

**TES-CT-EXC-GLE Excavation Specification
(CAN-US-MEX)**

Item ID: 005890120

Rev.: 04

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PURPOSE

This Specification defines the requirements for conducting an excavation, including (but not limited to) planning and supervising ground disturbance in Canada, the U.S. and Mexico for assets that are wholly owned and operated by the Company.

Within the Engineering Standards Collection, this Specification is governed by:

- TES-CT-GEN-GL *Pipeline Construction Specification (CAN)* (Item ID [003745282](#))
- TES-CT-GEN-G *Pipeline Construction Specification (US-MEX)* (Item ID [1013154643](#))
- TES-CT-GEN-L *Pipeline Construction Specification (US)* (Item ID [005408266](#))
- TES-CT-FCSTD-G *Facilities Construction Specification (CAN)* (Item ID [1015497914](#))
- TES-CT-FCSTD-G *Facilities Construction Specification (US-MEX)* (Item ID [1016741169](#))

This Specification is intended to ensure that the excavation process (the Work), including planning ground disturbances, identifying buried utilities, and conducting the excavation and backfilling, meets the Company's and the Contractor's requirements and regulatory standards and is done:

- according to a systematic methodology as documented and demonstrated
- by a qualified, trained and competent crew

This Specification is required to be attached as a schedule to the contract between the Company and the Contractor. The Contractor is solely accountable for ensuring all requirements of this specification are achieved, except where accountabilities and responsibilities are specifically noted for the Company. Adhering to this Specification is required to ensure that all work done for the Company meets regulatory compliance and is defensible to a regulatory body.

Applicable Life Saving Rule: We Will Control Excavations and Ground Disturbances.

SCOPE

This Specification applies to Contractors that are designated as Prime Contractor (British Columbia, Alberta, Manitoba), Constructor (Ontario), Maître d'Oeuvre (Quebec), or where the Contractor has control of the worksite whether as an employer (worksite regulated by the Canada Labour Code) or either an employer or contractor (Saskatchewan) or as a controlling employer, creating employer, exposing employer or correcting employer (U.S.) for Occupational Health and Safety.

By providing these minimum specifications for excavation, the Company is not assuming control of Occupational Health and Safety, nor agreeing to correct deficiencies.

This Specification also applies to all partially owned entities and/or joint ventures where the Company has or might have operational control in the future.

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Within an Engineering Standards Collection document, the following terms and definitions apply for requirements:

- 'Company' means the TC Energy entity for whom work, services and/or materials are being provided.
- 'Must' or a similar term (e.g., 'shall') is used to express a mandatory requirement. All statements in this document must be interpreted as mandatory requirements unless clearly stated as optional. A formally-approved Variance Request is required to deviate from a mandatory requirement.
- 'Should' or 'may' is used to express an optional recommendation or that which is advised or permissible but not required.

Wherein governmental or regulatory requirements conflict with this Specification, the more stringent requirement shall govern except in cases where use of an alternate requirement is mandated by regulation.

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1 GLOSSARY

Term	Definition
Company Authorized Representative	The person assigned on behalf of the Company to act in the Company's best interests and ensure the Contractor adheres to this Specification. This person will be the Project Manager or a designate.
Competent	Adequately qualified, suitably trained and with sufficient experience to safely perform the work as outlined, independently or with only a minimal degree of supervision.
Competent Person	One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
Confined space	An enclosed or partially enclosed space having restricted entry or access and exit or egress, and which, due to its design, construction, location, atmosphere, contents, work activities or other conditions, is or can become hazardous to personnel required to enter. Further, confined space: <ul style="list-style-type: none"> is large enough and so configured that a worker can bodily enter and perform assigned work is not designed for continuous worker occupancy
Contractor	Any person, firm or corporation contracting with the Company to perform the work as set out in the Contract.
Covered task	An operational or maintenance activity identified, as a requirement of Part 192 or 195 of the U.S. Code of Federal Regulations, for which a written Operator Qualification plan is required.
Crossing agreement	Documented Company approval for crossing, construction and excavation activities on or near the Company's rights-of-way, in accordance with legislation, to protect the public and reduce the risk of pipeline damage.
Danger Zone	Any location within 6 m (20 ft) of a piece of heavy equipment. For heavy equipment with extensions (e.g., booms, cables, counterbalances), the "Danger Zone" is extension length plus 6 m (20 ft).
Demonstrate	Provide evidence through actions and documentation.
Driven pile	A long slender column provided to support resisting forces made from a material having a predetermined shape and size.
Electronic locate sweep	The methodology used to identify unknown buried metal facilities within the search area, which involves conducting multiple swaths across or at the perimeter of the search area at different angles using inductive/indirect and passive locate modes.
Equipment Operator	The person assigned to operate mechanical excavation equipment. This individual works closely with the Signaler to accept and understand the signals and directions being given.

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Term	Definition
Excavation	Any work, operation or activity that results in an earth disturbance, including, without limitation, excavating, soft excavation, trenching, pile driving, drilling, tunnelling, backfilling, blasting, topsoil stripping and removal of surface whether by explosives or mechanical means, and by any other operation of earth movement (ground disturbance).
Excavation checklist	Document used in the planning, execution and ongoing evaluation of ground disturbance and excavation activities.
Excavation procedure	The Contractor's written procedure explaining the standard operating practice or work practice for conducting an excavation, as the case may be, in compliance with all regulations, industry standards and this Specification.
Excavation safety plan	A plan developed to address all hazards related to the excavation. This plan is reviewed and authorized by the Company's Authorized Representative.
Excavation Supervisor	The person assigned by the Contractor to be accountable for all activities directly related to planning an excavation, identification of facilities, excavation, protection of all people who access and egress excavations, protection of the excavation site and subsequent backfilling as described in this Specification. The Excavation Supervisor is required to be a Competent Person as defined by federal and provincial or state excavation regulations.
Excavation team	The personnel required to conduct excavations, i.e., the Excavation Supervisor, Equipment Operator and Signaler.
Foundation	The part of the trench that lies beneath the bedding. A foundation is required when the native trench bottom is greater than 150 mm (6 in.) from bottom of pipe (see Figure 8-2).
Ground disturbance	See Excavation.
Hand excavation	Excavation using non-powered, non-mechanical implements (e.g., shovels, dutch [hand] augers, track spades).
Hazard	Any source of potential damage or harm to individuals (potential adverse health effects) or to organizations (potential property or equipment losses).
Heavy equipment	All powered equipment that by the nature of its design and purpose is self-propelling or is intended to be propelled as an integral part of its function. Examples of heavy equipment include winch trucks, vehicles greater than 4500 kg (10,000 lbs), cherry pickers or crane trucks, dump trucks, tractor units and trailers (including large utility trailers), industrial tractors with rubber tired front-end loaders and/or backhoe-excavator combinations, mobile cranes (including those mounted on vehicles), backhoes, excavators, front end loaders, draglines, side-booms, trenchers, graders, earthmovers, bulldozers, bobcats, skid steers.
Integrity Support	Includes Integrity Engineering Services (US), Integrity Support (CAN) and Pipe Integrity (MEX)
Manual compactor	Walk-behind compactor sometimes referred to as plate tamper or jumping jack compactor. Maximum weight 100kg/220 lbs).

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Term	Definition
NPS	Nominal Pipe Size
One-Call system	An entity that administers a system through which third parties can notify owners and operators of buried facilities of their intent to perform a ground disturbance activity.
Operator Qualification Program (U.S.)	A program established to document that an individual has been evaluated and is deemed qualified to perform assigned covered tasks and recognize and react to abnormal operating conditions.
Soft Excavation	Exposure or partial exposure of an underground buried facility by use of water or air jets (e.g., hydrovac or airvac) or hand excavation.
Personal protective equipment	Equipment designed and worn to protect personnel from exposure to work site hazards (e.g., respirator, fall protection, side-impact hardhat, ear plugs, muffs, safety goggles and fire-retardant clothing).
Screw pile	A long slender steel column with a screw or helix on one end that is screwed into the ground to carry loads. Sometimes referred to as screw anchors, screw-piles, helical piles, or helical anchors.
Search area	The area from the edge of the proposed excavation to a distance of 30 m (100 ft).
Side cutter	Any tooth or added appurtenance that extends farther than the side of the bucket.
Signaler	The person assigned to provide hand and verbal signals to guide the Equipment Operator, and probe for and hand excavate pipelines and other underground facilities.
Special attachments	Special attachments include, but are not limited to, hoe rams, tampers, augers and spoons, thumbs, articulating buckets and attachments used in a nonconventional method (e.g., bucket installed backwards).
Springline	The line of the outermost horizontal points on the side of the pipe, the maximum horizontal dimension, and the horizontal centerline of the pipe (see Figure 8-2).
Spoon	An engineered excavator attachment that is flat (i.e., no sides or curvature) and is used to fragment remaining soil located directly under a buried facility, making room for access as needed (e.g., for repairs, tie-ins, inspection). Refer to Figure 6-2. A spoon is not used to scoop or carry soil below the pipe (i.e., by articulating the spoon).
Spooning	The Equipment Operator situates the spoon at the bottom of the excavated trench (with both sides and top of buried facility exposed), and slowly maneuvers the spoon below the buried facility (into the earth plug) to loosen the soil out from underneath, while maintaining clearance from the buried facility.
SSSP	Site-Specific Safety Plan
Stake-out Report	A document used during the facility identification process to verify that all facilities have been identified and any discrepancies noted. This report is approved and signed off by the Excavation Supervisor.

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Term	Definition
Tabulated Data	Tables and charts approved by a registered professional engineer and used to design and construct a protective system. The tabulated data provides the necessary information to use the equipment within design parameters.
TOP	TC Energy Operating Procedure. Internal only to the Company.
Work	As defined in this Specification as excavating (work), which includes but is not limited to planning, ground disturbances, searching for buried utilities, conducting the excavation and backfill.
Work authorization	Written permission by the operating authority (i.e., Field Operations) stating that the area in which work is to be performed is safe for work to begin.

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2 GENERAL REQUIREMENTS**2.1 Excavation Personnel Competency**

- 2.1.1 All personnel involved in the excavation must be evaluated based on a documented competency-based assessment and verification process.
- 2.1.2 For excavations conducted in the U.S., the individuals performing any covered tasks must be qualified according to the TC Energy *Operator Qualification Program* (Item ID [004504739](#)).
- 2.1.3 The Contractor must provide to the Company the documentation of all training, qualifications and competency verifications for all personnel performing, monitoring and supervising the excavations.
- 2.1.4 A competent Excavation Supervisor must be designated for on-site supervision for all excavations. All excavations must be completed according to the requirements in Table 6-1. The Excavation Supervisor must:
- be accountable for compliance with applicable regulatory and industry codes and standards, and compliance with this Specification
 - provide their name and signature on documents required for the project (e.g., Job Safety Analysis)
- 2.1.5 Before and during the early stages of the excavation activity, the Excavation Supervisor must monitor:
- the Equipment Operator to confirm their ability to manoeuvre the equipment (e.g., speed, positioning and response to hand signals)
 - all involved personnel to confirm their ability to effectively communicate and adhere to excavation procedures

3 PROCEDURAL REQUIREMENTS**3.1 Site Assessment and Planning**

- 3.1.1 Before starting the Work, a site assessment must be conducted to identify hazards that need to be addressed to perform the excavation safely.
- 3.1.2 The site assessment must include, but is not limited to, the following hazards:
- evidence of underground facilities
 - aboveground facilities
 - overhead power lines
 - hazardous soil conditions
 - steep slopes (refer to TES-CT-SLOPE-GL *Slope Work Specification (CAN-US-MEX)* (Item ID [009199892](#)))
 - evidence of leaking underground facilities

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- contaminants
- access, staging, marshalling area traffic and congestion

3.1.3 All relevant information pertaining to the excavation must be compiled and documented during the planning stage of the excavation including, but not limited to, the following:

- relevant drawings (see Appendix A)
- excavation planning checklist (see Appendix B)
- excavation plan (see Appendix C)

3.1.4 Individuals with local knowledge of the facility being excavated (Owner Site Representatives and Operators) must be consulted during the development of the excavation plan.

Clarification: This consultation with the individuals having local knowledge of the facility being excavated is to assist with identifying issues that could affect the execution and safety of the excavation (e.g., buried facilities not identified by surveys or drawings, red-line drawings or previous modifications and site-specific hazards). On brownfield projects, this is coordinated during the general work permit process.

3.1.5 For all underground facilities within a minimum 30 m (100 ft) from the edge of the proposed excavation (including sloping), all available and applicable records must be obtained and reviewed (see Figure 3-1). The process for obtaining and reviewing these records must be documented on Stake-out Report and confirmed by the Company Authorized Representative.

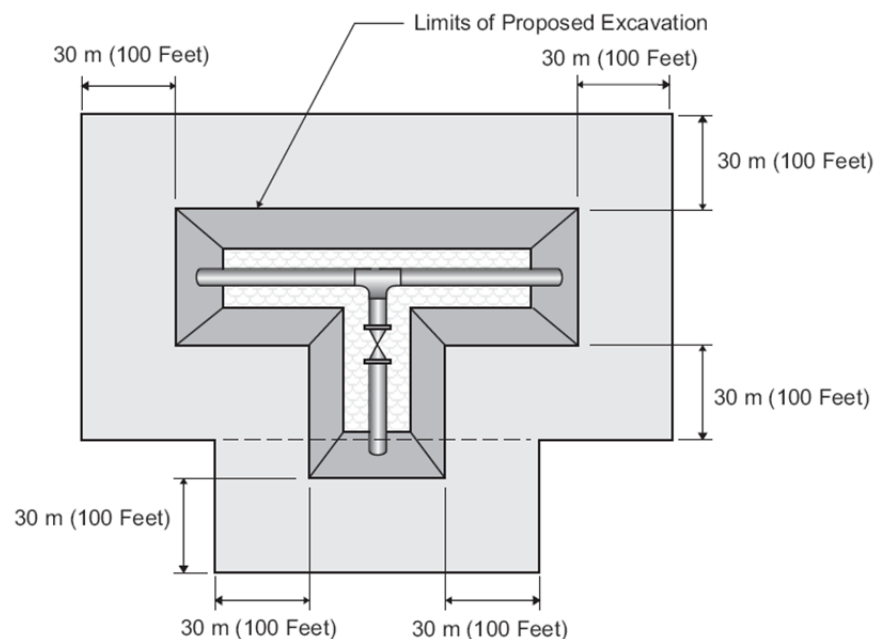


Figure 3-1: Search Area

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- 3.1.6 The Excavation Supervisor must consult the Company's Authorized Representative to verify the following:
- all landowners and other parties affected by the proposed excavation have been contacted
 - all buried facility owners have been notified as required by the applicable federal and provincial or state regulatory jurisdictions
 - all required crossing agreements and work authorizations have been obtained from the buried facility owners
- 3.1.7 When excavation is performed within Company facilities or within 30 m (100 ft) of Company buried facilities, Company Field Operation Work Authorization must be obtained. Authorization is obtained through the general work permit process and stake-out report.
- 3.1.8 Before excavation work begins, all required regulatory permits and approvals (e.g., excavation permits and notifications) must be obtained.

4 FACILITY IDENTIFICATION REQUIREMENTS**4.1 Locate Marks**

- 4.1.1 If a ground disturbance (excavation) site cannot be clearly and adequately identified on the One Call notification ticket, the Excavation Supervisor must designate the route or area, or both, to be excavated using white paint, stakes or flags before notifying the One-Call Centre.
- Clarification:** White-lining or pre-marking allows the excavators to accurately communicate to underground facility owners and operators (or their locating personnel) the limits of the excavation.
- 4.1.2 A One-Call notification must be completed within the required federal and provincial or state timeframe for all excavations.
- 4.1.3 In locations where a One-Call system does not exist, all underground facility owners must be contacted directly to accurately locate and mark all buried facilities.
- Note:** Some underground facility owners are not required to participate in the One Call system.
- 4.1.4 The Excavation Supervisor must confirm that owners of all buried facilities within the work area have accurately located and marked on the surface of the ground the horizontal position and alignment of their buried facilities.
- 4.1.5 Locate marks must be clearly distinguishable and be at adequate intervals to accurately represent the location of all buried facilities.
- 4.1.6 A Stake-out Report must be obtained from the owners of all the buried facilities within the work area.

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- 4.1.7 The Excavation Supervisor must confer with the persons conducting the locate activities to validate the results and identify any challenges or concerns that could cause difficulties with the locate activities. This may include, but is not limited to, the buried facility not identified on drawings, interference, ghost signals or site characteristics.
- 4.1.8 The Excavation Supervisor must ensure that an electronic locate sweep of the entire search area is completed using an electronic pipe and cable locator (locate and mark) to verify the site layout and validate the location of all known buried facilities.
- 4.1.9 The electronic locate sweep must be performed according to industry-accepted locating standards.
- 4.1.10 The most effective locating methods must be used, based on such things as site conditions and configuration, for locating and marking known buried facilities to identify accurately the horizontal position and alignment.
- 4.1.11 Sweeps performed to identify unknown buried facilities must involve both indirect and passive methods (see Figure 4-1).

Table 4-1: Locating Methods to Identify Buried Facilities

Method	Locate and Mark	Sweep
Direct and conductive	✓	
Indirect and inductive	✓	✓
Passive (cathodic protection, radio and power)	✓	✓

- 4.1.12 The excavation supervisor must confirm that aboveground locate marks are consistent with the location of all underground facilities shown on applicable drawings. Locates and the number of lines identified must align with the number of lines identified on line lists.
- 4.1.13 Any differences between the drawings, the actual facilities and the markings on site must be investigated. The investigation must entail soft excavation practices to physically validate the actual location and orientation of buried facilities before conducting mechanical excavation (see Subsection 4.3).
- 4.1.14 A Stake-out Report must be completed. This report must:
- include a sketch or drawing mark-up showing all located facilities and the electronic locate sweep limits
 - identify the drawings or information used to complete the location of underground facilities
- 4.1.15 The Excavation Supervisor must ensure the Stake-out Report remains valid for the timeframe of the excavation. Markings must be preserved and replaced upon disturbance.

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4.2 Maintaining Locate Marks

- 4.2.1 When a mark is no longer visible (i.e., if the locate marks are indistinguishable, disturbed or destroyed and no longer represent an accurate indication of the position and alignment of buried facilities) but work needs to continue around the facility, the excavation must be stopped and re-marking must be requested through the One-Call system (i.e., obtain a new locate).

Clarification: During long complex projects, the marks for underground facilities may need to be in place longer than the common durability of the locating method. Paint, staking and other marking techniques last only as long as the weather and other variables allow. Typically, marks are valid for 14 days, if a project has not yet started, and up to 30 days, during construction, if marks are maintained and the buried facility owner agrees to the extension.

- 4.2.2 Extension and/or refresh of locates must be documented, dated and signed by the party granting permission.

4.3 Soft Excavation Before Mechanical Excavation

- 4.3.1 Soft excavation must be conducted before mechanical excavation can proceed.
- 4.3.2 The facility must be soft excavated at sufficient intervals to confirm the pipeline or buried facility location and alignment, which must be exposed adequately to enable identification (e.g., NPS, coating type). Sufficient intervals are a minimum of two locations for straight pipe, in addition to bends and fittings. Fittings must be daylighted sufficiently to confirm the nature and orientation of the fitting (i.e., elbow versus tee)
- 4.3.3 All existing buried facilities that are within 5 m (15 ft) of the edge of the proposed excavation must also be located and soft excavated at sufficient intervals to confirm the facility location, alignment and identity (see Figure 4-1).
- 4.3.4 Intervals must be determined based on facility pipe diameter, factoring in the potential for smaller NPS pipes and cables to meander and fluctuate in depth.
- 4.3.5 If soft excavation is not possible or practicable, a site-specific procedure must be developed, subject to consent from the responsible Company's Authorized Representative.

Clarification: Soft excavation might not be possible in areas where the pipeline is under water or very deep, as with a horizontal directional drill.

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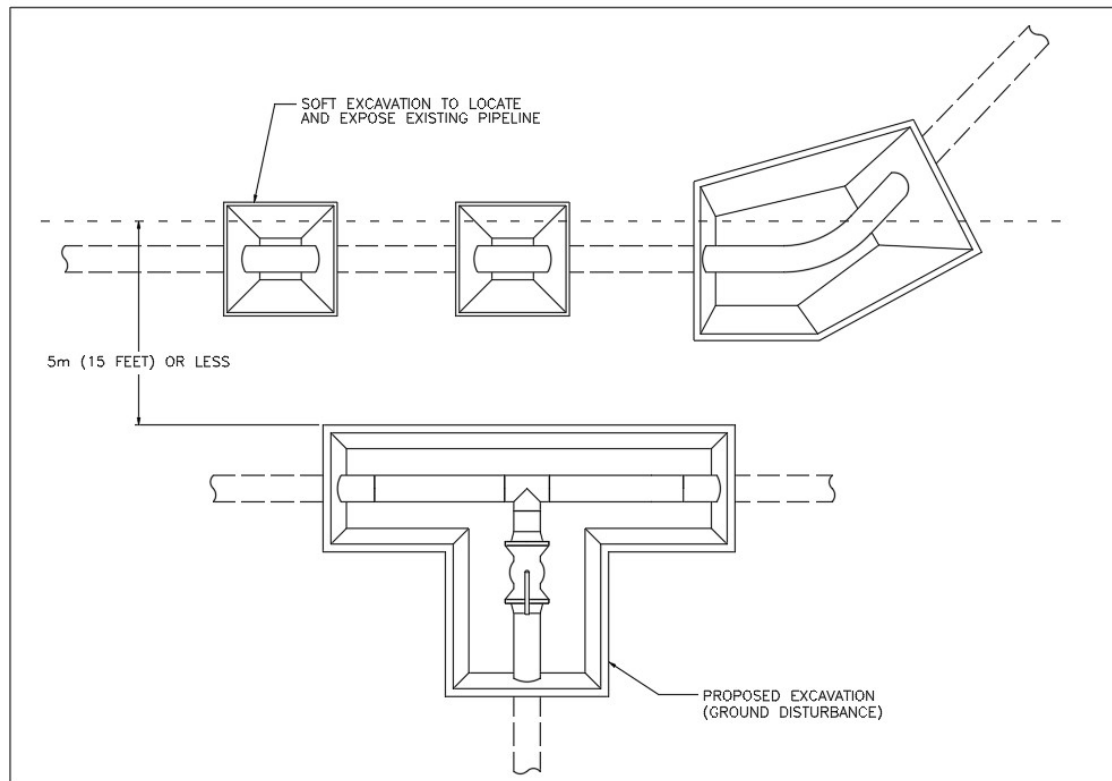


Figure 4-1: Locate and Expose Existing Buried Pipeline or Facility using Soft Excavation Techniques

4.4 Slit Trenching

4.4.1 If the excavation is within any fenced facilities, the following requirements must be met:

- A slit trench must be soft-excavated around the entire perimeter just outside of the proposed excavation area, including the side slopes and ramps.
- If the actual excavation extends outside of the original slit trench, an additional slit trench must be soft-excavated around the perimeter.
- Existing (known) facilities and discovered (unknown) facilities exposed by the slit trenches that are located within the perimeter of the proposed excavation area must be soft-excavated along their springline.
- Consideration should be given to the possibility of pile supports, saddles and other encumbrances that might not be exposed by means of soft excavation to springline.

Note: It is important to position the slit trench properly, so it is close enough to the excavation to identify any underground facilities entering and exiting the immediate area.

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Clarification: Owned or operated facilities may include, but are not limited to, compressor stations, meter stations, pump station, tank terminals, power stations, valve sites or any similar facilities.

- 4.4.2 The slit trenches within fenced facility areas must, at a minimum, be 300 mm (12 in.) below the final depth of the planned excavation (see Figure 4-2).
- 4.4.3 When the slit trench has potential to impede the mechanical excavation, the slit trench may be backfilled providing all identified underground facilities are documented in the Stake-out Report, the construction drawing and excavation checklist.
- 4.4.4 If a slit trench is backfilled for an extended period of time before excavation, the perimeter of the slit trench footprint will be surveyed for future reference of the slit trench extent.
- 4.4.5 Projects might require a slit trench be performed to facilitate pre-engineering validation. To avoid additional slit trenching at the time of excavation, it may be allowable (dependent on timeframe) to have the slit trench perimeter validated through surveyed control points. Consent for such a practice must be managed through the *Controlled Document Library Variance Procedure (CDN-US-MEX)* (Item ID [007728702](#)) and must include consultation with the Region.
- 4.4.6 Other hazards that may be introduced by slit trenching must be determined and managed.

Clarification: Although slit trenching greatly reduces the possibility of striking unknown buried underground facilities, it has the potential to introduce other hazards that might affect the excavation, access or trench stability.

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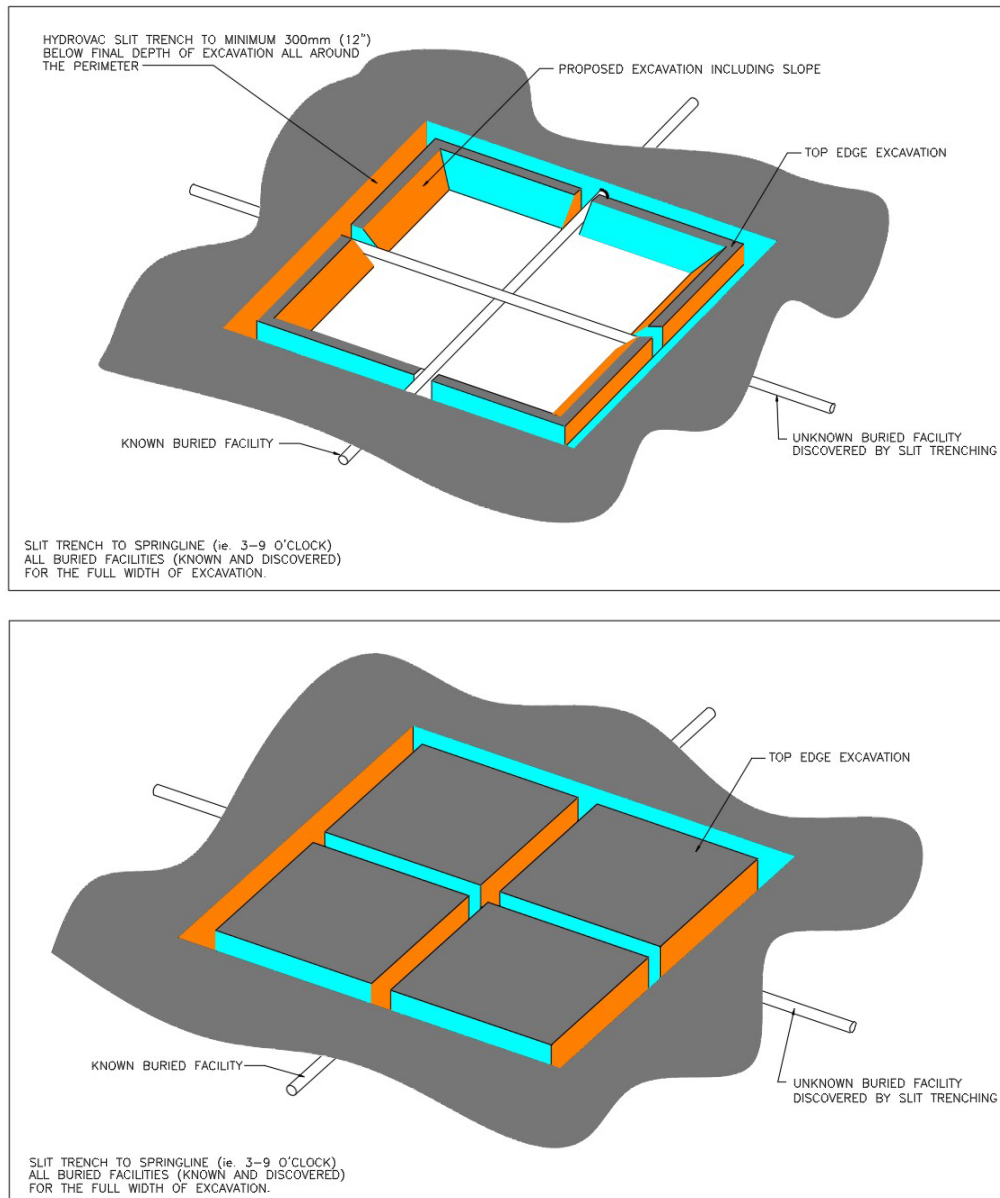


Figure 4-2: Slit Trenching Requirements within all Company Facility Areas

5 PRE-EXCAVATION REQUIREMENTS

5.1 Excavation Checklist

- 5.1.1 The Contractor must develop an excavation checklist in accordance with the criteria provided in Appendix B.

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- 5.1.2 Before excavation work begins, the Excavation Supervisor must complete and sign the excavation checklist to ensure all excavation steps, hazards and controls have been addressed and all personnel involved in the excavation are familiar with the hazards and the risk control measures.

Note: U.S. Gas Operations and the accountable project management team will jointly determine the requirement for on-site regional representation or qualified designate for excavation operations as part of the general work permit process.

- 5.1.3 Before beginning an excavation, a copy of the excavation checklist must be provided to the Company's Authorized Representative.

5.2 Communication and Review

- 5.2.1 Before beginning the excavation work, the Excavation Supervisor must document, communicate and review with on-site personnel their defined roles, responsibilities and all identified excavation hazard-control measures.

- 5.2.2 All individuals performing any tasks related to excavation must review and confirm their understanding of all relevant information pertaining to the excavation, including, but not limited to, the following:

- work scope
- SSSP
- emergency response plan
- crossing agreements
- permits
- drawings
- checklists
- procedures
- pre-job meeting and documentation
- stake-out or locate reports
- locate marks
- hazards and observations at the work site

- 5.2.3 All personnel involved in the excavation must review the location of all facilities and conduct a walk around the site before excavating to identify any additional hazards.

- 5.2.4 The Excavation Plan (see Appendix C) must be reviewed with:

- the Company's Authorized Representative
- a third-party facility owner's representative

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- 5.2.5 During planning, backfilling and reclamation, the Excavation Supervisor must enforce the applicable environmental protection plan as documented in the excavation planning checklist (refer to Appendix A).

5.3 Safe Excavation Pressure Assessment

- 5.3.1 Before the planned excavation of Company pressurized facilities, the Company's Authorized Representative must ensure that the Project Management Team has engaged with Company Integrity Support to provide a safe excavation pressure assessment as follows:
- Canada Only: Consult Integrity Support to perform a safe excavation pressure assessment for:
 - all mechanical excavation of pressurized piping
 - soft excavation below springline of pressurized pipe
 - US/MEX Only: Consult Integrity Support to perform a safe excavation pressure assessment for any excavations of pipeline with known or suspected integrity concerns (e.g., integrity digs, leaks, corrosion features, dents, gouges, coupled connections)

6 EXCAVATION REQUIREMENTS**6.1 General**

- 6.1.1 If the Excavation Supervisor has to leave the immediate location of the excavation, the excavation work must stop until the Excavation Supervisor returns or until an alternate Excavation Supervisor has been appointed.
- 6.1.2 The type and size of the mechanical excavation equipment used for the activities must be suited for the working conditions (i.e., work site, hazards) and the work being conducted.
- 6.1.3 The maximum unsupported length of pressurized pipe that can be exposed for the excavation must be defined by the Company.
- 6.1.4 If excavating on a pipeline system with pressurized couplings, extreme caution must be used. Refer to *Mechanical Pipeline Repair Tapping and Joining Procedure* (Item ID [1014961887](#)) for repairing, tapping or joining steel or plastic pipelines using mechanical devices in natural gas service, and repair methods for specific situations.

Clarification: Seal-only couplings (e.g., Dresser Style 39) are primarily designed for pressure containment and have minimal pull-out resistance.

6.2 Equipment Operator and Signaler

- 6.2.1 Whenever mechanical excavation is taking place, including backfilling, a Signaler must be assigned to provide accurate direction and assistance to the Equipment Operator to protect site safety and the underground facility.
- 6.2.2 Reliable communication must be established and maintained between the Equipment Operator and the Signaler.

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- 6.2.3 Where normal communication is difficult, additional precautions must be considered, such as two-way radios, intercom and a horn.
- 6.2.4 Hand signals must be established and verified as recognizable between the Equipment Operator and the Signaler. These verified hand signals must be used during the excavation.
- Clarification:** It is preferable to use industry standard hand signals, such as published by construction safety associations.
- 6.2.5 Emergency stop signals must be established and communicated to everyone on site.
- 6.2.6 All excavation activities must stop immediately when an emergency stop signal is issued by any person on site.
- 6.2.7 All excavation activities must stop immediately when any of the following occurs:
- the Equipment Operator is unable to see the Signaler
 - the Signaler leaves the excavation
 - a worker, including the Signaler, is in the immediate Danger Zone (see definition in Section 1)
 - if additional clarification is required, or directions are unclear
- 6.2.8 The Signaler must be available as required for guidance in congested locations, particularly during backing manoeuvres or when visibility is obstructed.

6.3 Protection Systems

- 6.3.1 Trenches and excavations must be assessed for confined space hazards. If there is a potential lack of sufficient oxygen resulting from the displacement of oxygen (O₂), or the presence of hazardous substances such as hydrogen sulfide (H₂S) and carbon monoxide (CO), the trench or excavation must be deemed a confined space.
- 6.3.2 The level of hazard must be identified, and proper controls put in place.
- 6.3.3 Applicable confined space entry procedures must be implemented as required.
- 6.3.4 Safe, effective and regulatory-compliant means must be provided to protect personnel entering an excavation from cave-ins and sliding or falling materials.
- 6.3.5 An acceptable excavation stability protection system must be installed whenever personnel are intended to enter an excavation that is 1.2 m (4 ft) in depth or more, or when inspections of excavations that are less than 1.2 m (4 ft) in depth show signs of a potential cave-in.
- 6.3.6 The protection system must be implemented according to applicable regulatory requirements that govern the activity, such as cutting back or sloping the walls, or the use of engineered support systems (e.g., shielding and shoring).

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- 6.3.7 If sloping is selected as the protection system, site soil conditions must be properly analyzed and assessed by the Excavation Supervisor or a Competent Person to determine the soil type, as defined by applicable regulations, to determine the required slope angle.

Note: During long duration excavations, soil conditions can change due to weather, water table, seasonal changes, vibrations or blasting. The Contractor has accountability to consider the longevity of the excavation when determining appropriate sloping requirements.

- 6.3.8 Soil assessments pertaining to ditch sloping and integrity must be completed and documented on the excavation inspection form (see Appendix D). Soil assessments must be completed periodically over long-duration excavations and after other hazard-increasing events such as rain.

- 6.3.9 If sloping is selected as the protection system, and the soil has not been analyzed and classified by a Competent Person, or if a soil type cannot be clearly established, the soil type having the most conservative slope angle (highest degree of safety) must be used.

- 6.3.10 If the potential to fall a vertical distance of 1.8 m (6 ft) or more exists at an excavation, or when an excavation is obscured, or has a narrow opening, controls must be implemented such as fences, guardrail systems, barricades, or other fall control measures.

- 6.3.11 A minimum distance of at least 1.2 m (4 ft) from the edge of the excavation to the spoil pile must be maintained. More distance may be required for certain soil conditions.

Note: Distance that exceeds regulatory requirements provides for visual inspection of the ditch bank surface for indications of sloping failure and reduces potential for spoil material to enter the ditch.

- 6.3.12 Construction materials (e.g., skids, water pumps, portable generators) must not be stored within 600 mm (2 ft) of the excavation edge.

- 6.3.13 The slope of the spoil pile must not exceed 45° from the horizontal. Access to critical pipeline operations (e.g., emergency isolation valves) must not be blocked by spoil pile placement.

- 6.3.14 The stability of structures adjacent to the excavation must be maintained. Any systems used to protect the stability of structures must be designed by a Professional Engineer.

- 6.3.15 For surface water or water in the ditch that has the potential to affect excavation safety, a water management plan must be implemented to control the water.

- 6.3.16 Vehicles or machinery must not be parked or driven within 3 m (10 ft) of the excavation edge unless the banks are frequently inspected by a Competent Person and confirmed to be stable.

6.4 Access and Egress into an Excavation

- 6.4.1 No person may enter an excavation who does not meet the applicable regulations for the jurisdiction in which the excavation is located.

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- 6.4.2 An excavation inspection process and forms must be developed to document safety conditions related to excavations (see Appendix D).
- 6.4.3 An excavation inspection must be performed and documented in the Contractor's excavation inspection form:
- before beginning work
 - periodically throughout the day
 - after work breaks
 - after a rainstorm or any other hazard-increasing occurrence (e.g., pile driving, heavy equipment travel, blasting)
- 6.4.4 The excavation inspection must focus on the adjacent areas for evidence of potential cave-ins, indications of protective system failures, hazardous atmospheres or other hazardous conditions.
- Note:** On steep slopes or severe grade cuts, the inspection area includes upslope of the excavation for indications of loose materials that can dislodge and enter the work area.
- 6.4.5 Copies of completed excavation inspection forms must be maintained on site.
- 6.4.6 If an inspection identifies any hazardous or potentially hazardous conditions, personnel must be removed from the excavation and prohibited from entry until necessary precautions have been taken to ensure personnel safety.
- 6.4.7 In all excavations that workers will enter, safe and effective means must be provided for excavation access and egress using cut-ins and temporary stairs or ladders as follows:
- A point of access and egress must be provided every 15 m (50 ft).
 - The maximum lateral distance an individual has to travel to an egress point must be equal to or less than 7.5 m (25 ft) unobstructed unless there is a more stringent jurisdictional requirement (e.g., Manitoba, Canada).
 - Access or egress must be provided on both sides of an obstruction, such as a pipeline.
 - If ladders are used for access and egress, each ladder must:
 - be secure to prevent movement
 - extend a minimum 0.9 m (3 ft) (vertical distance) above the level of the upper landing to which it provides access
- 6.5 Engineered Trench Stability Control**
- 6.5.1 Engineering alternatives for ensuring protection from a cave-in (e.g., manufactured shoring, trench boxes, sloping and benching) may be considered. However, geotextile must **not** be used as an excavation stability protection system.

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- 6.5.2 Engineering alternatives for cave-in protection must meet regulatory requirements and:
- be installed and inspected according to the manufacturers' instructions, where applicable. Instructions (Tabulated Data) must be available on site.
 - be approved or designed for the specific application by a professional engineer registered in the jurisdiction where the excavation is occurring
- 6.5.3 All parties engaged in the work or inspection of the work involving excavation stability protection systems (e.g., shoring or trench box systems) must have a clear understanding of the application and limitations of the specific system being installed.
- 6.6 Buried Facility Encroachment**
- 6.6.1 All excavations must be completed according to the requirements in Table 6-1: Buried Facility Encroachment Requirements.

Table 6-1: Buried Facility Encroachment Requirements

Excavation Type	Requirements
Mechanical Excavation greater than 15 m (50 ft) from any buried facility	<ul style="list-style-type: none"> • Excavation Supervisor must plan the excavation. • Excavation Supervisor or competent designee must provide on-site supervision. • A minimum of the following three individuals must be on site: <ul style="list-style-type: none"> ▪ Excavation Supervisor or designee ▪ Equipment Operator ▪ Signaler
Mechanical excavation less than 15 m (50 ft) up to 600 mm (2 ft) away from Company's buried facility	<ul style="list-style-type: none"> • Excavation Supervisor must provide direct supervision. • A minimum of the following three individuals must be on site: <ul style="list-style-type: none"> ▪ Excavation Supervisor ▪ Equipment Operator ▪ Signaler
Working from the side (perpendicular) with an underground facility	Side digging should be avoided if possible (see Clauses 6.10.5 and 6.10.6).
Mechanical excavation less than 600 mm (2 ft) of a buried facility	Permitted only under variance and integrity assessment or derate.

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Excavation Type	Requirements
Pipe Replacement: Pipe is depressurized and mechanically isolated (cold cut/hot cut) and pipe is designated for disposal	<ul style="list-style-type: none"> A 150 mm (6 in.) buffer must be maintained during mechanical excavation. Pipe must be marked "For Disposal" as removed. Exemption must begin no closer than 5m (15 ft.) from cut points. The exemption plan must be documented in the site hazard analysis.
Crossing Third Party	<ul style="list-style-type: none"> A minimum 1.5 m (5 ft) clearance must be maintained from a foreign or third-party facility. All terms and conditions of a crossing agreement or letter must be followed. The excavation plan must be reviewed and approved by the owner of the underground facility. All directions and instructions of the Owner's Representative must be followed. If any conflict exists amongst crossing agreements, this Specification or the Contractor's Excavation Procedure, the most stringent controls must be met. Any deviation from this Specification's requirements must follow the <i>Controlled Document Library Variance Procedure (CDN-US-MEX)</i> (Item ID 007728702) A minimum of the following three individuals must be on site: <ul style="list-style-type: none"> Excavation Supervisor Equipment Operator Signaler

6.6.2 If there is contact with any facility (e.g., mechanical and/or rocks) the following must occur:

- The excavation must stop immediately.
- Equipment must be immediately shut down and left in place unless this causes risk of further damage or injury.
- The Contractor must notify the Company's Authorized Representative before investigating the incident.
- The Company's Authorized Representative must ensure that the incident is entered into Company's Incident Management Database within 24 hours of occurrence.
- The Project Management Team must determine whether to perform its own investigation.
- The Contractor must obtain consent from the Company's Authorized Representative before resuming the excavation work.

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- 6.6.3 A Signaler must be used when working near overhead power lines, including unloading or moving equipment. The signaller must not perform simultaneous activities, such as monitoring pipe during excavation while monitoring proximity to a powerline.
- 6.6.4 Before conducting work around power lines, *TES-PROJ-OHP-GL Overhead Powerline Specification (CDN-US-MEX)* (Item ID [006179816](#)) must be reviewed.
- 6.6.5 Where there is a potential for heavy equipment and workers to interface, adequate controls must be implemented, including such controls as Signalers, reflective markings on workers and restricted area markings.
- 6.6.6 When mechanical excavation begins at a hand-excavated location, the Signaler and Equipment Operator must maintain a clear line of sight with the buried facility and each other.
- 6.6.7 In situations where the buried facility will likely become obscured by the soil overburden, physical markers must be used to mark the edge of the underground facility on the side being excavated. Physical markers may be a shovel, probe or 102 mm x 102 mm (4 in x 4 in) wooden skid.
- 6.6.8 Mechanical excavation activities must stop if the underground facility is not visible, or if the physical markers do not represent an accurate line of sight. Material should be moved off the pipe by hand excavation until the pipe is again visible to the Equipment Operator and mechanical excavation can recommence.
- 6.6.9 Mechanical excavation must not occur directly over the buried facility. Material should be moved off the top with the back of the bucket when safe to do so, ensuring appropriate clearance (min. 600 mm or 2 ft) between mechanical equipment and the buried facility.
- 6.7 Site Protection**
- 6.7.1 Temporary fencing must be installed around the perimeter of any excavation that is left unattended by the Contractor, is accessible by the public, and poses a potential hazard.
- 6.7.2 The temporary fencing must be at least 1.1 m (42 in.) high and highly visible.
- 6.7.3 If the excavation is within a secured fenced area, such as a compressor station or meter station, warning tape may be used in place of the temporary fencing.
- 6.7.4 The temporary fencing must be a minimum of 0.9 m (3 ft) from the excavation edge, up to an excavation depth of 1.2 m (4 ft).
- 6.7.5 If the excavation is deeper than 1.2 m (4 ft), the fence must be 1.8 m (6 ft) from the excavation edge.
- 6.7.6 Open excavation warning barriers and hazard lighting must be installed around the perimeter of any excavation near roads, trails and known off-road recreation areas that are accessible by the public and left unattended.

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- 6.7.7 The Excavation Supervisor must consider placing fencing around spoil piles and padding material in populated areas (especially if there are children around that could play in the material) to protect the public (children) and to prevent injury or death.
- 6.7.8 If it is necessary to conduct traffic control, the flag persons who perform the signalling must wear appropriate warning garments that conform to current applicable regulations.
- 6.8 Integrity of Pipeline or Underground Facility**
- 6.8.1 The Company's Authorized Representative must be notified if the integrity of the pipeline or underground facility is in question, including geotechnical instability, evidence of third-party damage, dents or corrosion. (Refer also to Clause 9.1.3.)
- 6.8.2 A detailed site-specific work procedure must be developed for any excavation where an underground pipeline facility is suspected to be leaking, the pipeline integrity is in question or a leak is present. This detailed site-specific work procedure must be consented to by the Company.
- 6.8.3 If an inspection indicates a hazard (e.g., unsafe spoil pile placement, unsafe or inadequate protective systems, water ingress or unsafe access or egress):
- Clause 6.4.6 must be complied with
 - Work may begin only after the hazard is adequately controlled
- 6.9 Work Surface**
- 6.9.1 The work surface must be stable to prevent equipment and mats from sliding and tipping.
- 6.9.2 External factors, such as wind, rain, snow, ice and mud must be considered when evaluating the work surface.
- 6.10 Mechanical Equipment**
- 6.10.1 Mechanical equipment must be positioned and operated in a manner that will not endanger any person involved in the excavation work. Avoid excavation with tracks in perpendicular alignment with the boom of the equipment.
- 6.10.2 Mechanical equipment must be operated off to the side of the pipe; preferably, on the side away from any other facilities, such as valves or stubs.
- 6.10.3 The mechanical equipment must be positioned so that the equipment and the line of digging are parallel with the pipeline or utilities but offset to maintain the distance required in Table 6-1. Refer also to Figure 6-1.
- 6.10.4 Depending on the NPS of the pipe being excavated, a track may be positioned over the pipe.
- 6.10.5 Digging towards (side digging) an underground facility must be minimized or eliminated to ensure safe excavation practices. In circumstances where digging towards an underground facility cannot be avoided, additional controls must be put into place.

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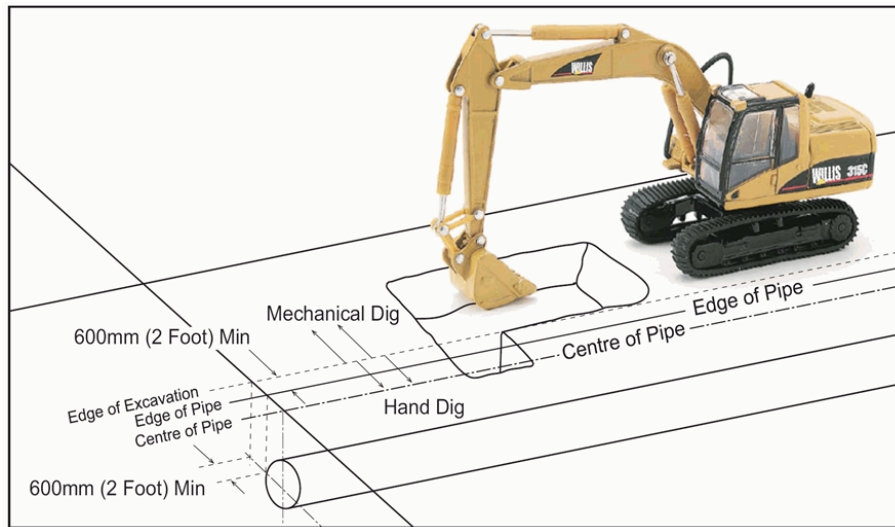


Figure 6-1: Proper Position of Equipment for Excavation

- 6.10.6 The Excavation Operator must excavate in thin layers in areas near pipelines, buried facilities and other structures.
- 6.10.7 The excavation equipment must be operated at a reduced speed when working close to the buried facilities, to ensure controlled and safe excavation.
- 6.10.8 The bucket must be curled up when swung overtop of a buried facility or pipe.
- 6.10.9 The bucket must never be swung overtop of a buried facility or pipe with the teeth pointing downward.
- 6.10.10 If cultural materials or unidentified facilities are exposed:
- all excavation work must stop immediately
 - the Company's Authorized Representative must be notified immediately
- 6.10.11 When repositioning equipment, or during excavation activity, necessary controls (i.e., temporary fencing, high visibility flagging or an additional signaller) must be implemented to ensure there is no possibility of contacting aboveground facilities.
- 6.10.12 No person may be inside or close to an unsafe excavation, including the Signaler.
- 6.10.13 During the excavation work, techniques must be used to accurately establish the physical location and/or maintain a visual line of sight to the underground facility. The physical location can be established via hand probes, hand excavation potholes, physical barriers or constant hand removal of overburden from the top and sides of the facility (12, 9, 3 o'clock positions on the pipe).

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- 6.10.14 Excavated material (spoil) must not be placed over known underground facilities, unless the location has been assessed per applicable Crossings and Encroachment Procedure and/or consent has been received from Integrity Support. Appropriate controls must be put in place to prevent damage to the facility from the weight of, or removal of, the material.

Clarification: Appropriate controls could include markers (e.g., tarps, geotextile or plywood) installed first on the undisturbed ground surface over the facilities. If controls are not established, the facility will be daylighted to verify the depth before spoil removal.

6.11 Special Attachments

- 6.11.1 Before using special attachments, a safety plan must be developed by the Excavation Supervisor and consented to by the Company's Authorized Representative.
- 6.11.2 Work with special attachments must be closely supervised by the Excavation Supervisor and the Company's Authorized Representative at all times.
- 6.11.3 All relevant personnel must:
- be competent in using the special attachments
 - understand all risks inherent to working with the special attachments
- 6.11.4 The Equipment Operator must have experience and competency specifically required for special attachment activities, due to the unique characteristics of the control movements and actions of the tool.

Note: These attachments on excavation equipment carry the additional risk of injury to workers and damage to buried facilities.

- 6.11.5 Use of tooth guards may be designated by the Company Authorized Representative and assessed on a site-specific basis.

Clarification: Tooth guards can reduce damage during inadvertent contact. However, they can introduce additional hazards in inappropriate soil conditions (frost and bedrock can cause the bucket to shift sideways).

- 6.11.6 The Equipment Operators must maintain a minimum 600 mm (2 ft) separation between any part of the excavation equipment and the buried facility at all times.

Note: For pipe separation limits at open cut and trenchless crossing locations, refer to TES-CT-GEN-GL *Pipeline Construction Specification (CAN)* (Item ID [003745282](#)) and TES-CT-GEN-G *Pipeline Construction Specification (US-MEX)* (Item ID [1013154643](#)).

6.12 Spoon (Special Attachment) Additional Requirements

- 6.12.1 The spoon must be kept horizontal under the buried facility. At all times, the angle between the spoon and the stick must be greater than 90° to ensure the spoon maintains a minimum 600 mm (2 ft) separation (see Figure 6-2).

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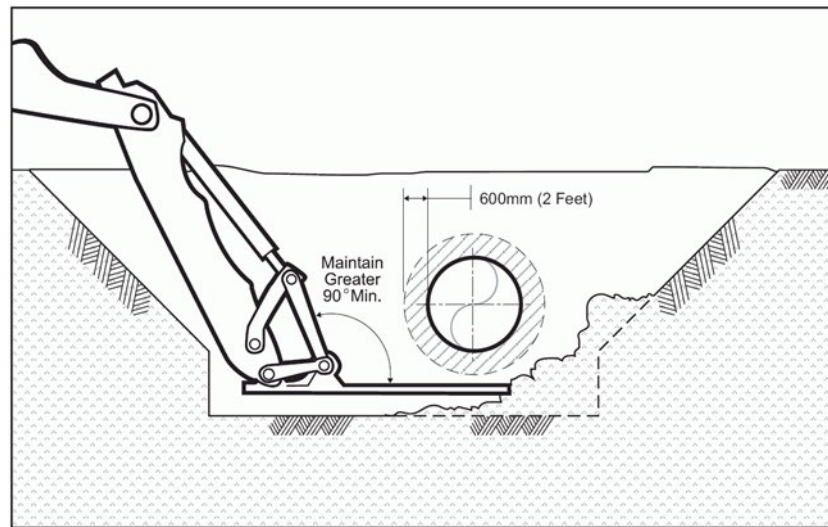
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**Figure 6-2: Spoon Position**

- 6.12.2 The spoon must not be articulated while under the pipe.
- 6.12.3 The spoon must not be used to scoop dirt.
- 6.12.4 The slope of the bank must be increased (as required) to maintain the specified clearance and to ensure the spoon is properly positioned.

7 PLACEMENT REQUIREMENTS FOR DRIVEN OR SCREW PILES**7.1 General**

- 7.1.1 A Spotter, under the supervision of the Excavation Supervisor, must be present at all times during the installation of driven piles or screw piles.
- 7.1.2 Driven piles or screw piles must not be suspended above an exposed pipeline or aboveground pressurized facilities.
- 7.1.3 Driven piles or screw piles must be adequately restrained using taglines to prevent uncontrolled movement while the piles are being hoisted, placed, removed or withdrawn.
- 7.1.4 Before piling, a site visit must be performed by the Excavation Supervisor to verify the exact location of piles and to confirm all piles are correctly located.
- 7.1.5 In locations where piling pins have the potential to be obscured, offsets must be installed and documented.
- 7.1.6 All underground facilities within 30 m (100 ft) of the driven or screw piling operation must be verified and marked. Refer to Subsection 4.1.

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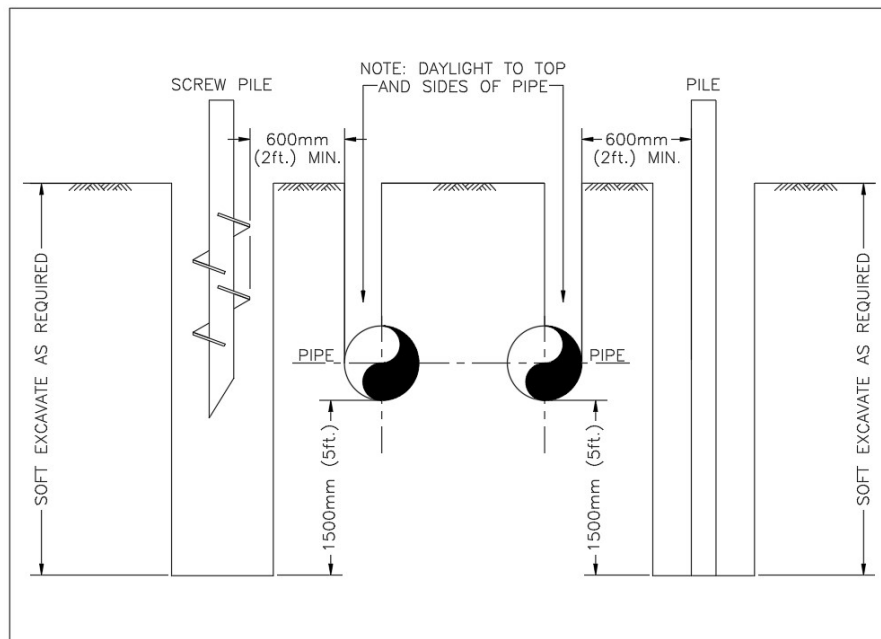
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- 7.1.7 All underground facilities within 5 m (15 ft) of piling locations must be exposed (at sufficient intervals to confirm location and alignment of underground facilities) using the Company's approved methods (soft excavation).
- 7.1.8 For installation of pilings, augering or geotechnical bores, pilot holes are an acceptable alternative to slit trenching requirements.
- 7.1.9 The hand or soft excavation pilot hole must be a minimum of 100 mm (4 in) greater in diameter (50 mm [2 in] on the radius) than the driven piles or the helix for screw piles.
- 7.1.10 The pilot hole width must be wide enough that the piling or drill helix does not contact the sidewall of the pilot hole during the entire installation.
- 7.1.11 The hand or soft excavation pilot hole must have a depth 1 m (3 ft) greater than the expected depth of any buried facility within the Search Area, to eliminate any possibility of encountering an underground facility.
- 7.1.12 Driven piles installed within a horizontal distance of 1.5 m (5 ft) of a buried pressurized or unpressurized gas or oil steel pipe must be pilot holed to a depth that will launch the piling at a distance of 1.5 m (5 ft) below the bottom of the pipe. See Figure 7-1.

**Figure 7-1: Pilot Hole Requirements for Piles**

- 7.1.13 If the pile is not within a horizontal distance of 1.5 m (5 ft) of a buried pressurized or unpressurized gas or liquid steel pipe, pilot holes may only be filled in before piling.
- 7.1.14 Before hand excavating or hydrovacing a pilot hole, all applicable drawings must be reviewed to confirm expected depth of the facilities.

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Note: Piles driven within 1.5m (5 ft) can induce unacceptable vibrations on the adjacent pipeline.

- 7.1.15 If a driven or screw pile is within a horizontal distance of 1.5 m (5 ft) of a buried pressurized or unpressurized gas or oil steel pipe, void space must be maintained between the piling and the in-situ soil to avoid energy transfer.
- 7.1.16 Driven piles or the helix for screw piles must not be maneuvered or installed within 600 mm (2 ft) from the edge of a buried pressurized or unpressurized gas or oil steel pipe, high voltage cable, fiber optics line or conduit.
- 7.1.17 The pile driver derrick (leads) must not be maneuvered within 600 mm (2 ft) horizontal distance from the edge of a buried pressurized or unpressurized gas or oil steel pipe, high voltage cable or fiber optics line.

8 POST EXCAVATION REQUIREMENTS

8.1 Backfilling Above and Below Steel Pipe

Note: This section applies to all construction and integrity digs for pipe covered under the following standards (latest edition):

- CSA Z662 *Oil and Gas Pipeline Systems*
- ASME B31.8 *Gas Transmission and Distribution Piping Systems*
- ASME B31.4 *Pipeline Transportation Systems for Liquids and Slurries*

- 8.1.1 If the piping or pipeline is not resting on undisturbed in-situ (native) soil:

- backfilling must account for foundation, bedding and the embedment material to the springline of the pipe
- any void space below the springline of the pipe must be eliminated

Clarification: If the soil or ground under the piping or pipeline is to be removed (bell hole for tie-ins or an integrity dig) extra care and compaction is required to reduce the probability of settlement of the piping or pipeline.

- 8.1.2 All backfilling operations for pipe and pipelines, including hand excavated holes, must be conducted according to one of the following:

- the project-specific backfill plan or procedure, and IFC drawings
- the Company's construction specifications
- *TES-CT-COMPC-GL Compaction Control Measures for Pipeline Excavations (CDN-US-MEX)* (Item ID [005974567](#)), which provides compaction requirements from the base of the trench to the springline of the pipe

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Note: As per the requirements of *TES-CT-COMPC-GL Compaction Control Measures for Pipeline Excavations (CDN-US-MEX)* (Item ID [005974567](#)), *TES-CI-EARTH-GLE Facility Earthwork Specification (CAN-US)* (Item ID [000006457](#)) is to be used when backfilling within 30 m (100 ft) of a section of the pipeline where the pipe is structurally supported (e.g., valve site, crossover, launcher/receiver, facility tie-in).

- 8.1.3 All backfilling operations for facilities with high-pressure piping must be conducted according to the following:
- the project-specific backfill plan or procedure, and IFC drawings
 - the Company's construction specifications
 - TES-CI-EARTH-GLE Facility Earthwork Specification (CAN-US)* (Item ID [000006457](#))
- 8.1.4 Flowable fill, if used, must meet the requirements in *TES-CI-FCRET-GLE Flowable Fill Specification* (Item ID [005848209](#)) and *TES-CT-COMPC-GL Compaction Control Measures for Pipeline Excavations (CDN-US-MEX)* (Item ID [005974567](#)).
- 8.1.5 The use of flowable fill must be consented to by the Company pipe stress engineering personnel before using flowable fill on a pipeline project or the pipeline right-of-way. The differential settlement along the pipe must be controlled and limited to minimize bending and radial stresses.
- 8.1.6 The overall stiffness of the foundation and bedding material must be consistent with that of the undisturbed in-situ soil material. The objective of compaction is to limit the bending stress in the pipeline when transitioning from an area of consolidated bedding material to an area that is disturbed.
- 8.1.7 The Company's Authorized Representative must judge the acceptable level of compaction to compare densities of in-situ versus fill material.
- 8.1.8 A foundation layer must be installed when the native trench bottom is greater than 150 mm (6 in.) from the bottom of the pipe as per *TES-CT-COMPC-GL Compaction Control Measures for Pipeline Excavations (CDN-US-MEX)* (Item ID [005974567](#)) (see Figure 8-1).
- 8.1.9 A bedding layer must be placed in the bottom of the trench, or on top of the foundation, to provide a uniform layer of material on which the pipe is supported as per *TES-CT-COMPC-GL Compaction Control Measures for Pipeline Excavations (CDN-US-MEX)* (Item ID [005974567](#)). (See Figure 8-1).

Note: Correct bedding is very important in limiting pipe deflection.

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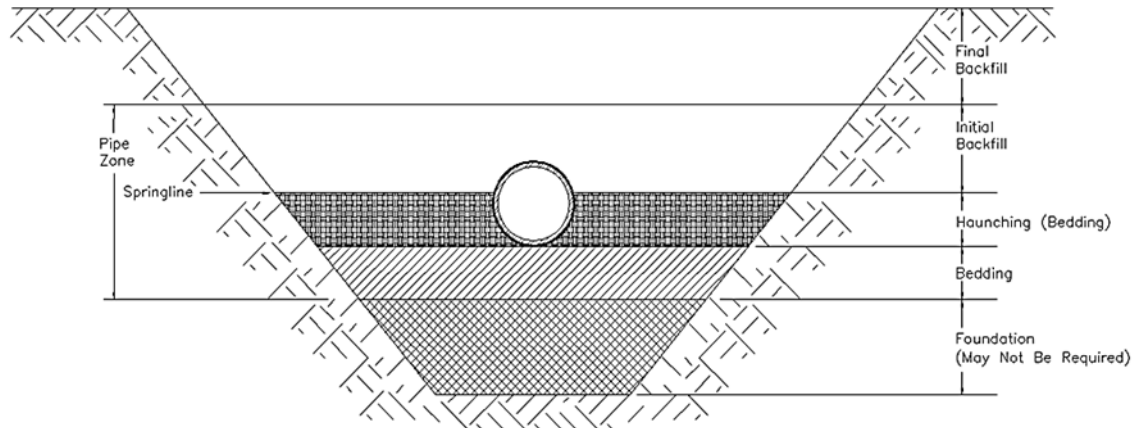


Figure 8-1: Defined Areas of Backfill Below the Springline

- 8.1.10 The initial layer of backfill must be in the embedment area on top of the bedding layer to the springline, to provide a uniform layer of material for laterally supporting the pipe.

Note: The springline is the line of the outermost horizontal points on the side of the pipe and the maximum horizontal dimension (see Figure 8-2).

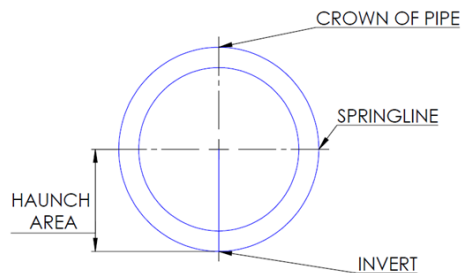


Figure 8-2: Defined the Points of the Pipe

8.2 Minimum Distances for Compaction Equipment to Facilities

- 8.2.1 Minimum distances from facilities and equipment must be maintained, as outlined in the buried facility encroachment requirements. All excavations must be completed according to the requirements in Table 6-1.
- 8.2.2 Walk-behind handheld plate tampers (manual compactor) may be used to compact backfill within 600 mm (2 ft) of a buried steel pipe or pipeline.
- 8.2.3 Walk-behind handheld plate tamper or walk behind jumping jack compactor (manual compactor) within 600 mm (2 ft) of a buried steel pipe or pipeline must not have a total weight that is greater than 100 kg (220 lb).

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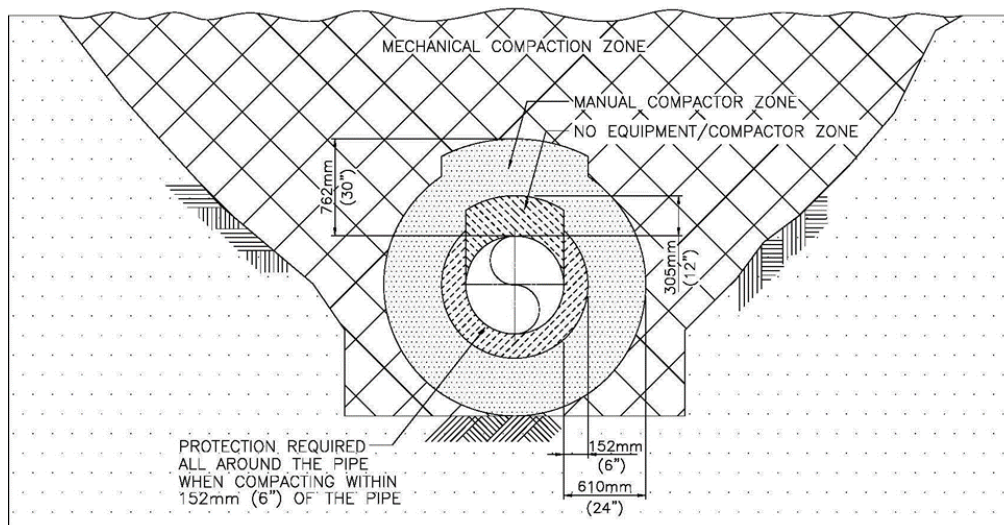
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- 8.2.4 Protection of the buried pipeline must be provided when handheld plate tamping is used during compaction within 600 mm (2 ft.) of the pipe (e.g., belting, plywood, rock shield).
- 8.2.5 The Excavation Supervisor must supervise the walk-behind handheld plate tamping and the mechanical compacting work.
- 8.2.6 All work must immediately stop if any damage to the pipe or coating occurs.
- 8.2.7 Care must be taken when compacting backfill material directly above and around the pipe.
- Note:** Caution is required when compacting around pressurized and unpressurized piping and/or pipeline, which has little capacity to resist denting and ovalizing.
- 8.2.8 The Equipment Operator conducting mechanical compaction must not apply excessive loading to the pipe and/or pipeline that could cause damage to the pipe and/or pipeline, such as denting and ovalizing or damage to the coating.
- 8.2.9 Compaction around the Company's steel pipe must meet the requirements in Table 8-1. Refer also to Figure 8-3.

Table 8-1: Offset Requirements when Compacting around the Company's Steel Pipe

Compaction Type	Springline and Above	Springline and Below
No equipment, no compactor zone	304 mm (12 in.) or less	N/A
Pipe (coating) protection zone	N/A	Pipe protection required when compacting within 152 mm (6 in.) or less
Manual compactor zone (maximum 100 kg/220 lbs)	304 mm (12 in.) or greater	152 mm (6 in.) or greater
Mechanical compactor zone (compactor attached to excavator)	762 mm (30 in.) or greater	610 mm (24 in.) or greater


Figure 8-3: Offset Requirements when Compacting around Pipe

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- 8.2.10 The requirements in Table 8-1 must not be used for plastic, composite or aluminum pipe and/or conduit, or any type of electrical wiring or cabling.
- 8.2.11 The project-specific backfill and compaction plan or procedure must be used when backfilling and compacting around the following:
- plastic, composite, or aluminum pipe and/or conduit as well as any type of electrical wiring or cabling
 - third-party or foreign pipe, pipelines or facilities
- 8.2.12 If any damage to the pipe or coating occurs, the incident must be immediately reported to the responsible Company's Authorized Representative.
- 8.2.13 The Company's Authorized Representative must ensure that the incident is entered into the Company's Incident Management Database within 24 hours of occurrence.
- 8.2.14 Backfill material and compaction (if required) must comply with engineering drawings and construction specifications.
- 8.2.15 The owner of any exposed foreign buried facility must be notified at least 24 hours before backfilling to allow for the inspection of the facility, or as per crossing agreement terms.
- 8.2.16 A written record of the inspection done by the owner of any buried facility that has been excavated and subsequently backfilled must be requested and attained. If the facility owner does not provide backfill inspection, the Company's Authorized Representative will document and photograph the backfill process including bedding, sand padding and final backfill.
- 8.2.17 The written record of the inspection done by the owner of any buried facility excavated and subsequently backfilled must be recorded in a project file for the life of the pipeline and a copy forwarded to the Company's Authorized Representative.

8.3 Document Revisions

- 8.3.1 All applicable documentation as required by this Specification must be forwarded to the Company's Authorized Representative for any required revisions to as-built drawings, alignment sheets and schematics as per excavation activities (see Appendix A).

9 CONDITION REQUIREMENTS**9.1 General**

- 9.1.1 Any damage to the Company's facilities from suspected past excavation activity, current excavation activity or natural causes must be reported immediately to the Company's Authorized Representative.
- 9.1.2 Any damage to third-party facilities from suspected past excavation activity, current excavation activity and natural causes must be reported immediately to the third-party facility owner and the Company's Authorized Representative.

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- 9.1.3 The condition of the coating and pipe on each exposed section of the Company's pipeline or underground facility, including pipelines and pipe in compressor, pump and meter stations, must be documented by the Company's Authorized Representative, as follows:
- for Canada and Mexico: complete and document on *Pipeline Inspection Report* (Item ID [1012490171](#))
 - for the United States: complete according to TEP-IN-PIP-GL *Pipeline Inspection Procedure (US)* (Item ID [1016425061](#))
- 9.1.4 Any evidence of internal or external corrosion or other integrity concerns must be documented and reported to the Company's Authorized Representative.
- 9.1.5 Before backfilling, the Contractor must confer with the Company's Authorized Representative to ensure that the condition of the coating and pipe on each exposed section is verified. Verification must be documented within 24 hours prior to backfilling.

10 VARIANCES

Any deviation from this Specification's requirements must follow the Company *Controlled Document Library Variance Procedure (CDN-US-MEX)* (Item ID [007728702](#)). To initiate a variance request, external parties (e.g., contractors and manufacturers) must contact the Company.

The detailed, documented notification must include the specifics of the section that is in question and the proposed methods to complete the task with an equivalent safety level.

11 ROLES AND RESPONSIBILITIES

Table 11-1 outlines the roles and responsibilities required for the use of this Specification.

Table 11-1: Roles and Responsibilities

Role	Responsibilities
Contractor	<p>The Contractor is responsible for:</p> <ul style="list-style-type: none"> • ensuring that all aspects of this Specification are reflected in the Contractor's excavation procedure and SSSP for the excavating work • ensuring that the sole responsibility for all applicable legal requirements and relevant industry standards has been identified • meeting all applicable legal requirements and relevant industry standards that have been identified in the Contractor's excavation procedure

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Role	Responsibilities
Contractor (Cont'd)	<ul style="list-style-type: none"> ensuring that all personnel performing, monitoring and supervising excavations are competent for the role assigned, are suitably trained, are qualified as per the excavation procedure and that they meet the minimum requirements in this Specification providing the documentation of all training, qualifications and competency verifications for all personnel performing, monitoring and supervising the excavations to the Company to demonstrate competency ensuring that for excavations being conducted in the U.S., the individuals performing any covered tasks are qualified, as required, under the Company's Operator Qualification Program
Excavation Supervisor	<p>The Excavation Supervisor is specifically accountable and responsible for all personnel involved in planning, supervising and conducting excavations. The Excavation Supervisor is responsible for:</p> <ul style="list-style-type: none"> ensuring that the excavation is conducted according to this Specification, and all records and documentation are complete and accurate ensuring all personnel performing, monitoring and involved with the excavation are competent for the role assigned, are suitably trained, are qualified as per the excavation procedure and that they meet the minimum requirements in this Specification providing documentation that the individuals performing any tasks considered as covered tasks are qualified as required under the Company's OQ Program, for excavations being conducted in the U.S. ensuring that all on-site personnel have appropriate personal protective equipment for the work being performed ensuring all relevant information pertaining to the excavation has been reviewed and understood by all individuals performing any tasks related to excavation consulting the Company's Authorized Representative to verify that all parties affected by the proposed excavation have been contacted monitoring the Equipment Operator's ability to manoeuvre the equipment (e.g., speed, positioning and response to hand signals) and the ability of all involved personnel to effectively communicate and adhere to excavation procedures

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Role	Responsibilities
Equipment Operator	<p>The Equipment Operator is responsible for:</p> <ul style="list-style-type: none"> ensuring the work surface is stable to prevent equipment from sliding and tipping ensuring the mechanical equipment is positioned and operated in a manner that will not endanger any person involved in the excavation work establishing and maintaining reliable communications with the Signalers. following all directions provided by the Signaler and immediately stopping work if the Signaler cannot be seen or leaves the excavation area (includes backfilling) immediately stopping excavating work if a stop signal is given by any person on site not returning to work until such time that the “stop work” condition has been evaluated and it is determined safe to do so reviewing and understanding all relevant information pertaining to the excavation
Signaler	<p>The Signaler is responsible and accountable for providing accurate direction and assistance to the Equipment Operator for protection of site safety and the underground facility, as required whenever mechanical excavation is taking place, including backfilling. The Signaler is responsible for:</p> <ul style="list-style-type: none"> ensuring reliable communications are established and maintained with the Equipment Operator being available as required for guidance in congested locations, particularly during backing manoeuvres or when visibility is obstructed reviewing and understanding all relevant information pertaining to the excavation
Company Authorized Representative	<p>The Company’s Authorized Representative is responsible for receiving the documentation of all training, qualifications and competency verifications for all personnel performing, monitoring and supervising the excavations for the Company to demonstrate competency, and filing such documentation in the project records.</p>

12 REFERENCES

This document relies on a number of references to regulation, industry codes and standards, general industry guidance as well as internal references. These documents are listed in Table 12-1, Table 12-2 and Table 12-3. Use the latest document revision, unless otherwise approved by TC Energy.

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Table 12-1: Regulatory References

Organization	Title
There are no specific regulatory references for this Specification.	

Table 12-2: External Industry References

Organization	Title
American Society of Mechanical Engineers	ASME B31.8 <i>Gas Transmission and Distribution Piping Systems</i>
	ASME B31.4 <i>Pipeline Transportation Systems for Liquids and Slurries</i>
Canadian Standards Association	CSA Z662 <i>Oil and Gas Pipeline Systems</i>

Table 12-3: Internal References

Item ID	Title
007728702	<i>Controlled Document Variance Procedure (Cdn-US-Mex)</i>
1012490171	<i>Pipeline Inspection Report Form</i>
004504739	<i>Operator Qualification Program</i>
1016425061	TEP-IN-PIP-GL <i>Pipeline Inspection Procedure (US)</i>
1014961887	<i>Mechanical Pipeline Repair Tapping and Joining Procedure</i>
000006457	TES-CI-EARTH-GLE <i>Facility Earthwork Specification (CAN-US)</i>
005848209	TES-CI-FCRET-GLE <i>Flowable Fill Specification (CAN-US)</i>
005974567	TES-CT-COMPC-GL <i>Compaction Control Measures for Pipeline Excavations (CDN-US-MEX)</i>
1015497914	TES-CT-FCSTD-G <i>Facilities Construction Specification (CAN)</i>
1016741169	TES-CT-FCSTD-G <i>Facilities Construction Specification (US-MEX)</i>
1013154643	TES-CT-GEN-G <i>Pipeline Construction Specification (US-MEX)</i>
003745282	TES-CT-GEN-GL <i>Pipeline Construction Specification (CAN)</i>
005408266	TES-CT-GEN-L <i>Pipeline Construction Specification (US)</i>
009199892	TES-CT-SLOPE-GL <i>Slope Work Specification (CAN-US-MEX)</i>
006179816	TES-PROJ-OHP-GL <i>Overhead Powerline Specification (CAN-US-MEX)</i>

13 DOCUMENTATION AND RECORDKEEPING

The deliverables listed in Table 13-1 are required to implement this specification. Each deliverable must be transmitted to (or stored in) the associated listed repository.

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Table 13-1: Documentation Requirements

Documentation Description	Repository
Documentation of personnel training, qualifications and competency verifications (see Clause 2.1.3)	Applicable Project SharePoint site.
All relevant information pertaining to the excavation, including: <ul style="list-style-type: none"> relevant drawings (see Appendix A) excavation planning checklist (see Appendix B) excavation plan (see Appendix C) excavation inspection form (see Appendix D) 	
Written record of the inspection done by the owner of any buried facility excavated and subsequently backfilled (see Clause 8.2.17)	
Evidence of internal or external corrosion or other integrity concerns (see Clause 9.1.5)	

14**DOCUMENT HISTORY**

Rev.		
04	Description	Effective Date
	Revised document.	2022-Dec-05
	Rationale Statement	Document Contact
	This document was revised to align with the Engineering Standards Collection authorship requirements and to address feedback received.	Jesse Kilgour
	Impact Assessment Summary	Document Owner
	There are no potential impacts to operations, training, competency, safety, regulatory compliance, the environment or lines of business, based on the impact analysis performed before the revision of the document.	Welding and Materials Engineering
03	Description	Effective Date
	Revised document.	2018-May-01
	Rationale Statement	Responsible Engineer
	This document was revised to implement <i>TES-PROJ-EXC Excavation Specification (CDN-US-MEX)</i> into new template.	Michael Martens

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Rev.		
	Impact Assessment Summary	Document Owner
	No impact to time or resources anticipated.	Pipe Integrity, Damage Prevention
02	Description	Effective Date
	Annual review	2015-Apr-30
	Rationale Statement	Document Contact
	Minor changes throughout to clarify. Added compaction information to Backfill section.	Michael Martens
	Impact Assessment Summary	Document Owner
	No impact to time or resources anticipated.	Pipe Integrity, Damage Prevention

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DESCRIPTION OF CHANGE

Section	Description of Change
Regulatory	
N/A	N/A
Industry Standards	
N/A	N/A
General	
Overall format	The content of this Specification was moved into the most recent template and aligned with the Engineering Standards Collection Authorship Requirements. Multiple figures were updated.
Organization	Significant revision occurred to reorganize content and remove duplication to improve clarity and provide a logical flow that reflects the typical order of work execution tasks.
Section 9	Removed content that was outside the scope of this document, i.e., not specific to excavation activities.
Appendices	Appendix B, Appendix C and Appendix D were added to provide minimum requirements for Contractor's excavation plan, excavation checklist and excavation inspection form.



APPROVALS

[illegible]

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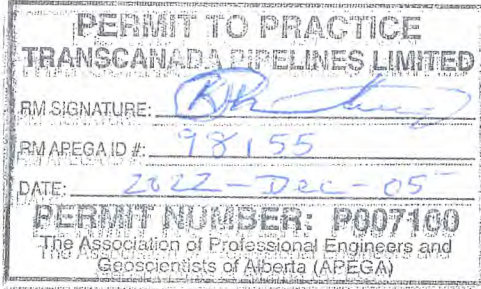
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APPROVALS

Document Contact	Jesse Kilgour Pipeline Integrity Engineering, Damage Prevention
Document Owner Manager	Brett Wakeham Pipe Integrity Engineering
Discipline Checker	Stan Tumoth CGE PI Ops Supports
Responsible Engineer	<p>Michael Martens M.Sc., P. Eng. Engineering Governance</p>  <p><i>Michael Martens</i> APEGA #58015 2022-Dec-05</p> <p>Signature/Date</p>
Corporate Authorization	<p>Robert Phernambucq, P.Eng Engineering Governance</p> 

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APPENDIX A DRAWINGS AND DOCUMENTATION TO REVIEW FOR EXCAVATION PLANNING

During the planning stage, review the following documents to identify potential buried facilities, safety impacts, isolation or any other factors that need to be accounted for:

- schematics*
- alignment sheets*
- as-built drawings*
- survey notes
- plot plans*
- engineering drawings (construction)
- red-lined drawings
- electrical and controls drawings*
- high-pressure piping drawings*
- titles
- excavation checklist
- pipeline base maps
- sales tap maps or drawings*
- low-pressure pipeline plats
- high-pressure pipeline plats
- well list
- township index plats (crown)
- public land standing
- legal plans
- survey plan index
- survey plans (crown)
- completion drawings*
- excavation safety plan
- environmental protection plan

*At the end of the project, as-built any changes, as necessary.

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APPENDIX B EXCAVATION PLANNING CHECKLIST – MINIMUM REQUIREMENTS

The Contractor's excavation planning checklist will document that the following criteria, at a minimum, have been confirmed before excavation.

PLANNING

The Contractor's excavation planning checklist will include confirmation of the following:

- Pre-job hazard assessment
- applicable crossing agreements or approvals, and access have been obtained, and required notifications are completed
- all applicable drawings have been reviewed (e.g., as-builts, alignment sheets, plot plans, fuel gas, electrical)
- a "One-Call" has been completed with evidence of positive response and the excavation area has been white-lined
- all owners of buried facilities that are not One-Call members have been contacted directly
- project notification has been provided to operations and the general work permit has been authorized
- owners of buried facilities have properly located and marked their underground facilities in the search area and provided documented confirmation of completion
- Company underground facilities have been properly marked using the most appropriate methods
- a survey sweep has been completed to identify ALL underground facilities in the search area
- a Stake-out Report and ground disturbance approval (clearly identifying the safe work area) has been obtained by regional operations, as applicable, and discussed with the locator to identify any problems or concerns with the locate
- search area has been visually inspected for signs of additional buried facilities, discrepancies between visual observations and underground facility records, and locate marks have been addressed
- roles and responsibilities have been communicated to applicable workers (Excavation Plan reviewed, hand-signals agreed upon) and workers have participated in a JSA to address excavation hazards
- competency of the Equipment Operator, Signaler, and Excavation Supervisor has been validated
- **(Canada only)** Integrity Support has been consulted to determine Safe Excavation pressure (mandatory for ALL mechanical excavation of pipe and soft excavation below springline)

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- Integrity Support has been consulted for safe dig pressure for known or suspected integrity concerns (e.g., equipment weights over pipeline, leaks, corrosion, unusual or unexpected frozen ground, and unsupported pipe)
- temporary support spacing requirements have been confirmed
- a soil evaluation has been completed by a Competent Person, or the maximum slope of the excavation is 1 ½ to 1 slope (i.e., for a Type C soil)
- **(U.S. only)** the qualification of all workers performing OQ covered tasks been verified
- an Environmental Resource has been consulted to address any potential concerns (e.g., contaminated soil or groundwater, PCB or asbestos containing coating, pipeline liquids)
- the JSA addresses finding known or potential contaminated soils, groundwater, or hazardous materials
- aboveground facilities within 30 m (100 ft) of the excavation have been marked
- an approved plan has been developed to manage disposal of hydrovac slurry
- if ramping is required (e.g., additional cover over pipe, swamp mats), they have been correctly installed
- if overhead power lines are present, Overhead Power line warning signs and goalposts are placed as per TES-PROJ-OHP-GL *Overhead Powerline Specification (CAN-US-MEX)* (Item ID [006179816](#)) and an additional signaller been designated for working near power lines

EXCAVATION PREPARATION

The Contractor's excavation planning checklist will include confirmation of the following:

- the buried facility has been hand excavated (or hydro-vac) sufficiently to confirm location and alignment
- it is understood that at all times during mechanical excavation the top and side of the facility being excavated must be kept visible
- all underground facilities within 5 m (Canada and Mexico) / 15 ft (U.S.) from the edge of the proposed ground disturbance have been located and hand excavated to confirm their horizontal location and alignment
- it is understood that a signaller is required to direct the Operator during all mechanical excavation activity (includes topsoil stripping and backfill) and during equipment operation that may pose a hazard to workers close by
- workers have been informed that they have the authority and obligation to stop work if the activity is deemed to be unsafe, and the universal stop hand signal has been communicated
- a soft excavation (positive identification) and daylighting plan have been developed

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- excavation equipment (type, size, condition) has been deemed suitable for the work site conditions and hazards, and buckets with side cutter are not permitted
- if working inside a fenced facility, a perimeter slit trench (including the excavation slope area) and exposure to the springline of all buried facilities encountered in the excavation area is completed
- before entering an excavation, the excavation has been assessed and determined safe (e.g., slope angle, signs of cracking, gas monitoring < 10% L.E.L.) and documented
- soil has been assessed for sloping requirements and the assessment method has been documented
- excavation has adequate access and egress, such as step cut-ins, ladders or other means every 15 m (50 ft) to account for the maximum lateral distance a worker can travel to an egress, i.e., 7.5 m (25 ft) unless there is a more stringent jurisdictional requirement (e.g., Manitoba, Canada)
- any excavation over 4 ft (1.2 m) deep has been assessed to identify any confined space hazards
- slope of excavations meets regulatory requirements or Engineering support systems are in place (e.g., trench box) to protect workers entering the excavation
- engineering documents, tabulated data and Manufacturers' instructions for trench boxes or engineered alternatives are available on site
- excavations over 20 ft (6 m) deep or requiring an engineered support system, have a Registered Professional Engineer approval
- if water control is necessary, suitable mitigation has been implemented (e.g., water pumps, sand points)
- slope of the spoil and topsoil pile (less than) ≤ 45 degrees from horizontal, and 1.2 m (4 ft) separation from the edge of the excavation to any material and/or the spoil pile has been maintained
- spoil piles are not located over buried facilities unless the location has been assessed per applicable Crossings and Encroachment Procedure and/or consent has been received from Integrity Support. Where applicable, appropriate controls are put in place for spoil piles located over buried facilities to prevent removal of existing cover and/or damage to facilities.
- it is understood that mechanical equipment is not allowed within 3 m (10 ft) of the edge of the excavation unless banks have been inspected for stability and are frequently monitored
- adequate fencing, barriers, signage and traffic control measures (as required) have been installed

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- it is understood that if contact is made or suspected with any buried or aboveground facility during mechanical excavation, the work is to stop immediately, all powered equipment and ignition sources are to be shut down, and Management and Facility Owners are to be contacted immediately
- the excavation checklist is signed and dated by the excavation team (i.e., Excavation Supervisor, Operator, Signaler, Company Authorized Representative)

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APPENDIX C EXCAVATION PLAN – MINIMUM REQUIREMENTS

The Contractor's Excavation Plan will provide, at a minimum, the following content:

- job scope including type of ground disturbance activity
- drawing of the project excavation extent
- SSSP
- safe excavation pressure assessment memo
- right of way easement agreements
- landowner consent
- access agreements, requirements, and map
- temp workspace agreement
- road use and road crossing agreements
- excavation checklist
- spoil handling management
- security and fencing requirements
- positive identification requirements and positive identification log
- safe limits of approach
- pad or mat requirements
- sloping and benching requirements
- shoring requirements
- trench maintenance requirements
- topsoil handling and separation requirements
- erosion control requirements
- spotter signaling
- variance approval process and requirements
- adjacent structure protection
- water management plan
- hydrovac slurry plan
- backfill soil requirements
- third party requirements for crossings
- compaction requirements

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- site clean up requirements
- reclamation and seeding requirements
- safety signage requirements
- slit trench plan
- load calculations and stress analysis

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APPENDIX D EXCAVATION INSPECTION – MINIMUM REQUIREMENTS

The Contractor's excavation inspection form will document that the following criteria, at a minimum, have been confirmed before entry into an excavation:

- date, time name and signature of competent personnel conducting inspection
- confirmation of excavation and protective systems inspection by a Competent Person daily, before start of work or if the conditions of the excavation changes throughout the workday
- areas adjacent to the excavation or right-of-way have been inspected for potential concerns (e.g., vehicular traffic, irrigation, flooding, mechanical vibration) and mitigations implemented, as applicable
- a Competent Person has authority to remove workers from excavation immediately
- surface encumbrances are supported or removed
- personnel are protected from loose rock or soil
- spoils, materials, and equipment are set back a minimum of 1.2 m (4 ft) from edge of excavation
- barriers are provided at all obscured excavations, wells, pits, shafts
- walkways and bridges over excavations 1.8 m (6 ft) or more in depth are equipped with guardrails
- workers are prohibited from working on the face of sloped or benched excavations situated above other workers
- a warning system is established and used when mobile equipment is operating near edge of excavation
- underground installations are protected, supported, or removed when excavation is open
- marks (stakes are preferred) of underground facilities are maintained throughout life of excavation
- precautions are taken to protect personnel from accumulation of water in excavation
- water removal equipment is monitored by a Competent Person
- surface is water controlled or diverted
- atmosphere is monitored in alignment with occupational health requirements
- oxygen content is maintained between 19.5% and 23%
- ventilation provided to prevent flammable gas build-up greater than 10% of lower explosive limit of the gas

**TES-CT-EXC-GLE Excavation Specification
(CAN-US-MEX)**

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- level of toxic substances present is not above the Action Level of the Threshold Limit Value (TLV), Permissible Exposure Limits (PEL), or Occupational Exposure Limits (OEL)
- emergency response equipment is readily available where a hazardous atmosphere could or does exist
- personnel are trained in the use of personal protective and emergency response equipment
- appropriate measures are applied to protect workers when entering confined excavations (e.g., continuous monitor, safety watch, safety harness, and lifeline individually attended)
- compressed gas (i.e., oxygen, acetylene, propane) cannisters are prohibited in excavation
- soil type is identified and excavation stability protection system (e.g., sloping, shoring, trench box, sheet pile) is in place
- methods used to classify soil
- JHA and FLHA documents are present at site and updated as needed for the work at hand
- for excavations involving a trench box and engineered alternatives:
 - current engineered-stamped documents are at the physical site where the trench box is being used
 - Manufacturer assembly instructions (or procedure) are available to the workers assembling the trench box
 - excavator or crane is used to assemble and disassemble trench boxes
 - workers are aware that they are not to exit the trench box from either end
 - the trench box is suitable for ground conditions for the product being used
 - access and egress is established (i.e., types of ladders to be used and how they are to be secured from movement)
 - excavation stability protection system requirements are met for:
 - wooden shoring (federal and provincial or state requirements)
 - air shoring (compressed gasses, depth limits, and suitable materials to be used)
 - hydraulic shoring (environmental concerns, hydraulic pressure, depth limits, suitable materials to be used)
 - slide rail systems (ground pressure with equipment working in close proximity, heavy equipment for installation, access and egress issues, other)