



INSTALLATION GUIDE FOR PERFECT PIPE

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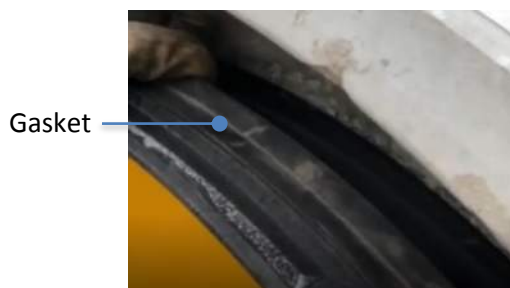
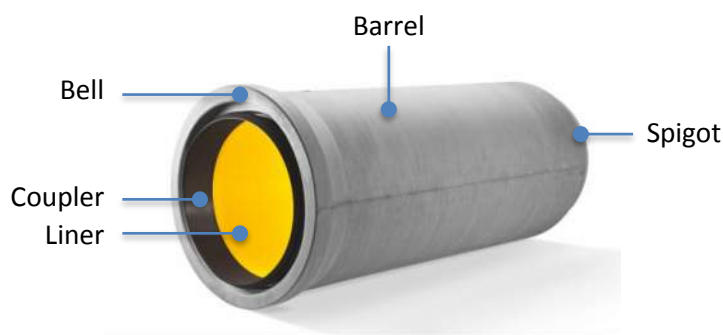
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1 SCOPE

This document provides contractor a guideline to handle, store, install and inspect PERFECT PIPE on site in order to protect the two main features PERFECT PIPE: the interior liner and the pipe joint. PERFECT PIPE installation also involves a general operation procedure including excavation, soil stabilization, backfilling, and control of groundwater and surface drainage. Adequate knowledge of subsurface conditions is essential for any type of excavation. However, these are not the scope of this guide.

2 DEFINITIONS

| | |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Barrel | The body of the pipe |
| Bell | The female end of the pipe |
| Coupler | A plastic ring made of polypropylene which house two double tilting gaskets used to connect the pipes. The coupler is factory installed in the bell end of the pipe. |
| Gasket | Double tilting gasket rest on the coupler provides hydrostatic pressure resistance |
| Liner | High density polyethylene yellow liner with anchors at the back that is cast in to the concrete covering entire interior surface |
| Load Transmission Ring | A rubber ring rests at the spigot protecting concrete to concrete impact during installation |
| Spigot | The male end of the pipe |



3 PRE-INSTALLATION

In addition to the project plan, installation direction, site condition and conventional open cut construction plan, contractor shall review the following technical information regarding to PERFECT PIPE prior to the installation:

- Product drawing
- Product specification
- Product installation guide

Plan for the required equipment for handling, area for storage, bunking, and protection for cold weather. Meeting with ACP technical representative prior to the installation is highly recommended.

4 ON SITE HANDLING

4.1 Safety Precaution

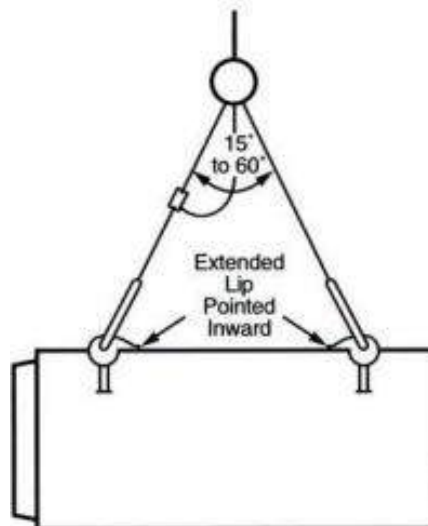
A competent person designated by the contractor should inspect all lifting assemblies and attachment hardware prior to each use. Any damage or defective lifting equipment must be immediately removed from service. All other safety procedures and recommended operating practices by the manufacturer of commercial lifting equipment must be followed. Failure to observe the above warnings may lead to property damage, personnel injury or death.

4.2 Reasonable Care

PERFECT PIPE shall be handled with reasonable care. The contractor must take all necessary precautions to ensure the method recommended in this guide is being followed. When moving the pipe, avoid contacting another pipe or hard object such as trench box etc.

4.3 Lifting Device

All PERFECT PIPEs are designed with two swift lift anchors except the spigot to spigot adaptor. When handling the pipe, use both swift lift anchors with maximum sling angel not exceeding 60 degrees. The extended lip of the swift lift eyes shall be pointed inward.



4.4 Handling Equipment

Following are recommended handling equipment:

- Handling using crane is always preferred.
- Extra care shall be exercised when handling using excavator. Transporting the pipe shall be done in a manner that prevents excessive impact or dynamic loads.



4.5 Don't

- Use any other equipment making contact to the inside of the pipe is prohibited. Use of front-end loader or forklift to handle the pipe from its interior will cause damage to the liner; hence, compromising the durability performance of the pipe.
- Use of front-end loader or forklift to handle the exterior barrel of the pipe is not recommended. This will cause potential damage when bouncing through the construction site.
- Do not drag pipe on the ground.
- Do not roll pipe over the ground.



5 RECEIVING

5.1 Visual Inspection

PERFECT PIPEs delivered to a job have gone through substantial quality control process. All pipes shall have identification indicating QC pass and product label identifying product size, class and manufacturing date. Contractor shall visually inspect the product for any potential deficiency listed below. These deficiencies are not uncommon due to handling and transportation activities between the factory and the job site. Report to ACP Representative if any of the following is observed:

- Check if the coupler is missing, damaged, cracked
- Check if the gasket is missing from the coupler
- Check if any concrete damage e.g. chipped, spalled, cracked
- Check if any scratch or other damage on the surface of the liner
- Check if the load transmission ring is missing



5.2 Unloading

Use the swift lift anchors to unload the pipe. Do not make contact to the inside of the pipe by any construction equipment. This will cause potential damage to the liner; hence, compromising the durability performance of the pipe.



600mm – 900mm



1200mm

5.3 Damage

If PERFECT PIPE is damaged by delivery and unloading, the pipe shall be set aside. Refer to Section 10 for disposition decision.

6 STORAGE ON SITE

PERFECT PIPE shall be stored as close as is safely possible to where the pipe will be installed and such that they are protected from traffic and construction equipment. The pipe shall be stored at a flat area preferably on an aggregates layer.

The pipe shall be wedged to avoid direct contact against the adjacent pipe. Alternate the spigot and bell of the pipe to avoid direct contact against the adjacent pipe. Stacking the pipe on the job site is not recommended. Contact ACP Technical Representative to provide a stacking plan if the stacking is required due to limited construction area.



7 INSTALLING PIPE

7.1 Preparation

Before final placement, contractor shall:

- Re-inspect the pipe in accordance with Section 5.1.
- Ensure the coupler and the inside of the bell and the inside of the spigot are free of are free of foreign objects such as dirt, soil, ice, snow etc.
- Ensure the load transmission ring is rest in the recess at the spigot.
- Lubricate the joint on the entire coupler and the inside of the spigot.



7.2 Installation

PERFECT PIPE shall be slowly lowered into position. Contactor can home the pipe using the following methods:

- Assist with pry bar: Keeping the pipe suspended with lifting sling. Use pry bar leverage on the ground to push the pipe in.
- Using lifting sling and adjacent pipe: Connect one of the lifting pins from the adjacent pipe and one from the pipe being homed. Lift the sling and let the gravity to push the pipe into place. Contractor should hear “boom” sound indicating concrete to concrete impact. Installed PERFECT PIPE shall not be bounced back.
- Using lifting sling to pull the pipe: Connect the lifting pin near the joint that need to be homed, pull in.



Do not use any other equipment such as bucket of the excavator to push the pipe in place. This will damage the joint.

8 JOINT VALIDATION

8.1 Exterior

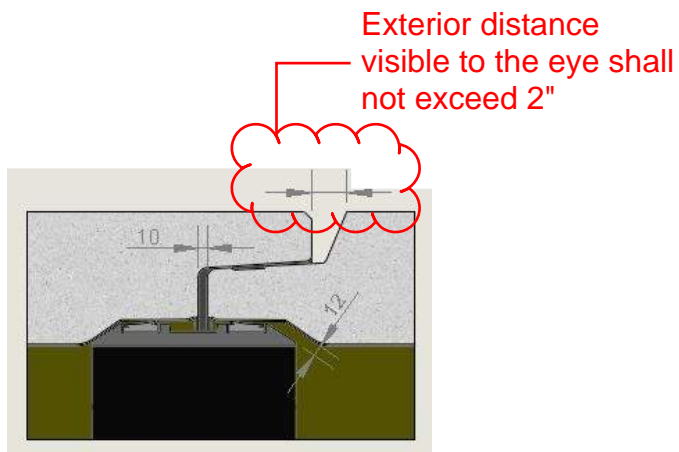
After homing the pipe, contractor shall immediately inspect the joint.

Unlike conventional concrete pipe, the pipe joint does not have a flush face on the spigot shoulder.



8.2 Joint Tolerances

By design, the interior distance between the pipe spigot shall be 10mm or 0.40". This is the maximum allowable joint gap without compromising the hydrostatic performance.





8.3 Interior

Contractor is recommended to check the interior face of the coupler to determine the quality of the joint as installed meet the requirement. Use following methods to evaluate the quality of the installation.

- Compare both side of the coupler. The factory installed (bell) side may be tighter than the field installed (spigot) side.



- Insert fingers into the gap to evaluate the tightness of the joint:

Factory installed coupler



Joint gap is too big if the gasket can be touched



The maximum recommended gap between the liner and the coupler is 13 mm.

8.4 Local Alignment

Use a 4-foot level to check the alignment across the pipe joint. Pipe is mis-aligned if gap is observed at the coupler (left) or at the pipe (right). Deflection of the pipe is caused by alignment or soil settlement. Additional joint gap at the deflected joint will compromise the pressure rating.



8.5 Risk

The hydrostatic performance depends on the joint of the pipe. Failed to validate the joint during installation increases the risk of leakage.

9 INSTALLATION IN WINTER

9.1 Winter Protection

Adequate winter protection shall be exercised to avoid excessive built up of snow or ice. Contractor is recommended to elevate dunnage, cover the pipe, especially both end face with tarp if substantial snow fall or freezing rain is expected.

9.2 Additional Inspection

Before the installation, the joint of the PERFECT PIPE including the inside face of the pipe, the coupler, and the inside face of the spigot shall be inspected. Snow and ice shall be removed. The joint shall be de-iced using the following method:

- Use frost buster to warm up the pipe / joint
- Remove the ice using non-metallic scraper
- Tap the ice using rubber hammer
- Wiggle the gasket on the coupler. An unfrozen gasket shall allow minor movement.



9.3 Unacceptable Condition



Ice built-up and freeze the low transmission ring



Ice build up on inside of the spigot






Ice build up on inside of the bell

10 PRODUCT DEFFICIENCY AND REPAIR

The key elements for Perfect Pipe are the liner and the coupler. Any damages impacting the quality of the liner and coupler shall be noted by the contractor. The pipe with such damage shall be removed from the installation. Table 1 provide a general guide for remediation on site. If the situation causes any uncertainty to the performance of Perfect Pipe, contact an ACP technical representative.

Table 1 Common Damage and Remediation

| Damage | Remediation |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Concrete damage with area that is smaller than 150 mm by 150 mm with depth less than 13 mm. No expose steel and no separation between liner and concrete are observed. | Patch with non-shrink cementitious material such as Rapid-Set Mortar Mix or approved equal. |
| Concrete damage at the bell with area that is smaller than 300 mm by 300 mm with depth greater than 13 mm. Expose steel but no separation between liner and concrete are observed and no damage to the coupler. | Patch with non-shrink cementitious material with minimum 28-day strength of 6,000 PSI. Repaired section must be properly cured to minimum 6,000 PSI prior to installation.  |
| Concrete damage  | Further assessment by ACP technical representative is required. |
| Cracked pipe | Further assessment by ACP technical representative is required. |
| Coupler damaged | Return and replace the pipe. Remove and replace the coupler on site is not recommended. |
| Gasket damaged | Replace gasket by ACP technical representative. |
| Load transmission ring damage | Replace load transmission ring. |
| Liner damaged or scratched | Replace the pipe |
| Liner black mark  | Inspect carefully the surface of the liner. If no scratch or stretch, the pipe is acceptable. |