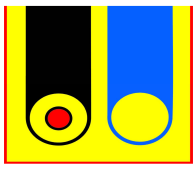

Preinsulated pipes for underground thermal utilities
system ZPU MIĘDZYRZECZ Sp. z o.o.

MANUAL OF EXECUTION AND SEALING OF COUPLING JOINT
Radiational cross-linked joints NTX type

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TABLE OF CONTENS

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1. Introduction

This manual contains a description of mounting, thermal isulation and sealing performance of coupling joint under the trade name NTX – heat shrinkable sleeve of radiational crosslinked polyethylene.
Application of new technology of radiational crosslinked heat shrinkable joints NTX type increases connections quality and durability of the preinsulated networks.

2. General terms of thermal insulation and sealing performance

2.1 Performance of thermal insulation and sealing of the bonded joint can be proceed only after:

- positive conducted pressure test of pipeline tightness,
- inspection and acceptance of welded joints in accordance with PN-EN ISO 17637 („Non-destructive testing of welded joints; Control of welded joints by visual inspection"), PN-EN 17636-1 („Non-destructive testing of welds. Radiographic testing – Part 1; Techniques for X and gamma radiation with membrane "), PN-EN ISO 17640 („Non-destructive testing of welds. Ultrasonic testing of welded joints."), PN-EN ISO 5817 („ Welding; Welded joints in steel, nickel, titanium and other alloys (with the exception of the bundle welded) - Quality levels according to non-compliance welding."), PN-EN ISO 6520-1 („Welding and allied processes. Classification of geometrical non-compliance welding in metals – Part 1 Welding."),
- In case of built-in pipeline leak detection - after performing conductors connection and after the technical tests of the alarm system carried out in accordance with the Instruction „ Pipeline leak detection – Pulse signaling cable connections", Instruction „ Pipeline leak detection – Signal cable connections" or „Gudelines for mounting of BRANDES instalation for pipe fittings with a coat made of plastic ".

2.2 Assembly of sleeve, thermal insulation and sealing of the bonded joint should be performed under favorable weather conditions:

- with dry and sunny weather,
- at ambient temperatures above +5 ° C and not more than +35°C
- during windless weather.

  In case of necessity to perform sealing of joints in harsh temperature conditions, in high humidity conditions (rainfall, dense fog) or strong wind operations associated with it should be carried out under portable cover, e.g. canvas tent (coversheet tent).

NOTE: until the assembly of NTX joints and during their assembly - during the leak test of joints and performance of thermal insulation – the temperature on the sleeve's surface can not exceed +40 ° C. To ensure this it should be:

- installation works to be carried out under portable cover, i.e. canvas tent (shielding tent),
- in the summer time to perform the work in the morning or evening, when the solar radiation is reduced,
- after removing the white film from sleeve, the joint must be secured with aluminum foil (AL) counteracting the excessive heating of the heat-shrinkable sleeve.

2.3 Decisive influence on the strength and quality of the NTX joints performed, have:

- cleanliness of the bonded surfaces (lack of sand, dust, grease and other contaminants),
- dryness (the surfaces to be bonded can not be moisture),
- appropriate shrinkage of ends radiational crosslinked heat shrinkable sleeve (prevent overheating of polyethylene or undertemperature of end of the joint),
- maintaining appropriate temperatures of PUR foam components and polyethylene (too cool joint space during foaming leads to incomplete filling the joints space),
- compounding accuracy and full use of foam mixture - PUR foam,
- skill and experience of joints assemblers.

2.4. Assembling of radiational crosslinked heat shrinkable joints NTX type may only be performed by trained personnel holding a certificate of completion of training, issued by Zakład Produkcyjno Usługowy Międzyrzecz POLSKIE RURY PREIZOLOWANE Sp. z o.o. seated at Zakaszewskiego 4 Str. in Międzyrzecz (Poland).

2.5. Polyurethane foam at the ends of insulated pipes should be dry, and a portion of the foam from the front insulation, to a depth of about 15 mm should be removed.

2.6. The carrier pipe connector assembly must be cleaned of dirt, dust, etc.

2.7. Surface temperature of the carrier and casing pipe at run time of thermal insulation should be $30^{O}C \div 35^{O}C$.

2.8. The surfaces of HDPE casing pipe of both connected preinsulated elements to a length of about 25 cm, measured from the edge of the casing pipe at the joint and at a distance of about 1 m, to which prior to welding the carring pipes, heat-shrinkable sleeve is pulled over – clean of dirt and dry.

2.9. Excavation at the site of thermal insulation and sealing performance of a coupling joint should be expanded and deepen by about 20 cm. During the process of preinsulated pipelines stacking excavation should be kept dry and clean and protected against the inflow of surface water or groundwater. The mirror of rainwater or groundwater can not have contact with thermal insulation (PUR foam) of preinsulated products until the completion of joints installation (encapsulation of pre-insulated pipeline welded connections).

2.10. Heat shrinkable sleeve secured with white foil (assembly cover) before welding steel carring pipe, preinsulated bonded elements, should be pushed onto the previously cleaned and dried section (approx. 1 m) of preinsulated pipe.

NOTE: in the summer time slided on pre-insulated pipe heat shrinkable sleeves wrapped in a white film, after film removing from sleeve up to its shrinkage, must also be protected from prolonged sunlight, so that the surface temperature of the NTX sleeve does not exceed 40 ^{O}C.

3. Storage

1. All materials used to perform insulation and sealing of a coupling joint to be stored in closed rooms.
2. The liquid ingredients of PUR foam (components A and B), portioned in plastic bottles separately on each joint, should be stored at temperatures above +15^{O}C and not exceeding +30^{O}C, in areas not exposed to direct sunlight.
3. Crosslinked heat shrinkable sleeves, wrapped up in a white foil should be stored in temperatures under 25^{0}C in areas not exposed to direct sunlight. Failure to comply with these conditions may lead to deformation of the sleeves.

4. Performance of insulation and sealing crosslinked heat shrinkable joint NTX type

4.1 Basic tools and materials

1. The basic tools necessary to perform the isolation and sealing of a coupling joint:

– electric belt grinder – *Photo No. 1*,
– wire brush – *Photo No. 2*,
– foot pump – *Photo No. 3*,
– knife or scraper – *Photo No. 4*,
– hammer – *Photo No. 5*,
– burner for liquid propane - butane gas – *Photo No. 6*,
– pyrometer to measure the temperature of the heat shrinkable sleeve – *Photo No. 7*,
– welding machine for plugs – *Photo No. 8*,
– cordless drill with drill for drilling holes with a diameter of inlet 25 mm - *Photo No. 9*,
– manual cone cutter - *Photo No. 10*,
– test manometer with expansion cap – *Photo No. 11*,
- devices for foaming in the case of a mechanical filling space of joint

In case of joints mounting with the alarm system the additional tools are:

– gas soldering – *Photo No. 12*,
– combination pliers - use pliers – *Photo No. 13*,
– wire cutting pliers– *Photo No. 14*,
– resistance measuring gauge – *Photo No. 15*.

On the following pages photos of example tools are preesented:

Photo No. 1 Electric belt grinder

Photo No. 2 Wire brush

Photo No. 3 Foot pump

Photo No. 4 Knife or scraper

Photo N.o 5 Hammer

Photo No. 6 Burner for liquid propane - butane gas

Photo No. 7 Pyrometer to measure the temperature of the heat-shrinkable sleeve - recommended

Photo No 8. Welding machine for plugs

Photo No 9. Cordless drill with drill for drilling holes with a diameter of inlet 25 mm

Photo No. 10 Manual cone cutter

Photo No. 11 Test manometer with expansion cap

Photo No. 12 Gas soldering

Photo No. 13 Combination pliers - use pliers

Photo No. 14 Wire cutting pliers

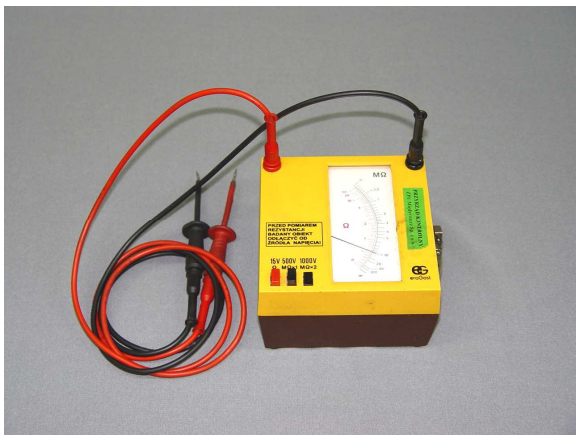

Photo No. 15 Resistance measurement gauge

2. Thermal insulation and sealing of a bonded joint should be made of materials contained in the product catalog system ZPU Międzyrzecz Sp. z o.o. - catalogue symbol NTX, namely:

- crosslinked shrink sleeve (packed in white foil) – *Photo No. 16 i 17*,
- components A and B of poliurethan foam, portioned in bottles - *Photo No. 18*,
- electrically welded plugs and venting plugs - *Photo No. 19*,

Photo No. 16 Radiation crosslinked shrink sleeve wrapped in a white foil

Photo No. 17 Radiation crosslinked heat-shrinkable sleeve

Photo No. 18 PUR foam(component A+B)

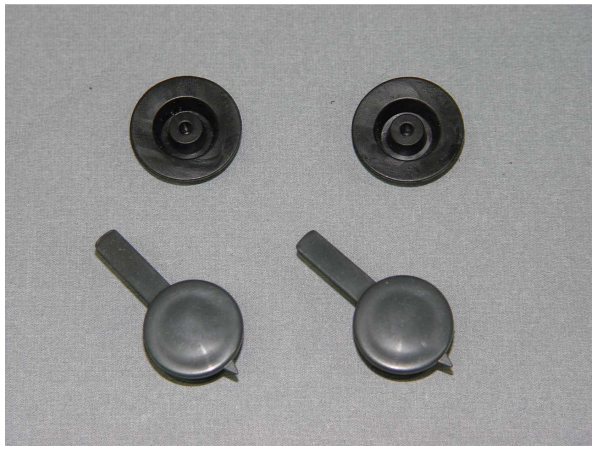

Photo No. 19 Heat-in plugs and venting plugs.

and also supporting materials:

- sandpaper,
- cleaning felts,
- sponge or cloth,
- acetone or carbon tetrachloride,
- propane - butane gas,
- aluminum or wooden wedges – *Photo No 20*,
- protective gloves.

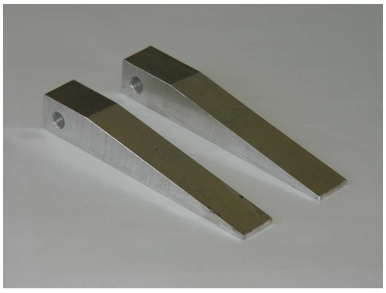

Photo No. 20 Aluminium wedges

4.2 Preparatory and auxiliary activities

1. The installation of NTX joint we the start by removing with a knife or scraper, part of thermal insulation – PUR foam thickness up to 15 mm, from the front of preinsulated bonded elements (*Photo No. 21*).
   If preinsulated components have built-in the signal wires, this procedure is to be performed prior to connecting these wires.

Photo No. 21 Remove with a knife or scraper, the thermal insulation - PUR foam with a thickness up to 15 mm from the face of preinsulated bonded parts.

2. Clean the carrier pipe with impurities such as sand, dust, grease, etc. and if in the course of welding joints testing the weld was covered with lubricant, then this place degrease for example with acetone or other degreaser.

3. The surface of the casing pipe,on which will be pulled over sleeve (place of assembly) should be dried and tear off with sandpaper. For this purpose, from the surface of casing pipes, should be removed the layer of polyethylene with a thickness of 0.1 to 0.25 mm through attrition over a length of about 200 mm counting from the end of insulation on the preinsulated element. Abrasive works should be performed with a manual electric belt sander with sandpaper grit from 50 to 70 or manually *(Photo No. 22)*.

Photo No. 22 ***Cleaning the casing pipe of preinsulated element using a belt grinder with sandpaper grit 50 ÷ 70***

4. The surface of the casing pipe at the connection point of HDPE pipe with shrinkable sleeve, over the length of approximately 20 cm from the edge of the casing pipe and additionally on a distance of about 1 m, a place where will be a shrinkable sleeve at the time of removal the white film, clean with acetone and dry dirt using abstergent *(Photo No. 23)*.

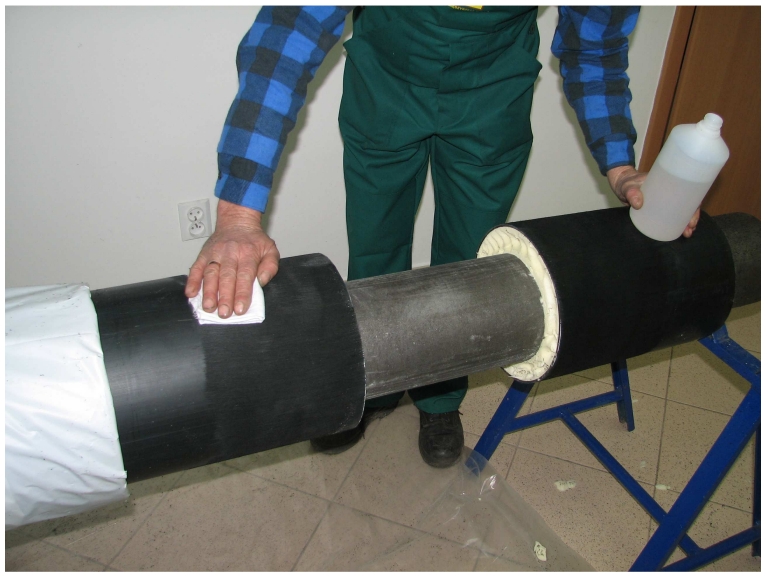

Photo No. 23 ***Cleaning with acetone the casing pipe of preinsulated element.***

5. Connect the conductors of the alarm system (tinned copper with tinned copper and copper with copper) in accordance with the applicable rules of the manual ZPU Międzyrzecz Sp. z o.o. under the title: "Leak detection of pipeline, impulse signaling installations connections; Description of installation; Principles of installation and operation". Conductors should be joined with clamping fittings, and then solder, checking each time bonding quality (cable conductors continuity and insulation resistance of PUR foam between the conductors and steel pipe). In case of alarm

installation BRANDES type cables connection of the alarm system perform according to "Installation instructions for BRANDES installation for conduit pipe with plastic jacket

6. Before applying the sleeve on the welded joint the surface of casing pipe at the connection point with sleeve heat with the burner flame of propane – butane gas. The surface temperature of the casing pipe, after 1 min. from cessation of heating, should be a minimum 40°C. Casing pipe temperature measurement should be performed with meter for measuring temperature, tactilely or touchless.

4.3 The sequence of operations of heat shrinkable sleeve NTX type installation

1. For a symmetric location of radiational crosslinked shrinkable sleeve on the welded joint of bonded preinsulated elements with the measure meter (universal meter) and marker (marker, pen or equalizer) of white colour mark the position of the outer edges of radiational crosslinked heat shrink sleevee *(Photo No. 24)*:
   - measure the length of the sleeve "L"(e.g. for DN≤ 200 mm the length of sleeve is L=600mm, for DN>200mm the length of sleeve is L=700mm),
   - measure the total length of bare steel pipe ends between the isolation fronts (e.g. 150mm+150mm=300 mm for preinsulated products diameter DN≤200, and for DN>200mm 200mm+200mm=400mm),
   - from the length of sleeve should be deducted the length of bare steel pipe ends and the resulting difference divide into 2 (e.g. for DN≤200mm 600mm-300mm=300mm; hence 300mm/2= 150mm),
   - thus calculated dimension (150mm), to locate the position of the outer edges of heat shrink sleeve, should be measured from the edge of the casing pipes pre-insulated bonded parts and mark with a white marker.

Photo No 24 ***Designation of calculated dimensions at determining the position of the edge of the radiational crosslinked heat shrinkable sleeve***

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2. Directly before the shrinking of sleeve, on the cleaned section of the casing pipe of preinsulated element a length of about 1 m, the white foil from sleeve should be removed *(Photo No. 25)*.

Photo No. 25 Removal of white foil from radiational crosslinked heat shrink sleeve

3. Prior to applying shrinkable sleeve onto the welded joint of bonded pre-insulated elements, the surface of casing pipes - the place of sleeve installation - to heat with "soft" burner flame so that the temperature of casing tubes surface, after 1 min. of heating cessation was min. 40°C. Temperature measurement of the casing pipe should be performed using the meter for measuring temperature, tactilely or touchless.
4. Heat shrinkable sleeve slide symmetrically on the joint so that the tab on the casing pipe at both ends was equal, in accordance with the previously determined position of the edge contour of the sleeve.
5. After heating the substrate and overthrust the heat shrink sleeve on the welded joint, immediately before shrinking the inner foil protecting the glue in sleeve should be removed (Photo No. 26).

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Photo No. 26 Removal of inner foil protecting the glue in radiational crosslinked heat shrink sleeve.

6. After removing the inner adhesive protection film in sleeve, the aluminum or wooden wedges, lifting up shrinkable sleeve should be inserted, which will enable symmetrical shrink at the ends of sections bonded preinsulated elements *(Photo No. 27)*.

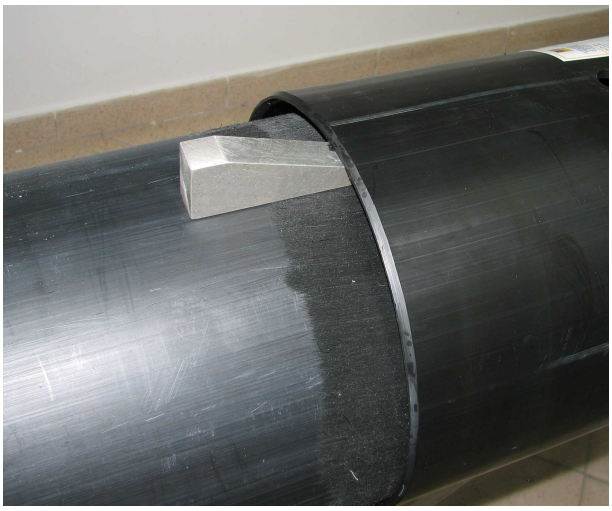
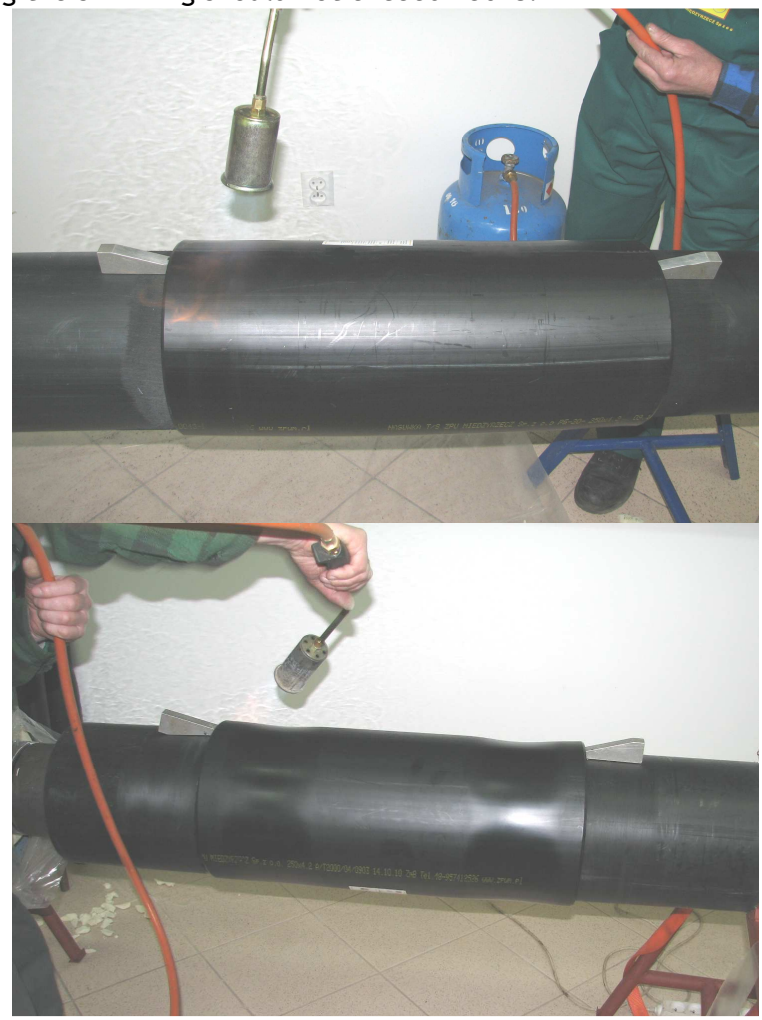


Photo No 27 The method of heat shrinkable sleeves support using wedges before shrinking of radiational crosslinked heat shrinkable sleeve.

7. Shrink the ends of the crosslinked shrinkable sleeve, on length of about 15 cm with "soft" flame burner on a propane butane gas *(Photos Nos. 28 and 29*).

Heating should be performed with a “soft” burner flame and should be done in the first place around the perimeter of edge of the sleeve in a strip width about 10 cm. The beginning of the strip is about 5 cm from the edge of the sleeve, and ends at distances of about 15 cm from the edge of sleeves. Then follow the shrinking of the edge of the sleeve (5 cm from the strip width of about 10 cm in the direction of the edge of the

sleeve) until the sleeve starts to fit tightly against the casing pipe preinsulated element, around the entire circumference. Shrinking is to be steadily performed by warming "soft" flame of burner, in such a way as not to cause overheating of sleeve, and on the sections located on the casing pipes will took place narrowing of shrinkable sleeve. In order to avoid overheating of shrinkable sleeve while performing shrinking, the meter should be used to measure the temperature of the outer surface of the sleeve. Temperature of the sleeve during the shrinking should not exceed 130°C.



Photos Nos. 28 and 29 Shrinking of heat shrinkable sleeves ends with "soft" flame of burner for liquid propane - butane gas.

8. Surface of shrinked shrinkable radiational crosslinked sleeve ends should be smooth, without hollows and creases on the circumference of the preinsulated pipe and sleeve *(Photos No. 30 and No.31)*.

Photo No. 30 ***View of radiational crosslinked heat shrinkable sleeves after shrinking.***

Photo No. 31 ***View the adhesive bead of glue on the edge of the heat shrinkable sleeve - preinsulated pipe circumference.***

5. Checking the tightness of NTX joint.

To leak test of NTX-type joint can be proceed after its cooling, i.e. when the temperature at the surface of both ends of the heat-shrinkable sleeve (in strips with a width of at least 150 mm shrinked its ends) will be no higher than 40°C.
The lower temperature of NTX joint at the time of the leak test, the risk of damage to the joint (loss of containment) is reduced due to too early to conduct a leak test.
Quality of shrinked radational crosslinked heat shrinkable joint NTX type depends on all the factors included in the technological process (ie. cleanness and dryness of joined surface and the experience of the installer).

The control of NTX joint leak testing should be performed in the following order:

5.1. Examine visually and tactilely external condition of the whole NTX joint. The attention should be paid that:

- on the surface of the joint shall not be any wrinkles, dents or cracks,
- the entire joint surface should be smooth with no visible discoloration.

5.2. In order to perform joint's leakage test, with air or other inert gas, using the spade drill, in heat-shrinkable sleeve should be made one hole with a diameter of ø 25mm in order to istall in it pressure gauge with expansion cap. When drilling a hole the attention should be paid not to damage the wiring of the alarm installation.

Radiational cross-linked heat-shrinkable sleeve has no a factory made vent - filling holes, therefore in order to perform joint's leakage test it is necessary to made one hole, to install in it pressure gauge with expansion cap. The location of the hole depends on the diameter of the HDPE casing pipe of bonded pre-insulated elements, because the hole at a later stage of the joint assembly (after obtaining a positive result of the carried joint leak test) will be used as filling hole for PUR foam. For performance of thermal insulation joints mounted on the pre-insulated products with diameters of HDPE casing pipes ϕ>160 mm it is necessary to drill two vent – filling holes ø 25mm, while for HDPE with a diameter ϕ>160mm one hole is sufficient, performed on stage of performing a joint leak test (there is no need to perform extra vent – filling hole). Thus, to perform a leak test in shrunk sleeve should be performed one hole located:

- for HDPE ϕ>160mm - in the middle of the sleeve length and on the upper surface thereof,
- for HDPE ϕ>160 mm, at a distance of about 80 mm from the center of the sleeve on its upper surface - viewed from the side of pre-insulated pipe *(Photo No. 32)*.

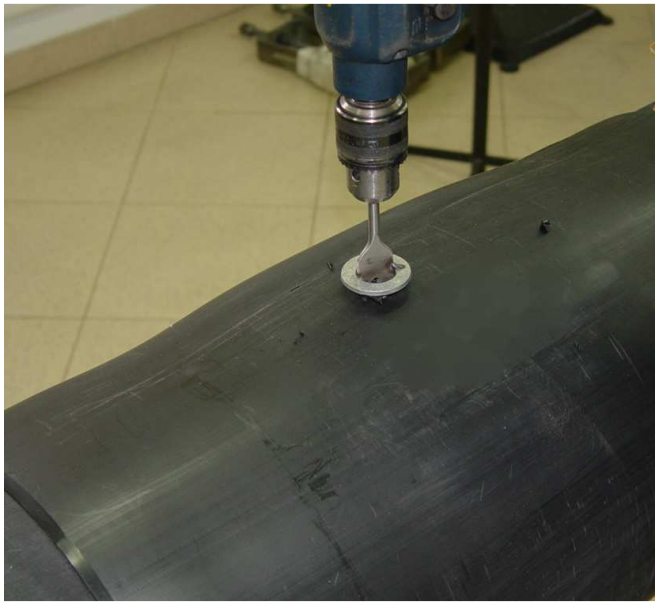


Photo No. 32 Making a hole with a diameter of ø 25 mm using a spade drill and drilling machine.

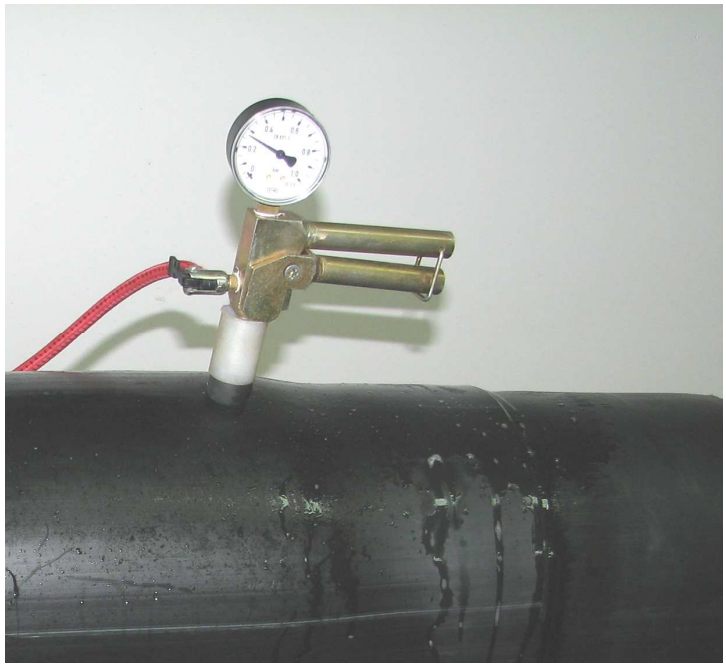
5.3. Break the outer edges of the drilled hole with a diameter of ø 25 mm using a knife or scraper.

5.4. In made hole mount control pressure gauge with expansion cap *(Photo No. 33)*.

Photo No. 33 Control pressure gauge mounting

5.5. Tightness of weld connections in the NTX joint check with soapy water (i.e. deionized water solution containing about 3% of detergent). In the first place,joint should be filled with air or other inert gas (N_2 or CO_2) to hypertension 2,5 m H_2O (0,25 Bar) *(Photo No. 34)*. If within two minutes the pressure shown by the pressure gauge does not decrease by more than one scale, that this condition is met. Then, using a brush or spray apply previously prepared solution, all around weld, joints edges and groins, over their entire length, simultaneously causing with brush strokes to produce a stable foam. The tightness of joint should be inspected visually - the joint is sealed, if on the joint sprayed surfaces will not occur "bubbles" and will not be observed increase in the volume of foam.

After such a leak test done the thermal insulation joint can be proceed - filling the spaces of NTX type joint with polyurethane foam.



Fot. Nr 34 Wypełnienie złącza powietrzem.

6. Manufacturing of thermal isolation of NTX joint.

6.1. In order to perform thermal insulation in the joint for HDPE casing pipes with diameter ϕ>160 mm an additional (second) filling hole ø 25 mm should be performed. The second filling hole should be made with a drill spade approximately 80 mm from the center of joint (holes should be arranged symmetrically in respect to the center of sleeve). The second hole to perform so as not to damage the wires of the alarm system. For HDPE casing pipes diameter ϕ≤160mm there is no need to perform extra hole (prepared hole for a leak test should be used).

6.2. Then should be prepared the liquid components of PUR foam to perform thermal insulation of joint. Components A and B of PUR foam are packed in plastic bottles separately on each joint depending from the nominal diameter of carrier pipe (portioned in bottles). Every bottle has a label that describes the type of component and the the nominal diameter of carrier pipe.

Example:

COMPONENT A DN 65

applies to component A (light) for joint with a nominal diameter of 65 mm

COMPONENT B DN 65

applies to component B (dark) for the joint of the same nominal diameter.

The two components A and B for the same nominal diameter of carrier pipe form a complete package of PUR components for particular joint.

The task of the performer of thermal insulation is to check if the text placed on the bottle of A component (light component) and component B (dark component), belong to the same nominal diameter pair and if the nominal diameter of carrier pipe in joint corresponds to nominal diameter placed on plastic bottles with the ingredients.
Temperature of the PUR foam components before foaming should be 20°C÷25°C. Before foaming, it should be checked with the meter for temperature measurement, the temperature of the surface of sleeve, which should be about 30°C÷35°C. Where the lower temperatures of sleeve is found, it should be gently heated with burner – „ with soft flame" to achieve the desired temperature on its surface, of $30^{O}C \div 35^{O}C$. The sleeve temperature during foaming should not exceed 40°C.
Content of the bottle with the component A (content of the smaller bottle) should be poured into a bottle with the component B (the larger bottle). The order of filling ie A to B or B to A is arbitrary, but it should be paid an attanention that the two components of the foam will fit into one bottle, in which the mixing will occur *(Photo No. 35)*.

Photo No. 35 The shedding of component A to the bottle with B component of PUR foam.

After components confluency and plug spin, both components should be thoroughly mixed *(Photo No. 36)*, then pour through one of the inlet openings into the space of insulated joint *(Photo No. 37)*. Time confluency of components, mixing and pouring to the joint should not exceed 40 seconds.

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Photo No. 36 Mixing of PUR foam components A and B

Photo No. 37 The pouring of foam to joint space

6.3. After pouring to the joint the mixed components of PUR foam, the venting plugs in ther filling holes should be embed, i.e. venting plug for HDPE with diameters $\phi \leq 160$mm and 2 venting plugs for HDPE $\phi \leq 160160$ mm (according to the amount previously made vent – inlet holes) in such a way to engage the first notch of plug, and the vent hole in the cap remained permeable *(Photos Nos. 38 and 39)*.

Photos Nos. 38 and 39 Embedding of vent plugs in the filling holes

The process of venting joint continues until in the opening of venting cap will be shown the first flow of PUR foam. When the PUR foam appears in the plug venting hole, plug should stick to end with a hammer.
The emergence of a small amount (not more than about 8 cm^3) of PUR foam bead from the plug's vent holes is permitted, after which absolutely vent plugs must be knocked to the end using a hammer.

6.4. Performed thermal insulation should be left for a period of about 3 to 6 hours at a time in which the PUR foam is chemically bind.

6.5. Then, it should be proceed to make the joint sealing with plugs electrically weld.

7. Implementation of NTX joint encapsulation using electrically weld plugs.

7.1. After performing joint's foaming mechanically remove venting plugs from filling holes – mounting location of electrically welded plugs *(Photos Nos. 40 and 41)*.

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Photos Nos. 40 and 41 Removing the vent plugs from the filling holes

7.2. Then using a scraper the edges of filling holes the foam should be cleaned to a depth of about 5 mm *(Photo No. 42)*.

Photo No. 42 Removal of the PUR foam from filling holes to a depth of about 5 mm

7.3. With a manual conical cutter edges of filling holes should be chamfered *(Photo No. 43)*.

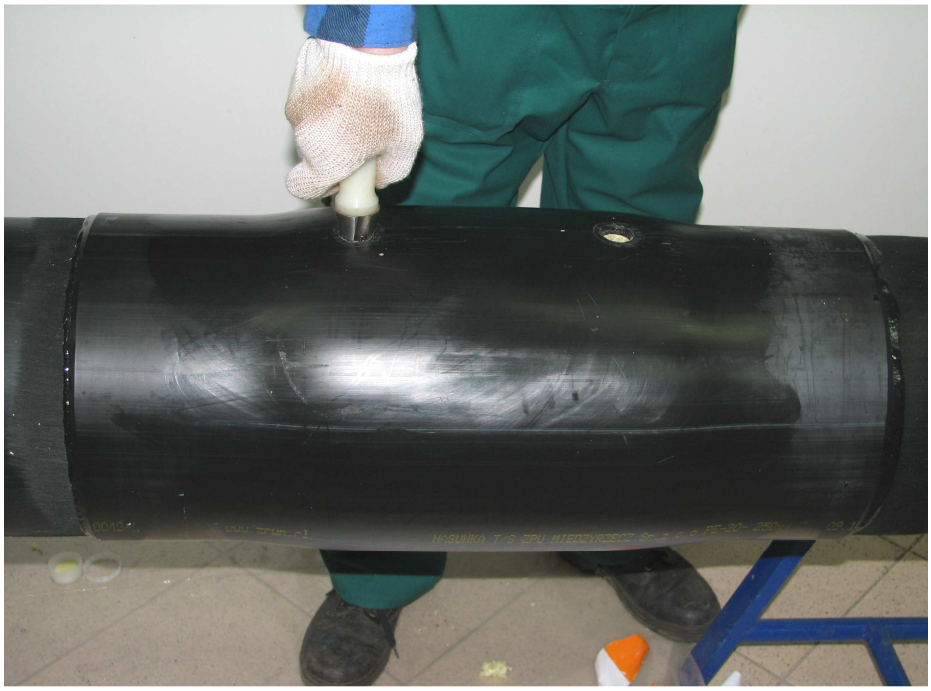

Photo No. 43 Chamfering of filling holes edges using manual conical cutter.

7.4. Thoroughly clean the edges of filling holes and the surface of the sleeves around the openings from the remaining foam, degrease with fresh cloth with a solvent (acetone) and dried thoroughly *(Photo No. 44)*. The action of welded plugs mounting places purification perform with clean cotton gloves. Accuracy of these activities determines the correct execution of joint sealing, so it should be performed with particular care.

Photo No. 44 Purification of the filling holes of welded plugs mounting places

7.5. With fresh cloth (abstergent) with solvent (acetone) to degrease the plug for welding and heater sockets and thoroughly dry.

Note: following steps should be carried out particularly carefully, because accuracy of activities performed prerequisite correctness of plug installation and obtaining adequate strength and tightness of joint.

7.6. Installation steps of plug should start by heating the substrate, i.e. edge of the filling hole in the muff - heat 1.5 minutes by applying the conical part of the heater head ijn filling hole (without plug in the plug socket). After the expiration of 1.5 minutes - the time of heating the edge of the hole, without interrupting this operation, embed in the heater socket degreased plug and heat it for 1 minute while warming the filling hole in sleeve. During heating the edge of the filling hole and in the time of plug heating set the reulator of plugs welder so as to get the actual temperature on the heater head with values: 235-240ºC for cone and 240ºC for socket. The control of the actual temperature should be carried out by its direct measurement, using meter for temperature measurement, with the contact method. The total heating time of the hole edge must be a minimum of 2.5 minutes to a maximum of 3 minutes, while the surface of the conical plug heating time must be at least 1 min to max. 1.5 minute *(Photo No. 45)*.

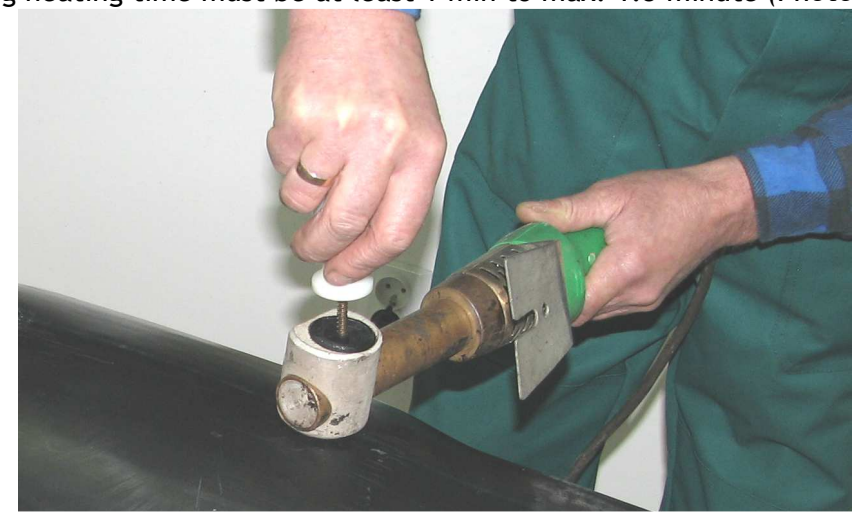

Photo No. 45 Heating to the state of the plastic deformation of the outer edge of the filling hole and the surface of the conical plug with the help of welding machine for plugs

7.7 Then, in a decisive manner the heated plug should be pressed into the filler hole and keep it in the hole, pushing it in a state of immobility - avoiding, in particular, rocking and twisting of plug - until cool down and harden of plasticized plug and hole surfaces *(Photo No. 46 and 47)*.

Photos Nos. 46 and 47 The location of the heated plug in the joint's filling hole

7.8. Align the plug surface in order to avoid the excessive protruding above the surface of the joint. Properly welded plug must adhere tightly to the sleeve material, could not be too deep pressed down and should not extend more than 1 mm ÷ 2 mm over the outer surface of the sleeve. Uniform beads of plug molten material and the edges of the filling hole sleeve are a sign of proper plug welding and hermetic joint *(Photo No. 48)*.

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Photo No. 48 View a properly installed welded plug

Assembly of the second plug should be performed in a manner analogous to the mounting of the first plug.

Welded plugs tend to rise before the total cooling down od joint material. Joint should be not mechanically charged until cooling its surface to the temperature of about 25÷30°C, i.e. temperature allowing free touch.

8. Additional important informations

8.8. This manual does not contain all the necessary information regarding installation of radiational cross-linked heat-shrinkable joints NTX-type, and above all does not replace training at the headquarters of ZPU Międzyrzecz Sp. z o.o company with respect to their installation and does not exempt from the obligation to participate in this training.

8.9. Persons carrying out the installation of radiational cross-linked heat-shrinkable joints NTX type are required are required to obtain the relevant qualifications and technical expertise for mounting NTX joints and are fully responsible for the correct installation of these joints.