



## CORE LINEPIPE

# PROJECT EXECUTION PACKAGE



Revision #2  
01/07/2019



CORE LINEPIPE

910, 736 - 8<sup>th</sup> Avenue SW  
Calgary, AB, T2P 1H4  
Office: (587) 333-6685

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## 1. Project Kickoff Meeting

### 1.1 Setting the Project Up for Success

To ensure a successfully executed CORE Liner® job, it is critical that all stakeholders are involved in a project kickoff meeting. This provides CORE Linepipe® (“CORE”), the customer, EPCM, and pipeline contractor a forum for dialogue to align expectations and plan for success.

### 1.2 Critical Meeting Attendees

- CORE Linepipe®
  - ✓ Project Coordinator
  - ✓ Sales Representative
  - ✓ Job Foreman or Superintendent
- Customer/End user
  - ✓ Inspector(s)
  - ✓ Project Manager(s)
  - ✓ Safety/QC (as required)
- EPCM
  - ✓ Project Manager(s)
- Pipeline Contractor
  - ✓ Spread Boss
  - ✓ Management (as required)
  - ✓ Safety/QC (as required)





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### 1.3 Project Review

Review and fill out the project details on the forms included in [Appendix A](#). This document is intended to provide a comprehensive review of the project and should be signed and stored by all involved parties.

Project Information: Overview of general project information.

Contact Information: Contact details for the main personnel involved.

Review drawings: Review the pipeline layout and detail drawings (If not already performed).

Material Information: Overview of the material required.





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## 2. Site Organization

### 2.1 General

The CORE Service® team integrates into any conventional pipeline spread. The CORE Liner® system and CORE Service® team completely eliminate the need for pipeline welding (with the exception of flow joint fabrication and pile supports). At a high level, the CORE Service® team replaces conventional welding and liner crews. All other activities on the project will operate as they normally would for a steel pipeline project.

### 2.2 Productivity

The productivity rate of the CORE Service® team is a function of the time of year, scope of project, man power and equipment loading schedule, and overall project execution methodology.

The CORE Service® team works diligently to ensure timely project execution. Please refer to your Sales Order for expected CORE Service® crew days on-site which is based on historical production rates in the project area, season, complexity of tie-ins, bore sections, and crossings. To ensure the most efficient and cost-effective installation, planning, and collaboration between the CORE Service® team and contractor team is critical. Plans should be in place to eliminate non-productive time (defining required support, sequence, and access to tie-ins, planning bends etc.)

Review the parameters of the sales order.

The expected CORE Service® crew rotation is 24 days on, 5 days off. This is based off the new OHS guidelines for 2018.

### 2.3 Weather Considerations

- The CORE Service® team will ClickWeld® and electrofuse linepipe in ambient temperatures from -22°F (-30°C) to +95°F (+35°C).
- Like most pipe joining systems, the ClickWeld® and electrofusion process may be challenging in severe weather conditions. Excessive dust, rain and snow must be kept clear of the ClickWeld® joining process.
- The CORE Service® team will review weather situations with the pipeline inspector. The CORE Service® team reserves the right to suspend operations if weather conditions have the potential to affect the quality of the pipe joining system.



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## 2.4 Scope Matrix

The below breakdown highlights the division of responsibilities and work between CORE Service® and the pipeline contractor.

### Customer/Contractor to Provide:

- Licenses and permits
- Site preparation and access
- Pipeline right-of-way preparation (min 50ft (15m))
- Strip, ditch, lower, and backfill
- Pipe stringing including all equipment and personnel
- In-field CORE equipment mobilization
- A dedicated crew and equipment to support the CORE Service® team (stabbing crew)
  - Side boom with operator and labourer (100% of job duration)
  - No side boom – **NO ClickWeld®ing**
  - Pipe handling, positioning, rotating, aligning, and stabbing
- Field bending
- Equipment, material, and labor for crossings/bores/HDD
- Excavation of bell holes (to CORE specifications)
- **Minimum two lifting implements are required for in the ditch tie-ins and risers (Additional equipment may be needed depending on the project conditions)**
- Installation of shrink sleeves over ClickWeld®
- Pipe jeeping
- Supply and installation of sleeves, patches, melt sticks, for field jeep repairs
- Support pile and hardware for risers
- Tie-in of CORE Liner® risers
- Bolt up of all flanges, including supply of studs (1" longer), washers, and nuts
- Hydrotest including fluids and disposal
- Supply and install consumables as needed
- Pipeline quality control
- Reclamation of ROW including back fill
- **All other typical activities not specified under CORE's scope of work**

### Scope of CORE Service® (included in day rate):

- Review of drawings
- Site visit – suggested for projects over 3.11mi's (5km's)
- Coordinate delivery of pipe, bends, and ancillary materials to site
- Joining of all ClickWeld® joints
- Supply ClickWeld® pull head
- Supply ClickWeld® QC package
- Supply material MTRs

### Purchased from CORE Linepipe® by Customer:

- Supply of CORE Liner® product (Gateway Tubulars)
- Mob/Demob of CORE Liner® crew and equipment
- Pipe freight
- Supply of CORE Liner® risers/ROW bends
  - Bends between 30 to 90 degrees are recommended to be factory bent
- Supply of ClickWeld® flanges and transition pups
- Supply of shrink sleeves (1 per ClickWeld®)
- Supply and install riser vents

**\*Without dedicated support, CORE Linepipe® is unable to work**



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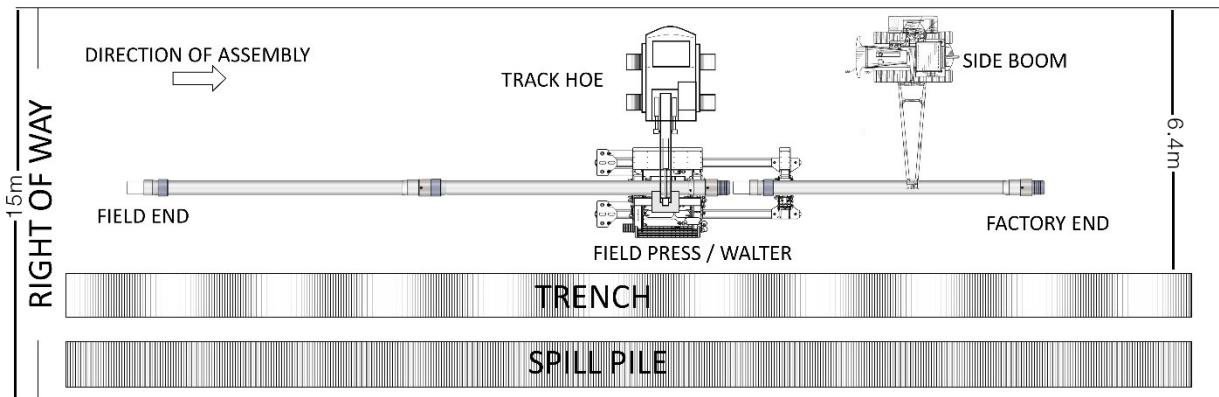
## 3. Installation Planning

### 3.1 Directional Assembly

CORE Liner® products have dissimilar ends. The product orientation has a significant impact on the installation logistics. To maximize efficiency, there is a need to properly synchronise the site layout with the direction of pipe loading, pipe stringing, work flow, crossing, boring, and tie-in directions. Proper planning can avoid wasted time on site as well as wasted materials.

CORE Liner® is assembled most efficiently in one direction as shown by the below ROW Layout. This is opposite to the direction of a typical pipeline workflow.

#### Directional Assembly and ROW Layout:



- Careful consideration and planning should be taken to ensure enough room is provided to tie-in the pipe.
- The standard CORE Liner® pull head connects to the factory end of the pipeline, this is the preferred end for the HDD pull direction.
- Throughout this document, the term “Factory End” will mean the mechanical male end of the product (alternatively described as the side of the factory installed press ring), whereas the term “Field End” will mean the mechanical female end (alternatively described as the side of the field installed press ring).

### 3.2 Pipe Position

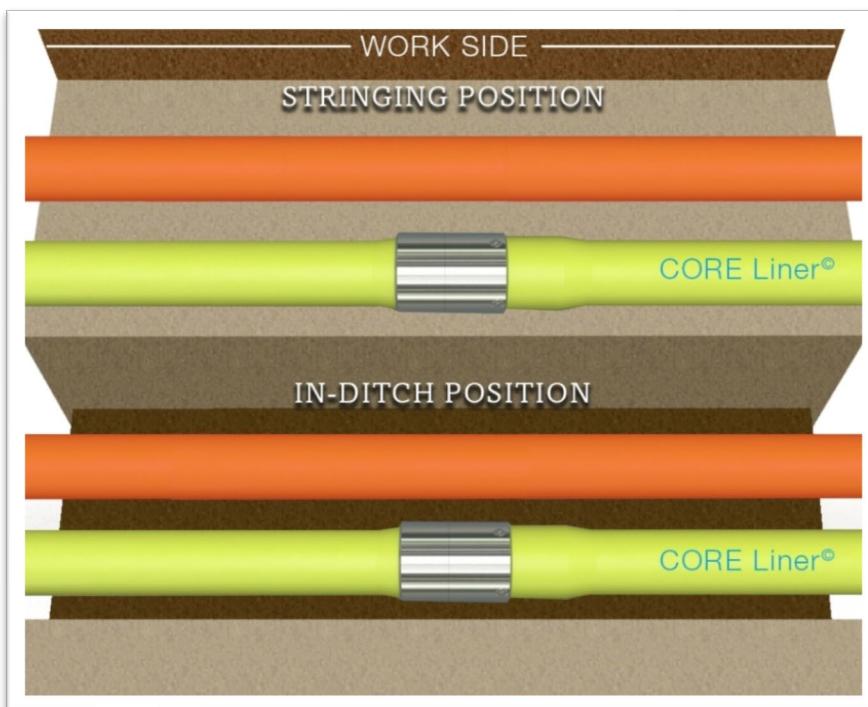
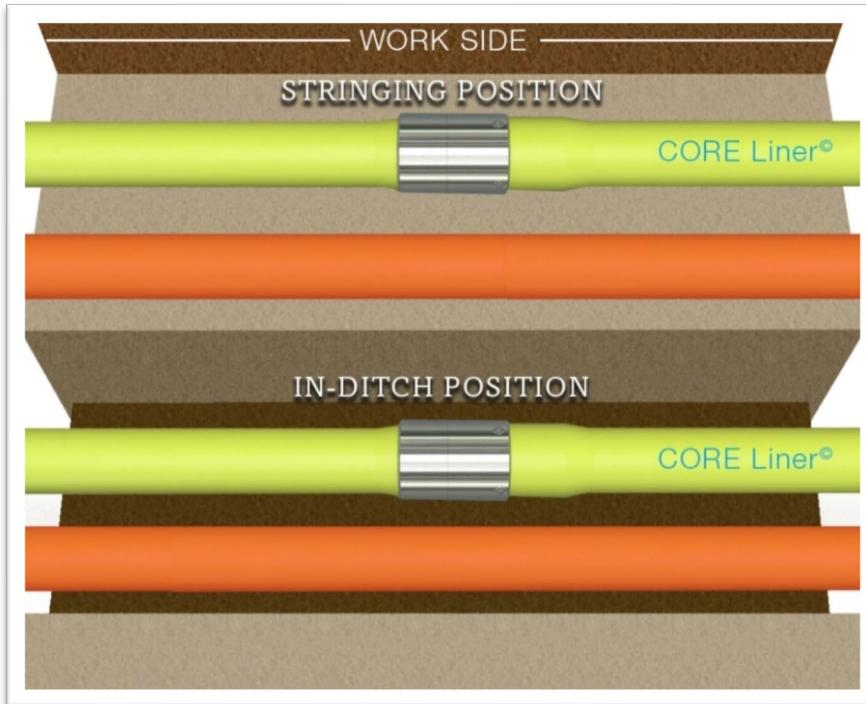
Sequencing of the ROW depends on the number of lines in the trench. For two lines, it is preferred that CORE Liner® is installed closer to the work side; however, it is workable to have CORE Liner® on the ditch side. For three or more lines that are to be installed in the trench, the pipelines should be laid out on the ROW such that to have the CORE Liner® be kept closest to the work side to allow for the movement of the installation equipment (Walter).



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**Two Lines:**

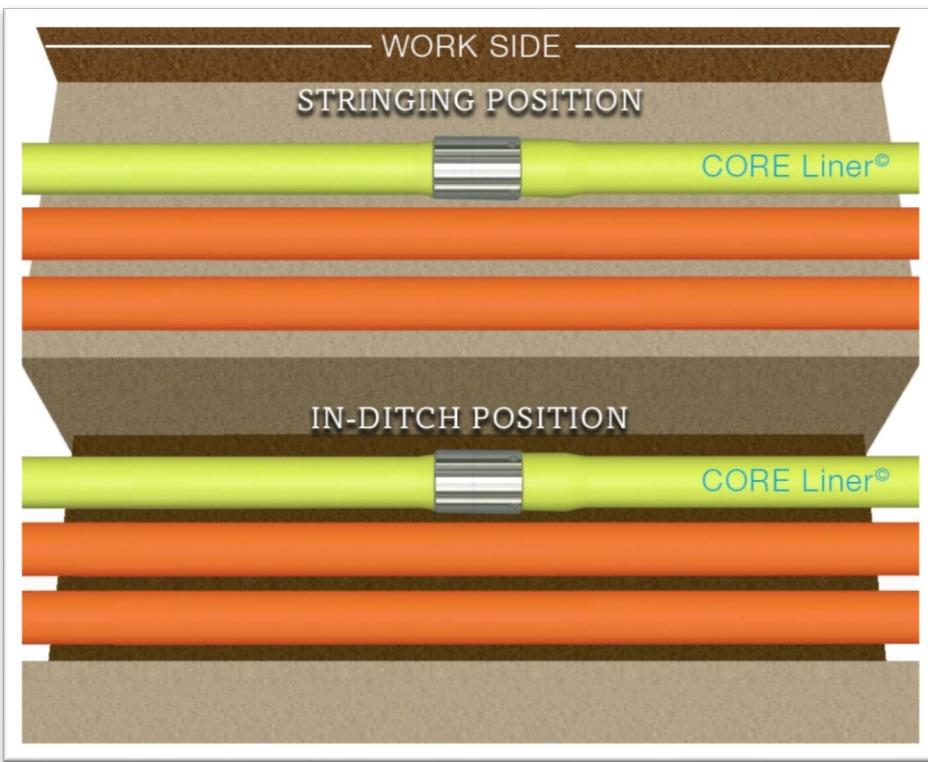




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Three (or more) Lines:



### 3.3 ROW Requirements

- Prior to the material arriving on site, the pipeline contractor should complete typical ROW preparation activities (fencing, stripping, clearing, brushing etc.).
- CORE Service® teams require unrestricted access to the ROW to ensure job efficiency.
- 50 feet (15 meters) minimum ROW is required.
- Workspace required is a minimum of 21 feet (6.4 meters) from the edge of ROW to the ditch.
- Spill pile and workspace to be on opposite sides of the ditch.

### 3.4 Custom Length

- CORE Liner® field crews are able to cut pipes to custom length on location using standard CORE Liner® product.
- CORE Service® utilizes the standard inventory that is shipped to the project site and recreates the ClickWeld® assembly utilizing CORE's patented equipment ("Walter") and process. This allows for the fabrication and installation of a precisely measured inline joint or flanged end fitting. There is NO welding required in this process. No pre-ordered fixed length PUPS are required.



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### 3.5 Bends & Risers

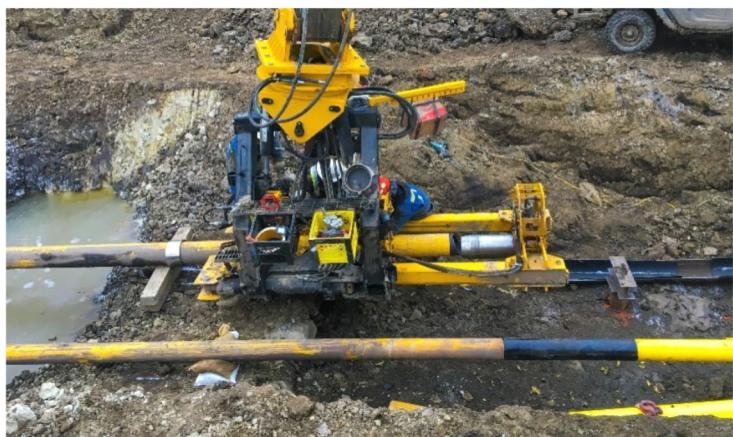
#### Bends



- Customer sign-off on ROW bend requirements (quantity and angle) is required prior to bending.

#### Risers

- Risers are factory bent and must be pre-ordered.
- Customer sign-off on CORE Liner® riser drawings is required prior to bending.
- A minimum of two separate lifting devices (track hoe, side boom, picker) are required for installation.
- CORE Liner® risers should be supported as per industry best practices or company policy.



- At all times ClickWeld® joints should be in straight sections of pipe, and at no time should the ClickWeld® joint be on the bent section.
- Roped bends, long sweeping bends, and drag sections react the same as conventional steel line pipe and are easily incorporated into the CORE system design.
- CORE Liner® should be bent cold to a minimum radius of 20D.
- Bends larger than 30 degrees should be factory bent and must be pre-ordered.

- Care should be taken to ensure that ditch depth and riser support options accommodate the riser dimensions.
- As-built drawings can be provided after bends are complete.

Example of Riser Sleeper



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### 3.6 Flow Joints

CORE Linepipe® does not supply custom flow joints at this time. Flow T's and Y laterals must be constructed using lap joint flanges and are easily integrated into the CORE Liner® system. Please contact your CORE Linepipe® representative for guidance.

Product Description	ID
6" 0.188" WT CORE Liner®	<b>5.75"</b>
8" 0.22" WT CORE Liner®	<b>7.53"</b>

### 3.7 Tie-Ins



- Above ground or below ground flange tie-ins can be accommodated.
- For in-line tie-ins, CORE Liner® requires a minimum of 3+ joint length gap starting from the joint needing connection.
- Refer to Bell Hole requirements and associated drawings for below grade work.
- A minimum of 2-Lifting units are required for tie-ins.



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### 3.8 Crossings

Plan the crossing such that to have at least half a pipe length from the live line to the ClickWeld®.



### 3.9 HDD and Boring

CORE Linepipe® products are compatible with HDD and boring scenarios.

CORE Linepipe® has developed custom pull heads to be used when pulling drag sections of CORE Liner®. The pull heads are specially designed to eliminate damage to the mandrel while providing excellent tensile pull capability.

The reusable CORE pull head can only attach to the factory end mandrel. Keep this configuration in mind when planning the directionality of a bore pull. It is possible to reverse the direction to accommodate nonconforming bore directions, but this will lead to extra work time and costs (i.e. welded pull head or transition pup).



To facilitate tie-in locations, ensure a minimum of 32.8 feet (10 meters) of pipe protrudes from the bore entry and exit.



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### 3.10 Bell Hole

At risers and tie-in points where CORE Service® is working in the ditch, bell holes are required with proper entrance and egress, following industry best-practices.

CORE Linepipe® requires accessible bell holes that are big enough to accommodate the installation equipment Walter. Typically, a bell hole of at least 8.2 feet (2.5 meters) wide by 20 feet (6 meters) long is required.



### 3.11 Planning Summary

Discuss, agree, and summarize the construction and site details using the forms in Appendix A.

- Construction Information: Overview of the construction details
- Site Considerations: Site specific considerations



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## 4. Pipe on Site

### 4.1 Pipe Delivery

CORE Linepipe® arrives on specially designed pipe bunks (provided by CORE) and can be unloaded using conventional slings, vacuum, or other approved methods.

**\*Stringing hooks are not to be used on pipe ends. This can potentially damage the packaging, mandrel, or liner ends of the CORE Liner® system.**

- Ensure appropriate lifting devices are in place according to customer's safety standards.
- Special care is to be taken at all times to ensure that the ends of each joint of pipe are not damaged.
- Do not unpack or unwrap the ends of the CORE Liner®. Please leave this until you are directed by the CORE Service® team.
- Pipe bunks need to be returned to CORE Linepipe®.

### 4.2 Pipe Storage

If pipe staging is necessary, set aside a flat level area of an appropriate size. CORE Linepipe® requires different storage practices from that of bare steel. Safe and effective storage of CORE Liner® products entails two main considerations over conventional steel pipe:

1. The ends of the pipe have rings that increase the diameter of the pipe. This larger diameter restricts the ability to "pyramid" stack the pipe. Spacers (pipe bunks) are required between the pipe layers to secure the pipe stack and to protect the pipe cover.
2. The ends of the pipe require keeping the packaging in place to protect the ClickWeld® components from the environment.

Follow the below steps for storing CORE Liner®:

1. Ensure the storage location has stable, level ground. Verify that the area has sufficient access for operators, lifting equipment, and pipe.
2. Clear the area of any hazards that may affect the pipe and the storage process.





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3. CORE Liner® can be placed on wooden dunnage for a single level. The spacing of the dunnage should allow equipment to access the pipe and evenly support the pipe. Sufficient support under the pipe is needed to reduce cover damage. There must however be stops on the ends to prevent the pipe from rolling.



4. When stacking pipe, pipe bunks are required. Ensure the pipe maintains even contact within the bunks. Misaligned or twisted bunks put unwanted stress on the pipe cover.



**CORE Linepipe® cannot be stacked without bunks.**

5. Place pipe into bunks. Follow industry standards for proper lifting and moving of pipe. Start by placing pipe in the back-bunk pocket. Slow controlled movement is needed to ensure the pipe fits into the pockets and does not roll off the bunks. If available, antiroll-off equipment should be used (like a forklift on the back side). Aggressive pipe placement should be avoided to reduce pipe cover and packaging damage.
6. Place each layer of bunks above the previous bunk layer as more pipe layers are added. Avoid stacking pipe layers too high (maximum 7 layers) as it becomes difficult to see pipe placement, and causes excessive cover damage.



Please refer to your external cover manufacturers for additional storage recommendations.



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#### 4.3 Pipe Stringing

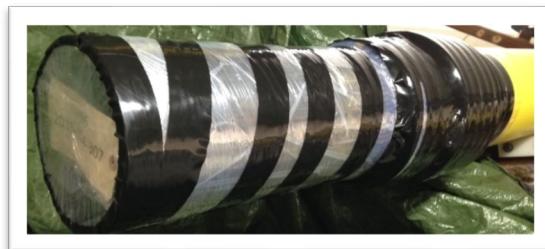
- Orient the pipe as determined at the pre-job meeting (factory and field end, directional stringing required).
- Pipe is to be strung to ensure that the factory end (mechanical male end) is aligned with the field end (mechanical female end) of the adjacent pipe.
- As CORE Liner® is required to be double tubbed, plan on using twice as many pipe tubs. The tubs should be placed 11.5 feet (3.5 meters) from the pipe end.

#### 4.4 End Protection

As end packaging performs a critical function in protecting ClickWeld® components, the packaging must be kept on the pipe ends up until the installation time. Prolonged storage without packaging can result in corrosion and contamination. In extreme circumstances, excessive corrosion and contamination of the ClickWeld® components may require the steel pipe to be reworked. Removal of contamination requires time and vigilance that typically slows down installation.

Ensure pipes in storage and pipes strung on the right of way have adequate packaging at the ends.

1. If the packaging has minor damage, repair by patching over the damaged area. Weather-resistant pipeline tape is recommended.
2. If there is no packaging on the pipe ends, or the packaging is severely damaged, the pipe ends need to be repackaged. The required material can either be procured locally or from CORE Linepipe®.
3. Basic layering of packaging consists of:
  - a. Plastic netting over steel parts: to provide an air gap between the steel and the plastic bag.
  - b. UV resistant plastic bag onto the pipe end extending over the steel onto the pipe cover: to keep out moisture.
  - c. Stretch wrap around the bag to hold it in place.
  - d. Tape around plastic bag: to seal the pipe end and secure bag.





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## 5. Pipeline Construction

### 5.1 Communication on Site

- At all times, ensure communication is established visually, and verbally (if possible), before moving any tubulars.
- It is CRITICAL that all personnel on the job site are aware of hazards and operations.
- COMMUNICATE AT ALL TIMES TO ENSURE WE ALL WORK SAFELY.
- If at any time there are questions or concerns the CORE Service® team strongly encourages you to STOP WORK and discuss the issue.
- Please ensure that the pre-job Hazard Assessment is done and revisited if scope of work changes.
- Any infield mobilization requirements must be communicated in advance to the CORE Service® Manager.



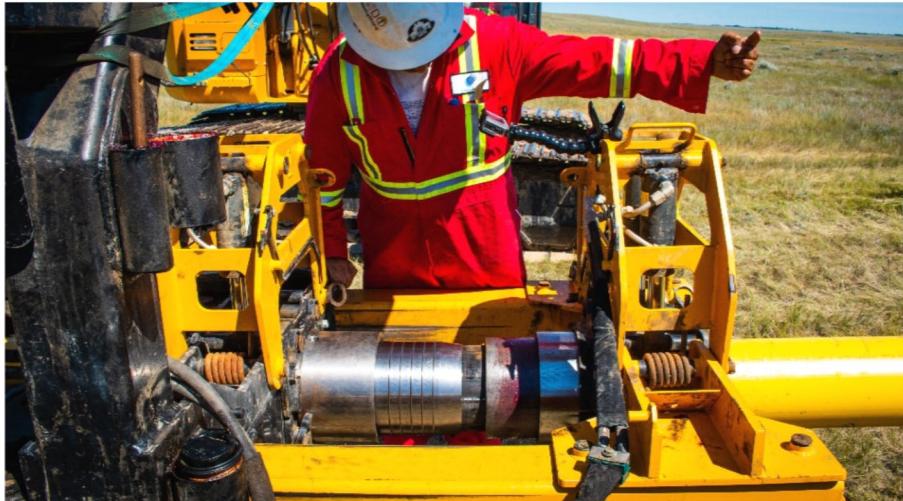


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## 5.2 ClickWeld®ing

- The packaging shall only be removed immediately prior to ClickWeld® assembly.
- Pipe is to be double tubbed, tubs to be placed a minimum of 11.5 feet (3.5 meters) from the end of the pipe. If possible, tall tubs are preferred.



## 5.3 Night Capping

Exposed pipe ends that are going to be left unjoined overnight, need to be repackaged (as described in [4.4 End Protection](#)) to prevent moisture and other contaminants/debris from entering the pipe.

If an unjoined pipe end must be left in the ditch, it must be elevated off the ditch bottom and a proper water tight end packaging must be provided by a qualified CORE representative. You must ensure to notify a CORE representative when a water tight end packaging is required.

\*Failure to properly protect the CORE Liner® ends may cause damage to the product resulting in the inability to use those sticks of pipe.

## 5.4 HDD & Boring

It is recommended to hydrotest the pull section prior to the pull job, according to industry best practice. Please refer to [5.5 Bore Section Hydrotest Procedure](#).

Follow the below guidance for a successful pull job:

1. Ensure plugs, seals and shrink sleeves are installed prior to pulling the drag section.
2. The leading edge of shrink sleeves should be protected to avoid damage. A Thrust-Bore Kit, Scar-Guard, or other protection is recommended on HDD sections.
3. The custom pull head, steel bell cover, and mandrel sealing plug must be used to eliminate damage and debris from entering the ClickWeld® joint.
4. Precautions should be taken to protect external coating of lined pipe if being installed into a bore casing (as per standard steel line pipe practices).



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5. The pipe section must be pulled from the factory end side (male mechanical end).

Product Description	Maximum Recommended Tensile Force	Maximum Recommended Torsional Force	Minimum Reamer Size in Compressible Soil	OD of ClickWeld® Joint
6" x 0.188"WT CORE Liner®	170,000lbs 756kN	**	12"	9.5"
8" x 0.22"WT CORE Liner®	190,000lbs 845kN	**	14"	12.8"

\*Parameters listed above are based on typical bore/HDD scenarios. Please consult CORE Linepipe® for any job specific considerations.

\*Consultation with HDD contractor is recommended.

**\*Care must be taken to ensure no dirt or contaminants enter the pipeline. Electrofusions that come in contact with any drilling fluid must be cut out. Please review with your CORE Service® team.**

\*\*No special design considerations required for torsional force. Use standard Engineering design limits for the base steel pipe.





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## 5.5 Bore Section Hydrotest Procedure

### CORE Linepipe® Recommended Test Procedure for Above Ground Hydrotests of pull sections:

- Vent lines are to remain open for the strength test and the leak test.
- Plugs, seals, and caps are to be properly installed.
- No shrink sleeves are to be installed prior to hydrotest.
- Use only medium density foam pigs.
- Install a digital pressure gauge to monitor bore pressure.
- Record volume of fluid pumped into pipe for each step below.

#### 1. Strength hydrotest:

	300 ANSI (PN 50)	600 ANSI (PN 100)	900 ANSI (PN 150)			
	MAOP 720 psi (4.96 MPa)	MAOP 1440 psi (9.93 MPa)	MAOP 2160 psi (14.89 MPa)			
a. Fill line, removing all trapped air.						
b. Bump to pressure and hold for at least 15 minutes and until there is no air flow at the vents.	50 psi 0.3 MPa	50 psi 0.3 MPa	50 psi 0.3 MPa			
c. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	300 psi 2.1 MPa	500 psi 3.4 MPa	500 psi 3.4 MPa			
d. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	500 psi 3.4 MPa	1000 psi 6.9 MPa	1200 psi 8.3 MPa			
e. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	700 psi 4.8 MPa	1500 psi 10.3 MPa	2200 psi 15.2 MPa			
f. Bump to pressure until stable or rising pressure is achieved. It is not uncommon to see small amounts of fluid from the vent ports during this portion of the test.	<b>Min</b>  900 psi 6.2 MPa	<b>Max<sup>1,3</sup></b>  1125 psi 7.8 MPa	<b>Min</b>  1800 psi 12.4 MPa	<b>Max<sup>1,3</sup></b>  2225 psi 15.3 MPa	<b>Min</b>  2700 psi 18.6 MPa	<b>Max<sup>2</sup></b>  2970 psi 20.5 MPa
g. Adjust the pressure to the appropriate test pressure, and hold for at least 30 minutes. Ambient temperature fluctuations will affect the recorded pressure. A flat or slightly increasing pressure is desired over the hold period.						

<sup>1</sup> Based on ASME B16.5 Group 1.1 materials (e.g. ASTM A 350 LF2 class 1 or CSA Z 245.12 GR 359)

<sup>2</sup> Equivalent to 100% of SMYS of 6" Pipe

<sup>3</sup> It is permitted to exceed the maximum pressure by up to 0.3 MPa (50 psi) during pressure stabilization.

#### 2. Liner leak test:

- Following the structural test, reduce the pressure to 2 MPa (290 psi) and hold for 30 minutes.
- During the liner leak test, the annulus vents shall be periodically monitored for flow of liquids.

#### 3. De-water/de-pressure line.



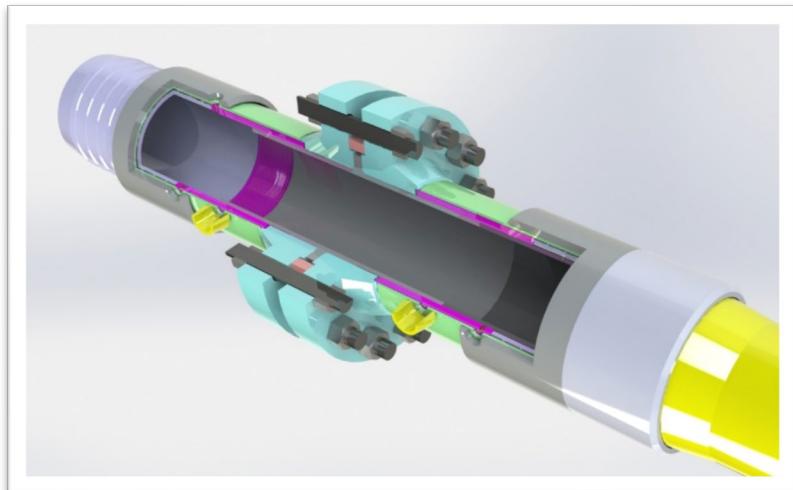
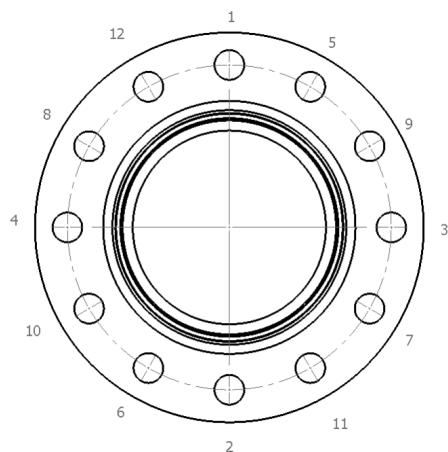
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## 5.6 Flanged Connections

- Flange fittings are applied to CORE Liner® product using the proprietary ClickWeld® process.
- CORE Liner® flanged joints require stud bolt that are one inch (1") longer than the stud bolts used on typical steel to steel flanges. This is to account for the HDPE liner stub ends.
- CORE Liner® flanged joints are to be connected as follows:
  - Install the CORE Liner® compression ring.
  - Install the stud bolts, nuts, and washers.
  - Tighten the bolts as per the below procedure:

**Tightening Pattern**



Flange Size	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
	Repeat 2X	Repeat 2X	Repeat 2X	Repeat 2X		Repeat as many times as necessary until all nuts are at final torque and compression ring is tight**
6" - 300 ANSI	80 ft-lbs	150 ft-lbs	300 ft-lbs	N/R	Wait at least 5 minutes*	300 ft-lbs
6" - 600 ANSI	80 ft-lbs	150 ft-lbs	300 ft-lbs	500 ft-lbs		500 ft-lbs
6" - 900 ANSI	80 ft-lbs	150 ft-lbs	360 ft-lbs	600 ft-lbs		600 ft-lbs
8" - 300 ANSI	80 ft-lbs	150 ft-lbs	300 ft-lbs	400 ft-lbs		400 ft-lbs
8" - 600 ANSI	80 ft-lbs	150 ft-lbs	360 ft-lbs	600 ft-lbs		600 ft-lbs

\*The plastic flange will relax over time. The longer you wait, the less cycles in step 6 will be necessary to reach final torque.

\*\*It is very important that the steel compression ring between the flanges is being compressed between the steel flanges.

\*\*\* Use a calibrated torque wrench.

- CORE does not apply external protection to flange assemblies. For underground flanges, it is recommended that the contractor apply Denso tape or equivalent to the flange assembly.



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## 6. Quality Control

### 6.1 ClickWeld®

The ultimate validation for CORE's ClickWeld® joints is a successful hydrotest. Prior to the CSA Z662 specified hydrotest, there are multiple quality control checks that demonstrate the robustness of the ClickWeld® joint.

- ✓ Daily calibrations are completed in the field
- ✓ Destructive electrofusion decohesion tests are completed after every 50 fusions
- ✓ Electrofusion computer processors are calibrated on a set schedule by a qualified third-party
- ✓ Processors generate digital logs of critical parameters for each fusion
- ✓ CORE ClickWeld® numbers match the electrofusion numbers so we can identify if any steps are out of sequence to prevent missing an electrofusion
- ✓ A ClickWeld® map is generated for each project, and is signed off by the Field Foreman prior to hydrotest

### 6.2 Pipeline Quality Control

CORE Linepipe® provides a complete Quality Control ("QC") package and weld map for CORE Liner® products. Any other QC requirements for mechanical works are to be provided by the mechanical contractor.





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## 7. Lowering in the Ditch

### 7.1 Lowering

- CORE Liner® product handles very similarly to conventional line pipe.
- **Only CORE approved pipe cradles (pneumatic rubber-tire)** must be used as the outer diameter (“OD”) of the ClickWeld® joint is larger than the OD of the pipe (see photo).
- Shrink sleeves are installed after electrofusion, plugs, and seals, but prior to lowering into the ditch.



When backfilling, follow industry best-practices to ensure the external coating is not compromised (selectively shade, no large rocks or ice clumps etc.). No special padding is required for CORE products. Review backfilling requirements with external coating supplier(s).

### 7.2 Buoyancy Control

CORE products are compatible with industry standard buoyancy control systems (pipe weights).



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## 8. Hydrotest Procedure

### One hydrotest, not two.

CORE has worked closely with industry regulators to ensure all products comply with testing requirements.

#### CORE Liner® and CSA Z662 13.2.7.1

Compared to traditional liner installation, factory-lined CORE Liner® has the advantage of being a one-step process. As a result, there is no need for two hydrotests as the verification of the steel and the liner integrity can be completed in one test.

*CSA Z662 13.2.7.1: Pressure testing following the liner insertion is primarily intended to leak test the liner, not to test the mechanical integrity of the steel carrier piping. The intent is to inspect annulus vents while the pressure is held at 2.0 MPa, after a leak test above 2.0 MPa, to check for evidence of possible liner leaks that might have been sealed in the annulus when the pressure was above 2.0 MPa. Controlled depressurization is required to avoid potential liner collapse or other damage due to rapid pressure reduction.*

*Following liner insertion, the lined pipeline shall be given a 4 h leak test at 100% of the maximum operating pressure. Where such a leak test pressure is above 2.0 MPa, the pressure shall then be lowered to 2.0 MPa and held for an additional 4 h. For liners installed in new steel pipelines that have passed field pressure tests in accordance with Clause 8, the 4 h liner leak test may be performed with air in accordance with a test procedure approved by the company.*

### Benefits

CORE Liner® joints are validated through tolerance control in the factory via incoming and outgoing inspections of pipe and fitting components. These parts are re-inspected visually in the field and ClickWeld® pressures are monitored during fitting energization. The hydrotest confirms structural integrity of these joints.

Liner and electrofusion couplers are inspected in the factory. The electrofusion joint is validated first through weld parameters and the fusion processor will identify that the fusion parameters are within specifications which proves fusion quality.

The hydrotest verifies the liner is sealed.

CORE Linepipe® recommends the following hydrotest procedure in accordance with the relevant sections of CSA Z662. (Section 4, 8, 13).

### Note

The amount of water required to fill and pressurize the CORE Liner® pipeline can be estimated as follows:

Pipeline diameter	6"	8"
Volume of water	995 ft <sup>3</sup> /mile (17.5 m <sup>3</sup> /km)	1705 ft <sup>3</sup> /mile 30 m <sup>3</sup> /km



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**CORE Recommended Test Procedure:**

As per CSA Z662 clause 8.7.1.1, piping intended for operation at pressures greater than 700 kPa shall successfully undergo a strength test followed by a leak test. Vent lines are to remain open for all tests. Use only medium density foam pigs. It is important to record the hydrotest information while the test is being performed. This will help in troubleshooting should the hydrotest become problematic. Please record the hydrotest details using form # CLP-F-HR-1.

1. Strength test:

As per CSA Z662 Table 8.1, it is required to perform the strength test at a minimum pressure of  $1.25 \times \text{MAOP}$  for water, oil and oil emulsion lines (LVP service fluids). The hydrotest shall be performed such that the hydrotest pressure of  $1.25 \times \text{MAOP}$  is applied at the pipeline section located at the lowest elevation. The actual pressures at pipeline sections located at higher elevations will be dictated by the elevation profile of the pipeline.

	300 ANSI (PN 50)	600 ANSI (PN 100)	900 ANSI (PN 150)			
	MAOP 720 psi (4.96 MPa)	MAOP 1440 psi (9.93 MPa)	MAOP 2160 psi (14.89 MPa)			
a. Fill line, removing all trapped air.						
b. Bump to pressure for 60 minutes per 1000m of pipeline. For example, if line is 1500m, time should be 90 minutes.	50 psi 0.3 MPa	50 psi 0.3 MPa	50 psi 0.3 MPa			
c. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	300 psi 2.1 MPa	500 psi 3.4 MPa	500 psi 3.4 MPa			
d. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	500 psi 3.4 MPa	1000 psi 6.9 MPa	1200 psi 8.3 MPa			
e. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	700 psi 4.8 MPa	1500 psi 10.3 MPa	2200 psi 15.2 MPa			
f. Bump to pressure and hold until stable or rising pressure is achieved. It is not uncommon to see small amounts of fluid from the vent ports during this portion of the test.	Min  900 psi 6.2 MPa	Max <sup>1,3</sup>  1125 psi 7.8 MPa	Min  1800 psi 12.4 MPa	Max <sup>1,3</sup>  2225 psi 15.3 MPa	Min  2700 psi 18.6 MPa	Max <sup>2</sup>  2970 psi 20.5 MPa
g. Adjust the pressure to the appropriate test pressure, and hold for at least 4 hours. Ambient temperature fluctuations will affect the recorded pressure. A flat or slightly increasing pressure is desired over the 4-hour hold period. <b>A slight pressure drop over the hold period combined with a quick reduction in the rate of the pressure drop typically indicates the pressure is stabilizing rather than the presence of a leak.</b>						

<sup>1</sup> Based on ASME B16.5 Group 1.1 materials (e.g. ASTM A 350 LF2 class 1 or CSA Z 245.12 GR 359)

<sup>2</sup> Equivalent to 100% of SMYS of 6" Pipe

<sup>3</sup> It is permitted to exceed the maximum pressure by up to 0.3 MPa (50 psi) during pressure stabilization.



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2. Liner leak test:

- a. Following the successful completion of the strength test, de-pressurize the line to atmospheric pressure and maintain for a duration of 1 hour. This is to allow the liner to relax, thus facilitating the detection of a pressure drop in the unlikely event of a leak.
- b. Increase the pressure to 2 MPa (290 psi) and stabilize the pressure at 2 MPa (290 psi) until a flat or slightly increasing pressure is achieved.
- c. Hold the pressure for 4 hours at 2 MPa (290 psi). Ambient temperature fluctuations will affect the recorded pressure. A flat or slightly increasing pressure is desired over the 4-hour hold period. A slight pressure drop over the hold period combined with a quick reduction in the rate of the pressure drop typically indicates the pressure is stabilizing rather than the presence of a leak.
- d. During the liner leak test, the vents on the annular space shall be periodically monitored for flow of liquids.

3. De-pressure/De-water the line.

Depending on the temperature of the hydrotest fluid, there may be a period of time required to reach temperature equilibrium. It is not unusual to take as much as 12 hours for this to occur.

During temperature equalization, it is not uncommon to see pressure changes of 0.7 – 2.0 MPa (100psi – 300psi).





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## 9. Cathodic Protection

The ClickWeld® joint in CORE Linepipe® products are high interference fit steel-to-steel joints and as such are electrically conductive with the same amount of electrical resistance as the base pipe. As a result, CORE Linepipe® products are compatible with industry standard cathodic protection systems.

## 10. Returning Material

### 10.1 Return Policy

CORE Linepipe® makes every effort to ensure enough pipe, risers, and flanged end fittings are shipped to each pipeline project. Contingency amounts are reviewed with each customer prior to loading pipe onto trucks.

In certain cases, left-over materials remain after a project that cannot be used on subsequent projects. In these instances, CORE Linepipe® and our distributors will accept a return of materials for credit less a restocking and inspection fee in the amount of 20%.

### 10.2 Return Procedure

Please contact your CORE representative for a **Return Material Authorization (RMA)** number. Please reference this RMA number when booking your unloading time at the CORE yard.

Please return pipe with the CORE packaging intact. Upon receipt at our plant, the pipe will be inspected for damage to:

- ✓ External coating
- ✓ Field ring
- ✓ Liner
- ✓ Mandrel
- ✓ Factory ring
- ✓ Electrofusion hole alignment
- ✓ Electrofusion quality (resistivity in ohms)

Any replacement parts or external coating repair sleeves will be invoiced to the end-user.

### FREQUENTLY ASKED QUESTIONS

#### Instead of returning pipe, how can I store CORE Liner® in my bone yard?

- CORE can provide customers with CORE custom pipe storage bunks to facilitate pipe handling and storage requirements.
- CORE Service® team members can provide end-cap material to keep the CORE Liner® pipe protected and clean.

#### How long can CORE Liner® pipe be held in storage?

- CORE Liner® can be stored like traditional steel lined pipe. Please refer to your external jacket coating manufacturer's recommendation.



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## Appendices

### APPENDIX A: Forms & Checklists



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### Project Information

SCOPE REVIEW ITEM	DETAIL	REVIEW COMPLETED
<b>Location</b>		<input type="checkbox"/>
<b>LSD</b>		<input type="checkbox"/>
<b>Camp or Closest Municipality</b>		<input type="checkbox"/>
<b>AFE/PO #</b>		<input type="checkbox"/>
<b>SOA #</b>		<input type="checkbox"/>
<b>Customer Project #</b>		<input type="checkbox"/>
<b>Billing/Invoicing Requirement</b>		<input type="checkbox"/>
<b>Approved Application Review #</b>		<input type="checkbox"/>
<b>Expected Start Date</b>		<input type="checkbox"/>
<b>Expected Project Duration</b>		<input type="checkbox"/>
<b>Drawing and Survey Review</b>		<input type="checkbox"/>



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### Contact Information

SCOPE REVIEW ITEM	DETAIL	REVIEW COMPLETED
<b>Project Manager</b>		<input type="checkbox"/>
<b>Phone #</b>		<input type="checkbox"/>
<b>Email</b>		<input type="checkbox"/>
<b>Project Supervisor</b>		<input type="checkbox"/>
<b>Phone #</b>		<input type="checkbox"/>
<b>Email</b>		<input type="checkbox"/>
<b>Contractor</b>		<input type="checkbox"/>
<b>Contractor Spread Contact</b>		<input type="checkbox"/>
<b>Phone #</b>		<input type="checkbox"/>
<b>Email</b>		<input type="checkbox"/>
<b>CORE Linepipe® Corporate</b>		<input type="checkbox"/>
<b>Phone #</b>		<input type="checkbox"/>
<b>Email</b>		<input type="checkbox"/>
<b>CORE Field Contact</b>		<input type="checkbox"/>
<b>Phone #</b>		<input type="checkbox"/>
<b>Email</b>		<input type="checkbox"/>
<b>Safety Contact</b>		<input type="checkbox"/>
<b>Phone #</b>		<input type="checkbox"/>
<b>Email</b>		<input type="checkbox"/>
<b>QC Contact</b>		<input type="checkbox"/>
<b>Phone #</b>		<input type="checkbox"/>
<b>Email</b>		<input type="checkbox"/>
<b>Accounts Payable Contact</b>		<input type="checkbox"/>
<b>Phone #</b>		<input type="checkbox"/>
<b>Email</b>		<input type="checkbox"/>



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### Material Information

SCOPE REVIEW ITEM	DETAIL	REVIEW COMPLETED
<b>Product</b>		<input type="checkbox"/>
<b>Survey Length</b>		<input type="checkbox"/>
<b>Total Pipe Length</b>		<input type="checkbox"/>
<b>Total Joints</b>		<input type="checkbox"/>
<b>Pipe - YJ m</b>		<input type="checkbox"/>
<b>Pipe- YJ joints</b>		<input type="checkbox"/>
<b>Shrink Sleeve Requirements</b>		<input type="checkbox"/>
<b>Pipe - YJ2K m</b>		<input type="checkbox"/>
<b>Pipe - YJ2K joints</b>		<input type="checkbox"/>
<b>Shrink Sleeve Requirements</b>		<input type="checkbox"/>
<b>Flanges, ANSI &amp; Grade</b>		<input type="checkbox"/>
<b>Risers</b>	<b>45 Degree Riser</b>	<input type="checkbox"/>
	<b>90 Degree Riser</b>	<input type="checkbox"/>
<b>Factory Bends</b>		



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### Construction Information

SCOPE REVIEW ITEM	DETAIL		REVIEW COMPLETED
Pipe Hauling supplied by			<input type="checkbox"/>
Pipe Hauling tarped			<input type="checkbox"/>
Stringing/loading direction confirmed	Mandrel Front	Mandrel Back	<input type="checkbox"/>
	Yes/No	Yes/No	
Stringing method (hooks not permitted)			<input type="checkbox"/>
Shrink Sleeve supplied by			<input type="checkbox"/>
Shrink Sleeve installed by			<input type="checkbox"/>
Estimated time of construction			
Productivity Expectations			<input type="checkbox"/>
Temperature and Weather Considerations			<input type="checkbox"/>
Pipeline Contractor Support for CORE			<input type="checkbox"/>
Main Line			<input type="checkbox"/>
Tie-Ins			<input type="checkbox"/>
Risers			<input type="checkbox"/>
Field Bending Specification			<input type="checkbox"/>
Line Crossings			<input type="checkbox"/>
Road Crossings (open cut)			<input type="checkbox"/>
Bores/HDD (number, meterage, procedure)	bore exit detail, excess pipe length		<input type="checkbox"/>
Bore direction/Pull head requirement			<input type="checkbox"/>
Transition pup requirements			<input type="checkbox"/>
In-line tie-ins (procedure review)			<input type="checkbox"/>
Flow Joint tie-ins requirements			<input type="checkbox"/>
CORE bell hole details			<input type="checkbox"/>
Jumper Vent Assembly			<input type="checkbox"/>
H <sub>2</sub> S Monitors?			<input type="checkbox"/>
Accommodations confirmed?			<input type="checkbox"/>
Fuel			<input type="checkbox"/>
Subsistence			<input type="checkbox"/>
Demob			<input type="checkbox"/>



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## Site Considerations

ITEM DESCRIPTION	NOTES
<b>Safety Considerations</b>  e.g. Tickets, hazards, other	
<b>Operational Activity Challenges</b>  e.g. Truck traffic, rigs, livestock, other concurrent projects	
<b>Ground Conditions</b>  e.g. Moisture and liquid pooling, regional soil conditions, muskeg, rocky conditions etc.	
<b>Topography</b>  e.g. Hills, valleys, streams, rivers, creeks etc.	
<b>ROW Access</b>  e.g. Infield mob	
<b>Construction Direction</b>  e.g. Loading, stringing, assembly, bores	
<b>Regional or Landowner Considerations</b>  e.g. Equipment cleanliness	



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## **APPENDIX B: Hydrotest Report Form**



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## CORE Linepipe Hydrotest Report

<b>Test Date</b>	
<b>Customer</b>	
<b>Job Number</b>	
<b>Pipeline Dia</b>	
<b>Test Section Length</b>	
<b>High Point Elevation</b>	
<b>Low Point Elevation</b>	

<b>Test Section Start LSD</b>	
<b>Test Section End LSD</b>	
<b>High Point Riser LSD</b>	
<b>High Point Riser Elevation</b>	
<b>Low Point Riser LSD</b>	
<b>Low Point Riser Elevation</b>	
<b>Pressure Sensor Location</b>	

<b>Test Pressure</b>	
<b>Test Medium</b>	
<b>Water Source</b>	
<b>Antifreeze Type and %</b>	
<b>Mixture Temperature</b>	

<b>Gauge Number</b>	
<b>Dead Weight Number</b>	
<b>Chart Recorder Number</b>	

<b>QC Inspector</b>	
<b>Signature</b>	
<b>Date</b>	

<b>Owner's Inspector</b>	
<b>Signature</b>	
<b>Date</b>	



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## **APPENDIX C: External Coating Bulletin**



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## External Coating Bulletin



CORE Linepipe

6/4/2018



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### Attachments:

- MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP): CANUSA-CPS MS1F
- MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP): CANUSA-CPS CRPO
- MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP): CANUSA-CPS K-60
- MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP): CANUSA-CPS TBK-60



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## EXTERNAL COATING & HOLIDAY DETECTION

### Holiday Detection (Jeeping)

- Holiday detection and jeeping is the responsibility of the pipeline contractor
- Standard industry holiday detection practices apply to CORE products



Figure 1 - Holiday Detection



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## Applying External Coating

### General

- This document describes applying external coating on CORE Liner®, and includes:
  - Repair of external coating, performed at the factory or in the field.
  - Applying external coating on assembled ClickWeld® joints, performed in the field.

### Products Used

CORE Linepipe® requires the use of the following products for external coating:

Activity	Product
Coating repair, damage size <1/2"	CANUSA-CPS MS1F
Coating repair, damage size 1/2" to 2"	CANUSA-CPS CRPO
Coating repair, damage size >2"	CANUSA-CPS K-60 Wrapid Sleeves™
Coating Clickweld® joints, open cut	CANUSA-CPS K-60 Wrapid Sleeves™
Coating Clickweld® joints, directional drilling	CANUSA-CPS TBK-60 Tunnel Bore Kit

CORE Linepipe® requires the use of the following shrink sleeves:

Activity	Product Name	Canusa Size <sup>1</sup>	Sleeve Width, mm
Coating repair, NPS 6" pipe <sup>2</sup>	K-60 170-600 WW YE/T	170	600
Coating repair, NPS 8" pipe <sup>3</sup>	K-60 230-600 WW YE/T	230	600
Coating repair, NPS 6" swage	K-60 230-600 WW YE/T	230	600
Coating repair, NPS 8" swage	K-60 280-600 WW YE/T	280	600
Coating Clickweld® joints, for NPS 6"	K-60 230-600 WW YE/T <sup>4</sup> TBK-60 230-600 BK/T <sup>5</sup>	230	600
Coating Clickweld® joints, for NPS 8"	K-60 280-600 WW YE/T <sup>4</sup> TBK-60 280-600 BK/T <sup>5</sup>	280	600

1. Canusa reference, not an actual dimension.
2. If the required shrink sleeve size is not readily available, shrink sleeves K-60 230-600 WW YE/T may be used instead.
3. If the required shrink sleeve size is not readily available, shrink sleeves K-60 280-600 WW YE/T may be used instead.
4. For open cut installations.
5. For directional drilling installations.



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\*The above materials can be used on both YJ and YJ2K coated pipes. Standard CORE Liner® product is rated to a maximum service temperature of 60°C. Please contact your CORE Linepipe® representative for applications requiring a service temperature above 60°C.

## Overview

- CORE Liner® has a polyethylene liner inside the pipeline. Overheating the steel pipe can damage the plastic liner.
- CORE Clickweld® joints are larger than the OD of the pipe and require shrink sleeves sized for the Clickweld® joint.
- Only installers having a valid Canusa ticket for the specific product used are allowed to apply external coatings on CORE Linepipe® products.
- The procedure for installing external coatings on CORE Linepipe® products must follow Canusa's Manufacturer Qualified Application Procedure (MQAP), in addition to the CORE Linepipe® specific requirements outlined in this document.

## CORE Linepipe® Best Practices

In principle, the application and functionality of typical pipeline external coatings are the same for CORE Liner®. In addition to following Canusa's Manufacturer Qualified Application Procedure (MQAP), the safe and effective use of external coatings with CORE Liner® requires some additional unique considerations:

1. Coating materials shall be transported, handled, and stored in accordance with the MQAP.
2. The application company shall be responsible to ensure the installers are trained by Canusa prior to the start of work. The training shall cover the appropriate Manufacturer's Qualified Application Procedure (MQAP) for the specific external coating product.
3. Only installers having a valid Canusa ticket for the specific product being used are allowed to install external coatings on CORE Linepipe® products.
4. A copy of Canusa's Manufacturer Qualified Application Procedure (MQAP) is available in each box of external coating materials.
5. The installers of the external coatings must be aware of the requirements as laid out in CSA Z245.30.
6. Each ClickWeld® joint has two plugs visible on the factory ring. Ensure both plugs are present prior to installing the shrink sleeve. Refer to Attachment 1 for further explanation.
7. It is required of the external coating installers to **record the relevant electrofusion number (EF # - for shrink sleeves at ClickWeld® joints) or pipe serial number (for repairs on pipe body) along with surface temperature measurements**. This information is to be provided to the CORE Linepipe® foreman and will be included in the pipeline quality control (QC) package.



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- a. Please speak with the onsite CORE representative to obtain a QC data capture sheet.
- b. See Attachment 2.
8. The surface preparation of the steel and the existing coating shall be in accordance with the MQAP. Grease may be present from the assembly of the ClickWeld®. Ensure any contaminants have been removed for effective adhesion of the external coating.
9. The ClickWeld® rings have abrupt shoulders. Contouring is required to allow effective shrink sleeve adhesion. CORE Linepipe® supplies Canusa-CPS mastic filler/AquaSeal to be used for contouring. Additional roller use may be required to remove entrapped air. Refer to Attachment 3 for further explanation.
10. CORE Liner® must not be overheated from the installation of the external coating. CORE Liner® has a polyethylene liner inside the pipeline. Damage/failure of the liner could occur as a result of overheating. Liner damage/failure is not visible from the outside of the pipeline. Overheat scenarios could require costly repairs.
11. The temperature of the entire surface to be coated shall be measured using a ***calibrated digital surface contact thermometer***. The surface temperature must be measured frequently (every 30 seconds for heating using a torch) to promptly detect when the required temperature is reached. When measuring the temperature, allow the digital surface contact thermometer to touch the surface for at least three seconds (and until the temperature reading stabilizes) before taking the temperature reading.
12. The installer shall uniformly heat the entire circumference of the center band of the application area to a target surface temperature of **100°C**. The installer shall measure the temperature in a manner that verifies that the maximum allowable surface temperature of **130°C** is not exceeded anywhere.
13. The installer shall uniformly heat the entire circumference at the edges of the application area (the abraded mainline coating) to achieve, or exceed, the minimum surface temperature specified in the MQAP. The installer shall measure the temperature in a manner that verifies that the maximum allowable surface temperature of **130°C** is not exceeded anywhere.
14. The installer shall stop the pre-heating process as soon as the entire application area reaches the minimum surface temperature specified in the MQAP.
15. Where heating ovens are used, all the elements of a heating oven must be functioning to avoid localized overheating.
16. Contact your CORE Linepipe® foreman for any questions or clarifications.



CORE LINEPIPE

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Calgary, AB, T2P 1H4  
Office: (587) 333-6685

17. All the personnel involved in applying external coatings on CORE Linepipe® products must sign the Sign-Off and Acknowledgement of CORE Linepipe® External Coating Requirements sheet. Refer to Attachment 4.
18. The CORE Liner® pipe should never be heated to a surface temperature greater than **130°C**. If this temperature is ever exceeded, you must contact a CORE Linepipe® representative immediately. The joint will be inspected and the damaged section will be replaced.



19. The warning sticker (shown above) is to be removed from on the pipe after the external coating is applied and prior to jeeping.



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910, 736 - 8<sup>th</sup> Avenue SW  
Calgary, AB, T2P 1H4  
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Attachment 1.

## Completed ClickWeld® - Ready to Sleeve



Check for ALL of the following Prior to Sleeving:

1. Both Plugs are installed
2. EF # is written
3. OK and initials are present

There is only one acceptable scenario that indicates a ClickWeld® joint is ready to be sleeved. The above image shows the requirement of the EF #, two installed plugs, and an ok with initials.

**If any of these three are missing, DO NOT SLEEVE.**

Contact a CORE Service® team member before moving forward.



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Calgary, AB, T2P 1H4  
Office: (587) 333-6685

## Incomplete ClickWeld® – DO NOT SLEEVE

### Scenario 1: No Plugs



Even if there is an EF # and an OK and initial, if both plugs are not installed, there should not be a sleeve.

**DO NOT SLEEVE IF A PLUG IS MISSING!**

### Scenario 2: No EF #



Even if there is an OK and initial and both plugs are installed, if there is no EF #, there should not be a sleeve.

**DO NOT SLEEVE IF "EF #" IS MISSING!**



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910, 736 - 8<sup>th</sup> Avenue SW  
Calgary, AB, T2P 1H4  
Office: (587) 333-6685

## Incomplete ClickWeld® – DO NOT SLEEVE

Scenario 3: No OK & Initial



Even if both plugs are installed and there is an EF #, if there is no OK and initial, there should not be a sleeve.

**DO NOT SLEEVE IF “OK & INITIAL” IS MISSING!**



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910, 736 - 8<sup>th</sup> Avenue SW  
Calgary, AB, T2P 1H4  
Office: (587) 333-6685

## Attachment 2.

# External Coating QC Data Entry Form

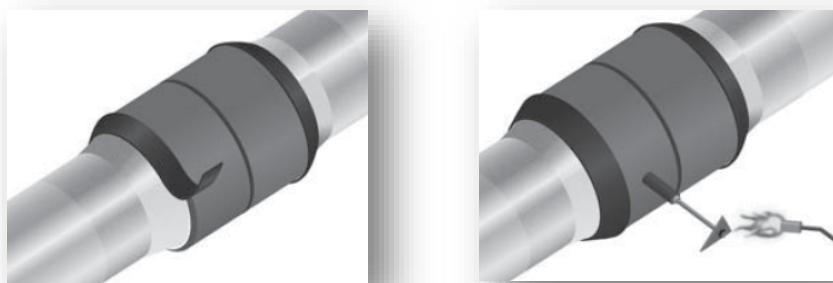


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Calgary, AB, T2P 1H4  
Office: (587) 333-6685

### Attachment 3.

## ClickWeld® Joint Contouring

Mastic filler/AquaSeal is required on both sides of the CORE Linepipe® ClickWeld® joint. Wrap around both sides of the joint. Using a heated scraper, form the mastic so it creates a 30° to 45° bevel transition. The mastic filler can be heated by torch to soften and allow better forming.



Please contact your CORE Service® foreman for any questions.



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910, 736 - 8<sup>th</sup> Avenue SW  
Calgary, AB, T2P 1H4  
Office: (587) 333-6685

## Attachment 4.

# Sign-Off and Acknowledgement of CORE Linepipe® External Coating Requirements

**MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP)**

Revision 1.0

**1. Product Description**

The MS1F is supplied in 25 mm x 300 mm (1" by 12") Melt Sticks. The MS1F is approved to repair damage in the above mainline coatings with exposed metal up to 12mm (1/2") in diameter.

Compatible with the following mainline coating systems:

- CSA Z245.21 System A
- CSA Z245.21 System B1
- CSA Z245.21 System B2

**2. Storage & Safety Guidelines**

To ensure maximum performance, store Canusa products in a dry, ventilated area. Keep products sealed in original cartons and avoid exposure to direct sunlight, rain, snow, dust or other adverse environmental elements. If the product must be removed from its original packaging then the new packaging must provide the same level of protection as the original. Avoid prolonged storage at temperatures above 35°C (95°F) or below -20°C (-4°F) for the melt stick. Avoid prolonged storage at temperatures above 40°C (104°F) or below 5°C (41°F) for the epoxy kit(s). Prior to installation the melt sticks and epoxy should be at or near room temperature 20°C ±3. Product installation should be done in accordance with local health and safety regulations.

**3. Equipment List**

Appropriately sized torch, propane tank, hose & regulator or standard "plumbers torch", knife, approved solvent, clean rags, 80 – 120 grit sand paper / coarse emery cloth (resin bonded preferred), grinder with a medium grit disc and standard safety equipment (leather gloves, impermeable gloves, safety glasses, hard hat, etc.)

Approved Solvents:

- Acetone
- MEK
- Denatured Alcohol ≥95%
- Isopropanol ≥95%
- Any solvent that flashes off 100% without leaving a residue

**4. Flame Intensity & Torch Size**

A standard "plumbers" torch can be used for this installation.

If using a torch that is normally used for sleeve installations use a torch with less than 150,000Btu.

The torch size may also differ depending on ambient conditions and expected production rates. The use of an improperly sized torch may cause damage to the field joint or mainline coating during installation.

**5. Surface Preparation - All Damage**

When identifying damage ahead of repairing use a paint pen to mark at least 50mm beyond the damaged areas on all sides. If repairing immediately after discovery marking is not necessary.

1. Remove all foreign contaminants such as ice, frost snow, mud, dirt, cement dust.
2. Scrap off all paint marker, magic marker, paint stick.
3. Trim off any damaged mainline coating due to previous construction steps.
4. Clean exposed steel and adjacent pipe coating with an approved solvent to remove the presence of oil, grease, and other contaminants if present. Ensure that the pipe is dry prior to mechanical cleaning.

This step shall be done anywhere the product will make contact with the pipe (steel and mainline coating).

**6. Surface Preparation - Minor Damage**

Using the sandpaper, abrade the mainline coating in the repair area. Remove all oxidation (shine) under area of the patch. The steel surface shall be cleaned using a hand or power wire brush to a minimum ISO St 3 / SSPC SP3 finish prior to coating application.

After surface preparation, wipe clean using a lint-free cloth or air blast the steel surface and pipe coating to remove foreign contaminants. In very dry ambient conditions a dry lint free rag may not remove the fine dust being held onto the pipe with static. In this case a little solvent on the rag will help clean the surface.

**7. Surface Preparation - Major Damage**

Using a knife carefully cut out only the damaged coating into a smooth sided shape.

After surface preparation, wipe clean using a lint-free cloth or air blast the steel surface and pipe coating to remove foreign contaminants. In very dry ambient conditions a dry lint free rag may not remove the fine dust being held onto the pipe with static. In this case a little solvent on the rag will help clean the surface.

**8. Preheat to application temperature**

Use a low intensity yellow flame for preheating the coating and applying the repair products. With quick back and forth strokes, pre-heat the repair zone sufficiently to remove moisture and assist in adhesion.

**CAUTION:**

Do not hold propane torch on one spot, but keep moving over the repair area. If a film develops on the mainline coating because of preheat, use a surface abrasion tool to remove it. If the mainline coating lifts or curls during preheat the curled section must be removed.

**9. Melt Stick Application**

Touch the Melt Stick to the pipe surface. If it melts or leaves a mark then the preheat temperature has been reached and you can continue with the application. If no mark is generated continue to preheat the pipe and check again. Heat the melt stick with the torch until the outermost layer becomes fluid.

**10. Melt Stick Application**

Heat the melt stick and the repair zone simultaneously with the torch and spread the melt stick over the damaged area. The torch must remain moving to prevent damage to the coating. Some ignition of the melt stick is acceptable but try to limit the ignition time by removing the flame as necessary.

**11. Melt Stick Application**

Continue spreading the melt stick over the holiday and the adjacent mainline coating until the entire area is covered. The area to cover is the holiday plus 25mm (1") all around the holiday. After sufficient melt stick material is on the surface, apply additional heat in quick back-and-forth strokes to create a smooth surface.

**12. Applied Melt Stick Inspection**

Visually and physically inspect the installed melt stick to ensure that:

- Proper overlap onto the mainline coating. ≥25mm (1")
- No entrapped air
- Ensure that the melt stick material completely covers the repair zone.
- The melt stick material should be spread liberally so that the material is raised above the coating surface.

**Backfilling/Laying Guidelines**

After application is complete, allow the repair patch to cool before pipe handling. For onshore applications, prevent damage to the melt stick repair by backfilling with select backfill or material with no sharp stones or large particles. Alternately, protect the repair patch with extruded polyethylene mesh or other suitable protective shield as approved by the Manufacturer. Allow the melt stick to cool to less than 50°C prior to laying, repair patch can be water quenched. For offshore if the field joint is to be infilled, then water quenching is unnecessary.

**DISCLAIMER:**

Always check with the mainline coating manufacturer for proper repair procedure prior to beginning repair work.

**Storage & Safety Guidelines**

To ensure maximum performance, store Shawcor's Canusa products in a dry, ventilated area. Keep products sealed in original cartons and avoid exposure to direct sunlight, rain, snow, dust or other adverse environmental elements. Avoid prolonged storage at temperatures above 35°C (95°F) or below -20°C (-4°F). Product installation should be done in accordance with local health and safety regulations.

These installation instructions are intended as a guide for standard products. Consult your Canusa representative for specific projects or unique applications.

**Head Office**

25 Bethridge Rd.  
Toronto, ON M9W 1M7 Canada  
Tel: +1 416 743 7111  
Fax: +1 416 743 5927

**Canada**

Suite 3200, 450 - 1st Street S.W.  
Calgary, AB T2P 5H1 Canada  
Tel: +1 403 218 8207  
Fax: +1 403 264 3649

**Americas**

3838 N. Sam Houston Pkwy E. Suite 300  
Houston, TX 77032  
Tel: +1 281 886 2350  
Fax: +1 281 886 2353

**Europe, Middle East, Africa & Russia**

Unit 3, Sterling Park,  
Gatwick Road, Crawley, West Sussex  
RH10 9QT United Kingdom  
Tel: +44 1293 541254  
Fax: +44 1293 541777

**Asia-Pacific**

101 Thomson Road,  
#11-03 United Square  
307591 Singapore  
Tel: +65 6749 8918  
Fax: +65 6749 8919

**Canusa-CPS is registered to ISO 9001:2008**

Canusa warrants that the product conforms to its chemical and physical description and is appropriate for the use stated on the installation guide when used in compliance with Canusa's written instructions. Since many installation factors are beyond our control, the user shall determine the suitability of the products for the intended use and assume all risks and liabilities in connection therewith. Canusa's liability is stated in the standard terms and conditions of sale. Canusa makes no other warranty either expressed or implied. All information contained in this installation guide is to be used as a guide and is subject to change without notice. This installation guide supersedes all previous installation guides on this product. E&OE



## MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP)

Revision 1.0

### 1. Product Description

The Coating Repair Patch Type 'O' (CRPO) is supplied in 150 mm x 150 mm patches or in rolls 150 mm wide by 15 m long that can be field cut-to-size.

Compatible with the following mainline coating systems:

- CSA Z245.20 System 1A
- CSA Z245.20 System 2A
- CSA Z245.20 System 2B
- CSA Z245.21 System A
- CSA Z245.21 System B1
- CSA Z245.22
- CSA Z245.30 System FC4

### 2. Storage & Safety Guidelines

To ensure maximum performance, store Canusa products in a dry, ventilated area. Keep products sealed in original cartons and avoid exposure to direct sunlight, rain, snow, dust or other adverse environmental elements. If the product must be removed from its original packaging then the new packaging must provide the same level of protection as the original. Avoid prolonged storage at temperatures above 35°C (95°F) or below -20°C (-4°F) for the repair patches. Avoid prolonged storage at temperatures above 40°C (104°F) or below 5°C (41°F) for the epoxy kit(s). Prior to installation the repair patch and the epoxy should be at or near room temperature 20°C ±3. Product installation should be done in accordance with local health and safety regulations.

### 3. Equipment List

Appropriately sized torch, propane tank, hose & regulator, digital surface contact thermometer, roller, knife, approved solvent, J roller, clean rags, 80 – 120 grit sand paper / coarse emery cloth (resin bonded preferred), grinder with a medium grit disc and standard safety equipment (leather gloves, impermeable gloves, safety glasses, hard hat, etc.).

Approved Solvents:

- Acetone
- MEK
- Denatured Alcohol ≥95%
- Isopropanol ≥95%
- Any solvent that flashes off 100% without leaving a residue

### 4. Flame Intensity & Torch Size

Minimum Torch Size: 150,000 Btu

The torch size may also differ depending on ambient conditions and expected production rates. The use of an improperly sized torch may cause damage to the field joint or mainline coating during installation.

### 5. Repair Analysis

The type of repair is dependent on the extent of the damage to the mainline coating. If the damage extends to the bare steel it shall be considered major and step 9 shall be followed for surface preparation. If only the PE backing is affected and there is no damage to the anti-corrosion coating, the damage shall be considered minor and step 8 shall be followed.

### 6. Surface Preparation - All Damage

Using a marker, mark a rectangle 50mm beyond the damaged areas on all sides.

1. Remove all foreign contaminants such as ice, frost snow, mud, dirt, cement dust.
2. Scrap off all paint marker, magic marker, and paint stick.
3. Trim off any damaged mainline coating due to previous construction steps.
4. Clean exposed steel and adjacent pipe coating with an approved solvent to remove the presence of oil, grease, and other contaminants if present. Ensure that the pipe is dry prior to mechanical cleaning.

This step shall be done anywhere the product will make contact with the pipe (steel and mainline coating).

### 7. Repair Patch Measurement

Measure the dimensions required for the Repair Patch. Cut the Repair Patch to the appropriate size to cover the patch area, with a minimum 50mm overlap from any point of the damage. Cut the 4 corners off the patch to avoid lifting of the corners.

### 8. Surface Preparation - Minor Damage

Using the sandpaper, abrade the mainline coating in the repair area. Remove all oxidation (shine) under area of the patch. The steel surface shall be cleaned using a hand or power wire brush to a minimum ISO St 3 / SSPC SP3 finish prior to coating application.

After surface preparation, wipe clean using a lint-free cloth or air blast the steel surface and pipe coating to remove foreign contaminants. In very dry ambient conditions a dry lint free rag may not remove the fine dust being held onto the pipe with static. In this case a little solvent on the rag will help clean the surface.

**9. Surface Preparation - Major Damage**

Using a knife, carefully cut out only the damaged coating into a smooth sided shape.

When repairing insulated pipe mainline coating also inspect the urethane foam. If the foam is damaged too much you may have to remove the damaged foam and repair according to the mainline coating manufacturer's recommendations.

**10. Preheat to application temperature**

Preheat the epoxy and the abraded mainline coating to be covered by the repair patch to a minimum of 75°C (167°F) with the appropriate propane torch, induction heating or infrared heating equipment. Ensure the correct temperature has been reached using a digital surface contact thermometer. When using an induction coil to preheat once the correct temperature has been reached on the steel you must heat the mainline coating with the appropriately sized propane torch. When installing over a PE mainline coating even if the preheat temperature has been reached you must heat the surface of the PE mainline coating with a propane torch to oxidize the surface to enhance adhesion. The thicker the mainline coating the greater the difference between the bare steel and surface temperature of the mainline coating. The preheat temperature must exceed the minimum required temperature but the mainline coating must not be damaged during preheat step.

**CAUTION:**

Do not hold propane torch on one spot, but keep moving over the repair area. If a film develops on the mainline coating because of preheat, use a surface abrasion tool to remove it. If the mainline coating lifts or curls during preheat the curled section must be removed.

**11. Heating of Repair Patch**

While holding the Repair Patch with a pair of pliers, use the propane torch to heat the black backing until the Repair Patch becomes soft and flexible.

**12. Applying the Repair Patch**

As the Repair Patch is laid on the pipe, place torch between Repair Patch Adhesive & pipe surface. Continue heating area as the Repair Patch is applied.

**13. Post heating Repair Patch**

Using the roller and propane torch, continue heating and rolling from the middle to each edge. Continue until the adhesive is fully molten and has wet out on all edges.

CAUTION: Too much heat in one spot can damage mainline coating. Keep the torch moving at all times.

**14. Installed Repair Patch Inspection**

Visually and physically inspect the installed repair patch to ensure that:

- Repair Patch is in full contact with the pipe.
- No cracks or holes in Repair Patch backing
- Proper overlap onto the mainline coating. ≥50mm (2")
- No entrapped air
- No large wrinkles

If there is any damage to the CRPO patch it shall be removed and a new patch is to be installed.

**Backfilling/Laying Guidelines**

After shrinking is complete, allow the repair patch to cool before pipe handling. For onshore applications, prevent damage to the repair patch by backfilling with select backfill or material with no sharp stones or large particles. Alternately, protect the repair patch with extruded polyethylene mesh or other suitable protective shield as approved by the Manufacturer. Allow the repair patch to cool to less than 50°C prior to laying, repair patch can be water quenched. For offshore If the field joint is to be infilled, then water quenching is unnecessary.

**DISCLAIMER:**

Always check with the mainline coating manufacturer for proper repair procedure prior to beginning repair work.

**Storage & Safety Guidelines**

To ensure maximum performance, store Shawcor's Canusa products in a dry, ventilated area. Keep products sealed in original cartons and avoid exposure to direct sunlight, rain, snow, dust or other adverse environmental elements. Avoid prolonged storage at temperatures above 35°C (95°F) or below -20°C (-4°F). Product installation should be done in accordance with local health and safety regulations.

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**Head Office**

25 Bethridge Rd.  
Toronto, ON M9W 1M7 Canada  
Tel: +1 416 743 7111  
Fax: +1 416 743 5927

**Canada**

Suite 3200, 450 - 1st Street S.W.  
Calgary, AB T2P 5H1 Canada  
Tel: +1 403 218 8207  
Fax: +1 403 264 3649

**Americas**

3838 N. Sam Houston Pkwy E. Suite 300  
Houston, TX 77032  
Tel: +1 281 886 2350  
Fax: +1 281 886 2353

**Europe, Middle East, Africa & Russia**

Unit 3, Sterling Park,  
Gatwick Road, Crawley, West Sussex  
RH10 9QT United Kingdom  
Tel: +44 1293 541254  
Fax: +44 1293 541777

**Asia-Pacific**

101 Thomson Road,  
#11-03 United Square  
307591 Singapore  
Tel: +65 6749 8918  
Fax: +65 6749 8919

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## MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP)

Revision 1.01

**1. Product Description**

K-60 Wrapid Sleeves™ are shipped pre-cut with a pre-attached CLW closure. K-60 bulk rolls are shipped as a roll and can be cut to size in the field. Closure seals will be separate from the bulk roll and may need to be cut to the width of the sleeve. The sleeve adhesive is protected from contamination by an inner liner.

Compatible with the following mainline coating systems:

- CSA Z245.20 System 1A
- CSA Z245.20 System 2A
- CSA Z245.20 System 2B
- CSA Z245.21 System A
- CSA Z245.21 System B1
- CSA Z245.22

**2. Storage & Safety Guidelines**

To ensure maximum performance, store Canusa products in a dry, ventilated area. Keep products sealed in original cartons and avoid exposure to direct sunlight, rain, snow, dust or other adverse environmental elements. If the product must be removed from its original packaging then the new packaging must provide the same level of protection as the original. Avoid prolonged storage at temperatures above 35°C (95°F) or below -20°C (-4°F) for the sleeves. Avoid prolonged storage at temperatures above 40°C (104°F) or below 5°C (41°F) for the epoxy kit(s). Prior to installation the sleeves and the epoxy should be at or near room temperature 20°C ±3. Product installation should be done in accordance with local health and safety regulations.

**3. Equipment List**

Appropriately sized torch, propane tank, hose and regulator, appropriate tools for surface abrasion, buffering wheel or wire brush, knife, J roller, 80 grit sand paper, rags and approved solvent, digital contact thermometer with suitable probe and standard safety equipment (leather and rubber gloves, goggles, hard hat, etc.)

Approved Solvents:

- Acetone
- MEK
- Denatured Alcohol ≥95%
- Isopropanol ≥95%
- Any solvent that flashes off 100 % without leaving a residue

**4. Flame intensity and torch size**

Pipe O.D. <450mm (18")

Minimum Torch Size: 150,000 Btu

Pipe O.D.> 450mm (18")

Minimum Torch Size: 300,000 Btu

The torch size may also differ depending on ambient conditions and expected production rates. The use of an improperly sized torch may cause damage to the sleeve or mainline coating during installation. The use of induction or infrared heating equipment is recommended for pipe sizes greater than 760mm (30") O.D.

**5. Surface Preparation**

1. Remove all foreign contaminants such as ice, frost snow, mud, dirt, cement dust.
2. Scrap off all paint marker, magic marker, and paint stick.
3. Trim off any damaged mainline coating due to previous construction steps.
4. Clean exposed steel and adjacent pipe coating with an approved solvent to remove the presence of oil, grease, and other contaminants if present. Ensure that the pipe is dry prior to mechanical cleaning.

This step shall be done anywhere the product will make contact with the pipe (steel and mainline coating).

**6. Surface Preparation**

Ensure that the pipe is at least 3°C (5°F) above the dew point prior to surface preparation. The steel surface shall be cleaned using a hand or power wire brush to a minimum ISO St 3 / SSPC SP3 finish prior to coating application.

Optional:

The steel surface shall be cleaned with a dry abrasive blasting to ISO Sa 2.5/ SSPC SP10/ NACE 2. Be careful not to direct the blasting nozzle at the mainline coating if it is CSA Z245.21 System A as it may cause the PE jacket to lift. If the PE jacket has lifted then you must remove the lifted section prior to continuing to the next step.

Factory coating edges should be abraded for a minimum width of 50mm (2") beyond the edge of where the sleeve will be installed using the 80 grit sandpaper or coarse emery cloth paper or a grinder with a 40-60 grit flap wheel disc and should be beveled to 30° to eliminate the vertical edge for FBE, Dual Powder or Liquid Epoxy. Thin PE mainline coatings shall only be abraded with the 80 grit sandpaper. After cleaning, wipe clean or air blast the steel surface and pipe coating to remove foreign contaminants.

**7A. Pre-Heat (torch)**

Pre-heat the cutback area and abraded coating to the minimum required temperature of 65°C with the appropriately sized propane torch. Ensure the correct temperature has been reached using a digital surface contact thermometer. The preheat temperature must exceed the minimum required temperature but the mainline coating must not be damaged during preheat. If a film develops on the mainline coating because of preheat, use a surface abrasion tool to remove it. If the mainline coating lifts or curls during preheat the curled section must be removed.

Dry abrasive blasted steel may flash rust when exposed to open flame when it is below 40°C. There are two ways to avoid flash rust:

1. Preheat the pipe prior to dry abrasive blasting such that after surface preparation is completed the pipe remains over 40°C
2. Dry abrasive blast the steel cold, then heat it up high enough that when you do a quick brush blast the pipe remains over 40°C

In cold and/or windy conditions you will have to raise the preheat temperature so that the pipe remains above the application long enough to install the sleeve. If you cannot raise the temperature high enough without damaging the mainline coating then you will have to change the application environment by using hoarding or shelters.

**7B. Pre-Heat (Infrared Heater)**

Pre-heat the cutback area and abraded coating to the minimum required temperature of 65°C with the appropriately sized infrared heater. Adjust the propane pressure so that the steel and the mainline coating reach the required temperature at the same time without damaging the mainline coating. Ensure the correct temperature has been reached using a digital surface contact thermometer. The preheat temperature must exceed the minimum required temperature but the mainline coating must not be damaged during preheat. If a film develops on the mainline coating because of preheat, use a surface abrasion tool to remove it. If the mainline coating lifts or curls during preheat the curled section must be removed.

**7C. Pre Heat (Induction Coil)**

Pre-heat the cutback area and abraded coating to the minimum required temperature of 65°C with the appropriately sized induction coil. Ensure the correct temperature has been reached using a digital surface contact thermometer. Once the correct temperature has been reached on the steel you must heat the mainline coating with the appropriately sized propane torch. When installing over a PE mainline coating even if the preheat temperature has been reached you must heat the surface of the PE mainline coating with a propane torch to oxidize the surface to enhance adhesion. The thicker the mainline coating the greater the difference between the bare steel and surface temperature of the mainline coating. The preheat temperature must exceed the minimum required temperature but the mainline coating must not be damaged during preheat step. If a film develops on the mainline coating because of preheat, use a surface abrasion tool to remove it. If the mainline coating lifts or curls during preheat the curled section must be removed.

**8. Sleeve Installation**

Partially remove the release liner and gently heat the underlap approximately 150 mm (6") from the edge. Centre the sleeve over the joint so that the sleeve overlaps between the 10 and 2 o'clock positions. With the minimum overlap onto the mainline coating. The minimum overlap onto existing coating shall be 2" after installation; greater overlap is required prior to installation as the sleeve will neck in after shrinking. Press the underlap firmly into place.

**9. Sleeve Installation**

Wrap the sleeve loosely around the pipe, ensuring the appropriate overlap. Lift the overlap so that the underlap is exposed all except for about 12mm (1/2") and gently heat the backing of the underlap until it just starts to recover. Lightly heat the adhesive side of the overlap until it is glossy and firmly press it down onto the underlap.

**10. Sleeve Installation**For "Wrapid Sleeves" with pre attached closure seals

Fold the closure seal back on itself and using the propane torch heat the underside of the closure seal until it starts to soften. Press the closure firmly into place. Gently heat the top of the closure and pat it down with a gloved hand. If the sleeve has the clear CLW closure the closure will go from opaque to clear when it is hot enough. Repeating this procedure, move from one side to the other. Smooth any wrinkles by gently working them outward from the center of the closure with a roller.

For "CanusaWrap" bulk roll

Select the correct closure for the sleeve installation as follows:

**CLW** - remove the liner from the closure seal and expose the adhesive strips on the closure seal, center the closure seal on the overlapping sleeve and press down firmly.

**CLS** - remove the liner and heat the underside of the closure seal, center the closure seal on the overlapping sleeve and press down firmly with a gloved hand.

**CLH** - heat the underside of the closure seal, center the closure seal on the overlapping sleeve and press down firmly with a gloved hand.

Roll out any entrapped air in the closure seal with a roller.

**11. Sleeve Installation**

Using the appropriate sized torch, begin at the center of the sleeve and heat circumferentially around the pipe using broad strokes. If utilizing two torches, operators should work on opposite sides of pipe and be careful not to have both torches aimed at one spot at the same time.

Pipe O.D.

<450mm (18") 1 torch

>450mm (18") 2 torches

If using an infrared heater to shrink the sleeve place it centered over the sleeve and leave it in position until the requirements of Step 12 have been met.



## 12. Sleeve Installation

Continue heating from the center toward one end of the sleeve until recovery is complete. In a similar manner, heat and shrink the remaining side. Shrinking has been completed when the adhesive begins to ooze at the sleeve edges all around the circumference. Finish shrinking the sleeve with long horizontal strokes over the entire surface to ensure a uniform bond.

## 13. Sleeve Installation

While the sleeve is still hot and soft, use a hand roller to gently roll the sleeve surface and push any trapped air up and out of the sleeve, as shown above. Focus on the areas where there is a change in height, both sides of the weld and the cutback edges. Press hard enough to move a little of the adhesive but all of the air. Pressing too hard may cause the sleeve to wrinkle and may cause excess adhesive to be removed from the sleeve. Roll the sleeve from the bottom towards the overlap/underlap seam. Once all the entrapped air is gathered in the underlap/overlap seam roll from the weld out towards the edge of the sleeve in a "v" motion. Continue the procedure by also firmly rolling the closure with long horizontal strokes from the weld outwards. If the sleeve becomes too stiff to roll it may be gently reheated with the torch. Also if the sleeve wrinkles the wrinkle may be removed with gentle heating and rolling.

## 14. Installed Sleeve Inspection

Visually and physically inspect the installed sleeve to ensure that:

- Sleeve is in full contact with the steel joint
- Adhesive flows beyond all sleeves edges
- No cracks or holes in sleeve backing
- Proper overlap onto the mainline coating ≥50mm (2")
- No entrapped air
- No large wrinkles

### Repairs

The K-60 sleeve shall be repaired using approved products. CRPO is for repairing damage from a pinhole up to 50mm (2") in diameter. A partial sleeve wrapped fully around the pipe can be used to repair damage larger than 50mm (2") and shall have at least 50mm (2") of overlap onto undamaged coating when fully installed. A full sleeve can be cut down in width from its original width. The smallest width allowed is 150mm (6"). Larger repairs can be made using a sleeve cut down to a maximum of 300mm (12"). If the damage to be repaired is larger than this can cover then you must do a full sleeve removal and reapplication of a new sleeve.

Note: Small repairs when heated to the repair products application temperature may cause the damage to increase in size.

See the appropriate MQAP for the above products for correct installation.

### Backfilling/Laying Guidelines

After shrinking is complete, allow the sleeve to cool before pipe handling. For onshore applications, prevent damage to the sleeve by backfilling with select backfill or material with no sharp stones or large particles.

Alternately, protect the sleeve with extruded polyethylene mesh or other suitable protective shield as approved by the Manufacturer. Allow the sleeve to cool to less than 40°C prior to laying, sleeve can be water quenched. For offshore if the field joint is to be infilled, water quenching is unnecessary.

### Storage & Safety Guidelines

To ensure maximum performance, store Shawcor's Canusa products in a dry, ventilated area. Keep products sealed in original cartons and avoid exposure to direct sunlight, rain, snow, dust or other adverse environmental elements. Avoid prolonged storage at temperatures above 35°C (95°F) or below -20°C (-4°F). Product installation should be done in accordance with local health and safety regulations.

These installation instructions are intended as a guide for standard products. Consult your Canusa representative for specific projects or unique applications.

#### Head Office

25 Bethridge Rd.  
Toronto, ON M9W 1M7 Canada  
Tel: +1 416 743 7111  
Fax: +1 416 743 5927

#### Canada

Suite 3200, 450 - 1st Street S.W.  
Calgary, AB T2P 5H1 Canada  
Tel: +1 403 218 8207  
Fax: +1 403 264 3649

#### Americas

3838 N. Sam Houston Pkwy E. Suite 300  
Houston, TX 77032  
Tel: +1 281 886 2350  
Fax: +1 281 886 2353

#### Europe, Middle East, Africa & Russia

Unit 3, Sterling Park,  
Gatwick Road, Crawley, West Sussex  
RH10 9QT United Kingdom  
Tel: +44 1293 541254  
Fax: +44 1293 541777

#### Asia-Pacific

101 Thomson Road,  
#11-03 United Square  
307591 Singapore  
Tel: +65 6749 8918  
Fax: +65 6749 8919

#### Canusa-CPS is registered to ISO 9001:2008

Canusa warrants that the product conforms to its chemical and physical description and is appropriate for the use stated on the installation guide when used in compliance with Canusa's written instructions. Since many installation factors are beyond our control, the user shall determine the suitability of the products for the intended use and assume all risks and liabilities in connection therewith. Canusa's liability is stated in the standard terms and conditions of sale. Canusa makes no other warranty either expressed or implied. All information contained in this installation guide is to be used as a guide and is subject to change without notice. This installation guide supersedes all previous installation guides on this product. E&OE

## Appendix I – Sleeve Cutting Guideline for Sleeves Supplied in Bulk

### Product Description



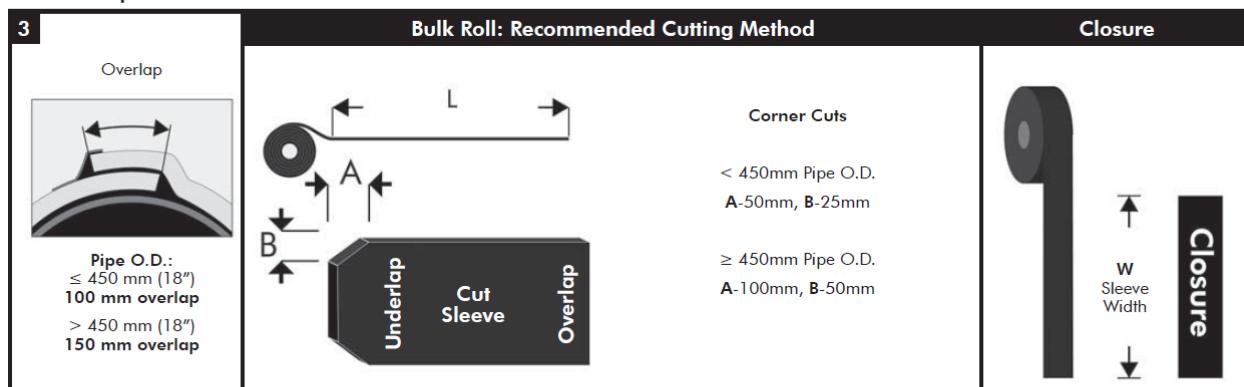
For bulk supply of material, the Heat Shrinkable Sleeve will be in a larger roll, with the adhesive being protected from contamination by an inner liner. Closures are shipped either in Bulk rolls or Pre-cut.

### Equipment List



Knife, tape measure; standard safety equipment; gloves and goggles

### Product Preparation Guidelines



See below for the guideline for sleeve layflat length, based on standard pipe diameters. For special diameters not mentioned, cut the required lengths of sleeve material (L) and Closure Material (W) from the bulk rolls as follows:

L = Coated Pipe Circumference + overlap dimension + 50 mm

W = Sleeve Width

Ensure that the sleeve and closure are not damaged or contaminated. Trim corners as shown.

## Appendix II - Layflat Lengths and Recommended Closure Widths

Canusa-CPS Sleeve Size (mm)	Nominal Pipe Size (NPS)	Actual Pipe Size OD		Cut Length		Minimum Closure Size/Overlap Width of Closure (mm) ± 3 mm Overlap on sleeve/off sleeve ± 10 mm
		(in)	(mm)	Sleeve Length (mm)	Sleeve Length (ft)	
55	2.0	2.375	60.3	280	0.919	100mm - 50mm/50mm
63	2.5	2.875	73.0	300	0.984	100mm - 50mm/50mm
90	3.0	3.500	88.9	355	1.165	100mm - 50mm/50mm
110	3.5	4.000	101.6	415	1.362	100mm - 50mm/50mm
115	4.0	4.500	114.3	460	1.509	100mm - 50mm/50mm
125	4.5	5.000	127.0	545	1.788	100mm - 50mm/50mm
140	5.0	5.563	141.3	590	1.936	100mm - 50mm/50mm
170	6.0	6.625	168.3	670	2.198	100mm - 50mm/50mm
230	8.0	8.625	219.1	835	2.740	100mm - 50mm/50mm
280	10.0	10.750	273.1	1030	3.379	100mm - 50mm/50mm
315	12.0	12.750	323.9	1195	3.921	100mm - 50mm/50mm
350	14.0	14.000	355.6	1305	4.281	100mm - 50mm/50mm
400	16.0	16.000	406.4	1475	4.839	100mm - 50mm/50mm
430	17.0	17.000	431.8	1560	5.118	100mm - 50mm/50mm
450	18.0	18.000	457.2	1645	5.397	100mm - 50mm/50mm
500	20.0	20.000	508.0	1820	6.091	100mm - 50mm/50mm
560	22.0	22.000	558.8	1990	6.659	100mm - 50mm/50mm
610	24.0	24.000	609.6	2160	7.228	100mm - 50mm/50mm
660	26.0	26.000	660.4	2330	7.797	100mm - 50mm/50mm
710	28.0	28.000	711.2	2455	8.216	100mm - 50mm/50mm
760	30.0	30.000	762.0	2675	8.952	100mm - 50mm/50mm
810	32.0	32.000	812.8	2835	9.487	100mm - 50mm/50mm
860	34.0	34.000	863.6	3000	10.039	100mm - 50mm/50mm
915	36.0	36.000	914.4	3170	10.608	150mm - 75mm/75mm
960	38.0	38.000	965.2	3335	11.270	150mm - 75mm/75mm
1015	40.0	40.000	1016.0	3510	11.861	150mm - 75mm/75mm
1060	42.0	42.000	1066.8	3680	12.436	150mm - 75mm/75mm
1120	44.0	44.000	1117.6	3850	13.010	150mm - 75mm/75mm
1170	46.0	46.000	1168.4	4020	13.585	150mm - 75mm/75mm
1220	48.0	48.000	1219.2	4195	14.176	150mm - 75mm/75mm
1270	50.0	50.000	1270.0	4240	14.328	150mm - 75mm/75mm
1320	52.0	52.000	1320.8	4400	14.869	150mm - 75mm/75mm
1370	54.0	54.000	1371.6	4560	15.409	150mm - 75mm/75mm
1420	56.0	56.000	1422.4	4720	15.950	150mm - 75mm/75mm
1470	58.0	58.000	1473.2	4875	16.474	150mm - 75mm/75mm
1520	60.0	60.000	1524.0	5035	17.015	150mm - 75mm/75mm
1620	64.0	64.000	1625.6	5325	17.995	150mm - 75mm/75mm
1720	68.0	68.000	1727.2	5640	19.059	150mm - 75mm/75mm

**MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP)**

Revision 1.01

**1. Product Description**

Canusa's Directional Drilling Kits - TBK systems are composed of two sleeves (main sleeve and sacrificial sleeve) and epoxy kit(s). The epoxy kit(s) includes: application accessories, latex gloves and pre-measured quantities of Canusa Epoxy Primer. The sleeve adhesive is protected from contamination by an inner liner.

Compatible with the following mainline coating systems:

- CSA Z245.20 System 1A
- CSA Z245.20 System 2A
- CSA Z245.20 System 2B
- CSA Z245.21 System A
- CSA Z245.21 System B1
- CSA Z245.22

**2. Storage & Safety Guidelines**

To ensure maximum performance, store Canusa products in a dry, ventilated area. Keep products sealed in original cartons and avoid exposure to direct sunlight, rain, snow, dust or other adverse environmental elements. If the product must be removed from its original packaging then the new packaging must provide the same level of protection as the original. Avoid prolonged storage at temperatures above 35°C (95°F) or below -20°C (-4°F) for the sleeves. Avoid prolonged storage at temperatures above 40°C (104°F) or below 5°C (41°F) for the epoxy kit(s). Prior to installation the sleeves and the epoxy should be at or near room temperature 20°C ±3. Product installation should be done in accordance with local health and safety regulations.

**3. Equipment List**

Appropriately sized torch, propane tank, hose & regulator, digital surface contact thermometer, roller, knife, dry abrasive blasting pot, appropriate abrasive media, approved solvent, J roller, clean rags, 80 grit sand paper / coarse emery cloth (resin bonded preferred) and standard safety equipment (leather gloves, impermeable gloves, safety glasses, hard hat, etc.).

Approved Solvents:

- Acetone
- MEK
- Denatured Alcohol ≥95%
- Isopropanol ≥95%
- Any solvent that flashes off 100% without leaving a residue

**4. Flame intensity and torch size**

Pipe O.D. <450mm (18")

Minimum Torch Size: 150,000 Btu

Pipe O.D. > 450mm (18")

Minimum Torch Size: 300,000 Btu

The torch size may also differ depending on ambient conditions and expected production rates. The use of an improperly sized torch may cause damage to the sleeve or mainline coating during installation. The use of induction or infrared heating equipment is recommended for pipe sizes greater than 760mm (30") O.D.

**5. Surface Preparation**

1. Remove all foreign contaminants such as ice, frost snow, mud, dirt, cement dust.
2. Scrap off all paint marker, magic marker, and paint stick.
3. Trim off any damaged mainline coating due to previous construction steps.
4. Clean exposed steel and adjacent pipe coating with an approved solvent to remove the presence of oil, grease, and other contaminants if present. Ensure that the pipe is dry prior to mechanical cleaning.

This step shall be done anywhere the product will make contact with the pipe (steel and mainline coating).

**6. Surface Preparation**

Ensure that the pipe is at least 3°C (5°F) above the dew point prior to surface preparation. The steel surface shall be cleaned using a hand or power wire brush to a minimum ISO St 3 / SSPC SP3 finish prior to coating application.

Optional:

The steel surface may be cleaned with a dry abrasive blasting to ISO Sa 2.5/ SSPC SP10/ NACE 2. Be careful not to direct the blasting nozzle at the mainline coating if it is CSA Z245.21 System A as it may cause the PE jacket to lift. If the PE jacket has lifted then you must remove the lifted section prior to continuing to the next step.

Factory coating edges should be abraded for a minimum width of 50mm (2") beyond the edge of where the sleeve will be installed using the 80 grit sandpaper or coarse emery cloth paper or a grinder with a 40-60 grit flap wheel disc and should be beveled to 30° to eliminate the vertical edge for FBE, Dual Powder or Liquid Epoxy. Thin PE mainline coatings shall only be abraded with the 80 grit sandpaper. After cleaning, wipe clean or air blast the steel surface and pipe coating to remove foreign contaminants.

**7A. Preheat to application temperature (Propane Torch)**

Pre-heat the cutback area and abraded coating to the minimum required temperature of 75°C with the appropriately sized propane torch. Ensure the correct temperature has been reached using a digital surface contact thermometer. The preheat temperature must exceed the minimum required temperature but the mainline coating must not be damaged during preheat. For insulated mainline coatings covered under CSA Z245.22 you shall only preheat the PE jacket, do not try to preheat the exposed insulation itself as it may start on fire. If a film develops on the mainline coating because of preheat, use a surface abrasion tool to remove it. If the mainline coating lifts or curls during preheat the curled section must be removed.

Dry abrasive blasted steel may flash rust when exposed to open flame when it is below 40°C. There are two ways to avoid flash rust:

1. Preheat the pipe prior to dry abrasive blasting such that after surface preparation is completed the pipe remains over 40°C
2. Dry abrasive blast the steel cold, then heat it up high enough that when you do a quick brush blast the pipe remains over 40°C

If neither of these methods work then an alternative dry heat source such as the infrared heater or induction coil shall be used.

**7B. Preheat to application temperature (Infrared Heater)**

Pre-heat the cutback area and abraded coating to the minimum required temperature of 75°C with the appropriately sized infrared heater. Adjust the propane pressure so that the steel and the mainline coating reach the required temperature at the same time without damaging the mainline coating. Ensure the correct temperature has been reached using a digital surface contact thermometer. The preheat temperature must exceed the minimum required temperature but the mainline coating must not be damaged during preheat. If a film develops on the mainline coating because of preheat, use a surface abrasion tool to remove it. If the mainline coating lifts or curls during preheat the curled section must be removed.

**7C. Pre Heat (Induction Coil)**

Pre-heat the cutback area and abraded coating to the minimum required temperature of 75°C with the appropriately sized induction coil. Ensure the correct temperature has been reached using a digital surface contact thermometer. Once the correct temperature has been reached on the steel you must heat the mainline coating with the appropriately sized propane torch. When installing over a PE mainline coating even if the preheat temperature has been reached you must heat the surface of the PE mainline coating with a propane torch to oxidize the surface to enhance adhesion. The thicker the mainline coating the greater the difference between the bare steel and surface temperature of the mainline coating. The preheat temperature must exceed the minimum required temperature but the mainline coating must not be damaged during preheat step. If a film develops on the mainline coating because of preheat, use a surface abrasion tool to remove it. If the mainline coating lifts or curls during preheat the curled section must be removed.

**8. Primary Sleeve Installation**

Using the wider sleeve, partially remove the release liner and gently heat the adhesive side of the underlap approximately 150mm (6") from the edge. Centre the sleeve over the joint so that the sleeve overlaps between the 10 and 2 o'clock positions. With the minimum overlap onto the mainline coating. The minimum overlap onto existing coating shall be 2" after installation; greater overlap is required prior to installation as the sleeve will neck in after shrinking. Press the underlap firmly into place.

**9. Primary Sleeve Installation**

Wrap the sleeve loosely around the pipe, ensuring the appropriate overlap. Lift the overlap so that the underlap is exposed all except for about 12mm (1/2") and gently heat the backing of the underlap until it just starts to recover. Lightly heat the adhesive side of the overlap until it is glossy and firmly press it down onto the underlap.

**10. Primary Sleeve Installation**

Fold the closure seal back on itself and using the propane torch heat the underside of the closure seal until it starts to soften. Press the closure firmly into place. Gently heat the top of the closure and pat it down with a gloved hand. Repeating this procedure, move from one side to the other. Smooth any wrinkles by gently working them outward from the center of the closure with a roller.

**11. Primary Sleeve Installation**

Using the appropriate sized torch, begin at the center of the sleeve and heat circumferentially around the pipe. Use broad strokes. If utilizing two torches, operators should work on opposite sides of pipe and be careful not to have both torches aimed at one spot at the same time.

**Pipe O.D.**

<450mm (18") 1 torch  
>450mm (18") 2 torches

If using an infrared heater to shrink the sleeve place it centered over the sleeve and leave it in position until the requirements of Step 12 have been met.

**12. Primary Sleeve Installation**

Continue heating from the center toward one end of the sleeve until recovery is complete. In a similar manner, heat and shrink the remaining side. Shrinking has been completed when the adhesive begins to ooze at the sleeve edges all around the circumference. Finish shrinking the sleeve with long horizontal strokes over the entire surface to ensure a uniform bond.

**13. Primary Sleeve Installation**

While the sleeve is still hot and soft, use a hand roller to gently roll the sleeve surface and push any trapped air up and out of the sleeve, as shown above. Focus on the areas where there is a change in height, both sides of the weld and the cutback edges. Press hard enough to move a little of the adhesive but all of the air. Pressing too hard may cause the sleeve to wrinkle and may cause excess adhesive to be removed from the sleeve. Roll the sleeve from the bottom towards the overlap/underlap seam. Once all the entrapped air is gathered in the underlap/overlap seam roll from the weld out towards the edge of the sleeve in a "v" motion. Continue the procedure by also firmly rolling the closure with long horizontal strokes from the weld outwards. If the sleeve becomes too stiff to roll it may be gently reheated with the torch. Also if the sleeve wrinkles the wrinkle may be removed with gentle heating and rolling.

#### 14. Primary Sleeve Inspection

Visually and physically inspect the installed sleeve to ensure that:

- Sleeve is in full contact with the steel joint.
- Adhesive flows beyond all sleeves edges.
- No cracks or holes in sleeve backing.
- Proper overlap onto the mainline coating.  $\geq 50\text{mm}$  (2")
- No entrapped air
- No large wrinkles

If there is any damage to the main sleeve it must be repaired prior to continuing to Step 15. See "Repairs" for procedure.

#### 15. Sacrificial Sleeve Installation

Ensure that the front 100mm (4") of the first sleeve and 100mm (4") onto the coating is at the required application temperature of 75°C. Remove release liner and heat the adhesive as in Step 8. Wrap the 150mm (6") sacrificial sleeve so that half of the sleeve overlaps the first sleeve and half of the sleeve extends onto the coating. Position the closure so that it does not line up with the first sleeve's closure. Recover the sleeve as in steps 8 to 13. If there is any damage to the main sleeve or the sacrificial sleeve it must be repaired prior to continuing to Step 16. See "Repairs" for procedure.

#### 16. Top Coat Epoxy Mixing

Put on impermeable gloves. Remove the retainer clip from the bubble pack. Place the package onto a room temperature surface and use a J-roller to push all of the base into the cure. Then turn the bag around and push all of the cure into the base. Continue to mix by rolling on one side of the bag then turn it around and roll the other side of the bag. Mix for 1 to 2 minutes. Be careful to not put too much pressure or the bag may rupture.

#### 17. Epoxy Top Coat Application

When the sleeve is between 15 - 40°C, apply epoxy over the sacrificial sleeve to form a wear cone; covering 50mm onto the pipe coating, the entire sacrificial sleeve and 50mm (2") onto the first sleeve. Epoxy applied should thoroughly cover the leading edge of the sacrificial sleeve such that there are no noticeable sharp edges exposed. The epoxy may be applied at higher temperatures but the epoxy will be harder to build up in a single pass and multiple passes may be required. Also applying the epoxy at higher temperatures may cause the epoxy to cure too quickly and it may crack as the sleeve cools. If the epoxy cracks it must be repaired by abrading the crack and at least 25mm (1") around the crack and new epoxy shall be applied so that that the crack is filled and the existing epoxy is covered for at least 25mm (1") around the crack.

#### 18. Epoxy Top Coat Application

Apply epoxy to trailing edge of first sleeve; 25mm (1") onto sleeve, 25mm (1') onto adjacent coating. It is best to allow the epoxy to cure at ambient temperature. If necessary, use a low flame to cure epoxy but try to avoid heating the sleeve over 60°C as it will soften the adhesive and could cause the cured epoxy to crack as the sleeve cools. Epoxy applied should thoroughly cover the edges of the sleeves. Cover the entire sleeve with any left-over epoxy.

#### 19. Completed Sleeve Inspection

Visually inspect the installed sleeve to ensure that:

- No cracks or holes in sleeve backing
- Epoxy top coat is complete
- No cracks in the epoxy topcoat

#### Repairs

The TBK-60 sleeve shall be repaired using approved products. No repairs shall be overlap onto epoxy topcoat that is applied onto a sleeve or the PE mainline coating. If a repair needs to be done in a location with epoxy topcoat under a repair the epoxy topcoat must be removed prior to the application of the repair. CRPO is for repairing damage from a pinhole up to 50mm (2") in diameter. A partial sleeve wrapped fully around the pipe can be used to repair damage larger than 50mm (2") and shall have at least 50mm (2") of overlap onto undamaged coating when fully installed. A full sleeve can be cut down in width from its original width. The smallest width allowed is 150mm (6"). Larger repairs can be made using a sleeve cut down to a maximum of 300mm (12"). If the damage to be repaired is larger than this can cover then you must do a full sleeve removal and reapplication of a new sleeve. Once the repair is complete it must be completely covered with the epoxy topcoat and the leading edge and the trailing edge plus 25mm (1") past.

Note: Small repairs when heated to the repair products application temperature may cause the damage to increase in size.

See the appropriate MQAP for the above products for correct installation.

#### Prior to Pulling

Allow the epoxy topcoat to cure hard enough that when a sharp knife is drawn sideways across it the epoxy scratches. If the knife grabs or bounces the epoxy must be cured further and the installed system to cool to a temperature of  $\leq 45^\circ\text{C}$  (115°F) prior to pulling. Water quenching can be used once the epoxy is cured to the appropriate hardness.

#### Storage & Safety Guidelines

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#### Head Office

25 Bethridge Rd.  
Toronto, ON M9W 1M7 Canada  
Tel: +1 416 743 7111  
Fax: +1 416 743 5927

#### Canada

Suite 3200, 450 - 1st Street S.W.  
Calgary, AB T2P 5H1 Canada  
Tel: +1 403 218 8207  
Fax: +1 403 264 3649

#### Americas

3838 N. Sam Houston Pkwy E. Suite 300  
Houston, TX 77032  
Tel: +1 281 886 2350  
Fax: +1 281 886 2353

#### Europe, Middle East, Africa & Russia

Unit 3, Sterling Park,  
Gatwick Road, Crawley, West Sussex  
RH10 9QT United Kingdom  
Tel: +44 1293 541254  
Fax: +44 1293 541777

#### Asia-Pacific

101 Thomson Road,  
#11-03 United Square  
307591 Singapore  
Tel: +65 6749 8918  
Fax: +65 6749 8919

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