

GENERAL NOTES

1. SEE M279 APPROVAL LETTER SER # P-42586RC DTD 1/22/02

10	CABLEWAY KEY PLAN	HMI PROD ENG-M283-FE44
	CABLE ROUTING	HMI PROD ENG-M283-PE52
8	TYPICAL STRUCTURAL DETAILS	HMI PROD ENG-M283-FH67
9	ELECTRICAL INSTALLATION DETAILS	HMI PROD ENG-M283-FE45, PE45
6	CABLEWAY DETAILS	HMI PROD ENG-M283-FE40, PE40
5	PENETRATION DETAILS	HMI PROD ENG-M283-FE41, PE41
4	LIGHTING SYSTEM ONE-LINE	HMI PROD ENG-M283-FE17, PE17
3	POWER ONE-LINE	HMI PROD ENG-M283-FE01, PE01
2	MAIN MACHINERY ROOM ARRANGEMENT	HMI PROD ENG-M283-FA03
1	GENERAL ARRANGEMENT DRAWINGS	HMI PROD ENG-M283-FA02
NO.	TITLE	DRAWING NUMBER

REFERENCES

HULL APPLICABILITY

M283 HULL 1953
M283 HULL 1956
M284 HULL 1957



AS-BUILT

0	0	0	REV
22	21	20	SHT
0	0	0	REV
19	18	17	16
15	14	13	12
11	10	SHT	
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REVISION STATUS

DRL NUMBERS

A034
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VT Halter Marine, Inc.



**Vision Technologies
Systems**

VESSEL

FRV40 CLASS 63m FISHERIES RESEARCH VESSEL

DRAWN BY BS 03/30/04	ABS APPV SEE NOTE 1
CHECKED BY GS 4/4/04	USCG APPV SEE NOTE 1
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HULL NO APPLICABILITY	CAGE CODE 3BJ86
ESTIMATE NO 00-104	SCALE NTS
SIZE A	

TITLE

BONDING AND GROUNDING DETAILS

JOB NO. M283	ITEM 304	DELIVERABLE FE43	SHEET 001	REV 03
FILE R:\M283\FUNCTIONALDESIGN\INWORK\ELECDWGS\			SHEET 1 OF 22	

PLOT:

REVISIONS

REV	ZONE	DESCRIPTION	DATE	APPROVED
1		1. EXTENDED HULL APPLICABILITY TO INCLUDE HULL 1956.	3/23/05	BMB
2	SHT1	1. EXTENDED HULL APPLICABILITY TO INCLUDE HULL 1957. AUTH: ITEM 1 PER ENGINEERING DEVELOPMENT	6/14/06	CC
3	SHT1	REFLECTS AS-BUILT CONDITION M283 HULL 1953	9/25/06	CC

DOCUMENT DISTRIBUTION RECORD															
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REV#	0	1	2	3											
ABS	0	0	0	0											
NAVY	E	E	E	E											
HMP PC	12	12	12	12											
PROG MGR	1	1	1	1											
PROJ ENG	1	1	1	1											
EL	E	E	E	E											
NA	E	E	E	E											
PI	E	E	E	E											
ST	E	E	E	E											
HVAC	1/E	1/E	1/E	1/E											
JOINER															
NOISE CONTROL															
PROP SSV															
TRAWL SSV															
AS BUILT									X						
ISSUED BY	JS														

HULL NO APPLICABILITY	CAGE CODE 3BJ86	SIZE A	JOB NO. M283	ITEM 304	DELIVERABLE FE43	SHEET 001A	03
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BONDING AND GROUNDING DETAILS OUTLINE

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2. Fabrication and Installation

Type I Bond Strap

Type IV Bond Strap

General

- Hardware
- Surface Preparation
- Location
- Corrosion Protection
- Weather Seal
- Anti-seize Compound

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A. GUIDELINES

Bonding details shall be used in the Installation of Cable Systems throughout Shipboard Installations of NOAA Fisheries Research Vessel FRV40-1. The details of these Bonding and Grounding Installations must be used in conjunction with Hull Standards for Structural plates and shapes. See Typical Structural Details, Ref 8.

Specific details pertaining to the welding and other assembly requirements for cableway hanger systems by type are provided in Cableway Details, Ref 6.

Detail guidelines shall also be used in conjunction with Regulatory Body and Classification Requirements. ABS Rules for Building and Classing Steel Vessels Part 4, Section 5B3 Cable Installation, IEEE Standards 45 Clause 10, Cable Installation and CFR, Title 46, Chapter I, Subchapter J, Subpart 111.05 Equipment Ground, National Electrical Code (NEC), Table 250-66, Grounding Electrical Conductor for AC Systems, Ground Detection and Grounded Systems, Department of Defense MIL-STD-1310G Standard Practice for Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility and Safety and MIL-DTL-24749A Detail Specification Grounding Straps and Bosses.

B. PROCEDURES

1. All cable and equipment shall be installed in accordance with Regulatory Body and Classifications, as well as the requirements shown in this standard.
2. The metal hull shall be designated ground potential.
Grounding refers to a low resistance electrical path (0.10 ohm or less) to the hull ground.
3. The following equipment and items shall be grounded:
 - Equipment utilizing electrical power
 - Metallic standing rigging and masts
 - Metallic cranes, hoisting gear, gantry and A-frame
 - Portable metallic lifeline stanchions, life-rails and ladderways
 - All metallic pipes and piping
 - Engines, bow thruster, bow thruster controls, rudder, rudder stock, struts, main shaft (engine or reduction gear mount), main shaft fairing (if not grounded internally), sonar trunks, all sea chests, centerboard, and all other large metallic underwater appendages
 - Portable vans
 - Fuel or water tanks
 - Metal ducts
 - Resilient mounted equipment (bonding strap on resilient mounted equipment should be the minimum length sufficient to account for equipment excursion envelope.)

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4. Bonding methods shall be classed as follows:

- Class A – a bond that is established by joining two metallic surfaces through the process of welding or brazing.
- Class B – a bond not exceeding 0.1 ohm(direct current (DC) resistance) that is established between an equipment housing, case or cabinet and ground potential, as a result of the installation of that equipment or as a result of the preparation of the mounting surface.
- Class C – a bond that is established by bridging two metallic surfaces with a metallic bond strap.

5. On below decks (weather protected) installed equipment, a metal-to-metal contact area shall be provided both on the equipment mounting surface and on the mounting foundation.

Contact area shall be provided around at least one mounting bolt. Metal-to-metal area shall be at least equal in diameter to the size of two mounting bolts. Equipment shall be installed and tested at the ground point and must not exceed a DC resistance of 0.1 ohm. On above deck (weather exposed) equipment where 0.1 ohm DC resistance or less is not inherent in the equipment installation, a class C bond shall be installed between the equipment and ground potential.

6. Class C bonding (via straps) shall use one of the following types of straps:

- Type I, Type II—bond straps are for use in shipboard topside areas
- Type IV – bond straps are for use in shipboard non-topside areas and bonding equipment utilizing sound isolated or shock mounts. See Figure FE43-2 and Fabrication and installation, Type IV Bond Straps.

7. The outermost metallic surface of all equipment connected to electrical power of 30 volts or more shall be grounded. All metal sheaths, armor of cable and mineral-insulated metal-sheathed cable are to be electrically continuous and are to be grounded to the metal hull at each end of the run except that final subcircuits may be grounded at the supply. All metallic coverings of power and lighting cables passing through hazardous area or connected to equipment in such an area are to be grounded at least at each end.

8. The following shall be Class B bonded:

- Hard mounted electrical and electronic equipment and subassemblies.
- Metal connection boxes, switch boxes, and breaker panels.

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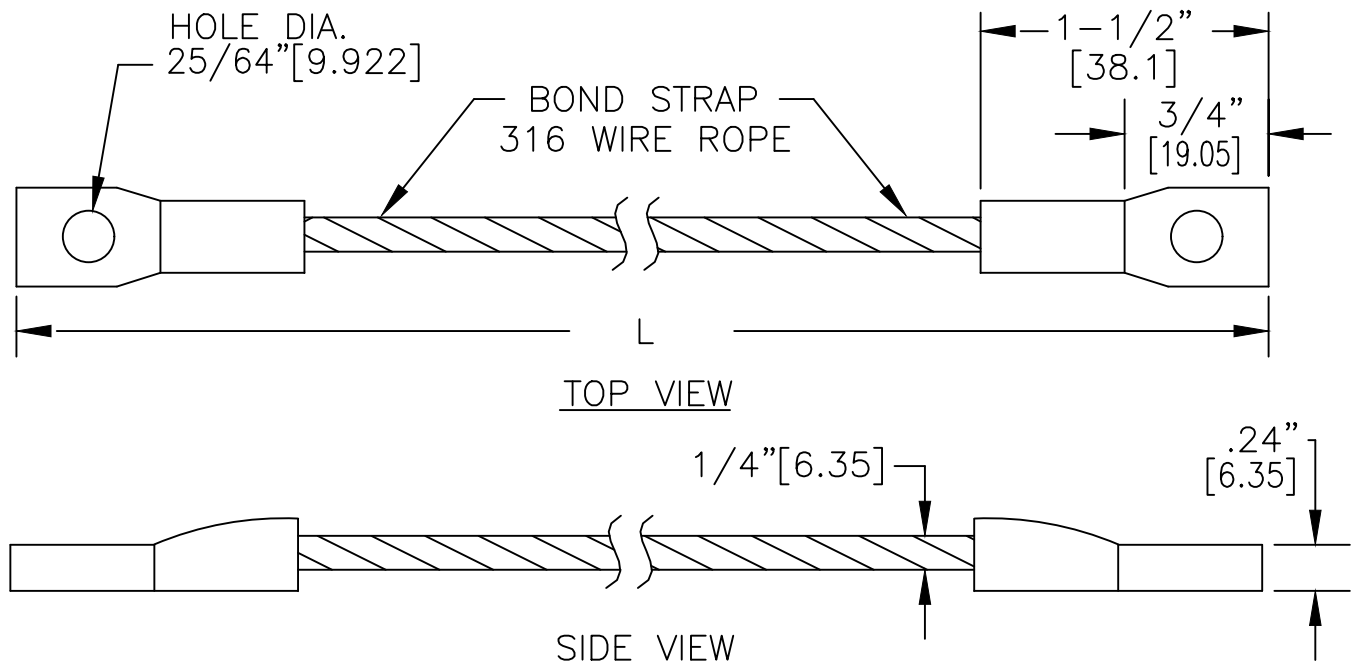
9. A third conductor within the equipment power supply cable harness shall be used to ground slide-mounted or roller-mounted equipment. Where it is not practical to provide this ground conductor, a flexible ground conductor shall be installed between the drawer frame or chassis and the enclosure frame (ground potential). The ground conductor size shall be in accordance with Table 250-66 NEC.
10. Equipment, electrical power connectors or terminals which have a terminal designated for grounding shall have that terminal grounded. Care should be taken that grounding equipment does not introduce grounds into the ships power distribution system.
11. Electrical equipment mounted on non-metallic bulkheads shall be grounded by a ground conductor routed internal or external to the power supply cable. The ground conductor shall be at least equal in size to the largest conductor supplying power to the equipment. The ground conductor shall be connected to ground potential at the power connection box or other convenient ground potential point and to the equipment case, chassis or frame.
12. Coaxial cables and other cables with an overall shield are considered properly shielded. When shielded cable is used, the overall shield shall be properly terminated at each end and shall be grounded at deck or weather bulkhead penetration points using the methods of Figure FE43-3. Armored cable does not meet these shielding requirements. Non-shielded cables of less than three feet in length may be routed topside. Non-shielded cable in excess of 3'[.914m] in length may only be routed topside in flexible or rigid conduit (Sch 40 or Sch 80 steel pipe may be used in lieu of rigid conduit), or when enclosed by a metal trunk or mast of which one or more sides may be ship's structure. Cable trunks may contain both shielded and unshielded cables. Where a shielded cable exits the cable trunk, the overall cable shield shall be grounded at this point using methods of Figure FE43-3. Wave guides will require replacing the weather flange gasket with an electrically conductive gasket.
13. Portable metallic flagstaffs, lifeline stanchions, etc., shall be bonded to ground potential as shown in Figure FE43-5.

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14. Metallic inclined ladders shall be grounded as shown in Figure FE43-6. Metallic vertical ladders are considered satisfactorily grounded when installation bolts are tightened securely. Climber safety rails are considered satisfactorily grounded when installed by welded brackets. Climber safety rails installed by brackets clamped to ladder rungs shall utilize a Type II bond strap at these points with the welded end of the bond strap attached to ship structure and the detachable end bolted to the safety rail.
15. Masts, mast braces, king posts, and other similar structures bolted in place shall be grounded by Type I bond straps spaced equally around each structure.
16. Portable vans shall be grounded using Type I straps as shown in Figure FE43-1.
17. Moving parts, other than removable accessories or attachments, having metal-to-metal bearing surfaces shall be considered to be electrically connected to each other through the bearing surfaces for grounding purposes. Monorail trolley shall be electrically grounded through a separate bonding conductor.
18. Dissimilar metals that are not electrically compatible may not be joined without use of insulation i.e. gaskets, washers, sleeves or bushings.
19. Fasteners in aluminum shall be CRES. Where aluminum will be joined with other metals, including galvanized steel, or wood, the aluminum surface must be protected by two coats of epoxy primer.
20. Where CRES is used it must be ASTM A276, A473, A167. Classes 304 or 316, passivated.
21. Grounding and short circuiting devices shall be provided for high voltage switchgear and maintenance purposes to ensure safety.
22. Protection for ground leakages shall be provided for electric main propulsion circuits, excitation circuits and AC/DC systems.
23. Automatic or remote control and monitoring systems shall not have common ground conductors with systems of higher voltage levels.
24. Each receptacle outlet that operates at 50 volts or more is to have a grounding pole.

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1. DIAGRAMS AND NOTATIONS



LENGTH
6" [152.4]
12" [304.8]
18" [457.2]

Standard Size
Type I Strap

Dimensions are in inch[mm]

Figure FE43-1 – Type I Bond Strap

Figure FE43-1 Notes:

1. Ensure surfaces where bond straps and lugs are to be attached are cleaned to bare metal.
2. Lug installation shall ensure water tightness and crimping methods shall ensure a lug pull off exceeding 600 pounds. Lugs shall be selected to match the mating surface.
3. Each bond strap shall be inspected after completion by slightly bending the bond strap at each terminal lug and looking for a gap between the cable jacket and the lug shroud. Bond straps placed in topside areas shall be weather sealed after installation by priming and painting the lugs and areas affected by welding or by coating the bolted lugs and associated hardware with weather sealing compound.

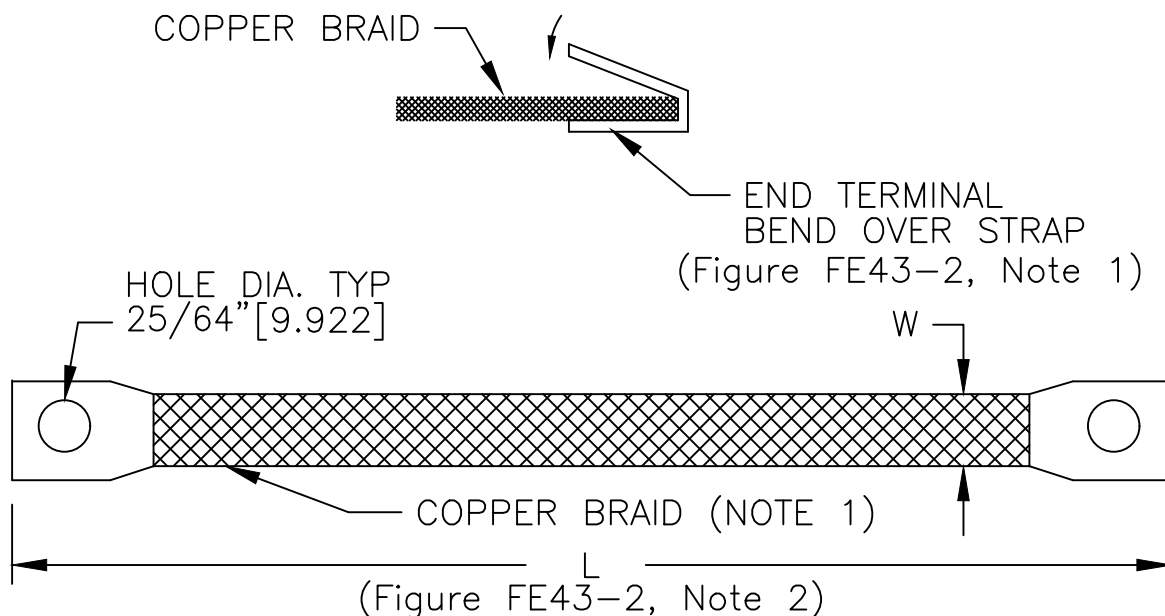
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Figure FE43-1 Notes (continued)

Bond straps are not to be painted.

- Bond strap length must be kept to minimum. In certain cases, such as flagstaffs, bond straps may be required to be slightly longer to prevent breaking the bond strap when the staffs are raised or lowered. Bond straps installed on climber safety rails may also require a slight increase in length.



LENGTH	WIDTH
6 [152.4]	1 [25.4]
12 [304.8]	1 [25.4]
18 [457.2]	1 [25.4]

Dimensions are in inch[mm]

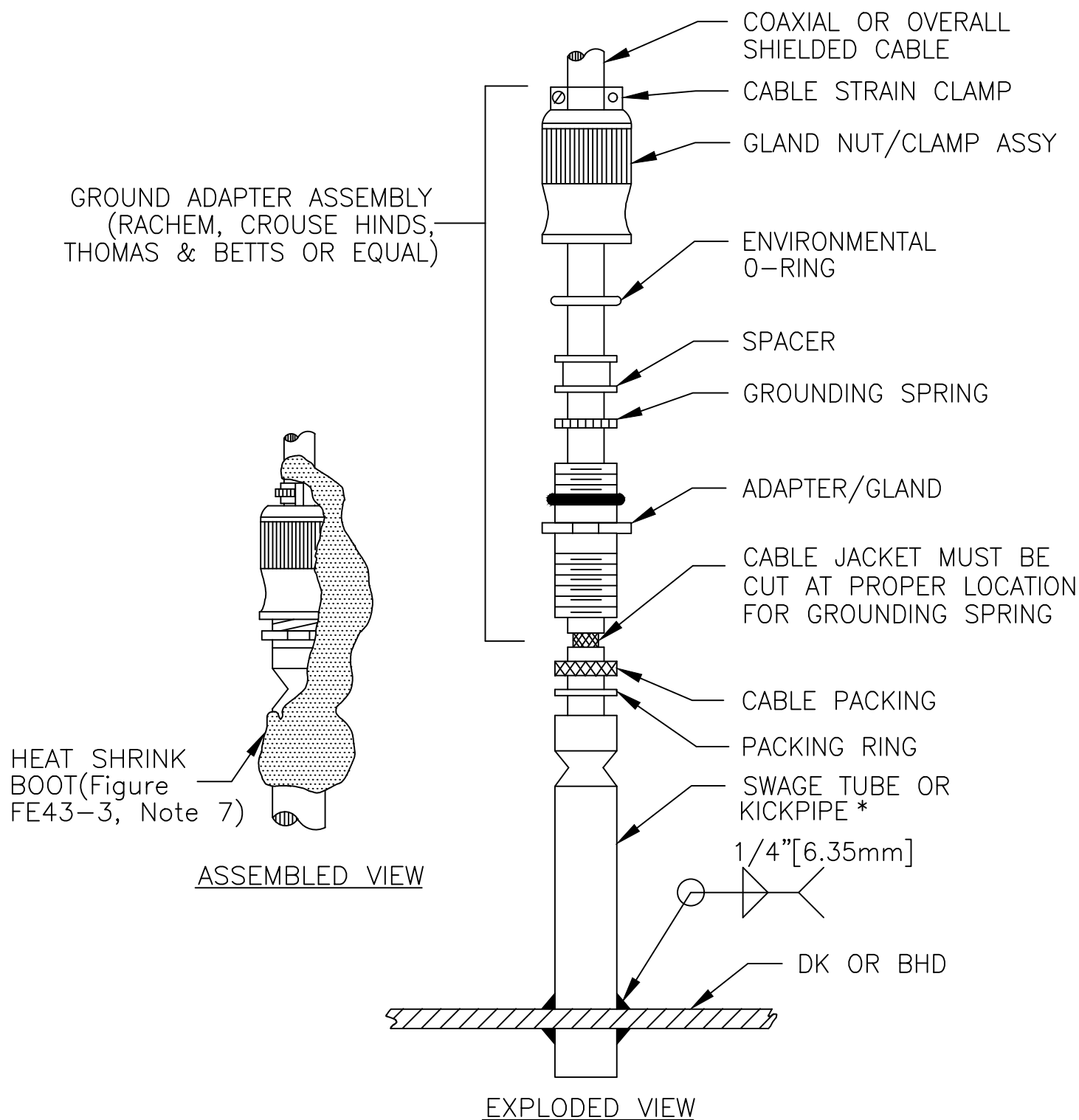
Standard Size
Type IV Strap

Figure FE43-2 - Type IV Bond Strap

Figure FE43-2 Notes:

- Type IV bond straps shall be fabricated from flat copper braid. End terminals shall be cut from flat copper and shall be 1" [25.4mm] W x 2" [50.8mm] L. End terminals shall be hot tin dipped, then solder coated on one side. Each terminal shall be bent 180 degrees to fit over braid using 1/16" [1.59mm] metal plate as a bending template. Confirm solder coating is on inside. Braid material shall be flux coated 1" [25.4mm] on each end. End terminals shall be heated and compressed onto the braid using additional solder as required. The required holes shall be punched in each end.
- Where a type IV bond strap is used only for personnel safety grounding, the length of strap shall be as required.

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* KICKPIPES SHALL BE MINIMUM
9"[228.6mm] ABOVE DECK

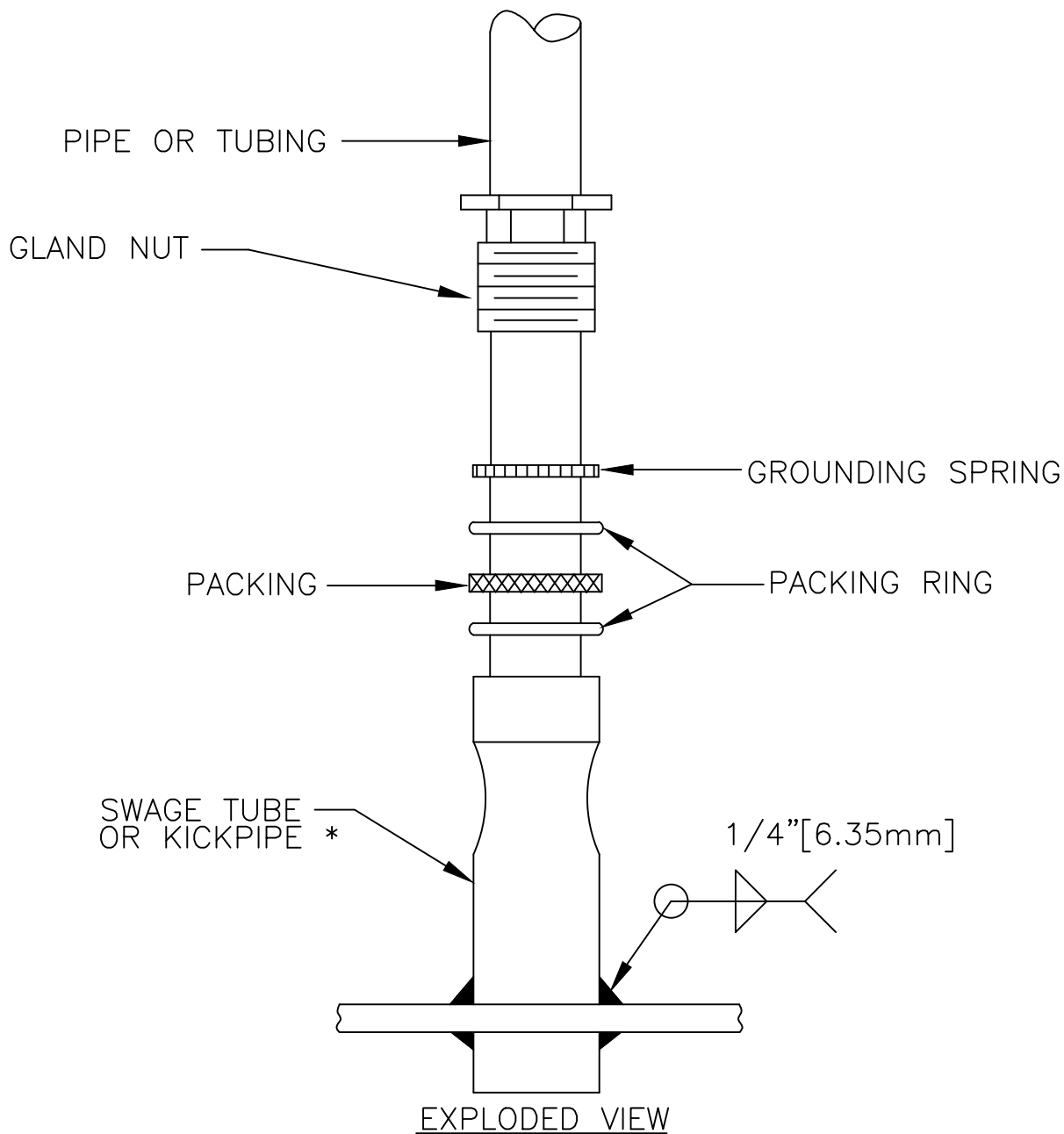
Figure FE43-3 - SHIELDED CABLE GROUNDING (See Figure FE43-3 Notes)

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Figure FE43–3 Notes: (See Figure FE43–3)

1. Prior to pulling cable through the stuffing tube, remove gland nut and replace with the adapter, lightly threading the adapter into top of tube. Pull cable through adapter and stuffing tube making sure cable does not damage adapter components.
2. After cable has been permanently installed, unscrew complete adapter and move it approximately 12”[304.8mm] up the cable and tape. Verify gland nut is loose to allow inner components (ground spring and environmental o–ring) to move freely on cable.
3. Pack the stuffing tube as required, then lower the adapter gland down over the cable and thread into top of stuffing tube and tighten as required for packing. Hand tighten gland nut onto adapter/gland sufficiently for ground spring to make an impression on the cable jacket.
4. Loosen gland nut, unscrew adapter/gland and move the entire adapter assembly several inches up the cable and tape. With a knife or other similar tool make a circular cut in the cable jacket on each side of the impression mark made by the ground spring. Note: Distance between cuts should not exceed one–quarter inch [6.35mm] apart.
5. Remove the cable jacket in the cut area exposing the cable shield. Coat the exposed shield and all adapter threads with an anti–sieze compound.
6. Lower the grounding adapter onto top of stuffing tube tightening adapter/gland as required for packing. Make sure the ground spring is positioned in the area of the cable where the jacket was removed. Hand tighten gland nut firmly.
7. Weather seal top of gland nut with permanent suitable weather sealing compound or install a backfit heat shrink boot or cable sleeve. When a heat shrink boot or sleeve is installed, further periodic tightening of the gland nut for water sealing is not required.
8. Grounding adapters other than those indicated are permissible providing that installation meets the intent of this drawing providing 360 degree ground at hull penetration.

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* KICKPIPES SHALL BE A MINIMUM OF 9"[228.6mm] ABOVE DECK

Figure FE43-4 - Pipe or Tubing Grounding

(See Figure FE43-4 Notes)

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Figure FE43-4 Notes: (See Figure FE43-4)

1. Prior to installing pipe or tubing, remove gland nut from tube or kickpipe and insert grounding spring above upper packing ring. (Two packing rings are required)
2. Grounding spring should fit snugly over pipe/tubing and inside tube or kickpipe.
3. Tighten gland nut to ensure contact between grounding spring and nut end pipe or tubing. (Packing is installed only to ensure proper grounding spring contact.)
4. Weather seal top of gland nut with permanent suitable weather sealing compound or install a backfit heat shrink boot or cable sleeve. When a heat shrink boot or sleeve is installed, further tightening of the gland nut for water sealing is not required.

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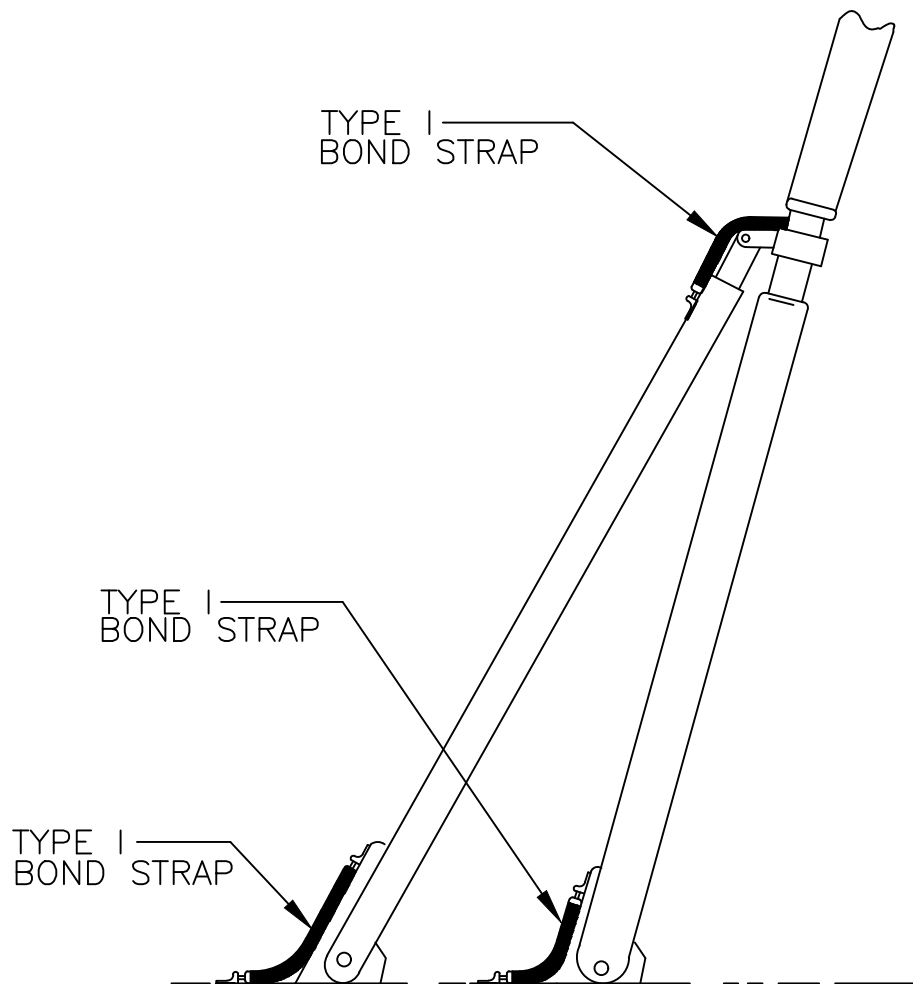


Figure FE43-5 — Flagstaff or Portable Lifeline Stanchion

Figure FE43-5 Notes:

1. Clean contact areas for bolt connections to bright metal and apply anti-seize compound before attaching straps.
2. Provide overall weather sealing using polysulfide sealing compound.

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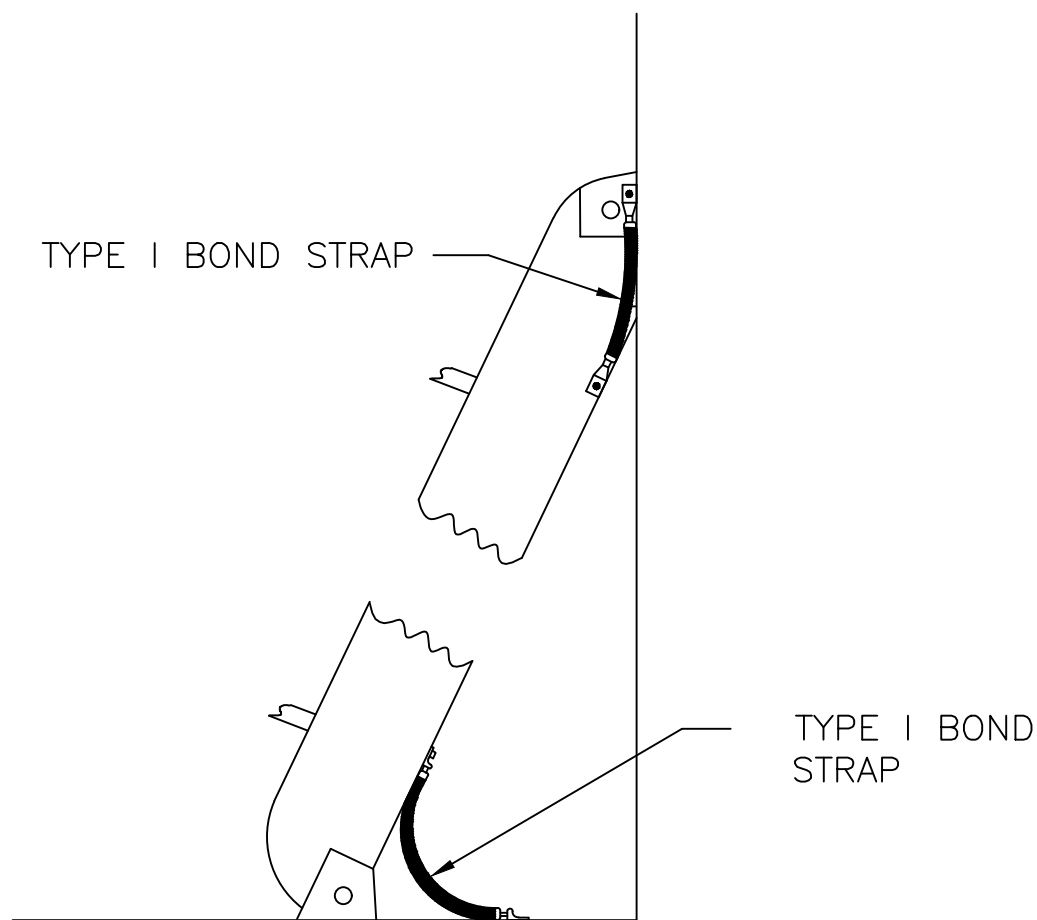
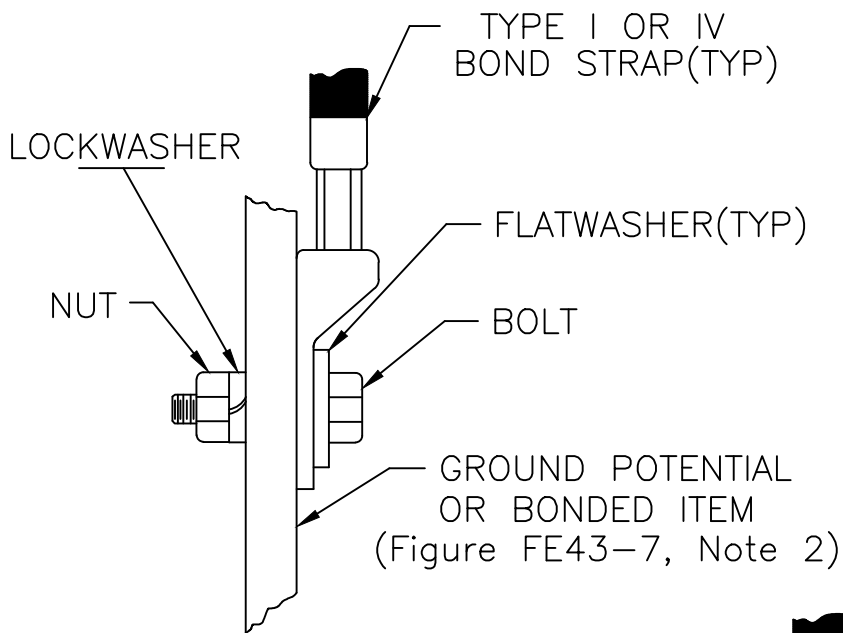


Figure FE43-6 – Inclined Ladders

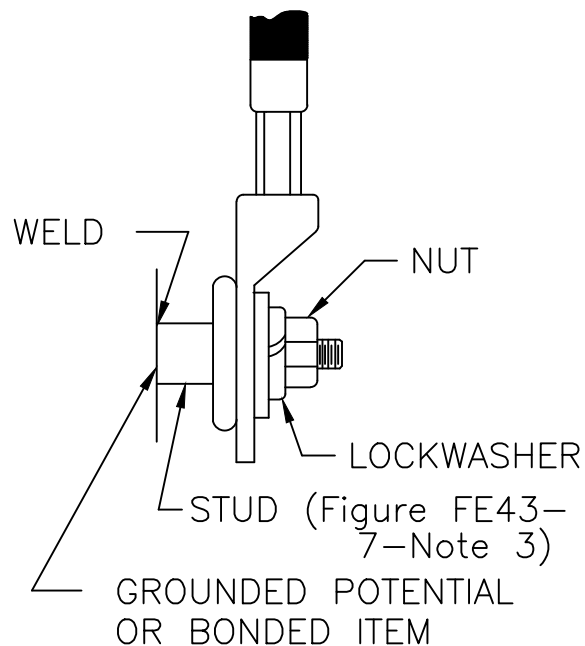
Figure FE43-6 Notes:

1. Inclined-tread ladders shall be bonded to ground potential by the installation of a bond strap across one top and one bottom pinned mount. Type I bond straps shall be installed.
2. Clean contact areas for bolt connections to bright metal and apply anti-seize compound before attaching straps.
3. Provide overall weather sealing using polysulfide sealing compound.

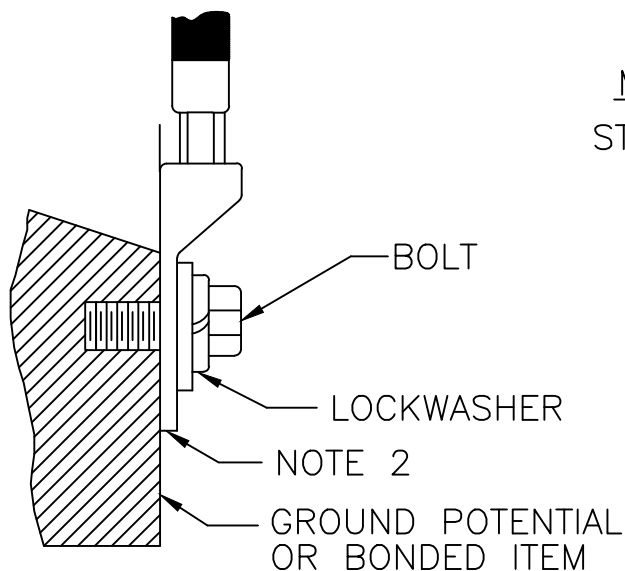
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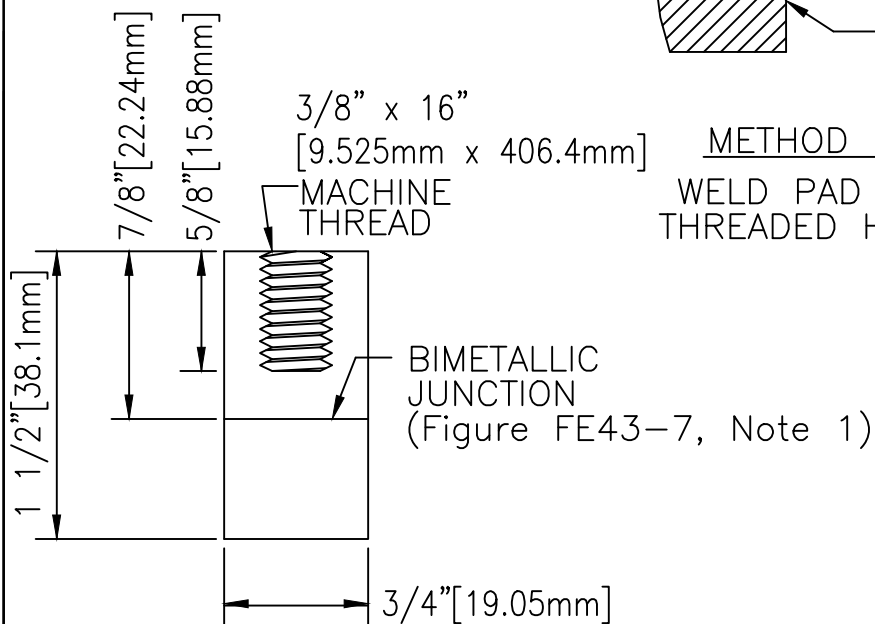
METHOD 1
BOLT & NUT



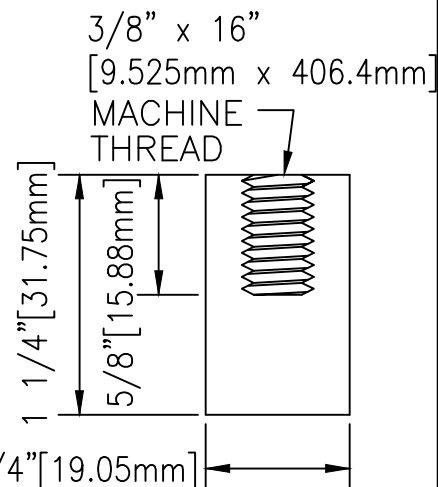
METHOD 2
STUD & NUT



METHOD 3
WELD PAD OR
THREADED HOLE



BIMETALLIC BOSS



CRES BOSS

Figure FE43-7 - Bolting Methods
(See Figure FE43-7 Notes)

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Figure FE43-7 Notes: (See Figure FE43-7)

1. Existing bolts, studs, or threaded holes on equipment may be used for bond strap installation.
2. The installation procedures for bolted bond straps shall provide for a clean metal-to-metal contact between the bond strap and the mating surface.
3. Studs used for bond strap attachment shall be a collar type. To permit welding, studs shall be corrosion resistant steel (CRES). Studs used for type I bond strap installations shall conform to the following requirements:

Stud Size – 3/8”–15”[9.53mm–381mm]
Steel Studs – type V, Class 4, CRES 316

4. Threaded hardware connections shall be prepared with an anti-seize compound and sealed using polysulfide sealing compound.

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2. Fabrication and Installation

Type I Bond Straps

Fabrication:

- Bond strap lugs punched or drilled for installation on a threaded stud or bolt (Figure FE43–1).
- Bond straps may be longer than 12”[304.8mm] for portable or tilting equipment.

Installation:

- Weld or braze a threaded stud to ground potential or to the item to be bonded, as appropriate, or if possible, use existing bolt holes.
- Attach the bolted end of the bond strap by use of the appropriate method and hardware as shown on Figure FE43–7.
- Coat the lugs as specified in sections. Corrosion Protection and Weather Seal.

Type IV Bond Straps

Fabrication:

- Type IV bond straps shall be fabricated as detailed on Figure FE43–2.
- Type IV bond straps may be fabricated in standard lengths of 6”[152.34mm], 9”[228.6mm] and 12”[304.8mm] as required. Longer lengths may be fabricated if required.

Installation:

- Secure strap across equipment using existing hardware where possible (Figure FE43–2). Where existing hardware is not convenient for bond strap installation, drill or drill and tap mounting holes, or install studs for installation of bond strap.

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General

Hardware:

Bond Strap installation nuts, bolts, washers and studs, shall be 5/16"[7.94mm] or 3/8"[9.53mm], as appropriate. For topside areas, non-topside mounting hardware shall be corrosion-resistant steel. For areas, mounting hardware shall be plated steel. Studs located in non-topside areas shall be plated steel. Bond strap installation hardware shall conform to the requirements as specified in Figure FE43-7.

Surface Preparation:

Bond straps fastened by bolts or studs shall be accomplished by cleaning to bare metal those areas where bond straps shall connect. Cleaned areas and all threaded hardware shall be coated with an antiseize compound prior to the installation of bolted bond straps. The preceding cleaning requirements do not imply the cleaning away of plating on items such as chassis and bond strap mounting hardware.

Location:

Bond Strap installation shall permit rapid inspection or replacement and shall be installed in such a manner that vibration, expansion, contraction or relative movement, circumstantial to normal service, shall not break or loosen the bond strap connection. Bond strap installations shall not interfere with the integrity of cabinets or enclosures and shall not weaken any structure or item to which a bond strap is attached. Bond Strap insulations shall not restrict the movement of any hinged or movable item. Type IV bond straps shall not be installed in weather-exposed locations.

Corrosion Protection:

- All materials used in installations specified by this standard shall be selected and installed to provide maximum protection against corrosion.
- CRES 316 shall be used for stuffing tube gland nuts, conduit adapters/connectors, and fittings used to terminate conduit to electrical boxes or equipment.

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Weather seal:

Cable shield grounding areas, conduit terminating fittings and bond straps shall be in accordance with the following:

- All fittings, which terminate shielding conduit, shall be weather sealed with heat shrinkable tubing.
- Cable shield grounding areas shall be weather sealed with an application of polysulfide sealant. Where fittings are installed in connection boxes, a fillet of polysulfide sealant shall also be applied around the fitting at the connection box.
- The ends of type I bond straps which are installed on threaded studs or bolts shall be weather sealed by coating the lugs and associated hardware with an application of sealing compound.
- Where bond strap installation has affected painted surfaces, affected areas shall be restored to the original paint finish. Bond straps installed in non-topside areas do not require painting. Painted areas affected by bond strap installation shall be restored to the original paint finish.

Anti-seize Compound:

- Anti-seize compound shall be applied to all threads and other non-weld connections where grounding is required.
- The anti-seize compound specified for use by this drawing shall be electrical conductive type and is for use between two metal surfaces to preserve grounding conductivity. The compound is added for the purpose of maintaining the quality of grounding by preventing oxidation of corrosion in the ground path area. This compound shall be used only in areas where metal-to-metal contact through the compound can be assured such as with threaded fittings and metal surfaces held together under pressure by the use of bolts. Any flat surface area where the compound is applied shall be edge sealed with sealing compound to prevent the anti-seize from melting and running under high temperatures.

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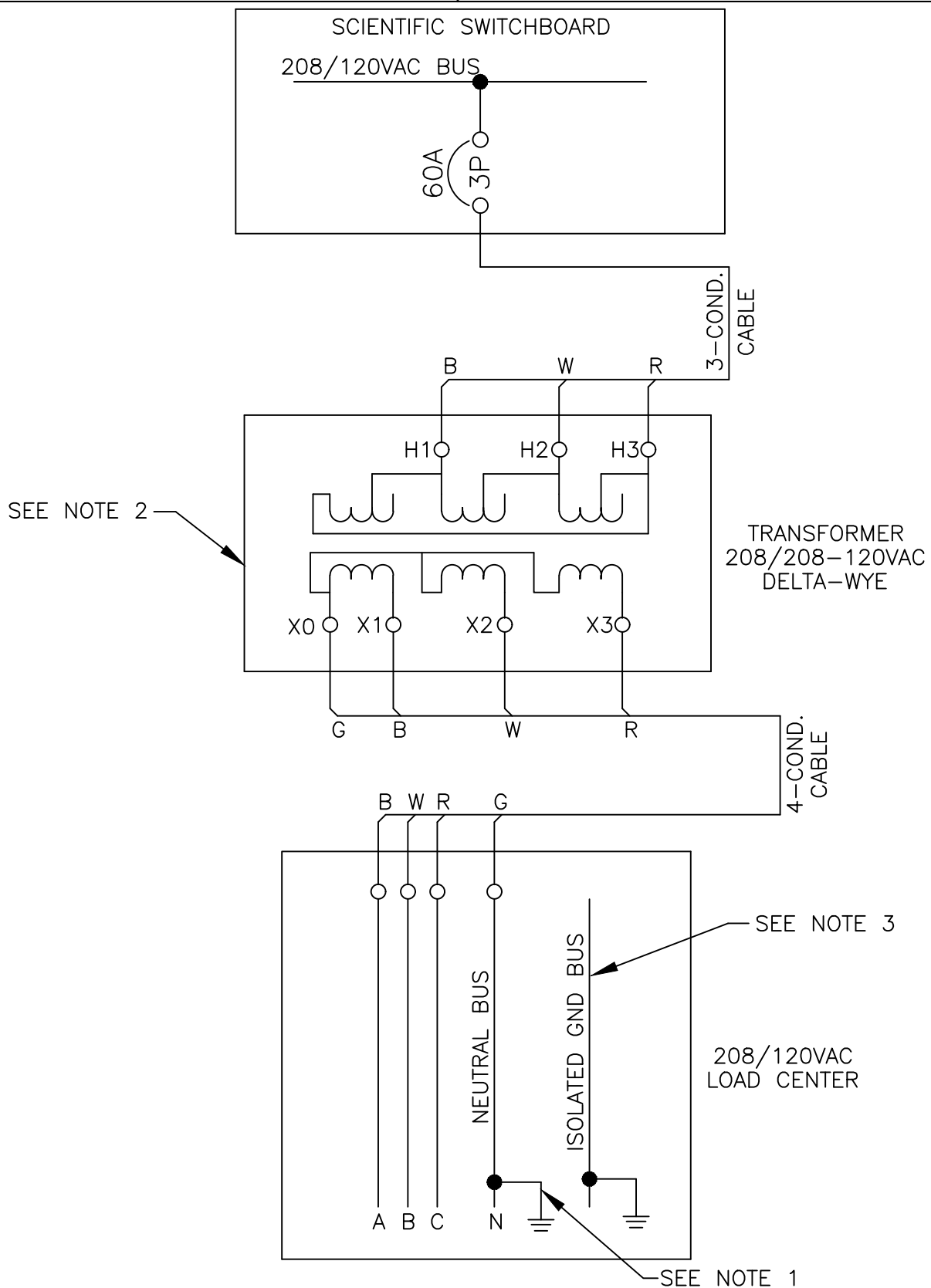


Figure FE43-8 - Proper Grounding of Neutral on Secondary of Transformer (See Figure 8 Notes)

HULL NO 1953	CAGE CODE 3BJ86	SIZE A	JOB NO. M283	ITEM 304	DELIVERABLE FE43	SHEET 020	00
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Figure FE43-8 Notes: (See Figure FE43-8)

1. The neutral bus from the secondary of the transformer shall be grounded at one point only. This point shall be in the 208/120VAC Load Center Panel and not in the transformer itself. The neutral bus, from other 208/120VAC Distribution Panels down stream from the Load Center Panel, shall not be grounded locally at these panels. The neutral bus of these panels shall be carried back to the Load Center Panel via the feeder cable for connection to the neutral bus of the Load Center Panel, which will be grounded directly to the hull.
2. The transformer should be checked during installation to see if the transformer was shipped with the neutral grounded. If so, the ground on the neutral shall be lifted.
3. The neutral bus and the isolated ground bus shall not be connected together at any time in the 208/120VAC Load Center Panel or any Distribution Panel down stream of the Load Center Panel. The isolated ground bus shall be used to provide an equipment ground for such circuits as receptacles and equipment mounted on joiner bulkheads.

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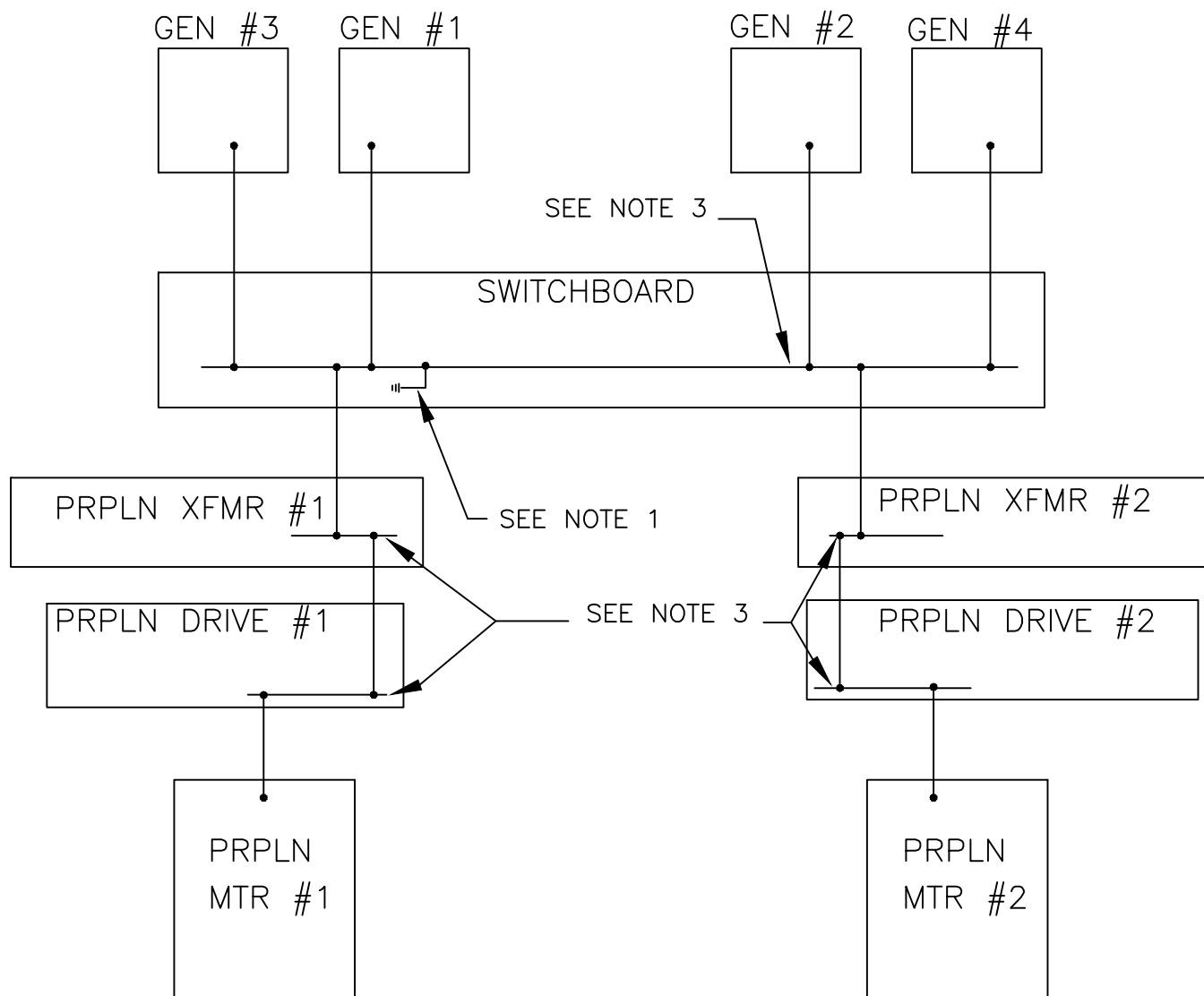


Figure FE43-9
PROPULSION SYSTEM GROUNDING GRID

Notes:

1. The Propulsion System and Generator shall be grounded at one point only. That point shall be in the Switchboard.
2. The Propulsion Transformers, Propulsion Drive Cabinets, Propulsions Motors, and the Generators shall not be grounded locally.
3. Thier shall be an isolated ground bar located in each peice of equipment. This isolated ground bar shall not be grounded locally.

HULL NO 1953	CAGE CODE 3BJ86	SIZE A	JOB NO. M283	ITEM 304	DELIVERABLE FE43	SHEET 022	00
ESTIMATE NO M283	SCALE NTS	FILE R:\M283\FUNCTIONALDESIGN\INWORK\ELECDWG\304-FE43-022-0			SHEET 22 OF 22		