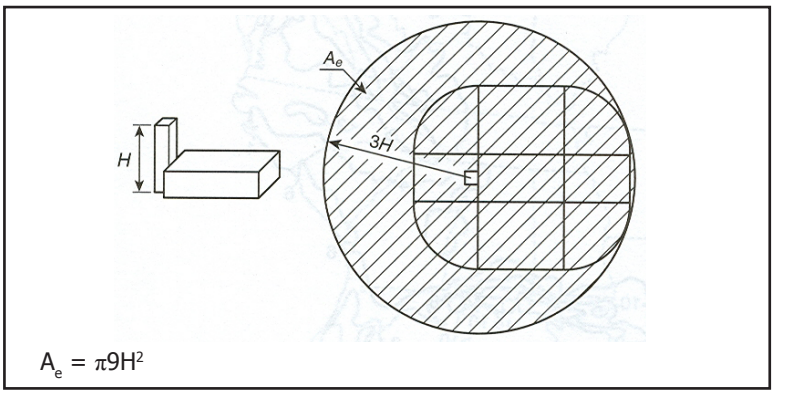
Where:
N_d = the expected yearly lightning strike frequency to the structure
N_g = the yearly average lightning flash density in the region where the structure is located (Determine value from Figure 1)
A_e = the equivalent collection area (m^2) of the structure (Determine from Figure 2)
C_1 = the environmental coefficient (Determine value from Table 1)

Figure 2: Calculation of Equivalent Collection Volume (A_e)



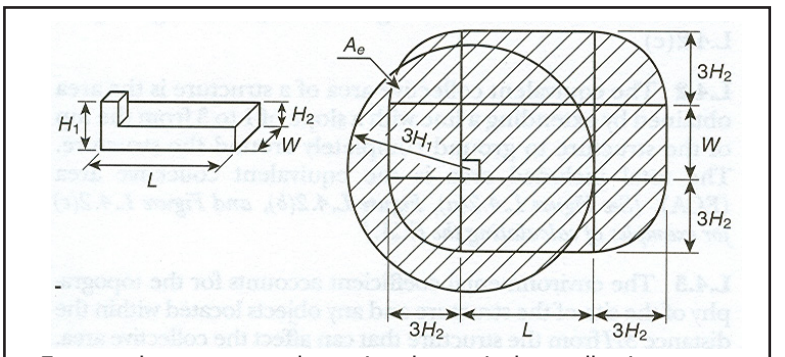
For a rectangular structure, $A_e = LW + 6H(L + W) + \pi 9H^2$.

Rectangular Structure



$A_e = \pi 9H^2$

Structure where a Prominent Part Encompasses All Portions of the Lower Part of the Structure.



For complex structures determine the equivalent collective area.

Structure where Prominent Part Encompasses a Portion of the Lower Part of the Structure.

Table 1: Environmental Coefficient C_1

Relative Structure Location	C_1
Structure located within a space containing structures or trees of the same height or taller within a distance of 3H	0.25
Structure surrounded by smaller structures within a distance of 3H	0.5
Isolated structure, no other structures within a distance of 3H	1
Isolated structure on a hilltop	2

Note: 3H = 3 times the highest point in the structure

Step 2: Tolerable Lightning Frequency (N_c)

The tolerable lightning frequency (N_c) is a measure of the damage risk to the structure including factors affecting risks to the structure, environment, and money loss.

It is calculated as follows:

$$N_c = \frac{1.5 \times 10^{-3}}{C_2 \bullet C_3 \bullet C_4 \bullet C_5}$$

Where values for C_2 , C_3 , C_4 and C_5 are determined from Tables 2 through 5.

Table 2: Determination of Structural Coefficient C_2

	C_2		
Structure	**Metal Roof**	**Nonmetallic Roof**	**Flammable Roof**
Metal	0.5	1	2
Nonmetallic	1	1	2.5
Flammable	2	2.5	3

Table 3: Determination of Structural Contents Coefficient C_3

Structural Contents	C_3
Low value and nonflammable	0.5
Stand value and nonflammable	1
High value, moderately flammable	2
Exceptional value, flammable, computer or electronics	3
Exceptional value, irreplaceable cultural contents	4

Table 4: Determination of Structural Occupancy Coefficient C_4

Structural Contents	C_4
Unoccupied	0.5
Normally occupied	1
Difficult to evaluate or risk of panic	3

Table 5: Determination of Lightning Consequence Coefficient C_5

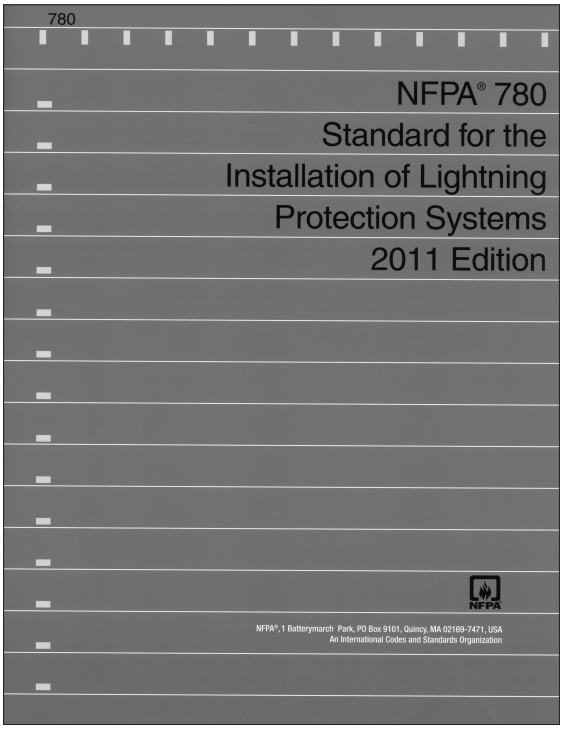
Structural Contents	C_5
Continuity of facility services not required, no environmental impact	1
Continuity of facility services required, no environmental impact	5
Consequences to the environment	10

Step 3: Determine Protection Level

Compare Step 1 Expected Lightning Frequency (N_d) to Step 2 Tolerable Lightning Frequency (N_c).

If $N_d > N_c$ then a lightning protection system should be installed.

If $N_d \leq N_c$ then a lightning protection system can be optional.



The risk assessment has been adapted from and conforms to the Lightning Risk Assessment presented in NFPA 780-2011, Annex L. NFPA 780-2011 can be purchased directly from the National Fire Protection Association (http://www.nfpa.org/).

Lightning Risk Assessment Worksheet

Project: _____

Date: _____

Data Input / Equations	Computation	Results
Equivalent collection volume area. $A_e = LW + 6H(L + W) + \pi 9H^2$ (for a rectangular structure) or $A_e = \pi 9H^2$ (structure with a prominent part encompassing all lower parts of structure)	L= W= H= H_2= or H=	A_e=
Expected lightning strike frequency to the structure $N_d = N_g \bullet A_e \bullet C_1 \bullet 10^{-6}$	N_g= A_e= C_1=	N_d=
Tolerable lightning frequency to the structure. $N_c = \frac{1.5 \times 10^{-3}}{C_2 \bullet C_3 \bullet C_4 \bullet C_5}$	C_2= C_3= C_4= C_5=	N_c=
If $N_d \leq N_c$ - Lightning Protection System may be optional		☐
If $N_d > N_c$ - Lightning Protection System should be installed		☐

Section 26 41 13 (Formerly 16670) – Structural Lightning Protection System Specification

Part 1 – GENERAL

1.01 Summary:

a. Provide a complete lightning protection system for the building(s) or structures included on the contract drawings. The system shall provide safety for the building, the buildings contents and occupants by preventing damage caused by lightning. The design of this system is to be in strict accordance with this section of the specifications and all contract drawings that apply.

b. The lightning protection system shall be installed by a firm actively engaged in the installation of Master Labeled Lightning Protection Systems and shall be so listed by Underwriters Laboratories Inc. The completed system shall comply with the latest editions of the Installation Requirements for Lightning Protection Systems, UL96A and of the National Fire Protection Association's Lightning Protection Standard, NFPA 780.

c. The work covered under this section of the specification consists of furnishing labor, materials and services required for the completion of a functional and unobtrusive lightning protection system approved by the architect, engineer and Underwriters Laboratories Inc.

1.02 References: The completed lightning protection system shall comply with the latest issue of the following standards and form a part of this specification.

a. NFPA 780, Standard for the Installation of Lightning Protection Systems.

b. UL 96A, Installation Requirements for Lightning Protection Systems

1.03 Submittals:

a. Shop drawings shall be submitted to the architect and engineer for approval prior to commencement of the installation. Shop drawing are to show the extent of the system layout designed specifically for the building(s) or structures included in the contract drawings along with details of the products to be used in the installation.

1.04 Quality Assurance:

a. The installing contractor shall furnish a UL Master Label or Letter of Findings upon completion of the installation.

Part 2 – PRODUCTS

2.01 Standard

a. All materials used in the installation shall be new and shall comply in weight, size and composition as required by UL 96A and NFPA 780 and shall be labeled or listed by Underwriters Laboratories Inc. for use in lightning protection systems. The system furnished under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection equipment. The manufacturer shall be listed by UL as a recognized manufacturer of lightning protection components.

2.02 Acceptable Manufacturers

a. Harger Lightning & Grounding
301 Ziegler Drive, Grayslake, IL 60030
847-548-8700 • 800-842-7437 • Fax 847-548-8755
E-mail: hargersales@harger.com • Website: www.harger.com

Section 26 41 13 (Formerly 16670) – Structural Lightning Protection System Specification

2.03 Materials

a. Class I materials shall be used on structures that do not exceed 75 feet in height and Class II materials shall be used on structures that are 75 feet or higher above average grade.

b. Copper materials shall not be mounted on aluminum surfaces including Galvalume, galvanized steel and zinc; this includes these materials that have been painted.

c. Aluminum materials shall not come into contact with earth or where rapid deterioration is possible. Aluminum materials shall not come into contact with copper surfaces.

2.04 Air Terminals

a. Air terminals shall project a minimum of ten inches above the object or area it is to protect and shall be located at intervals not exceeding 20'-0" along ridges and along the perimeter of flat or gently sloping roofs (flat or gently sloping roofs include roofs that have a pitch less than 3:12). Flat or gently sloping roofs exceeding 50'-0" in width shall be protected with additional air terminals located at intervals not exceeding 50'. Air terminals shall be located within two feet of roof edges and outside corners of protected areas.

b. Air terminals shall be installed on stacks, flues, mechanical units and other metallic objects not located within a zone of protection and which have an exposed metal thickness less than 3/16 of an inch. Objects having an exposed metal thickness 3/16 of an inch or greater shall be connected to the lightning protection system as required by the specified standards using main size conductor and bonding plates having a minimum of 3 square inches of surface contact area.

c. Air terminal bases shall be securely fastened to the structure in accordance the specified standards including the use of adhesive that is compatible with the surface it is to be used on or stainless steel fasteners.

d. Main conductors shall be sized in accordance with the specified standards for Class I or Class II structures and shall provide a two way horizontal or downward path from each air terminal to connections with the ground system. Conductors shall be free of excessive splices and no bend of a conductor shall form a final included angle of less than neither 90 degrees nor have a radius of bend less than 8 inches.

e. Down conductors shall be sized in accordance with the specified standards and in no case shall be smaller than the main roof conductor. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. In no case shall a structure have fewer than two down conductors. Where down conductors are installed exposed on the exterior of a structure and are subject to physical damage or displacement, guards shall be used to protect the conductor a minimum of 6 feet above grade. Metallic guards shall be bonded at each end.

f. In case of structural steel frame construction, down conductors may be omitted and roof conductors shall be connected to the structural steel frame at intervals not exceeding 100 feet along the perimeter of the structure.

Section 26 41 13 (Formerly 16670) – Structural Lightning Protection System Specification

2.05 Roof Penetrations

a. Roof penetrations required for down conductors or for connection to structural steel framework shall be made using thru-roof assemblies with solid riser bars and appropriate roof flashing. Conductors shall not pass directly through the roof. The roofing contractor shall furnish and install the materials required to properly seal all roof penetrations of the lightning protection components and any additional roofing materials or preparations required by the roofing manufacturer for lightning conductor runs to assure compatibility with the warranty for the roof including roof pads that may be required to protect the roof under each of the lightning protection components.

2.06 Ground Terminations:

a. Ground electrodes shall be copper clad steel and a minimum 5/8" diameter and 10 feet long. A ground electrode shall be provided for each down conductor. The down conductor shall be connected to the ground electrode using a bronze ground rod clamp having a minimum of 1½" contact between the ground electrode and the conductor measured parallel to the axis of the ground electrode, or by an Ultraweld exothermically welded connection. Ground electrodes shall be located a minimum of 2 feet below grade and shall be installed below the frost line where possible (excluding shallow topsoil conditions).

b. Where the structural steel framework is utilized as the down conductor for the system, ground terminals shall be connected to columns around the perimeter of the structure at intervals averaging not more than 60 feet apart. Columns shall be grounded using either bonding plates having 8 square inches of surface contact area or by Ultraweld exothermically welded connections.

c. All ground electrodes shall be interconnected with a ground loop conductor on structures that exceed 60 feet in height. The ground loop conductor shall be sized in accordance with the specified standards and in no case shall be smaller than the main roof conductor.

2.07 Equipotential Grounding

a. Common interconnection of all grounded systems within the building shall be ensured by interconnecting to the lightning protection system using main size conductor and fittings.

b. This interconnection shall include but is not limited to the electrical service, telephone and antenna system grounds as well as all underground metallic piping systems including water, gas and sewer. Interconnection to a gas or water line shall be made on the customer's side of the meter.

c. Grounded metal bodies located within the required bonding distance as determined by the bonding distance formula in the latest edition of NFPA-780 Standard for the Installation of Lightning Protection Systems shall be bonded to the lightning protection system using the required bonding conductors and connections.

2.08 Surge Protection

a. Surge suppression shall be provided at all power service entrances and at entrances of conductive signal, data and communication services.

Section 26 41 13 (Formerly 16670) – Structural Lightning Protection System Specification

Part 3 – EXECUTION

3.01 Installation

a. The installation shall be installed by an UL listed lightning protection installation company.

3.02 Coordination

a. Coordinate the installation of the lightning protection system with other trades

b. Coordinate all roof penetrations, fasteners and adhesive with the roofing contractor prior to installing any materials on the roof.

3.03 Inspection and Certification

a. New Structures:

i. Upon completion of the installation of the lightning protection system the contractor shall furnish the UL Master Label issued by Underwriters Laboratories Inc.

b. Additions or renovations:

i. If the protected structure is an addition to or is attached to an existing structure that does not have a functioning lightning protection system, the contractor shall certify that the new system installed complies with the specified standards and shall advise the owner on the lightning protection work required on the existing structure so that a Master Label may be obtained.

ii. If the protected structure is an addition to or is attached to an existing structure that does have a lightning protection system the contractor shall advise the owner of any additional work that may be required in order to bring the existing lightning protection system into compliance with the specified standards and thus qualify for a Reconditioned Master Label from Underwriters Laboratories Inc.

END OF SECTION 26 41 13

Master Label Inspection Service

Harger Lightning & Grounding is a subscriber to the MASTER LABEL CERTIFICATE PROGRAM of Underwriters Laboratories, Inc. (UL) as well as to the Factory Inspection Program for Lightning Protection Components.

Under the factory inspection service our lightning protection conductors and components are regularly inspected and tested by UL representatives. Harger components bear the UL label or listed mark depending on the type of component.

The Master Label Certificate is available for complete Lightning Protection System installations that have been installed using only UL listed or labeled components in accordance with the "Installation Requirements for Lightning Protection Systems", UL96A.

Underwriters Laboratories is a not-for-profit organization engaged in testing for public safety. It is THE ONLY third party testing and inspection service available to purchasers of lightning protection systems that DOES NOT have direct industry involvement. It is not involved in the marketing, manufacture, or installation of lightning protection systems or components. Underwriters Laboratories has been active in the testing and inspection of lightning protection components and systems since 1908. Their experience in the safety testing field has earned them worldwide recognition and respect. UL is not a trade organization with proprietary interests.

Underwriters inspection service for the lightning protection industry involves two separate inspection steps. A UL inspector inspects the lightning protection components and labels are applied to conductors and air terminals at the factory. A UL representative then inspects the installation of the completed lightning protection system The UL Master Label Certificate will be issued within 48 hours of the completion of the inspection or after variances are corrected. The UL Listed installer forwards the certificate to the owner, and can have the certificate posted to the UL web site providing proof that the lightning protection system is in compliance with UL Standards. Certificates must be renewed every five years which requires another inspection by UL.

Information on the UL Master Label Lightning Protection Inspection Certificate Program can be found at their web site http://www.ul.com/lightning/.

THERE IS NO SUBSTITUTE FOR THE MASTER LABEL

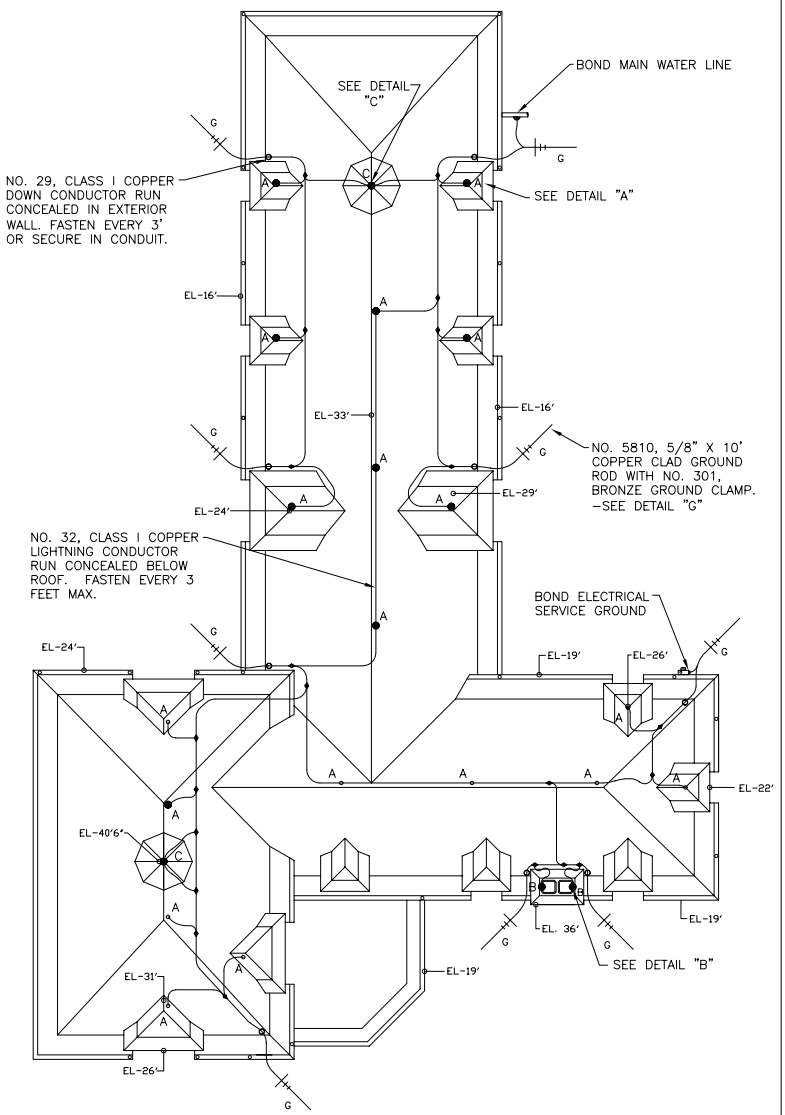
Residential Lightning Protection

NOTES

1. THE COMPLETED INSTALLATION SHALL MEET THE REQUIREMENTS OF THE NATIONAL FIRE PROTECTION ASSOCIATION'S "STANDARD FOR THE INSTALLATION OF LIGHTNING PROTECTION SYSTEMS, 2011 EDITION" (NFPA 780) AND THE "INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS, UL 96A" OF UNDERWRITERS LABORATORIES INC.
2. COPPER LIGHTNING PROTECTION SYSTEM COMPONENTS SHALL NOT BE MOUNTED TO ALUMINUM SURFACES. ALUMINUM COMPONENTS SHALL BE USED TO AVOID ELECTROLYTIC CORROSION.
3. GROUNDED METAL BODIES WITHIN THE BONDING DISTANCE DETERMINED BY NFPA 780 – 2011 EDITION SHALL BE BONDED TO THE SYSTEM IN ACCORDANCE WITH THOSE REQUIREMENTS.
4. UNDERGROUND METALLIC PIPING ENTERING THE BUILDING SHALL BE BONDED TO THE NEAREST DOWN CONDUCTOR OR GROUND ELECTRODE.
5. ADHESIVE USED WITH ADHESIVE AIR TERMINAL BASES, CONDUCTOR FASTENERS AND ROOF PENETRATIONS SHALL BE COMPATIBLE WITH ROOFING MATERIAL – VERIFY WITH ROOFING CONTRACTOR.
6. ALL ELEVATIONS ARE APPROXIMATE AND ARE TAKEN FROM AVERAGE GRADE.
7. THE DESIGNS SHOWN FOR THESE SYSTEMS ARE SCHEMATIC AND ARE INTENDED TO SHOW BASIC SYSTEM DESIGN. CONTRACTOR SHALL VERIFY DIMENSIONS AND SITE CONDITIONS AND PROVIDE SYSTEMS THAT COMPLY WITH CODE REQUIREMENTS.
8. AIR TERMINALS ARE TO BE LOCATED AS SHOWN. THEY ARE TO BE A MAXIMUM OF 24" FROM THE ROOF EDGE AND PROJECT A MINIMUM OF 10" ABOVE THE PROTECTED EDGE. THE SPACING BETWEEN AIR TERMINALS ARE NOT TO EXCEED 20 FEET. AIR TERMINALS THAT EXTEND 24" ABOVE THE PROTECTED EDGE ARE NOT TO EXCEED A SPACING GREATER THAN 25', EXCEPT FOR MID–ROOF AIR TERMINALS (50' MAX SPACING).
9. ALL LIGHTNING CONDUCTORS ARE TO MAINTAIN A HORIZONTAL OR DOWNWARD PATH. ALL BENDS IN THE CONDUCTOR SHALL HAVE A RADIUS BEND OF 8 INCHES OR GREATER, AND SHALL HAVE AN ANGLE BEND OF 90 DEGREES OR GREATER.
10. EACH INDIVIDUAL ITEM OF THE LIGHTNING PROTECTION SYSTEM IS NOT LABELED FOR THE SAKE OF CLARITY. ITEMS ARE INDICATED AT RANDOM LOCATIONS ONLY, BUT A COMPLETE SYSTEM SHALL BE PROVIDED TO MEET MASTER LABEL REQUIREMENTS.

LEGEND

- ● A — NO. 3812CUAT, 3/8" X 12" GENTLY TAPERED SOLID COPPER AIR TERMINAL WITH NO. 155–12, BRONZE CONCEALED BASE AND NO. 133, BRONZE AIR TERMINAL SWIVEL ADAPTER. –SEE DETAIL "A"
- ● B — NO. 3818CUATT, 3/8" X 18" GENTLY TAPERED TINNED COPPER AIR TERMINAL WITH NO. CFB1.5, TINNED CHIMNEY FLUE BASE. –SEE DETAIL "B"
- ● C — NO. 3812CUAT, 3/8" X 12" GENTLY TAPERED SOLID COPPER AIR TERMINAL WITH NO. 155–12, BRONZE CONCEALED BASE AND NO. 123, BRONZE AIR TERMINAL ADAPTER. –SEE DETAIL "C"
- ——— NO. 29 CLASS I COPPER LIGHTNING CONDUCTOR (29 STRANDS OF 16 AWG WIRE – 215 LBS. PER 1000 FEET). SEE AIR TERMINAL DETAILS FOR METHOD OF FASTENING. SECURE TO BUILDING EVERY THREE FEET MAXIMUM.
- G — NO. 5810, 5/8" X 10'–0" COPPER CLAD GROUND ROD WITH NO. 302U, UNIVERAL GROUND CLAMP. –SEE DETAIL "G"



North

LIGHTNING PROTECTION SYSTEM PLAN

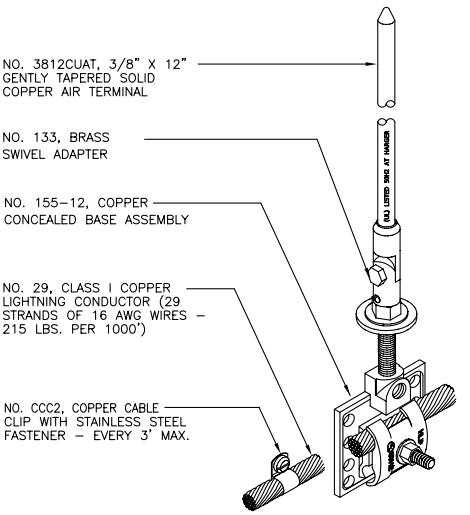
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Typ–1	KHO	

Typical Residential
Lightning Protection Drawing

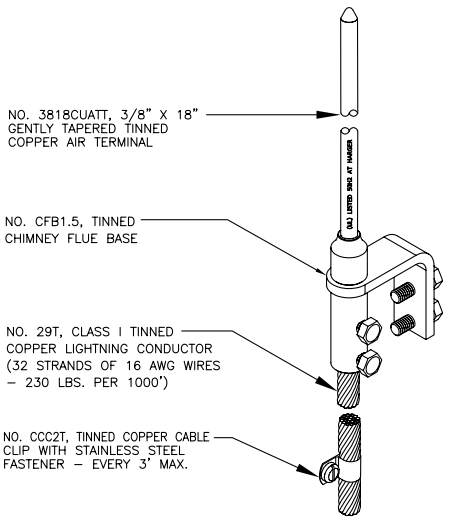
MATERIALS MANUFACTURED BY
HARGER
LIGHTNING PROTECTION • GROUNDING • EXOTHERMIC
301 ZIEGLER DRIVE
GRAYSLAKE, IL 60030
(847) 548–8700
www.harger.com

Residential Lightning Protection



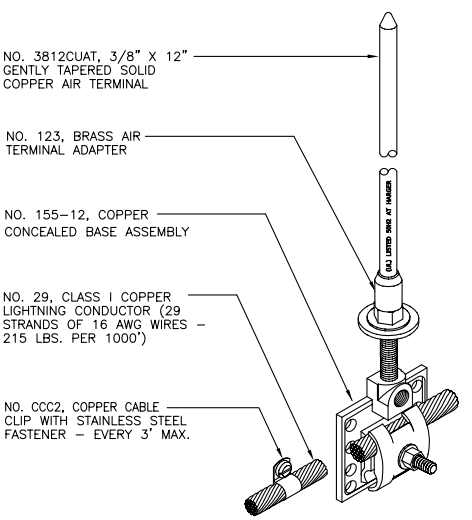
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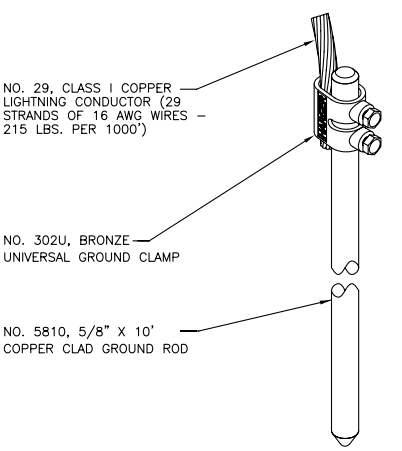
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AIR TERMINAL DETAIL "C"

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GROUND ROD DETAIL "G"

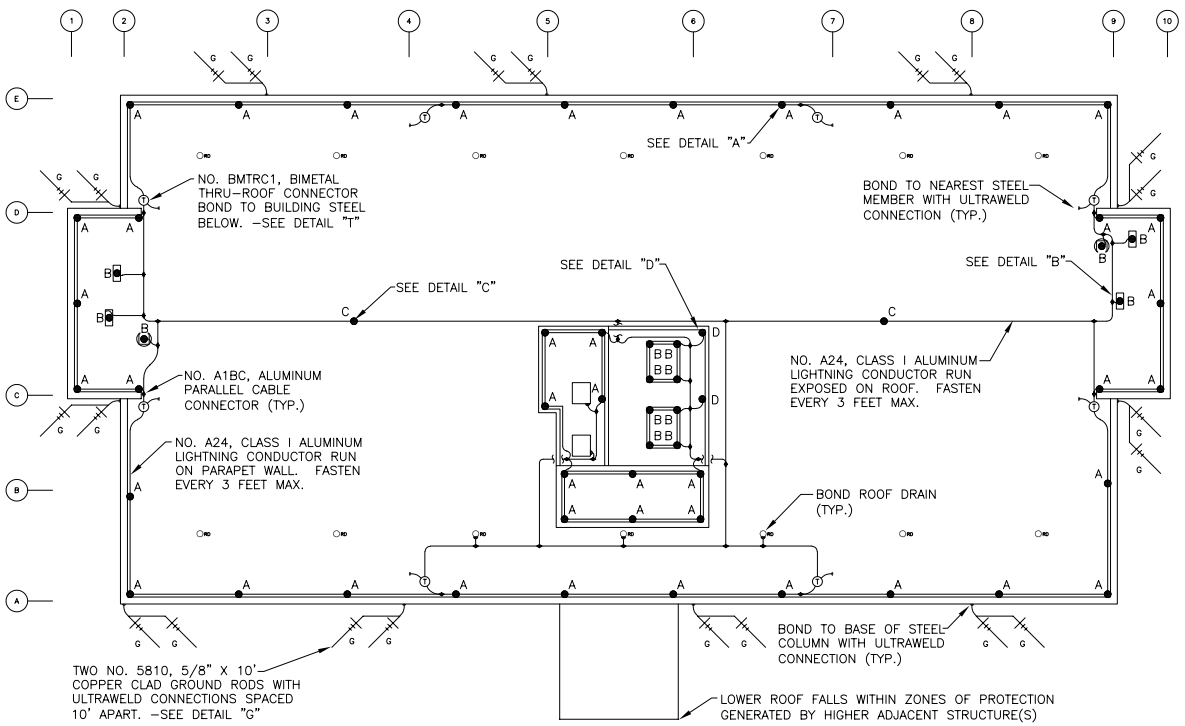
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DWG NUMBER	CHECKED BY:	© 2013
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TYPICAL RESIDENTIAL
Lightning Protection Details

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LIGHTNING PROTECTION • GROUNDING • EXOTHERMIC
301 ZIEGLER DRIVE
GRAYSLAKE, IL 60030
(847) 548-8700
www.harger.com

Commercial Lightning Protection



NOTES:

1. THE COMPLETED INSTALLATION SHALL MEET THE "INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS, UL96A" OF UNDERWRITERS LABORATORIES – CURRENT EDITION. A CERTIFICATE OF COMPLETION FROM AN AUTHORITY HAVING JURISDICTION SHALL BE FURNISHED TO THE OWNER UPON COMPLETION.
2. ALUMINUM LIGHTNING PROTECTION SYSTEM COMPONENTS SHALL NOT BE MOUNTED TO COPPER SURFACES. COPPER COMPONENTS SHALL BE USED TO AVOID ELECTROLYTIC CORROSION.
3. METAL BODIES WITHIN 6' – 0" OF THE LIGHTNING PROTECTION SYSTEM SHALL BE BONDED TO THE SYSTEM IN ACCORDANCE WITH UL96A.
4. UNDERGROUND METALLIC PIPING ENTERING THE BUILDING SHALL BE BONDED TO THE NEAREST DOWN CONDUCTOR OR GROUND ELECTRODE.
5. ADHESIVE USED WITH ADHESIVE AIR TERMINAL BASES AND CONDUCTOR FASTENERS SHALL BE COMPATIBLE WITH ROOFING MEMBRANE – VERIFY WITH ROOFING CONTRACTOR.
6. AIR TERMINALS HAVE BEEN LOCATED ON THE ROOF TOP EQUIPMENT AS REQUIRED. IF THE METAL THICKNESS OF AN OBJECT IS 3/16" OR GREATER, AIR TERMINALS MAY BE ELIMINATED IF THE OBJECT IS PROPERLY CONNECTED TO THE SYSTEM.
7. ROOF TOP EQUIPMENT NOT SHOWN ON THIS DRAWING SHALL BE PROTECTED AS REQUIRED TO MEET THE REQUIREMENTS LISTED ABOVE INCLUDING THE INSTALLATION OF AIR TERMINALS AND OR BONDING. IF THE METAL THICKNESS OF AN OBJECT IS 3/16" OR GREATER, AIR TERMINALS MAY BE ELIMINATED IF THE OBJECT IS PROPERLY CONNECTED TO THE SYSTEM.
8. AIR TERMINALS ARE TO BE LOCATED AS SHOWN. THEY ARE TO BE A MAXIMUM OF 24" FROM THE ROOF EDGE AND PROJECT A MINIMUM OF 10" ABOVE THE PROTECTED EDGE. THE SPACING BETWEEN AIR TERMINALS ARE NOT TO EXCEED 20 FEET. AIR TERMINALS THAT EXTEND 24" ABOVE THE PROTECTED EDGE ARE NOT TO EXCEED A SPACING GREATER THAN 25', EXCEPT FOR MID-ROOF AIR TERMINALS (50' MAX SPACING).
9. ALL LIGHTNING CONDUCTORS ARE TO MAINTAIN A HORIZONTAL OR DOWNWARD PATH. ALL BENDS IN THE CONDUCTOR SHALL HAVE A RADIUS BEND OF 8 INCHES OR GREATER, AND SHALL HAVE AN ANGLE BEND OF 90 DEGREES OR GREATER.
10. EACH INDIVIDUAL ITEM OF THE LIGHTNING PROTECTION SYSTEM IS NOT LABELED FOR THE SAKE OF CLARITY. ITEMS ARE INDICATED AT RANDOM LOCATIONS ONLY, BUT A COMPLETE SYSTEM SHALL BE PROVIDED TO MEET MASTER LABEL REQUIREMENTS.
11. ROOF PADS, PAVERS, FLASHINGS OR ANY OTHER SPECIAL ROOFING MATERIALS REQUIRED FOR THE INSTALLATION OF THE LIGHTNING PROTECTION SYSTEM SHALL BE FURNISHED AND INSTALLED BY THE ROOFING CONTRACTOR.

LEGEND

- A — NO. 1218ALAT, 1/2" X 18" GENTLY TAPERED SOLID ALUMINUM AIR TERMINAL WITH NO. AUBU12I, ALUMINUM UNIVERSAL BASE MOUNTED VERTICALLY. -SEE DETAIL "A"
- B — NO. 1212ALAT, 1/2" X 12" GENTLY TAPERED SOLID ALUMINUM AIR TERMINAL WITH NO. AUBU12I, ALUMINUM UNIVERSAL BASE MOUNTED HORIZONTALLY. -SEE DETAIL "B"
- C — NO. 1224ALAT, 1/2" X 24" GENTLY TAPERED SOLID ALUMINUM AIR TERMINAL WITH NO. AUBU12I, ALUMINUM UNIVERSAL BASE MOUNTED HORIZONTALLY SET IN ADHESIVE. -SEE DETAIL "C"
- D — NO. 1218ALAT, 1/2" X 18" GENTLY TAPERED SOLID ALUMINUM AIR TERMINAL WITH NO. AUBU12I, ALUMINUM UNIVERSAL BASE MOUNTED VERTICALLY. -SEE DETAIL "D"
- NO. 29 CLASS I COPPER LIGHTNING CONDUCTOR (29 STRANDS OF 16 AWG WIRE – 215 LBS. PER 1000 FEET). SEE AIR TERMINAL DETAILS FOR METHOD OF FASTENING. SECURE TO BUILDING EVERY THREE FEET MAXIMUM.
- NO. A24 CLASS I ALUMINUM LIGHTNING CONDUCTOR (24 STRANDS OF 14 AWG WIRE – 98 LBS. PER 1000 FEET). SEE AIR TERMINAL DETAILS FOR METHOD OF FASTENING. SECURE TO BUILDING EVERY THREE FEET MAXIMUM.
- T — NO. BMTRC1, BIMETAL THRU ROOF CONNECTOR ASSEMBLY WITH NO. 29, DOWN CONDUCTOR BOND TO STRUCTURAL STEEL BELOW. -SEE DETAIL "T"
- G — TWO NO. 5810, 5/8" X 10'-0" COPPERCLAD GROUND RODS WITH ULTRAWELD CONNECTIONS. SPACE 10 FEET APART AT EACH DOWN CONDUCTOR LOCATION. -SEE DETAIL "G"

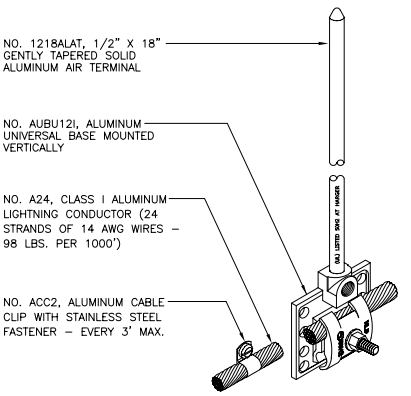
North

LIGHTNING PROTECTION SYSTEM PLAN

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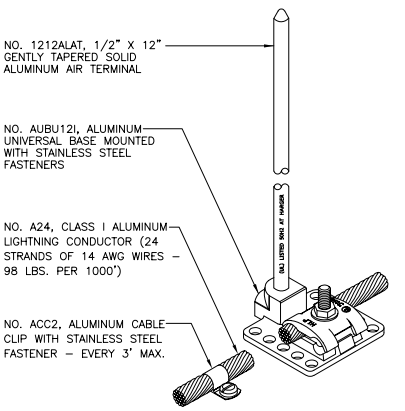
DATE © 2013 | HARGER | Typical Commercial Lightning Protection Drawing | SHEET NO. 1 OF 2

Commercial Lightning Protection



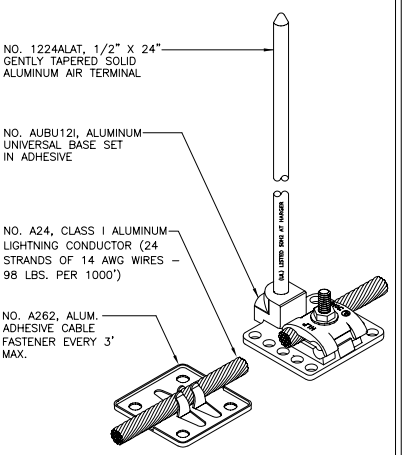
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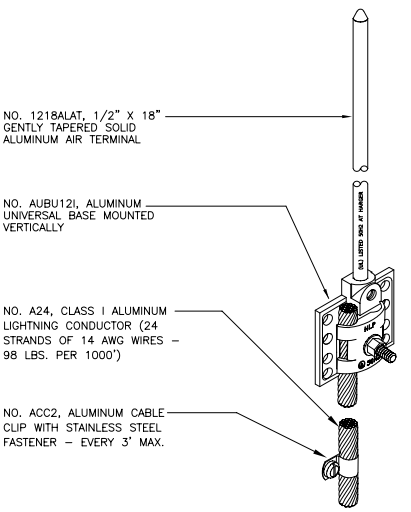
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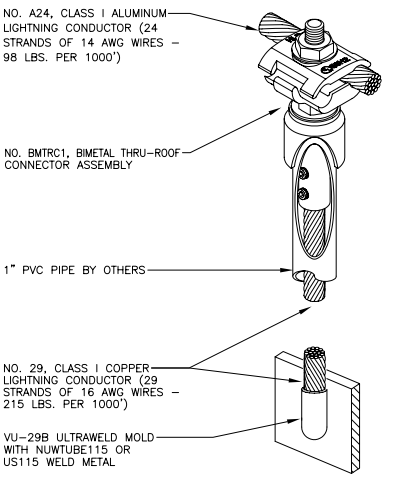
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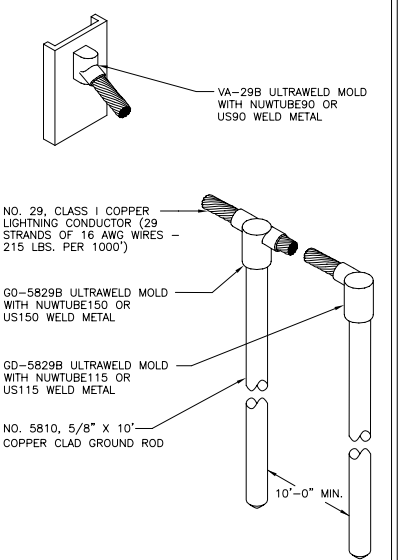
AIR TERMINAL DETAIL "D"

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THRU ROOF DETAIL "T"

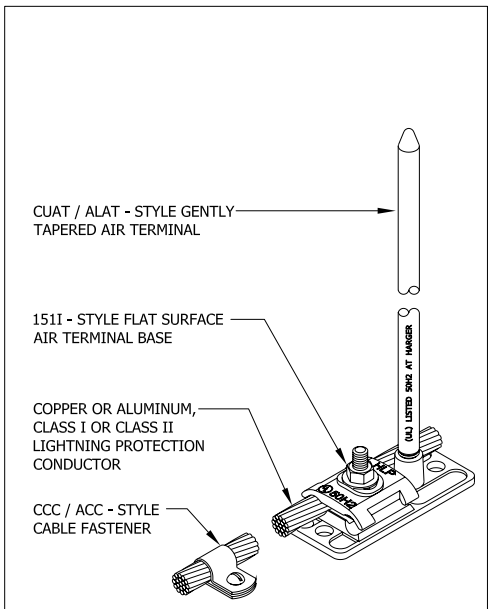
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GROUND ROD DETAIL "G"

NTS

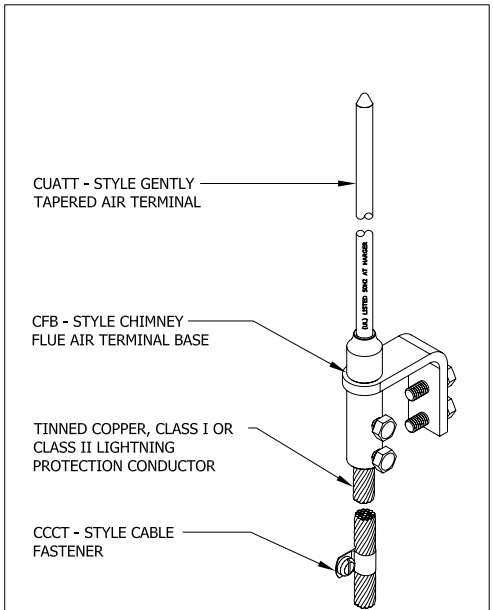
DATE ©2013 | Typical Commercial Lightning Protection Drawing | SHEET NO. 2 OF 2



151I - STYLE AIR TERMINAL BASE

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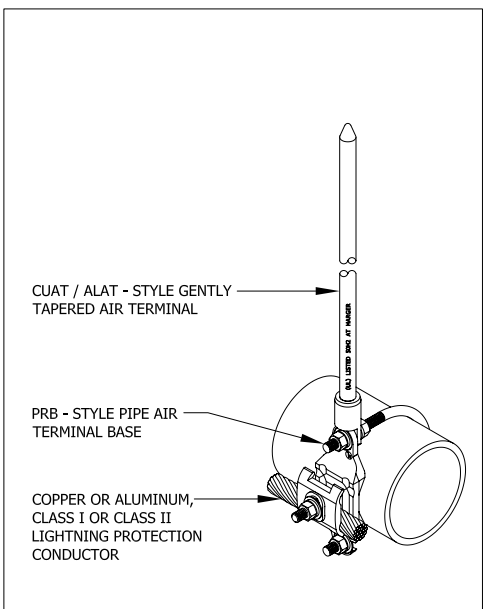
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CFB - STYLE AIR TERMINAL BASE

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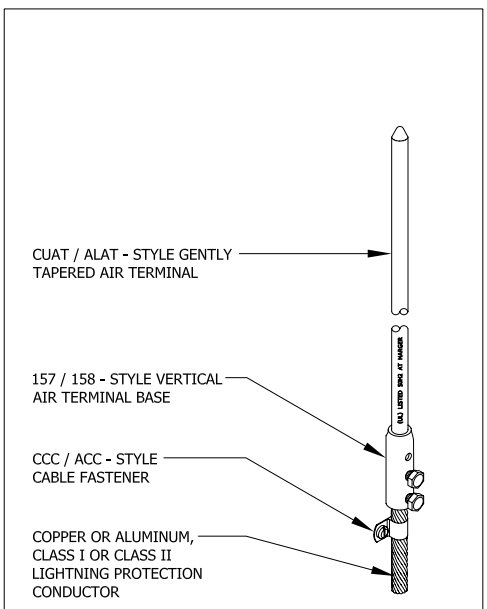
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PRB - STYLE AIR TERMINAL BASE

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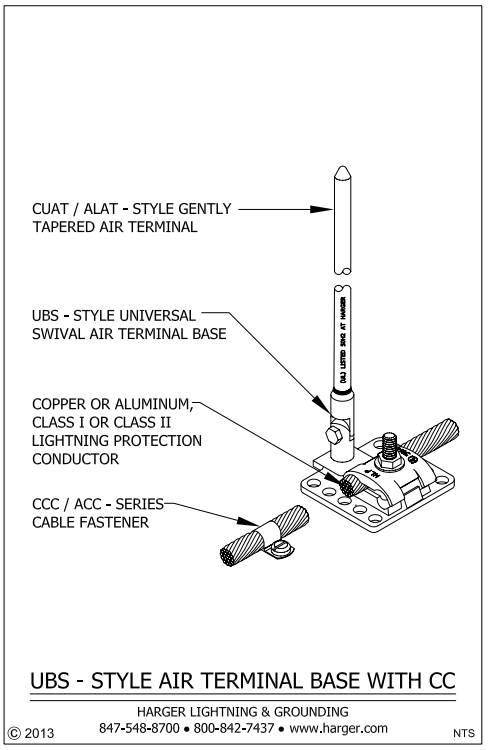
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157 / 158 - STYLE AIR TERMINAL BASE

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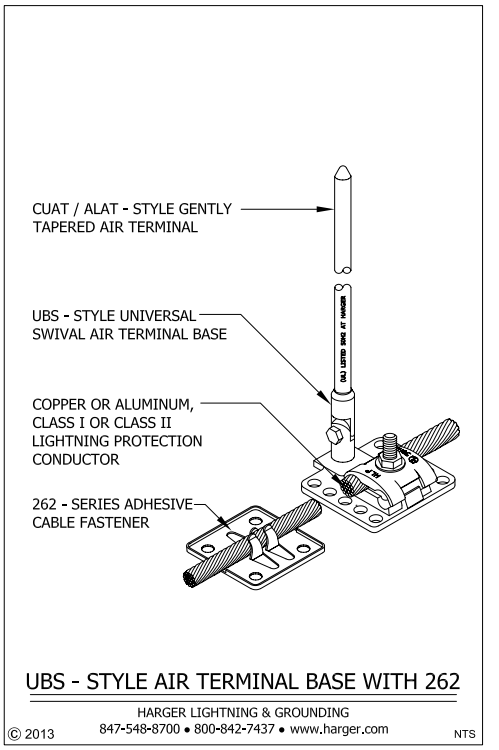
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UBS - STYLE AIR TERMINAL BASE WITH CC

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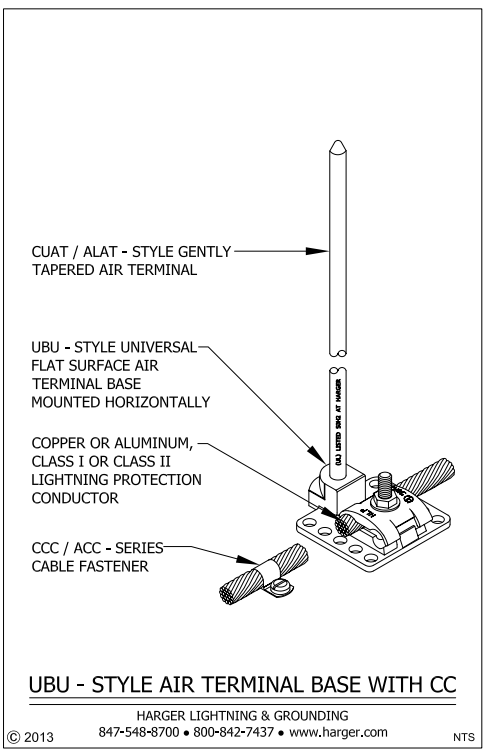
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UBS - STYLE AIR TERMINAL BASE WITH 262

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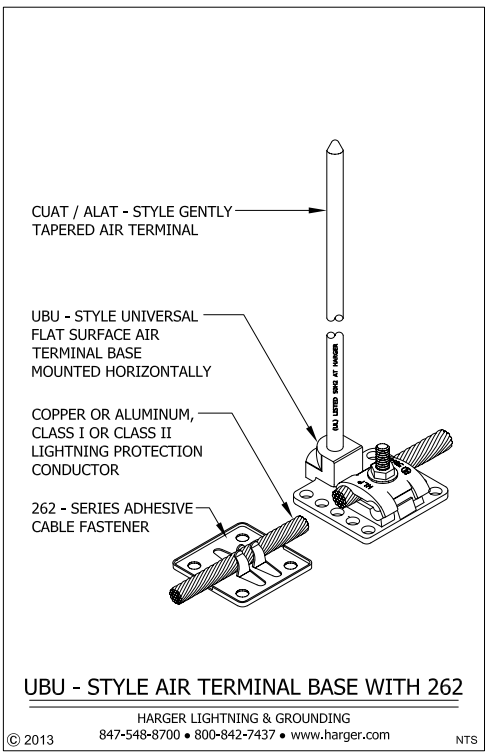
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UBU - STYLE AIR TERMINAL BASE WITH CC

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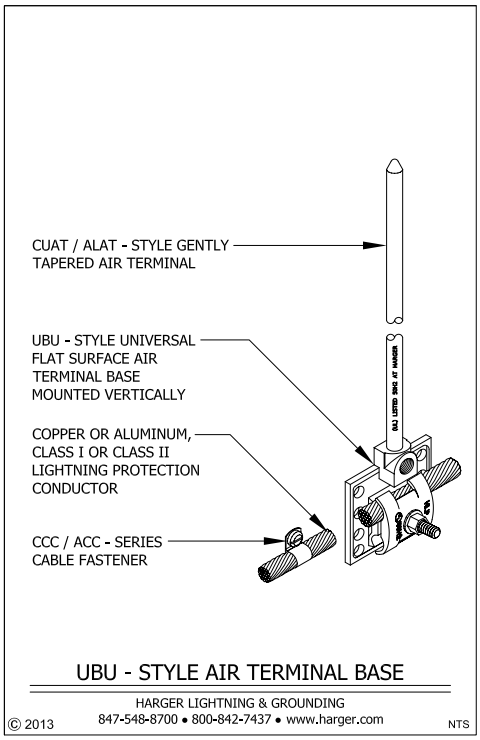
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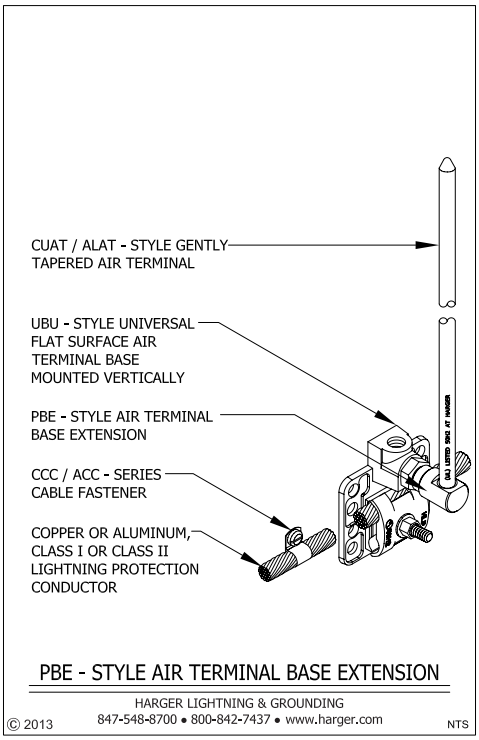


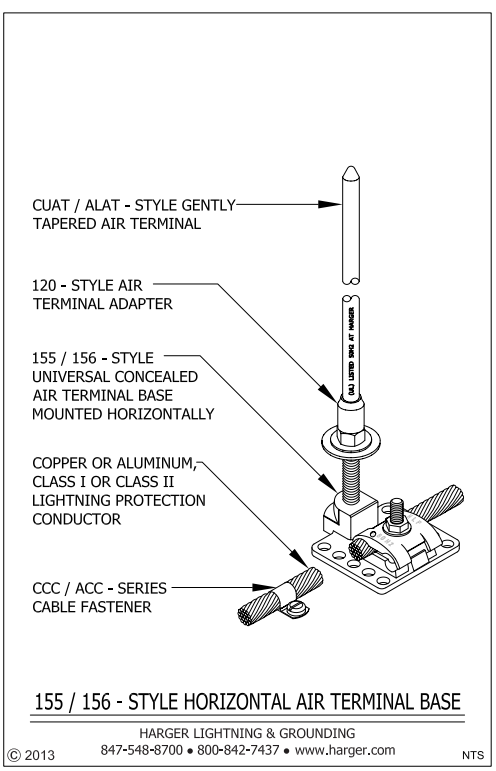
UBU - STYLE AIR TERMINAL BASE WITH 262

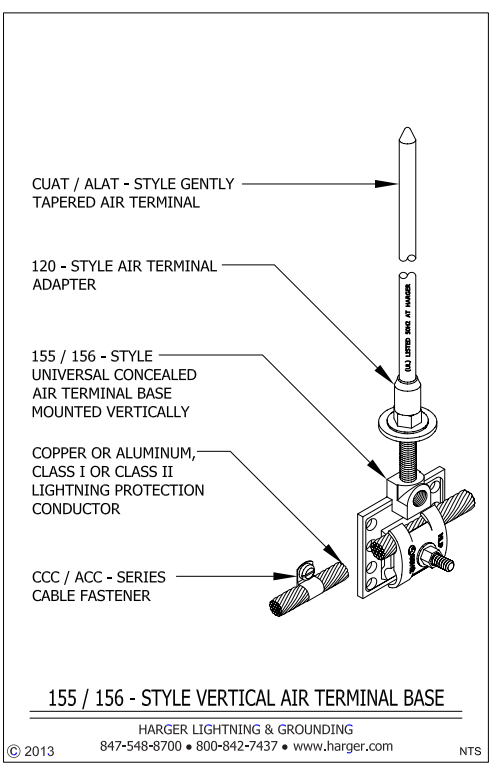
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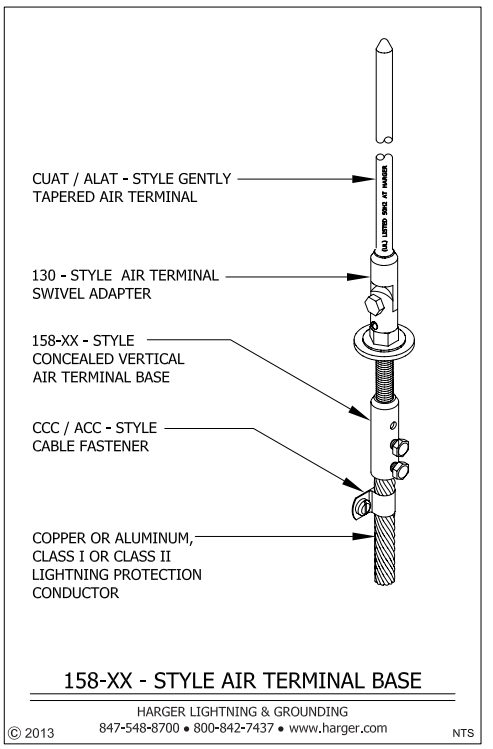
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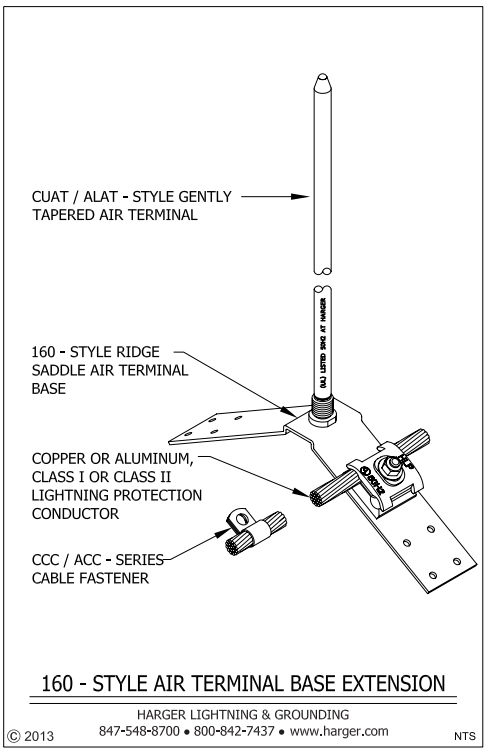

CUAT / ALAT - STYLE GENTLY TAPERED AIR TERMINAL
UBU - STYLE UNIVERSAL FLAT SURFACE AIR TERMINAL BASE MOUNTED VERTICALLY
COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
CCC / ACC - SERIES CABLE FASTENER
UBU - STYLE AIR TERMINAL BASE
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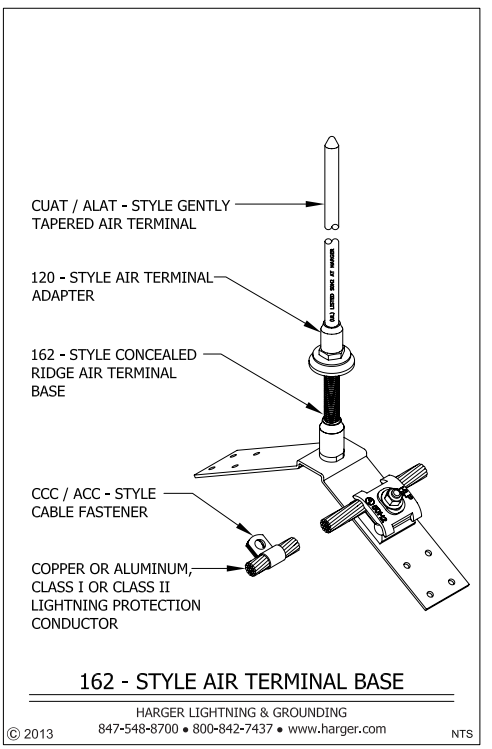

CUAT / ALAT - STYLE GENTLY TAPERED AIR TERMINAL
UBU - STYLE UNIVERSAL FLAT SURFACE AIR TERMINAL BASE MOUNTED VERTICALLY
PBE - STYLE AIR TERMINAL BASE EXTENSION
CCC / ACC - SERIES CABLE FASTENER
COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
PBE - STYLE AIR TERMINAL BASE EXTENSION
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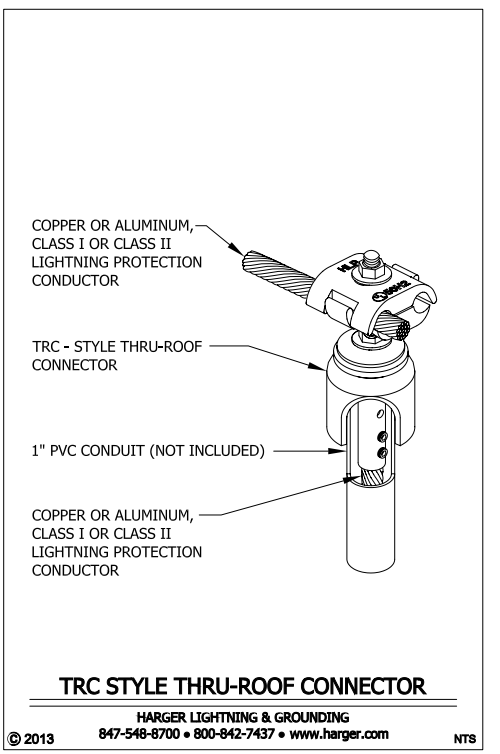

CUAT / ALAT - STYLE GENTLY TAPERED AIR TERMINAL
120 - STYLE AIR TERMINAL ADAPTER
155 / 156 - STYLE UNIVERSAL CONCEALED AIR TERMINAL BASE MOUNTED HORIZONTALLY
COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
CCC / ACC - SERIES CABLE FASTENER
155 / 156 - STYLE HORIZONTAL AIR TERMINAL BASE
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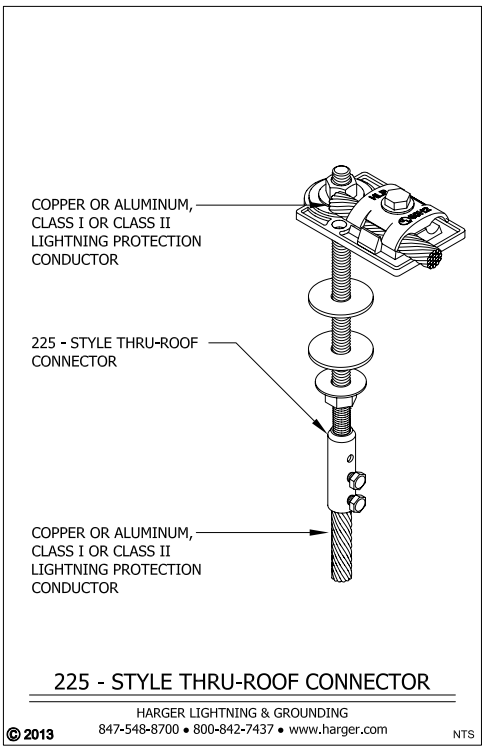

CUAT / ALAT - STYLE GENTLY TAPERED AIR TERMINAL
120 - STYLE AIR TERMINAL ADAPTER
155 / 156 - STYLE UNIVERSAL CONCEALED AIR TERMINAL BASE MOUNTED VERTICALLY
COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
CCC / ACC - SERIES CABLE FASTENER
155 / 156 - STYLE VERTICAL AIR TERMINAL BASE
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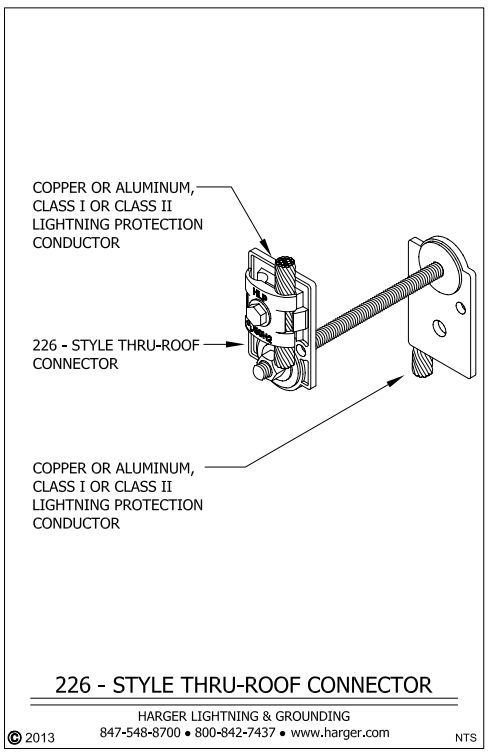

CUAT / ALAT - STYLE GENTLY TAPERED AIR TERMINAL
130 - STYLE AIR TERMINAL SWIVEL ADAPTER
158-XX - STYLE CONCEALED VERTICAL AIR TERMINAL BASE
CCC / ACC - STYLE CABLE FASTENER
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158-XX - STYLE AIR TERMINAL BASE
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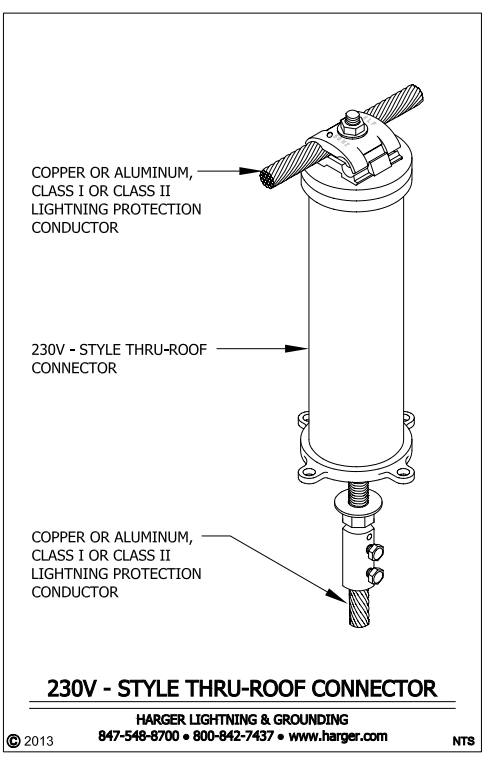

CUAT / ALAT - STYLE GENTLY TAPERED AIR TERMINAL
160 - STYLE RIDGE SADDLE AIR TERMINAL BASE
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CCC / ACC - SERIES CABLE FASTENER
160 - STYLE AIR TERMINAL BASE EXTENSION
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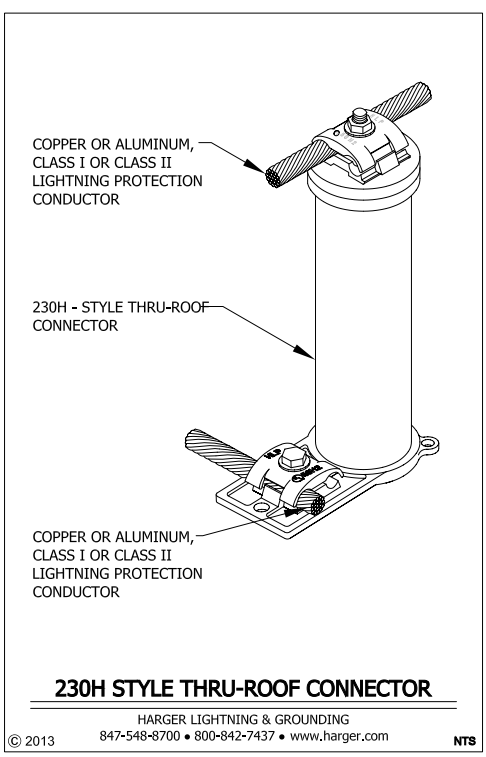

CUAT / ALAT - STYLE GENTLY TAPERED AIR TERMINAL
120 - STYLE AIR TERMINAL ADAPTER
162 - STYLE CONCEALED RIDGE AIR TERMINAL BASE
CCC / ACC - STYLE CABLE FASTENER
COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
162 - STYLE AIR TERMINAL BASE
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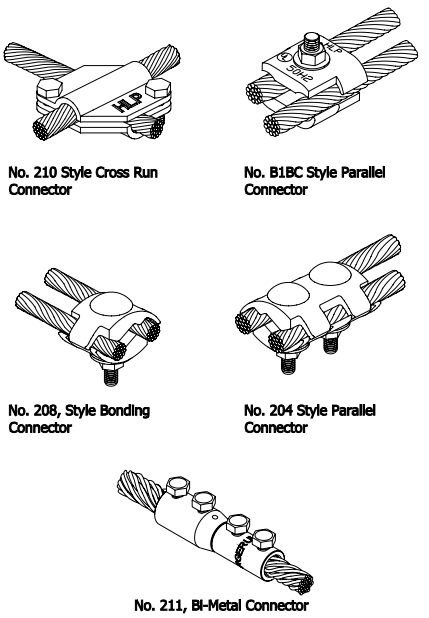

COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
TRC - STYLE THRU-ROOF CONNECTOR
1" PVC CONDUIT (NOT INCLUDED)
COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
TRC STYLE THRU-ROOF CONNECTOR
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COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
225 - STYLE THRU-ROOF CONNECTOR
COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
225 - STYLE THRU-ROOF CONNECTOR
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COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
226 - STYLE THRU-ROOF CONNECTOR
COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
226 - STYLE THRU-ROOF CONNECTOR
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COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
230V - STYLE THRU-ROOF CONNECTOR
COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
230V - STYLE THRU-ROOF CONNECTOR
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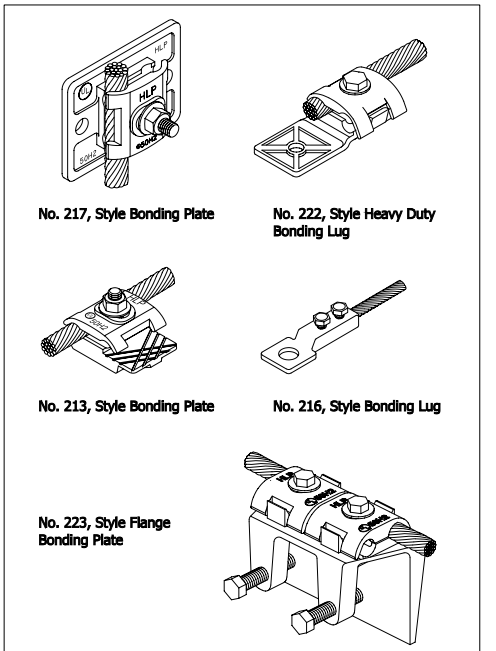

COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
230H - STYLE THRU-ROOF CONNECTOR
COPPER OR ALUMINUM, CLASS I OR CLASS II LIGHTNING PROTECTION CONDUCTOR
230H STYLE THRU-ROOF CONNECTOR
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TYPICAL CABLE CONNECTORS

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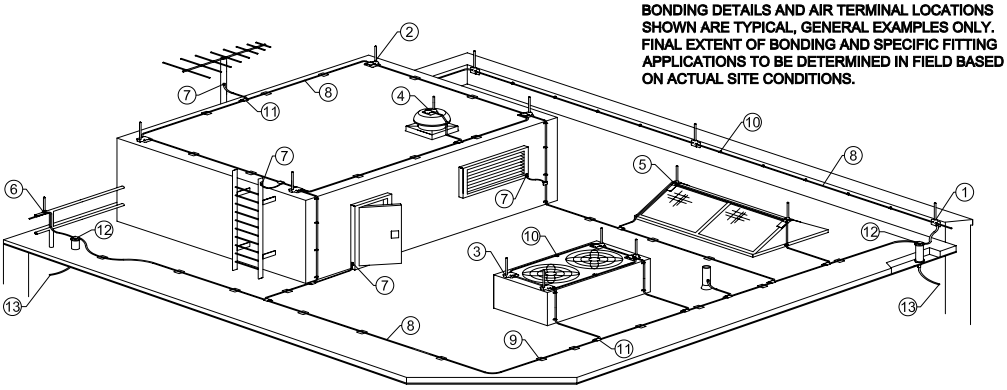
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TYPICAL BONDING LUGS & PLATES

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BONDING DETAILS AND AIR TERMINAL LOCATIONS SHOWN ARE TYPICAL, GENERAL EXAMPLES ONLY. FINAL EXTENT OF BONDING AND SPECIFIC FITTING APPLICATIONS TO BE DETERMINED IN FIELD BASED ON ACTUAL SITE CONDITIONS.

① VERTICALLY MOUNTED AIR TERMINAL ON PARAPET SPACE 20 FEET MAXIMUM. SEE AIR TERMINAL DETAIL.

② HORIZONTALLY MOUNTED AIR TERMINAL ON ROOF SPACE 20 FEET MAXIMUM. SEE AIR TERMINAL DETAIL.

③ AIR TERMINALS MOUNTED ON MECHANICAL EQUIPMENT ENCLOSURE.

④ AIR TERMINAL MOUNTED ON EXHAUST FAN (`DEAD-END' METHOD).

⑤ AIR TERMINAL ON SKYLIGHT WITH SADDLE TYPE AIR TERMINAL BASE.

⑥ AIR TERMINAL MOUNTED ON GUARDRAIL WITH PIPE RAILING BASE.

⑦ BOND WINDOW, DOOR FRAMES, V.T.R.'S, LADDERS, AND ANTENNAS, OR ANY METALLIC OBJECTS WITH BONDING LUGS AND SECONDARY CONDUCTOR.

⑧ MAIN LIGHTNING CONDUCTOR.

⑨ ADEHSIVE CABLE HOLDER EVERY 3 FEET MAXIMUM SPACING.

⑩ CABLE CLIP WITH STAINLESS STEEL SCREWS EVERY 3 FEET MAXIMUM SPACING.

⑪ CABLE CONNECTOR.

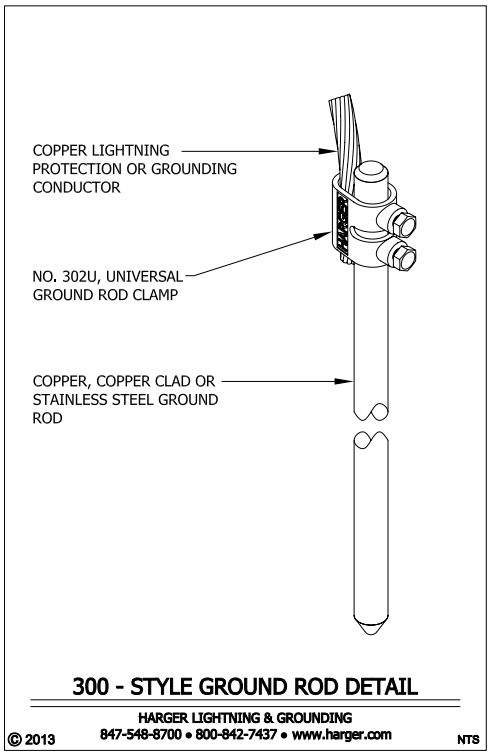
⑫ THRU-ROOF CONNECTOR.

⑬ LIGHTNING DOWN CONDUCTOR.

TYPICAL ROOF LIGHTNING PROTECTION LAYOUT

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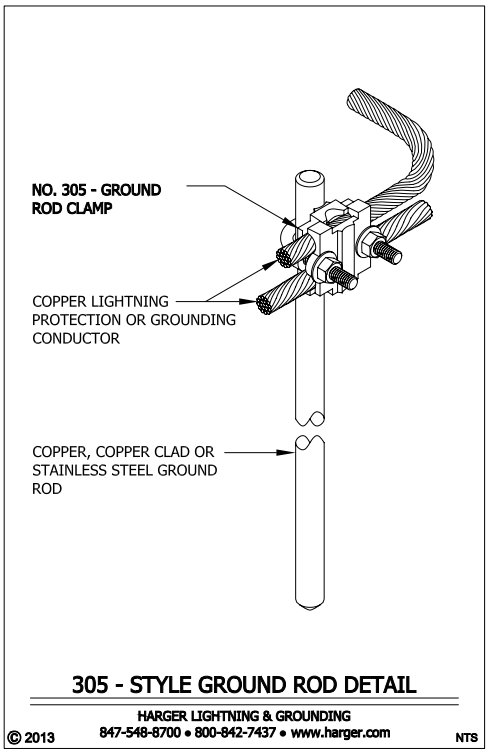
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300 - STYLE GROUND ROD DETAIL

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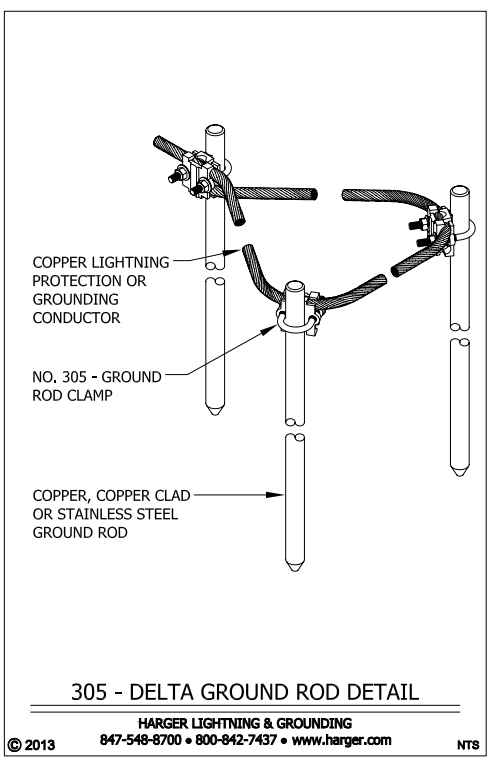
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305 - STYLE GROUND ROD DETAIL

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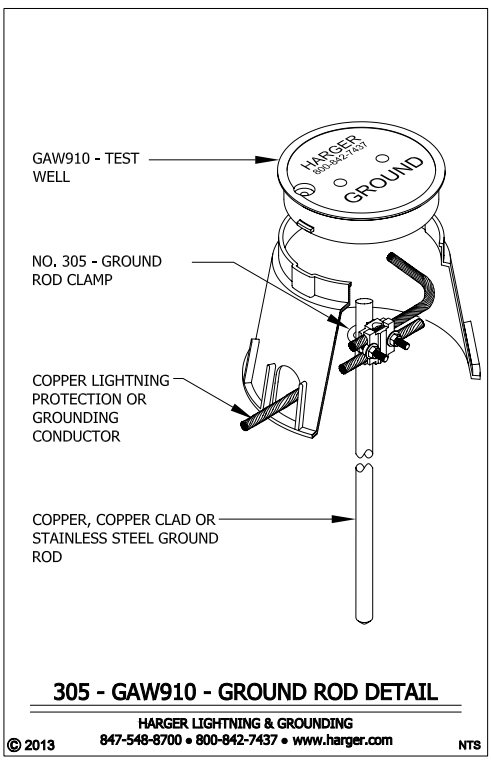
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305 - DELTA GROUND ROD DETAIL

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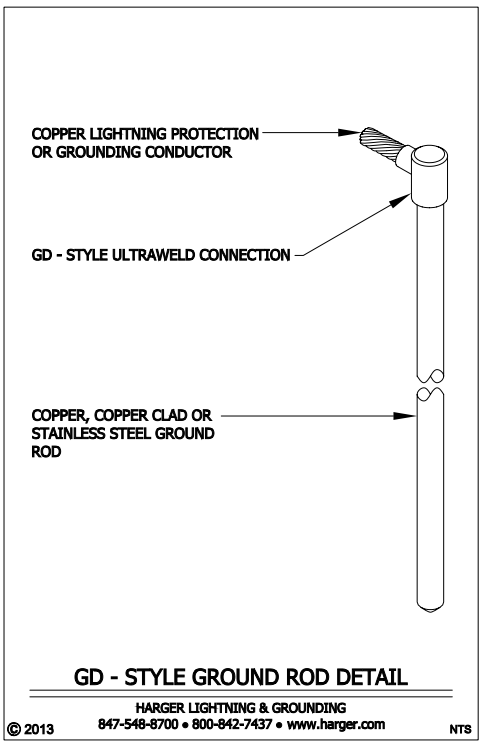
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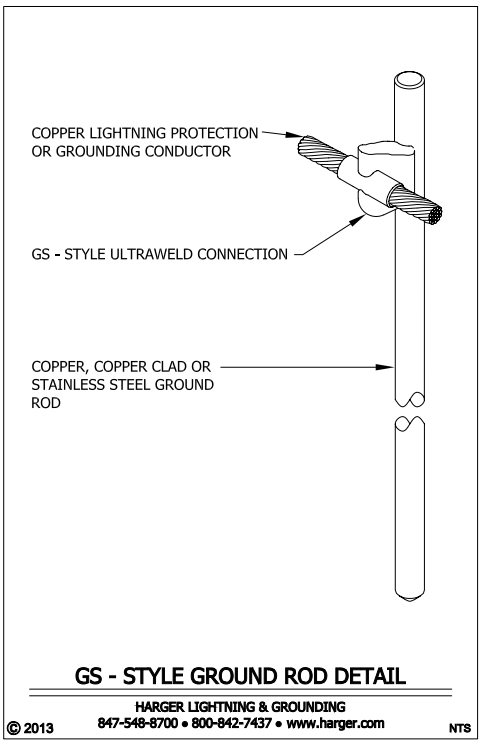


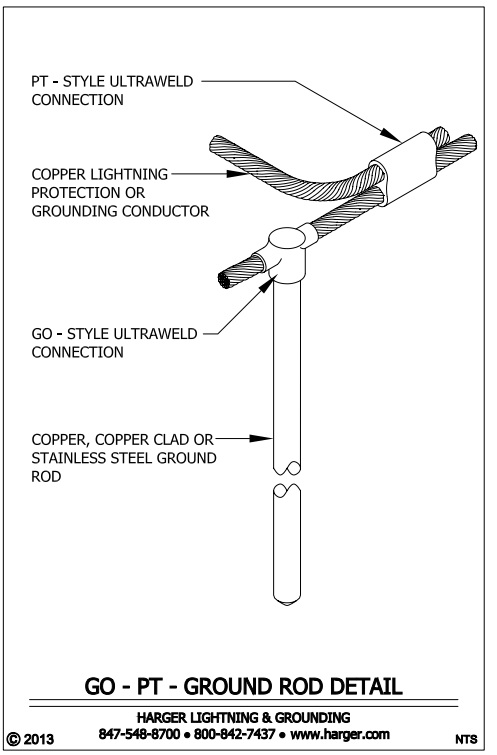
305 - GAW910 - GROUND ROD DETAIL

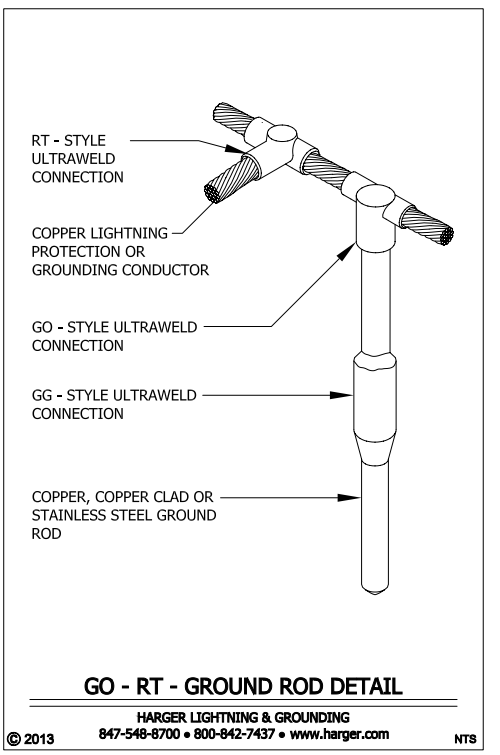
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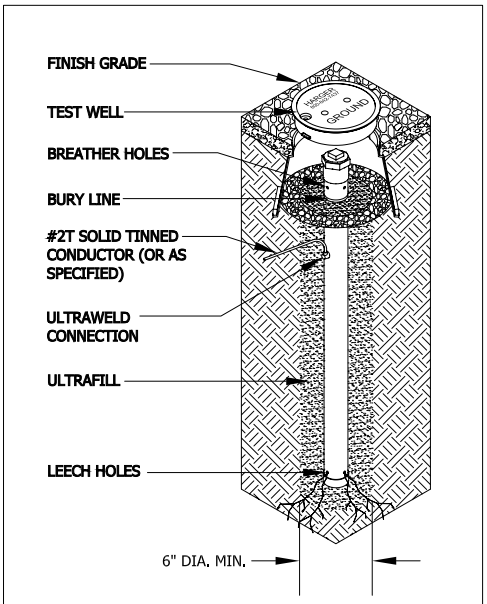
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COPPER LIGHTNING PROTECTION OR GROUNDING CONDUCTOR
GD - STYLE ULTRAWELD CONNECTION
COPPER, COPPER CLAD OR STAINLESS STEEL GROUND ROD
GD - STYLE GROUND ROD DETAIL
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COPPER LIGHTNING PROTECTION OR GROUNDING CONDUCTOR
GS - STYLE ULTRAWELD CONNECTION
COPPER, COPPER CLAD OR STAINLESS STEEL GROUND ROD
GS - STYLE GROUND ROD DETAIL
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PT - STYLE ULTRAWELD CONNECTION
COPPER LIGHTNING PROTECTION OR GROUNDING CONDUCTOR
GO - STYLE ULTRAWELD CONNECTION
COPPER, COPPER CLAD OR STAINLESS STEEL GROUND ROD
GO - PT - GROUND ROD DETAIL
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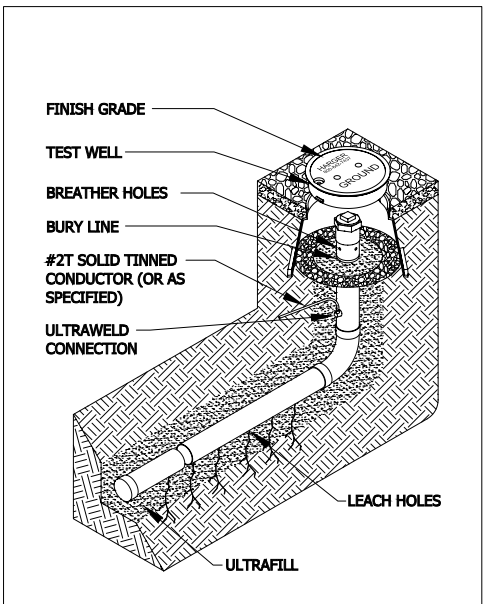

RT - STYLE ULTRAWELD CONNECTION
COPPER LIGHTNING PROTECTION OR GROUNDING CONDUCTOR
GO - STYLE ULTRAWELD CONNECTION
GG - STYLE ULTRAWELD CONNECTION
COPPER, COPPER CLAD OR STAINLESS STEEL GROUND ROD
GO - RT - GROUND ROD DETAIL
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EGR - VERTICAL STAINLESS STEEL ENHANCED GROUND ROD

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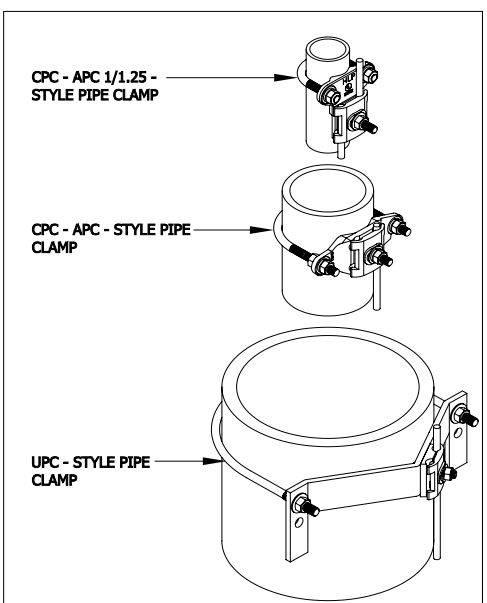
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EGR - HORIZONTAL ENHANCED STAINLESS STEEL GROUND ROD

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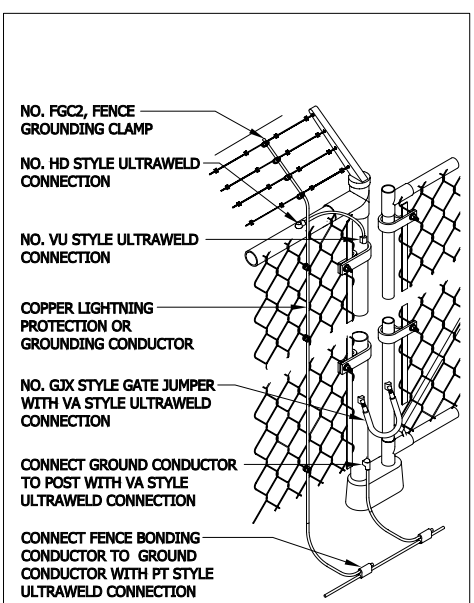
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CPC - APC - UPC - STYLE PIPE CLAMPS

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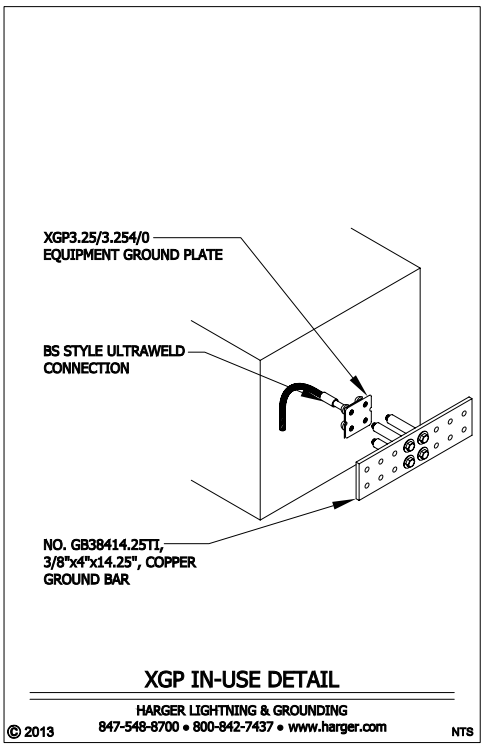
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TYPICAL FENCE & GATE BONDING DETAIL

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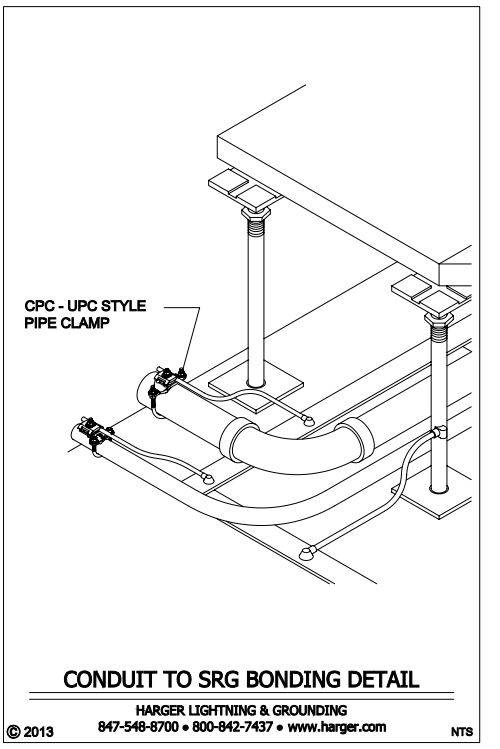
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XGP IN-USE DETAIL

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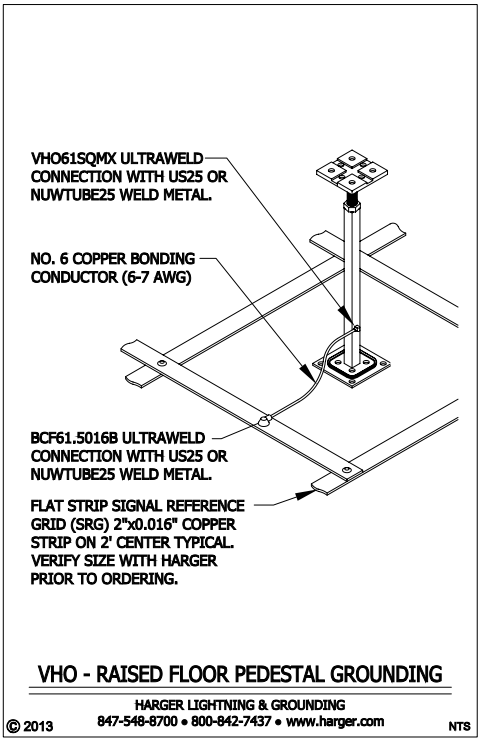
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CONDUIT TO SRG BONDING DETAIL

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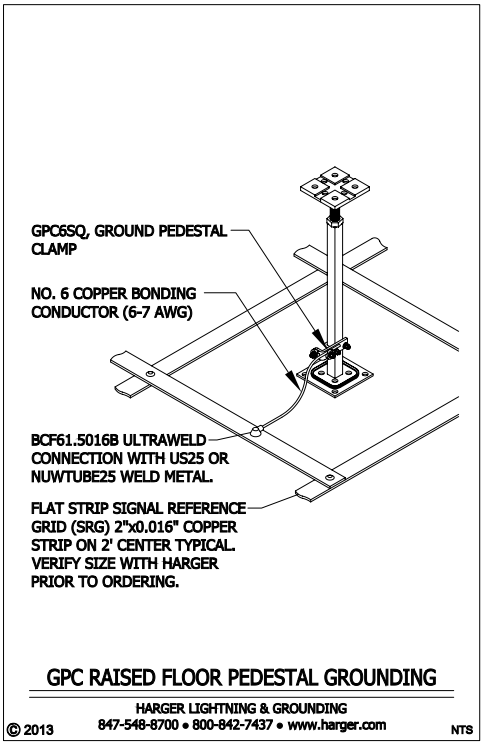
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VHO - RAISED FLOOR PEDESTAL GROUNDING

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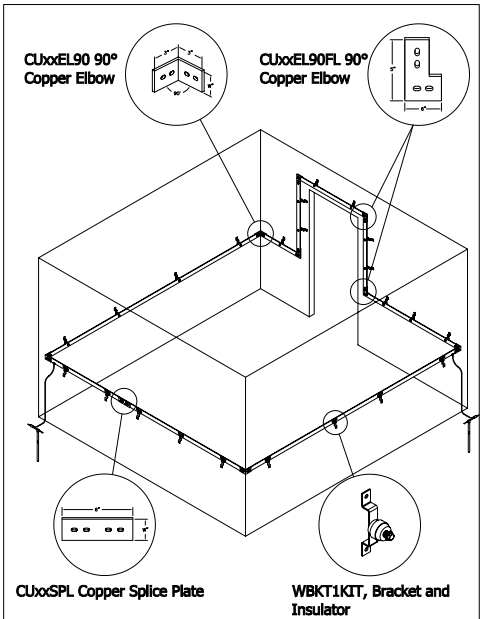
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GPC RAISED FLOOR PEDESTAL GROUNDING

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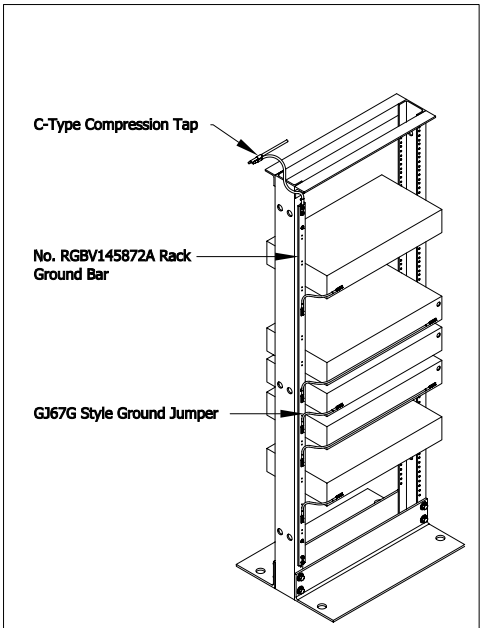
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TYPICAL PERIMETER GROUND BUS LAYOUT

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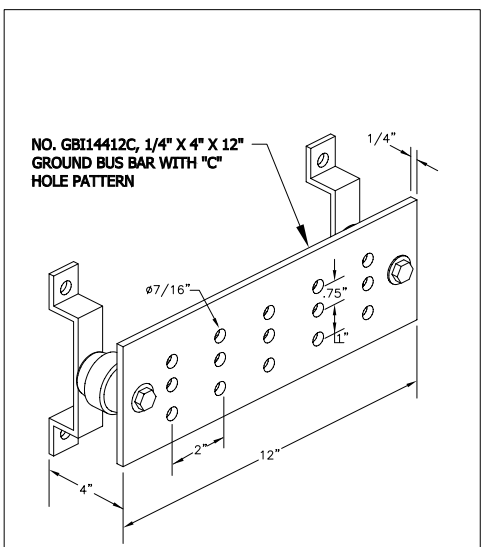
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RACK GROUNDING DETAIL

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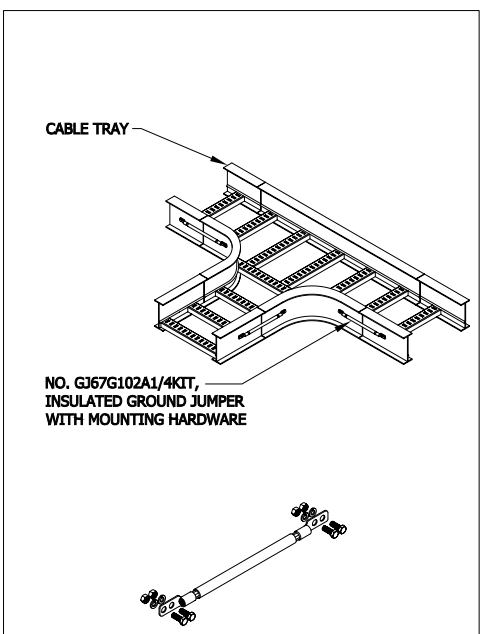
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NO. GBI14412C GROUND BAR DETAIL

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GJ67G102A1/4KIT GROUND JUMPER

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Section 33 79 00 (Formerly 16711) – Wireless Communication Site Lightning Protection and Grounding System Specification

Part 1 – GENERAL

1.01 Summary:

a. Provide a complete lightning protection and grounding system for the tower and the building(s) or structures included on the contract drawings that do not fall within a zone of protection generated by the taller tower. The system shall provide safety for the objects mounted on the tower, the building, the buildings contents and occupants by preventing damage caused by lightning. The design of this system is to be in strict accordance with this section of the specifications and all contract drawings that apply.

b. The lightning protection system on the building(s) shall be installed by a firm actively engaged in the installation of Lightning Protection System. The completed system shall comply with the latest editions of the Installation Requirements for Lightning Protection Systems, UL96A and of the National Fire Protection Association's Lightning Protection Standard, NFPA 780.

c. The work covered under this section of the specification consists of furnishing an adequate number of skilled trained personnel, materials and services required for the completion of a functional and unobtrusive lightning protection system on the shelter and a complete grounding system for the site.

1.02 References:

a. Lightning Protection for the Shelter
   I. NFPA 780, Standard for the Installation of Lightning Protection Systems.
   II. UL 96A, Installation Requirements for Lightning Protection Systems.
   III. Harger Lightning Protection System Specification Section 16670

b. Grounding
   I. NFPA 70, National Electric Code
   II. IEEE Std.1100, IEEE Recommended Practice for Powering and Grounding Electronic Equipment.

1.03 Submittals:

a. Shop drawings shall be submitted to the architect and engineer for approval prior to commencement of the installation. Shop drawings are to show the extent of the system layout designed specifically for the building(s) or structures included in the contract drawings along with details of the products to be used in the installation.

Part 2 – TOWER

2.01 Air Terminals:

a. Air terminal(s), (lightning rod) shall extend a minimum of two feet above the tallest object on the tower (verify all objects on the tower fall within a zone of protection, the zone of protection shall be determined by utilizing the 150 foot radius rolling sphere concept). If required the air terminals may be mounted at an angle on the side of the tower to insure the object falls within the zone of protection.

b. The air terminals shall be constructed of 304 stainless steel or copper clad steel for strength. Two inches of thread shall be provided on the bottom of the air terminal for mounting purposes. The air terminal shall be fastened to the tower with pressure type connections utilizing stainless steel nuts and lock washers.

Section 33 79 00 (Formerly 16711) – Wireless Communication Site Lightning Protection and Grounding System Specification

2.02 Down Conductors:

a. The tower legs shall be utilized as the down conductor for the lightning protection system as they provide an acceptable path of conductance; in addition utilizing the tower legs will eliminate the need to fasten the down conductor the entire height of the tower.

2.03 Grounding

a. Coax Cables:

I. The coax cables shall be grounded to the tower at the top and bottom, and right before entering the equipment shelter, using coaxial grounding kits. Ground bars may be mounted on the tower to provide grounding points for the coaxial grounding kits. If the tower is taller than 150', the cables shall be grounded every 75' or less. The coax cables shall be run down the center of the tower whenever possible.

b. Ground Rods:

I. Ground radials utilizing 5/8" x 10' copper clad steel ground rods and #2 AWG solid tin coated copper ground conductor shall be used as the grounding electrodes. The ground conductor shall be connected to the tower or to a tower leg grounding strap with Ultraweld exothermic connections. In new construction, the rebar in the tower footing shall also be connected to the grounding system with Ultraweld exothermic connections.

II. The ground rods shall be spaced 16' apart along the radial. The #2 AWG ground conductors shall be connected to the ground rod using Ultraweld exothermic connections. The length and number of ground radials required will vary due to ground resistance which is affected by the soil conditions. The length of the radials should not be more than 75'. The ground resistance shall be measured periodically, (during different climatic conditions), and shall always measure 5 Ohms or less.

c. Ground Loop Conductor

I. A ground loop conductor utilizing #2 AWG solid tinned copper conductor shall encompass the base of the tower and shall be connected to the shelter grounding system and shall interconnect all ground electrodes.

d. Guy Wires:

I. Guy wires and guy anchors shall also be grounded. Tinned coated bronze or stainless steel pressure connectors shall connect the guy wires to the #2 AWG solid tinned copper conductors. The ground conductor should be connected to the guy anchor with Ultraweld exothermic connections if permitted by the manufacturer. The conductors shall be connected to two 5/8" x 10' copper clad ground rods spaced 16' apart with Ultraweld exothermic connections.

Part 3 – SHELTER

3.01 A shelter that is not located within a zone of protection generated by the tower shall be protected by a lightning protection system.

Section 33 79 00 (Formerly 16711) – Wireless Communication Site Lightning Protection and Grounding System Specification

3.02 Air Terminals:

a. Air terminals shall project a minimum of ten inches above the object or area it is to protect and shall be located at intervals not exceeding 20'-0" along ridges and along the perimeter of flat or gently sloping roofs (flat or gently sloping roofs include roofs that have a pitch less than 3:12). Air terminals shall be located within two feet of roof edges and outside corners of protected areas.

b. Air terminals shall be installed on mechanical units and other metallic objects not located within a zone of protection and which have an exposed metal thickness less than 3/16 of an inch. Objects having an exposed metal thickness 3/16 of an inch or greater shall be connected to the lightning protection system as required by the specified standards using main size conductor and bonding plates having a minimum of 3 square inches of surface contact area.

c. Air terminal bases shall be securely fastened to the structure in accordance the specified standards including the use of adhesive that is compatible with the surface it is to be used on or stainless steel fasteners.

d. Main conductors shall be sized in accordance with the specified standards for Class I or Class II structures and shall provide a two way horizontal or downward path from each air terminal to connections with the ground system. Conductors shall be free of excessive splices and no bend of a conductor shall form a final included angle of less than neither 90 degrees nor have a radius of bend less than 8 inches.

e. Down conductors shall be sized in accordance with the specified standards and in no case shall be smaller than the main roof conductor. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. In no case shall a structure have fewer than two down conductors. Where down conductors are installed exposed on the exterior of a structure and are subject to physical damage or displacement, guards shall be used to protect the conductor a minimum of 6 feet above grade. Metallic guards shall be bonded at each end.

3.03 Roof Penetrations

a. Roof penetrations required for down conductors or for connection to structural steel framework shall be made using thru-roof assemblies with solid riser bars and appropriate roof flashing. Conductors shall not pass directly through the roof. The roofing contractor shall furnish and install the materials required to properly seal all roof penetrations of the lightning protection components and any additional roofing materials or preparations required by the roofing manufacturer for lightning conductor runs to assure compatibility with the warranty for the roof including roof pads that may be required to protect the roof under each of the lightning protection components.

3.04 Grounding

a. Ground loop conductor

I. A ground loop conductor utilizing #2 AWG solid tinned copper conductor shall encompass the shelter and be connected to the tower grounding system and shall interconnect all ground electrodes.

Section 33 79 00 (Formerly 16711) – Wireless Communication Site Lightning Protection and Grounding System Specification

b. Ground electrodes

I. Ground electrodes shall be copper clad steel and a minimum 5/8" diameter and 10 feet long. A ground electrode shall be provided for each down conductor and shall be spaced on average 16' apart. The down conductor shall be connected to the ground electrode by an Ultraweld exothermically welded connection. Ground electrodes shall be located a minimum of 2 feet below grade and shall be installed below the frost line where possible (excluding shallow topsoil conditions).

c. Bonding

I. The structural steel and or rebar of the shelter shall be connected to the ground loop at each corner with Ultraweld exothermic connections.

d. Ground mesh

I. Equipotential ground mesh shall be provided and connected to the tower grounding system and the shelter ground loop with Ultraweld exothermic connections. The ground mesh can be strategically placed to help protect personnel against step and touch voltages and improve the grounding system. 5/8" x 10' copper clad ground rods shall be connected to each corner of the ground mesh with Ultraweld exothermic connections.

e. Ground Bars

I. A ¼" thick copper exterior ground bar shall be provided and installed on the exterior of the shelter near the point where the coax lines enter the shelter. The ground bar shall be connected to the grounding system with an Ultraweld exothermic connection and shall serve as the single point ground bus.

II. A ¼" thick copper interior ground bar shall be provided and installed on the inside of the shelter on the opposite side of the wall that the exterior ground bar is mounted. The interior ground bar shall be connected to the exterior bar using a min. 2" wide copper strap, #2 AWG solid tinned copper ground conductor or with a solid copper or brass horizontal riser bar. When using a copper flat strap or conductor the connections to the interior and exterior bars should be with an Ultraweld exothermic connection when possible. All interior equipment and grounded metal bodies shall be connected to the interior ground bar.

3.05 Equipotential Grounding

a. Common interconnection of all grounded systems within the building shall be ensured by interconnecting to the lightning protection system using main size conductor and fittings.

b. This interconnection shall include but is not limited to the electrical service, telephone and antenna system grounds as well as all underground metallic piping systems including water, gas and sewer. Interconnection to a gas or water line shall be made on the customer's side of the meter. Fences, generators and rebar in new construction shall also be bonded to the grounding system. Steps shall be taken to ensure a continuous bond for all grounded metal bodies. All underground and wherever possible above ground connections shall be with Ultraweld exothermic connections.

Part 4 – Difficult Grounding Conditions

4.01 If the site soil resistivity is 15,000Ωcm or greater, standard approaches to achieving the required system ground resistance may be ineffective. In this situation, the ground electrode system may require the use of enhanced ground rod electrodes and or the utilization of Ultrafill ground enhancement backfill materials. Contact Harger Lightning & Grounding for solutions when difficult grounding conditions are encountered.

Section 33 79 00 (Formerly 16711) – Wireless Communication Site Lightning Protection and Grounding System Specification

Part 5 – Equipment Protection

5.01 RF Surge Protection

a. All coax cables shall be grounded to the single point exterior ground bar before entering the building. In-line suppressors shall be installed immediately after the coax enters the building. These suppressors shall be grounded to the interior ground bar.

5.02 A/C Surge Suppression

a. Surge suppression shall be provided at all service entrances.

b. Surge protection shall be installed at the service entrance panel. The unit shall have one time withstand surge capacity of 100 KA or more. (One time withstand if an 8 x 20 micro second pulse stated in thousands of amperes). The surge protection unit shall be a UL 1449 listed device.

c. Series type plug-in suppressors shall be installed at the plug-in receptacles where sensitive communications equipment is connected.

5.03 Telephone / Data Surge Suppression

a. Surge suppression shall be provided at all service entrances and at entrances of conductive signal, data and communication services.

b. In-line twisted pair protectors shall be installed for all telephone, data, fax, modem lines, etc. They shall also be bonded to the interior ground bar.

Part 6 – Acceptable Sources / Manufacturers

6.01 Acceptable Manufacturers

a. Harger Lightning & Grounding

301 Ziegler Drive, Grayslake, IL 60030

(847) 548-8700 • 800-842-7437 • Fax (847) 548-8755

E-mail: hargersales@harger.com • Web-site: www.harger.com

Section 33 79 00 (Formerly 16711) – Wireless Communication Site Lightning Protection and Grounding System Specification

Part 7 – List of Approved Materials

7.01 Air Terminals - #585CCAT, #586SS3AT, #586SS3AT, #585CCAT-2/0, #1224CUAT, #1212CUAT (Harger Lightning & Grounding) or other approved Harger air terminals

7.02 Air Terminals Bases - #CUBU12I, #CPRB1.5/2AT12, #158 (Harger Lightning & Grounding) or other approved Harger air terminal bases

7.03 Coax Ground Kits – CGKB Series (Harger Lightning & Grounding)

7.04 Pressure Connectors - #204T, #SSC25/875 (Harger Lightning & Grounding) or other approved Harger connectors

7.05 Ground Bars - #EPK Series, #GBIA14424M (Harger Lightning & Grounding) or other approved Harger ground bars

7.06 Ground Mesh - #GM121266, #GM121266SPR12 (Harger Lightning & Grounding)

7.07 Ground Rods - #5810 (Harger Lightning & Grounding)

7.08 Ground Conductor - #2T (Harger Lightning & Grounding)

7.09 Enhanced Ground Rods - #EGR Series (Harger Lightning & Grounding)

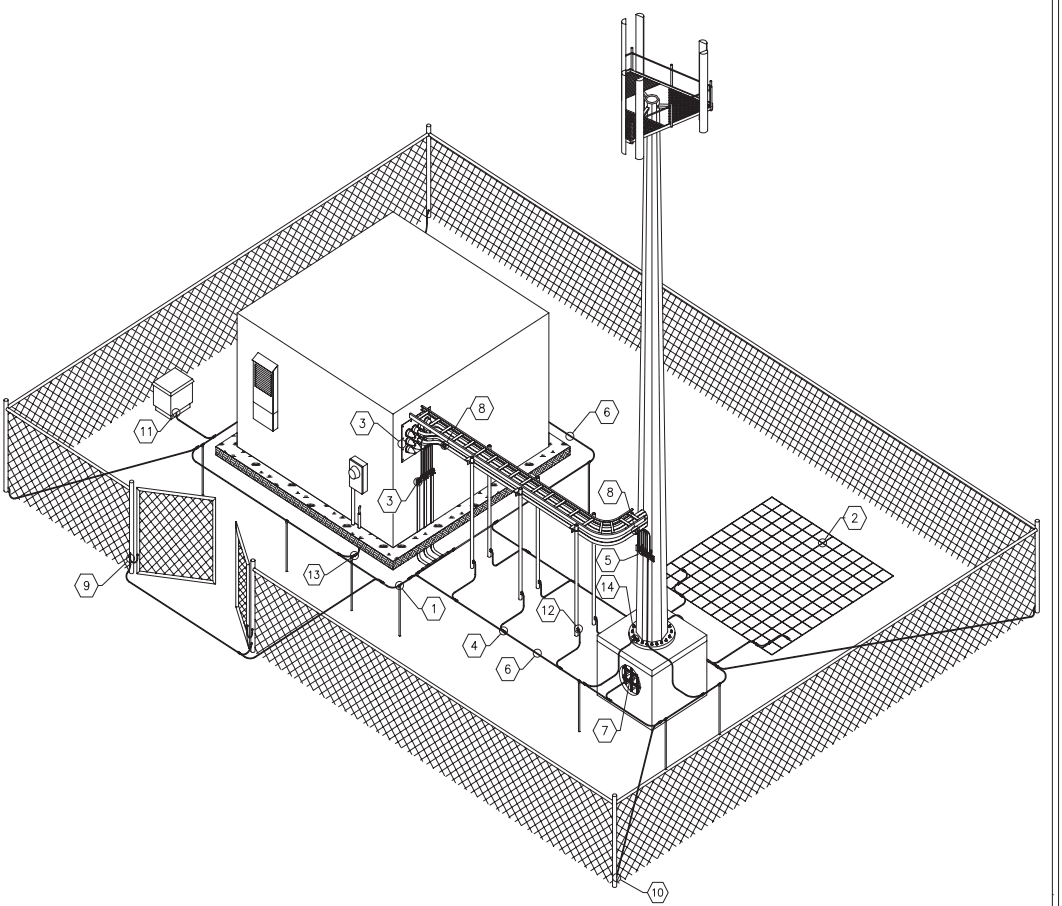
7.010 Ground Enhancement Material - #ULTRAFILL (Harger Lightning & Grounding)

7.011 Lightning Conductor - #28T (Harger Lightning & Grounding)

7.012 Exothermic Connections – Ultraweld (Harger Lightning & Grounding)

END OF SECTION 33 79 00

Exterior Grounding Layout



KEYED NOTES

1. NO. 5810, 5/8" x 10'–0" COPPERCLAD GROUND ROD SPACED AT 16' MINIMUM WITH ULTRAWELD CONNECTION TYPE "GO582SB" (MOLD NUMBER) AND NUWTUBE90 (WELD METAL SIZE–ONE PER LOCATION) SEE DETAIL "G".
2. NO. GM121266, 12'–0" x 12'–0" GROUND MAT WITH NO. 6 AWG. SOLID BARE COPPER CONDUCTOR AT 6" O.C. EACH WAY, 24" BELOW GRADE OR FROST LINE, WHICH EVER IS LOWER. NO. 2T, #2 AWG SOLID TINNED COPPER GROUND CONDUCTOR SHALL BE ATTACHED TO THE MAT USING ULTRAWELD CONNECTION PT6S2SB (MOLD NUMBER) AND US45 OR NUWTUBEW45 (WELD METAL SIZE) AT THREE PLACES PER NO. 2T GROUND CONDUCTOR.
3. NO. EPK12, 12 UNIT ENTRANCE PANEL KIT WITH INTEGRATED 1/4"x5"x24" SOLID COPPER INTERIOR GROUND BAR WITH INSULATORS AND 1/4"x3"x14.5" EXTERIOR GROUND BAR.(INSTALL NEAR THE POINT WHERE THE COAX LINES ENTER THE SHELTER) SEE DETAIL "EPK".
4. CABLE TO CABLE CONNECTION WITH NO. PT2S2SB (MOLD NUMBER) ULTRAWELD CONNECTION WITH NO. US65 OR NUWTUBE65 (WELD METAL SIZE – ONE PER LOCATION).
5. NO. GBIA14424M, 1/4"x4"x24" SOLID COPPER TOWER GROUND BAR WITH INSULATOR AND BEAM CLAMP STANDOFFS. COAX CABLES SHALL BE GROUNDED TO TOWER AT THE TOP AND BOTTOM OF THE TOWER AND EVERY 75' OR LESS IF THE TOWER IS TALLER THAN 150". SEE DETAIL "GB".
6. NO. 2T, #2 AWG SOLID TIN COATED COPPER CONDUCTOR (201 LBS. PER 1000) LOCATED AT 2'–6" MIN. BELOW GRADE OR 6" BELOW THE FROST LINE, WHICH EVER IS LOWER.
7. "RE" OR "RP" STYLE ULTRAWELD CONNECTION BONDING REBAR IN TOWER FOOTING. *VERIFY SIZE OF REBAR PRIOR TO ORDERING.
8. BOND COAX CABLE USING NO. CGKB SERIES GROUND KIT TO EXTERIOR GROUND BARS. PART NUMBER IS SPECIFIC TO COAX SIZE. SEE COAX CABLE GROUNDING DETAIL "CGK".
9. NO. GJX2S24, FLEXIBLE BONDING JUMPER WITH ULTRAWELD CONNECTION TYPE VA2SV1.5x4B (WELD MOLD) AND US45 OR NUWTUBE45 (WELD METAL SIZE) – ONE PER GATE. SEE DETAIL "FG"
10. ULTRAWELD CONNECTION TO 3" – 4" DIA. FENCE POST TYPE VA2SV1.5x4B (MOLD NUMBER) AND US45 OR NUWTUBE45 (WELD METAL SIZE)– ONE PER LOCATION. SEE DETAIL "FG"
11. ALL CONDUCTIVE BODIES SHALL BE BONDED TO THE GROUNDING SYSTEM.
12. BOND WAVE GUIDE SUPPORTS TO EXTERIOR GROUND LOOP.
13. PROVIDE CONNECTION TO EXTERIOR POWER AND TELEPHONE GROUNDING SYSTEMS AND WATER SERVICE.
14. GROUND TOWER (2 LOCATIONS) WITH NO. HD2SA (MOLD NUMBER) ULTRAWELD CONNECTION WITH NO. US45 OR NUWTUBE45 (WELD METAL SIZE)– ONE PER LOCATION.

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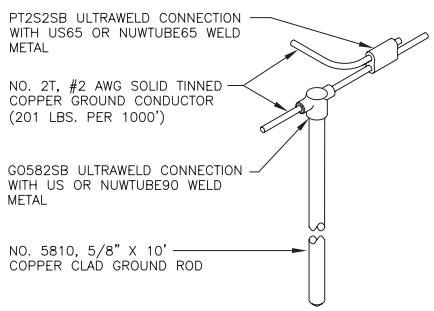
TYPICAL WIRELESS COMMUNICATION SITE
EXTERIOR GROUNDING PLAN

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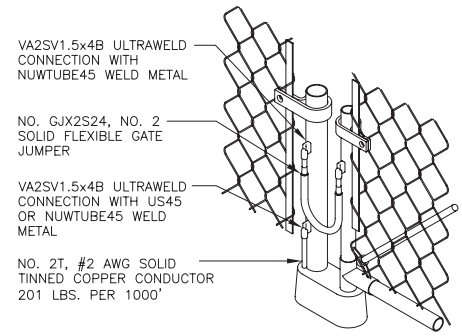
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Exterior Grounding Layout



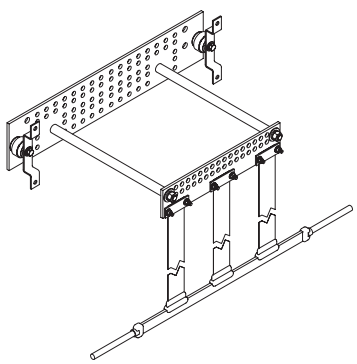
GROUND ROD DETAIL "G"

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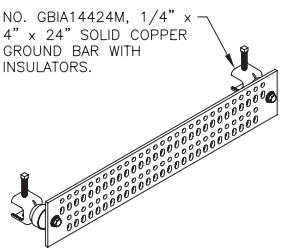
FENCE GROUNDING DETAIL "FG"

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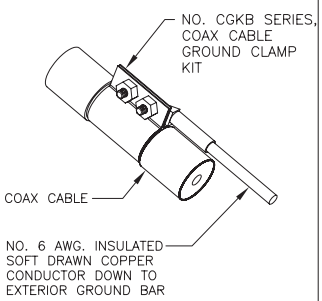
ENTRANCE PANEL DETAIL "EPK"

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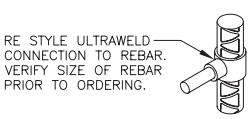
GROUND BAR DETAIL "GB"

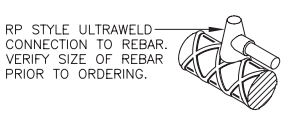
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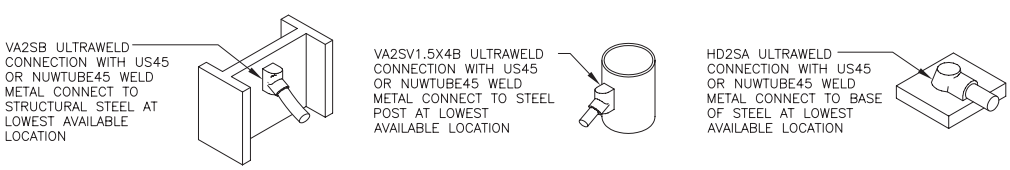


COAX GROUNDING DETAIL "CGK"

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ULTRAWELD DETAILS

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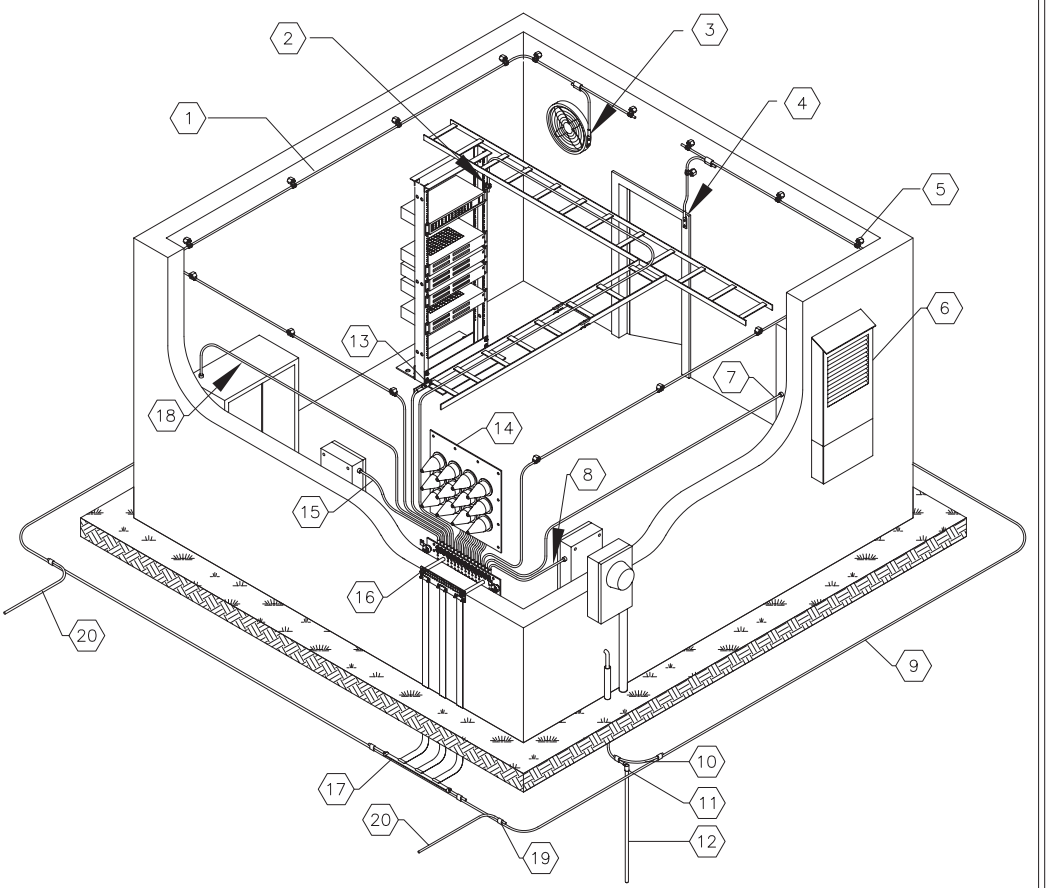
TYPICAL WIRELESS COMMUNICATION SITE EXTERIOR GROUNDING DETAILS

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Interior Shelter Layout



KEYED NOTES

1. NO.27G, #2AWG STRANDED, GREEN INSULATED CONDUCTOR. INTERNAL PERIMETER GROUND BUS. CONNECTED TO MGB AT ONE END. TYPICAL
2. EQUIPMENT RACK CHASSIS AND EQUIPMENT GROUND CONDUCTORS TO MGB
3. BOND EXHAUST FAN AND AIR VENTS TO INTERNAL PERIMETER GROUND BUS CONDUCTOR WITH NO. 6-7G CONDUCTOR, NO. CT2248LD TAP AND NO. GECLB62A LUG
4. BOND DOOR FRAME TO INTERNAL PERIMETER GROUND BUS CONDUCTOR WITH NO. 6-7G CONDUCTOR, NO. CT2248LD TAP AND NO. GECLB62A LUG
5. NO. HSC STYLE HALO STANDOFF CLAMP
6. HVAC UNIT
7. HVAC EQUIPMENT GROUNDING CONDUCTOR TO MGB
8. BOND AC ELECTRIC SERVICE TO MGB PER NFPA 70
9. SHELTER COUNTERPOISE GROUND LOOP. NO. 2T, SOFT-DRAWN TINNED SOLID COOPER CONDUCTOR RUN 30" MIN. OR BELOW FROST LINE.
10. BOND BETWEEN UTILITY GROUND AND SHELTER COUNTERPOISE WITH NO. 2T, SOFT-DRAWN TINNED SOLID COOPER CONDUCTOR
11. ULTRAWELD NO. GD582SB CONNECTION WITH NO. US65 OR NUWTUBE65 WELD METAL
12. NO. 5810, 5/8"X10' COPPER CLAD GROUND ROD. UTILITY SERVICE GROUND
13. BOND CABLE TRAY TO MGB
14. COAX ENTRY PORT
15. TELCO GROUND TO MGB
16. NO. EPK12, ENTRANCE PANEL KIT WITH THROUGH WALL MOUNTING OF EXTERIOR GROUND BAR AND INTERNAL (MGB) GROUND BAR.
17. THE EPK12 ENTRANCE PANEL KIT PROVIDES A GROUND STRAP (1/32" X 3") ASSEMBLY THAT IS EASILY EXOTHERMICALLY WELDED TO THE SHELTER COUNTERPOISE.
18. UPS EQUIPMENT GROUND CONDUCTOR TO MGB
19. ULTRAWELD NO. PT2S2SB CONNECTION WITH NO. US65 OR NUWTUBE65 WELD METAL OR NO. RT2S2SB WITH NO. US45 OR NUWTUBE45 WELDMETAL. TYPICAL
20. TO TOWER GROUND ELECTRODE SYSTEM

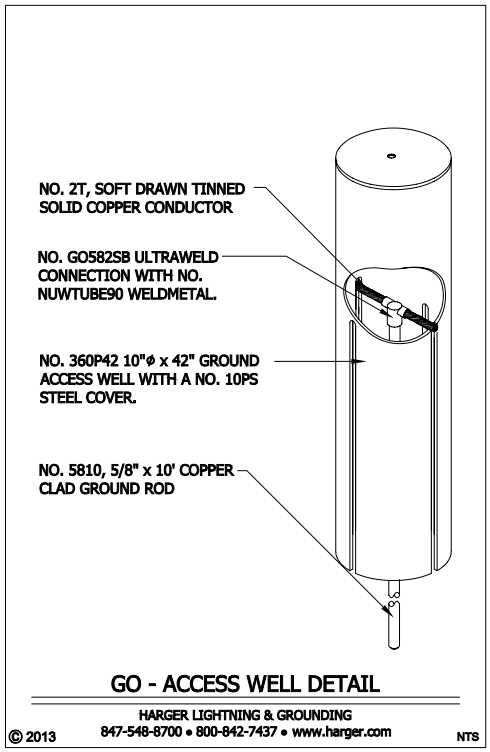
HARGER® LIGHTNING PROTECTION•GROUNDING•EXOTHERMIC
301 ZIEGLER DRIVE GRAYSLAKE, IL
60030 (847) 548-8700

INTERIOR SHELTER LAYOUT

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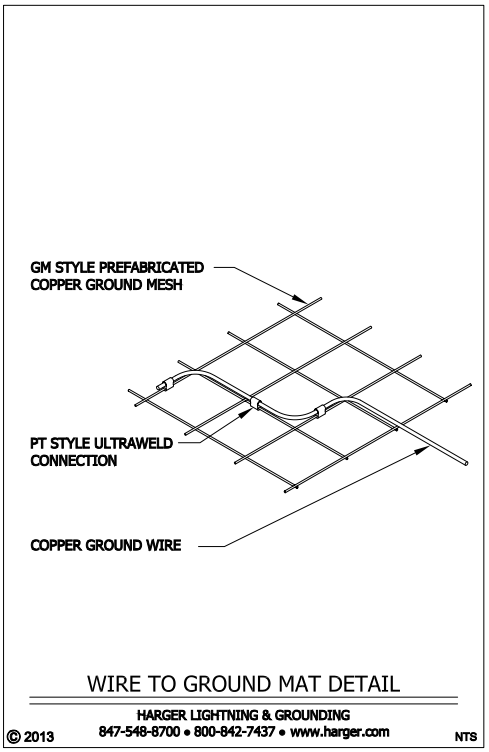
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GO - ACCESS WELL DETAIL

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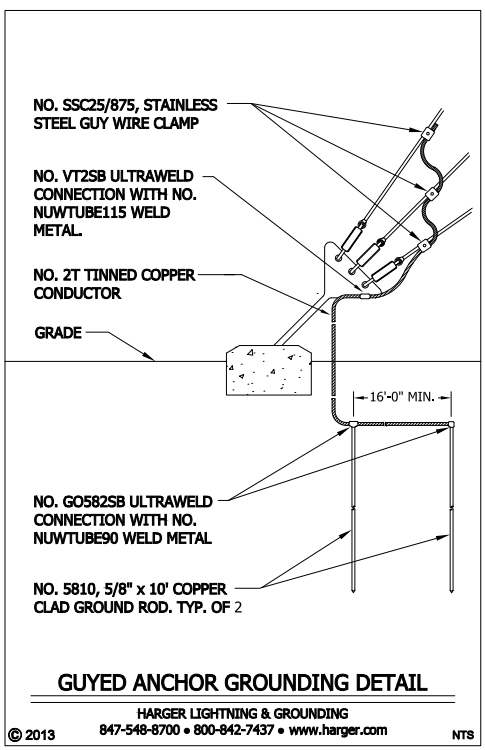
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WIRE TO GROUND MAT DETAIL

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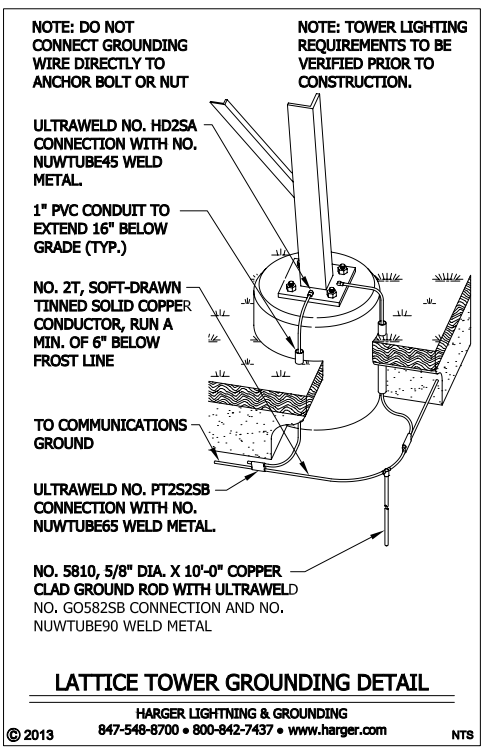
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GUYED ANCHOR GROUNDING DETAIL

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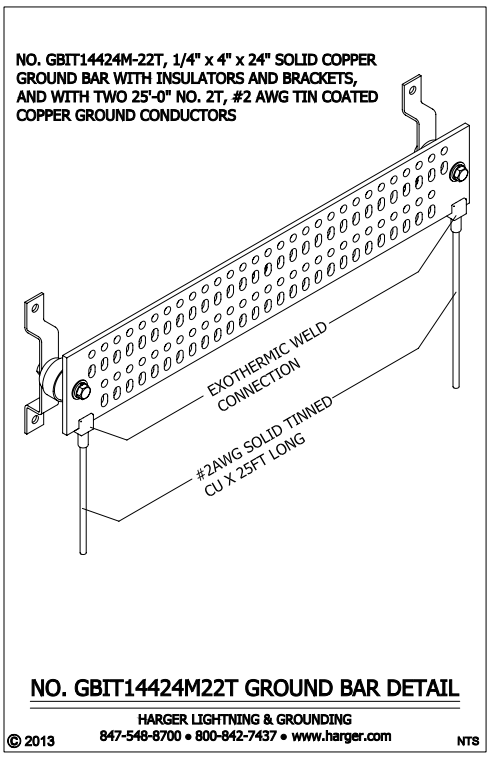
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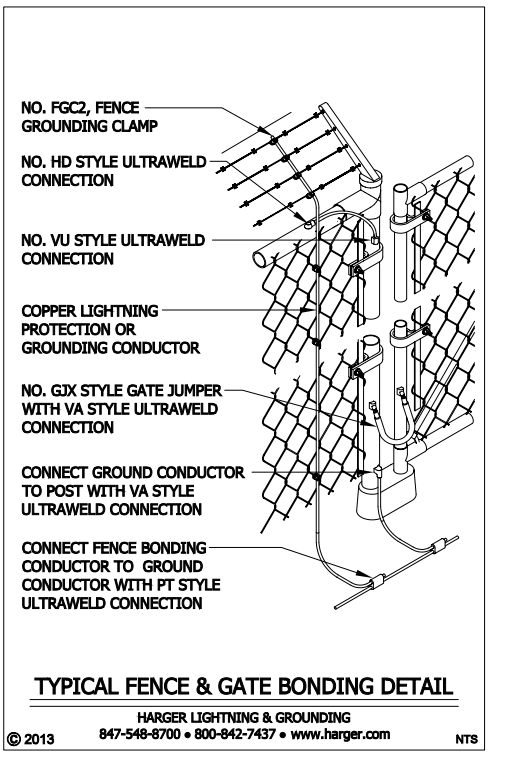


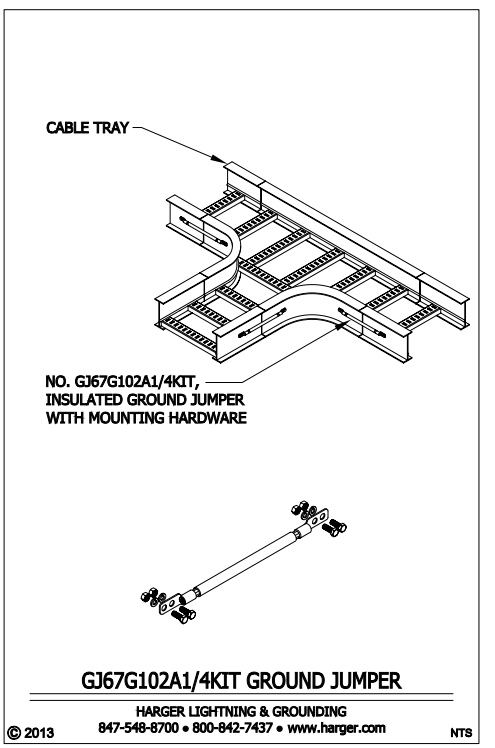
LATTICE TOWER GROUNDING DETAIL

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NO. GBIT14424M-22T, 1/4" x 4" x 24" SOLID COPPER GROUND BAR WITH INSULATORS AND BRACKETS, AND WITH TWO 25'-0" NO. 2T, #2 AWG TIN COATED COPPER GROUND CONDUCTORS
EXOTHERMIC WELD CONNECTION
#2AWG SOLID TINNED CU X 25FT LONG
NO. GBIT14424M22T GROUND BAR DETAIL
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NO. FGC2, FENCE GROUNDING CLAMP
NO. HD STYLE ULTRAWELD CONNECTION
NO. VU STYLE ULTRAWELD CONNECTION
COPPER LIGHTNING PROTECTION OR GROUNDING CONDUCTOR
NO. GJX STYLE GATE JUMPER WITH VA STYLE ULTRAWELD CONNECTION
CONNECT GROUND CONDUCTOR TO POST WITH VA STYLE ULTRAWELD CONNECTION
CONNECT FENCE BONDING CONDUCTOR TO GROUND CONDUCTOR WITH PT STYLE ULTRAWELD CONNECTION
TYPICAL FENCE & GATE BONDING DETAIL
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CABLE TRAY
NO. GJ67G102A1/4KIT, INSULATED GROUND JUMPER WITH MOUNTING HARDWARE
GJ67G102A1/4KIT GROUND JUMPER
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Section 26 05 26.xx (Formerly 16065) – Signal Reference Grid System Specification

Part 1 – GENERAL

1.01 Summary

a. Provide a complete grounding system that reduces or eliminates high frequency transients by achieving a common ground reference for all equipment within a contiguous area. It consists of a signal reference grid, low-impedance bonding straps, transient suppression plates and bare copper bonding conductors.

b. The signal reference grid system shall be installed by a firm actively engaged in the installation of high frequency ground systems.

c. The work covered under this section of the specification consists of furnishing labor, materials and services required for the completion of a functional signal reference grid system approved by the architect and engineer

1.02 References: The completed signal reference grid system shall comply with the latest issue of the following standards and form a part of this specification.

a. IEEE Std.1100, IEEE Recommended Practice for Powering and Grounding Electronic Equipment.

b. NFPA 70, National Electric Code

1.03 Submittals

a. Layout drawing(s) showing the configuration of the signal reference grid shall be submitted to the architect and engineer for approval prior to installation.

b. Catalog pages or technical data sheets for all products used to as part of the signal reference grid System shall be submitted to the architect and engineer for approval prior to installation.

1.04 Delivery, Storage and Handling

a. Store products in manufacturer's unopened packaging until ready for installation.

Part 2 – PRODUCTS

2.01 Standard

a. All materials used in the installation shall be new and shall comply in weight, size and composition as required by manufacturer and shall be labeled or listed by Underwriters Laboratories Inc. for use in electrical grounding. The system furnished under this specification shall be the standard product of a manufacturer regularly engaged in the production of high frequency grounding equipment.

2.02 Acceptable Manufacturers

a. Harger Lightning & Grounding
301 Ziegler Drive, Grayslake, IL 60030
(847) 548-8700 ● 800-842-7437 ● Fax (847) 548-8755
E-mail: hargersales@harger.com ● Web-site: www.harger.com

2.03 Materials

a. The signal reference grid (SBG) shall be made from soft copper flat strip, 2 inches wide by 26 gage, and factory-made using MIG welds on two-foot centers.

Section 26 05 26.xx (Formerly 16065) – Signal Reference Grid System Specification

b. SBG rolls shall be between 4 feet to 16 feet wide.

c. All field made connections to the signal reference grid (SBG), raised floor pedestals, building columns, pipes and other metal items shall be made using the Ultraweld® Exothermic Welding Process.

d. The SBG sections shall be rolled on tubes with the outside of the roll protected for shipment.

e. SBG rolls shall be labeled on the ends for easy identification.

Part 3 – EXECUTION

3.01 General Installation

a. The installation shall be installed by a qualified, licensed electrical contractor.

3.02 SBG Installation

a. SBG sections shall be welded together using Ultraweld Mold SBG2016K with US32 Weld Metal and MH1 Handle Clamp. For low smoke-no flame requirements when using the UltraShot process, use one of the kits found on page 276 for converting standard molds into low smoke-no flame molds. To join sections together, overlap the outside strip of one section over the outside strip of the adjacent section and weld together every two feet.

b. The SBG should be installed 6 inches to 18 inches from the outside walls to avoid interference with pedestals. SBG does not have to be exactly centered between pedestals.

c. Whenever an obstruction is encountered, it is acceptable to cut the SBG to go around the obstruction and splice connecting pieces of the SBG to suit.

d. SBG squares should not line up between adjacent sections in a room or between rooms. Offset squares, first in one direction, then the other. This prevents welds from lying on top of one another and minimizes interference to pedestals.

e. The SBG does not have to be bonded to the floor in most circumstances. If any section does not lie flat, pedestal mastic or other convenient means can be used to bond to the floor. Pedestal mastic should be used to hold the SBG to the floor near high-speed air inlets. The mastic should not contain sulfur.

f. Do not use mastic until all SBG mats have been installed and all Ultraweld connections between mats and all low impedance riser and pedestal connections have been made.

g. If a section of SBG is damaged, then repair with Mold SRG2016K with US32 Weld Metal and MH-1 Handle Clamp. For low smoke-no flame requirements when using the UltraShot process, use one of the kits found on page 276 for converting standard molds into low smoke-no flame molds. It is permissible to splice sections of copper strip to lengthen SBG conductors so they clear preexisting objects on floor.

h. Use Low Impedance Riser (LIR) to connect each equipment enclosure to the SBG. Ultraweld Mold SRG2016K with US32 Weld Metal and MH-1 Handle Clamp is used for this connection. For low smoke-no flame requirements when using the UltraShot process, use one of the kits found on page 276 for converting standard molds into low smoke-no flame molds.

i. LIR to be 26 gage x 2" x 72 copper strip, Part No. LIR72. Do not connect LIR risers to SBG strips closest to outside walls. If possible, connect LIR no closer than the second SBG row away from outside walls of room.

Section 26 05 26.xx (Formerly 16065) – Signal Reference Grid System Specification

j. Exceptions can be made regarding HVAC equipment if these are already positioned near walls. Cut LIR as short as possible in all cases.

k. Always install two LIRs per equipment cabinet with one LIR being 20% to 40% longer than the next and connect to the equipment on opposite sides.

3.03 Bonding Pedestals

a. Connect every sixth pedestal in each direction to the SBG using #6 AWG 7 strand copper cable.

b. #6 AWG 7 strand copper is connected to the SBG with Mold BCF61.5016B using US25 Weld Metal and MH-1 Handle Clamp.

c. For the 1" round pedestals, use Mold VH61RDMX, MH-4 Handle Clamp, and US25 Weld Metal.

d. For the 7/8" square pedestals, use Mold VHO6.8SQMX, MH-4 Handle Clamp and US25 Weld Metal.

e. For the 1" square pedestals, use Mold VHO61SQMX, MH-4 Handle Clamp and US25 Weld Metal. The cable should take the shortest path between the pedestal and the Signal Reference Grid. The length of the wire should not exceed 2 feet.

f. For low smoke-no flame requirements when using the UltraShot process, use one of the kits found on page 276 for converting standard molds into low smoke-no flame molds.

3.04 Bonding Building Steel

a. All columns within and at perimeter of the computer room shall be bonded to the SBG using #6 AWG 7 strand copper cable with Mold VA6B, MH-1 Handle Clamp and US45 Weld Metal.

b. #6 AWG 7 strand copper is connected to the SBG with Mold BCF61.5016B using US25 Weld Metal and MH-1 Handle Clamp. The cable should take the shortest path between the building steel and the Signal Reference Grid.

c. For low smoke-no flame requirements when using the UltraShot process, use one of the kits found on page 276 for converting standard molds into low smoke-no flame molds

3.05 Bonding Other Steel Members

a. All conduits, water pipes, ducts, etc. entering the computer room shall be bonded to the SBG (at each end of the room if these are horizontal).columns within and at perimeter of the computer room shall be bonded to the SBG using #6 AWG 7 strand copper cable with Mold VA6B, MH-1 Handle Clamp and US45 Weld Metal.

b. Use #6 AWG 7 strand copper cable.

c. Use Harger Lightning & Grounding CPC Series of pipe clamps for attaching the #6 wire to conduit, water pipes, and other round conductive members.

d. The #6 AWG 7 strand copper cable is connected to the SBG with Mold BCF61.5016B using US25 Weld Metal and MH-1 Handle Clamp.

Section 26 05 26.xx (Formerly 16065) – Signal Reference Grid System Specification

e. For low smoke-no flame requirements when using the UltraShot process, use one of the kits found on page 276 for converting standard molds into low smoke-no flame molds.

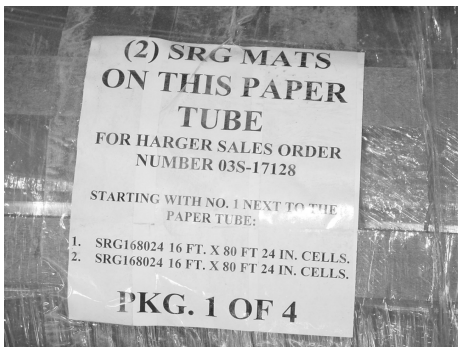
3.06 Coordination

a. Coordinate the installation of the high frequency signal reference grid grounding system with other trades to avoid damage of installed materials.

END OF SECTION 26 05 26.xx

These instructions are intended to ensure the proper installation of Harger Signal Reference Grids (SRG), while saving time and money for the installer.

Receiving & Storage

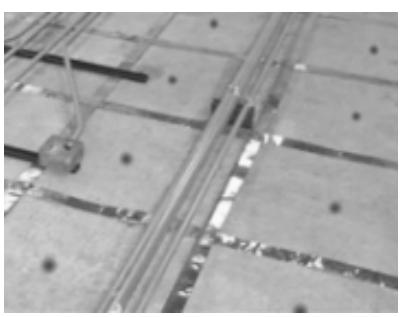


1. Harger SRG rolls are shipped in closed trucks unless otherwise specified. This usually requires a loading dock and a forklift truck capable of unloading the SRG rolls.
2. Harger tries to limit SRG rolls to a weight of 250 pounds each.
3. SRG rolls are labeled on the ends. If you are storing the rolls temporarily, make sure the marked ends are facing in the same direction for easy identification.
4. Rolls should be checked against drawings and stacked so the first rolls to be installed are the easiest ones to unstack.
5. Indoor storage is recommended.
6. Check your shipment against the shipping papers and installation drawings to be sure the proper quantity has been received. Any discrepancies of any kind should be brought to the attention of the carrier and your distributor.
7. Do not remove the roll protection until the roll is in place and ready to unroll.

Installation of the Signal Reference Grid

The SRG should be installed prior to the installation of the raised floor pedestals.

1. Mark the location of pedestals on floor so they can be avoided with the SRG strips.
2. Start in one corner of the room with the proper roll as identified on the drawing. The pedestal spot should be approximately in center of grid opening. This will normally be 12" from the wall.
3. Any obstructions, such as columns or existing obstacles, can be handled in either of the following ways:
   - Cut the SRG to fit around the obstruction.
   - Place the SRG on one side of the obstruction and, using one or more workers, pull the SRG around the obstruction cutting where needed.



Pedestal locations marked by the dot



Note - It's okay to cut and patch the SRG. Patching is done by welding cut sections together with the Ultraweld process.

4. The outside strip of adjacent sections must overlap for interconnecting with the Ultraweld Process. You can join adjacent sections of the SRG as you go, or you can wait until the entire room is covered with the SRG sections and then weld all at once. Never make a weld over a factory weld.
5. If the SRG were ever to rip or tear, it can be patched by welding.
6. Putting pedestal mastic between the SRG and the floor can smooth any buckles in the SRG out. It is not necessary to use other means of fastening to the floor. Do not use mastic until all Ultraweld connections have been made.
7. All connections between sections of the SRG and the risers, pedestal bonds, column bonds, and other metal bonded to the SRG shall use the Ultraweld molds and weld metal provided.



If not using UltraShot Low Smoke-No Flame System (see page 276), cover strip adjacent to the mold to prevent any splatter from marring the SRG strip. Never make welds over factory welds.



8. Pedestal mastic should be used to hold the SRG to the floor near high-speed air inlets. Do not use mastic until all ULTRAWELD connections have been made. Use mastic that does not contain sulphur.



During and after installation, care should be taken when walking or operating equipment over the SRG to avoid tripping and damaging the SRG. If heavy or extended traffic is expected, sheets of plywood or other durable covering should be used to cover the SRG.

9. When pulling cables after the floor is installed, especially cables with connectors installed it is suggested to put a cloth bag or other protection over the end of the cable to protect the connector and guard against snagging the SRG.

Specific Instructions for Making Ultraweld Exothermic Connections

1. Follow the general and specific instructions furnished with the mold.
2. If the UltraShot Low Smoke-No Flame System (see page 276) is not being used, cover strip adjacent to the mold to prevent any splatter from marring the SRG strip. Never make welds over factory welds.
3. If the UltraShot Low Smoke-No Flame System (see page 276) is being used and prevention of even a small amount of dust is critical, then clean and prepare the mold for next weld in an area outside of the "clean area".

Section 27 05 26 (Formerly 16740) – Grounding and Bonding for Communications Systems Specification

Part 1 – GENERAL

1.01 Work Included:

a. Provide all labor, materials, tools, installation equipment, and test equipment required for the complete installation of grounding and bonding for telecommunications systems within the structure.

1.02 References

a. ANSI/TIA 607-B – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

b. National Fire Protection Association (NFPA – 70), National Electrical Code (NEC) -2011

c. ANSI T1.333-2001 – Grounding and Bonding of Telecommunications Equipment

1.03 Quality Assurance

a. The materials and their installation shall conform to the requirements of ANSI/TIA 607-B and the National Electrical Code

b. Use adequate numbers of skilled work-persons thoroughly trained and experienced on the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

Part 2 – PRODUCTS

2.01 Standard

a. All materials used in the installation shall be new and shall comply in weight, size and composition as required by manufacturer and shall be labeled or listed by Underwriters Laboratories Inc. for use in electrical grounding.

2.02 Acceptable Manufactures

a. Harger Lightning & Grounding
301 Ziegler Drive, Grayslake, IL 60030
(847) 548-8700 • 800-842-7437 • Fax (847) 548-8755
E-mail: hargersales@harger.com • Web-site: www.harger.com

2.03 Telecommunications Main Grounding Busbar (TMGB)

a. The TMGB shall be Harger catalog number GBI14412TMGB, ¼"T x 4"W x 12"L copper ground bar.

I. The TMGB shall be predrilled with holes for use with standard sized lugs.

II. The TMGB shall be UL listed and meet the requirements of ANSI/TIA 607-B.

III. The TMGB shall be sized as above or lengthened to meet requirements of the immediate application with consideration for future growth.

Section 27 05 26 (Formerly 16740) – Grounding and Bonding for Communications Systems Specification

2.04 Telecommunications Grounding Busbar (TGB)

a. The TGB shall be Harger catalog number GBI14212TGB, ¼"T x 2"W x 12"L copper ground bar.

I. The TMGB shall be predrilled with holes for use with standard sized lugs.

II. The TMGB shall be UL listed and meet the requirements of ANSI/TIA 607-B.

III. The TMGB shall be sized as above or lengthened to meet requirements of the immediate application with consideration for future growth.

2.05 Conductors

a. Conductors shall be stranded copper conductors with green insulation

I. Minimum conductor size No. 6 AWG.

II. Conductors shall be sized at 2 kcmil per linear foot of conductor length. For example: A conductor 25 feet in length shall be No. 2 AWG (66,360 cmil). A conductor 100 feet in length shall be No. 4/0 AWG (211,600 cmil)

III. Insulation shall be rated for the environment where it is installed.

2.06 Connector Lugs

a. Lugs for connecting to the TMGB and TGB shall be UL Listed two-hole, long barrel, electro tin-plated compression lugs with inspection port, Harger series GECLB.

I. Antioxidant joint compound, Harger series HCAJC shall be applied to the contact areas.

II. Lugs shall be secured to the ground bars with ¼" minimum stainless steel hex head cap screws with stainless steel washers, lock washers and nuts.

2.07 Exothermic Welded Connections

a. Exothermic Welded connections shall be Ultraweld by Harger.

I. Weld types BE shall be made to the ground bars using appropriate size weld metal.

II. Weld types VA, VD, or VU shall be made to structural steel framework

Part 3 – EXECUTION

3.01 Installation

a. The telecommunications main grounding bar (TMGB) is a dedicated extension of the building grounding electrode system for the telecommunications system. The TMGB should be located near the telecommunications service entrance and the electric service entrance.

I. The TMGB shall be connected to the main electric service entrance panel ground or the branch electric panel ground that serves the telecommunications equipment.

II. The TMGB shall be located to minimize the length of the bonding conductor for telecommunications from the TMGB to the electric service ground.

III. The bonding conductor for telecommunications shall be at least the same size as the telecommunications backbone (TBB) conductor.

IV. The TMGB shall serve telecommunications equipment that is located in the same room or space.

V. Connections to the TMGB shall be made by exothermic welding or by listed two-hole compression lugs.

Section 27 05 26 (Formerly 16740) – Grounding and Bonding for Communications Systems Specification

VI. All metal conduits or raceways for telecommunications cabling located within the same room or space as the TMGB shall be bonded to the TMGB.

a. Metal conduits 1" diameter and larger shall be bonded using Harger series CPC electro tin-plated pipe clamps.

b. Metal conduits less than 1" diameter shall be bonded using Harger TBGC4SCS electro tin-plated conduit bonding clamps.

c. Metal cable trays shall be bonded using Harger TBCTC electro tin-plated cable tray bonding clamps.

d. Bonding surface areas shall be cleaned to bare metal removing all paint, etc. The contact area shall be protected from corrosion using antioxidant joint compound. Harger series HCAJC for copper to copper connections or Harger series HAAJC for copper to aluminum or steel connections.

VII. Where an electric power panel for telecommunications equipment is located in the same room or space as the TMGB, the panel ground bus or panel enclosure shall be bonded to the TMGB.

VIII. The TMGB shall be located in an area that is accessible to telecommunications personnel

b. The telecommunications backbone (TBB) is a conductor that originates at the TMGB and extends throughout the building interconnecting all telecommunications grounding busbars (TGBs) with the TMGB.

I. The TBB shall be a copper conductor. The minimum size of the conductor shall be No. 6 AWG. The size of the conductor shall be increased 2 kcmil per linear foot as the length of the TBB increases. For example: A TBB 25 feet in length shall be No. 2 AWG (66,360 cmil). A TBB 100 feet in length shall be No. 4/0 AWG (211,600 cmil)

II. The TBB conductors should be installed without splices. Where splices are necessary, the number of splices should be minimized and located in accessible telecommunications spaces. Splices shall be made using exothermic welding, listed irreversible compression connectors or equivalent.

III. The building water piping system shall not be used as a TBB.

IV. Metallic cable shields or metallic conduits shall not be used as a TBB.

c. A telecommunications grounding busbar (TGB) shall be provided in each area where telecommunication equipment is located. The TGB is the grounding connection point for telecommunications systems and equipment in each separate area.

I. The TGBs shall be connected to the TMGB via the TBB conductor.

II. The TBB and other TGBs within the same area shall be bonded to the TGB with a conductor the same size as the TBB.

III. The bonding conductor between the TBB and the TGB shall be continuous and routed in the shortest straight-line path possible.

Section 27 05 26 (Formerly 16740) – Grounding and Bonding for Communications Systems Specification

IV. Connections to the TGB shall be made by exothermic welding or by listed two-hole compression lugs.

V. All metal conduits or raceways for telecommunications cabling located within the same room or space as the TGB shall be bonded to the TGB.

VI. Where an electric power panel for telecommunications equipment is located in the same room or space as the TGB, the panel ground bus or panel enclosure shall be bonded to the TGB.

d. Where there are multiple telecommunications rooms or spaces with multiple TBBs, the TBBs shall be interconnected with a Grounding Equalizer (GE) conductor at the TGBs.

I. The GE shall be sized as specified for the TBB.

II. Connections of the GE to the TGBs shall be made by exothermic welding or by listed two-hole compression lugs.

e. In structural steel frame buildings, where the steel framework is accessible within the room; the TMGB and each TGB shall be bonded to the structural steel frame using a minimum No. 6 AWG conductor.

I. Connections to the structural steel frame shall be made by exothermic welding or by Harger No. 217 or Harger No. 223T electro tin-plated bronze bonding plates. The area of contact on the steel frame shall be cleaned to bare metal removing all paint and mill scale. The contact area shall be protected from corrosion using Harger series HAAJC antioxidant joint compound.

II. Where the structural steel frame is external to the room and is accessible, the structural steel should be bonded to the TGB or the TMGB using a minimum No. 6 AWG conductor.

END OF SECTION 27 05 26

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