

## CHAPTER 2

# Inspections, Tests and Safety Considerations

### Scope

*Once a PE piping system has been selected and designed for an application, the design is implemented by procuring the pipe, fittings and other necessary appurtenances, installing the system, and placing it in service. Piping installation involves people and machines in motion to move, assemble, install, inspect and test the piping system. Whenever moving machinery, piping parts, and personnel are engaged in piping system construction, safety must be a primary consideration. This chapter presents some of the inspections, tests and safety considerations related to installing PE piping, placing an installed system in service, and operating a PE piping system.*

*Cautionary statements are provided in this chapter, but this chapter does not purport to address all of the product applications, inspections, tests, or construction practices that could be used, nor all of the safety practices necessary to protect persons and property. It is the responsibility of the users of this chapter, installers, inspectors and operators of piping systems to establish appropriate safety and health practices, and to determine the applicability of regulatory limitations before any use, installation, inspection, test or operation.*

### Introduction

Generally, piping system installation begins with the arrival and temporary storage of pipe, fittings, and other goods required for the system. Assembly and installation follow, then system testing and finally, release for operation. Throughout the installation process, various inspections and tests are performed to ensure that the installation is in accordance with specification requirements and that the system when completed is capable of functioning according to its design specifications. In the selection, design, and installation of PE piping systems, professional engineering services, and qualified installers should be used.

PE piping products are integrated pipe and fitting systems for a broad range of commercial, municipal, utility and industrial applications. They may be buried, laid on the surface, supported above grade, installed underwater, or floated on the surface of lakes or rivers.

PE piping products are manufactured from 1/4" (6 mm) diameter through 120" (3050 mm) diameter under applicable industry standards (ASTM, AWWA, etc.) for pressure and non-pressure applications. As well, PE fittings, custom fabrications, special structures and appurtenances are available for full pressure rated, reduced pressure rated, or non-pressure rated applications.

Conventionally extruded PE pipes have homogeneous walls and smooth interior and exterior surfaces. Profile pipes are manufactured by extruding a profile over a mandrel. These pipes have smooth interiors, and may have a smooth or a profiled exterior.

Fittings, fabricated structures, tanks, and manholes are constructed for pressure, low pressure and non-pressure applications. Smaller size fittings are usually injection molded. Larger fittings, fabricated structures, tanks, and manholes are fabricated in manufacturer's facilities. Thermal joining techniques used for fabrication usually limit the design pressure capacity of the structure. Complex structures are generally not suitable for field fabrication.

## **PE Piping in the Field**

After the piping system has been designed and specified, the piping system components must be procured. Typically, project management and purchasing personnel work closely together so that the necessary components are available when they are needed for the upcoming construction work.

### **Packaging for Commercial Transport**

PE fittings, fabrications and pipe are shipped by commercial carriers who are responsible for the products from the time they leave the manufacturing plant until they are accepted by the receiver. Molded fittings and small fabrications and components are usually packaged in cartons. Large orders may be palletized. Large fabrications may require custom packaging. Commercial transport may be by parcel service or commercial carrier in enclosed vans or on flatbed trailers depending on packaging.

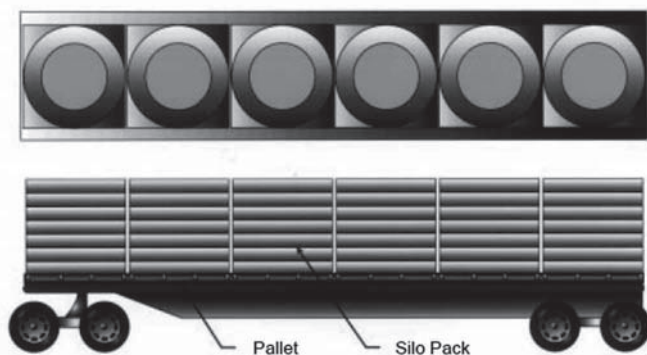


**Figure 1** Typical Truckload of Coiled, Silo-Pack Pipe (40' Trailer)

PE pipe is produced in coils or in straight lengths and shipped on flatbed trailers. Coils are typically limited to 6-inch and smaller sizes. Coils may be laid flat and stacked together into silo packs, or may be individual large vertical coils, or may be reels of coiled pipe. Straight lengths are bundled together in bulk packs or loaded on the trailer in strip loads. Standard straight lengths for extruded pipe are 40 feet long; however, shorter lengths or lengths 60 feet long or longer depending on transportation restrictions may be produced. State transportation restrictions on length, height and width usually govern allowable load configurations. Higher freight costs may apply to loads that exceed length, height, or width restrictions. Although PE pipe is lightweight, weight limitations may restrict load size for very heavy wall or longer length pipe. Profile wall extruded pipes 96-inch ID (2438 mm ID) and 120-inch ID (3048 mm ID) will exceed 8 feet overall permissible width, and are subject to wide load restrictions.

Figures 1 through 3 are general illustrations of truckload and packaging configurations for conventionally extruded PE pipes. Actual truckloads and packaging may vary from the illustrations. “Nesting”, or sliding a smaller pipe length inside a larger pipe, is generally not practiced for commercial flatbed loads because it is difficult to remove the inner pipe when the load is delivered at the jobsite, because nesting can result in an overweight load, and because most commercial flatbed trailers do not have structural bulkheads at both ends to prevent nested pipes from sliding out during acceleration or braking. Fully enclosed containers for overseas delivery can occasionally be nested. Occasionally, silos of small tubing sizes may be “nested” in silos of larger coiled pipe. Nested silos must have special packaging to lift the tubing silo out of the pipe silo. De-nesting should only be performed after the nested silos have been unloaded from the truck and placed on the ground.

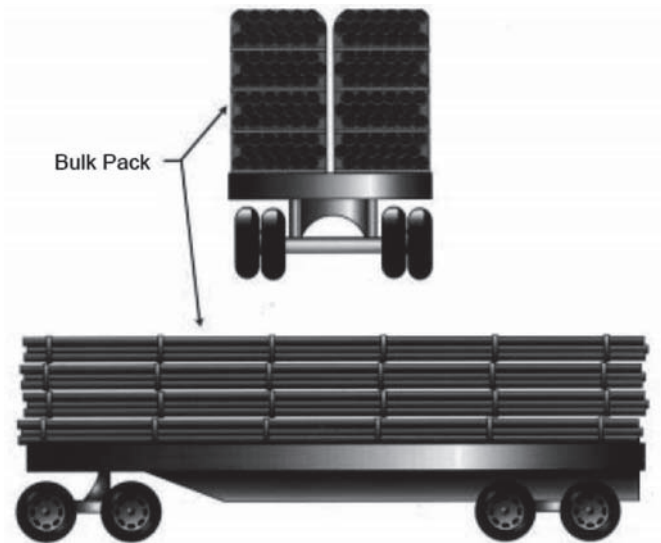


**Figure 2** Typical Straight Length Bulk Pack Truckload

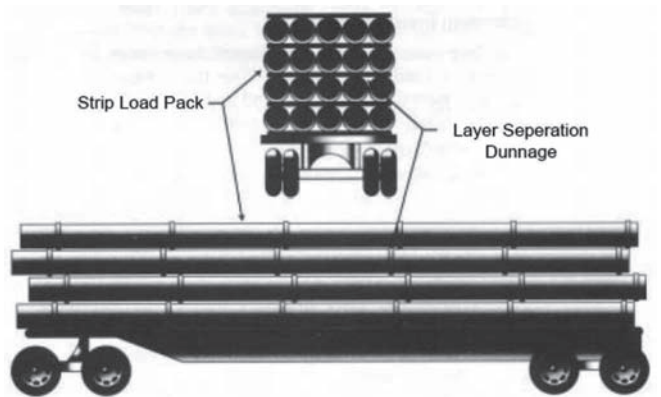


**Figure 3** Typical Straight Length Strip Load Truckload

Occasionally, when coiled pipe silo packs and boxed fittings are shipped together, fitting cartons are placed in the center of the silo packs. Tanks, manholes, and large fittings and custom fabrications are usually loaded directly onto flatbed trailers.

### Receiving Inspection

Few things are more frustrating and time consuming than not having what you need, when you need it. Before piping system installation begins, an important initial step is a receiving inspection of incoming products. Construction costs can

be minimized, and schedules maintained by checking incoming goods to be sure the parts received are the parts that were ordered, and that they arrived in good condition and ready for installation.

### Checking and Inspecting the Order

When a shipment is received, it should be checked to see that the correct products and quantities have been delivered in a condition that is suitable for installation. Several documents are used here. The Purchase Order or the Order Acknowledgment lists each item by its description, and the required quantity. The incoming load will be described in a Packing List which is attached to the load. The descriptions and quantities on the Packing List should match those on the Purchase Order or the Order Acknowledgment.

The carrier will present a Bill of Lading that generally describes the load as the number of packages the carrier received from the manufacturing plant. The Order Acknowledgment, Packing List, and Bill of Lading should all be in agreement. Any discrepancies must be reconciled among the shipper, the carrier, and the receiver. The receiver should have a procedure for reconciling any such discrepancies.

There is no substitute for visually inspecting an incoming shipment to verify that the paperwork accurately describes the load. Products are usually identified by markings on each individual product. These markings should be checked against the Order Acknowledgment and the Packing List. The number of packages and their descriptions should be checked against the Bill of Lading.

Before and during unloading, the load should be inspected for damage that may occur anytime products are handled. Obvious damage such as cuts, abrasions, scrapes, gouges, tears, and punctures should be carefully inspected. Manufacturers should be consulted for damage assessment guidelines. Product with damage that could compromise product performance should be segregated and a resolution discussed with the manufacturer.

When pipe installation involves saddle fusion joining, diesel smoke on the pipe outside surface may be a concern because it may reduce the quality of saddle fusion joints. Smoke damage is effectively prevented by covering at least the first third of the load with tarpaulins or by using truck tractors with low exhaust. If smoke tarps are required, they should be in place covering the load when it arrives.

### Receiving Report & Reporting Damage

The delivering truck driver will ask the person receiving the shipment to sign the Bill of Lading, and acknowledge that the load was received in good condition. Any damage, missing packages, etc., should be noted on the bill of lading at that time.

Shipping problems such as damage, missing packages, document discrepancies, incorrect product, etc., should be reported to the product supplier immediately. Shipping claims must be filed within 7 days.

## Field Handling

PE piping product transportation and handling is generally subject to governmental safety regulations such as OSHA in the United States or CCOSH in Canada. Persons transporting and handling PE piping products should be familiar with applicable governmental safety regulations. Additional PE pipe handling and transportation information is available in the PPI Material Handling Guide<sup>(1)</sup>, and in handling and unloading recommendations from product manufacturers. The responsibility for safe transport and handling; however, rests primarily with persons that actually perform transport and handling activities.

Manufacturer handling and unloading recommendations are typically given to the truck driver when the load leaves the manufacturing plant with instructions for the truck driver to give the manufacturer's handling and unloading recommendations to jobsite personnel upon delivery.

*Always observe applicable governmental safety regulations and manufacturer's handling and unloading recommendations when transporting or handling PE piping products in the field. Unsafe handling can result in damage to property or equipment, and be hazardous to persons in the area. Keep unnecessary persons away from the area during unloading and while handling pipe and piping components. See and be seen at all times. All persons involved in unloading and handling PE pipe and piping components should be sure that they can see all other persons and be seen by all other persons engaged in unloading and handling.*

PE pipe is tough, lightweight, and flexible. Installation does not usually require high capacity lifting equipment. Pipe up to about 8" (219 mm) diameter and weighing roughly 6 lbs per foot (9 kg per m) or less can frequently be handled manually. Heavier, larger diameter pipe will require appropriate handling equipment to lift, move and lower the pipe. Pipe must not be dumped, dropped, pushed, or rolled into a trench.

Lengths of heat fused PE pipe may be cold bent in the field. The PE pipe manufacturer should be consulted for field bending radius recommendations. Field bending usually involves sweeping or pulling the pipe string into the desired bend radius, then installing permanent restraint such as embedment around a buried pipe, to maintain the bend. If used, temporary blocking should be removed before backfilling to avoid point loads against the pipe.

*Considerable force may be required to field bend larger pipe, and the pipe may spring back forcibly if holding devices slip or are inadvertently released while bending. Observe appropriate safety precautions during field bending.*

## Handling Equipment

Unloading and handling equipment must be appropriate for the type of packaging, must be in safe operating condition, and must have sufficient capacity (load rating) to safely lift and move the product as packaged. Equipment operators should be trained and preferably, certified to operate the equipment. Safe handling and operating procedures must be observed.

Although PE piping components are lightweight compared to similar components made of metal, concrete, clay, or other materials, larger components can be heavy. Lifting and handling equipment must have adequate rated capacity to safely lift and move components. Equipment that lifts from the bottom of the load such as a forklift, or from above the load such as a crane, a side boom tractor, or an extension boom crane is used for unloading. Above the load lifting equipment may employ slings or slings and spreader bars to lift the load.

When using a forklift, or forklift attachments on equipment such as articulated loaders or bucket loaders, lifting capacity must be adequate at the load center on the forks. Forklift equipment is rated for a maximum lifting capacity at a distance from the back of the forks. If the weight-center of the load is farther out on the forks, lifting capacity is reduced.

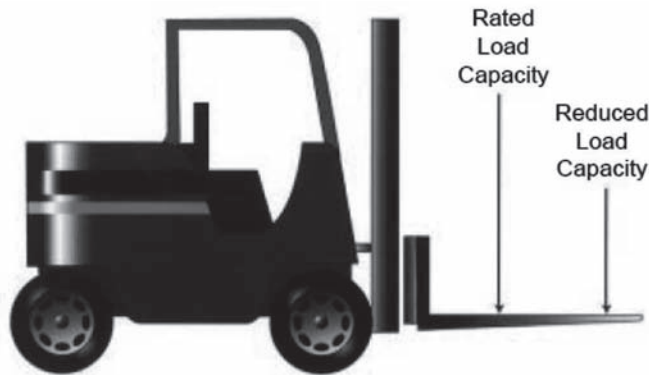


**Figure 4** Forklift Load Capacity

Before lifting or transporting the load, forks should be spread as wide apart as practical, forks should extend completely under the load using fork extensions if necessary, and the load should be as far back on the forks as possible. During transport, a load on forks that are too short or too close together, or a load too far out on the forks, may become unstable and pitch forward or to the side, and result in damage to the load or property, or hazards to persons.

Above the load lifting equipment such as cranes, extension boom cranes, and side boom tractors, should be hooked to wide fabric choker slings that are secured

around the load or to lifting lugs on the component. Wire rope slings and chains can damage components, can slip, and should not be used. Spreader bars should be used when lifting pipe or components longer than 20'. *Before use, inspect slings and lifting equipment. Equipment with wear or damage that impairs function or load capacity should not be used.*

### Unloading Site

A suitable unloading site will be generally level and large enough for the carrier's truck, handling equipment and its movement, and for temporary load storage.

### Unloading Bulk Packaged Pipe, Fittings and Fabrications

Silo packs and other palletized packages should be unloaded from the side or end with a forklift. Non-palletized pipe, fittings, fabrications, manholes, tanks, or other components should be unloaded from above with suitable lifting equipment and wide fabric slings, or from the side with a forklift.

*Pipe, fittings, fabrications, tanks, manholes, and other components must not be pushed or rolled or dumped off the truck, or dropped.*

### Unloading Large Fabrications, Manholes and Tanks

Large fabrications, manholes and tanks should be unloaded using a wide web choker sling and lifting equipment such as an extension boom crane, crane, or lifting boom. The choker sling is fitted around the manhole riser or near the top of the tank. Do not use stub outs, outlets, or fittings as lifting points, and avoid placing slings where they will bear against outlets or fittings. Larger diameter manholes and tanks are typically fitted with lifting lugs. All lifting lugs must be used. *The weight of the manhole or tank is properly supported only when all lugs are used for lifting. Do not lift tanks or manholes containing liquids.*

### Pre-Installation Storage

The size and complexity of the project and the components, will determine pre-installation storage requirements. For some projects, several storage or staging sites along the right-of-way may be appropriate, while a single storage location may be suitable for another job.

The site and its layout should provide protection against physical damage to components. General requirements are for the area to be of sufficient size to accommodate piping components, to allow room for handling equipment to get around them and to have a relatively smooth, level surface free of stones, debris, or other material that could damage pipe or components, or interfere with handling. Pipe may be placed on 4-inch wide wooden dunnage, evenly spaced at intervals of 4 feet or less.

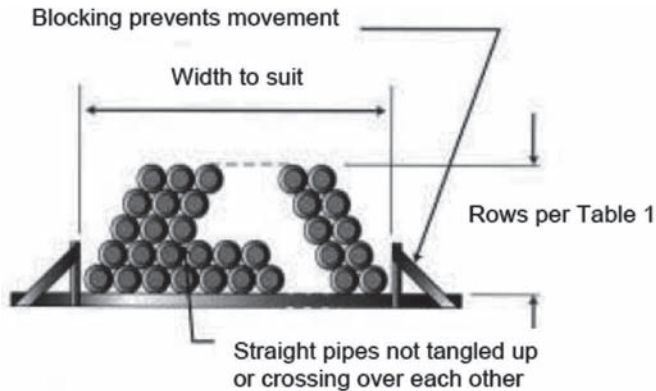


**Figure 5** Loose Pipe Storage

### Pipe Stacking Heights

Coiled pipe is best stored as-received in silo packs. Individual coils may be removed from the top of the silo pack without disturbing the stability of the remaining coils in the silo package.

Pipe received in bulk packs or strip load packs should be stored in the same package. If the storage site is flat and level, bulk packs or strip load packs may be stacked evenly upon each other to an overall height of about 6'. For less flat or less level terrain, limit stacking height to about 4'.

Before removing individual pipe lengths from bulk packs or strip load packs, the pack must be removed from the storage stack, and placed on the ground.