



ENMAX POWER GROUND DISTURBANCE GUIDELINES

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1.0 PURPOSE

This document provides guidance to Contractors regarding safe practices in relation to exposing buried ENMAX POWER facilities.

Note: These guidelines are for information only and do not supersede Provincial legislation. They are intended to support the development of safe work procedures for exposing energized underground power cables and to assist in meeting the requirements of:

- Section 2-020 of the Alberta Electrical Utility Code (AEUC) 4th Edition 2013, and
- Part 32 Section 447 and 448 of the Alberta Occupational Health & Safety Code
- THESE ARE THE MINIMUM REQUIREMENTS FOR CONTRACTORS.

Note: All Contractors must independently assess work requirements and implement their own work procedures to address all requirements of this guideline and all other legislative and regulatory requirements. All Contractor ground disturbance safe work procedures or methods must be sent to ENMAX Occupational Health and Safety Department hotdigs@ENMAX.com for acceptance prior to any ground disturbances as defined by the AEUC. The Contractor must have their ENMAX Power accepted Safe Work Practice on site at all times while exposing ENMAX Power facilities.

Definitions

Refer to the following definitions for this document:

- (a) **Contractor** – anyone disturbing the ground including home owners
- (b) **ENMAX Power QUE** – Qualified Utility Employee deemed competent by the utility
- (c) **Hand Dig** – no mechanical excavation work. The only tool allowed is a clean, non-conductive shovel until all buried facilities have been found or hydrovac. (See Part 32 Section 448-1 of AOH&S Explanation Guide)
- (d) **Hand Expose Zone** – distance from outside of locator chevrons that must be exposed by hand dig or non- destructive hydrovac methods (See Figure 1.)
- (e) **Non-destructive** – See hand dig definition and Figure 1.

2.0 WORK STANDARDS AND PLANNING CONSIDERATIONS

2.1 Locates

Prior to disturbing the ground, the Contractor must ensure that underground utility locations for all buried facilities have been completed through Alberta-1-Call.

All location documentation must be current and on site with the person doing the excavating.

Note: ALL POWER CABLES ARE TO BE CONSIDERED TO BE ENERGIZED DURING THE EXCAVATING AND BACKFILLING PROCEDURES.

Note: For overhead electrical lines, contractors must ensure that safe distances to exposed electrical lines and equipment are always adhered to (AEUC Table 2.1 and approved hot dig procedure):

- **If you do not know the voltage:** personnel and equipment must stay a minimum of 7 metres from overhead lines.
- **If you must work closer, call 403-514-6100 for clarification of voltage and working clearances.**

Locator's Paint Marks

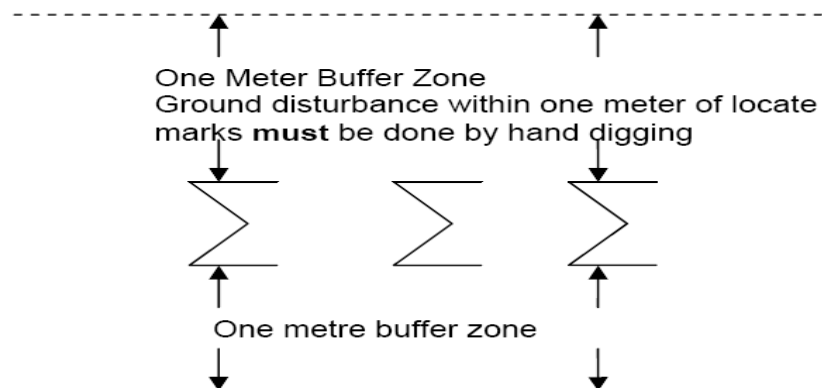


Figure 1: Hand Digging or Non Destructive (Hydrovac) Zone

NOTE: Depending on equipment being exposed this distance will vary as per document.

2.2 Protection of Cables and Equipment in Open Excavations

Contractor and personnel will ensure exposed energized equipment and cables are secured from public contact while they are unattended. During periods of inactivity all open excavations will be covered, barricaded and adequately fenced off with 6-foot rigid fencing to minimize access to the exposed facilities.



2.3 Damage

If damage has occurred while exposing ENMAX Power facilities:

1. **STOP WORK** and call 911 if an injury has occurred.
2. **Exit the excavation** immediately and secure the site.
3. **Notify ENMAX Power** at 403-514-6100. Do not re-enter the excavation until clearance has been given and repairs have been completed by an ENMAX Power QUE.

2.4 Clearance Standards—Hand Expose Zone for Secondary, Primary and Transmission Voltages and Distribution Equipment

2.4.1 Primary and Secondary Cables

No mechanical excavation work is to be undertaken in any circumstances within the hand expose zone of 1.0 metre on either side of the location markers placed by Alberta One-Call. Only a non-destructive means of excavating is permitted within the one metre buffer zone. (hand-dig or hydrovac)

Note: An ENMAX Power QUE must stand by when exposing buried cable with a voltage rating of 69,000 volts or above.

2.4.2 Underground Transmission Cables

When there is a “NO CLEARANCE TO DIG” sticker from ENMAX Power on the locate slip, then no mechanical excavation work is to be undertaken in any circumstances within 5 metres on either side of the location markers. ENMAX Power must be contacted using the number provided on the sticker. A QUE must be on-site and providing guidance before excavation will be allowed within this area.

2.5 Transformers, Switches and Pull Boxes

No mechanical excavation will be permitted within 2 metres of any ENMAX Power transformer, switch, or pull box. Only non-destructive hydrovacating or hand exposing will be permitted within 2 metres of the equipment.

CAUTION: System ground wires and ground rods are not locatable and are typically buried below the final grade and encompass a 1 metre area around or adjacent to ENMAX transformers, pull boxes and switches. Contacting the ground system may cause damage to the adjacent structures or equipment and/or personal injury or death. No mechanical excavation work is to be undertaken in any circumstances when disturbing the ground within 2 metres of the equipment.

2.6 Structure Support

ENMAX Power poles and pole anchors that may be impacted by excavations must be supported. The contractor must call ENMAX Power trouble dispatch at 403-514-6100 to contact a representative prior to excavating.

ENMAX Power equipment, cables, ducts and concrete duct banks that may be undermined must be supported. The Contractor must call the ENMAX Power Trouble Dispatch at 403-514-6100 to contact a representative prior to excavating near ENMAX Power equipment, ducts, cables or concrete duct banks. A support beam or beams for cables and duct banks shall be employed. The actual sizing and supply of the support beams, slings and/or chains will be determined by the contractor. The support system must be sufficient to prevent sag, bending, and deflection of the ENMAX Power duct, cables and/or duct banks. The support beam must be in the form of a steel "I" beam or wood pole set across the excavation running parallel with the undermined facility, and it must have sufficient span length to reach a minimum of 3 metres (on each side) beyond the edge of the excavation so that the supporting structure will not slough into the excavation due to unstable soil conditions. ENMAX Power facilities not encased in concrete (direct buried cable or ducts) must be supported by nylon slings. Cable or plastic duct chains may be used to support concrete encased duct banks. The maximum distance between supports or slings is 2 metres.

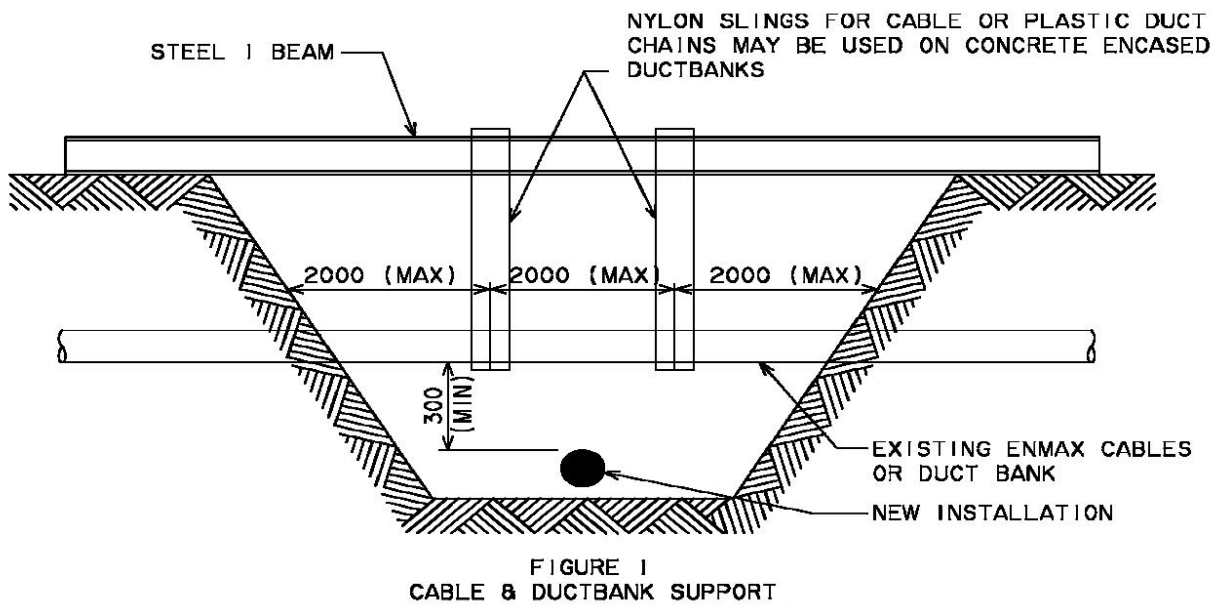


Figure 2: Cable, Duct and Duct Bank Support

Note: All Dimensions are in Millimetres.

2.7 Backfill Requirements

Upon completion of the work near ENMAX Power facilities, all exposed direct buried cables and ducts must be padded with bedding sand at a depth of 200 mm. Bedding sand shall be well graded and free of ice, frozen material, loam, organic material and stones larger than 5 mm. The remaining common fill must be compacted to City of Calgary compaction specifications. The Contractor shall be prepared to provide compaction test results if requested by ENMAX Power. Common fill may be material removed from excavation but must be free of snow, ice, loam, organic material and boulders larger than 200 mm.

Final grade shall be restored to a level that ensures the burial depth of ENMAX Power cables has not changed. If there is a rise or fall in the final grade, ENMAX Power must be contacted prior to backfill so the new grade can be recorded. Transmission circuits require specific instruction from ENMAX Power for backfill requirements.

Notify ENMAX Power Trouble Dispatch at 403-514-6100 prior to any back filling.

Note: ALL POWER CABLES ARE TO BE CONSIDERED TO BE ENERGIZED DURING THE EXCAVATION AND BACKFILL PROCEDURES.

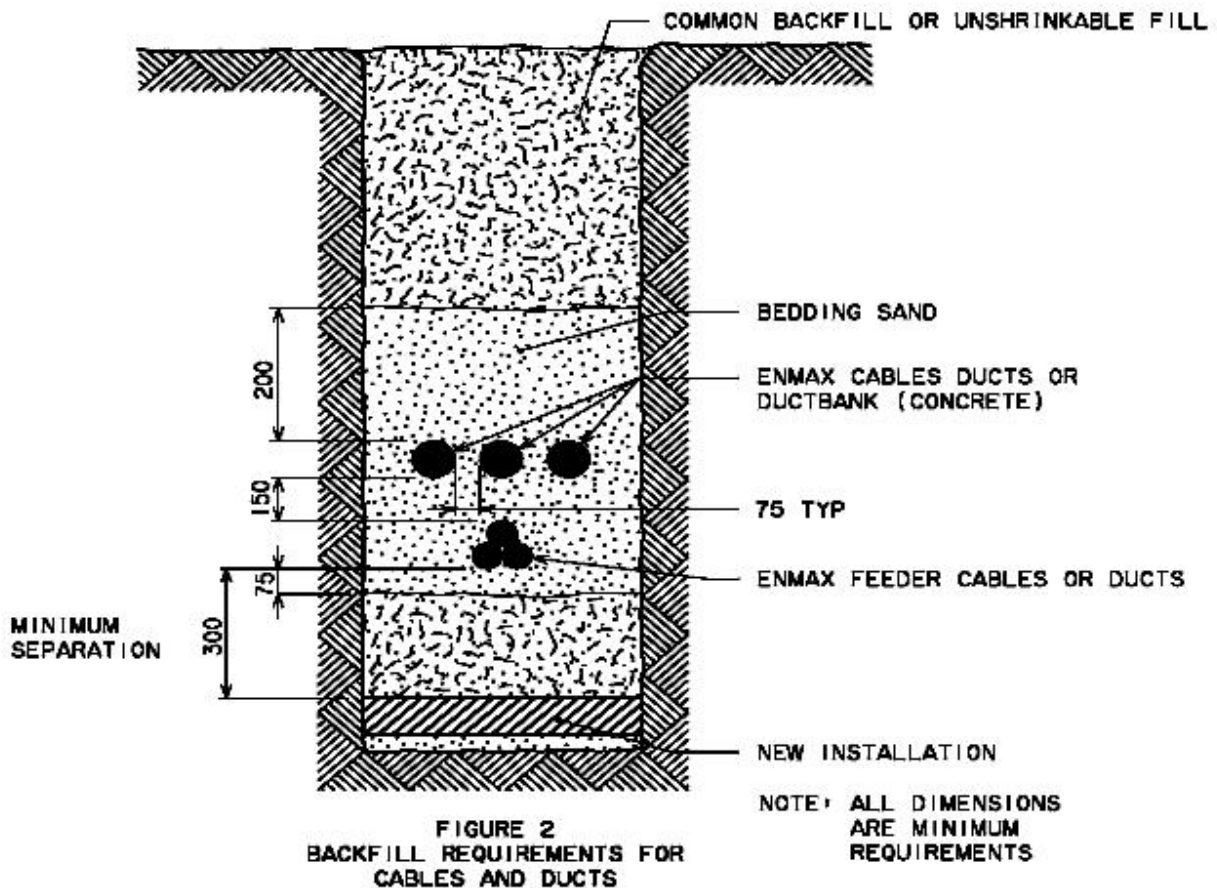


Figure 3: Backfill Requirements for Cables and Ducts

Note: All Dimensions are in Millimetres.



3.0 HAND DIGGING GUIDELINES FOR EXPOSING ENMAX POWER FACILITIES

3.1 Contact Information

The Contractor must call the ENMAX Power Trouble Dispatch at 403-514-6100 to contact a representative prior to excavating near ENMAX Power equipment, ducts, cables or concrete duct banks.

At the worksite the Contractors must have the contact information for ENMAX Power Trouble Dispatch Centre (403-514-6100) and a cell phone or other means of contacting the ENMAX Power Trouble Dispatch Centre.

3.2 Competency and Personal Protective Equipment

Contractors must ensure that all personnel involved in hand exposing ENMAX Power facilities are competent by definition of AOH&S Code Part 1 which means: adequately qualified, suitably trained and with sufficient experience to safely perform work without supervision or with only a minimal degree of supervision (“competent employee”). Contractors must also ensure that all personnel involved in hand exposing ENMAX Power facilities are equipped and wearing the following Personal Protective Equipment (PPE) at all times during and while exposing any ENMAX Power Plant or Equipment:

- (a) C.S.A. - Approved Safety Glasses (Z94.3)
- (b) C.S.A. - Approved Hard Hat
- (c) Class 3 high voltage rubber insulated gloves (rated at 30,000 volts) with outside leather protectors (must follow manufacturer’s instructions for use)
- (d) C.S.A. - Approved dielectric footwear (with green triangle and omega symbol)
- (e) Fire resistant outer layer clothing, ankle to cuff (HRC 2 = 8 Cal/cm² minimum)
- (f) Personal protective equipment as per part 18 of the Alberta Occupational Health & Safety Code.

3.3 Hand Exposing Tools

When hand exposing cables in the no dig buffer zone (within 1 metre either side of the markers placed by Alberta One-Call locators), a shovel with a dry, non-conductive handle must be used to remove materials away from all cables. (No pointed probe that could pierce the cables shall be used in the excavation process)

(See Hand Expose or Non Destructive (Hydrovac) Zone and Section 1.10)

3.4 Splices

Use extreme caution when working within 1 metre of any cable splices. Do not move, walk on, or disturb splices while exposing cables. Notify ENMAX Power Trouble Dispatch at 403-514-6100 to contact for inspection prior to backfilling splices.



4.0 HYDROVAC GUIDELINES FOR EXPOSING ENMAX POWER FACILITIES.

The Contractor must call the ENMAX Power Trouble Dispatch at 403-514-6100 to contact a representative prior to excavating near ENMAX Power equipment, ducts, cables or concrete duct banks.

4.1 Personal Protective Equipment

Contractors must ensure that all personnel involved in hydrovacating procedures are competent or are under the direct supervision of a competent employee and are equipped and wearing the following personal protective equipment (PPE) at all times during and while exposing any ENMAX Power plant or equipment.

- (a) C.S.A. - Approved Safety Glasses (Z94.3)
- (b) C.S.A. - Approved Hard Hat
- (c) Fire resistant outer layer clothing, ankle to cuff (HRC 2 = 8 Cal/ cm² minimum)
- (d) C.S.A. approved dielectric footwear (with green triangle and omega symbol)
- (e) Personal protective equipment as per part 18 of the Alberta Occupational Health & Safety Code

4.2 Job Site Protection Associated with Hydrovac Equipment

When a Contractor is exposing energized or isolated cables, the following apply:

- (a) The job site and truck must have signage in accordance with the contractor's procedures and must be supervised to warn staff or public of site-related hazards and against entering the job site.
- (b) Signs indicating "Danger" must be located a minimum of 3 metres from the truck to reduce the risk of injury from step and/or touch potential. No person should touch the truck while excavating is in progress to avoid touch potential.

4.3 Safety Precautions

Note: All water pressure/vacuum systems (hydrovacating) using a combination of water temperature and pressure have the potential to damage underground cables and facilities.

Note: Cable damage may occur by too much water pressure and will appear as a slice into the cable sheath of an unknown depth or as though the outer sheath has been torn and pulled outward. If damage is suspected, exit the excavation immediately and secure the site. Notify ENMAX Power at 403-514-6100. Do not re-enter the excavation until clearance has been given and repairs have been completed by an ENMAX Power QUE.

When exposing cables, the operator must direct the high-pressure nozzles (single head oscillating-type nozzle) in a circular motion and NOT allow the wand to become stationary



when excavating. If a sweeping motion is being used, ensure that the direction is across the cables (perpendicular) and not following the cables length (parallel); this avoids any stationary contact with the cable at the end of each sweep which will prevent cable damage. Once the buried facility has been exposed, a distance of at least 175 mm (7 inches) should be maintained between it and the oscillating head of the water wand. Avoid positioning the vacuum tube directly over exposed facilities.

If there has been damage to the cables, notify ENMAX Power immediately at 403-514-6100.

Note: Under faulted conditions the water, wand and vacuum pipe may become energized.

4.4 Hydrovac Specifications

The following specifications for the normal operation of the hydrovac equipment when exposing ENMAX Power equipment and facilities **MUST** be followed:

- (a) Water pressure must not exceed 1500 psi (to be measured on the truck's gauge, not at the end of the wand);
- (b) Water temperature must not exceed 37.8° C (100° F);
- (c) Vacuum pipe end must have a neoprene or equivalent lip to protect the cable or facilities;
- (d) There must be a single oscillating tip nozzle;
- (e) The wand must be kept moving at all times.

Note: Hydrovac excavation operators are permitted to stand on portable bond mats and shall follow the manufacturer's instructions.

Note: ALL POWER CABLES ARE TO BE CONSIDERED AS ENERGIZED DURING EXCAVATION AND BACKFILLING.

5.0 DIRECTIONAL CORING GUIDELINES

The Contractor must call the ENMAX Power Trouble Dispatch at 403-514-6100 to contact a representative prior to excavating near ENMAX Power equipment, ducts, cables or concrete duct bank.



Safety Precautions

When a Contractor is doing directional coring, the following apply:

- (a) The job site and equipment must have signage in accordance with the contractor's procedures and must be supervised to warn staff or public of site-related hazards and against entering the job site.
- (b) Signs indicating "Danger" must be located a minimum of 3 metres from the equipment to reduce the risk of injury from step and/or touch potential. No person should touch the truck while excavating is in progress to avoid touch potential.

All directional coring machines have the potential to damage underground ENMAX Power cables and facilities. Extreme caution must be used when working near energized cables.

Before coring begins, all located ENMAX Power cables and facilities in conflict must be exposed to sight and must have a minimum of 600 mm area excavated on the drill side. This is done so the drill head can be observed approaching the cable and has time to stop if needed.

If coring parallel to a cable, the cable must be exposed at regular intervals to make sure the drill head will not impact the cable.

The machine operator will not allow any persons within 3 metres of the machine while the coring operation is in progress. This is to prevent touch potential if the drill head contacts an energized cable.

The drill operator will remain on the machine if an energized cable is contacted until he has been given clearance from an ENMAX Power QUE.

6.0 REFERENCES

For additional information regarding Ground Disturbance or Standards, refer to:

- AEUC Section 2- 018 (Moving Equipment or Buildings)
- Alberta OH&S Act, Regulation and Code Part 18 and Part 32
- Alberta Occupational Health and Safety Code 2009 Explanation guide
- CSA Standard C22.3 No.7-10 "Underground Systems"
- Canadian Common Ground Alliance: CAN/ULC-S801-(7.15.6.2):
<http://www.albertacga.ca/Resources/Documents/CCGA%20Best%20Practices%20-%20Volume%201.0.pdf>