Pig for pigging system

JM

Instructions

Reference: JM_NOT_EN

Version D

34-36 Avenue Roger Hennequin
78197 Trappes cedex - France
Tel.: + 33 (0)1 30 16 15 00
Fax: +33 (0)1 30 16 15 01
Home page: http://www.servinox.com

1 INTRODUCTION

1.1. The manufacturer

SERVINOX is a specialist, making process equipment for the brewing, food, cosmetic and chemical industries.

Skill and knowledge about process equipment:
In areas such as the protection of tanks, sampling, injection of gas in liquids, scraping or cleaning pipes with patented products.

SERVINOX is certified ***ISO 9001: 2008*** and makes products complying with the following applicable standards and directives:

- Pressure Equipment Directive ***(PED) 2014/68/EU***
- European Directive concerning Devices for Use in Explosive Atmospheres ***(ATEX) 2014/34/EC***
- Hygienic standard for manufacturers US 3A

We are an active member of the association ***EHEDG France*** (hygienic standard for European manufacturers).

1.2. Instructions

To ensure the integrity of the device and the safety of people, you should be aware of the information contained in these instructions before installing and using the device.

Depending on the installation and the fluid, the specific directives and regulations apply, and should be complied with.

In addition to these instructions, the general instructions for safety at work and protection should be applied. The regulations concerning the protection of the environment must also be followed.

1.3. How it functions

The scraper shuttle is designed to recover the residual mass of a product in a pipeline. To do this, it is introduced into the transfer line upstream of the area to be evacuated, and then propelled through the pipe by a fluid, motor-driven by a suitable system. Under certain conditions, the scraper shuttle can also separate two products conveyed successively in the same pipe.

It is sealed by a series of elastomer disks suitable for the fluid being processed.

The scraper shuttle can be fitted with a magnetic insert to allow detection.

1.4. Signs

The scraper shuttle has no signs

If you have difficulties these instructions cannot resolve, you should ask for further information from the manufacturer or from the equipment distributor.

It is essential to mention the SERVINOX order for all special requests.

2 SAFETY INSTRUCTIONS

This technical manual contains basic instructions that should be followed. It is therefore essential to read it before installation and commissioning.

2.1. Indications and symbols

The following pictograms are designed to draw your attention to important points relating to the safety of people and the integrity of the equipment:

SYMBOL	DEFINITION
	Direct danger for people
	Possible damage to the product or its environment
	Essential information
	Minimum number required for certain operations. (The number of characters in the pictogram indicates the minimum number of persons).
	Minimum technical skill level. (the number in red indicates the minimum level required).

Some jobs require special technical skills and qualifications, such as for maintenance repairs or work on electrical equipment.

Three levels specify the required technical skill (knowledge of the equipment concerned, experience, training, etc):

	WORKER'S PROFILE	QUALIFICATIONS
Level 1	**End user** with no technical knowledge	**Default level** if the skill pictogram is not present. Permits only **ordinary use and routine maintenance**.
Level 2	**Experienced professional**	**Trained and experienced - knowing the equipment and the technologies used**.
Level 3	**The manufacturer's personnel** / expert of the product	**Work reserved for the manufacturer** of the documented device.

2.2. Safety of workers

Installation, test, adjustment, maintenance and replacement should be performed:

- By qualified persons
- Following the recommendations and guidelines given in these instructions
- Complying with the arrangements for safety at work, procedures and resources of the fitter, and the legal notifications for the prevention of accidents, especially those concerning electrical installations.

Not following these safety instructions can result in the loss of all right to claim damages .

2.3. Intended use

Correct utilisation

Check that the device chosen is right for its intended use, using the documents supplied with it .

Incorrect utilisation

The device must not be used for any other purpose other than its intended use. The manufacturer cannot be held responsible in case of incorrect utilisation .

The device must not be used beyond the following operating limits:

PARAMETERS	LIMITS
Maximum admissible pressure	10 bar
Minimum / maximum temperature	0°C / 120°C (depending on the elastomer)

This scraper shuttle must be used on a circuit conveying clear or viscous liquid products from group 2 (Article 9 of the EU Directive 2014/68/EU)

3 TECHNICAL SPECIFICATIONS

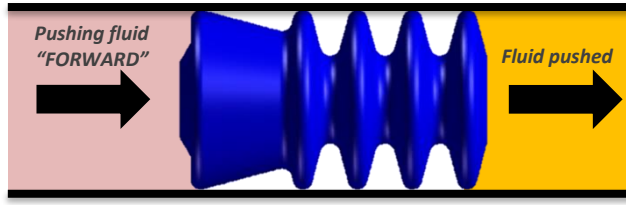
3.1. Shape and functioning

The scraper shuttle is bidirectional.

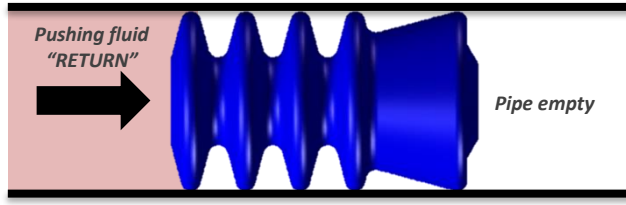
Its asymmetrical shape, designed to optimise its functioning when subjected to the back pressure of the product to be pushed, accordingly means it must be fitted in the correct way.

The series of identical disks should be in front of the pusher in the pipe scraping phase.

"FORWARD" phase of normal scraping



"RETURN" phase of normal scraping

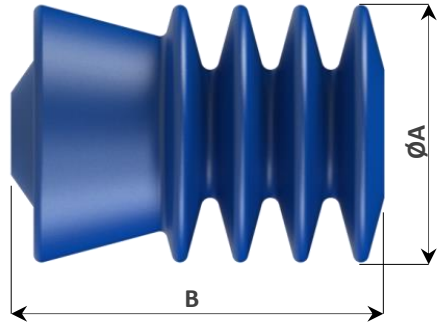


3.2. Specifications

Pipe fittings complying with paragraph 3.3 of the European Directive 2014/68/EU.

SPECIFICATIONS	SERVINOX PROPOSAL
Materials	*SHUTTLE*: VMQ (blue), VMQ filled with PTFE (grey), EPDM (black), NBR, FKM *MAGNETIC INSERT*: Neodynium
Hardness of the elastomer	50 shore A
Operating temperature	MINIMUM: 0°C MAXIMUM: +120°C

3.3. Dimensions



The scrapper shuttle conform to the ISO 3302-1 category M2 standard for dimensional tolerances and their values for solid molded rubber products.

- ***Scraper shuttle DIN***

SIZES	ND 25	ND 40	ND 50	ND 65
Tubes	29 x 1.5	41 x 1,5	53 x 1,5	70 x 2
ØA	26.5 ±0,4	39.5 ±0,4	51 ±0,5	67.3 ±0,7
B	42 ±0,5	61,5 ±0,5	74,7 ±0,7	95,5 ±0,7

SIZES	ND 80	ND 100	ND 125	ND 150
Tubes	85 x 2	104 x 2	129 x 2	154 x 2
ØA	82.6 ±0,7	102 ±0,8	127.5 ±0,8	153 ±0,8
B	117 ±0,8	144,4 ±0,8	178,7 ±1,3	225 ±1,6

- ***Scraper shuttle SMS/OD***

SIZES	ND 25	ND 38	ND 51	ND 63.5
Tubes	25 x 1.2	38 x 1.2	51 x 1.2	63.5x1.5
ØA	23 ±0,35	36.7 ±0,4	49.6 ±0,5	61.7 ±0,5
B	40 ±0,4	62,7 ±0,5	71,7 ±0,7	91 ±0,7

SIZES	ND 76.1	ND 104
Tubes	76 x 1.6	104 x 2
ØA	74.3 ±0,7	102 ±0,8
B	107,5 ±0,8	144,4 ±0,8

- ***Scraper shuttle ISO***

SIZES	ND 25	ND 40	ND 50	ND 80
Tubes	33,7 x 1,6	48,3 x 1,6	60,3 x 2	88,9 x 2
ØA	31,1 ±0,4	46 ±0,5	57,4 ±0,5	86,7 ±0,7
B	47 ±0,5	66,4 ±0,7	84 ±0,7	124 ±0,8

SIZES	ND 100	ND 125	ND 150
Tubes	114,3 x 2	139,7 x 2	168,3 x 2
ØA	112,5 ±0,8	138,4 ±0,8	169 ±1,2
B	163 ±1,1	202,5 ±1,4	255 ±1,8

4 COMMISSIONING

4.1. Transport / Reception / Handling

Upon receipt, check :

- That ***the package is in good condition***
- That the device ***is delivered as ordered***
- That the device ***has not been damaged***

If the shuttle is damaged, it must not be fitted on the installation. Contact the manufacturer or your distributor.

4.2. Storage

If the device is not fitted immediately after delivery, ***it should be stored carefully***.

It should be ***stored in its original packaging***, in a covered area, with protection against dirt, rain, snow, insects and other nuisances.

The safe storage temperature is ***a constant ambient temperature of 20°C***, with relative humidity of the air < 50%.

The ***shuttle should be protected from exposure to light***.

You are advised not to store it for more than one year.

The shuttle has no marking or identification on its production batch.

You are advised to store the shuttles by batch (physical separation of batches) and use the FIFO system (First In First Out, that is to say: first entered in stock = first leaving the stock).

Preparing the installation to be scraped

The work described below must be performed by trained and experienced personnel.

The installation to be scraped by the shuttle must be constructed following the recommendations below (described in this notice):

- Welding of the pipe
- Tolerances of the pipes to be scraped
- Geometry of the pipes to be scraped (branch connections and elbows)
- Diameter of the shuttle stop
- Shuttle "return" diaphragm
- Operating pressure

POOR CONSTRUCTION OF THE INSTALLATION AND NOT FOLLOWING THE ADVICE IN THIS NOTICE MAY SERIOUSLY DAMAGE THE SHUTTLE, WHICH MAY NO LONGER ENSURE ITS SCRAPING FUNCTION BECAUSE OF A SEAL FAULT.

If the fluid in contact with the shuttle is harmful, flammable, toxic, etc., protect the user and fit the pipe installation with a discharge, leading to a safe place.

You are advised to check the compatibility of these products with the seals and materials before use.

4.3. Welding the pipe

The pipes to be scraped must be welded and assembled by qualified personnel according to the directives of the country of installation.

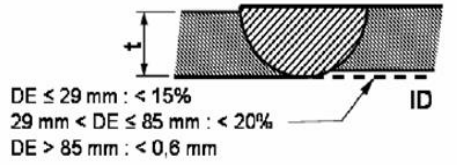
SERVINOX MINIMUM RECOMMENDATION FOR WELDING THE TUBES TO BE SCRAPED:

- Penetration faults of connecting welds for tubes and fittings must be within a tolerance of +/- 25% of the tube thickness.
- Misalignments: we advise following the extract from guide no. 35 (EHEDG) below.

6.2 Misalignment

Misalignment of the walls of the two pipe elements to be welded may create a raised portion of the inner surface of the welded area, which could result in the retention of material (dust, product, etc.). This raised portion may be due to a poor coincidence of the centrelines of the two elements to be assembled, a mismatch in their diameters and their thicknesses, or non-circularity of the tube ends. The misalignment tolerances are:

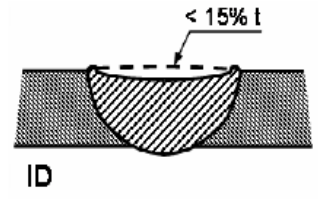
- *< 15% of the thickness of the thinner tube, for tubes with an outside diameter less than or equal to 29 mm*
- *< 20% of the thickness of the thinner tube, for tubes with an outside diameter greater than 29 mm and less than or equal to 85 mm*
- *< 0.6 mm for tubes with an outside diameter greater than 85 mm.*



For the most demanding processes we advise you to follow all the recommendations of guide no. 35 EHEDG, an extract from which is given below.

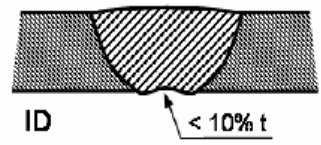
6.3 Concavity on the outside diameter

For a good quality weld, the concavity on the outside diameter of the tube should be less than 15% of the thickness of the thinnest tube.



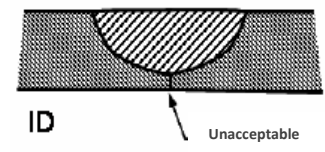
6.4 Concavity on the inside diameter

In order to avoid problems of product retention and decrease in cleanability, the concavity on the inside diameter of the tube must be less than 10% of the thickness of the thinnest tube.



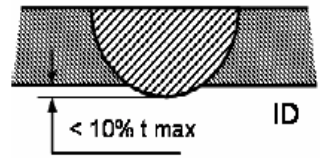
6.5 Penetration

An incomplete penetration of the solder to the inner face of the tube must never be tolerated.



6.6 Convexity

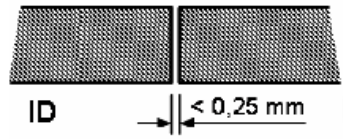
Convexity on the inner diameter must not be greater than 10% of the thickness of the thinnest tube.



Also, we must be particularly vigilant concerning the alignments of the various pipe elements.

6.1 Spacing

Whenever possible, avoid spacing the edges of the parts to be welded. A space of less than 0.25 mm before welding is acceptable. A wider space will create a concave weld, which is not recommended in this document. Also, a wider space can cause blowing of the weld due to the pressure of the inert gas within the tubes.



BEFORE USING:

Ensure that pipe welds have been done properly:
- No burr
- No irregularity
- No faults inside the pipes

The pipe to be scraped must be cleaned, pickled, passivated and without residue (welding, grinding, etc).

4.4. *Tolerances of the pipe to be scraped*

The scraper shuttle is calibrated to fit a given pipe diameter, the line to be scraped must be of constant diameter. Furthermore, these pipes must meet the following dimensional and non-circularity tolerances:

DIMENSIONAL TOLERANCES	
Tube ext. Ø ≤ **100 mm**	**± 0.5 %**
Tube ext. Ø > **100 mm**	**± 0.75%**
Tube ext. Ø tolerance compared with the inner nominal dimension (thickness ±10%)	

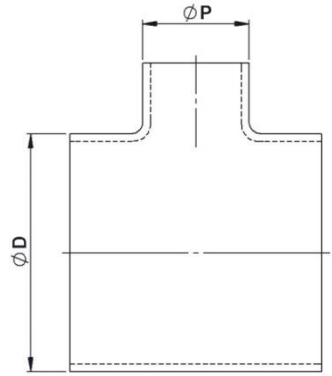
NON-CIRCULARITY TOLERANCES FOR ELBOWS AND T'S	
Tube ext. Ø ≤ **41 mm**	**±0.3mm**
Tube ext. Ø > **41mm**	**± 0.75%**

4.5. Geometry of the pipe to be scraped

- ***Tapping points***

The elastic and deformable behaviour of an elastomer also applies to the shuttle. To prevent a shuttle from going into a tap on the line to be scraped, comply with the two following parameters:

1) ***The DN of the tap (ØP) must be less by 2 DN than that of the line to be scraped (ØD). Keep within the ØP MAXIMUM values using the tables below.***



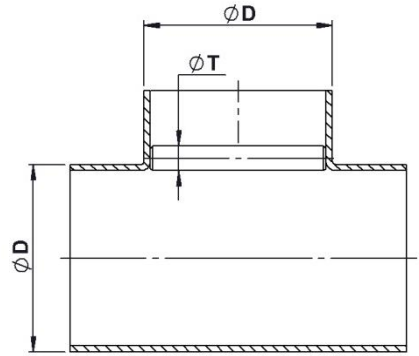
STANDARD DIN					
ØD	**DN25**	**DN40**	**DN50**	**DN65**	**DN80**
ØP MAX.	DN15	DN20	DN25	DN40	DN50
ØD	**DN25**	**DN40**	**DN50**	**DN65**	**DN80**
ØP MAX.	DN65	DN80	DN100	DN40	DN50

STANDARD SMS					
ØD	**25mm**	**38mm**	**51mm**	**63.5mm**	**76.1mm**
ØP MAX.	12mm	18mm	25mm	38mm	51mm
ØD	**104mm**				
ØP MAX.	63.5mm				

STANDARD OD					
ØD	**1''**	**1'' ½**	**2''**	**2'' ½**	**3''**
ØP MAX.	½''	¾''	1''	1'' ½	2''
ØD	**4''**				
ØP MAX.	2'' ½				

<u>If the conditions cannot be met:</u>

It is imperative to weld a stainless-steel guide rod (ØT) flush with the line to be scraped and following a centreline intersecting the centreline of the tapping point. This prevents the shuttle from going into the tap and/or from jamming or even from tearing on a sharp edge.

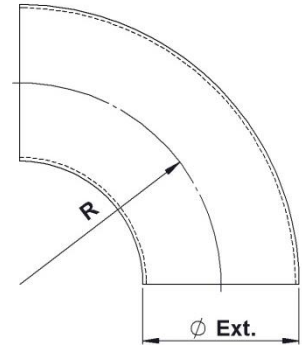


Ø D	DN25	DN40	DN50	DN65
Ø T	4 mm	5 mm	6 mm	8 mm
Ø D	**DN80**	**DN100**	**DN125**	**DN150**
Ø T	10 mm	12 mm	16 mm	20 mm

2) ***Taps made on the line to be scraped must not have sharp edges: extruded tapping points are strongly recommended.***

- ***Elbows***

The scraper shuttle can pass through 45° elbows and tighter bends provided that these bends have a minimum radius of curvature as shown in the tables below.



MINIMUM RADII OF THE ELBOWS:

- ***Radii of elbows DIN 11867***

SIZES	DN25	DN40	DN50	DN65	DN80
Tubes	29x1.5	41 x 1.5	53 x1.5	70 x 2	85 x 2
Min. radius (mm)	65	95	125	160	200

SIZES	DN80	DN100	DN125	DN150
Tubes	85 x 2	104 x 2	129 x 2	154 x 2
Min. radius (mm)	200	250	312.5	375

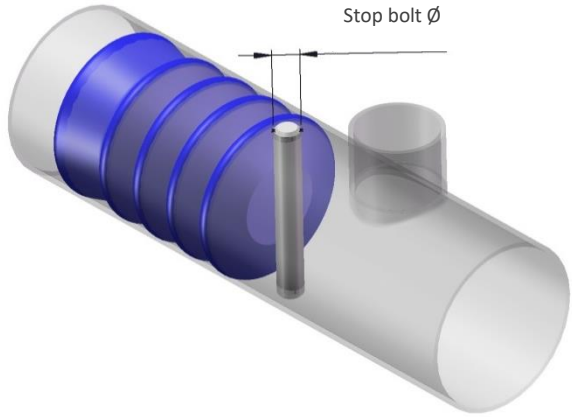
- ***Radii of elbows SMS***

SIZES (MM)	25	38	51	63.5	76.1	104
Tubes	25 x 1.2	38 x 1.2	51 x 1.2	63.5x1.6	76 x 1.6	101.6 x 2
Min. radius (mm)	37.5	57	76.5	95.3	114	250

- ***Radii of elbows OD DIN 11866***

SIZES	1"	1"1/2	2"	2"1/2	3"	4"
Tubes	25.4x1.65	38.1 x 1.65	50.8 x 1.65	63.5x1.65	76.2 x 1.65	101.6 x 2.11
Min. radius (mm)	38.1	57.2	76.2	95.3	114.3	237.5

4.1. Diameter of shuttle stop bolt

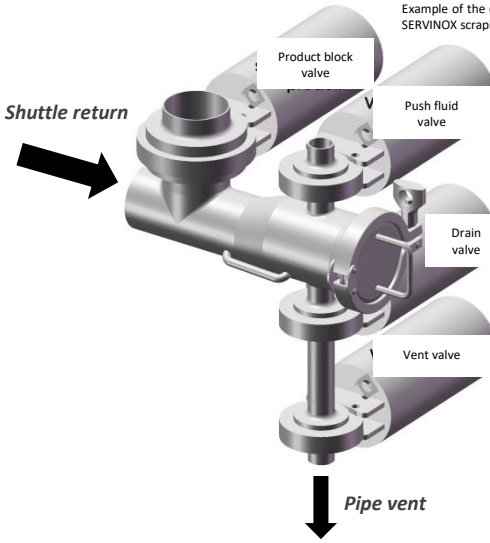


PIPE	DN25	DN40	DN50	DN65
Stop bolt Ø	6 mm	6 mm	8 mm	10 mm

PIPE	DN80	DN100	DN125	DN150
Stop bolt Ø	12 mm	16 mm	20 mm	30 mm

4.2. "RETURN"phase diaphragm

Example of the departure station (SRD) of a SERVINOX scraping system



In return phase of the shuttle in the departure station, the departure station valves are in the following positions:

- Product block valve = closed
- Push fluid valve = closed
- Drain valve = open
- Vent valve (drilled) = closed

In order to limit the air vent flow rate in shuttle return phase, the vent valve must be drilled to the specifications given below.

PUSH FLUID RETURN: **AIR**

PIPING	DN25	DN40	DN50	DN65
Ø diaphragm	3 mm	3 mm	4 mm	4 mm

PIPING	DN80	DN100	DN125	DN150
Ø diaphragm	6 mm	6 mm	8 mm	8 mm

PUSH FLUID RETURN: **WATER**

PIPING	DN25	DN40	DN50	DN65
Pig speed	2 m/s	2 m/s	1.5 m/s	1.5 m/s
Ø diaphragm	6 mm	8 mm	8 mm	10 mm

PIPING	DN80	DN100	DN125	DN150
Pig speed	1 m/s	0.5 m/s	0.5 m/s	0.5 m/s
Ø diaphragm	14 mm	20 mm	24 mm	30 mm

4.3. Operating pressure

The maximum operating pressure (bar) can vary in the pipe during scraping, so you may have greater operating pressures in the pipe on the stop bolts (arrival station or intermediate station of the scraper – type MVB).

The differential pressure for moving the shuttle in a pipe is about 1 bar (except for shuttles made of Viton < 1.5 bar). But, you must take into account the nature of the product (density, viscosity, etc) conveyed in the pipe before the scraping phase.

- ***Scraper shuttle DIN***

SIZES	DN25	DN40	DN50	DN65
Tubes	29 x 1.5	41 x 1.5	53 x 1.5	70 x 2
MAX. pressure in pipe	10 bar	10 bar	10 bar	10 bar
MAX. pressure on stop (2 m/s max.)	5 bar	5 bar	5 bar	5 bar

SIZES	DN80	DN100	DN125	DN150
Tubes	85 x 2	104 x 2	129 x 2	154 x 2
MAX. pressure in pipe	10 bar	8 bar	6 bar	4 bar
MAX. pressure on stop (2 m/s max.)	4 bar	4 bar	4 bar	3 bar

- ***Scraper shuttle SMS/OD***

SIZES	25 MM	38 MM	51 MM	63.5 MM
Tubes	25 x 1.2	38 x 1.2	51 x 1.2	63.5x1.5
MAX. pressure in pipe	10 bar	10 bar	10 bar	10 bar
MAX. pressure on stop (2 m/s max.)	5 bar	5 bar	5 bar	5 bar

SIZES	76.1MM	104MM
Tubes	76 x 1.6	104 x 2
MAX. pressure in pipe	10 bar	8 bar
MAX. pressure on stop (2 m/s max.)	4 bar	4 bar

5 USE

Check for compatibility of your products with the shuttle before use

5.1. Precautions

The shuttle must only be fitted on an isolated and inert installation (no pressure and no risk of transfer of fluid)

- ***Never perform dry scraping during tests.*** This can severely damage or even destroy the shuttle. Also, speed can make it reach high temperatures and cause burns.
- ***It is important to check the condition of the shuttle before each entry into a pipe.*** It is vital to check for:
    - The absence of abnormal wear on the edges of the disks; so, check dimension (A), (see chapter "Specifications / Dimensions").

      If dimension (A) is less than the MINIMUM tolerance, change the shuttle.
    - The absence of damage linked to cracking of the surface of the elastomer, or absence of tearing and breaking.
    - The absence or lack of material
    - The absence of packaging waste
    - The cleanliness of the shuttle
- We remind you that the scraper shuttle cannot be easily inserted into a pipe, ***because its outside diameter is equal to the inside diameter of the pipe increased by 2%*** to ensure a good seal.

CAUTION WHEN REMOVING THE SHUTTLE:

If there is residual pressure in the pipe, the shuttle will come out violently from the station and could be thrown towards the user; also, a large amount of air will escape with a loud noise.

5.2. Scraping cycle

A push with water or a lubricating fluid is particularly recommended when pushing organic solvents, alcohol, liquid sugar, 'Clean In Place' (CIP) solution (to avoid "dry pushes").

You must plan a decompression time on the line for manipulating the various actuators (to be decided with Servinox during testing and commissioning).

To prevent excessive speeds, which can damage the shuttle, you are advised to follow the recommendations of Servinox when automating the scraper stations.

Also, if necessary, Servinox can provide a self-regulating push system (shuttle speed control plate (RVO)).

6 SERVICING AND MAINTENANCE

6.1. Overview

The scraper shuttle is a wear part, which does not require maintenance. However, it must be inspected periodically to check the state of wear.

The workers

The work described below should be carried out by qualified and experienced persons .

The personnel must be equipped with gloves, helmet, and safety shoes.

6.2. Inspections

<u>Do the following before any inspection of the shuttle:</u>

- Isolate the equipment
- Depressurise the system
- The installation must be empty
- The fluid must be cooled to ambient temperature
- Ventilate the conduits if the fluid is corrosive and aggressive

Frequency of inspection

The frequency of inspection is decided case by case, as this depends on the frequency of use, conditions of service and certain fluid properties (corrosive, aggressive, abrasive, residues, viscosity, etc.).

Kind of inspection

At every inspection, carry out the following checks:

- Number of scraping cycles or distance travelled
- Scraping cycle time
- Check the dimension ØA
- Visual inspection (discoloration, tear, scratches, etc)

You are strongly advised to keep a record of inspections.

7 DIAGNOSTIC AID

The table below is a diagnostic aid and is intended to help you remedy simple problems.

PROBLEM	POSSIBLE CAUSE	REMEDY
Deep scratches in the material of the fins	**These faults are due to incorrect welding (blistering), which mark the shuttle with each passage**	Locate the faulty welds; then repair these welds.
The marks left by shocks	**These faults are generally due to a misalignment between two pipe sections or a tapping point not in accordance with the recommendations.**	Inspect the pipe and repair the alignments.
Removal of material (nibbling) from the lips	**This fault emphasises a scraping cycle problem, especially as regards the shuttle stopping against the MVB valve stop. (The shuttle remains compressed against the MVB valve during its rotation)**	Review the automated scraping cycle (15 secs. minimum): extend the line vacuum time after detection of the shuttle.
Cutting of the shuttle (side marks)	**Problem link to a jammed piston exit (SRD - departure station)**	Examine the sequencing of the automation.

8 WARRANTY

Unless otherwise stated in the proposal, the device is guaranteed ***12 months as from the date of delivery***.

After an examination in our factory, the parts considered as defective will be replaced at our expense.

All replacement of the device's components (wear parts, seals, etc) must be replaced by SERVINOX original parts

The warranty does not cover damage due to:

- Poor fitting, inappropriate or abusive utilisation
- An accident or non-compliant installation
- Modification of the equipment
- Leaks following the passage of impurities will not be taken into account
- Required maintenance not performed

The warranty on our products covers the free repair of parts returned when proved that they have become unusable prematurely, following a manufacturing or material fault.

We are not bound to any compensation or any other obligation of this kind.

This equipment has been inspected before leaving the factory.

This device has been certified as having been inspected and authorised for sale

solutions
engineered for you
dprozesse: Proces
ösungen fluid
für Ihre dise
de solu
vendung adaptada
indu

34-36 Avenue Roger Hennequin
78197 Trappes cedex - France
Tel.: + 33 (0)1 30 16 15 00
Fax: +33 (0)1 30 16 15 01
Home page: http://www.servinox.com