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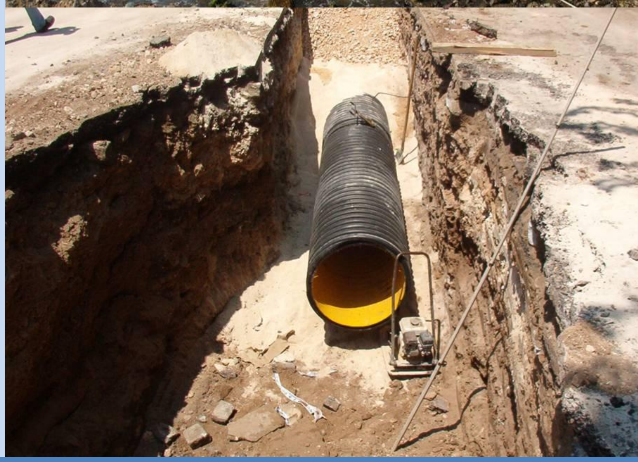
UNITED GULF PIPE MANUFACTURING CO. LLC

INSTALLATION HANDBOOK



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WELDING AND SITE INSTALLATION INSTRUCTIONS FOR PIPES WITH INTEGRATES ELECTRO FUSION

Welding and site installation instructions for pipes with integrates electro fusion

Pic. 1

1. Electric power supply: Generator with minimum capacity of 15 kVA. Pay attention to a constant power output.

2. Welding is just to be done by authorized personnel.

3. The welding area has to be protected against dirt, humidity, and direct solar radiation.

   In case of temperatures below +5°C appropriate actions like covering by a tent and preheating are to be carried out to prevent a further decrease of temperature. *(Pic. 1).*

Pic. 2

4. Do not remove the protective film until cleaning and assembling socket and spigot end *(Pic. 2)*.

5. Check socket and spigot end for transportation damages.

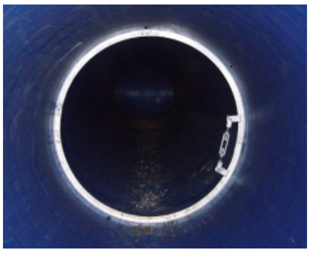
6. Position the pipes so that the welding connections are easily accessible.

Pic. 3

7. Socket and spigot end has to be cleaned with PE cleaner, lint-free and not pigmented paper towel *(Pic. 3)*.

8. Mark insert-depth (according to the socket length) at the spigot end with a waterproof pen.

9. Put the pipes together until arrester / marking; adjust them axially and vertically. Take care that there is no humidity between socket and spigot end.



Pic. 4

10. Place a support ring into the spigot end (approx. 20 mm from edge) of PKS pipes ≥ DN 800 *(Pic. 4)*.

All these preparations have to be done before welding!

11. Insert the KRAH chain tensioning device into the groove at the socket end, the KRAH chain tensioning device has to be placed staggered to the connection wires (distance at least 25 cm) *(Pic. 5)*.

Pic. 5

Pic. 6

12. Tighten the tension band with a tool until the socket is touching tthe spigot end.

13. In case of short-length pipes fix socket and spigot end additionally.

14. Connect the adapter with the connection wire. Now join the welding wires of welding device and the connection adapter (Pic. 6).

Take care that no tractive forces interfere with the connection wires (danger of short-circuit).

Pic. 7

15. Enter welding parameter into welding device (Barcode or manually). Start the welding process *(Pic. 7)*.

16. During the last third of the welding time retighten the KRAH chain tensioning device.

17. After the welding procedure mark the seam with a waterproof pen (seam number, date, welding voltage, and time, welder) *(Pic. 8)*. Remove the adaptor from the connection wires.

Pic. 8

18. Do not move the pipe during cooling time.

19. After the cooling process (approx. 40 min.) remove tightening band, tool and support ring (inside).

20. The tightness of the welding connection has to be checked according to DIN EN 1610 (from DN 700 e.g. with a pneumatic socket test device).

It is very important to test the tightness (according to DIN EN 1610, section 10) before filling the sides respectively before inserting into a jacket tube *(Pic.9)*.

With reservation for technical modification (09/2009)

Pic. 9

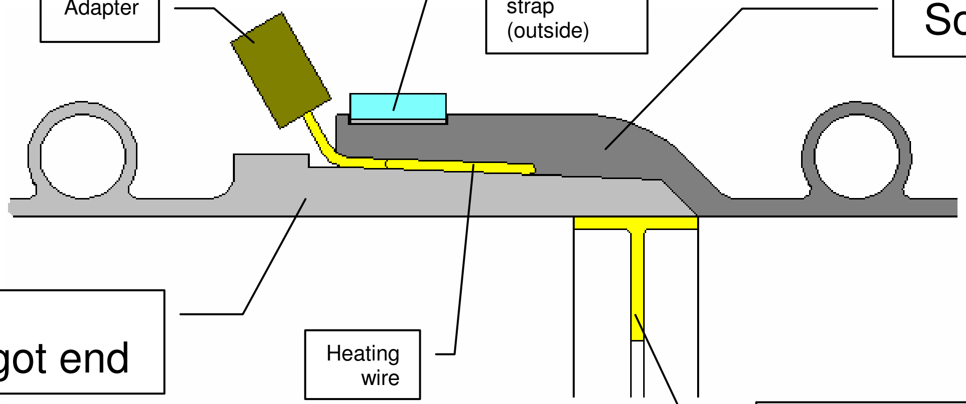
Lapping torsional moment at chain tensioning device for welding of e-socket KR-pipes

Diameter	Torsional at the beginning of the welding	Torsional after 2/3 of the welding time
DN 300	45 Nm	55 Nm
DN 400	48 Nm	58 Nm
DN 500	53 Nm	63 Nm
DN 600	53 Nm	65 Nm
DN 700	55 Nm	65 Nm
DN 800*	58 Nm	68 Nm
DN 900*	58 Nm	70 Nm
DN 1000*	60 Nm	73 Nm
DN 1200*	62 Nm	74 Nm
DN 1400*	65 Nm	76 Nm
DN 1500*	68 Nm	78 Nm
DN 1600*	70 Nm	85 Nm
DN 1800*	80 Nm	95 Nm
DN 2000*	80 Nm	95 Nm
DN 2200*	85 Nm	100 Nm
DN 2400*	88 Nm	100 Nm
≥ DN 2500	The torsional have to be calculated at this welding test	

- From DN 800 an internal support ring is needed for welding
- While the cooling time (30-45 min. depending upon outside temperature) the chain tensioning device remains tighten at the socket.

WELDING PARAMETER
AND
WELDING TIME

Welding parameter for electro fusion socket DN300-2300



Socket	Voltage	Time at sek. at any Spirals	Voltage	Time at sek. at two Spirals
DN300	15 Volt	780		
DN400	18 Volt	840		
DN500	20 Volt	900		
DN600	24 Volt	1020		
DN700	25 Volt	1080		
DN800	33 Volt	1020		
DN900	39 Volt	720		
DN1000	40 Volt	1080		
DN1100	41 Volt	1200		
DN1200	43 Volt	1260		
DN1300	46 Volt	1320		
DN1400	48 Volt	1500	28 Volt	1020
DN1500	48 Volt	1740	32 Volt	1020
DN1600			32 Volt	1080
DN1700			36 Volt	1140
DN1800			40 Volt	880
DN1900				
DN2000			39 Volt	1200
DN2100			40 Volt	1230
DN2200			41 Volt	1260
DN2300			44 Volt	1300
DN2400				

Tab.: PKS-welding-time in sec. for manuel input

Dimension [mm]	Voltage [Volt]	Temperature **20° bis 15°**	Temperature **15° bis 10°**	Temperature **10° bis 5°**	Temperature **5° bis 0°**
DN 300	15 V	700 up to 735	735 up to 770	770 up to 805	805 up to 840
DN 400	18 V	800 up to 840	840 up to 880	880 up to 920	920 up to 960
DN 500	20 V	900 up to 945	945 up to 990	990 up to 1035	1035 up to 1080
DN 600	24 V	1020 up to 1065	1065 up to 1115	1115 up to 1165	1065 up to 1250
DN 700	25 V	1080 up to 1120	1120 up to 1170	1170 up to 1230	1230 up to 1280
DN 800	33 V	1020 up to 1065	1065 up to 1100	1100 up to 1150	1150 up to 1200
DN 900	39 V	720 up to 780	780 up to 840	840 up to 920	920 up to 1000
DN 1000	40 V	1080 up to 1130	1130 up to 1180	1180 up to 1220	1220 up to 1270
DN 1100	41 V	1200 up to 1250	1250 up to 1320	1320 up to 1400	1400 up to 1480
DN 1200	43 V	1200 up to 1260	1260 up to 1320	1320 up to 1380	1380 up to 1440
DN 1300	46 V	1300 up to 1430	1430 up to 1500	1500 up to 1560	1560 up to 1620
DN 1400 *	*28 V*	*1020 up to 1065*	*1065 up to 1110*	*1110 up to 1160*	*1160 up to 1210*
DN 1500 *	32 V	*1000 up to 1050*	*1050 up to 1100*	*1100 up to 1150*	*1150 up to 1200*
DN 1600 *	32 V	*1080 up to 1120*	*1120 up to 1170*	*1170 up to 1220*	*1220 up to 1270*
DN 1800 *	*40 V*	*880 up to 930*	*930 up to 1000*	*1000 up to 1070*	*1070 up to 1150*
DN 2000 *	*39 V*	*1200 up to 1250*	*1250 up to 1300*	*1300 up to 1350*	*1350 up to 1400*

Welding time at one Spirals

DN1400	48 V	1500 up to 1560	1560 up to 1620	1620 up to 1700	1700 up to 1760
DN1500	48 V	1740 up to 1800	1800 up to 1860	1860 up to 1940	1940 up to 2000

Stand: 10.09.07

(* Welding time at two Spirals)

Important: During the welding and cooling time do not move the pipe at all!

Electro-fusion welding parameters for Preheating

Welding Preheat Intervals		
DN mm	Welding Voltage	Preheating Interval sec.
300	15	300
400	18	300
500	20	350
600	24	350
700	25	400
800	33	400
900	39	400
1000	40	400
1100	41	400
1200	43	450
1300	46	450
1400	28	500
1500	32	500
1600	32	500
1800	40	500
2000	39	600

The preheating should be applied at the pipes to be welded as see above in the table, in case of the ambient temperature of welding location is lower than 10℃.

Except under extreme conditions, welding operation under the ambient temperature below 5℃ is not recommended.

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STORAGE

Storage

The pipes should only be loaded and unloaded from trained staff to prevent damages on the pipes.

To prevent deformation at the connection, watch carefully during the transport, that there will be no punctual pressure on the socket or spigot end.
Before unloading the pipes, check for damages during the transport.

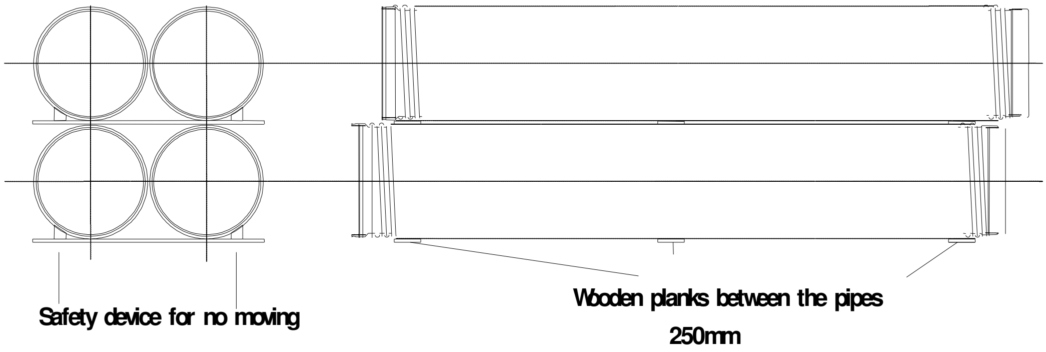
Prepare the storage place so that the pipes will lay straight (horizontal), no punctual pressure on the socket and spigot end and that no deformation can appear.
To prevent deformation at the socket and spigot end store the pipes staggered, so that no socket touches with another.
To prevent contamination of the connection, build the storage place corresponding to this.
Damage on the padded foil, which covers the socket and the spigot end, is to prevent.

Make sure, that the pipe stack can not move to the left or to the right.
The height of the stack should not be higher as 2.4 meters.

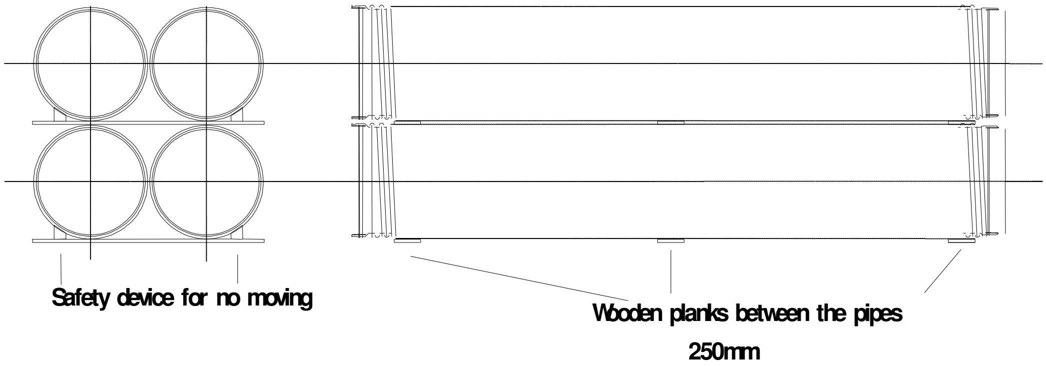
Watch for no contamination during installation at the building ground. Remove the padded foil just before putting the spigot end in the socket.

For welding the pipes, look for the regulations ‚welding of pipes‘.

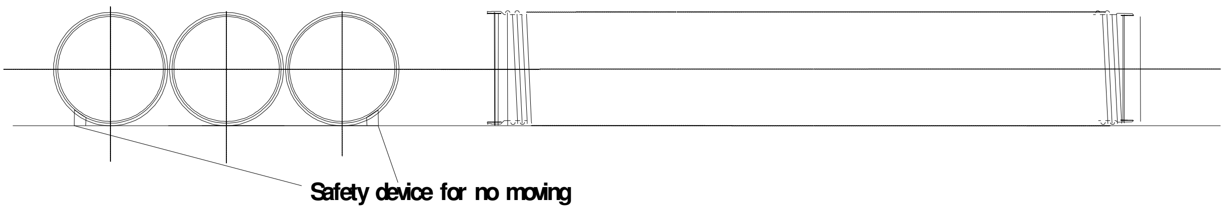
Staggered stack



Stack



Single stack



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PRACTICAL USE

Practical use

a) Delivery

This installation instruction includes additional information for the transport, storage and installation of KPPS® or PKS® pipes and is no supersedure of appropriate documentation like worksheets, norms, guidelines, data sheets and accident prevention regulations.

It is assumed that the installation of the pipes has been planed according to the norms and that the installation workers know the contents of the above-mentioned documents. Apart from this installation instruction the following norms and worksheets have to be taken into account:

DIN EN 1610
ATV A 127
ATV-DVWK-A139
ZTVE-STB 94
ZTVA-STB 97

b) Transport

Pipes and fittings have to be transported with appropriate vehicles. During the transport and especially during the loading and unloading they have to be protected against damages.

Unloading of pipes
During the unloading of the pipes with hoists only belts should be used.
Steel wire ropes, chains as wells as sharp-edged hoists should be avoided.
During the unloading of the pipes with a fork lift the prongs which carry the pipes should be examined for sharp edges.

It is recommendable to wrap e.g. a protecting foil around the prongs or to use a suitable KPPS® or PKS® pipe inside the pipes that have to be unloaded.

Before unloading on site the condition of the pipes should be checked. Reclamations have to be indicated on the cargo documents.

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Unloading of fittings

The same guidelines as for the pipes apply.
During unloading of fittings the belts should be fastened on all factory-made brackets. Before lifting it should be assured that the belts are correctly fastened on the brackets.

Attention:

Depending on the construction of the fittings a tilt may occur. Therefore the safe distance during the unloading has to be kept.
As instructed for pipes the condition of the fittings should be checked before unloading on site. Reclamations have to be indicated on the cargo documents.

c) Storage

The pipes should be stored on even ground which is free of stones or sharp-edged objects. The pipes are to be stored in such a way that they cannot deform and are protected against dirt, mechanical damages and punctual load. (figure 1); this applies especially for the socket, the spigot and the Electro-Fusion wire inside of socket.

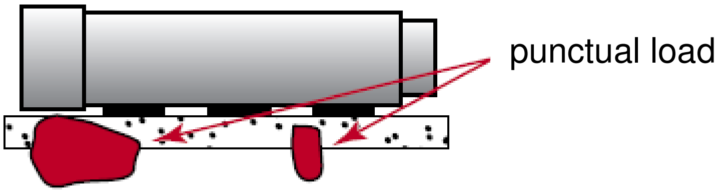

figure 1

Pipes of different nominal diameters can be stored one in another if the following conditions are respected:
Only the pipes in the lowest row can be stored one in another and the diameter difference of the two pipes should be 200 mm.

In order to guarantee a later proper and qualified welding it has to be checked before storing that the original packing has not been damaged. Should damages have been occurred, firstly the socket and the spigot have to be checked if they are clean and possible dirt has to be washed away with clean water. Afterwards the cleaned areas should be protected with a foil. In order that a later proper welding is not at risk, in no case adhesive film may mingle with the outside of the spigot as well as the inside of the socket (heating wire). Under optimum conditions, if blanks with a width of at least 200 mm are laid underneath the pipes, a maximum stack height of 3 m can be reached.

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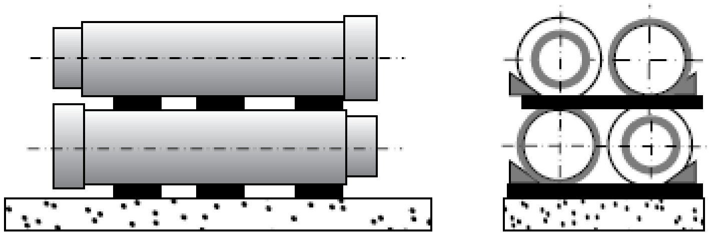

figure 2: height may not succeed 1m

If no blanks are used as underlay, even if the underground is smooth, the maximum stack height of 3 m does not apply anymore.

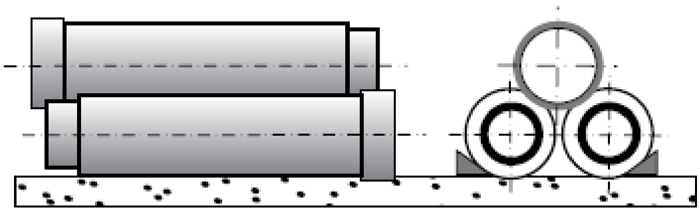

figure 3: **It has to be prevented, that the pipes only lay on the socket and spigot!**

d) Installation - compaction

KPPS® pipelines are engineered products. The static calculation for these pipes is based on the worksheet ATV A 127. The basis of the calculation procedure is:

DIN EN 1610
The worksheet ATV A 139
ZTVE-STB 94
ZTVA-STB 97 as well as
the “Merkblatt für das Verfüllen von Leitungsgräben”.

In EN 1610 the following definitions apply:

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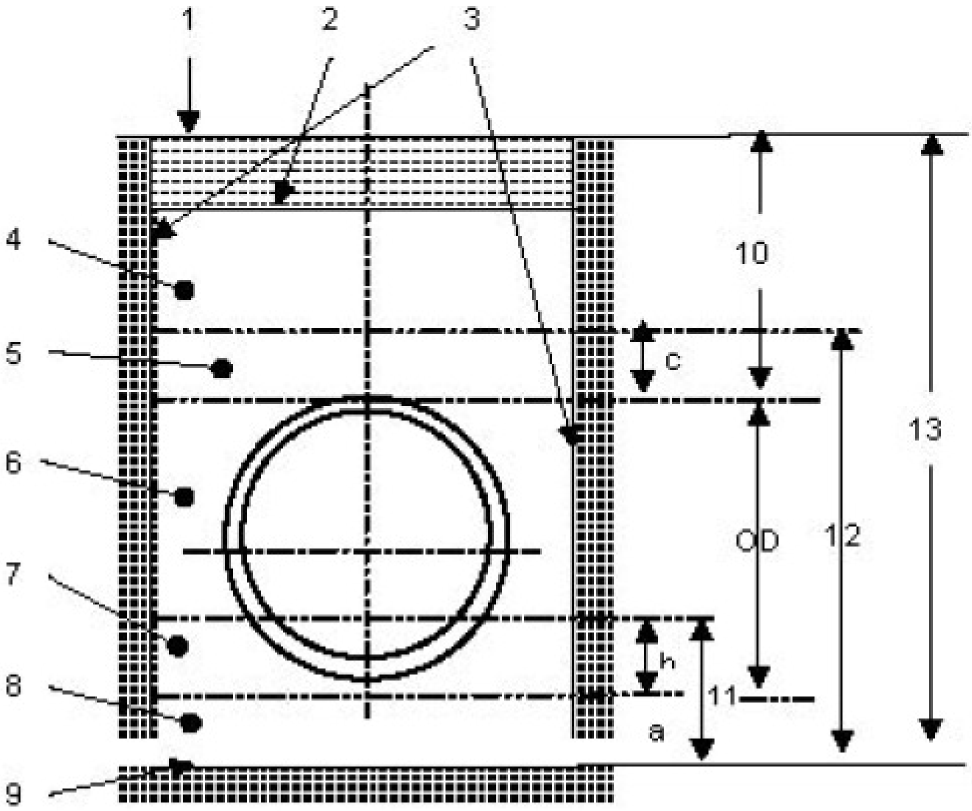

1. surface
2. lower edge of the road or rail construction, if existing
3. trench wall
4. main backfilling
5. cover
6. side backfilling
7. upper bedding layer
8. lower bedding layer
9. trench bottom
10. coverage height
11. thickness of the bedding
12. thickness of the conduction area
13. depth of the trench

a Thickness of the lower bedding layer (view type 1)
b Thickness of the upper bedding layer (minimum 100mm + 1/10 OD in mm)
c Thickness of the cover
OD outer diameter of the pipe

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According to EN 1610 the load carrying capacity pipe / ground for earth-laid pipes has to be proved before the start of the installation. This evidence is provided by the static calculation ATV A 127.

Conduction area

By using appropriate actions it has to be prevented that the soil enters into the conduction area (12) or that a displacement of material from the conduction area to the soil can occur.

The conduction area has to be protected against any predictable damaging change of its carrying capacity, stability or location. Reasons of such changes can be:

- Removal of the blank walls
- Impact of ground water
- Other neighbouring ground works

Water retention

During the installation works the trenches are to be kept free of water. The way of the water retention may not affect the conduction area and the pipeline.
Further instructions can be taken from EN 1610.

Note:
The compaction which is determined in the static calculation cannot be reached with wet compaction material >11% humidity.

Trench width

Big head access holes as well as a greater trench width for welders are not required for the Electro-Fusion socket jointing technique. Here, the widths indicated in EN 1610 resp. in the static calculation are sufficient. It only has to be guaranteed that the used welding device can work without any problems.

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Compaction of the conduction area

The embedding of the pipes considerably rules the load distribution and the pressure distribution on the pipe. False bedding can lead to excessive pipe deformation. It is recommendable to fill the pendentive area with a compactor, should the pipes be ≥ DN 1000. For pipes ≤DN 900 the lateral compaction power of the devices is sufficient in order to compact the pendentive area adequately.

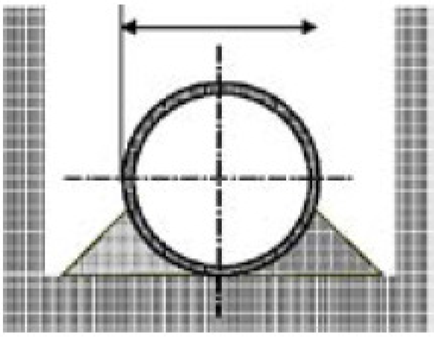

figure 4

The pendentive area has to be compacted.

On the side of the pipe it is compacted with a respective vibratory plate.

In the area of the conductive area (12), pipe support and embedding, until 0.30 m of over the pipe apex, if embankment sideways of the pipe at least 1,5da, only the

Picture 1

compactionable soil which is indicated in ATV Statik A127 may be used.

The bedding material has to be filled up in layers of 30 cm

The soil on both sides of the pipeline has to be filled up in layers at the same time and compacted accurately. It has to be paid attention that the pipeline remains in its position. The compaction grade D_{pr} has to correspond to the indications in the static calculations ATV A 127.

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The EN 1610 describes the following three types of carrying out the bedding:

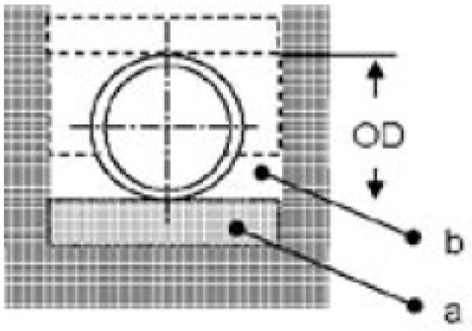

figure 5

Bedding of type 1 (figure 5) can be used for any conduction area, that allows a support of the pipes along their total length and that is produced by taking into account the required thickness of the layer a, and b. This applies for any dimension and form of the pipes. As far as nothing else is given, the thickness of the lower bedding layer a) measured under the pipe bottom may not fall below the following values:
100 mm with normal soil conditions
150 mm with rock or hard soil

The thickness b) of the upper bedding layer has to be according to the static calculation.

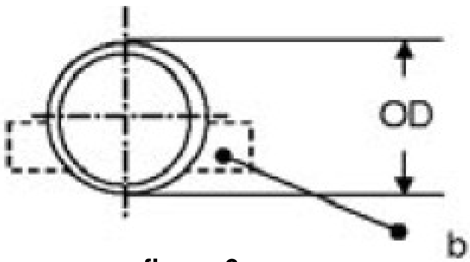

figure 6

Bedding type 2 (figure 6) may be used in smooth, relatively lose, fine-grained soil, which allows a support of the pipes in their total length. The pipes can be laid directly on the preformed trench bottom. The thickness b) of the upper bedding layer has to be according to the static calculations.

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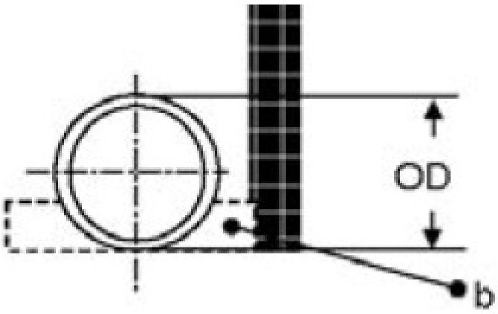


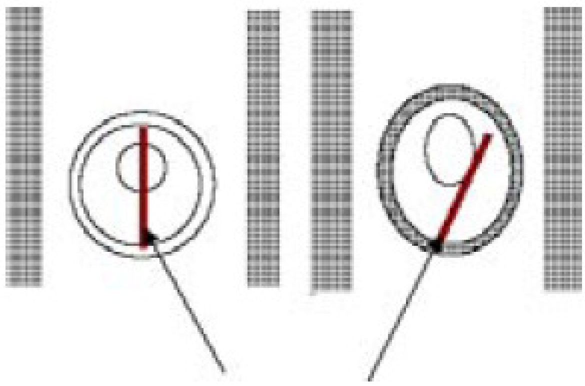
figure 7

Bedding type 3 (figure 7) may be used in smooth, relatively lose, fine-grained soil, which allows a support of the pipes in their total length. The pipes can be laid directly on the preformed trench bottom. The thickness be of the upper bedding layer has to be according to the static calculations.

Decisive is the bedding type which is indicated in the static ATV A 127!
minimum 300 mm above the apex of the pipe.

For the compaction works the following simple help has been proved in practice, which gives first information of a compaction on the side of the pipe.

figure 8



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Before the compaction works with suitable devices a wooden stick, which is adapted in its length to the inside pipe diameter, can be put vertically into the pipe. After compaction on the side of the pipe, the pipe becomes a little bit vertically oval, but which is hardly measurable. The clamp effect for the wooden stick decreases and it drops. (figure 7)

The compaction grade required according to the static calculation has to be checked by a device-specific regulation or has to be proved by a measurement.

The load which is determined in the static requires that in the trench filling the compaction grade is proved according to ZTVE-STB 94.

Compaction of the main backfilling

The mechanical compaction of the main backfilling (4) directly above the pipe should only be started when a layer of minimum 300 mm is above the apex of the pipe.

Picture 2

The mechanical compaction of the main backfilling is carried out with the help of a vibratory plate.

min. 300 mm above the apex of the pipe

f) Bending radius

The high flexibility is one of the most important advantages of KPPS pipes.
Before the installation into the trench the pipes are welded together in a straight line and can then be installed in a radius of 100 x DN.
Should smaller bending radius be necessary it has to be coordinated together with our technical department taking into account the installation temperature, the installation time (bending time), diameter, wall thickness and the technical devices.

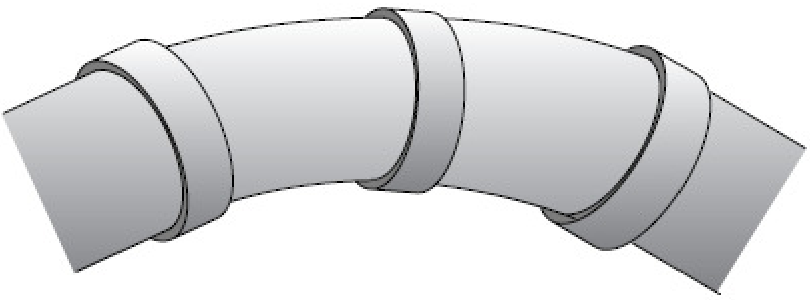

figure 9

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For pipes, which are not installed in a bent pipeline before welding the above-mentioned indications in respect of the bending radius do not apply. In order to be able to carry out a secure welding of the E-Fusion socket, the pipes may not be bended more than 0.6°. That means that a pipe with a length of 6 m may differ 60 mm from the pipe axis.

Should the turnarounds be bigger, that means the radius smaller; pipe bends and fittings should be used.

The basis for the indications of the bending radius is an installation temperature of 20 °C.

g) Inspection

I. Preparation

Filling and anchor

If needed the pipes have to be covered with filling material before the pressure tests, so that changes in position which can lead to leakage are avoided.

A filling in the area of the joints is facultative. Thrust bearings and anchor have to be mounted in a way that they also bear up against the forces of the test pressure. Thrust bearings of concrete have to have a sufficient strength before the beginning of the test. It has to be paid attention that the end parts of the pipe and other temporary installed end fittings are sufficiently supported and the force is distributed according to the admissible bottom pressing. Temporary installed supports or anchors on the ends of the test section may not be removed before the pressure test of the pipeline.

Determination and filling of the test sections

The pipelines are to be tested in total or if necessary in sections. The test sections have to be determined so that:

- the test pressure is reached on the deepest point of each test section
- on the highest point of each test section minimum MDP can be reached, except of differing determination of the planner.
- The required quantity of water for the pressure tests are readily available and can be discharged without any problems.

Any kind of rubble and foreign substances have to be removed from the pipe before the beginning of the test. The test section is filled with water. If not otherwise determined by the planner, drinking water should be used for the pressure test of drinking water.

The pipeline has to be deaerated as good as possible. The pipeline has to be filled, if possible from the low point, in a way that a back suction is prevented and the air can exhaust through adequately dimensioned primers.

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II. Test pressure

For all pipelines the system test pressure (STP) has to be calculated as follows, based on the highest system operating pressure (MDP).
When calculation the water hammer: STP = MDP_o + 100 kPa

When the water hammer is not calculated: STP = MDP_a -1.5 or STP = MDP_a + 500 kPa. The respectively lower value applies.

The value included in MDP_a for water hammer may not be smaller than 200 kPa.

The calculation of the water hammer has to be carried out according to suitable procedures under application of the appropriate basic equation and the assumptions of the planner. The unfavourable operation conditions should be taken as the basis.

Usually the measuring devices have to be connected on the lowest point of the test line.

If the measuring devices can not be connected at the lowest point of the test section, the pressure for the pressure test arise from the system test pressure, calculated for the lowest point of the test line minus difference in height.

In special cases, especial with short pipelines and connecting lines < DN 80 and shorter than 100 m, the operating pressure can be taken as system test pressure if not otherwise determined by the planner.

III. Pressure test procedure

General

For all kinds of pipes and materials different approved pressure test procedures can be used. The test procedure has to be determined by the planner und can be carried out in up to 3 steps:

- preliminary test
- decrease of pressure test
- main pressure test

The separate steps have to be determined by the planner.

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Preliminary test
The preliminary test serves for:
- the stabilisation of the pipe section which is to be tested after the most extensive dying out of the initial settlement
- sufficient water content by using of water-absorbing pipe materials und coatings
- Anticipation of the pressure depending on the increase of the volume of flexible pipes before the main test

The pipeline has to be divided into suitable test sections, completely filled with water, it has to be deaerated and the pressure has to be brought at least to the operating pressure, but without exceeding the system test pressure.

Should inadmissible changes in position of a pipe section or leakages occur, then the pipeline has to be released from the pressure and the cause has to be eliminated.

The duration of the preliminary test is depending on the pipe material and the coating and has to be determined by the planer by taking into account the respective product norms.

Decrease of pressure test
The decrease of pressure test makes possible a determination of the remaining air in the pipeline.

Air in the test section of the pipeline leads to wrong results, which show an apparent leakage or in some cases cover a small leakage. Existing air diminishes the accuracy of the pressure loss procedure and loss of water procedure.

The planner determines if a decrease of pressure test has to be carried out. A procedure for the execution of the test as well as the necessary calculations are described in A 26.

During the main test the loss of pressure □p has to show a decreasing tendency und may not succeed the following values in the end of the first hours:
- 20 kPa for pipes like ductile pipes with or without cement mortar coating, steel pipes with or without cement mortar coating, pre-stressed concrete cylinder pipes, plastic pipes.
- 40 kPa for pipes like fiber-cement pipes and not circular concrete pipes. For fiber-cement pipes the admissible pressure loss can be increased from 40 kPa to 60 kPa if the planner is convinced that excessive absorption conditions are present.

Alternatively for pipes with a viscose elastic behaviour (e.g. PE-pipes), for which in appropriate time during this procedure no water tightness can be proved, a special test can be carried out (refer to A. 27). For the test of the safe position in this case the system test pressure (STP) has to be restored during a stipulated time at regular intervals, while the pressure loss has to show a decreasing tendency.

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Following test of the pipeline system

If a pipeline has been separated into several test sections for the pressure test and all sections have passed the pressure test, the total pipeline has to be set under the operating pressure for at least 2 hours, as far as this has been determined by the planner. Any additional part of the pipeline, which was installed after the pressure test has to be examined for leakage and changes in position by a visual inspection.

Record of the test results

A complete documentation of the test results has to be made and archived.
Plastic piping for non-pressure underground drainage and sewerage – structured wall piping systems of unplasticised polyvinylcloride, polypropylene and polyethylene – part 1: Specifications for pipes, fittings and system.

h) Welding of the Electro-Fusion socket

Axially tight, permanent pipe joint
In DIN 16961 part 1 the Electro-Fusion socket are described in picture 10 and the extrusion welding in picture 8 as pipe joints. The service ability of the pipe joints has to be proved according to table 18 of prEN 13476-1.

Electro-Fusion socket
Power supply: generators with a minimum output of 15kVA. It has to be paid attention to the constant output of the generator. The welding has to be carried out by trained personal.

The welding section has to be protected against dirt, humidity and direct solar radiation.

At temperatures below +5°C as well as rain, suitable actions, which make sure that in this section the temperatures cannot go lower, for example to cover with tarps or to pre-heat as well as longer welding times, have to be carried out. (picture 3)

The protection film should only be removed shortly before cleaning or jointing the socket and spigot. (picture 4).

Socket and spigot have to be checked for possible transport damages. The pipes should be positioned in such a way that the welding connections are easily accessible.


Picture 3


Picture 4


Picture 5

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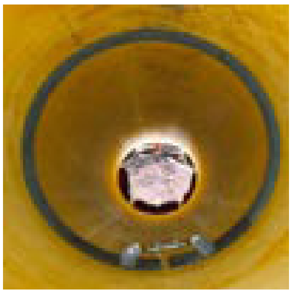

Picture 6

Spigot and socket should be cleaned with PE-cleanser, fuzz-free and uncoloured paper. The plug-in depth (minimum 20 mm) should be marked on the spigot with a water-resistant pen.

The pipes should be put into one another till the mark, and then should be aligned axially and vertically. It has to be paid attention that there is no humidity between the socket and the spigot.

Inside the PKS® pipes >= DN 800 in the section of the spigot (some 20 mm from the edge) should be placed a support ring. Working with wall collars always a support ring has to be used. This has not to be used in KPPS® pipes, because the stiffness of the spigot is approx. SN2.

Picture 7

The welding has to be carried out immediately after the preparation.

The tensile band has to be put into the groove in the end of the socket and the tightening tool has to be put beside the connection wires (distance of minimum 25 cm) (picture 7).

Picture 8

The tensile band has to be tensed with the tool until the socket touches the spigot.
With short pipes the socket and spigot has to be protected additionally against displacement.

For the welding Krah AG can make available special welding devices. (picture 9).
The welding wire has to be connected to the connection adapter.

The connection wires have to be shortened in such a way that the adapter nearly touches the socket end (picture 7). It has to be paid attention that no tractive force or push force take effect on the connection wires. (short circuit)

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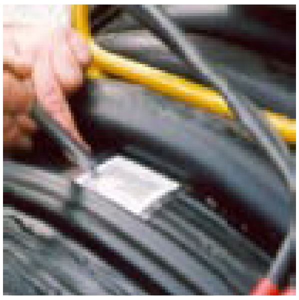
The welding parameters have to be read in (by hand or with barcode). Now the welding procedure can be started. The average welding times are:

Picture 9

Picture 10



Picture 11

In the last third of the welding time the tensile band has to be retightened.

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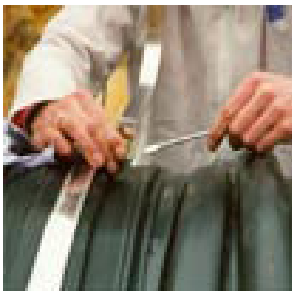

Picture 12

Picture 13

After the welding time the welding seam has to be marked with a water-resistant pen. (joint no., date, welding voltage, time, welder, picture 13)

The adapter has to be removed from the connection wires.

The pipe may not be moved during the cooling time.

The cooling times depend on the respective pipe temperature and are:
Pipe temperature times (approx.)
≤ 15 °C 35 min
15 °C – 40 °C 45 min

After expiration of cooling time the tensile band, the tools and support rings (inside) (where appropriate) have to be removed. The whole welding procedure is recorded by the welding device.

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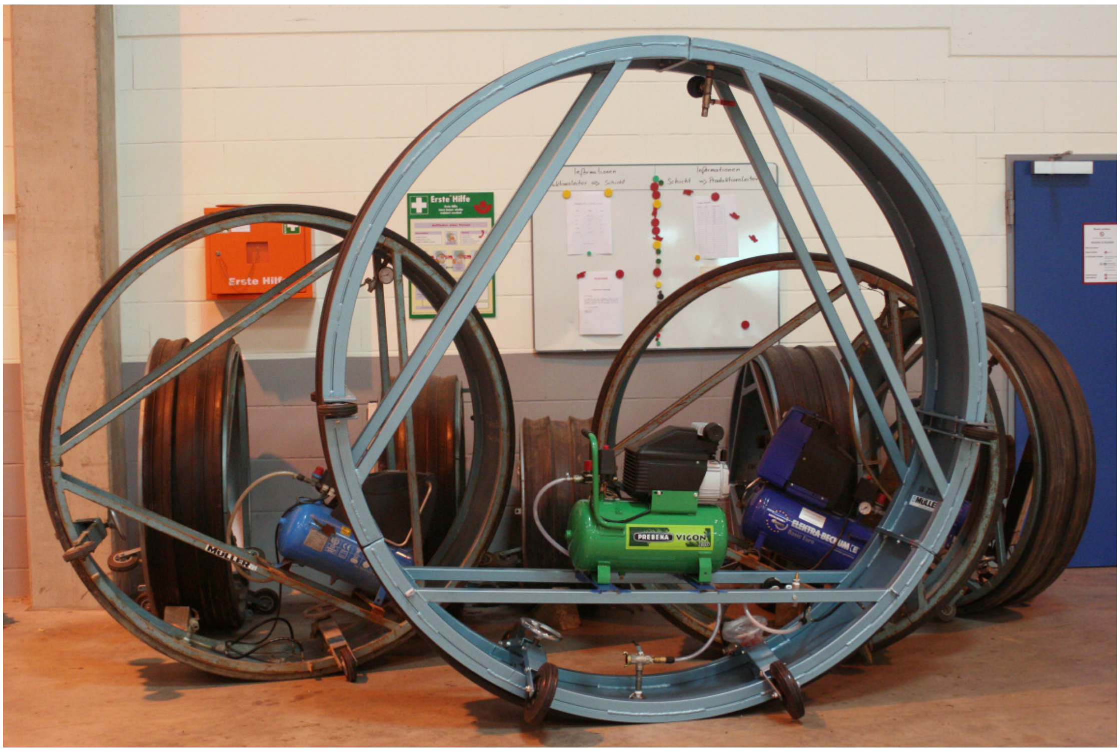
Pneumatic Joint Control Unit

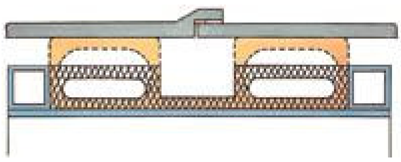


Pneumatic Joint Control Unit

The problem:

Sewerage pipe seal testing is a very awkward expensive operation especially in pipes with a large diameter. Often it is necessary while building sewerage pipes to test each individual joint. How can we solve this problem?

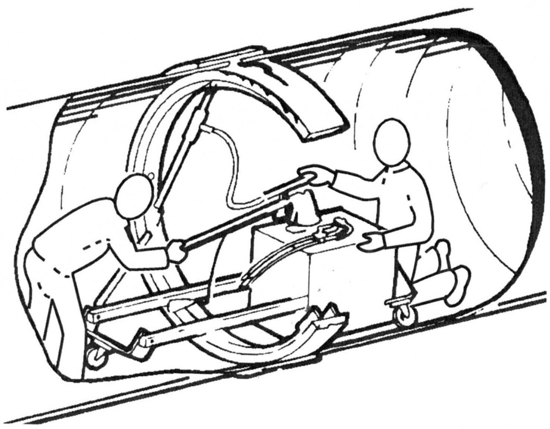
Our solution:



We offer a complete range of testing equipment for all pipe diameters and profiles to companies specializing in pipe joint sealing operations. A patented double seal with integrated testing chamber achieves a particulary light and unproblematic dismountable construction. Compressed air or water can be used to test the joints

Your benefits:

- reduced workload and testing outlay due to immediate localisation of damage
- realisation of leaks in the building stage relieves expensive repair costs
- flexibility due to testing with air or water
- Other cross sections on request!
- Sizes: Dia. 1000 – 3000



Operating Manual

The connection of two pipes (or other parts like manholes...) are often the weak point of a pipe system.
The quality of a pipe system depends also previously on the quality of the connection.
For the connection, we have to focus on the solitity, but also and maybe mainly on the closeness.
The claim for a pipe system is mainly, that the transported medium passes the pipe system without loss.

Pipe systems out of PE and PP can be connected with the Electro- Fusion Connection, developed by Krah GmbH. Using that connection, the two parts will be moved together with a socket and a spigot end. Inside the socket there is a wire installed, what can be heated up through electrical current. The material of the socket and the spigot end melt **homogenous** together.

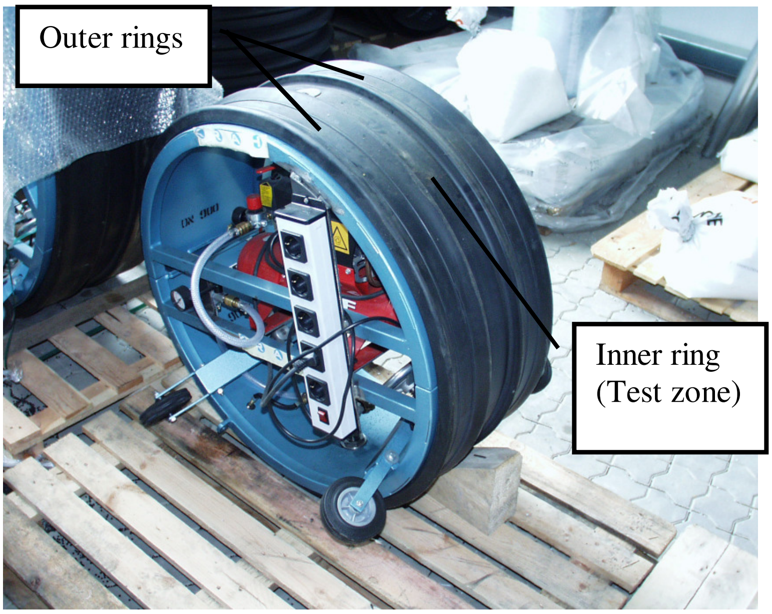
The result out of that melting is a high quality connection with a high solidity and closeness.

In case that the welding has been made like the documentation says, the closeness is given.

Refedred to DIN EN 1610, every connection has to be tested. For these tests is the Connection Testing device. The Connection Testing Device works only for a speciffic diameter.

Function:

The function of the Connection Testing Device is:

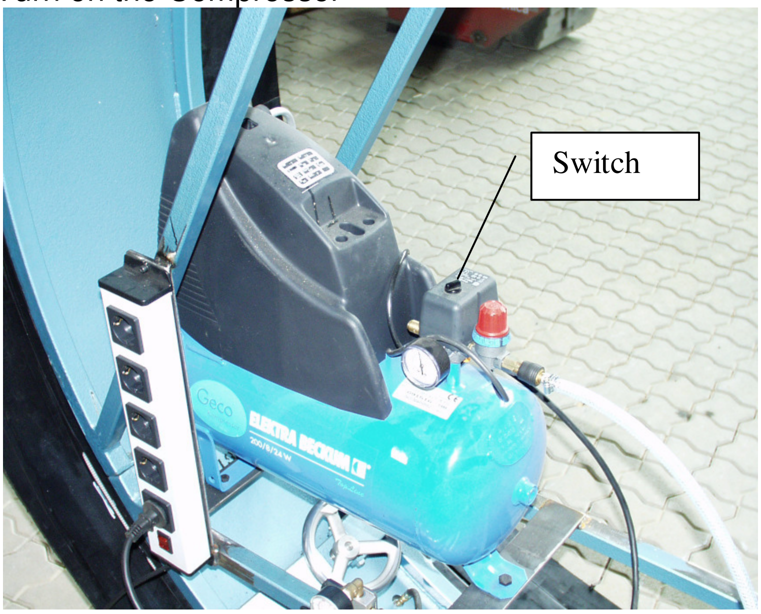


The device is moved on the place, what shall be tested (normally a connection). A Compressor blows up the two outer rings. Through this, in the middle (inner ring) is a closed up chamber (Test zone).

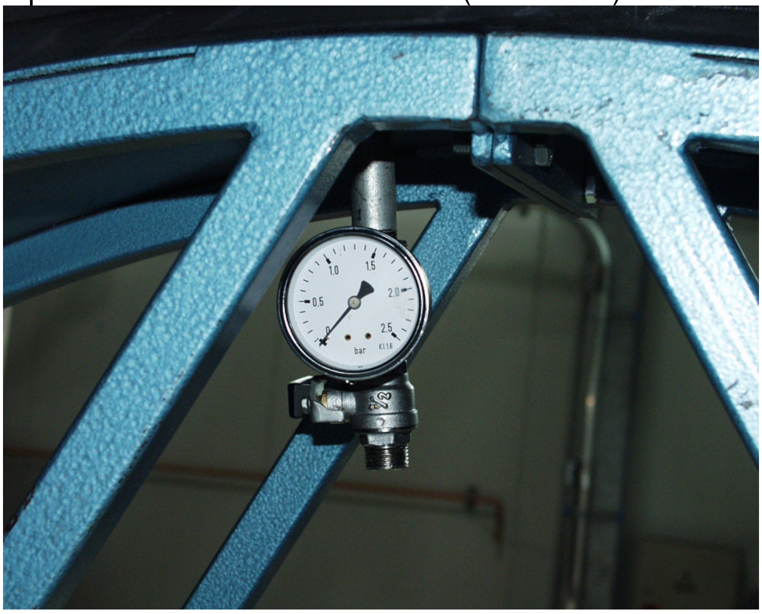
After the two outer rings are filled up, the air is kept in the rings through a valve. Now there will be inserted a defined test pressure in the test zone. This test pressure shall be controlled by a exact manometer.
The pressure decrease during a certain time is an index for the closeness of the connection.

Test:

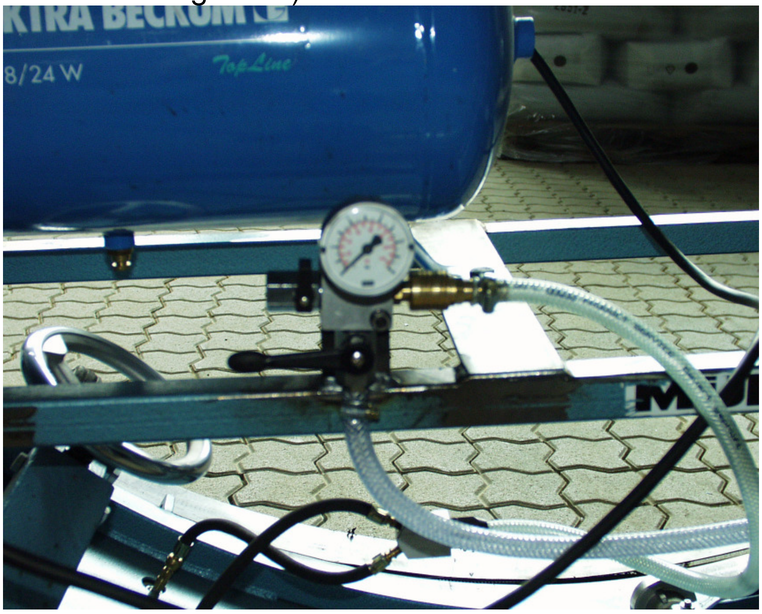
- Prerpare the area what shall be tested (usually a connection) in a way, that possible blisters or other damages will be removed.
  Only in that condition the two outer rings can close up to the inner side as necessary.
- Move the unit in the pipe in a way, that you can see the operators side.
- Adjust the unit visuell that it is straight in the pipe.
- Connect to an electrican source (1~ 240V, 50/60 Hz, 16A).
- Turn on the Compressor



- Open the valve for the chamber (Test zone)



- Connect the hose for the 2 outer rings to the Compressor, close the aerating valve and fill up to 3 by 3,5 bar (viewable on the manometer close to the aerating valve)



When the pressure is reached, close the incoming valve and deconnect the hose from the Compressor.

- Connect the hose for the chamber (Test zone) and fill up the Test zone with the following value:

Testpressure: 200 mbar (20kPa)

- Fill up to 300 mbar (30kPa)
- After 5 minutes the testing time starts to count.
- The pressure should be now 200 mbar (20kPa). This pressure shall not exceed a degrease of more than 1,5 mbar (0,15 kPa) in the time ‘t’ seen in the table below.

DN	100	200	300	400	600	800	1000
t [min]	1,5	1,5	2	2,5	4	5	7

Is the degrease after the time ‚t’ less than (< 25 mbar),corresponds the welding (connection) to the requirements.

- After the test, turn off the Compressor, disconnect the electrical source, remove the air in the outer rings through opening of the aeratin valves, move the wheels in go-position and move the unit to the next testing place or out of the pipe.

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UNITED GULF PIPE MANUFACTURING CO. LLC

REPAIR INSTRUCTIONS
FOR KRAH STRUCTURED-WALL PIPE SYSTEMS

www.krah.net

Repair Instructions

for

Krah Structured-wall Pipe Systems

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Repair Instructions for Krah structured wall pipe systems

1. Introduction

In the day to day business inadequate transport procedures, wrong handling and/ or storage can cause pipes to become damaged. External mechanical force may also damaged pipes which are already laid.

Choosing the right form of repair depends on the magnitude of the damage. You can classify the appropriate procedure to adopt depending on the following three damage categories:

- It is localized, small sized damage
- The damage affects a whole section of a pipe
- The damage affects a complete pipe

We offer you a complete guide on what to do in which situation and how to do it, similar to the “Maintenance Guide” drawn up for Krah pipe systems . We include a list of tools necessary to carry out eventual repairs as well as a list of accessories.

It is recommended to follow the procedures very closely as described in this manual in order to guarantee a long service live and trouble-free function of the Krah pipe system.

2. Repair Procedures

2.1 Small sized damage (fissure, crack) detected

When the damage detected consists of a fissure or a small crack only, it is possible to repair it by using a hand held welding device. The affected pipe section must be cleaned thoroughly making sure that absolutely no contamination such as dirt, dust, grease, oil etc. stick to the surface of the pipe. As cleansing liquid, alcohol is recommended. While additional pipe material is fed onto the damaged spot the welding is done using a manual welding extruder (please also see 4.) The welding temperature is set at approx. 220°C. Repairs can be done from both outside and inside the pipe (given that the pipes diameter is large enough to permit inside welding). The wall thickness of the repaired section should exceed the original wall thickness of the affected area. Once the repair has been completed the pipe must cool down before it can be put back into service.

2.2 Large sized damage detected

If the damage is also detected but bigger than just a small crack or a fissure the affected section of the pipe can be repaired as follows:

i. Identify the type of pipe affected (diameter and type of profile)

ii. Visual control of the damaged area and precise identification of its size.

Figure 1: Damaged pipe

iii. By using a cutting tool take off the core tube which is forming the profile of the pipe. Once the section has been cleared off the core tube, thoroughly clean the affected area, making sure all types of contamination (i.e. dirt, dust) are removed.

Figure 2: Removal of the core tube

Figure 3: Clean cutting edges

iv. Prepare a piece of pipe wall (without the core tube) made of the same material the pipe consists of. The thickness of this piece should be the same as the one of the profile. Its size has to be equal to the size of the area to be repaired.

v. Place the piece onto the affected area.

Figure 4: Place a solid wall pipe piece on the spot

vi. Now the piece is welded onto the pipe using a manual welding extruder.

Please note that for this kind of repair an internal supporting ring may be needed in order to avoid a collapsing of the diameter at the heated spots.

Figure 5: Extrusion welding of the pipe piece

vii. After having completed the repairs the pipe needs to cool down before it can be put back into use.

2.3 Replacement of a pipe section

If the damage is too large to be repaired as described in 2.2 and the decision to replace a whole section of the pipe has been made, the following method should be adopted:

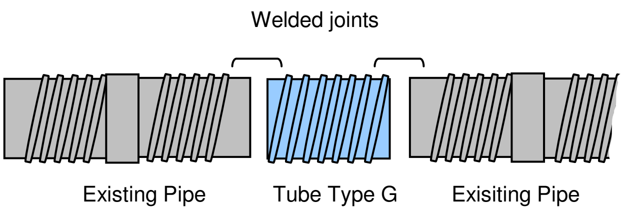

Figure 6: Replacement of a pipe section

i. The pipe has to be cut through vertically twice. Once at both sides of the damage while the distance between the two cuts should either be 1, 2, 3 or 4 meters. The distance of the cuts depends on the size of the damage. Special care is to be taken that the cuts run precisely perpendicular to the axis of the pipeline. Should the size of the section which needs to be cut out exceed 4 meters it is recommended to replace the complete pipe (as seen in 2.4).

ii. Remove the damaged part of the pipe.

iii. The core tubes on the remaining ends are cut off up to 5 cm from the cut edge (up to the existing welded joints).

iv. A “Type G” tube, having the same length as the pipe section to be replaced, is inserted into the gap of the remaining pipe.

v. The tube is then jointed with the remaining ends of the pipe. This is done using a manual welding extruder.

vi. After having completed the repairs the pipe needs to cool down before it can be put back into use.

2.4 Replacement of a whole pipe

Depending on the size of the damage it may be decided to replace an entire pipe. In order to do this there are the following options to choose from (please revert to the option which is most convenient to you):

<u>Option no. 1: one-to-one replacement</u>

This method comprises the replacement of the damaged pipe by another pipe which has the following specifications: profiled pipe with solid wall pipe ends (without socket/ spigot), the solid wall pipe ends are produced thicker as usual and cover 150 mm of each end. (Please also see 3.)

i. By using a jig saw a cut through the pipe is done right next to the socket of the faultless, previous pipe, taking care that the socket remains.

ii. A second cut is made into the socket of the damaged pipe cutting it off from the following, faultless pipe.

iii. A tension ring either made of plastic or steel is placed either inside or outside of the pipe (depending on the diameter of the pipe) in order to centre it.

iv. For the welding of both ends a manual welding extruder is used.

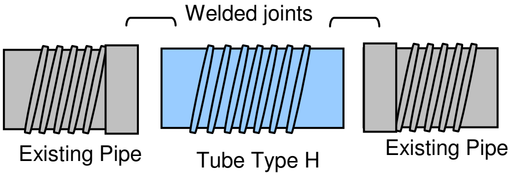

Figure 7: Replacement of a whole pipe

<u>Option no. 2: Welded Joints</u>

This method consists of the replacement of the one damaged pipe by three shorter pipe pieces, so called accessories. Two of them will be electro-fusion welded to the ends of the existing pipes, while the third one will be jointed using a manual welding extruder. This method is always appropriate whenever welding is possible. The following procedure has to be respected:

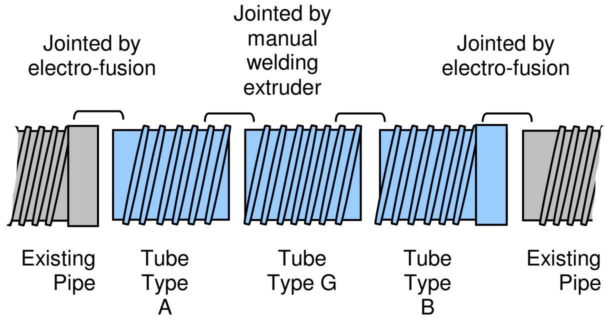

Figure 8: Replacement of a whole pipe with welded joints

i. The pipe which has to be replaced will be cut through vertically at the two prescribed positions as shown in the drawing, hence dividing the pipe into three sections.

ii. The electro-fusion device is connected to the pipe joints of both the foregoing and the succeeding pipe. It heats the joint until the cut pipe sections can be separated from faultless pipe.

iii. Remove the three parts of the pipe (first the one in the middle, afterwards the remaining two.)

iv. As replacement for these three parts, the following special pipe accessories (each one of 2 meters length) are used:

- One pipe accessory "Type A"
- One pipe accessory "Type B"
- One pipe accessory "Type G"

v. The spigot end of accessory "Type A" is inserted into the socket of the faultless pipe and then joint by electro-fusion welding.

vi. The socket of accessory "Type B" is put onto the spigot end of the other faultless pipe and then joint by electro-fusion welding.

vii. Accessory "Type G" is placed between accessories "Type A" and "Type B", hence closing the gap.

viii. The middle piece is jointed to the other two using a manual welding extruder.

ix. After having completed the repairs the pipe needs to cool down before it can be put back into use.

Option no. 3: Flange Connection

Just as described in Option no. 2, this option also involves the replacement of the damaged pipe by three shorter pipe pieces. The two outer pieces will be jointed to the faultless pipes by electro-fusion welding. However the middle piece will be jointed by two flange connections. Should extruder welding for any reason not be possible this method may be applied. The following procedure has to be followed:

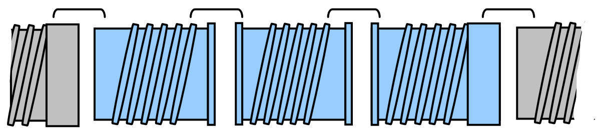

Figure 9: Replacement of a whole pipe with flange

i. The pipe which has to be replaced will be cut through vertically at the two prescribed positions as shown in the drawing, hence dividing the pipe into three sections.

ii. The electro-fusion device is connected to the pipe joints of both the foregoing and the succeeding pipe. It heats the joint until the cut pipe sections can be separated from faultless pipe.

iii. Remove the three parts of the pipe (first the one in the middle, afterwards the remaining two).

iv. As replacement for these three parts, the following special pipe accessories (each one of 2 meters length) are used:

- One accessory "Type C" (socket - flange)
- One accessory "Type D" (spigot - flange)
- One pipe accessory "Type E" (flange - flange)

v. The spigot end of accessory "Type D" is inserted into the socket of the faultless pipe and then joint by electro-fusion welding.

vi. The socket of accessory "Type C" is put onto the spigot end of the other faultless pipe and then joint by electro-fusion welding.

vii. Accessory "Type E" is placed between accessories "Type D" and "Type C", hence closing the gap.

viii. The middle piece is screwed tightly to the other two pieces.

ix. The pipe can now be put back into use without any delay.

Option no. 4: Solid Wall Pipe

Another option is the use of a solid wall pipe (this pipe does not have core tubes) having the same wall thickness as the pipe which needs to be replaced. (Please refer to annex). The following procedure has to be adopted:

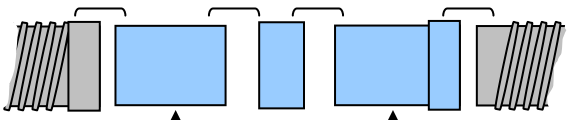

Figure 10: Replacement of a whole pipe with solid wall

i. The pipe which has to be replaced will be cut through vertically at the two prescribed positions as shown in the drawing, hence dividing the pipe into three sections.

ii. The electro-fusion device is connected to the pipe joints of both the foregoing and the succeeding pipe. It heats the joint until the cut pipe sections can be separated from the faultless pipe.

iii. Remove the three parts of the pipe (first the one in the middle, afterwards the remaining two.)

iv. The solid wall pipe is produced (having the same wall thickness as the pipe to be replaced according to specifications outlined in the annex) with spigot end-socket. It needs to be cut in half exactly in the middle. In order to facilitate a subsequent installation of this kind of pipe a section of 15 cm (7.5 cm of each side) is cut out.

v. An accessory "Type F", a slip-on connection, is prepared. (Please also see Fig. 16). It has to have the same diameter as the outer diameter of the solid wall pipe, the same wall thickness and a length of 1 meter.

vi. The slip-on connection is slid onto one part of the new pipe and then moved 1 meter towards the other side.

vii. The two pieces of the new pipe are placed into the joints of the neighbouring pipes and are then newly electro-fusion welded. It remains a gap of 15 cm between both pipe pieces.

viii. The slip-on connection is moved towards the middle of both pieces to cover the existing gap. (Whereas the 15 cm gap should rest in its middle).

ix. The jointing of the slip-on connection with each one of pieces of the solid wall pipe is also effected by electro-fusion welding.

x. Once all pieces are jointed the pipe can be put back into service.

3. List of Accessories

Please find below a list of all accessories for KRAH pipe systems as mentioned in 2. The accessories you will actually need to effect eventual repairs depend on the method of repair you choose.

Piece "Type A": These pipe pieces are manufactured in any diameter and with any type of profile. One of its ends is equipped with a spigot whereas the other end is covered with profile.

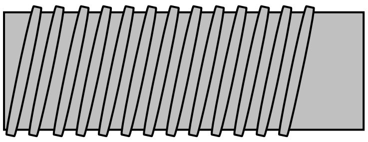

Figure 11: Piece "Type A"

Piece "Type B": These pipe pieces are manufactured in any diameter and with any type of profile. One end is equipped with a socket (including wiring for electro-fusion welding) whereas the other end is covered with profile.

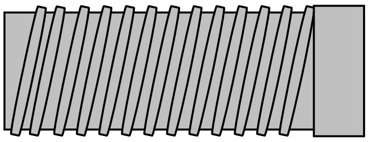

Figure 12: Piece "Type B"

Piece "Type C": These pipe pieces are manufactured in any diameter and with any type of profile. One end is equipped with a socket (including wiring for electro-fusion welding) whereas the other end is equipped with a flange.

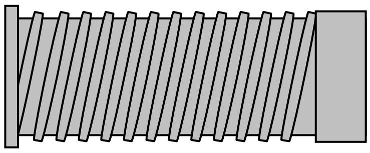

Figure 13: Piece "Type C"

Piece "Type D": These pipe pieces are manufactured in any diameter and with any type of profile. One end is equipped with a spigot whereas the other end is equipped with a flange.

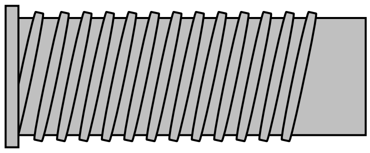

Figure 14: Piece "Type D"

Piece "Type E": These pipe pieces are manufactured in any diameter and with any type of profile. Both ends are equipped with flanges.

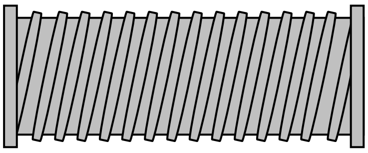

Figure 15: Piece "Type E"

Piece "Type F": These pieces are slip-on connections produced for solid wall pipes. They come in different diameters as well as different wall thicknesses with a length of 1 meter. The inner surface of both ends is equipped with wiring for electro-fusion welding.

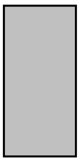

Figure 16: Piece "Type F"

Piece "Type G": These pipe pieces are manufactured in any diameter and with any type of profile. The piece is covered with profile up to both ends.

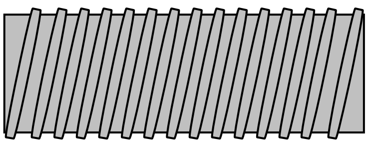

Figure 17: Piece "Type G"

Piece "Type H": These pipe pieces are manufactured in any diameter and with any type of profile and feature solid wall pipe ends (without socket/ spigot), the solid wall pipe ends are produced thicker as usual and cover 150 mm of each end.

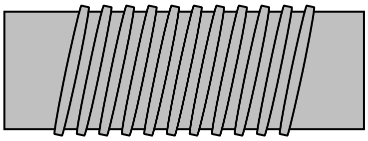

Figure 18: Piece "Type H"

Solid wall pipes: These pipes do not have a profile. One end is equipped with a socket (including wiring for electro-fusion welding) whereas the other end is equipped with a spigot.
They are used for different diameters and different wall thicknesses.

Figure 19: Type solid wall pipe

Solid plates: These are flat plates made of PE and PP. They come in different thicknesses as well as different sizes.

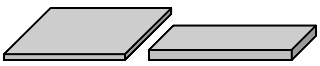

Figure 20: Type solid plates

Adaptors for flanges: They consist of special parts which convert the traditional KRAH joint into a flange joint. For this spigot-flange and socket-flange adaptors are relied on. They are especially useful when it is required to connect a KRAH pipe to pipes or accessories made of other materials than PE or PP.

4. List of Tools

Figure 21:
Kaeser Classic Compressor, displacement 210l/ min,
pressure: 10 bar

Figure 22: Electrical Chain Saw

Figure 23: Gasoline Chain Saw

Figure 24: Hot Air Gun

Figure 25:
Hand Held Circular Saw

Figure 26:
Manual Welding Extruder

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Figure 27: Jig Saw

Figure 30:
Krah Welding Extruder with flexible hose output 10kg/ hr.

Figure 28: Pneumatic Stapler

Figure 31:
Tiny Data: Krah electro-fusion equipment, for E-Fusion sockets from 300 mm up to 4000 mm

Figure 29: Hand Welder Duratherm

Apart from the before mentioned tools and appliances you will need some additional material i.e.:

- Scrapers
- Planers
- Welding rod
- Welding nozzles
- PE-cleansing liquid
- Wipes
- Calliper Gage and Measuring Band

On request we offer you a complete kit of all materials, instruments and tools to keep on stock for any repair and/ or maintenance you wish to carry out.