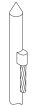
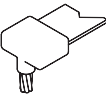
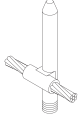
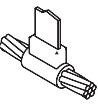
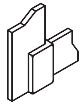
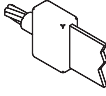
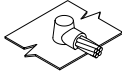
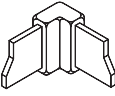
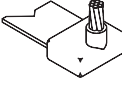
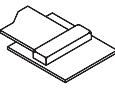
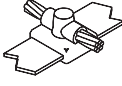
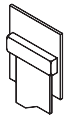
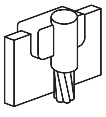
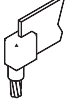
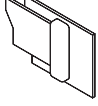
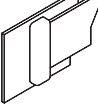
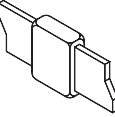
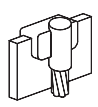
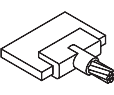
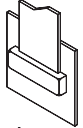
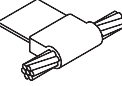
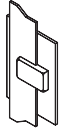
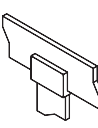


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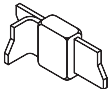
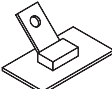
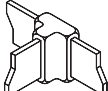
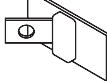
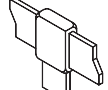
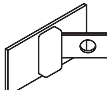
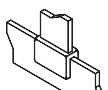
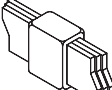
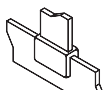
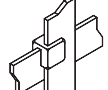
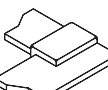
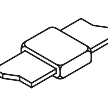
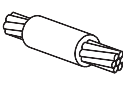
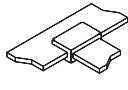
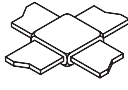
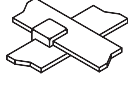
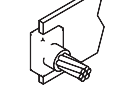
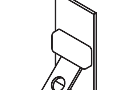
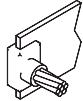
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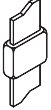
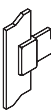
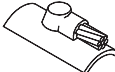
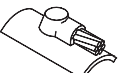
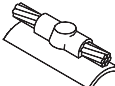
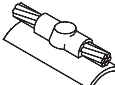
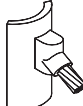
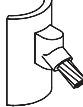
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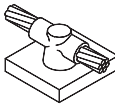
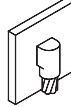
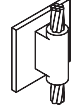
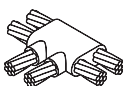
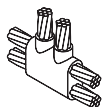
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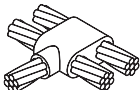
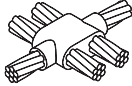
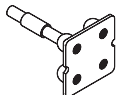
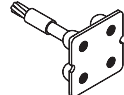
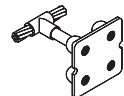
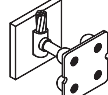
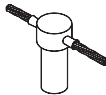
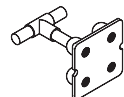
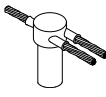
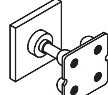
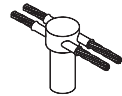
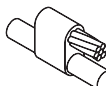
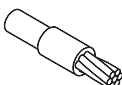
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Connection Types

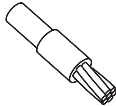
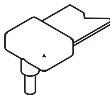
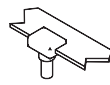
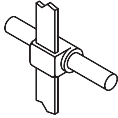
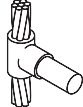
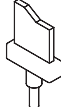
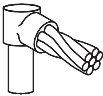
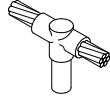
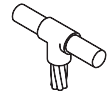
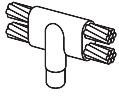
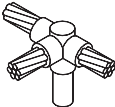
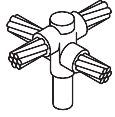
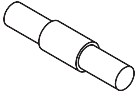
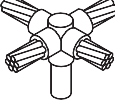
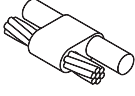
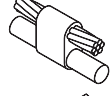
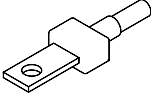
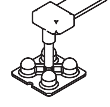
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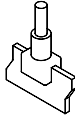
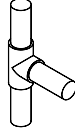
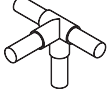
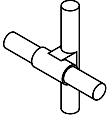
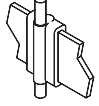
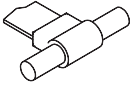
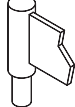
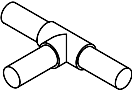
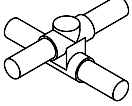
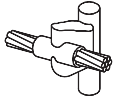
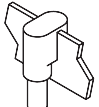
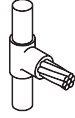
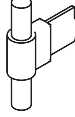
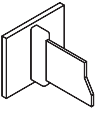
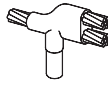
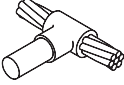
Connection Types

Connection Type	Catalog Item	Page	Connection Type	Catalog Item	Page
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	DX	No		FGRBS	Yes 313
	DX1C	No		FGRGD	Yes 313
	EGPBS	No		FGRGO	Yes 313
	EGPCB	Yes 310		FGRIGD	Yes 313
	EGPCT	Yes 310		FGRIGO	Yes 313
	EGPCVD	No		G11	Yes 305
	EGPCVU	No		G21	Yes 305
	EGPGRT	No		G31	Yes 305
	EGPHB	No		G41	Yes 305
	EGPID	Yes 310		GASO	No
	EGPIO	Yes 310		GB	No
	EGPSG	No		GCB	No

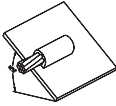
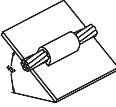
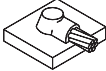
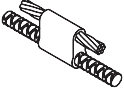
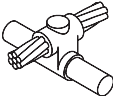
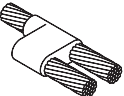
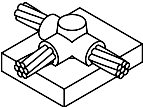
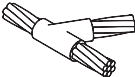
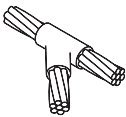
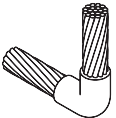
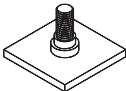
Connection Types

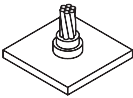
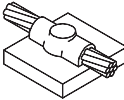
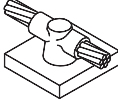
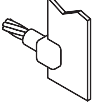
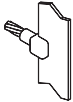
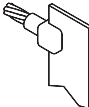
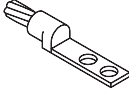
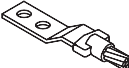
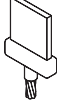
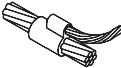
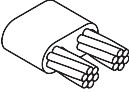
Connection Type	Catalog Item	Page	Connection Type	Catalog Item	Page
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	GCD	No		GHSO	No
	GCH	No		GHSRT	No
	GCT	No		GHVSX	No
	GCU	No		GLA	No
	GCV	No		GLV	No
	GD	Yes 279		GO	Yes 281
	GE	No		GOC	No
	GF	Yes 280		GOT	No
	GG	Yes 283		GOXO	No
	GGH	No		GOXX	No
	GH	No		GP	No
	GHLE	No		GPHSD	No

Connection Types

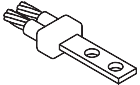
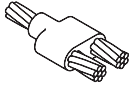
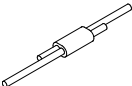
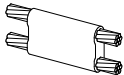
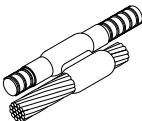
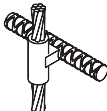
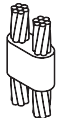
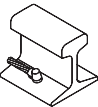
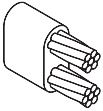
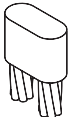
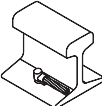
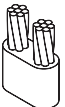
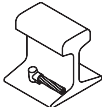
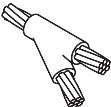
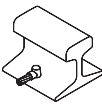
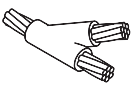
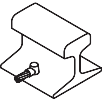
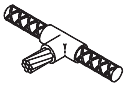
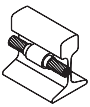
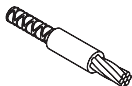
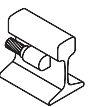
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	GRH90B	No			GUBV	No	
	GRHT	No			GUC	No	
	GROT	No			GV	No	
	GRS	No			GVSAS	No	
	GRST	No			GVSD	No	
	GRT	No			GVSO	No	
	GRXO	No			GVSP	No	
	GS	Yes	282		GVSS	No	
	GSC	No			HB	Yes	284
	GSSD	No			HBUVS	No	
	GT	Yes	283		HBVS	No	
	GTC	No			HCHP	No	

Connection Types

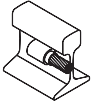
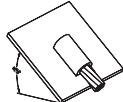
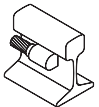
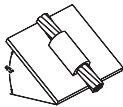
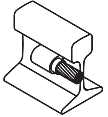
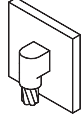
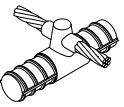
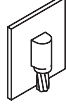
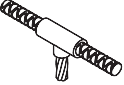
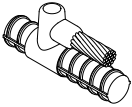
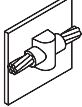
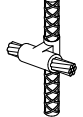
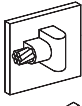
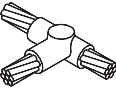
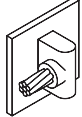
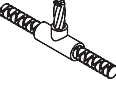
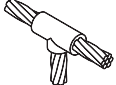
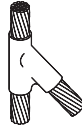
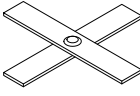
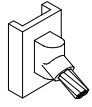
Connection Type	Catalog Item	Page
	HCLVS45	No
	HCTVS45	No
	HD	Yes 284
	HRCT	No
	HRDHT	No
	HRH90B	No
	HRHCX	No
	HRPHT	No
	HRT	No
	HRV30TL	No
	HRV30TR	No
	HRV90B	No
	HSVB	No

Connection Type	Catalog Item	Page
	HSVC	No
	HT	Yes 286
	HU	Yes 286
	HVBB	No
	HVBM	No
	HVBT	No
	LBJ	Yes 295
	LE	Yes 294
	LU	No
	LV	No
	PB	Yes 272
	PD	No
	PHD	No

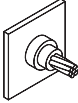
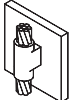
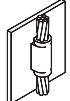
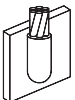
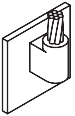
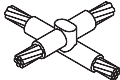
Connection Types

	Connection Type	Catalog Item	Page		Connection Type	Catalog Item	Page
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	PRPT	No			RCU	No	
	PS	Yes	273		RE	Yes	299
	PT	Yes	273		RH	No	
	PU	No			RHCVT	No	
	PV	No			RMFPL	No	
	PVD	No			RMFPLB	No	
	PVDD	No			RMFPR	No	
	PVDU	No			RMFPRB	No	
	RATD	No			RMFT	No	
	RATU	No			RMFTB	No	
	RB	Yes	298		RMVH	Yes	303
	RCB	No			RMVL	Yes	304

Connection Types

Connection Type	Catalog Item	Page	Connection Type	Catalog Item	Page
	RMVR	Yes 304		VCDVS45	No
	RMVLB	No		VCTVS45	No
	RMVRB	No		VD	Yes 287
	RO	Yes 300		VDO	No
	ROC	No		VH	Yes 290
	RP	Yes 301		VHO	No
	RS	Yes 302		VL	Yes 290
	RT	Yes 274		VLO	No
	RUC	No		VR	Yes 290
	RVT	No		VR45DT	No
	SRG	No		VRCD	No
	VA	Yes 287		VRCT	No
	VBS	No		VRCU	No

Connection Types

	Connection Type	Catalog Item	Page		Connection Type	Catalog Item	Page
	VRH90B	No					
	VRV45T	No					
	VRVCAD	No					
	VRVCAU	No					
	VSAU	No					
	VSHB	No					
	VSHBS	No					
	VT	Yes	292				
	VTO	No					
	VU	Yes	292				
	VUO	No					
	XO	Yes	276				
	XX	Yes	278				

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 maintained. 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 cap from NUWTube, pour weld metal into mold.



Step 5:
Close lid, remove Orange cap from starting powder chamber and sprinkle next to ignition hole.



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® Drop-In Process



Step 1:
Dry and clean the mold and conductor.



Step 2:
Place conductors and UltraShot cartridge into mold.



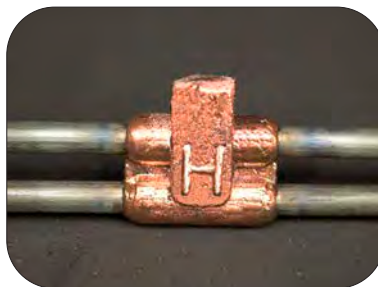
Step 3:
Close the lid and attach DRONE cord to the UltraShot igniter.



Step 4:
Push and hold both igniter buttons at the same time.



Step 5:
Reaction is made, open mold to remove connection and clean mold before next connection.



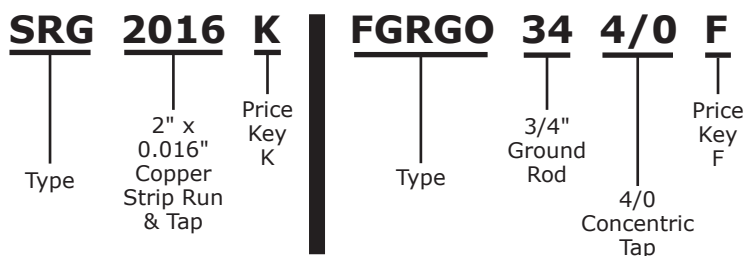
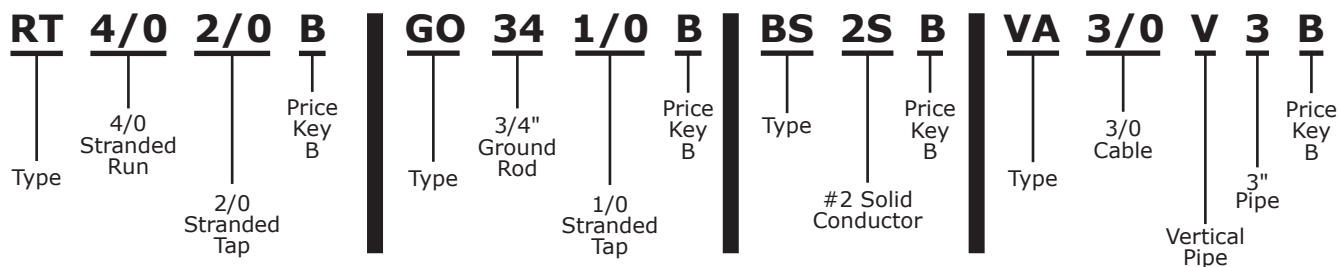
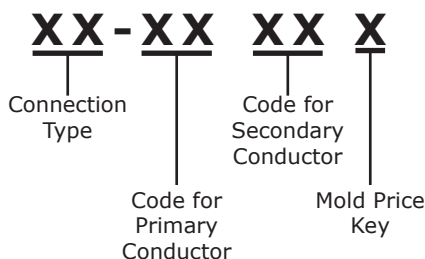
A completed UltraShot connection

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

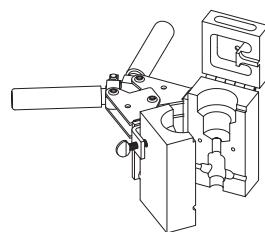
The Part Number gives, in code, the complete information of the mold.

- Type of connection, conductor size(s) and mold price key.
- Some connection types have more than 2 characters.

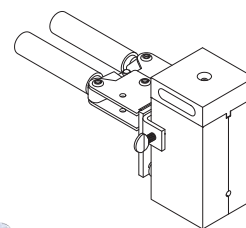


Molds

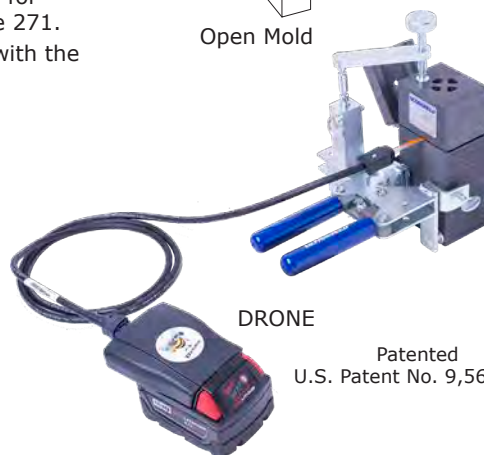
- Depending on the care and treatment of the mold, it will average 50 or more welds. Substantially more with the UltraShot process.
- The LOSmoke™ process uses an integrated filter system on the mold and electric ignition of the weld metal to produce a finished connection with minimal smoke emission. Ideal for indoor and confined space working conditions. See page 271.
- For the LOSmoke™ process, ignition is accomplished with the use of a DRONE.
- Mold Handle not included.



Open Mold



Closed Mold



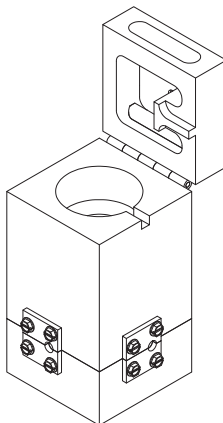
LOSmoke™ Mold

DRONE

Patented
U.S. Patent No. 9,562,751

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 Copper-Clad Steel cable 7/#10 through 19/#6.
- To order, add the suffix "WP" to the Ultraweld part number.
Example: RT-4/04/0B-WP



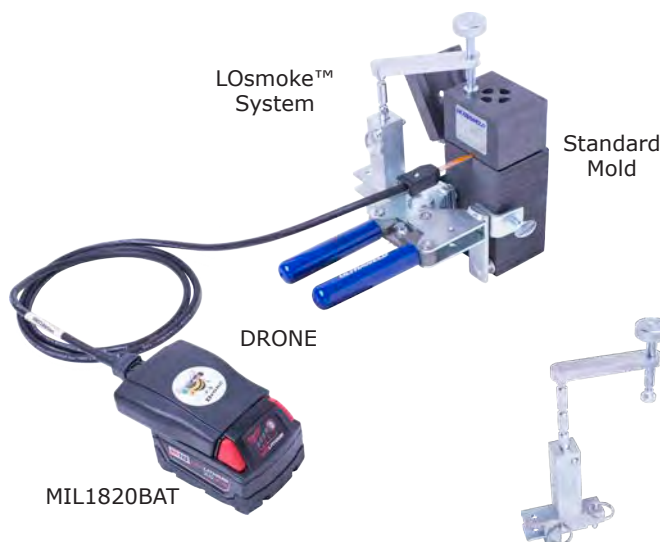
Available Weld Type	Number of Wear Plates
BH	2
BS	2
GD	2
GO	3
GS	3
HB	1
HU	2
LE	1
PB*	3
PT*	4
RO	2
RS	2
RT	3
VA	1
VH	2
VT	2
XO	4
XX	4

*Wear plates only available on 1/0 stranded and larger or Copper-Clad Steel 7/#10 and larger run and tap cables. Also available from #2 solid run and tap cables.

LOsmoke™ System

Using Harger's unique mold design and patented handle clamps, any mold that uses an MH1 or MH2 handle can be used with the LOsmoke™ System. The USSKIT, which includes a LOsmoke™ Adapter Clamp, Filter Housing, and 10 Disposable Filters is all that is required. There are three different USSKIT sizes, the selection of which is driven by the weld metal size and mold price key for the desired application.

- The use of LOsmoke™ requires the UltraShot® electronic ignition system.
- LOsmoke™ Filters should be replaced after every connection to ensure optimal system performance.



Part No.	Qty.	Approx. Each Wt. (lbs.)
DRONE	EA	1

LOsmoke™ Adapter Clamp

Part No.	Qty.	Approx. Each Wt. (lbs.)
USSXADPTR	EA	4

Milwaukee® M18™ REDLITHIUM™ Battery

Part No.	Qty.	Approx. Each Wt. (lbs.)
MIL1820BAT	EA	1-1/2



LOsmoke™ Kit



Filter



Filter Housing

Kit Part No.	Fits Mold Price Key	Weld Metal Size	Kit Approx. Each Wt. (lbs.)	Filter Part No.	Filter Approx. Pack Wt. (lbs.)	Filter Housing Part. No.	Filter Housing Approx. Each Wt. (lbs.)
USSKIT1	B, E, K, I, P, Q	25 thru 115	6	USSXFLR1.8	1/4	SAFHB25115	1/2
USSKIT2	B, E, K, I, P, Q	150 thru 300	6	USSXFLR2	1/4	SAFHB150300	1/2
USSKIT3	C, D, F, G, J, Y, Z	150 thru 400	6	USSXFLR3	1/4	SAFHC400	3/4

Kit Includes:

- (1) Adapter Clamp (USSXADPTR)
- (1) Filter Housing
- (10) Filters

• Filters sold as 10 pack.

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.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

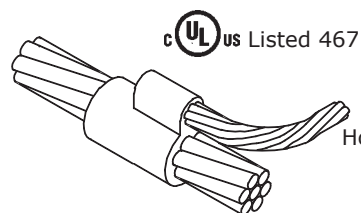
MH1 - Handle for "B" Price Key Molds

MH2 - Handle for "C" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

MCBRS1 - Mold Cleaning Brush



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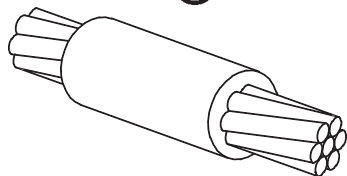
PB

(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-48 SB	US32	NUWTUBE32
	#6 Sol	PB-46 SB	US32	NUWTUBE32
	#6	PB-46 B	US32	NUWTUBE32
	#4	PB-44 B	US32	NUWTUBE32
#2 Sol	#2 Sol	PB-2S2 SB	US65	NUWTUBE65
#2	#8 Sol	PB-28 SB	US32	NUWTUBE32
	#6 Sol	PB-26 SB	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-1/08 SB	US45	NUWTUBE45
	#6 Sol	PB-1/06 SB	US45	NUWTUBE45
	#6	PB-1/06 B	US45	NUWTUBE45
	#4	PB-1/04 B	US65	NUWTUBE65
	#2 Sol	PB-1/02 SB	US65	NUWTUBE65
	#2	PB-1/02 B	US65	NUWTUBE65
	1/0	PB-1/01/0 B	US90	NUWTUBE90
2/0	#8 Sol	PB-2/08 SB	US65	NUWTUBE65
	#6 Sol	PB-2/06 SB	US65	NUWTUBE65
	#6	PB-2/06 B	US65	NUWTUBE65
	#4	PB-2/04 B	US65	NUWTUBE65
	#2 Sol	PB-2/02 SB	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-4/08 SB	US90	NUWTUBE90
	#6 Sol	PB-4/06 SB	US90	NUWTUBE90
	#6	PB-4/06 B	US90	NUWTUBE90
	#4	PB-4/04 B	US90	NUWTUBE90
	#2 Sol	PB-4/02 SB	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

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BS

(Butt End Splice of Horizontal Cables)

BS Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6 Sol	BS-6 SL	US25	NUWTUBE25
#4	BS-4 L	US25	NUWTUBE25
#2 Sol	BS-2 SL	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-25 CM B	US115	NUWTUBE115
300 MCM	BS-3 CM B	US115	NUWTUBE115
350 MCM	BS-35 CM B	US150	NUWTUBE150
500 MCM	BS-5 CM B	US200	NUWTUBE200
750 MCM	BS-75 CM C	US300	2-NUWTUBE150
1000 MCM	BS-1 MM C	US400	2-NUWTUBE200

Cable to Cable

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.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

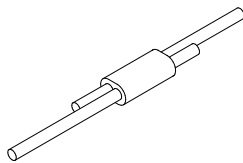
Required Tools & Accessories:

MH1 - Handle for "B" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush

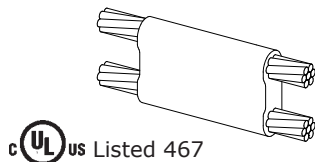


PS

(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-8S8SL	US25	NUWTUBE25
#8	#8	PS-88L	US25	NUWTUBE25
#6 Sol	#6 Sol	PS-6S6SL	US25	NUWTUBE25
#6	#6	PS-66L	US25	NUWTUBE25
#4 Sol	#4 Sol	PS-4S4SM	US32	NUWTUBE32
#4	#4	PS-44M	US32	NUWTUBE32
#2 Sol	#2 Sol	PS-2S2SM	US45	NUWTUBE45



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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-66B	US25	NUWTUBE25
#4	#8 Sol	PT-48SB	US32	NUWTUBE32
	#8	PT-48B	US32	NUWTUBE32
	#6 Sol	PT-46SB	US32	NUWTUBE32
	#6	PT-46B	US32	NUWTUBE32
	#4	PT-44B	US32	NUWTUBE32

PT Connection Type continued

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	Ultraweld
#2 Sol	#2 Sol	PT-2S2SB	US65	NUWTUBE65
#2	#8 Sol	PT-28SB	US45	NUWTUBE45
	#8	PT-28B	US45	NUWTUBE45
	#6 Sol	PT-26SB	US45	NUWTUBE45
	#6	PT-26B	US45	NUWTUBE45
	#4	PT-24B	US65	NUWTUBE65
1/0	#2 Sol	PT-22SB	US65	NUWTUBE65
	#2	PT-22B	US65	NUWTUBE65
	#8 Sol	PT-1/08SB	US65	NUWTUBE65
	#8	PT-1/08B	US65	NUWTUBE65
	#6 Sol	PT-1/06SB	US65	NUWTUBE65
2/0	#6	PT-1/06B	US65	NUWTUBE65
	#4	PT-1/04B	US65	NUWTUBE65
	#2 Sol	PT-1/02SB	US65	NUWTUBE65
	#2	PT-1/02B	US65	NUWTUBE65
	1/0	PT-1/01/0B	US90	NUWTUBE90
3/0	#8 Sol	PT-2/08SB	US65	NUWTUBE65
	#8	PT-2/08B	US65	NUWTUBE65
	#6 Sol	PT-2/06SB	US90	NUWTUBE90
	#6	PT-2/06B	US90	NUWTUBE90
	#4	PT-2/04B	US90	NUWTUBE90
4/0	#2 Sol	PT-2/02SB	US90	NUWTUBE90
	#2	PT-2/02B	US90	NUWTUBE90
	1/0	PT-2/01/0B	US115	NUWTUBE115
	2/0	PT-2/02/0B	US115	NUWTUBE115
	3/0	PT-3/03/0B	US150	NUWTUBE150
3/0	#8 Sol	PT-3/08SB	US90	NUWTUBE90
	#8	PT-3/08B	US90	NUWTUBE90
	#6 Sol	PT-3/06SB	US90	NUWTUBE90
	#6	PT-3/06B	US90	NUWTUBE90
	#4	PT-3/04B	US115	NUWTUBE115
4/0	#2 Sol	PT-3/02SB	US115	NUWTUBE115
	#2	PT-3/02B	US115	NUWTUBE115
	1/0	PT-3/01/0B	US115	NUWTUBE115
	2/0	PT-3/02/0B	US150	NUWTUBE150
	3/0	PT-3/03/0B	US150	NUWTUBE150
4/0	#8 Sol	PT-4/08SB	US90	NUWTUBE90
	#8	PT-4/08B	US90	NUWTUBE90
	#6 Sol	PT-4/06SB	US90	NUWTUBE90
	#6	PT-4/06B	US90	NUWTUBE90
	#4	PT-4/04B	US150	NUWTUBE150
4/0	#2 Sol	PT-4/02SB	US150	NUWTUBE150
	#2	PT-4/02B	US150	NUWTUBE150
	1/0	PT-4/01/0B	US150	NUWTUBE150
	2/0	PT-4/02/0B	US150	NUWTUBE150
	3/0	PT-4/03/0B	US200	NUWTUBE200
4/0	4/0	PT-4/04/0B	US200	NUWTUBE200

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 270 for details.

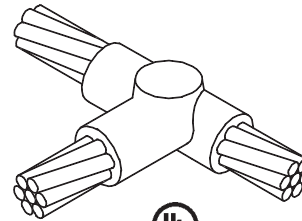
Required Tools & Accessories:

MH1 - Handle for "B" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush



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RT

(Tee of Horizontal Run & Tap Cables)

Horizontal Split 2-Piece Design

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-2S2 S B	US45	NUWTUBE45
#2	#6	RT-26 B	US45	NUWTUBE45
	#4	RT-24 B	US45	NUWTUBE45
	#2 Sol	RT-22 S 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-1/02 S 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-2/02 S 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-3/02 S 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

Cable to Cable

Mold Information:

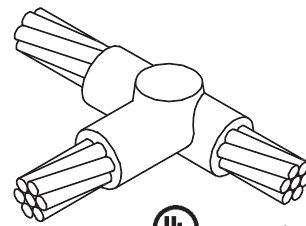
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

- MH6 - Handle for "I" Price Key Molds
- MH7 - Handle for "J" Price Key Molds

Recommended Tools & Accessories:

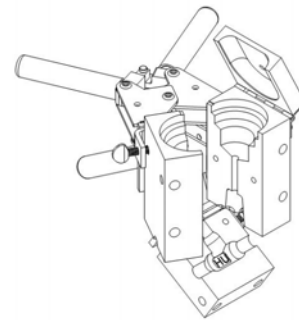
- CCBRSH1 - Cable Cleaning Brush
- MCBRSH1 - Mold Cleaning Brush



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RT

(Tee of Horizontal Run & Tap Cables)



**Vertical &
Horizontal Split
3-Piece Design**

RT Connection Type

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
4/0	#6	RT-4/06 I	US90	NUWTUBE90
	#4	RT-4/04 I	US90	NUWTUBE90
	#2 Sol	RT-4/02 S	US90	NUWTUBE90
	#2	RT-4/02 I	US90	NUWTUBE90
	1/0	RT-4/01/0 I	US90	NUWTUBE90
	2/0	RT-4/02/0 I	US90	NUWTUBE90
	3/0	RT-4/03/0 I	US115	NUWTUBE115
	4/0	RT-4/04/0 I	US150	NUWTUBE150
250 MCM	#2	RT-25CM2 I	US90	NUWTUBE90
	1/0	RT-25CM1/0 I	US90	NUWTUBE90
	2/0	RT-25CM2/0 I	US90	NUWTUBE90
	3/0	RT-25CM3/0 I	US150	NUWTUBE150
	4/0	RT-25CM4/0 I	US150	NUWTUBE150
250 MCM	250 MCM	RT-25CM25CM I	US150	NUWTUBE150
300 MCM	#2	RT-3CM2 I	US90	NUWTUBE90
	1/0	RT-3CM1/0 I	US90	NUWTUBE90
	2/0	RT-3CM2/0 I	US90	NUWTUBE90
	3/0	RT-3CM3/0 I	US150	NUWTUBE150
	4/0	RT-3CM4/0 I	US150	NUWTUBE150
	250 MCM	RT-3CM25CM I	US200	NUWTUBE200
300 MCM	300 MCM	RT-3CM3CM I	US200	NUWTUBE200
350 MCM	#2	RT-35CM2 I	US90	NUWTUBE90
	1/0	RT-35CM1/0 I	US90	NUWTUBE90
	2/0	RT-35CM2/0 I	US90	NUWTUBE90
	3/0	RT-35CM3/0 I	US150	NUWTUBE150
	4/0	RT-35CM4/0 I	US150	NUWTUBE150
	250 MCM	RT-35CM25CM I	US200	NUWTUBE200
	300 MCM	RT-35CM3CM I	US200	NUWTUBE200
	350 MCM	RT-35CM35CM I	US200	NUWTUBE200

RT Connection Type continued

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
500 MCM	#2	RT-5CM2 I	US90	NUWTUBE90
	1/0	RT-5CM1/0 I	US90	NUWTUBE90
	2/0	RT-5CM2/0 I	US90	NUWTUBE90
	3/0	RT-5CM3/0 I	US150	NUWTUBE150
	4/0	RT-5CM4/0 I	US150	NUWTUBE150
	250 MCM	RT-5CM25CM I	US200	NUWTUBE200
	300 MCM	RT-5CM3CM I	US200	NUWTUBE200
	350 MCM	RT-5CM35CM I	US200	NUWTUBE200
750 MCM	500 MCM	RT-5CM5CM I	US300	2-NUWTUBE150
	1/0	RT-75CM1/0 I	US150	NUWTUBE150
	2/0	RT-75CM2/0 I	US150	NUWTUBE150
	3/0	RT-75CM3/0 I	US150	NUWTUBE150
	4/0	RT-75CM4/0 I	US150	NUWTUBE150
	250 MCM	RT-75CM25CM I	US200	NUWTUBE200
	300 MCM	RT-75CM3CM I	US200	NUWTUBE200
	350 MCM	RT-75CM35CM I	US250	NUWTUBE250
1000 MCM	500 MCM	RT-75CM5CM J	US400	2-NUWTUBE200
	750 MCM	RT-75CM75CM J	US500	2-NUWTUBE250
	1/0	RT-1MM1/0 I	US150	NUWTUBE150
	2/0	RT-1MM2/0 I	US150	NUWTUBE150
	3/0	RT-1MM3/0 I	US200	NUWTUBE200
	4/0	RT-1MM4/0 I	US200	NUWTUBE200
	250 MCM	RT-1MM25CM I	US200	NUWTUBE200
	300 MCM	RT-1MM3CM I	US200	NUWTUBE200
1000 MCM	350 MCM	RT-1MM35CM I	US250	NUWTUBE250
	500 MCM	RT-1MM5CM J	US400	2-NUWTUBE200
	750 MCM	RT-1MM75CM J	US500	2-NUWTUBE250
	1000 MCM	RT-1MM1MM J	US500	2-NUWTUBE250

NOTES:

- Innovative 3-piece design allows for ease of cleaning mold cavities and tap holes between connections.
- Proper care and cleaning extends the life of exothermic molds.

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 270 for details.

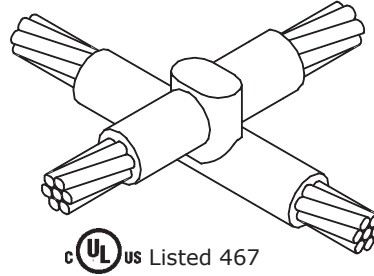
Required Tools & Accessories:

MH1 - Handle for "B" & "Q" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush



XO

(Cross of Horizontal Cables, Lapped & Not Cut)

**Horizontal Split
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

Cable to Cable

Mold Information:

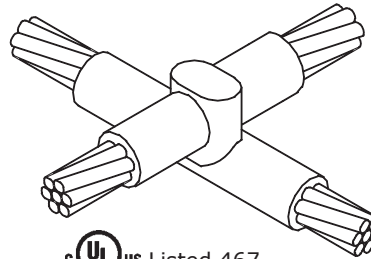
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

- MH6 - Handle for "I" Price Key Molds
- MH7 - Handle for "J" Price Key Molds

Recommended Tools & Accessories:

- CCBRSH1 - Cable Cleaning Brush
- MCBRSH1 - Mold Cleaning Brush

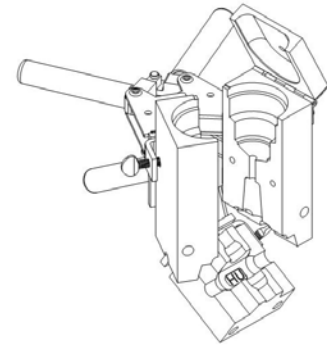


cUL US Listed 467

XO

(Cross of Horizontal Cables, Lapped & Not Cut)

**Vertical &
Horizontal Split
3-Piece Design**



XO Connection Type continued

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
4/0	#2	XO-4/02 I	US150	NUWTUBE150
	1/0	XO-4/01/0 I	US200	NUWTUBE200
	2/0	XO-4/02/0 I	US200	NUWTUBE200
	3/0	XO-4/03/0 I	US250	NUWTUBE250
	4/0	XO-4/04/0 I	US250	NUWTUBE250
250 MCM	#2	XO-25CM2 I	US150	NUWTUBE150
	1/0	XO-25CM1/0 I	US250	NUWTUBE250
	2/0	XO-25CM2/0 I	US250	NUWTUBE250
	3/0	XO-25CM3/0 I	US300	2-NUWTUBE150
	4/0	XO-25CM4/0 I	US300	2-NUWTUBE150
	250 MCM	XO-25CM25CM I	US300	2-NUWTUBE150
500 MCM	#2	XO-5CM2 I	US250	NUWTUBE250
	1/0	XO-5CM1/0 I	US300	2-NUWTUBE150
	2/0	XO-5CM2/0 J	US400	2-NUWTUBE200
	3/0	XO-5CM3/0 J	US500	2-NUWTUBE250
	4/0	XO-5CM4/0 J	US500	2-NUWTUBE250
	250 MCM	XO-5CM25CM J	US500	2-NUWTUBE250
	300 MCM	XO-5CM3CM J	US600	3-NUWTUBE200
	350 MCM	XO-5CM35CM J	US600	3-NUWTUBE200
	500 MCM	XO-5CM5CM J	US750	3-NUWTUBE250

NOTES:

- Innovative 3-piece design allows for ease of cleaning mold cavities and tap holes between connections.
- Proper care and cleaning extends the life of exothermic molds.

Cable to Cable

Mold Information:

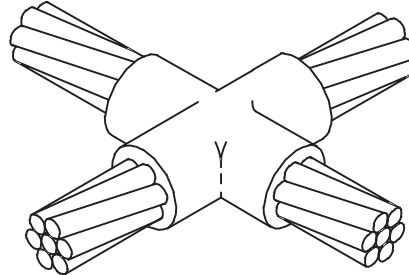
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:

- MH1 - Handle for "B" Price Key Molds
- MH2 - Handle for "C" Price Key Molds

Recommended Tools & Accessories:

- CCBRSH1 - Cable Cleaning Brush
- MCBRSH1 - Mold Cleaning Brush



XX

(Cross of Horizontal Cables, Tap Cable Cut, Cables in Same Plane)

cUL US 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
	#2			
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

XX Connection Type continued

Cable Size		Mold Part No.	Weld Metal	
Run	Tap		UltraShot	NUWTUBE
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
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

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.
- 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 270 for details.

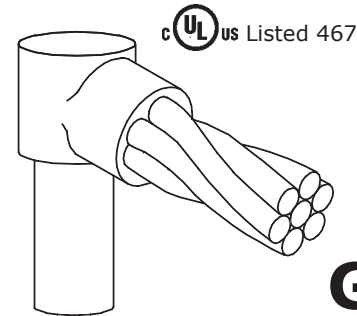
Required Tools & Accessories:

MH1 - Handle for "B" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning 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-12F6 L	US25	NUWTUBE25
	#4	GD-12F4 L	US25	NUWTUBE25
	#2 Sol	GD-12F2 S B	US65	NUWTUBE65
	#2	GD-12F2 B	US65	NUWTUBE65
	1/0	GD-12F1/0 B	US90	NUWTUBE90
	2/0	GD-12F2/0 B	US90	NUWTUBE90
	3/0	GD-12F3/0 B	US90	NUWTUBE90
	4/0	GD-12F4/0 B	US90	NUWTUBE90
	250 MCM	GD-12F25 C M B	US90	NUWTUBE90
	300 MCM	GD-12F3 C M B	US90	NUWTUBE90
5/8"	#6	GD-586 L	US32	NUWTUBE32
	#4	GD-584 L	US32	NUWTUBE32
	#2 Sol	GD-582 S 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-5825 C M B	US115	NUWTUBE115
	300 MCM	GD-583 C M B	US115	NUWTUBE115
5/8"	350 MCM	GD-5835 C M B	US115	NUWTUBE115
	500 MCM	GD-585 C M 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-342 S 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-3425 C M B	US90	NUWTUBE90
	300 MCM	GD-343 C M B	US115	NUWTUBE115
1"	350 MCM	GD-3435 C M B	US115	NUWTUBE115
	500 MCM	GD-345 C M B	US150	NUWTUBE150
	750 MCM	GD-3475 C M B	US250	NUWTUBE250
	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-1025 C M B	US150	NUWTUBE150
	300 MCM	GD-103 C M B	US200	NUWTUBE200
	350 MCM	GD-1035 C M B	US200	NUWTUBE200
1"	500 MCM	GD-105 C M B	US200	NUWTUBE200
	750 MCM	GD-1075 C M B	US250	NUWTUBE250
	1000 MCM	GD-101 M B	US300	2-NUWTUBE150

NOTES:

- Molds shown are for copper-clad steel ground rods.
- 1/2" molds are for full size ground rods.
- For welding to 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 330 for details.

Cable to Ground Rod

Mold Information:

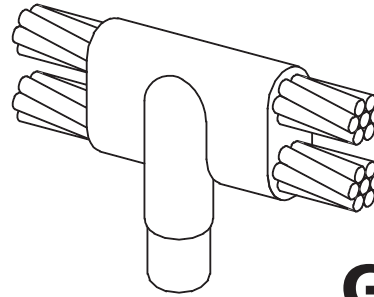
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds listed are for tapered ground rods. For threaded sectional rods, add suffix "S" after the ground rod number. i.e. 58S = 5/8" sectional ground rod.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:

- MH1 - Handle for "K" Price Key Molds
MH2 - Handle for "D" Price Key Molds

Recommended Tools & Accessories:

- CCBRSH1 - Cable Cleaning 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-12F6 K	US90	NUWTUBE90
	#4	GF-12F4 K	US115	NUWTUBE115
	#2 Sol	GF-12F2 S K	US115	NUWTUBE115
	#2	GF-12F2 K	US115	NUWTUBE115
	1/0	GF-12F1/0 K	US150	NUWTUBE150
	2/0	GF-12F2/0 K	US200	NUWTUBE200
	3/0	GF-12F3/0 K	US250	NUWTUBE250
5/8"	4/0	GF-12F4/0 K	US250	NUWTUBE250
	#6	GF-586 K	US90	NUWTUBE90
	#4	GF-584 K	US115	NUWTUBE115
	#2 Sol	GF-582 S 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 K	US300	2-NUWTUBE150
	4/0	GF-584/0 K	US300	2-NUWTUBE150
	250 MCM	GF-5825 C M D	US400	2-NUWTUBE200
	300 MCM	GF-583 C M D	US500	2-NUWTUBE250
	350 MCM	GF-5835 C M 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-342 S 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 K	US300	2-NUWTUBE150
	4/0	GF-344/0 K	US300	2-NUWTUBE150
	250 MCM	GF-3425 C M D	US400	2-NUWTUBE200
	300 MCM	GF-343 C M D	US500	2-NUWTUBE250
1"	350 MCM	GF-3435 C M D	US500	2-NUWTUBE250
	#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 K	US300	2-NUWTUBE150
	3/0	GF-103/0 D	US400	2-NUWTUBE200
	4/0	GF-104/0 D	US400	2-NUWTUBE200
	250 MCM	GF-1025 C M D	US500	2-NUWTUBE250

NOTES:

- Molds shown are for copper-clad steel ground rods.
- 1/2" molds are for full size ground rods.
- For welding to 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 330 for details.

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.
- Molds with Price Key "**L**" and "**M**" SOLD WITH HANDLES.
- 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 270 for details.

Required Tools & Accessories:

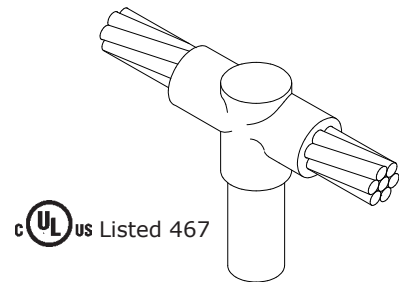
MH1 - Handle for "**B**" Price Key Molds

MH2 - Handle for "**C**" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush



GO

(Horizontal Thru Cable
to Top of Ground Rod)

GO Connection Type

Ground Rod Size	Cable Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE
1/2"	#6	GO-12F6 L	US32	NUWTUBE32
	#4	GO-12F4 L	US32	NUWTUBE32
	#2 Sol	GO-12F2 S B	US90	NUWTUBE90
	#2	GO-12F2 B	US90	NUWTUBE90
	1/0	GO-12F1/0 B	US90	NUWTUBE90
	2/0	GO-12F2/0 B	US90	NUWTUBE90
	3/0	GO-12F3/0 B	US115	NUWTUBE115
	4/0	GO-12F4/0 B	US115	NUWTUBE115
	250 MCM	GO-12F25C M B	US150	NUWTUBE150
5/8"	300 MCM	GO-12F3C M B	US200	NUWTUBE200
	#6	GO-586 L	US32	NUWTUBE32
	#4	GO-584 L	US32	NUWTUBE32
	#2 Sol	GO-582 S 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-5825C M B	US150	NUWTUBE150
	300 MCM	GO-583C M B	US200	NUWTUBE200
	350 MCM	GO-5835C M B	US200	NUWTUBE200
	500 MCM	GO-585C M 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-342 S 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-3425C M B	US150	NUWTUBE150
	300 MCM	GO-343C M B	US200	NUWTUBE200
1"	350 MCM	GO-3435C M B	US200	NUWTUBE200
	500 MCM	GO-345C M B	US250	NUWTUBE250
	750 MCM	GO-3475C M C	US400	2-NUWTUBE200
	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-1025C M B	US200	NUWTUBE200
	300 MCM	GO-103C M B	US200	NUWTUBE200
	350 MCM	GO-1035C M B	US200	NUWTUBE200
	500 MCM	GO-105C M B	US250	NUWTUBE250
	750 MCM	GO-1075C M C	US400	2-NUWTUBE200
	1000 MCM	GO-101M M C	US500	2-NUWTUBE250

NOTES:

- Molds are for copper-clad steel ground rods.
- 1/2" molds are for full size ground rods.
- For welding to 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 330 for details.

Cable to Ground Rod

Mold Information:

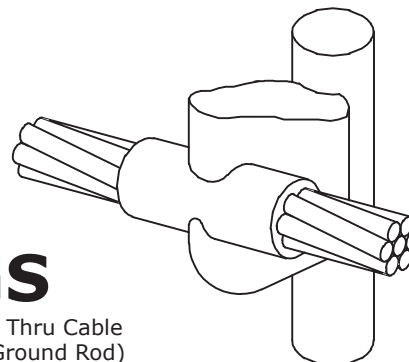
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

- MH1 - Handle for "P" Price Key Molds
- MH2 - Handle for "Y" Price Key Molds
- MH3 - Handle for "R" Price Key Molds

Recommended Tools & Accessories:

- CCBRSH1 - Cable Cleaning 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-12F6 R	US65	NUWTUBE65
	#4	GS-12F4 R	US65	NUWTUBE65
	#2 Sol	GS-12F2 S R	US65	NUWTUBE65
	#2	GS-12F2 R	US65	NUWTUBE65
	1/0	GS-12F1/0 P	US115	NUWTUBE115
	2/0	GS-12F2/0 P	US115	NUWTUBE115
	3/0	GS-12F3/0 P	US150	NUWTUBE150
	4/0	GS-12F4/0 P	US150	NUWTUBE150
	250 MCM	GS-12F25 C P	US150	NUWTUBE150
5/8"	#6	GS-586 R	US65	NUWTUBE65
	#4	GS-584 R	US65	NUWTUBE65
	#2 Sol	GS-582 S 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-5825 C P	US150	NUWTUBE150
	500 MCM	GS-585 C 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-342 S 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-3425 C P	US200	NUWTUBE200
	500 MCM	GS-345 C Y	US500	2-NUWTUBE250

NOTES:

- Molds shown are for copper-clad steel ground rods.
- 1/2" molds are for full size ground rods.
- For welding to 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 330 for details.

Cable to Ground Rod

Mold Information:

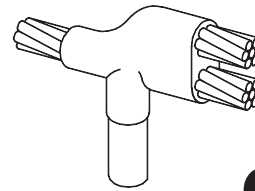
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds listed are for tapered ground rods. For threaded sectional rods, add suffix "S" after the ground rod number. i.e. 58S = 5/8" sectional ground rod.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:

- MH1 - Handle for "K" Price Key Molds
MH2 - Handle for "D" Price Key Molds

Recommended Tools & Accessories:

- CCBRSH1 - Cable Cleaning 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-582 S 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-5825 CM K	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-342 S 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-3425 CM K	US300	2-NUWTUBE150
	300 MCM	GT-343 CM D	US400	2-NUWTUBE200
	350 MCM	GT-3435 CM D	US400	2-NUWTUBE200

Ground Rod to Ground Rod

Mold Information:

- 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 "B" Price Key Molds
MH2 - Handle for "C" Price Key Molds

Recommended Tools & Accessories:

- CCBRSH1 - Cable Cleaning Brush
MCBRSH1 - Mold Cleaning Brush

GG Connection Type

Ground Rod Size	Heavy Duty Mold		
	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
1/2"	GG-12 F 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 shown are for copper-clad steel ground rods.
- 1/2" molds are for full size ground rods.
- For welding to 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 330 for details.

Cable to Steel Surface

Mold Information:

- **HB** mold cable is off the steel surface.
- **HD** mold cable is on the steel surface.
- **HD** molds used on conductors 1/0 and larger may need Mold Sealer (MLDSLRL, see page 324).
- 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 HB mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

MH1 - Handle for "**B**" Price Key Molds

MH2 - Handle for "**C**" Price Key Molds

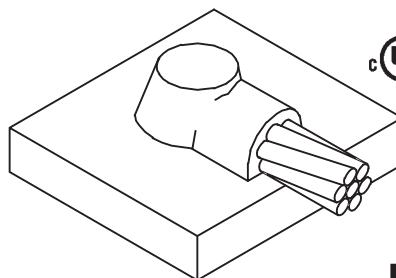
Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush

UMHDKIT - Hold Down Kit

UMMHDA - Hold Down Kit when Price Key is "**A**"



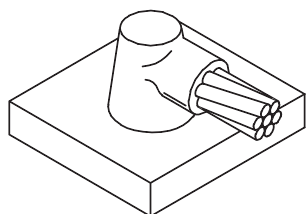
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HD

(Horizontal Cable to Horizontal Flat Steel Surface, ON Surface)

HD Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6 Sol	HD-6 SA	US45	NUWTUBE45
#6	HD-6 A	US45	NUWTUBE45
#4	HD-4 A	US45	NUWTUBE45
#2 Sol	HD-2 SA	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-25 CMB	US115	NUWTUBE115
300 MCM	HD-30 CMB	US150	NUWTUBE150
350 MCM	HD-35 CMB	US200	NUWTUBE200
500 MCM	HD-50 CMB	US200	NUWTUBE200
750 MCM	HD-75 CMB	US300	2-NUWTUBE150
1000 MCM	HD-1 MMC	US400	2-NUWTUBE200



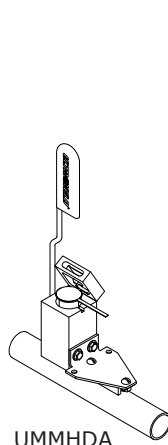
HB

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(Horizontal Cable to Horizontal Flat Steel Surface, OFF Surface)

HB Connection Type

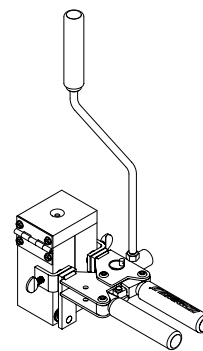
Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	HB-6 B	US65	NUWTUBE65
#2 Sol	HB-2 SB	US65	NUWTUBE65
#2	HB-2 B	US65	NUWTUBE65
1/0	HB-1/0 B	US90	NUWTUBE90
2/0	HB-2/0 B	US90	NUWTUBE90
3/0	HB-3/0 B	US115	NUWTUBE115
4/0	HB-4/0 B	US115	NUWTUBE115
250 MCM	HB-25 CMB	US115	NUWTUBE115
300 MCM	HB-30 CMB	US150	NUWTUBE150
350 MCM	HB-35 CMB	US200	NUWTUBE200
500 MCM	HB-50 CMB	US200	NUWTUBE200
750 MCM	HB-75 CMB	US300	2-NUWTUBE150
1000 MCM	HB-1 MMC	US400	2-NUWTUBE200



UMMHDA



UMHDKIT



UMHDKIT with Mold & Handle

U.S. Patent No. 6,382,496

Cable to Steel Surface / Pipe

Mold Information:

- **HB** mold cable is **off** the pipe surface.
- **HD** mold cable is **on** the pipe surface.
- **HD** molds used on conductors 1/0 and larger may need Mold Sealer (MLDSLR, see page 324).
- 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.
- 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 270 for details.

Required Tools & Accessories:

MH1 - Handle for "B" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

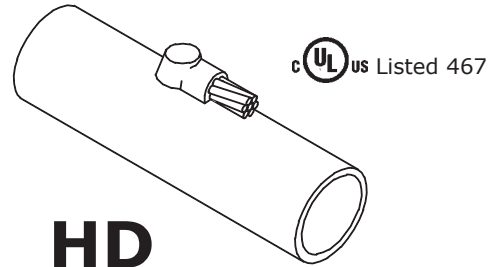
MCBRSH1 - Mold Cleaning Brush

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)

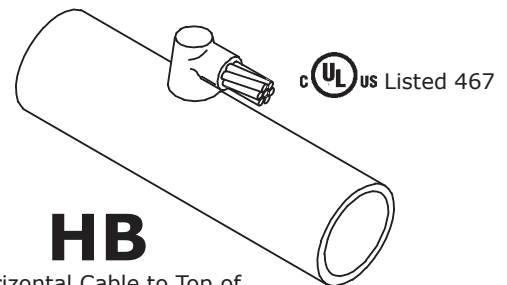
HD (Pipe) Connection Type

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-1/02.5B		

[°] See page 329 for pipe sizes.



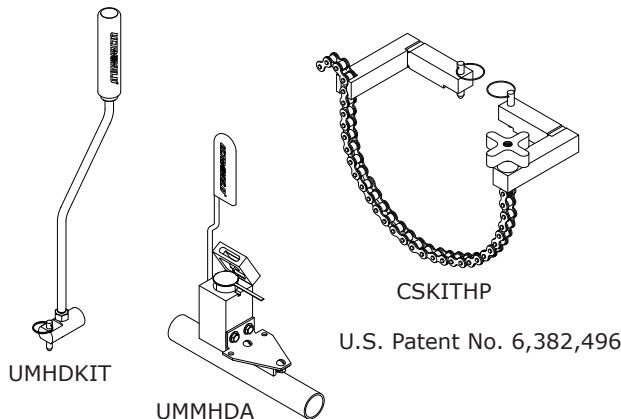
HB

(Horizontal Cable to Top of Horizontal Steel Pipe, OFF Surface)

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.



Cable to Steel Surface

Mold Information:

- **HU** mold cable is **off** the steel surface.
- **HT** mold cable is **on** the steel surface.
- **HT** molds used on conductors 1/0 and larger may need Mold Sealer (MLDSLRL, see page 324).
- 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 270 for details.

Required Tools & Accessories:

MH1 - Handle for "**B**" Price Key Molds

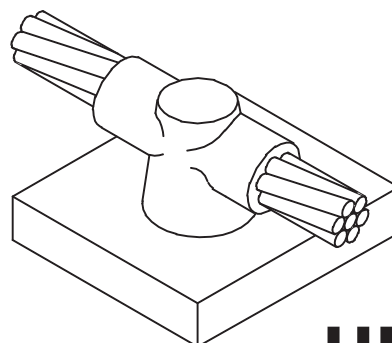
Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush

UMHDKIT - Hold Down Kit

UMMHDA - Hold Down Kit when Price Key is "**A**"

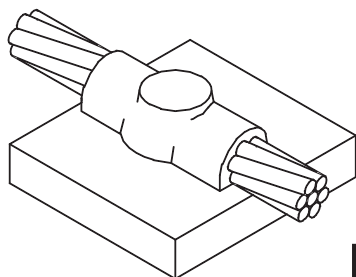


HU

(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-25C M	US150	NUWTUBE150
300 MCM	HU-3C M	US200	NUWTUBE200
350 MCM	HU-35C M	US250	NUWTUBE250
500 MCM	HU-5C M	US300	2-NUWTUBE150

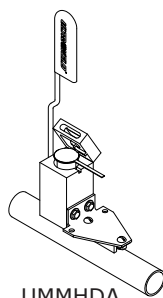


HT

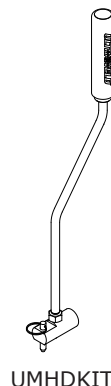
(Horizontal Thru Cable to Horizontal Flat Steel Surface, ON Surface)

HT Connection Type

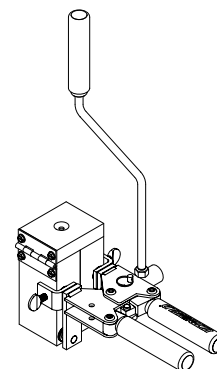
Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	HT-6 A	US45	NUWTUBE45
#4	HT-4 A	US45	NUWTUBE45
#2 Sol	HT-2S A	US45	NUWTUBE45
#2	HT-2 A	US45	NUWTUBE45
1/0	HT-1/0 B	US90	NUWTUBE90
2/0	HT-2/0 B	US115	NUWTUBE115
3/0	HT-3/0 B	US115	NUWTUBE115
4/0	HT-4/0 B	US150	NUWTUBE150
250 MCM	HT-25C M	US150	NUWTUBE150
300 MCM	HT-3C M	US200	NUWTUBE200
350 MCM	HT-35C M	US200	NUWTUBE200
500 MCM	HT-5C M	US300	2-NUWTUBE150



UMMHDA



UMHDKIT



UMHDKIT with Mold & Handle

U.S. Patent No. 6,382,496

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 **VA** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

MH1 - Handle for "B" Price Key Molds

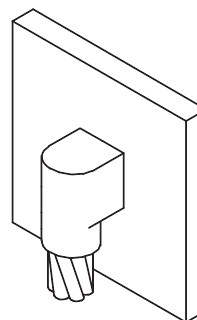
MH2 - Handle for "C" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush

MSKIT - Magnetic Support Kit

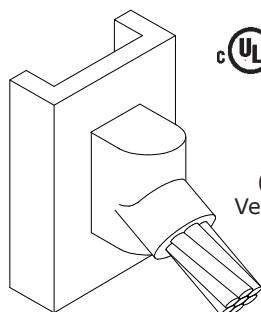


VD

(Vertical Downward Cable 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-2 SB	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-25C MB	US200	NUWTUBE200
300 MCM	VD-30C MB	US200	NUWTUBE200
350 MCM	VD-35C MB	US250	NUWTUBE250
500 MCM	VD-50C B	US300	2-NUWTUBE150



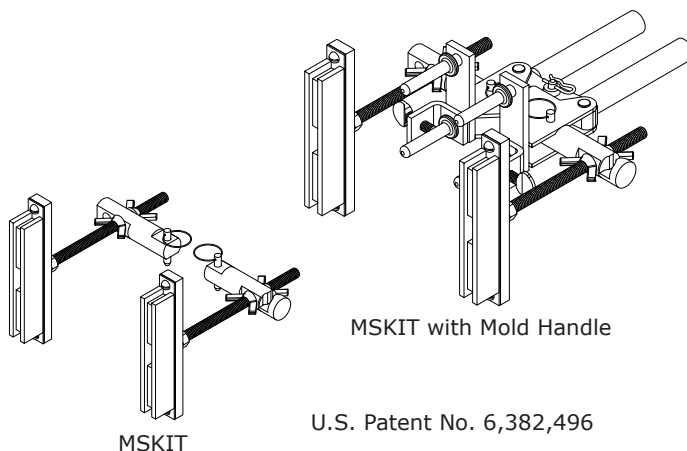
cUL US Listed 467

VA

(Cable Down at 45° to Vertical Flat Steel Surface)

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-2 SB	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-25C MB	US115	NUWTUBE115
300 MCM	VA-30C MB	US150	NUWTUBE150
350 MCM	VA-35C MB	US200	NUWTUBE200
500 MCM	VA-50C B	US200	NUWTUBE200
750 MCM	VA-75C MC	US300	2-NUWTUBE150
1000 MCM	VA-1M MC	US400	2-NUWTUBE200



Cable to Steel Surface / Pipe

Mold Information:

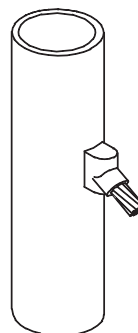
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

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 - Cable Cleaning Brush
- MCBRSH1 - Mold Cleaning Brush



VA

(Cable Down at 45° to Side of Vertical or Horizontal Steel Pipe)

cUL US Listed 467

VA (Pipe) Connection Type (Range Taking)

Cable Size	Nominal Pipe Size	Mold Part No.	Weld Metal		Cable Size	Nominal Pipe Size	Mold Part No.	Weld Metal	
			UltraShot	NUWTUBE				UltraShot	NUWTUBE
#6	1-1/4" to 4" Pipe	VA-6V1.25X4 B	US45	NUWTUBE45	1/0	2" to 4" Pipe	VA-1/0V2X4 B	US90	NUWTUBE90
	4" to 6" Pipe	VA-6V4X6 B	US45	NUWTUBE45		4" to 6" Pipe	VA-1/0V4X6 B	US90	NUWTUBE90
	6" to 10" Pipe	VA-6V6X10 B	US45	NUWTUBE45		6" to 10" Pipe	VA-1/0V6X10 B	US90	NUWTUBE90
	12" to 30" Pipe	VA-6V12X30 B	US45	NUWTUBE45		12" to 30" Pipe	VA-1/0V12X30 B	US90	NUWTUBE90
	32" Pipe or Larger	VA-6 B	US45	NUWTUBE45		32" Pipe or Larger	VA-1/0 B	US90	NUWTUBE90
#4	1-1/2" to 4" Pipe	VA-4V1.5X4 B	US45	NUWTUBE45	2/0	2" to 4" Pipe	VA-2/0V2X4 B	US90	NUWTUBE90
	4" to 6" Pipe	VA-4V4X6 B	US45	NUWTUBE45		4" to 6" Pipe	VA-2/0V4X6 B	US90	NUWTUBE90
	6" to 10" Pipe	VA-4V6X10 B	US45	NUWTUBE45		6" to 10" Pipe	VA-2/0V6X10 B	US90	NUWTUBE90
	12" to 30" Pipe	VA-4V12X30 B	US45	NUWTUBE45		12" to 30" Pipe	VA-2/0V12X30 B	US90	NUWTUBE90
	32" Pipe or Larger	VA-4 B	US45	NUWTUBE45		32" Pipe or Larger	VA-2/0 B	US90	NUWTUBE90
#2 Sol	1/2" to 1" Pipe	VA-2SV.5X1 B	US45	NUWTUBE45	3/0	2" to 4" Pipe	VA-3/0V2X4 B	US115	NUWTUBE115
	1-1/2" to 4" Pipe	VA-2SV1.5X4 B	US45	NUWTUBE45		4" to 6" Pipe	VA-3/0V4X6 B	US115	NUWTUBE115
	4" to 6" Pipe	VA-2SV4X6 B	US45	NUWTUBE45		6" to 10" Pipe	VA-3/0V6X10 B	US115	NUWTUBE115
	6" to 10" Pipe	VA-2SV6X10 B	US45	NUWTUBE45		12" to 30" Pipe	VA-3/0V12X30 B	US115	NUWTUBE115
	12" to 30" Pipe	VA-2SV12X30 B	US45	NUWTUBE45		32" Pipe or Larger	VA-3/0 B	US115	NUWTUBE115
#2	1-1/2" to 4" Pipe	VA-2V1.5X4 B	US45	NUWTUBE45	4/0	2" to 4" Pipe	VA-4/0V2X4 B	US115	NUWTUBE115
	4" to 6" Pipe	VA-2V4X6 B	US45	NUWTUBE45		4" to 6" Pipe	VA-4/0V4X6 B	US115	NUWTUBE115
	6" to 10" Pipe	VA-2V6X10 B	US45	NUWTUBE45		6" to 10" Pipe	VA-4/0V6X10 B	US115	NUWTUBE115
	12" to 30" Pipe	VA-2V12X30 B	US45	NUWTUBE45		12" to 30" Pipe	VA-4/0V12X30 B	US115	NUWTUBE115
	32" Pipe or Larger	VA-2 B	US45	NUWTUBE45		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 32" and Larger	Nominal Pipe Size [°] 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 329 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 on page 141.

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.

Required Tools & Accessories:

CSH1 - Chain Support Handle clamp for "B" Price Key Molds

OR

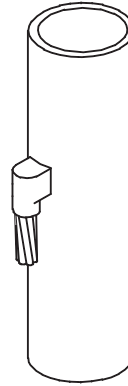
MH1 - Mold Handle for "B" Price Key Molds AND

CSKIT - Chain Support Kit

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

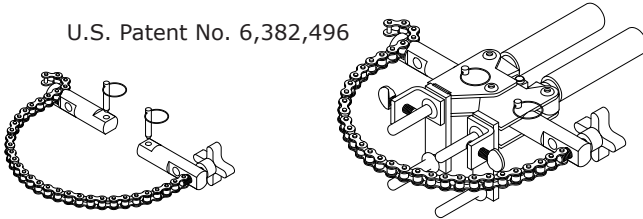
MCBRSH1 - Mold Cleaning Brush



VD

(Vertical Downward Cable to Side of Vertical or Horizontal Steel Pipe)

U.S. Patent No. 6,382,496



CSKIT

CSKIT with Mold Handle

VD (PIPE)

Connection Type (Range Taking)

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

Mold Part No.	Cable Size	Nominal Round Fence Post Size	Weld Metal	
			UltraShot	NUWTUBE
VD-2SV1.25X4 B	#2 Sol	1-1/4" to 4" Post	US65	NUWTUBE65
VD-2V1.25X4 B	#2	1-1/4" to 4" Post	US65	NUWTUBE65
VDRFP-1/0 B	1/0	1-1/4" to 4" Post	US90	NUWTUBE90
VDRFP-2/0 B	2/0	1-1/4" to 4" Post	US90	NUWTUBE90
VDRFP-4/0 B	4/0	1-1/4" to 4" Post	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 329 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 on page 141.

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 270 for details.

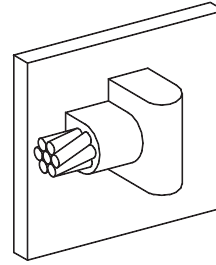
Required Tools & Accessories:

MH1 - Handle for "B" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush

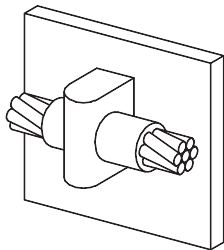


VL

(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-2 SB	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-25C MB	US115	NUWTUBE115
300 MCM	VL-3C MB	US150	NUWTUBE150
350 MCM	VL-35C MB	US200	NUWTUBE200
500 MCM	VL-5C MB	US200	NUWTUBE200



VH

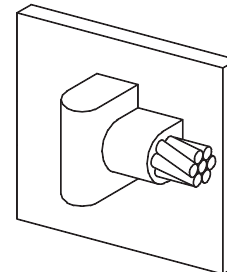
(Horizontal Thru Cable to Vertical Flat Steel Surface)

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-2 SB	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-25C MB	US150	NUWTUBE150

♦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-6B.



VR

(Horizontal Dead End Cable to Vertical Flat Steel Surface°)

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 VH mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

For **VH** mold: MH1 - Mold Handle for "B" Price Key Molds **AND**

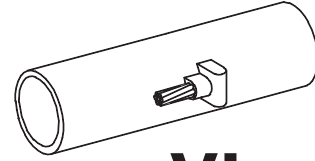
CSKITHSVM - Chain Support Kit for VH Mold

For **VL & VR** molds: MH1 - Handle for "B" Price Key Molds

Recommended Tools & Accessories:

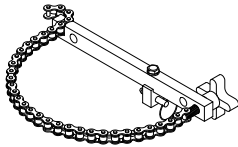
CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush



VL

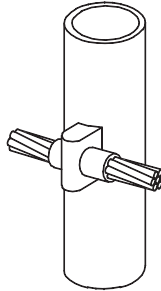
(Horizontal Dead End Cable to Side of Horizontal Steel Pipe°)



CSKITHSVM
(Required for VH Mold)

VH

(Horizontal Thru Cable to Side of Vertical 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.

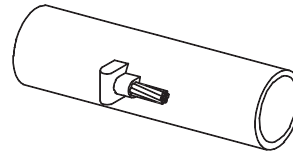
VH (Pipe) Connection Type

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.

♦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-6B.



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 329 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 329 for pipe sizes.

Cable to Steel Surface

Mold Information:

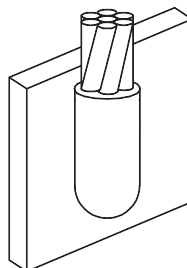
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For VT mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

- MH1 - Handle for "B" and "K" Price Key Molds
- MH2 - Handle for "D" Price Key Molds

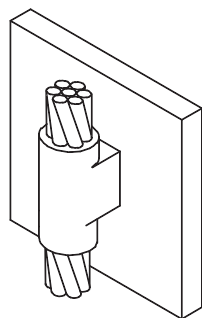
Recommended Tools & Accessories:

- CCBRSH1 - Cable Cleaning Brush
- MCBRSH1 - Mold Cleaning Brush
- MSKIT - Magnetic Support Kit



VU

(Vertical Cable Dead End to Vertical Flat Steel Surface)



VT

(Vertical Thru Cable to Vertical Flat Steel Surface)

VU Connection Type

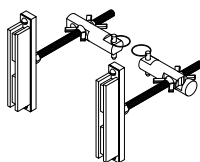
Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VU-6 B	US65	NUWTUBE65
#4	VU-4 B	US65	NUWTUBE65
#2 Sol	VU-2 SB	US65	NUWTUBE65
#2	VU-2 B	US65	NUWTUBE65
1/0	VU-1/0 B	US150	NUWTUBE150
2/0	VU-2/0 B	US150	NUWTUBE150
3/0	VU-3/0 K	US200	NUWTUBE200
4/0	VU-4/0 K	US200	NUWTUBE200
250 MCM	VU-25CM K	US200	NUWTUBE200
300 MCM	VU-3CM K	US250	NUWTUBE250
350 MCM	VU-35CM K	US300	2-NUWTUBE150
500 MCM	VU-5CMD*	US400	2-NUWTUBE200
750 MCM	VU-75CMD*	US500	2-NUWTUBE250

* MSKITXL recommended

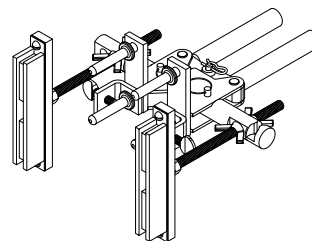
VT Connection Type

Cable Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTUBE
#6	VT-6 B	US90	NUWTUBE90
#4	VT-4 B	US90	NUWTUBE90
#2 Sol	VT-2 SB	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

* MSKITXL recommended



MSKIT



MSKIT with Mold Handle

U.S. Patent No. 6,382,496

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 **VT** mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

CSH1 - Chain Support Handle clamp for "B" and "K" Price Key Molds

OR

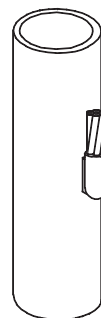
MH1 - Mold Handle for "B" and "K" Price Key Molds **AND**

CSKIT - Chain Support Kit

Recommended Tools & Accessories:

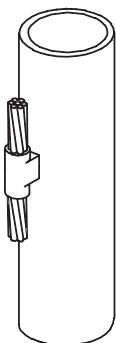
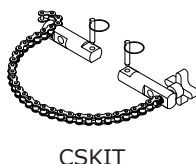
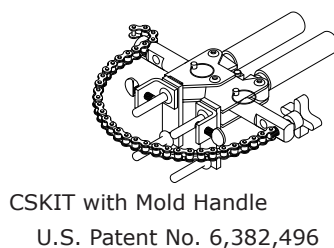
CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush



VU

(Vertical Cable Dead End to Side of Vertical or Horizontal Steel Pipe)



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 329 for pipe sizes.

Cable to Lug or Busbar

Mold Information:

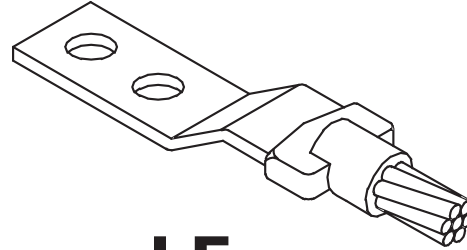
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

- MH1 - Handle for "B" Price Key Molds
- MH2 - Handle for "C" Price Key Molds

Recommended Tools & Accessories:

- CCBRSH1 - Cable Cleaning Brush
- MCBRSH1 - Mold Cleaning Brush



LE

(Butt End Splice of Horizontal Cable to Lug or Busbar)

See pages 307 & 308 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	LE-1/0181 B	US45	NUWTUBE45
	1/4 x 1	LE-1/0141 B	US65	NUWTUBE65
2/0	1/8 x 1	LE-2/0181 B	US65	NUWTUBE65
	1/4 x 1	LE-2/0141 B	US65	NUWTUBE65
3/0	3/16 x 1	LE-3/03161 B	US90	NUWTUBE90
	1/4 x 1	LE-3/0141 B	US90	NUWTUBE90
4/0	3/16 x 1	LE-4/03161 B	US90	NUWTUBE90
	1/4 x 1	LE-4/0141 B	US90	NUWTUBE90
	1/4 x 1-1/4	LE-4/0141.25 B	US90	NUWTUBE90
	1/4 x 1-1/2	LE-4/0141.5 B	US90	NUWTUBE90
250 MCM	1/4 x 1	LE-25CM141 B	US90	NUWTUBE90
	1/4 x 1-1/4	LE-25CM141.25 B	US90	NUWTUBE90
	1/4 x 1-1/2	LE-25CM141.5 B	US90	NUWTUBE90
500 MCM	1/4 x 1-1/2	LE-5CM141.5 B	US200	NUWTUBE200
	1/4 x 2	LE-5CM142 B	US200	NUWTUBE200
	3/8 x 1	LE-5CM381 B	US200	NUWTUBE200
	3/8 x 1-1/2	LE-5CM381.5 B	US200	NUWTUBE200
	3/8 x 2	LE-5CM382 B	US300	2-NUWTUBE150
750 MCM	1/4 x 2	LE-75CM142 C	US300	2-NUWTUBE150
	3/8 x 1-1/2	LE-75CM381.5 C	US300	2-NUWTUBE150
	3/8 x 2	LE-75CM382 B	US300	2-NUWTUBE150
1000 MCM	3/8 x 2	LE-1MM382 C	US400	2-NUWTUBE200
	7/16 x 2	LE-1MM7162 C	US400	2-NUWTUBE200
	1/2 x 2	LE-1MM122 C	US500	2-NUWTUBE250

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 270 for details.

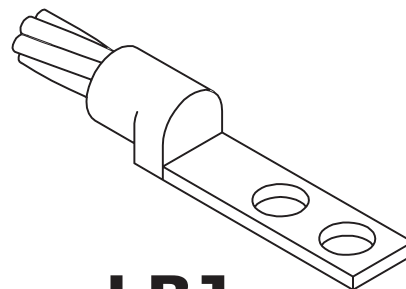
Required Tools & Accessories:

MH1 - Handle for "B" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush

MCBRSH1 - Mold Cleaning Brush



LBJ

(Butt End Splice of Horizontal Cable to Lug Bent J)

See page 308 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	US32	NUWTUBE32
1/0	1/8 x 1	LBJ-1/0181 B	US45	NUWTUBE45
2/0	1/8 x 1	LBJ-2/0181 B	US45	NUWTUBE45
	3/16 x 1	LBJ-2/03161 B	US65	NUWTUBE65
3/0	1/8 x 1	LBJ-3/0181 B	US65	NUWTUBE65
	3/16 x 1	LBJ-3/03161 B	US65	NUWTUBE65
4/0	1/8 x 1	LBJ-4/0181 B	US65	NUWTUBE65
	3/16 x 1	LBJ-4/03161 B	US65	NUWTUBE65

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.

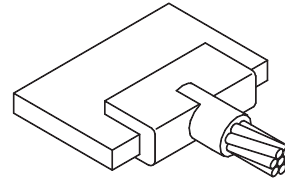
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:

- MH1 - Handle for "B" Price Key Molds
- MH2 - Handle for "C" Price Key Molds

Recommended Tools & Accessories:

- CCBRSH1 - Cable Cleaning 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-141.52 SB	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-141.525C MB	US115	NUWTUBE115
	300 MCM	BE-141.53C MB	US115	NUWTUBE115
	350 MCM	BE-141.535C MB	US150	NUWTUBE150
3/8 x 1-1/2 & WIDER	500 MCM	BE-141.55C MB	US200	NUWTUBE200
	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-381.525C MB	US150	NUWTUBE150
	300 MCM	BE-381.53C MB	US150	NUWTUBE150
	350 MCM	BE-381.535C MB	US200	NUWTUBE200
	500 MCM	BE-381.55C MB	US250	NUWTUBE250
	750 MCM	BE-381.575C MC	US300	2-NUWTUBE150
	1000 MCM	BE-381.51M MC	US400	2-NUWTUBE200

Cable to Reinforcing Steel

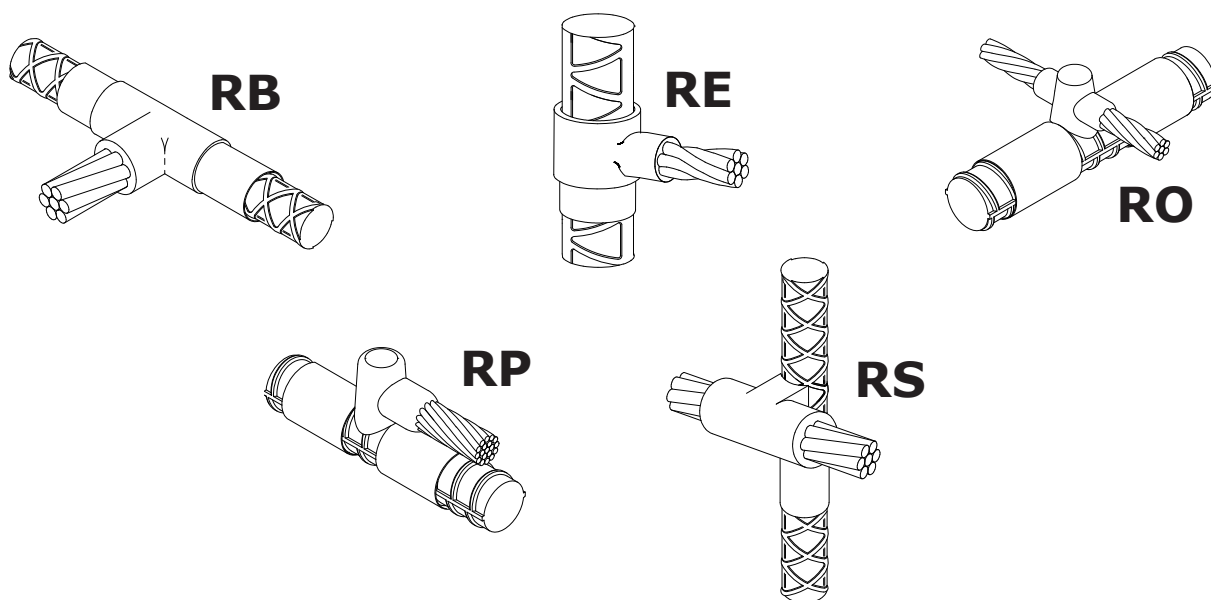
APPLICATION NOTES:

Ultraweld Connections Used for Grounding Reinforcing Steel

The Ultraweld process is ideal for providing permanent connections of grounding conductors and lightning protection conductors to reinforcing steel. Exothermically welding to the reinforcing steel 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 reinforcing steel 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 reinforcing steel and thus prevents weld metal leakage. A piece of packing material is good for one connection.

Ultraweld Connections to Structural Reinforcing Steel

The Ultraweld process is only to be used for attaching conductors to reinforcing steel and not as a means to provide a structural welded joint of the reinforcing steel itself. The welding of ground conductors to reinforcing steel using the Ultraweld process will not be harmful if the stresses in the reinforcing steel are below its yield point. Design stresses for reinforcing steel 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 reinforcing steel in areas away from the point of maximum stress. It is best to make connections near the free end of the reinforcing steel.



Cable to Reinforcing Steel

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:

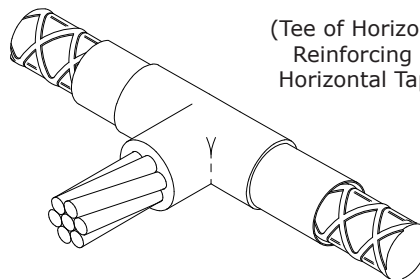
MH1 - Handle for "B" Price Key Molds
WRPSLV - Wrap Sleeve Packing Material

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush
MCBRSH1 - Mold Cleaning Brush

RB

(Tee of Horizontal Thru
Reinforcing steel &
Horizontal Tap Cable)



Important: See Packing Material Notes.

RB Connection Type

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	4/0	RB-34/0 B	WRPSLV	US115	NUWTUBE115
	#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
5	3/0	RB-43/0 B	WRPSLV	US115	NUWTUBE115
	4/0	RB-44/0 B	WRPSLV	US115	NUWTUBE115
	#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
6	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	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

- (2) #WRPSLV Wrap Sleeves required per weld.

Packing Material Notes

Packing Material or Wrap Sleeve(s) are necessary when making Ultraweld connections to reinforcing steel. 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 reinforcing steel 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 323 & 324 for Packing Material.

Cable to Reinforcing Steel

Mold Information:

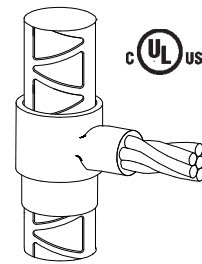
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:

- WRPSLV or CERPM - Packing Material
- MH1 - Handle for "B" and "K" Price Key Molds
- **CSKIT or CSH1 - Chain Support Kit or Chain Support Handle clamp for #7 & Larger reinforcing steel

Recommended Tools & Accessories:

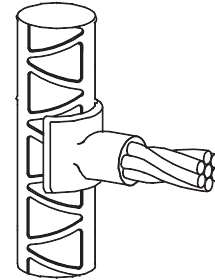
- CCBRSH1 - Cable Cleaning Brush
- MCBRSH1 - Mold Cleaning Brush



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RE

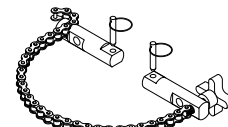
(Tee of Vertical Thru Reinforcing Steel & Horizontal Tap Cable)



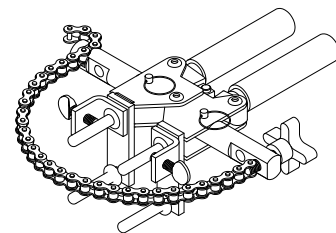
RE 7 & Larger

RE Connection Type

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-32 SB	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-42 SB	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-52 SB	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
6	#6	RE-66 B	WRPSLV	US45	NUWTUBE45
	#4	RE-64 B	WRPSLV	US65	NUWTUBE65
	#2 Sol	RE-62 SB	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-7L2 SK	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



CSKIT



CSKIT with Mold Handle

U.S. Patent No. 6,382,496

Important: See Packing Material Notes On Page 298.

**Requires #CSKIT Chain Support Kit for welds made to #7 and Larger reinforcing steel.

- (1) #WRPSLV Wrap Sleeve required per weld.
- (1) #CERPM3 Ceramic Packing Material required per weld.

Cable to Reinforcing Steel

Mold Information:

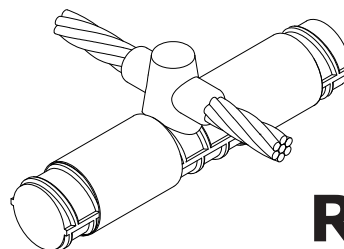
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Price Key is the **Bold Letter** in the Mold Part No.
- For mold Wear Plates, add suffix "WP" to the end of the Mold Part No. See page 270 for details.

Required Tools & Accessories:

MH1 - Handle for "B" and "Q" Price Key Molds
WRPSLV or CERPM - Packing Material
UMHDKIT - Hold Down Kit

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush
MCBRSH1 - Mold Cleaning Brush



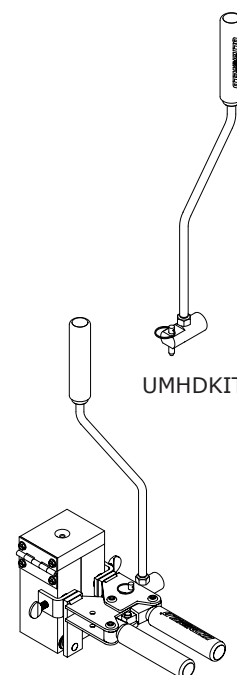
RO

(Cross of Horizontal Cable
Lapped Over Horizontal
Reinforcing Steel)

UL US Listed 467

RO Connection Type

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-32 SB	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-42 SB	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-52 SB	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-6L2 SB	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



UMHDKIT with Mold & Handle
U.S. Patent No. 6,382,496

** Requires #UMHDKIT Hold Down Kit for welds made to #6 and Larger reinforcing steel.

- (2) #WRPSLV Wrap Sleeve required per weld.
- (1) #CERPM1 or #CERPM2 Ceramic Packing Material required per weld.

Important: See Packing Material Notes On Page 298.

Cable to Reinforcing Steel

Mold Information:

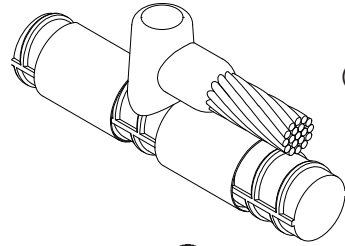
- Molds listed are for stranded cable. For solid conductor, add suffix "S" after conductor number. i.e. 4S = 4 AWG solid conductor.
- Molds with Price Key "A" SOLD WITH FRAME.
- If Frame not required, add suffix "-X" after the Mold Part No.
- Price Key is the **Bold Letter** in the Mold Part No.

Required Tools & Accessories:

MH1 - Handle for "B" Price Key Molds
WRPSLV or CERPM - Packing Material

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning 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 Reinforcing Steel)

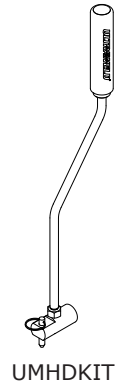
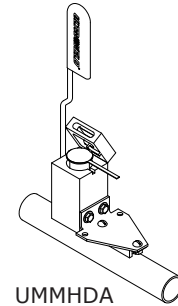
cUL US Listed 467

RP Connection Type

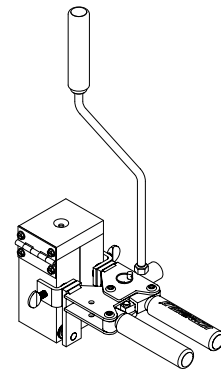
Size	Cable Size	Mold Part No.	Packing Mat'l No.	Weld Metal	
				UltraShot	NUWTUBE
3	#6	RP-36 B	WRPSLV	US25	NUWTUBE25
	#4	RP-34 B	WRPSLV	US32	NUWTUBE32
	#2 Sol	RP-32S B	WRPSLV	US45	NUWTUBE45
	#2	RP-32 B	WRPSLV	US45	NUWTUBE45
	1/0	RP-31/0 B	WRPSLV	US90	NUWTUBE90
	2/0	RP-32/0 B	WRPSLV	US90	NUWTUBE90
	3/0	RP-33/0 B	WRPSLV	US115	NUWTUBE115
4 & 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 #UMHDKIT Hold Down Kit for welds made to #6 and Larger reinforcing steel.

- (2) #WRPSLV Wrap Sleeve required per weld.
- (1) #CERPM1 or #CERPM2 Ceramic Packing Material required per weld.



U.S. Patent No. 6,382,496



UMHDKIT with Mold & Handle

Important: See Packing Material Notes On Page 298.

Cable to Reinforcing Steel

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 270 for details.

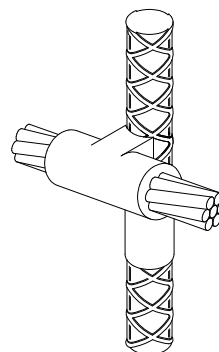
Required Tools & Accessories:

MH1 - Handle for "B" and "P" Price Key Molds
WRPSLV or CERPM3 - Packing Material

**CSKITHSVM - Chain Support Kit for #7 and Larger reinforcing steel

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning Brush
MCBRSH1 - Mold Cleaning Brush



RS

(Horizontal Thru Cable
to Side of Vertical
Reinforcing Steel)

RS Connection Type

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	4/0	RS-34/0 P	WRPSLV	US150	NUWTUBE150
	#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
5	3/0	RS-43/0 P	WRPSLV	US150	NUWTUBE150
	4/0	RS-44/0 P	WRPSLV	US150	NUWTUBE150
	#6	RS-56 P	WRPSLV	US90	NUWTUBE90
	#4	RS-54 P	WRPSLV	US90	NUWTUBE90
	#2 Sol	RS-52S P	WRPSLV	US90	NUWTUBE90
6	#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

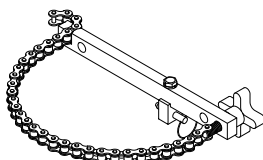
RS Connection Type continued

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
7** & Larger	4/0	RS-64/0 P	WRPSLV	US150	NUWTUBE150
	#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
7** & Larger	3/0	RS-7L3/0 B	CERPM3	US150	NUWTUBE150
	4/0	RS-7L4/0 B	CERPM3	US150	NUWTUBE150

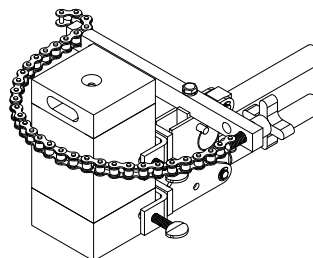
** Requires #CSKITHSVM Chain Support Kit for welds made to #7 and Larger reinforcing steel.

- (1) #WRPSLV Wrap Sleeve required per weld.
- (1) #CERPM3 Ceramic Packing Material required per weld.

U.S. Patent No. 6,382,496



CSKITHSVM



CSKITHSVM with Mold & Handle

Important: See Packing Material Notes On Page 298.

Cable to Rail 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:

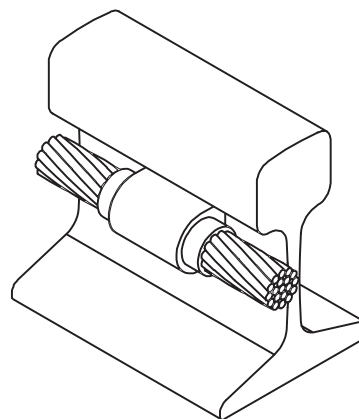
- MH1 - Handle for "K" Price Key Molds
- RMFRMW105C - Rail Clamp

Recommended Tools & Accessories:

- CCBRSH2 - Cable Cleaning Brush
- MCBRSH1 - Mold Cleaning Brush
- RASP - Rasp for cleaning rail

RMVH

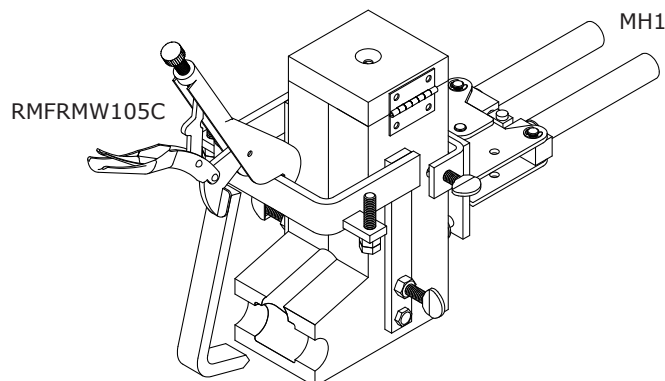
(Rail Mold Vertical Web Horizontal Cable)



RMVH Connection Type

Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTube
4 Concentric	RMVH4WEB K	US90R	NUWTUBE90R
2 Concentric	RMVH2WEB K	US90R	NUWTUBE90R
1 Concentric	RMVH1WEB K	US90R	NUWTUBE90R
1/0 Concentric	RMVH1/0WEB K	US115R	NUWTUBE115R
2/0 Concentric	RMVH2/0WEB K	US115R	NUWTUBE115R
4/0 Concentric	RMVH4/0WEB K	US150R	NUWTUBE150R

- Ultraweld exothermic materials meet requirements of AREMA 8.1.34.
- Mold Sealer may be required for 1/0 and larger conductor.



The adjusting screws on mold frame position conductor at neutral axis of rail where stresses are minimal.

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:

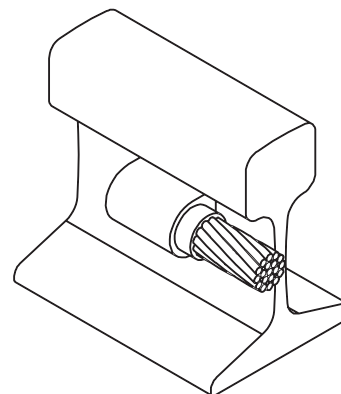
- MH1 - Handle for "K" Price Key Molds
- RMFRMW105C - Rail Clamp

Recommended Tools & Accessories:

- CCBRSH2 - Cable Cleaning Brush
- MCBRSH1 - Mold Cleaning Brush
- RASP - Rasp for cleaning rail

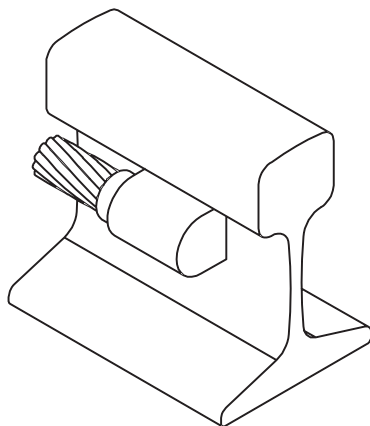
RMVR

(Rail Mold Vertical Web Right Hand Mold)



RMVL

(Rail Mold Vertical Web Left Hand Mold)



RMVR Connection Type

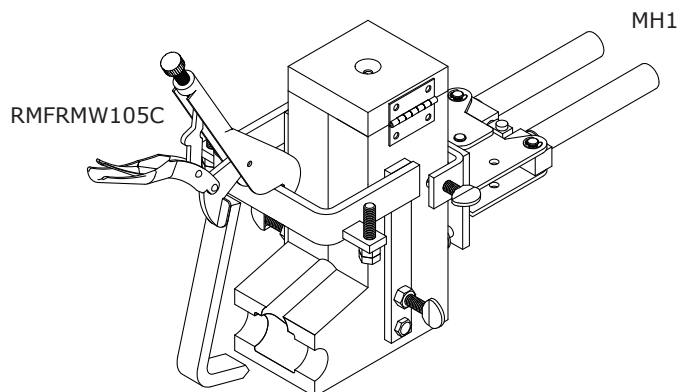
Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTube
4 Concentric	RMVR4WEB K	US65R	NUWTUBE65R
2 Concentric	RMVR2WEB K	US65R	NUWTUBE65R
1 Concentric	RMVR1WEB K	US65R	NUWTUBE65R
1/0 Concentric	RMVR1/0WEB K	US90R	NUWTUBE90R
2/0 Concentric	RMVR2/0WEB K	US90R	NUWTUBE90R
4/0 Concentric	RMVR4/0WEB K	US115R	NUWTUBE115R

- Ultraweld exothermic materials meet requirements of AREMA 8.1.34.
- Mold Sealer may be required for 1/0 and larger conductor.

RMVL Connection Type

Size	Mold Part No.	Weld Metal	
		UltraShot	NUWTube
4 Concentric	RMVL4WEB K	US65R	NUWTUBE65R
2 Concentric	RMVL2WEB K	US65R	NUWTUBE65R
1 Concentric	RMVL1WEB K	US65R	NUWTUBE65R
1/0 Concentric	RMVL1/0WEB K	US90R	NUWTUBE90R
2/0 Concentric	RMVL2/0WEB K	US90R	NUWTUBE90R
4/0 Concentric	RMVL4/0WEB K	US115R	NUWTUBE115R

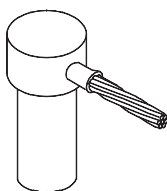
- Ultraweld exothermic materials meet requirements of AREMA 8.1.34.
- Mold Sealer may be required for 1/0 and larger conductor.



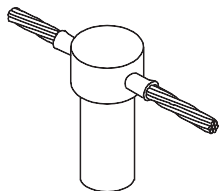
The adjusting screws on mold frame position conductor at neutral axis of rail where stresses are minimal.

cUL US Listed 467

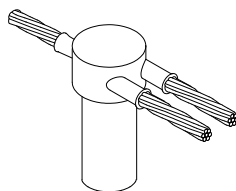
Uni-Shots - NUWTube



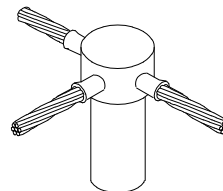
G11



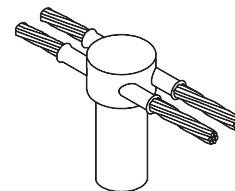
G21



G31



G31*



G41

Type	Cable Sizes		Ground Rod			
	Solid	Stranded	5/8 Copper Clad	5/8 Full	3/4 Copper Clad	3/4 Full
G11	#6, #8	#8	G11-588NU	G11-58F8NU	G11-348NU	G11-34F8NU
G11	#3, #4	#4, #6	G11-584NU	G11-58F4NU	G11-344NU	G11-34F4NU
G11	#1, #2	#2, #3	G11-582NU	G11-58F2NU	G11-342NU	G11-34F2NU
G11	2/0, 1/0	1/0, #1	G11-581/0NU	G11-58F1/0NU	G11-341/0NU	G11-34F1/0NU
G11	-	2/0	G11-582/0NU	G11-58F2/0NU	G11-342/0NU	G11-34F2/0NU
G11	-	4/0	G11-584/0NU	G11-58F4/0NU	G11-344/0NU	G11-34F4/0NU
G21	#6, #8	#8	G21-588NU	G21-58F8NU	G21-348NU	G21-34F8NU
G21	#3, #4	#4, #6	G21-584NU	G21-58F4NU	G21-344NU	G21-34F4NU
G21	#1, #2	#2, #3	G21-582NU	G21-58F2NU	G21-342NU	G21-34F2NU
G21	2/0, 1/0	1/0, #1	G21-581/0NU	G21-58F1/0NU	G21-341/0NU	G21-34F1/0NU
G21	-	2/0	G21-582/0NU	G21-58F2/0NU	G21-342/0NU	G21-34F2/0NU
G21	-	4/0	G21-584/0NU	G21-58F4/0NU	G21-344/0NU	G21-34F4/0NU
G31	#6, #8	#8	G31-588NU	G31-58F8NU	G31-348NU	G31-34F8NU
G31	#3, #4	#4, #6	G31-584NU	G31-58F4NU	G31-344NU	G31-34F4NU
G31	#1, #2	#2, #3	G31-582NU	G31-58F2NU	G31-342NU	G31-34F2NU
G31	2/0, 1/0	1/0, #1	G31-581/0NU*	G31-58F1/0NU*	G31-341/0NU*	G31-34F1/0NU*
G41	#6, #8	#8	G41-588NU	G41-58F8NU	G41-348NU	G41-34F8NU
G41	#3, #4	#4, #6	G41-584NU	G41-58F4NU	G41-344NU	G41-34F4NU
G41	#1, #2	#2, #3	G41-582NU	G41-58F2NU	G41-342NU	G41-34F2NU

NOTES:

- Disposable single use ceramic mold provides convenience and ease of use.
- Packaged 12 per box.
- Requires only a Flint Igniter (FLTIG) to make a connection. See page 323.
- No frames or handle clamps are required.

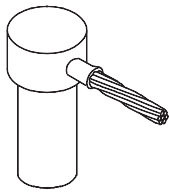
Use locking pliers
to support mold



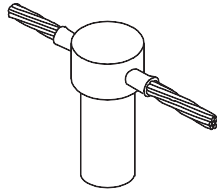
NUWTube
(Pour & Shoot)



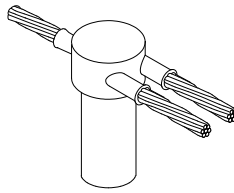
Uni-Shots - UltraShot



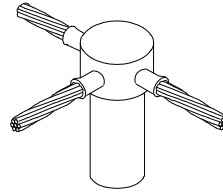
G11



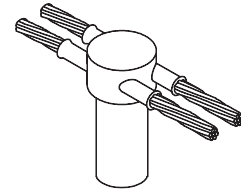
G21



G31



G31*

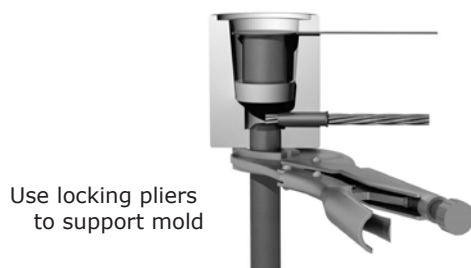


G41

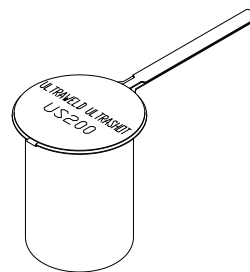
Type	Cable Sizes		Ground Rod			
	Solid	Stranded	5/8 Copper Clad	5/8 Full	3/4 Copper Clad	3/4 Full
G11	#6, #8	#8	G11-588US	G11-58F8US	G11-348US	G11-34F8US
G11	#3, #4	#4, #6	G11-584US	G11-58F4US	G11-344US	G11-34F4US
G11	#1, #2	#2, #3	G11-582US	G11-58F2US	G11-342US	G11-34F2US
G11	2/0, 1/0	1/0, #1	G11-581/0US	G11-58F1/0US	G11-341/0US	G11-34F1/0US
G11	-	2/0	G11-582/0US	G11-58F2/0US	G11-342/0US	G11-34F2/0US
G11	-	4/0	G11-584/0US	G11-58F4/0US	G11-344/0US	G11-34F4/0US
G21	#6, #8	#8	G21-588US	G21-58F8US	G21-348US	G21-34F8US
G21	#3, #4	#4, #6	G21-584US	G21-58F4US	G21-344US	G21-34F4US
G21	#1, #2	#2, #3	G21-582US	G21-58F2US	G21-342US	G21-34F2US
G21	2/0, 1/0	1/0, #1	G21-581/0US	G21-58F1/0US	G21-341/0US	G21-34F1/0US
G21	-	2/0	G21-582/0US	G21-58F2/0US	G21-342/0US	G21-34F2/0US
G21	-	4/0	G21-584/0US	G21-58F4/0US	G21-344/0US	G21-34F4/0US
G31	#6, #8	#8	G31-588US	G31-58F8US	G31-348US	G31-34F8US
G31	#3, #4	#4, #6	G31-584US	G31-58F4US	G31-344US	G31-34F4US
G31	#1, #2	#2, #3	G31-582US	G31-58F2US	G31-342US	G31-34F2US
G31	2/0, 1/0	1/0, #1	G31-581/0US*	G31-58F1/0US*	G31-341/0US*	G31-34F1/0US*
G41	#6, #8	#8	G41-588US	G41-58F8US	G41-348US	G41-34F8US
G41	#3, #4	#4, #6	G41-584US	G41-58F4US	G41-344US	G41-34F4US
G41	#1, #2	#2, #3	G41-582US	G41-58F2US	G41-342US	G41-34F2US

NOTES:

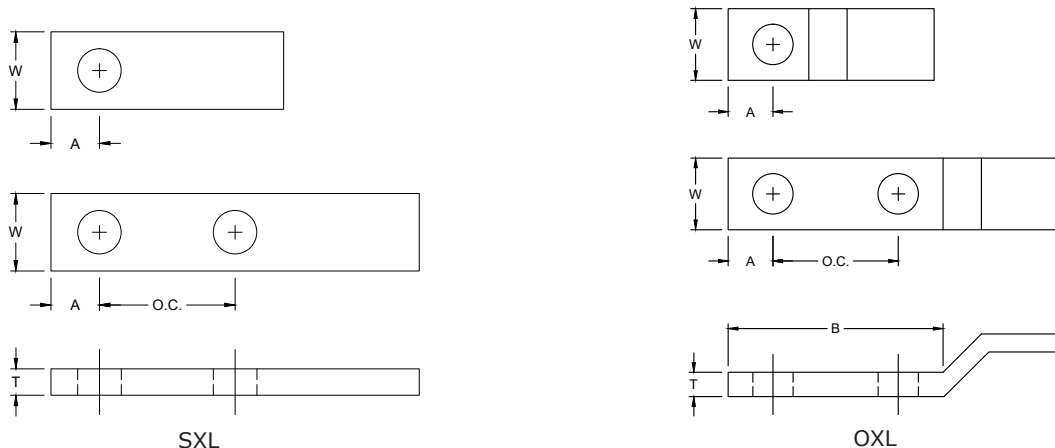
- Disposable single use ceramic mold provides convenience and ease of use.
- Packaged 12 per box.
- No frames or handle clamps are required.
- DRONE or USCONTROLLER required to make UltraShot Uni-Shot connection. See page 316.



UltraShot
(Drop-in)



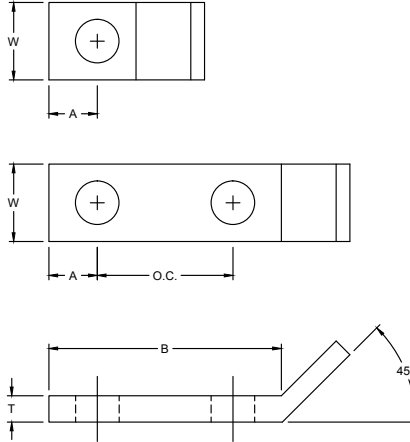
Tinned Copper Lugs Straight & Offset



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 294.

Tinned Copper Lugs Bent & Bent J

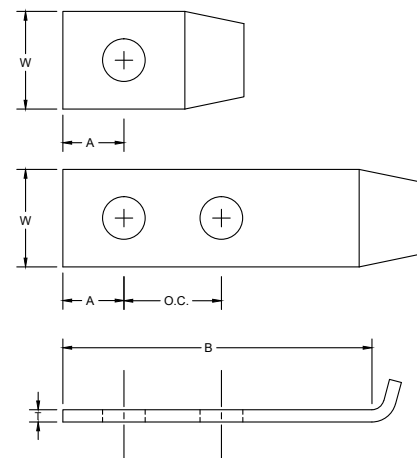


Lug Size	Bent Part No.	No. of Holes	Screw Size	O.C. Dimension	T	W	A	B
1/8 x 1	BXL-181	1	3/8	---	1/8	1	7/16	7/8
	BXL-1812B	2	3/8	.75	1/8	1	5/8	3
	BXL-1812C	2	1/2	1	1/8	1	5/8	3
	BXL-1812D	2	1/2	1.75	1/8	1	5/8	3
3/16 x 1	BXL-3161	1	1/2	---	3/16	1	5/8	1-1/4
	BXL-31612B	2	3/8	.75	3/16	1	5/8	3
	BXL-31612C	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 294.

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

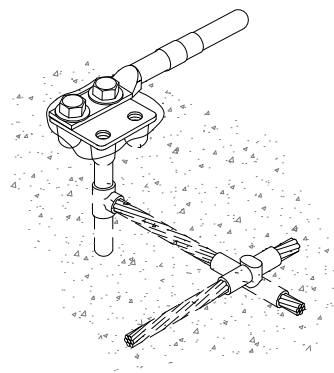
For Use with LBJ Style Molds on Page 295.



Equipment Ground Plates

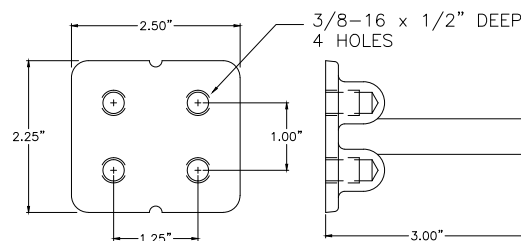
APPLICATION NOTE:

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.



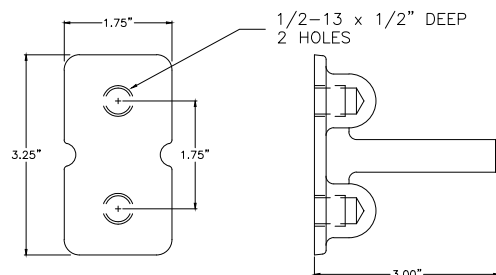
Part No.	Stud Size	Qty.	Approx. Each Wt. (lbs.)
XGP2.5/2.54/0	4/0 AWG Conc	EA	2
XGP2.5/2.55CM	500 MCM Conc	EA	2

- Stud fits mold openings for concentric strand conductor of stud size listed.



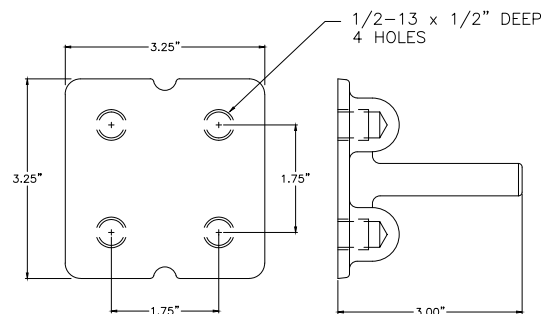
Part No.	Stud Size	Qty.	Approx. Each Wt. (lbs.)
XGP1.75/3.254/0	4/0 AWG Conc	EA	1-1/2

- 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 270 for details.

Required Tools & Accessories:

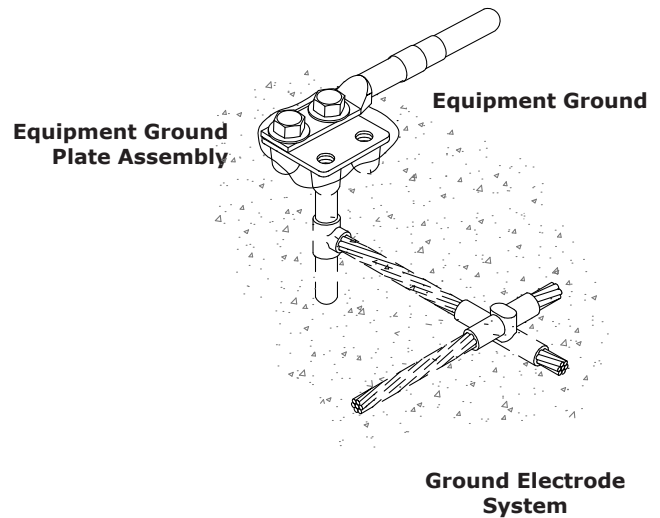
MH1 - Handle for "B" Price Key Molds

Recommended Tools & Accessories:

CCBRSH1 - Cable Cleaning 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:

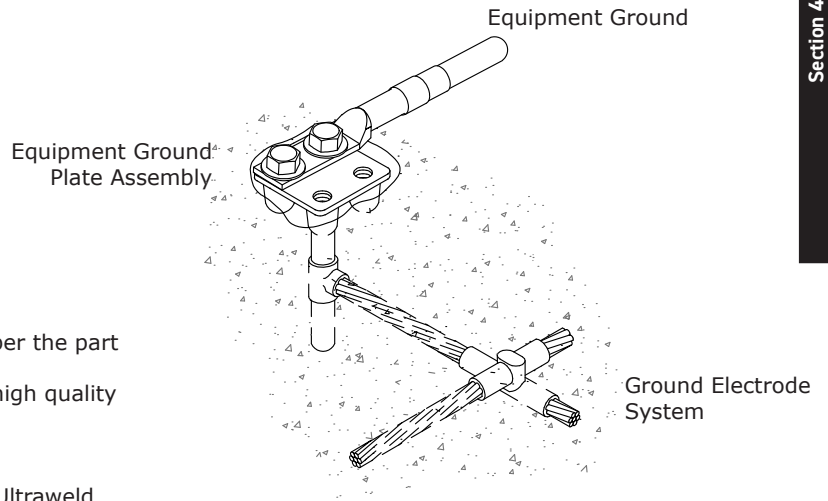
- Style EGPID and EGPIO assemblies have posts formed from the Ultraweld connection that fit into 1/2" pipe that is used for support and positioning the ground plate.

Prefabricated Equipment Ground Plate Assemblies

APPLICATION NOTE:

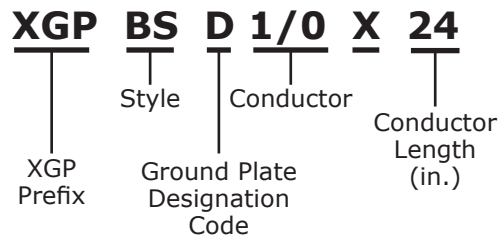
Equipment ground plates are cast into concrete structures to offer convenient high quality connection points to the ground system. The equipment ground plate assemblies provide ease of installation and reduce labor.

- 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 ASTM B584.
- The copper conductor is factory welded using the Ultraweld process.



Part Numbering System:

"XGP" + "Style" + "Ground Plate Designation Code" + "Conductor" + "X" + "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	

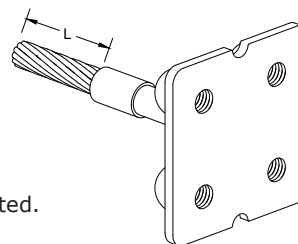
Part Numbering Example:

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.



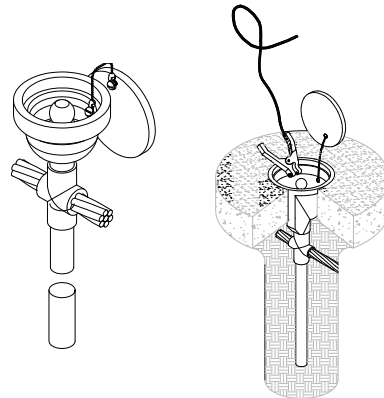
Aircraft Ground Receptacle

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

- Ground receptacle designed to be exothermically connected to a ground rod.
- Includes Brass Ball Stud (BBSTUD12) (See page 26).
- Receptacle: top is 3" in diameter, height is 3-1/2" tall.

APPLICATION NOTES:

- Aircraft Ground Receptacles are used when temporary grounds must be established.
- Used for grounding aircrafts during refueling.



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.
- Custom assemblies available. Please contact factory for more information.

Ufer Ground Assemblies

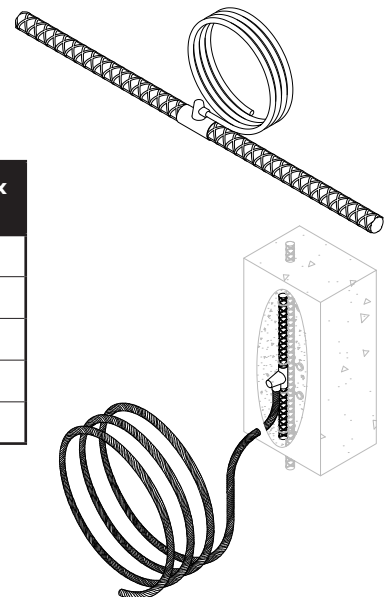
Ufer Ground Assemblies Numbering System

RB5GA 28 X 10

Reinforcing Steel Size Conductor Type Length of Conductor (ft.)

Part No.	Reinforcing Steel 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

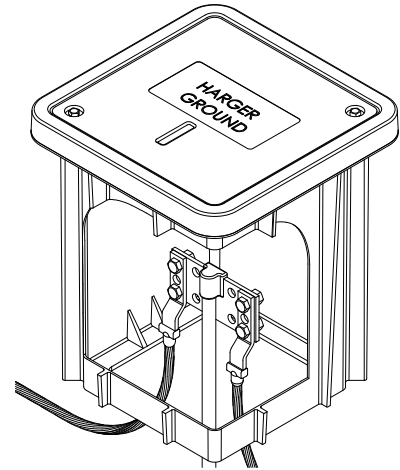
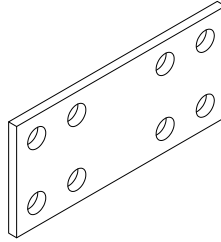
- Prefabricated reinforcing steel ground assembly.
- Standard 24" long reinforcing steel.
- Exothermically welded connection.
- Can be wire tied or welded to reinforcing steel cage prior to concrete pour.
- Conductor can be stubbed out for connection to a downlead or ground grid.
- Other sizes available.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



Ground Access Ground Bar

GB1436.5GRDCB

cUL us Listed 467

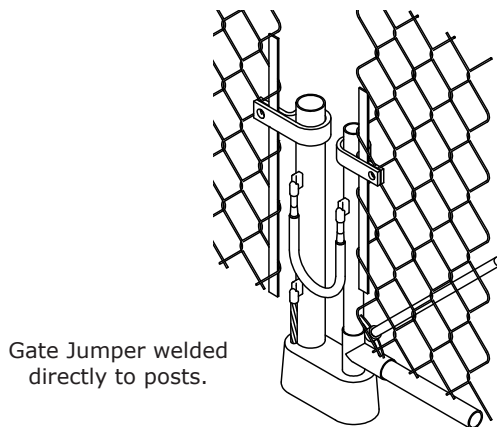
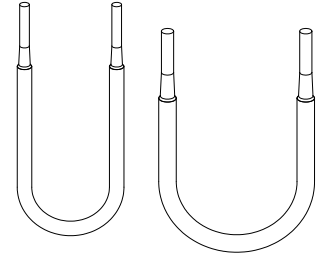


- Provides disconnecting means to grounding system.
- 1/4" x 3" x 6-1/2" electrolytic tough pitch copper alloy 110 bar.
- Accommodates "D" spaced two hole lugs (9/16" punched holes, 1-3/4" on center).
- Use GVSS style mold to exothermically weld ground rod to bar.
 - GVSS58142B for 5/8" copper clad ground rod, 250 weld metal.
 - GVSS34142B for 3/4" copper clad ground rod, 250 weld metal.
- Use OXL or JXL exothermic lugs (See pages 307-308).
- Approximate weight is 2 (1.57) pounds.

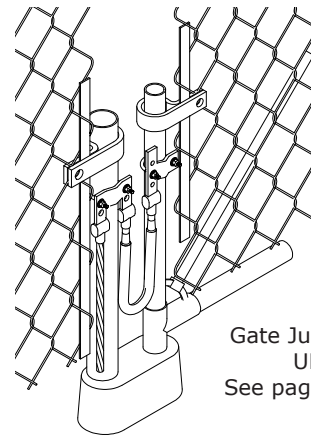
Flexible Gate Jumpers

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 132 for UPC's.

VD (Pipe) Connection Type (Range Taking)

Mold Part No.	Cable Size	Nominal Pipe Size	Weld Metal	
			UltraShot	NUWTUBE
VD-2SV1.25X4B	#2 Sol.	1-1/4" to 4" Pipe	US65	NUWTUBE65
VD-2/0V1.25X4B	2/0	1-1/4" to 4" Pipe	US115	NUWTUBE115
VD-4/0V1.25X4B	4/0	1-1/4" to 4" Pipe	US150	NUWTUBE150

*See page 289 for more VD (Pipe) Connection Types.

LE Connection Type

Mold Part No.	Cable Size	Lug Size	Weld Metal	
			UltraShot	NUWTUBE
LE-2S141B	#2 Sol.	1/4" x 1"	US65	NUWTUBE65
LE-2/0141B	2/0	1/4" x 1"	US65	NUWTUBE65
LE-4/0141B	4/0	1/4" x 1"	US90	NUWTUBE90

*See page 294 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 on page 141.

Materials, Tools & Accessories

UltraShot Controllers

- UltraShot is a patented copper drop-in cartridge that is consumed during the exothermic reaction process initiated by either the DRONE or USCONTROLLER.
- 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.



Part No.	Qty.	Approx. Each Wt. (lbs.)
DRONE	EA	1

- Ignition is accomplished with the use of a hand held DRONE and 18 volt battery.
- Audible ignition alert.
- Makes over 1,300 connections on a single charge.
- UltraBright LED indicates instantaneous ignition.
- Includes six-foot cord with quick latch disconnect.



Part No.	Qty.	Approx. Each Wt. (lbs.)
DRONEKIT	EA	6-1/2

Kit Includes:

- (1) Controller #DRONE - Compact US Controller
- (1) Battery #MIL1820BAT - Milwaukee® M18™ REDLITHIUM™
- (1) Charger #MIL1812CHARGER - Milwaukee® M18™ & M12™ Multi-Voltage
- (1) Case #DRONECASE - Storage case for Drone, Battery and Charger.



Part No.	Qty.	Approx. Each Wt. (lbs.)
USCONTROLLER	EA	11

- 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.

Materials, Tools & Accessories

UltraShot Controller Accessories

DRONE & USCONTROLLER Cords

Part No.	Description	Qty	Approx. Each Wt. (lbs.)
DRONECORD	6' Drone Cord	EA	1/8
DRONECORD15	15' Drone Cord	EA	1/8
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.



Milwaukee® M18™ REDLITHIUM™ Battery

Part No.	Qty.	Approx. Each Wt. (lbs.)
MIL1820BAT	EA	1-1/2

- Utilized by the DRONE to make UltraShot connections.
- 18 volt battery featuring a built-in fuel gauge.



Milwaukee® Charger

Part No.	Qty.	Approx. Each Wt. (lbs.)
MIL1812CHARGER	EA	2

- Accepts M18™ & M12™ battery packs.



DRONE Accessory Kit

Part No.	Qty.	Approx. Each Wt. (lbs.)
DAK	EA	17-1/4

- Includes the Drone Case, Battery & Charger.



Materials, Tools & Accessories

DRONE Storage

Part No.	Qty.	Approx. Each Wt. (lbs.)
DRONECASE	EA	5
DRONEPOUCH	EA	1/4

- Organized storage option.
- DRONECASE holds the Drone, Battery, Charger & Cord (not included).
- DRONEPOUCH easily transports the DRONE hands-free from connection to connection



DRONECASE



DRONEPOUCH

UltraWeld Mold Box

Part No.	Qty.	Approx. Each Wt. (lbs.)
UWMOLDBOX	EA	13

- Convenient and rugged UltraWeld mold storage.
- 20-1/16" long, 8-7/16" wide 9-7/16" tall.
- 20 gauge electrostatically painted steel box, central lockable clasp.
- Aluminum tray included to store 6 Harger UltraWeld price key "B" molds.



UltraShot Box Kit

Part No.	Qty.	Approx. Each Wt. (lbs.)
USBOXKIT	EA	10-1/2

- Convenient and rugged exothermic UltraShot storage.
- 20-1/16" long x 8-7/16" wide x 9-7/16" tall
- 20 gauge electrostatically painted steel box, central lockable clasp.
- 3 stackable aluminum trays included to store Harger UltraShot size range 25-300.
- UltraShot not included. See UltraShot on page 319.
- Additional trays are available.

Kit Includes:

- (1) USBOX Storage Box
- (1) USSBT25/65 Storage Tray
- (1) USSBT90/200 Storage Tray
- (1) USSBT250/300 Storage Tray



USBOX & Storage Trays

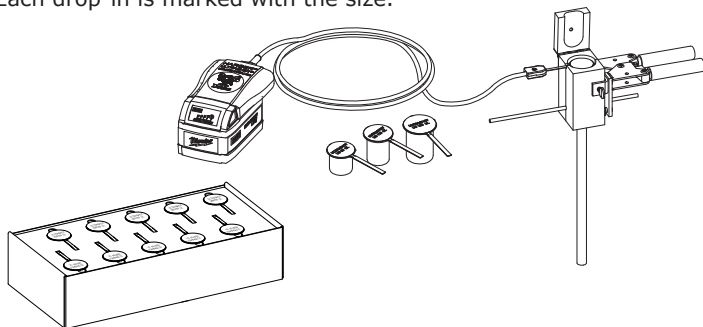
Part No.	Description	For UltraShot Sizes	Total Shot Capacity	Qty.	Approx. Each Wt. (lbs.)
USBOX	Storage Box	n/a	n/a	EA	5-1/2
USSBT25/65	Storage Tray	25 - 65	32	EA	1-1/2
USSBT90/200	Storage Tray	90 - 200	18	EA	1-1/2
USSBT250/300	Storage Tray	250 - 300	18	EA	1-1/2
USSBT400/500	Storage Tray	400 - 500	12	EA	1-1/2

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.

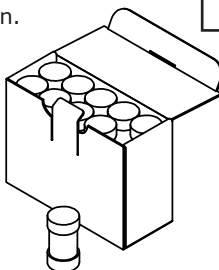


UltraShot® (Drop-In) Weld Metal

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.

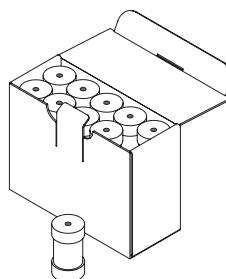


NUWTube® (Pour & Shoot) Weld Metal

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.



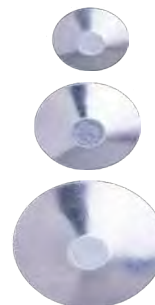
Cast Iron NUWTube® Weld Metal

Size	Qty. Per Carton
NUWTUBE25CI	20
NUWTUBE32CI	20
NUWTUBE45CI	20
NUWTUBE65CI	20
NUWTUBE90CI	10
NUWTUBE115CI	10

Materials, Tools & Accessories

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.)
DISKIT1	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 (4" wide)	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
MH6	For 3 Piece I mold price key	EA	4-3/4
MH7	For 3 Piece J mold price key	EA	5

- Mold Handle Clamps are required for all molds.
- Some molds are used with specialized frames.
- Handle clamps have a Zinc plated finish.
- MH3 mold handle clamps are included with L & M molds.



MH3



MH4



MH1, MH2



MH6, MH7

U.S. Patent No. 6,382,496

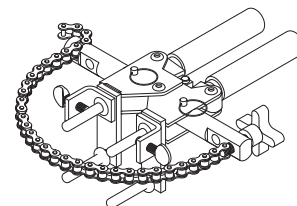
Materials, Tools & Accessories

Mold Fastening & Mounting continued

Chain Support Handle Clamps

Part No.	Fits Mold Price Key	For Following Connection Types	Pipe/ Reinforcing Steel	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

- Handle clamps CSH1 & CSH2 come with MH1 & MH2 clamps respectively.
- 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.



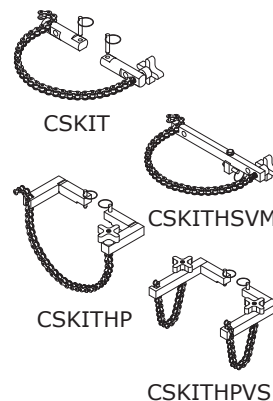
U.S. Patent No. 6,382,496

Chain Support Kits

Part No.	Fits Mold Price Key	For Following Connection Types	Pipe/ Reinforcing Steel	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

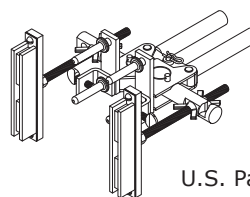
- These kits convert standard mold handle clamps into chain support clamps.

U.S. Patent No. 6,382,496



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

- Handle clamps MSHC1 & MSHC2 come with MH1 & MH2 clamps respectively.
- 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.

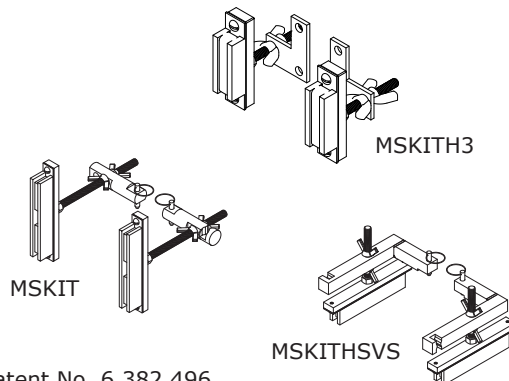


U.S. Patent No. 6,382,496

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
MSKITH3	L, M, N, R	5-1/2"	EA	1
MSKITHSVS	B, C, D, K	10"	EA	5

- These kits convert the standard mold handle clamp into a magnetic support handle clamp.



U.S. Patent No. 6,382,496

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

U.S. Patent No. 6,382,496

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

- 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



CSKIT



MSKIT

Mold Stabilization Spike Kit

Part No.	Qty.	Approx. Each Wt. (lbs.)
MLDSTBLZR	EA	2

- Help stabilize the mold when making cable to cable connections in the trench.
- Fits both the MH1 and MH2 mold handle.
- Kit Includes:
 - (2) 6" spike
 - (2) 12" spike
 - (1 set) Mold handle adapter
 - (1 set) Quick release pin



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.



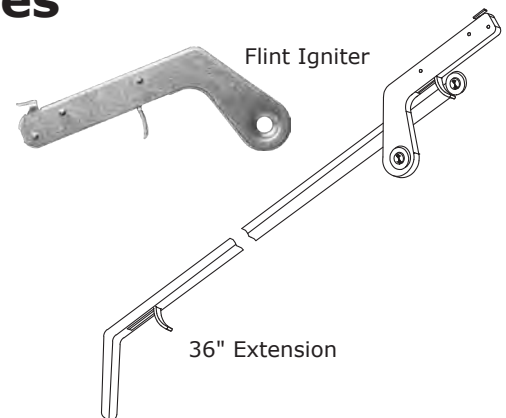
Materials, Tools & Accessories

Mold Accessories

Flint Igniters

Part No.	Description	Qty.	Approx. Each Wt. (lbs.)
FLTIG	Flint Igniter	EA	1/4
FLTIGEXT	36" Extension	EA	1-1/2
RPLFLT	Replacement Flints	EA	1/8

- When making an Ultraweld connection with NUWTube weld metal, Flint Igniters are used to ignite the starting material.



Torch Head

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



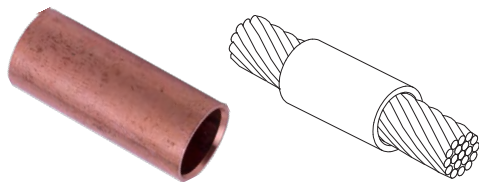
- Self-igniting Torch Head is designed to fit 14 or 16 ounce propane cylinders.
- Torches are required to remove moisture from molds and conductors before making Ultraweld connections.

Adapting Molds to Fit Conductors

Exothermic Adapter Kit with Case

Part No.	Qty.	Approx. Box Wt. (lbs.)
EXOADPKIT	EA	10

- Most common adapters and packing material used when required with specific molds.



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 Sol.	.156	.111	1.00	25	1/4
ADPSLV4	#7, 8, 10	#6, 8	#4 Str.	.227	.177	1.00	25	1/4
ADPSLV2A	#6	#5	#2 Str.	.292	.198	1.00	25	1/4
ADPSLV2B	#4, 5	#3, 4	#2 Str.	.287	.246	1.00	25	1/4
ADPSLV1	#4	n/a	#1 Str.	.340	.246	1.00	25	1/4
ADPSLV1/0	#2	#1	1/0 Str.	.370	.307	1.00	25	1/4
ADPSLV2/0	#1	1/0	2/0 Str.	.420	.359	1.00	25	1/4
ADPSLV3/0	1/0, #1	2/0	3/0 Str.	.452	.389	1.00	25	1/4
ADPSLV4/0	2/0, 1/0	3/0	4/0 Str.	.524	.437	1.50	25	1/4

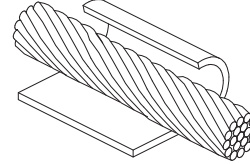
- Adapter Sleeves can be used when welding cables smaller than indicated on mold tag.
- Adapter Sleeves slide over the cable to adapt smaller size cables to a larger size mold.

Materials, Tools & Accessories

Adapting Molds to Fit Conductors continued

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 reinforcing steel for certain connection styles.

Ceramic Reinforcing Steel 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 reinforcing steel 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.)
MLDSLRL	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	14

- Instant cold galvanizing spray provides protection equal to hot dip galvanizing.
- Used for touching up surfaces affected by welding.
- Actual weight of the can is 18.5 oz.



Rasp

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

- Ideal for removing mill scale and rust from steel surfaces.



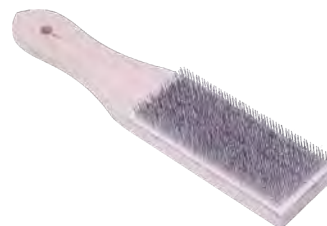
Materials, Tools & Accessories

Cable & Work Surface Preparation continued

Cable Cleaning Brush

Part No.	Qty.	Approx. Each Wt. (lbs.)
CCBRSH1	EA	1/4

- The Cable Cleaning Brush has short, stiff, metal bristles which are generally preferred for cleaning concentric conductors and busbars, that are not heavily oxidized.



Cable Cleaning Brush - Heavy Duty

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

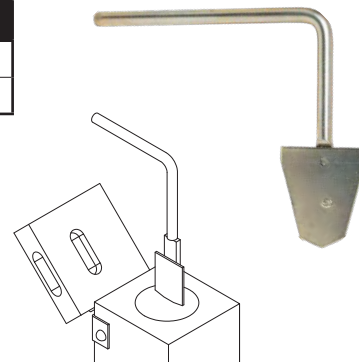
- Slag can be removed from molds by using a Mold Cleaning Brush.
- The brush is especially useful on vertical split molds.
- Consistent and proper use of the brush will aid in maintaining or exceeding the average mold life of 50 connections.



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

Toolbox & Tools

Toolbox

Part No.	Qty.	Approx. Each Wt. (lbs.)
TOOLBOX	EA	5-1/2

- Durable metal toolbox measures 20-1/16" x 8-7/16" x 9-7/16" 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

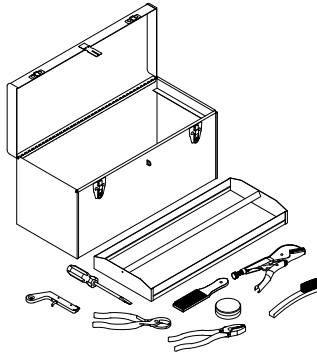
- 10" Vise-Grip® straight jaw locking pliers can be used as a pliers, adjustable wrench, pipe wrench, or clamp.
- They have a strong grip with quick release and locks on to a variety of sizes.



Materials, Tools & Accessories

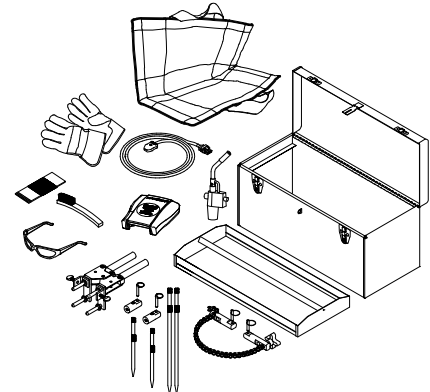
Toolkits

Part No.	Qty.	Approx. Each Wt. (lbs.)
TOOLKIT	EA	10
USTOOLKIT	EA	23-1/4



• **TOOLKIT Includes:**

- (1) TOOLBOX: 20-1/16" x 8-7/16" x 9-7/16 metal 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) CCBRS1: Cable Cleaning Brush
- (1) MCBRS1: Mold Cleaning Brush
- (1) DISKKIT: Disk Kit



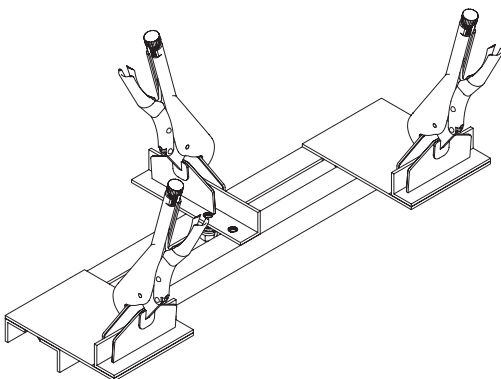
• **USTOOLKIT Includes:**

- (1) DRONE
- (1) TOOLBOX: 20-1/16" x 8-7/16" x 9-7/16 metal toolbox with tray
- (1) MH1X: Mold Handle without Igniter
- (1) CSKIT: Chain Support Kit
- (1) MCBRS2: Mold Cleaning Brush
- (1) SFTYGLS: Safety Glasses
- (1) GLOVES: Leather Palm Gloves
- (1) 3MABPAD: Abrasive Pad
- (1) ULTRAWRAP: Mold Blanket
- (1) TRCHD: Torch Head
- (1) MLDSTBLZR: Mold Stabilizer Kit

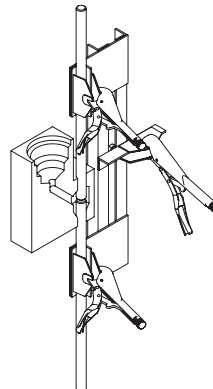
Ground Rod & Cable Clamp

Part No.	Qty.	Approx. Each Wt. (lbs.)
GRCC	EA	18

- Clamp properly aligns and supports Ground Rods for welding type GG connections. See page 283 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

Technical Information

Conductor Identification

Bare Class A, B, and C Concentric Stranded Conductors Based on A.S.T.M Standard Specifications

Size in Circular mils	Size AWG	Conductor Diameter	Number of Wires - Strand Diameter					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 AWG	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 7.862×10^{-4} = Square Inches

Square Inches x 645.2 = Square Millimeter
Square Millimeter x 1.550×10^{-3} = Square Inches

Square Millimeters x 1.9736 = MCM
MCM x 0.5067 = Square Millimeters

1 MCM = 1 kcmil = 1,000 circular mil

Technical Information

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 **ASTM A53-90-B**
(Schedule 40) **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

Technical Information

Ground Rods

Nominal Size	Material	Type	Body Diameter	Thread Size	Ground Rod Code
1/2"	Copper-Clad	Sectional	.504"	9/16"	12S
	Copper-Clad	Plain	.504"	N/A	12F
	Steel*	Plain	.504"	N/A	12F
	Copper-Clad	Plain	.475"	N/A	12
5/8"	Steel*	Plain	.625"	N/A	58F
	Copper-Clad	Plain	.56"	N/A	58
	Copper-Clad	Sectional	.56"	5/8"	58S
3/4"	Steel*	Plain	.75"	N/A	34F
	Copper-Clad	Plain	.678"	N/A	34
	Copper-Clad	Sectional	.678"	3/4"	34S
1"	Steel*	Plain	1.00"	N/A	10F
	Copper-Clad	Plain	.912"	N/A	10
	Copper-Clad	Sectional	.912"	1"	10S

* Stainless steel, galvanized steel, solid copper

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

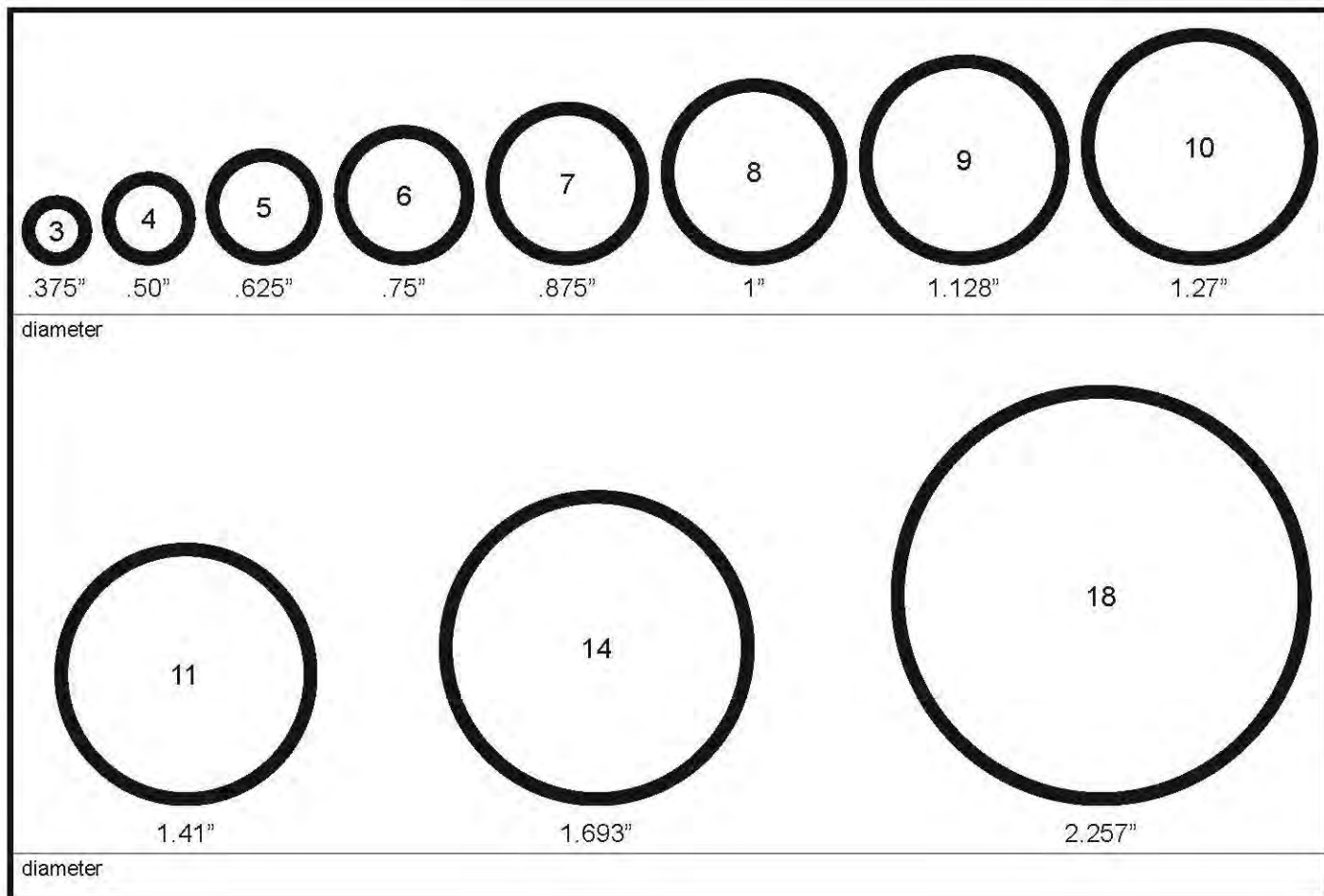
Technical Information

Reinforcing Steel

Size	Nominal Dimensions		Equivalent Copper Size*	Reinforcing Steel 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.

Reinforcing Steel Size Chart



Technical Assistance

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**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 2017 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

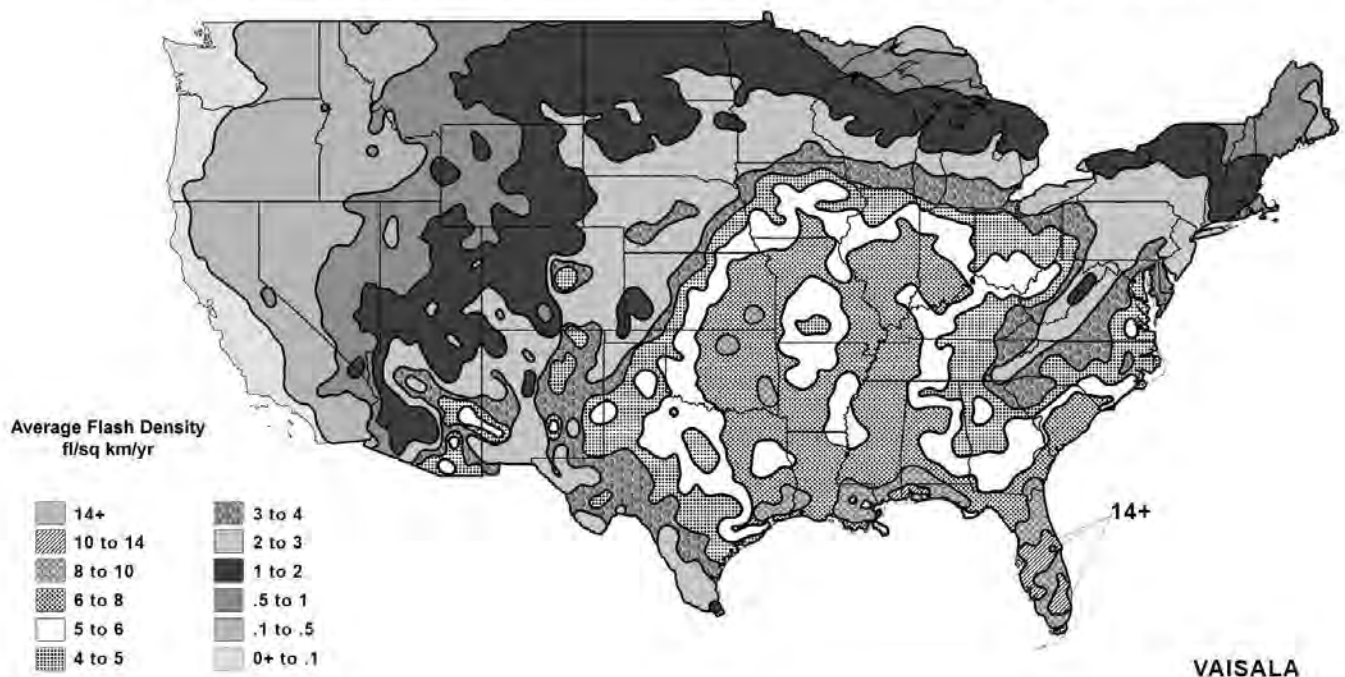
Lightning risk for a structure is the product of the lightning strike frequency and the consequence of the strike to the structure.

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/km²/year - for the United States.

Vaisala's National Lightning Detection Network (NLDN) Cloud-to-Ground Lightning Incidence in the Continental U.S. (1997 - 2010)



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Lightning data provided by the U.S. National Lightning Detection Network™
(Measured lightning flash density corrected for NLDN detection efficiency)

1997-2010 Average U.S. Lightning Flash Density Map (Flashes per Square Kilometer per Year). (Courtesy Vaisala, Inc.)

Method:

Calculate and compare the expected Lightning Strike Frequency (N_d) for the facility to the Tolerable Lightning Strike Frequency (N_e).

Step 1: Determination of Expected Lightning Strike Frequency (N_d)

$$N_d = N_g \cdot A_e \cdot C_1 \cdot 10^{-6}$$

Where:

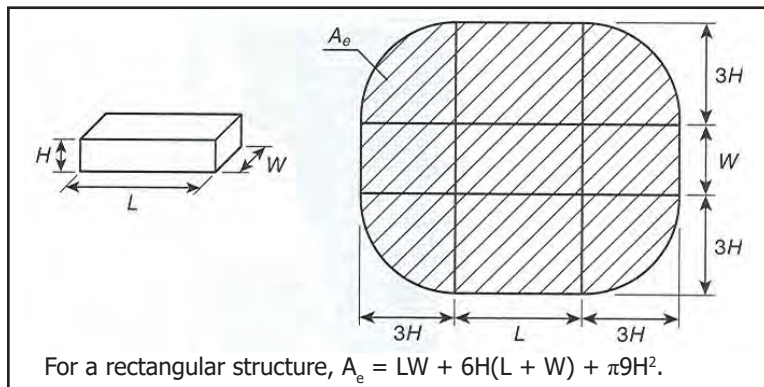
N_d = the expected yearly lightning strike frequency to the structure

N_g = the yearly average lightning flash density in the region where the structure is located (Determine value from Figure 1)

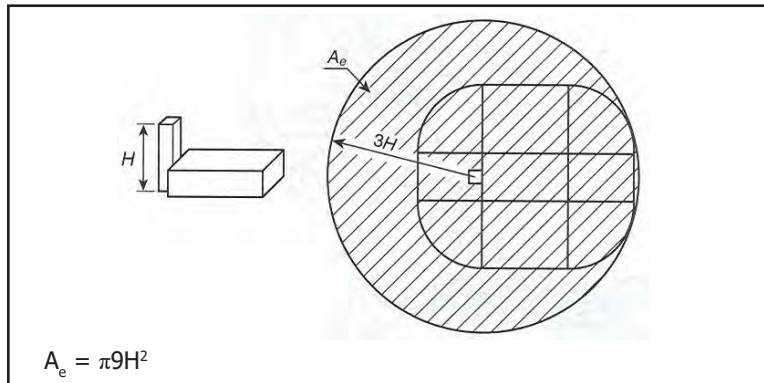
A_e = the equivalent collection area (m^2) of the structure (Determine from Figure 2)

C_1 = the environmental coefficient (Determine value from Table 1)

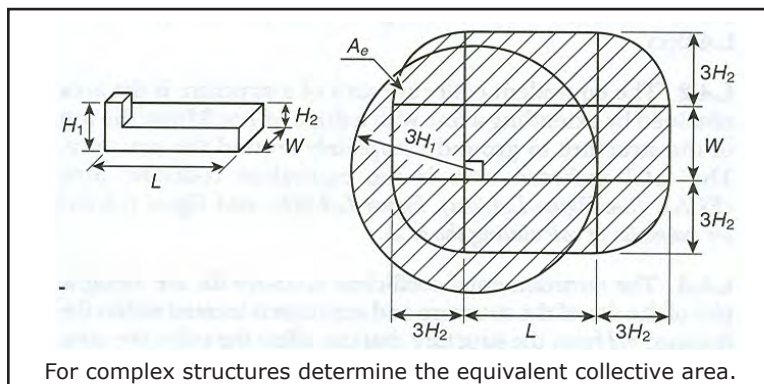
Figure 2: Calculation of Equivalent Collection Volume (A_e)



Rectangular Structure



Structure where a Prominent Part Encompasses All Portions of the Lower Part of the Structure.



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:

$$N_c = \frac{1.5 \times 10^{-3}}{C_2 \cdot C_3 \cdot C_4 \cdot C_5}$$

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

Type of Construction - 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 Occupancy	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

Lightning Damage Consequence	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 780-2020, Annex L. NFPA 780-2020 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= H₂= or H=	A_e=
Expected lightning strike frequency to the structure $N_d = N_g \cdot A_e \cdot C_1 \cdot 10^{-6}$	N_g= A_e= C₁=	N_d=
Tolerable lightning frequency to the structure. $N_c = \frac{1.5 \times 10^{-3}}{C_2 \cdot C_3 \cdot C_4 \cdot C_5}$	C₂= C₃= C₄= C₅=	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) – Lightning Protection System Specification

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes lightning protection installation requirements for buildings and associated structures and requirements for lightning protection system components.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 – Grounding and Bonding for Electrical Systems
- B. Section 26 01 40.13 - Operation and Maintenance of Lightning Protection Systems

1.03 REFERENCES

A. NFPA 780 – Standard for the Installation of Lightning Protection Systems (Current Edition)

1.04 FURNISHED AND INSTALLED BY 26 05 00

- A. Surge Protective Devices (SPD's) shall be installed at the entrances of all power service entrances and conductive communications systems.
- B. Surge Protective Device Ratings
 - 1. The power service entrance SPD shall have a nominal discharge current (In) rating of at least 20 kA 8/20 μ s per phase and be listed and labeled by UL 1449, *Standard for Safety for Surge Protective Devices*.
 - 2. Signal, data, and communications SPDs shall have a maximum discharge current (Imax) rating of at least 10 kA 8/20 μ s when installed at the entrance.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Installing contractor shall coordinate a site walkthrough with the lightning protection manufacturer prior to the start of any work. Manufacturer representative shall provide a pre-installation site report which includes guidance for design changes or confirmation that current site conditions match contract documents.
- B. Post-Installation Meeting: Installing contractor shall coordinate a site walkthrough with the lightning protection manufacturer at the commencement of work. Manufacturer representative shall provide a post-installation site report to the installing contractor which contains the following:
 - 1. Any deficiencies in the installation or confirmation that the current installation meets the requirements of the standards specified.
 - 2. Electronic markup of the approved shop drawing with embedded images showing all concealed bonding (gas piping, water main, electrical service ground, communication grounds) and a random selection of concealed connections (cable to ground rod, cable to cable, cable to steel).
 - a. Photographic documentation shall be provided from the installing contractor to the lightning protection manufacturer representative prior to concealing or backfilling.

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- C. Sequencing: Coordinate installation of lightning protection system with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection system, and building finishes.

1.06 SUBMITTALS

- A. Product Data: Manufacturer's descriptive and technical literature or catalog cuts.
- B. Shop Drawings:
 - 1. Layout of the lightning protection system, specifically for the building(s) or structures included in the contract drawings.
 - 2. Installation details of the products to be used in the installation.
- C. Manufacturer's Instructions: Installation instructions shall be provided for lightning protection components that require field assembly or fabrication.
- D. Qualification data for firms or persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by a Nationally Recognized Testing Laboratory (NRTL).
- E. Certification, signed by roofing contractor, that roof adhesive and installation method for air terminals, conductors and thru-roof penetrations is approved by manufacturers of the lightning protection components, the roofing manufacturer and the decorative metal finishing manufacturer.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Contracts: Installing contractor shall provide building owner with pricing for yearly system inspections. Building owner is under no obligation to have yearly inspections performed.
- B. Operation and Maintenance Data: Installing contractor shall provide building owner with an operation and maintenance manual. Refer to Section 26 01 40.13 - Operation and Maintenance of Lightning Protection Systems
- C. Warranty Documentation: The completed installation shall carry a one-year guarantee against defects in material or installation.
 - 1. Exclusions: Routine preventative maintenance, accidental or intentional damage shall not be included as part of the warranty service.
- D. Record Documentation: Installing contractor shall provide building owner a copy of the pre-installation site report, post-installation site report and (3) full-size plots of accurate as-built shop drawings.

1.08 EXTRA STOCK MATERIALS

- A. Provide extra stock materials to building owner in a single, durably packed container labeled with "26 41 13 – Lightning Protection for Structures", installing contractor contact information, date and complete listing of contents.
 - 1. (5) Air Terminal Assemblies
 - 2. (5) Secondary sized bonding lugs

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3. (5) Main sized bonding lugs or bonding plates
4. (10) Cable-to-Cable splice connectors
5. (100') Main sized conductor
6. (50) Cable fasteners/holder with related hardware

1.09 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer shall maintain current lightning protection material listings by a Nationally Recognized Testing Laboratory (NRTL).
 2. Installer Qualifications: Engage an experienced installer who has been trained and certified to perform installations by the lightning protection manufacturer.
- B. The system shall be physically inspected by a Nationally Recognized Testing Laboratory (NRTL) to the current edition of NFPA 780. The certification shall be provided to the building owner at completion of the project.

PART 2 - PRODUCTS**2.01 APPROVED MANUFACTURER**

- A. Harger Lightning & Grounding
301 Ziegler Drive, Grayslake IL 60030
<http://www.harger.com> | hargersales@harger.com

2.02 AIR TERMINALS

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding air terminals.
- B. Substitution Limitations: Project conditions may dictate the use of an air terminal not shown, installing contractor shall coordinate with lightning protection manufacturer to determine proper materials.
- C. Product Options:
 1. Length: 12" minimum when installed around the perimeter or along the ridge of a building and 24" minimum when installed in mid-roof areas or mounted on equipment.
 2. Point Type: Gently tapered air terminals shall be used in all areas. Exception, mid-roof mounted air terminals shall be safety tipped to prevent personnel injury.
 3. Material Type: Where applicable, copper air terminals shall be used. Exception, copper materials shall not be mounted on aluminum, Galvalume®, galvanized steel, zinc or directly onto other ferrous metal surfaces. In these instances, aluminum air

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terminals shall be used.

Material Type	Class I - 12"	Class I - 24"	Class II - 12"	Class II - 24"
Aluminum	1212ALAT	1224ASTAT	5812ALAT	5824ALAT
Copper	3812CUAT	3824CUAT	1212CUAT	1224CSTAT
Tinned	3812CUATT	3824CSTATT	1212CUATT	1224CSTATT

2.03 AIR TERMINAL BASES

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding air terminal bases.
- B. Substitution Limitations: Project conditions may dictate the use of an air terminal base not shown. Installing contractor shall coordinate with lightning protection manufacturer to determine proper materials.
- C. Product Options:

Material Type	Universal	Swivel	Ridge Saddle	Pipe Railing
Aluminum	AUBU Series	AUBS Series	A160 Series	APRB Series
Copper	CUBU Series	CUBS Series	160 Series	CPRB Series
Tinned	TCUBU Series	TCUBS Series	160T Series	CPRB Series

2.04 CONDUCTORS

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding conductors.
- B. Substitution Limitations: No Substitutions
- C. Product Options:
 - 1. Material type: Where applicable, bare copper conductors shall be used. Exception, copper materials shall not be mounted on aluminum, Galvalume®, galvanized steel, zinc or directly onto other ferrous metal surfaces. In these instances, aluminum conductors shall be used.

Material Type	Class I	Class II
Aluminum	A24 A28	A37R
Copper	24 29 32	28 40-28
Tinned	24T 29T 32T	28T 4028T

2.05 CONDUCTOR FASTENERS

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning & Grounding conductor fasteners.
- B. Substitution Limitations: No Substitutions
- C. Product Options:
 - 1. Material type: Where applicable, bare copper conductors shall be used. Exception,

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copper materials shall not be mounted on aluminum, Galvalume®, galvanized steel, zinc or directly onto other ferrous metal surfaces. In these instances, aluminum conductors shall be used.

Material Type	Adhesive Cable Holder	Mechanical Cable Clip
Aluminum	A262	ACC Series
Copper	262	CCC Series
Tinned	262T	CCCT Series

2.06 ABOVE GRADE CONNECTORS

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding connectors.
- B. Substitution Limitations: No Substitutions
- C. Product Options:
 1. Material type: Where applicable, bare copper connectors shall be used. Exception, copper materials shall not be mounted on aluminum, Galvalume®, galvanized steel, zinc or directly onto other ferrous metal surfaces. In these instances, aluminum connectors shall be used.

Material Type	Parallel	"T"	Straight	Cross
Aluminum	A1BC	A207	A206	A210
Copper	B1BC	207	206	210
Bi-Metal	BM1BC	n/a	211R	210BM

2.07 BONDING LUGS AND PLATES

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding bonding lugs and plates.
- B. Substitution Limitations: No Substitutions
- C. Product Options:
 1. Material type: Where applicable, bare copper bonding connections shall be used. Exception, copper bonding materials shall not be mounted on aluminum, Galvalume®, galvanized steel, zinc or directly onto other ferrous metal surfaces. In these instances, aluminum or bi-metallic bonding connections shall be used.

Material Type	Secondary	Main Sized	Flat Bonding Plate	Flange Bonding Plate	Pipe Bonding Clamp
Aluminum	A214	A222	A217	A223	APC Series
Copper	214	222	217	223	CPC Series
Bi-Metal	216BM	BMBL	BMBP	n/a	APCBM Series

2.08 THRU-ROOFS / THRU-WALLS

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding thru-walls or thru-roofs.

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B. Substitution Limitations: No Substitutions

C. Product Options:

Material Type	Metal Roofing	Flat Roofing -Economy	Flat Roofing – Stainless Steel	Thru-Wall
Aluminum	A225 Series	ATRC1	SSTRAA Series	A226 Series
Copper	225 Series	CTRC1	SSTRCC Series	226 Series
Bi-Metal	225BM Series	BMTRC1	SSTRACBM Series	226BM Series

2.09 GROUNDING ELECTRODES

A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding, grounding electrodes

B. Substitution Limitations: Soil conditions may dictate the use of a grounding electrode not shown. Installing contractor shall coordinate with lightning protection manufacturer to determine proper materials.

C. Product Options:

Standard Soil	Corrosive Soil	Shallow Topsoil	Rocky Conditions
3410	3410SS3	336	EGRSS10LWG4/0

2.10 GROUND ACCESS WELLS

A. Basis of Design: Subject to compliance with requirements, provide a minimum of (1) Harger Lightning and Grounding ground access well.

B. Substitution Limitations: Soil conditions may dictate the use of a ground access well not shown. Installing contractor shall coordinate with lightning protection manufacturer to determine proper materials.

C. Product Options:

Standard	Traffic Rated	Heavy Duty
GAW910	GAW121212HD	GAW121212TDLH

2.11 BELOW GRADE CONNECTIONS

A. Basis of Design: Subject to compliance with requirements, provide UltraShot® exothermically welded connections by Harger Lightning and Grounding

B. Substitution Limitations: No Substitutions

C. Product Options:

Parallel	"T"	Straight	Cross	Ground Rod
PT Series	RT Series	BS Series	XO Series	GO Series

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PART 3 - EXECUTION

3.01 INSTALLERS

- A. Installer List: Refer to <http://www.harger.com/maps/v2/> for current Harger Lightning and Grounding factory trained installers.

3.02 INSTALLATION

- A. Install lightning protection system as indicated on approved shop drawing, according to manufacturer's written instructions.
- B. Installation shall comply with all aspects of NFPA 780.
- C. Conductors shall be concealed from public view.

3.03 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.
- B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.04 FIELD QUALITY CONTROL

- A. The system shall be physically inspected by a Nationally Recognized Testing Laboratory (NRTL) to the current edition of NFPA 780. The certification shall be provided to the building owner at the completion of the project.

END OF SECTION

Section 26 01 40.13 – Operation and Maintenance of Lightning Protection System Specification**Part 1 – GENERAL****1.01 Description**

- a. There are no lights, horns, or other indicators to verify that a lightning protection system is in proper working order and ready to receive a lightning strike. When a strike does occur, the system must function properly or severe damage to the structure may result.
- b. A lightning protection system that has been designed and installed in conformance with nationally recognized lightning protection installation standards can be expected to operate as intended to provide protection against lightning strikes to the protected structure. Continued operation of this system is assured as long as the system is properly maintained and as long as there are no changes to the protected structure that renders the system inadequate.
- c. An inspection and maintenance program is important to assure that the lightning protection system is in good working order, should a lightning strike occur to the protected structure.

1.02 Related Sections

- a. Section 26 05 26 – Grounding and Bonding for Electrical Systems
- b. Section 26 41 13 – Lightning Protection Systems
- c. Section 26 41 23 – Lightning Protection Surge Arresters and Suppressors
- d. Section 33 79 93 – Site Lightning Protection

1.03 References

- a. NFPA 780 – Standard for the Installation of Lightning Protection Systems
- b. UL 96A – Installation Requirements for Lightning Protection Systems

Part 2 – DOCUMENTATION**2.01 Operation and Maintenance Manuals**

- a. Three (3) complete copies of the operation and maintenance manual labeled as described herein shall be submitted to the building owner for approval in as many three (3) ring loose leaf binders, as required. The copies shall be submitted a minimum of two weeks prior to completion of project.
- b. The manuals shall be typewritten and include a table of contents. The information shall be arranged in a logical order for use by the building owner to maintain the installed system.
- c. The manuals shall include (at a minimum) the following:
 1. Table of Contents.
 2. Materials list with place of purchase
 3. Product data sheets for each installed item, data sheets shall include a product image, short description and part number for future re-ordering.
 4. Installation, servicing, maintenance and operating instructions.

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5. Manufacturer's guarantees and warranties.
6. Approved copies of as-built shop drawing plotted on full size sheets.
7. Copies of all inspection certificates and approvals from all inspection agencies.

2.02 Tour, Instruction and Demonstration

- a. Maintenance Manuals
 1. Maintenance manuals shall be furnished a minimum of two weeks prior to any instructions and demonstrations to building owner. See Paragraph 26 01 40.13, 2.01 for manual content.
- b. Tours for Building Owner
 1. At the completion of the work, immediately after Substantial Completion, the Contractor shall conduct a walk-through tour of the project work areas. The purpose of the tour shall be to introduce the building owner who will have charge of the equipment or use of the space to the new areas. Generalities of the type of equipment installed shall be discussed during the tour.
- c. Instructions to Building Owner
 1. At the completion of the work, after the building owner has taken over use of the Building or work area, the Contractor shall instruct those building owner employees who will have charge of the equipment, the care, adjustment, and operation of all parts of the system. Such instruction shall cover a minimum period, as required, to effectively train building owner and shall be arranged for at the building owner convenience.
- d. Demonstration to Building Owner
 1. In addition to the instruction period mentioned above, the Contractor shall demonstrate the routine maintenance and inspection required.
- e. Schedule
 1. Maintenance and Operations personnel shall be given a minimum two-week notice of each of the above schedule tour and instruction dates.

Part 3 – WARRANTIES

3.01 General

- a. The completed installation shall carry a one-year guarantee against defects in material or installation.

3.02 Terms

- a. The manufacturer shall carry a warranty against defects in material for a period of one (1) year.
- b. The installer shall carry a warranty against workmanship or installation defects for a period of (1) year.

3.03 Exclusions

- a. Routine preventive maintenance, accidental or intentional damage shall not be included as part of the warranty service.

END OF SECTION

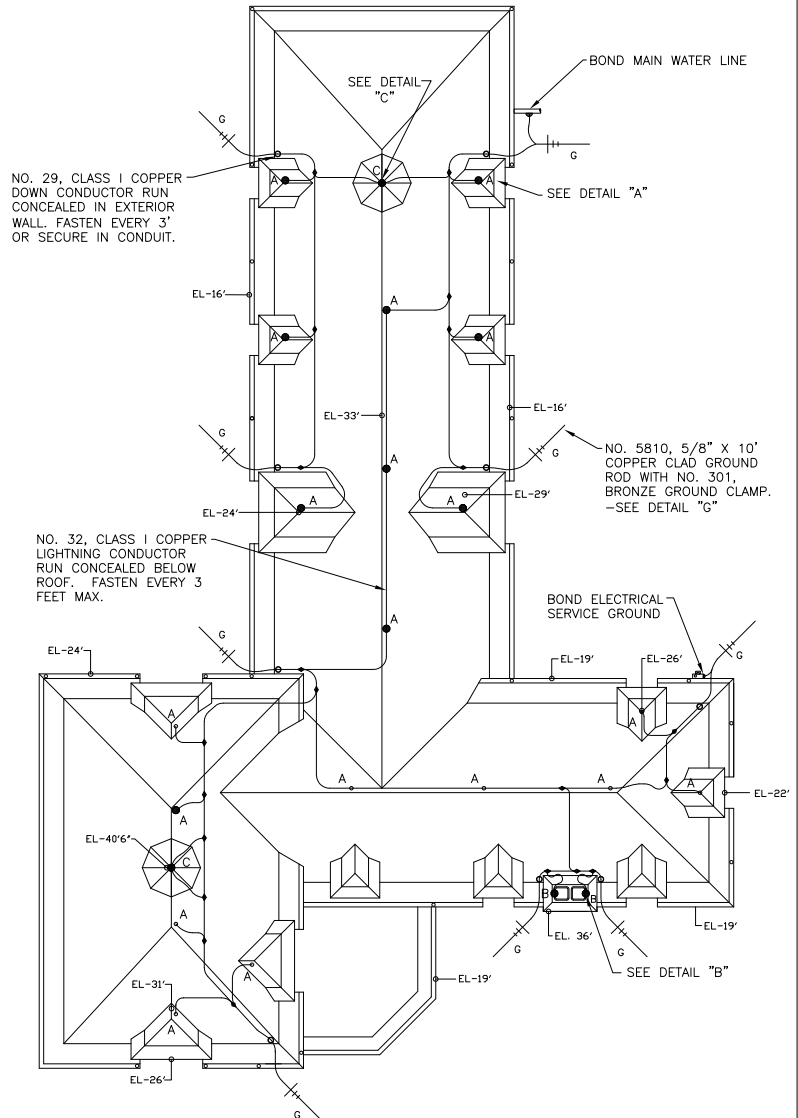
Residential Lightning Protection

NOTES

1. THE COMPLETED INSTALLATION SHALL MEET THE REQUIREMENTS OF THE NATIONAL FIRE PROTECTION ASSOCIATION'S "STANDARD FOR THE INSTALLATION OF LIGHTNING PROTECTION SYSTEMS, 2008 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 - 2008 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, UNIVERSAL GROUND CLAMP. -SEE DETAIL "G"



North

LIGHTNING PROTECTION SYSTEM PLAN

SCALE: NTS

SHEET NO.
1 OF 2

DRAWN BY:
KHO

DATE
©2021

DWG NUMBER
Typ-1

CHECKED BY:
NAN

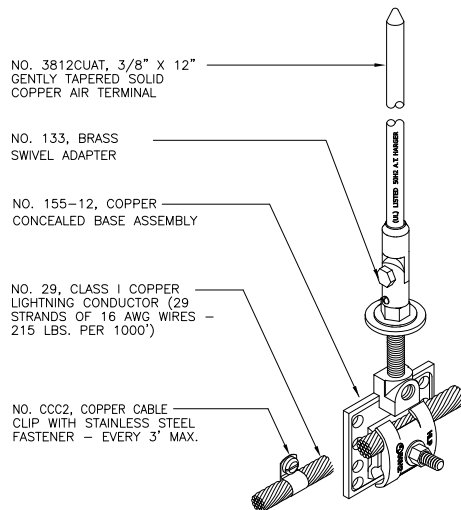
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TYPICAL RESIDENTIAL
Lightning Protection Details

MATERIALS MANUFACTURED BY
HARGER®
LIGHTNING PROTECTION • GROUNDING • EXOTHERMIC

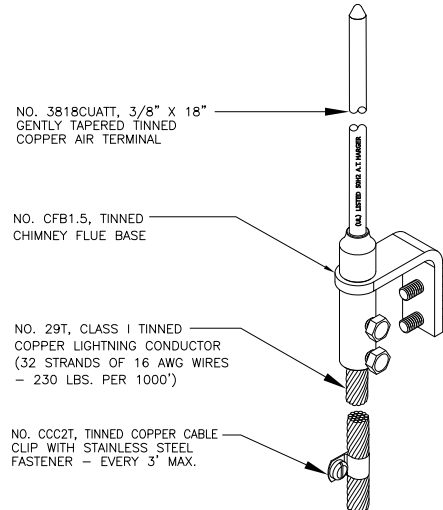
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Residential Lightning Protection



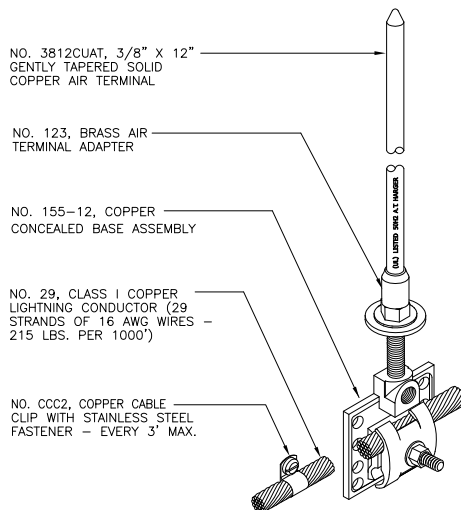
AIR TERMINAL DETAIL "A"

NTS



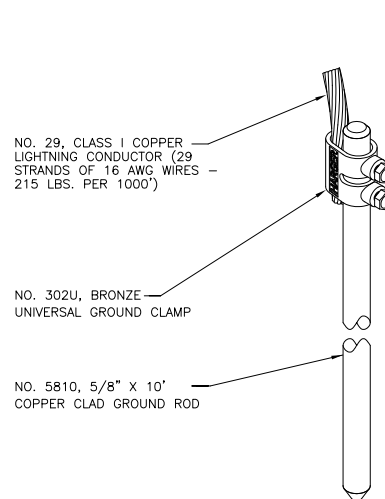
AIR TERMINAL DETAIL "B"

NTS



AIR TERMINAL DETAIL "C"

NTS



GROUND ROD DETAIL "G"

NTS

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DWG NUMBER Typ-1	CHECKED BY: NAN	©2021

TYPICAL RESIDENTIAL
Lightning Protection Details

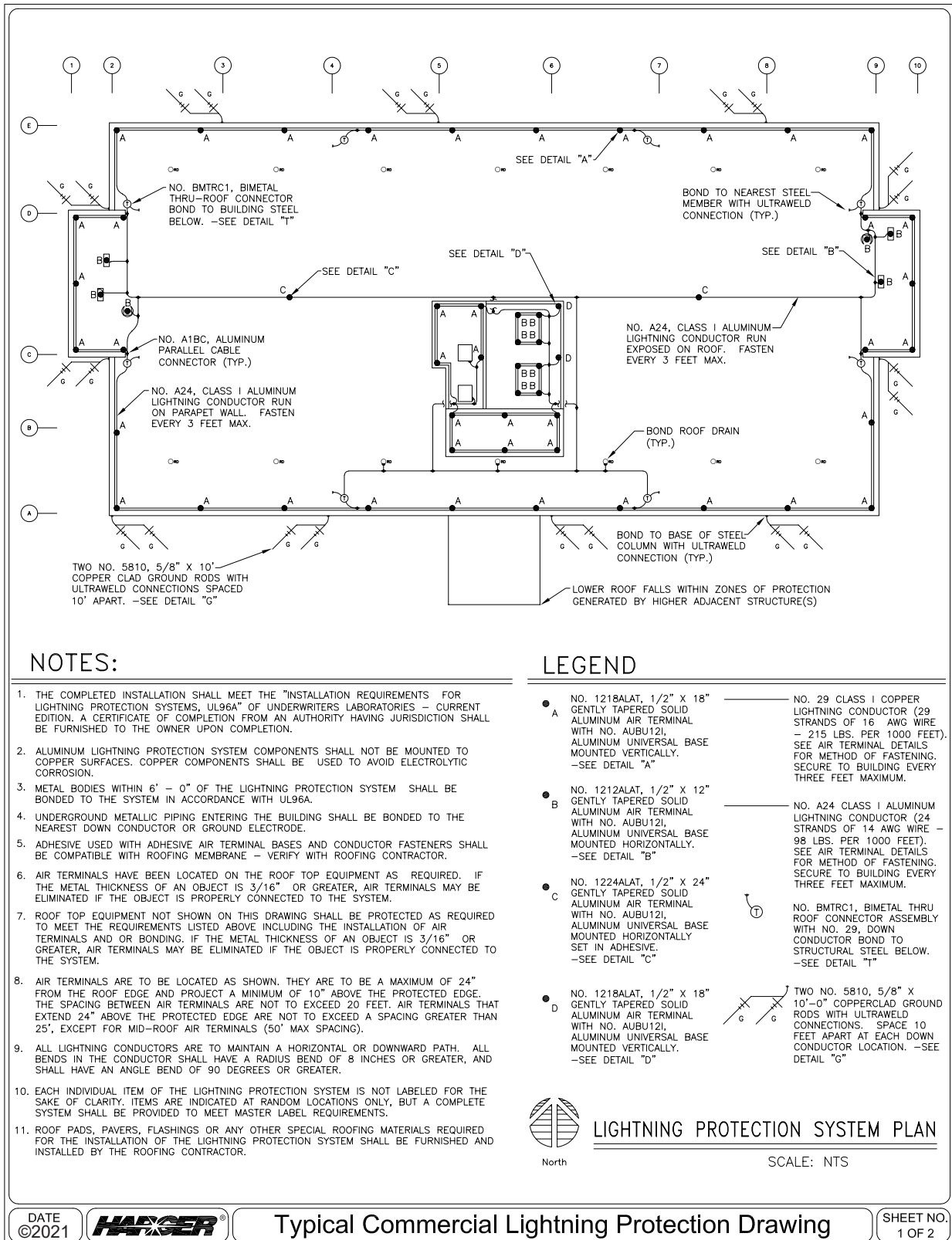
MATERIALS MANUFACTURED BY

HARGER

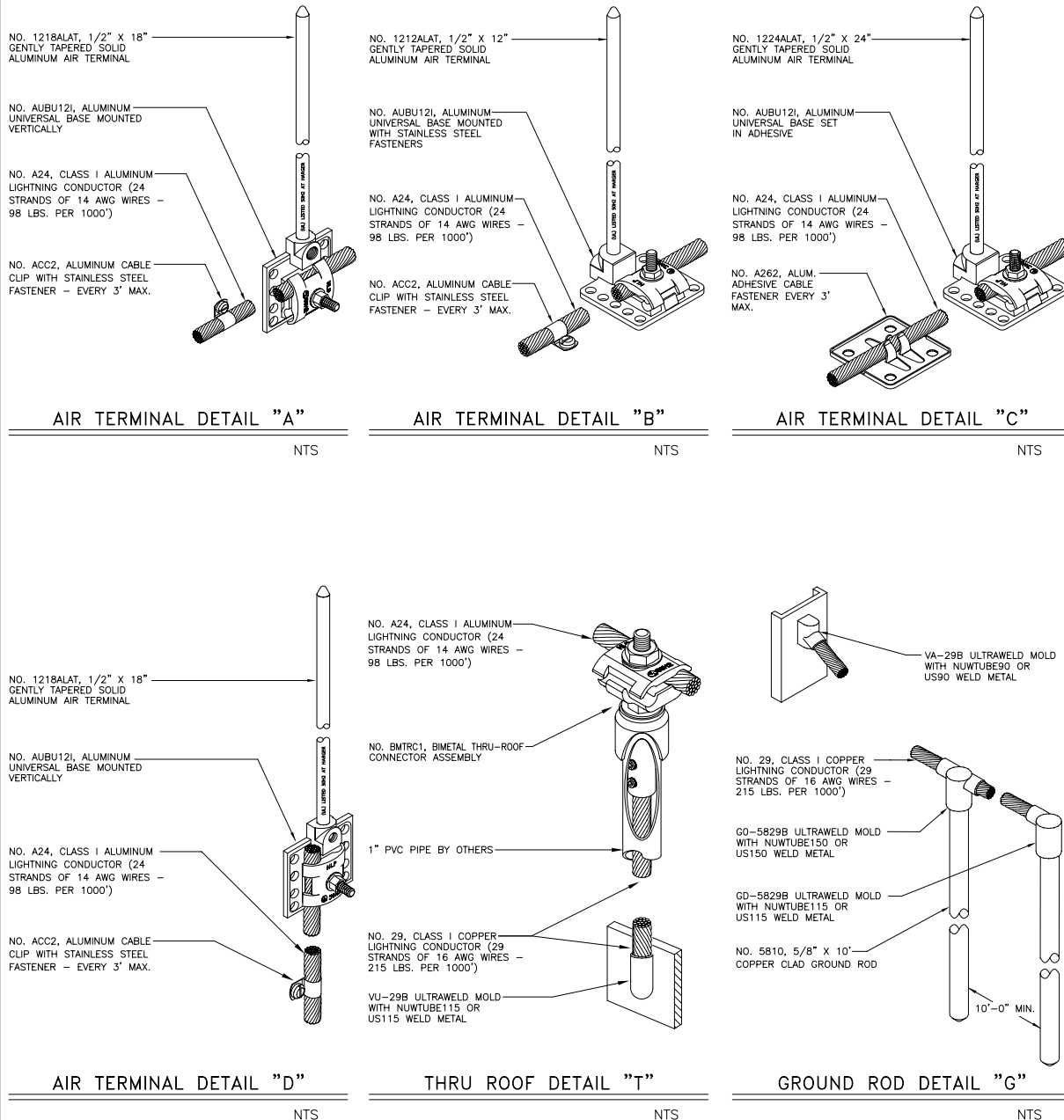
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Commercial Lightning Protection



Commercial Lightning Protection

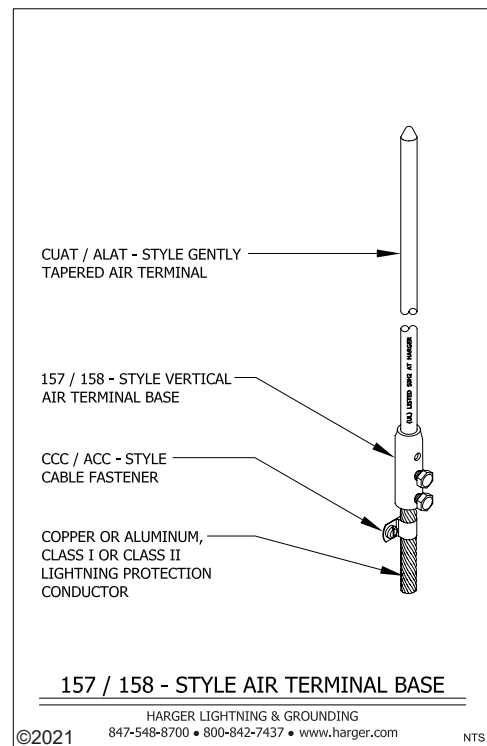
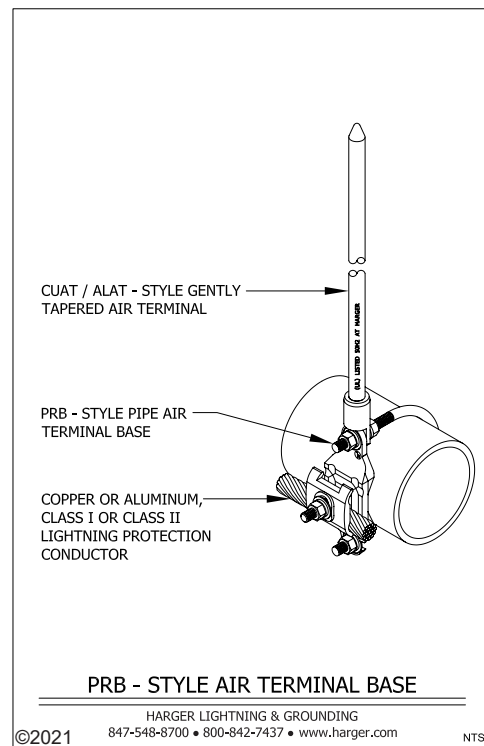
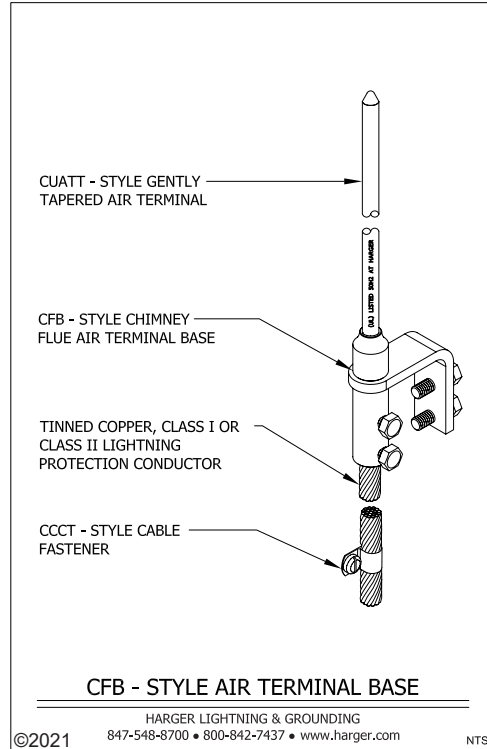
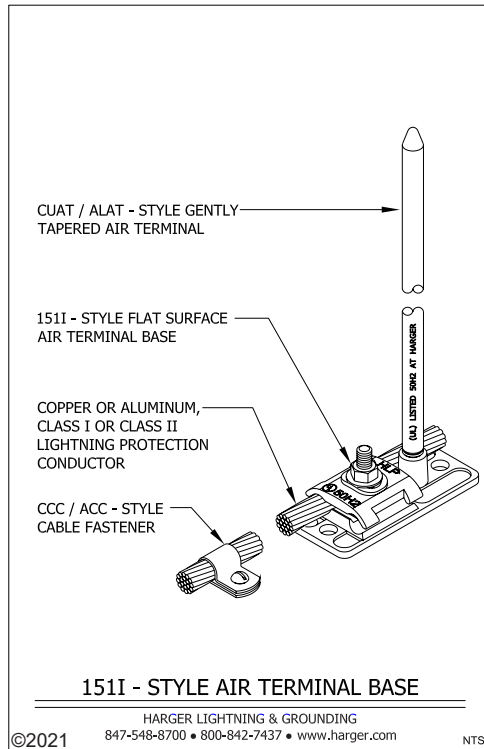


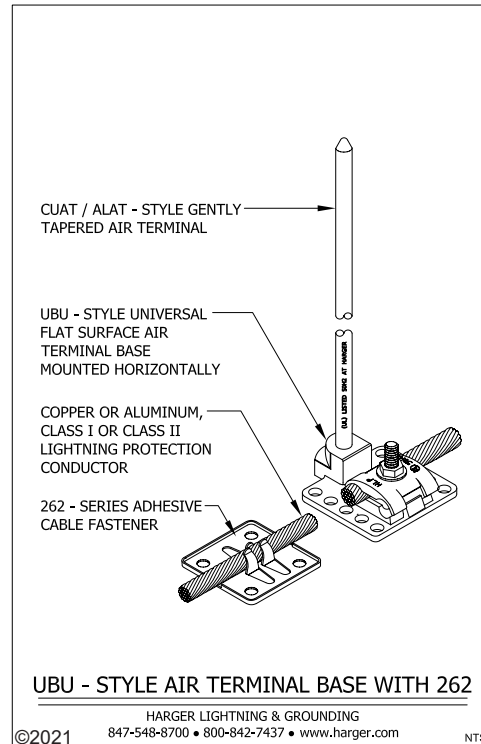
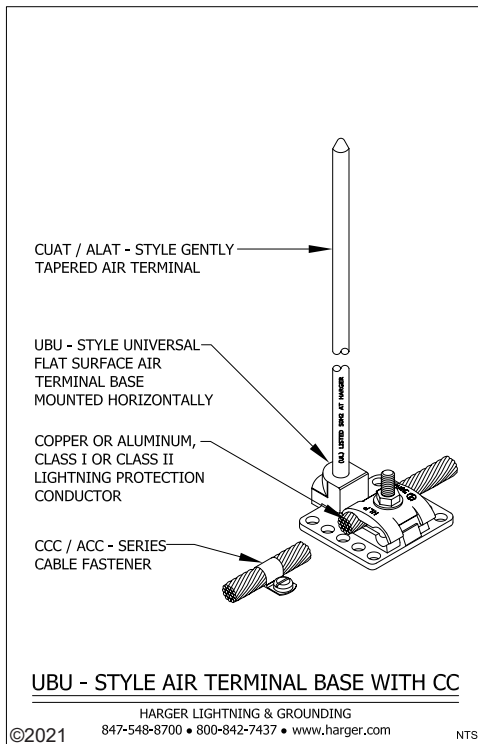
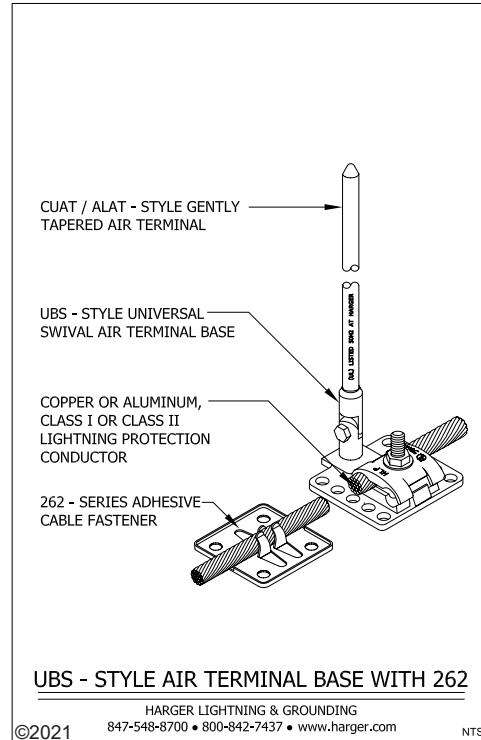
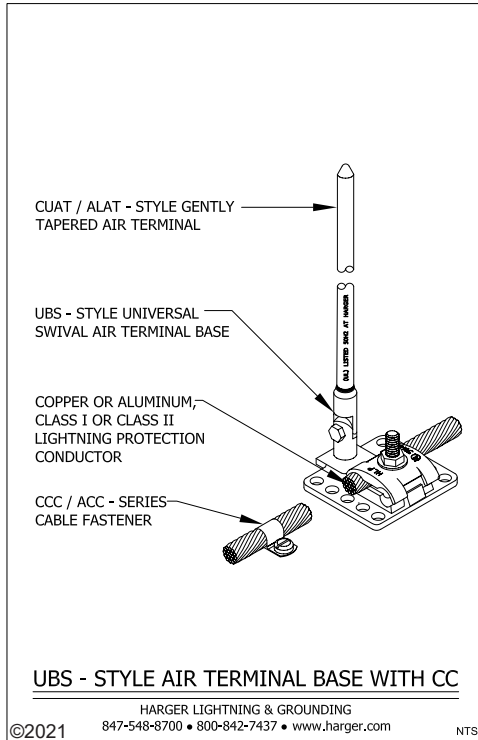
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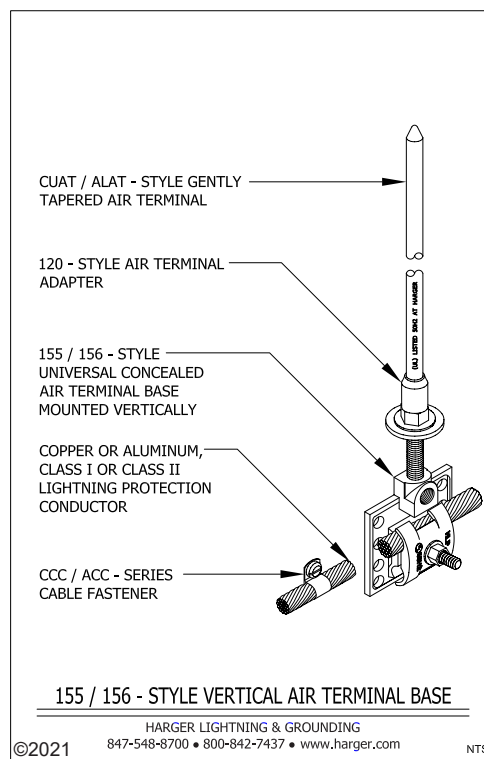
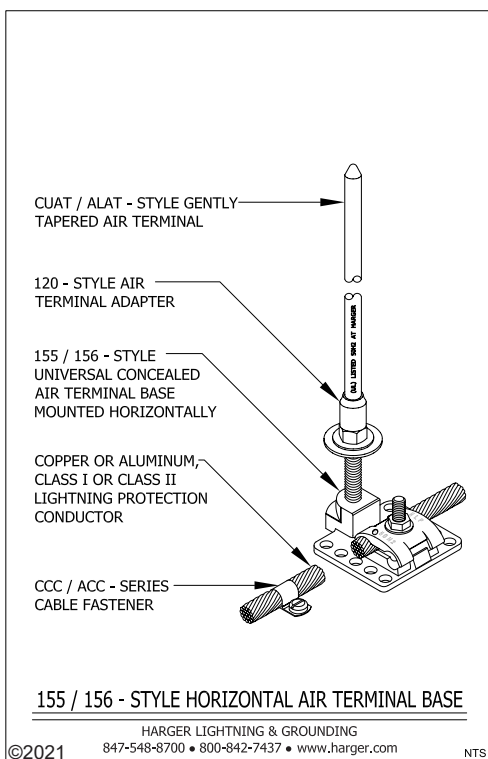
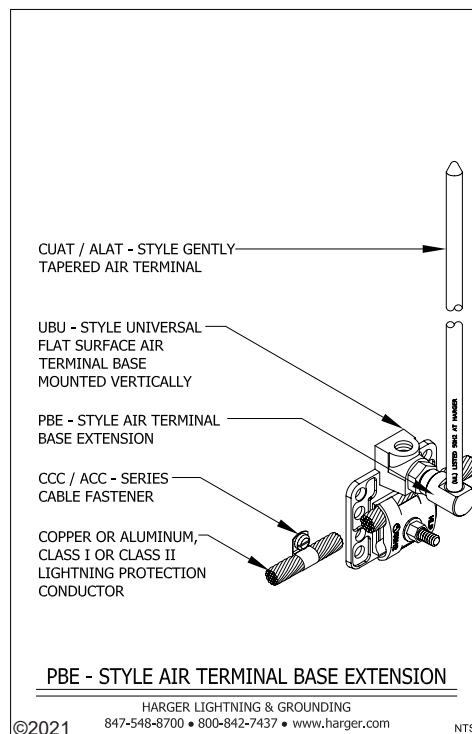
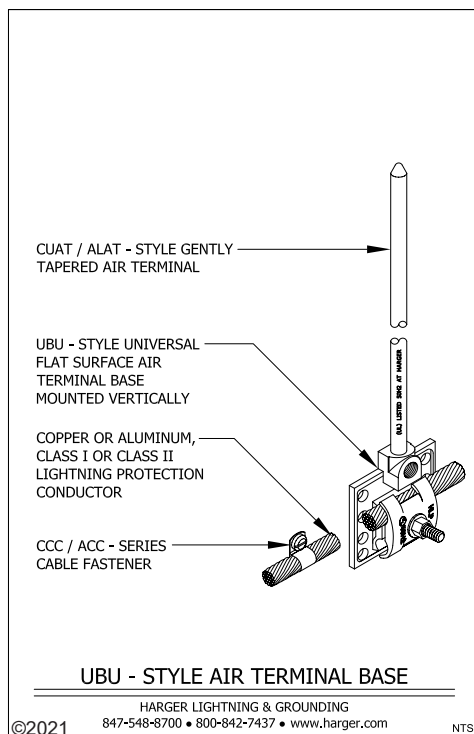


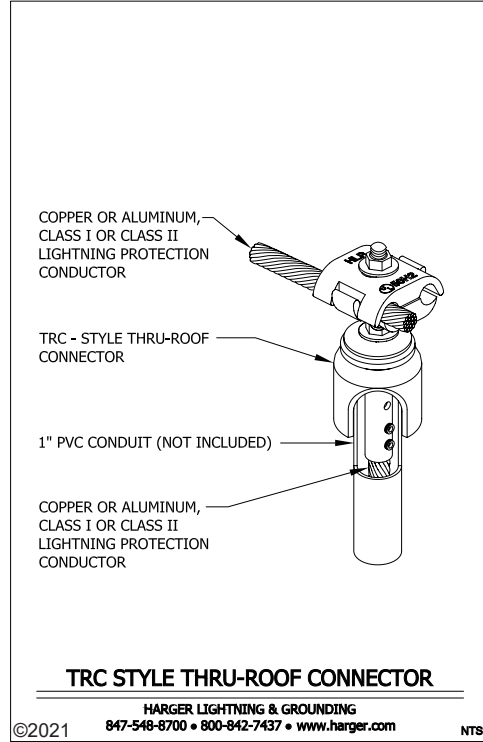
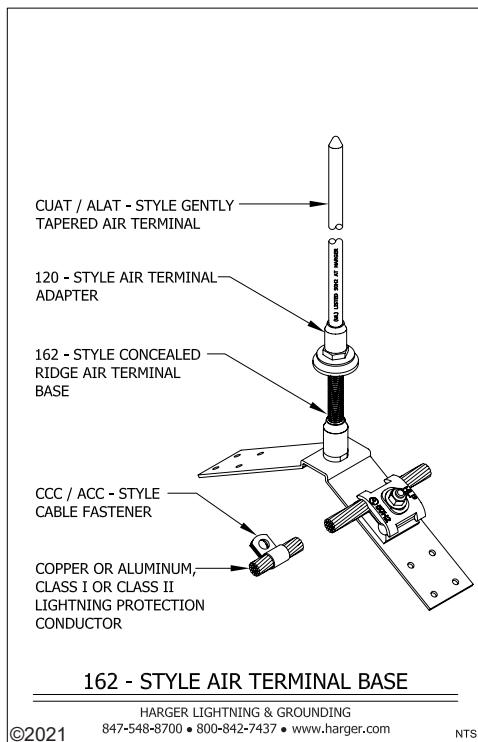
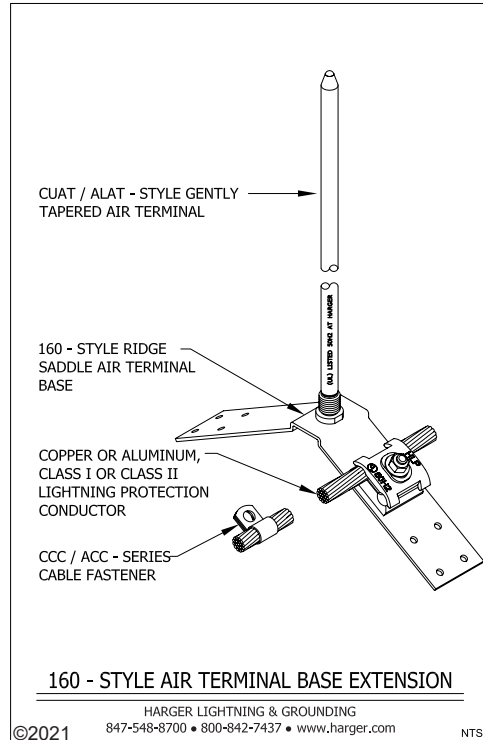
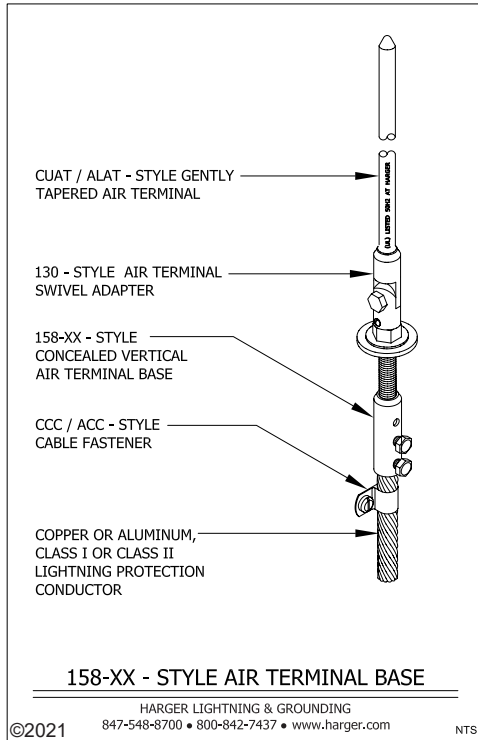
Typical Commercial Lightning Protection Drawing

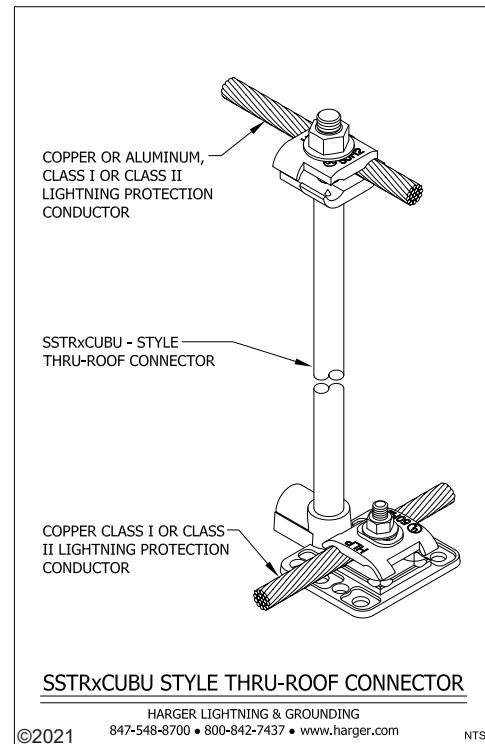
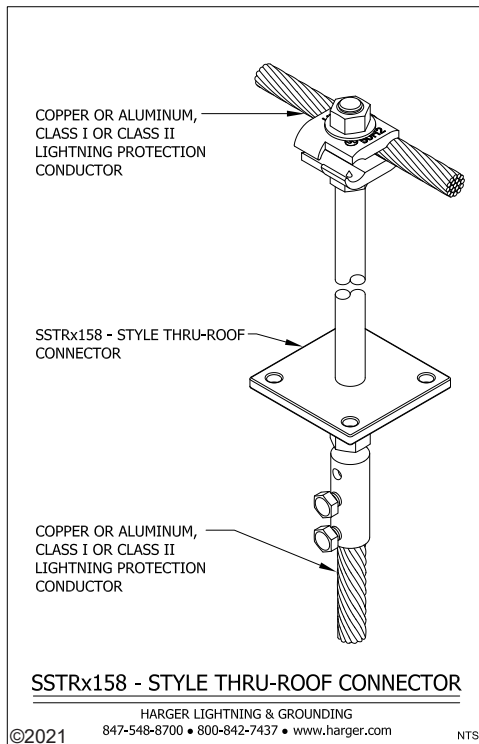
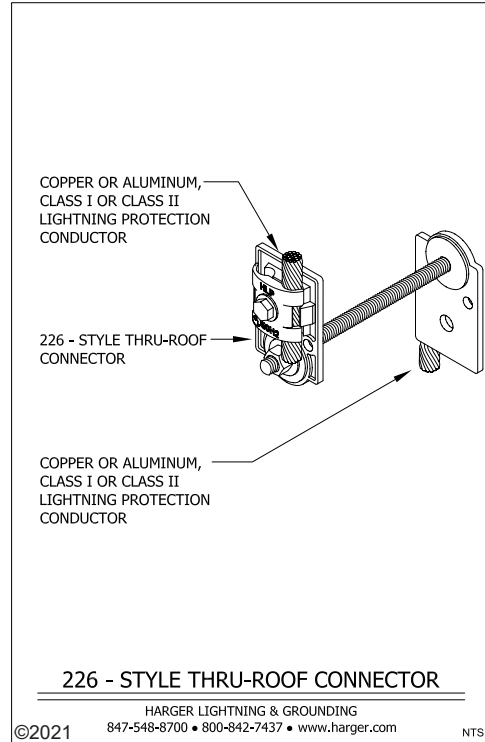
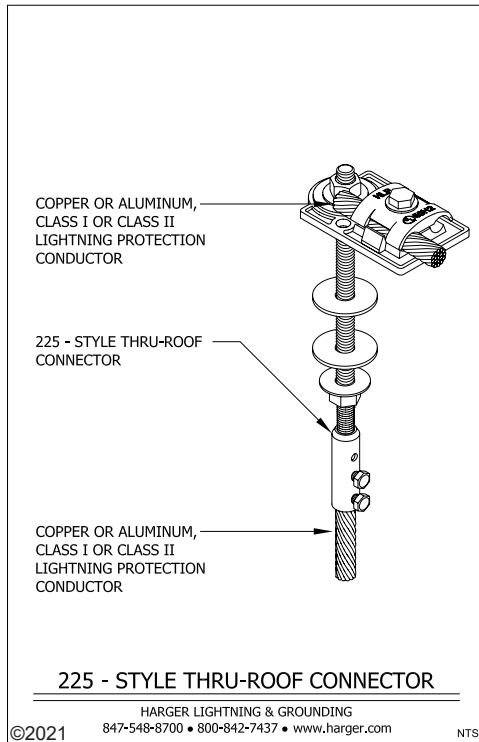
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2 OF 2

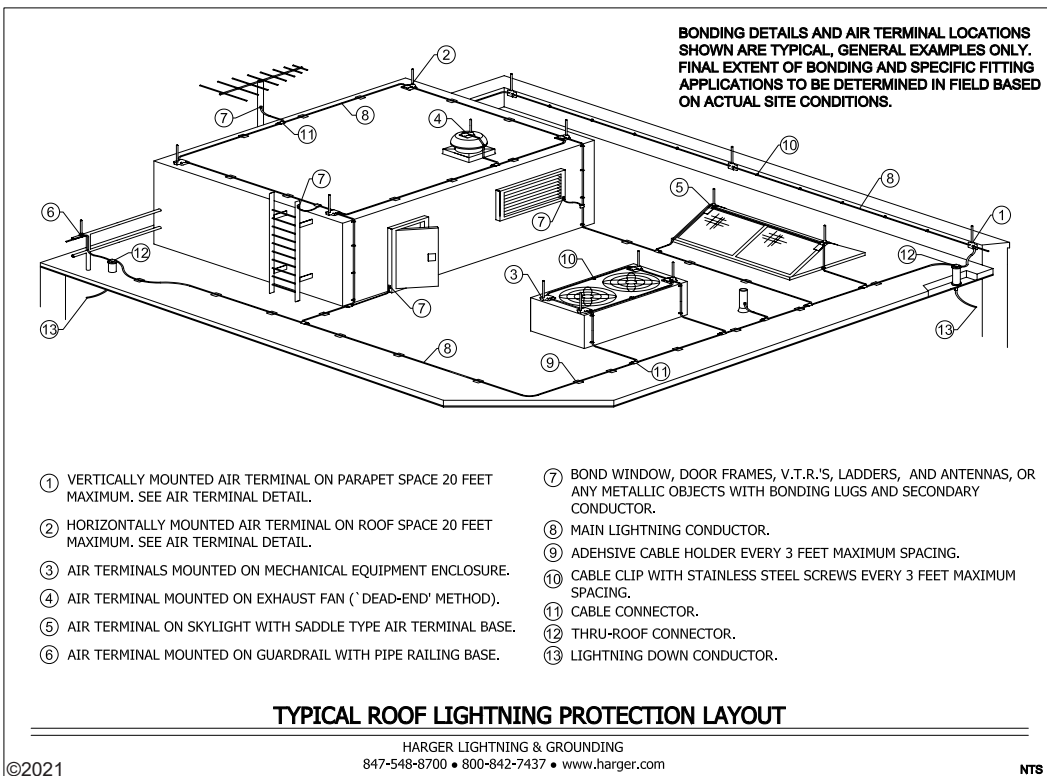
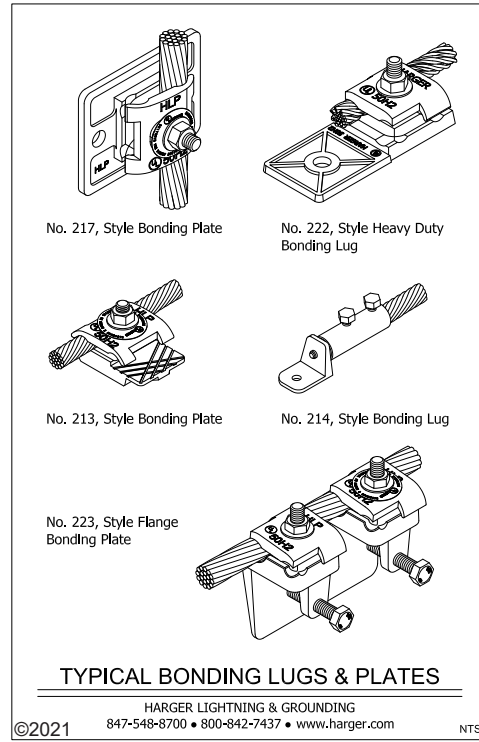
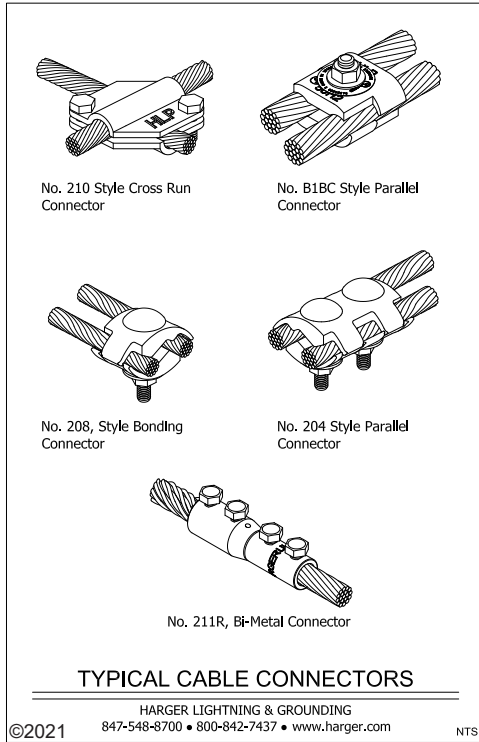


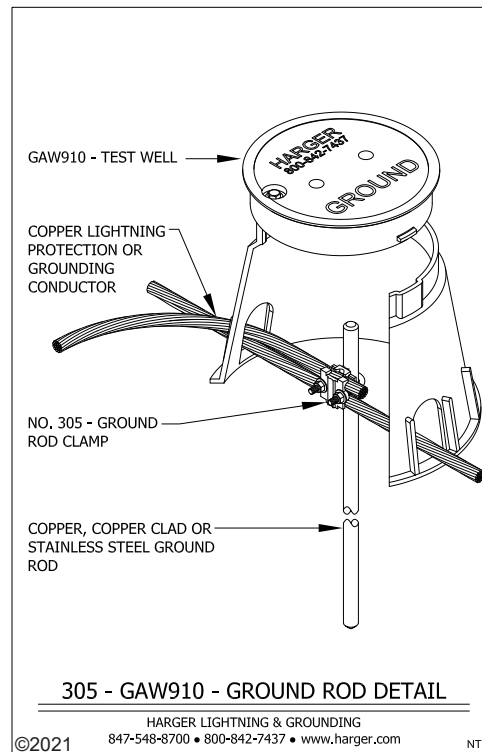
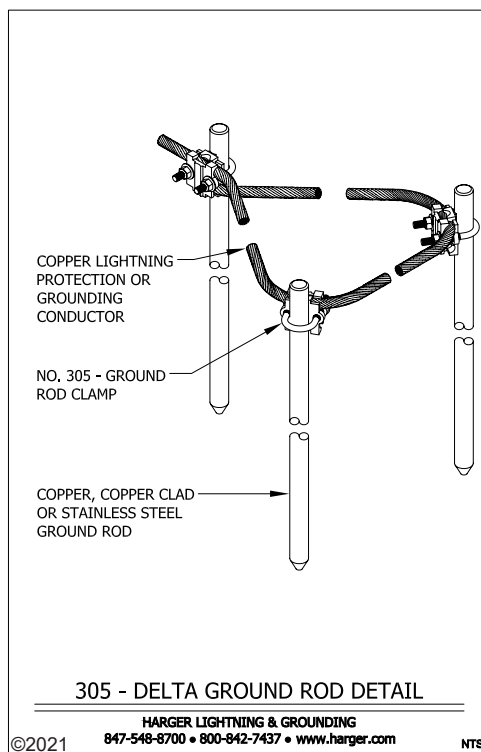
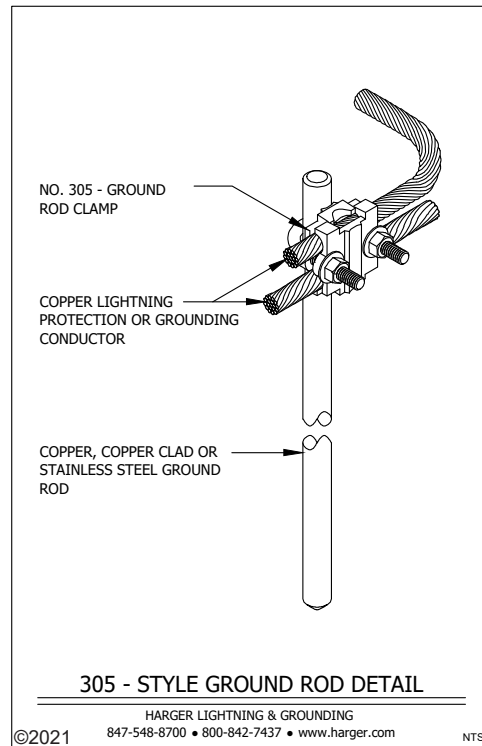
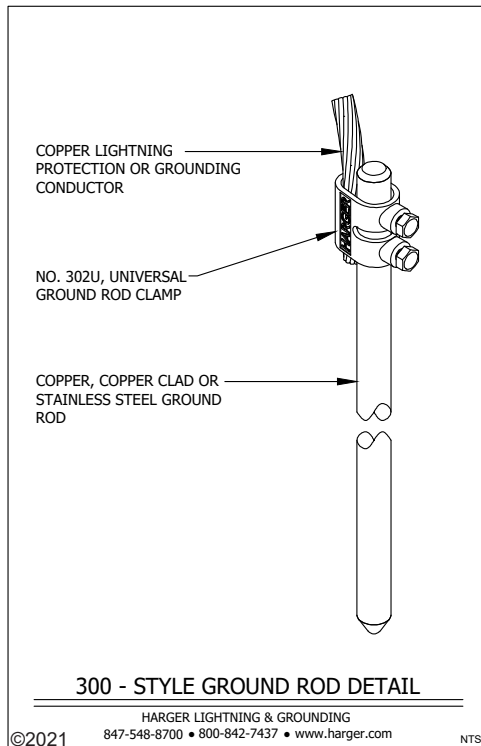


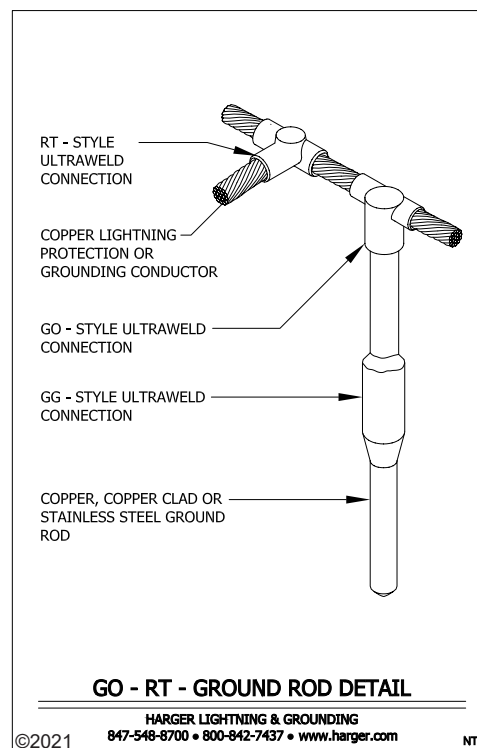
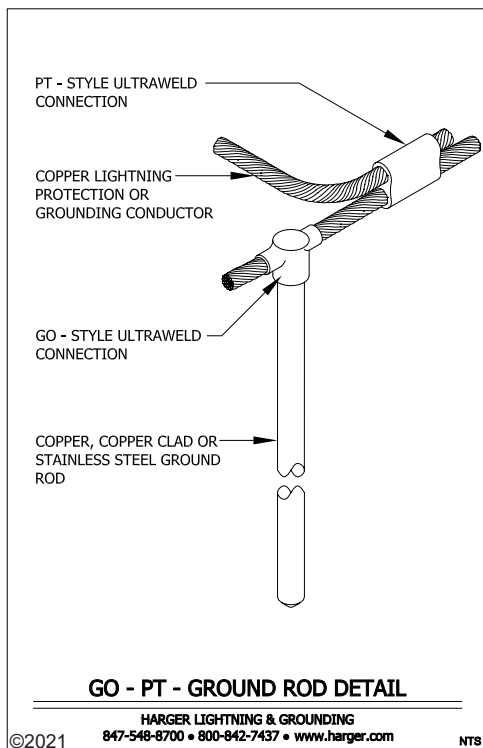
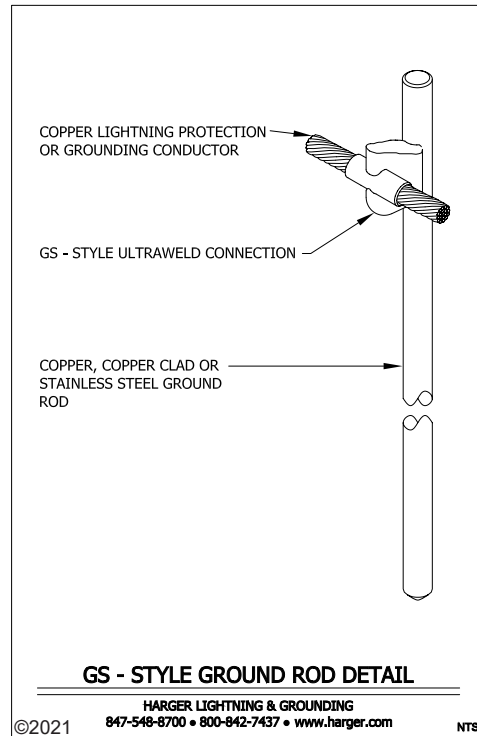
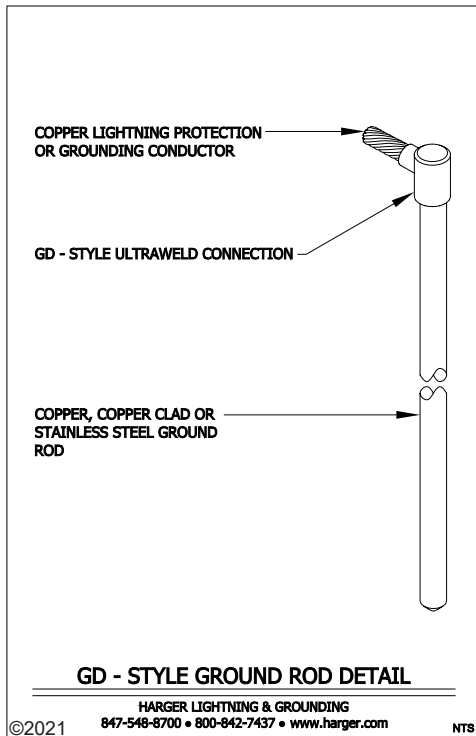


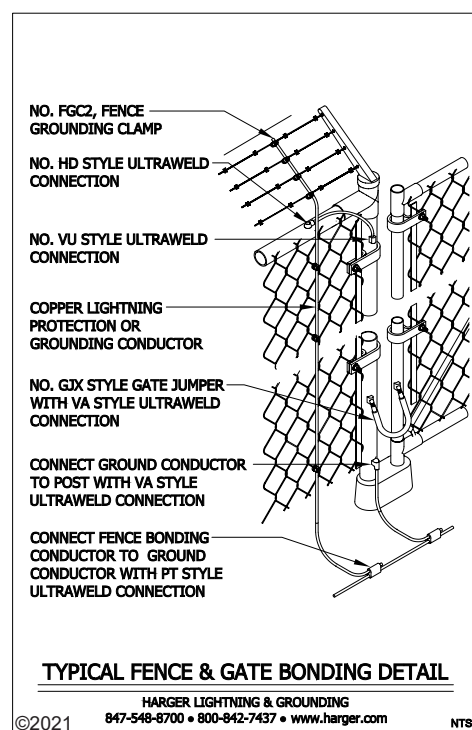
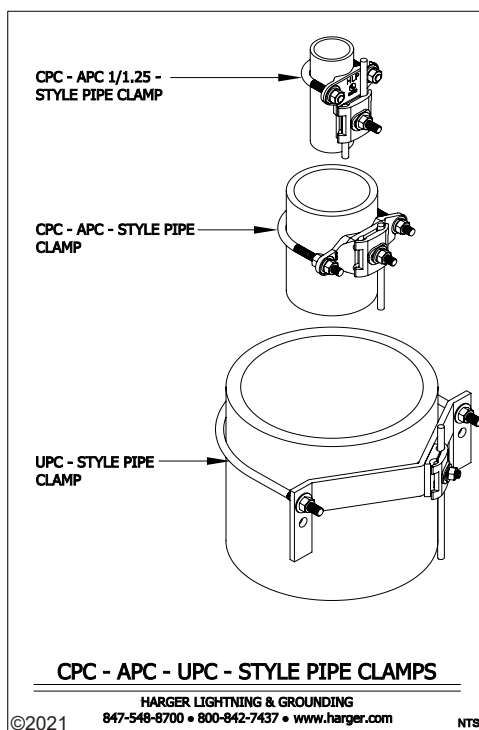
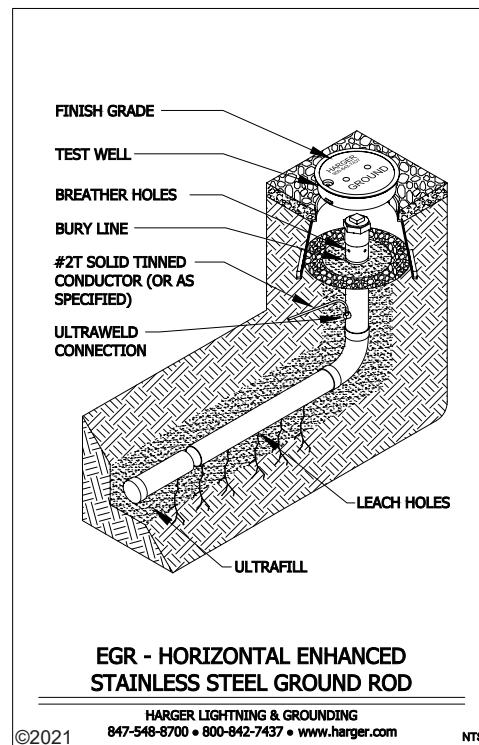
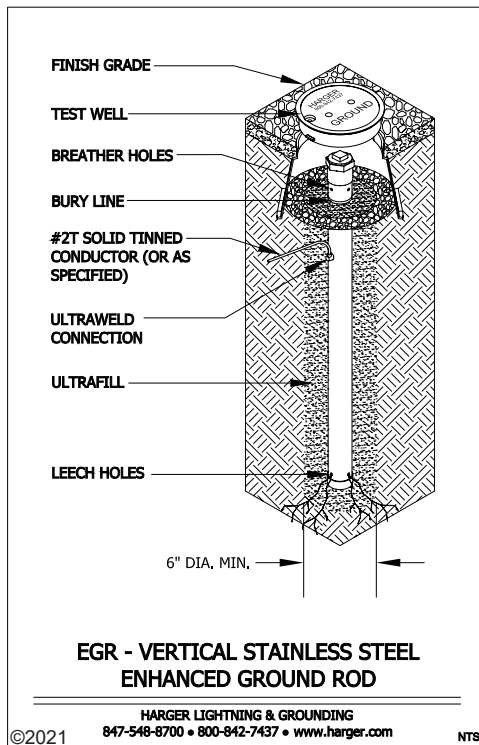


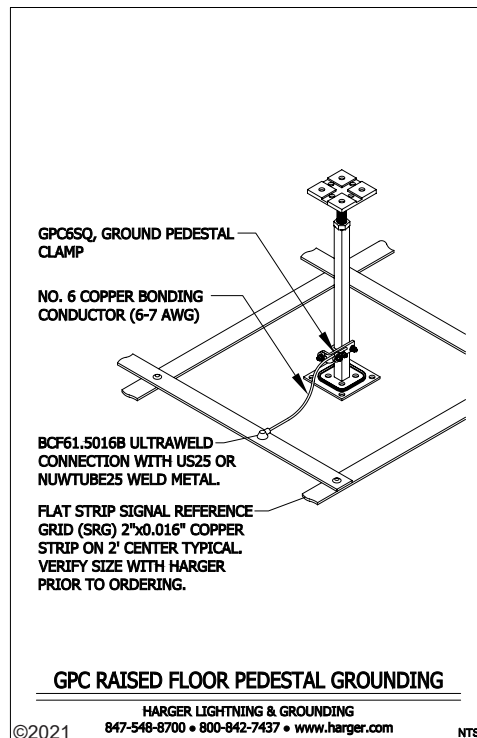
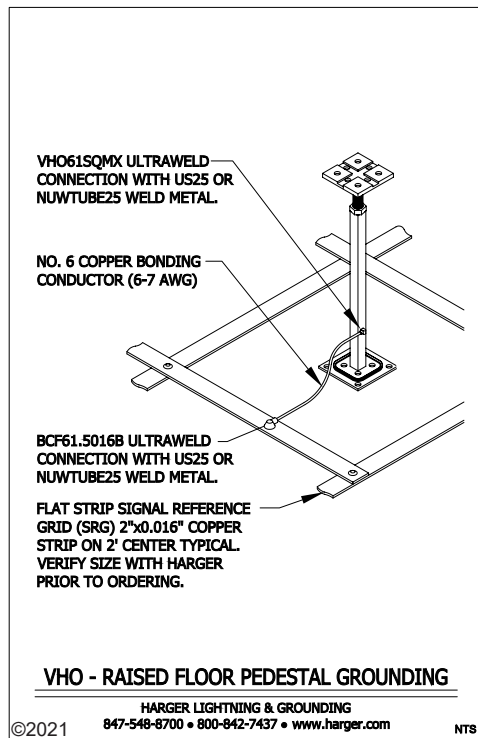
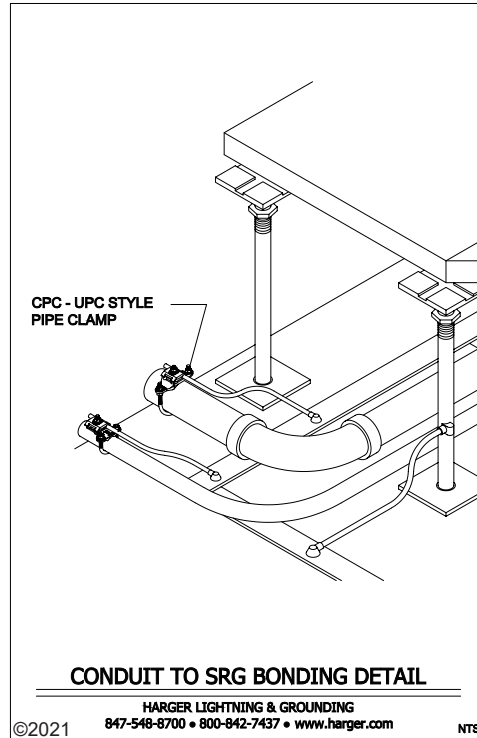
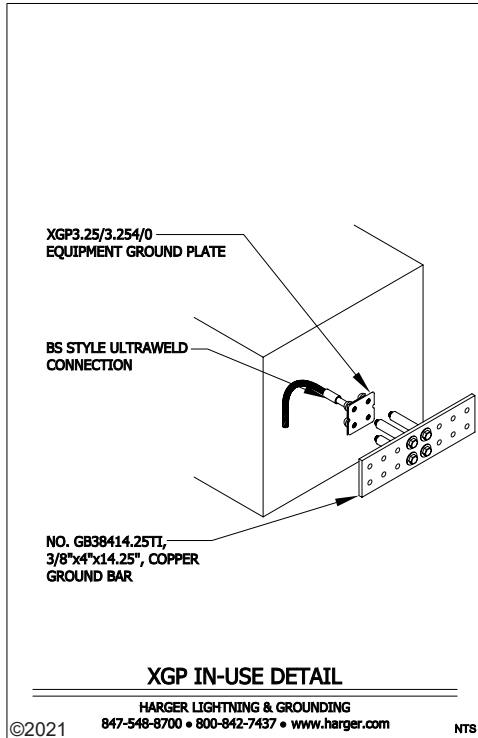


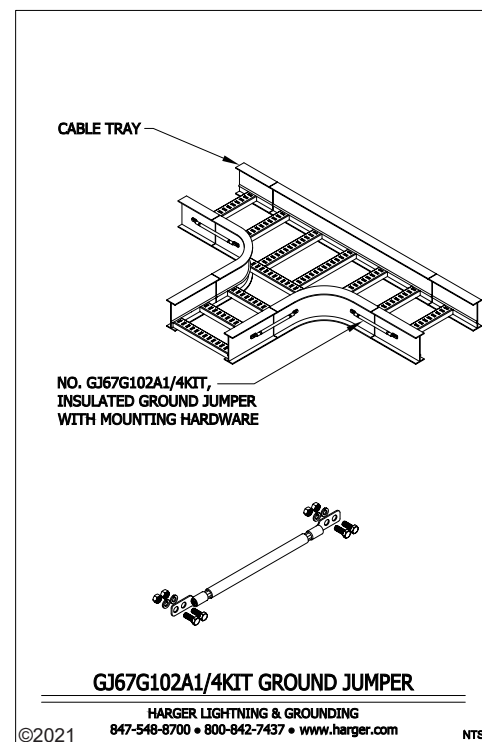
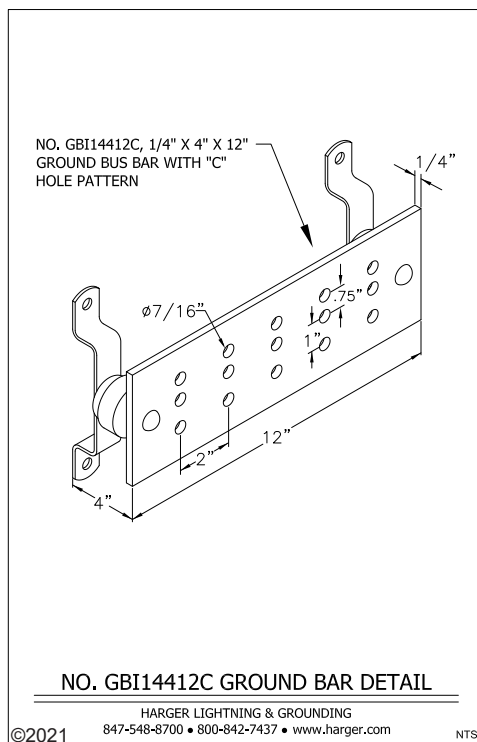
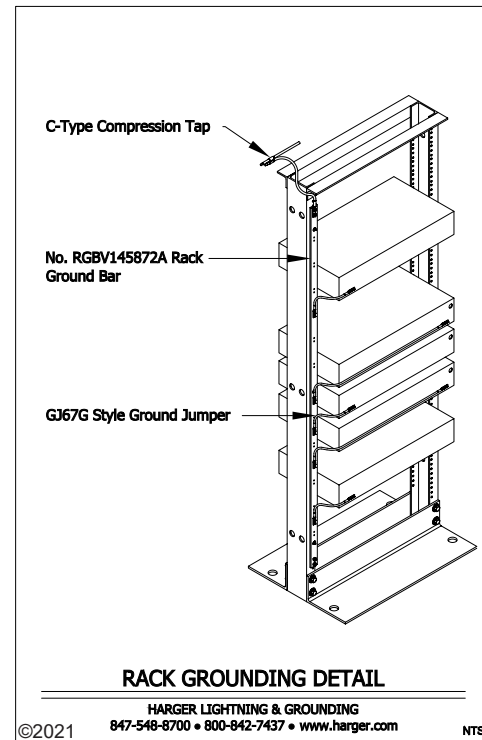
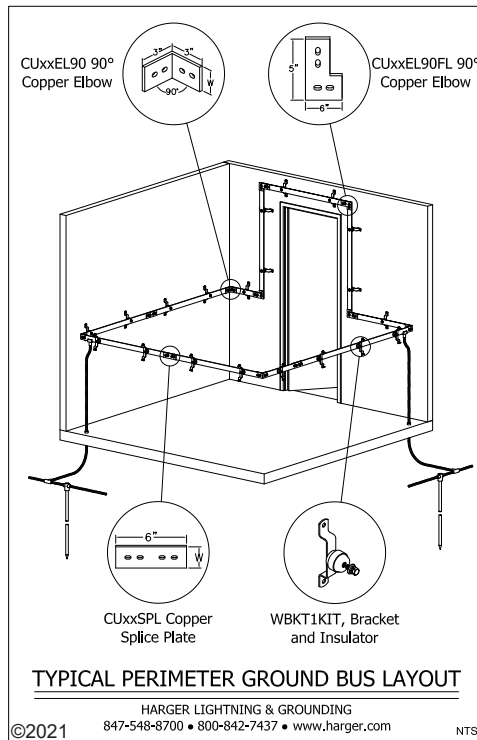












Section 33 79 16 - Tower Grounding for Wireless Communication Site Specification

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes requirements for Communications or Antenna Tower grounding and bonding.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 – Grounding and Bonding for Electrical Systems
- B. Section 26 01 40.13 - Operation and Maintenance of Lightning Protection Systems
- C. Section 26 41 13 – Lightning Protection for Structures

1.03 REFERENCES

- A. ANSI/TIA 607-C – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

1.04 FURNISHED AND INSTALLED BY 26 05 00

- A. Surge Protective Devices (SPD's) shall be installed at the entrances of all power service entrances and conductive communications systems.
- B. Surge Protective Device Ratings
 - 1. The power service entrance SPD shall have a nominal discharge current (In) rating of at least 20 kA 8/20 μ s per phase and be listed and labeled by UL 1449, Standard for Safety for Surge Protective Devices.
 - 2. Signal, data, and communications SPDs shall have a maximum discharge current (Imax) rating of at least 10 kA 8/20 μ s when installed at the entrance.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Installing contractor shall coordinate a site walkthrough with the grounding and bonding manufacturer prior to the start of any work. Manufacturer representative shall provide a pre-installation site report which includes guidance for design changes or confirmation that current site conditions match contract documents.
- B. Post-Installation Meeting: Installing contractor shall coordinate a site walkthrough with the grounding and bonding manufacturer at the commencement of work. Manufacturer representative shall provide a post-installation site report to the installing contractor which contains the following:
 - 1. Any deficiencies in the installation or confirmation that the current installation meets the requirements of the standards specified.
 - 2. Electronic markup of the approved shop drawing with embedded images showing all concealed bonding (gas piping, electrical service ground, communication grounds) and a random selection of concealed connections (cable to ground rod, cable to cable, cable to reinforcing steel).
 - a. Photographic documentation shall be provided from the installing contractor to the grounding and bonding manufacturer representative prior to concealing or backfilling.
- C. Sequencing: Coordinate installation of grounding and bonding system with installation of other building systems and components, including electrical wiring, supporting structures and building materials, and building finishes.

1.06 SUBMITTALS

- A. Product Data: Manufacturer's descriptive and technical literature or catalog cuts.
- B. Shop Drawings:

**Section 33 79 16 - Tower Grounding for Wireless Communication
Site Specification**

1. Layout of the grounding and bonding system, specifically for the building(s) or structures included in the contract drawings.
2. Installation details of the products to be used in the installation.
- C. Manufacturer's Instructions: Installation instructions shall be provided for grounding and bonding components that require field assembly or fabrication.
- D. Qualification data for firms or persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by a Nationally Recognized Testing Laboratory (NRTL).
- E. Certification, signed by tower erection contractor, that the connection method to the tower is approved by manufacturers of the grounding and bonding components, and the tower manufacturer.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Contracts: Installing contractor shall provide building owner with pricing for yearly system inspections. Building owner is under no obligation to have yearly inspections performed.
- B. Warranty Documentation: The completed installation shall carry a one-year guarantee against defects in material or installation.
 1. Exclusions: Routine preventative maintenance, accidental or intentional damage shall not be included as part of the warranty service.
- C. Record Documentation: Installing contractor shall provide building owner a copy of the pre-installation site report, post-installation site report and (3) full-size plots of accurate as-built shop drawings.

1.08 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer shall maintain current grounding and bonding material listings by a Nationally Recognized Testing Laboratory (NRTL).
 2. Installer Qualifications: Engage an experienced installer who has been trained and certified to perform installations by the grounding and bonding manufacturer.
- B. The system shall be physically inspected by a Nationally Recognized Testing Laboratory (NRTL) to the current edition of ANSI/TIA-607-C. The certification shall be provided to the building owner at completion of the project.

PART 2 - PRODUCTS**2.01 APPROVED MANUFACTURER**

- A. Harger Lightning & Grounding
301 Ziegler Drive, Grayslake IL 60030
<http://www.harger.com> | hargersales@harger.com

2.02 BONDING BUSBARS

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning & Grounding, bonding busbars.
- B. Substitution Limitations: No Substitutions
- C. Product Options:

Tower Busbar	External Busbar	Internal Busbar	Entrance Panel Kit
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Section 33 79 16 - Tower Grounding for Wireless Communication Site Specification

TGBIA14420M	TGBI14424TMGB	GBI14424TMGB	EPK24
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2.03 GROUND CONDUCTORS

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning & Grounding, ground conductors.
- B. Substitution Limitations: No Substitutions
- C. Product Options:

Tower Ground	Wooden Pole Ground	Cabinet Ground	Rooftop Ground
2T (minimum)	2T (minimum)	2T (minimum)	Refer to 26 41 13
Transmission Line Ground	Fence Ground	Generator Ground	Satellite Dish Ground
2T (minimum)	2T (minimum)	2T (minimum)	2T (minimum)

2.04 FENCE GROUNDING

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning & Grounding, grounding components.
- B. Substitution Limitations: Soil conditions may dictate the use of a grounding electrode not shown. Installing contractor shall coordinate with lightning protection manufacturer to determine proper materials.
- C. Product Options:

Deterrent Wire Bonding Clamp	Fence Fabric Bonding Clamp	Gate Jumper	Connection To Line/Gate Post
FGC2TP	FGC2TP	GJX2S24	VA Series

2.05 GROUNDING ELECTRODES

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning & Grounding, grounding electrodes.
- B. Substitution Limitations: Soil conditions may dictate the use of a grounding electrode not shown. Installing contractor shall coordinate with lightning protection manufacturer to determine proper materials.
- C. Product Options:

Standard Soil	Corrosive Soil	Shallow Topsoil	Rocky Conditions
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Section 33 79 16 - Tower Grounding for Wireless Communication Site Specification

3410	3410SS3	336	EGRSS10LWG4/0
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2.06 GROUND ACCESS WELLS

- A. Basis of Design: Subject to compliance with requirements, provide a minimum of (1) Harger Lightning & Grounding ground access well.
- B. Substitution Limitations: Soil conditions may dictate the use of a ground access well not shown. Installing contractor shall coordinate with lightning protection manufacturer to determine proper materials.
- C. Product Options:

Standard	Traffic Rated	Heavy Duty
GAW910	GAW121212HD	GAW121212TDLH

2.07 BELOW GRADE CONNECTIONS

- A. Basis of Design: Subject to compliance with requirements, provide UltraShot® exothermically welded connections by Harger Lightning & Grounding
- B. Substitution Limitations: No Substitutions
- C. Product Options:

Parallel	"T"	Straight	Cross	Ground Rod
PT Series	RT Series	BS Series	XO Series	GO Series

PART 3 - EXECUTION

3.01 INSTALLERS

- A. Installer List: Contact Harger Lightning and Grounding for a list of factory trained installers.

3.02 INSTALLATION

- A. Install grounding and bonding system as indicated on approved shop drawing, according to manufacturer's written instructions.
- B. Installation shall comply with all aspects of ANSI/TIA-607-C.
- C. Conductors shall be concealed from public view.

3.03 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.
- B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

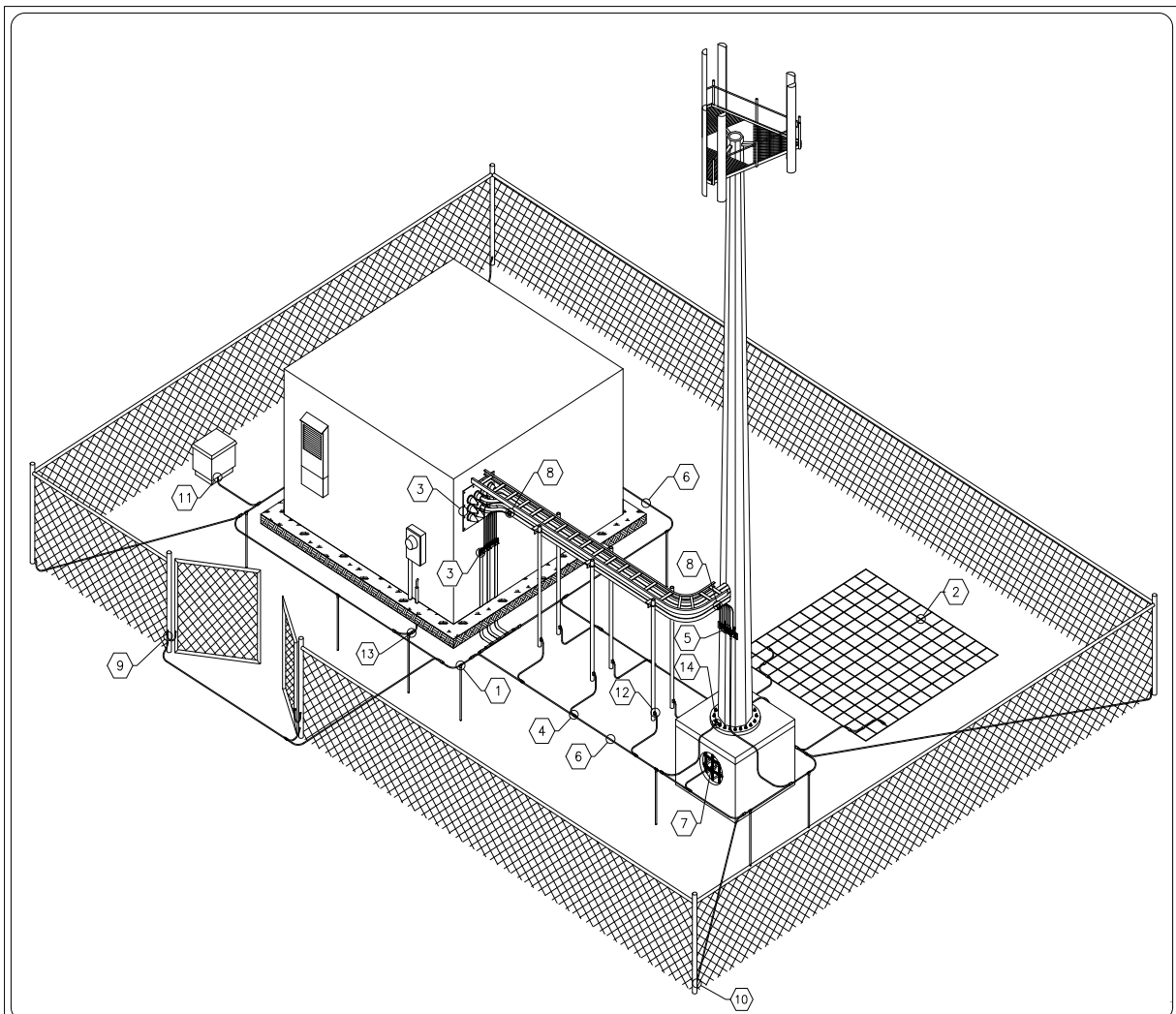
3.04 FIELD QUALITY CONTROL

- A. The system shall be physically inspected by a Nationally Recognized Testing Laboratory (NRTL) to the current edition of ANSI/TIA-607-C. The certification shall be provided to the building owner at the completion of the project.

**Section 33 79 16 - Tower Grounding for Wireless Communication
Site Specification**

END OF SECTION

Exterior Grounding Layout



KEYED NOTES

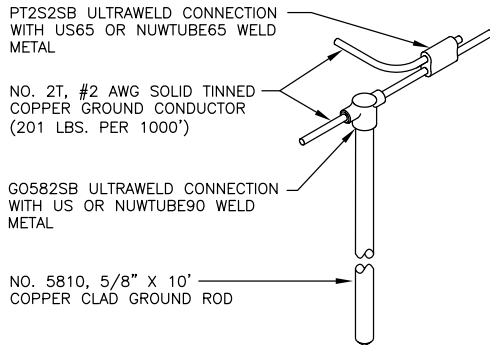
- 1 NO. 5810, 5/8" x 10'-0" COPPERCLAD GROUND ROD SPACED AT 16' MINIMUM WITH ULTRAWELD CONNECTION TYPE "G0582SB" (MOLD NUMBER) AND NUWTUBE90 (WELD METAL SIZE-ONE PER LOCATION) SEE DETAIL "G".
- 2 NO. GM121266, 12'-0" x 12'-0" GROUND MAT WITH NO. 6 AWG. SOLID BARE COPPER CONDUCTOR AT 6" O.C. EACH WAY, 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 NUWTUBE45 (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. GB1A14424M, 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.



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

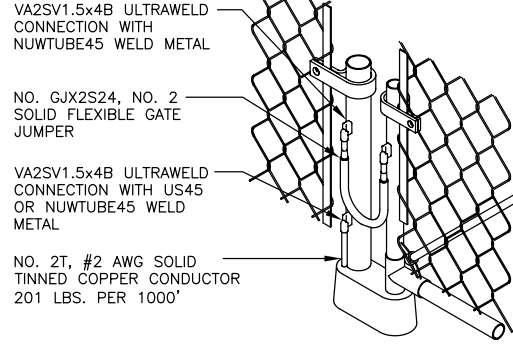
Typical Wireless Communication Site
Exterior Grounding Plan

Exterior Grounding Layout



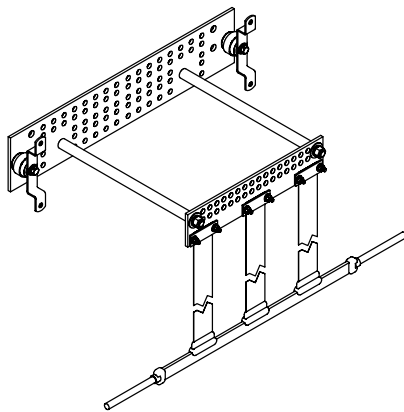
GROUND ROD DETAIL "G"

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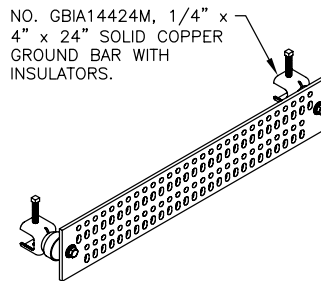
FENCE GROUNDING DETAIL "FG"

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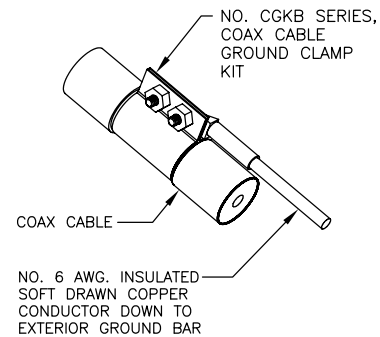
ENTRANCE PANEL DETAIL "EPK"

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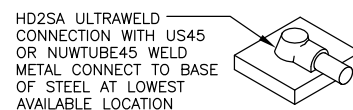
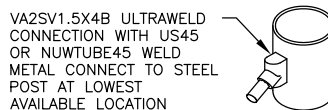
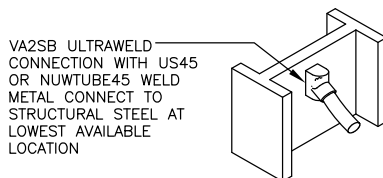
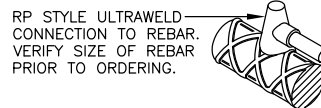
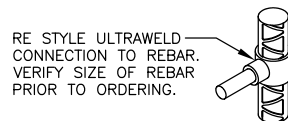
GROUND BAR DETAIL "GB"

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COAX GROUNDING DETAIL "CGK"

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ULTRAWELD DETAILS

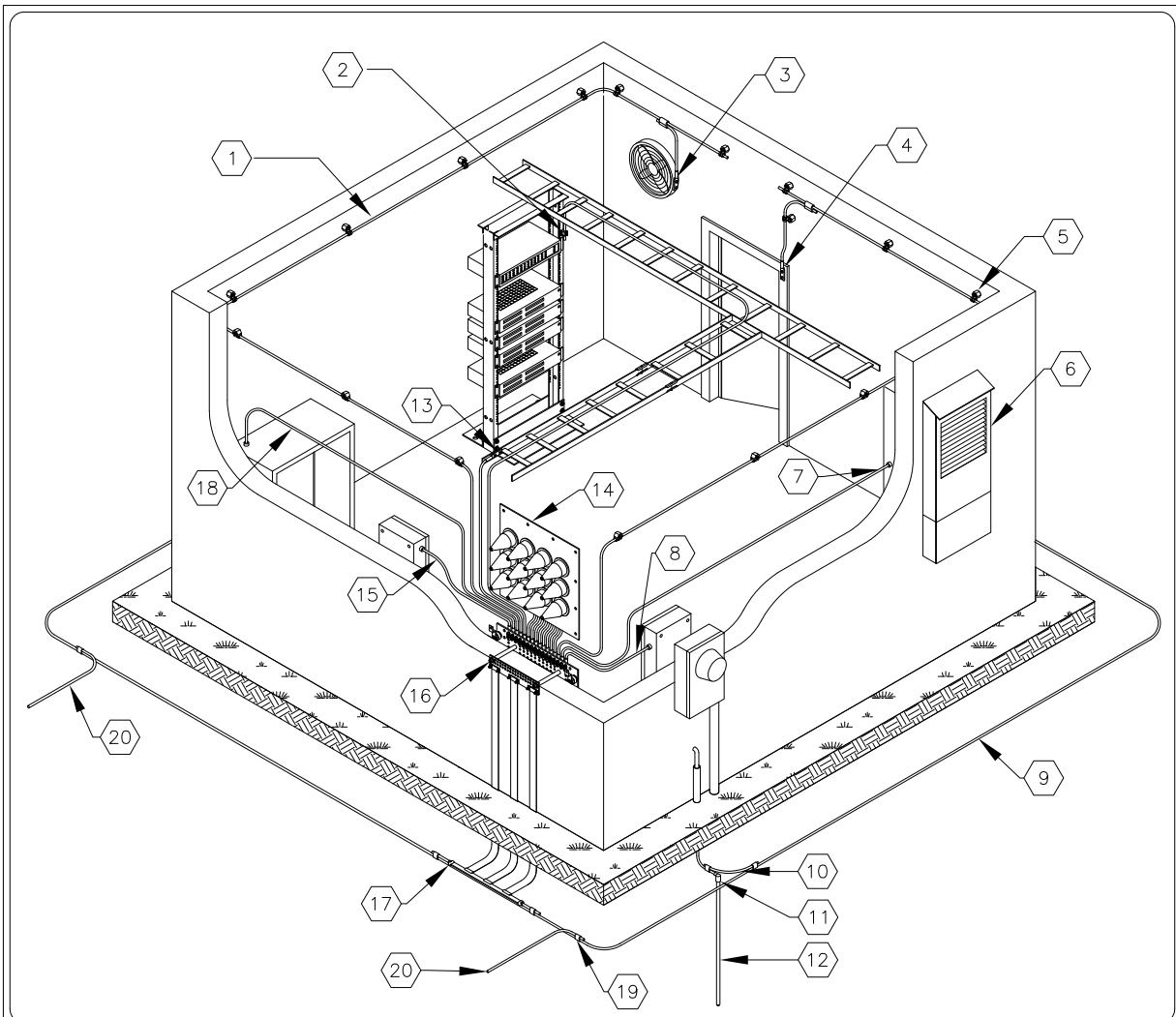
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Typical Wireless Communication Site
Exterior Grounding Plan

Interior Shelter Layout



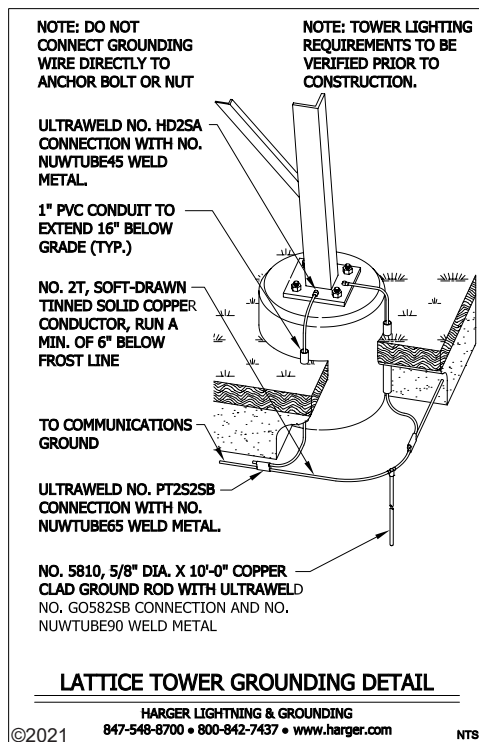
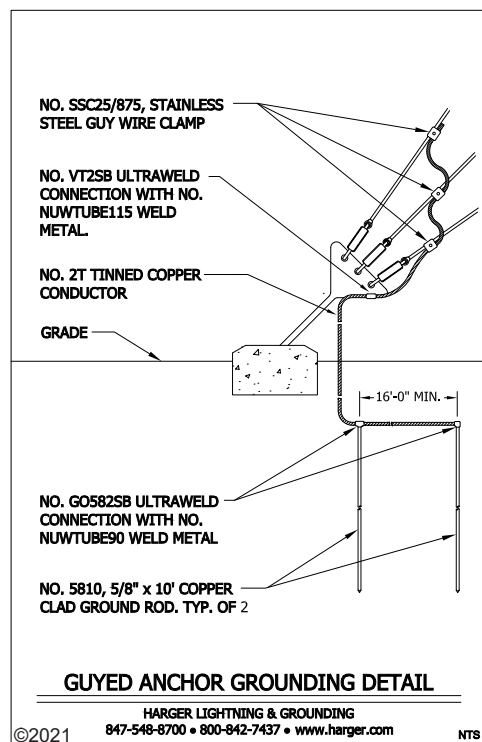
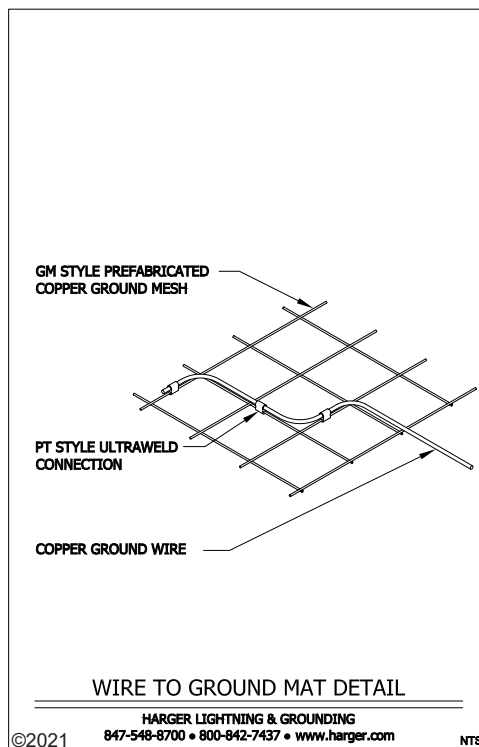
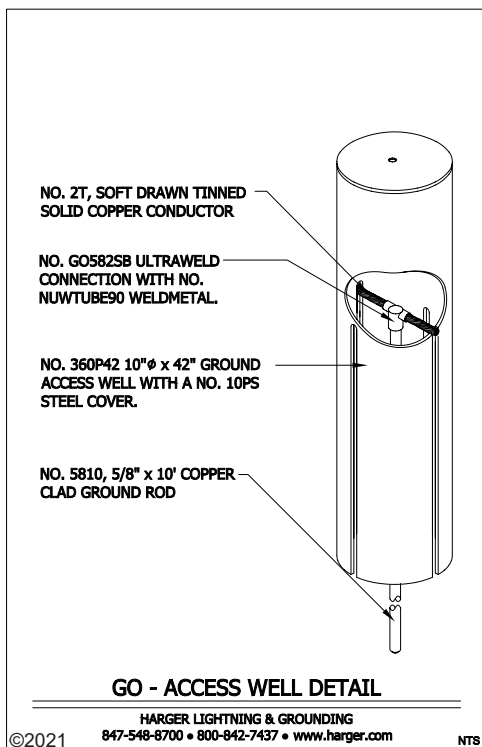
KEYED NOTES

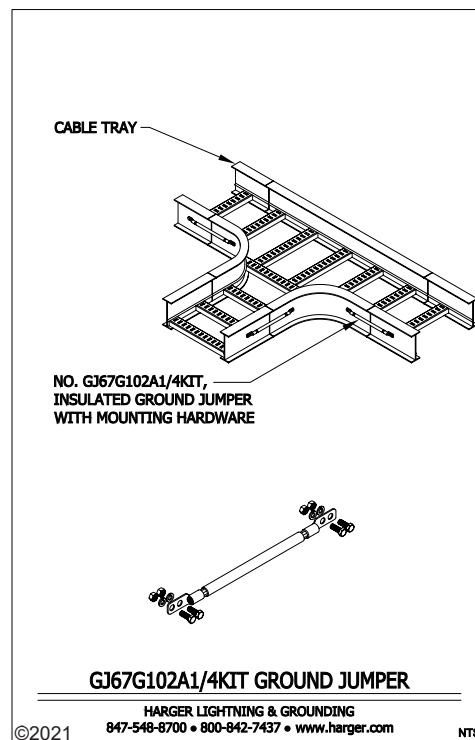
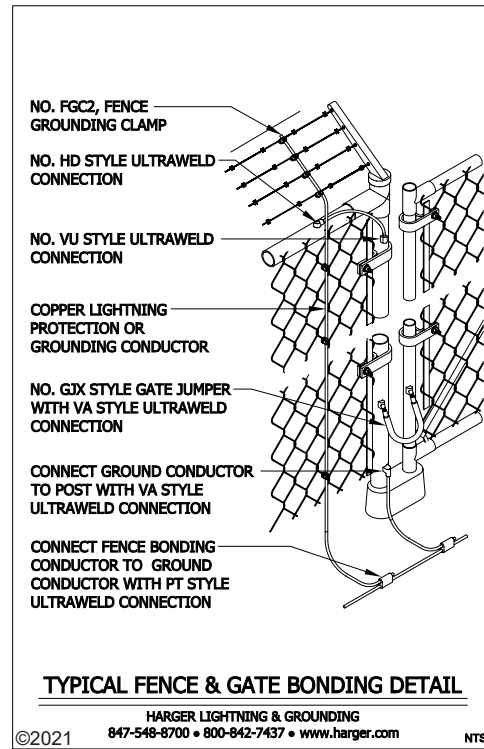
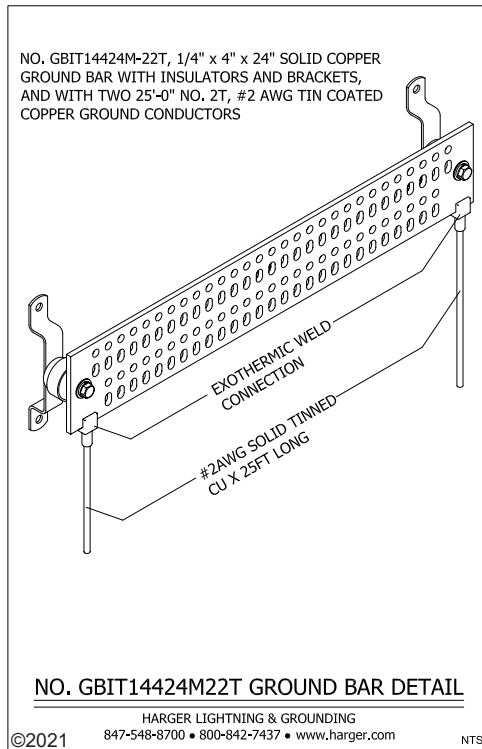
- | | | |
|--|--|---|
| 1 NO.27G, #2AWG STRANDED, GREEN INSULATED CONDUCTOR. INTERNAL PERIMETER GROUND BUS. CONNECTED TO MGB AT ONE END. TYPICAL | 8 BOND AC ELECTRIC SERVICE TO MGB PER NFPA 70 | 15 TELCO GROUND TO MGB |
| 2 EQUIPMENT RACK CHASSIS AND EQUIPMENT GROUND CONDUCTORS TO MGB | 9 SHELTER COUNTERPOISE GROUND LOOP. NO. 2T, SOFT-DRAWN TINNED SOLID COOPER CONDUCTOR RUN 30" MIN. OR BELOW FROST LINE. | 16 NO. EPK12, ENTRANCE PANEL KIT WITH THROUGH WALL MOUNTING OF EXTERIOR GROUND BAR AND INTERNAL (MGB) GROUND BAR. |
| 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 | 10 BOND BETWEEN UTILITY GROUND AND SHELTER COUNTERPOISE WITH NO. 2T, SOFT-DRAWN TINNED SOLID COOPER CONDUCTOR | 17 THE EPK12 ENTRANCE PANEL KIT PROVIDES A GROUND STRAP (1/32" X 3") ASSEMBLY THAT IS EASILY EXOTHERMICALLY WELDED TO THE SHELTER COUNTERPOISE. |
| 4 BOND DOOR FRAME TO INTERNAL PERIMETER GROUND BUS CONDUCTOR WITH NO. 6-7G CONDUCTOR, NO. CT2248LD TAP AND NO. GECLB62A LUG | 11 ULTRAWELD NO. GD582SB CONNECTION WITH NO. US65 OR NUWTUBE65 WELD METAL | 18 UPS EQUIPMENT GROUND CONDUCTOR TO MGB |
| 5 NO. HSC STYLE HALO STANDOFF CLAMP | 12 NO. 5810, 5/8"X10' COPPER CLAD GROUND ROD. UTILITY SERVICE GROUND | 19 ULTRAWELD NO. PT252SB CONNECTION WITH NO. US65 OR NUWTUBE65 WELD METAL OR NO. RT252SB WITH NO. US45 OR NUWTUBE45 WELDMETAL. TYPICAL |
| 6 HVAC UNIT | 13 BOND CABLE TRAY TO MGB | 20 TO TOWER GROUND ELECTRODE SYSTEM |
| 7 HVAC EQUIPMENT GROUNDING CONDUCTOR TO MGB | 14 COAX ENTRY PORT | |



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INTERIOR SHELTER LAYOUT





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 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

Section 26 05 26.xx (Formerly 16065) – Signal Reference Grid System Specification**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.
- 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 emission (LOsmoke™) requirements when using the UltraShot process, use one of the kits found "System" on page 271 for converting standard molds into low emission 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 emission (LOsmoke™) requirements when using the UltraShot process, use one of the kits found "System" on page 271" for converting standard molds into low emission molds. It is permissible to splice sections of copper strip to lengthen SBG conductors so they clear preexisting objects on floor.

Section 26 05 26.xx (Formerly 16065) – Signal Reference Grid System Specification

- 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 emission (LOsmoke™) requirements when using the UltraShot process, use one of the kits found on page 266 for converting standard molds into low emission 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.
- 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 emission (LOsmoke™) requirements when using the UltraShot process, use one of the kits found "System" on page 271 for converting standard molds into low emission 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 emission (LOsmoke™) requirements when using the UltraShot process, use one of the kits found "System" on page 271" for converting standard molds into low emission molds.

3.05 Bonding Other Steel Members

Section 26 05 26.xx (Formerly 16065) – Signal Reference Grid System Specification

- 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.
- e. For low emission (LOsmoke™) requirements when using the UltraShot process, use one of the kits found on "System" on page 271 for converting standard molds into low emission molds.

3.06 Coordination

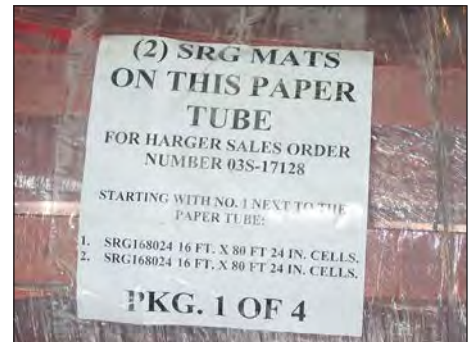
- a. Coordinate the installation of the high frequency signal reference grid grounding system with other trades to avoid damage of installed materials.

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 LOsmoke™ System (see page 271), 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 LOsmoke (see page "System" on page 271) 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 LOsmoke (see "System" on page 271) 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 SUMMARY

- A. Provide all labor, materials, tools, installation equipment, and test equipment required for the complete installation of grounding and bonding for communications systems within the structure.

1.02 RELATED REQUIREMENTS

- A. Section 01 33 00 – Submittal Procedures
- B. Section 26 05 26 – Grounding and Bonding for Electrical Systems

1.03 REFERENCES

- A. ANSI/TIA 607-C – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Current Edition)
- B. ATIS 0600333-2013 – Grounding and Bonding of Telecommunications Equipment
- C. NFPA 70 – National Electrical Code (Current Edition)

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing: Coordinate installation of communications grounding and bonding with installation of other building systems and components, including electrical wiring, supporting structures and building materials, and building finishes.

1.05 SUBMITTALS

- A. Product Data: Manufacturer's descriptive and technical literature or catalog cuts.
- B. Shop Drawings:
 - 1. Layout of the communications grounding and bonding system, specifically for the building(s) or structures included in the contract drawings.
 - 2. Installation details of the products to be used in the installation.
- C. Manufacturer's Instructions: Installation instructions shall be provided for communications grounding and bonding components which require field assembly or fabrication.
- D. Qualification data for firms or persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by a National Recognized Testing Laboratory (NRTL).

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Contracts: Installing contractor shall provide building owner with pricing for yearly system inspections. Building owner is under no obligation to have yearly inspections performed, however any changes to the equipment installed within a structure could render the grounding and bonding system ineffective.
- B. Warranty Documentation: The completed installation shall carry a one-year guarantee against defects in material or installation.
 - 1. Exclusions: Routine preventative maintenance, accidental or intentional damage shall not be included as part of the warranty service.

Section 27 05 26 (Formerly 16740) – Grounding and Bonding for Communications Systems Specification

- C. Record Documentation: Installing contractor shall provide building owner (3) full-size plots of accurate, as-built shop drawings.

1.07 EXTRA STOCK MATERIALS

- A. Provide extra stock materials to building owner in a single, durably packed container labeled with "27 05 26 – Telecom Grounding and Bonding", installing contractor contact information, date and complete listing of contents.
1. (10) #GECLB62A, Two-hole compression lugs for #6 AWG conductor
 2. (20) #CS46S, 1/4" x 3/4" Stainless steel hex head cap screw
 3. (20) #W4S, 1/4" Stainless steel flat washer
 4. (10) #BW4S, Bonding lug washer
 5. (20) #N420S, 1/4" Stainless steel hex nut
 6. (100') #67G, #6AWG Green insulated copper conductor
 7. (5) #HCAJC1/2, 1/2 oz. Antioxidant

1.08 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer shall maintain current electrical grounding material listings with a National Recognized Testing Laboratory (NRTL).

PART 2 - PRODUCTS**2.01 APPROVED MANUFACTURER**

- A. Harger Lightning & Grounding
301 Ziegler Drive, Grayslake IL 60030
<http://www.harger.com> | hargersales@harger.com

2.02 PRIMARY BONDING BUSBAR (PBB)

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding "TMGB" series
- B. Substitution Limitations: Project conditions may dictate the use of an alternate PBB, installing contractor shall coordinate with Harger Lightning and Grounding to determine proper material selection.
- C. Product Options:
1. The PBB Shall be predrilled with holes for use with standard sized lugs.
 2. The PBB shall be listed and meet the requirements of ANSI/TIA 607-C.
 3. The PBB length shall be sized with consideration for future growth.
 4. The PBB shall have a minimum thickness of 1/4" (6mm) and height of 4" (100mm).

2.03 SECONDARY BONDING BUSBAR (SBB)

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding "TGB" series

Section 27 05 26 (Formerly 16740) – Grounding and Bonding for Communications Systems Specification

- B. Substitution Limitations: Project conditions may dictate the use of an alternate SBB, installing contractor shall coordinate with Harger Lightning and Grounding to determine proper material selection.
- C. Product Options:
 - 1. The SBB Shall be predrilled with holes for use with standard sized lugs.
 - 2. The SBB shall be listed and meet the requirements of ANSI/TIA 607-C.
 - 3. The SBB length shall be sized with consideration for future growth.
 - 4. The SBB shall have a minimum thickness of 1/4" (6mm) and height of 2" (50mm).

2.04 RACK BONDING BUSBAR (RBB)

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding Part No. RGBHKIT14119.25, horizontal rack bonding busbar or Part No. RGBVKIT145872A, vertical rack bonding busbar.
- B. Substitution Limitations: Project conditions may dictate the use of an alternate RBB, installing contractor shall coordinate with Harger Lightning and Grounding to determine proper material selection.
- C. Product Options:
 - 1. The RBB Shall be predrilled with holes for use with standard sized lugs.
 - 2. The SBB shall be listed and meet the requirements of ANSI/TIA 607-C.
 - 3. The SBB length shall be sized per the horizontal width or vertical height of the rack.
 - 4. The SBB shall have a minimum thickness of 1/4" (6mm) and height of 5/8" (16mm).

2.05 BONDING NETWORK (MESH-BN)

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding series SRG.
- B. Substitution Limitations: Project conditions may dictate the use of an alternate mesh-BN, installing contractor shall coordinate with Harger Lightning and Grounding to determine proper material selection.

Section 27 05 26 (Formerly 16740) – Grounding and Bonding for Communications Systems Specification

2.06 CONDUCTORS

- A. Conductors shall be stranded copper and may be insulated.
1. Conductors shall be rated for the environment where it is to be installed.
 2. Conductors shall be a minimum of 6 AWG and should sized at 2 kcmil per linear foot of conductor length. Refer to the table below conductor sizing.

TBB/BBC linear length ft (m)	Conductor Size (AWG)
Less than 13 ft (4m)	6
14 – 20 ft (4 – 6m)	4
21-26 ft (6 – 8m)	3
27 – 33 ft (8 – 10m)	2
34 – 41 ft (10 – 13m)	1
42 – 52 ft (13 – 16m)	1/0
53 – 66 ft (16 – 20m)	2/0
67 – 84 ft (20 – 26m)	3/0
85 – 105 ft (26 – 32m)	4/0
106 – 125 ft (32 – 38m)	250 kcmil

3. Where structural metal of a building is bonded to the building's grounding electrode system, the structural metal may be used in lieu of a TBB, a BBC, or both. Structural metal shall be electrically continuous; either through construction or the use of jumpers. Concrete reinforcing steel shall not be used in lieu of a TBB, a BBC, or both.

2.07 CONNECTIONS TO PBB OR SBB

- A. Mechanical connections to the PBB or SBB shall be made with; listed, two-hole, long barrel, electro tin-plated compression lugs with inspection port. The following part numbers shall be used:

Conductor Size (AWG)	Part Number
6	GECLB62A
4	GECLB42A
3	GECLB32A
2	GECLB22C
1	GECLB12C
1/0	GECLB1/02C
2/0	GECLB2/02C
3/0	GECLB3/02C
4/0	GECLB4/02C
250 kcmil	GECLB2502C

- B. Exothermic connections to the PBB or SBB should be made to the sides (top, bottom or vertical) of the busbars. The following Ultraweld® series shall be used; BD, BE, or BU.

Section 27 05 26 (Formerly 16740) – Grounding and Bonding for Communications Systems Specification

2.08 CONNECTIONS FROM EQUIPMENT TO THE RBB

- A. Equipment mounted in a rack or cabinet shall be bonded to the RBB with Harger Lightning and Grounding UBC series bonding jumpers.

2.09 ANTIOXIDANTS

- A. Bonding surfaces shall be cleaned to bare metal by removing all paint, protective coverings, oxidation, etc. The contact area shall be protected from corrosion using an approved antioxidant joint compound.
1. Copper (including tinned) to copper (including tinned) connections – Part No. HCAJC
 2. Copper (including tinned) to aluminum (including tinned) connections – Part No. HAAJC
 3. Copper (including tinned) to other metals – Part No. NOOXCLR

2.10 BONDING TO MISCELLANEOUS SYSTEMS

- A. Metallic conduits and piping
1. Metallic conduits or piping less than 1" (25mm) in diameter shall be bonded with no. TBGC4SCS*, electro-tin plated copper pipe clamp.
 2. Metallic conduits or piping greater than 1" (25mm) in diameter shall be bonded per the table below.

Nominal Pipe Size	Part Number
1" – 1-1/4" (25 – 30mm)	CPC1/1.25
1-1/2" – 2" (38 – 50mm)	CPC1.5/2
2-1/2" – 3" (64 – 76mm)	CPC2.5/3
3-1/2" – 4" (89 – 100mm)	CPC3.5/4
5" – 6" (127 – 150mm)	CPC5/6
8" (203mm)	UPC8C
10" (254mm)	UPC10C

- B. Metallic Raceways
1. Metallic cable trays or raceways shall be bonded with no. TBCTC, electro-tin plated copper cable tray bonding clamps.
- C. Access Floor
1. Bonding of pedestals utilized in raised access floors shall be made with GPC series, pedestal clamps.
- D. Structural Steel Framework
1. Mechanically bonded connections to the building steel shall be made with either Part No. 217, tinned copper bonding plate or Part No. 223T, tinned copper flange bonding plate.

**Section 27 05 26 (Formerly 16740) – Grounding and Bonding for
Communications Systems Specification**

2. Exothermic connections to the building steel shall be made with one of the following series of Ultraweld®; VU, VD, or VA.

2.11 GROUND ACCESS WELLS

- A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding Part No. GAW121212HD, ground access well.
- B. Substitution Limitations: Project conditions may dictate the use of an alternate access well, installing contractor shall coordinate with Harger Lightning and Grounding to determine proper material selection.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Install grounding and bonding for communications systems as indicated on approved shop drawing, according to manufacturer's written instructions.
- B. Ground conductors and grounding connections shall be installed in a neat and workmanlike manner.
- C. Installation shall comply with all aspects of ANSI/TIA 607-C.

3.02 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.
- B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

END OF SECTION

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