Installation manual

Version 2024-01

Inpipe Liner
Inpipe Flexliner
Inpipe Freeliner

Inversion Liner (INV)

Thank you for choosing products from Inpipe Sweden AB.

Our ambition is for your installations to be as simple, safe and fast as possible.
We hope that you will be satisfied with the manual, the installation and the end result and that our system will help you to more and better installations / business now and in the future.

Nicklas Björnvind
CEO
Inpipe Sweden AB

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General Information

Installers should undergo the "Inpipe Certified Installer" training before starting installation.

The manual is not comprehensive in all situations, and the ambition is not for it to be.

Inpipe has quality assured the method descriptions in the manual and taught by the installation training "Inpipe Certified Installer."

Inpipe assumes no responsibility for any methods or procedures not described in the manual. Inpipe must be allowed to assess any proprietary techniques to be approved by Inpipe Sweden AB. Inpipe must approve a method or procedure in writing.
Using methods or procedures not described in the manual or not approved in writing by Inpipe Sweden AB removes the possibility of making claims against Inpipe Sweden AB for guarantees and warranty obligations.

This manual's contents are confidential. It may not be shared with a third party, in part or in full, without the written consent of Inpipe Sweden AB.

Inpipe Sweden AB's general terms and conditions of delivery, which are valid at any given time, apply unless otherwise agreed in writing.

This manual replaces previous editions of Inpipe's installation manual.

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Warning information and warning symbols

Inpipe Sweden AB cares about installers' and the environment's safety in connection with the handling and installation of Inpipe liner. The installation manual marks risky and sensitive steps with safety symbols.
A summary of these symbols and their description can be found below:

	Wear protective clothing
	Wear safety shoes
	Use a safety harness
	Wear a respirator
	Wear safety glasses
	General warning sign
	Warning: Optical radiation
	Warning: Oxidizing substance
	Warning: Explosive material
	Environmentally hazardous substances

	Wear a seatbelt
	Wear protective gloves
	Wear head protection
	Wear ear protection
	Important information
	Warning: Hot surface
	Warning: Floor height obstacles
	Warning: Toxic material
	Warning: Crushing hands
	Substances hazardous to health

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Personal Safeguards

As an installer, your workplace can be risky and hazardous to health.
Vehicle traffic occurs frequently, which is why your own routines and arrangements regarding traffic safety are important.
Safety arrangements at and around the installation site must be made in accordance with local regulations, laws and requirements. It is the installer's responsibility to ensure that these are followed. Inpipe takes no responsibility for ensuring that local regulations, laws and requirements are followed.

Working in wells can be risky and hazardous to health.

- Toxic gas may be present.
- There may be a risk of drowning.
- Infectious agents may be present.

The installer is responsible for ensuring that local rules, laws, norms and safety regulations for working in wells are followed.

The installer is responsible for ensuring that protective equipment is used and protective measures are taken.

Inpipe liner contains uncured polyester plastic. This contains substances that, in high concentrations, can pose risks to health and the environment.

- Always ensure good ventilation.

If the liner is damaged during the installation process

- Avoid inhaling fumes.
- Avoid getting polyester on your skin and eyes.
- Prevent polyester from leaking into the environment.

NOTE! For more information, see the safety data sheet.

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The Inpipe Freeliner contains uncured polyester plastic. This contains substances that, in high concentrations, can pose risks to health and the environment.

- Always ensure good ventilation.

If the liner is damaged during the installation process

- Avoid inhaling fumes.
- Avoid getting polyester on your skin and eyes.
- Prevent polyester from leaking into the environment.

NOTE! For more information, see the safety data sheet.

Safety Data Sheet Inpipe Liner

The Safety Data Sheet is available for download on Inpipe's website
https://www.inpipe.se/sakerhetsdatablad/

The document can also be ordered by contacting us.

Phone: +46 940 395 30

E-mail: info@inpipe.se

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Inpipe Liner INV – variants

The Inpipe Liner INV is manufactured and delivered in the following variants:

Inpipe Liner INV / Inpipe Liner INV Flexliner
- Standard liner sealed at both ends.
- Dimensions and dimensions see the current product data sheet.
- Delivered in customized lengths or as cutting lines.

Inpipe Liner INV / Inpipe Liner INV Flexliner – Installation Ready
- Pre-expanded at transmitter end for easy mounting on bend/pole.
- Pre-assembled valve holder at receiver end for easy installation.
- Dimensions that can be ordered ready for installation and its dimensions, see the current product data sheet.
- Delivered in customized lengths.

For information on the range of **Inpipe Freeliners**. Contact Inpipe.

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Inspection, assessment and documentation before installation

Not all wires are suitable for Inpipe liner installation.
Installation must be preceded by an assessment of the suitability of the pipe and the choice of installation product.
The responsibility for collecting correct facts, inspection, calculations and assessment always lies with the installer.
If necessary, Inpipe can act as an advisor in the selection of product, calculation of loads and the need for ring stiffness.
NOTE! The installer is always responsible for ensuring that local guidelines, rules, laws and any dimensioning requirements specific to the installation are followed.

Pre-installation assessment points

Before deciding on installation, each pipe must be assessed and documented based on the criteria below.

Checkpoints	Action and limits
Temperature of medium in conduction	Inpipe Liner: up to 60°C.
Chemical environment in management	If there is a suspicion of corrosive or otherwise aggressive chemicals that are not normally found in wastewater from households, such as wastewater from dairies, breweries or process water from industries, contact Inpipe.
Diameter of the wire	Measure diameter
Oval	Controlled and documented
Displacement of pipe segments	Maximum 10% of the diameter of the wire
Groundwater pressure	Do not exceed air pressure in liner during installation. (1mGVP = 0.1bar)
Do deformations affect future maintenance of the pipe?	Remaining space after installation should allow passage with film equipment and flushing equipment
Differences in diameter of distance	Measured and documented carefully for any choice of Flexliner
Changes of direction	Are risks/outcomes acceptable to the installer and end customer. See Direction changes.
Dimensioning of liner	Must be carried out in accordance with the applicable norms or standards

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Checkpoints	Action and limits
Checking wells	• Vehicle accessibility • Is there room for equipment and to carry out work down in the well? • Are other measures needed to facilitate access to the pipeline?
Need for preparatory work	See section Cleaning Wiring Before Installation.

Changes of direction

Changes in direction on the line always mean an increased risk of damage during the installation phase and that creases can occur on the liner. In all forms of change of direction on wires, the retracting/pulling of light trains must be done with great care.

NOTE! Even with successive minor changes of direction, the risk of damage during the installation phase increases. Exercise great caution. Ensure that cords and cables are flawless and properly lubricated, to reduce the risk of abrasion damage to the foil.

Change of direction (deviation in degrees)	
0-15 degrees	• Minor creases may occur • Gradually increasing size as a function of bend size • A dialogue about creases should be held with the client before installation, as the creases may exceed the maximum permitted additional irregularities according to ISO 11296-4.* • Pulling in light trains should be done with great caution as there is a risk that the installer during this step can cause damage to the inner foil. • Lubrication of brake line / retraction rope and li.ght train cable can be advantageously done to reduce friction. • Inpipe takes no responsibility for any damage that can be traced to the installation phase.

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Change of direction (deviation in degrees)	
15-30 degrees	• Provides clear crease that may affect flow or self-cleaning ability. Installation is usually not recommended • A dialogue about creases should be held with the client before installation, as the creases may exceed the maximum permitted additional irregularities according to ISO 11296-4.* • Increased risk of injury. Pulling in light trains should be done with great caution as there is a risk that the installer during this step can cause damage to the inner foil. • LubricatiThe on of brake line / retraction rope and light train cable can be advantageously done to reduce friction. • Installations under these conditions are risky • Inpipe takes no responsibility for any damage to the pipe with a change of direction exceeding 15 degrees.

Change of direction (deviation in degrees)	
>30 degrees	• Gives big creases. Installation is usually not recommended • A dialogue about creases should be held with the client before installation, as the creases may exceed the maximum permitted additional irregularities according to ISO 11296-4.* • Significant risks of injury. Pulling in light trains should be done with great caution as there is a risk that the installer during this step can cause damage to the inner foil. • Lubrication of brake line / retraction rope and light train cable can be advantageously done to reduce friction. • Inpipe advises against installing liner under these conditions • Inpipe takes no responsibility for any damage to the pipe with a change of direction exceeding 15 degrees.

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Change of direction (deviation in degrees)	
The line deviates in the direction of a longer distance.	• Crease formation is uncommon • This can pose a risk of damage to the liner when the light train is pulled in. • In these conditions, the retraction of light trains must be done with great caution as there is a risk that the installer during this step can cause damage to the inner foil. • Lubrication of brake line / retraction rope and light train cable can be advantageously done to reduce friction. • Inpipe takes no responsibility for any damage that can be traced to the installation phase.

*ISO 11296-4, point 8.2. In straight pipe lengths with constant inner circumference, CIPP must not cause surface irregularities beyond those found in the existing pipeline, which exceed 2% of the nominal diameter or 6mm, whichever is greater.

NOTE! Inpipe assumes no responsibility for results and for damage that has occurred due to changes in direction and pipe deviations as described above.
The installer is responsible for ensuring that correct measurements and assessments of conditions are made and documented.

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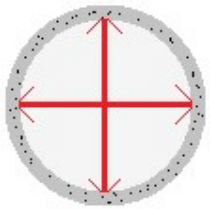
Checking the Wiring

A prerequisite for a satisfactory result is that the pipe is carefully measured and that its condition is checked before a decision is made on installation.

Control and measurement of management

1. *Inspection:* The pipeline should be inspected and documented with adequate equipment to determine its condition and what measures are required. Save videos and any other assessment documentation for final documentation.
2. *Diameter:* The diameter of the pipe must be measured and documented. The customer is responsible for ensuring that adequate equipment is used for correct measurement. When measuring, the diameter of the pipe should be measured horizontally and vertically.



NOTE! If there are dimensional changes, these must be measured for the choice of Flexliner.
NOTE! If the pipe has a different shape, the inner circumference should be carefully measured.

3. *Length:* The installation length should be measured on the current wire. The installation length is the length of the pipe to be relined, i.e. from the well connection to the well connection or equivalent. The customer is responsible for ensuring that adequate equipment is used for correct measurement.

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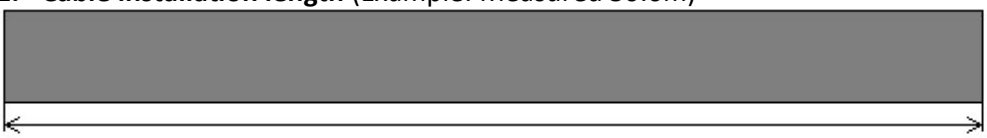
Before ordering

1. Determine the type of liner to be installed. See current product data sheets
2. Determine which SN class is required. See current product data sheets
3. Inpipe liner length: An additional addition to the liner length is required for the assembly of installation equipment and for the liner to expand to the correct pipe diameter (coning).
   Ø150 – Ø500mm, Order length liner = measured length + surcharge 1.2m
   The customer is always responsible for ordering the correct length.

The addition is since there must be space to attach the liner to installation equipment. There must also be the ability for the liner to expand up to full diameter before connecting to the line.

Example: Your Ø225mm pipe is measured at 50.0m installation length. Your order length = 50+1.2 = 51.2m

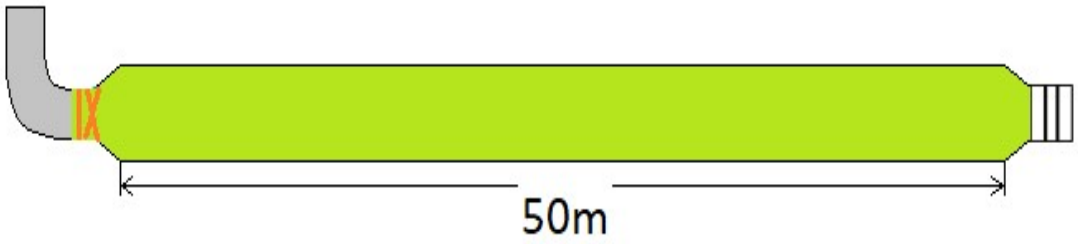
1. **Cable installation length** (Example: Measured 50.0m)



2. **Ordered liner** (Example: 50m + 1.2= 51.2m)

3. **Delivered INV liner** (Example 51.2m)

4. **Installed INV liner** (Example 51.2m liner becomes 50m installed liner)



Ordering Inpipe liner

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When ordering Inpipe liner, all information relevant to the project must be stated. Missing or incorrect information can lead to complications in the installation procedure.
Inpipe has developed a template for ordering that can be used to advantage.

Use Appendix 7 Ordering Inpipe liner or equivalent document.

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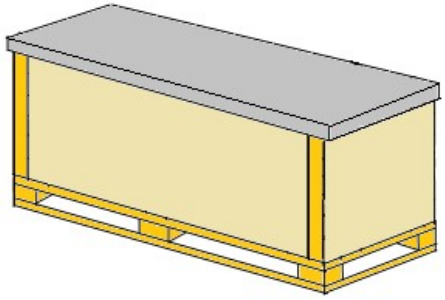
Receipt control on delivery

Reception inspection as described must take place immediately when your Inpipe Liner arrives at you. Inpipe liners are delivered packed in a box on a pallet as sketched below.



Check lid, drawer and pallet

- If any part is damaged, this must be noted on the consignment note and acknowledged by the driver upon receipt.
- A transport complaint must be made to Inpipe.

Check that the delivery is correct

Check that the right products have been delivered compared to your order. Information about the contents of the shipment can be found on the delivery note and the product certificate.

The following must be checked:

- Production number (T-number) on product certificate against Production number (T-number) on box/pallet.
- Diameter of the line
- SN class
- Length
- Goods mark if applicable, e.g. project name, route
- That any ordered pree-liner and other accessories are included in the delivery.

NOTE! Inpipe should be contacted immediately if something is missing or not correct.

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Storage and transport

Storage

- The box with liner should be stored on a flat, horizontal surface.
- Box and liner should not come into contact with water.
- Storage must take place at the correct temperature
- Liner should not be exposed to sunlight or daylight, including daylight without sun or any other form of ultraviolet (UV) light.

NOTE! Storing liner/liner in packaging under sunlight can create high temperatures for the liner. Make sure that the liner / liner in packaging is stored in a cool and shaded place.

Transport

- Liner should always be transported in its transport box.
- The appropriate method of transport shall be used.

Storage time/shelf life

Liner type	Storage temperature	Maximum durability of liner
Inpipe LinerInpipe Freeliner	5 to 30 °C	6 months from the date of production

NOTE! Improper storage, storage temperature, or installation after the expiration date will void all warranties.

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Preparation of workplace and equipment

Recommended installation direction

To reduce the ingress stress on the liner and reduce the amount of water in depressions and accumulations, Inpipe recommends that the liner, if possible, be installed in the direction of fall.

Water protection of installation site

Incoming water flows can complicate installation and affect the work environment and personal safety of staff.
Inpipe liner with inner and outer tube foil can, provided the installer ensures that the foil is not damaged during installation as well as during distortion/expansion, be installed in pipes with incoming water flow and pipe depressions with water. The groundwater pressure must not exceed air pressure in the liner during installation.
Water proofing of wells must be carried out before the installation starts, taking into account the installation process, personal safety and working environment.

NOTE! The installer is responsible for compliance with local regulations, laws and requirements regarding personal safety.
NOTE! Inpipe assumes no responsibility for quality defects, damage or problems that arise or may have arisen as a result of inadequate water protection at the installation site.

Water protection can involve plugging pipes, over pumping, diversion or other suitable measures.
The installer is responsible for the choice of method and material.
Inpipe takes no responsibility regarding the choice of method for water protection.

Liner and ambient temperature during installation

The liner must have a temperature of 15 - 30°C when installed.
If the liner has been stored at a temperature below 15°C, the liner must be heated so that the entire liner has a temperature of 15 - 30°C before installation.
In case of uncertainty, the temperature in the liner must be measured and documented in direct connection with the installation.

At ambient temperatures below 15°C, measures should be taken to maintain the correct liner temperature during transport and installation.

- A suitable transport method is used so that cooling of the liner does not take place.
- Liner must be stored so that cooling does not take place before installation.
- Liner should be calibrated and cured immediately after distortion.
- Installation air must have a temperature of +7°C - +40°C

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NOTE! The outdoor air temperature and installation air must be logged automatically during installation and attached to the installation report.
NOTE! During installation, the installer is responsible for ensuring that the liner and installation air are at the correct temperature. Inpipe Sweden AB takes no responsibility for damage and problems during installation due to incorrect temperatures.

Cleaning the Wire Before Installation

When installing a liner, the pipe must always be free of grease, soil, sand, gravel, roots, dirt, and more. All protruding/sticking objects such as service pipes, fittings, or other things that can damage the liner, e.g., damaged/heavily frayed pipes, must be removed before installation, or measures must be taken to protect the liner, e.g., installation in Pree-liner.

Immediately before installation of the liner, you should:

- Ensure that protruding/sticking objects are removed.
- The line is cleaned by flushing.

The installer is responsible for executing, cleaning, and removing protruding objects and for selecting methods.

NOTE! Inpipe Sweden AB assumes no responsibility for damage or substandard results due to the pipe not being cleaned and protruding objects not being removed.

Pre-installation inspection

After any protruding objects are removed and cleaned, the pipeline must be inspected and documented before installation using CCTV inspection with adequate equipment and expertise.

- Documentation must be carried out in direct connection with the start of the installation.
- Documentation will form the basis for decisions on whether the pipeline is suitable for re-lining.
- Documentation must be saved for possible follow-up.

Measurement of connections and service pipes

Branches, connections, and service lines that will be in operation after the liner is installed must be measured and documented before installation.

The installer is responsible for choosing the measurement and documentation methods and for ensuring that measurement and documentation are carried out.

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Pre-installation equipment check

Before installation, make sure that:

- Maintenance of installation equipment is carried out according to the supplier's instructions. See manual installation equipment.
- Equipment and other things, e.g. light train legs and bends, which can come into contact with the liner, do not have damage or sharp edges and are free of dirt (e.g. gravel, sand, clay, polyester residue and others).
- The installation equipment's automatic logging and recording system works, is switched on and logs the requested parameters.
- The light train's lamps work and give the proper UV effects; see manual current Light train.
- Light trains and light train cables do not have protruding or sharp deviations that can damage the liner.
- The surface of the tow/brake line is free from damage.
- The tow/brake line is clean. It should be free of mud, sand, gravel, polyester residue or anything else that can rub on the inner foil of the liner.
- The correct light train legs are used. See the product sheet for the correct light train legs with Inpipe installation equipment.
- The following parameters do automatic logging throughout the process:
  - System pressure air
  - Air pressure in liner
  - Temperature of air entering the liner
  - UV Lamps on/off
  - Power UV Lamps
  - Curing speed
  - Temperature of liner inner surface during curing
  - Film from the light train's camera(s) must be stored and saved

Hint!
It is recommended that the customer draw up a checklist of checkpoints to aid in daily maintenance. It is a good idea to start with Appendix 8 Maintenance Checklist and supplement it with the points relevant to your installation equipment and procedure.

Protect the liner from damage.
The liner should always be protected from damage during all parts of the process.

- The installer is responsible for taking adequate measures to ensure that the liner is not damaged during transportation to the installation site, preparation, and installation process.
  NOTE! Inpipe accepts no liability for damage that occurred or may have occurred due to failure to protect the liner from damage.

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Sealing against extraneous water

According to ISO 11296-4, a liner must be sealed at well entrances and exits to stop the infiltration of extraneous water. Inpipe recommends using a bubble rubber seal type SikaSwell A or Quicklock. The installer is responsible for choosing the method and design.

Pree-liner – over-expansion protection/liner protection

Pree-liner (accessory) protects the liner from over-expanding and reduces the risk of damage to the liner during installation. If the liner is accessible from the pipeline during installation or for some other reason is deemed to be at risk of overexpanding, pralines of the correct length and dimension must always be used.

NOTE! Installation in Pralines does not replace the requirement that all protruding/sticking objects, such as service lines, pipe fittings, or other things that can damage the liner, such as damaged/heavily frayed pipes, must be removed before installation.

Pralines should be used in the following ways:

- Installation well, between bend/shaft and pipeline
- Intermediate wells
- Receiver well
- Shafts or other open fittings
- Large service connections or other connections that may pose a risk of overexpansion
- Other passages where the liner is free or there is a risk of overexpansion are considered to exist

NOTE! Inpipe takes no responsibility for damage to the liner due to overexpansion.

Installer's adjustment of liner length

Too long liner

- Inpipe Liner INV Ø150 – Ø500: If the liner is too long, it can be shortened/cut; this is done at the installer's own risk.

NOTE! When cutting the liner, make sure that air does not get trapped between the foils and laminates, as this can cause air damage during installation.
Check the measurement procedure to avoid liners that are too long in the future.

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Installation according to manual

The current installation manual must be used for the installation. The installer should have quality assurance systems ISO9001 or equivalent and comply with the applicable quality assurance of installations according to ISO 11296-4, equivalent standard, or national standard.

NOTE! Ensure you have the manual version of the current liner.

Before starting the installation

Ensure:

- That the correct liner for the route is used, diameter, length and SN class.
- That the correct measurement of bend is used. See product sheet
- The correct size of light train legs must be mounted on the light train. See the product sheet.
- correct values for calibration pressure, curing pressure and curing speed for the current liner are used. See Appendices 2, 3 and 4.

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Inpipe Liner INV - Preparation

The liner must be protected from damage throughout the installation process.

NOTE! According to ISO 11296-4 point 9.4.2, the temperature between the laminate and the existing pipe must be logged during installation. This is not a requirement from Inpipe but can be a requirement in procurements.

Liner handling

The liner should be protected from damage.

- The installer is responsible for taking adequate measures to ensure that the liner cannot be damaged during transportation to the installation site, preparation, and installation process.
- **NOTE!** Do not expose the liner to UV light, which can cause it to harden unintentionally.

Inpipe Liner INV - Installation Procedure

The installation procedure for the different variants of the Inpipe Liner INV liner is the same. The size of installation equipment refers to the product data-sheet.
Inversion, calibration, and curing pressures and rates may differ depending on liner diameter and SN class. See Appendix 2, 3, and 4.

Inpipe INV Liner - Mounting on installation bend

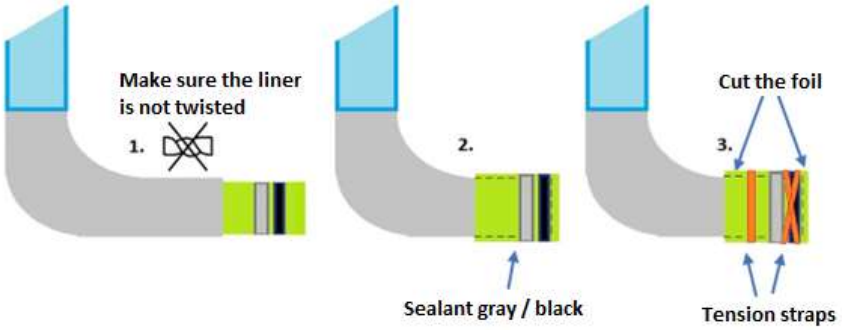
Before inversion can begin, the liner must be mounted on the installation equipment. The manual lists the current installation equipment.
The assembly must be documented with a photo, partly with a photo of the equipment before installation and partly when the liner is mounted and tensioned on the equipment.

For Inpipe Installation Equipment

1. Pass the liner through the twisting equipment and the installation bend (see sketch one below). Note that the liner should not be twisted between the box and the bend. Twisting can cause serious problems or unsuccessful installation.
2. Install the liner over the end of the installation bend see sketch 2. Exercise caution; the foil should not be damaged.
3. Note the location of the black/grey sealant on the bend. It should be far enough up on the steel bend for the tension straps to seal on both sides of the sealant. See sketches 2 & 3.
4. The liner must be secured to the bend with two straps. The inner should be set straight, and the outer two rounds should be as close to the end of the bend as possible. Please note that the weeping mass should be between the straps; see Sketch 3 below. Exercise caution when tightening; the foil should not be damaged. In the event of a compressed

air leak between the liner and the bend, additional tension straps can be used to reduce pressure loss.

5. the outer foil should be cut on both sides of the straps after the liner pressure kit, as shown in sketch three below. This will release any trapped air in the liner.
   NOTE! Make sure that water cannot get into the laminate as this can cause the polyester not to be able to harden
6. Connect the liner to the pipeline in the starter well.



Suitable type of straps

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Inpipe INV liner - connection in starting well
Before the inversion starts, the bend with the connected liner must be brought towards the mouth of the line. This should be done with great caution.

- Liner on the bend shall be protected from bumping against objects when connecting to the conduit.
- The liner should be connected to the line as close to the line as possible.
- Pree lines of the correct length and dimension should be used between the bend and the conduit

Installation under continuous pressure

The compressed air system must be pressurised according to specification throughout the installation phase (see manual for equipment). The pressure in the system and liner must never be released. Pressure loss can result in substandard or failed installation.

The installation equipment should automatically log the pressure in the system and liner during all process phases.

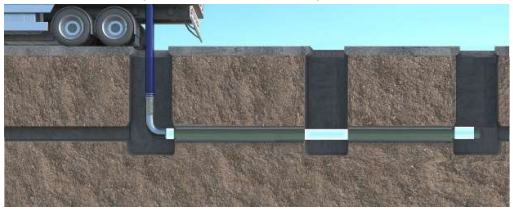
NOTE! Inpipe takes no responsibility for problems that may have occurred due to any pressure loss during installation.

Inpipe INV Liner - Inversion

Start the Distortion Process
The liner must be twisted into the pipeline using compressed air.
NOTE! Liner should be lubricated with silicone oil throughout the installation.
NOTE! Make sure to use fireproof silicone oil. Contact Inpipe for more information.

Inpipe installation equipment:
When step feeding, the amount of liner per shot should never exceed the amount that, without tightly packing the liner, can fit in the step feeder's magazine.
NOTE! Ensure the liner has the time/opportunity to stretch fully between each shot.

- In connection with installation, the liner must be equipped with pree-lines in the transmitter, intermediate, and end maintenance holes; see picture.



- Proper air pressure should be used during distortion. For information on inward pressure, see Appendix 2.
- Depending on the installation equipment type, the distortion procedure varies.

For the handling of installation equipment during the distortion process, see the manual for the installation equipment you use for information.

Installation of constant flow valve and pull rope
The constant flow valve should be installed during any phase of the distortion. The type of installation equipment used determines when this should happen.

Inpipe step feeder or equivalent: The constant flow valve and pull line must be installed when 50% of the liner has been turned in, i.e. before the last part of the liner goes down into the step feeder or equivalent equipment.

Inversion drum or equivalent: Constant flow valve and pull rope must be installed before the liner is rolled up on the drum.

NOTE! Before use, the tow cord should be checked:
- That the surface layer is free from damage
- That it is clean. The line must be free of mud, sand, gravel, polyester residue or anything else that can chafe on the liner's inner foil.

Constant Flow Valve Assembly
1. Thread the pull/brake line through the constant flow valve and valve washer, observing the direction; see the picture below.
   (Using a valve washer reduces the need for compressed air during calibration and increases liner pressure, making contours from connecting lines more visible).
2. The line must be secured with a stop knot (picture 2). The installer is responsible for choosing the type of knot and ensuring it is secure and does not slip during installation.
3. The constant flow valve is mounted in the valve holder with the knot side inserted into the liner, Fig. 3.
4. The constant flow valve should be secured in the valve holder with two pins, Fig. 4.
5. The pins for the constant flow valve must be taped to prevent them from coming loose (Fig. 5).
6. Start or continue the intrusion process.

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Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

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Continuous distortion
The correct distortion pressure and velocity should be used; see Appendix 2.
The pressure must be checked and logged automatically
For installation equipment settings in case of distortion, refer to your installation equipment manual for operation, control, and regulation information.
The permissible distortion speed shall be 12 meters/minute during continuous distortion.

Installation under continuous pressure
The compressed air system must be pressurised according to specification throughout the installation phase; contact Inpipe Teknik if you have any questions.
The pressure in the liner must never be released. Pressure loss can result in substandard or failed installation.

The installation equipment should log the pressure in the system and liner during all process phases.

NOTE! Inpipe takes no responsibility for problems that have arisen as a result of pressure loss during installation.

Installation must be done according to the current installation manual
The installer should have quality assurance systems ISO9001 or equivalent. The installer should comply with the applicable quality assurance of installations according to ISO 11296-4 2018, equivalent standard or national standard.

- Make sure you have the latest version of the installation manual for the current liner.

Inpipe INV Liner - Calibration

After distortion, the liner should be calibrated to ensure an excellent connection to the pipeline walls.
If a valve washer is mounted on the pull line, the pull cord must be tensioned and secured so that the valve washer closes against the constant-flow valve. This reduces the need for compressed air and increases liner pressure. **NOTE!** After calibration, ensure that the valve washer does not continue to block the constant-flow valve's air outlet.

- Ensure the liner is fully expanded by checking that the minimum distance between the liner and the pipe wall in wells has been reached.
- For correct calibration pressure, see Appendix 2
- For calibration settings, see the installation equipment manual.

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Inpipe INV Liner - Retracting Light Train to Starting Point for Curing

The retraction of light trains must be done per the installation equipment manual.

- The light train must be retracted with the help of a tow/brake line.
- Light train cables can be lubricated with silicone oil before retraction.
- Before and during the retraction of the light train, a check via the light train camera must be made to ensure that the liner is not damaged and ready to be cured. In the event of damage or signs of damage, the installer, at his own risk, decides whether to harden or interrupt the installation. Care should be taken when withdrawing the light train. The inner foil must not be damaged.
  NOTE! Film from the light train camera must be saved when retracting and curing the liner.
- **Starting point:** The light train should be pulled into the liner 10 – 15 cm from the drawbar / constant flow valve.
  NOTE! Safety rack that the liner meets the desired properties and is ready for curing.

Inpipe Liner INV - Curing

In direct connection with the liner being correctly calibrated, it must be hardened. Inpipe liner INV should be cured with ultraviolet light.

For the operation of hardening equipment, see the manual.

Inpipe Liner INV - Curing

For the settings and operation of your installation equipment, see the manual.

Avoid staying in wells where the liner is being cured due to the fire risk.

When lit, the light train's lamps emit intense UV radiation, which can cause irritation and damage to the eyes and skin. Avoid looking at the light train lights. Wear adequate protection and safety glasses.

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Execution of curing

1. Check that your curing equipment is set correctly regarding the start-up sequence and curing speed.
2. Start the curing process; refer to the manual for equipment installation.
3. The curing process should be logged and data saved.
4. The operator should supervise the curing process.
5. The curing process will be monitored via the light train's camera system.
6. The curing process is complete when the light train reaches the installation bend/connection nozzle.
7. The light train must be shut down according to the end sequence; see manual installation equipment.

NOTE! Ensure installation parameters and videos are saved before shutting down the system.

Inpipe INV Liner - Removal of the inner foil

After curing, the foil on the liner's inside should be permanently removed. The foil can/should be pulled out by twisting using the pull/brake line for the light train.

Hint! The foil is more accessible to pull out of the liner if it cools properly. If possible, please wait 30 minutes before starting to extract the foil.

1. In the receiver well: A hatch must be cut in the upper part of the liner, or the end must be cut off from the liner.
2. The inner foil should be detached from the liner via the door/liner end and securely attached to the pull line.

Completion and commissioning of installed liner

After removing the inner foil, the liner should be completed for operation. This may include:

- Opening of branches, connections and service lines
- Cutting off liner parts in intermediate wells
- Sealing of service connections
- Sealing of liner connection in wells

The installer is responsible for selecting equipment and methods for the completion and commissioning of the liner.

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Problem-solving

Reverse stop

Twisting jams most often occur in connection with overfilling the liner in twisting equipment, insufficient lubrication of the liner, changes in the liner's direction, or loss of air pressure.
If the liner does not twist into the conduit:

1. Increase the inversion pressure incrementally. Evaluate the results of the pressure increase step by step. **NOTE!** The maximum pressure for the current liner should not be exceeded.
2. Release the pressure on the liner and pull it back about 1 meter. After that, restart the writ process. **NOTE!** Be careful not to damage the foil on the liner.

NOTE! If the pressure in the liner is not continuous throughout the installation process, the consequence of the pressure loss can create a substandard or a failed installation.
The light train camera must be checked before and during retraction to ensure the liner is not damaged and is ready to be cured. In the event of damage or signs of damage, the installer, at his own risk, decides whether to harden or interrupt the installation. Care should be taken when withdrawing the light train. The inner foil must not be damaged.

NOTE! Inpipe takes no responsibility for problems that may have occurred due to any pressure loss during installation.

Inner foil stuck in liner

- Allow the liner to cool completely. Then, try to pull out the foil.
- If possible, pull out the foil after about 12 hours
- The foil should not be left behind! It will come loose and then create significant problems for the line owner.

The foil has fallen from the liner and gets stuck in connection with the extraction.

If the foil can be pulled out a piece, it gradually sticks. Please do not continue to pull, or it will stick harder. The reason is probably that the foil may have detached from the liner, fallen, and, when pulled out, formed a plug of foil that gradually locked the foil into the line.

- If possible, pressurise the foil using your installation equipment to attempt to blow it out toward the receiver well.
- If possible, continue extracting the foil under low air pressure after the foil has been blown out.
- If this is not successful, high-pressure flushing can be used.

HINT! The liner can be routinely pressurised during the foil extraction to avoid the foil coming off spontaneously and causing problems. Use pressure so low that it is possible to pull out the foil.

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Inspection and Installation Report

Control

The wire should be checked along its length after installation and completion. This must be done directly after the installation is completed. A soiled liner can be challenging to check and assess.

- Control must be carried out by filming with appropriate equipment.
- Film from the inspection must be documented and stored.

Installation report

An installation report must be prepared for documentation and reporting of the installation. The report must contain at least one written report, preferably according to Appendix 1, Installation Report.

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If something goes wrong – Warranty and complaints

Warranty and complaint matters must always be made in writing and sent to claims@inpipe.se

Warranty or complaint matters

- The matter must always be reported in writing by filling in and submitting Appendix 5
- The notification must be received by Inpipe Sweden AB immediately or no later than within four days of the incident.
- Requested material, according to Appendix 5, must be delivered to Inpipe
- The current installation manual must store the product.
- The current installation manual must install the product.
- The product must be installed before the specified "installed by" date on the product certificate.
- Deviations from the installation manual must be approved in writing by Inpipe Sweden AB before being used.

In the event of a warranty or complaint, the requested material in Appendix 5 must always be saved and can be referred to by Inpipe Sweden AB:

To handle large film files, please get in touch with the claims manager at Inpipe for instructions.

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Appendix 1: Installation report

Product data

Production number (T-no): ..... Dimension:..... SN Class: .....

Order length: ..... Order No.: ..... Pos No: .....

INSTALLATION REPORT

Customer:..... Entrepreneur:.....
Contacts:..... Responsible operator:.....
Street:..... Bilreg.nr: .....
Place:..... Brunn no.: .....

Maintenance control equipment for installation: Yes ☐ No ☐
Flushing before distortion: Yes ☐ No ☐
Video before the invasion: Yes ☐ No ☐

Wire Type: Wastewater ☐ Stormwater ☐ Mixed water ☐
Other, specify: .....

Material management: Concrete ☐ Earthenware ☐ Cast iron ☐
Plastic/PVC ☐ Other ☐

Measured: Dimension..... mm Installation Length ..... m
Tableware: Number:..... Big

Product temperature before distortion .....° C

Inward pressure: My..... naked Max..... naked
Calibration pressure: My..... naked Max..... naked
Curing pressure: My..... naked Max..... naked

Lights in operation, number: .....Big
Watt Lights: .....w
Curing rate: ..... m/hr
Curing temperature .....° C

Extraction of foil: Easy, Normally ☐ Heavily ☐

Selection sample Yes ☐ No ☐

Place and date:

Signature responsible operator:

Name clarification:

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Appendix 2:

Air pressure table Inpipe Liner INV / Inpipe Freeliner INV

Ø	Inversion pressure	Calibration	Hardening pressure
mm	bar	bar	bar
150	0,55 - 1,00	0,50 - 1,00	0,50
200	0,40 - 0,85	0,50 - 0,85	0,50
225	0,40 - 0,80	0,50 - 0,80	0,50
230	0,40 - 0,80	0,50 - 0,80	0,50
250	0,35 - 0,80	0,40 - 0,80	0,40
300	0,30 - 0,40	0,40 - 0,60	0,40
350	0,20 - 0,30	0,40 - 0,50	0,40
375	0,20 - 0,30	0,40 - 0,50	0,40
400	0,15 - 0,30	0,30 - 0,50	0,30
500	0,15 - 0,30	0,25 - 0,40	0,25

Air Pressure Table Inpipe Flexliner INV / Inpipe Freeliner INV

Ø	Inversion pressure	Calibration	Hardening pressure
mm	bar	bar	bar
225	0,40 - 0,80	0,50 - 0,90	0,50
230	0,35 - 0,80	0,50 - 0,90	0,50
250	0,30 - 0,40	0,40 - 0,80	0,40
300	0,20 - 0,30	0,40 - 0,80	0,40
350	0,20 - 0,30	0,40 - 0,60	0,40
400	0,15 - 0,30	0,30 - 0,50	0,30
500	0,15 - 0,30	0,25 - 0,45	0,25

For air pressure tables for Egg profiles, contact Inpipe.

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Inversion Liner (INV)

Appendix 3: Curing timetable for Inpipe liner

Tabell 1

Curing schedule for Inpipe Liner, standard polyester, with Inpipe Light Train 2024-02-16

Number of Lamps		9	9	9	8	6	6	6	5	4	3	3	3	2	2
Power per lamp (W)		1000	800	600	400	1000	800	600	400	400	1000	800	600	400	150
	Thickness	9000 W	7200 W	5400 W	3200 W	6000 W	4800 W	3600 W	2000 W	1600 W	3000 W	2400 W	1800 W	800 W	300 W
Liner Ø	min -max	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h
150	3,0-3,5				45		65	50	28	22		33	25	10	3
200	3,0-3,9		67	56	33	63	50	37	21	17		25	19	7	
225	3,0-4,0	78	64	50	30	55	45	33	18	15	28	23	17	6	
250	3,0-4,4	75	60	45	26	50	40	30			25	20	15		
300	3,0-4,5	62	50	37	22	41	33	25			20	17	13		
350	3,5-6,0	53	42	32	19	35	28	22			18	14	11		
375	3,5-6,0	50	38	29		34	26				17	13			
400	3,5-5,7	46	37	28		31	25				15	12			
450	4,0-6,5	42	33	25		28	22				14	11			
500	4,3-7,0	37	30	22		25	20				12	10			
600	5,0-8,5	31	25	18		20	16				10				
700	5,5-9,0	26	20	15		17	13								
800	6,2-10,0	23	21	13		15	12								
900	6,5-10,5	21	19	12		13	11				The temperature during curing must be between 70 and 120 degrees Celcius. The temperature can be regulated via air flow in the liner or that the curing speed is regulated.				
1000	7,5-11,0	18	16	11		12	10								
1100-1300		10													
1400-1700		8													
1800		6													

Tabell 2

Curing schedule for Inpipe Liner, standard polyester, with Inpipe Light Train 2024-02-16

Number of Lamps		9	9	9	8	6	6	6	5	4	3	3	3	2	2
Power per lamp (W)		1000	800	600	400	1000	800	600	400	400	1000	800	600	400	150
	Thickness	9000 W	7200 W	5400 W	3200 W	6000 W	4800 W	3600 W	2000 W	1600 W	3000 W	2400 W	1800 W	800 W	300 W
Liner Ø	min -max	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h
150	3,6-7,0				42		60	46	26	20		31	23	9	3
200	4,0-7,0		62	52	31	58	46	34	19	16		23	18	6	
225	4,5-8,0	72	59	46	28	51	42	31	17	14	26	21	16	6	
250	4,5-8,0	63	51	38	22	42	34	25			21	17	13		
300	4,6-9,0	55	44	33	19	36	29	22			18	15	11		
350	6,1-10,0	47	37	28	17	31	25	19			16	12	10		
375	6,5-11,0	42	32	24		29	22				14	11			
400	7,0-11,0	37	30	22		25	20				12	10			
450	7,9-11,0	31	24	18		20	16				10	8			
500	9,0-11,0	24	20	14		16	13				8	7			
600	11,0-11,0	21	17	12		13	11				7				
700	9,1-12,0	17	13	10		11	8								
800	10,1-13,0	18	17	10		12	9								
900	10,6-13,0	16	15	9		10	8				The temperature during curing must be between 70 and 120 degrees Celcius. The temperature can be regulated via air flow in the liner or that the curing speed is regulated.				
1000	11,5-14,0	14	12	8		9	8								
1100-1300		10													
1400-1700		8													
1800		6													

Inpipe Liner
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Appendix 4: Curing Timetable for Inpipe Flexliner

Curing timetable for Inpipe Flexliner, standard polyester, with Inpipe Light Train 2024-02-16

Number of Lamps		9	9	9	8	6	6	6	5	4	3	3	3	2	2
Power per lamp (W)		1000	800	600	400	1000	800	600	400	400	1000	800	600	400	150
	Outer Ø	9000 W	7200 W	5400 W	3200 W	6000 W	4800 W	3600 W	2000 W	1600 W	3000 W	2400 W	1800 W	800 W	300 W
Name	min -max	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h	m/h
FX 230	185-230				45-30		65-45	80-33	28-18	22-15		33-23	25-17	10-6	
FX 250	220-250		65-60	51-45	31-26	57-50	47-40	35-30			29-25	24-20	18-15		
FX 300	238-300	76-62	61-50	47-37	28-22	52-41	42-33	32-25			27-20	21-17	16-13		
FX 350	290-350	62-53	50-42	37-32	22-19	41-35	33-28	25-22			20-18	17-14	13-11		
FX 400	340-400	54-46	43-37	33-28		36-31	29-25				19-15	15-12			
FX 450	367-450	51-42	39-33	30-25		35-28	27-22				18-14	14-12			
FX 500	436-500	44-37	35-30	27-22		29-25	23-20				13-12	11-10			
FX 600	480-600	40-31	31-25	23-18		26-20	21-16				13-12				
FX 700	585-700	32-26	26-20	19-15		21-17	17-13		The temp during hardening must be 70 to 120 degrees Celcius.						
FX 800	676-800	27-23	23-19	16-13		18-15	14-12		The temperature can be regulated via air flow in the liner or						
FX 900	749-900	24-21	21-18	13-12		15-13	12-11		that the curing speed is regulated.						
FX 1000	796-1000	23-18	21-16	13-11		15-12	12-10		The first value of the hardening speed refers to the smaller diameter						
FX 1300	920-1300	10							in the dimension span.						

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Appendix 5: Warranty Matters and Complaints

If there are complaints, the completed complaint form and the requested material, as described below, must be submitted.

(2)			**Page 1**
Enterprise			
Installer			
Phone installer			
Email installer			
Project Name			
Name of the installation route			
Date of installation			
Date of inspection/inspection			
Production number (T-no)			
Liner Dimension			
Dimension of pipes that were lined	Fixed Ø:	Dim. deversive Ø:	
Length of ordered liner			
Length of real/installed liner			
Was the liner cut before the installation	□ No	□ Yes Length:	
Number of tableware			
Number of intermediate wells			
How was the liner stored before installation?		Storage temperature:	
Weather conditions at the installation	□ Sun □ Rain □ Snow	Outdoor temperature:	
Were there changes in the direction of the management	□ No	□ Yes Quantity: Angle:	
The liner was installed as	□ Wip □ Wip Flex	□ Egg Profile	
Installation Direction	□ With a fall	□ Against falls	
How was the liner experienced	□ Soft □ Medium	□ Hard □ Dry	□ Supersaturated
Was the liner lubricated during the installation	□ Silicone Oil □ Not Lubricated	Other:	
What was it like to mount the liner on the bend	□ Lightweight	□ Medium	□Difficult"
Was the foil cut at the bend/Rosemount	□ Yes	□ No	
How was the calibration experienced?	□ Lightweight Pressure:	□ Medium	□Difficult" Time:
The liner was hardened with	□ UV □ LED	Speed: Effect:	
When did the problem occur	□ Expansion □ Calibration □ Retraction of Light Train □ Other:		
How was the extraction of the inner foil	□ Lightweight		□Difficult"
Description of problems and consequences			
Do you / the installer have any theory about what caused the deviation?			
Other observations and information			

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Warranty Cases and Complaints (2)				**Page 2**
In the event of a fault/complaint, the following material must be marked with T-no and sent to Inpipe	□ Inner foil (croquet marked at 12 noon)	□ Sending end closure	□ End with valve holder	□ Sample
	□ Inspection film on flushed liner after installation □ Installation Report			
Available inspection film before installation	□ Yes = To be attached to the file: □ With case □ Against falls □ No = Reason:			
There is a film from the light train camera	□ Yes = To be attached to the file: □ With case □ Against falls □ No = Reason:			
Is there inspection film on the flushed liner after installation	□ Yes = To be attached to the file: □ With case □ Against falls □ No = Reason:			
Are there inspection protocols with changes of direction according to Swedish Water P91	□ Yes = To be attached □ No = Reason:			
There is a photo of the liner mounting on the bend/shaft	□ Yes = To be attached □ No = Reason:			
Installation log file available	□ Yes = To be attached □ No = Reason:			
Has film/s from the installation been filmed in the same direction as the installation	□ Yes □ No			
Pree-liners were mounted in	□ Transmitter well □ Medium well/s □ End well			
What width of the sliding foil was used				
How was the sliding foil secured?				
Was the slide foil lubricated before retracting the liner	□ Yes □ No			
What size of the sow was used for the installation				
What was it like to mount the liner on the stem	□ Lightweight □ Medium □Difficult"			
With the end customer, a written agreement on measures due to deviations	□ Yes attached: □ No Reason:			

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Appendix 6: Sample of installed liner

If the customer requires it, sampling of the installed liner shall be done according to the customer's specifications of ISO 11296-4 2018 or comply with local laws, regulations, and guidelines.

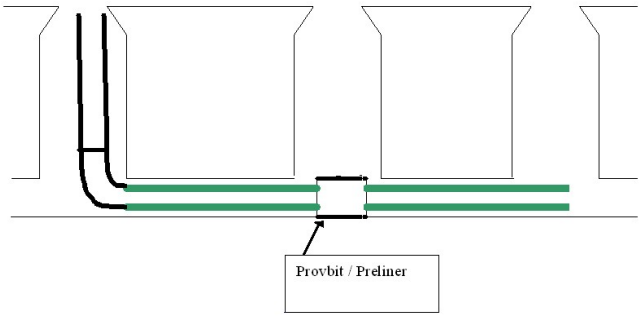
THE HARDENED LINER SHOULD BE SAMPLED TO ENSURE THE RESULT AND QUALITY. THE TEST RESULT SHOULD BE SAVED AS PART OF THE INSTALLATION'S FINAL DOCUMENTATION.

According to the ISO standard, three tests can be performed to determine the product's characteristics. The choice of method depends on availability and the possibility of extracting suitable samples.

1. Ring stiffness measured on the circular sample, ISO 7685:1998
2. 3-point bend measured on rectangular pieces, ISO 178:2019
3. Residue Styrene Laminate Hardened Laminate, ISO 4901:2011-08

Sample selection
Samples should be taken as far as possible in the intermediate descent well rather than at one or the other end of the installation.
NOTE! Samples taken outside the line, for example, where the liner has been hardened in Pree-liner, often have slightly lower ring stiffness during tests. The reason is that the diameter becomes slightly larger in a Pree-liner because it has some flexibility and, therefore, expands slightly during the installation and curing process.

Circular sample. (Diameter less than 500mm)
Cut a ring of whole liner where possible.



NOTE! The sample piece should be completely circular, fully expanded towards the Pree-liner and straight.
The length of the piece is essential; see the table below!

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Wire diameter(mm)	150	200	225	250	300	400	450	500
Length of sample piece (mm)	190	240	265	290	340	340	340	340

Samples with more than 300 mm diameter must always be 340 mm. The test laboratory cuts the sample piece to the correct length.

Rectangular sample
If taking a complete ring is impossible, a rectangular sample piece for 3-point bending testing is cut out. See procedure below

2) Sample bit for the 3-point bending test. If possible, place a test piece in between wells.
Cut a rectangular piece out of the liner, at least 150x150 mm.
Cut out the liner part without overlapping fabrics; see the picture below.

Figure 2, Suggested socket for 3-point bend

Picture 3, the overlap of fabrics in the finished liner

Packaging and labelling of sample pieces

Immediately after the sample has been cut out, the piece must be marked with the following:

- Production number (T-no)
- Installation Date

For example, the sample must be protected with UV-light-proof plastic foil before it is sent to the laboratory.

Check with your laboratory to learn how sample pieces should be labelled and packed and what other information is required.

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Appendix 7: Ordering Inpipe Liner

"Place for logotype"

Order INPIPE LINER

Project: Order date:

Delivery address: Requested delivery date

Order no:

Markings:

Customer:

Contact:

Phone:

Stretch / brand	Standard max out. Ø	Flex* max out. Ø	SN-Class Short	SN-Class Long	Length	Type of liner INV	Type of liner WIP	Blind-Shot	Integrated protectionfoil**	Installation prepared***	Number of Pree-liner	Pree-liner Ø	Sliding foil**** width	Sliding foil**** length	Not. no.

When ordering Freeliner or liner with vinyl ester, state this under notes.

Orders are emailed to: order@inpipe.se

* See product data sheet Inpipe Felxliner for dimension range

* Inpipe WIP liner Ø150 up to Ø600 can be ordered with pre-assembled sliding / protective film. For more information, see the current installation manual/product data sheet

** Inpipe INV Ø150 up to Ø500 and WIP liner Ø150 up to Ø450 can be ordered ready for installation. For more information, see the current installation manual/product data sheet.

*** For recommended Glidfoil width, see installation manual.

Notes:

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Inversion Liner (INV)

Appendix 8: Example Maintenance Checklist

Logotype

Checklist periodic check

Month: _____

For more information, see the installation equipment manual

Dag	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Light train: Legs, whole, correct size																															
Light train: Lamp housing, screws, IR																															
Light train: Light rail routes																															
Light train cable: Whole and clean																															
Light train tube: Seal rear cover																															
Step feeder: Clean inside, sharp edges																															
Step feeder: Lubrication system function																															
Step feeder; Bellows																															
Blue hose: Whole and clean																															
Bends / stos: Whole and clean																															
Brake line: Whole and clean																															
Straps: Whole and clean																															
Compressor: Fuel and function																															
Generator: Fuel and function																															

Månad	Jan	Feb	Mar	Apr	Maj	Jun	Jul	Aug	Sep	Okt	Nov	Dec
Light train puller: Speed control												
UV Lamps: UV effect												
Light train tube: Inside												
Pressure gauge: Calibration												
Step feeder: Attachment points												

År	2025
Installation Unit: Inspection by Inpipe	