TROJAN PIPE LLC

TECHNICAL PROCEDURE INSTALLATION OF **COMPRESSED FIT HDPE LINER**

TROJAN PIPE
LLC

2019

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1. Introduction

Technical procedure for the installation of Compressed Fit HDPE Liner with high density polyethylene (HDPE) and PVDF pipes, PA 11 and PA12, high temperature in new steel pipe or rehabilitated by a highly specialized process.

TROJAN PIPE COMPRESSED FIT HDPE LINER from 2 "to 48"

Figure Nº1. Rehabilitation or new construction

Compressed Fit HDPE Liner Technical Installation Procedure with High Density and High Molecular Weight Polyethylene (HDPE) pipe in new steel pipe or process rehabilitation.

This process is highly specialized and recommended when there is little maneuvering space and pipe housing to be cased.

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1. OBJECTIVES

- Make known to our customers a sustainable solution to their fluid transport problems when their conductive lines do not support the agents (corrosive, abrasive, others), and also has little maneuvering space and pipe accommodation to be wrapped using our system of Trojan Pipe Compressed Fit HDPE Liner. We offer our customers the efficient use of the smallest maneuvering spaces that we can get.

- To internally cover rehabilitated pipes (already built) by means of methodical and specialized processes, when such pipelines to be retained retain their mechanical, physical and chemical characteristics, that is to say they withstand the service pressures to which they will be subjected, which makes unnecessary a process where Maneuver spaces can not use our methodology.

- Offer alternative technical proposals for internal protection to steel pipe systems, existing or new against corrosion and abrasion. All this, using an inner coating based on high density and high molecular weight polyethylene pipe, by inserting it into the carbon steel pipe under the TP Compressed Fit HDPE Liner system.

- Evaluate and propose the materials (HDPE) to be used according to the real and specific factors of each project in terms of the agents that will transport the pipeline to (service pressure and temperature).

- Show the advantages of the installation of the casing (high density polyethylene pipe and high molecular weight) in new or rehabilitated steel pipes as the solution to problems of unaffected working areas.

- Ensure the functionality and integrity of the steel pipe jacket and protection.

- Indicate zero angular space as between the operation of the duct.

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2. REACH

- Applies to new or rehabilitated steel pipes where corrosion and internal abrasion represents serious problems as it is in the oil and mining industry (leaching processes, transport of pulp, ores to mention some), although in its design it is basic already maximum advantage in already constructed pipes and is to rehabilitate the current use.

- For piping systems that transport or handle highly corrosive fluids such as crude oil, gas, and salt water, congenital, hydrogen sulfide, emulsions and pulps.

- The cladding applies to new and rehabilitated steel pipes in diameters from 2 "to 48" of any thickness.

- High density and high molecular weight polyethylene ASM D3350. For more information see CHEMICAL RESISTANCE CHART.

Table Nº1. Chemical Resistance High Density Polyethylene (Sulfhydric Acid)

SULFHYDRIC	◉
BROWN RAW	◉
BRINE	◉
NITROGEN	◉
BUTANE	◉
SWEET GAS	◉
BITTER GAS	◉
PROPANE	◉
HYDROGEN	◉
ETANO	◉

3. DEFINITIONS

High density polyethylene

Raw material used in the manufacture of pipes, is produced from the polymerization of ethylene and is the product of a long process of research and development by manufacturers and specialized institutes.

Trojan Pipe Compressed Fit HDPE Liner

It is an inner coating system based on high density and high molecular weight polyethylene tubing, inserting it into the carbon steel pipe which is chemically inert to most corrosive and abrasive products.

It is also highlighted that it is the process used for the casing of a pipe with high density polyethylene (HDPE), which by its elastic capacities in reference to thickness evidently, allows it to achieve both extrusion (up to 10%), Is subjected in our TP Compressed Fit HDPE Liner process as the expansion (up to 10%).

It is also noted that the characteristics (from the inner tube) allows the transport of fluids or corrosive or abrasive agents up to 80ºC temperature and above all supports the pressures supported by the steel pipe to be coated or clad, ie, it supports the External containment pressure.

The high density polyethylene tube to be introduced shall be no more than 7% less than the inner diameter (ID) of the tube to be covered and its thickness a minimum of 10% more than the minimum base thickness 0.220 * (WT), depending on the Diameter (OD).

4. OVERVIEW OF TROJAN PIPE Compressed Fit HDPE Liner PROCESS PROTECTION SYSTEM

Due to the physical and chemical characteristics of the high density and high molecular weight polyethylene pipe, the internal protection system in the steel pipe is reduced by up to 10% in diameter and expands in the same proportion up to 10% this basically depends on the wall thickness (WT), type of material and the inside diameter of the jacketed steel pipe is reduced in the same way.

However, the operating conditions are not to the detriment of the characteristics of the coefficients of friction of the polyethylene relative to the steel which is smaller. Regarding the specifications and operating limits of the cladding system, its characteristics like any product are limited, due to the following factors:

- Pressure and temperature of operation of the duct.

- Physico-chemical characteristics of the fluid.

- Percentage of solids, transportation expense.

- Length and diameter.

- Degree of cleaning and thickness of the inner wall of the pipe.

- Existing pipe diameters

- Curved line characteristics, connections, others.

- Accessibility to affected areas and maneuvering area.

For the oil industry has a large range of products that can be transported. For special applications it is recommended to perform compatibility studies between the characteristics of the casing and the operating characteristics and the characteristics of the fluid, in order to be able to make a better suggestion and design of the system. The range of pressures and temperatures that can currently be handled with the Compressed Fit HDPE Liner system is up to 4,000 psi in the oil industry and 12,000 psi in the mining industry and the operating temperature up to 80 ° C for a larger range will need to specify the type of Material to use.

5. RESPONSIBILITIES

It is the responsibility of Trojan Pipe LLC to communicate the basic requirements necessary to carry out the work of coating the pipeline or piping system to be protected and / or internally coated.

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5.1 Basic requirements for carbon steel pipes using the TP Compressed Fit HDPE Liner process, see Table N°2

Table Nº2. Basic requirements for carbon steel pipes

BASIC REQUIREMENT	LIMITING	COMMENT
Cladding pipe with non-destructive tests according to customers requirements	◙	The tube proposed for insertion must have destructive tests and quality certificates for its use
Tubing of jacketed steel hydrostatically tested according to design pressure	◙	The tube to be jacketed requires a hydrostatic test before coating.
Pipe free of water, mud, wood or any other body that could damage the free passage of the special devil with control gauge or sujesor.	◙	POLY-PIG cleaning devil run required
Excessive weld penetration no greater than 1/8 "	◙	Damage of the polyethylene tube to be inserted.
No high low, (If they exist it should be sectioned and indicate diameter and length)	◙	
No deformations in the pipe by blows or bad bend of curves.	◙	Damage of the polyethylene tube to be inserted.
No radius of curvature less than 30 diameters (tube of origin to be covered)	◙	
Radius less than 30 curvature diameters, receive specific study	◙	It can be cut.

GAIA must submit in writing the minimum requirements for the realization and also the customers should be requested the necessary data for the evaluation and presentation of proposals of the project of jacket.

5.2. Data needed for design assessment to implement TP Compressed Fit HDPE Liner technology

a. Conditions of the pipeline to be rehabilitated

b. Diameter

c. Length

d. Topography (determined point of inflection and degrees of curvature)

e. Composition of the product and agents to be transported by the tube at...

f. Design or operating temperature of the duct at

g. Pressure of design or operation of the duct at

h. Type of land where the works of...

i. Specification of the diameter (Internal and external) of polyethylene pipe in case of coming defined in the request of the client.

The project supervisor of the cladding area or its assignee (Client) is responsible for coordinating and ensuring that the conditions necessary for carrying out the cladding work (radius of curvature in PI, availability of work areas, specific information, Necessary for changes of thickness in pipe in dimensions and length, as well as its punctual indication where these occur), as well as to provide the personnel and equipment for them to be given.

The Compressed Fit HDPE Liner quality control supervisor is responsible for verifying that the cladding is performed according to the procedure, as well as request and coordinate the inspection services of the companies or personnel assigned. It is the responsibility of Trojan Pipe to comply with safety recommendations for cladding work, as well as to verify that personnel make correct use of their equipment and personnel.

6. Technical procedure for installation of cladding

6.1 Definition of the length of the installation sections

6.1.1 The first phase of the installation of the cladding is based on the determination of the sections or length of the sections to be installed and material to be used, as well as the availability of work areas both of which corresponds to the pipe line To intervene as the available length for the alignment and thermo fused high density polyethylene pipe to be inserted. The sections can range from 20 to 2,000 meters in length when they are straight sections, small diameters and meets the optimum favorable conditions, from 500 to 750 meters is the recommended length.

6.1.2 To evaluate the installation voltage will be determined according to the maximum tension of the material and will be within the values of the elastic curve of the material, in addition the following factors will be taken into account: The roughness between the steel and the polyethylene, are of contact, radius and angle of the section. When the factors most determined are:

I. WEIGHT = Diameter of the tube wall thickness.

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6.2 Design

6.2.1 During this phase of Compressed Fit HDPE Liner, the following parameters will be taken into account, which are related to the information provided by the client, such as: Fluid characteristics; Temperature and operating pressure, length, diameter, steel tube thickness; Conditions and cleanliness of the pipeline in case of rehabilitation, stroke, access conditions, type of terrain and areas and / or spaces available to the client for the development of the works.

Table Nº3. Design

Shipping Agents	Coating material (coating tube)
Operating temperature	Coating material (coating tube)
Operating Pressure	Capacity of flanges, valves, weldolets, couplings system joints, vent ..
Length, curves and degrees (p)	Cladding sections and material count to be used
External diameter and thickness of the pipe to be covered	Determinant for tube design for jacketed
Special works and location	Sections of cladding, logistics and material account to be used
Piping to be cased or recovered	Determinant for the preparation and definition of type of system to be used as well as tube design for jacketed
Type of land and management areas	Determinant for logistics and definition of type of system to be used as tubular pipe design.

Based on the above data we can define the use of the system to be used.

6.2.2 Compressed Fit HDPE Liner

6.2.2.1 The Compressed Fit HDPE Liner process emerges as an alternative form of cladding, when our customers provide us with very limited piping management spaces for the development of Compressed Fit HDPE Liner processes.

STUDY CASE

600 meters of steel pipe to be cased, delivering a limited area of 60 meters long x 30 meters wide.

Figure Nº2. Case study

6.2.2.2 We have achieved this by introducing a polyethylene tube whose OD OD is smaller than the inner diameter ID of the steel pipe, in dimensions that allow the elastic capacity of the pipe to recover as soon as the tightness test is done and during Its operation. This elastic capacity has been chosen for the behavior observed from it (HDPE PIPE), during the compression phase of our Compressed Fit HDPE Liner system.

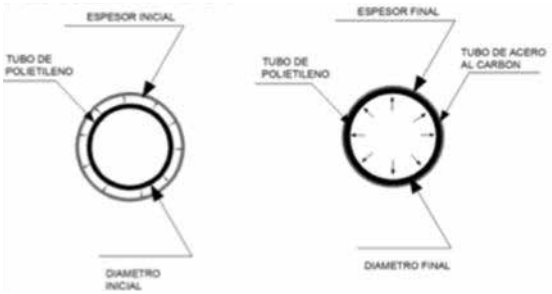

Figure Nº3. Compression phase

6.2.3 Null annular space, to achieve the void annular space under the following premise.

6.2.3.1 The specially used high density polyethylene (ASTM D3350), PE4710 (3408), ASTM D1505 density, high density polyethylene is of RD 26 and RD 34, ie 0.220 to 0.600 * thickness, according to diameter, stand alone maximum pressures of 5.5 kg / cm2, that is that according to our sealing test process explained below is 7 kg / cm2, exceeding 5.5 kg / cm2 or less as applicable for each diameter, will begin to undergo a stretch, within the normalized parameters of elasticity of the polyethylene tube, to support its mechanical containment in the steel tube.

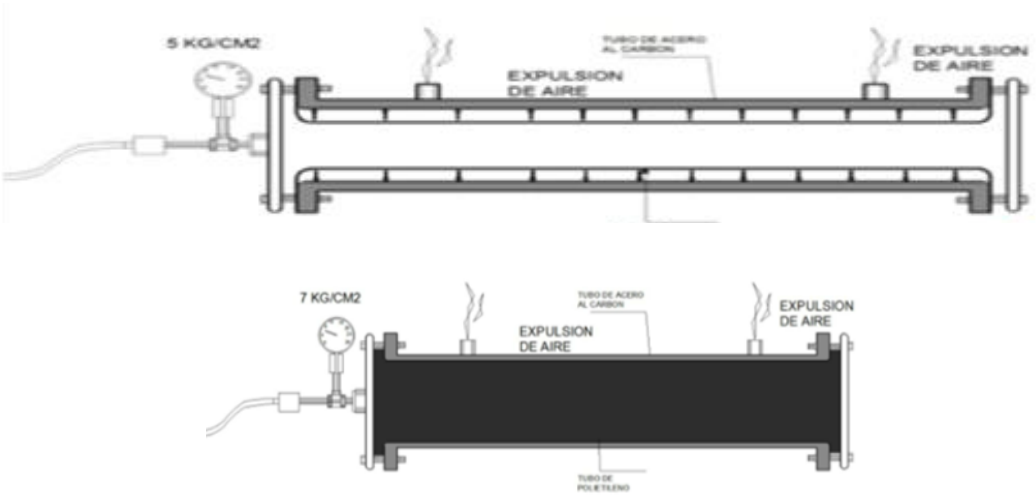

Figure Nº4. Tightness Test

6.2.3.2 Normalized parameter of maximum elasticity, it must be calculated according to the internal diameter of the steel tube against the inserted polyethylene tube, not exceeding 10% its external diameter.

CASE STUDY:

OD STEEL PIPE: OD AC "
WT TUNO STEEL: WT AC "
ID = OD- (WTX2)
ID = OD "AC" - (WT AC "X2) ID = AC ID"

DIAMETER

OD HDPE TUBE: OD HDPE "
WT HDPE TUBE: WT HDPE "

EXPANSION <10% (FACTOR 1.1) EXPANSION PEAD = ID STEEL TUBE
EXPANSION <10% = 1.1> PEAD EXPANSION FACTOR

6.2.3.3 Thickness parameter: If we recommend a minimum wall of 0.220 "in its optimum conditions of operation of the TROJAN PIPE LLC then we must calculate that the design thickness of tube to be inserted has at least 1.5 times of thickness the required factor of elasticity at which will be submitted to support the mechanical containment in the steel tube.

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CASE STUDY

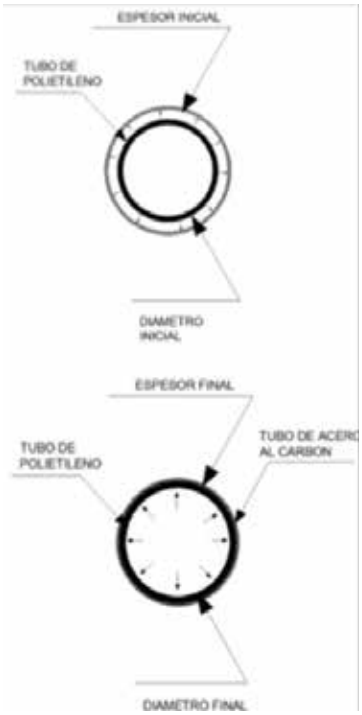
WT HDPE EXPANDED> 0.220 "<(WT HDPE X FACTOR EXPANSION HDPE)

THICKNESS

WT HDPE EXPANDED = (WT HDPE (0.220) X FACTOR HDPE EXPANSION) X 1.25

WT HDPE EXPANDED "=> 0.220" ANY MINOR VALUE TO 0.220 "

6.2.3.4 In compliance with the standard tolerances for HDPE, the expansion and minimum thickness required for tube selection is ensured by:



The initial thickness of the high density polyethylene tube (WT I HDPE) is greater than the final thickness before undergoing the expansion.

WT I HD> WT F HD

The initial OD (HDPE) diameter of the high density polyethylene tube is smaller than the final diameter before undergoing the expansion.

OD I HD OD HD

The final thickness of the high density polyethylene tube (WT F HDPE) is less than the initial thickness after undergoing expansion.

WT F HDPE> -0.220 "

Figure Nº5. Thickness of the pipe

The outer diameter (OD F HDPE) End of the high density polyethylene tube is larger than the initial diameter after undergoing expansion.

OD EXPANDED HDPE <- (1.1) (OD I HDPE)

6.2.4 The information above determines the type of material and process to be used and manufacturing and installation programs, indicating the connection points, quantity and type of materials as well as number of joints required.

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6.3 Preparation and verification of new or rehabilitated steel line for the Compressed Fit HDPE Liner system

6.3.1 For new piping is recommended, start the preparation after the hydrostatic test and that the line is released, that is, that it is finished complying with the construction standards determined by the user.

a. Will be checked in cabinet the standards of construction of the line have fulfilled those required for this system. Making immediately the observations of anomalous points and their probable corrections.

b. The verification process will begin once the pipe has been cleaned internally by a conventional cleaning devil of any material outside the pipe known as Poly Pig, run with air or water.

Figure Nº6. Verification process

6.3.2 For the rehabilitated pipe the preparations are made after the internal cleaning of the pipe by means of a conventional devil of cleaning of any matter outside the pipe known as Poly Pig, run with air or water, and at the same time Anomalies of the pipeline, as well as material considerations and piping process to be used.

It is really important to note that any variation in internal diameter due to change of thickness or excessive penetration of welding over 1/8 "will seriously damage the cladding system.

When it comes to existing piping and you are in the process of cladding using the Compressed Fit HDPE Liner system. TROJAN PIPE LLC, makes the customer aware in case the line presents residues, condensates, flammable or toxic liquids, it will be the customer's responsibility to withdraw this material.

A. Damage due to change of thickness in pipes greater than 1/8 "of an inch.

If the thickness variants are not considered at the time of the expansion of the polyethylene pipe, it will be uneven (the thickness of the polyethylene pipe) and staggered, causing irregular adhesions, which will weaken those staggered areas in the annular spaces , Which will force a recalculation of thickness in the polyethylene pipe to be used as a measure of reinforcement in the annular spaces.

Also as a corrective measure should be smoothed by anti-bevelled by devastated or cut.

B. Excessive penetration damage greater than 1/8 ".

If the anomalies in the form of drops by excessive penetrations are not considered at the moment of insertion of the pipe this could cut or devastate the same weakening its structural capacity when expanding in the irregular annular spaces, forcing a recalculation of thickness in the Polyethylene pipe to be used as well as the insertion process to be used.

As a corrective measure, these species of steel beads should be softened by running a series of special witness plates with reinforced steel alloy from highest to lowest diameter starting with a ½ "plate on each side until reaching 1/8" each side.

Nº7. Excessive penetration damage

C. Damages for excessive penetration greater than 1/8 "of an inch, must correct the anomalies, through a process of removal and devastated metal, with the use of special devils of thinning.

6.3.3 In both cases, new or rehabilitated piping consists of inspecting the internal conditions of the pipeline, this means that the pipeline shall be free of:

a) Excessive penetrations of maximum welding of 1/8 ".

b) De alignments between pipes, dents.

c) Excessive ovaling of pipes by bending points.

d) French cut or miter.

e) Radius of curvature less than that allowed by polyethylene pipe 30 diameters or 15 with their respective restrictions. (Referring with special emphasis to the sectioning, the curves whose radius is to be inferred to 50 diameters). By radius of curvature is meant the diameter of the pipe multiplied by the diameter of the curve.

The inspection is carried out by the passage of a control gauge plate whose diameter shall be 1/16 to 1/8 "less on each side, less than the inside diameter of the steel pipe to be jacketed, pushed with air.

When you have directional crossings you must perform the special devil inspection with the gauge plate before lowering the pipe to be able to corroborate that there is no excess penetration of the welding and if it is presented will be repaired.

The specialized technician of Trojan Pipe is the one who will interpret and determine according to the damages or blows that can receive the calibrador plate the type of anomaly that exists inside the tube, such as: Excessive penetration (it is reflected like a kind of hammering) , Oval (reflected as a double in some (s) of the plate). Then you can determine if it is feasible to perform the piping of the pipe.

In cases of excessive penetration of welding, two types of these can be considered:

-Type drop: This is not considered harmful to Compressed Fit HDPE Liner systems, as long as it does not exceed the 1/8 "wall thickness (WT) limits of the polyethylene tube.

- Angular crest type: Highly damaging, forced to roughing through the repetitive passage of the special devil and witness plate from smaller to larger diameter, or occasionally the repair or elimination of the anomaly by road.

Figure Nº8. Control gauge plate without any anomaly

Figure Nº9. Control plate with Oval anomaly

Figure Nº10. Control calibrator plate with crest penetration anomaly

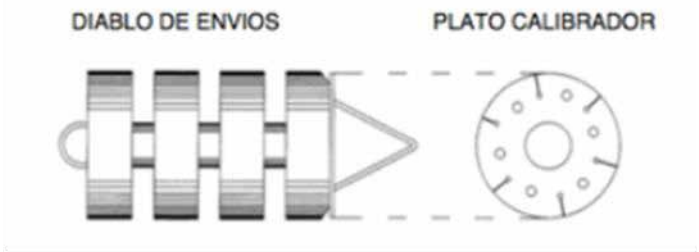

Figure Nº11. Shipping Devil

The elimination of anomaly more practical and simple either for new lines and / or rehabilitated always by the replacement of new steel tube removal effects (taxiing).

6.3.4 this activity will be carried out with calibrated plate carrying equipment (special devil), while introducing the cable that will allow the casing to be connected.

Figure 12. Troubleshooting

6.4 High-density polyethylene tube

6.4.1 Once the points 6.1 and 6.2 have been completed, the polyethylene pipe sections shall be melted, which may be 12 to 18 meters long, depending on their transport condition and diameter. We use the equipment and special procedure, which guarantees us a perfect union.

This activity basically consists of heating the ends of the polyethylene pipe to a certain temperature and applying a linear pressure with respect to the pipe axis, on its edges until reaching the mixing and joining of the edges. During these activities the thermofusion pressure and temperature ranges are verified. Each junction is visually checked by the technician, the inspection parameters are as follows:

6.4.1.1 Care of both ends of the pipe to be thermofused, ie the ends will be smooth, clean and aligned.

Figure Nº13. Contrast of the two ends of the pipes

6.4.1.2 Align the edges of the sections, do not have Hi-Low difference between them, verifying that it is perpendicular to the pipe axis.

Figure Nº14. Edge Alignment

6.4.1.3 Heating and pressure, it is verified that the aligned faces are heated and reach the selected temperature according to the diameter and thickness of the pipe. This parameter is visually checked when pressure is formed ring with flange at the end to be joined.

Figure Nº15. Heating and pressure

6.4.1.4 Merging binding action between the edges once the heating has been reached and is performed, when exerting pressure. This results in a molecular mixing of the two pipe sections.

Figure Nº16. Merging of pipelines

By cooling it is verified that the melting time has ended and the joint can withstand the movements of the polyethylene pipe. The two sections of polyethylene are formed in a single section or element.

6.4.1.6 Thermal fusion integrity test. It consists of a destructive test that is performed at the beginning of each day according to the specific test procedure that basically consists of performing the heat melt on a 10 "reel or 2" coupons. It is subjected to a bending test using a press or bench vise, leaving the melting zone free, which must not fracture, in case of fracture, the parameters are assembled and the test is repeated.

Figure Nº17. Integrity test

6.4.1.7 Non-destructive test to be performed after completing the integrity test, which consists in checking that it is removed at each junction.

6.4.1.8 Finally, any failure of the cladding is monitored through the venting points.

6.5 INSTALLATION OF THE JACKET

6.5.1 ANSI RF steel flanges specially made for our Compressed Fit HDPE Liner system must be installed before the jacketed installation is started according to the design clearance, the inside diameter of which must be equal to the inner diameter of the pipe to be jacketed.

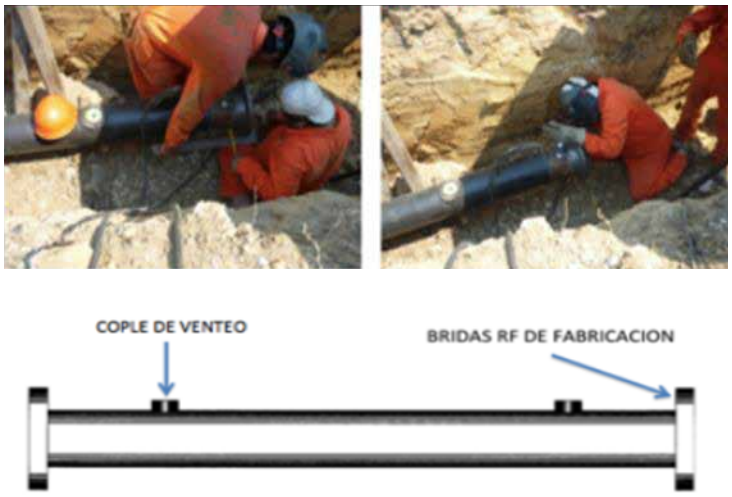

Figure 18. Installation of flanges

6.5.2. VENTING POINTS OR MONITORING

In the same way, copies of venting and ½ "monitoring and valve placement according to the design librage shall be installed, at the ends of the section to be covered, which shall be close to the steel flanges, in the pipe where the A 1/16 "hole is drilled to verify the conditions of the polyethylene tubing when performing pneumatic or hydrostatic test of the line. The drilling of the steel pipe can be done before or after welding the coupling but never after the line has been clad.

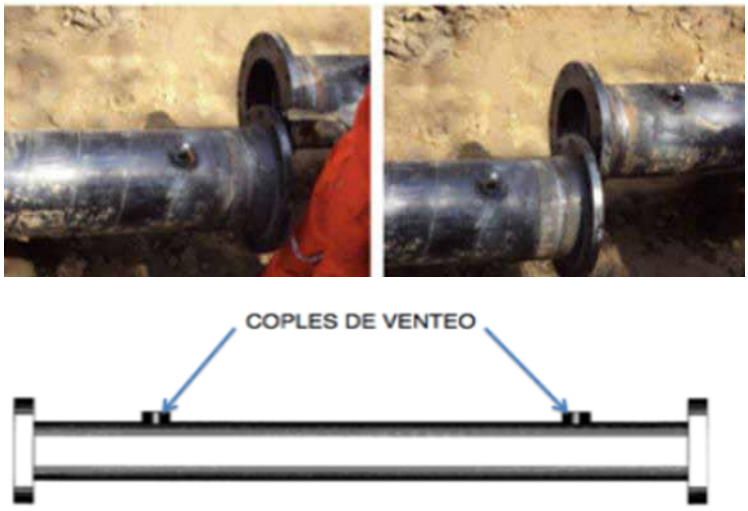

Figure 19. Points of venting or monitoring

6.5.3 For those cases in which the construction of the line is carried out under the minimum recommendations pipes for jacket after the installation of vents, will be sent the special devil carrier plate calibrador and successor, by injection and pushing pneumatically, while introducing the cable to connect the PAD, HDPE pipe.

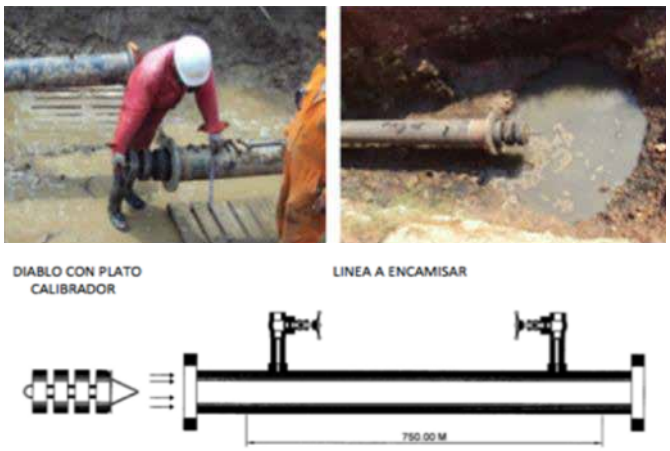

Figure Nº20. Devil Shipment

Note: the length of 750 mts, is representative not limited.

6.5.4 INSTALLATION PROCESS THROUGH OUR SYSTEM

When the cladding is carried by our Compressed Fit HDPE Liner system the following will be performed:

A. Once the pipeline has been qualified as jacketed and the polyethylene pipe handling parameters are set, the suction cup for the tubing of the polyethylene is placed (it is very important to check that the communication systems do not suffer from interference and have a clear communication since it is important the communication of technicians at both ends, point of insertion and point of expulsion of the PAD pipe).

B. The alignment of sills is performed in such a way that it is truly comfortable considering the least possible damage of the pipe by handling, aligning, thermofusioning and pulling of the same.

Figure Nº21. Installation process

A. The Pull head is thermofused to the section to be inserted, verifying the integrity of thermofusion and integrity of the fastening.

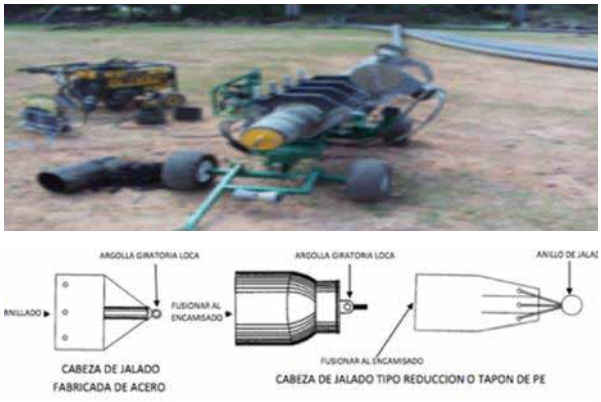

Figure Nº22. Thermofusion Process

B. The line is drawn by means of the Dynawinch or specialized winch, placing personnel in the mouth of the carbon steel tube for the centering and accommodation, to safeguard the perfect operation in its introduction and its constant rate of induction in reference to the pulling the Compressed Fit HDPE Liner pipe.

Figure Nº23. Pulling the line through Dynawinch

C. Both at the beginning and during insertion, a uniform bath must be made to the polyethylene tube. Before the mouth of the steel tube with slippery liquid, for friction smoothness, taking care at all times the amount of pipe pulled against the inserted one.

Figure Nº24. Uniform bath to the polyethylene tube

D. The thermofusion equipment (position and temperature) is prepared for operation, and flange to fit the polyethylene.

Figure Nº25. Polyethylene Adjustment

E. Once the Pull head has been observed in the outlet port of steel pipe, it is produced to give notice to the other end of the insertion.

Figure Nº26. Polyethylene insertion notice

F. The cutting of the polyethylene pipe is carried out and the process of thermo-fusion of flange to adjust polyethylene is started, considering all the steps that this entails.

Figure 27. Cutting and thermofusion

G. Once the polyethylene flange is released, the adjustment process is resumed by pulling the specialized winch (Dynawinch) until the flange is adjusted to 100%.

Figure Nº28. Adjustment process

H. Since the tube is subjected to the pulling tension, it should be allowed to relax for at least 12 hours as the polyethylene tube is subjected to tension.

Figure Nº29. Adjustment process

I. After the 12 hours occurs with the revision of equipment, materials and tools necessary for the process of placement of adjustment flange.

Figure Nº30. Review of equipment, materials, and tools

J. The pulling of the polyethylene pipe is resumed until the cut-off point of the flange installation is determined.

Figure Nº31. The pulling of the pipe is resumed

K. The CLAMPS or staples of hydraulic steel are made by cutting and releasing the HDPE, PAD and HDPE and specialized winches.

Figure 32. Placement of staples

L. We started with the process of thermofusion of flange to adjust of polyethylene, considering all the steps and times that this entails.

Figure No. 33. Burst Flange Merger

M. The CLAMPS are released, verifying that the adjusting flange is hermetically sealed in the steel flange.

Figure N°34. Staple release

6.6 RECONNECTION AND TESTING

6.6.1 This activity consists of connecting all the sections of the jacketed duct by means of the steel and polyethylene flanges, as well as the placement of the steel ring of spacing, which allows the understanding of the flanges in the parameters which allows us the polyethylene flanges, during elongation and the steel tube.

Figure Nº35. Connecting the jacketed tube

6.6.2 The pneumatic test equipment is assembled to test the system's tightness and proper expansion of the polyethylene tube. The test pressure shall be at least 7 kg / cm2 and 2 hours, and may be longer if the customer so requires. Any failure in the system manifests itself in the points of venting or monitoring.

Figure N°36. Testing of equipment tightness

6.6.2.1 For the particular case of Compressed Fit HDPE Liner because the polyethylene tube is of a smaller outside diameter than the inner diameter of the steel, and it is known that the polyethylene tube only withstands at most 5.5 kg / cm2 by accurately taking the emanations discharged By the venting points until eta is null, that is, the polyethylene tube is stuck to the steel tube transferring the mechanical resistance to corrosion.

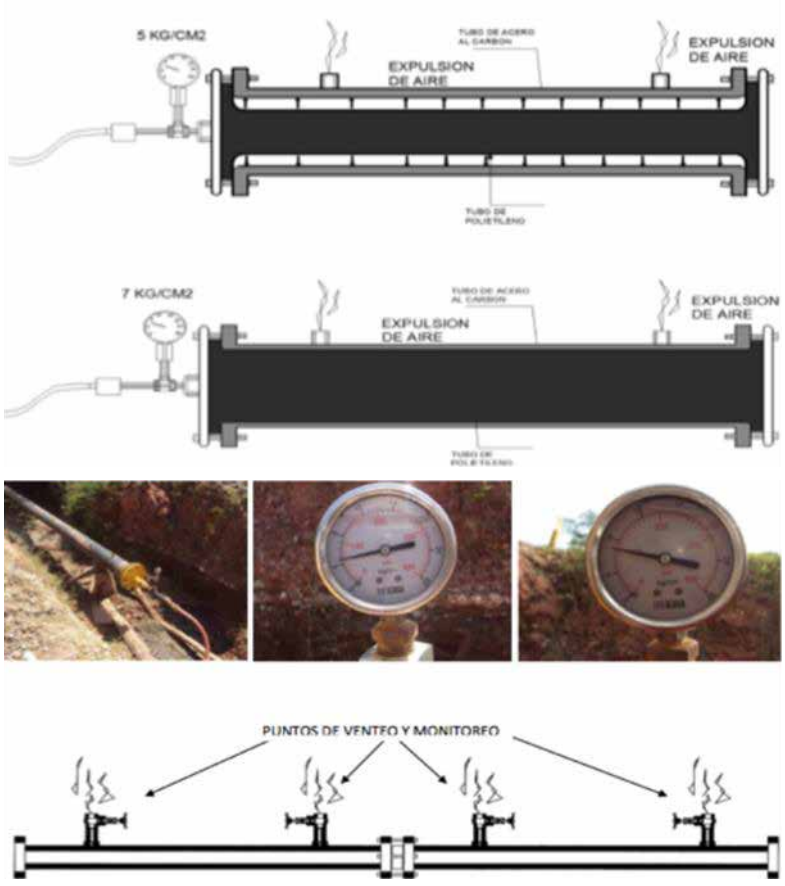

Figure N° 37. Pneumatic test will reach from 5.5 kg / cm2 to 7 kg / cm2 gradually in 4 or 5 minutes

Hydrostatic tests can be performed at a higher pressure than 7kg / cm2, up to the limit of preparation or design of the steel tube under supervision of TROJAN PIPE LLC technicians.

For the effects of pressure drop during the test or operation, this should be gradual, under certain recommendations.

6.6.3 Before the line is blurred and after confirming that nothing is emitted by the vents, the valves must be closed. After the closing of valves of the vents is that can be proceeded to release the TROJAN PIPE line or pipeline Compressed Fit HDPE Liner, whether hydrostatic or pneumatic tests.

7. PREPARATION OF UNDERGROUND UNIONS

7.1 Connection of flanges with provisional preparation

Whatever the reasons for the need to cover excavations where the flanged ends are already clad, it is recommended to place comals made of steel plate with a thickness of not less than 1/4 "or gently screwed down without the need for tighten them too much, if it is so lucky that they seal, place industrial plastic tape in a diametrical way.

Figure N°38. Flange joint interim preparation

In the case of flanged joints already clad, industrial plastic tape will be placed diametrically.
In both cases, a kind of steel plate box of not less than 1/4 "thick covering these points must be made, and the placement of a wooden beacon to locate the point well, in order to cover it.

Figure N°39. Steel plate

8 OPERATION

When operating the jacketed line, certain operating ranges must be considered in order to ensure the proper operation of the Compressed Fit HDPE Liner system. This system offers permanent corrosion protection, the specifications listed below must be followed in a timely manner to ensure correct operation of the system and thus preserve the availability of the jacket.

a) When arresting and starting the line it is recommended that the pressure is reduced or increased slowly so that the cladding is not damaged or can cause a vacuum collapse. Negative pressures or vacuum conditions should be avoided as this could cause a collapse of the jacket.
b) The operating temperature that was designed by the Compressed Fit HDPE Liner system at 67 ° with hydrocarbons and 80°C with salt or process water.
c) With Compressed Fit HDPE Liner system eliminates the need to run instrumented devils for the internal inspection of the line since the jacket provides a permanent protection to prevent corrosion.
d) If it is desired to clean the pipe, it can be done by means of the POLY-Pig type cleaning devils.
e) Our clients will be able to check the integrity of the system whenever they wish, through monitoring points or also called venting. For this purpose, they should only slowly open the valves until they are fully open, and can perceive any existing emanation. Specifically when the piping is made of HDPE, and particularly when handling gas, the valves after system testing and start of the system, the venting or monitoring valves should remain open, as the gas permeate in truly insignificant amounts The POLYETHYLENE, and this should be expelled on a regular basis. Now it is necessary to clarify that the quantities of gas that can permeate the POLYETHYLENE, never affect the behavior of its operation, much less the performance of anticorrosive insulation.
f) For any questions you may have regarding repairs, modifications or alterations of service or design please contact the email: autrymarvin@gmail.com.

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9 Technical data sheets for of the Polyethylene Pipe PE3608/(HDPE3408) and PE4710/(3408)

PE3608/(HDPE3408)

PIPE AND FITTINGS DATA SHEET

Typical Material Physical Properties — PE3608/(HDPE3408)

High Density Polyethylene Material

PROPERTIES	UNIT	TESTS PROCEDURE	TYPICAL VALUES
Material designation	--------	PPI TR-4	PE3606
Classification of the cell	--------	ASTM D3350	345464C
PIPE PROPERTIES			
Density	gms/cm3	ASTM D1505	0.955 (black)
Melting Index Condition 190 / 2.16	gms/ 10 minutes	ASTM D1238	0.08
Hydrostatic design base 73 ° F (23 °C)	Psi	ASTM D2837	1600
Hydrostatic design base 140 ° F (60 °C)	Psi	ASTM D2837	800
Color UV stabilizer (C) (E)	--------	ASTM D3350	Min 2% -carbon black Color UV stabilizer
PROPERTIES OF THE MATERIAL			
Bending Module 2% secant- span 16: 1 Depth 0.5 in / min	Psi	ASTM D790	> 110,000
Tensile strength in the performance	Psi	TAySpTeM IV D638	3200
Elongation at break 2 in / Min., Type IV bar	%	ASTM D638	> 700
Elastic module	Psi	ASTM D638	> 150,000
Hardness	Shore D	ASTM D2240	62
Pent	hrs	ASTM F1473	> 100
THERMAL PROPERTIES			
Temperature of Softening vicat	°F	ASTM D1525	256
Cold Fragility	°F	ASTM D746	- 103
Thermal Expansion	in / in / °F	ASTM D696	1.0 x 10

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RAW MATERIALS HDPE RESINS

Bimodal Polyethylene Resin

Overview

CONTINUUM™ DGDA-2490 BK Bimodal Polyethylene Resin is produced using UNIPOL™ II process technology. This product may be utilized for pipe applications where long-term hydrostatic strength combined with outstanding resistance to slow crack growth and rapid crack propagation is desired. Suitable applications include natural gas distribution pipes, industrial piping, mining, sewage, and municipal water service lines.

Industrial Standards Compliance:

- ASTM D 3350: cell classification
  - Black - PE445576C (MRS)(See NOTES 1)
  - Black - PE445574C (HDB) (See NOTES 1)
- Plastics Pipe Institute (PPI): TR-4
  - Black Pipe - CONTINUUM™ DGDA-2490 BK (See NOTES 1)
  - ISO PE100 pipe grade - CRS 10 @ 20°C; MRS 10 @ 20°C, 100 yr; CRS 8 @ 40°C, 50 yr; CRS 6.3 @ 60°C, 11 yr; CRS 11.2 @ 14°C, 50 yr
  - ASTM PE4710 pipe grade - 1600psi HDB and 1000psi HDS @ 73°F, and 1000psi HDB @ 140°F
- NSF International: Standard 14 and 61
  - Black Pipe - DGDA-2490 Black 100 (See NOTES 1)

Consult the regulations for complete details.

NOTES:
(1) Natural resin extruded under proper conditions with carbon black masterbatch DFNF-0092 (6.5%).

Additive

- Antiblock: No
- Slip: No
- Processing Aid: Yes

Physical	Nominal Value (English)		Nominal Value (SI)		Test Method
Density					
Natural	0.949	g/cm³	0.949	g/cm³	ASTM D792
Black	0.959	g/cm³	0.959	g/cm³	ASTM D792 [1]
Melt Index					ASTM D1238
190°C/2.16 kg	0.080	g/10 min	0.080	g/10 min	
190°C/21.6 kg	7.5	g/10 min	7.5	g/10 min	
Mechanical	**Nominal Value (English)**		**Nominal Value (SI)**		**Test Method**
Tensile Strength (Yield)	> 3500	psi	> 24.1	MPa	ASTM D638 [2]
Tensile Elongation (Break)	> 500	%	> 500	%	ASTM D638 [2]
Flexural Modulus	150000	psi	1030	MPa	ASTM D790B [3, 2]
Creep Rupture Strength - 1798 psi (12.4 MPa) (68°F (20°C))	> 200	hr	> 200	hr	ISO 1167
Hydrostatic Strength					ISO 4427 [1]
1798 psi (12.4 MPa); 68°F (20°C)	> 200	hr	> 200	hr	
725 psi (5.0 MPa); 176°F (80°C)	> 1000	hr	> 1000	hr	
Resistance to Rapid Crack Propagation, Pc					
Full Scale: 32°F (0°C)	> 667	psi	> 46.0	bar	ISO 13478 [4]
S-4: 32°F (0°C)	> 174	psi	> 12.0	bar	ISO 13477 [5]
Resistance to Rapid Crack Propagation, Tc - S-4					ISO 13477 [5]
32°F (0°C)	< 2	°F	< -17	°C	
Slow Crack Growth PENT	> 10000	hr	> 10000	hr	ASTM F1473 [2]
Stress Crack Resistance - Pipe notch (176°F (80°C))	> 1000	hr	> 1000	hr	ISO 13479 [6]
Impact	**Nominal Value (English)**		**Nominal Value (SI)**		**Test Method**
Notched Izod Impact (73°F (23°C))	9.1	ft·lb/in	490	J/m	ASTM D256A [2]
Thermal	**Nominal Value (English)**		**Nominal Value (SI)**		**Test Method**
Brittleness Temperature	< -103	°F	< -75.0	°C	ASTM D746A [2]
Thermal Stability	> 428	°F	> 220	°C	ASTM D3350

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CONCLUSION

a) The use of non-metallic pipe (jacketed with high density polyethylene and high molecular weight) offers an alternative for the rehabilitation of lines in corridors that present corrosion problems and impairments in their right of way.

b) Maintenance costs are minimal.

c) The costs and installation times are considerably reduced.

d) The solids deposit is practically eliminated.

e) It offers advantages for the handling of abrasive fluids.

f) Provides a high cost-benefit compared to metal pipes during the life-span.

g) We can cover pipes with little maneuvering space and accommodation, saving or avoiding the payment of rights of way in third party properties.
Calibrator or warning plate = circular steel plate.
PULL Head = Pencil-shaped polyethylene and steel head.
Roller BOX = Role Box WT = Wall Thickness.

BIBLIOGRAPHIC REFERENCES

Cyclofs Corporation "Recommended methods for desing, installation and testing of polyethilene pipe for oil and gas service".

Standard ASTM D 2321. "Practical recommendations for underground piping installation.

Standard ASTM D 2657-90. "Practice for heat joining polyolefin pipe and fitting.

ASME Standard, Non Destructive Examination. Code V.

Standard ISO / DIS 13953, "Polyethylene (PE) Pipes and Fittings - Determination of the tensile strength of test specimens form a but-fused joint".