

**PRIJE UPORABE**  
**trebate pažljivo pročitati i razumjeti upute za**  
**uporabu**

# PNEUMATSKI ČEPOVI

**UPUTE ZA SIGURNO KORIŠTENJE**

**Nepoštivanje uputa i sigurnosnih mjera sa radom s pneumatskim čepovima mogu dovesti do TEŠKIH OZLJEDA ili čak SMRTI.**

## DVANAEST PRAVILA ZA SIGURAN RAD SA PNEUMATSKIM ČEPOVIMA

1. Nemojte stajati u blizini čepa kada je pod pritiskom (11)
2. Uvijek koristite zaštitnu odjeću i opremu (5)
3. Uvijek koristite precizno kalibrirane instrumente (3)
4. Nikad ne prelazi maksimalni tlak punjenja (8)
5. Nikad ne prelazi preporučenu maksimalnu vrijednost protutlaka (9)
6. Uvijek koristite sigurnosnu podršku (potporu) u slučaju protutlaka da zaštitite čep (10)
7. Uvijek ispuštite pritisak iz segmenta (protutlak), a zatim ispuštite pneumatski čep (12)
8. Prije i nakon svake uporabe, očistite čep i provjerite da njegova površina nije oštećena, zarezana ili da nema nekih drugih vrsta oštećenja (2)
9. Uvijek odaberite pravu veličinu pneumatskog čepa (4)
10. Prije umetanja pneumatskog čepa, temeljito očistite cijev (6)
11. Uvijek ispravno umetnite pneumatski čep u cijev (7)
12. Uvijek utvrditi iznos protutlaka pneumatskog čepa koji mora izdržati tijekom uporabe (1)

## ŠEST KORAKA ZA UPOTREBU PNEUMATSKIH ČEPOVA POVEZANIH SA DVANAEST PRAVILA ZA SIGURAN RAD

### KAKO IZABRATI PRAVI PNEUMATSKI ČEP?

1. Uvijek odredite protutlak koji pneumatski čep mora izdržati pri upotrebi.
2. Uvijek izaberite pravu veličinu čepa na način da prije izmjerite unutrašnji promjer cijevi.

### KAKO PRIPREMITI PNEUMATSKI ČEP ZA CIJEV?

1. Prije svake upotrebe čep očistite i pregledajte da na površini nema razderotina, zareza ili nekakvih drugih oštećenja.
2. Uvijek provjerite priključke na čepu da ne puštaju.
3. Prije umetanja čepa u cijev uvijek ukloniti prljavštinu i blato iz cijevi (sve nečistoće).

### UPOTREBA SIGURNOSNIH NAPRAVA

1. Uvijek upotrebljavajte zaštitnu odjeću, obuću i opremu.
2. Uvijek upotrebljavajte sigurnosne potpore za čep.
3. Upotrebljavajte samo pravilno kalibrirane (umjerene) manometre.

### PRAVILNO UMETANJE ČEPA U CIJEV

1. Provjerite je li čep potpuno umetnut u cijev, tako da nijedan dio ne strši iz cijevi kada je čep napuhan.
2. Prvo, ispunite (napuhajte čep) tako da dodiruje stijenku cijevi. Zatim polako i oprezno povećavajte pritisak do najvećeg dozvoljenog radnog tlaka.

### PRAVILNA UPOTREBA ČEPA UNUTAR CIJEVI

1. Ne zadržavajte se u blizini čepa kada je napuhan.
2. Nikada nemojte prekoračiti najveći dozvoljeni tlak punjenja čepa (radni tlak čepa).
3. Nikada nemojte prekoračiti najveći dopušteni protutlak.

### ISPRAVNO ODSTRANJIVANJE ČEPA IZ CIJEVI

1. Uvijek prvo ispuštite protutlak, a zatim ispuštite zrak iz čepa.

## UPUTE ZA UPOTREBU ČEPOVA

Pri upotrebi čepova potrebno je poštivati kombinaciju: izvor zraka - tlačni regulator - kontrolni manometar - dovodna cijev za zrak - čep, s čime sprečavamo da bi pri punjenju čepa prekoračili dozvoljeni tlak. Nikada se ne smije zaobići korištenje kontrolnog manometra (tlačnog regulatora) pri punjenju čepa. Kontrolni manometar je opremljen sigurnosnim ventilom koji je kalibriran u odgovarajućem rasponu tlaka (svakako je potrebno obratiti pozornost na tlak za koji je dizajniran kontrolni manometar).

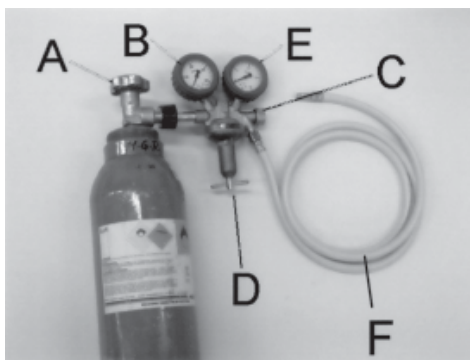
Pred uporabo čepov je potrebno najprej s tlačnim regulatorjem nastaviti tlak, ki je napisan na kontrolerju. Velikost tlaka ne sme preseči vrednosti, ki je označena kot maksimalni dovoljeni vstopni tlak. Čep preko cevi povežemo s kontrolerjem, ki je povezan z izvorom zraka in ga pravilno vstavimo v cev, ga podpremo in se umaknemo iz nevarnega območja. Šele v trenutku ko smo upoštevali vse varnostne ukrepe lahko odpremo ventil za polnjenje čepa na kontrolerju. Med napihovanjem kontroliramo delovni tlak na manometru. Ko dosežemo maksimalni dovoljeni tlak v čepu prenehamo s polnjenjem. V primeru daljše časovne uporabe čepa je možen padec tlaka v čepu, zato je potrebna vmesna kontrola. Če pride do padca tlaka ga je potrebno ustrezno korigirati.

### Dovod zraka

Za napihovanje čepov se lahko uporablja vsak izvor zraka, ki ne presega maksimalnega vstopnega tlaka na kontrolerju. Če je dovodni tlak višji je potrebno uporabiti tlačni regulator. Če stisnjen zrak vsebuje olje, uporabite oljni separator.

### Uporaba jeklenke s stisnjnim zrakom pod tlakom 200 ali 300 barov

Tlačni regulator preko nastavka z navojem priključite na jeklenko s stisnjnim zrakom. Zaprite izhod zraka na tlačnem regulatorju, tako da privijete regulacijski vijak (C) reduktorja. Odprite ventil jeklenke (A); manometer (B) kaže zračni tlak v jeklenki.

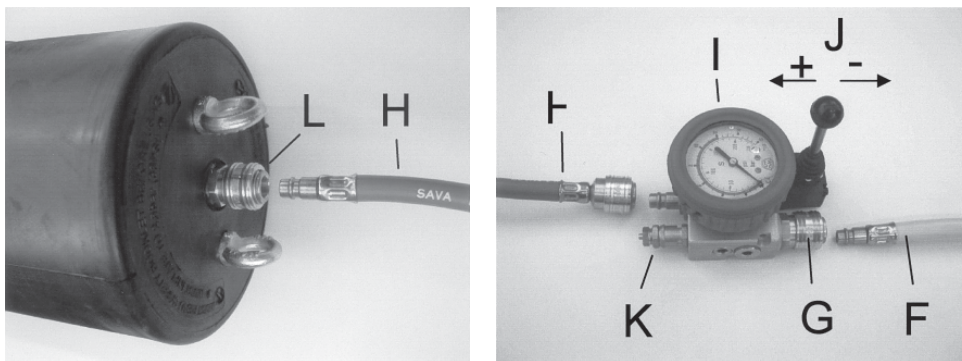


Z regulacijskim ventilom (D) nastavite izhodni tlak na vrednost, ki je ustrezna za kontroler. Velikost nastavljenega tlaka je prikazana na manometru (E); ponovno odprite regulacijski vijak (C).

### Napuhovanje čepov s kontrolnikom,

Pomembno je, da povežete cev za zrak na tlačnem regulatorju (F) s kontrolnikom (G). Povežite cevi tako, da moški del vstavite v ženskega in pritisnete, da se zaskoči.

Kontrolnik preko cevi za zrak (H) povežite s čepom (L). Vtič na dovodni cevi se vstavi v spojko na čepu. Uporabi se taka potisna sila, da se vtič v spojko zaskoči.



Če uporabljate druge izvore stisnjenega zraka, nujno nastavite dohodni tlak na vrednost, ki ne sme preseči maksimalnega vstopnega tlaka, ki je označen na kontrolniku.

Čep napolnite tako, da potisnete ročico (J) proti manometru. Sprotno preverjajte manometer (I), ki kaže dosežen tlak v čepu.

Ko dosežete delovni tlak, polnjenje prekinite, tako da ročico sprostite. Ročica se avtomatsko povrne v nevtralni položaj (položaj varnostne zapore).

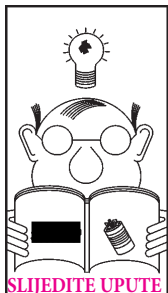
Če tlak v čepu preseže maksimalni polnilni tlak, ki je označen na kontrolerju, ga varnostni ventil (K) avtomatsko sprosti.

Kadar želite čepe sprazniti oz. zmanjšati tlak v čepu uporabite ročico (J), ki jo pomaknete v smeri proč od manometra.

### Uporaba drugih izvorov stisnjenega zraka

Za druge izvore stisnjenega zraka (industrijske instalacije, kompresorji, ...) je potrebno uporabiti različne adapterje. Če maksimalni tlak izvora stisnjenega zraka presega maksimalni vstopni tlak, ki je označen na kontrolniku, uporabite tlačni regulator in zmanjšajte tlak na predpisano vrednost.

## NAVODILA ZA VARNO DELO



Navodila za varno in pravilno delo s Savinimi pnevmatskimi čepi.

### OPOZORILO!

**PREDEN UPORABITE SAVINE PNEVMATSKE ČEPE NATANČNO PREBERITE NAVODILA. NAVODILA VELJAJO ZA VSE VELIKOSTI IN TIPE SAVINIH PNEVMATSKIH ČEPOV. NAVODILA MORAJO BITI NA VOLJO VSEM UPORABNIKOM SAVINIH PNEVMATSKIH ČEPOV.**

Priporočila, zahteve in navodila za uporabo Savinih pnevmatskih čepov veljajo za vse velikosti in tipe Savinih pnevmatskih čepov.

Navodila za konstrukcijo, proizvodnjo in kontrolo Savinih produktov vedno upoštevajo visoko stopnjo varnosti, ki ne zavezuje samo proizvajalca temveč tudi uporabnika. Uporabnik in proizvajalec morata pri uporabi Savinih pnevmatskih čepov vedno upoštevati navodila za varno in pravilno delo.

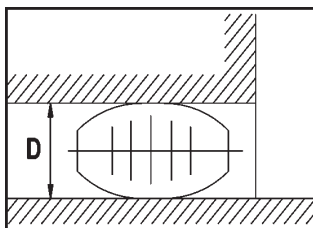
Natančno preberite navodila. V primeru kakršnihkoli vprašanj ali v primeru, da nastopijo posebne okoliščine, ki niso opisane v tem priročniku, se posvetujte s svojim nadzornim delavcem ali varnostnim inženirjem.

Dodatne kopije tega priročnika lahko vedno dobite v Savatech – EKO program. Če želite dodatne kopije ali če imate kakšno vprašanje, nas pokličite (telefon +386 04 2066 388).

### 1. Vedno določite zastojni tlak, ki ga pnevmatski čep med uporabo mora zdržati

#### OPOZORILO!

**MED UPORABO PNEVMATSKEGA ČEPA – KO JE LE-TA VSTAVLJEN V CEV IN NAPOLNjen Z ZRAKOM – LAHKO V IN ZA ČEPOM NASTANEJO OGROMNE SILE. SKUPNA SILA, KI DELUJE NA PNEVMATSKI ČEP JE PREMOSORAZMERNNA S TLAKOM KOT TUDI S POVRŠINO ODPRTINE CEVI. VIŠINE ZASTOJNIH TLAKOV ZA POSAMEZEN PNEVMATSKI ČEP SO NAVEDENE V TABELAH NA KONCU TEGA PRIROČNIKA.**

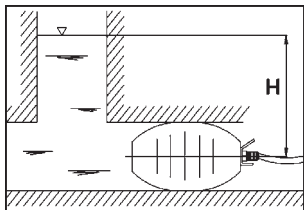


1. Izmerite notranji premer D (mm) cevi, ki bo zaprta s pnevmatskim čepom.
2. Izračunajte površino S (mm<sup>2</sup>) prereza cevi po naslednji enačbi:

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

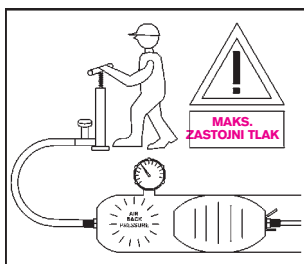
kjer je  $\pi = 3,1416$

D – notranji premer (mm) (in)



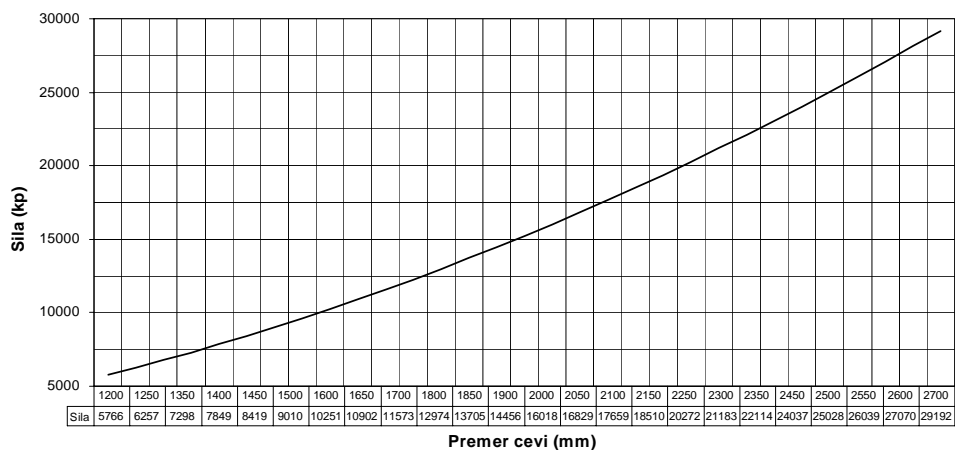
3. Izračunajte skupno silo, ki jo čep mora zdržati, po naslednji formuli:

$$F = p_z \cdot S \cdot 0,1 \text{ (N)}$$



kjer je  
 S - površina prereza (mm<sup>2</sup>)  
 p<sub>z</sub> - zastojni tlak (bar)

**Sila v cevi kot posledica zastojnega tlaka 0.5bar**



Zastojni tlak P<sub>z</sub> je določen z višino vodnega stolpca za čepom, npr. 10 m visko vodni stolpec pomeni zastojni tlak 1 bar, velikost površine in oblika vodnega stolpca nista pomembni temveč je pomembna le višina.

Hidrostatski pritisk (pritisk vodnega stolpca) je odvisen od nivoja višine vode h nad merilnim mestom in ne od oblike.

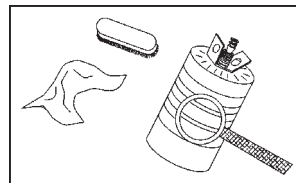
Če imate v zvezi s temi enačbami kakšna vprašanja, se posvetujte s svojim nadzornim delavcem ali odgovornim inženirjem.

- 2. Pred in po vsaki uporabi očistite čep in preverite, da na površini nima raztrganin, zarez ali kakšnih drugih poškodb**

Savine pnevmatske čepe lahko očistite z raztopino vode in detergenta. Po čiščenju čep

### **OPOZORILO!**

NIKOLI ZA ČIŠČENJE NE UPORABLJAJTE TOPIL, OGLJIKOVIH HIDRATOV IN DRUGIH AGRESIVNIH SREDSTEV. UPORABA TAKŠNIH SREDSTEV LAHKO POŠKODUJE ALI CELO UNIČI ČEP.



Pred in po vsaki uporabi preverite, da pnevmatski čep nima kakšnih poškodb kot npr. zareze, mehurje med gumenimi plastmi, obrabljenih delov, poškodovanih priključkov, itd.

### **3. Vedno uporabite natančno umerjene manometre**

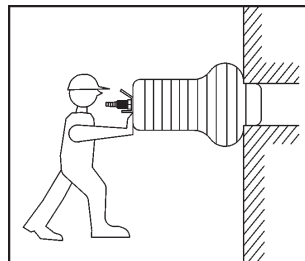
Vedno skrbno preglejte cevi za polnjenje čepa, krmilne in varnostne naprave in jih po potrebi zamenjajte. Pazite, da so varnostni ventili, tlačni ventili in prižeme vedno čiste, kar je zagotovilo za nemoteno in pravilno delovanje čepa.

### **OPOZORILO!**

ČE SUMITE, DA JE PNEVMATSKI ČEP ALI OPREMA POŠKODOVAN, SE POSVETUJTE S SAVINIM PREDSTAVNIKOM IN SE DOGOVORITE ZA VRNITEV PRODUKTA NA PREGLED V SAVO ALI PA IZDELEK UNIČITE IN GA NADOMESTITE Z NOVIM. ČE OPAZITE KARKOLI NENAVADNEGA, ODSTRANITE ČEP IN SE POSVETUJTE Z NADZORNIM DELAVCEM ALI VARNOSTNIM INŽENIRJEM.

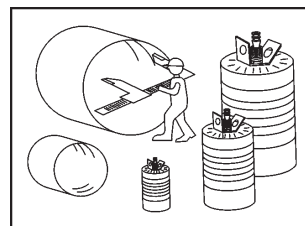
### **4. Vedno izberite pravo velikost pnevmatskega čepa**

Za vsak Savin pnevmatski čep je definirano spodnje in zgornje območje uporabe. Nominalna velikost čepa ali obseg, v katerem čep lahko uporabljate, sta jasno označena na samem čepu.



Pred uporabo pnevmatskega čepa vedno:

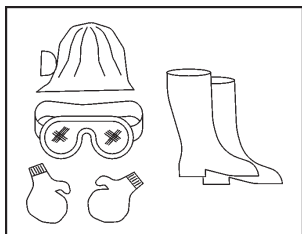
- izmerite notranji premer cevi, v katero boste vstavili čep
- se prepričajte, da je premer cevi v območju določenem za čep



### **OPOZORILO!**

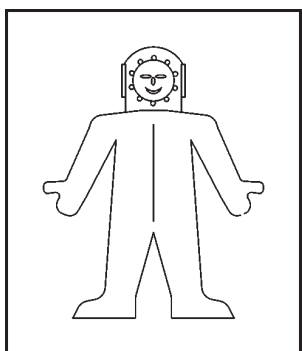
NIKOLI NE UPORABITE ČEPA V CEVEH, KATERIH PREMER JE VEČJI ALI MANJŠI KOT JE DEFINIRAN Z OBMOČJEM UPORABE.

## 5. Vedno uporabljajte zaščitno obleko in opremo



Pri delu s Savinimi pnevmatskimi čepi vedno uporabljajte predpisano zaščitno opremo (očala, čelada, ušesni čepi in obleko).

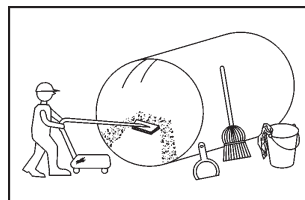
Uporaba zaščitne obleke je odvisna od okoliščin v katerih se uporablja pnevmatski čep.



**OPOZORILO!**  
VEDNO NOSITE ZAŠČITNA OČALA, ČELADO IN ROKAVICE.

## 6. Pred vstavitvijo čepa temeljiti očistite cev

Cev mora biti ustrezno očiščena, vse ostre delce je potrebno odstraniti zato, da preprečite slabo tesnenje in znižanje vrednosti zastojnega tlaka kot tudi možne poškodbe pnevmatskega čepa. Obstaja nekaj načinov čiščenja cevi: voda pod visokim tlakom ali t.i. frez-avtomati ob istočasnem vbrizgu vode.



**OPOZORILO!**  
UMAZANIJA ALI OSTRI DELCI V CEVI LAHKO POVZROČIJO SLABO TESNENJE ALI CELO POŠKODUJEJO PNEVMATSKI ČEP.

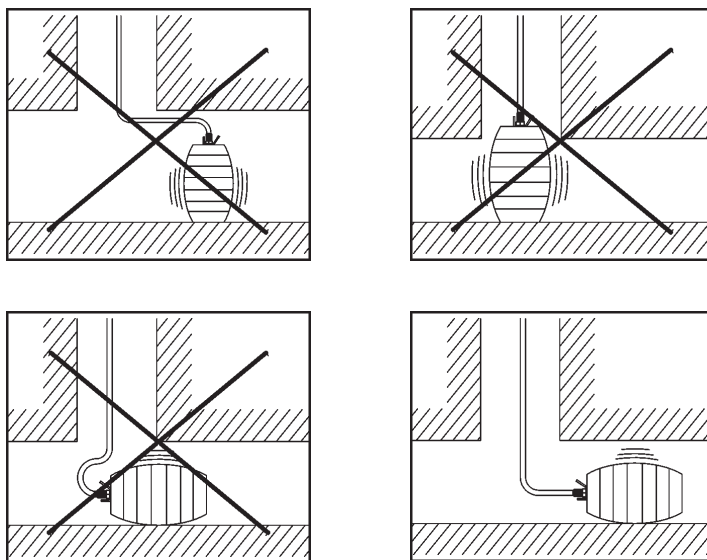
## 7. Vedno pravilno vstavite pnevmatski čep v cev

Pred polnjenjem pnevmatskega čepa z zrakom, čep pravilno vstavite v cev: najkrajša razdalja od začetka cevi do pnevmatskega čepa mora biti enaka premeru cevi. Med polnjenjem se nekateri od čepov raztezajo tudi v aksialni smeri.



## NEVARNOST!

Pred in med vstavljanjem pnevmatskih čepov upoštevajte štiri osnovna pravila:



1. NIKOLI NE POLNITE PNEVMATSKEGA ČEPA IZVEN CEVI
2. NIKOLI NE POLNITE PNEVMATSKEGA ČEPA V UMAZANI CEVI ALI KADAR SO V CEVI OSTRI DELCI
3. PNEVMATSKI ČEPI NE SME ŠTRLETI IZ CEVI
4. NIKOLI NE POLNITE PNEVMATSKEGA ČEPA SKOZI ODPRTINO.

### 8. Nikoli ne prekoračite maksimalnega polnilnega tlaka



Čep napolnite samo do predpisanega polnilnega tlaka. Pravilni polnilni tlak je jasno označen na vsakem produktu in je naveden na tabelah na koncu vsakega priročnika. Med delom s čepi natančno izmerite in spremljajte vrednosti polnilnega in zastojnega tlaka.

Pnevmatski čepi so konstruirani za začasno zaporo cevi, zaradi česar je potrebno zastojni tlak preveriti vsaj vsakih pet ur.

### **OPOZORILO!**

**VEDNO UPORABLJAJTE NATANČNO UMERJENE MANOMETRE, PREKORAČITEV PREDPISANEGA POLNILNEGA TLAKA LAHKO POŠKODUJE ALI CELO UNIČI ČEP. PRENIZKI POLNILNI TLAKI LAHKO POVZROČIJO ZDRS ČEPA IZ CEVI.**

OPOMBA: Predpisani polnilni tlak je tako največji kot najmanjši polnilni tlak. Je edini polnilni tlak, pri katerem pnevmatski čep zdrži največji dovoljeni zastojni tlak.

### **9. Nikoli ne prekoračite največjega dovoljenega zastojnega tlaka**

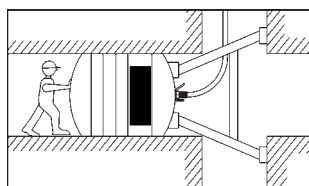
Največji zastojni tlaki so definirani za tiste Savine pnevmatske čepe, ki so vstavljeni v čiste cevi. Umazanija v ceveh (alge, maščobe, detergenti, plesni, pesek itd.) lahko znatno znižajo vrednosti zastojnega tlaka. Cevi, ki so izdelane iz materialov z nižjimi koeficienti trenja, npr. polietilen ali nove cevi z ostanki maščob ali drugih sredstev, direktno znižujejo koeficient trenja in s tem vrednosti zastojskih tlakov.



### **OPOZORILO!**

**KADAR NASTOPIJO TAKE OKOLIŠČINE, SE TAKOJ POSVETUJTE S SVOJIM NADZORNIM DELAVCEM ALI VARNOSTNIM INŽENIRJEM, KI BOSTA DOLOČILA POTREBNE UKREPE, T.J. ČIŠČENJE CEVI PRED VSTAVITVIJO PNEVMATSKEGA ČEPA.**

### **10. Vedno uporabite podporo, ki zavaruje čep v primeru zastojnega tlaka**



### **NEVARNOST!**

**V PRIMERIH, KO SE PRIČAKUJE, DA BO MEJNI ZASTOJNI TLAK DOSEŽEN IN PREKORAČEN, JE POTREBNO VEDNO UPORABITI PODORO, KI BO PREPREČILA ZDRS ČEPA.**

Nikoli ne uporabljajte ušesc ali ročajev na čepu, ker so ti namenjeni samo za spuščanje in dviganje pnevmatskega čepa in niso konstruirani, da bi prenesli močne sile, ki jih ustvarijo zastojski tlaki.

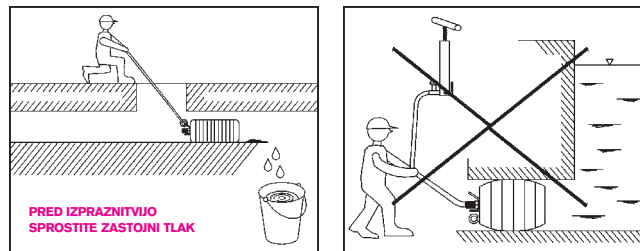
## 11. Ne zadržujte se v bližini čepa, ko je ta pod pritiskom

Nevarno se je zadrževati v bližini čepi ali odprtine, ki vsebuje pnevmatski čep pod pritiskom.



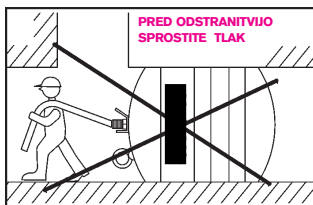
### NEVARNOST

NE ZADRŽUJTE SE V NEVARNEM OBMOČJU. NEUPOŠTEVANJE NAVODIL SE LAHKO KONČA S POŠKODBAMI ALI CELO SMRTJO.



## 12. Vedno sprostite zastojni tlak in šele nato izpraznite pnevmatski čep

Pred izpraznitvijo pnevmatskega čepa popolnoma sprostite zastojni tlak. Šele potem lahko skozi polnilno cev sprostite tlak v čepu. Pnevmski čep je potrebno popolnoma izprazniti preden ga odstranite iz cevi.



### OPOZORILO!

ODSTRANITE ČEP IZ CEVI ŠELE KO JE ČEP POPOLNOMA IZPRAZNJEN. NIKOLI GA NE ODSTRANJUJTE S POMOČJO POLNILNE CEVI. VEDNO UPORABITE VRV, KI JO NAPELJETE SKOZI UŠESCA ALI ROČAJE. UPORABA POLNILNE CEVI LAHKO POŠKODUJE ČEP ALI SAMO POLNILNO CEV, ZARADI ČESAR JE UPORABA ČEPA ALI OPREME NEVARNA.

Nepoštivanje uputa i sigurnosnih mjera sa radom s pnevmatskim čepovima mogu dovesti do TEŠKIH OZLJEDA ili čak SMRTI.

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

# **PNEUMATIC PIPE PLUGS**

**SAFETY INSTRUCTION MANUAL**

**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 USE OF PLUGS

In order to prevent exceeding the permissible pressure during inflation plugs should be used in the combination air source – pressure regulator – controller – air supply hose – plug. Never left the controller out of this combination and connect the pressure regulator directly to the plug. Controllers are equipped with safety valves and pressure gauges that are calibrated to the adequate pressure area.

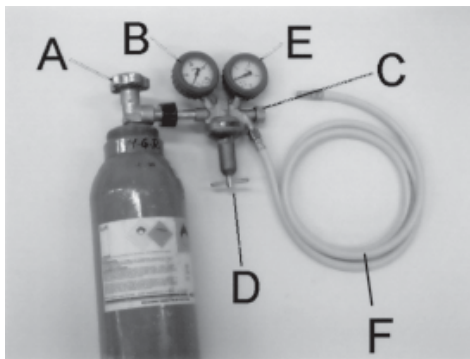
Before using a plug set the prescribed pressure by means of the pressure regulator. The pressure value may not exceed the maximum permissible supply pressure. Connect the plug with a hose to the controller, which is further connected to the air source and insert the plug correctly in the pipeline (see instructions for safe work). Draw back from the dangerous area. You may open the plug inflation valve on the controller only after all safety measures have been followed. During the inflation check the working pressure on the pressure gauge. When the maximum permissible pressure is reached, stop the inflation. In case of a longer plug use the pressure in the plug may drop therefore check the pressure; should the pressure drop, correct it adequately.

### Air supply

Any air source, which does not exceed the maximum supply pressure on the controller may be used to inflate the plug. If the supply pressure is higher than allowed, use the pressure regulator. If the compressed air contains oil, use the oil separator.

### Use of compressed-air cylinder under pressure of 200 or 300 bar

Use a joining piece to connect the pressure regulator to the compressed air cylinder. Shut the air outlet on the pressure regulator by screwing down the regulator valve (C) of the pressure reducer. Open the valve (A); pressure gauge (B) indicates the air pressure in the compressed air cylinder.

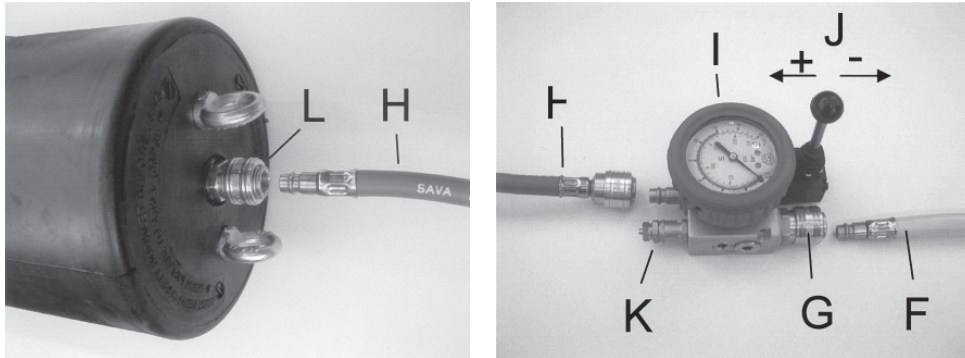


By means of a regulator valve (D) set the outlet pressure to the suitable value as indicated on the pressure gauge (E) and repeatedly open the regulator valve (C).

### Plug inflation by a controller

Connect the air supply hose on the pressure regulator (F) with the controller (G). Insert the male into the female hose connection and press to mesh.

Connect the controller through the supply hose (H) with the plug (L). Connect the joining piece of the supply hose with the plug coupling and press to mesh both pieces.



If other compressed air sources are used, set the supply pressure to the value that does not exceed the maximum supply pressure indicated on the controller.

Inflate the packer by pushing the lever (J) towards the pressure gauge. Continually check the pressure gauge (I) indicating the pressure in the plug.

When the working pressure is reached, interrupt the procedure and release the lever. The lever automatically returns to its neutral position (safety position).

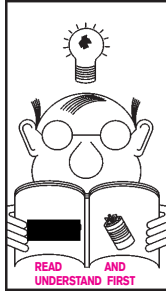
If the pressure in the packer exceeds the maximum inflation pressure indicated on the pressure gauge, it is automatically released by the safety valve (K).

If you wish to empty the plug or reduce the plug pressure turn the lever (J) away from the pressure gauge.

### Use of other air sources

If other compressed air sources (industrial installations, compressors etc.) are used, various adapters should be applied. If the compressed air source exceeds the maximum supply pressure indicated on the controller, use the pressure regulator and reduce the pressure to the prescribed value.

## INSTRUCTIONS FOR SAFE OPERATION



Instructions for safe and correct operation of pneumatic plugs

### WARNING!

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

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

Instructions given for construction, production and inspection of 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 pneumatic plugs.

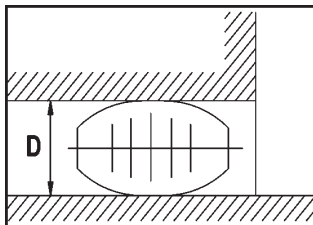
Read instructions carefully. Should you have any questions or if any extraordinary circumstances appear - not stated and described in this brochure - consult your supervisor or safety engineer.

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 PNEUMATIC PLUGS ARE GIVEN IN THE TABLES AT THE END OF THE BROCHURE.



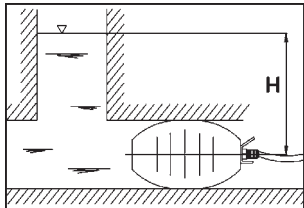
1. Measure the inner diameter  $D$  (mm) (in) of a pipeline to be blocked with the pneumatic plug.
2. Calculate the surface  $S$  (mm<sup>2</sup>) of the pipeline cross-section according to the following equation:

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

where  $\pi = 3,1416$

$D$  - inner pipe diameter (mm) (in)

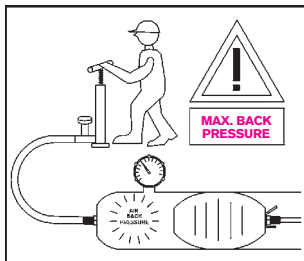




3. Calculate the total force that the plug has to resist according to the following equation:

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

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

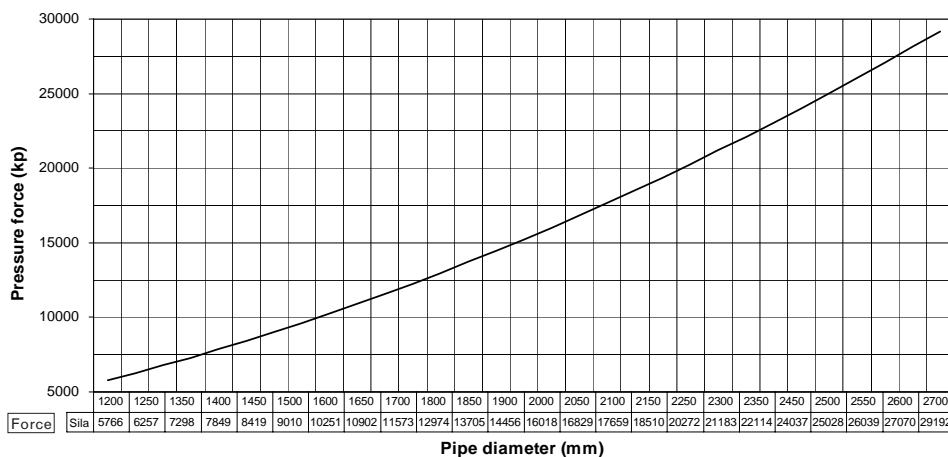


where

S - cross-section surface (mm<sup>2</sup>) (in<sup>2</sup>)

p<sub>z</sub> - back pressure (bar) (PSI)

**Force in plug as result of back pressure 0.5bar**



The back pressure P<sub>z</sub> 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.

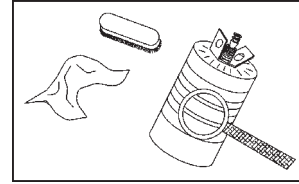
**2. Before and after each use, clean the plug and inspect for surface tears, cuts or any other damage**

Pneumatic plugs can be cleaned with a solution of water and detergent. After clean-

**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!**

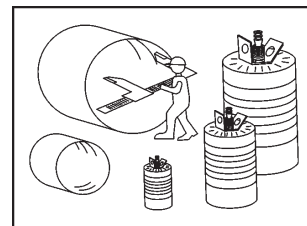
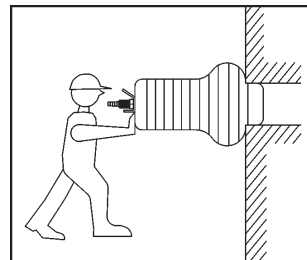
IF YOU SUSPECT THAT THE PNEUMATIC PLUG OR ACCESSORIES ARE DAMAGED, CONSULT REPRESENTATIVE AND AGREE ON RETURNING OF THE PRODUCT TO BE INSPECTED AT OR SCRAP THE PRODUCT AND REPLACE IT WITH A NEW ONE. IF YOU NOTICE ANYTHING EXTRAORDINARY, REMOVE THE PLUG AND ADVISE THE SUPERVISOR OR SAFETY ENGINEER.

**4. Always choose the proper size of pneumatic plugs**

For each 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.

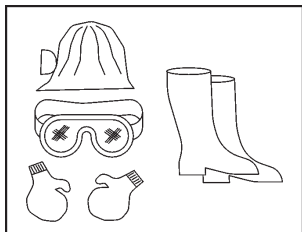
Before using the pneumatic plug always:

- 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!**

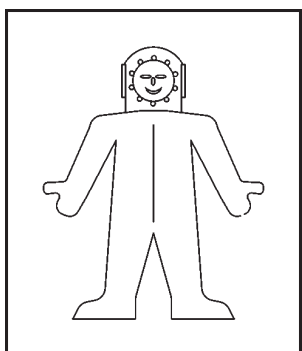
NEVER USE THE PLUG IN PIPELINES OF A LARGER OR SMALLER DIAMETER AS DEFINED FOR THE RANGE OF APPLICATION.



### 5. Always wear protective clothing and equipment

When handling 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.

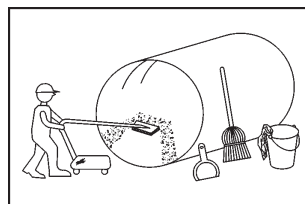


#### **WARNING!**

**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!**

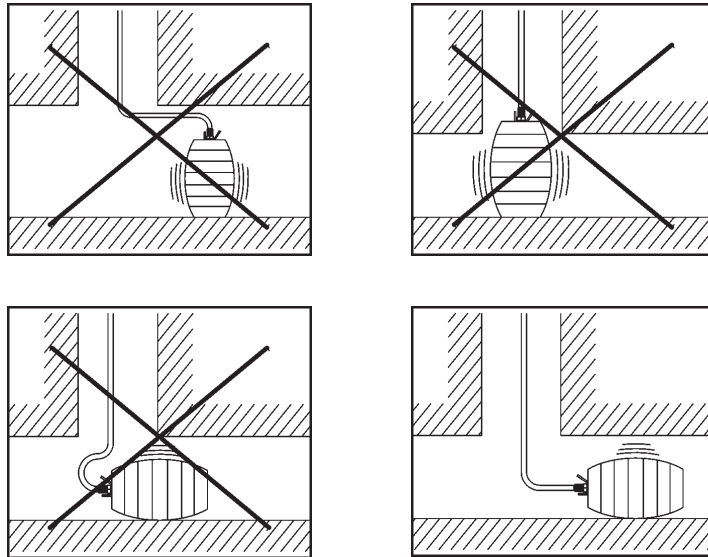
**DIRT OR SHARP PARTICLES IN THE PIPELINE CAN CAUSE POOR SEALING OR EVEN DAMAGES TO THE PNEUMATIC PLUG.**

### 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.

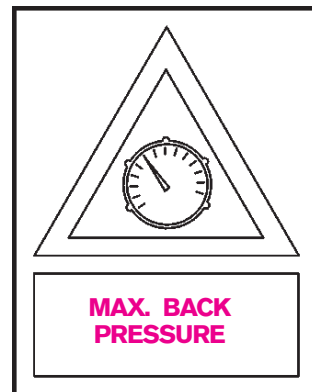
**WARNING!**

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.

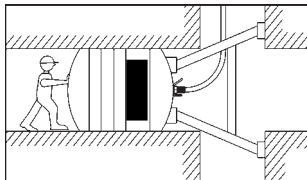
**9. Never exceed the maximum allowable back pressure**

Maximum back pressures are defined for those 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.

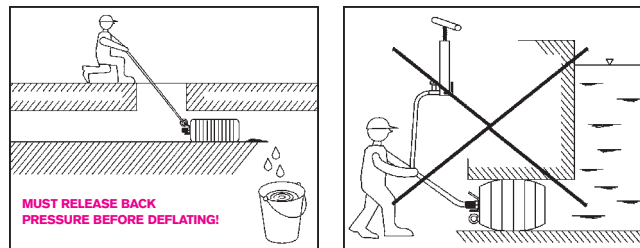
### 11. Stay clear of the plug when under pressure

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



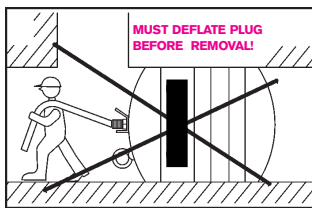
#### **DANGER**

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.

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