6 CONNECTION TECHNOLOGY JACKET-PIPE

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6.1.1 Explanation / Sleeves / Coupler Test Procedure

Explanation

There are several coupler constructions available for the different technical requirements. All PEHD-connection couplers are used in order to reach a non-positive safety, gas- and watertight jacket-pipe connection. The pipe layer will be responsible for slipping on the coupler before starting the welding works. All couplers consist of a PEHD-socket pipe with material properties as described in **chapter 2.1.4**. It will be generally possible to deliver all couplers in special length, i. e. for post-insulation of the welding seams of an uninsulated one-time-ball-valve, an one-time-compensator or a fitting piece. Insulation and sealing of all kind of couplers, except of **isocompact**, will be carried out generally by **isoplus**-works-educated assembling specialists, tested by AGFW- and BFW.

Sleeves

The manual usable shrink-sleeves which are part of the different kind of couplers consist of a heat shrinkable, molecular cross-linked and modified polyolefin with a sealing adhesive system consisting of an elastic-viscous sealing area. This kind of sleeve is resistant against thermal ageing, weather conditions and chemical influence as well as UV-rays and alkaline-earth.

Coupler Test Procedure

In co-operation with accepted test institutes, like i. e. **FFI** in Hanover (District Heating Research Institute e.V.) **isoplus** offers extensive analysis of PUR-local foam and sleeves respectively of complete couplers. The test procedures include all quality guidelines of EN 253 and EN 489 standard. Depending from requirements the quality control includes i. e.:

⇒ Visual expertise of storage, quality and processing of the material

⇒ Preparing of a test sample in a test box, for local used foam with expertise concerning starting time, rise- as well as foaming behaviour

⇒ Taking out of a 30 mm drill-cone from the PUR-foam of a coupler followed by a visual check concerning colouring, homogeneity and cell-structure

⇒ Testing of the foam sample in the laboratory concerning cell-structure, closed cells, foam density, pressure resistance and water absorption during boiling test

All taken samples will be recorded with the relevant parameters like date, time project and-section, constructing company and installer, weather conditions, temperature, dimension, kind of coupler and -number, local foam (mechanical or manual) and trench conditions, and transferred to the corresponding test institute. After writing of the certificate it will be given to the buyer for documentation. The content of the test procedure as well as the determination of the samples has to be decided by agreement between the purchasers or by an authorized third party and the coupler-assembling company, respectively with **isoplus**. As executing company of the test procedure **isoplus** has to be informed concerning this decision. Parallel to this the procedure after completion of the test report has to be determined before starting of the quality test procedure. Please contact **isoplus**-quality-engineering specialists in case of additional questions.

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6.1.2 Survey Basic Material & Properties

	Coupler construction / -type	PEHD Shrinkable	isojoint X-Shrinkable	isojoint III	Electro-Welding	isocompact	Spiro
Socket-pipe	Uncross-linked PEHD-pipe	√	-	-	√	-	-
	Cross-linked PEHD-pipe	-	√	√	-	√	-
	Heat shrinking	√	√	√	√	√	-
	Extruder weldable and to shorten	√	-	-	√	-	-
	Steel-spiral-pipe (Spiro), separated	-	-	-	-	-	√
Accessories	two shrinkable sleeves	√	-	-	-	-	-
	two PE-weldable plugs	√	√	-	√	-	-
	PE-hole-lockers	2	2	-	2	-	1
	Butyl-rubber-sealing tape	√	√	√	√	√	√
	two single copper-heat conductors	-	-	-	√	-	-
	Shrinking foil + sealing compound	-	-	√	-	√	alternative
	Sealing sheet metal	-	-	-	-	-	√
	Blind riveting	-	-	-	-	-	√
	Silicon sealing	-	-	-	-	-	eventual
Insulation	Polyurethane-local foam (PUR)	√	√	√	√	-	√
	PUR-insulation shells	-	-	alternative	-	√	alternative
Characteristic	.....sealing	double	double	double	electric	double	single
	Gas- and water tight	√	√	√	√	√	-
	Splash proof	√	√	√	√	√	√
	Air pressure test 0,2 bar	√	√	-	√	-	-
	Test certificate acc. to						
	EN 489 - 100 Cycles	√	√	√	√	√	-
	DVS-guideline 2207-part 5	-	-	-	√	-	-
	suitable for:						
	Flexible Compound Systems - Single pipe	√	√	√	-	√	-
	Rigid Compound Systems - Single pipe	√	√	√	√	√	-
	Rigid Compound Systems - Double pipe	√	√	√	√	√	-
	Steel-spiral-pipe (Spiro) - Jacket-pipe	-	-	-	-	-	√
	Application	2	2	3	3	1	4

1 = suitable for all pipe net works with standard operating- and soil conditions
2 = suitable for all pipe net works with increased operating- and soil conditions, like ground- and pressing water
3 = like 2, however especially for big pipe sizes
4 = suitable for all pipe net works layed inside of buildings or in the open

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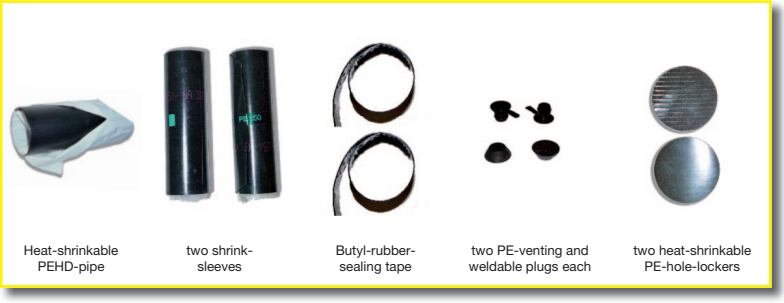
6.2.1 Delivery Range



Heat-shrinkable PEHD-pipe	two shrink-sleeves	Butyl-rubber-sealing tape	two PE-venting and weldable plugs each	two heat-shrinkable PE-hole-lockers

6.2.2 Description

The uncross-linked, PE-weldable coupler is a double-sealing system which consists of a PEHD-socket-pipe in one piece with heat shrinkable properties, two shrink-sleeves for sealing of the coupler at the transitions to the jacket-pipe as well as of two PE-welding plugs and two PE-hole-lockers. During assembling the coupler will be shrinked down to the original diameter by use of soft gas-flame; the so called memory-effect. A sealing tape made of butyl-rubber will be placed between jacket- and socket-pipe before the first shrinking procedure, which will result in a first sealing.

The cross-linked shrinking joint will be subjected to an air pressure test of 0,2 bar before foaming and will be tested using an appropriate indicator liquid. After foaming the second sealing by use of shrink-sleeves will follow. The foam filling-in- and venting opening will be sealed by PE-plugs and additionally with PE-hole-lockers.

Application:	Suitable for all pipe-networks with high operating- and soil conditions, like ground- and pressing water. According to **EN 489** in sand box sliding test approved with 100 cycles
Available as:	Connecting coupler, long coupler, reduction coupler, Double-reduction coupler, end coupler
Diameter:	from $\mathbf{D_a \geq 65\ mm}$ up to maximum $\mathbf{D_a = 800\ mm}$
Delivery length:	Standard = **700 mm**

Assembling sequence see **chapter 11.3.1**

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6.3.1 Delivery Range

Heat-shrinkable cross-linked PEHD-pipe

Butyl-rubber-sealing tape

two PE-venting and weldable plugs each

6.3.2 Description

The cross-linked, self-sealing **isojoint X** –shrinkable coupler is a system consisting of an undivided PEHD pipe with heat-shrinking characteristics in addition to two polyurethane welding plugs. After extrusion, the joint body will be cross-linked. The radiation cross-linking gives technical plastics the mechanical, thermal, and chemical qualities of high-performance plastics.

Stretched while warm during production, the socket is shrunk back to its original diameter using a soft gas flame. This shape memory is also called the Memory Effect. Before the shrinking process, a sealing strip of butyl rubber is inserted between the casing pipe and the joint, so that a very high ring key strength is achieved due to the shrinking and the seal, which means that no additional collars are required.

The cross-linked shrinking joint will be subjected to an air pressure test of 0,2 bar before foaming and will be tested using an appropriate indicator liquid. After foaming, the foam filling and the ventilation openings will be sealed with polyethylene stoppers. In order to enable welding of the polyethylene plugs, the area of the welding plugs will not be cross-linked and therefore will be weldable.

Application:	Suitable for all pipe-networks with high operating- and soil conditions, like ground- and pressing water. According to **EN 489:2009** (D)
Diameter:	from $\mathbf{D_a \geq 90}$ **mm** up to maximum $\mathbf{D_a = 560}$ **mm**
Delivery length:	Standard = 700 mm

Assembling sequence see **chapter 11.3.2**

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6.4.1 Delivery Range

Heat-shrinkable cross-linked PEHD-pipe

PE-X-shrinking foil with sealing compound

Butyl-rubber-sealing tape, extra wide

6.4.2 Description

The two-fold sealed joint system, **isojoint III**, consists of a PE-X casing joint, shrinkable along its entire length, a PE shrinking foil with mastic melt adhesive, and a special, semi-crystalline melt adhesive.

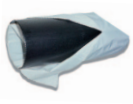
The basic material of the **isojoint III** is a molecularly cross-linked carrier material made of modified PEHD. In combination with the polyethylene pre-insulation of the joint cavity, the PE-X shrinking foil and an exceptionally peel- and shear-resistant adhesive, a high-quality, economically processable and permanently sealed joint system is created.

Bored holes, foam holes and ventilation holes are no longer required since the joint cavity in the **isojoint III** joint system is foamed before sealing the joint using polyethylene foam and a foam mold. This enables to non-destructively test the flawless quality of the foam.

Application:	Suitable for all pipe-networks with high operating- and soil conditions, like ground- and pressing water. According to **EN 489:2009** (D)
Available as:	Connecting coupler
Diameter:	from $D_a \geq 315$ **mm** up to maximum $D_a = 1400$ **mm**
Delivery length:	Standard = **730 mm**

Assembling sequence see **chapter 11.3.3**

6.5.1 Delivery Range



Heat-shrinkable PEHD-pipe

two processor controlled copper-heat conductors

two PE-venting and weldable plugs each

two heat-shrinkable PE-hole-lockers

6.5.2 Description

The patented **electro-welding coupler without** axial-welding seam consists of a closed, uncross-linked, PE-weldable shrinkable coupler, two loose copper-heat conducting wires which will be put in shortly before assembling as well as of two PE-welding plugs each with PE-hole lockers. The separated delivery of heat conductor and coupler will guarantee a maximum of cleanness as well as an ideal overcoming of measure tolerances and ovality at the jacket-pipe ends. By using a microprocessor controlled welding transformer for a 400 V/15 A three-phase- respectively power current connection the electrical welding procedure will run off self controlling and fully automatically. Starting with the heating up period the transformer is determining the procedure under considering all other secondary conditions.

The **Electro-welding coupler** can be tested before foaming by air-pressure of 0,2 bar and soaped in. The results as well as the data of the welding procedure have to be recorded. After foaming the foam filling-in- and venting opening will be sealed by PE-plugs and additionally with PE-hole lockers.

Application:	Suitable for all pipe-networks with high operating- and soil conditions, like ground- and pressing water, especially in case of bigger pipe dimensions. According to **EN 489** in sand box sliding test approved with 100 cycles, PE-welding wire acc. to DVS-guideline 2207 - part 5, approved with time-fracure test
Available as:	Connecting coupler and long coupler
Diameter:	from $\mathbf{D_a \geq 90}$ **mm** up to maximum $\mathbf{D_a = 800}$ **mm**
Delivery length:	Standard = **700 mm**, and in 100 mm steps up to maximal 1500 mm

Assembling sequence see **chapter 11.3.4**

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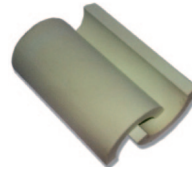
6.6.1 Delivery Range

Heat-shrinkable cross-linked PEHD-pipe

Butyl-rubber-sealing tape, extra wide



a two-parted insulation shell made of PUR-hard-foam

PE-shrinking foil with sealing compound

6.6.2 Description

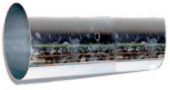
With the **isocompact**-coupler the pipe layer can carry out the post insulation independently at the connection spots of **isoplus**-pipes, except of double pipe-systems. It consists of a two-parted PUR-insulation-shell, a shrink-foil coated with sealing compound, the corresponding quantity of sealing tape as well as of a closed, totally cross-linked, not weldable shrinkable coupler. For the shrinking foil and -coupler PE with heat shrinkable properties will be used, both will be shrinked during assembling by use of a soft gas-flame.

Between shrinking foil and socket-pipe the sealing adhesive will be placed after the first shrink-procedure, in order to reach a high circular conclusive strength during and after the shrink procedure. The coupler length of 780 mm will guarantee an insulation of maximum 220 mm long steel pipe ends respectively a maximum length of 440 mm not insulated area. **isocompact**-coupler is not available as reducing- or end coupler.

Application:	Suitable for all pipe-networks with normal operating- and soil conditions. According to **EN 489** in sand box sliding test approved with 1000 cycles
Available as:	Connecting coupler
Diameter:	from $\mathbf{D_a \geq 65\ mm}$ up to maximum $\mathbf{D_a = 560\ mm}$
Delivery length:	Standard = **780 mm** (Long coupler not possible)

Assembling sequence see **chapter 11.3.5**

6.7.1 Delivery Range



separated
sheet metal-pipe

Butyl-rubber-
sealing tape

one sealing sheet metal
and venting-plug each

blind- resp.
machine rivets

6.7.2 Description

Spiro-couplers are used for actuated jacket-pipe connections for industrial, open line constructions or building lines. Inner folded spiro-jacket or outside folded spiro-jacket can be concerned. The delivery range includes a longitudinal separated jacket-pipe husk and a sealing sheet metal for closing the foam opening.

Depending from jacket-pipe diameter the corresponding quantity of blind resp. machine rivets for fixing of the longitudinal seam and the sealing sheet metal, as well as a sealing tape made of Butyl-rubber which will be placed at the radial material overlappings, are belonging additionally to the delivery range of a coupler. On request all material edges may be covered additionally by a silicon layer after foaming.

Application:	Suitable for all open line or pipe-networks inside of buildings with standard operating conditions
Avialable as:	Connecting coupler and long coupler
Diameter:	from **$D_a \geq 65$ mm** up to maximum **$D_a = 1200$ mm**
Delivery length:	Standard = **700 mm**

Assembling sequence see **chapter 11.3.6**

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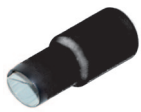
6.8.1 Delivery Range



Heat-shrinkable PEHD-pipe with 1x jacket-pipe-reduction

two shrinkable sleeves

Butyl-rubber-sealing tape

two PE-venting and weldable plugs each

two heat-shrinkable PE-hole-lockers

6.8.2 Description

Reduction-shrinkable couplers will be used at the spot where a medium pipe will be reduced, as transition of different jacket-pipe diameter. The corresponding reducing ring is in the middle of the socket-pipe. Reducing of the carrier pipe is part of the work executed by the pipe line constructing company.

In order to avoid not permitted high frontal soil pressure loads in case of hot-operating and buried PE-jacket-pipes, reducing should be made only about maximum two dimensions. At the bonding area of a thermal pre-stressed line only one dimension step will be admissible.

The coupler has to be generally padded at the reducing ring in circumference direction. Expansion pad is not part of the delivery range of a reduction coupler.

Application:	Analog **chapter 6.2**
Available as:	Uncross-linked PEHD-Shrinkable Coupler
Diameter:	from $\mathbf{D_a \geq 75\ mm}$ up to maximum $\mathbf{D_a = 800\ mm}$
Delivery length:	Standard = **1000 mm, 1400 or 1500 mm**
Kind of Delivery:	centrical

Assembling sequence see **chapter 11.3.7**

6.9.1 Delivery Range

Heat-shrinkable PEHD-pipe with 2x jacket-pipe-reduction

two shrinkable sleeves

Butyl-rubber-sealing tape

two PE-venting and weldable plugs each

two heat-shrinkable PE-hole-lockers

6.9.2 Description

Double reduction-shrinkable couplers are used for post insulation of not insulated components with an outside diameter which is bigger than the carrier pipe. The coupler will be enlarged in the middle with two reducing rings. Due to this the required insulation thickness will be guaranteed in case of special components, i. e. one-time compensators. Parallel the metallic contact (short circuit) of the leak detecting wires with the mounting part will be avoided.

In order to avoid not permitted high frontal soil pressure loads in case of hot-operating and buried PE-jacket-pipes, reducing should be made only about maximum two dimensions. At the bonding area of a thermal pre-stressed line only one dimension step will be admissible. The coupler has to be padded at the reducing rings in circumference direction. Expansion pad is not part of the delivery range of a double-reduction coupler. In case of one-time compensators the expansion pad is not necessary, because one-time compensators will be generally within the bonding area of a line.

Application:	Analog **chapter 6.2**
Available as:	Uncross-linked PEHD-Shrinkable Coupler
Diameter:	from $\mathbf{D_a \geq 75\ mm}$ up to maximum $\mathbf{D_a = 800\ mm}$
Delivery length:	Standard = **1000 mm**
Kind of Delivery:	centrical

Assembling sequence see **chapter 11.3.8**

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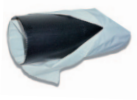
6.10.1 Delivery Range



Heat-shrinkable PEHD-pipe with 1x blind cover

one shrinkable sleeve

Butyl-rubber-sealing tape

two PE-venting and weldable plugs each

two heat-shrinkable PE-hole-lockers

6.10.2 Description

Shrinkable end couplers are used for temporary closing of blind ending pipes. Therefore the coupler end is closed with a blind cover. The carrier pipe end has to be closed tight before foaming, with a torospherical head, a pipe cap or similar. The pipe caps respectively torospherical heads are part of the performance of the pipe construction company.

In order to avoid high frontal not permitted axial expansion movements in case of hot-operating and buried PE-jacket-pipes, the blind cover generally has to be padded. The expansion pad is not part of the delivery range of an end-coupler.

Only one shrinking-sleeve is part of the delivery range of a shrinkable coupler.

Application:	Analog **chapter 6.2**
Available as:	Uncross-linked PEHD-Shrinkable Coupler
Diameter:	from $\mathbf{D_a \geq 65\ mm}$ up to maximum $\mathbf{D_a = 800\ mm}$
Delivery length:	Standard = **700 mm**
Kind of delivery:	Plug-execution

Assembling sequence see **chapter 11.3.9**

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Assembly parts should GENERALLY BE AVOIDED FOR QUALITY AND WARRANTY REASONS !

Assembling components should be generally used ONLY EXCEPTIONALLY (!!!) i. e. spud-tapping-branch. Production will be made ONLY AFTER WRITTEN REQUEST of the purchaser.

Assembly joints/assembly fittings do NOT meet the requirements and regulations of EN 253 !

6.11.1 Delivery Range - Spud-Tapping-Branch

Transition coupler with outlet nozzle | PEHD-Assembling elbow | four shrinkable sleeves | Butyl-rubber-sealing tape | three PE-venting and weldable plugs | three heat-shrinkable PE-hole-lockers

6.11.2 Description

If connections to buildings are subsequently required, in very exceptional cases branch fittings may be used. This requires making a carrier pipe branch, by tapping. The PEHD branch is split apart in the axial direction, folded over the carrier pipe and then welded using the PEHD extruder process. Branch fittings with a diameter of ≥ 280 mm should be avoided.

A special coupling is included with an outlet nozzle. The main pipe consists of a long shrunk-on coupling similar to **chapter 6.2.1**, where the outlet nozzle of not shrinkable PEHD casing pipe is welded in at the factory. The shrinkable PEHD elbow, reduced on one side, is mounted on this piece.

The diameter of the outlet nozzle and the installation elbow depends on the tapping procedure used. To ensure the necessary insulation thickness is maintained, it may be necessary for the assembly elbows to be supplied in a diameter that is several times greater. It is therefore imperative that **isoplus** is notified prior to tapping, with a scale drawing giving the following details:

Tapping procedure or system, nominal inlet and outlet diameter, inlet and outlet casing pipe diameter, type of outlet, axis height and spacing of carrier pipe, inlet to outlet, outlet form (45°, parallel or 90° vertical tiers), non-insulated or peeled length (max. 400 mm) and outlet (max. 250 mm).

Without these parameters, PEHD branch fittings will not be delivered or made!

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