

Excavation, Support, and Backfill of Existing Pipelines

STD.4508

Scope

The scope of this document is to present general guidelines for performing safe excavation, support and backfill of existing pipelines. This specification does not apply to New Construction or to lowering of existing pipelines.

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1.0 REFERENCES

1.1. Occupational Safety and Health Administration (OSHA)

29 CFR Part 1926.650	Excavations
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1.2. Pipeline and Hazardous Materials Safety Administration (PHMSA)

49 CFR Part 192.319	Installation of Pipe in a Ditch
49 CFR Part 195.252	Backfilling

1.3. Company Standards and Procedures

Safety Policies Manual	3.4 - Excavation and Trenching
STD.0250	Project Records Management
STD.9006	Pipeline Defect Evaluation and Repair
STD.9009	Stress Corrosion Cracking Procedure
STD.9010	Enterprise Operated Pipeline Segments with Identified Stress Corrosion Cracking
STD.9015	In-Field Pipe Material Testing Standard
STD-PIDT-4651	Pipe Support for Existing Pipe During Excavation – Sandbags and Earthen Plug Details
STD-PIDT-4648	Pipe Support for Existing Pipe During Excavation – Timber Cribbing and Air Bag Details
Enterprise Form 140	Maintenance Form

2.0 DEFINITIONS

Company – Enterprise (if used in connection with a contract or other agreement, the actual Enterprise entity will be the specific Enterprise entity referenced in the contract).

Earthen Plug – Undisturbed soil in the area of excavation above and underneath the existing pipeline. An earthen plug is created when excavations are performed on existing pipelines, leaving sections of pipe that is unexcavated. An earthen plug is generally, but not limited to, 3-5 feet in length along the pipeline axis and extends 3-5 feet beyond and perpendicular to the OD of pipe to be supported.

Engineering Review – A technical review of the situation, using sound engineering principles, performed by an individual with an accredited engineering degree and relevant experience with pipeline stress analysis

Excavation – Any man-made hole, cavity, trench or depression in an earth surface formed by earth removal.

Hydro-Excavation – A process that allows for removal of soil without the inherent hazards associated with mechanized digging. Hydro- excavating features the use of vacuum and a high-pressure water gun attached to a vacuum truck to remove soil for locating and exposing underground piping or utilities or for surface debris cleanup.

MPI - Magnetic Particle Inspection

SCC - Stress Corrosion Cracking

C-SCC – Circumferential Stress Corrosion Cracking

3.0 PURPOSE

The purpose of this document is to describe a procedure for execution of practical and safe excavation, support and backfill of existing pipelines. This document, when used in combination with the Company's Safety Policies Manual 3.4 *Excavation and Trenching*, will ensure that additional stresses or loads onto existing pipelines are minimized during excavation and backfill.

4.0 PREPARATION FOR EXCAVATION

This section defines the general requirements necessary to prepare for excavation of existing pipelines and related facilities.

- (1) Excavation of existing pipelines shall be performed in compliance with:
 - Company Safety Policies Manual 3.4 *Excavation and Trenching*
 - OSHA 1926.650, Excavations
 - 49 CFR 195.252
 - 49 CFR 192.319
 - STD.9009 *Stress Corrosion Cracking Procedure*
 - STD.9006 *Pipeline Defect Evaluation and Repair*
- (2) Comply with the required notifications and location specific requirements in advance of excavation activities.
- (3) Generate the Pre-Excavation report from AIM, for the location(s) of the excavation(s).
 - (a) For Pipeline Integrity Rehab projects, the Pipeline Integrity Dig Package can be utilized.
- (4) Ensure that all company and foreign lines or facilities are located and staked.
- (5) Perform a review of the area to be excavated and determine if an environmental permit should be obtained or proper notification to the agency having jurisdiction shall be made before commencement of excavation activities.
- (6) Consult with local operations, alignment sheets, flow diagrams or facility drawings to identify possible underground structures or pipeline appurtenances.
- (7) Refer to the guidelines established in the Company's Safety Policies Manual 3.4 *Excavation and Trenching* for additional pre-excavation requirements.
- (8) Prior to excavation, refer to the Pipeline Integrity Standards & Guidelines document STD.9009 *Stress Corrosion Cracking Procedure* for additional non-destructive examination guidance pertaining to SCC. Support spacing requirements shall be in accordance with the requirements of this document (STD.4508).
- (9) Prior to excavation, refer to the Pipeline Integrity Standards & Guidelines document STD.9010 *Enterprise Operated Pipeline Segments with Identified Stress Corrosion Cracking* for a list of pipelines with known Stress Corrosion Cracking (SCC). Documentation of the review shall be maintained with the project files.
- (10) Prior to excavation, a review of joint connection types for the pipeline to be excavated (acetylene weld, couplings...etc.) should be performed in order to properly plan the excavation activities.
- (11) **(For Natural Gas Transmission Pipelines Only)** - Prior to excavation, determine if pipe Material Testing, in accordance with STD.9015, or Component Pressure Rating Verification is required by reviewing the Pre-Excavation Report within AIM at the location(s) of the proposed excavation(s).

5.0 EXCAVATION

This section defines the general requirements necessary for excavating existing pipelines and related facilities.

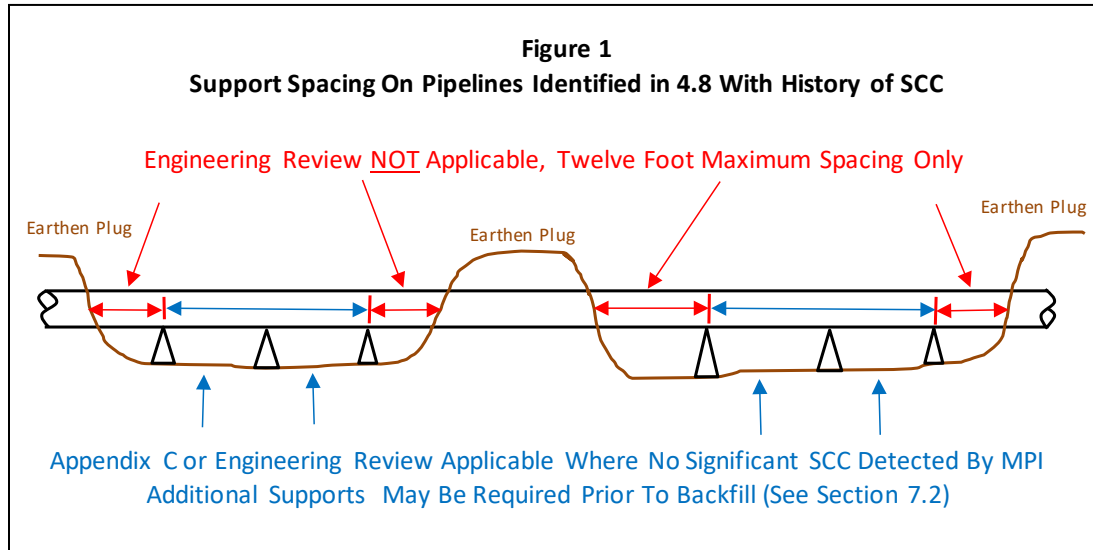
- (1) Confirm pipeline depth and horizontal location of any adjacent pipeline(s).
- (2) Hydro-excavation, hand digging, or other methods that will not damage the carrier pipe or underground appurtenances should be considered where underground structures, power lines, instrument lines or other pipelines may exist within the same corridor.
- (3) Ensure excavation equipment is maintained at a safe distance from the pipeline and at such distance that the equipment operator can maintain eye contact with the spotter/swamper.
- (4) If the excavation site is to be left open at the end of the day, ensure the site is properly fenced, security measures have been taken and proper notifications have been made.
- (5) Refer to the guidelines established in the Company's Safety Policies Manual 3.4 *Excavation and Trenching* for additional excavation requirements.
- (6) Topsoil should be removed separately and conserved (Double Ditch) wherever applicable.
- (7) For line segments identified as having SCC in Section 4.8:
 - (a) A survey of the excavation area shall be established and documented on or appended to the Maintenance Report prior to any excavation. The survey will establish a reference benchmark for the top of pipe elevation and location (lateral and vertical position) of pipe before the soil is removed around the pipe. Once the pipe elevation and location profile have been established, excavation may continue to remove soil beside or below the pipe. Once excavation has been completed, a second profile shall be taken to ensure that significant changes (3 inches or more) have not occurred on pipelines where circumferential SCC has been found in the past, and documented on or appended to the Maintenance report. If movement greater than 3 inches has occurred, contact Pipeline Integrity Engineering for further instructions. If a girth weld is contained within the extent of the excavation, excavation around girth welds will be kept to a minimum with only as much pipe exposed as necessary to complete the examination of the welds. Excavation should be via pot holing, when possible. Pipe on either side of the girth welds should be supported as identified in Section 6.0.
 - (b) Refer to STD.9009 *Stress Corrosion Cracking Procedure* and STD.9006 *Pipeline Defect Evaluation and Repair* for additional guidance related to non-destructive examination criteria and guidance to address any anomalies found during excavation.

6.0 SUPPORTS

This section defines the general requirements necessary for supporting existing pipelines and related facilities during excavation activities.

- (1) Excavations performed on existing pipelines should include proper pipe support at all times. Use approved support materials and support techniques defined within this procedure.
- (2) Excavations should be performed in such a manner as to minimize the length of unsupported span. Where practical, pipe should be directly supported by the bottom of the ditch with the existing, undisturbed soil via the earthen plug method. Leave as much of the undisturbed soil below and to the sides of the existing pipe in the ditch as possible. Soil removal should be limited while maintaining excavation safety practices as required by OSHA 1926.650, for sloping, shoring and all other excavation activities.
- (3) Where practical, backfill of excavated areas shall be performed before removal of the earthen plugs. Refer to Section 7.0 for Backfilling requirements.

- (4) When use of existing, undisturbed soil via the earthen plug method is not practical, sand bags shall be the preferred method to support the existing pipeline. Alternative methods, such as timber cribbing or air bags may also be used. Other commercially available supports such as *PipePillo™* Structured Pipeline Pillows or equivalent are also acceptable support methods.
- (5) Supports should be installed with a sufficiently wide base and to the height necessary to prevent lateral or downward movement of the pipe. Refer to standard drawings STD-PIDT-4651 *Pipe Support for Existing Pipe During Excavation – Sandbags and Earthen Plug Details* and STD-PIDT-4648 *Pipe Support for Existing Pipe During Excavation – Timber Cribbing and Air Bag Details* (see Appendices A and B).
- (6) Sandbag or *PipePillo™* Structured Pipeline Pillows (or equivalent) supports used during excavation may be backfilled in place. If other temporary supports are used (e.g. timber cribbing, air bags, etc.), care should be taken to provide adequate, permanent, support to the pipe prior to removing the temporary support.
- (7) Excavations should generally not exceed the spacing intervals in Appendix C without the use of supports. Support spacing intervals greater than those given in Appendix C must include an engineering review of the pipe properties, characteristics, and any site specific bending stresses prior to implementation. An Engineering review should consider the following as applicable: pipe age, elevation profile, brittleness, history of cracking, seam type, joint type, history of in-service releases, any NDE results, etc. Documentation of the engineering review shall be maintained with the project files.
- (8) Supports should be placed at points to minimize lateral or downward movement of the existing pipeline during excavation and backfill. Whenever practical, undisturbed soil via the earthen plug method should be used to prevent lateral movement of the pipe.
- (9) If the pipe to be excavated is vintage pipe or joined by acetylene weld, bell and spigot, collared or weld plus end, ensure the joined sections are supported to limit additional stress on the connections. Where these types of joints are encountered and will be exposed, consideration should be given to potholing and reinforcement of the joints (such as with a reinforcing sleeve) prior to removing support from the pipe (general excavation) or providing and maintaining pipe support within 8 feet of these types of joints.
- (10) For line segments identified as having SCC in Section 4.8:
 - (a) All exposed pipe sections will be supported at intervals not exceeding the lesser of 12 feet or the value in Appendix C. Support spacing intervals greater than 12 feet must include an engineering review of the pipe properties, characteristics and any site specific bending stresses prior to implementation. An engineering review should consider the following as applicable: pipe age, elevation profile, brittleness, history of cracking, seam type, joint type, history of in-service releases, presence of corrosion, potential for existence of circumferential cracking, any NDE results, etc. Documentation of the engineering review shall be maintained with the project files.
 - (b) Where Magnetic Particle Inspection has confirmed that significant axial SCC as defined in STD.9009, or circumferential SCC (C-SCC) is not present along the affected pipe length, then pipe support spacing may be in accordance with Figure 1 below. Otherwise, the 12 foot maximum support spacing shall apply:



- (c) Care should be taken to provide adequate support to the pipe prior to removing any temporary supports.
- (d) Once work has been completed, any temporary supports will be replaced with sandbag supports and backfilled in place in accordance with Section 7.0.
- (11) Supports should be provided to the pipeline for all cased crossings. These supports should be located under the pipeline at a maximum of 8 feet from the edge of the casing.

7.0 BACKFILL

This section defines the general requirements necessary to backfill existing pipelines and related facilities during excavation activities.

- (1) Prior to backfilling, the ditch should be pumped dry and the line inspected to ensure that no timber cribbing, brush, stumps, trees, boulders or debris that could damage coating are in the ditch or the backfill material.
- (2) Any temporary supports used will be replaced with sandbag supports per Section 6.0 and backfilled in place. Prior to backfilling, additional supports may be required to prevent unsupported spans from being overstressed by the load imposed by the soil overburden. Maximum support spacing prior to backfill should comply with Appendix D. Support spacing intervals greater than those given in Appendix D will require an engineering review as described in Section 6.7
- (3) After the pipe has been inspected and damage to the protective coating has been repaired, as necessary, backfill and compact the area sufficiently to prevent pipe sag or movement.
- (4) Backfill will be completed with the native soil or other fill material that will prevent pipe sag or movement. Excavated material shall be "placed" in the ditch in a manner as to not damage the pipe or pipe coating. Material will be "placed" in the ditch and compacted until the level of the pipe has been reached, such as by use of the backhoe bucket or tamping equipment. Backfill should be done in layers of 12 to 18 inches with compaction occurring after each layer. Mechanical equipment shall maintain a minimum of 18 inches clearance from the pipeline. After the pipe has been exposed, mechanical equipment is allowed within 6 inches. Refer to Company's Safety Manual, 3.4, *Excavation and Trenching*. Ensure no voids remain beneath the pipe after completion of the backfill.
- (5) For line segments identified as having SCC in Step 4.8:

- (a) Support spacing prior to backfill shall comply with the lesser of those given by Appendix D or 12 feet. Greater support intervals can only be permitted with an engineering review as per 6.10(a) and MPI examination as per 6.10(b).
 - (b) Confirm that the top of pipe elevation and lateral location has not changed significantly (more than 3 inches) from the pre-excavation profile on lines where circumferential SCC has been found in the past. Take necessary measures to return the pipe to its pre-excavation profile, where appropriate.
 - (c) Once the backfill and compaction has been completed to pipe level, a final pipe elevation and location profile will be completed to ensure that significant (more than 3 inch) changes have not occurred on pipelines where circumferential SCC has been found in the past, and documented on or appended to the Maintenance report. Once the final profile has been verified, backfill and final clean up may be completed.
- (6) Complete the filling of the ditch, ensuring proper compaction until backfill has reached grade. Ensure no voids remain in the backfilled area. Topsoil, where it has been segregated, shall be backfilled as close as possible to its original location.
- (7) Rock, two inches in diameter and larger, or like materials shall not be backfilled directly onto the pipe. Where such materials are encountered, haul, if necessary, sufficient earth or sand to be backfilled around and over the pipe to form a protective padding or cushion. Rock shield may also be utilized as a means to protect the carrier pipe during backfill. Large rock or boulders shall not be backfilled into the ditch.
- (a) Rock shield material that does not impede the flow of cathodic protection current shall be used.
 - (b) The correct grade of rock-shield must be selected. Manufacturers offer varying grades such as standard duty or heavy duty. Prior to selecting a rock-shield product, the Project Manager shall consult with the manufacturer to ensure the correct grade is utilized.

8.0 BUOYANCY EFFECT

- (1) During the time a trench is open, it may unexpectedly fill with water. Depending on the pipe diameter, wall thickness and contents, the pipe may tend to float due to the buoyant effect of being submerged in water. Generally, this is not a problem for pipelines in liquid service, but is of concern for pipelines in gas service. Due to the substantial upward buoyant force on submerged gas pipelines, the earthen plugs may not be of sufficient mass to restrain the pipeline, causing long spans to be created which could result in unacceptable stresses being imposed. Based on a simply supported beam model, several example cases were analyzed to determine the maximum submerged span of gas pipelines which would still be within acceptable limits. The cases all assumed that the pipelines were in natural gas service at 72% SMYS.

Maximum Submerged Excavation Length Before Exceeding
Stress Limits Due to Buoyancy Effect on Gas Pipelines

OD (in)	WT (in)	Grade	Net Upward Force (lb/ft)	Maximum Excavation (ft)
10.750	0.188	X52	15.46	90
12.750	0.203	X52	24.75	90
14.000	0.219	X52	30.50	90
16.000	0.219	X52	45.69	85
20.000	0.312	X52	80.50	85

24.000	0.250	X52	124.96	80
30.000	0.281	X52	206.43	85
30.000	0.375	X52	173.63	105
30.000	0.375	X65	170.02	135
36.000	0.344	X52	294.58	95
36.000	0.344	X65	290.73	120
42.000	0.521	X52	342.65	125
42.000	0.521	X65	335.65	160

It should be noted that the above table is presented for informational purposes to illustrate the effects of buoyancy on submerged gas pipelines in trenches. The span lengths in the above table can be used as a guideline to determine the overall maximum excavation length (between areas of undisturbed backfill) which should be exposed at any one time if flooding is possible during recoating projects or other activities involving trenching. Consideration should also be given to increasing the length of the earthen plugs to increase their stability if flooding is a possibility. Actual situations encountered in the field should be evaluated on a case by case basis. The use of weights such as *PipeSak®* Geotextile Pipeline Weights or equivalent could also be considered as means of preventing a pipeline from floating. It should be noted however that the addition of weights to the excavated pipeline would require that support spacing be in accordance with Appendix D until the weights are removed.

9.0 DOCUMENTATION

- (1) Original training records and documentation are retained and producible for each Company Employee.
- (2) Daily excavation inspection reports, Excavation Checklists, or daily logs are maintained at the excavation site for use by personnel entering the excavation until completion of the excavation.
- (3) Maintain documentation of the ONE-CALL SYSTEM notification.
- (4) Enterprise Form 140 - Maintenance Report shall be used to document the excavation performed and any pipeline profiles taken during excavation.
- (5) Project records and documentation shall be maintained in accordance with STD.0250 *Project Records Management*.

Appendix A STD-PIDT-4651



STD-PIDT-4651-02

Appendix B STD-PIDT-4648



STD-PIDT-4648-02

Appendix C Maximum Allowable Support Spacing During Excavation

C-1. Design Basis

The following assumptions were used to produce Table C1 found here in this appendix based on a continuous beam model (3 spans):

Operating at the Design Maximum Operating Pressure, $DF =$	0.72
Maximum temperature differential from installation to operating is, $\Delta T =$	72°F
Minimum temperature differential from installation to operating is, $\Delta T =$	-36°F
Allowable Limit on Von Mises Equivalent Stress $\sigma_{eq} =$	0.90
Allowable Limit on Longitudinal Stress $\sigma_L =$	0.675
The pipe is filled with a fluid with a specific gravity =	1.00
The Span Deflection is Limited to:	3 inches
The Span Length is Limited to:	100 feet
Mass Multiplier To Account For Unknown Loadings =	1.10

C-2. Notes:

Please note the following before using Table C1:

- (1) Table C1 is to be used in accordance with Section 6.7 and Appendix A and B for maximum support spacing during excavation and subsequent rehabilitation or other maintenance work. It may be necessary to add more supports prior to backfill to comply with the support spacing requirements of Appendix D.
- (2) Acetylene, bell and spigot, collared or weld plus end type joints will require special consideration during excavation. Refer to Section 6.9 for guidance.
- (3) Pipelines identified as having SCC in Section 4(8) require special consideration prior to using a support spacing greater than 12 feet. Refer to Section 6.10 for instructions on excavation of pipelines with potential SCC.
- (4) Support should be provided under the pipeline a maximum of 8 feet from the edge of any casing involved in an excavation. See Section 6.11, Appendix A and Appendix B.
- (5) If a wall thickness is encountered during an excavation which is not shown in the table, use the next lower wall thickness for that diameter to determine the maximum support spacing.

Table C1: 2 inches through 8 inches

Maximum Allowable Span For Excavation of Pipelines												
OD	W. T.	Unknown	A-25	Gr A	Gr B	X-42	X-46	X-52	X-56	X-60	X-65	X-70
2.375"	0.125"	14'	14'	14'	13'	14'	15'	18'	21'	27'	30'	30'
	0.154"	14'	14'	14'	13'	14'	15'	18'	21'	27'	31'	31'
	0.218"	14'	15'	13'	12'	13'	15'	17'	20'	26'	31'	31'
3.500"	0.109"	15'	15'	17'	18'	21'	23'	27'	32'	35'	35'	35'
	0.125"	15'	16'	17'	19'	21'	23'	27'	32'	35'	35'	35'
	0.154"	16'	16'	18'	19'	21'	23'	27'	32'	36'	36'	36'
	0.156"	16'	16'	18'	19'	21'	23'	27'	32'	36'	36'	36'
	0.216"	17'	17'	19'	19'	20'	22'	27'	31'	37'	37'	37'
4.500"	0.125"	16'	17'	18'	20'	27'	30'	35'	39'	39'	39'	39'
	0.141"	17'	17'	19'	21'	27'	30'	35'	40'	40'	40'	40'
	0.156"	17'	18'	19'	21'	27'	30'	35'	40'	40'	40'	40'
	0.172"	18'	18'	20'	21'	27'	29'	35'	40'	40'	40'	40'
	0.188"	18'	18'	20'	22'	27'	29'	35'	41'	41'	41'	41'
	0.237"	19'	19'	21'	23'	27'	29'	34'	40'	42'	42'	42'
	0.250"	19'	19'	21'	23'	26'	29'	34'	40'	42'	42'	42'
5.563"	0.141"	18'	18'	20'	22'	29'	34'	39'	42'	43'	43'	43'
	0.243"	20'	21'	23'	24'	33'	36'	43'	46'	46'	46'	46'
	0.275"	21'	21'	23'	25'	33'	36'	43'	46'	46'	46'	46'
6.625"	0.125"	18'	18'	20'	22'	29'	34'	39'	42'	45'	45'	45'
	0.128"	18'	18'	20'	22'	30'	34'	39'	43'	45'	45'	45'
	0.141"	19'	19'	21'	23'	31'	35'	41'	44'	46'	46'	46'
	0.156"	19'	20'	21'	23'	31'	36'	42'	45'	46'	46'	46'
	0.172"	20'	20'	22'	24'	32'	37'	43'	47'	47'	47'	47'
	0.188"	20'	21'	23'	24'	33'	38'	44'	48'	48'	48'	48'
	0.203"	21'	21'	23'	25'	34'	39'	45'	48'	48'	48'	48'
	0.219"	21'	21'	23'	25'	34'	39'	46'	48'	48'	48'	48'
	0.250"	22'	22'	24'	26'	35'	40'	47'	49'	49'	49'	49'
	0.275"	22'	22'	25'	27'	36'	41'	48'	50'	50'	50'	50'
	0.280"	22'	22'	25'	27'	36'	41'	48'	50'	50'	50'	50'
	0.312"	22'	23'	25'	27'	37'	42'	49'	50'	50'	50'	50'
	0.322"	23'	23'	25'	27'	37'	42'	49'	50'	50'	50'	50'
	0.344"	23'	23'	25'	28'	37'	43'	50'	51'	51'	51'	51'
	0.432"	24'	24'	26'	28'	38'	42'	50'	51'	51'	51'	51'
7.625"	0.332"	24'	24'	27'	29'	39'	45'	52'	53'	53'	53'	53'
8.625"	0.156"	20'	21'	23'	25'	33'	38'	44'	48'	51'	51'	51'
	0.165"	21'	21'	23'	25'	34'	39'	45'	49'	51'	51'	51'
	0.172"	21'	21'	23'	25'	34'	39'	46'	49'	52'	52'	52'
	0.188"	21'	22'	24'	26'	35'	40'	47'	51'	52'	52'	52'
	0.203"	22'	22'	25'	27'	36'	41'	48'	52'	53'	53'	53'
	0.219"	22'	23'	25'	27'	37'	42'	49'	53'	53'	53'	53'
	0.250"	23'	24'	26'	28'	38'	43'	50'	54'	54'	54'	54'
	0.277"	24'	24'	27'	29'	39'	44'	52'	55'	55'	55'	55'
	0.322"	25'	25'	27'	30'	40'	46'	53'	56'	56'	56'	56'
	0.344"	25'	25'	28'	30'	41'	47'	54'	56'	56'	56'	56'
	0.375"	25'	26'	28'	31'	41'	47'	55'	57'	57'	57'	57'
	0.500"	26'	27'	30'	32'	43'	50'	58'	58'	58'	58'	58'

Table C1: 10 inches through 18 inches

Maximum Allowable Span For Excavation of Pipelines												
OD	W. T.	Unknown	A-25	Gr A	Gr B	X-42	X-46	X-52	X-56	X-60	X-65	X-70
10.750"	0.188"	22'	23'	25'	27'	37'	42'	49'	53'	57'	57'	57'
	0.190"	23'	23'	25'	27'	37'	42'	49'	53'	57'	57'	57'
	0.203"	23'	23'	26'	28'	38'	43'	50'	54'	57'	57'	57'
	0.206"	23'	24'	26'	28'	38'	43'	50'	55'	57'	57'	57'
	0.219"	24'	24'	26'	28'	39'	44'	51'	56'	58'	58'	58'
	0.221"	24'	24'	26'	28'	39'	44'	51'	56'	58'	58'	58'
	0.250"	24'	25'	27'	30'	40'	46'	53'	58'	59'	59'	59'
	0.277"	25'	26'	28'	30'	41'	47'	55'	59'	60'	60'	60'
	0.279"	25'	26'	28'	30'	41'	47'	55'	59'	60'	60'	60'
	0.307"	26'	26'	29'	31'	42'	48'	56'	61'	61'	61'	61'
	0.365"	27'	27'	30'	32'	44'	50'	59'	62'	62'	62'	62'
	0.500"	29'	29'	32'	35'	47'	54'	62'	64'	64'	64'	64'
12.750"	0.203"	24'	24'	27'	29'	39'	44'	52'	56'	60'	61'	61'
	0.219"	24'	25'	27'	29'	40'	46'	53'	57'	61'	61'	61'
	0.225"	25'	25'	27'	30'	40'	46'	53'	58'	62'	62'	62'
	0.250"	25'	26'	28'	31'	41'	47'	55'	60'	63'	63'	63'
	0.281"	26'	27'	29'	32'	43'	49'	57'	62'	64'	64'	64'
	0.312"	27'	28'	30'	33'	44'	51'	59'	64'	65'	65'	65'
	0.343"	28'	28'	31'	33'	45'	52'	60'	65'	66'	66'	66'
	0.375"	28'	29'	32'	34'	46'	53'	62'	66'	66'	66'	66'
	0.406"	29'	29'	32'	35'	47'	54'	63'	67'	67'	67'	67'
	0.500"	30'	31'	34'	36'	49'	57'	66'	68'	68'	68'	68'
14.000"	0.219"	25'	25'	28'	30'	40'	46'	54'	58'	63'	63'	63'
	0.234"	25'	26'	28'	31'	41'	47'	55'	60'	64'	64'	64'
	0.250"	26'	26'	29'	31'	42'	48'	56'	61'	65'	65'	65'
	0.281"	27'	27'	30'	32'	44'	50'	58'	63'	66'	66'	66'
	0.355"	29'	29'	32'	35'	47'	54'	62'	67'	68'	68'	68'
	0.375"	29'	30'	32'	35'	47'	54'	63'	68'	69'	69'	69'
	0.406"	30'	30'	33'	36'	48'	55'	64'	69'	69'	69'	69'
	0.562"	32'	32'	36'	38'	52'	60'	69'	72'	72'	72'	72'
16.000"	0.219"	25'	26'	28'	31'	41'	47'	55'	60'	64'	66'	66'
	0.235"	26'	26'	29'	31'	42'	49'	56'	61'	66'	67'	67'
	0.250"	26'	27'	30'	32'	43'	50'	58'	62'	67'	68'	68'
	0.267"	27'	28'	30'	33'	44'	51'	59'	64'	68'	69'	69'
	0.281"	27'	28'	31'	33'	45'	51'	60'	65'	69'	69'	69'
	0.283"	28'	28'	31'	33'	45'	52'	60'	65'	69'	69'	69'
	0.312"	28'	29'	32'	34'	46'	53'	62'	67'	70'	70'	70'
	0.344"	29'	30'	33'	35'	48'	55'	64'	69'	71'	71'	71'
	0.375"	30'	31'	33'	36'	49'	56'	65'	71'	72'	72'	72'
	0.438"	31'	32'	35'	38'	51'	58'	68'	74'	74'	74'	74'
	0.500"	32'	33'	36'	39'	53'	60'	70'	75'	75'	75'	75'
	0.625"	34'	35'	38'	41'	55'	63'	74'	77'	77'	77'	77'
18.000"	0.312"	29'	30'	32'	35'	48'	54'	63'	69'	73'	73'	73'
	0.344"	30'	31'	33'	36'	49'	56'	65'	71'	74'	74'	74'
	0.375"	31'	31'	34'	37'	50'	57'	67'	72'	75'	75'	75'
	0.500"	33'	34'	37'	40'	54'	62'	72'	78'	78'	78'	78'

Table C1: 20 inches through 42 inches

Maximum Allowable Span For Excavation of Pipelines												
OD	W. T.	Unknown	A-25	Gr A	Gr B	X-42	X-46	X-52	X-56	X-60	X-65	X-70
20.000"	0.235"	27'	27'	30'	32'	44'	50'	58'	63'	68'	72'	72'
	0.236"	27'	27'	30'	32'	44'	50'	58'	63'	68'	72'	72'
	0.243"	27'	28'	30'	33'	44'	51'	59'	64'	69'	73'	73'
	0.250"	27'	28'	31'	33'	45'	51'	60'	65'	69'	73'	73'
	0.255"	28'	28'	31'	33'	45'	52'	60'	65'	70'	73'	73'
	0.281"	29'	29'	32'	34'	47'	53'	62'	67'	72'	74'	74'
	0.290"	29'	29'	32'	35'	47'	54'	63'	68'	73'	75'	75'
	0.300"	29'	30'	33'	35'	48'	55'	64'	69'	74'	75'	75'
	0.312"	30'	30'	33'	36'	48'	55'	64'	70'	75'	76'	76'
	0.317"	30'	30'	33'	36'	49'	56'	65'	70'	75'	76'	76'
	0.344"	31'	31'	34'	37'	50'	57'	66'	72'	77'	77'	77'
	0.375"	31'	32'	35'	38'	51'	59'	68'	74'	78'	78'	78'
	0.438"	33'	34'	37'	40'	54'	62'	72'	78'	80'	80'	80'
	0.500"	34'	35'	38'	41'	56'	64'	74'	80'	81'	81'	81'
	0.864"	39'	39'	43'	47'	63'	72'	84'	87'	87'	87'	87'
22.000"	0.344"	31'	32'	35'	37'	51'	58'	68'	73'	79'	80'	80'
24.000"	0.250"	28'	29'	31'	34'	46'	53'	61'	66'	71'	77'	77'
	0.270"	29'	29'	32'	35'	47'	54'	63'	68'	73'	78'	78'
	0.281"	29'	30'	33'	35'	48'	55'	64'	69'	74'	79'	79'
	0.283"	29'	30'	33'	36'	48'	55'	64'	69'	74'	79'	79'
	0.312"	30'	31'	34'	37'	50'	57'	66'	72'	77'	81'	81'
	0.321"	31'	31'	34'	37'	50'	58'	67'	73'	78'	81'	81'
	0.344"	31'	32'	35'	38'	52'	59'	69'	74'	80'	82'	82'
	0.375"	32'	33'	36'	39'	53'	61'	71'	77'	82'	83'	83'
	0.500"	35'	36'	40'	43'	58'	66'	77'	84'	87'	87'	87'
	0.515"	36'	37'	40'	43'	59'	67'	78'	84'	87'	87'	87'
	0.469"	35'	36'	40'	43'	58'	66'	77'	83'	88'	88'	88'
26.000"	0.643"	39'	40'	44'	48'	65'	74'	86'	93'	95'	95'	95'
28.000"	0.281"	30'	31'	34'	36'	49'	56'	66'	71'	76'	82'	85'
	0.312"	31'	32'	35'	38'	51'	59'	68'	74'	79'	86'	86'
	0.313"	31'	32'	35'	38'	51'	59'	68'	74'	80'	86'	86'
	0.344"	33'	33'	36'	39'	53'	61'	71'	77'	82'	88'	88'
	0.353"	33'	34'	37'	40'	54'	62'	72'	78'	83'	88'	88'
	0.375"	34'	34'	38'	41'	55'	63'	73'	79'	85'	89'	89'
	0.429"	35'	36'	39'	43'	58'	66'	77'	83'	89'	92'	92'
	0.500"	37'	38'	41'	45'	61'	69'	81'	87'	94'	94'	94'
	0.565"	38'	39'	43'	46'	63'	72'	84'	91'	96'	96'	96'
	0.625"	40'	40'	44'	48'	65'	74'	86'	94'	97'	97'	97'
	0.643"	40'	41'	45'	48'	65'	75'	87'	94'	98'	98'	98'
	0.707"	41'	42'	46'	50'	67'	77'	90'	97'	99'	99'	99'
30.000"	0.344"	33'	34'	37'	40'	55'	62'	73'	79'	84'	91'	93'
	0.375"	34'	35'	38'	42'	56'	64'	75'	81'	87'	94'	95'
	0.395"	35'	36'	39'	42'	57'	66'	76'	83'	89'	96'	96'
	0.406"	35'	36'	40'	43'	58'	66'	77'	84'	90'	96'	96'
	0.429"	36'	37'	40'	44'	59'	68'	79'	85'	92'	97'	97'
	0.438"	36'	37'	41'	44'	60'	68'	79'	86'	92'	97'	97'
	0.482"	38'	38'	42'	46'	62'	71'	82'	89'	95'	99'	99'
	0.515"	39'	39'	43'	47'	63'	72'	84'	91'	98'	100'	100'
	0.529"	39'	40'	44'	47'	64'	73'	85'	92'	98'	100'	100'
	0.555"	40'	40'	44'	48'	65'	74'	86'	93'	100'	100'	100'
	0.625"	41'	42'	46'	50'	67'	77'	90'	97'	100'	100'	100'
	0.665"	42'	43'	47'	51'	69'	79'	91'	99'	100'	100'	100'
	0.741"	43'	44'	48'	52'	71'	81'	94'	100'	100'	100'	100'
	0.521"	40'	40'	44'	48'	65'	74'	86'	94'	100'	100'	100'
	0.529"	40'	41'	45'	48'	65'	75'	87'	94'	100'	100'	100'
	0.678"	43'	44'	49'	52'	71'	81'	95'	100'	100'	100'	100'
	0.975"	48'	49'	54'	59'	79'	91'	100'	100'	100'	100'	100'

Appendix D Maximum Allowable Support Spacing Prior To Backfill

D-1. Design Basis

The following assumptions were used to produce Table D1 found here in this appendix using a continuous beam model (3 spans):

Operating at the Design Maximum Operating Pressure, $DF =$	0.72
Maximum temperature differential from installation to operating is, $\Delta T =$	72°F
Minimum temperature differential from installation to operating is, $\Delta T =$	-36°F
Allowable Limit on Von Mises Equivalent Stress $\sigma_{eq} =$	0.90
Allowable Limit on Longitudinal Stress $\sigma_L =$	0.675
The pipe is filled with a fluid with a specific gravity =	1.00
The Span Deflection is Limited to:	3 inches
The Span Length is Limited to:	60 feet
Mass Multiplier To Account For Unknown Loadings =	1.00
Estimated Backfill Height =	3.0 feet

D-2. Notes:

Please note the following before using Table D1:

- (1) Table D1 is to be used in accordance with Section 7.2 for maximum support spacing prior to backfill of excavations and subsequent rehabilitation or other maintenance work
- (2) Acetylene, bell and spigot, collared or weld plus end type joints will require special consideration during excavation. Refer to Section 6.9 for guidance.
- (3) Pipelines identified as having SCC in Section 4.8 require special consideration prior to using a support spacing greater than 12 feet. Refer to Section 6.10 for instructions on backfill of pipelines with potential SCC.
- (4) Support should be provided under the pipeline a maximum of 8 feet from the edge of any casing involved in an excavation. See Section 6.11, Appendix A and Appendix B.
- (5) If a wall thickness is encountered during an excavation which is not shown in the table, use the next lower wall thickness for that diameter to determine the maximum support spacing.

Table D1: 2 inches through 8 inches

Maximum Support Spacing Prior To Backfilling Pipeline												
OD	W. T.	Unknown	A-25	Gr A	Gr B	X-42	X-46	X-52	X-56	X-60	X-65	X-70
2.375"	0.125"	7'	7'	8'	8'	11'	13'	15'	16'	17'	19'	20'
	0.154"	7'	8'	8'	9'	12'	14'	16'	17'	19'	20'	21'
	0.218"	8'	8'	9'	10'	13'	15'	17'	19'	21'	22'	23'
3.500"	0.109"	7'	7'	8'	8'	11'	13'	15'	16'	17'	19'	20'
	0.125"	7'	7'	8'	9'	12'	14'	16'	17'	18'	20'	21'
	0.154"	8'	8'	9'	10'	13'	15'	17'	19'	20'	22'	23'
	0.156"	8'	8'	9'	10'	13'	15'	17'	19'	20'	22'	23'
	0.216"	9'	9'	10'	11'	15'	17'	19'	21'	23'	24'	26'
4.500"	0.125"	8'	8'	8'	9'	12'	14'	17'	18'	19'	21'	22'
	0.141"	8'	8'	9'	10'	13'	15'	17'	19'	20'	22'	23'
	0.156"	8'	8'	9'	10'	14'	16'	18'	20'	21'	23'	24'
	0.172"	9'	9'	10'	10'	14'	16'	19'	20'	22'	24'	25'
	0.188"	9'	9'	10'	11'	15'	17'	19'	21'	23'	24'	26'
	0.237"	10'	10'	11'	12'	16'	18'	21'	23'	25'	27'	28'
	0.250"	10'	10'	11'	12'	16'	19'	22'	23'	25'	27'	29'
5.563"	0.141"	8'	8'	9'	10'	14'	16'	18'	20'	21'	23'	24'
	0.243"	10'	11'	12'	13'	17'	19'	23'	24'	26'	28'	30'
	0.275"	11'	11'	12'	13'	18'	20'	24'	26'	27'	30'	32'
6.625"	0.125"	8'	8'	9'	10'	13'	15'	18'	19'	21'	22'	24'
	0.128"	8'	8'	9'	10'	14'	16'	18'	20'	21'	23'	24'
	0.141"	9'	9'	10'	10'	14'	16'	19'	20'	22'	24'	25'
	0.156"	9'	9'	10'	11'	15'	17'	20'	21'	23'	25'	26'
	0.172"	9'	10'	11'	11'	15'	18'	21'	22'	24'	26'	27'
	0.188"	10'	10'	11'	12'	16'	18'	21'	23'	25'	27'	28'
	0.203"	10'	10'	11'	12'	17'	19'	22'	24'	26'	27'	29'
	0.219"	10'	11'	12'	13'	17'	19'	23'	25'	26'	28'	30'
	0.250"	11'	11'	12'	13'	18'	21'	24'	26'	28'	30'	32'
	0.275"	11'	12'	13'	14'	19'	21'	25'	27'	29'	31'	33'
	0.280"	11'	12'	13'	14'	19'	21'	25'	27'	29'	31'	33'
	0.312"	12'	12'	13'	14'	19'	22'	26'	28'	30'	32'	35'
	0.322"	12'	12'	13'	15'	20'	23'	26'	28'	30'	33'	35'
	0.344"	12'	13'	14'	15'	20'	23'	27'	29'	31'	34'	36'
	0.432"	13'	14'	15'	16'	22'	25'	29'	31'	34'	36'	39'
7.625"	0.332"	13'	13'	14'	15'	21'	24'	28'	30'	32'	35'	37'
8.625"	0.156"	10'	10'	11'	12'	16'	18'	21'	23'	24'	26'	28'
	0.165"	10'	10'	11'	12'	16'	19'	22'	23'	25'	27'	29'
	0.172"	10'	10'	11'	12'	16'	19'	22'	24'	25'	27'	29'
	0.188"	10'	11'	12'	13'	17'	20'	23'	25'	26'	29'	30'
	0.203"	11'	11'	12'	13'	18'	20'	24'	26'	27'	29'	31'
	0.219"	11'	11'	12'	13'	18'	21'	24'	26'	28'	30'	32'
	0.250"	12'	12'	13'	14'	19'	22'	26'	28'	30'	32'	34'
	0.277"	12'	13'	14'	15'	20'	23'	27'	29'	31'	33'	36'
	0.322"	13'	13'	15'	16'	21'	24'	28'	31'	33'	36'	38'
	0.344"	13'	14'	15'	16'	22'	25'	29'	32'	34'	36'	39'
	0.375"	14'	14'	15'	17'	23'	26'	30'	33'	35'	38'	40'
	0.500"	15'	16'	17'	18'	25'	29'	33'	36'	39'	42'	44'

Table D1: 10 inches through 18 inches

Maximum Support Spacing Prior To Backfilling Pipeline												
OD	W. T.	Unknown	A-25	Gr A	Gr B	X-42	X-46	X-52	X-56	X-60	X-65	X-70
10.750"	0.188"	11'	11'	12'	13'	18'	21'	24'	26'	28'	30'	32'
	0.190"	11'	11'	12'	13'	18'	21'	24'	26'	28'	30'	33'
	0.203"	11'	12'	13'	14'	19'	22'	25'	27'	29'	31'	33'
	0.206"	12'	12'	13'	14'	19'	22'	25'	27'	29'	32'	34'
	0.219"	12'	12'	13'	14'	19'	22'	26'	28'	30'	32'	35'
	0.221"	12'	12'	13'	14'	20'	22'	26'	28'	30'	33'	35'
	0.250"	13'	13'	14'	15'	21'	24'	27'	30'	32'	34'	37'
	0.277"	13'	13'	15'	16'	21'	25'	29'	31'	33'	36'	38'
	0.279"	13'	13'	15'	16'	22'	25'	29'	31'	33'	36'	38'
	0.307"	14'	14'	15'	17'	22'	26'	30'	32'	35'	37'	40'
	0.365"	15'	15'	16'	18'	24'	27'	32'	35'	37'	40'	43'
	0.500"	16'	17'	18'	20'	27'	31'	36'	39'	42'	45'	48'
12.750"	0.203"	12'	12'	14'	15'	20'	23'	26'	29'	31'	33'	35'
	0.219"	13'	13'	14'	15'	20'	23'	27'	30'	32'	34'	36'
	0.225"	13'	13'	14'	15'	21'	24'	28'	30'	32'	35'	37'
	0.250"	13'	14'	15'	16'	22'	25'	29'	31'	34'	36'	39'
	0.281"	14'	14'	16'	17'	23'	26'	30'	33'	35'	38'	40'
	0.312"	15'	15'	16'	18'	24'	27'	32'	34'	37'	40'	42'
	0.343"	15'	15'	17'	18'	25'	28'	33'	36'	38'	41'	44'
	0.375"	16'	16'	18'	19'	26'	29'	34'	37'	40'	43'	46'
	0.406"	16'	16'	18'	20'	26'	30'	35'	38'	41'	44'	47'
14.000"	0.219"	13'	13'	14'	16'	21'	24'	28'	30'	33'	35'	37'
	0.234"	13'	14'	15'	16'	22'	25'	29'	31'	34'	36'	39'
	0.250"	14'	14'	15'	16'	22'	26'	30'	32'	35'	37'	40'
	0.281"	14'	15'	16'	17'	23'	27'	31'	34'	36'	39'	42'
	0.355"	16'	16'	18'	19'	26'	30'	34'	37'	40'	43'	46'
	0.375"	16'	16'	18'	20'	26'	30'	35'	38'	41'	44'	47'
	0.406"	17'	17'	19'	20'	27'	31'	36'	39'	42'	45'	49'
	0.562"	19'	19'	21'	23'	31'	35'	41'	45'	48'	51'	55'
16.000"	0.219"	13'	14'	15'	16'	22'	25'	29'	32'	34'	37'	39'
	0.235"	14'	14'	15'	17'	23'	26'	30'	33'	35'	38'	40'
	0.250"	14'	15'	16'	17'	23'	27'	31'	34'	36'	39'	41'
	0.267"	15'	15'	16'	18'	24'	27'	32'	35'	37'	40'	43'
	0.281"	15'	15'	17'	18'	25'	28'	33'	35'	38'	41'	44'
	0.283"	15'	15'	17'	18'	25'	28'	33'	35'	38'	41'	44'
	0.312"	16'	16'	18'	19'	26'	29'	34'	37'	40'	43'	46'
	0.344"	16'	17'	18'	20'	27'	31'	36'	39'	41'	44'	47'
	0.375"	17'	17'	19'	20'	28'	32'	37'	40'	43'	46'	49'
	0.438"	18'	18'	20'	22'	29'	34'	39'	42'	46'	49'	52'
	0.500"	19'	19'	21'	23'	31'	35'	41'	45'	48'	52'	55'
	0.625"	21'	21'	23'	25'	34'	39'	45'	49'	52'	56'	60'
18.000"	0.312"	16'	17'	18'	20'	27'	30'	35'	38'	41'	44'	47'
	0.344"	17'	17'	19'	20'	28'	32'	37'	40'	43'	46'	49'
	0.375"	18'	18'	20'	21'	29'	33'	38'	42'	45'	48'	51'
	0.500"	20'	20'	22'	24'	32'	37'	43'	47'	50'	54'	58'

Table D1: 20 inches through 42 inches

Maximum Support Spacing Prior To Backfilling Pipeline												
OD	W. T.	Unknown	A-25	Gr A	Gr B	X-42	X-46	X-52	X-56	X-60	X-65	X-70
20.000"	0.235"	15'	15'	17'	18'	24'	28'	32'	35'	38'	41'	43'
	0.236"	15'	15'	17'	18'	24'	28'	32'	35'	38'	41'	43'
	0.243"	15'	15'	17'	18'	25'	28'	33'	36'	38'	41'	44'
	0.250"	15'	16'	17'	18'	25'	29'	33'	36'	39'	42'	44'
	0.255"	15'	16'	17'	19'	25'	29'	34'	36'	39'	42'	45'
	0.281"	16'	16'	18'	19'	26'	30'	35'	38'	41'	44'	47'
	0.290"	16'	17'	18'	20'	27'	31'	36'	39'	41'	45'	48'
	0.300"	17'	17'	19'	20'	27'	31'	36'	39'	42'	45'	48'
	0.312"	17'	17'	19'	20'	28'	32'	37'	40'	43'	46'	49'
	0.317"	17'	17'	19'	21'	28'	32'	37'	40'	43'	46'	49'
	0.344"	18'	18'	20'	21'	29'	33'	38'	42'	44'	48'	51'
	0.375"	18'	19'	20'	22'	30'	34'	40'	43'	46'	50'	53'
	0.438"	19'	20'	22'	23'	32'	36'	42'	46'	49'	53'	57'
	0.500"	21'	21'	23'	25'	34'	38'	45'	48'	52'	56'	60'
	0.864"	25'	26'	28'	30'	41'	47'	55'	59'	64'	68'	70'
22.000"	0.344"	18'	19'	20'	22'	30'	34'	40'	43'	46'	50'	53'
24.000"	0.250"	16'	17'	18'	20'	27'	30'	35'	38'	41'	44'	47'
	0.270"	17'	17'	19'	20'	28'	31'	37'	40'	42'	46'	49'
	0.281"	17'	17'	19'	21'	28'	32'	37'	40'	43'	47'	50'
	0.283"	17'	18'	19'	21'	28'	32'	37'	41'	43'	47'	50'
	0.312"	18'	18'	20'	22'	29'	34'	39'	42'	45'	49'	52'
	0.321"	18'	19'	20'	22'	30'	34'	40'	43'	46'	49'	53'
	0.344"	19'	19'	21'	23'	31'	35'	41'	44'	47'	51'	54'
	0.375"	19'	20'	22'	23'	32'	36'	42'	46'	49'	53'	56'
	0.500"	22'	22'	24'	26'	36'	41'	48'	52'	55'	60'	64'
	0.515"	22'	23'	25'	27'	36'	41'	48'	52'	56'	60'	64'
26.000"	0.469"	22'	22'	25'	26'	36'	41'	48'	52'	55'	60'	64'
28.000"	0.643"	26'	26'	29'	31'	42'	48'	56'	60'	65'	70'	74'
30.000"	0.281"	18'	19'	21'	22'	30'	34'	40'	43'	47'	50'	54'
	0.312"	19'	20'	22'	23'	32'	36'	42'	46'	49'	53'	56'
	0.313"	19'	20'	22'	23'	32'	36'	42'	46'	49'	53'	56'
	0.344"	20'	21'	23'	24'	33'	38'	44'	48'	51'	55'	59'
	0.353"	20'	21'	23'	25'	33'	38'	44'	48'	52'	56'	59'
	0.375"	21'	21'	23'	25'	34'	39'	46'	49'	53'	57'	61'
	0.429"	22'	23'	25'	27'	36'	42'	48'	52'	56'	60'	65'
	0.500"	24'	24'	26'	29'	39'	44'	52'	56'	60'	64'	69'
	0.565"	25'	25'	28'	30'	41'	47'	54'	59'	63'	68'	72'
	0.625"	26'	26'	29'	31'	42'	49'	56'	61'	66'	71'	75'
	0.643"	26'	27'	29'	32'	43'	49'	57'	62'	66'	71'	76'
	0.707"	27'	28'	30'	33'	45'	51'	59'	64'	69'	74'	79'
36.000"	0.344"	21'	22'	24'	26'	35'	40'	47'	50'	54'	58'	62'
	0.375"	22'	23'	25'	27'	36'	42'	48'	52'	56'	61'	65'
	0.395"	23'	23'	25'	27'	37'	43'	50'	54'	57'	62'	66'
	0.406"	23'	23'	26'	28'	38'	43'	50'	54'	58'	63'	67'
	0.429"	24'	24'	26'	28'	39'	44'	51'	56'	60'	64'	69'
	0.438"	24'	24'	27'	29'	39'	45'	52'	56'	60'	65'	69'
	0.482"	25'	25'	28'	30'	41'	46'	54'	58'	63'	68'	72'
	0.515"	25'	26'	28'	31'	42'	48'	56'	60'	64'	69'	74'
	0.529"	26'	26'	29'	31'	42'	48'	56'	61'	65'	70'	75'
	0.555"	26'	27'	29'	32'	43'	49'	57'	62'	67'	72'	77'
	0.625"	28'	28'	31'	33'	45'	52'	60'	65'	70'	75'	80'
	0.665"	28'	29'	32'	34'	46'	53'	62'	67'	72'	77'	82'
	0.741"	30'	30'	33'	36'	48'	55'	64'	70'	75'	81'	86'
42.000"	0.521"	27'	28'	30'	33'	44'	50'	59'	64'	68'	73'	78'
	0.529"	27'	28'	30'	33'	44'	51'	59'	64'	69'	74'	79'
	0.678"	30'	31'	34'	36'	49'	56'	66'	71'	76'	82'	88'
	0.975"	35'	35'	39'	42'	57'	65'	76'	82'	88'	95'	99'

Attachment Revision Log

Revision 0.0			Publish Date: 08 Apr 11
Location of Change	Type of Change	Reason for Change	
N/A	N/A		
Revision 1.0			Publish Date: 26 Jan 12
Location of Change	Type of Change	Reason for Change	
Section 5.0	Addition	Added section 5.6 to require separate removal of topsoil.	
Revision 1.1			Publish Date: 03 May 13
Location of Change	Type of Change	Reason for Change	
Section 3(3) and 6(5), Appendix A and B	Revision	Updated references to standard drawings.	
Revision 2.0			Publish Date: 17 Dec 18
Location of Change	Type of Change	Reason for Change	
Section 3(3), 4-6	Editorial	Updated references to current standard numbers.	
Section 5(6)	Revision	Made double ditching optional based on conditions.	
Section 5(7)(a)	Addition	Added requirement to survey pipeline profile a second time where C-SCC has been found.	
Section 6.0	Addition	Added allowance of <i>PipePillo</i> ™ Structured Pipeline Pillows or equivalent.	
Section 6(7)	Revision	Replaced 15 foot maximum spacing with reference to Appendix C.	
Section 6(8)	Revision	Replaced “vertical” with “downward” since most pipe supports do not prevent upward movement of pipe.	
Section 6(9)	Addition	Added consideration of reinforcing pipeline joints that are particularly susceptible to bending loads.	
Section 6(10)(a)	Revision	For lines identified with SCC, updated maximum support spacing without engineering review to from 10 to 12 feet to allow use of standard sleeve material.	
Section 6(10)(a)	Addition	For lines identified with SCC, allowed support spacing to be increased based on an engineering review.	

Section 6(10)(b)	Addition	Clarified that for lines previously identified with SCC, where circumferential cracks have been confirmed to be absent, then allowed pipeline spans are the same as for lines not previously identified with SCC. Added Figure 1.
Section 7(2)	Revision	Changed requirements for temporary supports and allow use of Appendix D.
Section 7(4)	Addition	Added requirements for backfilling in 12" to 18" increments. Added reference to EPCO safety manual.
Section 7(5)	Revision	Set requirement for using Appendix D when SCC is identified.
Section 7(7)	Addition	Added specific requirements for rock shield.
Section 8.0	Addition	Section added to address buoyancy effect for submerged pipe.
Appendix A and B	Revision	Revised maximum spacing to show reference to Appendix C.
Appendix C	Addition	Added Appendix C, which is a table showing maximum support spacing during excavation for various pipe diameters, wall thicknesses and grades.
Appendix D	Addition	Added Appendix D, which is a table showing maximum support spacing prior to backfill for various pipe diameters, wall thicknesses and grades.
Revision 3.0		Publish Date: 07 Feb 22
Location of Change	Type of Change	Reason for Change
Section 1.3	Addition	Added reference STD.9015 In-Field Pipe Material Testing Standard
Section 2.0	Revision	Revised Company definition
Section 4.0	Addition	Added AIM Pre-Excavation Report requirement (Section 4(3)). Added Material Verification review requirement for Natural Gas Transmission pipelines (Section 4(11)).