

CORE LINEPIPE

**PROJECT
EXECUTION
PACKAGE**





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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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Sign Off and Acknowledgment of CORE Linepipe® Project Execution Package and Kickoff Meeting

This is to acknowledge having attended the project kickoff meeting and to have received the CORE Linepipe® project execution requirements as described in the CORE Linepipe® Project Execution Package and confirms receipt of a copy of the CORE Linepipe® Project Execution Package revision 8.

Date:

Name	Position	Company	Email	Signature



1.3 Project Review

Review and fill out the project details, this document is intended to provide a comprehensive review of the project and should be signed and stored by all involved parties.

Scope Review Item	Detail	
CORE Project Number		
Customer Project Number		
AFE/ PO#		
SOA#		
Expected start Date		
Product		
Survey Length		
Total Pipe Length		
Total Joints		
Pipe- YJ m (ft)		
Pipe- YJ Joints		
Pipe- YJ2K m (ft)		
Pipe- YJ2k Joints		
Shrink Sleeve Requirements (type, quantity)		
BORE Section Length's & Quantity		
Flanges, ANSI & Grade, Quantity		
Are test flanges required for bore sections?		
Risers (Quantity)	45 Degree	
	90 Degree	
Factory Bends		
Riser Drawings (Approved)		
List of materials		
Contingency Pipe (how much)		



Safety:

PPE requirements e.g.: FR, Hi-Vis, Monitors	
Tickets required? CORE's minimum employee requirements are: First Aid, H ₂ S, WHIMIS, TDG	
What orientations are required?	
Company specific rules outside the norm e.g. designated smoking areas, road rules	
Are radios required? What channels are required and does CORE need signed authority to obtain those channels?	
Toolbox/ safety meeting- typically held in conjunction with the contractor.	
Permit requirements? (Daily, Weekly, Monthly?)	
ERP- CORE would like to have before project kick off, who can provide this to CORE?	
Is there a medic on site? What company are they with? Where are they located?	
Cell phone use: CORE requires cell phones for SiteDocs and safety paperwork	



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Safety:

Additional notes on safety:

Crew Rotation/ Hours of work:

- The expected CORE service crew rotation is 24 days on and 5 days off. This is based off the current OH&S guidelines in Alberta.
 - If regional work standards or project requirements differ from this, a custom rotation can be established.
- No more than 12 hours of work per day including travel

Additional notes on crew rotation:

Project Location/ Accommodation:

LSD and/ or pin drop required	
Closest recommended accommodation location (or camp location)	



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Billing:

Customer preference for billing? (daily, weekly?) CORE bills weekly	
Who should be included on the email list for daily tickets and reports? Make sure to get the inspector at a minimum (name, number, email if not already on the sign in sheet) When sending signed tickets back please respond all	

*There will be an upfront materials ticket that will reflect the sales order and shipping tally at the beginning of the project to accompany the daily tickets/ reports.

*All materials will be billed at the beginning of the project.

Additional notes on billing:



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Shipping and Receiving:

- Minimum 7 days notice to secure load time and delivery time
 - CORE's expectation is for pipe to be strung the day of delivery; additional charges may apply if pipe trailers are staged.
- No returns without appropriate completed Return Material Authorization (RMA) number and form filled out, must be approved by Gateway and CORE representative
- All pipe bunks need to be shipped back to CORE manufacturing plant in Crossfield

*Please refer to section 10 for more detail on this topic.

CORE Liner® Weights - CANADA	CL-440		CL-648		CL-671		CL-856	
	lbs	kg	lbs	kg	lbs	kg	lbs	kg
Max Truck Weight (60,000 lbs or 27,216 kg)	60,000	27,215	60,000	27,215	60,000	27,215	60,000	27,215
Max joints per truck	104	104	58	58	43	43	37	37
Recommend	98	98	56	56	42	42	34	34
	7 levels of 14, new bunks so no pipe required on top		5 levels, 11 row bunks, 1 on top				4 levels, 8 row bunks, plus 2 on top	

CORE Liner® Weights - USA	CL-440		CL-648		CL-671		CL-856	
	lbs	kg	lbs	kg	lbs	kg	lbs	kg
Total Weight per Joint	594	269	1028	466	1182	536	1612	731
Max truck weight (35,300 lbs or 16,000kg)= Because rear axle is overweight for most states	35,316	16,033	35,316	16,033	35,316	16,033	35,316	16,033
Max joints per truck	59	59	36	36	30	30	23	23
CORE Liner® meters per truckload		1124		680		565		427
CORE Liner® feet per truckload		3689		2232		1852		1400

Scope Review Item	Detail
Pipe Hauling supplied by	
Pipe Hauling tarped	



Pipe onsite stringing/ storage:

- Pipe is delivered to site on wooden bunks that need to be shipped back to CORE's manufacturing plant in Crossfield
- Synchronized pipe loading with direction for stringing. (Factory end of CORE pipe to front or rear of truck)
- The CORE Liner® joint is directional
- There is less pipe per truck if required to be loaded mandrel to rear
- CORE representative to be onsite for first time client, inspector, contractor (or existing contractor with a new spread boss)
- Consider direction so that bores are pulled from CORE factory end (typically direction of workflow) so we can utilize CORE pull head and eliminate additional field cuts/ transition pups or a welding unit to having to be on site
- Pipe is to be double tubbed, tubs to be placed a minimum of 3.5m (11.5ft) from the end of the pipe. If possible, tall tubs are preferred. Maintain 0.3m (1ft) between pipe for front end work (cut, scrape, pre-clean)
- No end hooks to be used- slings, vacuum pack or Calipers recommended
- Spacing required for Walter between multi- lines, minimum 1.2m (4ft) on either side and 6.4m (21ft) from edge of ROW to ditch. If limited ROW 2 booms (1 in front and one behind Walter) speeds up mainline and then you do not require the spacing on either side of CORE Liner®.
- End packaging must remain on pipe until time of connection
- End packaging that is open on pipe and is not connected must be capped at the end of each day (typically after lowering in or pre-jeep)
- Lowered in pipe must have pipe ends elevated from ditch bottom, if potential of submersion exists, end packaging needs to be waterproof
- Pipe staging (off delivery trailer) or remaining onsite post job needs to be done in accordance to *Project Execution Package Section 4.2* to maintain pipe quality
- Failure to properly protect the CORE Liner® ends may cause damage to the product resulting in the inability to use those sticks of pipe

Scope Review Item	Detail
Stringing/ loading direction confirmed	
Bore/ HDD (number, meterage, pre test)	
Bore direction/ Pull head requirement	



Pipe Position:

- CORE Liner® can be installed in any sequence or in- ditch position on multi- line projects
- Stringing position of CORE Liner® does not have to match the install position.
- To maximize productivity when constructing multiple lines, it is optimal to have the CORE Liner® line in the following installed positions (in the ditch)
 1. Outside position on dual line
 2. Inside position on 3 or more lines
 3. Avoid being a middle line

Additional notes on pipe position:

How many lines in ditch?

Where is CORE Liner® positioned?

Bends/ Risers:

- Riser drawing and ROW bend requirements must be signed off prior to bending
- Bends/ risers are to be pre-ordered and are subject to bend shop time availability. Average delivery is 10 days from order
- Bends minimum of 20D bend radius. Bends 30D bend radius or greater recommended to be factory bent
- Avoid slip bending
- 1.82m (6ft) of straight pipe required to make a field cut

Mainline:

- Crotch required on every start joint and end joint
- Crotch minimum requirement every 5 joints
- The CORE Service Team will ClickWeld® and electrofuse linepipe in ambient temperatures from -30°C (-22°F) to +35°C (+95°F)



Lowering In:

- Pneumatic rubber tire cradles for lowering in to eliminate cover damage
- If regular cradles want to be used another lifting device will be required to allow cradles to pass by connections

HDD & Boring:

- Reference section 5.4 execution package for maximum pull force and hydrotest procedure
- Reference section 5.5 execution package for Bore Hydro Test Procedure
- The O.D. of the pipe is larger than the nominal pipe size
- 4"-6" O.D., pull head sleeve- 7 5/16 O.D.
- 6"-8" O.D., pull head sleeve- 9.5" O.D.
- 8"-10" O.D., pull head sleeve- 12 7/8"
- It is best practice to pre- hydrotest all high profile bore sections before pulling bores
- CORE has a bolt on pull head that can be utilized if the pipe is strung the correct way
- If a bore is pre-tested a regular weld-on pull head will be required

Bell hole/ Tie-In:

- Reference section 3.10 execution package for bell hole drawing
- For in- line tie- ins, CORE Liner® requires a minimum of +3 joint length gap starting from the joint needing connections
- Bell holes need to be a minimum of 2.5m (8ft) by 6.0m (19.68ft) with a description of the bell hole orientation in reference to the factory end (3.04m (10ft) minimum from backside of factory ring)
- Spacing required at tie-in for bore locations/ crossings (10m (1/2 joint) *(32.8ft) to be hanging out either side of bore exit/ entry. If you must cut the bore once its pulled Walter needs 3.35m (11ft) minimum from ditch wall to end of pipe

Sleeving:

- Sleeving document must be reviewed and signed off by inspector, contractor's spread boss and all sleeving personnel before any sleeves are to be installed
- Only installers having a valid Canusa ticket for the specific product being used are permitted to install external coatings of CORE Linepipe products

Garbage Disposal:

- At commencement of a project CORE will typically generate 10+ bags of garbage per day per crew removing end packaging
- If a factory end must be cut off there will be a portion of secured HDPE within the steel, HDPE liner may be removed from a field end cut off



Completion of Construction Letter:

- Completion of Construction Letter must be signed off by CORE representative, Contractor and Owner Representative
- Please see a copy of the Completion of Construction Letter in Appendix A.

Onsite Meeting:

- Schedule an onsite visit prior to stringing with inspector, contractor, and CORE field management/foreman

Key points for CORE to maintain maximum productivity:

- The productivity rate of the CORE Service team is a function of the time of year, scope of project, manpower and equipment loading schedule, and overall project execution methodology
- Historical production rates in the project area are typically available upon request
- String complete ROW on lines less the 5km (3.1mi) of stringing ahead of CORE mainline crew to eliminate waiting for additional stringing
- For single line projects, CORE is more productive if work side and ditch are reversed (from kickoff work side on the left)
- CORE to complete tie-ins first when scheduling allows
- Continuous flow from one end to the other on mainline and tie-ins to eliminate jumping back and forth up/ down ROW causing infield mobs
- Spill pile and workspace must be on opposite sides of the ditch





2. Site Organization

2.1 General

The CORE Service® team integrates into any conventional pipeline spread. The CORE Liner® system and CORE Service® team 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, manpower 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 and 5 days off. This is based off the current OH&S guidelines in Alberta.
 - If regional work standards or project requirements differ from this, a custom rotation can be established.
- No more than 12 hours of work per day including travel

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.



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 jeeeping
- 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**



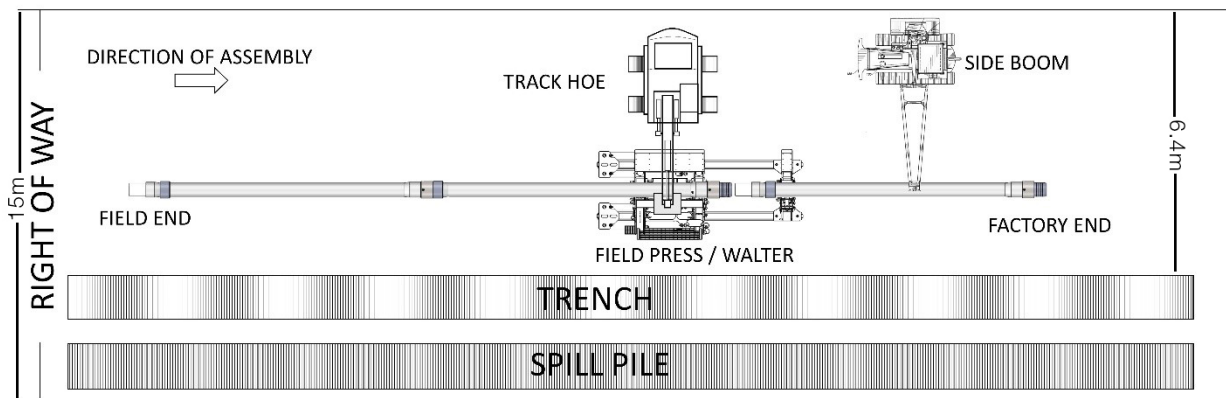
3. Installation Planning

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 synchronize the site layout with the direction of pipe loading, pipe stringing, workflow, 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).

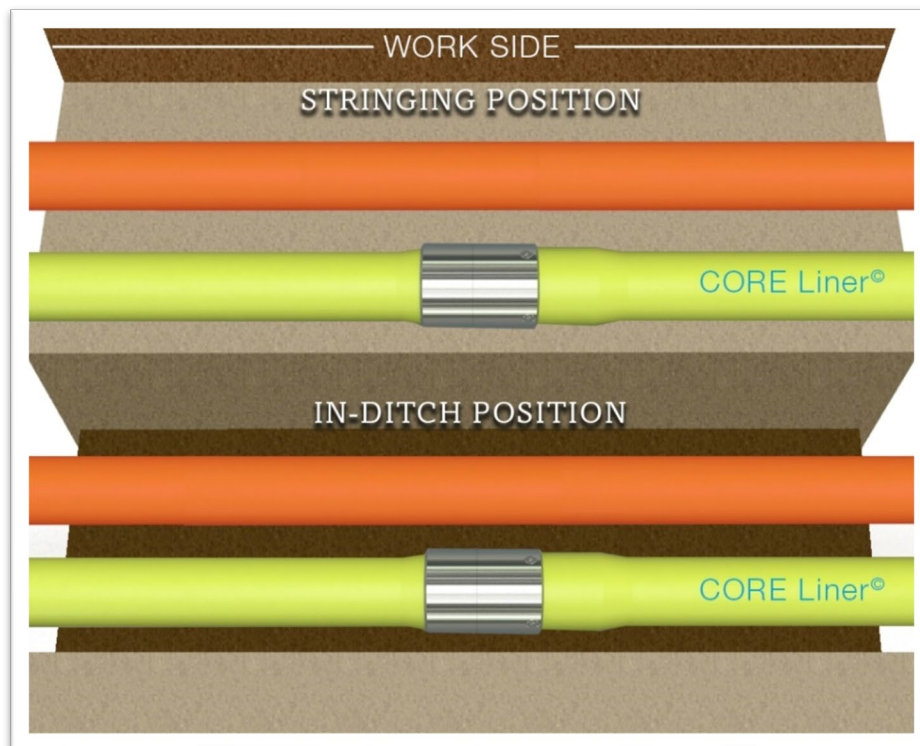


3.2 Pipe Position

Preferred sequencing of the ROW depends on the number of lines in the trench.

- CORE Liner® can be installed in any sequence or in- ditch position on multi- line projects
- Stringing position of CORE Liner® does not have to match the install position.
- To maximize productivity when constructing multiple lines, it is optimal to have the CORE Liner® line in the following installed positions (in the ditch)
 4. Outside position on dual line
 5. Inside position on 3 or more lines
 6. Avoid being a middle line

Two Lines:

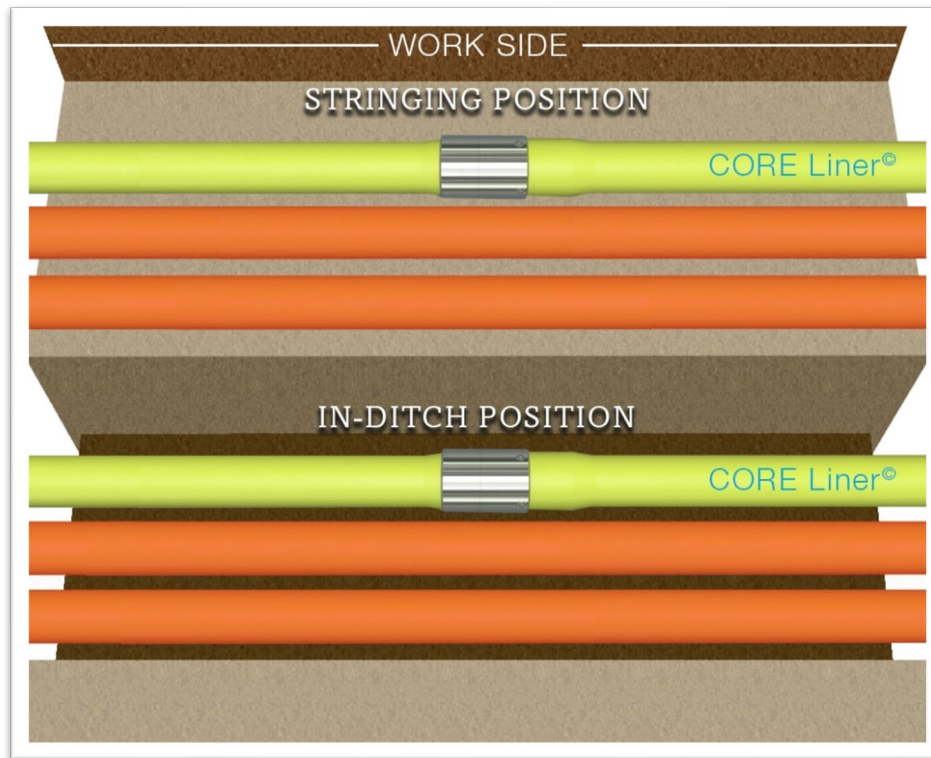




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Three (or more) Lines:



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.

***To maximize productivity 4 feet of workspace is required on each side of CORE Liner®**

3.4 Custom Length

- CORE Liner® field crews can cut pipe to custom length on location using standard CORE Liner® product.
- 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.



3.5 Bends & Risers

Bends

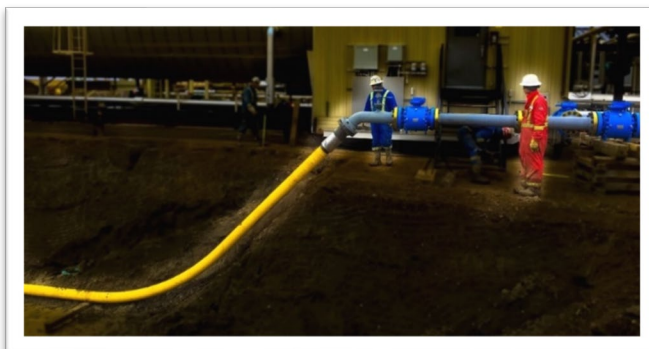


- At all times ClickWeld® joints should be in straight sections of pipe, and at no time should the ClickWeld® joint be on the bent section.
- Roped bends, long sweeping bends, and drag sections react the same as conventional steel line pipe and are easily incorporated into the CORE system design.
- CORE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

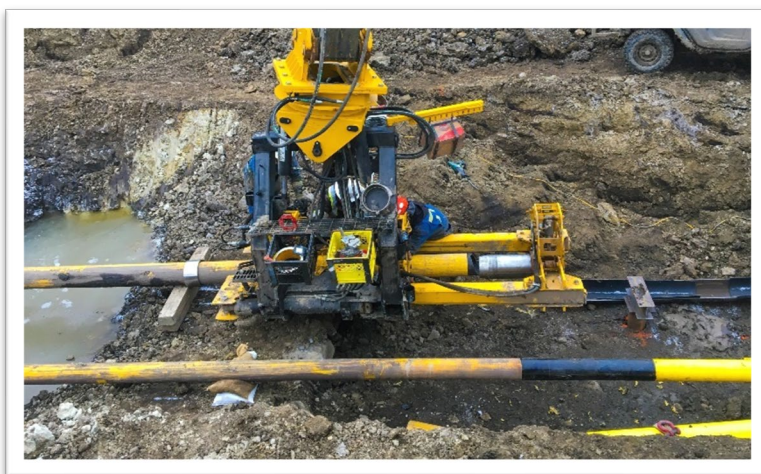
- Customer sign-off on ROW bend requirements (quantity and angle) is required prior to bending.

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.



- 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



3.6 Flow Joints

CORE Linepipe® can supply custom stainless steel, flanged, Flow T's and Y laterals upon request. Flanged flow joints and are easily integrated into the CORE Liner® system. Alternatively, lap joint, raised faced flanged flow joints can be fabricated and internally coated by a third party. Please contact your CORE Linepipe® representative for guidance.

Product Description	ID (in)	ID (mm)
4" 0.157" WT CORE Liner®	3.84	97.5
6" 0.188" WT CORE Liner®	5.75	146.0
6" 0.279" WT CORE Liner®	5.58	141.0
8" 0.22" WT CORE Liner®	7.53	191.0

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 section 3.10 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

Crossings should be planned to have at least half a pipe length from the live line to the ClickWeld®.



3.9 HDD and Boring

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

CORE Linerpipe® 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.

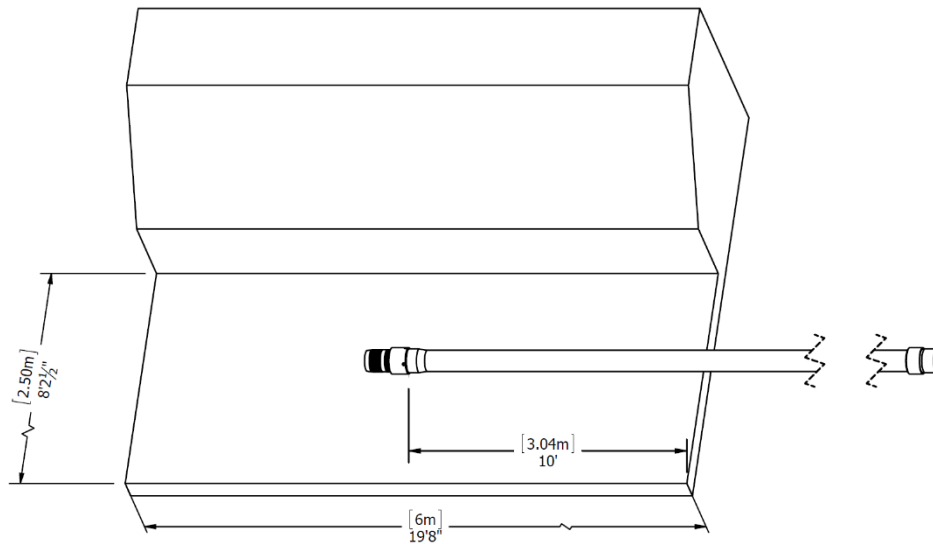




3.10 Bell Hole

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. Typically, a bell hole of at least 8.2 feet (2.5 meters) wide by 20 feet (6 meters) long is required.



NOTE:
CELLAR OF MINIMUM 2' (0.6M) DEPTH MAY BE REQUIRED
IF THERE ARE LIFTING RESTRICTIONS; EX. HOT LINE CROSSING





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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. Each level of pipe is individually strapped to ensure safe delivery and stringing.

***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 must 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 require 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.



4.3 Pipe Stringing

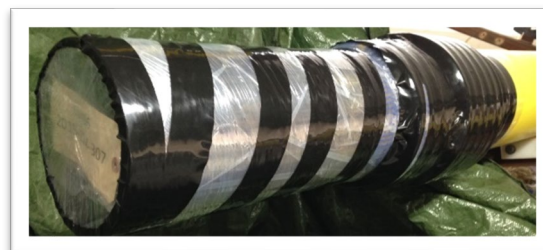
- Orient the pipe as determined at the pre-job meeting (factory and field end, directional stringing required).
- Pipe is to be strung to ensure that the factory end (mechanical male end) is aligned with the field end (mechanical female end) of the adjacent pipe.
- As CORE Liner® is required to be double 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. Pipe that has been stored in the field is subject to inspection and approval prior to installation. Removal of contamination requires time and vigilance that typically slows down installation. This is a critical step to ensure product quality.

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

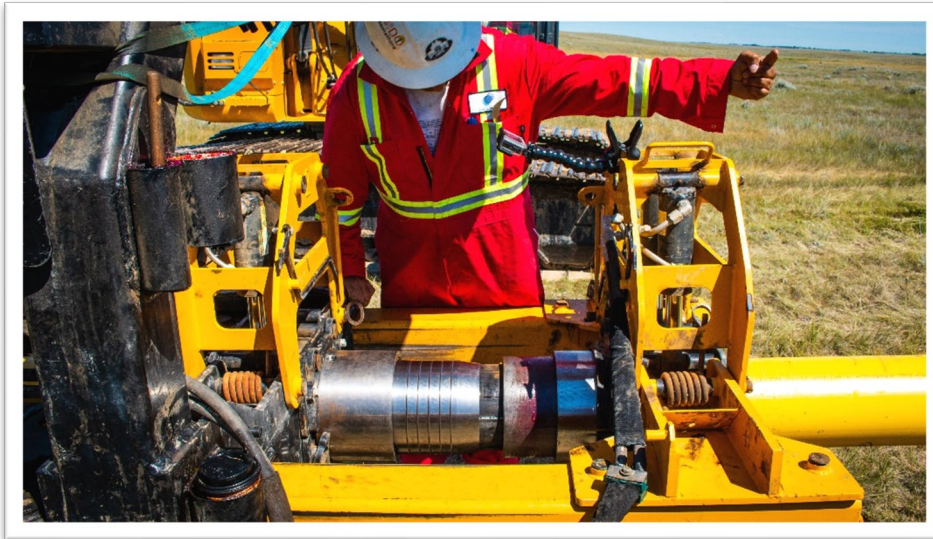
- At all times, ensure communication is established visually, and verbally (if possible), before moving any tubulars.
- It is CRITICAL that all personnel on the job site are aware of hazards and operations.
- COMMUNICATE AT ALL TIMES TO ENSURE WE ALL WORK SAFELY.
- If at any time there are questions 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® Team.





5.2 ClickWeld® (Pipe Joining)

- 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 unjointed overnight, need to be repackaged (as described in section [4.4 End Protection](#)) to prevent moisture and other contaminants/debris from entering the pipe.

If an unjointed 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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Size	Product Description	Clickweld Max. Pull Load (welded pull head)		Clickweld Max. Pull Load (Reusable pull head)		Max rec torsional force	Clickweld OD		Pull Head Assembly OD (reusable)		Min. Reamer Size in Compressible Soil	
		kN	lb	kN	lb		In	mm	In	mm	In	mm
4	CL-440	401	90,000	267	60,000	**	6.00	152.4	7.30	185.42	12	304.8
6	CL-648	713	160,000	356	80,000	**	8.25	209.55	9.50	241.3	14	355.6
6	CL-671	1,024	230,000	356	80,000	**	8.75	222.25	9.50	241.3	14	355.6
8	CL856	846	190,000	356	80,000	**	10.75	273.05	12.80	325.12	16	406.4

*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.





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 and seals 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 the test details on the CORE Linepipe Hydrotest Report form.

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

Pipeline diameter	4"	6"	8"
Volume of water	455 ft ³ /mile (8.0 m ³ /km)	990 ft ³ /mile (17.5 m ³ /km)	1700 ft ³ /mile (30 m ³ /km)

1. Strength test:

Rating	300 ANSI (PN 50)		600 ANSI (PN 100)		900 ANSI (PN 150)	
Product	All		All		CL-648	
Maximum Allowable Operating Pressure	MAOP 720 psi (4.96 MPa)		MAOP 1440 psi (9.93 MPa)		MAOP 2140 psi (14.76 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 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	Max ^{1,3}	Min	Max ^{1,3}	Min	Max ^{2,3}
	900 psi 6.2 MPa	1125 psi 7.8 MPa	1800 psi 12.4 MPa	2225 psi 15.3 MPa	2675 psi 18.4 MPa	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. 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.						

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

² Equivalent to 100% of pipe SMYS

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



Rating	900 ANSI (PN 150)		1500 ANSI (PN 250)		1500 ANSI (PN 250)	
Product	CL-440 & CL-671		CL-440		CL-671	
Maximum Allowable Operating Pressure	MAOP 2160 psi (14.89 MPa)		MAOP 2620 psi (18.09 MPa)		MAOP 3160 psi (21.81 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.	500 psi 3.4 MPa		800 psi 5.5 MPa		1000 psi 6.9 MPa	
d. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	1200 psi 8.3 MPa		1800 psi 12.4 MPa		2200 psi 15.2 MPa	
e. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	2200 psi 15.2 MPa		2800 psi 19.3 MPa		3400 psi 23.4 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	Max ^{1,3}	Min	Max ^{2,3}	Min	Max ^{2,3}
	2700 psi 18.6 MPa	3350 psi 23.1 MPa	3275 psi 22.6 MPa	3640 psi 25.1 MPa	3950 psi 27.2 MPa	4390 psi 30.3 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. 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.						

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

² Equivalent to 100% of pipe SMYS

³ 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 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.
- 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.
- Hold the pressure for 30 minutes at 2 MPa (290 psi). Ambient temperature fluctuations will affect the recorded pressure. A flat or slightly increasing pressure is desired over the 30-minute 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.
- During the liner leak test, the vents on the annular space shall be periodically monitored for flow of liquids.

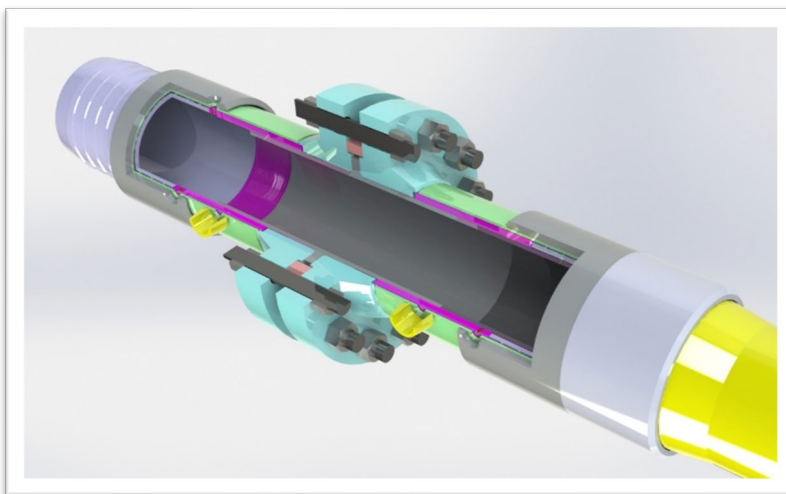
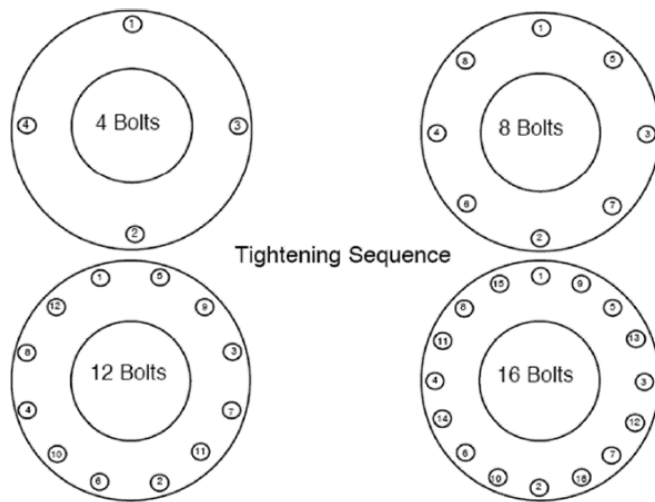
3. De-water/de-pressure line.



5.6 Flanged Connections

- Flange fittings are applied to CORE Liner® product using the proprietary ClickWeld® process.
- CORE Liner® flanged joints require longer stud bolts than typical flanges. Please refer to the table below.
- CORE Liner® flanged joints are to be connected as follows:
 - Install the CORE Liner® compression ring. (Flange/ ANSI specific)
 - Install the stud bolts, nuts, and washers.
 - Tighten the bolts as per the below procedure:

Tightening Pattern





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Torques:

Flange Size	Type of Compression Ring***	Step 1 Repeat 2X	Step 2 Repeat 2X	Step 3 Repeat 2X	Step 4 Repeat 2X	Step 6 Repeat as many times as necessary until all nuts are at final torque and compression ring is tight**	
						Step 5	
4": 300 ANSI	Standard	80 ft-lbs	150 ft-lbs	300 ft-lbs	N/R	Wait at least 1 hour*	300 ft-lbs
4": 600 ANSI	Standard	80 ft-lbs	150 ft-lbs	300 ft-lbs	400 ft-lbs		400 ft-lbs
4": 900 ANSI	High Performance	80 ft-lbs	150 ft-lbs	300 ft-lbs	500 ft-lbs		500 ft-lbs
4": 1500 ANSI	High Performance	80 ft-lbs	160 ft-lbs	390 ft-lbs	650 ft-lbs		650 ft-lbs
6": 300 ANSI	Standard	80 ft-lbs	150 ft-lbs	300 ft-lbs	N/R		300 ft-lbs
6": 600 ANSI	Standard	80 ft-lbs	150 ft-lbs	300 ft-lbs	500 ft-lbs		500 ft-lbs
6": 900 ANSI	High Performance	80 ft-lbs	150 ft-lbs	360 ft-lbs	600 ft-lbs		600 ft-lbs
6": 1500 ANSI	High Performance	80 ft-lbs	200 ft-lbs	500 ft-lbs	820 ft-lbs		820 ft-lbs
8": 300 ANSI	Standard	80 ft-lbs	150 ft-lbs	300 ft-lbs	400 ft-lbs		400 ft-lbs
8": 600 ANSI	Standard	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.

Stud Lengths:

Flange Size	Stud Spec			Nut Spec		
	Size	Length Single*	Length Double*	Material	Size	Material
4" – 300 ANSI	0.75"-10 UNC	6"	6"	A193 B7M OR A320 L7M STUD	0.75"-10 UNC HEAVY HEX NUT	A194 2HM OR 7M
4" – 600 ANSI	0.875"-9 UNC	7"	7"		0.875"-9 UNC HEAVY HEX NUT	
4" – 900 ANSI	1.125"-7 UNC	8"	8"		1.125"-7 UNC HEAVY HEX NUT	
4" – 1500 ANSI	1.25"-7 UNC	10"	10"		1.25"-7 UNC HEAVY HEX NUT	
6" - 300 ANSI	0.75"-10 UNC	6"	6"		0.75"-10 UNC HEAVY HEX NUT	
6" - 600 ANSI	1"-8 UNC	8"	8"		1"-8 UNC HEAVY HEX NUT	
6" - 900 ANSI	1.125"-7 UNC	10"	10"		1.125"-7 UNC HEAVY HEX NUT	
6" - 1500 ANSI	1.375"-8 UNC	14"	14"		1.375"-8 UNC HEAVY HEX NUT	
8" - 300 ANSI	0.875"-9 UNC	6"	8"		0.875"-9 UNC HEAVY HEX NUT	
8" - 600 ANSI	1.125"-7 UNC	8"	8"		1.125"-7 UNC HEAVY HEX NUT	



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- 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.

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
- ✓ Completion of Construction Letter to be signed once Hydrotest is complete

6.2 Pipeline Quality Control

CORE Linepipe® provides a complete Quality Control ("QC") package for CORE Liner® products, a weldmap can be provided upon special request, prior to project commencement. Any other QC requirements for mechanical works are to be provided by the mechanical contractor.





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).



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 the structural integrity of these joints.

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

The hydrotest also verifies that 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	4"	6"	8"
Volume of water	455 ft ³ /mile (8.0 m ³ /km)	990 ft ³ /mile (17.5 m ³ /km)	1700 ft ³ /mile (30 m ³ /km)

**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. Fill the pipeline with water by using water under pressure to push a medium density foam pig along the pipeline length, thus filling the pipeline with water while minimizing the potential for having air pockets. 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 the CORE Linepipe Hydrotest Report form.

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 x MAOP for water, oil and oil emulsion lines (LVP service fluids). The hydrotest shall be performed such that the hydrotest pressure of 1.25 x 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.

Rating	300 ANSI (PN 50)		600 ANSI (PN 100)		900 ANSI (PN 150)	
Product	All		All		CL-648	
Maximum Allowable Operating Pressure	MAOP 720 psi (4.96 MPa)		MAOP 1440 psi (9.93 MPa)		MAOP 2140 psi (14.76 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	Max ^{1,3}	Min	Max ^{1,3}	Min	Max ^{2,3}
	900 psi 6.2 MPa	1125 psi 7.8 MPa	1800 psi 12.4 MPa	2225 psi 15.3 MPa	2675 psi 18.4 MPa	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. 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.						

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

² Equivalent to 100% of pipe SMYS

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



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Rating	900 ANSI (PN 150)		1500 ANSI (PN 250)		1500 ANSI (PN 250)	
Product	CL-440 & CL-671		CL-440		CL-671	
Maximum Allowable Operating Pressure	MAOP 2160 psi (14.89 MPa)		MAOP 2620 psi (18.09 MPa)		MAOP 3160 psi (21.81 MPa)	
h. Fill line, removing all trapped air.						
i. 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	
j. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	500 psi 3.4 MPa		800 psi 5.5 MPa		1000 psi 6.9 MPa	
k. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	1200 psi 8.3 MPa		1800 psi 12.4 MPa		2200 psi 15.2 MPa	
l. Bump to pressure and hold for 15 minutes or until stable or rising pressure is achieved.	2200 psi 15.2 MPa		2800 psi 19.3 MPa		3400 psi 23.4 MPa	
m. 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	Max ^{1,3}	Min	Max ^{2,3}	Min	Max ^{2,3}
	2700 psi 18.6 MPa	3350 psi 23.1 MPa	3275 psi 22.6 MPa	3640 psi 25.1 MPa	3950 psi 27.2 MPa	4390 psi 30.3 MPa
n. 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. 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.						

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

² Equivalent to 100% of pipe SMYS

³ 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 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.
- 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.
- 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.
- 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:



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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 (100 psi – 300 psi).





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

To initiate a return, please complete RMA form found in Appendix B. Once submitted to your CORE representative, **Return Material Authorization (RMA)** number will be issued. 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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APPENDIX A: Sign- Off and Acknowledgment



CORE LINEPIPE INC.

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CORE LINEPIPE INC. - CONSTRUCTION COMPLETION CERTIFICATE

Date:

Time:

Project Name:

Location:

Contract Name/Date:

(the "Contract")

Owner:

(the "Owner")

Contractor:

(the "Contractor")

This is to certify that an inspection of the scope of work performed by Core Linepipe Inc. ("Core") under the terms of the above referenced Contract was carried out on _____, 2019 by _____ on behalf of the Owner, _____ on behalf of the Contractor and _____ on behalf of Core. The parties hereto certify that all of the work performed by Core has been constructed and completed in accordance with the specifications, provisions and conditions of the Contract, and the work is accepted as complete by the Owner and the Contractor.

The effective date for the start of the warranty period (as defined in the Contract) will be _____, 2019.

Certified by:

CORE representative:

Print Name: _____

Witness Name: _____

Contractors Designated
Representative:

Print Name: _____

Witness Name: _____

Owners Designated
Representative:

Print Name: _____

Witness Name: _____



CORE LINEPIPE USA, INC.

CORE Linepipe USA, Inc.
Suite 200 - 2002 Timberloch Place
The Woodlands, Texas 77380

CORE LINEPIPE USA, INC. - CONSTRUCTION COMPLETION CERTIFICATE

Date:

Time:

Project Name:

Location:

Contract Name/Date:

(the "Contract")

Owner:

(the "Owner")

Contractor:

(the "Contractor")

This is to certify that an inspection of the scope of work performed by Core Linepipe Inc. ("Core") under the terms of the above referenced Contract was carried out on _____, 2019 by _____ on behalf of the Owner, _____ on behalf of the Contractor and _____ on behalf of Core. The parties hereto certify that all the work performed by Core has been constructed and completed in accordance with the specifications, provisions and conditions of the Contract, and the work is accepted as complete by the Owner and the Contractor.

The effective date for the start of the warranty period (as defined in the Contract) will be _____, 2019.

Certified by:

CORE representative:

Print Name:

Witness Name:

Contractors Designated
Representative:

Print Name:

Witness Name:

Owners Designated
Representative:

Print Name:

Witness Name:



CORE LINEPIPE

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APPENDIX B: Forms



RETURN MATERIAL AUTHORIZATION

Document #: QF-0840-21

Revision: 5

RMA #:		Date:	
Customer:		Estimated Return Date:	
Sales Order #:		Items sold by CORE? (Y/N)	
Release #:		Items sold by Distributor? (Y/N)	
		Distributor Name:	Gateway Tubulars

Return Product Information

Indicate what type of items are being returned (Yes/No):

Pipe	
Risers/Bends	
Ancillary	

(Ancillary items are flanges, shrink sleeves, etc.)

	<u>Quantity (pcs)</u>	<u>Quantity (meters for pipe)</u>
Product or Item:		
Product or Item:		
Product or Item:		

*If more than 3 items, please use the Notes section below.

Reason for Return

Authorization/Approval to invoice charges for:

(Please put Yes or No in the boxes below)

Handling	
Inspection	
Repair labour/ materials	
Restocking fee	
Storage	

Core to Invoice charges to:

(Please put Yes or No in the boxes below)

Distributor	
Customer	

Do you authorize CORE Linepipe to accept this return?

Name & Company	Signature	Date

Notes or special instructions:

--



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APPENDIX C: Hydrotest Report Form



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CORE Linepipe Hydrotest Report

Test Date	
Customer	
Job Number	
Pipeline Dia	
Test Section Length	
High Point Elevation	
Low Point Elevation	

Test Section Start LSD	
Test Section End LSD	
High Point Riser LSD	
High Point Riser Elevation	
Low Point Riser LSD	
Low Point Riser Elevation	
Pressure Sensor Location	

Test Pressure	
Test Medium	
Water Source	
Antifreeze Type and %	
Mixture Temperature	

Gauge Number	
Dead Weight Number	
Chart Recorder Number	

QC Inspector	
Signature	
Date	

Owner's Inspector	
Signature	
Date	



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APPENDIX D: External Coating Bulletin



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CORE Liner	Sleeve Type	Approved Coating
CL440	K60 170-600 x 2 overlap	TBD
	WrapidBond	YJ & YJ2K
	WrapidCoat	YJ & YJ2K
	TBK60 170-600 x 2 overlap	TBD
	GTS80 170-600 x 2 overlap	TBD
	Scar Guard	YJ & YJ2K
CL648	K60 230-600	YJ & YJ2K
	WrapidBond	YJ & YJ2K
	WrapidCoat	YJ & YJ2K
	TBK-60 230-600	YJ & YJ2K
	TBK-80 230-600	YJ2K only
	GTS 80 230-600	YJ2K only
	Scar Guard	YJ & YJ2K
CL671	K60 230-775	YJ & YJ2K
	WrapidBond	YJ & YJ2K
	WrapidCoat	YJ & YJ2K
	TBK60 230-775	YJ & YJ2K
	GTS80 230-775	YJ2K only
	Scar Guard	YJ & YJ2K
CL856	K60 280-775	YJ & YJ2K
	WrapidBond	YJ & YJ2K
	WrapidCoat	YJ & YJ2K
	TBK-60 280-775	YJ & YJ2K
	TBK-80 280-600	YJ2K only
	GTS 80 280-600	YJ2K only
	Scar Guard	YJ & YJ2K



CORE LINEPIPE

External Coating Bulletin



CORE Linepipe

30-Aug-2019

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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
- MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP): CANUSA-CPS GTS-80
- MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP): CANUSA-CPS TBK-80
- MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP): CANUSA-CPS WrapidBond
- MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP): CANUSA-CPS Scar- Guard



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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

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

For pipelines with operating temperatures up to 60°C:

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 Sleeve™
Coating Clickweld® joints, open cut	CANUSA-CPS K-60 Wrapid Sleeve™
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 ¹	Sleeve Width, mm
Coating repair, NPS 6" pipe ²	K-60 170-600 WW YE/T	170	600
Coating repair, NPS 8" pipe ³	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 ⁴ TBK-60 230-600 BK/T ⁵	230	600
Coating Clickweld® joints, for NPS 8"	K-60 280-600 WW YE/T ⁴ TBK-60 280-600 BK/T ⁵	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.

*The above materials can be used on both YJ and YJ2K coated pipes.

For pipelines with operating temperatures between 61°C and 80°C:

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"	CANUSA-CPS GTS-80 Wrapid Sleeve™
Coating Clickweld® joints, open cut	CANUSA-CPS GTS-80 Wrapid Sleeve™
Coating Clickweld® joints, directional drilling	CANUSA-CPS TBK-80 Tunnel Bore Kit

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

Activity	Product Name	Canusa Size ¹	Sleeve Width, mm
Coating repair, NPS 6" pipe ²	GTS-80 170-600 WS BK/T	170	600
Coating repair, NPS 8" pipe ³	GTS-80 230-600 WS BK/T	230	600
Coating repair, NPS 6" swage	GTS-80 230-600 WS BK/T	230	600
Coating repair, NPS 8" swage	GTS-80 280-600 WS BK/T	280	600
Coating Clickweld® joints, for NPS 6"	GTS-80 230-600 WS BK/T ⁴ TBK-80 230-600 BK/T ⁵	230	600
Coating Clickweld® joints, for NPS 8"	GTS-80 280-600 WS BK/T ⁴ TBK-80 280-600 BK/T ⁵	280	600

1. Canusa reference, not an actual dimension.
2. If the required shrink sleeve size is not readily available, shrink sleeves GTS-80 230-600 WS BK/T may be used instead.
3. If the required shrink sleeve size is not readily available, shrink sleeves GTS-80 280-600 WS BK/T may be used instead.
4. For open cut installations.
5. For directional drilling installations.

*The above materials are intended for use on YJ2K coated pipes.

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.
 - 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. For K-60 and TBK-60 sleeves, 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. For GTS-80 and TBK-80 sleeves, the installer shall uniformly heat the entire circumference of the center band of the application area to a target surface temperature of **120°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.
14. 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.
15. The installer shall stop the pre-heating process as soon as the entire application area reaches the minimum surface temperature specified in the MQAP.
16. Where heating ovens are used, all the elements of a heating oven must be functioning to avoid localized overheating.
17. Contact your CORE Linepipe® foreman for any questions or clarifications.
18. 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.



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19. 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.



WARNING

WHEN APPLYING SHRINK SLEEVES DO NOT OVERHEAT THE PIPE.
OVERHEATING WILL DAMAGE THE PLASTIC LINER.

- DO NOT EXCEED **130°C SURFACE TEMPERATURE** AT ANY TIME DURING SLEEVING.
- SHRINK SLEEVES TO ONLY BE APPLIED BY TECHNICIANS WITH A VALID CANUSA TICKET.
- REFER TO CORE LINEPIPE[®] SHRINK SLEEVE BULLETIN.
- CONTACT CORE LINEPIPE[®] FOREMAN FOR PROJECT SPECIFIC INSTRUCTIONS.

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



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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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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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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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Attachment 2.

External Coating QC Data Entry Form

Company	Name	Position	Ticket #	Date	Signature
EF #/Serial #	Product	Surface Temperatures (Min & Max)		Installer Initials	



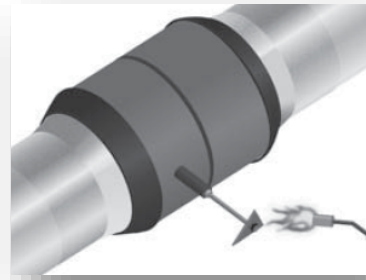
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Attachment 3.

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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Attachment 4.

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

Name	Position	Ticket #	Product	Date	Signature

**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 not 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. $\geq 25\text{mm}$ (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.

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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 oxide 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.

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

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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 1.01

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, buffing 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 oxide 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 it 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 $\geq 50\text{mm}$ (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.

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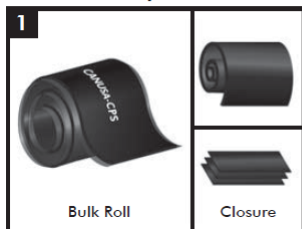
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Appendix I – Sleeve Cutting Guideline for Sleeves Supplied in Bulk

Product Description



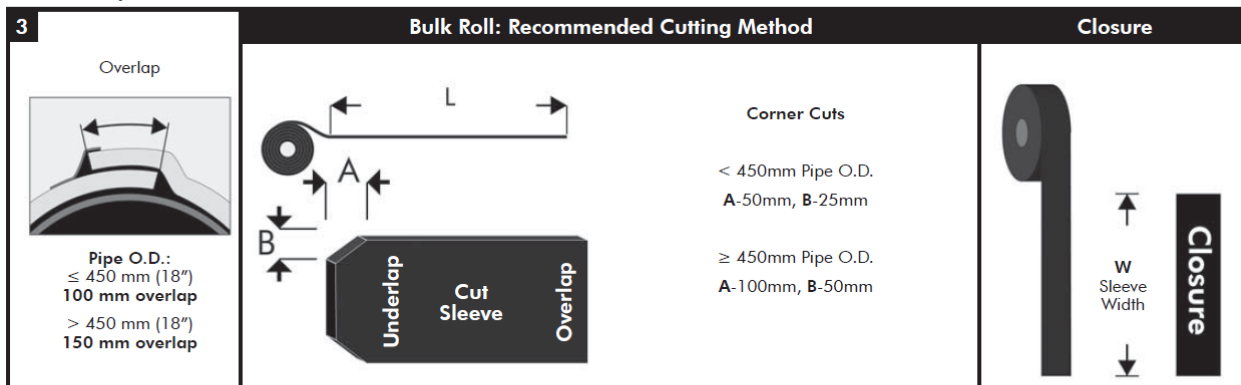
For bulk supply of material, the Heat Shrinkable Sleeve will be in a larger roll, with the adhesive being protected from contamination by an inner liner. Closures are shipped either in Bulk rolls or Pre-cut.

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
		(in)	(mm)	Sleeve Length (mm)	Sleeve Length (ft)	Width of Closure (mm) \pm 3 mm Overlap on sleeve/off sleeve \pm 10 mm
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 it 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 oxide 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 it 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 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

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.

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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 1.02

1. Product Description

GTS-80 Global Transmission Sleeves are shipped pre-cut with a pre-attached closure. GTS-80 Global Transmission 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. The joint completion system also uses a liquid epoxy which is supplied in premeasured bubble packs or bulk quantities.

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 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 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), wet film thickness gauge and standard safety equipment (leather gloves, impermeable gloves, safety glasses, hard hat, etc.).

If epoxy primer is in bulk form add these items: Mixing sticks, graduated cups, applicator pad.

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. Preheat the pipe prior to dry abrasive blasting such that after surface preparation is completed the pipe remains 20°C to 60°C, ideally around 40°C. The steel surface shall be thoroughly cleaned to "near white metal" SIS Sa 2½ (SSPC-SP10) or equivalent. Materials used for abrasive blasting shall produce an angular surface profile of 2.5-5 mils (64-127 µm). 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 if the mainline coating is CSA Z245.21 System B1 or B2. If the mainline coating is CSA Z245.20 System 1A or 2A or 2B then it shall be brush blasted with a 2 to 4 mil profile (50 to 100 microns) and should be beveled to 30° to eliminate the vertical edge.

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.

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

Pre-heat the cutback area and abraded coating to the required temperature range of 20°C to 60°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

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 required temperature range of 20°C to 60°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. 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 required temperature range of 20°C to 60°C with the appropriately sized induction coil. Ensure the correct temperature has been reached using a digital surface contact thermometer. 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. 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 the base into the cure. Then turn the bag around and push 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.

For bulk quantities, mix the epoxy cure with epoxy base (see Liquid Epoxy Product data sheet for mixing ratio) using a new clean mixing stick in a clean graduated cup. Stir for a minimum of 45 seconds to ensure a uniform mixture.

9. Liquid Epoxy Application

Apply mixed epoxy to a minimum wet film thickness of 4 mils (100 µm) with a target uniform thickness of 4-6 mils (100-150 microns) on all exposed bare metal plus a maximum of 10mm (0.5") onto the adjacent pipe coating if it is CSA Z245.21 System B1 or B2. If the adjacent pipe coating is CSA Z245.20 System 1A or 2A or 2B then you must also apply 4-6 mils (100-150 microns) to 10mm (1/2") past where the sleeve is to overlap onto the adjacent mainline coating using the applicator pads as supplied or an approved tool. The wet film thickness shall be taken in at least four locations around the pipe on the steel and on the adjacent mainline coating if the epoxy primer has been applied per previous instruction. Ensure that you repair the WFT gauge marks by adding a small amount of the epoxy primer to the repair area and spreading it out evenly. If you do not add more epoxy primer during the WFT gauge mark repair you may cause low film thickness.

10a. Preheat to application temperature

Preheat the epoxy primer and the abraded mainline coating to be covered by the sleeve to a minimum of 110°C (230°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 epoxy primed 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.

If required to record DFT readings continue with the next step. If no DFT readings are required then skip to Step 11.

10b. Preheat to application temperature – DFT readings

The Liquid Epoxy Type E is 100% solids, the WFT readings will be the same as the DFT readings if performed correctly. DFT reading shall be measured and recorded in accordance with CSA Z245.30 if required by the applicable Owner specification.

When performing a DFT measurement ensure that the applied epoxy primer is cured. Typically when applied and force cured when you achieve a temperature of around 90C the applied epoxy primer will be dry to touch. Stop preheating long enough to measure the DFT and immediately continue with the pre heat to the final required preheat temperature.

If a low DFT area is discovered it shall be repaired by abrading the low area and at least 50mm (2") around the low area with 80 grit sand paper. All created epoxy dust shall be removed and more epoxy primer shall be added to the low area and shall cover all the abraded area.

Apply the epoxy for repairs only at these extreme temperatures. Do not try to apply large areas at this temperature as the epoxy primer will cure almost immediately. Dispense a small amount onto the applicator and quickly apply it to the repair area. Once the material is dry to touch additional DFT readings can be taken to ensure that the minimum 100 micron (4 mil) DFT has been achieved. Do not try to perform WFT readings for repairs as the gauge may not be accurate as the gauge may not be sitting on the steel surface.

11. Sleeve Installation

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 with the minimum overlap onto the mainline coating which shall be 50mm (2") after shrinking and so that the sleeve overlaps itself between the 10 and 2 o'clock positions. Press the underlap firmly into place. Remove the remaining release liner.

**12. 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.

13. 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. 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.

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.

14. 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 15 have been met.

15. 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.

16. 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.

17. Quality Check for Adhesion Test

Test sleeve adhesion by gently pulling the edge of the backing back to ensure that the adhesive remains in place and is fully bonded to the factory coating. The sleeve is well bonded when the adhesive and coating remain intimately contacted. If required to improve bonding, additional heat should be applied to the sleeve.

18. 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 GTS-80 sleeve shall be repaired using approved products. CRP-PE 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.

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

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

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 60°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.

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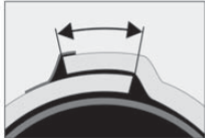
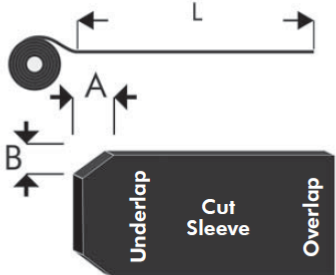



Appendix I – Sleeve Cutting Guideline for Sleeves Supplied in Bulk

Product Description		Equipment List	
<div>1</div> <div> Bulk Roll</div> <div> Closure</div>		<div>2</div> <div></div> <div></div> <div></div>	

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.

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

Product Preparation Guidelines	
<div>3</div> <div> Overlap</div> <div>Pipe O.D.: ≤ 450 mm (18") 100 mm overlap > 450 mm (18") 150 mm overlap</div>	<div>Bulk Roll: Recommended Cutting Method</div> <div></div> <div>Corner Cuts < 450mm Pipe O.D. A-50mm, B-25mm ≥ 450mm Pipe O.D. A-100mm, B-50mm</div>


W
Sleeve Width
Closure

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:

$L = \text{Coated Pipe Circumference} + \text{overlap dimension} + 50 \text{ mm}$

$W = \text{Sleeve Width}$

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
		(in)	(mm)	Sleeve Length (mm)	Sleeve Length (ft)	Width of Closure (mm) \pm 3 mm Overlap on sleeve/off sleeve \pm 10 mm
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 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 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), wet film thickness gauge and standard safety equipment (leather gloves, impermeable gloves, safety glasses, hard hat, etc.)

If epoxy primer is in bulk form add these items: Mixing sticks, graduated cups, applicator pad

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. Preheat the pipe prior to dry abrasive blasting such that after surface preparation is completed the pipe remains 20°C to 60°C, ideally around 40°C. The steel surface shall be thoroughly cleaned to "near white metal" SIS Sa 2½ (SSPC-SP10) or equivalent. Materials used for abrasive blasting shall produce an angular surface profile of 2.5-5 mils (64-127 µm). 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 if the mainline coating is CSA Z245.21 System B1 or B2. If the mainline coating is CSA Z245.20 System 1A or 2A or 2B then it shall be brush blasted with a 2 to 4 mil profile (50 to 100 microns) and should be beveled to 30° to eliminate the vertical edge.

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.

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

Pre-heat the cutback area and abraded coating to the required temperature range of 20°C to 60°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

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 required temperature range of 20°C to 60°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. 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 required temperature range of 20°C to 60°C with the appropriately sized induction coil. Ensure the correct temperature has been reached using a digital surface contact thermometer. 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. 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 the base into the cure. Then turn the bag around and push 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.

For bulk quantities, mix the epoxy cure with epoxy base (see Liquid Epoxy Product data sheet for mixing ratio) using a new clean mixing stick in a clean graduated cup. Stir for a minimum of 45 seconds to ensure a uniform mixture.

9. Liquid Epoxy Application

Apply mixed epoxy to a minimum wet film thickness of 4 mils (100 µm) with a target uniform thickness of 4-6 mils (100-150 microns) on all exposed bare metal plus a maximum of 10mm (0.5") onto the adjacent pipe coating if it is CSA Z245.21 System B1 or B2. If the adjacent pipe coating is CSA Z245.20 System 2A or 2B then you must also apply 4-6 mils (100-150 microns) to 10mm (1/2") past where both the main sleeve and the sacrificial sleeve is to overlap onto the adjacent mainline coating using the applicator pads as supplied or an approved tool.

10a. Preheat to application temperature

Preheat the epoxy primer and the abraded mainline coating to be covered by the sleeve to a minimum of 110°C (230°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 epoxy primed 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.

If required to record DFT readings continue with the next step. If no DFT readings are required then skip to Step 11.

10b. Preheat to application temperature – DFT readings

The Liquid Epoxy Type E is 100% solids, the WFT readings will be the same as the DFT readings if performed correctly.

DFT reading shall be measured and recorded in accordance with CSA Z245.30 if required by the applicable Owner specification.

When performing a DFT measurement ensure that the applied epoxy primer is cured. Typically when applied and force cured when you achieve a temperature of around 90C the applied epoxy primer will be dry to touch. Stop preheating long enough to measure the DFT and immediately continue with the pre heat to the final required preheat temperature.

If a low DFT area is discovered it shall be repaired by abrading the low area and at least 50mm (2") around the low area with 80 grit sand paper. All created epoxy dust shall be removed and more epoxy primer shall be added to the low area and shall cover all the abraded area.

Apply the epoxy for repairs only at these extreme temperatures. Do not try to apply large areas at this temperature as the epoxy primer will cure almost immediately. Dispense a small amount onto the applicator and quickly apply it to the repair area. Once the material is dry to touch additional DFT readings can be taken to ensure that the minimum 100 micron (4 mil) DFT has been achieved. Do not try to perform WFT readings for repairs as the gauge may not be accurate as the gauge may not be sitting on the steel surface.

11. 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 with the minimum overlap onto the mainline coating and so that the sleeve overlaps itself between the 10 and 2 o'clock positions. Press the underlap firmly into place. Remove the remaining release liner.

12. 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.

**13. 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.

14. 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 16 have been met.

15. 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.

16. 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.

17. 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 18. See "Repairs" for procedure.

18. 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 $\geq 110^{\circ}\text{C}$ (230°F). Remove release liner and heat the adhesive as in Step 11. 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 11 to 16.

If there is any damage to the main sleeve or the sacrificial sleeve it must be repaired prior to continuing to Step 19. See "Repairs" for procedure.

19. 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 the base into the cure. Then turn the bag around and push 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.

For bulk quantities, mix the epoxy cure with epoxy base (see Liquid Epoxy Product data sheet for mixing ratio) using a new clean mixing stick in a clean graduated cup. Stir for a minimum of 45 seconds to ensure a uniform mixture.

20. 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 the crack is filled and the existing epoxy is covered for at least 25mm (1") around the crack.

21. 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 80°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.

22. 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-80 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. CRP-PE 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. If the epoxy topcoat is damaged or cracked to repair you must abrade the existing epoxy topcoat with 80 grit sandpaper to remove the shine from it. The abrasion shall be performed for at least 25mm (1") around the damaged epoxy topcoat. The surface may be heated with a propane torch to the appropriate temperatures covered in Step 20. The damaged area plus the abraded area shall be covered with the epoxy topcoat to an appropriate thickness and can be force cured according to Step 21.

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

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

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 Shore D value.

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.

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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 1.02

1. Product Description

Wrapid Bond is typically shipped in bulk rolls and is protected from damage and contamination by an inner roll core and a special release liner. Wrapid Coat™ PVC or Wrapid Coat™ PE are the outer wraps and are supplied separately. Wrapid Shield XL can also be used as an outer wrap, refer to MQAP for installation instructions.

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 Z245.21 System B2
- 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 WrapidBond. 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 material 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, buffing wheel or wire brush, knife and/or dry abrasive pot with appropriate media and air compressor, 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 field joint 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 2 / SSPC SP2 finish prior to coating application.

Optional:

Ensure that the pipe is at least 3°C (5°F) above the dew point prior to surface preparation. The steel surface shall be thoroughly cleaned to "medium blast" SIS Sa 2 or equivalent. Materials used for abrasive blasting shall produce an angular surface profile of 2.5-5 mils (64-127 µm). Factory coating edges should be abraded for a minimum width of 50mm (2") beyond the edge of where the tape will be installed using the 80 grit sandpaper or coarse emery cloth paper or a grinder with a 40-60 grit flap wheel disc if the mainline coating is CSA Z245.20 System A1 or A or B1 and should be beveled to 30° to eliminate the vertical edge. For CSA Z245.22 factory coating edges should be abraded for a minimum width of 50mm (2") beyond the edge of where the WrapidBond will be installed using the 80 grit sandpaper or coarse emery cloth paper or a grinder with a 40-60 grit flap wheel disc



Optional:

If the mainline coating is CSA Z245.20 System A1 then it shall be brush blasted with a 2 to 4 mil profile (50 to 100 microns) and should be beveled to 30° to eliminate the vertical edge.

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. Preheat to Application Temperature

The substrate temperature range for application is -20°C (-4°F) to 95°C (203°F) and when the pipe steel temperature is 3°C (5°F) above the dew point. If the Wrapid Bond and Wrapid Coat PVC / PE is being installed without heating the pipe or in a situation where you cannot heat the pipe such as a live line or within a live plant you can install the tape as long as the pipe is within the above requirements.

8A. Preheat to application temperature (Propane Torch) - Optional

Pre-heat the cutback area and abraded coating to the required temperature range of -20°C to 95°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

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

8B. Preheat to application temperature (Infrared Heater) - Optional

Pre-heat the cutback area and abraded coating to the required temperature range of -20°C to 95° 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. 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 it the curled section must be removed.

8C. Pre Heat (Induction Coil) - Optional

Pre-heat the cutback area and abraded coating to the required temperature range of -20°C to 95° with the appropriately sized induction coil. Ensure the correct temperature has been reached using a digital surface contact thermometer. 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 it the curled section must be removed.

9. Product Width Selection

Choose product width based on pipe diameter and type application using the following chart as a guideline. Project requirements and applicator preference may specify alternate widths.

Pipe O.D.	Width of Tape
<75 mm (3")	50 mm (2")
>100 mm (4")	100 mm (4")
>600 mm (24")	150 mm (6")
Field Joints Machine Wrap	200 mm (8")

10. WrapidBond Application Method Selection

There are two methods for the application of the WrapidBond:

1. This method is used for long sections of bare steel - Proceed to Step 11
2. This method is used for girth welds - Skip to Step 13

11. WrapidBond Installation - Long Sections

Apply the first wrap of Wrapid Bond™ circumferentially around the pipe at a 90° angle, overlapping the tie-in or factory coating by a minimum of 100 mm. Start the wrap at either the 3 or 9 O'clock position on the pipe with the loose end facing down. Apply subsequent wraps with a minimum overlap of 10 mm (or as otherwise specified), and with a 50% overlap over girth-weld areas. Press or roll lightly over the entire coated area.

If wrapping a bent pipe or curved fitting ensures that the 50% overlap is maintained around the outside of the curved portion of the pipe.

12. WrapidBond Installation - Long Sections

Continue application with light to moderate tension. Finish with a circumferential wrap applied at 90° to the pipe length, overlapping any adjacent existing coatings by a minimum of 100 mm and with the loose end terminating at the 3 or 9 O'clock position on the pipe facing down.

Skip to Step 14

13. WrapidBond Installation - Girth Weld Sections

Measure the circumference of the of pipe and cut two (2) lengths of Wrapid Bond at a length equal plus 75mm (3"). For wide cutbacks, additional wraps may be required. Wrap the first length circumferentially around the pipe overlapping the mainline coating by a minimum of 75 mm (3") and with one edge completely covering the weld bead plus 25mm (1") beyond the edge of bead. Press or roll lightly over the coated area. Wrap the second length circumferentially around the pipe overlapping the first length by a minimum of 50mm (2") such that 2 layers of



Wrapid Bond completely cover the weld bead and overlap the mainline coating by a minimum of 75 mm (3"). Press or roll lightly over the coated area.

If more than two circumferential wraps are required add the third and subsequent wraps as above.

14. Installed WrapidBond Inspection

Visually and physically inspect the installed tape to ensure that:

- Tape is in full contact with the steel joint.
- **No cracks or holes in tape backing**
- **Proper overlap onto the mainline coating. $\geq 50\text{mm}$ (2")**
- **No entrapped air**
- **No large wrinkles**
- **Proper wrap overlap during entire length of installation.**

If repairs are required please repair according to this MQAP before proceeding to the next step.

15. WrapidCoat PVC / PE Outer Wrap

There are two methods for the application of the WrapidCoat:

1. This method is used for long sections of bare steel - Proceed to Step 16
2. This method is used for girth welds - Skip to Step 17

Optional:

Apply the Wrapid Shield XL per its relevant MQAP instead of or in addition to the Wrapid Coat PVC / PE.

16. WrapidCoat PVC / PE Installation – Long Sections

Apply the first Wrapid Coat™ PVC / PE circumferentially around the pipe at a 90° angle, leaving ~ 3mm (1/8") of Wrapid Bond™ exposed. Start the first wrap with the loose end at either the 3 or 9 O'clock position on the pipe. Continue application with a 50% overlap at moderate tension. End with a circumferential wrap applied at 90° to the pipe length and with the loose end at either the 3 or 9 O'clock position on the pipe.

Skip to Step 18.

17. WrapidCoat PVC / PE Installation – Girth Weld Sections

Apply the first layer circumferentially around the pipe at a 90° angle, leaving ~3mm (1/8") of Wrapid Bond™ exposed. Continue application with a 50% overlap at moderate tension. Continue application with light to moderate tension. Finish with a circumferential wrap applied at 90° to the pipe length, overlapping any adjacent existing coatings by a minimum of 100 mm and with the loose end terminating at the 3 or 9 O'clock position on the pipe facing down.

Apply a circumferential wraps around the pipe at a 90° angle at each end overlapping the factory coating by 50% of the tape width.

18. Installed WrapidCoat PVC / PE Inspection

Visually and physically inspect the installed tape to ensure that:

- Tape is in full contact with the steel joint.
- No cracks or holes in tape backing
- Proper overlap onto the mainline coating. $\geq 50\text{mm}$ (2")
- No entrapped air
- No large wrinkles
- Proper wrap overlap during entire length of installation.

If repairs are required please repair according to this MQAP.



Repairs

The WrapidBond and WrapidCoat PVC / PE shall be repaired using approved products. Additional layers of WrapidBond shall be applied to repair damages from a pinhole up to a maximum size of 300 mm (12") in diameter. If the damaged area is larger than 300 mm (12") in diameter than this then you must remove Wrapid Bond and Wrapid Coat PVC / PE from the damaged area and reapply a new section of Wrapid Bond. The installed Wrapid Bond must extend 100 mm (4") onto coating in good condition on both sides of the damage. Apply Wrapid Coat PVC / PE on top of the repair as described in this MQAP.

If the damage only extends through the Wrapid Coat PVC / PE, additional layers of WrapidCoat PVC / PE shall be applied to repair damages from a pinhole up to up to a maximum size of 300 mm (12") in diameter. If the damage to be repaired is larger than 300 mm (12") in diameter you must remove the damaged section of WrapidCoat PVC / PE and reapply a new section of WrapidCoat PVC / PE.

Backfilling/Laying Guidelines

After application of Wrapid Coat™ PVC / PE, backfilling can be done immediately. For onshore applications, prevent damage to the WrapidBond by backfilling with select backfill or material with no sharp stones or large particles. Alternately, protect the WrapidBond with extruded polyethylene mesh or other suitable protective shield as approved by the Manufacturer.

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.

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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



1. Product Description

Scar-Guard is typically shipped in rolls and is protected from damage and contamination by a foil pouch. Scar-Guard is an optional protective outer wrap only, it is not to be applied as a standalone anticorrosion coating. It can be used as the alternative Outer Wrap for Wrapid Bond. It can be used as an alternative to the Epoxy Top Coat in the TBK line of products. It can be used as an alternative protective outer layer on any of the Canusa Products. It can be used to protect long sections of mainline coating for HDD applications. Scar-Guard is supplied in two widths, a 150mm (6") wide and a 250mm (10"). The 150mm wide material is suggested for pipe OD up to 12" NPS. The 250mm wide material is suggested for pipe OD greater than 12" NPS. The compression film is supplied in two widths, a 100mm (4") and a 300mm (12"). The 100mm material is suggested for pipe OD up to 12" NPS. The 300mm wide material is suggested for pipe OD greater than 12" NPS. Different widths of the Scar-Guard and the compression film can be used than is recommended but consultation with your Canusa Technical Representative is required.

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 40°C (104°F) or below 5°C (41°F). Prior to installation the WrapidShield should be at or near room temperature 20°C ±3. Inspect the pouch for signs of off gassing which may indicate that the pouch had been punctured and the Scar-Guard may not be fit for application. If the Scar-Guard material feels hard inside the pouch it should be discarded and not be used for application. 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, wire brush, knife, J roller, 60-80 grit sand paper, rags and approved solvent, digital contact thermometer with suitable probe, air pressurizable spray system or pump spray system, clean water and standard safety equipment (leather and rubber gloves, goggles, hard hat, etc.), optional: propylene glycol

Approved Solvents:

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

4. Surface Preparation

The mainline coating should be have been inspected for holidays and all holidays shall have been repaired prior to continuing. The field joint coating shall have had all required inspection tests completed and have been declared a pass prior to continuing.

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 mainline pipe coating and girth weld coatings 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.
 - If the mainline coating is CSA Z245.21 System B1 (YJ) or B2 (YJIK) it shall be abraded with 60-80 grit sand paper 200mm (8") beyond the field joint coating on the leading edge and 100mm (4") beyond the field joint coating on the trailing edge.
 - If the mainline coating is CSA Z245.20 System 1A (FBE) or 1B (NapGard) or 2A or 2B(ARO) then it shall be brush blasted with a 1 to 3 mil profile (25 to 75 microns) 200mm (8") beyond the field joint coating on the leading edge and 100mm (4") beyond the field joint coating on the trailing edge. If brush blasting is not an option then the mainline coating shall be abraded with 60-80 grit sand paper to create a profile of 1 to 3 mil profile (25 to 75 microns) 200mm (8") beyond the field joint coating on the leading edge and 100mm (4") beyond the field joint coating on the trailing edge.
 - If the field joint coating is CSA Z245.30 System FC4 or FC5 or FC6 it shall not be abraded.
 - If the field joint coating is CSA Z245.30 System FC1 or FC2 or FC3 it shall be brush blasted with a 1 to 3 mil profile (25 to 75 microns). If brush blasting is not an option then the field joint coating shall be abraded with 60-80 grit sand paper to create a profile of 1 to 3 mil profile (25 to 75 microns).

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.

This step shall be done anywhere the product will make contact with the pipe.

5a. Preheat to Application Temperature

The substrate temperature range for application is 5°C to 60°C. Scar-Guard can be installed onto sweating pipe and can be applied when precipitation is present. If the Scar-Guard is being installed without heating the pipe or in a situation where you cannot heat the pipe such as a live line or within a live plant you can install the XL as long as the pipe is within the above requirements. If the temperature for application is outside of the recommended temperature please contact your Canusa representative for alternate materials. During cold weather ensure that the substrate remains warm enough throughout the cure cycle so that it can reach the required Shore D hardness. During cold weather there is a risk that the water can freeze in the spraying container.

A solution of up to 5% of propylene glycol can be used without affecting the performance of the Scar-Guard.

5b. Preheat to Application Temperature

The substrate temperature range for application is 5°C to 60°C. Scar-Guard can be installed during cold weather. Immediately after installing the girth weld coating. Allow the girth weld coating to cool down enough to perform holiday inspection then once the temperature of the pipe is within the required temperature range the application of the Scar-Guard material can begin. Alternately the procedures contained within Step 6 can be followed. The warmer the application temperature the quicker it will cure to meet the required hardness.

6a. Preheat to application temperature (Propane Torch) - Optional

Pre-heat the cutback area and abraded coating to the required temperature range of 5°C to 60°C with the appropriately sized propane torch. Ensure the correct temperature has been reached using a digital surface contact thermometer. The existing coating must not be damaged during preheat. If the girth weld or mainline coating is damaged it shall be repaired prior to the application of the Scar-Guard material.



6b. Preheat to application temperature (Infrared Heater) - Optional

Pre-heat the cutback area and abraded coating to the required temperature range of 5°C to 60°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 existing coating. Ensure the correct temperature has been reached using a digital surface contact thermometer. If the girth weld or mainline coating is damaged it shall be repaired prior to the application of the Scar-Guard material.

6c. Pre Heat (Induction Coil) - Optional

Pre-heat the cutback area and abraded coating to the required temperature range of 5°C to 60°C with the appropriately sized induction coil. Ensure the correct temperature has been reached using a digital surface contact thermometer. If the girth weld or mainline coating is damaged it shall be repaired prior to the application of the Scar-Guard material.

7. Scar-Guard Installation

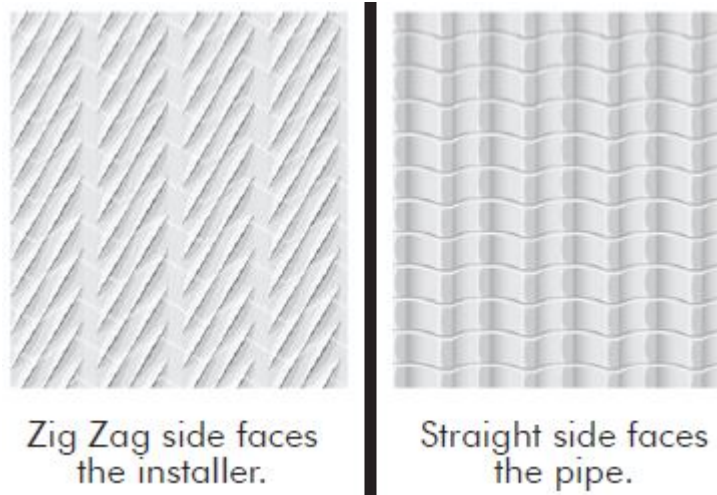
Water is needed to activate Scar-Guard. Open the foil pouch, remove the roll. A water spray system during application is required. The more water that is used will ensure a complete reaction of the resin. If not enough water is used the resin may not react fully.

Note: Once opened, the product cannot be repackaged.

8a. Scar-Guard Installation

Water shall be misted onto the product as you wrap it around the pipe. Ensure that during application that the water is misted onto the top and bottom of the material as this will allow the material to fully cure. Warm water with a temperature up to 60C can be used to speed up the curing process during colder applications.

Scar-Guard must be wrapped onto the field joint in the correct orientation. The "Zigzag" patterned side must be facing outward. The straight side of the Scar-Guard is the side that makes contact with the pipe. See the illustration below.



Begin the application at a minimum distance of 50mm (2") beyond the girth weld coating on the trailing edge. Apply the first wrap circumferentially around the pipe at a 90° angle then begin spiral wrapping towards the leading edge ensuring that a 50% overlap is maintained. Apply pressure during application by pulling firmly on the roll as it is applied. Continue wrapping until the material is at a minimum distance of 100 mm (4") beyond the leading edge of the girth weld coating. Finish with a 90 degree wrap around the pipe and trim off any extra material.

8b. Scar-Guard Installation –for long sections

Water shall be misted onto the product as you wrap it around the pipe. Ensure that during application that the water is misted onto the top and bottom of the material as this will allow the material to fully cure. Warm water with a temperature up to 60C can be used to speed up the curing process during colder applications.

Begin the application at a minimum distance on the trailing edge of the pipe section to be coated. Apply the first wrap circumferentially around the pipe at a 90° angle then begin spiral wrapping towards the leading edge ensuring that a 50% overlap is maintained. Apply pressure during application by pulling firmly on the roll as it is applied. Finish with a 90 degree wrap around the pipe and trim off any extra material. When there is enough distance to allow the application of the compression film the application should begin immediately. When there is enough distance to allow the use of the perforating tool the perforating of the compression film should begin.

9. Scar-Guard Installation

For high shear or impact requirements, additional layers may be applied. Please contact your Canusa representative for technical advice.



10. Scar-Guard Installation

Apply compression film immediately after the Scar-Guard **material** has been applied. Starting 50mm (2") beyond the outer edge of the Scar-Guard. Pull firmly during application and ensure that you maintain a 50% overlap. Continue wrapping the compression film until it extends 50mm (2") beyond the applied Scar-Guard **wrap**. Apply 2 passes of the compression film over the entire area, it is allowable to wrap the compression film in one direction as prescribed then change directions and wrap it in the reverse direction as prescribed.

For long sections being wrapping the compression film once there is enough space for the applicators to work without interfering with the Scar-Guard application. Starting 50mm (2") beyond the outer edge of the Scar-Guard. Pull firmly during application and ensure that you maintain a 50% overlap. Continue wrapping the compression film until it extends 50mm (2") beyond the applied Scar-Guard **wrap**. Apply 2 passes of the compression film over the entire area. It is preferable to have the first and second pass performed immediately behind the other instead of two separate passes.

Perforate the compression film using the perforating tool by rolling it firmly on the compression film. Do not press so hard that the perforating tool passes through the Scar-Guard material and damages the girth weld coating. Perforation allows the CO₂ gas generated by the curing process to escape. During curing the material will foam slightly and some of the foam will rise through the perforations. When the foam material is hard enough to flick off the surface of the compression film the compression film can be removed. Leaving the compression film on longer will not affect or damage the Scar-Guard wrap.

Repairs

Scar-Guard shall be used for repairs. The newly installed Scar-Guard must be circumferentially wrapped around the pipe and must extend 75 mm (3") onto the existing Scar-Guard in good condition on both sides of the damage. The cured Scar-Guard must be solvent wiped and abraded with 60-80 grit sandpaper and the dust removed prior to installation of the repair. Install according to this MQAP.

Backfilling/Laying Guidelines

After application of Scar-Guard it must cure to a minimum Shored D 60 prior to backfilling or HDD applications. To speed up the curing process hot water with a temperature up to 90C can be sprayed onto the applied Scar-Guard until the minimum hardness has been reached.

Storage & Safety Guidelines

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MANUFACTURER'S QUALIFIED APPLICATION PROCEDURE (MQAP)

Revision 1.0