

Report 1272E5114

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**Soil stress test and water impermeability test according to
EN 489:2009 for non-welded joint system
of the type non-shrinkable oversized casing with sleeves
type "Superseal L"
for pre-insulated bonded pipe system**

Order of

Canusa Systems, a division of ShawCor UK Ltd.
in West Sussex RH109QT, England

2015-05-26



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Project Engineer:

Volker Herbst

Hemmingen, 2015-06-17

This report contains 13 pages.

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1. Task

The Fernwärme-Forschungsinstitut (FFI) receives the order from Canusa Systems Limited, West Sussex, to carry out a soil stress test and a water impermeability test according to the EN 489:2009 as single test of the non-welded joint system non-shrinkable oversized casing with sleeves type “Superseal L” for pre-insulated bonded pipe system (KMR) for outer diameter of 160 mm.

The requirements of the European standard for joint systems are described currently in the regulations of the EN 489:2009.

2. Test material

The test specimen consists of a non-welded joint which is mounted in the centre of about 3 m long pre-insulated plastic bonded pipe dimension of DN 80/160 mm. The sealing is done by means of cross-linked shrinkable sleeves type “Superseal L”. The installation of the joint is done in the presence of the FFI project manager at the FFI laboratory. The length of the cutback is 300 mm. Over the cutback an oversized casing is placed. On both ends of the oversized casing sleeves are mounted. Afterwards the foaming with PUR foam is applied. The shrinking of the shrinkable sleeve type "Superseal L" takes place according to the valid processing and assembling guidelines. The general conditions for the processing and assembly terms as well as the specification of the system can be found in the **/Appendix/**. The system is subsequently subjected to a test according to EN 489:2009.

The joint obtains sample number 4137. **/Figure 1/** shows the joint before start of the soil stress test in the 12-o`clock position.



Figure 1 Joint before the start of the test (sample number 4137, DN 80/160).

In the following **table 1**/ the measurements and markings of the joint is documented.

Table 1 Measurements and markings of the joint.

FFI- Specimen no.	4137
Description	Non-shrinkable oversized casing with sleeves of the type "Superseal L"
Dimension	DN 80/160
Maximum outer diameter of the oversized casing	173.8
Length of the oversized casing [mm]	687
Length of the sleeve 1 [mm]	150
Length of the sleeve 2 [mm]	151
Number of foam holes	1
Cutback [mm]	300
Imprint sleeve	QA 14-A-489 CANUSA SUPERSEAL GS

3. Test conditions

The soil stress test is carried out at the FFI according to the EN 489:2009. The water impermeability test is performed following the soil stress test.

3.1 Soil stress test according to EN 489:2009

The variations in the length of the piping system which are caused by seasonal differences of the main operating temperature lead to axial movements and mechanical stress in the pipes. During the life cycle of district heating pipes, the form parts of bonded pipe systems have to withstand these axial forces during operation. The soil stress tests are carried out with one hundred full load changes of without any break. (Remark: One full load change means: warming up the pipe to operating temperature and cooling down to ambient temperature.) The verification of the resistance to axial forces and the abrasion resistance of sleeve joints is carried applying the following test conditions and tolerances:

Grain size of the sand bed:	up to 4 mm
Relative humidity of the back filling sand:	$\leq 0.5 \%$
Sand overfills and load	0.3 m sand + rigid compression plate
Surface load on upper pipe crest:	18 kN/m ² static
Preheating temperature of the service pipe:	120°C \pm 1 K
Duration of preheating:	24 h
Operating temperature during the test:	120°C \pm 1 K
Displacement (force attack one-sided):	(75 \pm 0.5) mm
Speed of displacement	
forward or in the direction of compression:	(10 \pm 1) mm/min
backwards or in the direction of pull:	(50 \pm 1) mm/min
Number of displacement cycles:	100

Having finished the sand overfill the service pipe is preheated with 120°C of hot water for 24 hours, and then displaced by means of a hydraulic press by 75 mm back and forth starting in the direction of pressure. After 100 displacement cycles the excavation takes place and the joint is checked visually.

3.2 Water impermeability test

The joint casings of district heating pipes have to withstand an external water pressure throughout their life time and prevent water ingress.

After the sand box test, the test specimens are immersed into a water tank for the water impermeability test, where it is subjected to water with a constant pressure for 24 hours. The water is blue coloured. According to the European standard EN 489:2009 the following conditions have to be fulfilled:

Water temperature:	23°C ± 1 K
Water pressure:	(30 ± 0.05) kPa
Duration of test:	24 h

After the test period, the influx tightness is checked through exposing the supplementary insulation area of the joint. The requirements of the water impermeability test are fulfilled if there is no water penetration.

4. Results

The following has been observed after the soil stress test with 100 cycles:

The joint (sample no. 4137) shows damage after the soil stress test on the compression side (D). The sleeve has partially lost its bound with the pre-insulated pipe casing.

The /**figures 2 to 3**/ show the joint in the 12-o'clock position and 6-o'clock position after the soil stress test.



Figure 2 Joint 4137 after soil stress test in the 12-o'clock position, pull side (Z), compression side (D).



Figure 3 Joint 4137 after soil stress test in the 6-o'clock position, pull side (Z), compression side (D).

In order to prove the tightness immediately after removal from the water tank, the joint is tested destructively. The following /figure 4 to 5/ show the joint after removal of the joint casing in the 12-o'clock-position and in the 6-o'clock-position.

There is no water penetration in the joint.



Figure 4 Destructive test after withdrawals from water tank in the 12-o'clock position (sample 4137, DN 80/160), pull side (Z), compression side (D): dry.

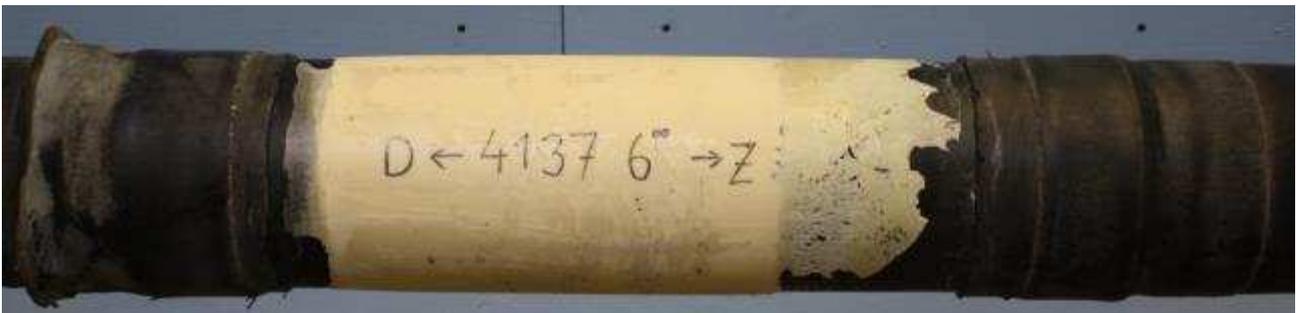


Figure 5 Destructive test after withdrawals form water tank in the 6-o'clock position (sample 4137, DN 80/160), pull side (Z), compression side (D): dry.

5. Summary assessment

The non-welded joint of the system **non-shrinkable oversized casing with sleeves type “Superseal L”** for pre-insulated bonded pipes for nominal outer diameter of 160 mm manufactured by Canusa Systems Limited, West Sussex has been tested in the FFI according to the criteria of EN 489:2009 as single test in respect of the soil stress test and the water impermeability test.

During the soil stress test the sleeve on the compression side has partially lost its bound with the pre-insulated bonded pipe casing.

There has been no water ingress in the joint. Therefore the soil stress test and the water impermeability test according to EN 489:2009 is passed.

For the test, certificate no. 489 1506 142A has been issued.

6. Appendix



Installation Guide

SuperSeal™ - WTD/WLD/WSD

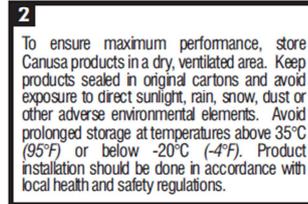
Two-piece bulk roll sleeve with separate closure for District Heating pipes

Product Description



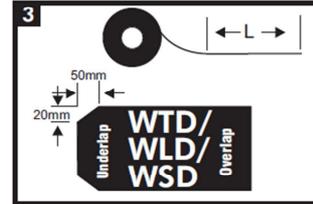
CanusaWrap™ Superseal sleeves are shipped in bulk rolls. Closures are shipped either in bulk rolls or pre-cut. The adhesive is protected from contamination by an inner liner.

Storage & Safety Guidelines



These installation instructions are intended as a guide for standard products. Consult your Canusa representative for specific projects or unique applications.

Cutting Sleeve



Cut the required length (L) of sleeve material from the bulk roll.

WTD (L = circumference of casing + 100mm)

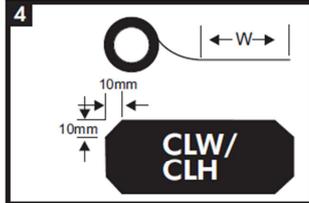
WLD/WSD (L = circumference of casing + 120mm)

Corner cuts: WTD and WLD and WSD

Underlap – 20X 50mm

Ensure that the sleeve is ready for installation, that there is no dirt or moisture on the sleeve and that the sleeve is not damaged.

Cutting Closure



Cut the required length (W) of closure material from the bulk roll.

CLW/CLH (W = sleeve width less 5 mm)

Corner cuts: All corners (10 X 10 mm)

Ensure that the closure seals is ready for installation, that there is no dirt or moisture on the closure seal and that the closure seal is not damaged.

Use CLW Closures with WTD/WLD and CLH closures with WSD.

Equipment List

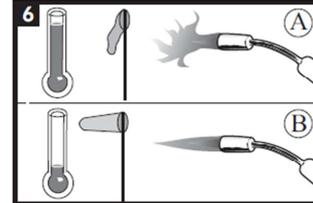


Propane tank, hose, torch & regulator

Appropriate tools for surface abrasion (40-60 grade sandpaper) Knife, roller, rags & approved solvent cleanser Digital thermometer with suitable probe

Standard safety equipment, gloves, goggles, hard hat, etc.

Flame Intensity



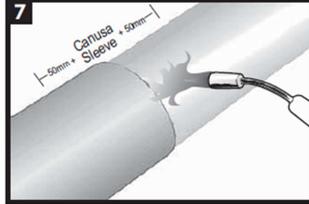
Adjust the flame according to outside conditions.

a. Use yellow flame for low wind, higher temperatures

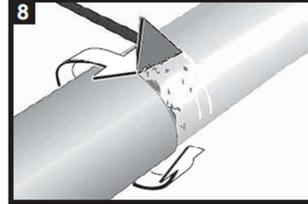
b. Use blue flame for high wind, lower temperatures

Always aim the torch perpendicular to the pipe and move in a circumferential direction.

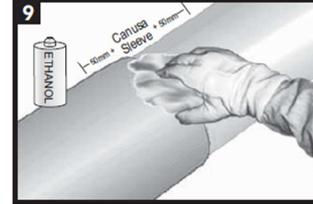
Surface Preparation



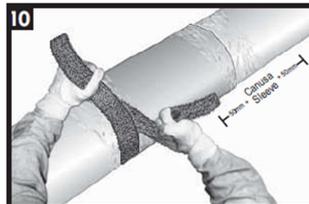
Dry the surface of the casing and carrier pipe (width of sleeve + 50 mm on each side) with the torch. Clean the surface with a dry, grease and lint-free rag to remove any grease or dirt.



Clean the edges of the casing to remove any sharp corners and burrs, foam and dirt, using a triangular scraper.



De-grease the surface (width of sleeve + 50 mm on each side) using a grease and lint-free rag soaked in ethanol (min. 94%).

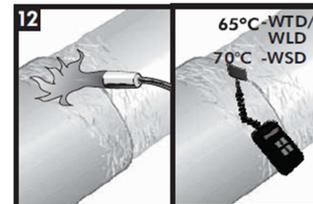


Roughen the surface (width of sleeve + 50 mm on each side) using 40-60 grade sandpaper or a wire brush.



Clean the roughened surface to remove any polyethylene or sand particles, using a dry grease and lint-free rag.

Pre-Heat



Using the torch, preheat the surface to be covered with the shrink sleeve (casing+pipe) to a minimum of 65°C (70°C for WSD). Check the temperature all around the surface with a temperature stick.

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Part No. 99060.027

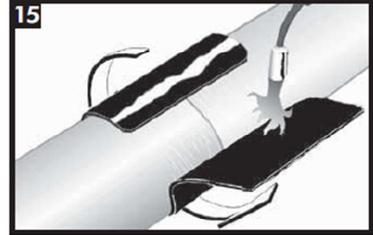
Sleeve Installation



Partially remove the release liner from the sleeve (~15 cm from the edge) and gently heat the adhesive along the underlap with a torch.



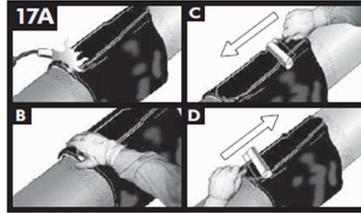
Centre the sleeve over the area to be sealed (casing pipe/PE pipe) and press the underlap into place. Remove the remaining release liner from the sleeve.



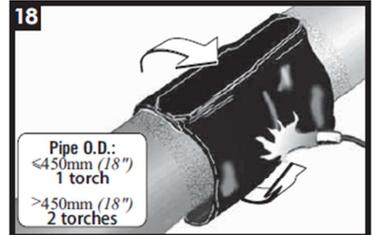
Wrap the sleeve loosely around the pipe, ensuring the appropriate overlap. Gently heat the backing of the underlap and the adhesive side of the overlap.



Remove the release liner from the hold down tape on the closure seal, centre it over the overlap and press it down.

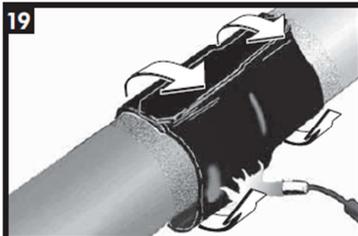


Gently heat the closure and pat it down with a gloved hand. Repeating this procedure, move from one side to the other. Smooth any wrinkles by gently working them outward from the centre of the closure with a roller.

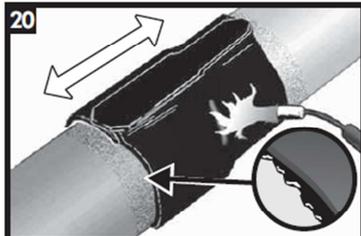


Pipe O.D.:
 <450mm (18")
 1 torch
 >450mm (18")
 2 torches

Using the appropriate torch, begin at the centre of the sleeve and heat circumferentially around the pipe. Use broad strokes. If utilizing two torches, operators should work on opposite sides of pipe.



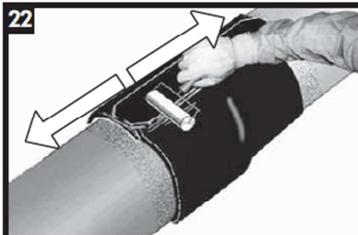
Continue heating from the centre toward one end of the sleeve until recovery is complete. In a similar manner, heat and shrink the remaining side.



Shrinking has been completed when the adhesive begins to ooze at the sleeve edges all around the circumference. Finish shrinking the sleeve with long horizontal strokes over the entire surface to ensure a uniform bond.

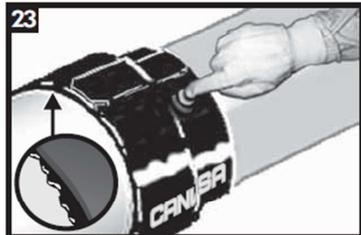


While the sleeve is still hot and soft, use a hand roller to gently roll the sleeve surface and push any trapped air up and out of the sleeve, as shown above. If necessary, reheat to roll out air.

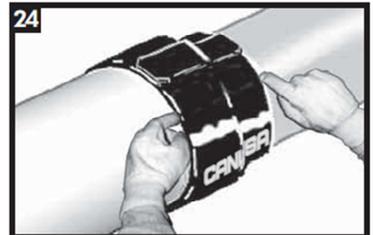


Continue the procedure by also firmly rolling the closure with long horizontal strokes from the weld outwards.

Quality Check

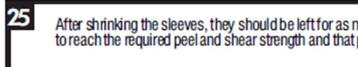


During shrinking, press down on the sleeve to ensure adhesive flow over the entire surface. Special attention should be given along the circumference between 4 and 8 o'clock and along the overlap area. In order to avoid a channel formation at the step down, the sleeve should be pressed down. The shrinking has been completed when an adhesive ooze begins at the sleeve edges all around the circumference.



As a final check, ensure that the sleeve follows the entire contour of the surface and that there are no cold spots or burning of the sleeve. The edges of the sleeve should be sunk into the adhesive ooze and should not lift. This can be checked by feeling the edges all around the circumference of the sleeve. If there is edge lifting, the edge should be reworked with additional heat.

Recommendations



25 After shrinking the sleeves, they should be left for as much time as possible prior to backfill (min. 30 minutes to 1 hour, depending on ambient temperature). This ensures that the adhesive has cooled enough to reach the required peel and shear strength and that permanent sealing is attained.



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SuperSeal™

Heat shrinkable sleeve for protection of pre-insulated pipe joints

SuperSeal™ is a high performance, heat shrinkable product intended for sealing of pre-insulated pipe joints. SuperSeal™ provides superior barrier against moisture ingress while protecting the joints from the soil stresses associated with Pre-Insulated Pipelines.

Specifically designed for bonding to polyethylene pipes and casings, SuperSeal™ offers low substrate pre-heat temperature thus making the installation of this product simple, forgiving, and most importantly, reliable.

Effective Long Term Sealing

- A combination of cross-linked polyethylene backing with a layer of unique hot melt adhesive, results in a long term barrier impermeable to moisture.
- As part of an insulated pipe joint casing and sealing system, SuperSeal™ complies with the stringent requirements of the EN 489 standard.

Proven Track Record

- SuperSeal™ has been protecting joints of pre-insulated pipelines for over 25 years

Reliable and Consistent Performance

- Low installation pre-heat temperature ensures uniform and consistent bond to the substrate
- High performance backing provides superior mechanical strength required for high stress environments

Flexible Product Options Save Time and Money

- Available in three configurations: pre-cut to specific pipe size, bulk rolls and tubes
- Allows for lower inventories of pre-cut sleeves and just-in-time sleeve cutting, thus reducing cost



Applications



Pre-Insulated Pipes



Foam-In-Place



Pre-Foamed Joints



SuperSeal™

Heat shrinkable sleeve for protection of pre-insulated pipe joints

Adhesive Properties		Test Method	Typical Values	
Softening Point		ASTM E28	90°C	
Lap Shear @ 23°C		EN 12068	135 N/cm ²	
Backing Properties				
Tensile Strength		ASTM D638	24 MPa	
Elongation		ASTM D638	700	
Hardness		ASTM 2240	48 Shore D	
Abrasion Resistance		ASTM D1044	35 mg	
Sleeve Properties				
Adhesion Strength @ 23°C		EN 12068	80 N/cm	
Water Absorption		ASTM D570	0.05 %	
Low Temp. Flexibility		ASTM D2671	-30°C	
Soil Box & Pressure Vessel Test*		EN 489	100 cycles, 30 kPa @ 30°C for 24 h (Tested with 8.0% sand humidity)	
Soil Box & Pressure Vessel Test		EN 489	1000 cycles, 100 kPa @ 40°C for 600 h (Tested with 8.0% sand humidity)	
Thickness		T	L	Tubes
Backing (nominal thickness as supplied)		0.6 mm	0.9 mm	0.6 mm
Adhesive (nominal thickness as supplied)		0.9 mm	1.3 mm	0.8 mm



Effective
long term sealing



Over 15 years of
in service sealing

*Tested as part of joint casing system

Since 1967, Canusa-CPS has been a leading developer and manufacturer of specialty pipeline coatings for the sealing and corrosion protection of pipeline joints and other substrates. Canusa-CPS high performance products are manufactured to the highest quality standards and are available in a number of configurations to accommodate many specific project applications.

The product information shown here is intended as a guide for standard products.

Consult your Canusa representative for specific projects or unique applications.



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