

DoubleTrac[®]

Easy Installation. Zero Permeation.

Flexible Double Containment Piping Manual-October 2013



OmegaFlex[®]



The Environmental Choice
Next Generation of UL971A
Flexible Double Containment Piping

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DoubleTrac Underground, Above Ground and Marina Piping System

SECTION 1.0 – INTRODUCTION

▲ CAUTION

This manual provides the installer with general instructions for the design and installation of underground, above ground and marina fuel piping systems using DoubleTrac® flexible petroleum piping system with built-in secondary containment.

This information deals primarily with underground, above ground and marina fuel piping. Other components of the piping system have their own individual installation instructions provided by the equipment manufacturer. The installation instructions provided by all component manufacturers must be followed for the underground, above ground and marina petroleum piping system to operate safely as designed.

The OmegaFlex DoubleTrac® flexible piping system must only be installed or serviced by a qualified installer who has been trained through the Underground, Above Ground and Marina Petroleum Piping Systems Installation Training Program. The use of non-trained personnel or any deviations from these written procedures could result in damage or leakage of the system and void the product warranty. Contact OmegaFlex Customer Service for more information at 800-355-1039.

These instructions must be used in conjunction with federal and state regulations for underground, above ground and marina bulk petroleum storage and piping.

All underground, above ground and marina fuel piping systems must be installed in accordance with recognized engineering practices. The industry standards for the installation of underground, above ground and marina tanks including piping systems are PEI RP100, RP200 and RP1000.

At the completion of work this installation manual must be given to the site operator or owner.

▲ CAUTION

If the DoubleTrac® system is improperly installed, the contents of the piping may leak and possibly cause personal injury or damage to the environment. The instructions in this manual and applicable local codes must be strictly followed.



Important Information Follow All Instructions

SECTION 2.0 - LISTINGS and APPROVALS

OmegaFlex DoubleTrac® flexible piping system has both a primary and secondary containment jacket and is listed with UL 971A/ULC S667-11 under file number MH 45578, titled: METALLIC UNDERGROUND FUEL PIPE. DoubleTrac® flexible piping may be used in the following applications.

- Pressure System Supply Piping
- Suction System Supply Piping
- Tank Vent Piping
- Stage II Vapor Recovery Piping
- Remote Fill Lines

Although DoubleTrac is listed with UL/ULC; these are specific for metallic underground fuel piping. As of the revision date of this Design and Installation Guide, UL/ULC does not offer a listing for double containment piping for aboveground or marina fuel systems.

DoubleTrac is designed for above ground and marina installations as the Nylon 12 is extremely durable and is UV stabilized to be exposed to the elements. When requested, OmegaFlex can supply documentation supporting these installations.

SECTION 3.0 - PRESSURE RATINGS

DoubleTrac® flexible piping and fittings have a minimum five to one safety factor from the maximum rated operating pressure for the primary and secondary pipes. The product media should not exceed the maximum operating pressures indicated for each pipe size shown in Table 1.

SECTION 4.0—OPERATING TEMPERATURE

All DoubleTrac® products are rated for -40°F to +120°F.

SECTION 5.0—BEND RADIUS

DoubleTrac® flexible piping should never be bent at a radius smaller than the designed bend radius shown in Table 2.

Table 2

Pipe Size	Minimum Bend Radius
1"	12"
1-1/2"	24"
2"	32"

SECTION 6.0 - INSPECTION, HANDLING and STORAGE

Inspect all piping, fittings and components when they arrive at the job site. Any piping that has been cut, crushed, or otherwise subjected to physical damage during transportation or storage shall be discarded and never used. The piping and fittings shall be handled in such a manner that will not cause any unnecessary damage. Keep all components in the original packaging until ready for use. Inspect fittings prior to installation.

⚠ CAUTION

The end of the piping must be protected at all times. Extra caps are provided with each shipment.

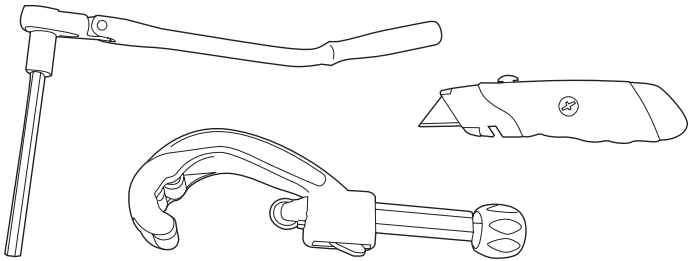
Table 1

Pipe Size	O.D. Nom	Weight	Primary Max Operating Pressure	Secondary Max Operating Pressure	Max Vacuum Rating
1"	1.55	0.75 lbs/ft	125 psig	50 psig	29" Hg
1-1/2"	2.30	1.50 lbs/ft	100 psig	50 psig	29" Hg
2"	2.93	2.00 lbs/ft	75 psig	50 psig	29" Hg

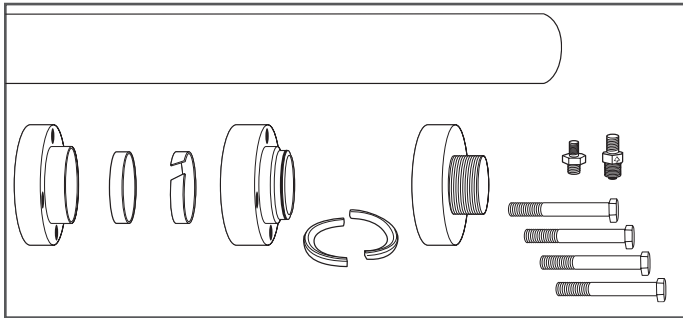
SECTION 7.0 - ASSEMBLY OF DoubleTrac® BF FITTING

Tools required for Assembly

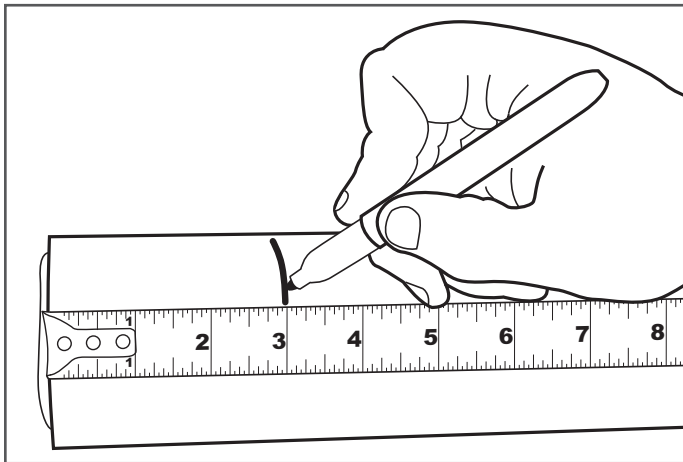
- Utility Knife with sharp blade
- Appropriate size allen wrench
- Tubing Cutter



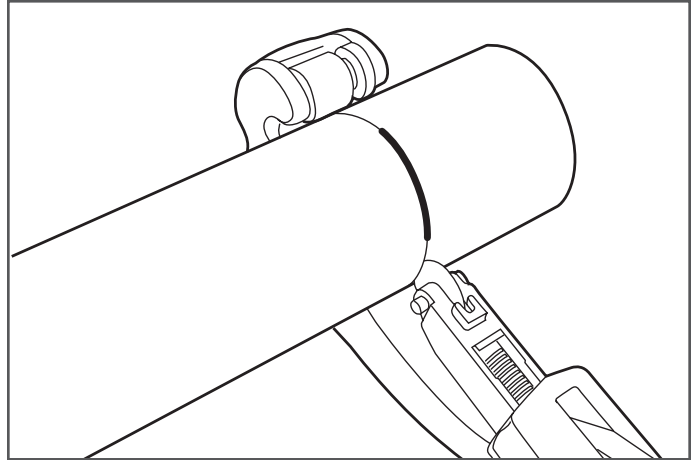
1. Components



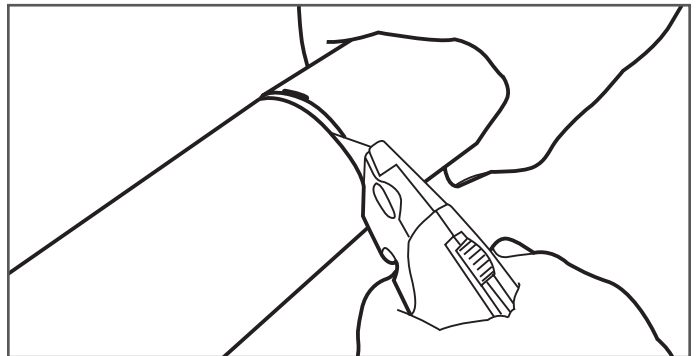
2. To determine the rough jacket strip length measure back 3" from the end.



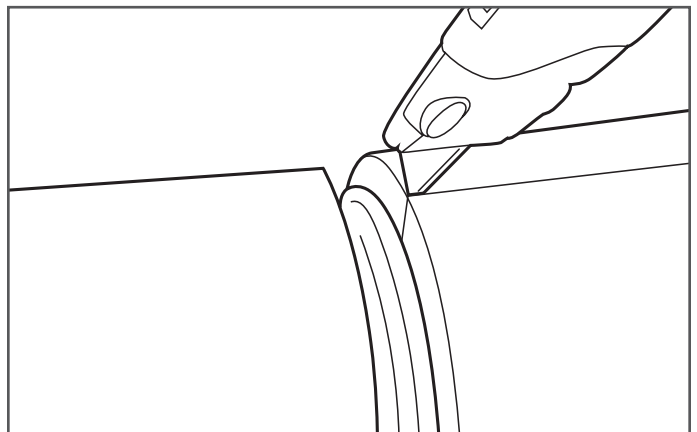
3. Using the tubing cutter, score the black sleeve approximately half of the way through all around the sleeve circumference. Use extreme caution not to cut or score the stainless corrugated pipe. Typically, no more than two turns on the cutter is sufficient.



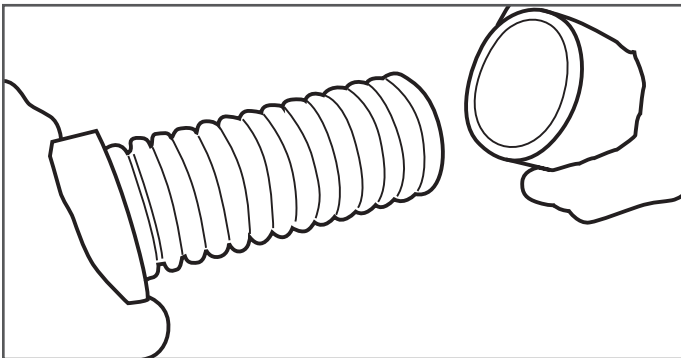
4. Finish cutting through the outer jacket down to the stainless corrugated pipe using a sharp utility knife.



5. Carefully cut jacket with a utility knife for ease of removal. Do not score DoubleTrac® piping.



6. Remove portion of jacket



▲ CAUTION

NOTE: Inspect the stainless steel pipe for scoring from the tubing cutter. If the stainless steel pipe is damaged, remove the damaged portion and repeat this procedure.

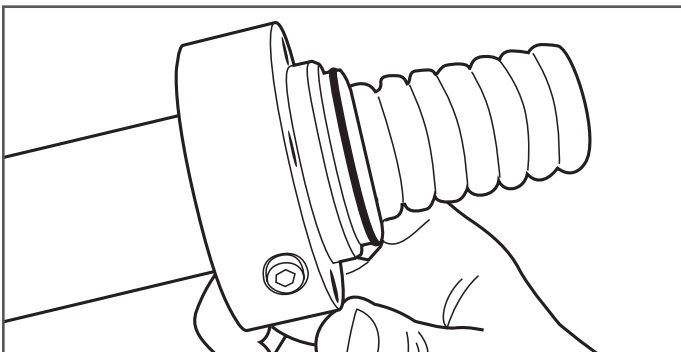
▲ CAUTION

Finishing the cut by bending or twisting may cause an improper seat.

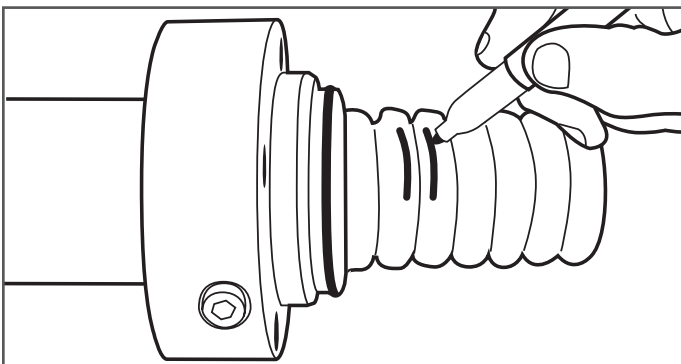
▲ CAUTION

NOTE: When making the final cut, do not cut DoubleTrac® with a reciprocating saw or hack saw.

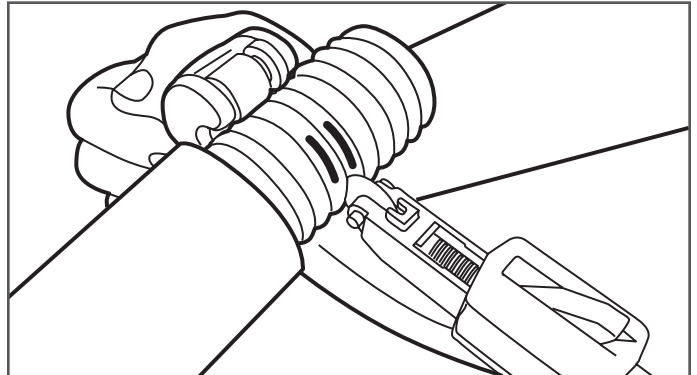
7. Preparing piping for final cut. Slide middle section of fitting into the DoubleTrac pipe until it bottoms out.



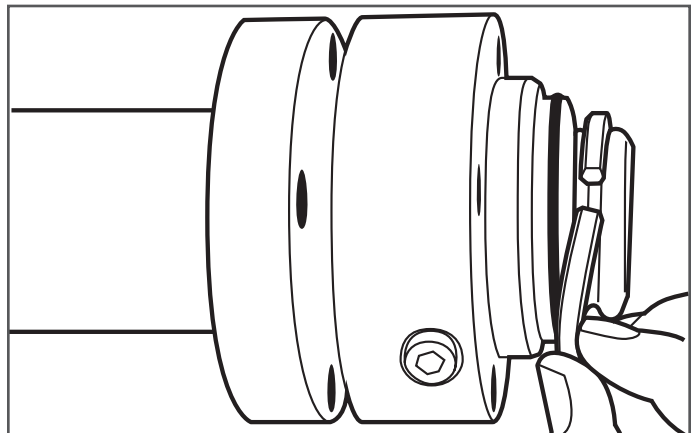
8. Marking the piping for final cut. Once the middle section of the fitting has bottomed out on piping, place a mark on top of the first two corrugations that are past the middle section of the fitting.



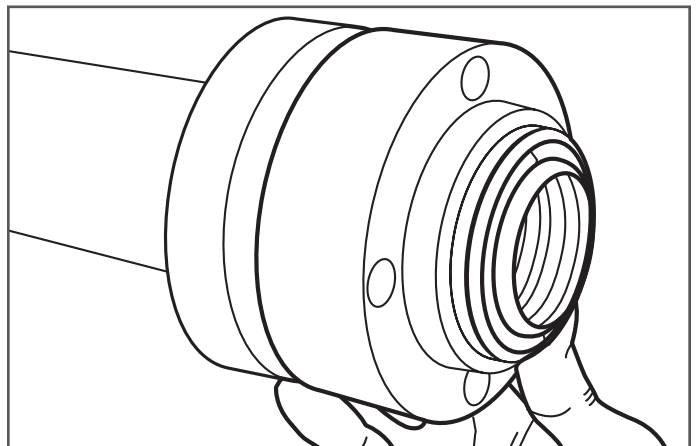
9. Cut through the corrugated piping using a tubing cutter with a sharp wheel. Cut must be centered in the valley between the two marked corrugations. Use full circular strokes in one direction and tighten roller pressure slightly after each revolution. DO NOT over tighten roller which may flatten tube.



10. Slide the back and middle section of the fitting onto the pipe and insert the split rings into the valley of the first corrugation closest to middle section of the fitting.

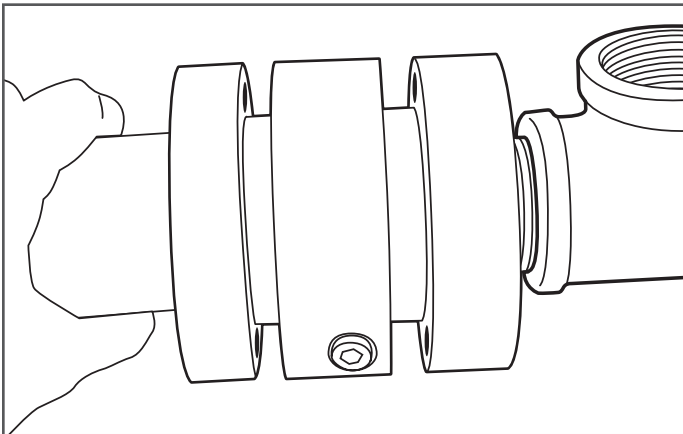


Slide the back and middle section of the fitting up until the split rings are covered by fitting.



Important Information Follow All Instructions

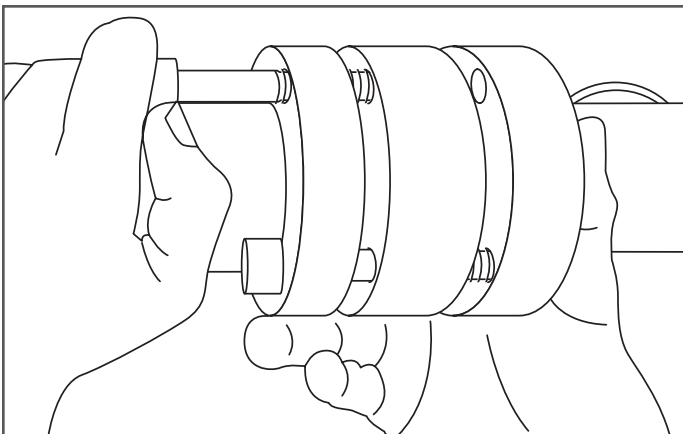
11. Thread the NPT front section into the existing piping (elbow, tee, valve etc). Slide the middle and back sections up to the front section and hold in place.



⚠ CAUTION

NOTE: Do not use any pipe dope or thread sealants on the self-flaring connection. This connection is a metal to metal seat and will not seal properly if pipe dope or thread sealants are used. Sealants are to be used on the NPT Connector to the equipment only.

Insert cap screws into the back section of the fitting and tighten the screws in an alternating pattern to ensure an even compression of the fitting.

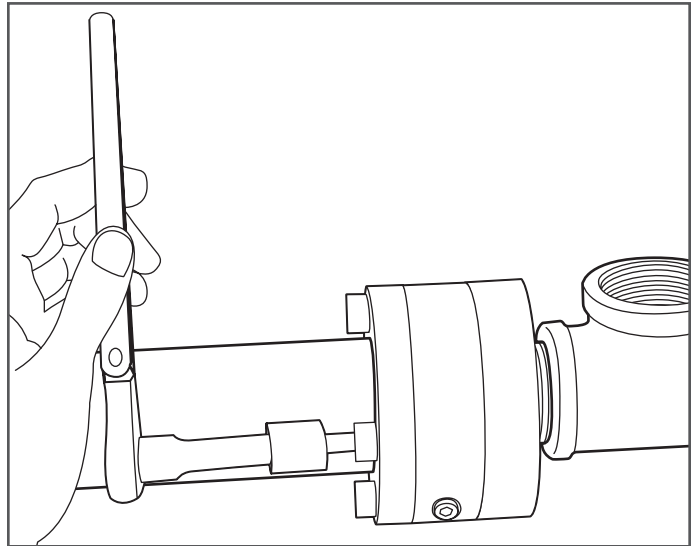


12. Tighten all cap screws in an alternating pattern.

Table 2

DoubleTrac® Pipe Size Recommended Torque Values

DoubleTrac® Pipe Size	Torque Settings
1"	30 FT-LBS
1-1/2" & 2"	50 FT-LBS



SECTION 8.0 - TIGHTNESS TESTING OF SECONDARY CONTAINMENT PIPING

For tightness testing of DoubleTrac flexible piping, the secondary piping (Interstitial space) is pressurized with air up to 50 psig for a minimum of 30 minutes with no loss of pressure allowed. All joints should be wetted with a non-corrosive leak test solution and inspected for bubbles. The use of “soap” solutions is not permitted with stainless steel piping due to the corrosion potential of chlorinated compounds.

The installer shall deliver a copy of the test results to the site owner or operator, who shall keep a copy of all final test results.

NOTE: When testing the secondary, the primary is also being tested.

⚠ CAUTION

NOTE: When performing a tightness test, the piping must be completely isolated from the rest of the system.

Important Information Follow All Instructions

SECTION 9.0 - TIGHTNESS TESTING OF PRIMARY PIPING

Before the piping system is backfilled, it must be isolated from the tanks and subjected to a pipe tightness test on the primary and secondary piping.

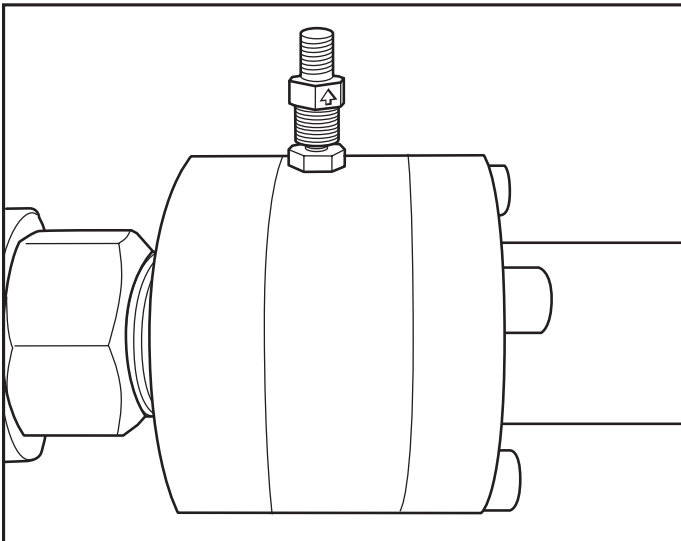
For tightness testing of DoubleTrac® flexible piping, the primary piping is pressurized with air to a level of 1.5 times the maximum operating pressure of the system. Maintain this pressure for a minimum of one hour, making sure there is no drop in pressure.

SECTION 10.0—INSTALLATION OF CHECK VALVES

Once all testing has been completed, remove body of Schrader valve and thread on check valve to Schrader valve. The arrow on the check valve should point away from the fitting.

▲ CAUTION

NOTE: If check valves are not installed, then the plug which originally came with the fitting must be installed. Prior to releasing for service, either a plug or check valve must be installed. Failure to do so voids all warranty.



SECTION 11.0—PIPE BURIAL, TRENCHING AND BACKFILL REQUIREMENTS

Provide a trench width equal to the pipe diameter plus six inches on each side. Separate multiple lines by at least 4 inches. The distance between any piping and the trench excavation walls must be at least 6 inches. For example, an installation of three 2" diameter pipes, the trench would be 26" wide and a minimum of 26" deep.

Whenever possible, product lines should be run in a single trench between the tank area and pump dispenser island area. Vent lines between the tank and the structure to which the aboveground vent lines are attached should also be installed in a single trench. Where more than one trench is required, piping should not cross over each other or cross over underground, above ground and marina tanks.

The trench bottom must be sloped uniformly from the dispensers back to the tanks or sumps at a minimum slope of 1/8 inch per foot and be free of any sharp or protruding hard objects. The trench bottom must be graded with a minimum of six inches of backfill such as washed sand, or pea gravel.

For backfilling, provide a minimum level of clean backfill between the top of the pipe and the surface as provided in Table 6.

Table 6

Surface Pavement	Min. Depth of Pavement	Min. Level of Clean Backfill
Unpaved	N/A	18"
Asphalt	2"	8"
Reinforced Concrete	4"	4"

▲ CAUTION

Native back fill materials should never be used.

SECTION 12.0 – PENETRATION BOOT

OmegaFlex recommends the boots shown in tables 7 and 8 to properly mate up with DoubleTrac piping. These boots have been evaluated to proper sizing, although other boots and manufacturers might also be compatible. All boots must meet local, state, and federal regulations for bulk petroleum storage and piping.

Table 7 - DoubleTrac Pipe Size-Recommended Fittings for Single Wall Sumps

DoubleTrac Pipe Size	O.D. Nom	Bravo Part No.	Diversified Part No.	Icon Part No.
1"	1.55	UGF-10-OFLX	B 3.5-1.6	RFSF1.6
1-1/2"	2.30	UGF-15-OFLX	B 3.5-2.4	RFMF2.25
2"	2.93	UGF-20-OFLX	B 5-3.0	RFMF3.0

Table 8 - DoubleTrac Pipe Size - Recommended Fittings for Double Wall Sumps

DoubleTrac Pipe Size	O.D. Nom	S.A. Bravo Part No.	Diversified Products Part No.
1"	1.55	UGF-10-OFLX-D	U8M-1.6
1-1/2"	2.30	UGF-15-OFLX-D	U8M-2.4
2"	2.93	UGF-20-OFLX-D	U8M-3.0

SECTION 13.0 – ROUTINE MAINTENANCE AND VISUAL INSPECTIONS - PROBLEMS

It is recommended that a visual inspection of the inside of all containment sumps be completed at least once per month. Fuel leaks collected in containment sumps must be reported immediately and investigated by the site owner. If leakage or damage to the piping system is suspected, OmegaFlex must be notified immediately.

All sumps must be kept free of fuel, water and debris. When changing fuel filters at the dispenser, make sure any spilled product is cleaned out of the bottom of the dispenser sump to prevent possible fire hazard.

SECTION 14.0 – OmegaFlex Inc. Contact Information

OmegaFlex Inc. can be contacted if there are any questions concerning the installation, maintenance or repair of DoubleTrac® flexible piping system. Please contact OmegaFlex customer service and 1-800-355-1035 or on the web at www.omegaflex.com or www.doubletrac.net.

▲ CAUTION

Ignoring or disabling leak detection alarms can lead to further damage and possible failure of the system.

Failure to remove fuel and liquids from the containment sumps may compromise the performance and integrity of the sump and its associated fittings (entrance boots) and seals over prolonged periods of time.

APPENDIX A

DoubleTrac® Piping Guide for Above Ground Applications

Overview

DoubleTrac’s® innovative double wall design includes a primary interior layer of zero-permeation, highly corrosion resistant corrugated stainless steel with an outer EFEP barrier layer bonded to a Nylon 12 protective layer. The unmatched strength of stainless steel combined with the superior chemical resistance of EFEP in the secondary barrier layer provide a highly durable design utilizing proven materials in the industry. The interstitial space provides continuous monitoring for leak detection—making DoubleTrac® the industry’s most effective Zero Permeation piping solution. This piping is suitable for use in marinas, harbors, fuel terminals, fuel oil lines, and emergency generator feed and return lines.

Operating Parameters

SIZE	1"	1.5"	2"
MAX WORKING PRESSURE (psig)	125 Primary 50 Secondary	100 Primary 50 Secondary	75 Primary 50 Secondary
MINIMUM BEND RADIUS (inches)	12	24	32
WEIGHT (lbs / ft)	0.75	1.50	2.00
OPERATING TEMPERATURE (deg F)	-40 / 120		

Application Basics

All installations must be performed by a trained operator. Typically each installation is unique and requires some level of review; however there are some general guidelines that are applicable to all installations. Inspect all piping, fittings and components when they arrive at the job site. Any piping that has been cut, crushed, or otherwise subjected to physical damage during transportation or storage shall be discarded and never used. The piping and fittings shall be handled in such a manner that will not cause any unnecessary damage. Keep all components in the original packaging until ready for use. Inspect fittings prior to installation.

Maintaining a continuous slope from the dispenser to the tank is oftentimes not possible; specifically regarding marina refueling systems. Maintain a uniform slope for as much of the piping as feasible, whether the slope is toward the tank or toward the dispenser. To the extent practical, minimize the number of times the direction of the piping slope changes.

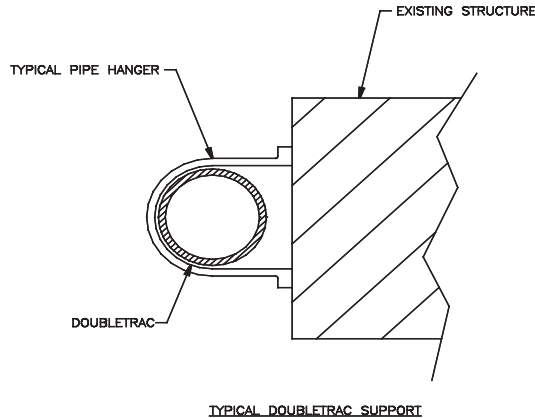
In particular, marinas have some specific requirements. Additionally, refer to the DoubleTrac® design and installation guide (DBT-001) for proper fitting assembly technique.

Outdoor Installations

When installed outdoors, the DoubleTrac piping must be adequately protected from puncture, shear, crush or other physical damage threats, including possible damage from:

- vehicular or pedestrian traffic, corrosion,
- twisting, bending, kinking, chafing, or other excessive or prolonged movement of the piping,
- construction and excavation,

When installed along the side of a structure in an exposed condition, the DoubleTrac piping shall be installed in a location which will not subject the piping to mechanical damage. NOTE: For support and protection, OmegaFlex recommends that outside runs along the side of a building be clipped securely to the wall or other structural component every six feet. Typical supports are Unistrut conduit hangers, “U” bolts, PVC pipe couplers, or Hosebuns.



Marina Installations

Fixed Dock

When installing DoubleTrac® on a fixed dock, the piping may be run along the side or underneath it. In either case, the routing must be such that it cannot be damaged, crush, kinked during normal use of the dock. The piping must be supported evenly along the entire run; supports are required every six feet. Typical supports are Unistrut conduit hangers, “U” bolts, PVC pipe couplers, or Hosebuns.

Floating Dock

DoubleTrac® should not be installed on the walkway from the shore to the dock. The constant flexing due to tide changes will cause fatigue and possible failure of the primary piping. The dock to shore connection should be an approved flexible connector. DoubleTrac® piping can be installed along the length of the floating dock portion. The routing must be such that it cannot be damaged, crush, kinked during normal use of the dock. The piping must be supported evenly along the entire run; supports are required every six feet. Typical supports are Unistrut conduit hangers, “U” bolts, PVC pipe couplers, or Hosebuns.

▲ CAUTION

DoubleTrac® piping is not an approved flex connector. Please contact OmegaFlex Engineering Department for flexible double contained dock connectors at 1-800-355-1039.

Routine Maintenance and Visual Inspections

It is recommended that a visual inspection of all components as well as the inside of all containment sumps be completed at least once per month. Typical monthly inspections include, but are not limited to:

- visual inspection of piping: no visible damage to the outer jacket such as cracks, crushing, kinking, or puncture
- visual inspection of all mounting hardware: all hardware must be intact and securely mounted in the original location
- visual inspection of DoubleTrac fittings: no visible damage to fittings, no sign of leakage, any vent/test port fittings or bypass hoses should show no sign of crushing, kinking, or puncture.

Fuel leaks collected in containment sumps must be reported immediately and investigated by the site owner. If leakage or damage to the piping system is observed or suspected, OmegaFlex must be notified immediately. All sumps must be kept free of fuel, water and debris. When changing fuel filters at the dispenser, make sure any spilled product is cleaned out of the bottom of the dispenser sump to prevent possible fire hazard.

Contact Information

OmegaFlex Inc. can be contacted if there are any questions concerning the installation, maintenance or repair of DoubleTrac® flexible piping system. Please contact OmegaFlex customer service and 1-800-355-1035 or on the web at www.omegaflex.com or www.doubletrac.net.

LIMITED WARRANTY- Installation Form

Warranty Disclaimer: The DoubleTrac Limited Warranty is only valid if this form is received by the DoubleTrac Customer Service Team within 30 days after installation is complete.

Contractor

Installation Site

Name _____ Name _____
 Address _____ Address _____
 Email _____
 Phone _____ Installation Date _____
 Fax _____ Completion Date _____
 Distributor _____
 Installer's State Certification No. _____ Installer's Training Cert No.: _____

Piping

1. What size pipe was used? (*Circle one*) 1" 1.5" 2"
 2. Was any other underground piping used other than DoubleTrac? (*Circle one*) Yes No

If so, what kind?

3. What types of fuels are to be stored? (*Circle all that apply*)

Gasoline Gasohol Diesel Ethanol Methanol Fuel Oil Bio-diesel
 Other _____

Please circle yes or no to the following:

4. Was the site contaminated before installation? Yes No
 If yes: (a) Was the site fully remediated? Yes No
 (b) Did the site receive clearance from government authorities? Yes No
 (c) What is the name of the environmental contractor? _____

5. Were all piping and fittings inspected for damage before and after installation? Yes No
 6. Was approved backfill material used? Yes No
 7. Was the Installation Manual followed? Yes No
 8. Was any direct bury pipe crossed over? Yes No If so were crossover supports used? Yes No
 9. Were all Self-Flaring Fittings tightened to spec? Yes No
 10. Was the DoubleTrac Primary Pipe pressure tested? Yes No
 11. Was the DoubleTrac Interstitial Space pressure tested? Yes No
 12. Was Chase Pipe used? Yes No
 13. Was the Secondary Jacket left open to atmosphere after testing? Yes No

Pipe Entry Points (*please provide*)

Name of Boot Manufacturer _____
 All Boot part numbers _____
 Circle yes or no: Was the exact size hole drilled for each entry boot? Yes No
 Were all band clamps secured? Yes No Were the entry boot nuts properly tightened? Yes No

Dispenser Sumps (*please provide*)

Name of Dispenser Sump Manufacturer _____
 All Dispenser Sump part numbers _____
 Circle yes or no: Were sumps inspected for damage before and after installation? Yes No
 Were the instructions followed? Yes No

Tank Sumps (*please provide*)

Name of Tank Sump Manufacturer _____
 All Tank Sump part numbers _____

Contractor Signature _____ Date _____



Manufacturer of Flexible Metal Hose and Gas Piping Products

DoubleTrac® Pre-Installation Check List

The following items should be completed before OmegaFlex® personnel arrive on site for training:

- Two week minimum lead time for OmegaFlex personnel to be on site
- All existing product removed
- All ancillary equipment set i.e. tanks & sumps
- All ground work completed i.e. trenches dug or supports hung
- DoubleTrac pipe and fittings are on site

Please fill out the following information:

Contact for DoubleTrac Installation _____

Company Name _____

Telephone _____

Project Name _____

Project Type (*circle*) UST AST Retail Marina Emergency generator/boiler

Requested installation Date _____

Sign _____

Date _____

Please fax form to **610.524.6484**

LIMITED WARRANTY- Above Ground and Marina

PRODUCT	LENGTH OF WARRANTY
DoubleTrac flexible petroleum pipe & fittings	15 years

Omega Flex, Inc. warrants to the purchaser of the DoubleTrac® flexible piping system that the products listed above (the “Product”) when installed in above ground applications or on fixed or floating docks will be free from defects in material or workmanship for period stated above, as measured from the date of shipment from DoubleTrac. This excludes DoubleTrac dock connectors which are covered under a separate warranty.

If upon examination, the Product is shown to have a defect in material or workmanship during the warranty period, DoubleTrac will, at its option, either repair or replace that part of the Product which is shown to be defective, or issue a credit for the amount of the defective product that may be applied to future orders of the Product.

This limited warranty does not apply:

- If the Product has been subjected to misuse or neglect, has been accidentally or intentionally damaged, or has been altered or modified in any way.
- If the Product has been repaired by anyone who is not a DoubleTrac authorized service representative.
- If the Product has not been installed in accordance with the DoubleTrac installation guidelines.
- If the Product has been installed with unauthorized third party components, except those components that are recommended for use with DoubleTrac in the DoubleTrac installation guide.
- To any costs or expenses incurred during investigation, removal or reinstallation of the defective Product, including without limitation any costs or expenses for clean-up, downtime, or lost profits.
- To any damage or impairment of the Product caused by any casualty, including without limitation fires, storms, floods, earthquakes, or acts of God.
- To any workmanship of the installer of the Product.

This limited warranty is conditional upon:

- Receipt of a written warranty claim during the applicable warranty period.
- Installment of the Product by an individual who has received factory authorized training on the installation and proper use of DoubleTrac.
- All site and warranty registration forms are completed and received by DoubleTrac within 30 days of installation.
- All piping and connections are installed with an approved leak detection device in each tank and dispenser sump.
- A sump inspection log or EPA checklist is maintained and provided to DoubleTrac on request.
- DoubleTrac receives notice of warranty claim within 24 hours of any known or suspected failure of the Product.

Product can only be returned with prior written approval from DoubleTrac. All returns must be freight prepaid. Manufacturer will inspect the alleged defective part, and provide the customer with the results of that inspection whether or not in the reasonable opinion of DoubleTrac, that there exists a defect in material or workmanship. Repair or replacement of any part under this Limited Warranty shall not extend the duration of the warranty with respect to such repaired or replaced part beyond the stated warranty period.

IMPORTANT

This limited warranty is in lieu of all other warranties, either express or implied, and all such other warranties, including without limitation implied warranties of merchantability or fitness for a particular purpose, are hereby disclaimed and excluded from this limited warranty.

LIMITATION OF LIABILITY

In no event will DoubleTrac be liable in any way for (a) any consequential, special, or incidental damages of any nature whatsoever, or (b) any amounts in excess of the selling price of the Product or any parts thereof found to be defective.

LIMITED WARRANTY- Below Ground

PRODUCT	LENGTH OF WARRANTY
DoubleTrac flexible petroleum pipe & fittings	30 years

Omega Flex, Inc. warrants to the purchaser of the DoubleTrac® flexible piping system that the products listed above (the "Product") when installed in below ground applications will be free from defects in material or workmanship for period stated above, as measured from the date of shipment from DoubleTrac.

If upon examination, the Product is shown to have a defect in material or workmanship during the warranty period, DoubleTrac will, at its option, either repair or replace that part of the Product which is shown to be defective, or issue a credit for the amount of the defective product that may be applied to future orders of the Product.

This limited warranty does not apply:

- If the Product has been subjected to misuse or neglect, has been accidentally or intentionally damaged, or has been altered or modified in any way.
- If the Product has been repaired by anyone who is not a DoubleTrac authorized service representative.
- If the Product has not been installed in accordance with the DoubleTrac installation guidelines.
- If the Product has been installed with unauthorized third party components, except those components that are recommended for use with DoubleTrac in the DoubleTrac installation guide.
- To any costs or expenses incurred during investigation, removal or reinstallation of the defective Product, including without limitation any costs or expenses for clean-up, downtime, or lost profits.
- To any damage or impairment of the Product caused by any casualty, including without limitation fires, storms, floods, earthquakes, or acts of God.
- To any workmanship of the installer of the Product.

This limited warranty is conditional upon:

- Receipt of a written warranty claim during the applicable warranty period.
- Installment of the Product by an individual who has received factory authorized training on the installation and proper use of DoubleTrac.
- All site and warranty registration forms are completed and received by DoubleTrac within 30 days of installation.
- All piping and connections are installed with an approved leak detection device in each tank and dispenser sump.
- A sump inspection log or EPA checklist is maintained and provided to DoubleTrac on request.
- DoubleTrac receives notice of warranty claim within 24 hours of any known or suspected failure of the Product.

Product can only be returned with prior written approval from DoubleTrac. All returns must be freight prepaid. Manufacturer will inspect the alleged defective part, and provide the customer with the results of that inspection whether or not in the reasonable opinion of DoubleTrac, that there exists a defect in material or workmanship. Repair or replacement of any part under this Limited Warranty shall not extend the duration of the warranty with respect to such repaired or replaced part beyond the stated warranty period.

IMPORTANT

This limited warranty is in lieu of all other warranties, either express or implied, and all such other warranties, including without limitation implied warranties of merchantability or fitness for a particular purpose, are hereby disclaimed and excluded from this limited warranty.

LIMITATION OF LIABILITY

In no event will DoubleTrac be liable in any way for (a) any consequential, special, or incidental damages of any nature whatsoever, or (b) any amounts in excess of the selling price of the Product or any parts thereof found to be defective.



Omega Flex, Inc.
451 Creamery Way, Exton, PA 19341-2509
800-355-1039 • Fax 610-524-6484
www.omegaflex.com
ISO 9001 Registered Company

Corporate Offices
13 Court Street, Suite 1001, Middletown, CT 06457
860-704-6820 • Fax 860-704-6830

DBT-001 REV 10/13



SPECIFICATION DATA SHEET

DOUBLETRAC PIPING MATERIALS

PRIMARY PIPE: ASTM A240 316 Series Stainless Steel
 OUTER JACKET: Nylon 12; Resistant to hydrocarbons, chemical and water exposure, UV
 Stabilized for above ground and marina use
 SECONDARY BARRIER: EFEP; Permeation resistance

DOUBLETRAC FITTING MATERIAL

MECHANICAL JOINT FITTING: Alloy 360 Brass or Stainless Steel Fitting
 NOTE: Fitting to piping joint shall provide a metal-to-metal seal; no gaskets permitted
 NOTE: All fittings meet Salt Spray Test requirements of ASTM B-117-90;
 NOTE: UL 971A listed file number MH 45578, titled Integral Primary/Secondary for all Fuels

PRESSURE RATINGS

	1"	1-1/2"	2"
PRIMARY MAX OPERATING PRESSURE:	125 PSIG	100 PSIG	75 PSIG
SECONDARY MAX OPERATING PRESSURE:	50 PSIG	50 PSIG	50 PSIG

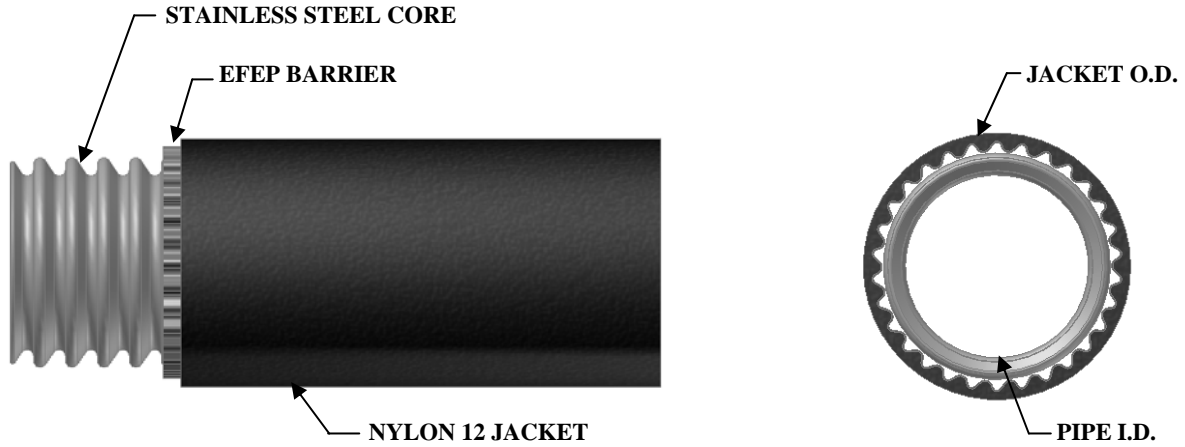
TEMPERATURE LIMITS

PRIMARY PIPE: Melting Point: 2400 deg. F
 Maximum Operating Temp: 400 deg. F
 (Less Jacket)

JACKET: Melting Point: 350 deg. F
 Maximum Operating Temp: -20 deg. F to 120 deg. F

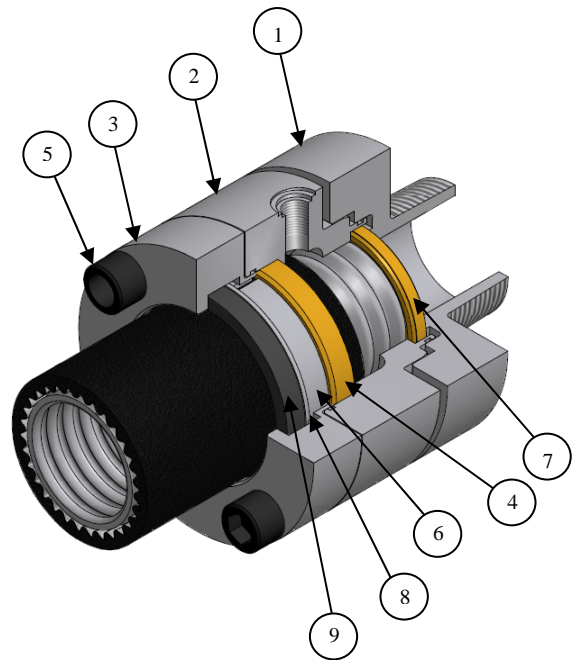
ACCESSORIES

<u>ITEM</u>	<u>DESCRIPTION</u>
BY-PASS TUBING:	FUEL GRADE PVC TUBING
SCHRADER VALVES:	BRASS SCHRADER VALVE
TUBING CUTTERS	(1", 1-1/2", 2"); AND REPLACEMENT WHEELS
LEAK DETECTION	NON- CORROSIVE LEAK TEST SOLUTION



PART #	UGF-FSP-16	UGF-FSP-24	UGF-FSP-32
SIZE (Inch)	1"	1-1/2"	2"
JACKET O.D. (Nom)	1.550"	2.300"	2.925"
INSIDE DIAMETER (Nom)	1.060"	1.525"	2.060"
MINIMUM BEND RADIUS	12"	24"	32"
WEIGHT / FT (lbs)	0.75	1.50	2.00

#	DESCRIPTION
1	NPT ADAPTOR END - BRASS OR SST
2	MAIN BODY - BRASS OR SST
3	REAR BODY - BRASS OR SST
4	JACKET LOCK - BRASS
5	CAP SCREW - HIGH ALLOY STEEL
6	REAR SLEEVE - BRASS OR SST
7	SPLIT RING SET - BRASS OR SST
8	RETAINING RING - SST
9	REAR SEAL - VITON®





Manufacturer of flexible metal hose and gas piping products



DoubleTrac ASME / NFPA / CFC / MSS Compliance

ASME B31.1:

- DoubleTrac is in compliance with ASME B31.1 specifically:
- ASME B31.1, specifies approved materials, Table 126.1 Lists ASTM A240 as an approved material. DoubleTrac primary pipe is manufactured from stainless steel per ASTM A240 which puts it in compliance.

ASME B31.3:

- DoubleTrac is in compliance with ASME B31.3 specifically:
- ASME B31.3, specifies approved materials, Appendix A, Specification Index, lists ASTM A240 as an approved material. DoubleTrac primary pipe is manufactured from stainless steel per ASTM A240 which puts it in compliance.

ASME B31.4:

- DoubleTrac is in compliance with ASME B31.4 specifically:
- ASME B31.4, specifies approved materials, Table 423-1-1, lists ASTM A240 as an approved material. DoubleTrac primary pipe is manufactured from stainless steel per ASTM A240 which puts it in compliance.

ASME B31.9:

- DoubleTrac is in compliance with ASME B31.9 specifically:
- ASME B31.4, specifies approved materials, in Mandatory Appendix I, and listed materials in ASME B31.1. ASME B31.1, specifies approved materials, Table 126.1 Lists ASTM A240 as an approved material. DoubleTrac primary pipe is manufactured from stainless steel per ASTM A240 which puts it in compliance.

NFPA 30 Section 27:

- DoubleTrac is in compliance with NFPA 30 specifically:
- NFPA 30 Section 27.4.1 Materials Specifications: Material must meet ASME B31.1, which compliance is addressed above.
- NFPA 30 Section 27.4.6.1 Nonmetallic Piping: Additionally pipe materials shall be in accordance with UL 971, of which, DoubleTrac is listed to UL971A, which puts it in compliance.

NFPA 37 Chapter 6.8:

- DoubleTrac is in compliance with NFPA 37 Chapter 6.8 specifically, 6.8.1 specifies compliance to NFPA 30 which has been addressed above.
- Additions, NFPA 37 6.8.1 specifies that piping must be steel, which DoubleTrac pipe is stainless steel, per ASTM A240. This is in compliance with NFPA 30 Section 27 which refers to ASME B31.1, and ASTM A240 is an approved material per table 126.1 in ASME B31.1.

2010 CFC Section 3403.6 Piping Systems:

- DoubleTrac is in compliance with 2010 CFC3403.6
- Specifically, 3403.6.2.1 states nonmetallic piping must be per NFPA Section 27.4.6, which specifies compliance to UL971 for which DoubleTrac is UL Listed.
- 3403.6.10 Pipe Joints – DoubleTrac fittings on the primary pipe are a mechanical metal to metal seal, not reliant on the plastic portion to maintain a seal. The primary pipe to fitting joint does not utilize any O-rings or gaskets and will not leak during a fire.
- 3403.6.2.1 Clauses 1 through 3 are addressed by the design/installation.

2013 CFC Section 5703.6 Piping Systems:

- DoubleTrac is in compliance with 2013 CFC5703.6
- Specifically, 5703.6.2.1 states piping must be in accordance with the standards listed in Table 5703.6.2 ASME B31.1, ASME B31.3, ASME B31.4, and ASME B319.9, compliance to each of those is listed above.
- 5703.6.2 States that all nonmetallic piping must be per NFPA 30 Section 27.4.6, which specifies compliance to UL971 for which DoubleTrac is UL Listed.
- 5703.6.10 Pipe Joints – DoubleTrac fittings on the primary pipe are a mechanical metal to metal seal, not reliant on the plastic portion to maintain a seal. The primary pipe to fitting joint does not utilize any O-rings or gaskets and will not leak during a fire.
- 5703.6.2.1 Clauses 1 through 3 are addressed by the design/installation.

MSS SP-69:

- This has now been incorporated in MSS SP-58. Although this is not specifically a design requirement for DoubleTrac; the recommendation is that the installers utilize hanger Type 11 or Type 12 to facilitate mounting and securing DoubleTrac to the appropriate structure. These clamp types are readily available from a number of suppliers.



Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2012-06

DoubleTrac UV Testing / Product Validation

1. INTRODUCTION:

Validate and verify the accelerated UV aging of DoubleTrac Piping.

2. SCOPE:

Complete 16,000 hours of accelerated UV aging and conduct crush tests and burst tests on the primary and secondary, and permeation resistance on the secondary of the DoubleTrac piping which is listed per Underwriters Laboratory UL 971A. As UL 971A does not include any testing for outdoor use, this testing will substantiate the use for outdoor environments.

Up to and including 14k hours will be tested at OmegaFlex for Primary and Secondary burst; remaining (3), 16k hour exposure samples, which represents worst case, will be sent to CSA for 3rd party evaluation of crush, primary and secondary burst, and permeation testing.

3. TESTING PROCEDURES:

3.1. UV Exposure Testing

UV Exposure Testing to be conducted at:

Trace Laboratories, Inc.
5 North Park Drive
Hunt Valley, MD 21030

QUV Exposure:

- Test of thirty (24) pieces of DoubleTrac piping
- Expose to QUV-A340 – Accelerated Weathering Procedure
- Irradiance = 0.85 W/M²/nm
- Dry continuous exposure
- Temperature 55° C
- Duration = 16,000 hours
- Mount samples so one side is exposed to UV continuously – opposite side will not be exposed to UV at all
- Remove three (3) samples every 2,000 hours



Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2012-06

DoubleTrac UV Testing / Product Validation

3.2. Visual Inspection – Performed at OmegaFlex

Perform a visual inspection, specifically looking for any irregularities or discontinuities in the outer jacket.

3.3. Primary and secondary pressure testing up to 14k hour samples – Performed at OmegaFlex

Primary:

- Pneumatic test #1 Sample to 125 PSI and hold for 5 minutes (air- under water)
- Hydrostatic test #2 Sample to 650 psi and hold for 5 minutes, increasing the pressure until failure (water/air- out of water)
- Sample # 3 Retain

Secondary:

- Pneumatic test #1 Sample to 50 PSI and hold for 5 minutes (air- under water)
- Hydrostatic test #2 Sample to 250 psi and hold for 5 minutes, increasing the pressure until failure (water/air- out of water)
- Sample #3 Retain

3.4. Crush, Primary and Secondary Burst Testing, Permeation Testing 16k hour sample Performed at CSA

Primary and Secondary Burst, and Crush and Permeation Testing Performed at:

CSA GROUP
8501 East Pleasant Valley Road
Cleveland, Ohio 44131-5575

- Crush samples #1 and #2 OD to 40% of original OD. Leak Check primary and secondary.
- After crush test, burst test primary; sample #1.



Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2012-06

DoubleTrac UV Testing / Product Validation

- After crush test, burst test secondary; sample #2.
- Permeation test sample #3.

4. Test results:

2,000 Hours Visual – All samples no discernable change in appearance.

2,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNUEMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNUEMATIC 5 MIN.	1221 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNUEMATIC 5 MIN.	50 PSI PNUEMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	620 PSI	GOOD BURST MIDDLE 90° FROM UV
Sample 3	Retain sample	Retain sample	Retain sample	Retain sample	Retain sample

4,000 Hours Visual Inspection – All samples no discernable change in appearance.

4,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
sample 1	125 PSI PNUEMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNUEMATIC 5 MIN.	1171 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNUEMATIC 5 MIN.	50 PSI PNUEMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	413 PSI	GOOD BURST MIDDLE 90° FROM UV
Sample 3	Retain Sample	Retain Sample	Retain Sample	Retain Sample	Retain Sample



Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2012-06

DoubleTrac UV Testing / Product Validation

6,000 Hours Visual Inspection – All samples no discernable change in appearance.

6,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNEUMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN.	1183 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNEUMATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	411 PSI	GOOD BURST MIDDLE 180° FROM UV
Sample 3	Retain Sample	Retain Sample	Retain Sample	Retain Sample	Retain Sample

8,000 Hours Visual Inspection – All samples no discernable change in appearance.

8,000 Hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNEUMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN.	1195 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNEUMATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	485 PSI	GOOD BURST MIDDLE 180° FROM UV
Sample 3	Retain sample	Retain sample	Retain sample	Retain sample	Retain sample

10,000 Hours Visual Inspection – All samples no discernable change in appearance.

10,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNEUMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN.	1171 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNEUMATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	474 PSI	GOOD BURST MIDDLE 180° FROM UV
Sample 3	Retain Sample	Retain Sample	Retain Sample	Retain Sample	Retain Sample



Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2012-06

DoubleTrac UV Testing / Product Validation

12,000 Hours Visual Inspection – All samples no discernable change in appearance.

12,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNEUMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN.	1183 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNEUMATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	443 PSI	GOOD BURST MIDDLE 90° FROM UV
Sample 3	Retain Sample	Retain Sample	Retain Sample	Retain Sample	Retain Sample

14,000 Hours Visual Inspection – All samples no discernable change in appearance.

14,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNEUMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN.	1181 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNEUMATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	575 PSI	GOOD BURST MIDDLE 90° FROM UV
Sample 3	Retain sample	Retain sample	Retain sample	Retain sample	Retain sample

16,000 Hours Visual Inspection – All samples no discernable change in appearance.

5. CONCLUSION:

The results of the testing to date confirms that the accelerated UV aging has not degraded the exterior of the DoubleTrac piping, nor has it effected the crush, pressure/burst values, and permeation resistance which substantiates the use for above ground and outdoor environments.



Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2012-06

DoubleTrac UV Testing / Product Validation

6. CURRENT REVISION – Revision C

Revision Date: 11/2014

Written By: Randy Bayless
Manager of Sales Engineering
Industrial Division
OmegaFlex, Inc.

Approved By: Dean W. Rivest, P.E.
Vice-President & General Manager
Industrial Division
OmegaFlex, Inc.



Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2012-06

DoubleTrac UV Testing / Product Validation

APPENDIX "A"

*Created 10-Dec-2012
Revision C – Jul-2013*

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OMEGAFLEX, INC., 451 Creamery Way, Exton, PA 19341-2509
Voice: 800-355-1039 or 610-524-7272 Fax: 610-524-7282 URL: www.omegaflex.com



CSA FINDINGS LETTER

Master Contract - Project Number: 188984-70009285

Date: October 15, 2014

Attention: Mr. Randy Bayless
Omega Flex, Inc.
451 Creamery Way
Exton, PA 19341 USA

Subject: Custom Testing, 1" DoubleTrac Containment Piping for Diesel, Gasoline, Biofuels and DEF.

Dear Mr. Bayless:

We have completed the evaluation of the 1" DoubleTrac Piping that you had submitted for evaluation to the OmegaFlex test plan. The three (3) test samples submitted to CSA group were previously tested for 16,000 hour QUV exposure (advanced aging). Validation is required to determine whether-or-not the exposure compromised or degraded the UV Stabilized Nylon 12 outer jacket.

This Findings Letter provides the results of this evaluation.

REQUIREMENTS

2. TESTING PROCEDURE:

2.1. Crush Resistance Test:

- 2.1.1. #1 & #2 1" DoubleTrac 16,000 hour samples will test in accordance with ASTM D 2412 Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading. The plate shall be 2" long and the width not less than pipe contact width at maximum pipe deflection. The Load is to be applied at the pipe center perpendicular to the axis at ½ inch per minute until conditions per 2.1.2 are met. After unloading the force, the #1 sample will be visually examined before being subjected to primary leakage testing. #2 sample will be visually examined before being subjected to secondary leakage test.
- 2.1.2. The load to obtain a 40 percent reduction of O.D. shall be held for one minute.
- 2.1.3. Leakage Test pressure is twice the pressure rating, and shall be held for 2 minutes and there shall be no leakage or any noncomplying damage while the sample is pressurized.
- 2.1.4. The samples shall not leak or show signs of noncomplying damage after applied force or when subjected to the leakage test.



2.2. Burst Test:

2.2.1. Burst test Primary:

2.2.1.1. Using #1 sample DoubleTrac 16,000 hour (1" DoubleTrac assembly) supplied by OmegaFlex pressurize the primary with air to a MAWP of 125 psig and hold for one minute. Increase pressure to 625 psig and hold for one minute. Increase pressure until primary of 1" DoubleTrac assembly burst.

2.2.2. Burst Test Secondary:

2.2.2.1. Using #2 sample DoubleTrac 16,000 hour (1" DoubleTrac assembly) supplied by OmegaFlex pressurize the secondary with air to a MAWP of 50 psig and hold for one minute. Increase pressure to 125 psig and hold for one minute. Increase pressure until secondary of 1" DoubleTrac assembly burst.

2.3. Permeation Testing:

2.3.1. Permeation values for permeation test samples

2.3.1.1. Motor vehicle fluids/high blend fuels

2.3.1.1.1. Max allowable permeation 4.0 g/m² per day (.079 Oz/ft²)

2.3.2. Using #3 sample DoubleTrac 16,000 hour (1" DoubleTrac assembly) supplied by OmegaFlex weigh the 1" DoubleTrac assembly and record weight.

2.3.3. The DoubleTrac 16,000 hours (1" DoubleTrac assembly) is to be filled to 80% capacities with diesel fuel and store at 80+/-5 F (27+/-3C) for 60days. Measure O.D. (D) & exposed length (L)

2.3.3.1. Fill interstitial space with Diesel fuel and weigh the 1" DoubleTrac assembly and record.

2.3.3.2. Hold filled 1" DoubleTrac assembly for 30 days and re-weigh and record results.

2.3.3.3. Hold filled 1" DoubleTrac assembly for 60 days and re-weigh and record results.

2.3.3.4. The collected time & weight data are to be used to calculate the permeation rate.

2.3.3.4.1. Surface Area = $PI(D)X(D/2+L)$

2.3.3.4.2. Permeation Rate= Max wt change/surface area /#of days

TEST RESULTS

Sample #1	2.1 Crush Resistance Test	<u>Satisfactory Results Obtained</u>
Sample #1	2.2 Burst Test Primary	<u>Satisfactory Results Obtained</u>
Sample #2	2.1 Crush Resistance Test	<u>Satisfactory Results Obtained</u>
Sample #2	2.2 Burst Test Secondary	<u>Satisfactory Results Obtained</u>
Sample #3	2.3 Permeation Testing	<u>Satisfactory Results Obtained</u>

Please reference the attached report for details pertaining to the test procedures conducted.



ATTENTION: The test results contained within the attached report cannot be utilized and/or promoted as CSA Group Certification to any Standards/Regulations.

If you have any questions, please feel free to contact me. Thank you for your continued business.

Best Regards,

John Kristoff-Kichka

John Kristoff-Kichka
Project Engineer/Certifier
CSA GROUP
8501 East Pleasant Valley Road
Cleveland, Ohio 44131-5575
Tel: (216) 524-4990 ext. 88224
Fax: (216) 642-3081
email: john.kristoff-kichka@csagroup.org



TRACE LABORATORIES, INC
5 North Park Drive
Hunt Valley, MD 21030 USA
Telephone: 410/584-9099 / Fax: 410/584-9117
Website: www.tracelabs.com / Email: info@tracelabs.com

TEST REPORT FOR:

OMEGAFLEX, INCORPORATED
451 Creamery Way
Exton, PA 19341

Attn: Randy Bayless

DATE IN:

July 12, 2011

P/O #:

148240

QUOTE IDENTIFICATION:

OmegaFlex110712a

SUBMISSION IDENTIFICATION:

Twenty-four (24) tube samples were submitted for QUV exposure.

APPROVED:

A handwritten signature in black ink, appearing to read "Keith M. Sellers".

Keith M. Sellers
Managing Scientist



ISO/IEC 17025



S/O 81925

Page 1 of 5

QUV EXPOSURE

METHOD:

The samples were loaded into a QUV chamber set at the following parameters:

- Irradiance of 0.85 W/m²/nm
- Temperature of 55°C
- Exposure type – dry, continuous

The samples were loaded such that one (1) “side” of the tube saw continuous UV exposure. The opposite “side” of the tube saw no UV exposure.

Three (3) samples were removed from the chamber at every 2,000 hour interval and returned to Omegaflex, Inc.

Photographs #1 and #2, below, display representative overviews of the submitted tube samples as-received and within the chamber housing.



Photograph #1: Representative Overview of Submitted Tube Samples, As-received



Photograph #2: Representative Overview of Submitted Tube Samples Within Chamber Housing

RESULTS:

The samples were exposed for a total of 16,000 hours. At every 2,000 hour interval, three (3) samples were removed from the chamber and were returned to Omegaflex, Inc.

The final exposure was completed on July 27, 2013.



TRACE LABORATORIES, INC
5 North Park Drive
Hunt Valley, MD 21030 USA
Telephone: 410/584-9099 / Fax: 410/584-9117
Website: www.tracelabs.com / Email: info@tracelabs.com

Trace Laboratories, Inc. certifies that the test equipment used complies with the calibration test purposes of ISO 10012-1, ANSI/NCSL Z540-1-1994, and MIL-STD-45662A and that the data contained in this report is accurate within the tolerance limitation of this equipment.

All test procedures detailed within this report are complete. The results in this report relate only to those items tested. If any additional information or clarification of this report is required, please contact us. This test report shall not be reproduced except in full, without the written approval of Trace Laboratories, Inc.

Thank you for selecting Trace Laboratories, Inc. for your testing purposes.

PERFORMED BY:

A handwritten signature in blue ink, appearing to read "Daniel D. Phillips".

Daniel D. Phillips
Engineer

ATTACHMENTS: one (1) Equipment Used list

SAMPLE DISPOSITION: samples returned to Omegaflex, Inc.

DATE COMPLETED: July 29, 2013



ISO/IEC 17025



S/O 81925



TRACE LABORATORIES, INC
5 North Park Drive
Hunt Valley, MD 21030 USA
Telephone: 410/584-9099 / Fax: 410/584-9117
Website: www.tracelabs.com / Email: info@tracelabs.com

EQUIPMENT USED

Trace ID	Manufacturer	Equipment Name	Serial/Model Number	Calibration Date	Calibration Due Date
CH-25	Q-Lab	UV Chamber	11-1352-78- SPRAY/ QUV/SPRAY	Every 500 Hours	Every 500 Hours



ISO/IEC 17025



S/O 81925



SPECIFICATION DATA SHEET

DOUBLETRAC PIPING MATERIALS

PRIMARY PIPE: ASTM A240 316 Series Stainless Steel
 OUTER JACKET: Nylon 12; Resistant to hydrocarbons, chemical and water exposure, UV
 Stabilized for above ground and marina use
 SECONDARY BARRIER: EFEP; Permeation resistance

DOUBLETRAC FITTING MATERIAL

MECHANICAL JOINT FITTING: Alloy 360 Brass or Stainless Steel Fitting
 NOTE: Fitting to piping joint shall provide a metal-to-metal seal; no gaskets permitted
 NOTE: All fittings meet Salt Spray Test requirements of ASTM B-117-90;
 NOTE: UL 971A listed file number MH 45578, titled Integral Primary/Secondary for all Fuels

PRESSURE RATINGS

	1"	1-1/2"	2"
PRIMARY MAX OPERATING PRESSURE:	125 PSIG	100 PSIG	75 PSIG
SECONDARY MAX OPERATING PRESSURE:	50 PSIG	50 PSIG	50 PSIG

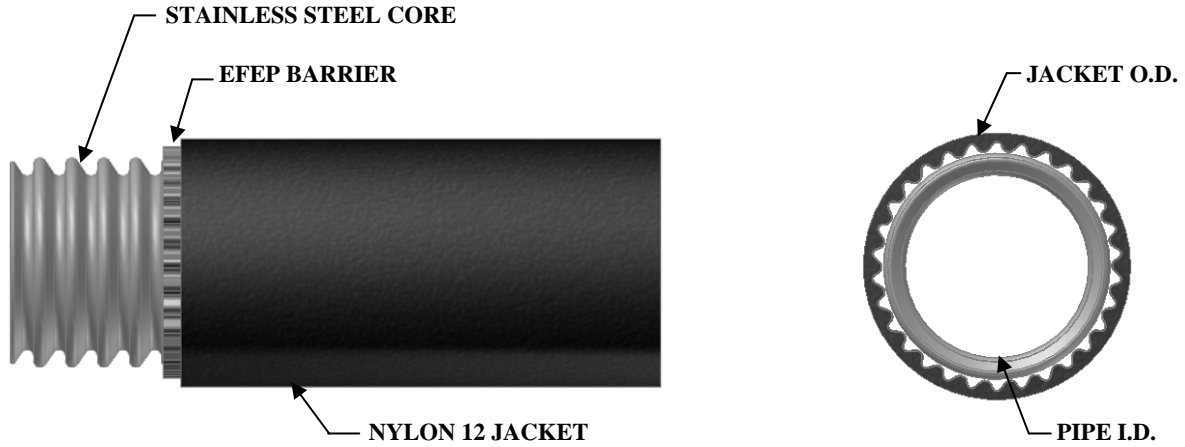
TEMPERATURE LIMITS

PRIMARY PIPE: Melting Point: 2400 deg. F
 Maximum Operating Temp: 400 deg. F
 (Less Jacket)

JACKET: Melting Point: 350 deg. F
 Maximum Operating Temp: -20 deg. F to 120 deg. F

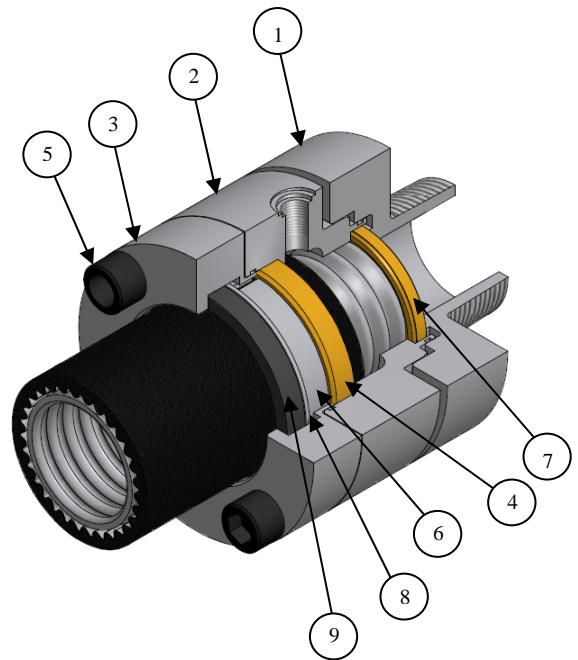
ACCESSORIES

<u>ITEM</u>	<u>DESCRIPTION</u>
BY-PASS TUBING:	FUEL GRADE PVC TUBING
SCHRADER VALVES:	BRASS SCHRADER VALVE
TUBING CUTTERS	(1", 1-1/2", 2"); AND REPLACEMENT WHEELS
LEAK DETECTION	NON- CORROSIVE LEAK TEST SOLUTION



PART #	UGF-FSP-16	UGF-FSP-24	UGF-FSP-32
SIZE (Inch)	1"	1-1/2"	2"
JACKET O.D. (Nom)	1.550"	2.300"	2.925"
INSIDE DIAMETER (Nom)	1.060"	1.525"	2.060"
MINIMUM BEND RADIUS	12"	24"	32"
WEIGHT / FT (lbs)	0.75	1.50	2.00

#	DESCRIPTION
1	NPT ADAPTOR END - BRASS OR SST
2	MAIN BODY - BRASS OR SST
3	REAR BODY - BRASS OR SST
4	JACKET LOCK - BRASS
5	CAP SCREW - HIGH ALLOY STEEL
6	REAR SLEEVE - BRASS OR SST
7	SPLIT RING SET - BRASS OR SST
8	RETAINING RING - SST
9	REAR SEAL - VITON®





Permeation Testing

Model #UGF-FSP-16

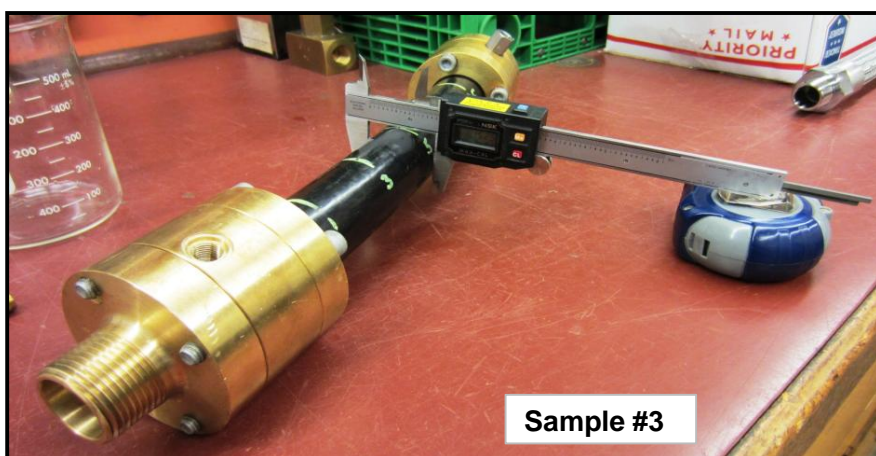
Validate that DoubleTrac 16,000 hour QUV exposure (advanced aging) did not compromise or degrade the UV Stabilized Nylon 12 outer jacket of DoubleTrac.

Length of exposed UV stabilized nylon "black" outer jacket	(inches)	(feet)
	9.5	0.79

Outside Diameter measured at the following locations before adding test fluid to the interstitial space (from left to right):



Location (inches)	Start (inches)	After 30 days (inches)	After 60 days (inches)	Test Temperature Maintained Throughout The Test 80°F (+/- 5°F)
1	1.521	1.525	1.529	
3	1.526	1.530	1.527	
5	1.525	1.535	1.520	
7	1.522	1.527	1.521	
8.5	1.525	1.525	1.526	
Average	1.524	1.528	1.525	
	8/6/2014	9/4/2014	10/3/2014	
Average	0.13	0.13	0.13	feet



EFEP Secondary Barrier Jacket

Interstitial space capacity at 100%	50 mL	tap water & glass beaker used to determine capacity
Interstitial space capacity at 80%	40 mL	calculated

	Start (lbs.)	After 30 days (lbs.)	After 60 days (lbs.)	Test Temperature Maintained Throughout The Test 80°F (+/- 5°F)
Weight empty with fittings attached	8.02			
Weight filled (diesel oil) with fittings attached	8.08	8.08	8.08	
	8/6/2014	9/4/2014	10/3/2014	
Max. Weight Change (lbs.)		0.00	0.00	
Max. Weight Change (grams)		0.00	0.00	
Max. Weight Change (Oz)		0.00	0.00	

Equipment Used:

Item	CSA #	Cal.	Cal. Due
Digital Calipers	D-3	1/22/2014	1/22/2016
Bench Scale	WL-52	11/18/2013	11/18/2014
Glass Beaker	n/a	0 to 140 mL	
Rotella T	SAE 15W-40 Heavy Duty Diesel Engine Oil		
Digital Calipers	D-133	12/18/2013	12/18/2015



Surface Area = $\pi(D)(D/2+L)$ **0.34** ft²

Permeation Rate = $\frac{\text{Maximum Weight Change}}{\text{Surface Area} / \# \text{ of Days}}$ **0.000000** Oz/ft²/day

Max allowable permeation 4.0 g/m² per day (.079 Oz/ft²)

RESULTS: Satisfactory

Signature: John Kristoff-Kichka

Title: Project Engineer



Crush Resistance Test

Model #UGF-FSP-16

Validate that DoubleTrac 16,000 hour QUV exposure (advanced aging) did not compromise or degrade the UV Stabilized Nylon 12 outer jacket of DoubleTrac.

In Accordance With **ASTM D 2412-11** Standard Test Method For Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

1 Scope

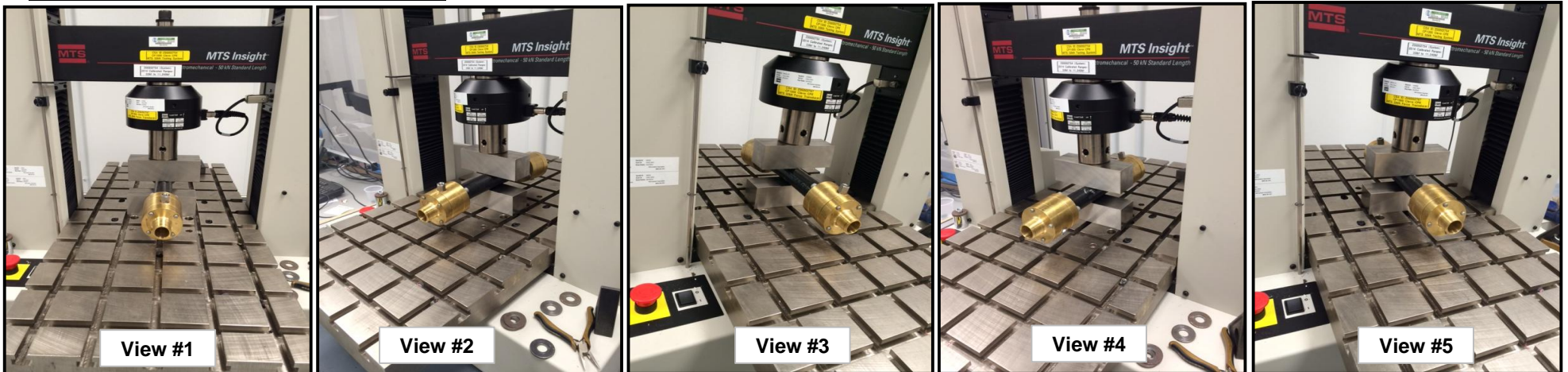
- 1.1 This test method covers the determination of load-deflection characteristics of plastic pipe under parallel-plate loading.
- 1.2 This test method covers thermoplastic resin pipe, reinforced thermosetting resin pipe (RTRP), and reinforced polymer mortar pipe (RPMP).
- 1.3 The characteristics determined by this test method are pipe stiffness, stiffness factor, and load at specific deflections.

4 Summary of Test Method

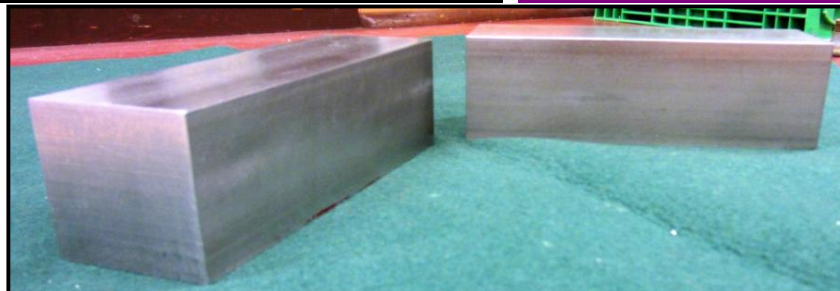
A short length of pipe is loaded between two (2) rigid parallel plates at a controlled rate of approach to one another. Load-deflection (of the pipe diameter) data are obtained. If cracking, crazing, delamination, or rupture occurs, the corresponding load and deflection are recorded.

6 Apparatus

- 6.1 **Testing Machine** - A properly calibrated compression testing machine of the constant-rate-of-crosshead movement type meeting the requirements of Test Method D695 shall be used to make the tests. The rate of head approach shall be 0.50 +/- 0.02 in. (12.5 +/- 0.5 mm)/minute.



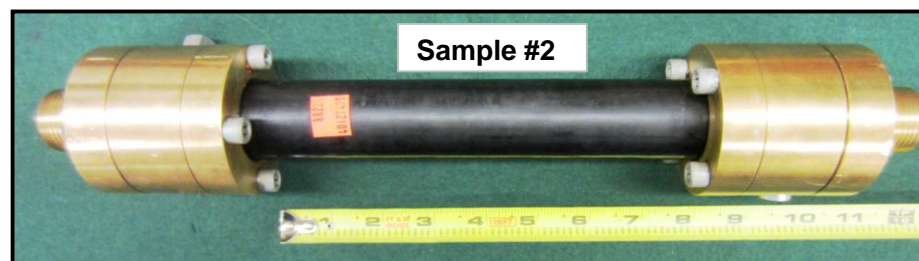
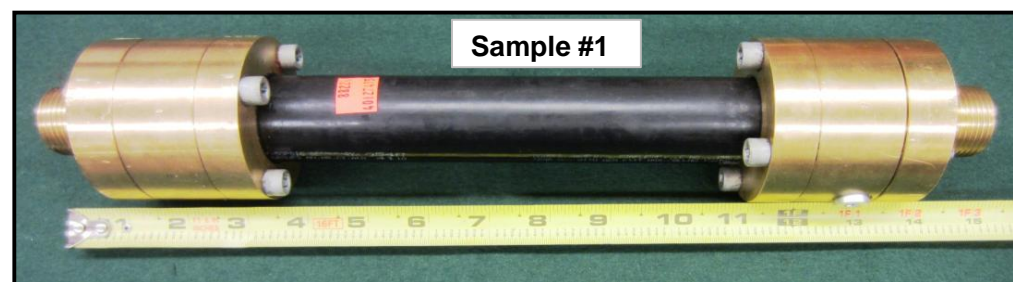
- 6.2 **Loading Plates** - The load shall be applied to the specimen through two (2) parallel steel bearing plates. The plates shall be flat, smooth, and clean. The thickness of the plates shall be sufficient so that no bending or deformation occurs during the test, but it shall not be less than 0.25 in. (6.0 mm). The plate length shall be equal or exceed the specimen length and the plate width shall be not be less than the pipe contact width at maximum pipe deflection plus 6.0 in. (150 mm). *Plates are 2" x 2" x 6", Type 316 S.S.*



- 6.3 **Deformation (Deflection) Indicator** - The change in inside diameter, or deformation parallel to the direction of loading, shall be measured with a suitable instrument meeting the requirements of Test Method D695, except that the instrument shall be accurate to the nearest 0.010 in. (0.25 mm). The instrument shall not support the pipe test specimen or the plate or affect in any way the load deflection measurements. Changes in diameter are measured during loading by continuously recording plate travel or by periodically computing it.

7 Test Specimens

Samples 1 & 2 - 1" DoubleTrac Assemblies with Brass End Fittings.



8 Conditioning

Following 16,000 hour QUV exposure (advanced aging)
 Test samples #1 and #2 maintained at room temperature 72°F (+/- 2°F) and 48% relative humidity.

9 Procedure

Determine:	Size	Tube Length	Wall Thickness	Avg. Inside Dia.	Avg. Outside Dia.	Weight (Lbs.)
Sample #1	1"	8.5"	0.490"	1.060"	1.550"	7.98
Sample #2	1"	7.5"	0.490"	1.060"	1.550"	7.94

No End Fittings Calculated: (Outside Dia. - Inside Dia.)

W/End Fittings



The Load is to be applied at the pipe center perpendicular to the axis at 1/2 inch per minute until a 40% reduction of O.D.

Loading The Force

Determine:	Size	40% Reduction	Test Time	Visual Examination After Unloading The Force
Sample #1	1"	YES	1 minute	Satisfactory Results - Reference Photographs Below!
Sample #2	1"	YES	1 minute	Satisfactory Results - Reference Photographs Below!

Un-Loading The Force

Determine:	Size	Pressure Rating	Twice the Rating	Test Time	Leakage	Non-Complying Damage
Sample #1	1"	125 psig/50 psig	250 psig/100 psig	2 minutes	0 / 0	No Damage to Report
Sample #2	1"	125 psig/50 psig	250 psig/100 psig	2 minutes	0 / 0	No Damage to Report

Nitrogen Gas Used

Photographs After Crush Resistance Test



Test Equipment Used: MTS Electromechanical Test Fixture, CSA#Z00002754, Calibrated On 3/5/2014, Due On 3/5/2015.

Burst Test

Model #UGF-FSP-16

Validate that DoubleTrac 16,000 hour QUV exposure (advanced aging) did not compromise or degrade the UV Stabilized Nylon 12 outer jacket of DoubleTrac.

Tested Using: WATER, OIL

Burst Test Primary:

Determine:	Size	Test Pressure	Test Time	Increase Test Pressure	Test Time
Sample #1	1"	125 psig	1 minute	625 psig	1 minute

RESULTS: Satisfactory - No Damage or Leakage Observed

Determine:	Size	Increase Test Pressure until the primary 1" DoubleTrac assembly burst.
Sample #1	1"	Test Pressure at Burst:

RESULTS: BURST at 1,403 PSI (Leakage Observed From The Secondary Barrier Fill Fitting).

Burst Test Secondary:

Determine:	Size	Test Pressure	Test Time	Increase Test Pressure	Test Time
Sample #2	1"	50 psig	1 minute	125 psig	1 minute

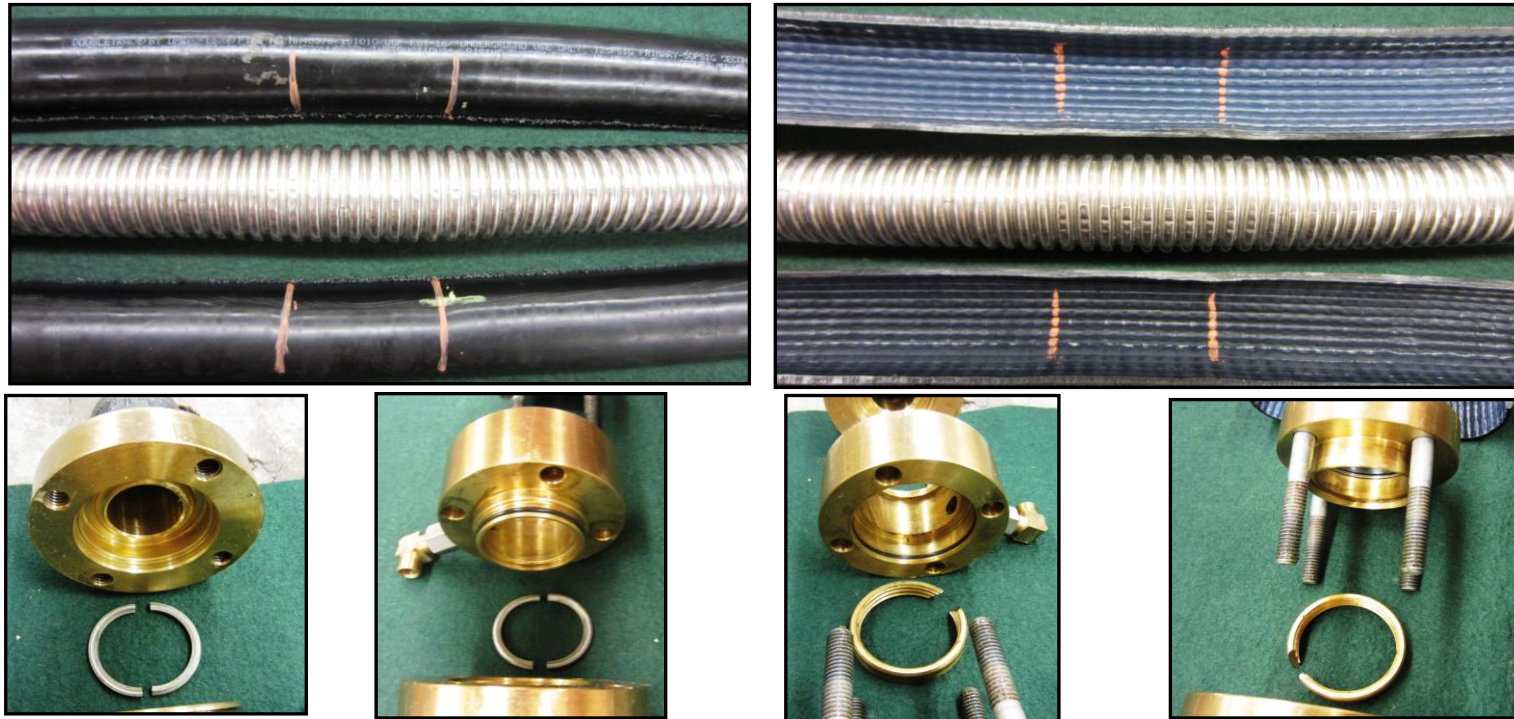
RESULTS: Satisfactory - No Damage or Leakage Observed

Determine:	Size	Increase Test Pressure until the secondary 1" DoubleTrac assembly burst.
Sample #2	1"	Test Pressure at Burst:

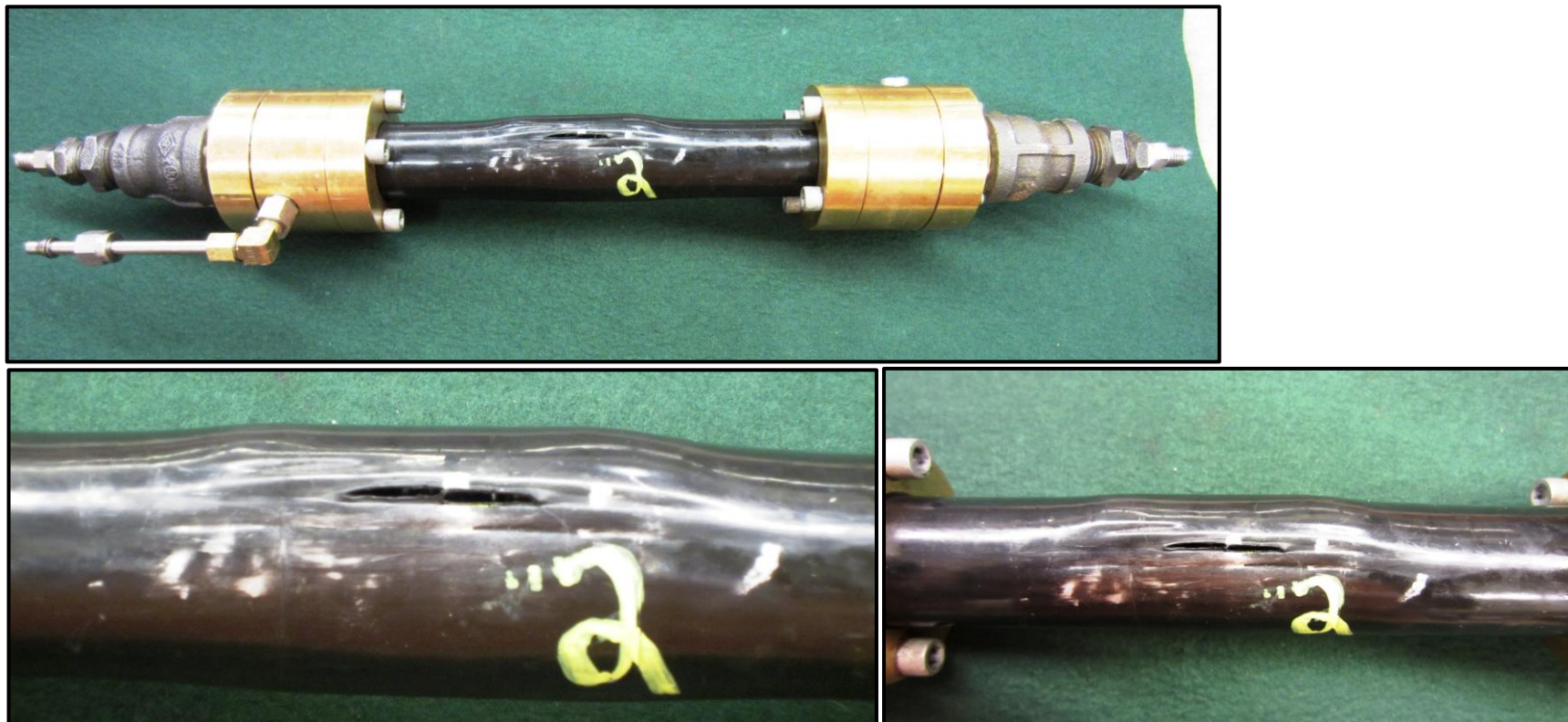
RESULTS: BURST at 494 PSI (Leakage Observed From The Outer Jacket)

Photographs After Burst & Crush Test - Sample #1 (Primary Pipe)





Photographs After Burst & Crush Test - Sample #2 (Secondary Barrier Jacket)



Test Equipment Used: Hydro-Pac Test Fixture, CSA#Z00001141, Calibrated On 2/20/2014, Due On 2/20/2015.

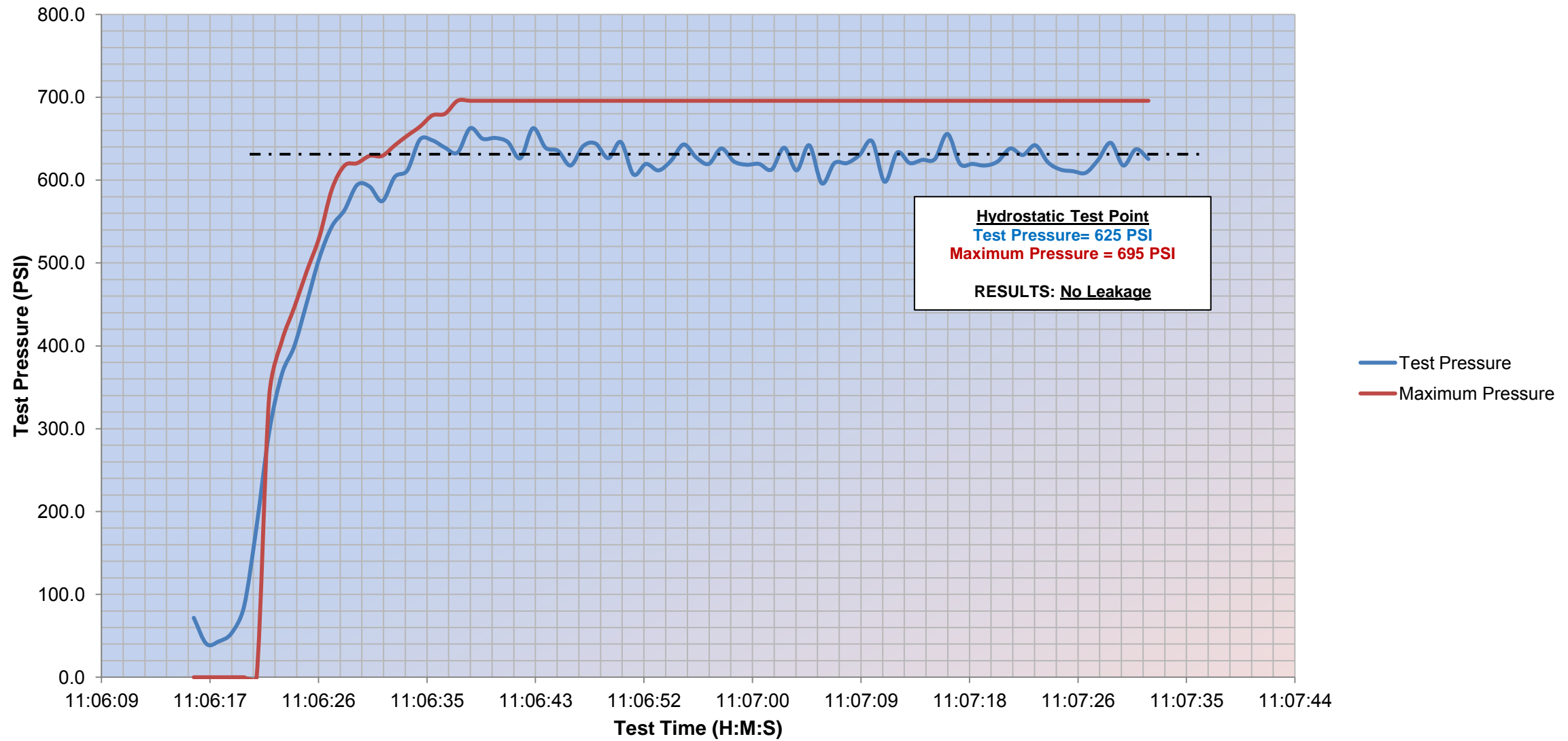
Pressure Test Gauge, CSA#PG-74, Calibrated On 3/26/2014, Due On 3/26/2015

Signature: John Kristoff-Kichka

Title: Project Engineer

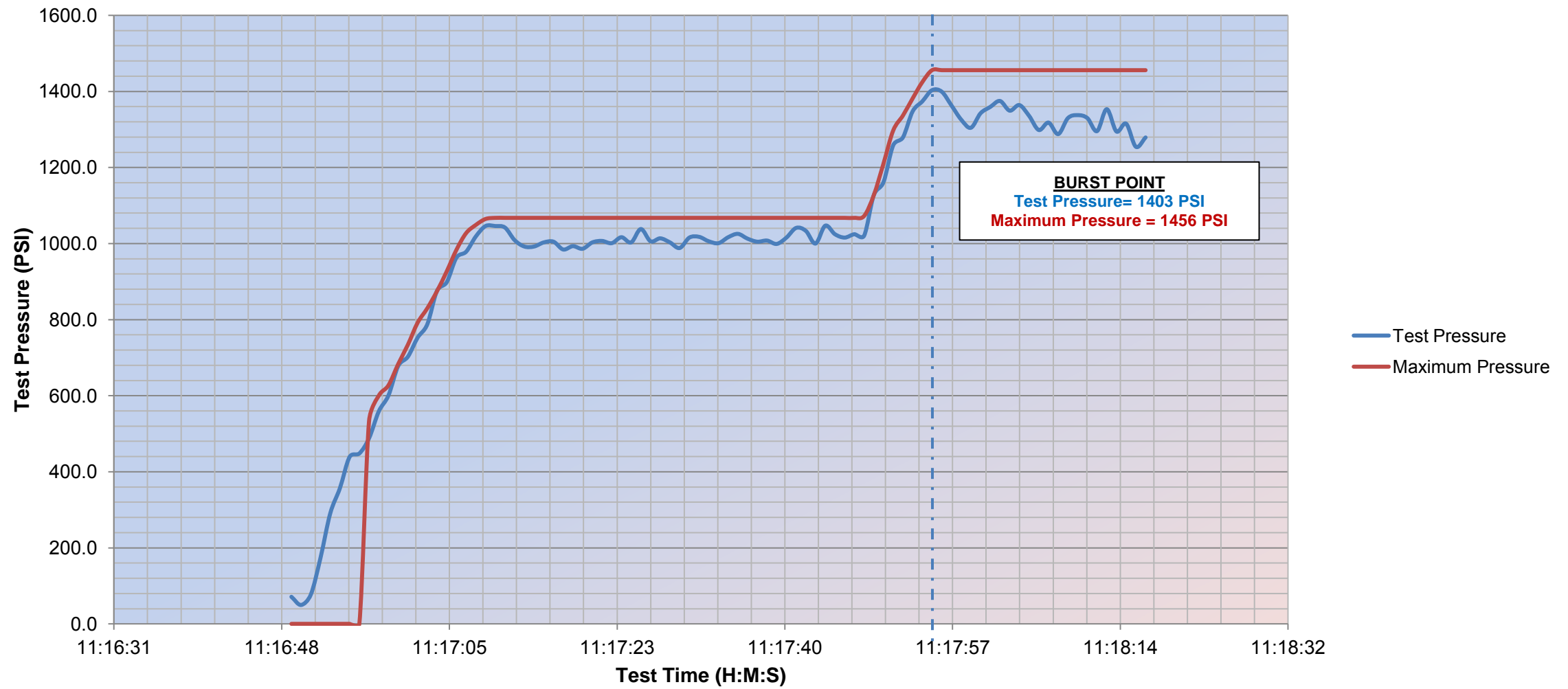


Test Sample #1 - Hydrostatic Test Primary



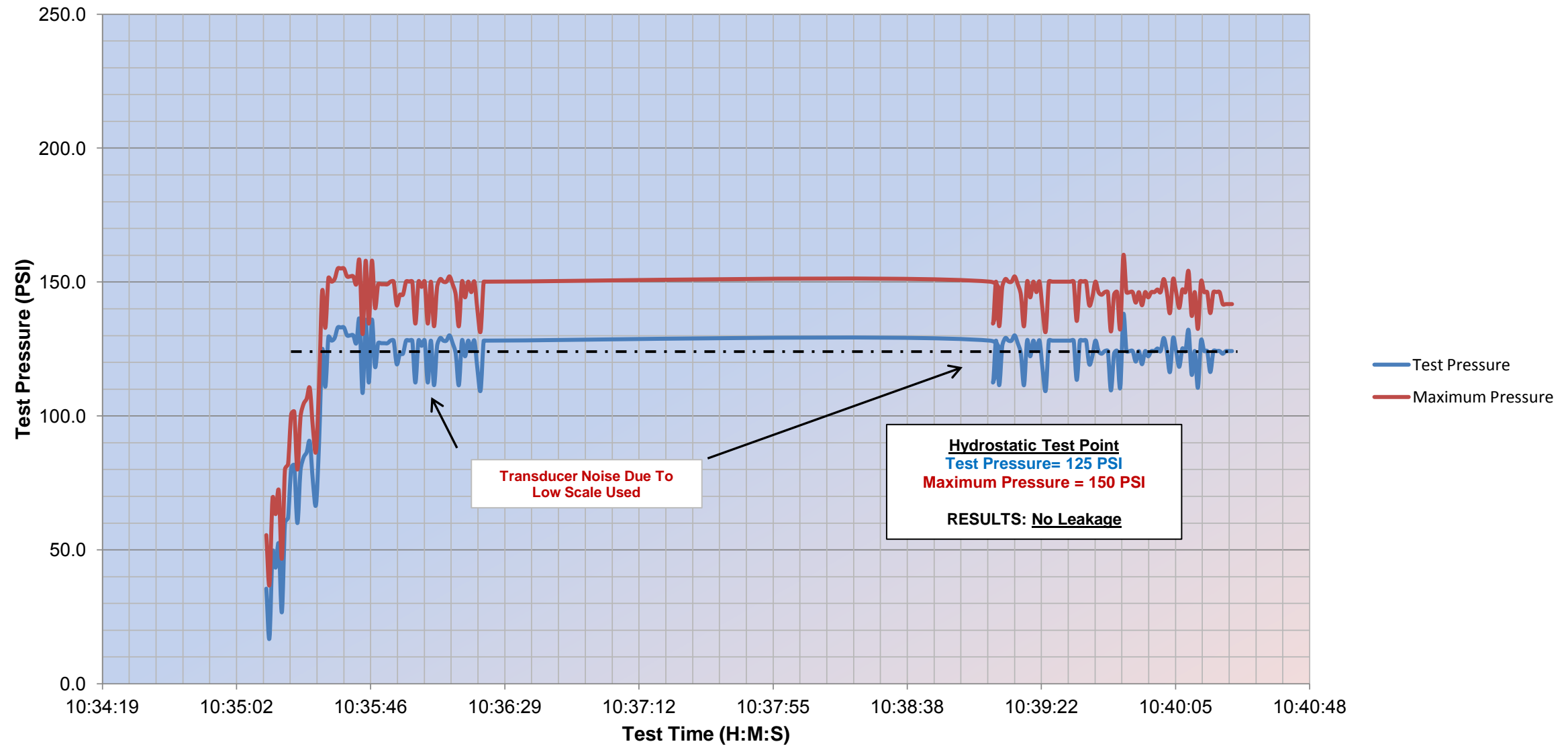


Test Sample #1 - Burst Test Primary



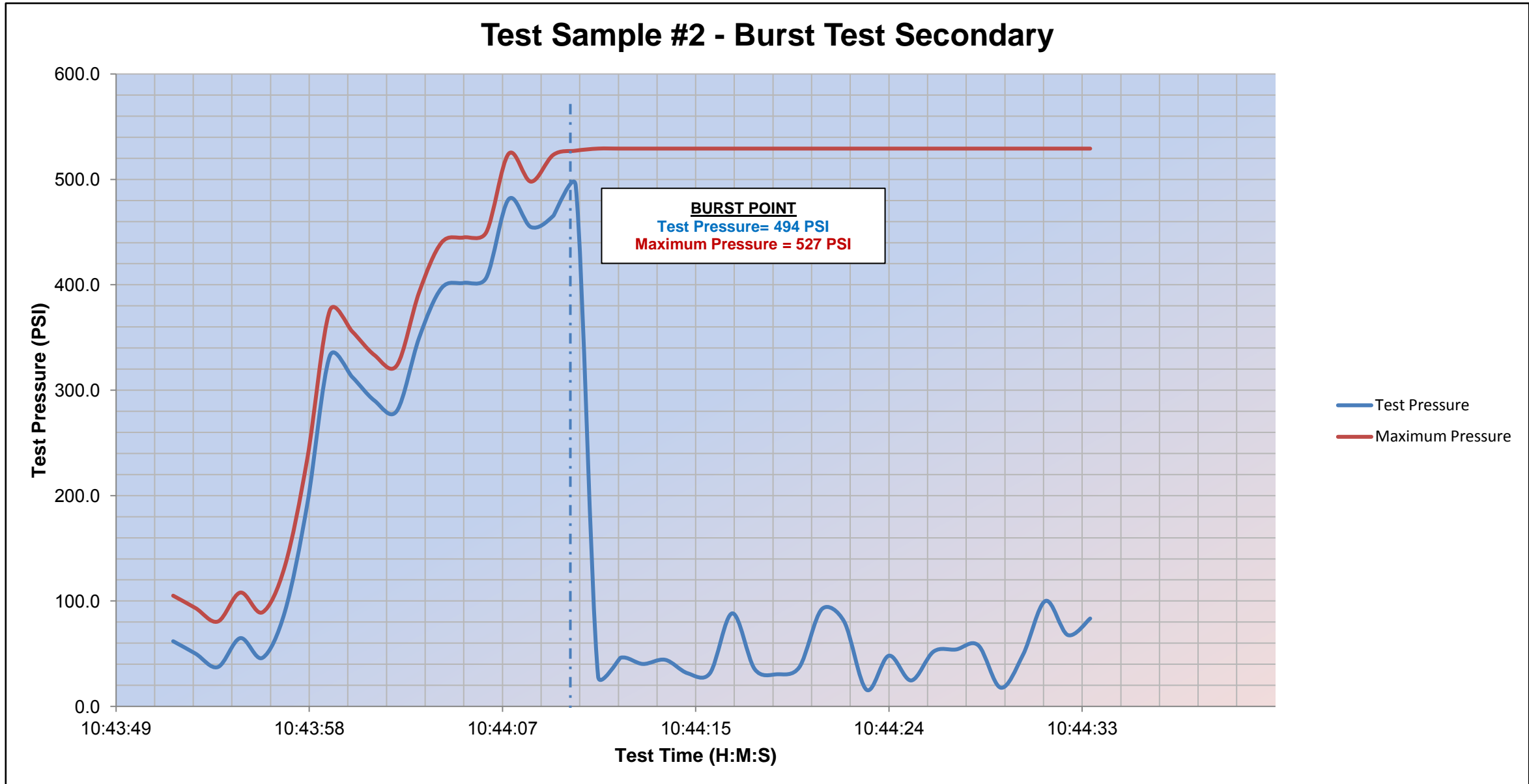


Test Sample #2 - Hydrostatic Test Secondary





Test Sample #2 - Burst Test Secondary





Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2014-04

DoubleTrac 2 hr Fire Test

1. INTRODUCTION

Fire Test 1" unjacketed DoubleTrac (worst case size, as it has the thinnest wall thickness) for 2 hours in an open flame per a modified UL 2039 test protocol.

2. SCOPE

Three 18" long unjacketed samples with stainless steel end fittings will be fabricated using production material and standard field assembly procedures for DoubleTrac. The samples will not contain the secondary jacket, as this test is only determining primary pipe and end fitting fire resistance. The samples will be tested at UL for the 2 hour Fire Test, resulting in a fact finding report issued by UL.

Test Location:

UL LLC
1285 Walt Whitman Rd
Melville, NY 11747

3. BACKGROUND

Without an existing standard to test the piping to obtain a 2 hour rating, OmegaFlex utilized a portion of UL 2039 Section 13 (Outline Investigation for Flexible Connector Piping for Fuels) to establish the test parameters. The only change to the UL 2039 test parameters, was increasing the time in flame from 30 minutes to 2 hours.

The UL report issued, is not a UL listing, but a fact finding report which shows compliance to the test protocol established by OmegaFlex.

4. SET-UP / EXPERIMENTAL PROCEDURE

1" DoubleTrac with Stainless Steel end fittings will be subjected to the hydrocarbon pool fire described below for 2 hours for aboveground rated pipe.



Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2014-04

DoubleTrac 2 hr Fire Test

The sample will be filled with water, capped/plugged at one end and connected to a metal pipe or tube with a shutoff valve, pressure gauge, pressure regulator or equivalent means at the other end to maintain the rated pressure throughout the fire exposure.

The sample will be pressurized to 50 psi, centered and supported 4 inches above the rim of a steel liquid-tight fire pan, approximately 20 inch diameter by 6 inch deep, so that one end fitting, and at least 1/2 of the pipe is exposed to the flame.

After the sample is positioned and pressurized, approximately 1 gal for aboveground rated of commercial grade kerosene (K1) will be ignited in the fire pan, followed by additional amounts of kerosene, as needed to maintain the fire for 2 hours.

After the 2 hours flame test, the fire will be extinguished using an appropriate method that does not damage the sample. After cooling, the sample will be visually examined for damage before repeat leakage test at lab temperature.

5. CONCLUSION

The test assemblies did not leak during the fire test, or subsequent to the fire test when leak tested at room temperature.

All assemblies passed all testing, as defined by OmegaFlex, and testing by UL.



Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2014-04

DoubleTrac 2 hr Fire Test

6. CURRENT REVISION – Revision NC

Written By: Brian Breitinger
Project Engineer
OmegaFlex, Inc.

Approved By: Randy Bayless
Director of Manufacturing and Engineering
OmegaFlex, Inc.

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Created: 15-Nov-2014
Revision NC

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Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2014-04

DoubleTrac 2 hr Fire Test

APPENDIX

Created: 15-Nov-2014
Revision NC

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OMEGA FLEX INC
451 Creamery Way
Exton, PA 19341-2508

E-mail: randy.bayless@omegaflex.net

Reference: File: SV16157 Project: 4786592323

Subject: This report covers Non Certification Test Services for model UGF-FSP-16 (1” DoubleTrac un-jacketed 316L stainless steel core with 316 stainless steel field attachable fitting)

Dear Mr. Randy Bayless

Per your request, project 4786592323 was opened, in accordance with your testing requirements for the evaluation of model UGF-FSP-16 on 9/26/2014. An executive summary of our findings can be found just below and a copy of the test data has been included at the end of this report.

UL LLC did not select the samples, determine whether the samples were representative of production samples or witness the production of the test samples, nor were we provided with information relative to the formulation or identification of component materials used in the test samples. The test results apply only to the actual samples tested.

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This letter will serve to report that all tests on the subject product have been completed. Thank you for the opportunity to provide your company with these services. Please do not hesitate to contact us if you should have any questions or comments.

Sincerely:
Joshua Frescott
Laboratory Manager

UL LLC
1285 Walt Whitman Rd
Melville, NY 11747
T: 631-546-2741
Joshua.Frescott@ul.com

FIRE TEST METHOD – SU2039 – Sec. 13

Samples of all connector pipe types in worst case size(s) were subjected to the hydrocarbon pool fire described below for 2 hours for aboveground rated pipe.

The sample was filled with water, capped/plugged at one end and connected to a metal pipe or tube with a shutoff valve, pressure gauge, pressure regulator or equivalent means at the other end to maintain the rated pressure throughout the fire exposure.

The sample was then pressurized to rated 50 psi, centered and supported 4 inches above the rim of a steel liquid-tight fire pan, approximately 20 inch diameter by 6 inch deep, so that one end fitting, joints and at least 1/2 of the pipe is exposed to the flame.

After the sample is positioned and pressurized, approximately 1 gal for aboveground rated of commercial grade kerosene (K1) was ignited in the fire pan, followed by additional amounts of kerosene, as needed to maintain the fire for the test period.

After the required time, the fire was extinguished using an appropriate method that did not damage the sample. After cooling, the sample was visually examined for damage before repeat Leak Testing at lab temperature.

RESULTS

All samples tested; Sample No. 1 did lead at shut off valve (part of test setup) and Sample Nos. 2 and 3 did not show evidence of leakage during Fire Test, and all samples did not leak after the repeat Leakage Test.

Fire and Leakage Results

Sample No.	Size (in)	Fire Test Pressure (psig)	Fire Test Leakage ? (Y/N)	Leakage @ 2X ? (Y/N)	Fire Damage ? (Location & Type)
1	18	50	Leakage noted from shut off valve stem.	N	No visual damage other than at shut off valve.
2	18	50	No leakage noted during test. Valve was removed before testing.	N	No visual damage.
3	18	50	No leakage noted during test. Valve was removed before testing.	N	No visual damage.

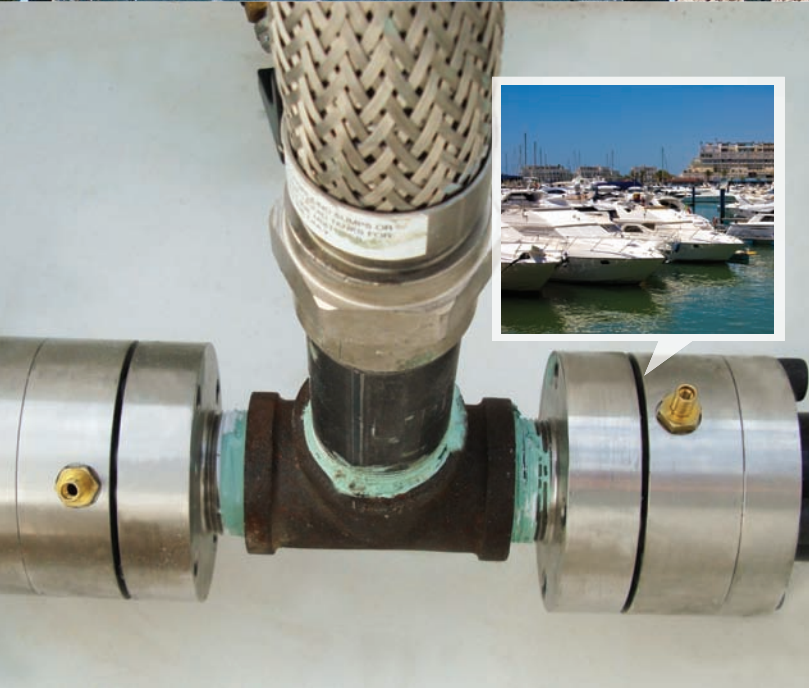
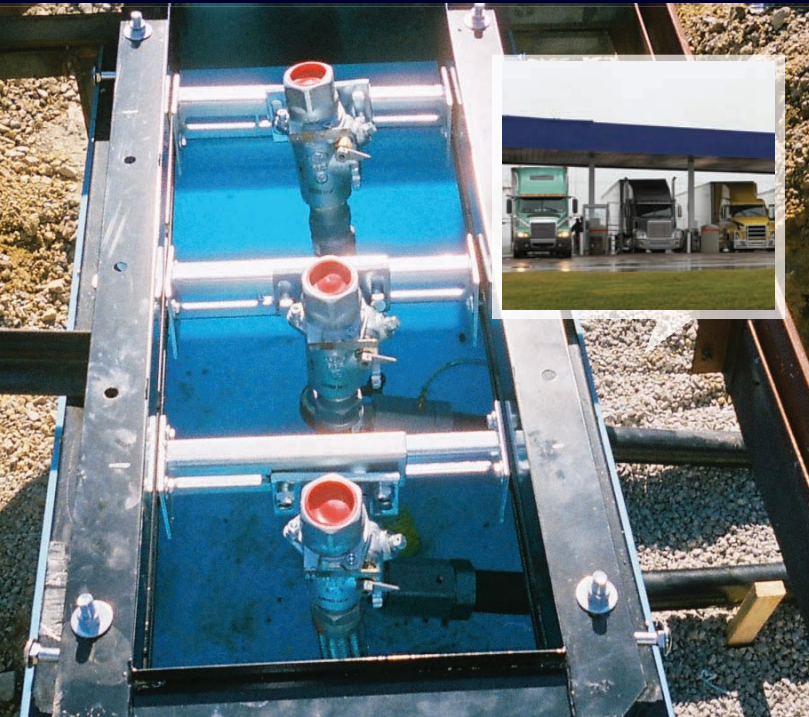
PDE Note – Base worst case type on least fire resistant materials & thinnest pipe wall combo.

Water may be used as a buffer for the delivery of additional fuel through a metal tube at the bottom of the pan with a control system.

The pressure was monitored with water adjusted and/or steam removed as needed to maintain the pressure within +/-5% of the rated value.



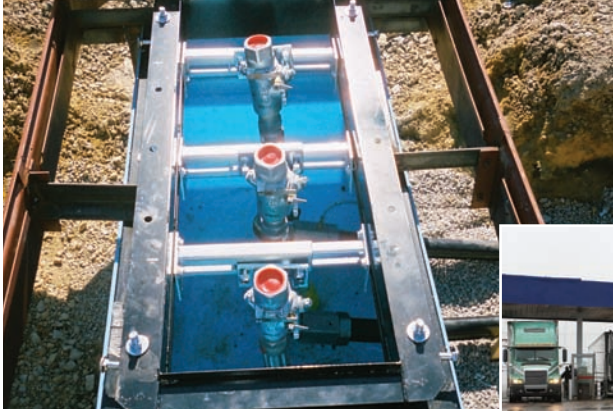
Double Containment Piping for Diesel, Gasoline, Biofuels and DEF



New UL 971A Listed Fitting for Easier Assembly



Installation Applications and Uses



UST – Features and Benefits

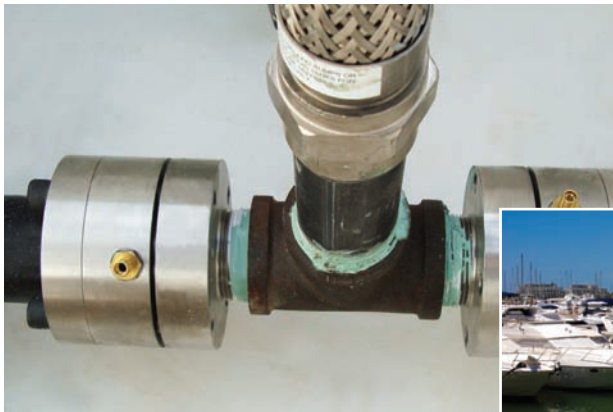
As with the entire line of semi-rigid piping from OmegaFlex, DoubleTrac is flexible, direct burial piping that is easier to install and is less labor intensive than rigid piping installations. DoubleTrac requires no special tools to assemble, can be bent by hand and the patented field attachable fittings provide a reliable metal to metal seal through proven technology. It's supplied in continuous lengths from a spool that eliminates the need for splice joints, no electro-fusion joint welding, no adhesives, no curing problems, and no leaks.



AST – Features and Benefits

DoubleTrac's innovative double wall design includes a UV stabilized Nylon 12 outer layer, providing excellent resistance to weathering, and chemical exposure.

Elbows and tees available to facilitate installations in restricted spaces, double containment flow through maintained throughout all fittings.



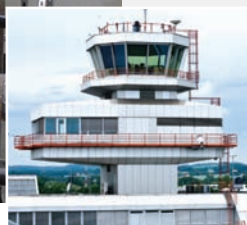
Marina – Features and Benefits

Routes easily along or underneath docks. The Nylon 12 outer jacket is UV stabilized and salt water resistant; no chase pipe required. Can be supplied in extra long continuous lengths; eliminating transition sumps on the dock. Additionally, a double containment flexible floating dock connector is available.



Aviation – Features and Benefits

Suitable for use with all aviation fuels; utilizing the DoubleTrac stainless steel fittings, all wetted surfaces are stainless steel. Secondary containment rated for 50 psig or full vacuum allowing for continuous monitoring.



Product Specifications / DoubleTrac® Flexible Piping

Size	1"	1.5"	2"
Part No.	UGF-FSP-16	UGF-FSP-24	UGF-FSP-32
Description	1" Double Wall Flexible Piping	1.5" Double Wall Flexible Piping	2" Double Wall Flexible Piping
Working Pressure (PSIG)	125 Primary 50 Secondary	100 Primary 50 Secondary	75 Primary 50 Secondary
Minimum Bend Radius (INCHES)	12	24	32
Weight (LBS/FT)	0.75	1.50	2.00
Lengths	up to 1000 ft.	up to 1000 ft.	up to 1000 ft.
Operating Temperature	-20° F to 120° F		

1) Corrugated Stainless Steel Primary Pipe

This zero-permeation, ASTM A 240 316 series stainless steel pipe is highly resistant to corrosion, providing longer life and exceptional crush resistance.

2) EFEP Secondary Barrier Jacket

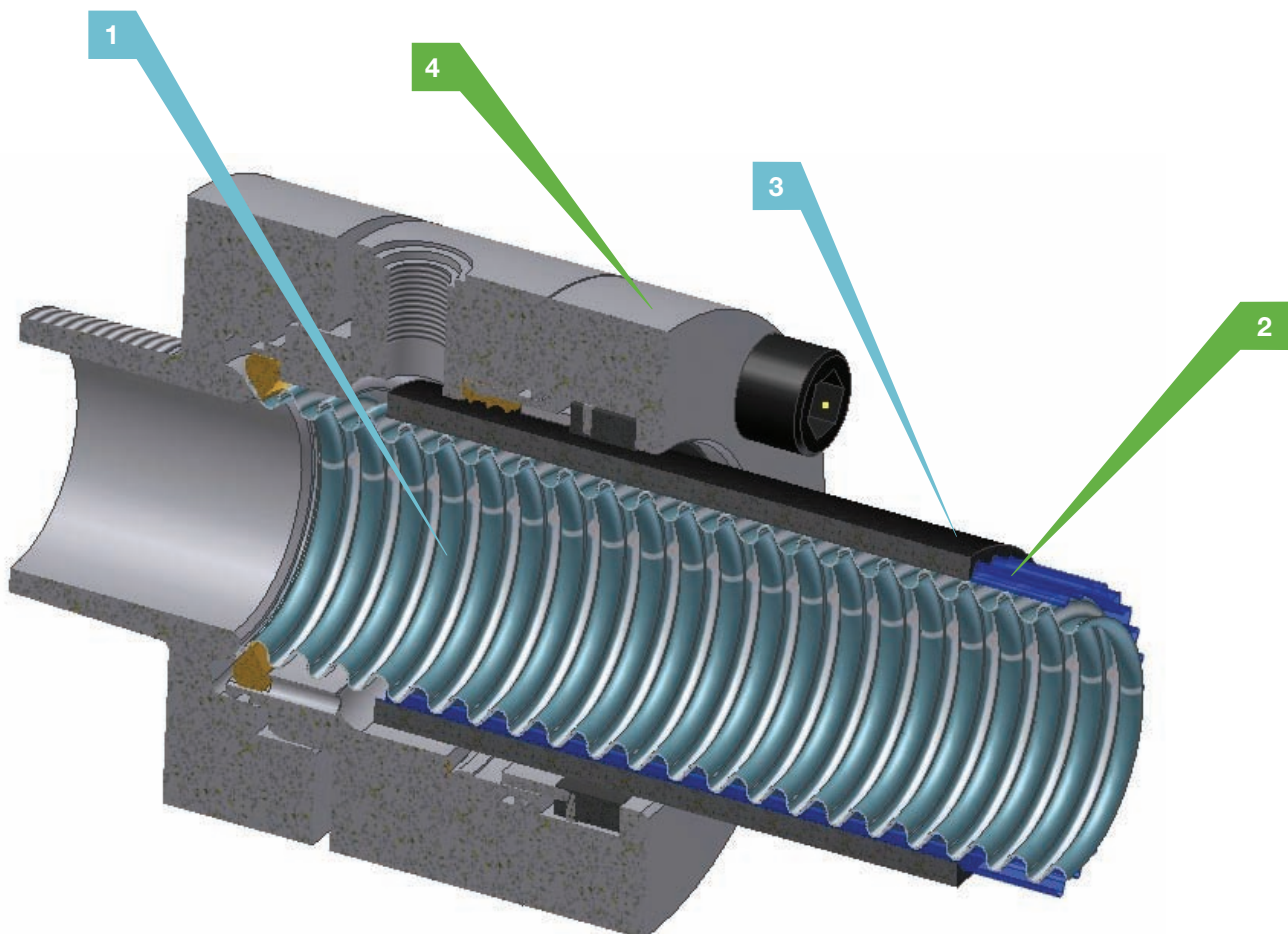
This layer is bonded to the Nylon 12 protective layer to offer secondary containment with exceptional permeation resistance for product compatibility. Interstitial space allows continuous monitoring for leak detection, with a 50 psig rating for pressurized systems.

3) UV Stabilized Nylon 12 Outer Jacket

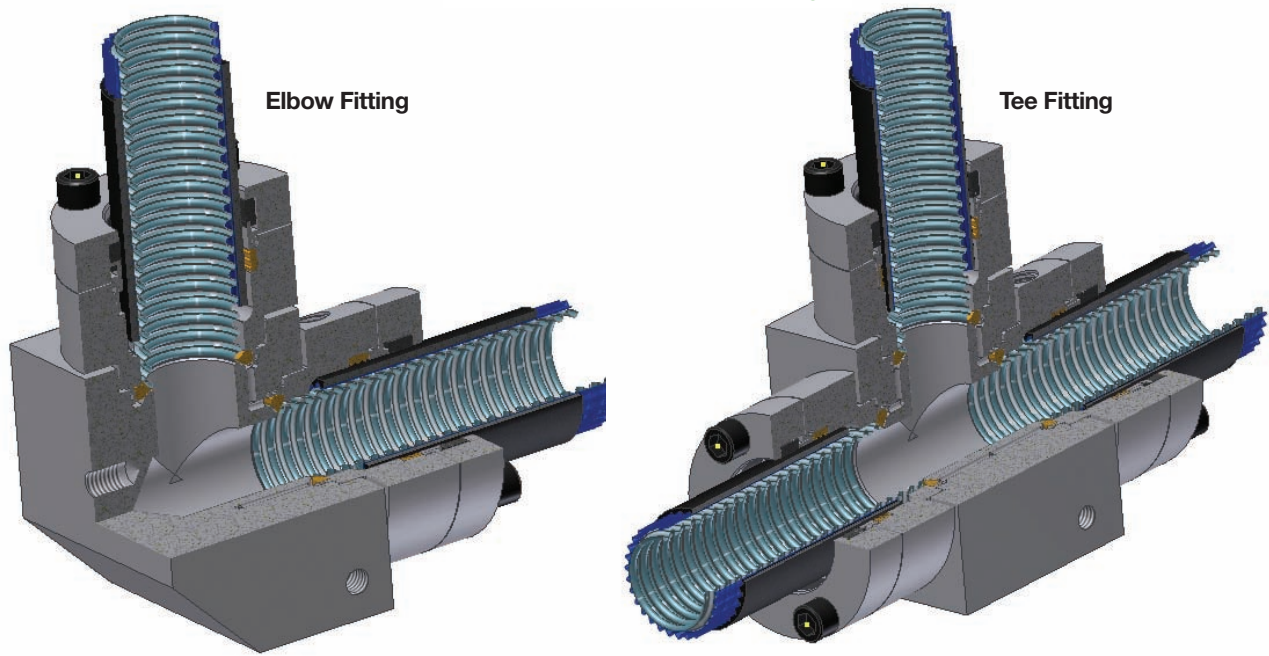
This direct-burial layer offers exceptional resistance to hydrocarbons, chemical and water exposure, and carries a 50 psig rating. UV stabilized for above ground and marine use.

4) New Quicker, Easier Assembly Fitting

Provides a metal to metal sealing surface that's unsurpassed in reliability and user friendliness, and is field-attachable using standard tools. Available in Alloy 360 Brass or Stainless Steel.



New Easier Assembly Fittings



Specification Data

Corrugated Stainless Steel Tubing Materials

MECHANICAL JOINT FITTING: Alloy 360 Brass or Stainless Steel Fitting

NOTE: Fitting joint with tubing shall provide a metal-to-metal seal; no gaskets permitted

NOTE: All fittings meet Salt Spray Test requirements of ASTM B-117-90

NOTE: UL 971A listed file number MH 45578, titled Integral Primary/Secondary for all Fuels

OmegaFlex®

Background

Established in 1975, OmegaFlex is the preeminent international producer of flexible metallic piping products. With over 90 patents registered worldwide, OmegaFlex supplies proprietary products for a broad number of applications and markets, which include primary steel production, semiconductor, medical, pharmaceutical, petrochemical, residential and commercial construction, and power generation.

OmegaFlex Philosophy

- Provide our customers quality products through teamwork and continuous improvements
- Strive for zero defects
- Create an environment that allows continuous and above average growth
- Provide a positive working environment with a commitment to employee training
- Stress quality awareness and its benefits to both customers and employees
- Empower our employees to perform to the best of their abilities

OmegaFlex Products and Install Base

OmegaFlex is committed to serving its customers with the largest selection of sizes and materials in the corrugated metal flexible piping industry. Whether it is designing highly engineered specialty assemblies for OEM applications, gas piping for new home construction, supporting its large network of fabricating distributors, or designing the new DoubleTrac® flexible piping system, OmegaFlex has the dedication and the resources to meet the needs of today's demanding requirements. Listed below are some of the standard products offered by OmegaFlex.

Industrial Metal Hose—Highly engineered assemblies for numerous applications such as steel mills, petrochemical facilities, power generation and cryogenic applications.



For more information please visit us at
www.doubletrac.net or call 1-800-355-1039.

www.DoubleTrac.net

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DBT-110 / REV 3/2013