

	<h1>Bonding and Grounding for the Prevention of Fire and Explosion Hazards Protocol</h1>
Date Reviewed: October 16, 2023	Document Type: Process Safety Stewardship Protocol

1.0 Purpose

This protocol defines Oviniv's minimum standards and expectations for bonding and grounding to prevent electrical (alternating or direct current, static, etc.) discharge or spark at all Oviniv field locations.

2.0 Scope

The scope of this protocol is limited to bonding and grounding for the prevention of fire and explosion hazards. This is not a procedure; however, elements of this protocol must be incorporated into procedures that require bonding and grounding.

3.0 Bonding and Grounding Requirements

3.1 Bonding and Grounding in the Transfer of Flammable and Combustible Liquids

- Proper grounding cables must always be used when transferring flammable or combustible liquids and must remain attached until all other connections are removed. Static discharging hoses do not substitute as a grounding/bonding cable.
- Prior to loading/off-loading flammable or combustible liquids, connections must be visually checked for proper bonding.
- In temporary situations (e.g., tank truck loading/off-loading) where there is little or no foot/machine traffic, and the chances of dislodgment of the bonding cables is negligible, alligator clamps may be used, providing they are in good condition and make sufficient contact (e.g., non-corroded or unpainted surfaces).
- Ensure containers are in contact with each other or connected using a bonding cable and remain continuously electrically bonded throughout the transfer to prevent accumulation of static electric charge.
- Servicing and maintenance must not be carried out on a tank truck when transferring flammable or combustible liquids, as to not interfere with bonding.
- A worker's sole duty during the transfer of flammable or combustible liquids is to monitor and operate equipment used during the transfer operation. This worker must remain in the immediate area and must be able to shut off equipment if required.
- Nozzles must not be propped open, except with a device designed and approved for the task by a manufacturer.
- Keep vessel filling rates low until the loading spout is submerged in the liquid to help avoid excessive turbulence and separation between the liquid and the loading spout.

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- Place fill spouts as low as possible and fill the containers to help dissipate any charge build-up.
- When loading/off-loading flammable or combustible liquids, all vent lines and hoses required by the manufacturer and regulations must be in place. The outlet of these must be in an area that does not impact workers in case of a release and that has no risk of flash fire/explosion at Oviniv sites.
- Ensure containers are made from a conductive material compatible with the fluid being transferred. Tanks constructed of non-conductive materials are not permitted for storage of National Fire Prevention Association (NFPA) Class I, Class II and Class IIIA liquids unless otherwise approved in writing by an engineer. Any plastic containers used to store flammable liquids must be designed to be anti-static or dissipative and utilized in accordance with manufacturer's recommendations. Tanks, mixers, and process vessels used for flammable or explosive substances must be bonded and grounded together during liquid transfer.

NOTE: In accordance with NFPA and OSHA guidance, bonding and grounding is not required for propane tanks. See NFPA 58 Chapter 6 and 29 CFR 1910.110(b)(17) for additional guidance and discussion.

3.2 Bonding and Grounding of Non-Electrical Equipment on Drilling and Completions Sites

- Ensure metal parts of equipment (e.g., mud pumps, mud tanks, centrifuges, boilers, or large generators) on Oviniv sites are electrically bonded together and grounded (e.g., rig anchors, well casing) to prevent dangerous electrical potentials in the event of an electrical fault, and to reduce any potential difference from occurring that could lead to an explosion.
- Use bonding wires no smaller than #6 American Wire Gauge (AWG) copper cable to prevent physical damage; #4 AWG copper cable is recommended.
- Attach wires with approved lugs or clips to dedicated locations that are unpainted and clean. Use an ohmmeter to test the connection if unsure. There is not one standard maximum ground resistance threshold that is recognized by all agencies. However, regulatory bodies recommended a ground resistance value of 25 ohms or less (see regulations in Section 4.0 References). Alligator clamps or spring enabled booster clamps are not acceptable as they may easily dislodge.
- Ensure bonding and grounding wires are without joints or splices throughout their length.
- Ensure continuity of bonding and grounding system controls (e.g., by flagging, traffic control, inspections).

3.3 Bonding and Grounding of Electrical Equipment

- For bonding and grounding requirements of electrical equipment refer to the applicable regulation or industry standard. See references in Section 4.0 References of this protocol for additional guidance.
- Light plants and portable generators need not be grounded to earth when the frame serves as the ground, and both of the following conditions are met:
 - The portable generator or light plant supplies only the equipment mounted on the generator or light plant and/or cord, and plug-connected equipment through GFCI receptacles mounted on the generator or light plant.

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- The non-current-carrying metal parts of the portable generator or light plant equipment (e.g., fuel tank, engine, generator's housing) are bonded to the generator or light plant frame, and the equipment grounding conductor terminals (of the power receptacles that are a part of the generator or light plant) are bonded to the frame.
- If a light plant or portable generator is not grounded to its frame, or if this condition cannot be verified and controlled, the light plant or portable generator must be grounded to earth in accordance with Ovintiv's Electrical Safety Protocol or the directions provided with the equipment. In other words, **when in doubt, ground it out.**

3.4 Steam Cleaning and High-Pressure Washing

- Ensure proper atmospheric monitoring is conducted prior to cleaning any vessel containing hazardous materials. Atmospheric monitoring must be done with the proper equipment and by personnel with the proper training in accordance with Ovintiv's Hot Work and Confined Space Practices. Bonding and grounding of steam cleaning or pressure washing equipment is required any time work is being conducted within an area classified as Class I Division 1 or 2 per American Petroleum Institute Recommended Practice 500.
- Bond the hose nozzles and lines to the vessel or equipment being cleaned. Ensure all components of the system are conductive and grounded. Hoses must be wire braided or wrapped and wand tips must be metal. A second bonding wire from the nozzle to the vessel is recommended. Ensure no insulated or spark-promoting objects are present inside the vessel.
- Ensure all conductive components of the tank or equipment being cleaned are bonded together and grounded.
- Start the initial flow of steam at a low rate until most of the atmosphere in the vessel is replaced by steam. During pressure washing operations, start the flow of fluid slowly prior to utilizing full pressure.
- Operators of pressure-washing and vacuum trucks must bond their trucks to the equipment being cleaned prior to commencing work.

4.0 References

Owner	Name
Canada	<ul style="list-style-type: none">• Canadian Electrical Code<ul style="list-style-type: none">○ Electrical Safety Information Bulletin (STANDATA), Section 10, Bonding and Grounding○ Rule 18-074 Bonding in Hazardous Locations○ CEC 20 Outdoor Aboveground Gasoline Storage Tanks and Dispensing• Canadian Standards Association C22.2 No. 41, Grounding and Bonding Equipment• Transportation of Dangerous Goods Act and Regulations
British Columbia	<ul style="list-style-type: none">• Occupational Health & Safety (OHS) Regulation<ul style="list-style-type: none">○ Control of Static Electricity – Part 23.6
Ovintiv	<ul style="list-style-type: none">•

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Owner	Name
Other	<ul style="list-style-type: none">• 29 CFR 1910.110• National Fire Protection Association (NFPA)<ul style="list-style-type: none">◦ NFPA 58◦ NFPA 70 National Electric Code, Article 250: Grounding and Bonding◦ NFPA 77: Recommended Practice on Static Electricity• American Petroleum Institute<ul style="list-style-type: none">◦ Recommended Practice 500: Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class 1, Division 1, and Division 2◦ Recommended Practice 2003: Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents

5.0 Revision History

Rev #	Description of Change	Date	Sign Off	
			Owner	Reviewer
01	Development of protocol	Jan. 17, 2019	Occ. Health and Industrial Hygiene	EH&S directors
02	Clarification of grounding requirements related to portable generators and light plants	Oct. 16, 2019	Occ. Health and Industrial Hygiene	N/A
03	Ethos administrative update: Ovintiv rebrand and SPEM content	Dec. 10, 2020	Operational EH&S	Operational EH&S
04	Ethos committee review and amendment	Oct. 16, 2023	Operational EH&S	Ethos committee
05	Added clarification on requirements pertaining to propane tanks	Apr. 30, 2024	Central EH&S	Central EH&S
06	DCR to change language in Section 3.2 around regulatory recommendation of ground resistance of 25 ohms or less (from 5 ohms).	Oct. 7, 2024	Central EH&S	Central EH&S