The Plastics Experts.

Installation guidelines

Installation Guidelines

Introduction

This manual addresses the Quality Control Program developed and utilized by AGRU Company's Installation partners to assure the quality of workmanship and the installation integrity of geo- membranes and other geo-synthetic products.

All geo-synthetic components of lining systems will be addressed in this manual, including geo-membranes, geotextiles, geonets, geo- composites, and geo-synthetic clay liners. AGRU Company recognizes that careful and specific documentation of the installation is required to substantiate this Quality Control Program.

Transport and Storage at AGRU

In house the AGRU Liners are handled carefully with adequate equipment to avoid deformation or damage to the rolls after manufacturing. The rolls are wrapped in PE-protection film and stored on plane ground, so that no damage can occur. A stapling of the rolls can be permitted to a maximum of five layers for long-term storage. The authorized installer has to take care on site to store the liners adequately to avoid any damages.

Truck charging with fork lifts and loading belts

- width defined by roll size plus 0.4m each side
- even, free of stones or protected (e.g.: geotextiles or sand) ground
- protected against mechanical damages
- unopposed access for delivering of rolls per truck

The AGRU in house transportation of the rolls are executed by using special equipped fork-lifts or cranes, so no punctual forces can occur to the rolls respectively no damages.

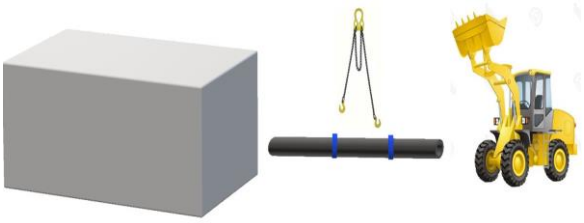
Liner stock AGRU Bad Hall

The transport to the prefabricator or on site is executed by adequate trucks (Lorries) or in containers.

The transport on site or the unloading of a container has to be performed by equipment capable to unload without damaging the liner rolls. Therefore, every roll is delivered with lashing points (loading belts). For unloading the rolls out of a box, container only mandrel (dorm) lifters shall be used to avoid deformation and damage to the rolls.

Material delivery and storage on site

A third Party QA Representative should be present, whenever possible, to observe and assist in material delivery and unloading on site. The Third Party QA Representative should note any material received in damaged state and take any necessary conformance samples. Upon mobilization to site, a Representative certified by AGRU shall:



Unloading on site

- Verify the equipment used on site is adequate
- In addition, does not risk damage to the geomembranes or other materials.
- Mark rolls or portions of rolls, which appear, damaged.
- Verify that storage of materials ensure adequate protection against dirt, theft, vandalism, and passage of vehicles.
- Ensure that rolls are properly labeled and that labeling corresponds with Quality Control documentation.
- Complete roll numbers, date, roll size and any damage will be logged on the AGRU Material Delivery Checklist

Liner storage on site

Geomembrane installation

a. *Earth Work*

The General and/or Earthwork Contractor shall be responsible for preparing and maintaining the subsoil in a condition suitable for installation of the liner unless specifically agreed otherwise.

In cases where no site-specific earthwork quality control guidelines exist, the following general guidelines shall comply with the following general specifications

Subsoil preparation for the following day`s lining progress

Surfaces to be lined shall be smooth and free of debris, roots, and angular or sharp rocks. All padding shall consist of well-graded material, free of organics, trash, clay-balls, or other non adequate material that may cause damage to the geo-membrane. Unless otherwise required by design specifications, the upper 15.0 cm (6”) of the finished subsoil shall not contain stones or debris larger than 1.2 cm (1/2”). The subsoil shall be compacted in accordance with design specifications, but at least in a quality to provide a firm sub base sufficient to allow the movement of vehicles and welding equipment over the subsoil without causing damage to the prepared surface (e.g. wheel tracks). The subsoil should consist of homogeneous material and none abrupt changes in grade.

The Earthwork Contractor shall protect the subsoil from desiccation, flooding, or freezing. Protection, if required, may consist of a thin Plastic foil (or other material as approved by the engineer) placed over the prepared completed subsoil until the placement of the geo-membrane begins. Prepared subsoil with cracks greater than 1.2 cm (1/2”) in width or depth shall be replaced or reworked by the General and/or Earthwork Contractor to remove those defects.

Repair of small defects

The moisture content of the subsoil should not exceed 20%. If the moisture content exceed 20%, then the Contractor should prepare a sufficient dewatering system and in addition to it spraying some bentonite to ensure the subsoil condition for a proper installation of the geomembrane.

Upon request, the Site Supervisor will provide the Owner’s and/or Contractor’s representatives with a written acceptance of the surface to be lined. This acceptance will be limited to an amount of area that the Installer is capable of lining during a particular work shift. Subsequent repairs to the subsoil and the surface shall remain to the responsibility of the Earthwork Contractor.

b. *Crest Anchorage System*

The General and/or the Earthwork Contractor as specified in the design drawings prior to geo-membrane placement shall excavate the anchor trench.

Anchor trench

Anchor trenches should be excavated only the distance required for that day's liner placement to minimize the potential of collapsing

Corners in the anchor trench shall be constructed with a sufficient radius to avoid sharp bends or over folding of the geomembrane.

c. *Preparation for Geomembrane Deployment*

Prior to start the liner deployment, layout drawings shall be drafted to indicate the panel configuration and general location of field seamsfor the project.

Each panel used for the installation will be given a number that will correlate to a batch or roll number. This roll identification number shall be related to the Installer's roll Placement Form, which will be used when required.

d. *Field Panel Placement*

Membrane deployment will generally not be done during any precipitation, in the presence of excessive moisture, in an area of flooded water, or during heavy winds or rainfall.

AGRU`s installation partner will attempt to install field rolls as indicated on the layout drawing. If the rolls are deployed in a location other than indicated on the layout drawings, the revised location will be noted in the field. These notes will be maintained and submitted by AGRU`s partner and/or third party QA Consultant as determined on a site-specific basis.

Information relating to membrane roll placement including date, time, panel number, and roll dimensions may be maintained on a site specific base, on the roll Placement Form.

If a portion of a roll is set aside to be used at another time, the roll number will be written on the remainder of the roll in several places.

e. *Method of Deployment*

The method and equipment used to deploy the rolls must be chosen as not to damage the membrane or the prepared subsoil surface.

Installation on slope

No personnel working on the membrane will wear shoes that can damage the geo-membrane or engage in actions that could result in damage to the membrane.

Adequate temporary loading and/or anchoring, (e.g. sandbags, tires) which will not damage the membrane. It will be placed to prevent uplift of the membrane by wind or under flooding by rain.

Temporary loading with sand bags

The membrane will be deployed in a way that typical thermal expansion can take place.

Any area of a seriously damaged roll (torn, twisted, or folded) will be marked and repaired in accordance with later description in this document.

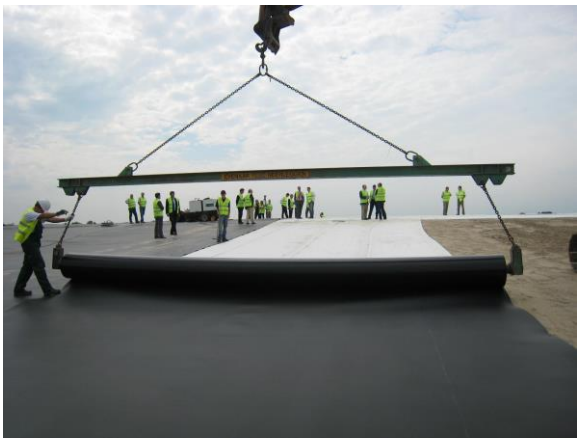
f. *Geomembrane Field Seaming*

Temperature and humidity seaming shall only be performed at temperatures above +5°C ambient temperature. In an Environment where the humidity exceeds 80% special care shall be taken that, the difference to the dew point is minimum 3K.

Seams parallel to the slope

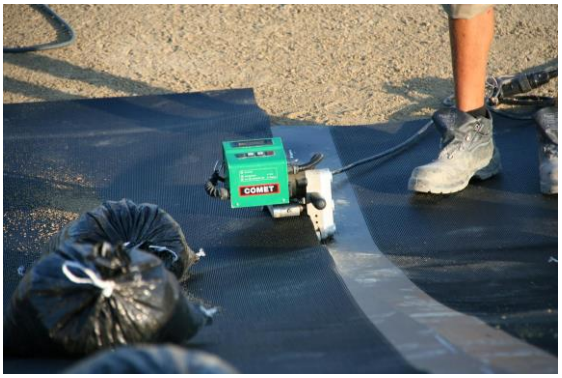
In general, seams shall be oriented parallel to the slope, e.g. oriented along, not across the slope. Whenever possible, horizontal seams should be located on the base of the cell, not less than 1.5 m (five feet) from the toe of the slope or when the guidance of the wedge welder is assured. Each seam made in the field shall be numbered. Seaming information to include seam number, welder ID, machine number, temperature setting, and weather conditions may be maintained on Installer's Panel Seaming Form.

All personnel performing seaming operations shall be trained in the operation of the specific seaming equipment, being used and will qualify by successfully welding a test seam.

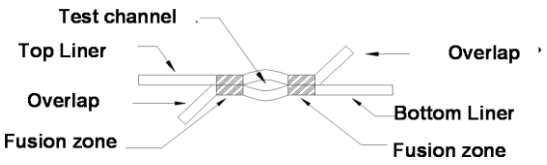


Sealing of long slopes

g. Equipment



Hot wedge welding



Double seam

Fusion welding consists of placing a heated wedge, mounted on a self-propelled unit, between two overlapped sheets such that the surface of both sheets are heated above the polyethylene's melting point. After being heated by the wedge, the overlapped panels pass through a set of pressure wheels that compress the two panels together to form the weld. The hot wedge-welding machine is equipped with a sensor that continuously monitors the temperature of the wedge and the speed of the machine.

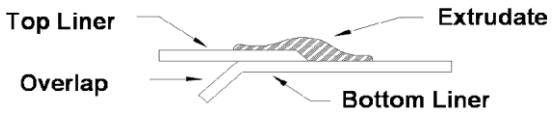
Overlap the panels of membrane approximately 10.0 cm – 15.0 cm (4" to six 6") prior to weld clean the seam area prior to seaming to assure the area is clean and free of moisture, dust, dirt, or debris of any kind. No grinding is required for hot wedge welding.

Adjust the panels in a way that seams are aligned with a minimum number of wrinkles or „fish- mouths". A piece of sliding liner may be used, directly under ness the overlap of the membrane that will be seamed to prevent build-up of dirt or moisture between the panels.

The Installer relies on his and the experience of the Project Superintendent and the results of test seams to determine whether seaming is restricted by weather. Many factors, such as the membrane temperature, humidity, wind, precipitation, etc., can affect the integrity of field seams and must be taken into account when deciding whether or not seaming should proceed. Test seams, are required prior to daily production seaming to determine if the weather conditions will effect the Installer's ability to produce quality seams.

Additional non-destructive and destructive testing of production seams substantive the decision made by the Project Superintendent to seam on any given day. The daily protection of the placed membranes has be done by the responsibility of customer. Important is the protection against wind and storms.

Extrusion welding



Extrusion seam

Extrusion welding is used beside the hot wedge welding method as standard method for welding the liner where hot wedge welding cannot take place. For joining the liner according DVS 2225-1 only the process variant II, manual continuous Hot Gas Extrusion Welding method has to be considered. This welding technique is characterized as follows:

- Welding process is performed with welding filler being pressed out of a compounding unit.
- The welding filler is homogenous and completely plasticized.
- The joining surfaces have been heated up to welding temperature.
- Joining is performed under pressure.

Whenever possible, the edge of the welded patch will be beveled prior to perform the weld.

Overlap the panels of geo-membrane a minimum of 8.0 cm (3”).

Using a hot-air gun, tack welds the panels or patches to be welded, taking care not to damage the membrane.

Cleaning of the seam area

Clean the seam area prior to seaming to assure the area is clean and free of moisture, dust, dirt and debris.

Grind seam overlap prior to welding properly with not damage the geo-membrane. Grind marks should be covered with extrudate whenever possible. In all cases grinding should not extend more than 8.0 mm (1/4”) past the edge of the area covered by the extrudate during welding (recommended disc grid 80 - 100)

Whenever possible, Welding Technicians will cut a 2.5 cm (1”) peel specimen at the end of every seam. Prior to welding the next seam, the specimen will be tested for peel.

Failed peel test

In the case of non-complying seam, more specimens will be cut out, the welding machine will be taken out of service until a passing trial weld is obtained, and additional peel specimens will be taken to localize the reason for the failure.

The CQC Coordinator may, after consulting the Installer‘s Site Superintendent, to take destructive samples from any seam, if defects are suspected.

h. *Seaming Documentation*

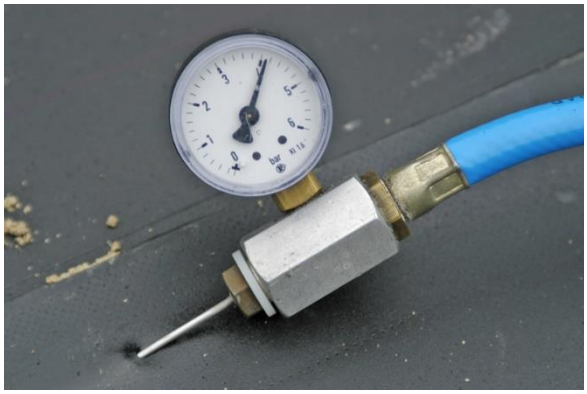
Welding Technicians will mark on the liner with permanent markers, such as Mean Streak, at the start of all seams information regarding, date, time Welding Technicians ID, machine number and set temperature. CQC Coordinator or Assistant will record date, time, seam number, Technician ID, machine ID, set temperature speed and weather conditions on the Installer’s panel seaming form.

Welding Technicians will periodically check operating temperature and speed and mark the information along the seam.

CQC Coordinator will make periodically checks on welding operations to verify overlap, cleanliness, etc.

i. Non-Destructive Seam Continuity Testing

The Installer shall non-destructively test, field seams over their full length using a vacuum test unit or spark tester (for extrusion seams only) and air pressure test (for double seams). The testing shall be carried out to the accepted standards of the industry. The purpose of non-destructive tests is to check the continuity of seams. It doesn't provide any information on seam strength. Continuity testing shall be carried out on 100 percent of the seams as the seaming work progresses.



Testing of double seam

The general air pressure testing procedure used by the Installer shall be as follows:

- Seal both ends of the test channel with a heat gun or other acceptable clamping method.
- Insert a hollow needle with attached pressure gauge into the test channel.
- Inflate the test channel to 300 kPa (3 bar), close valve, and observe initial pressure after approximate air temperature and pressure have stabilized.
- Observe and record the test pressure 10 minutes after reading the initial test pressure.
- If pressure loss exceeds 30 kPa (0,3 bar), or if the pressure does not stabilize, locate the faulty area and repair.

At the conclusion of the pressure test, the end of the seam opposite the pressure gauge shall be cut to verify seam channel continuity. A decrease in a gauge pressure must be observed or the air channel will be considered "blocked" and the test will have to be repeated after the blockage is corrected. Remove needle or other approved pressure feed device and seal the resulting hole. Test results will be recorded by the Installer. Recommended test pressure by DVS 2225-2 standard for HDPE:

Up to 20°C	5 bar
20 to 40° C	4 bar
40 to 55° C	3 bar

For flexible materials like VLDPE/PP-flex/FPO the test pressure shall be reduced 2 bar (28 psi) less than HDPE.

In the event of a non-complying air pressure test, the following procedure shall be followed:

Check the seamed, seal and retest the seams. If the seam fails air pressure testing, the Installer may isolate the failing zone, air pressure test the seam outside the failing zone, then repair the failing zone by the methods listed below. Alternatively, the Installer may repair the entire seam by the methods listed below:

Cap-strip the suspect area when sufficient overlap exists 50.0 mm, heat tack the overlap and extrusion weld the entire seam:

- Further isolate the air pressure failure
- Test the entire length of the repaired seam by vacuum testing.

All needle holes in air channels, within the boundaries of the active cell, will be repaired (closed) by extrusion bead.

All information regarding air-pressure test (date, initial time, temperature and pressure, final time and pressure, pass/fail designation and technicians number) will be written on one end of the seam, or portion of seam tested. All of the above information will also be logged on the Installers non destructive testing form.

Unless otherwise specified, the general vacuum testing procedure used by the Installer shall be as follows:

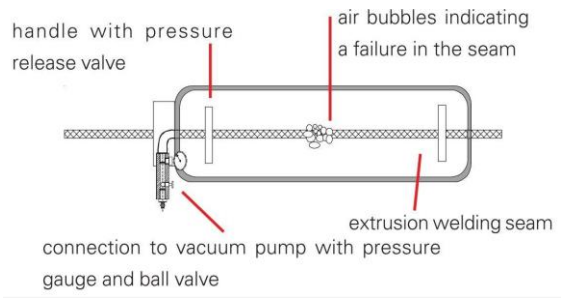
- Turn on the vacuum pump to reduce the vacuum box.
- Apply a generous amount of liquid soap and water solution to the area to be tested.
- Place the vacuum box over the area to be tested and apply sufficient downward pressure to “seat” the seal strip against the liner.
- Close the release valve and open the ball valve.
- Ensure that a leak tight seal is created.
- For a period of not less than 15 seconds, examine the geomembrane through the clear top view for the presence of soap bubbles.
- If no bubbles appear after 15 seconds, open the vacuum release valve and move the box over the next adjoining area with a minimum of 75 mm overlap, and repeat the process.

Vacuum test

Vacuum testing crew will use mean streak permanent markers to write on liner indicating tester‘s ID number, date and pass/fail designation on all areas tested.

The CQC Coordinator or testing crew on Installers will maintain records of vacuum testing.

All cuts through the liner, as a result of testing, will be repaired by extrusion welding (patching) and retest by vacuum testing.



Drawing of vacuum bell

j. *Destructive Testing*

The purpose of destructive testing is to determine and evaluate seam strength. These tests require direct sampling and thus subsequent patching. Therefore, destructive testing should be executed to a minimum in the field area to reduce the amount of repairs to the geo-membrane except remaining liner in the trench.

Destructive test samples shall be marked and cut out randomly at a minimum average frequency of one test location every 150.0 m(500 feet) of seam length, unless otherwise specified or agreed.

CQC Coordinator (or the third party QA Representative) will select location of destructive samples, with samples cut by Installer's welding Personnel.

Destructive samples should be taken and tested as soon as possible after the seams are welded (1 hour after welding), in order to receive test results in a timely manner.

Field tensiometer test

Installer's qualified personnel will observe all field destructive testing and record date, time, seam number, location, and test results on Installer's Destructive Testing form.

All destructive test locations with pass/fail designation will be marked on liner with permanent markers, such as „Edding".

The sample should be 300.0 mm (12") wide with a seam 400.0 mm (16") long with the seam in the center. The sample may be increased in size if an independent laboratory testing shall make at client's request or as specified in the project specifications.

A 25.0 mm (1") specimen shall be cut from each end of the chosen seam for field testing. The two specimens shall be tested on a field tension-meter for peel strength. If either field specimen does not pass, it can be assumed that the sample would also not pass specified destructive testing. The procedure mentioned shall be followed to locate passing samples for specified testing.

Cut additional field samples out of the seam where tested specimen failed at peel testing. The distance should be approximately 3.0 m (10 feet) in each direction from the location of the initial non-complying sample. Perform a field test for peel strength. If those field samples pass, then all sampling material can be cut for specified testing. If all specimen of the full sample length pass, then repair should be carried out in the area between the two passing sample locations according to procedures described.

If either of the samples is still in non-compliance, the additional samples are taken in accordance with the above procedure until two passing samples are located to establish the zone where the seam should be reconstructed.

All passing seams must be bounded by two locations wherefrom full samples, passing specified destructive test, have been taken.

In cases of repaired seams exceeding 45.0 m (150 feet), a sample must be taken out and pass destructive testing within the zone where the seam has been reconstructed. Each part must be considered as an independent seam.

All destructive seam samples shall be numbered and recorded on Installation Company's Destructive Test Form.

The Installer will perform full destructive test on samples when required by the site-specific QC plan or in the event that third party destructive testing is not being performed. Full samples will be tested under appropriate conditions on site unless off site laboratory testing is required by the specifications or the site Supervisor's request of laboratory testing.

Destructive samples will be tested for „shear strength" and „peel adhesion" (according to DVS 2226-1/2/3). Five specimens shall be tested for each test method and results shall be considered in accordance to the tables shown in the above mentioned DVS standard

k. *Defects and Repairs*

The Installation Company's CQC Coordinator and/ or project Superintendent shall carefully after completion of seams visually check all seams and areas of the geo-membrane for defects, holes, blisters, or any signs of damage.

All other installation personnel shall, at all times, be on the lookout for any damages on the geomembrane. Damaged areas shall be marked and repaired.

Any part of the geo-membrane seam showing a defect, or having a destructive or non-destructive test in non-compliance shall be repaired. Several procedures exist for repair and the decision as to the appropriate repair procedure shall be made by Installer Company's project Superintendent.

In general to repair large holes, deep notches or cut outs where destructive samples were taken. All patches shall extend at least 8.0 cm (3") all the edges of the defect and all corners of patches shall be rounded.

Every repair shall be non-destructively tested. Repairs which pass the non-destructive test shall be considered acceptable. Repairs exceeding 45.0 m in length (150 feet) require a destructive test. Non- destructive testing of repair shall be logged on an Installer Repair Report Form when specified.

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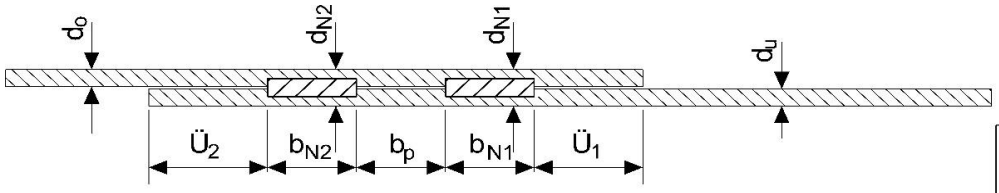
Test report for lap joints with inspection channel (HH)		No.	
Construction project		Lining membrane	
Date		Manufacture	
Joining technique		Raw material	
Weld no.		Nominal Thickness	

I. External condition

Station	Weld course	Bead formation	Notches and grooves	Remarks

II. Dimensions [mm]



Station	$\ddot{U}_1$	$\ddot{U}_2$	b_{N1}	b_{N2}	b_P	d_o	d_u	$d_o + d_u$	d_{N1}	d_{N2}	Δd_{N1}	Δd_{N2}	Remarks

III. Failure behaviour in the peel test ☐ with force indication ☐ without force indication

Station	Width of specimen(mm)	Maximum tensile force (N)	Deformation and failure behaviour	Assessment	Remarks

IV. Leak test with compressed air

Test parameters		Pressure [bar]:		Duration [min]:		temp. of membrane [°C]:		pressure drop [%]:
		Start of test		End of Test		Difference		
Station	width b_P	Time	bar	Time	bar	bar	Time	Remark

Inspector	Site manager/foreman	Construction supervision
date signature	date signature	date signature

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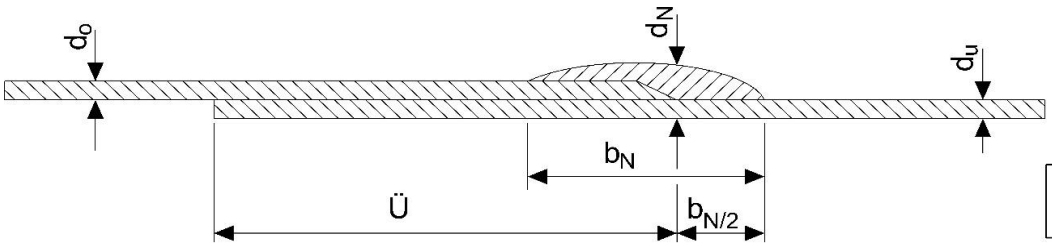
Test report for slot welds (WE)			No.	
Construction project		Lining membran		
Date		Manufacture		
Joining technique		Raw material		
Weld no		Nominal Thickness [m		

I. External condition

Station	Weld course	Bead formation	Notches and grooves	Remarks

II. Dimensions [mm]



$$F_{NA}=d_N/(d_o+d_u)$$

Station	Ü	b_N	$b_{N/2}$	d_o	d_u	$d_o + d_u$	d_N	f_{NA}	Remarks

III.Failure behaviour in the peel test ☐ with force indication ☐ without force indication

Station	Width of specime [mm]	Maximum tensile force [N]	Deformation and failure behaviour	Assessment	Remarks

IV Leak test with compressed air

Station	Vacuum		High Voltage		Remarks
	Vacuum [bar]	duration [sek]	Device Typ	Voltage [kV]	

Inspector	Site manager/foreman	constrution supervision
date signature	date signature	date signature

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Welding report for lap joints with inspection channel (HH)		**No.**	
Construtions Project		Installation company	
Joining technique		Manufacter	
Welder		Raw material	
Welding mashine		Nominal Thickness	

Seam-Number								
	Start	Finish	Start	Finish	Start	Finish	Start	Finish
Time								

Weather Conditions	Start	Finish	Start	Finish	Start	Finish	Start	Finish
General(Cloud cover,/wind)								
Air temperature in [°C]								
Relative humidity in [%]								

Condition of Lining membranes	Start	Finish	Start	Finish	Start	Finish	Start	Finish
Surface temperature [°C]								
Condition [smooth, structure, ground]								
The joining area was sanded and cleaned according to the requirements.								

Welding paramteres		Start	Finish	Start	Finish	Start	Finish	Start	Finish
Wedge temperature / hot-gas temperature[°C]	Setting								
	Measurement								
speed in [m/min]	Setting								
	Measurement								
Joining force in [N]	Setting								
	Measurement								

Weld sample									
Test weld - start	No.								
Test weld - finish	No.								

Remarks:

Welder	Site manager/foreman	Construction supervision
date signature	date signature	date signature

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Welding report for slot welds (WE)				No.	
Construtions Project			Installation company		
Joining technique			Manufacter		
Welder			Raw material		
Welding mashine			Nominal Thickness		

Seam-Number								
	Start	Finish	Start	Finish	Start	Finish	Start	Finish
Time								

Weather Conditions	Start	Finish	Start	Finish	Start	Finish	Start	Finish
General (Cloud cover/wind)								
Air temperature in [°C]								
Relative humidity in [%]								

Condition of Lining membranes	Start	Finish	Start	Finish	Start	Finish	Start	Finish
Surface temperature [°C]								
Condition [smooth, structure, ground]								
The joining area was sanded and cleaned according to the requirements.								

Manufacture,Type	AGRU

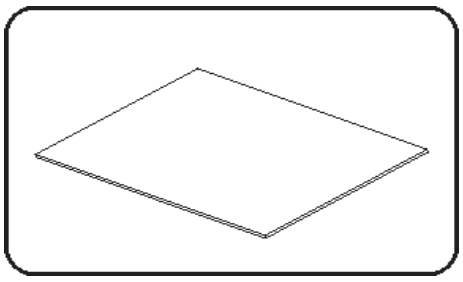
Welding parameters		Start	Finish	Start	Finish	Start	Finish	Start	Finish
Extrudate temperature [°C]	Setting								
	Measurement								
Hot-air temperature [°C]	Setting								
	Measurement								
Test weld - Start	No.								
Test weld - Finish	No.								

Remarks

Welder	Site manager/foreman	Construtions supervision
date signature	date signature	date signature

smooth HDPE liner
high density polyethylene

- Liner G / G
- smooth / smooth
- width: 5.0 m / 7.0 m
- calandered
- HDPE black



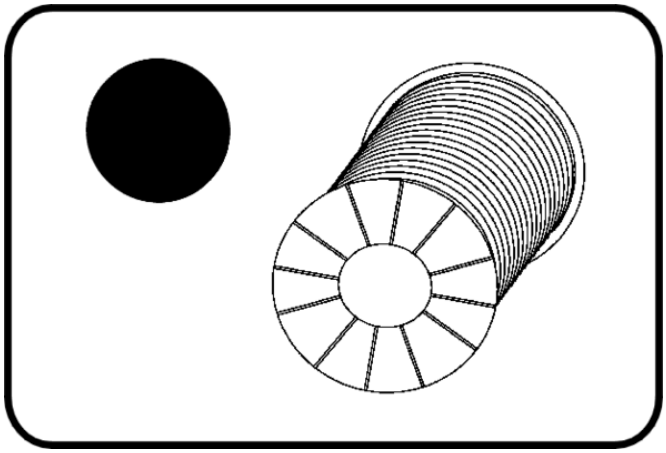
Code: 27.500 / 27.507

Properties	Test Method	Unit							
Width	-	m	5.0	5.0/ 7.0	5.0/ 7.0	5.0/ 7.0	5.0/ 7.0	5.0/ 7.0	5.0/ 7.0
Thickness (average)	EN ISO 9863-1	mm	≥ 0.5	≥ 0.75	≥ 1.0	≥ 1.5	≥ 2.0	≥ 2.5	≥ 3.0
Thickness (single values)	EN ISO 9863-1	%	±10						
Density	EN ISO 1183	g/cm³	≥ 0.94						
Melt Flow Rate (190/ 5)	EN ISO 1133	g/ 10 min	0.4 - 3.0						
Dimensional stability									
(100°C/1h)	EN 1107-2	%	-	-	-	≤ 2.0	≤ 2.0	≤ 2.0	≤ 2.0
(80°C/6h)	EN 1107-2	%	≤ 2.0	≤ 2.0	≤ 2.0	-	-	-	-
Tear resistance	EN ISO 34-1	N/mm	≥ 130	≥ 130	≥ 130	≥ 130	≥ 130	≥ 130	≥ 130
Tensile properties:									
Stress at Yield	EN ISO 527	N/mm²	≥ 15	≥ 15	≥ 15	≥ 15	≥ 15	≥ 15	≥ 15
Elongation at Yield	EN ISO 527	%	≥ 9	≥ 9	≥ 9	≥ 9	≥ 9	≥ 9	≥ 9
Elongation at Break	EN ISO 527	%	≥ 400	≥ 400	≥ 500	≥ 700	≥ 700	≥ 700	≥ 700
CBR - static puncture test	EN 12236	N		≥ 1500	≥ 2000	≥ 3500	≥ 4500	≥ 5500	≥ 7500
Foldability at low temperatures	EN 495-5	-20°C	no break	no break	no break	no break	no break	no break	no break
Water absorption	EN ISO 62	%	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1
Root resistance	OENORM S 2073	-	fulfilled*	fulfilled*	fulfilled*	fulfilled*	fulfilled*	fulfilled*	fulfilled*
Resistance to microorganism	OENORM S 2073	-	fulfilled*	fulfilled*	fulfilled*	fulfilled*	fulfilled*	fulfilled*	fulfilled*
Rodent resistance	OENORM S 2073	-	fulfilled*	fulfilled*	fulfilled*	fulfilled*	fulfilled*	fulfilled*	fulfilled*
NCTL/ ESCR-behaviour	EN 14576	h	> 340	> 340	> 340	> 340	> 340	> 340	> 340
Carbon black content	EN ISO 11358	%	2 - 3	2 - 3	2 - 3	2 - 3	2 - 3	2 - 3	2 - 3

The data in this table are approximate values and based upon results of the internal inspection, data of raw material suppliers as well as tests in the course of approval procedures and external inspections. The results can differ slightly from the indicated mean values in longitudinal and transverse direction and due to different nominal thicknesses and raw materials. In any case requirements relating to a special project (tender documents) have to be agreed with AGRU. Independent of the indicated test standards, internal tests and data on test certificates are generally carried out in accordance with the appropriate test procedures according to OENORM/DIN /EN/ISO AGRU assumes no liability in connection with the use of this data. The specifications on this sheet are subject to change without notice.

* acc. OENORM S2073 liners made of polyolefins shall be considered resistant without proof being furnished.

Accessories, Welding-Rod



Code: 410.5

- **Welding-Rod 3kg roll**

- circular profile
- NRW,Dibt,ASQUAL,GRI GM 13
- extruded

- **Extrusion-welding**

- **HDPE black**

Dimension	Code	Detail	Unit	Weight
3	27.410.5000.30	3mm x min. 380m	kg	1
4	27.410.5000.40	4mm x min. 220m	kg	1
5	27.410.5000.50	5mm x min. 138m	kg	1