Bonding and Grounding Illustrations
# What's Inside

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## Bonding and Grounding Systems – Typical Assembly Illustrations

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Other Resources
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

1/4" FLEXIBLE BRONZE
(BARE) GROUND CABLE
OF REQUIRED LENGTH

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

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

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

#1/0 – 1/C STRANDED BARE COPPER WIRE BUILDING STATIC GROUNDING “BUS” TYPICAL ARRANGEMENT

1/4” BRONZE (BARE) GROUNDING CABLE OF LENGTH REQUIRED TO REACH EQUIPMENT TO BE GROUNDED

SEPARATE STRANDS OF WIRE AND MAKE CONNECTION WITH 1/4” – 20 BOLT, WASHER, AND LUG, INSERT INTO ANCHOR AND TIGHTEN FOR GOOD CONTACT

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-3
TYPICAL ASSEMBLY NO. 3

SMALL GROUND CLAMP
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.

Illustration Courtesy of Lind Equipment Ltd.
TA-4
TYPICAL ASSEMBLY NO. 4

LARGE GROUND CLAMP
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-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, EQUIPMENT, DEVICES, CABLES AND CONNECTIONS MUST BE CHECKED FOR ELECTRICAL CONTINUITY AT THE TIME OF INSTALLATION AND PERIODICALLY THEREAFTER.
TA-7
TYPICAL ASSEMBLY NO. 7

GROUNDING OF PORTABLE “MATERIAL TRANSFER CHUTE”
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-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:
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-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:
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-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:
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-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:
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-15**

**TYPICAL ASSEMBLY NO. 15**

**GROUNDING SYSTEM FOR SMALL VOLUME SOLVENT HANDLING – TYPICAL ASSEMBLY**

Fasten lug with 1/4” - 20 bolt & washer.

Insulator support ('C' clamp). Tighten set screw until good contact is made with pail.

Standard 5 gallon paint can, coated with special solvent resisting paint of distinctive red color. Interior of container shall be uncoated.

Standard small grounding clamp and 5’ - 6” long cable with lug & clamp for fastening to can.

**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-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

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-18
TYPICAL ASSEMBLY NO. 18

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

NOTE: IMPORTANT!
IDENTICAL GROUNDING ARRANGEMENT REQUIRED FOR EACH PAIR OF DRUMS

"RETRACT – A – CABLE" GROUND ASSEMBLY

FASTEN GROUND CABLE TO RACK WITH 3/8" ONE HOLE CONDUIT CLAMPS ON 2’ – 0’ CENTERS

BUILDING GROUND BUS

CLAMP TO DRUM “LIP” AND DRUM RACK

TO BEAM CLAMP ON UPPER DRUM

GROUNDING TAB FOR CONNECTING CLAMPS WHEN TRANSFERRING SOLVENTS

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-19
TYPICAL ASSEMBLY NO. 19

TANK CAR OR TRUCK LOADING/UNLOADING
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.
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.
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.
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.
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

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Toll-free: 1-800-406-IAPA (4272)
www.iapa.ca