

Bonding and Grounding Illustrations

IAPA

It's About Making A Difference.

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About These Illustrations

Not sure how to bond or ground your flammable and combustible liquid storage and handling systems? Need confirmation that they are bonded and grounded with the right kind of systems? This collection of bonding and grounding illustrations can help.

Review the illustrations to help you assess your bonding and grounding systems and determine whether you need to make improvements. The illustrations show 19 typical assemblies for a building ground, fixed equipment ground, clamps, “bus” extensions, transfer chutes, piping, drop valves, mixing units, small volume solvent handling, drums in storage racks, and truck and rail car loading.

Also review the four confirmation system illustrations. These systems can be used to confirm proper ground contact for your existing bonding and grounding equipment.

Bonding and Grounding Systems – Illustrations

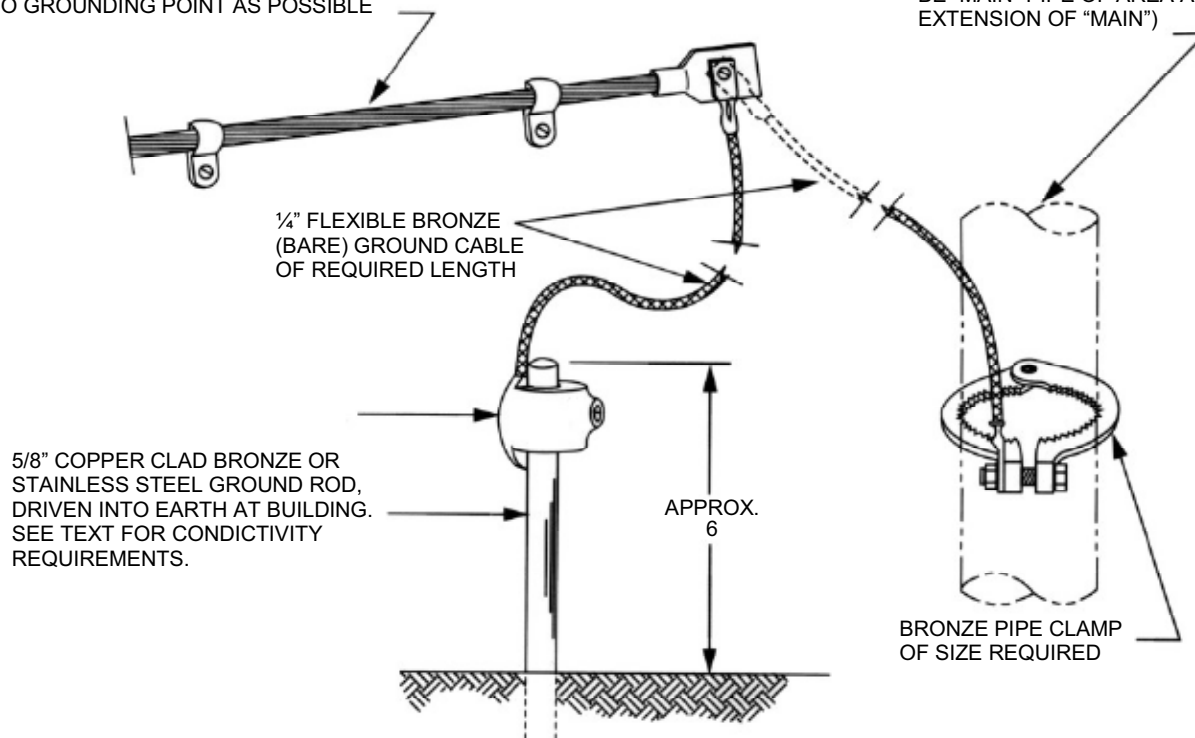
TA-1

TYPICAL ASSEMBLY NO. 1

GROUND CONNECTION OF BUILDING GROUND BUS – TYPICAL ASSEMBLY

#1/0-1/C STRANDED, BARE COPPER WIRE BUILDING STATIC GROUNDING "BUS" TYPICAL ARRANGEMENT ROUTED AS CLOSE TO GROUNDING POINT AS POSSIBLE

ALTERNATE GROUND CAN BE BUILDING COLD WATER PIPE (SHALL BE "MAIN" PIPE OF AREA AND NOT EXTENSION OF "MAIN")



5/8" COPPER CLAD BRONZE OR STAINLESS STEEL GROUND ROD, DRIVEN INTO EARTH AT BUILDING. SEE TEXT FOR CONDUCTIVITY REQUIREMENTS.

APPROX.
6

BRONZE PIPE CLAMP
OF SIZE REQUIRED

NOTE:

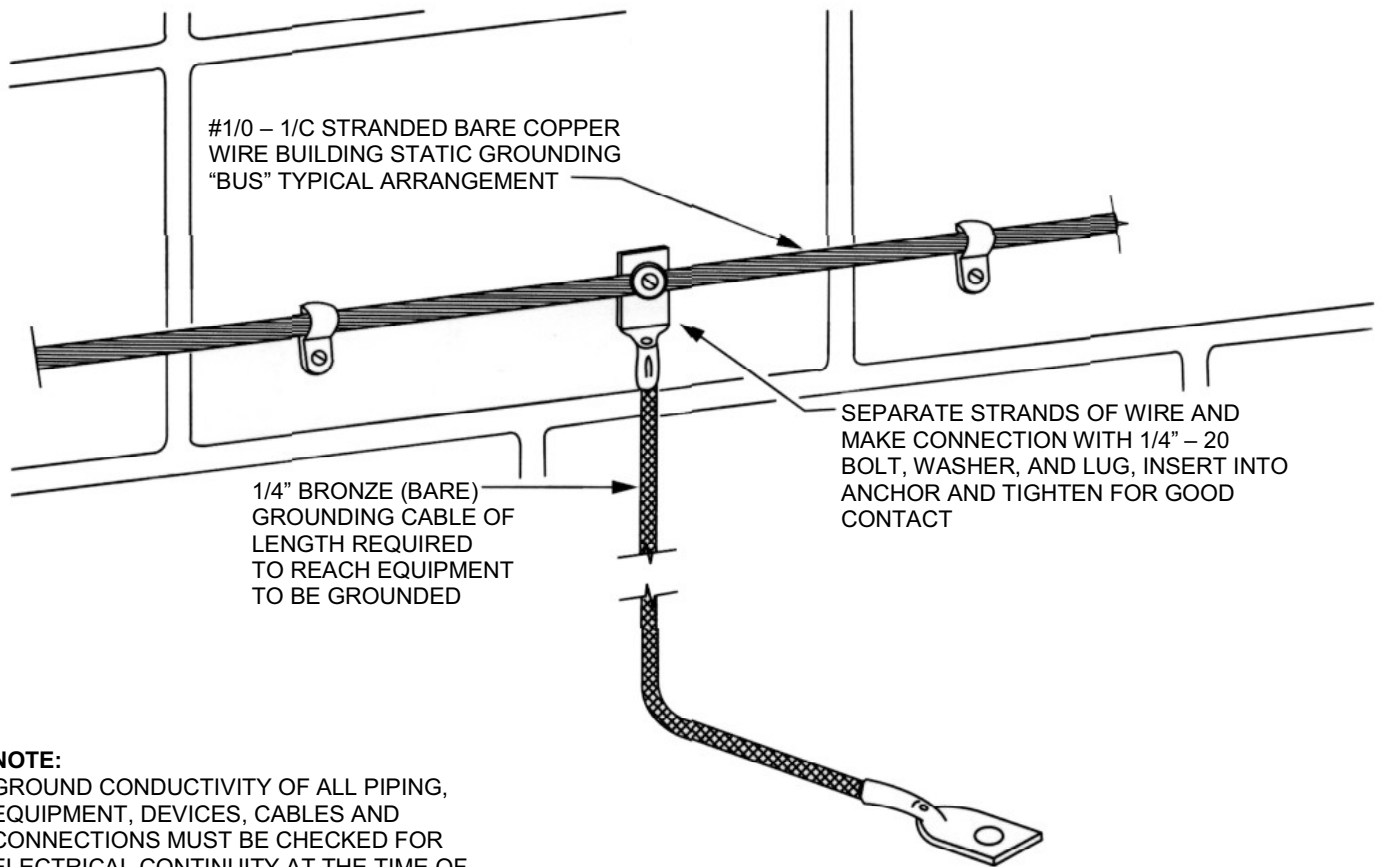
GROUND CONDUCTIVITY OF ALL PIPING, EQUIPMENT, DEVICES, CABLES AND CONNECTIONS MUST BE CHECKED FOR ELECTRICAL CONTINUITY AT THE TIME OF INSTALLATION AND PERIODICALLY THEREAFTER.

Illustration Courtesy of Lind Equipment Ltd.

TA-2

TYPICAL ASSEMBLY NO. 2

PERMANENT – FIXED, EQUIPMENT GROUND EXTENSION TO BUILDING GROUND “BUS” TYPICAL ASSEMBLY



NOTE:

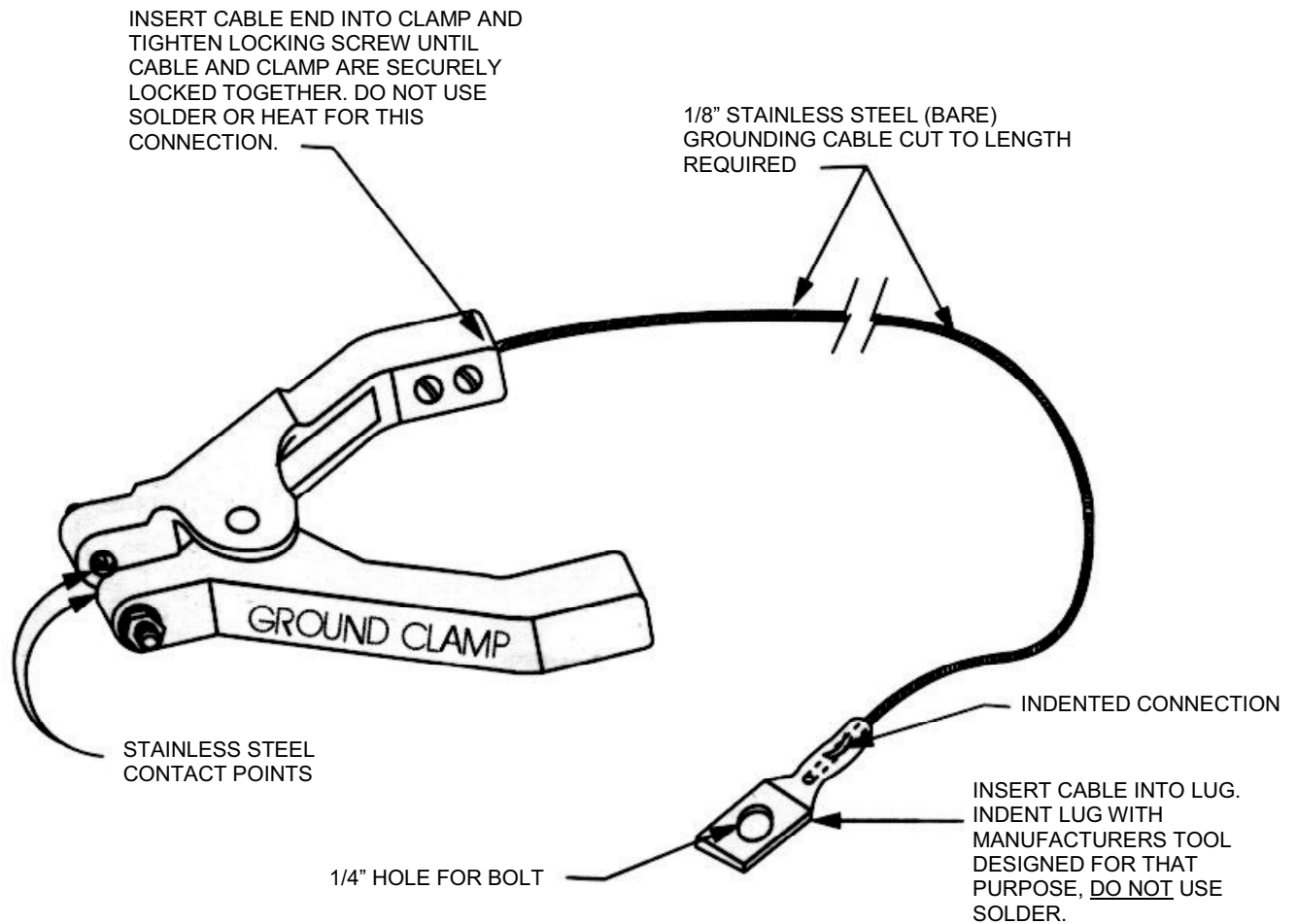
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Illustration Courtesy of Lind Equipment Ltd.

TA-3

TYPICAL ASSEMBLY NO. 3

SMALL GROUND CLAMP TYPICAL ASSEMBLY



NOTE:
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Illustration Courtesy of Lind Equipment Ltd.

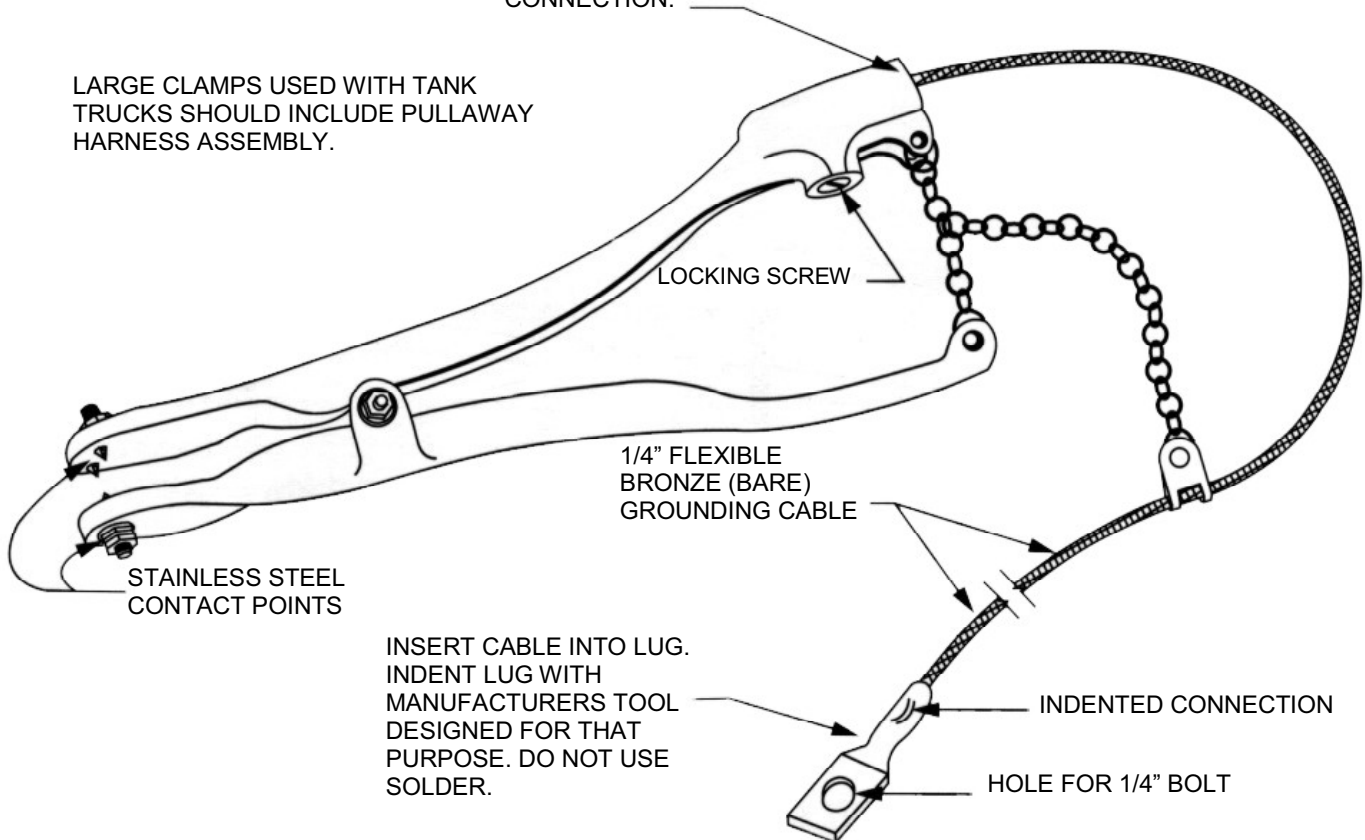
TA-4

TYPICAL ASSEMBLY NO. 4

LARGE GROUND CLAMP TYPICAL ASSEMBLY

INSERT CABLE END INTO CLAMP AND TIGHTEN LOCKING SCREW UNTIL CABLE AND CLAMP ARE SECURELY LOCKED TOGETHER. DO NOT USE SOLDER OR HEAT FOR THIS CONNECTION.

LARGE CLAMPS USED WITH TANK TRUCKS SHOULD INCLUDE PULLAWAY HARNESS ASSEMBLY.



INSERT CABLE INTO LUG. INDENT LUG WITH MANUFACTURERS TOOL DESIGNED FOR THAT PURPOSE. DO NOT USE SOLDER.

INDENTED CONNECTION

HOLE FOR 1/4" BOLT

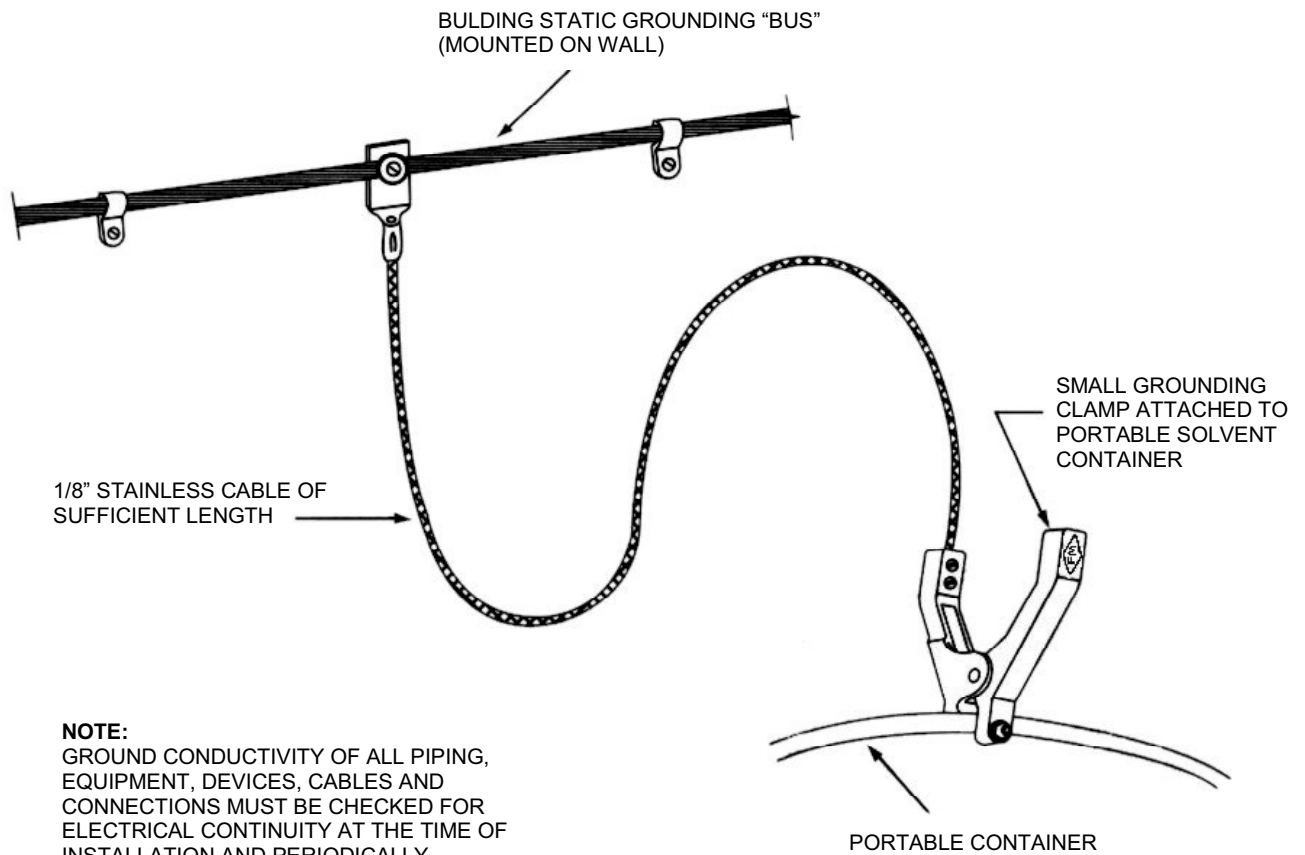
NOTE:

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TA-5

TYPICAL ASSEMBLY NO. 5

BUILDING GROUND "BUS" EXTENSION TO PORTABLE SOLVENT CONTAINERS TYPICAL ASSEMBLY

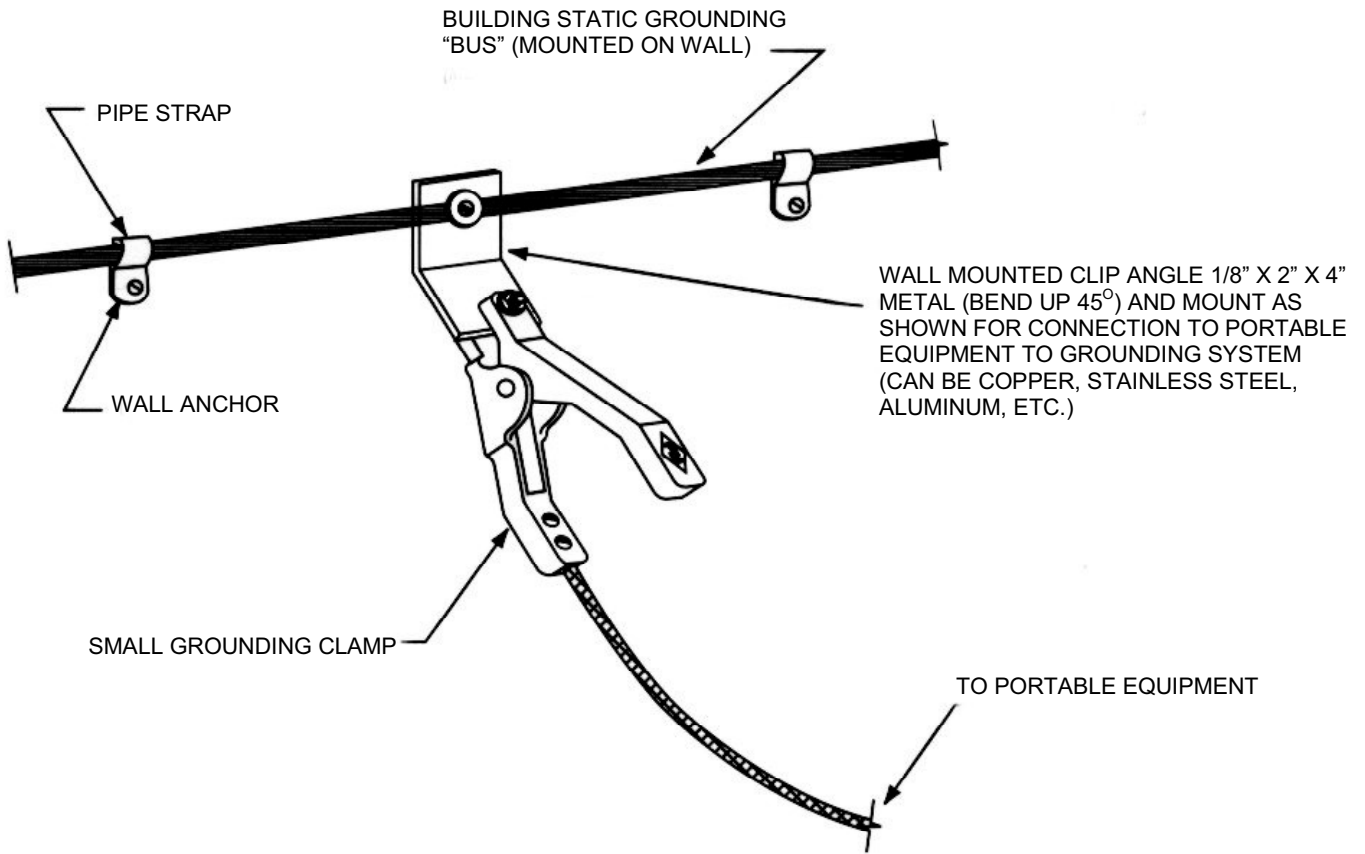


NOTE:
GROUND CONDUCTIVITY OF ALL PIPING,
EQUIPMENT, DEVICES, CABLES AND
CONNECTIONS MUST BE CHECKED FOR
ELECTRICAL CONTINUITY AT THE TIME OF
INSTALLATION AND PERIODICALLY
THEREAFTER.

TA-6

TYPICAL ASSEMBLY NO. 6

LARGE GROUND CLAMP TYPICAL ASSEMBLY

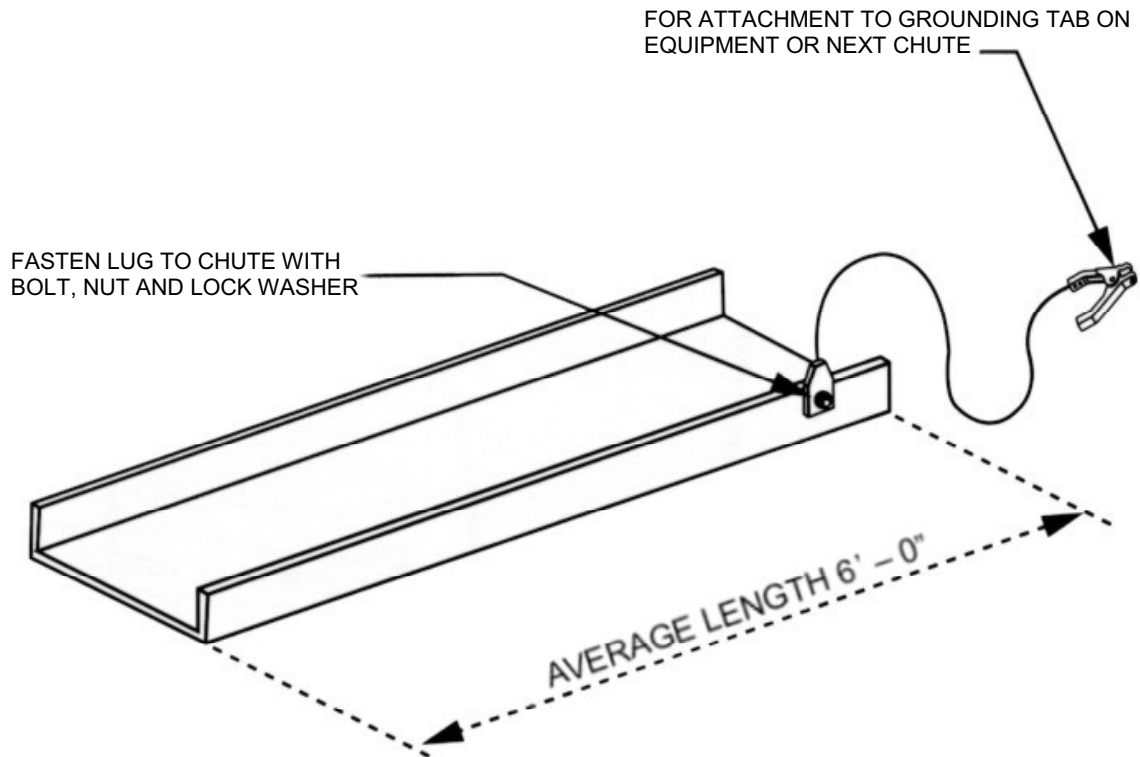


NOTE:
GROUND CONDUCTIVITY OF ALL PIPING,
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CONNECTIONS MUST BE CHECKED FOR
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INSTALLATION AND PERIODICALLY
THEREAFTER.

TA-7

TYPICAL ASSEMBLY NO. 7

GROUNDING OF PORTABLE "MATERIAL TRANSFER CHUTE" TYPICAL ASSEMBLY

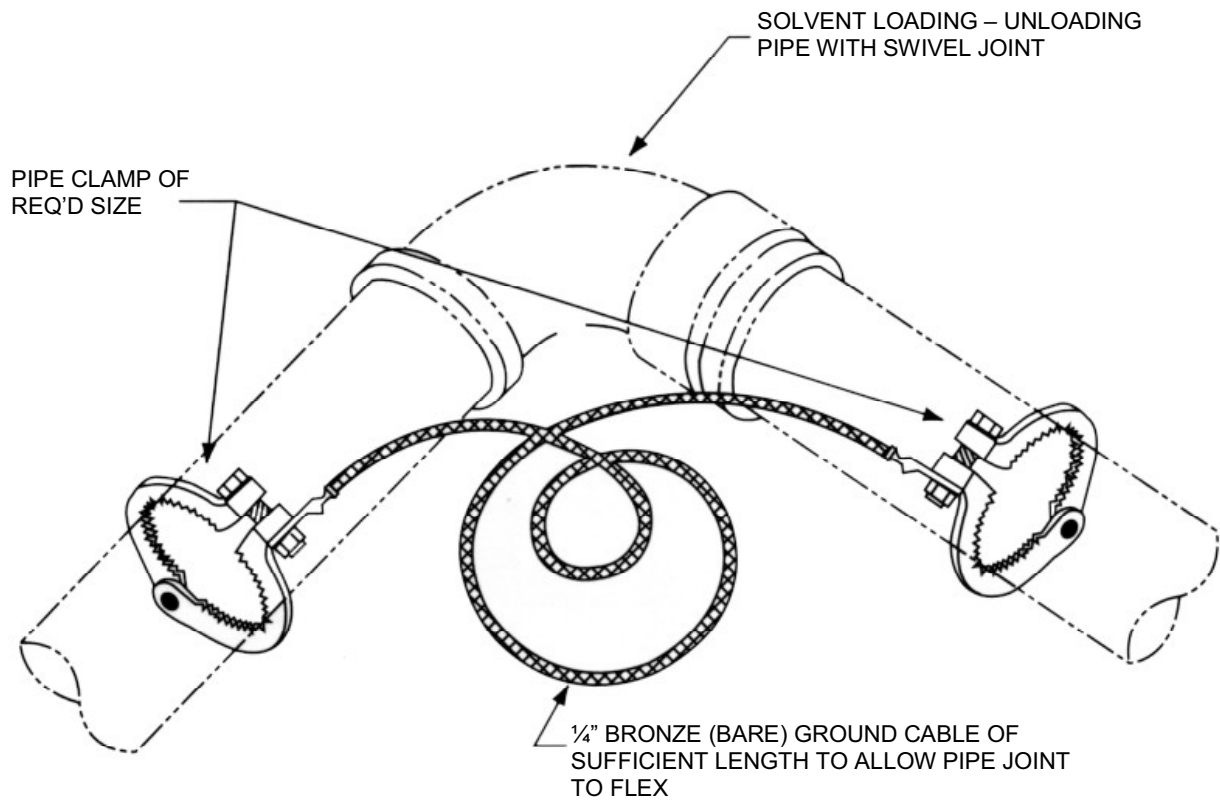


NOTE:
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EQUIPMENT, DEVICES, CABLES AND
CONNECTIONS MUST BE CHECKED FOR
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TA-8

TYPICAL ASSEMBLY NO. 8

PIPE GROUNDING JUMPER TYPICAL ASSEMBLY



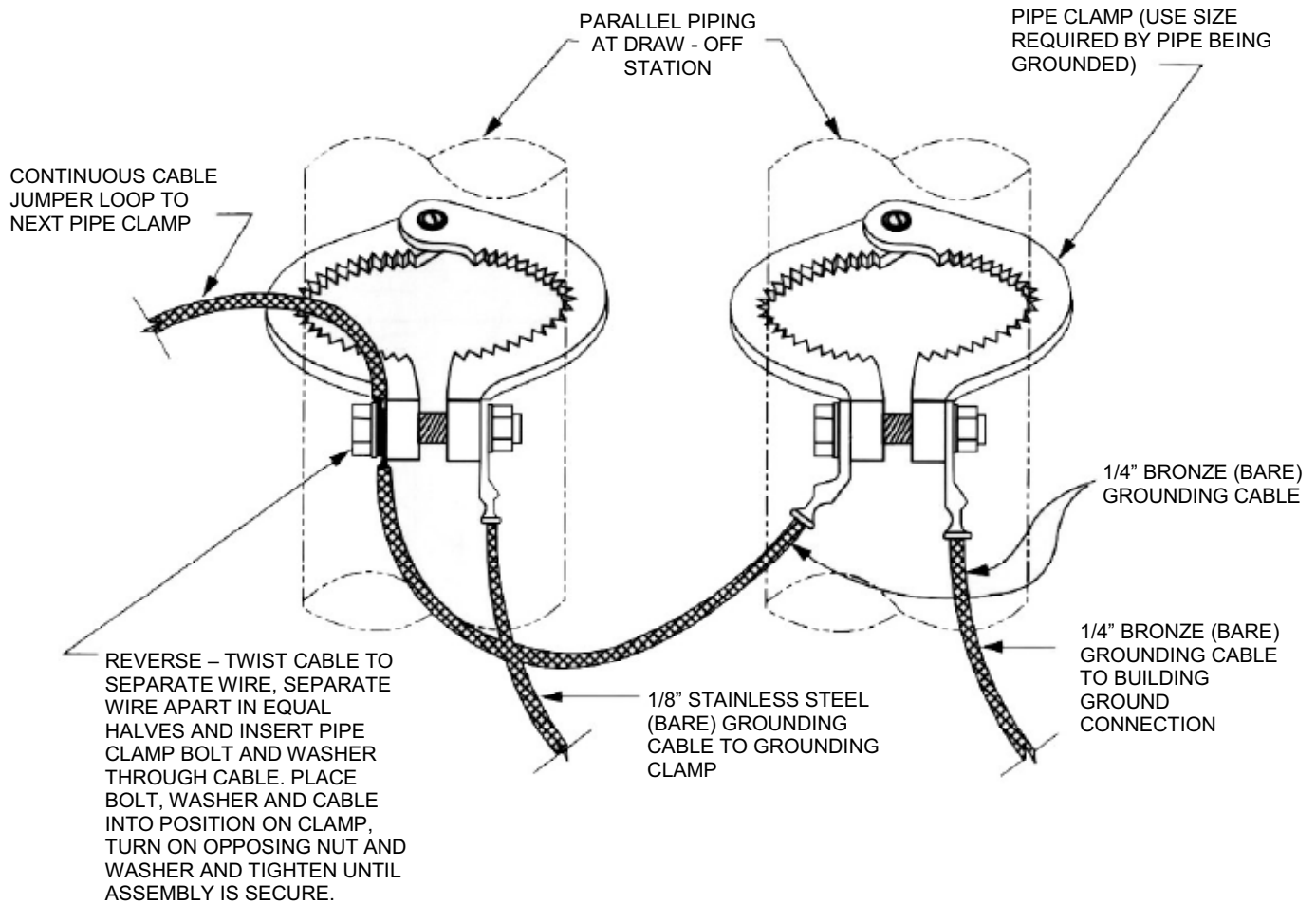
NOTE:

GROUND CONDUCTIVITY OF ALL PIPING, EQUIPMENT, DEVICES, CABLES AND CONNECTIONS MUST BE CHECKED FOR ELECTRICAL CONTINUITY AT THE TIME OF INSTALLATION AND PERIODICALLY THEREAFTER.

TA-9

TYPICAL ASSEMBLY NO. 9

PIPE GROUNDING CLAMP TYPICAL ASSEMBLY



NOTE:

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TA-10

TYPICAL ASSEMBLY NO. 10

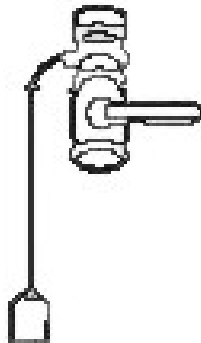
GROUNDING AT "DROP VALVE" OF THINNING OR MIXING TANK – TYPICAL ASSEMBLY

NOTE: LIMIT FREE FALL OF SOLVENT TO LESS THAN 5' TO REDUCE STATIC GENERATION.

14

THINNING OR MIZING EQUIP. GROUNDED TO BUILDING CABLE GROUND BUS ON FLOOR ABOVE

"DROP VALVE" GROUNDING ASSEMBLY OF PIPE CLAMP, CABLE AND METAL TAB



ATTACH GROUNDING CLAMPS OF PIPE, CHUTES OR HOSES USED TO ROUTE BATCH DOWN TO THINNING TANK OR FILLING MACHINE TO THESE GROUNDING TABS.

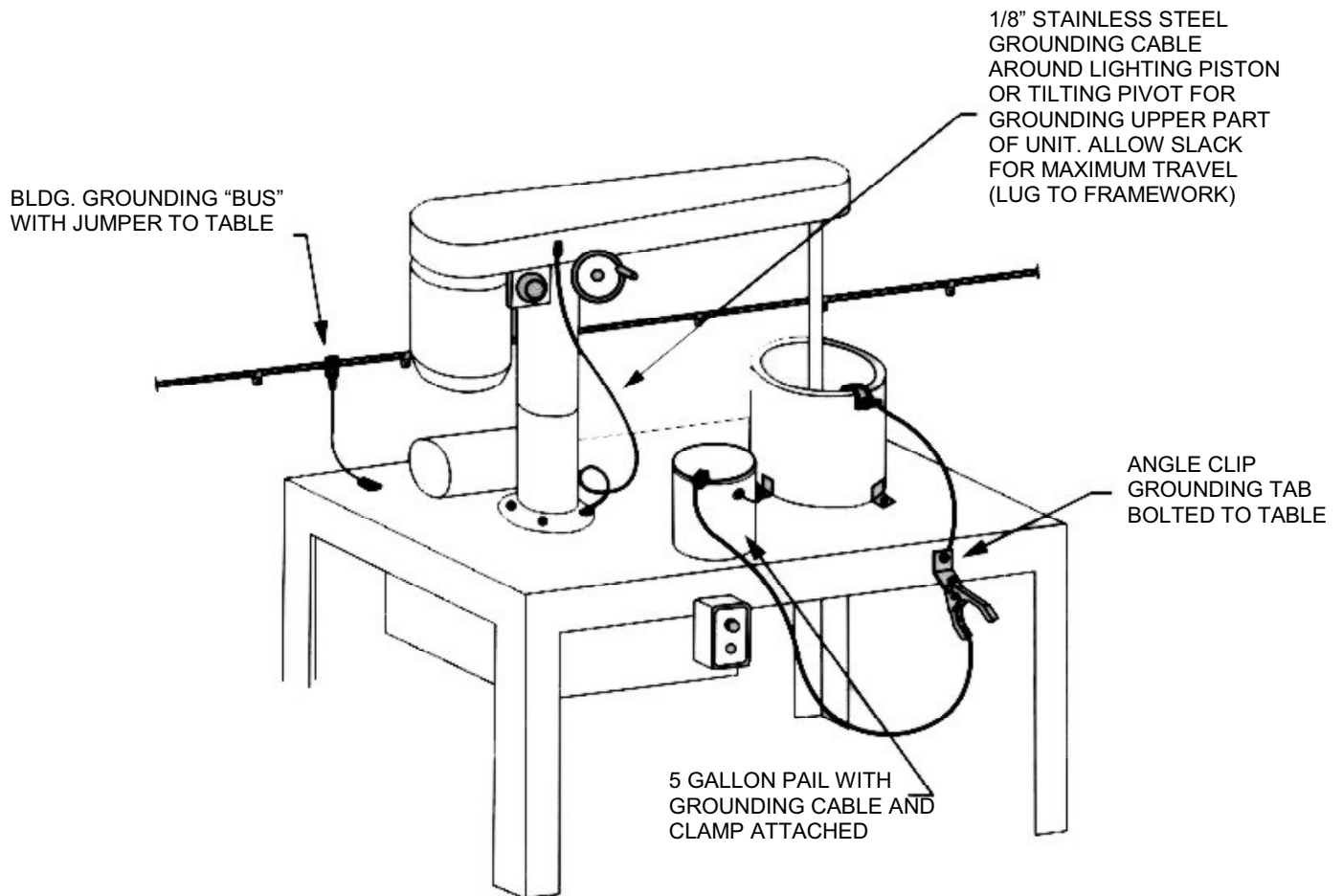
NOTE:

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TA-11

TYPICAL ASSEMBLY NO. 11

GROUNDING OF LABORATORY MIXING UNIT TYPICAL ASSEMBLY

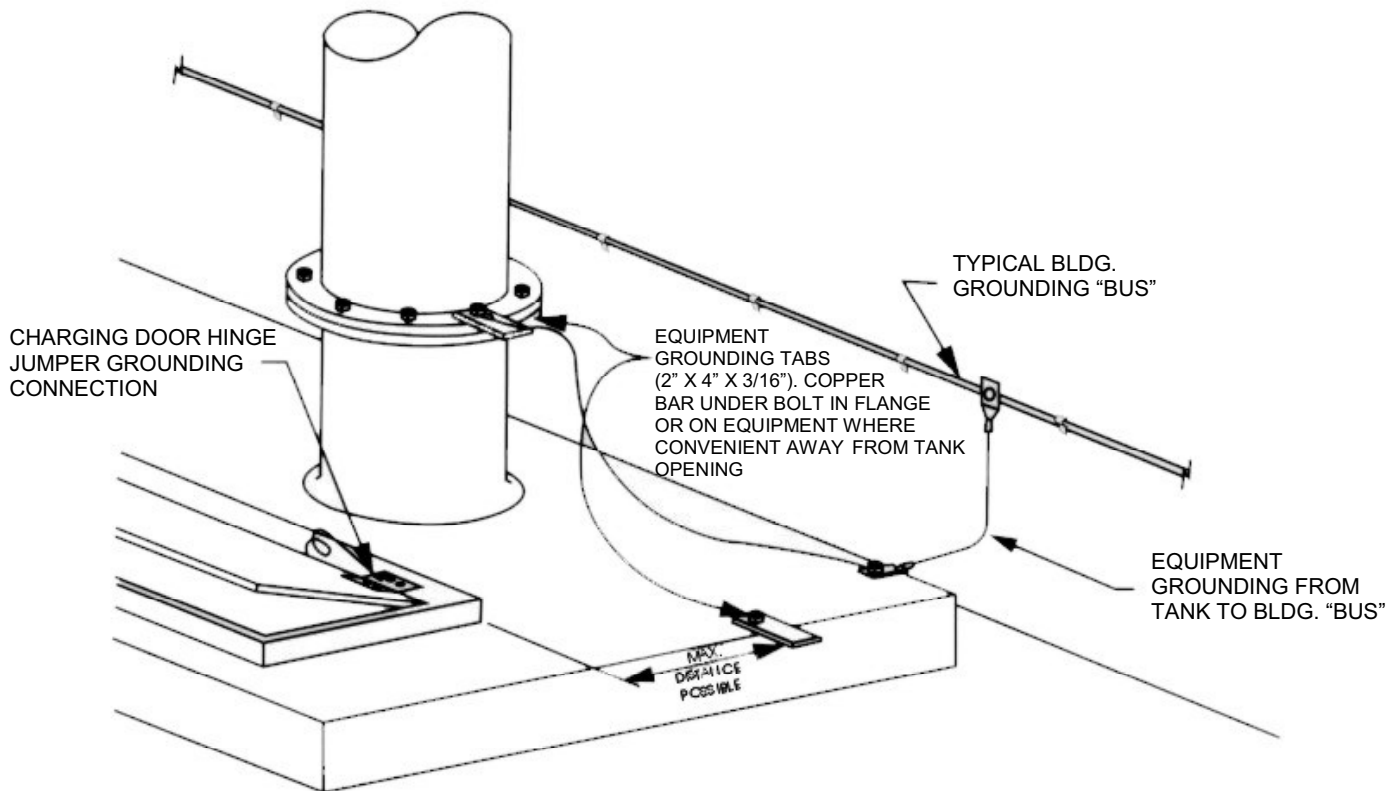


NOTE:
GROUND CONDUCTIVITY OF ALL PIPING, EQUIPMENT, DEVICES, CABLES AND CONNECTIONS MUST BE CHECKED FOR ELECTRICAL CONTINUITY AT THE TIME OF INSTALLATION AND PERIODICALLY THEREAFTER.

TA-12

TYPICAL ASSEMBLY NO. 12

GROUNDING SYSTEM STANDARD ARRANGEMENT AT THINNING OR MIXING EQUIPMENT – TYPICAL ASSEMBLY

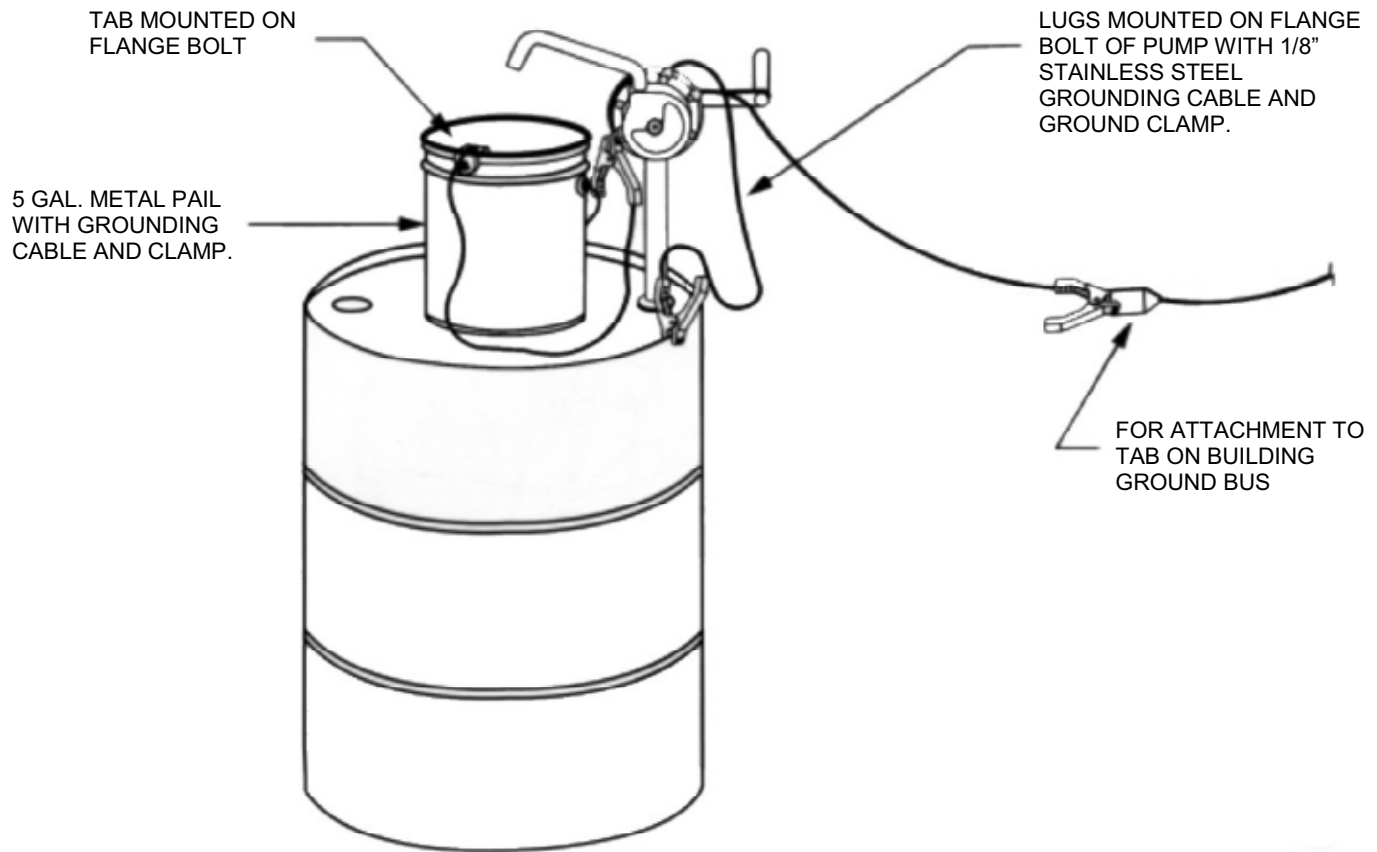


NOTE:
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TA-13

TYPICAL ASSEMBLY NO. 13

GROUNDING SYSTEM FOR SMALL VOLUME SOLVENT HANDLING – TYPICAL ASSEMBLY

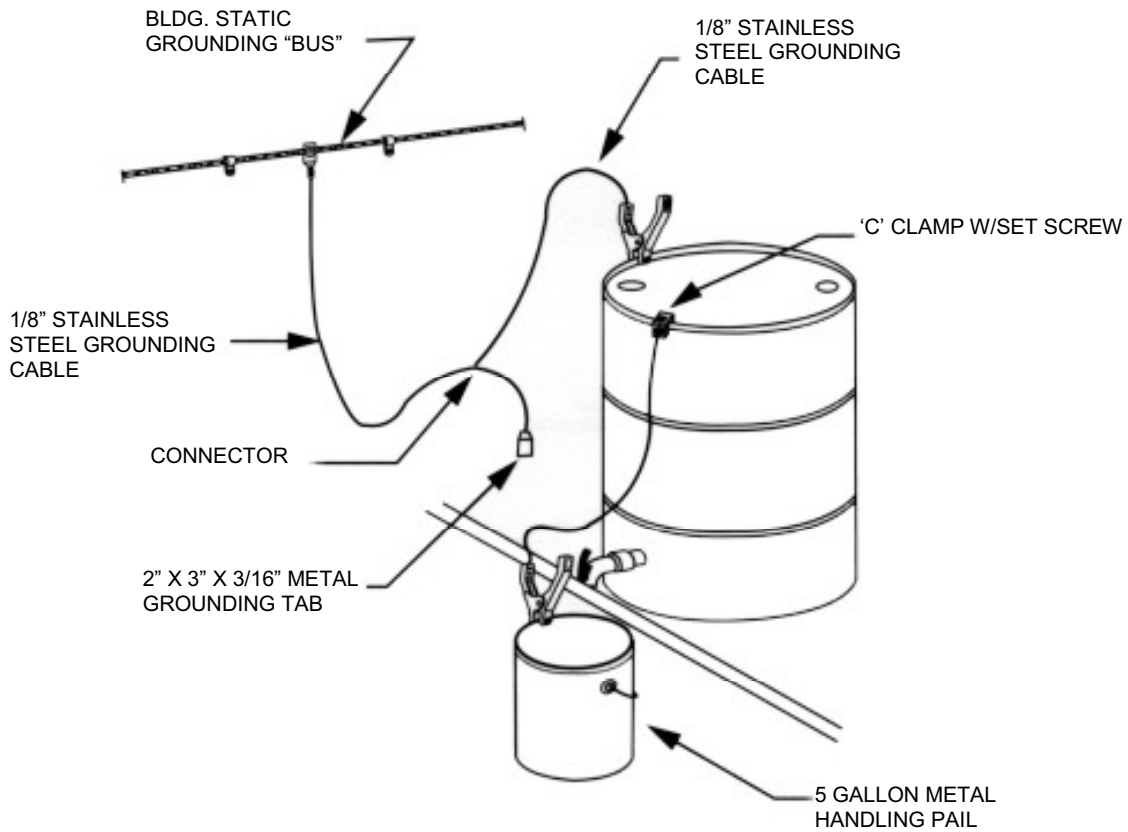


NOTE:
GROUND CONDUCTIVITY OF ALL PIPING, EQUIPMENT, DEVICES, CABLES AND CONNECTIONS MUST BE CHECKED FOR ELECTRICAL CONTINUITY AT THE TIME OF INSTALLATION AND PERIODICALLY THEREAFTER.

TA-14

TYPICAL ASSEMBLY NO. 14

GROUNDING SYSTEM FOR SMALL VOLUME SOLVENT HANDLING – TYPICAL ASSEMBLY



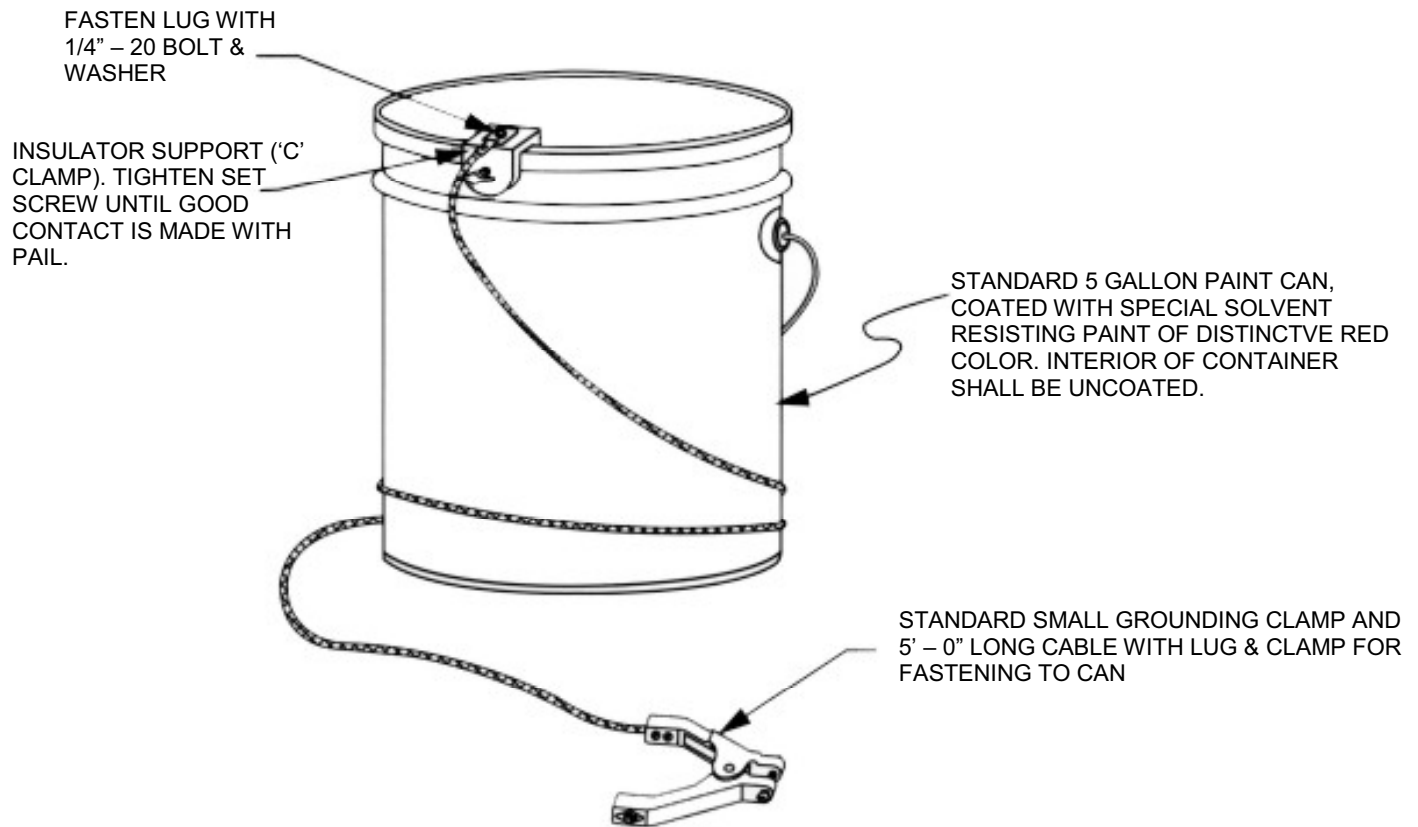
NOTE:

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TA-15

TYPICAL ASSEMBLY NO. 15

GROUNDING SYSTEM FOR SMALL VOLUME SOLVENT HANDLING – TYPICAL ASSEMBLY

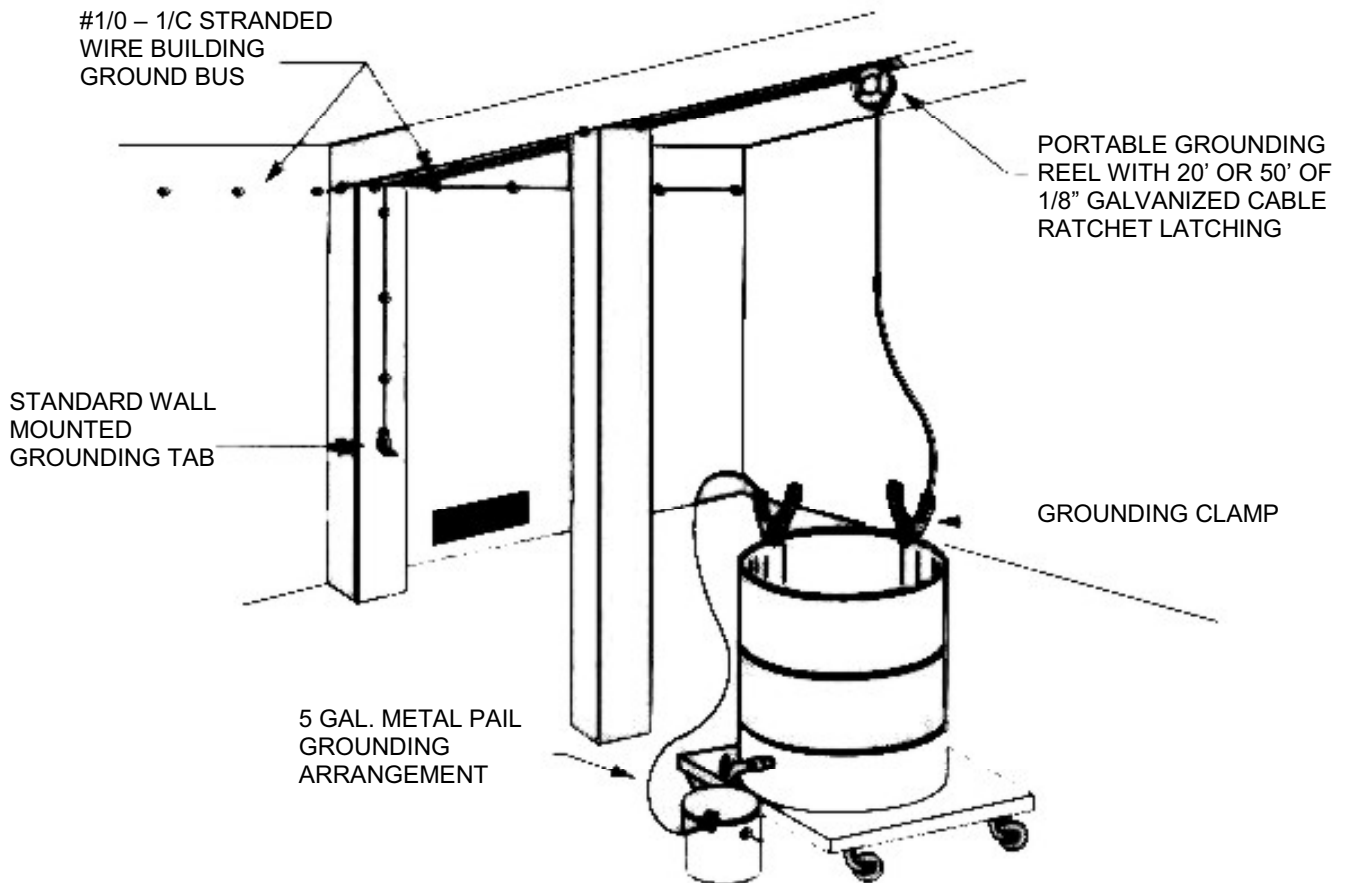


NOTE:
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THEREAFTER.

TA-16

TYPICAL ASSEMBLY NO. 16

PORTABLE TANK AND DRUM TRANSFER AREA STATIC GROUNDING ARRANGEMENT – TYPICAL ASSEMBLY



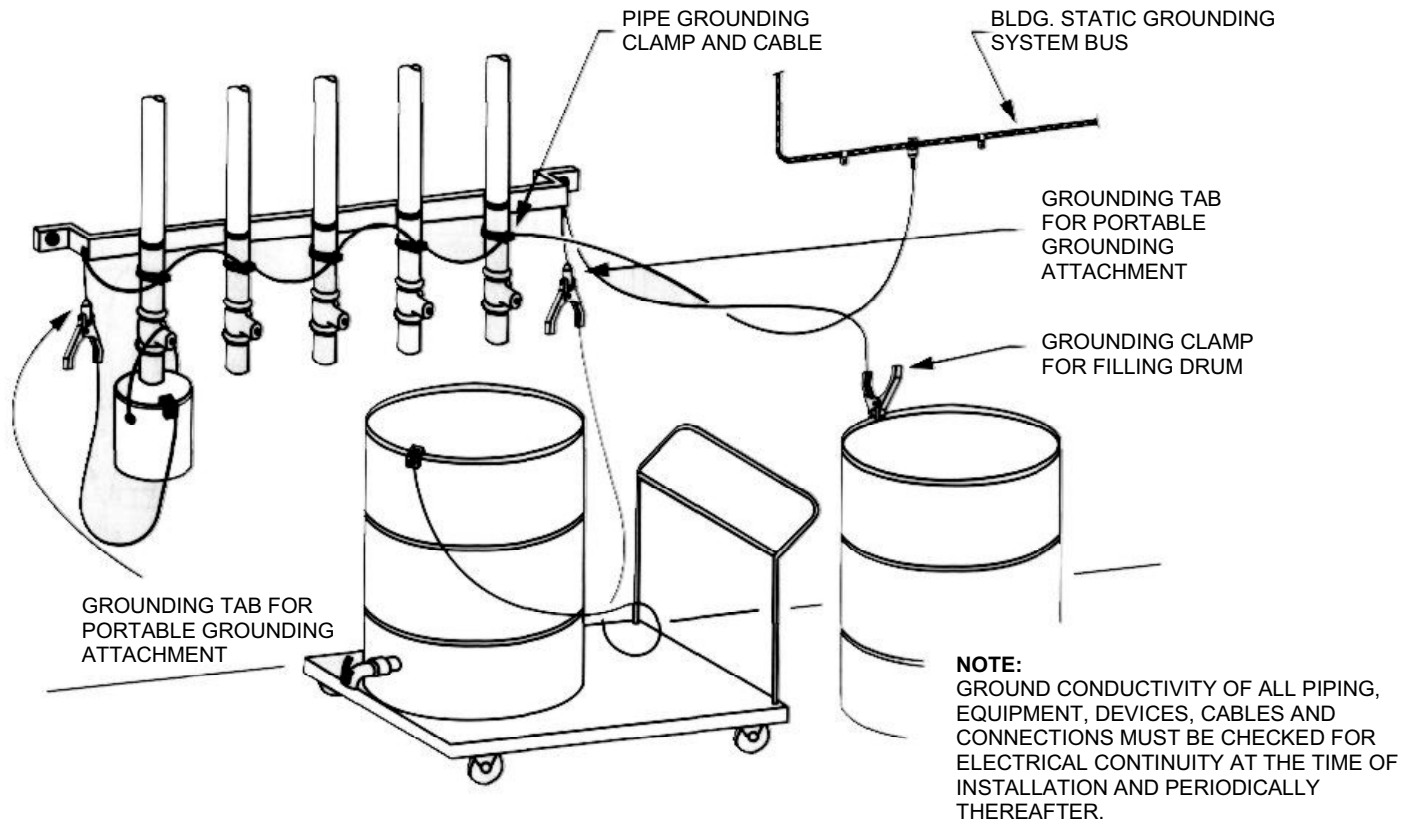
NOTE:

GROUND CONDUCTIVITY OF ALL PIPING, EQUIPMENT, DEVICES, CABLES AND CONNECTIONS MUST BE CHECKED FOR ELECTRICAL CONTINUITY AT THE TIME OF INSTALLATION AND PERIODICALLY THEREAFTER.

TA-17

TYPICAL ASSEMBLY NO. 17

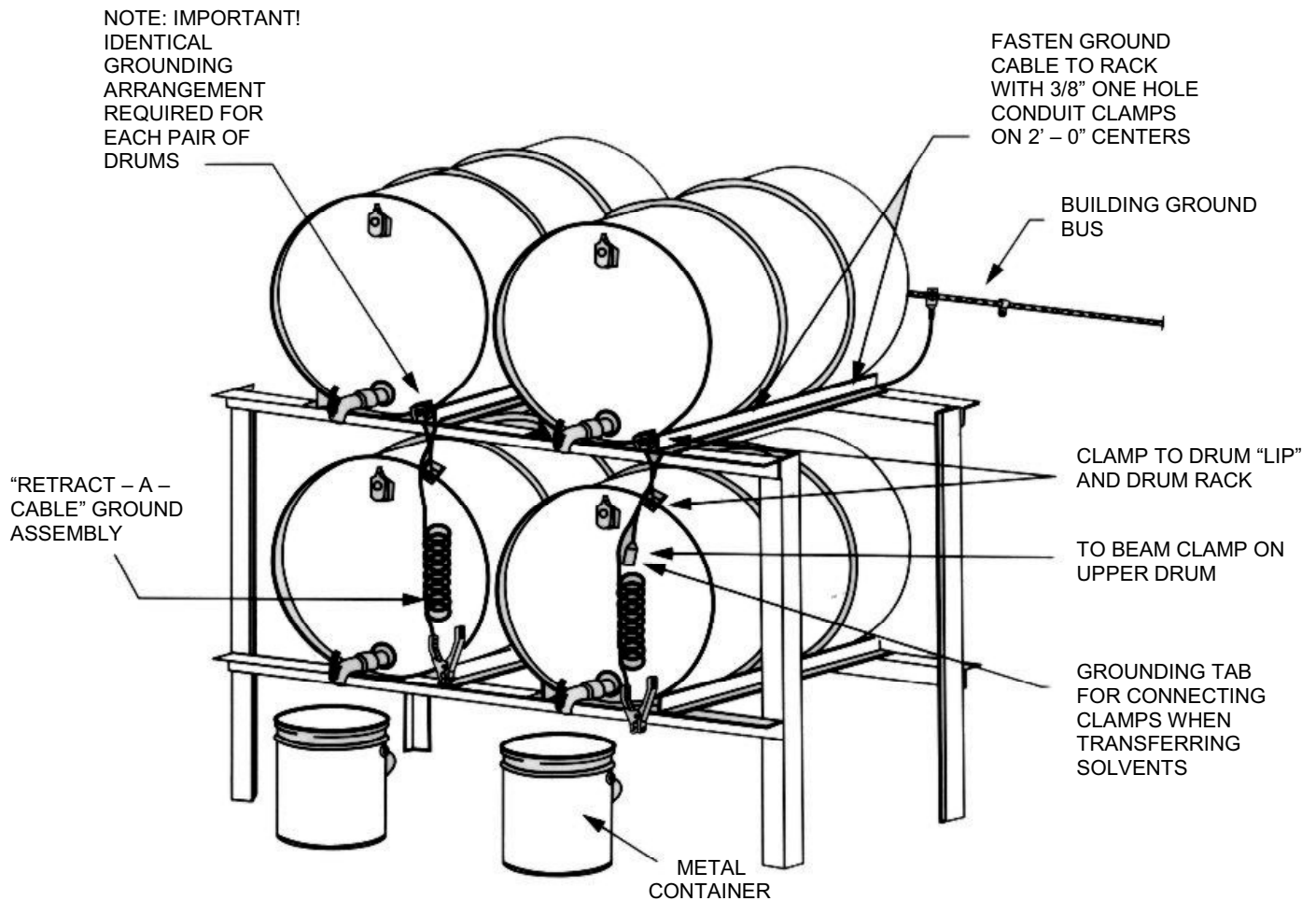
GROUNDING SYSTEM FOR SMALL VOLUME SOLVENT HANDLING – TYPICAL ASSEMBLY



TA-18

TYPICAL ASSEMBLY NO. 18

STATIC GROUNDING OF 55 GALLON DRUMS IN STORAGE RACK – TYPICAL ASSEMBLY

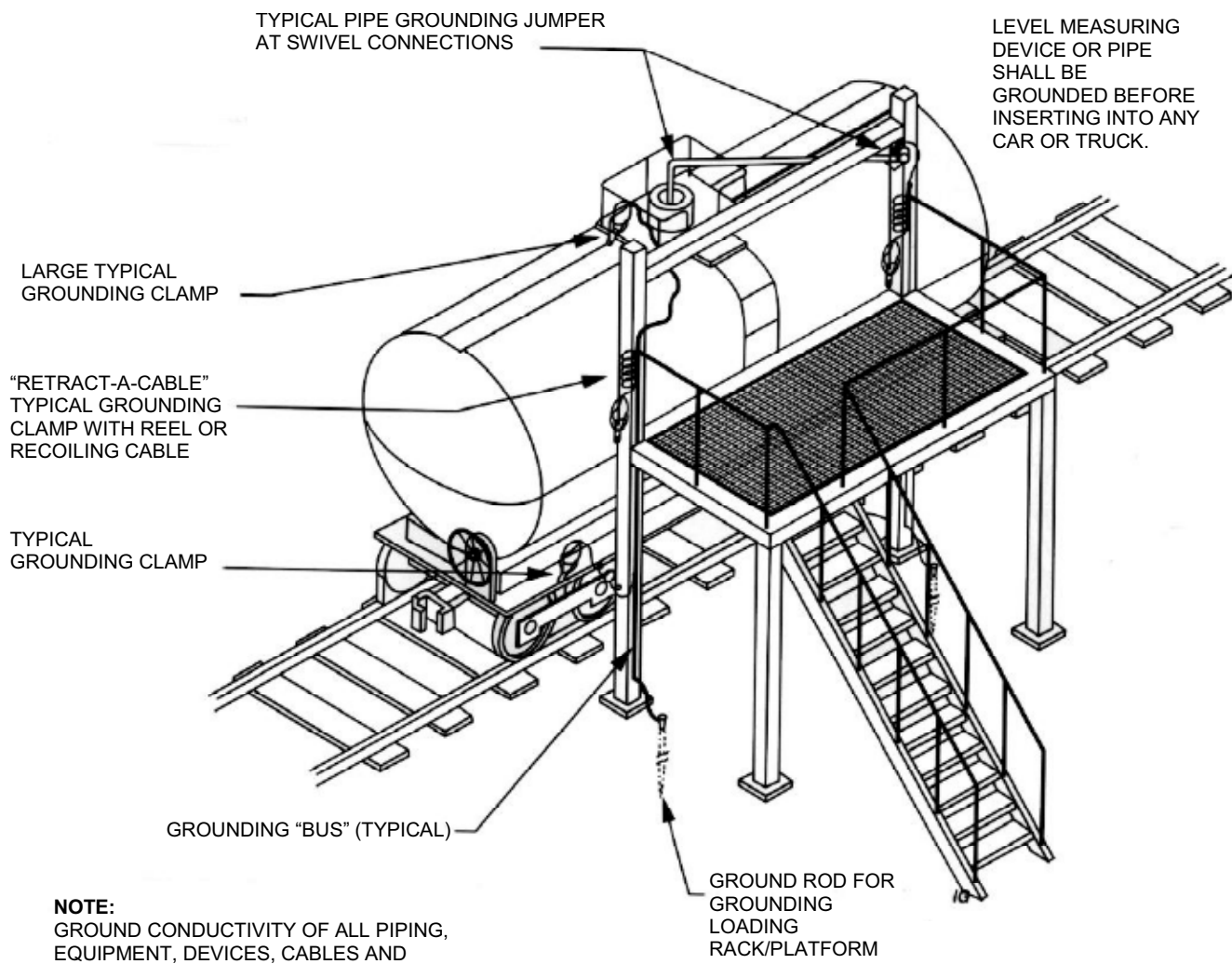


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TA-19

TYPICAL ASSEMBLY NO. 19

TANK CAR OR TRUCK LOADING/UNLOADING GROUNDING ARRANGEMENT – TYPICAL ASSEMBLY

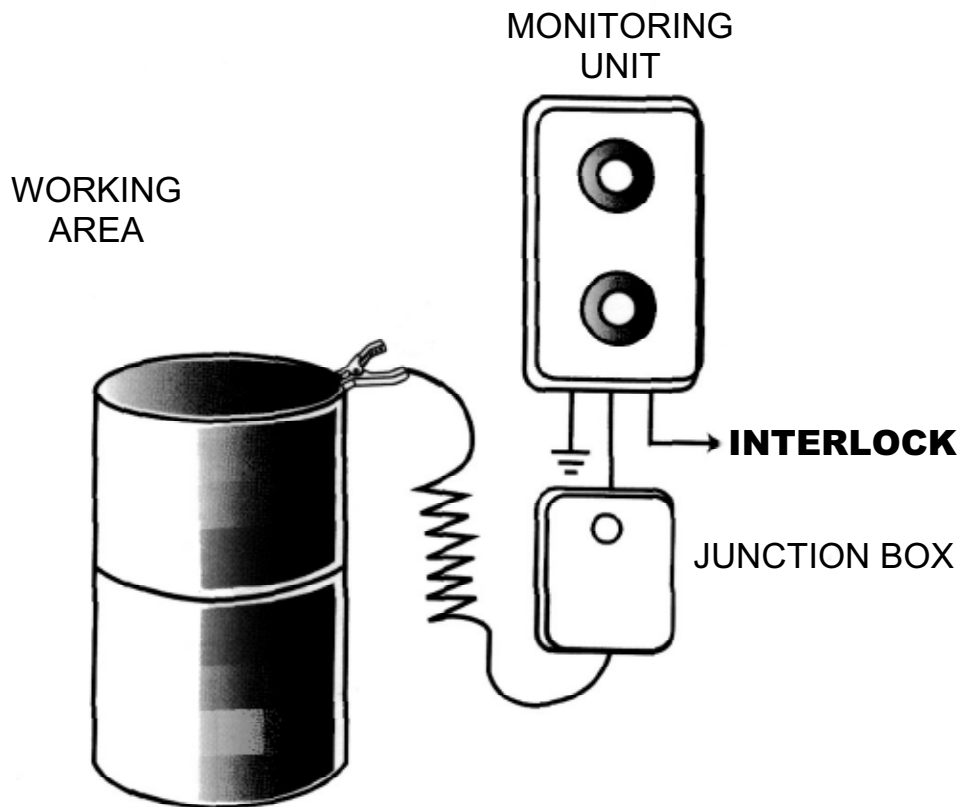


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Confirmation Systems – Illustrations

TA-20

TYPICAL ASSEMBLY NO. 20



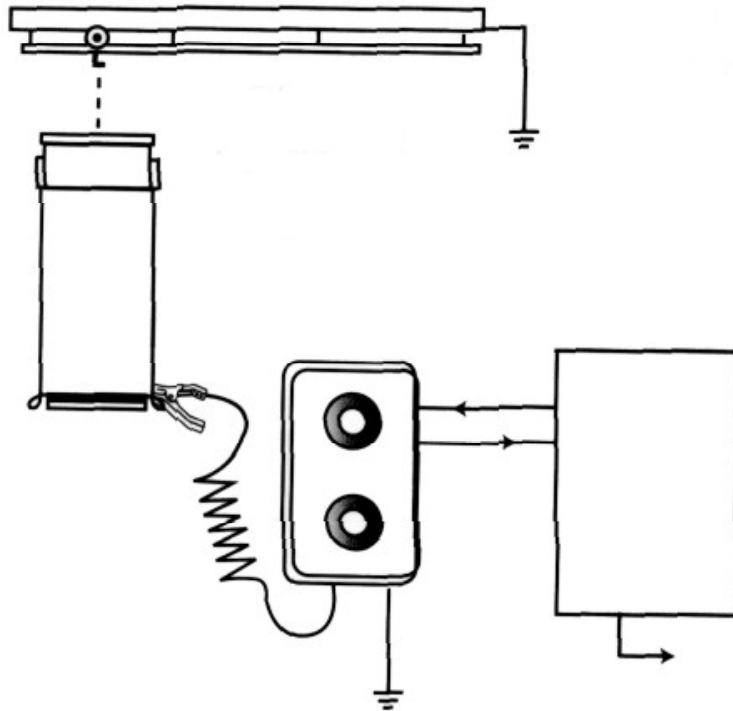
Confirmation System for Drum and Tote Loading – Typical Assembly

Provides connection to “high-integrity” ground point. Offers visual “light” display for confirmation of proper ground contact. Units are available to interlock with pumps, valves and motors, or interface with PLC or DCS controls. An optional system is available with battery-operated circuitry eliminating the need for field wiring.

Illustration Courtesy of Lind Equipment Ltd.

TA-21

TYPICAL ASSEMBLY NO. 21



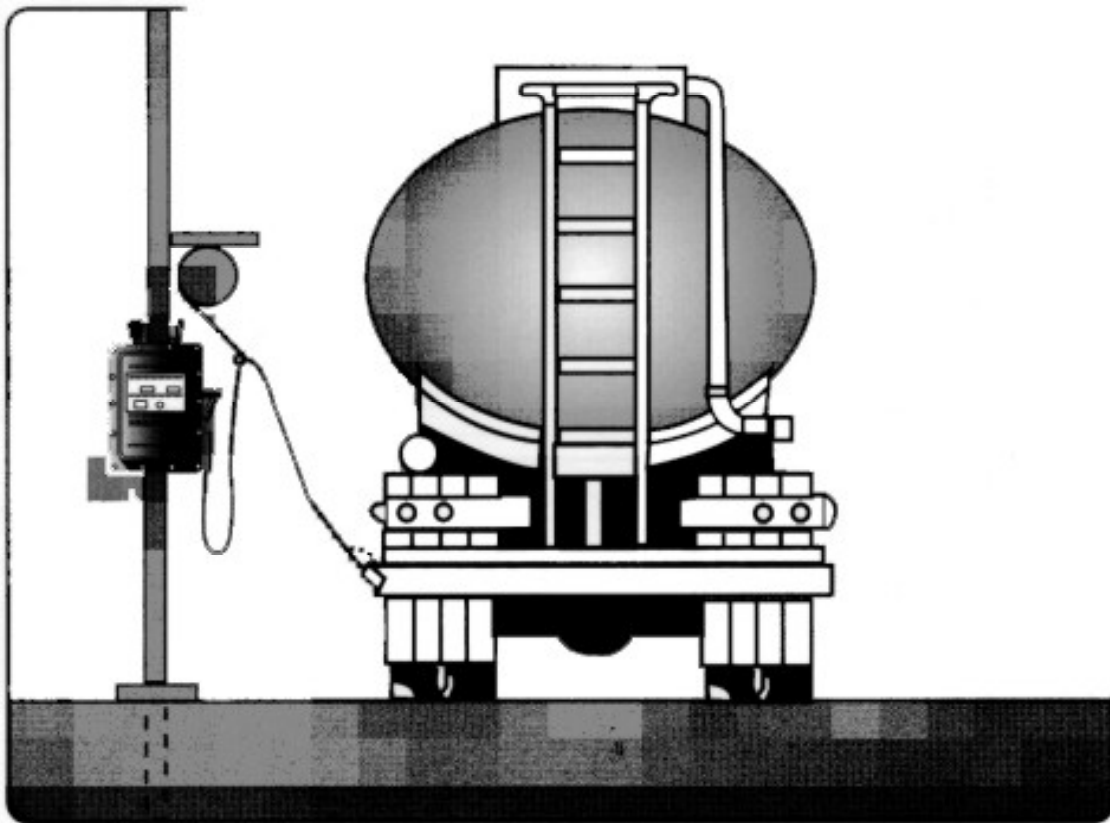
Confirmation System for Flexible Intermediate Bulk Containers (FIBC) – Typical Assembly

Provides connection to “high integrity” ground point. Tests the bag surface for resistance and offers visual “light” display for confirmation of proper ground contact. Used with material handling of dry powders in bulk form and in conjunction with “Type C” super sacks for large bags.

Illustration Courtesy of Lind Equipment Ltd.

TA-22

TYPICAL ASSEMBLY NO. 22



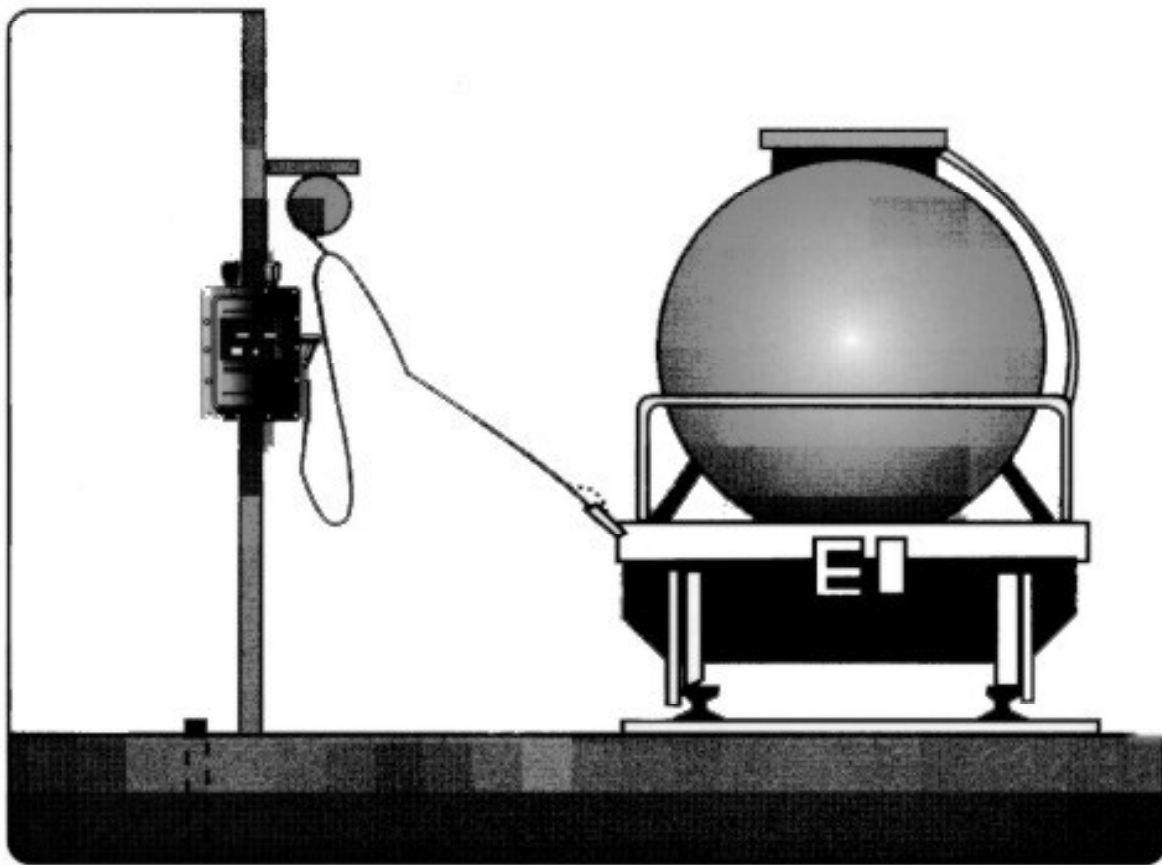
Confirmation System For Tanker Truck Loading – Typical Assembly

Provides connection to “high-integrity” ground point. Offers visual confirmation of proper ground contact and through “interlocks”, can control pumps, valves, motors or interface with PLC or DCS controls. Can also initiate a sound alarm if needed. For road tankers, an optional system is available offering “tanker recognition” in addition to the above mentioned functions.

Illustration Courtesy of Lind Equipment Ltd.

TA-23

TYPICAL ASSEMBLY NO. 23



Confirmation System For Railcar Loading – Typical Assembly

Provides connection to “high-integrity” ground point. Offers visual confirmation of proper ground contact and through “interlocks”, can control pumps, valves, motors or interface with PLC or DCS controls. Can also initiate a sound alarm if needed.

Illustration Courtesy of Lind Equipment Ltd.

Other Resources

IAPA offers a variety of products, programs and services to help your workplace address the issue of fire safety in general and static electricity in particular. These include:

Products and programs

- ▶ Emergency/Disaster Guidelines and Procedures for Employees (book available directly through CCH Canadian at 1-800-461-4131)
- ▶ WHMIS (one-day)
- ▶ Controlling Hazardous Energy: Get a Lock on Safety (1/2 day)
- ▶ WHMIS for Workers (VBT or DVD-based)
- ▶ Certification Part Two training

Health and safety guidelines

- ▶ Fire Extinguishers
- ▶ Fire Protection
- ▶ Flammable Liquids Storage
- ▶ Static Electricity

To download these guidelines, visit the IAPA website at www.iapa.ca and click on Resources.

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Revised: June 2007

For more information, to register for training or to order products:

IAPA (Industrial Accident Prevention Association)

Toll-free: 1-800-406-IAPA (4272)

www.iapa.ca