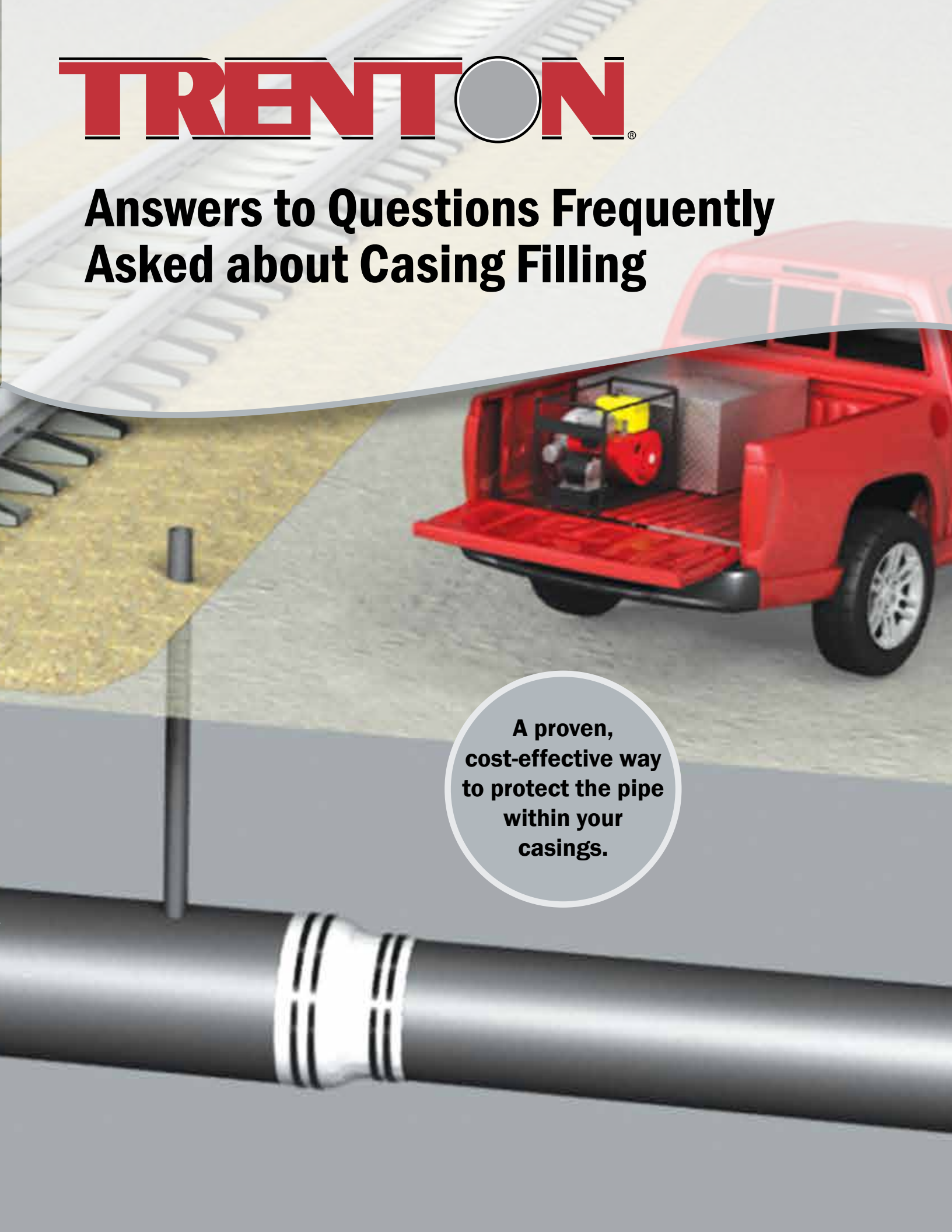
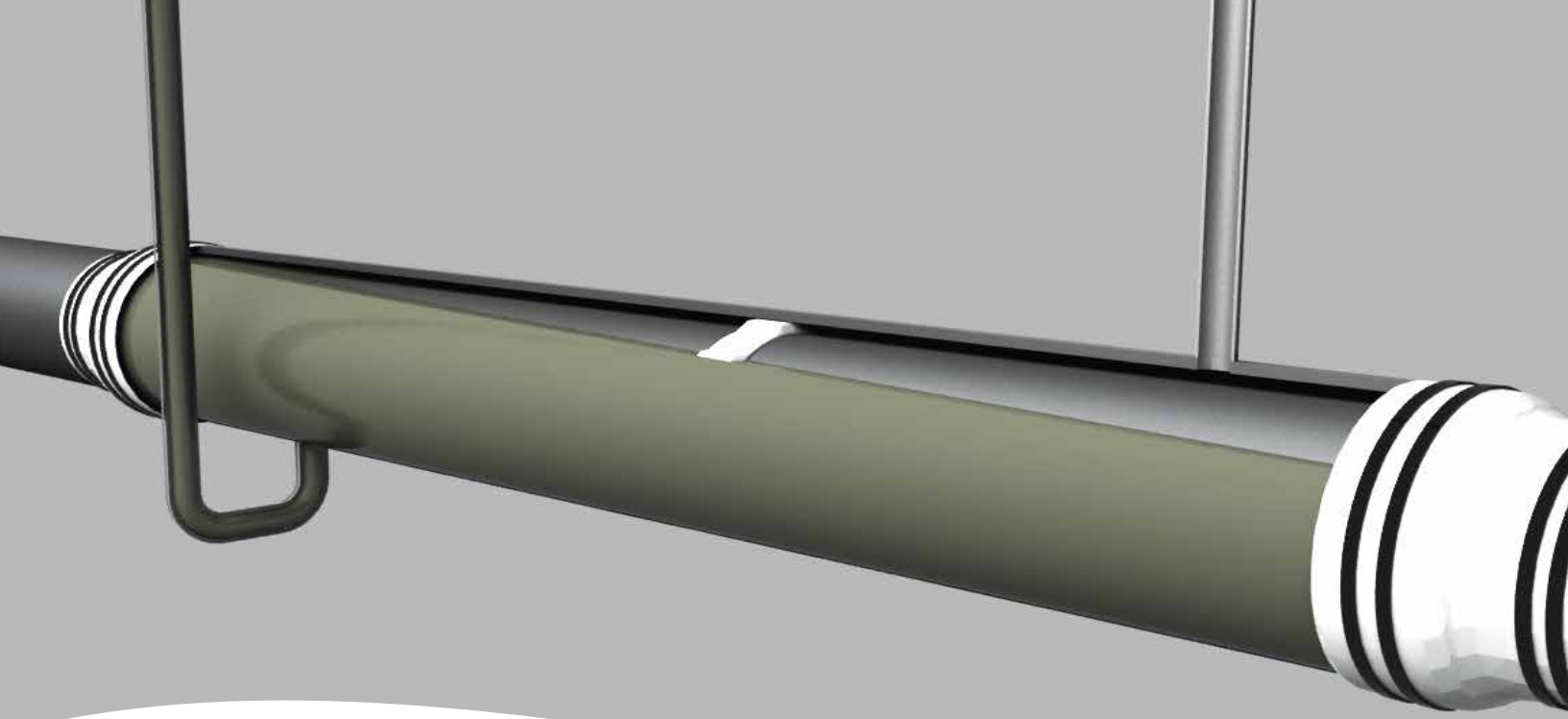




Answers to Questions Frequently Asked about Casing Filling



**A proven,
cost-effective way
to protect the pipe
within your
casings.**



Over thirty years ago, Trenton developed the large-scale, hot-installed casing filling method. They continue to be world leaders in the casing filling industry.

▲ This cutaway view shows how Trenton Fill-Coat® #1 hot-installed casing filler is pumped down the fill vent to fill the annulus of the casing. The white casing spacer does not block the filler, because Fill-Coat #1 hot-installed casing filler is melted before being pumped. When the wax cools, it provides an excellent, stable, long-term protection for the carrier pipe.

The pickup truck carries the special pump used to pump out the water in the casing. The tanker has a proprietary system of pumps, fittings, meters and gauges to pump the heated Trenton Fill-Coat® #1 hot-installed casing filler down the fill vent, into the annulus that is between the carrier pipe and the casing, and up the discharge vent. ▶



Why Fill Casings?

■ **To Avoid Corrosion:** Water tends to accumulate in the casing by condensation or by leaks in the end seals or in the casing itself. Oxygen in this water creates a potentially corrosive environment in the casing. When the casing is filled with a high-dielectric material, the water is displaced and any new water with new oxygen is prevented from entering. This greatly reduces the possibility of corrosion.

■ **To Reduce the Need for Increased Cathodic Protection:** Cathodic protection current flowing through the casing and through the water in the casing on the carrier pipe will be reduced. This assumes that the casing is not mechanically shorted (metal is not touching metal).

■ **To Satisfy U.S. DOT Requirements:** U.S. Department of Transportation requirements for attending to mechanically shorted casings are satisfied by installing a high dielectric casing filler in the annulus of the casing.

■ **To Correct a Shorted Casing:** In some instances a mechanical short between the casing and the carrier pipe can be corrected when the casing is filled. Generally all electrolytic shorts are corrected with filling.

■ **To Help Prevent Future Shorted Casings:** If the pipe is not shorted, the casing filler provides both additional support of the carrier pipe and a high dielectric barrier that can prevent a future short.

■ **To Protect the Casing Itself:** Casing filler will protect the casing itself from corroding. Holes one could put a hand through have occurred in the walls of casings as the cathodic protection current leaves the inner surface of the casing and flows through casing water to the carrier pipe.

■ **To Prevent Atmospheric Corrosion:** Even in the absence of ground water, moisture and condensation are usually present in the atmosphere in the annulus of the casing. This moisture, together with the oxygen present, can result in corrosion of the carrier pipe at pin holes and other damaged areas of the coating.

■ **To Prevent Possible Interference from Cathodically Protected Casings:** Current flowing from a cathodically protected casing could flow to the pipe at one point and flow off the pipe back to the casing at some other point, causing corrosion at the second point.

Case History: Extreme Cold

Fill or Freeze

It was 20 degrees below zero and the casing had to be filled now, because of construction restrictions.

The temperature of the casing filler had to be high enough so that it would not solidify during the fill. Extra heating was required prior to and during the filling operation.

In addition to the extreme cold, flow was restricted because of blockage in the vent and there was

water in the casing. The casing had to be filled slowly and carefully to minimize fill pressure and to displace the water. To prevent freeze-up in the fill hose, torches were used to heat the hoses while filling.

Despite the obstacles presented by the cold weather, the casing was filled successfully, due to careful preparation and technical expertise.

Methods

What are the two basic methods of installing casing filler?

■ Hot-Installed:

The casing filler is delivered to the job site in a heated truck and pumped down the casing vent as a hot liquid. As the material cools, it firms up to a wax consistency, forming a high-dielectric, anticorrosive barrier.



▲ *Fill-Coat® #1 hot-installed casing filler is transported and heated in large tankers.*

■ Cold-installed:

The casing filler is delivered to the job site in 55-gallon drums. It has the consistency of grease and is pumped down the casing vent with a powerful mastic pump. If the temperature drops below 50 °F, the drum must be heated in order to lower the filler's viscosity and allow it to be pumped.

What are the advantages of hot-installed casing filler?

The hot-installed casing filler is more commonly used because it is better for larger casings or jobs with numerous casings. It has these advantages:

- Generally more economical
- Filling of the casings is completed in less time than drum-installed filler
- Material is installed at lower operating pressures, reducing the force on the end seals
- No 55-gallon drums to inventory, handle during installation and dispose of when empty
- Can be used in cold weather, because it goes in as a hot liquid
- Can be installed into long casings, where it may not be possible to use cold-installed filler because of the high pressures required to push cold materials long distances
- Can be metered so that actual material installed can be determined to the gallon
- Client administration, supervision and labor costs are minimized, because the casings are filled from start to finish by Trenton personnel.

Case History: Resourcefulness

Trenton has pioneered the development of equipment and fittings specifically designed for effective casing filling in a wide variety of settings.

Some Casing Fills are More Complicated

This casing was located in a large metropolitan area with heavy traffic congestion. Special care was taken to prevent traffic mishaps and a 3,000-gallon single-unit tank truck was used for maneuverability and to minimize traffic disruption.

Further, the casing vents were located 10 feet below street level under manholes in the center of the street. Ladders had to be used because of the absence of built-in ladder rungs. Technicians were stationed inside the manholes at each vent and the casings were successfully filled.

What are the advantages of cold-installed casing filler?

Cold-installed casing filler is sometimes preferred for jobs requiring very small quantities of filler.

Cold-installed casing filler has these advantages:

- Economical for small projects
- Casing can be prepared singly and filled immediately after preparation.

Both methods are equally effective in helping to stop corrosion of the carrier pipe in the casing.

Trenton Fill-Coat® #1 & #2 casing fillers are excellent hot- and cold-installed casing fillers with decades of proven effectiveness.

▼ *Fill-Coat® #2 cold-installed casing filler is delivered in 55-gallon drums and usually pumped into the casing by the customer or contractor. Trenton rents out specially adapted pumps and provides expertise for filling these smaller, isolated casings.*



Planning

How do I go about getting my casings filled?

Call Trenton Corporation and discuss your situation. They will ask you for the number of casings and their locations, the size of pipe and casing, and the length of each casing.

Some additional information is usually helpful. Are there top or bottom vents? What is the vent size? Are there dog-legged vents? What is the type of casing end seal? Is it new or old construction? What is the access to the vents? Which is the high end and which is the low end of the casing?

Because of Trenton's experience in casing filling, they can help you assemble information that will be important in planning of the successful filling of your casings.

How do I calculate how much casing filler I need?

First, determine the diameter and length of your casing and the diameter of your carrier pipe. Then call Trenton and they will help determine the number of gallons needed.

When installing Fill-Coat® #1 hot-installed casing filler, Trenton always has extra material available to assure a complete fill, and there are no extra charges for the material not used.

A Tight Fit

A few years ago in Lexington, Kentucky a 6-inch line was inserted within an existing but abandoned 8-inch line that was 1200 feet long. Of course a 6-inch pipe inside an 8-inch casing does not leave much of an annulus to fill and the extreme length make it particularly difficult.

The crew raised the temperature to upwards of 300° F and pumped at a pressure up to 150 psi at the fill end. (An end seal was required that would withstand such high pressure.) A

How is casing filler priced?

Based upon an estimate of the number of gallons required, the number of casings and their locations, the time of year, and other circumstances, the cost of doing the work will be submitted to you either as; 1) a lump sum price, including material, delivery and installation, 2) a price per gallon installed, or 3) a price per gallon f.o.b. shipping point (for Fill-Coat® #2 in 55 gallon drums).

The Trenton Corporation generally provides their clients with both a fixed price per gallon of casing filler material delivered and installed into the casing and a total project cost.

What if my casing vents are not located near a road?

Trenton crews bring several hundred feet of hose to the job if necessary, and Trenton tankers have off-road capability.

Case History: Small Annulus and Long Casing

variable capacity pump that could pump to such high pressure was essential because the filler tends to cool much more rapidly in such a small annulus.

The crew pumped long and hard. The Fill-Coat® casing filler material that reached the discharge vent was cooled, but the crew successfully completed the fill.

Can I have my casings filled in cold weather?

Yes. All Trenton tankers are equipped with self-contained heating systems so proper installation temperature can be maintained, regardless of ambient temperature. Tank-mounted thermometers offer easy monitoring to make sure the fill temperature is right for the ambient temperature.

What happens if I delay filling casings?

Sometimes there is no immediate risk. However, there is; 1) the continued exposure to corrosion inside the casing, 2) the possible lack of compliance with federal code provisions if the casings are shorted, and 3) the consideration that costs tend to rise over time.

How much lead time do I need to get my casings filled?

It depends on the size of the project and the schedule of the supplier.

The Trenton Corporation maintains a continuing inventory of casing filler materials, owns and maintains their own casing filler installation equipment and retains experienced casing filling technicians. Therefore, lead time is kept to a minimum with the Trenton Corporation, usually only a few days or a few weeks at most.

Trenton has developed “portable” technology that enables Trenton to bring its proprietary expertise to a wide range of locations.

▼ Trenton has developed special technology for taking its system of pumps, fittings, valves, etc., to locations outside the United States.



Decades of innovation can now be delivered around the globe.

Preparation

What preparation should be done make prior to filling?

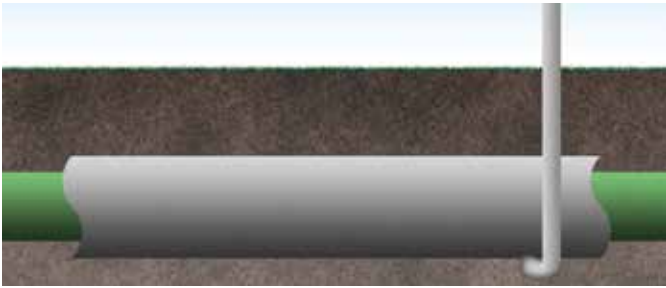
First, determine that the vents are clear and open into the casing.

Second, check that the end seals are intact and able to hold filler.

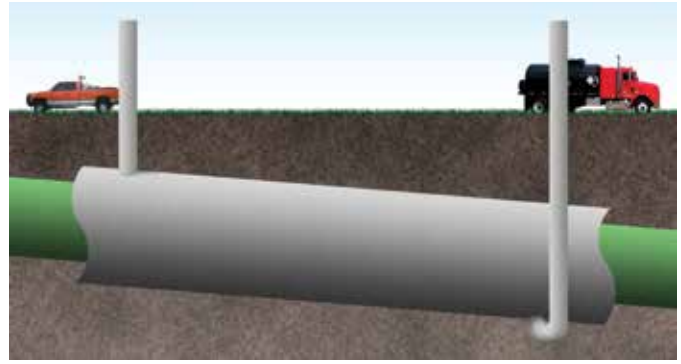
Third, remove water from the casing if possible.

How do you determine if the vent is clear?

Blow air through one vent and out the other vent. This will identify some restricted vents, but not all of them. The surest method is to excavate, cut the vent off to check the size of the vent hole in the casing, visually inspect the vent pipe to make sure that the vent pipe is clear, and then reattach the vent.



It is possible to fill a casing with only one vent, but it takes special equipment and expertise.



A top vent on the higher end of the casing and bottom vent on the lower end is ideal.

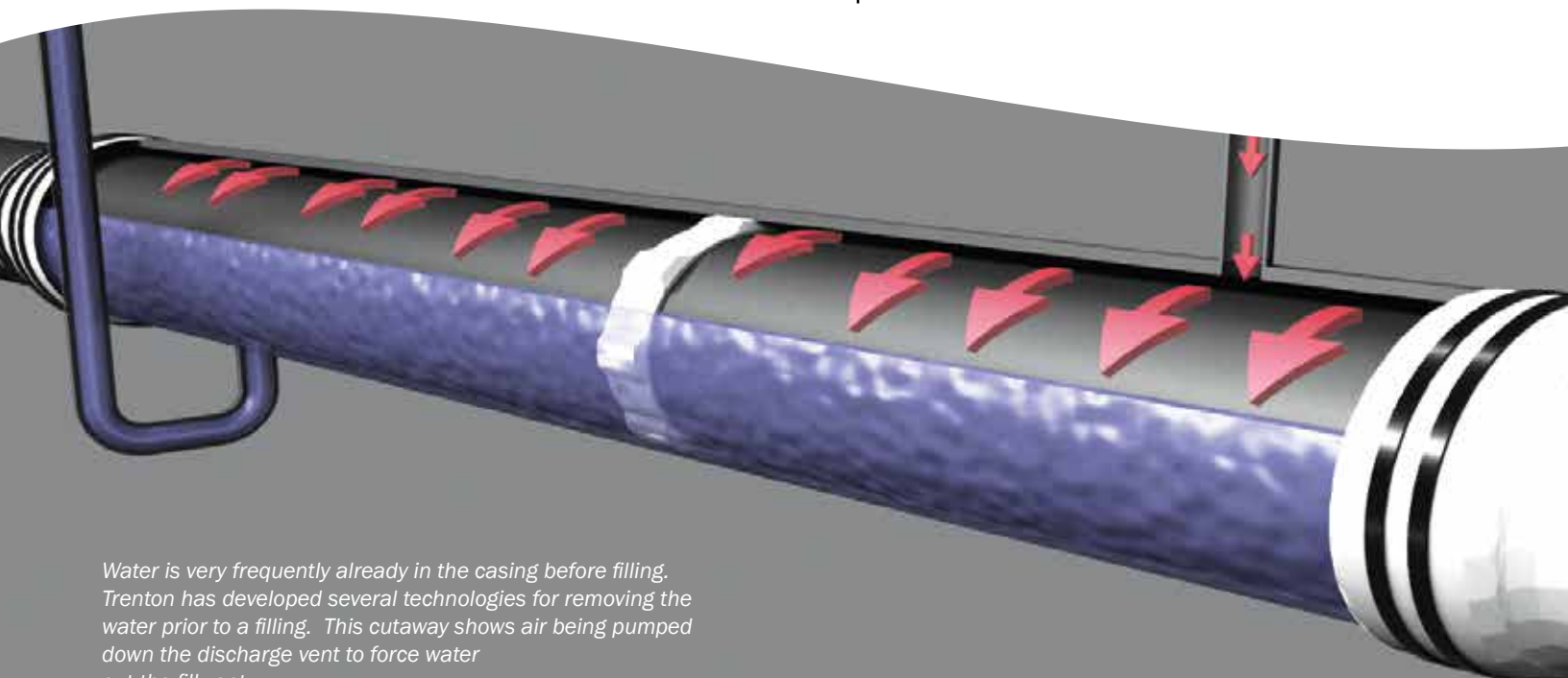
Can a casing be filled that has only one vent?

Yes, if the casing is dry. However, this is accomplished with considerable difficulty and requires special techniques and fittings. It is nearly impossible to fill a single vent casing if water is present. Second vents on all casings are highly recommended.

If a vent is added, should it be a top or a bottom vent?

For best results, the casing should have one top vent on the high end and one bottom vent on the low end. However, Trenton's experienced technicians can get a satisfactory fill with any combination of two vents.

The preferred method of adding a second vent is to weld or mechanically attach the vent. However, other less elaborate methods have proven acceptable.



Water is very frequently already in the casing before filling. Trenton has developed several technologies for removing the water prior to a filling. This cutaway shows air being pumped down the discharge vent to force water out the fill vent.

What size should vents be?

Trenton can fill through any size vent. However, it is desirable to use at least a 2-inch diameter vent pipe with at least a 1 ½-inch opening in the casing at the vent.

How can a company determine if the end seals are intact?

The surest method is visual inspection. Another method is a low pressure air test, to see if the casing will hold pressure.

What if the seal is not intact?

There are several end seal products that can be used to repair damaged or defective end seals.

Trenton Seal-Wrap™ End Seal has advantages for replacing or repairing existing seals and for new construction.

How is water removed from a casing?

There are four basic methods of removing water:

- 1) Excavate the ends, remove the end seals, drain the water from the casing, and install new end seals.
- 2) Use a vacuum truck to suck out the water. If this is not done immediately before filling, water can often fill the casing again.

3) Trenton uses a special pump to push out the water from the high end vent to the low end vent in a way that does not blow out the end seals.

4) In cases where there is only one vent or two top vents, Trenton uses a suction pump with a special hose to suck the water out of the casing. The hose must reach the lowest point to be effective.

Can a casing be filled if water has not been removed?

Yes, but there are usually problems and it is difficult to get a very high fill percentage. While the filling process will displace most of the water. In some instances small quantities of water may remain entrapped in the casing after filling.

If water is not removed from the casing prior to filling, it is highly recommended that a casing water conditioner, such as Trenton Pre-Con®, be added to the casing prior to filling. This method neutralizes entrapped water in order to avoid corrosion.

A Trenton Exclusive:

Pre-Con® Casing Water Conditioner

Sometimes small amounts of water are entrapped in a casing after it has been filled. Trenton Pre-Con® is a corrosion inhibitor that is poured into a casing prior to filling to neutralize this entrapped water to prevent corrosion.

The process of adding a corrosion inhibitor to the casing prior to filling with casing filler was developed and patented by the Trenton Corporation under U.S. Patent #4,469,469.



Trenton Pre-Con® mitigates any corrosion that would be caused by water left in the casing.

Installation

Can excessive casing filling pressure cause leaks in the end seals?

It can, depending upon the end seal material, the effectiveness with which the end seals have been installed, the pressure reached in filling, and the skill of the fill technicians.

Trenton tankers are equipped with a pressure gauge so that fill pressure can be monitored, and Trenton personnel are experienced in working with flow pressures.

What if an end seal or carrier pipe leaks during a fill?

Sometimes a leak is detected by seeing filler come up to the surface. When that happens, the fill is immediately shut down and adequate time is allowed for the fill material to set up in the ground and form its own seal. Trenton's experienced crews are careful with fill pressure to minimize the likelihood of leaks, but also have experience in how to deal with leaks when they do happen. A Trenton casing fill will also have ample manpower in the fill crew to continuously watch for leaks at each casing end. In addition, Trenton crews have the equipment and experience to clean up and dispose of whatever material may have come to the surface.

How do you know when the casing is full?

One important measure of a successful filling is "fill percentage." Any one individual casing fill percentage may be low or high for a variety of reasons, such as erroneous estimated gallonage, inaccurate casing length, unknown coating thickness, unknown number of spacers, foreign material in casings (such as mud), leaking carrier pipe or defective end seals. This variability of individual casings is the reason for using an average fill percentage. An experienced and skillful filling crew should normally have an 85-100% average fill percentage.

Casing filler coming out the discharge vent is only a partial indicator of fill percentage. Water or air could be trapped in the casing, so it is very important to wait and let the filler settle after seeing it in the discharge vent. In nearly every casing filling there is a need to add more filler after there has been time to let the filler cool and settle.

If water has not been removed prior to filling the casing, most of it will be pushed out by the filler material. Before the water stops coming out and

Case History: Difficult Access

Down the Hill and Across the River

Even after driving a mile through pasture, the only access to the casing was 600 feet from the tanker, down an extremely steep hill, across a 60-foot wide river, and across another 300 feet to the casing vent. An extra utility truck was required to carry the extra hose, rigid steel pipe, drum floats, and a boat.

The hose was strung down the river bank and connected to the 2-inch rigid pipe, which was used to cross the river. The pipe was supported on drum floats (55-gallon drums banded together). This was done so that the river water

would not cool off the casing filler material and cause it to solidify during the fill. The remaining 300 feet to the casing vent was reached with standard, flexible casing filler hose.

Because of the length of hose required, a gravity fill technique was used at the completion, draining the hose at the same time in order to minimize material waste. Special shut off valves were located on both sides of the river to prevent any possible spillage into the river.

Documentation

casing filler material starts coming out, there is often a mixture of filler and water and it takes expertise to determine when to pause, when to pump, and when to stop.

What if my filler requirements are higher than estimated?

Because so many things can affect the accuracy of estimated fill percentage, it is very important to have additional, ready filler at the job site to ensure a complete fill. Trenton takes many steps to ensure adequate material is available in the tankers to complete the fill. Surplus material is returned to Trenton storage at no charge to the customer.

Can a carrier pipe be removed from a filled casing?

Yes, especially if the filler is a wax-based material, which is standard with Trenton casing fillers.

Does casing filling remedy shorted casings?

Casing filling will remedy shorted casings that result from ground water or condensation acting as an electrolyte between the carrier pipe and the casing.

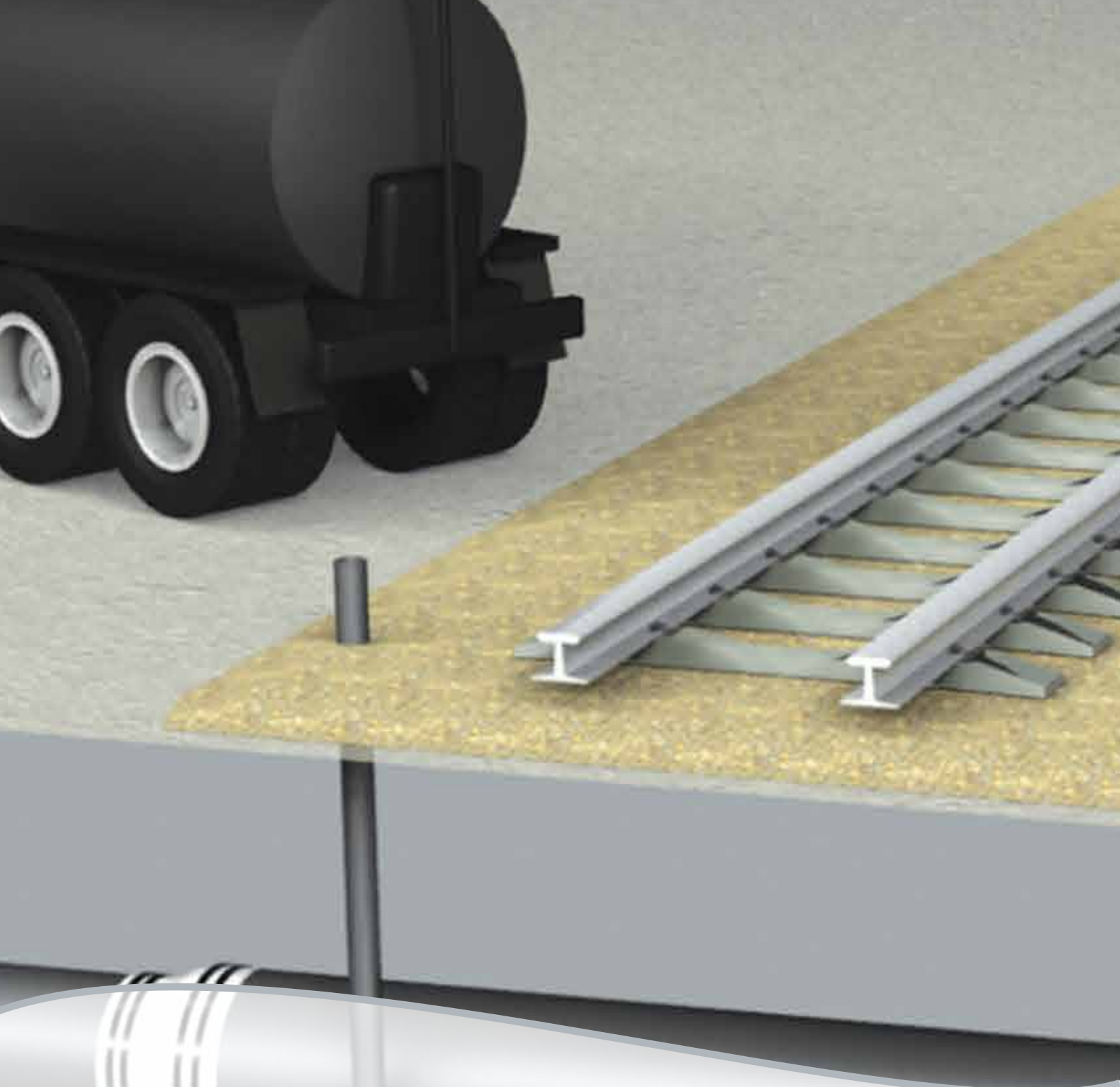
Further, in some instances mechanical shorts will be corrected by filling. Slight movement or floating of the carrier pipe subsequent to or during filling will allow some dielectric material to work its way between metal-to-metal contacts so as to reduce or eliminate the short.

What information should be expected from the installer after job completion?

With governments becoming evermore vigilant about the verifiable integrity of pipelines, clear and complete documentation has become absolutely essential. Utilities must prove their pipelines are protected. As part of its detailed, standardized casing filling process, Trenton maintains and provides thorough records that utilities can use to document that their casings have been professionally filled and protected. Information on location, fill percentage, observable conditions of the end seals, and fill-process details are provided to the customer in a well-organized report.

▼ Trenton has developed the Trenton Seal-Wrap™ end seal for sealing the casing pipe to the carrier pipe. A big advantage of Trenton Seal-Wrap™ end seal is that it can be used when the casing and carrier pipe are not evenly concentric.





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