

INSTALLATION MANUAL

Expand-in-Place Styrene-Free PVC Lining Solution
for Existing Sewer & Culvert Rehabilitation

FLAT: 6" – 12" | H-SHAPE: 15" – 30"



Email: novaform@ipexamerica.com

Toll Free: 800 463-9572

ipexna.com



CONTENTS

Proprietary Notice.....	3
Introduction	4
Safety.....	4
Description of Equipment.....	5
Material Handling	7
The NovaForm™ PVC Liner Process	8
1. Preparing.....	8
a. Getting Started	
b. Equipment Setup	
c. Liner Pull Head Setup (for 6" to 12" Liners with Flat profile)	
d. Preparing Liner Pull Head (for 6" to 12" Liners with Flat profile)	
e. Liner Pull Head Setup (for 15" to 30" Liners with H-profile)	
f. Preparing Liner Pull Head (for 15" to 30" Liners with H-profile)	
2. Conditioning	13
a. Internal Steaming with Coil Rotation (for 6" to 12" liners)	
b. Internal Steaming with Coil Rotation (for 15" to 30" liners)	
3. Pulling.....	14
a. Preparing Liner for Pulling	
b. Preparing "A" Side for Full Pull	
c. Pull Liner	
4. Processing	15
a. Insert "A" Side Plug	
b. Insert "B" Side Plug	
c. Pipe Stress Release/Relaxation	
d. Heating	
e. Expansion/Cooling	
5. Finishing	17
NovaForm™ Processing Procedures Reference Chart	18
PVC Liner Process Record	20



Proprietary Notice

This Manual and all of its content are the property of IPEX. This Manual has been provided by IPEX and is subject to confidentiality. No reproduction in any form of any portion of this Manual can be made without the prior written consent of IPEX.

© IPEX 2021

Introduction

This manual provides step-by-step instructions necessary to successfully and safely install NovaForm™ PVC Liner.

It is important that you pay particular attention to the safety section of this manual. IPEX makes your safety our first priority at all times.

Each installation will require procedural modifications which cannot be made without an intimate knowledge of all conditions pertaining to a specific installation. Since IPEX does not and cannot act as a consultant in this regard, responsibility for use of information or advice herein or otherwise provided to determine installation procedures for a specific installation rests solely with the installer.

Installers receive training and technical support from authorized representatives of IPEX to promote competency and mutual confidence in the installer's ability to make proper installation decisions. If an installer desires to attempt an installation with unfamiliar or new variables, the installer is advised to contact IPEX to draw upon the cumulative knowledge of the manufacturer and the other installers.

Installers are solely responsible to ensure that their personnel follow all applicable local and national laws relating to the installation of NovaForm PVC Liners.

Safety



Be aware that machinery can crush your hands, or anything else that might be caught in certain areas of the machines while they are in operation.

As it is used during various stages of the NovaForm™ PVC Liner Process, steam should be carefully directed to prevent exposure to skin. Handling of hoses and plugs under pressure should be limited at all times.

Description of Equipment

a. Product Reel



4' wide by 8' tall. Larger reels are available upon request. Please refer to the brochure for available lengths and reel sizes. (The reel is loaded on an A frame, in the above picture.)

**b. Conditioning Trailer/
A-Frame**



Steam is passed through the entire length of the liner and thus the product is internally heated in the conditioning trailer (as depicted in the picture)/A-frame prior to pulling into the existing host pipe.

c. Boiler



Used to generate steam required for the conditioning and processing phases of the NovaForm installation. A boiler should be housed in a trailer for mobility. It should also include a water reservoir and water feed pump.

d. Winch



Used to pull the product from the product reel through the host pipe at 100 - 150 ft/min with a minimum of 6,500 LBS of force.

e. Rollers



Rollers are used to help guide the product from the conditioning trailer/A-frame to the host pipe and can be set up at both manholes or any other bending impediments.

f. Sump Pump



Used to drain liquid from a hostpipe, sewer manhole or drainage ditch.

g. Plugs



Used for processing pipe. The plugs are inserted into the pipe ends and inflated. Steam is passed through the plug into the host pipe during the processing phase. 2 plugs are required per size. Industry standard plugs are readily available from third party suppliers.

h. Air Compressor



The air compressor is used to supply air for plug inflation and product processing. In the processing stage, the air supplied is used to cool and harden the installed liner.

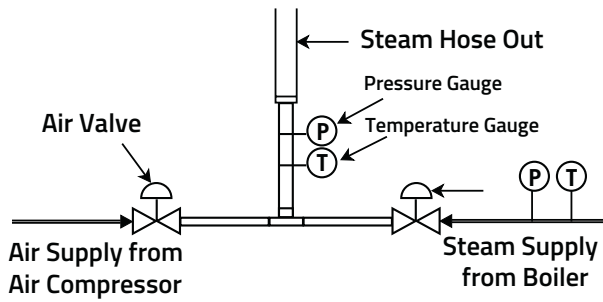
6" to 12" - 185 CFM
15" to 30" - 375 CFM

**i. Propane Torch Kit /
Heavy Duty Weed Burner**



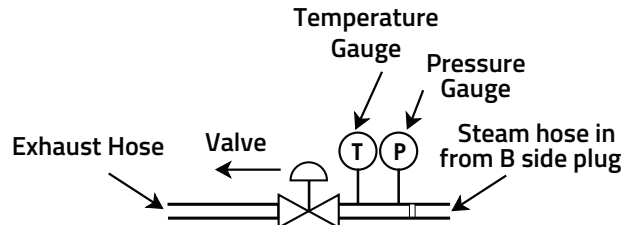
The propane torch is used at the 'B' side to heat the liner end, after the pull head is removed. This softens the liner up for plug insertion.

j. "A" Side Control Station



An assembly of gauges displaying temperature and pressures. The Control Station also includes valves to control the in-flow of steam and air. The Station is typically housed within the boiler trailer.

k. "B" Side Control Station



An assembly of gauges displaying temperature and pressures. The Control Station also includes a valve to control the exhaust of steam and air.

l. Tripod with Support Cable



Tripod shall be used at sides 'A' and 'B' to support the chimney weight in the case of sewer and sanitary rehabs.

m. Thermal Gun



Used to measure pipe temperature during the processing phase of installation.

n. Miscellaneous Equipment



- Generator (20 KW)
- Reciprocating Saw
- Hole Saw
- Power Drill
- Steam and Compressed Air Hoses
- Puller

o. End Seal



The suggested material is Insignia™ End Seal Sleeve by LMK Technologies. The end seal guarantees a uniform water-tight seal at the ends of the liner.

p. Swivel & Pulling Cable



The swivel connection on the pulling cable ensures that the liner does not twist during the pull.

q. Grout / Sealant



The grout / sealant shall be used to block liquid seepage into the host pipe.

Material Handling

Care shall be taken while handling the NovaForm reel using forklifts. This is to ensure that the forklift blades do not accidentally hit the liner material and damage it.

The picture depicts the right way to lift the reel using a forklift. The forklift blades shall lift the coil ONLY by the metal part of the reel. Contractors shall train the forklift operators in this practice.



Care shall be taken to ensure that the coil is not lifted by the forklift blades against the liner material itself. In the event that this is unavoidable, a thick material such as burlap shall be laid on the forklift blades to ensure that they do not directly come into contact with the liner material.

The NovaForm™ PVC Liner Process

NovaForm PVC Liner is available in sizes ranging from 150mm (6") to 750mm (30") for use in rehabilitation of sewers and culverts.

Factory made, NovaForm is extruded and coiled onto reels. Once on the jobsite, it is conditioned using steam and pulled into an existing sewer or culvert by mechanical means.

NovaForm PVC liner is plugged and expanded using steam and air, allowing it to fit snugly against the host pipe. As air is introduced, the pipe cools and hardens, producing a fully functional and rehabilitated pipe.



A. Getting Started

- For any lining technology, host pipe preparation is key to a successful installation. The following are a few of the preparatory works necessary prior to lining using NovaForm.
- Identify any conditions in the pipeline that could impede or prevent the proper installation of the liner.
- Keep a record of the pre-lined condition of the host pipe.
- Accurately record the position of all service connections using CCTV camera.
- Typical pipeline conditions that must be remediated prior to lining: roots, large quantities of groundwater infiltration, collapsed pipe, dropped joints or offsets of more than 12.5% of the inside pipe diameter and protruding taps.
- Roots may be removed by using a chemical root treatment or by mechanical means.
- Infiltration may be eliminated either by chemical grouting or installing a patch prior to lining. To avoid ribs in the liner sections of the pipeline containing collapsed pipe, dropped or offset joints should be point repaired prior to lining.
- Prior to insertion of the liner, clean the pipeline using a high pressure water jet to remove any debris.
- Set up a bypass in applications where there is a constant flow of liquids and working service applications. Care must be taken to divert flow from the line being rehabilitated.
- Set up traffic control.
- Consult "NASSCO Performance Specification Guideline for the Installation of Folded (Thermoplastic) Pipe (FP)" for more information.

B. Equipment Setup

- Already loaded with the product reel, position conditioning trailer/A-frame at the "A" side (upstream manhole).
- Set up and start boiler; connect steam hose from boiler to conditioning trailer/A-frame.
- Position the winch.
- Install roller on the B-side.
- Prepare all accessories and tools on the "A" and "B" side ; plugs, reciprocating saw, thermal gun, tarp, generator, etc.

C. Liner Pull Head Setup (For 6" to 12" Liners with Flat profile)

- In order to successfully pull the liner through the host pipe, it is necessary to prepare a strong, yet flexible pull head.
- The following items will be necessary and can be purchased from any sling/rigging supplier:



1. Wire rope cable (aircraft cable) with Min. 4:1 Breaking to Working Load Limit

- Specifications: Galvanized or Stainless Steel, 7 x 19 Multi-strand construction, with thimble loops on each end
- Thickness: 1/4" diameter, 2,600 lb rating for basket pulling setup. 1/4" for thimble.
- Length will vary according to liner diameter:
 - » 6" – 10 ft minimum
 - » 8" – 12 ft minimum
 - » 10" – 14 ft minimum
 - » 12" – 16 ft minimum



2. Threaded Quick-links with Min. 4:1 Breaking to Working Load Limit

- Specifications: Galvanized or Stainless Steel, 1/4" minimum thickness, threaded, 880lb load limit



3. Anchor Shackle with screw pin with Min. 4:1 Breaking to Working Load Limit

- Specifications: Galvanized or Stainless Steel, 1/2" minimum thickness, threaded, 4,000 lb load limit

D. Preparing Liner Pull Head (For 6" to 12" Liners with Flat Profile)

1. Prepare product for cable attachment by softening, folding and duct taping pipe end.



2. Cut end of liner in a V profile with a reciprocating saw.



3. Drill two 1" overlapping holes in fold of liner, approximately 1" from the end.



4. Wrap wire cable rope around liner at the start of the folded section, and twist on itself once.



5. Continue wrapping cable around folded pipe, and securing the crossed sections using threaded Quick-links, both at the top and bottom of liner.



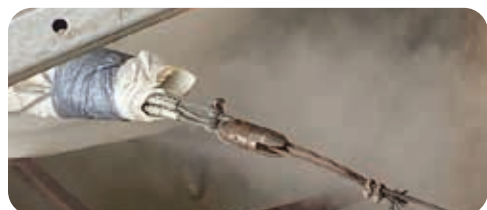
6. Once the end of the liner is reached, ensure that remaining cable loop ends are the same length, and if not, adjust wraps and Quick-links accordingly. Then, feed both loop ends through drilled hole, one at a time.



7. Secure the two cable loop ends to the shackle by inserting the shackle pin through cable loops and threading it closed.



8. The liner pull head shall be connected to the cable using a swivel connection. This is to ensure that the liner does not twist during the liner pull process.



E. Liner Pull head setup (For 15" to 30" Liners with H-profile)

- When pulling through a culvert or other pipe that exits horizontally through an open ended outlet, standard chains can be used and inserted through drilled out holes in the liner pull head.
- Specifications: Steel, Grade 80, 3/8", 7,100lb load limit
- Length: 5ft minimum
- When pulling in a sanitary/storm sewer line that exits vertically through a manhole or catch basin, the following items will be required:



1. Wire rope cable (aircraft cable) with Min. 4:1 Breaking to Working Load Limit

- Specifications: Galvanized or Stainless Steel, 6 x 19 Multi-strand construction, with thimble loops on each end
- Thickness: 3/8" diameter, 5,800lb rating for basket pulling setup. 3/8" for thimble.
- Length will vary according to liner diameter:
 - » 15"-18" – 16.40ft/5m minimum
 - » 24-30" – 19.68ft/6m minimum



2. Threaded Quick-links with Min. 4:1 Breaking to Working Load Limit

- Specifications: Galvanized or Stainless Steel, 5/16" minimum thickness, threaded, 1525lb load limit, 3/8" Pin opening



3. Anchor Shackle with screw pin with Min. 4:1 Breaking to Working Load Limit

- Specifications: Galvanized or Stainless Steel, 5/8" minimum thickness, threaded, 6,500lb load limit

F. Preparing Liner Pull head (For 15" to 30" Liners with H-profile)

1. **Horizontal** exit from host pipe (Culverts):
 - Cut the ends of the liner in a V profile as shown in the picture, using a reciprocating saw.
 - Drill two 1" holes on either side of the liner, approximately 2"-3" behind the V profiled section.
 - Make sure that the holes are drilled through both folds of the liner, so that the chain passes through completely. This ensures that the pull head will "close" under tension during the pull and will not open (see below).



2. **Vertical** exit from host pipe (Sanitary/Storm sewers):
 - Cut the ends of the liner in a V profile using a reciprocating saw.
 - Drill a 2" hole in the center of the liner, approximately 4" behind the V profiled section. Make sure that the hole is drilled through both folds of the liner, so that both ends of the wire rope can pass through completely. This ensures that the pull head will "close" under tension during the pull.
 - Wrap the wire cable around the liner and secure using Quick-Links, as for the flat (6" to 12") liners.
 - Secure the two cable loop ends to the shackle by inserting the shackle pin through cable loops and threading it closed.

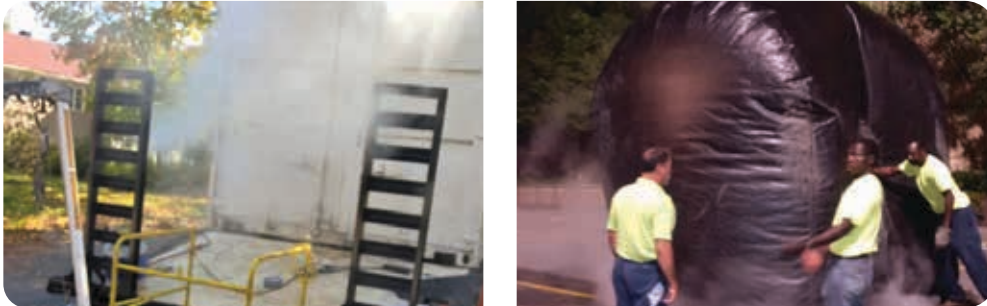


2

CONDITIONING

Open steam valve directing steam into the Conditioning trailer/A-Frame.
Adjust valve to required steam pressure and temperature as detailed below.

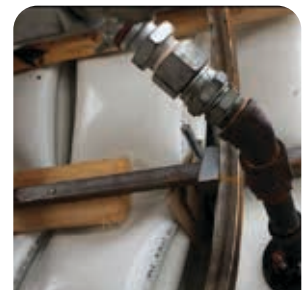
6" – 12" Coil Steaming – Internal Heating with Coil Rotation



- With the reel in the stationary position on the conditioning trailer / A-frame, connect steam hose to the conditioning plug.
- Start with 15 psi of steam until steam comes out of the liner pull head. Once steam comes out at the other end, cover the liner with tarp, if the reel is on an A-frame. If the reel is inside the conditioning trailer, close the doors to retain the heat inside.
- Once steam comes out for 1 minute, reduce steam pressure to 5 psi.
- Begin reel rotation at 5 - 6 RPM, using electric or hydraulic drive motor.
- Heating time is 20 minutes for coils of 350 ft. or less
- Add 10 minutes for every additional 100 ft. on a coil

15" – 30" Coil Steaming – Internal Heating with Coil Rotation

- With the reel in the stationary position on the conditioning trailer / A-frame, connect steam hose to the fitting.
- Start with 15 psi of steam until steam comes out of the liner pull head. Once steam comes out at the other end, cover the liner with tarp, if the reel is on an A-frame. If the reel is inside the conditioning trailer, close the doors to retain the heat inside.
- Once steam comes out for 1 minute, reduce pressure of steam to 5 PSI and heat the coil for the times listed below:



Reel Size	4ft Wide Reel – 30 to 40 mins.	6ft Wide Reel – 45 to 60 mins.	8ft Wide Reel – 75 - 90 mins.
Liner Sizes	15" up to 400ft	15" up to 650ft	15" up to 1200ft
	18" up to 200ft	18" up to 490ft	18" up to 1000ft
	24" up to 150ft	24" up to 255ft	24" up to 480ft
	30" up to 125ft	30" up to 185ft	30" up to 350ft

NOTE: Colder ambient temperatures and wind chill will affect above times and will require additional heating times. Good practice is to check liner temperature at various locations on the reel.

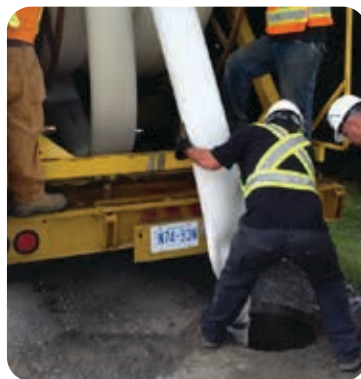
3 PULLING

A. Preparing Liner for Pulling

- Set up communication channel between "A" and "B" side operators.
- Shut off stream.
- Open reel trailer doors or remove tarp.
- Ensure liner pull head is soft and flexible; if not heat longer until pull head is soft (185 °F minimum).
- Attach winch cable to pipe end cable.

B. Preparing "A" Side for Full Pull

- Lubricate host pipe liberally at entrance using IPEX pipe lubricant, vegetable oil or diluted dish soap.
- Using winch, slowly pull liner into manhole opening
- Ensure liner is free from any kinks and bends.
- During the liner pull, steam at a pressure of 1 - 2 Psi shall be passed through the liner. The purpose is to ensure that the liner stays hot inside the host pipe, during the pulling process.



C. Pull Liner

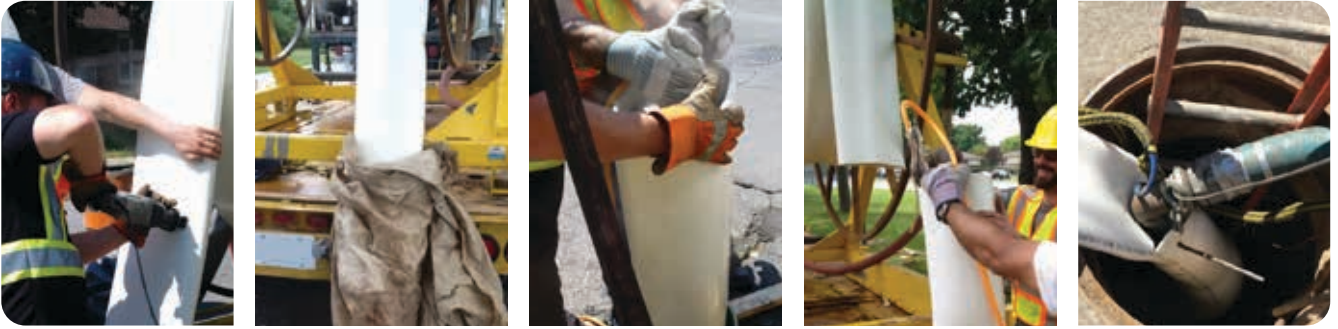
- Begin pulling using winch at a faster speed. Typical pulling speed is between 100 – 150 FPM.
- Carefully monitor pulling speed. The pipe should be pulled through the host pipe at a speed dependent upon field conditions and host pipe material.
- Rotate the reel manually or using the rotating mechanism, if so equipped. In the later case, speed has to be carefully monitored so that the pulling process is not adversely affected. The purpose is to ensure that the coiled liner in the A frame or the conditioning trailer has some material sag. This will ensure that the liner unreels easily without too much pull force.
- Lubricate liner continuously throughout pull.
- Once liner reaches B-Side, continue pulling until pipe is 6 – 8 feet past the manhole cover opening, or as high as the winch can pull.
- If the liner requires more power to pull around the B-side roller, set the winch into low gear setting (i.e. higher pull force).



4

PROCESSING

A. Insert "A" Side Plug



- Cut "A" side pipe from reel leaving 6 feet of pipe past the manhole cover opening. Alternatively, cut a slit on one side of liner in a 'kangaroo pocket' fashion and insert plug.
- Position plug on "A" side close to pipe end.
- Encapsulate the plug and liner in a tarp.
- Open steam valve allowing the pipe end to be softened.
- Once softened, turn off steam valve.
- Fully insert plug into softened pipe end.
- Attach compressed air line to plug / plug bladder.
- Inflate to recommended pressure, provided by plug supplier.
- Apply cold water to the liner over the plugged pipe end to harden it.
- Install safety device (metal rod) closely behind the location of the plug, as illustrated.
- Inside the manhole, ensure that the weight of the liner does not rest on the bend / kink. This can be prevented by holding the liner up by tying it off to a fall-arrest tripod. Alternatively, if the 'kangaroo-pocket' method is considered, the A-frame or steam trailer can be used to support the weight.

B. Insert "B" Side Plug



- As mentioned in the 'Pulling' stage, the liner at B-side extends 6 - 8 feet past the manhole cover opening. Remove the pullhead by cutting it off with a reciprocating saw.
- Carefully heat the B-side liner using the heavy duty propane torch / weed burner. Once the liner is soft enough, the plug can be fully inserted into the liner.
- Alternatively, similar to side 'A', steam can be used at side 'B' as well for plug insertion. Encapsulate the end of the liner with a tarp to retain the heat, while the plug is kept in close proximity. Steam is passed through the liner via the now-installed-and-expanded plug at 'A' end. Steam travels the entire length of the liner and comes out at the 'B' end. This shall heat the tarp covered 'B' side and plug insertion can be carried out after the liner has softened enough.
- Attach compressed air line to plug / plug bladder.
- Inflate to recommended pressure provided by plug supplier.
- Apply cold water to the liner over the plugged pipe end to harden it.
- Install safety device (metal rod) closely behind the position of the plug, as illustrated.
- Inside the manhole, ensure that the weight of the liner does not rest on the bend / kink. This can be prevented by holding the liner up by tying it off to a fall-arrest tripod.

C Pipe Stress Release/Relaxation

- During the pull of the liner, there will be a limited amount of stretching of the liner. This is based on several factors such as: host pipe length and material (which will affect friction), lubricant, liner temperature during pull, ambient temperature in host pipe, offset joints, winch power and pulling speed. In order to remove the residual stress caused by the pulling, and to allow the liner to relax back into the host pipe the following procedures MUST be followed:
 1. Going into the stress relaxation procedure, the liner is now inside the host pipe with plugs inserted at A and B sides. Moreover, the chimneys are supported at both ends by tripods using cables connected to the expanded plugs so that the weight of the chimneys are not exerted at the bends / kinks. These supports keep the tension on the liner at both ends so that pipe relaxation can take place during the relaxation phase from both ends.
 2. Now, relax the tension on the cable at the 'A' end and open steam valve providing a limited amount of pressure, typically between 3 – 5 psi showing on the A-side pressure gauge. Steam will vent off to the atmosphere on the B-side, through the expanded plug.
 3. Continue with limited steam for a minimum of 20 minutes. The process is carried out until liner movement into the host pipe at the A-side has slowed to less than 2" movement in a 5 minute period. This will be observed by using a marking on the liner and reference point at the bottom of the manhole.
 4. Release tension on the liner using the cable at the B-side, and allow for approximately 1 – 2 ft. of relaxation back into host pipe.
 5. Shut off steam and allow liner to deflate in the host pipe. After 1 minute, re-open the steam valve at 3 – 5 psi and observe if any further movement of liner occurs at both A and B manholes. If none, relaxation is complete.

D. Heating

- Please refer to NovaForm Processing Procedures Reference Chart on page 18 & 19.

E. Expansion/Cooling

- Please refer to NovaForm Processing Procedures Reference Chart on page 18 & 19.

5 FINISHING

- For detailed information on the proper procedure to “Finish” a PVC liner installation, please review section 3.3 of the NASSCO Performance Specification Guideline for the Installation of Folded (Thermoplastic) Pipe (FP).

STEP #	A-SIDE				B-SIDE			
	Time	Press. (PSI)	Temp. (F)	Comments	Time	Press. (PSI)	Temp. (F)	Comments
1				Plugs have been inserted on both A and B sides of the liner.				
2				Tarp has been wrapped around the liner, from the host pipe/wall to about 2ft away from the end of the host pipe (important for colder weather installations – below 50F/10C). Liner section with plugs inserted MUST remain exposed and uncovered, to prevent overheating/expansion, resulting in loosening of plugs.				
3	10 min	5	227	Set boiler output as indicated	10 min	0	212	Valve fully open
4	4-5 min	6	229.4	No adjustments	4-5 min	3	220	Throttle valve partially closed (roughly 35-40 degrees)
5	4-5 min	7	231.8	Increase pressure on A side	4-5 min	4	225	Skin temperature ~ 165F
6	4-5 min	8	234.2	Increase pressure on A side	4-5 min	5	227	No adjustment on valve
7				Check size of liner to see if it has flared open to host pipe size on both A and B sides. If so, proceed to Step 14 below				
8	4-5 min	9	236.6	Increase pressure on A side	4-5 min	6	229.4	No adjustment on valve
9				Check size of liner to see if it has flared open to host pipe size on both A and B sides. If so, proceed to Step 14 below				
10	4-5 min	10	239	Increase pressure on A side	4-5 min	7	231.8	No adjustment on valve
11				Check size of liner to see if it has flared open to host pipe size on both A and B sides. If so, proceed to Step 14 below				
12	4-5 min	11	241	Increase pressure on A side	4-5 min	8	234.2	No adjustment on valve
13				Wait until liner has expanded tightly to host pipe on A and B sides and hold 1 additional minute. Verify liner skin temperature is minimum 175F on both sides. Check the liner under the tarp periodically to make sure that the flare is forming properly. If at any stage, it is noted that the liner flares / bells too much, the tarp has to be removed immediately and the flare has to be quenched with water. Otherwise the tarp cover could cause the temperature to increase in the enclosed space there by causing the liner to balloon out further and tear.				
STAGE E - Expansion/Cooling								
14	10-15 sec	10-11	240	Close steam and open air valve	10-15 sec	9	229	No adjustment on valve
15				No further adjustments	20-30 sec	10-15	220	Throttle valve further closed to boost air pressure
16				Check flare of liner on both sides and confirm it has expanded beyond the host pipe dimensions, then quench the liner chimney stacks with water on both A and B sides. This prevents further expansion of the chimney stacks and locks in the liner into the host pipe.				
17				On A side, turn on cooling system for compressed air (if equipped).				
18					Variable	10-15	90	Throttle valve as liner cools to maintain pressure, until liner cools to 90F
19					5 min			Open valve fully, maintain cooling additional 5 minutes
20				Shut off compressed air system, remove plugs, trim/finish liner ends, and proceed with CCTV post-lining inspection and robotic service reinstatement (if applicable).				

- A. **YELLOW CELLS** Indicate Valve throttling required. **NOTE** that adjustment is only done on **EITHER** A-side or B-side in sequence, **NEVER** at the same time.
- B. The above **Time**, **Temperature** and **Pressure** parameters **WILL VARY** depending on:
 1. **Liner diameter and length:** Longer and/or Longer liners will take more time to reach required skin temperatures during Heating and Cooling
 2. **Equipment:** Boiler, Air compressor, plugs, steam hose size and lengths, temperature and pressure gauges
 3. **Ambient Conditions above ground** at the surface: Weather – Temperature, Sun/Clouds, Precipitation, Wind
 4. **Ambient Conditions under ground** in the access points (manhole, catch basin) and host pipe: Temperature, Water (stagnant and/or infiltration)
- C. **Liner Processing Log sheet** must be used and should be filled out at each of the above **Heating Stage** Steps every 5 minutes.
 During **Cooling Stage**, logging can be done every 10 minutes.
- D. **IMPORTANT:** Above procedures are **GUIDELINES**; Visual Confirmation of liner expansion/flaring **MUST** be performed **CONTINUOUSLY** throughout Processing.

NOVAFORM™ PROCESSING PROCEDURES REFERENCE CHART
F1504 Formulation for 15" (375mm) to 30" (750mm) Sizes

STEP #	A-SIDE				B-SIDE			
	Time	Press. (PSI)	Temp. (F)	Comments	Time	Press. (PSI)	Temp. (F)	Comments
STAGE D - Heating/Processing								
1				Plugs have been inserted on both A and B sides of the liner.				
2				Tarp has been wrapped around the liner, from the host pipe/wall to about 2ft away from the end of the host pipe (important for colder weather installations – below 50F/10C). Liner section with plugs inserted MUST remain exposed and uncovered, to prevent overheating/expansion, resulting in loosening of plugs.				
3	5 min	5	227	Set boiler output at A-station as indicated	5 min	0	212	Valve fully open
4	10 min	6	229/4	No adjustments	10 min	3	220	Throttle valve partially closed (roughly 35-40 degrees)
5	10-30 min	7	231.8	Increase pressure on A side	10-30 min	4	225	Skin temperature ~ 175F
6	<p>Check size of liner to see if it has flared open to host pipe size on both A and B sides. If so, proceed to Step 7 below. If it isn't, continue to heat pipe until skin temperature is reached and flare is achieved. Check the liner under the tarp periodically to make sure that the flare is forming properly. If at any stage, it is noted that the liner flares / bells too much, the tarp has to be removed immediately and the flare has to be quenched with water. Otherwise the tarp cover could cause the temperature to increase in the enclosed space there by causing the liner to balloon out further and tear.</p>							
STAGE E - Expansion/Cooling								
7	10-15 sec	7	231.8	Close steam and open air valve	10-15 sec	4	225	No adjustment on valve
8				No further adjustments	20-30 sec	10-12	220	Throttle valve further closed to boost air pressure
9	<p>Check flare of liner on both sides and confirm it has expanded beyond the host pipe dimensions, then quench the liner chimney stacks with water on both A and B sides. This prevents further expansion of the chimney stacks and locks in the liner into the host pipe.</p>							
17	On A side, turn on cooling system for compressed air (if equipped).							
18					Variable	10-15	90	Throttle valve as liner cools to maintain pressure, until liner cools to 90F
19					5 min			Open valve fully, maintain cooling additional 5 minutes
20	Shut off compressed air system, remove plugs, trim/finish liner ends, and proceed with CCTV post-lining inspection and robotic service reinstatement (if applicable).							

- A. **YELLOW CELLS** Indicate Valve throttling required. **NOTE** that adjustment is only done on **EITHER** A-side or B-side in sequence, **NEVER** at the same time.
- B. The above **Time**, **Temperature** and **Pressure** parameters **WILL VARY** depending on:
 1. **Liner diameter and length:** Larger and/or Longer liners will take more time to reach required skin temperatures during Heating and Cooling
 2. **Equipment:** Boiler, Air compressor, plugs, steam hose size and lengths, temperature and pressure gauges
 3. **Ambient Conditions above ground** at the surface: Weather – Temperature, Sun/Clouds, Precipitation, Wind
 4. **Ambient Conditions under ground** in the access points (manhole, catch basin) and host pipe: Temperature, Water (stagnant and/or infiltration)
- C. **Liner Processing Log sheet** must be used and should be filled out at each of the above **Heating Stage** Steps every 5 minutes. During **Cooling Stage**, logging can be done every 10 minutes.
- D. **IMPORTANT:** Above procedures are **GUIDELINES**; Visual Confirmation of liner expansion/flaring **MUST** be performed **CONTINUOUSLY** throughout Processing.

PVC Liner Process Record

Date: <input style="width: 90%;" type="text"/>	Contractor Name: <input style="width: 90%;" type="text"/>
Contractor Job #: <input style="width: 90%;" type="text"/>	Location: <input style="width: 90%;" type="text"/>
Host Pipe Size: <input style="width: 90%;" type="text"/>	Service: <input style="width: 90%;" type="text"/>
Host Pipe Material: <input style="width: 90%;" type="text"/>	Length: <input style="width: 90%;" type="text"/>
# of Laterals: <input style="width: 90%;" type="text"/>	USMH Depth: <input style="width: 90%;" type="text"/>
Pull Direction: <input style="width: 90%;" type="text"/>	DSMH Depth: <input style="width: 90%;" type="text"/>
	Reel Description: <input style="width: 90%;" type="text"/>
	Reel Part #: <input style="width: 90%;" type="text"/>
	Weahter: <input style="width: 90%;" type="text"/>

PRE-HEAT LOG

Boiler Temp. Output:

Boiler Press. Output:

Time	Temp. (F)

PROCESSING/EXPANSION/COOLING LOG

Time	Press. (PSI)	Temp. (F)	Side	Comments

I certify this record sheet to be true and accurate:

Signature of Foreman



NOTES

NOVAFORM™
PVC LINER



IPEX
by *alixis*

Products are manufactured by IPEX Inc. and distributed in the United States by IPEX USA LLC.
NovaForm™ is a trademark of IPEX Branding Inc.