



**PLEASE READ AND UNDERSTAND
THIS MANUAL BEFORE
USING SAVA PNEUMATIC
PIPE PLUGS**

PNEUMATIC PIPE PLUGS

SAFETY INSTRUCTION MANUAL



Savatech, d.o.o.
Škofjeloška 6, 4000 Kranj, Slovenia
Tel.: +386 4 2066 388, Fax: +386 4 2066 390

**NONOBSERVANCE OF INSTRUCTIONS AND WARNINGS FOR SAFE OPERATION OF PNEUMATIC
PLUGS CAN DAMAGE PRODUCTS, CAUSE SERIOUS BODILY INJURIES OR EVEN DEATH.**



TWELVE RULES FOR SAFE OPERATION OF PNEUMATIC PLUGS

1. Stay clear of the plug when under pressure (11)
2. Always wear protective clothing and equipment (5)
3. Always use accurate air pressure gauges (3)
4. Never exceed the maximum inflation pressure for the plug (8)
5. Never exceed the maximum allowable back pressure (9)
6. Always provide support and/or bracing to secure the plug when back pressure is present (10)
7. Always release the back pressure first before deflating the pneumatic plug (12)
8. Before and after each use, clean the plug and inspect for surface tears, cuts or any other damage (2)
9. Always choose the proper size of pneumatic plugs (4)
10. Before insertion of the pneumatic plug thoroughly clean the pipeline (6)
11. Always correctly insert the pneumatic plug into pipeline (7)
12. Always determine the back pressure that the pneumatic plug will have to resist during the application. (1)

SIX STEPS FOR USE OF PNEUMATIC PLUGS FOLLOWING THE TWELVE RULES FOR SAFE OPERATION

HOW TO CHOOSE THE CORRECT PNEUMATIC PLUG?

1. Always determine the back pressure that the plug will have to resist during use
2. Always choose the proper size of the plug by measuring the internal diameter of the pipe

HOW TO PREPARE THE PNEUMATIC PLUG AND THE PIPELINE?

1. Prior to each and every use, clean and inspect the plug for any visible surface tears, cuts or any other damage
2. Always check air line connections and hoses to make sure they are not leaking
3. Always remove dirt and debris from the pipe before inserting the plug

USE OF SAFETY DEVICES

1. Always wear protective clothing and equipment
2. Always use safety support or bracing for the plug
3. Use only properly calibrated air pressure gauges

CORRECT INSERTION OF THE PLUG INTO THE PIPE

1. Be sure that the plug is fully inserted into the pipe so that no part of its is protruding when inflated
2. At first, inflate the plug only until it touches the pipe wall. Then slowly and carefully build up the pressure up to the maximum allowable inflation pressure

PROPER USE OF THE PLUG INSIDE THE PIPE

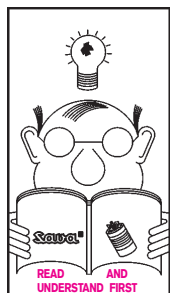
1. Stay clear of the pneumatic plug while inflated
2. Never exceed the maximum inflation pressure for the plug in use
3. Never exceed the maximum allowable back pressure

PROPER REMOVING OF THE PLUG FROM THE PIPE

1. Always release the back pressure before deflating the plug
2. Do not pull on the air hose to remove the plug



INSTRUCTIONS FOR SAFE OPERATION



Instructions for safe and correct operation of Sava pneumatic plugs

WARNING!

BEFORE USE OF SAVA PNEUMATIC PLUGS, PLEASE READ THE INSTRUCTIONS VERY CAREFULLY. THE INSTRUCTIONS APPLY TO ALL SIZES AND TYPES OF SAVA PNEUMATIC PLUGS. THE INSTRUCTIONS MUST BE MADE AVAILABLE FOR ALL USERS OF SAVA PNEUMATIC PLUGS.

Recommendations, demands and instructions for use of Sava pneumatic plugs apply to all sizes and types of Sava pneumatic plugs.

Instructions given for construction, production and inspection of Sava products always include a high level of safety which does not bind the manufacturer only but the user as well. The user and the manufacturer shall always bear in mind safe and correct procedures when using Sava pneumatic plugs.

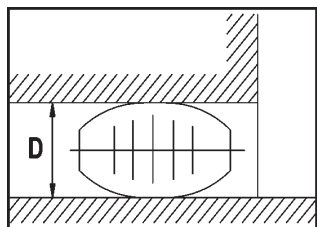
Read instructions carefully. Should you have any questions or if any extraordinary circumstances appear - not stated and described in this brochure - consult your supervisor or safety engineer.

Additional copies of this brochure are always available from Savatech - **Environmental Protection Products**. If you require additional copies or you have any question please do not hesitate to contact us (phone No. +386 4 2066 388).

1. Always determine the back pressure that the pneumatic plug will have to resist during the application

WARNING!

DURING USE OF THE PNEUMATIC PLUG - WHEN IT IS INSERTED IN A PIPELINE AND FILLED WITH AIR - POWERFUL FORCES MAY EMERGE IN AND BEHIND THE PLUG. THE TOTAL FORCE IMPACTING THE PNEUMATIC PLUG IS PROPORTIONAL TO THE PRESSURE AS WELL AS THE SURFACE OF THE PIPELINE OPENING. BACK PRESSURE LEVELS FOR INDIVIDUAL SAVA PNEUMATIC PLUGS ARE GIVEN IN THE TABLES AT THE END OF THE BROCHURE.

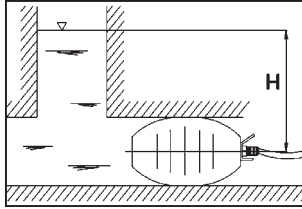


1. Measure the inner diameter D (mm) (in) of a pipeline to be blocked with the pneumatic plug.
2. Calculate the surface S (mm²) of the pipeline cross-section according to the following equation:

$$S = \pi \cdot \frac{D^2}{4} \quad (\text{mm}^2) \quad (\text{in}^2)$$

where $\pi = 3,1416$

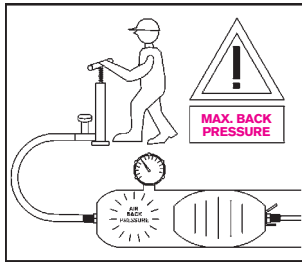
D - inner pipe diameter (mm) (in)



3. Calculate the total force that the plug has to resist according to the following equation:

$$F = p_z \cdot S \cdot 0.1 \text{ (N)}$$

$$F = p_z \cdot S \text{ (Lbf)}$$

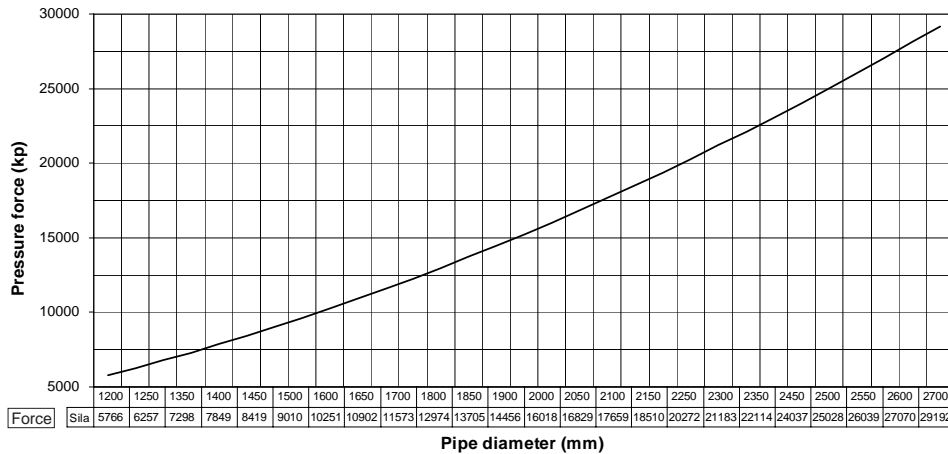


where

S - cross-section surface (mm²) (in²)

p_z - back pressure (bar) (PSI)

Force in plug as result of back pressure 0.5bar



The back pressure P_z is defined with the water column height behind the plug, e.g. a 10-meter-high (32,8 ft) water column means a back pressure of 1 bar (14,4 PSI), the surface size and the water column shape are not important, the height is only important.

Hydrostatic pressure (water column pressure) depends on the water level height h above the measurement spot and not on the shape.

Should any questions regarding the equations arise, please consult your supervisor or responsible engineer.

2. Before and after each use, clean the plug and inspect for surface tears, cuts or any other damage

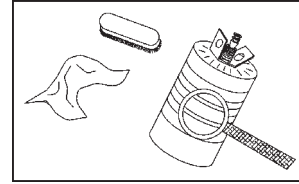
Sava pneumatic plugs can be cleaned with a solution of water and detergent. After cleaning, dry the plug.



WARNING!

NEVER CLEAN WITH SOLVENTS, HYDROCARBONS AND OTHER AGGRESSIVE AGENTS FOR THE PLUG CAN BE DAMAGED OR EVEN DESTROYED.

Before and after use carefully check the pneumatic plug for any damages, such as cuts, blisters between rubber layers, worn out parts, damaged connections, etc.



3. Always use accurate air pressure gauges

The pneumatic packer may only be connected and operated through a single fitting controller or a comparable controller with a pressure regulator (1.5 or 2.5 bar).

Always carefully check plug inflation hoses, control and safety devices, and replace them, if required. See that safety valves, pressure valves and clamps are clean which will assure undisturbed and correct plug operation.

WARNING!

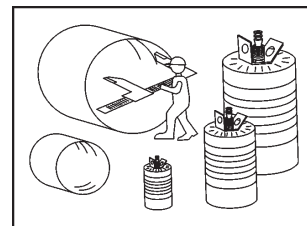
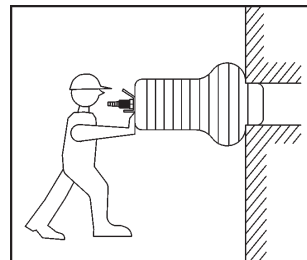
IF YOU SUSPECT THAT THE PNEUMATIC PLUG OR ACCESSORIES ARE DAMAGED, CONSULT SAVA REPRESENTATIVE AND AGREE ON RETURNING OF THE PRODUCT TO BE INSPECTED AT SAVA OR SCRAP THE PRODUCT AND REPLACE IT WITH A NEW ONE. IF YOU NOTICE ANYTHING EXTRAORDINARY, REMOVE THE PLUG AND ADVISE THE SUPERVISOR OR SAFETY ENGINEER.

4. Always choose the proper size of pneumatic plugs

For each Sava pneumatic plug the lower and upper range of application is defined. The nominal size of the plug or the range in which it may be used is clearly marked on the plug itself.

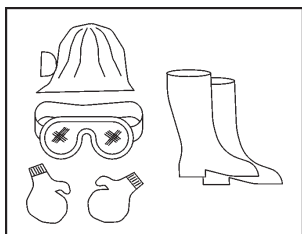
Before using the pneumatic plug always:

- measure the inner pipeline diameter in which the plug will be inserted
- make sure the pipeline diameter is within the range defined for the plug



WARNING!

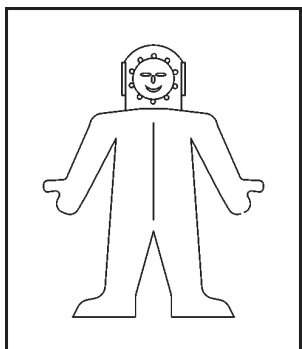
NEVER USE THE PLUG IN PIPELINES OF A LARGER OR SMALLER DIAMETER AS DEFINED FOR THE RANGE OF APPLICATION.



5. Always wear protective clothing and equipment

When handling Sava pneumatic plugs always use required protective equipment (goggles, helmet, ear plugs and clothing).

The use of protective equipment depends on circumstances in which pneumatic plugs are used.

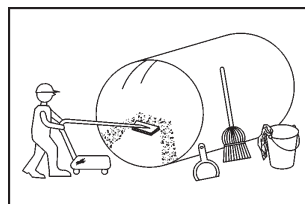


WARNING!

ALWAYS WEAR PROTECTIVE GOGGLES, HELMET AND GLOVES.

6. Before insertion of the pneumatic plug thoroughly clean the pipeline

The pipeline should be properly cleaned, all sharp particles removed in order to prevent poor sealing and decrease of back pressure values as well as possible damages of pneumatic plugs. There are several ways to clean the pipe: high water pressure and cleaning with the so called milling robots at the simultaneous water injection.



WARNING!

DIRT OR SHARP PARTICLES IN THE PIPELINE CAN CAUSE POOR SEALING OR EVEN DAMAGES TO THE PNEUMATIC PLUG.

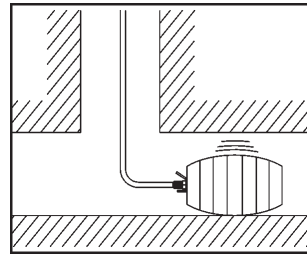
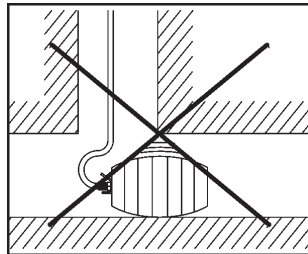
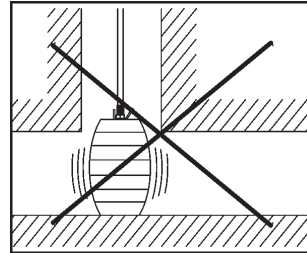
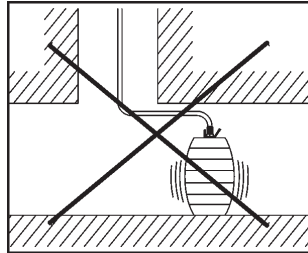
7. Always correctly insert the pneumatic plug into pipeline

Before inflating pneumatic plug with air, place it correctly in the pipeline: the shortest distance from the beginning of the pipeline to the pneumatic plug shall equal the pipeline diameter. During inflation some of the plugs expand also in axial direction.



DANGER

Before and during inserting pneumatic plugs follow the four basic rules:



1. NEVER INFLATE PNEUMATIC PLUG OUTSIDE THE PIPE
2. NEVER INFLATE PNEUMATIC PLUG IN DIRTY PIPE OR WHEN SHARP PARTICLES ARE PRESENT
3. PNEUMATIC PLUG MAY NOT SPACE OUT OF THE PIPE
4. NEVER INFLATE PNEUMATIC PLUG THROUGH OPENING



8. Never exceed the maximum inflation pressure for the plug

Inflate the plug only to the prescribed inflation pressure. The correct inflation pressure is clearly marked on each product and given in the tables at the end of the brochure. During work with plugs accurately measure and pursue the inflation and back pressure values.

Pneumatic plugs are designed for temporary pipeline blocking which is why it is required to check the pressure at least every 5 hours.



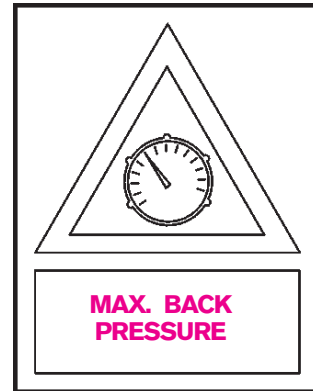
WARNING!

ALWAYS USE ACCURATELY CALIBRATED GAUGES. EXCEEDING PRESCRIBED INFLATION PRESSURE CAN DAMAGE OR EVEN DESTROY THE PLUG. UNDERINFLATED PLUGS CAN SLIP OUT OF THE PIPELINE.

NOTE: The prescribed inflation pressure is both the maximum as well as the minimum inflation pressure. It is the only inflation pressure at which the pneumatic plug will hold the maximum allowable back pressure.

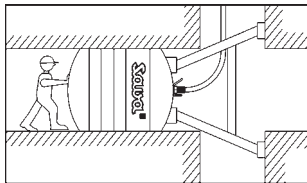
9. Never exceed the maximum allowable back pressure

Maximum back pressures are defined for those Sava pneumatic plugs which are inserted into clean and dry plugs. Dirt in pipes (algae, grease, detergents, mildew, sand etc. can considerably decrease the back pressure values. Pipelines made of materials with lower coefficient of friction, e.g. polyethylene or new pipelines with remains of grease or agents directly decrease the coefficient of friction as well as the back pressure values.



WARNING!

IF SUCH CIRCUMSTANCES ARISE, IMMEDIATELY CONTACT THE SUPERVISOR OR SAFETY ENGINEER IN ORDER TO DEFINE PROPER MEASURES, E.G. PIPELINE CLEANING BEFORE INSERTION OF THE PNEUMATIC PLUG.



10. Always provide support and/or bracing to secure the plug when back pressure is present

DANGER

IN CASES WHEN REACHING AND EXCEEDING THE LIMIT BACK PRESSURE IS ANTICIPATED, ANCHORING OR BRACING MUST ALWAYS BE USED IN ORDER TO SAFELY PREVENT THE PLUG FROM SLIPPING. (FOR AXIAL FORCES SEE DIAGRAM/TABLE ON PAGE 4).

THE WATER PRESSURE IN THE PIPE MAY NOT EXCEED 0.5 BAR = 5M WATER COLUMN.

Never use ring bolts or holders fitted on the plug as a safety device for they are only intended for lowering and lifting of pneumatic plugs. They are not designed to transfer powerful forces initiated by back pressures.



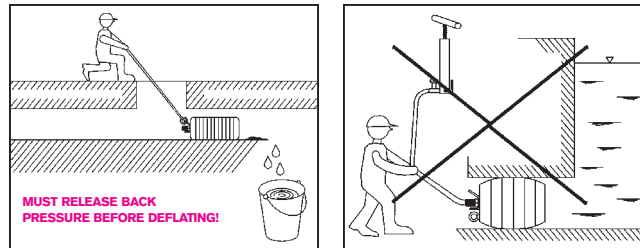
11. Stay clear of the plug when under pressure

It is dangerous to stand near a pipe or a manhole containing a pneumatic plug under pressure.



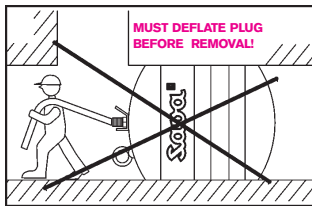
DANGER

STAY CLEAR OF THE DANGER ZONE. NOT FOLLOWING THE INSTRUCTIONS CAN RESULT IN SERIOUS INJURIES OR EVEN DEATH.



12. Always release the back pressure first before deflating the pneumatic plug

Before deflating the pneumatic plug completely, release the back pressure. Only then the pressure in the plug can be released through the inflation hose. Pneumatic plug must be completely deflated before removing from the pipeline.



WARNING!

REMOVE THE PLUG ONLY WHEN COMPLETELY DEFLATED. NEVER REMOVE IT WITH INFLATION HOSE. ALWAYS APPLY A ROPE IN RING BOLTS OR HOLDERS. USE OF THE INFLATION HOSE CAN DAMAGE THE PLUG OR THE INFLATION HOSE TO WHICH THE USE OF THE PLUG ITSELF OR ITS ACCESSORIES CAN BE DANGEROUS.



LIMITED WARRANTY

Manufacturer warrants all pneumatic plugs manufactured by it and shown in this manual will be free from defects in material and workmanship for twelve (12) months following the date of delivery. If any of the goods are found to be defective, such goods will, at manufacturer's option, be replaced or repaired at manufacturer's cost. The parties hereto expressly agree that buyer's sole and exclusive remedy against the manufacturer shall be for the repair or replacement of defective goods, or returning of the purchase price as provided herein. The main purpose of the stipulated shall be to provide the buyer with free repair and replacement of defective goods in the manner provided herein. The exclusive remedy shall not be deemed to have failed of its essential purpose as long as the manufacturer is willing and able to repair or replace defective goods in the prescribed manner. Goods which may be sold by manufacturer but are not manufactured by it are not warranted by manufacturer, but are sold only with the warranties, if any, of the original manufacturer thereof. Manufacturer's warranty does not apply to any goods which have been subjected to misuse, mishandling, misapplication, neglect (including but not limited to use of unauthorised parts or attachments), or adjustment or repair performed by anyone other than manufacturer or one of manufacturer's authorised agents.

Any claim by buyer with reference to the goods sold hereunder shall be deemed waived by the buyer unless submitted in writing to manufacturer within the earlier of (i) eight (8) days following the date buyer discovered, any claimed breach of the foregoing warranty, or (ii) twelve (12) months following the date of delivery. Any cause of action for breach of the foregoing warranty shall be brought within one year from the date the alleged breach was discovered or should have been discovered, whichever comes first.

LIMITATION OF LIABILITY. Manufacturer's liability (whether under the theories of breach of contract or warranty, negligence, or strict liability) for its goods shall be limited to repairing or replacing parts found by the manufacturer to be defective, or at manufacturer's option, to refunding the purchase price of such goods or parts thereof.

DISCLAIMER OF CONSEQUENTIAL DAMAGES. In no event shall manufacturer be liable for consequential damages arising out or in connection with this agreement, including without limitation breach of any obligation imposed on manufacturer hereunder or in connection herewith. Consequential damages for purposes hereof shall include, without limitation, (including death) to any person, or loss of or damage property (including without limitation property handled or processed by the use of the goods). Buyer shall indemnify manufacturer against all liability, cost or expense which may be sustained by manufacturer on account of any such loss, damage or injury.

DEFECTIVE PRODUCTS POLICY. To obtain performance under this warranty, any product suspected of having a manufacturing defect in materials or workmanship at manufacturer's request must be returned to Savatech, družba za proizvodnjo in trženje gumenotehničnih proizvodov in pnevmatike, d.o.o., Škofjeloška c. 6, 4000 Kranj, Slovenia, freight prepaid, for inspection. Manufacturer obliges itself to decide upon the justification of the claim within forty-five (45) days following the date manufacturer receives such a claim.

CUSTOMER TRANSPORTATION REIMBURSEMENT. Whenever manufacturer repairs or replaces a product at manufacturer's expense, or returns the purchase price, manufacturer will reimburse the distributor by credit note, the same surface freight amount it costs manufacturer to return the warranty items, or in the event of returning the purchase price the cost manufacturer would pay returning the warranty items.

The foregoing warranty is in lieu of all other warranties expressed or implied, including those of merchantability or fitness for any purpose not expressly set forth herein. No affirmation of manufacturer, by words or action, other than as set forth herein shall constitute a warranty. The rules of UN Convention on contracts for the international sale of goods shall not apply.

NONOBSERVANCE OF INSTRUCTIONS AND WARNINGS FOR SAFE OPERATION OF PNEUMATIC PLUGS CAN DAMAGE PRODUCTS, CAUSE SERIOUS BODILY INJURIES OR EVEN DEATH.