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The magazin for large **Plastic Pipe Technology** (up to DN/ID 5000mm)
3rd 2017

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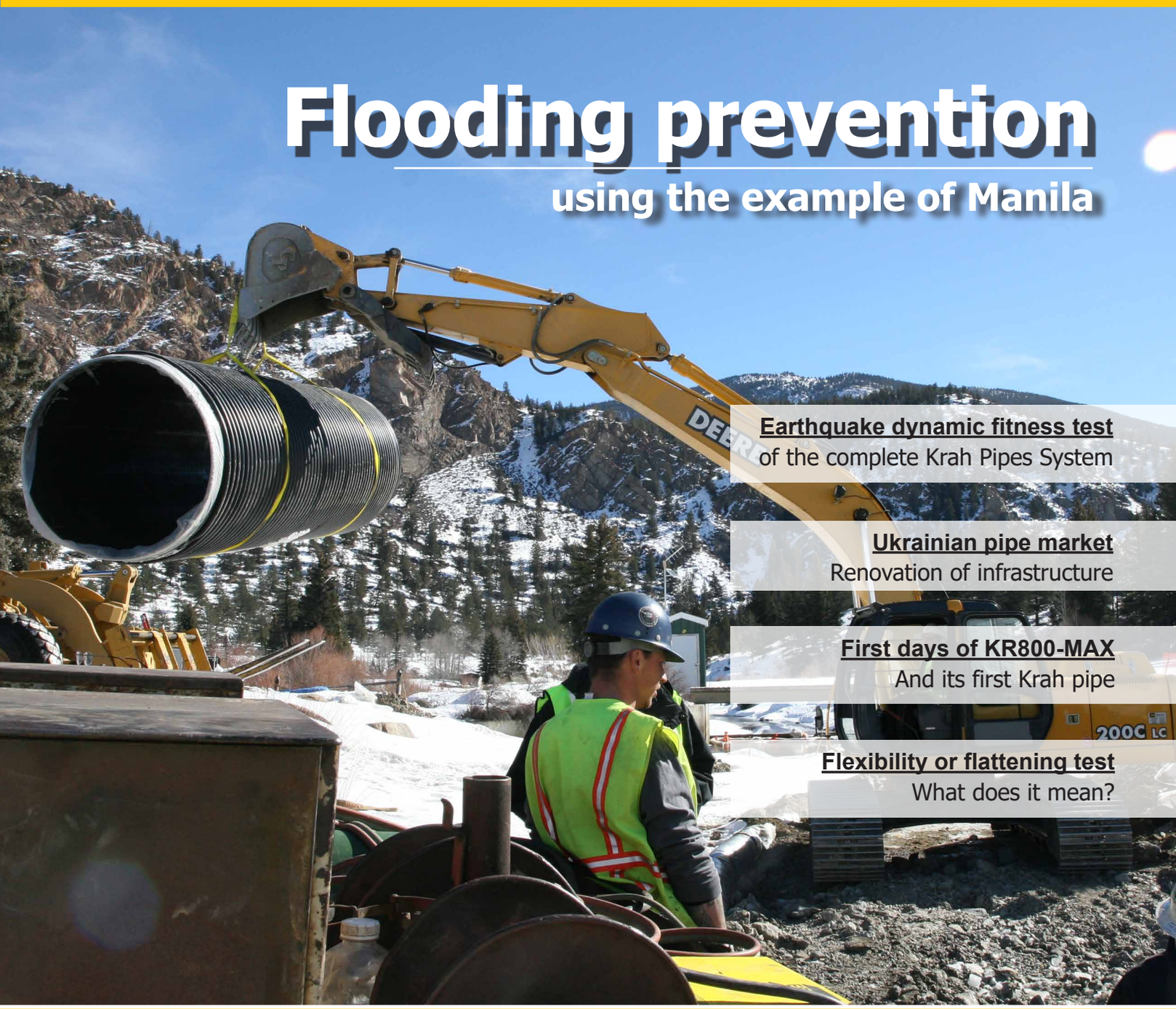


Flooding prevention
using the example of Manila

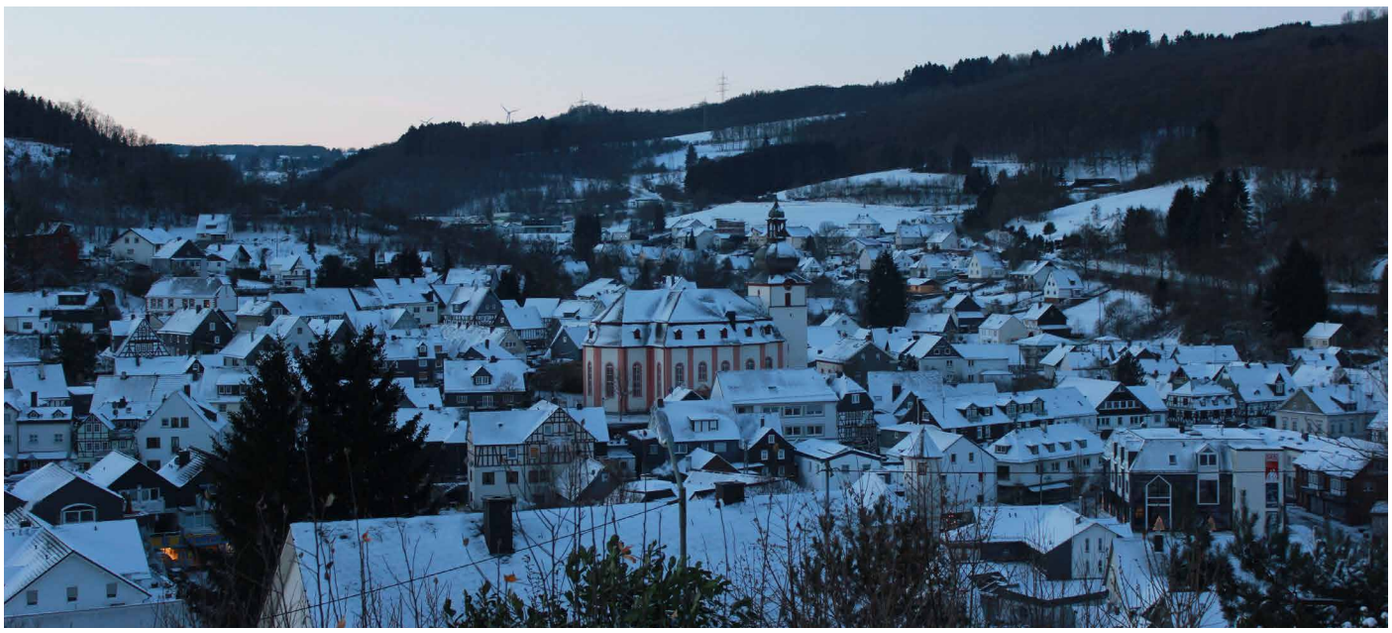
Earthquake dynamic fitness test
of the complete Krah Pipes System

Ukrainian pipe market
Renovation of infrastructure

First days of KR800-MAX
And its first Krah pipe

Flexibility or flattening test
What does it mean?

Merry Christmas!



City of Krah machine manufacturing facility

Here, in the region of the Westerwald, in the middle of Germany, the days become shorter, the temperatures drop and the nature seems to be in winter sleep. If we are lucky we will even have a "white Christmas" this year after quite a long time. People are putting on warm clothes and reduce their activities.

Christmas is just around the corner, the most important holiday of the year for us. These days signify a time of joy and quality with family and friends for all of us, but also tranquility and contemplation.

Also our company will be put into "sleep mode" for a couple of days. Most of the companies close their business year on 31 December just as the calender year will end.

Last turnovers will be accounted, last emails and letters of the year will be sent, among those a lot of Christmas cards as well as our last issue of the Improfil Newsletter for 2017.

We can proudly say that we have achieved and developed a lot in 2017. Also this issue contains a lot of technically interesting reports.

We are looking forward to 2018, full of new products, ideas and developments.

Wishing you all, wherever you might live on this beautiful planet a peaceful and contemplative Christmas season and a healthy start into the new year of 2018!

All the best!

Alexander Krah

Flooding prevention

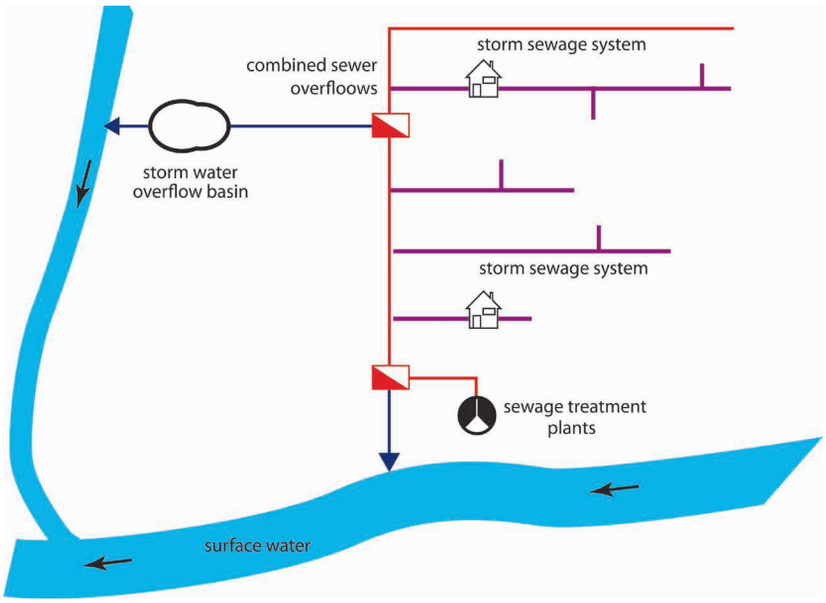
using the example of the City and metropolitan area of Manila

Picture 1: People trying to escape the enormous amounts of sewage waters

Manila, capital of the Philippines, has around 1,8 Mio inhabitants and is situated in the agglomeration "Metro Manila" with a total of 12,9 Mio citizens. The immense population pressure since the middle of the 20th century caused an uncontrolled expansion of the city Manila and the surrounding conurbation.

The planning and construction of the installations of sewage discharge and treatment systems as well as storm water distribution could not keep up with this growth. Thus, drainage systems yes do exist, but do not meet in any way to the objectives of integral urban drainage systems. Especially the inadequate hydraulic dimensioning of the distribution pipelines, which are mostly done in the diameter of DN/ID 900 mm, regularly lead to overload flooding in a lot of districts of Manila.

The hydraulic failure of the systems is even intensified by the need of relining and repair, wrongly constructed manholes, false installation of the pipelines as well as root infiltration and blockings. On basis of the applied regulations of the German association for water management, waste water and waste (Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e. V. (DWA)) and DIN norms possibilities for a safe discharge of waste water as well as the protection against flooding shall be presented. The current situation in Manila is difficult: Due to the demographic development of the last decades in the agglomeration of „Metro Manila" and the city of Manila, the populated areas have multiplied. This expansion of populated areas happened without a sustainable planning of a secure waste water discharge and storm water distribution system. Thus, consequently, the protection of humans and goods against flooding in the residential areas and a proper discharge of waste water were not ensured. The sewage system based on a sewage and storm mixed system was extended with the growing settlement but without adapting the existing system to the hydraulic additional load. Natural discharge ways and retention areas were overbuilt without creating sufficient countervailing measures. The still existing open water channels were often limited and restricted by dense constructions. Bridges without sufficient freeboard, encroaching buildings of all kinds as



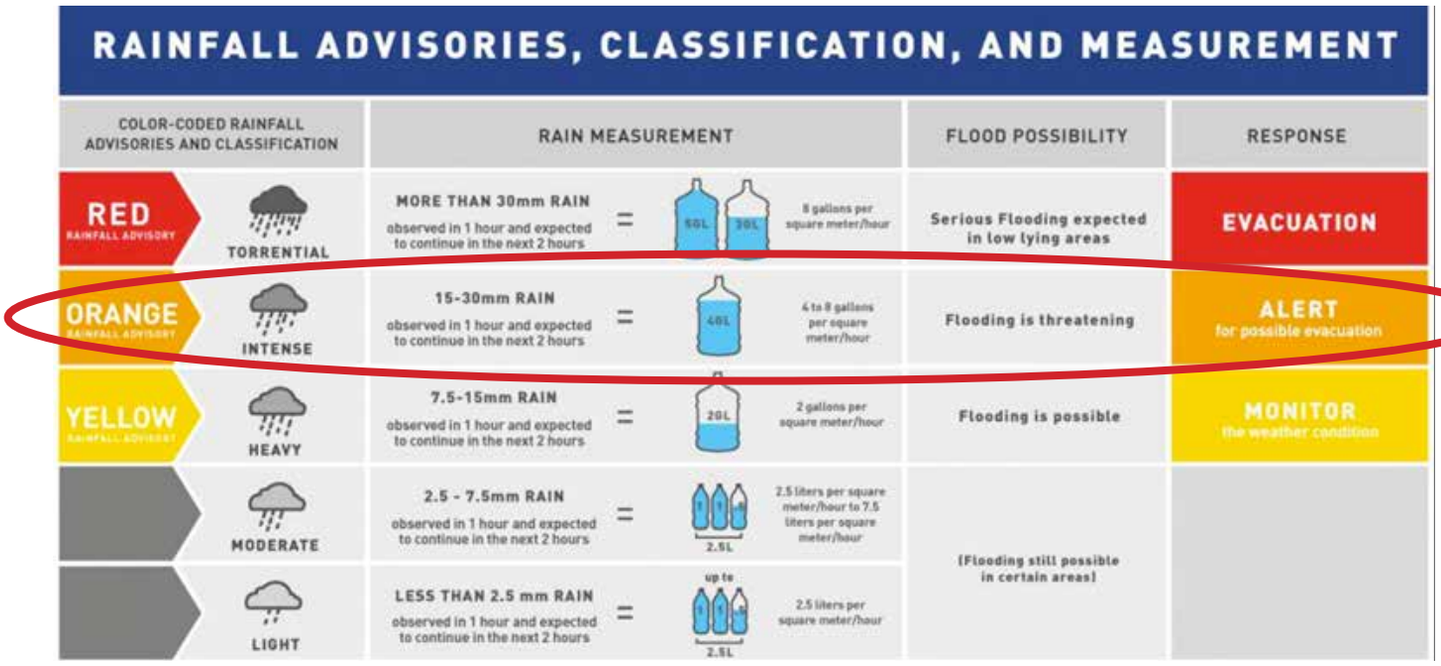
Scheme 1: Storm sewage system

well as deposit of rubbish is existent, which reduces the drainage system width considerably.

On the basis of the population of 1,8 Mio for Manila and an urban area of around 39 km², there is a population density of around 46.000 inhabitants/km². Thus, the area is very densily crowded and built and discharge areas are very high. Green and other permeable areas are not really existent. Manila`s climate is semi-humid tropical. Annually it rains approx. 2.070 mm, ¾ of it during the months of the monsoon from June to September. Heavy rain falls during the monsoon lead to continuous flooding in the city area, which also result from an insufficient drainage system. It is expected that in the future the rainfalls will increase in intensity and frequency due to the climate change. During the flooding when the drainage systems that transport the waste water fail, inacceptable hygienic conditions and large damages are the results. Possible approaches and solutions on the basis of the German guidlines have been evaluated in the past time: A future-oriented and strategic draining system plan for the agglomeration "Metro Manila" respectively the city of Manila is not directly derivable from the European norms and regulations due to the different climate zones. Especially the protection against overflow and flooding has to be respected because of the strong and heavy rainfalls in the subtropical areas. Generally the procedure of planning and construction of drainage systems in Germany is given among others by the DIN norms and regulations of the DWA. The study area Manila is a grown mega city. Existing drainage systems are based on combined storm and sewage systems. This means that domestic and operational waste water are discharged together with storm water in one line. Sewage treatment plants to clean the waste water do not exist for all areas of Manila yet. Partly the sewage is led without any treatment directly into surface water.

A combined sewage and storm system in Germany always leads to a sewage treatment plant that cleans the waste water and part of the storm water.

Sewage treatment plants are not designed to treat the complete incoming storm water. For this reason surcharge storages and storm water overflows should be planned and situated under streets and places in highly populated areas. To create cost-effective, underground storage volumes large diameter pipe systems should be considered. With the help of the storm water overflows the heavily diluted waste water is being transported to receiving waters after being mechanically treated. Before starting to create sewage treatment plants the drainage system of the city areas should be prepared and secured. Therefore the hydraulically powerful pipe systems should be constructed starting at the site of a potential sewage treatment plant to the living areas. To determine the water amount for the hydraulic dimensioning of the necessary line system in Germany the regulation DWA-A 118 "Hydraulic dimensioning and proof of drainage systems" („Hydraulische Bemessung und Nachweis von Entwässerungssystemen") is used.



Picture 2: Rainfall advisories, classification and measurement

Exemplary is the determination of the water amount according to the rain classification applied in the Philippines for a rain of the classification "orange".

On the basis of scheme 2 the corresponding occurring sewage and storm water quantity for a classified rainfall of the colour "orange" will be determined for the city areas of 20 ha, 50 ha and 100 ha. Due to the climate change an additional 20% of intensity of rain fall will be added in order to guarantee a future-proof drainage system. Simplified exemplary calculation for the determination of the amount of precipitation:

Drainage area: 20 ha; 50 ha; 100 ha

Covered areas: 90 %

Duration of rain Orange: 60 min

Intensity in 60 minutes: 30 mm = 30 l/m² h = ~ 83 l/ha s

Addition for climate change: 20 %

The quantity of sewage water will be calculated with assumed values of 4 l/(s 1000E) => Qs = 4 l/(s *1000 E) * 46.000 E/km² / 1000 = 184 l/(s * km²)

Quantity of sewage and storm water EZG 20 ha:

QM = QR + QS = 1.800 l/s + 37 l/s = 1.837 l/s

Quantity of sewage and storm water EZG 50 ha:

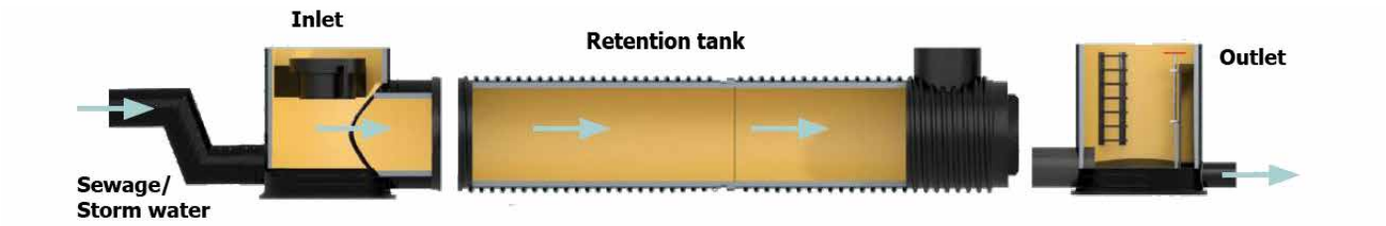
QM = QR + QS = 4.480 l/s + 92 l/s = 4.572 l/s

Quantity of sewage and storm water EZG 100 ha:

QM = QR + QS = 8.960 l/s + 184 l/s = 9.144 l/s

Sewage lines are dimensioned in Germany according to worksheet DWA-A 110 „Hydraulic dimenisiong and performance record of sewage lines and cannels" („Hydraulische Dimensionierung und Leistungsnachweise von Abwasserleitung und –kanälen".) The considered city area is topographically gently sloped. Thus, also the waste water lines can only be installed with a low longitudinal slope. On the basis of the water amount calculated above the following necessary dimensioning derives for lines with an assumed longitudinal slope of I = 0,25 % and kb (operative roughness of the pipe system) = 0,75 mm:

Drainage area, EZB	Quantity of sewage and storm water, Q_M	Necessary pipe inside diameter
20 ha / 0,2 km²	1.837 l/s = 1,84 m³/s	DN/ID 1.200 mm
50 ha / 0,5 km²	4.572 l/s = 4,57 m³/s	DN/ID 1.700 mm
100 ha / 1,0 km²	9.144 l/s = 9,14 m³/s	DN/ID 2.200 mm



Scheme 2: Storm water retention tank

The large dimensioned pipelines should consist of a smooth inside surface in order to avoid deposits during dry seasons. Especially large Krah-Pipes out of Polyethylene High Density are very suitable. Another big advantage of these kinds of pipes are the self cleaning behavior, due to a homogenous system with a low system roughness.

This example shows that in the city area efficient and high performance large dimensioned pipelines are required. Because of the dense population only few waters and flood channels still exist. Thus the rainwater has to be collected, drained and locally teed in qualified and hydraulically efficient waters through pipeline systems laid under the streets.

Due to the dense population only few water bodies or flood channels are existent. The occurring storm water thus has to be collected and transported necessarily by underground installed pipelines and should be lead locally if possible into hydraulic capable waters. It is highly recommended to design local storages as well as surface water seepage areas. The storage of the storm water is done with the help of storm water overflows or storm water retention tanks. Storm retention tanks have an additional storage area for polluting loads. As an example please refer to the following shown storm water retention tank, designed with an overhead load removal. The highly diluted waste water and storm water coming from the pipe system will be deducted mostly from the retention tank to surficial waters.

The outlet is, under normal conditions, as big as the double amount of the normal waste water. A sewage treatment plant should be situated close to powerful waters and at a geographically lowest point of the drainage area. When developing city areas the guidelines of an integral urban drainage system (working sheet DWA-A 100) should be respected. Here, all objects of protection should be considered like waste water management services for residential areas, water protection, safety in use as well as other issues as nature protection, soil protection etc. For new developments sewage and storm water systems (mixed systems) as well as separate sewage systems are possible. For the conduction of storm water for both systems however, big diameter pipes are absolutely necessary. Additionally a sewage pipeline is necessary beside the storm drain pipeline. In order to avoid flooding in waters and city areas situated below, ground basins as storm water retention basins should be planned for new developments. Those basins will store the surplus storm water during heavy rains and will then deduct it throttledly to the receiving waters. As final word you can say that the development of an integrated sewage and drainage system for the city and agglomeration of Manila, considering the protection objects "hygiene", "flood prevention" and "water protection" is only realizable with high technical and economical efforts, due to the insufficiently available infrastructure as well as the dense and still growing population. In the living areas, a comprehensive and big-volume pipe system with retention tanks for collecting and deducting sewage and storm water should be developed and expanded. The expansion of the drainage systems should be started at existing or potential sites for sewage treatment plants and/or powerful receiving waters with direction to the living areas. The existing waters

should be carefully checked for possibilities to improve the hydraulic comprehensive system in order to use them by conducting storm water out of the living areas and to support and relief the pipelines. For future extensions and developments of living as well as commercial and industrial areas also sufficiently large volumes of storage and retention possibilities should be created. Beside the necessary measurements for the handling of storm water it is also crucial to consider and create flood protections for the surrounding areas and drainage areas in order to avoid flooding of populated areas coming from outer areas. Due to the seismic activities a flexible pipe system should be used, which is capable of adapting to the earth movements. Furthermore the tightness should be of high value as well as to avoid infiltration of roots in the pipe joints. A welded pipe system made of Polyethylene corresponds to the today´s requirements of an integral pipe system. Suppliers as Krah Pipes can offer the complete pipe system – a pipe system out of Polyethylene (kb= 0,25 mm) with integrated electro-fusion jointing in large diameters with all manholes and fittings necessary.

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Ukrainian pipe market

INSTALPLAST and INSTALBUD - Experience that matters

Picture 1: Site after installation

Leaders of Ukrainian market of construction and installation of pipelines are ready to work on international level.

On November 2016 in Lviv, Ukraine, there was a solemn ceremony of opening a new tramline connecting residential district Sykhiv with central part of the city. Only few people attending the ceremony knew that it was preceded by another event, not less important for the city's life. It was replacement of old 520-meters underground non-pressure sewage collector located directly under the future tramline track. Replacement of the old sewage collector on the Stusa Street was the biggest infrastructural project implemented in the period of Ukraine's independence over last 26 years. Worn-out condition of the old collector could have caused damage of the road bed above it. That's why Lviv City Council and Lvivvodocanal organization decided to urgently replace the old collector with a new one. This difficult task was assigned to INSTALPLAST HV company and its subdivision INSTALBUD which performs works on construction and installation of internal and external pipelines, natural gas pipelines and sewage networks. Replacement works were done according to the project designed by German specialists. The works started in June 2015 and were accomplished in July 2016. Pipes PE of DN 1600 mm SN10 were used for a new collector. These pipes were manufactured by INSTALPLAST on its own equipment purchased from leading German company KRAH. Presently, INSTALPLAST is the only owner of such equipment on the territory of former USSR. This equipment allows manufacturing pipes in sizes from DN 300mm up to 4000 mm with a stiffness interval of 1 SN, thus proving possibility to manufacture specific pipes for different infrastructural objects. Such approach allows customers to reduce budget costs. Similar equipment of other manufacturers allows producing pipes with only standard intervals of stiffness, e.g. SN2, SN4, SN8 etc. Top quality raw materials made by BOREALIS and SABIC were used for manufacturing pipes for the new sewage collector. Engineers of INSTALBUD used electrofusion jointing during installation of the new collector.

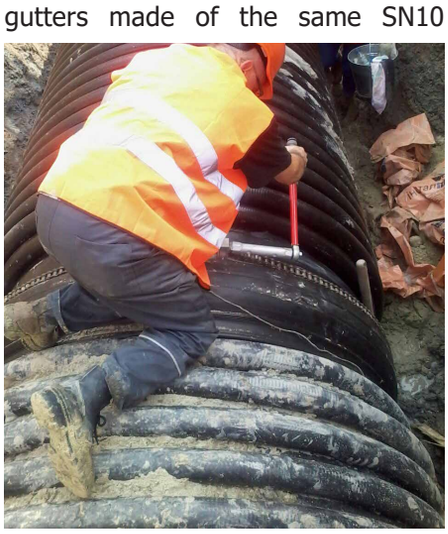
Picture 2: Site during installation

Picture 3: Site after installation

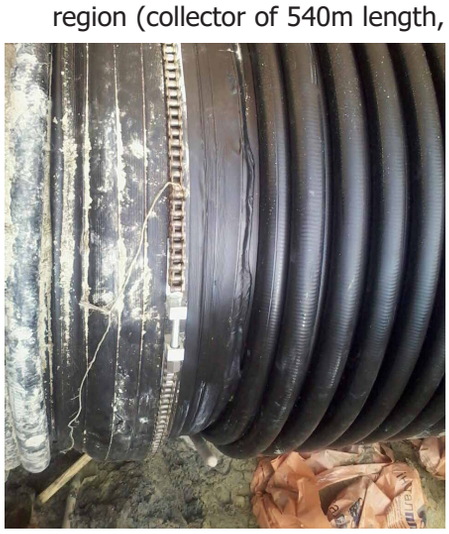
The installation works were done under difficult conditions with a 8m maximum depth of pipes laying. Over abundance of groundwater was another negative factor which complicated welding and installation works. INSTALBUD's specialists also had to avoid pipelines and networks in the way of laying the new collector. One more problem was a significant slope of the landscape on the Stusa Street. In order to reduce speed of water flow in the new collector, specialists of INSTALBUD designed and manufactured 7 welded gutters made of the same SN10 pipe. Slopes on different parts of the area were considered in order to achieve the best results. Also, employees of INSTALBUD made fettling of ferroconcrete chambers of the collector to protect them from aggressive sewages (lining up the chambers from inside with a 4 mm thick polyethylene sheet). Experience gained during accomplishment of the above-mentioned project allowed INSTALBUD later to implement not less difficult projects of replacement of non-pressure collectors:

- in Nadvirna, Ivano-Frankivsk region (collector of 540m length, DN 1600mm, SN8);
- in Irpin, Kyiv region (1200m length, DN 1000mm, SN8);
- in Poltava (600m length, DN 750mm and 1000mm; 400 meters length, DN 750mm, SN8);
- in Zhytomyr (580m length, DN 750mm, SN8);
- in Zaporizhzhia (178m length, DN 1000mm, SN4);
- in Dnipro (150m length, DN 800mm, SN8)

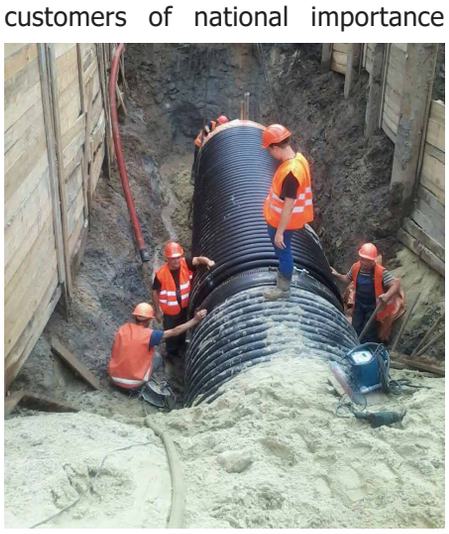
After implementation of those projects INSTALPLAST and INSTALBUD won customers of national importance



Picture 4: Krah Electrofusion installation



Picture 5: Finished Krah Electrofusion



Picture 6: Pipe jointing

Picture 7: Deep trench installation (until 8m depth)

Picture 8: Handling of Krah pipe SN 10, DN 1600 by Instalplast, UKR

and size, who deal not only with installation of pipelines, but also build subways and other infrastructural objects of increased complexity. Thus, after gaining experience of implementation of very difficult projects in Ukraine, companies INSTALPLAST and INSTALBUD are ready to work on international level and provide construction and installation services in different parts of the world.

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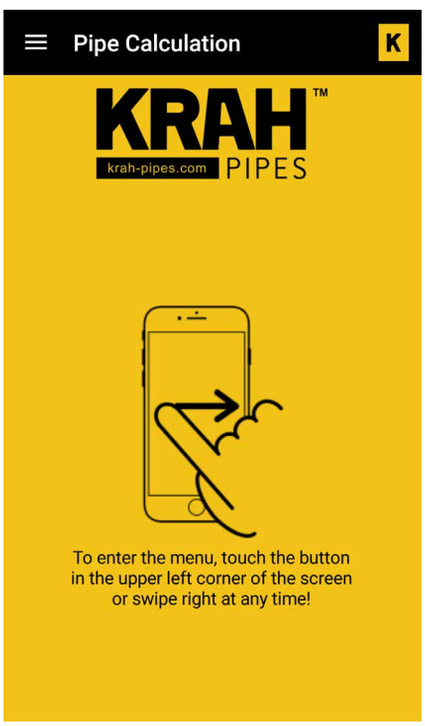
Krah Pipes App

Krah Know-How to take away

First Krah App for Android OS

After many requests from a lot of Krah Pipe users, we started to develop our own little tool to support Krah customers and partners worldwide. A little app (available on Google Playstore) provides many tools of the complete environment of Krah Pipes. Like easy hydraulic calculations, short guidelines for electro-fusion, providing electro fusion bar codes on your mobile, volume calculation of storm-water retention tanks, etc.



Now, the beta version is available, simply search for "Krah Pipes" in your PlayStore.

In case you need more calculations or have any suggestions of which information should be in the app, please send us an email, and we'll try to add the new feature in nearly "no-time". Your help / feedback is absolutely necessary to have a tool you need and not a tool we like. By the way, the tool will also work off-line. All ideas can be sent as remarks in Google PlayStore or via email to app@krah.net.

Extensive earthquake dynamic fitness test
of the complete Krah Pipe system

1. Preface

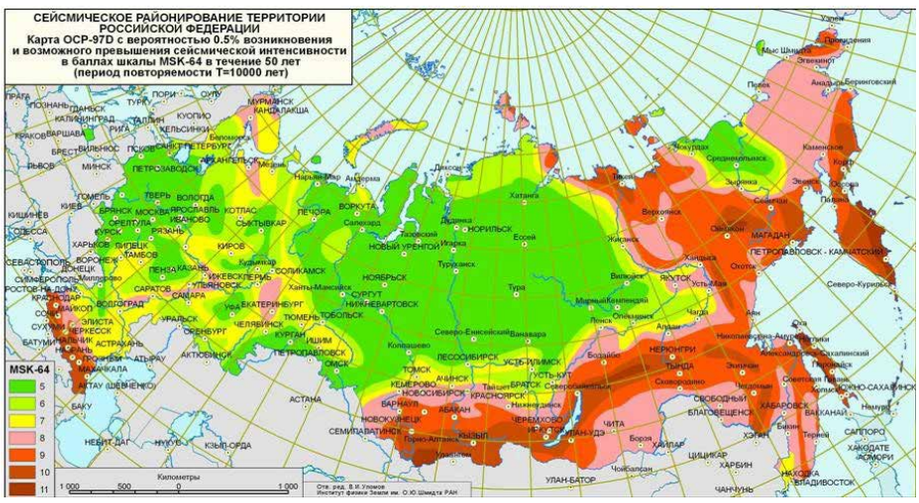
One of the most used arguments for plastic pipe systems is the flexibility and durability. If a question appears about earthquake fitness, the plastic pipe industry normally replies by showing damage-statistics. And indeed, the statistic results are very convincing, especially with damage statistics of rigid pipe systems. In the last editions of our IMPROFIL magazine we published many reports regarding earthquakes (mainly from our friends in Japan)- but a practical orientated dynamic test of a complete plastic pipe system with all aspects of different jointing methods, fittings and constructions has never been done before.

Thanks to the initiative of Krah Pipes Estonia, the well-known Russian JSC Research Center of Construction in Moscow has performed an extensive test program to investigate the earthquake fitness of the full Krah Pipe System with seismic intensity of 7-9 magnitudes. For the complete technical report please contact the management of Krah Pipes Germany directly (email: krah@krah-pipes.de). Below please find the summarized technical report with the original title:

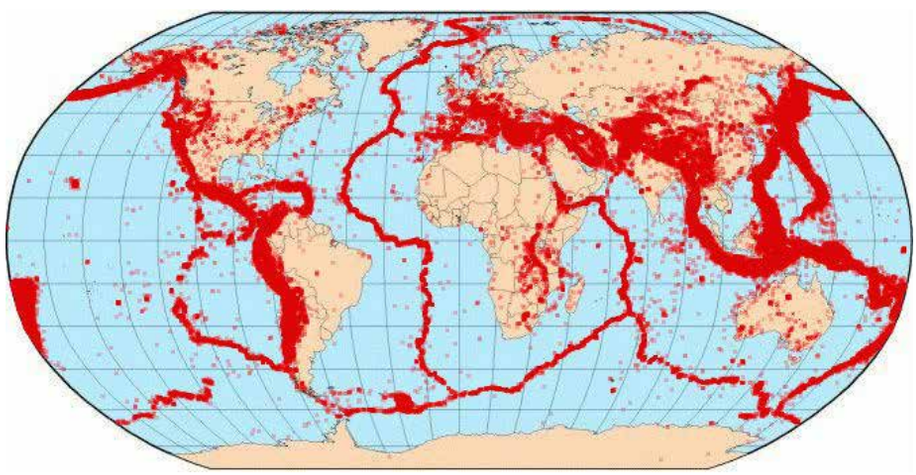
"Conduction of dynamic tests of conduits system including pipes, fittings, containers, wells, and pump stations of trade mark "KRAH PIPES" with assessment of the opportunity of their application in the regions of Russian Federation with seismic intensity 7-9 magnitudes".

2. Introduction

The technical report is using the results of experimental researches of polyethylene conduit elements of the trade mark "KRAH PIPES", designed for outdoor sewerage, disposal of waste water and ventilation.



Picture 1: Seismic regionalization of Russian Federation

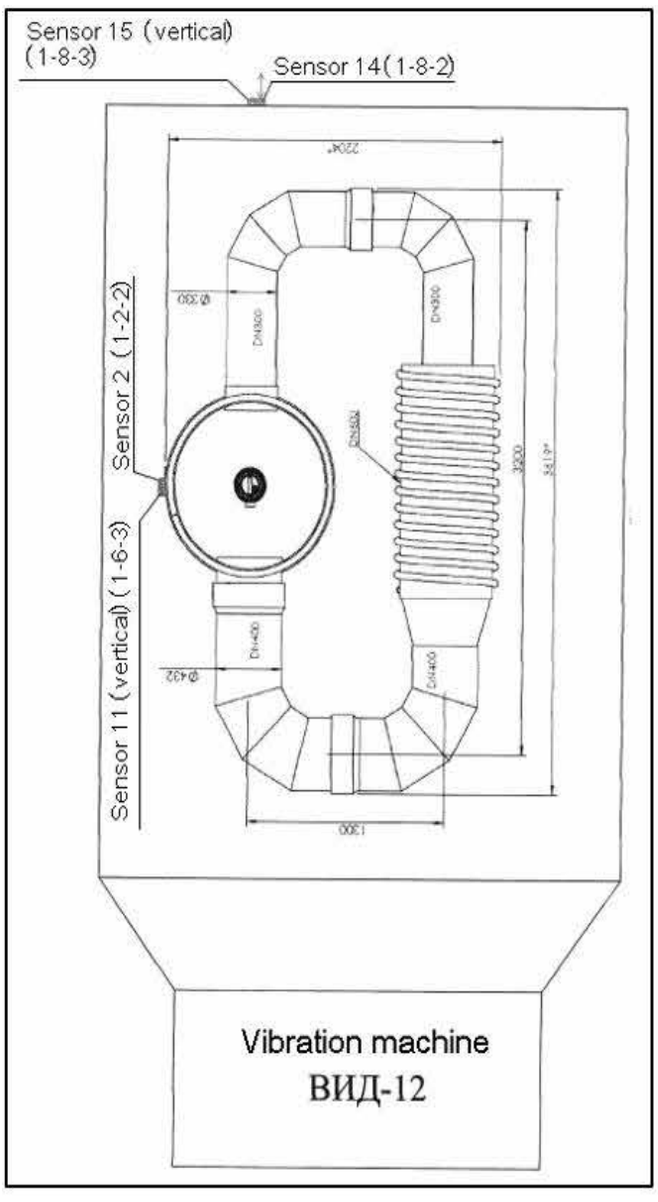


Picture 2: Worldwide high seismic regions

The tests were conducted on the stand which was specially designed by JSC Research Center of Construction, Research Institute of Building Constructions. The stand is a pendulum-type platform vibrator.

The purpose of the laboratory tests is estimation of workability and exploitative reliability of polyethylene pipe conduit elements in seismic regions of Russian Federation with 7÷9 degrees of intensity according to the MSK-64 scale.

The report is issued in accordance with the requirements of existing regulations. The terms and definitions from SNIP II-7-81* were used for describing methods and results of seismic stability experimental researches of polyethylene pipe conduit elements for outdoor sewerage, disposal of waste water and ventilation. Worldwide the risk of earth quakes is a big issue, the population in the "red" areas is high and so the infrastructure is a critical point.



Picture 3: Test set-up

3. Test setup

A Krah Pipe system is assembled by using typical jointing procedures:

a. Electrofusion
b. Extrusion Welding
c. Rubber gasket

The pipe system is installed as a loop, including different pipe diameters between DN/ID 300 and DN/ID 500 mm, different kinds of fittings like bends and reducers and also a manhole-shaft. For the pipes, fittings, bends and manholes typical profiled wall structure is used. The complete setup is filled with water.

Everything is installed on a vibration platform, designed for the simulation of earthquake loads under consideration of typical accelerations and amplitudes.The vibration tests were conducted in the day time at an air temperature lower than +15˚C. During the tests the vibration platform acceleration, by the data of accelerometers which were installed on the platform, was changed in intervals from 1.04 to 8.36 m/s2. Oscillation frequencies of the system were changed in intervals from 1.0 to 11.4 Hz, the oscillation amplitudes were changed in intervals from 0.7 to 33.2 mm.

4. Test program and test procedure

The dynamic tests program of the conduit elements of the trade mark "KRAH PIPES" on the vibration platform includes the following:
The tests of water-filled conduits are conducted with the change of frequency spectrum from 0 to 15 Hertz with the fixed displacement amplitude of the vibration platform. Then the value of amplitude changes and the frequencies are set in the specified spectrum. The duration of all the specified dynamic loadings (with the fixed amplitude and frequency) is approximately 30 seconds.
By the tests results the levels of impacts are set corresponding to the resonance oscillation of the system and the accelerations levels of the vibration platform correspond to 7÷9 magnitude by the MSK-64 scale.

When the tests are performed the repeated tests with combinations of amplitude frequency parameters corresponding to the resonance oscillation of the system and 7÷9 magnitude impacts are conducted in accordance with testing program of measuring of amplitude frequency spectrum of the vibration platform.

5. Conclusions and recommendations

On the basis of dynamic tests results analysis of conduit elements of trade mark "KRAH PIPES" it may be noted that:

a) In accordance with the program of experimental researches on the vibration platform of Research Institute of Building Constructions the dynamic tests of polyethylene elements of conduit made by ТУ 2248-001-30233670-2011 and ТУ 4859-002-30233670-2011. During the tests dynamic loads corresponding to 7÷9 magnitudes were simulated. The fragment of pipeline during the tests was filled with water.

b) During the tests the vibration platform acceleration, by the data of accelerometers which were installed on the platform, was changed in intervals from 1.04 to 8.36 m/s2 what exceed the value of acceleration corresponding to earthquake action 9 magnitudes. (4 m/s2)

c) During the tests when the values of natural oscillations frequencies of conduit coincided with the oscillation frequencies of the vibration platform, the resonance occurred. This phenomenon was observed when the system oscillated with the frequency f = 10.4 Hz. At the resonance the maintenance reliability was not broken.

d) Polyethylene elements of pipe line system of trade mark "KRAH PIPES" incudes the pipe with the next types of connection: electrofusion, connection with the help of the rubber gasket, connection with the help of the hand extruder, and also pipe fittings, reservoirs, wells, and pump stations which are recommended for application in Russian Federation in regions with seismic intensity of 7÷9 magnitudes.

The complete report (90 pages) and videos are available, just send a request to krah@krah-pipes.de.

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Examplary Accelerograms (m/s2) and spectrums of the maximum value of amplitudes (mm), recorded by installed sensors.

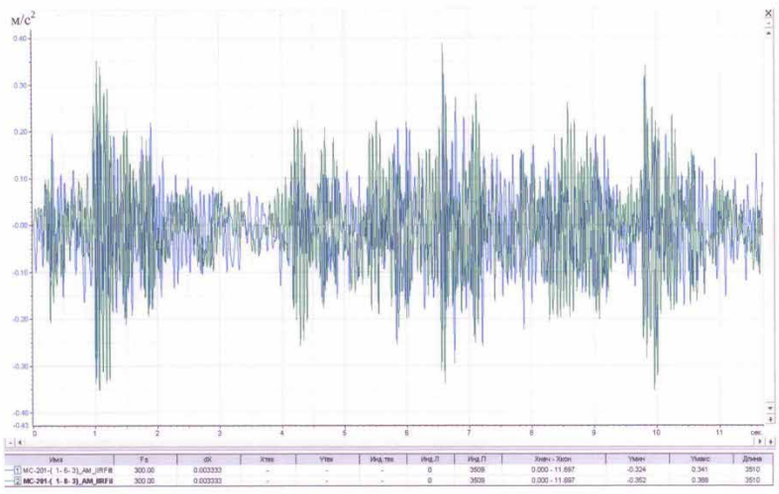


Рис. П-1-4. Акселерограммы (м/с^2), записанные с датчика 1-6-3 (синим цветом) и датчика 1-8-3 (зеленым цветом) при 9-м режиме испытаний (частота *f*=1.3 Гц; амплитуда A=16.4 мм)

Picture 4: Accelerograms (m/s2) recorded from installed sensors.The test mode #9 (frequency f = 1.3 Hz; amplitude A = 16.4 mm)

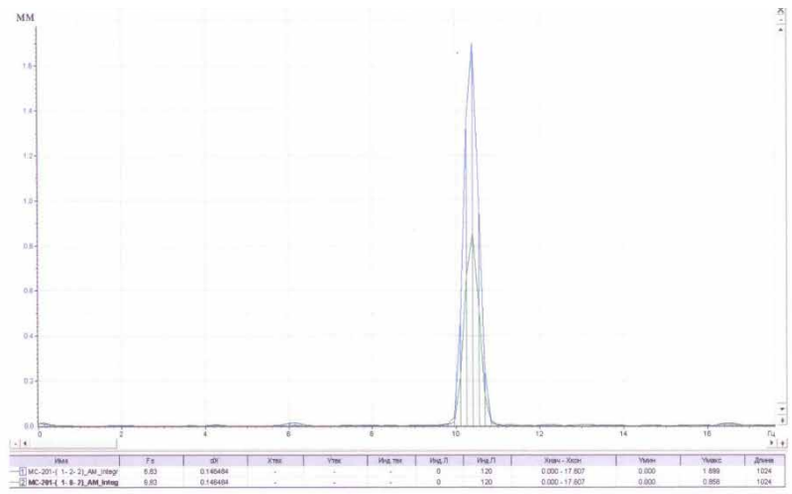


Рис. П-1-15. Спектры пиковых значений амплитуд (мм) для датчика 1-2-2 (синим цветом) и датчика 1-8-2 (зеленым цветом) при 25-м режиме испытаний (частота *f*=10.4 Гц; амплитуда A=0.9 мм)

Picture 5: Spectrums of the maximum value of amplitudes (mm) for installed sensors. The test mode #25 (frequency f = 10.4 Hz; amplitude A = 0.9 mm)

Flexibility or flattening test?

What does it mean and why should a pipe fulfil the requirements?

Today the requirements for a sustainable pipe system have changed, not always the cheapest solution is the best for a country. More and more designers and engineers dare to search for the technically best product for a project, with very reasonable costs. Also the cost aspect changed from single costs to the „lifetime cost"– from cradle to crave, including all. So, which support for a designer or a quality control department does the so called flexibility test or flattening test mean? How is the test-procedure and how should the result be valued? In several international and national standards like EN13476, DIN16961, ISO 21138 or the ASTM F-894 a link to these tests is given – but why?

Basically the test will check how flexible a pipe can be, without having any irreversible damages on the pipe. This pipe property will give safety to the designers against overloading of the pipe or ground-movements occurred by earthquakes or unexpected soil settlement.

The standards for the test: The flexibility test is ruled in ISO 13968 and the flattening test is ruled in ASTM F894 8.6.

What is the difference?

ISO 13968: Determination of ring flexibility: The ring flexibility of a pipe is tested by measuring the force and the deflection while deflecting a ring section from the pipe diametrically at a constant speed until at least the specified deflection is achieved or prior fracture is occurred. The test should be in accordance with ISO9969, but continue compression while measuring the change in either inside or outside diameter until the specified deflection has been achieved, unless otherwise specified the referring standard, the deflection shall be 30% of the outside diameter. The test report should include the applied forces. Usually the standard is only for pipes and not for socket/spigot or fittings.

ASTM F894: The Flattening test: Flatten three specimens of pipes (also with bell and spigot), in a suitable press until the internal diameter has been reduced by 40% of the original inside diameter of the pipe – so the deflection is 60% (double of the ring flexibility test) –The rate of loading shall be uniform and at 2in./min. (50,8 mm/min).

Picture 1: Deflection test at 30 %

Picture 2: Deflection test at 30 %

Which test equipment is needed?

For both tests a compression testing machine, as specified for ISO 9969, is needed, but capable of producing at least the specified diametric deflection of the test piece at the applicable speed.

What will be checked during and after the test?

During the compression, look out for signs of failure until the specified deflection has been reached. The checking should be done under normal light and with unaided eye.

a. Inspect the force/ deflection graph for compliance to the requirements in the standard
b. Check for any cracking or crazing in any part of the wall structure
c. Check for any wall delamination or separation
d. Check for any permanent buckling in any part of the structured wall
e. Check bracing of profiles.
f. Any other observation as specified in the referring standard

What is the he meaning of a memory effect ?

Usually PE-Pipes will go back almost to the prior shape after the load is taken away and so far the strain at yield is not exceeded. This material hysteresis is a very good property of thermoplastic pipes, so the pipe will still work with nearly the same hydraulic capacity.

Why a designer should consider this test in the decision for a pipe supplier?

One of the biggest advantages of polyethylene (gravity) pipes is flexibility, but the pipes are sold according to stiffness classes. To produce a stiff pipe some pipe producers are mixing cheap stiff material in the pipe (like filled by calcium carbonate up to 50%) – by doing this; the pipe will break under overload conditions or unexpected soil movements.

How do Krah Pipes handle these tests?

Krah pipes produced with the Krah production technology have no problem to comply to both tests, even higher deflections – up to 90% can be handled – but only if the raw material is good. Especially taking into account the cost pressure, many thermoplastic pipe producers try to reduce the costs of their pipe by using high filled thermoplastics, or they are running their lines in a high controlled speed, so that the pipe will have many frozen stresses in the pipe wall, or the waterway wall is detached from the structured wall.Additional remark: it would be good to also check the joints with the same test, to prove that not only the pipe works after/during a deflection, because in the end the designers / clients want to have a secure and sustainable pipe system and not only „a" pipe.

Author:

Alexander Krah
CEO Krah Pipes

First days of KR800-MAX

The final test of the latest pipe production line before shipping

Picture 1: Some of our team with customers during the testrun of KR800-MAX

At least once or twice per year interested companies are invited to attend the final test run or the „first days" of a new production line KR800-MAX for a Krah-Pipes production at the facility of the machine producer (KAT -Krah Advanced Technology GmbH) in Schutzbach, Germany.

This time the newest KR800-MAX is tested according to a very specific testing procedure to guarantee a quick and error free installation at the customer´s site. Several potential new customers from all over the world took the unique opportunity to enjoy the high performance of Krah-Pipe Production machines and also to take a company tour – so they can pay a visit in the RnD Department, Software developing department (WIN-KDR, MICKEY, PONTIS and all other APPs are developed here), tool making, construction, installation and also to the very impressive „mandrel"-production, where black-smiths are working hard with steel to produce giant mandrels up to DN/ID 5000 mm.

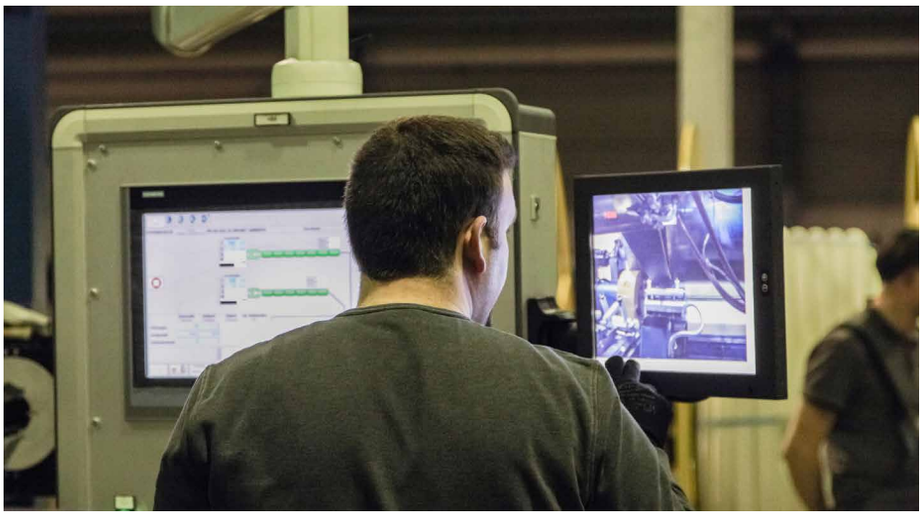
The machine presented will be shipped and installed for a customer in the Middle East where it will produce pipes successfully for a lot of pending huge projects.

This test procedure is the same for every production line, before being packed and leaving our facility. The test are mainly done with the extrusion line, because many other parts are already shipped in partial shipments before. It is the first time in the machine life a pipe will be produced. The heart of the extrusion line is a Kraus-Maffei single screw extruder 125x36D.

This extruder is the best choice for this kind of production – low RPM (revolutions per minute) and a high output with perfect plastification.

Usually the pipe for our performance test is a: standard Krah Pipe (with a structured/profiles wall) – for an irrigation project- DN/OD 1000 mm (42") , according to DIN16961, SN8 (according to ISO9969), 1 bar working

pressure and a yellow co-extruder inspection friendly inside surface. Material should be PE100. The pipe should have a solid wall socket and spigot. The minimum extrusion output of the performance test for this pipe is 1000 kg/hr. (but during the test we also try to find the upper border of the output – we reached up to 1.300 kg/hr). The real output in pipe is even higher, due of thanks to using the "pre-made" core-tube.



Picture 2: Control screens,on the right side the video of camera is shown

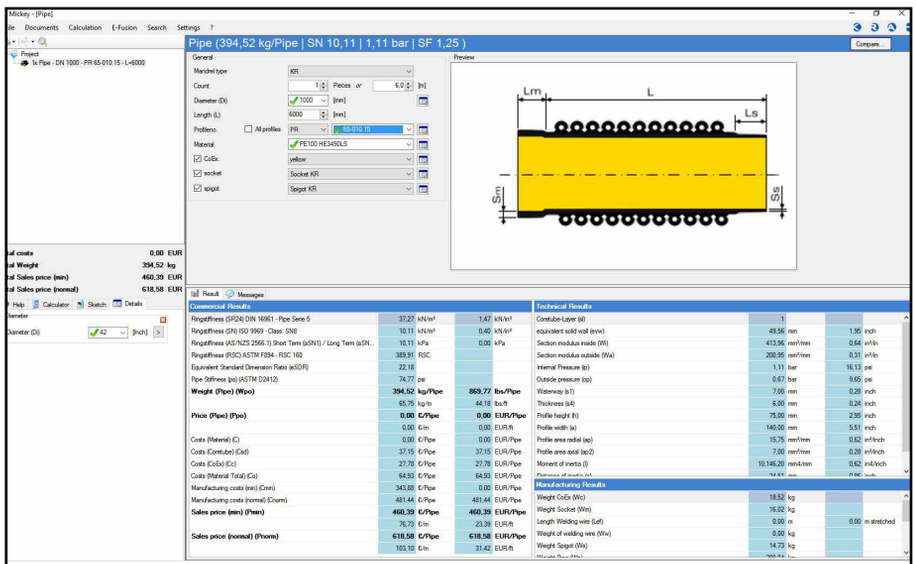
Beside the performance test, all new features are tested and will be shown to the attendees during the little "open house". New features are mainly in the software, in simplifying tools and machines, logging of data, cost and production factor control and this time a special machine lighting to show the actual mode of the machine (e.g: idle or not idle). All next generation lines (from 2018) will have a second screen, so the programming can be done on the machine and for a better visualization of the complete line.

The second screen can also show the installed cameras on the machine – to have a better overview without physical movement of the operator. Another big advantage is the possibility – during a problem – that our technicians can see and chat in real-time with the operator and the production line. This fact will decrease the down-time and the cost in case of a production problem.

The standard final test procedure(before shipment) is like this:

1. Selection of the pipe, by using the MICKEY-Software

The Mickey program (new version available in March 2018) is able to "create" a special pipe or "choose" a standard pipe. Standard pipes are usually classified in different stiffness



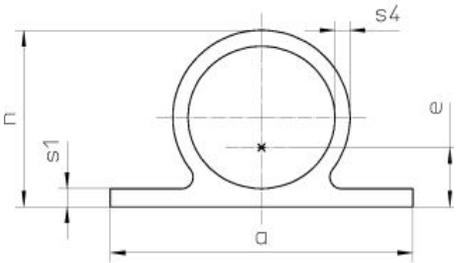
The entry data are:

Material:	PE100
Pipe diameter:	DN/ID 42"
Nominal stiffness:	>=SN 8, according to ISO9969
Inside pressure:	>=1 bar (working pressure)
Pipe length:	6000 mm
Connection:	Socket and spigot

Picture 3: Screenshot of the program "Mickey"

classes and pipe diameters. The Mickey Software can handle different international pipe standards, for gravity, low pressure and pressure pipes with different materials. Different kind of Stiffness classes can be chosen or they could be the background information for the "creation" of a new profile/pipe. The most common ones are at the moment ISO9969 and ASTM F894.

The Mickey software will find the weight optimum profile to fulfill



Picture 4: Profile cross-section

the above mentioned requirements (stiffness and inside working pressure). If a standard profile is suitable, the software will choose the lightest profile, if not a special profile is generated.

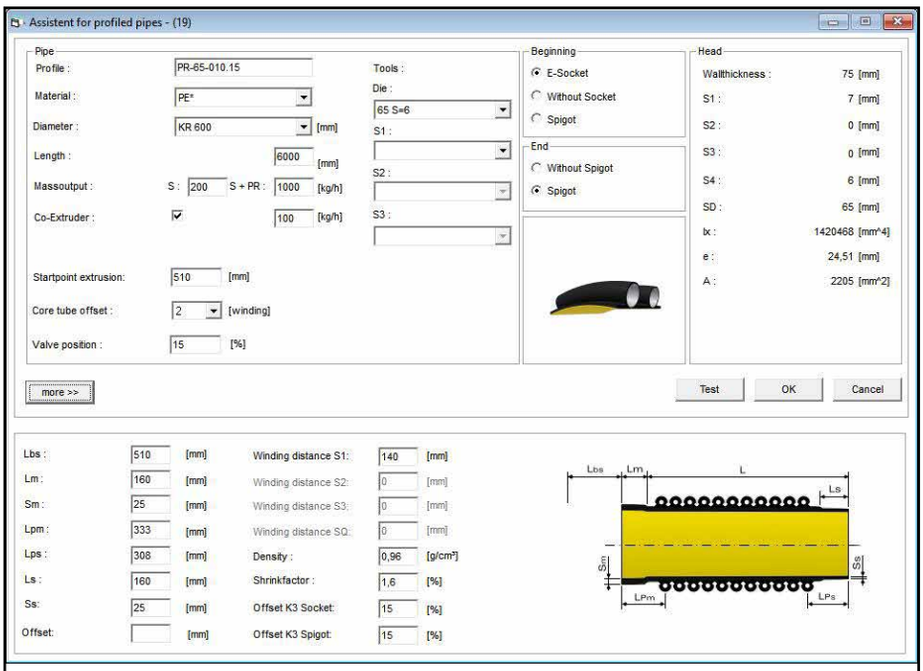
The result after optimation is:
Profile type: PR 65-10.10,
Pipe weight: 370 kg/Pipe;
weight per meter 66 kg / m
(incl. weight of the core-tube)
Working pressure: ≥ 1 bar
Stiffness (ISO9969): ≥ SN8
Ring stiffness (DIN 16961):
37 kN/m² (Pipe Series 5)
RSC (ASTM F894):
RSC 390 (RSC-Class 160)
eSDR: 22

The exact dimensions are in the screenshot below.

2. Preparing the "real" production program by using WIN-KDR

The WIN-KDR software is converting pipe and machine information in a NC-Program, which will be sent to the production line – online. The pipe information is coming from the MICKEY program – electronically or as a production order in paper. The software can run in the office (there is a direct LAN-connection to the KR-800 Line) or directly on the machine`s "second"-screen.

Here the "programmer" can decide which output we want to reach and all the other pipe dimensions. He will get a preferred set of dies and other tools. After finishing the entries, the software will generate the "production program". In our case the pipe is produced only in 1 layer, but this software is able to handle up to 99 layers in a single or bi-directional production.



Entries in the Software:

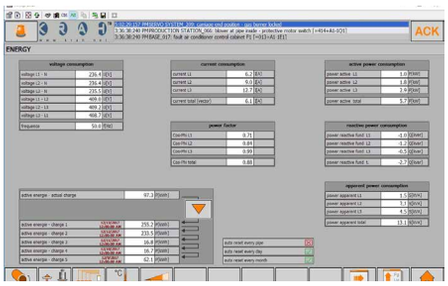
Material:
Main Extruder: Borealis HE 3490-LS (Black)
Co-Extruder main: Borealis HE 3492-LS-H (Orange)
Co-Extruder sec.: Polybatch 2200 (Orange)
Core-Tube: DN/OD65, PP
Used Machine: KR800-MAX V. 2018
Used Tools: Mandrel: 1067 mm (42")
Solid wall layer die: 140/7 (a/s1)
Profile die: DN65,S4=6
Extruder output: 1000 kg/h (max. 1200 kg/h (HDPE))
Co-Extruder output: 100 kg/h (max. 300 kg/h (HDPE))
Pipe length: 6000 mm + socket
Pipe weight: 370 kg/pipe
Production time: 24 min/Pipe; 4 min/m (incl. socket/spigot, pre-heating and setup-time)

Picture 5: Assistance program for profile planning

3. Pipe Production

After the operator selected the "production program" and loaded it to the KR800-MAX machine, the pipe is produced. As follows you can find some photo-moments of the production. Just the extrusion part and the production station is installed, all the rest is already shipped. Before the operator can start the KR800-MAX, he will make some plausibility checks, like if the right mandrel is placed on the machine and corresponding with the loaded program. These tests are made by integrated RFID-chips. As soon as the extrusion starts the lighting of the machine will change from red (IDLE) to green (NOT IDLE) – so from far way the status of the machine is visible. During the production you can see on the screen some important values:

a) All production settings (temperatures, etc.)
b) Production-coefficients and demand of material / Extrusion Output
c) Production-coefficients and demand of electricity
d) Production-coefficients and demand of gas



Picture 7: Screenshot Energy consumption

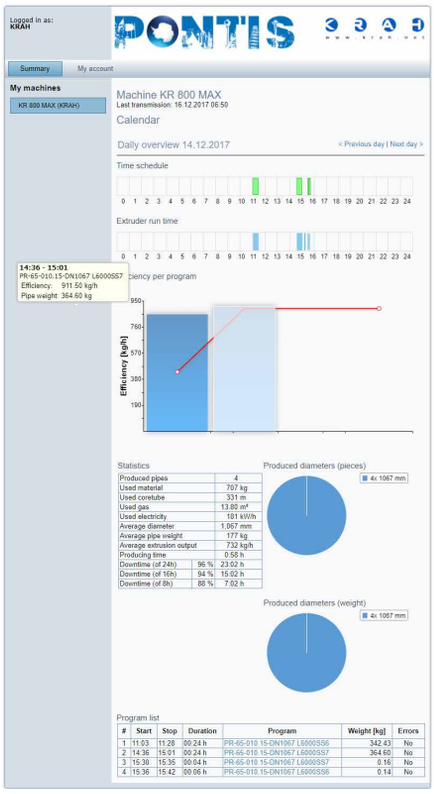
One of the latest developments for 2018 is an automatic quality control station, where the pipe is measured by laser. This development will be published and available in the mid of 2018 – today extensive test are carried out in Estonia.

4. After Production

Approx. 15 min. after the pipe is produced, all production data are online and they can be shown with the Software "Pontis" – The bridge between production and office. The software is a WEB-Based APP and can run on computers, mobiles and tablets.

Beside different diagrams several numbers/data showing of the screen are:

a) idle/not idle time of the line



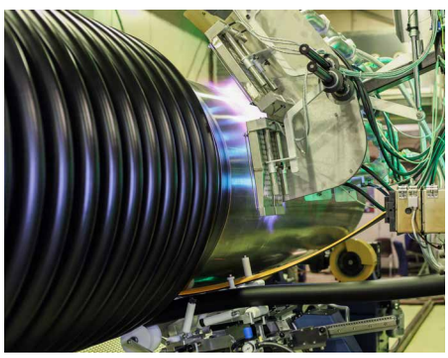
Picture 9: Screenshot of the program "Pontis"

b) demand of all factors (material, energy, gas, core tube,)
c) other commercial information (number of produced pipes, average output, average pipe diameters, etc.)

Beside the pure pipe information all information are stored for daily, weekly, monthly and yearly reports, without the fact that somebody has to enter the data before – all done by the nature of the machine KR800-MAX.

Picture 6: Machine testrun

Picture 8: A test pipe on the new machine



Picture 10: Preheating the mandrel

These data will help to have the production cost under control.

5. Disassembling and Packaging

Directly after the test run, the disassembling started because the complete line will be shipped before Christmas to the Middle East. From the customers side an inspection party (SGS Control Co.), attended the test run and the packaging. Hopefully the machine will arrive in the Middle- East in January 2018 and the installation/ commissioning will start as soon as possible, to that the machine can do its job: "producing Krah-Pipes in good quality and high output".

Author:
Alexander Krah,
CEO at Krah Pipes

Pictures 11 + 12: Goodbye "KR800-MAX"! The production line will leave its nursery

Introducing ....

Mohammed Al Hashani, UGPM Oman

Mohammed Al Hashani is the Vice President, Krah Middle East based in Kuwait. In addition, he is the Managing Director of United Gulf Pipe Manufacturing Co LLC (UGPM), which is based in the Sultanate of Oman. Key products include HDPE pipes, fabricated items such as Manholes, House Connections etc and other accessories. UGPM, under his able leadership, has achieved the following quality certifications: ISO 9001, ISO 14001, ISO 18001 related to Quality, Environment and Health & Safety.

In the interview, he informed us that he works hand in hand with the three C's: Client, Consultant, Contractor; utilizing complex calculation techniques to arrive at a customized product that meets specific and definite requirements. Products developed are highly cost effective, with a long life, meeting environmental concerns, keeping low maintenance costs, producing homogenous product using specializing welding techniques for secure jointing, for quick and easy installation without additional training or expensive equipment. Given the nature of the products, their applications, and stringent requirements from the three C's, the company places maximum emphasis on Quality. This is evidenced by the fact that the department head reports directly to the MD. In addition, the company provides training for its products from reputed worldwide companies, thus emphasizing the importance it places on long term relationships.

Mohammed was born in Saudi Arabia, but he grew up in Kuwait where they had a family business. He was initially exposed to Krah AG, Germany in 2001 when his father, Mr Khaled Al Hashani acquired major shareholding in the company. He started his journey with Krah AG in 2005 after graduating with a degree in Industrial Management and Systems Engineering from Kuwait University. During his academic experience, he performed an optimization study for waste oil recovery firm producing more than 250 products. His recommendations were incorporated leading to a cost saving of Euros 200,000/- per month. Post-graduation, he proceeded to Krah AG for on the job training.

Moving from the Middle East to a European work culture was an eye opener and a rewarding process. Following a strict work culture with a stringent emphasis on quality and productivity left marked impression on the young candidate. This culture is carried over into his current professional experience. A project that is etched in his memory was the maintenance and repair of a critical piece of equipment for a customer.

Picture 1: Mr. Mohammed Al Hashani

Due to machine breakdown, the company was incurring heavy loss. The team, including Eng Mohammed, set out to complete the task from the early hours of the day, overnight in to the early hours of the next day, not stopping until the machine was restored to operating status.

The work ethic inculcated during this period has extended into his current professional environment. Another interesting experience was in dealing with the fabrication production station. This machine enables to make precise incisions into the HDPE pipes thus allowing a company to produce high quality products for critical applications. After a solid introduction into German working environment, Mohamed travelled to M/s Aqua Biotech, a company specializing in wastewater treatment plants. After building critical high quality products for wastewater application as one of the outputs for Krah products, he was now able to appreciate their usage in a sensitive environment.

High regulation concerning the industry and meeting government requirements for the same added to the high learning for the young Saudi engineer. Mohammed has invested huge amount of resources in the introduction and knowledge awareness of utilizing HDPE products, especially in the Middle East and North Africa region. This has resulted in the products being adopted for special applications in some of the world's largest companies like Saudi Aramco, Saudi Arabia, Oman Wastewater Services CO (HAYA Water).

His efforts have enabled the company, United Gulf Pipe Manufacturing to have crucial tie ups for knowledge transfer and an approved vendor in major companies in the region. Key project references during this period include Jazan Gasification Project, Al Amerat and Al Seeb Wastewater projects among others. Apart from his interests in the infrastructure filed and HDPE products, Mohammed has varied business interests in trading and supply of manpower to esteemed clients like the US military.

Mohammed maintains an active interest in sports and luxury vehicles preferable of German origin. He is an ardent supporter of football clubs, including Al Hilal of Saudi Arabia, Bayern Munchen of Germany and of course the German National team. His favorite cars include Porsche, Audi and VW. Needless to say, he speaks fluent German and prefers to spend his annual vacation in Germany during the summer.

We thank Mr. Al Hashani for his time to answer our questions and tell us something about him!

Moha's Bio

Date of birth:
24 November 1982

Family:
Married since 2010, soon father of 3 children

Joined Krah:
in the year of 2005

Favourite meal:
Steak

Plastic Pipes Conference 2017

A get-together of leaders in the plastic pipe field

Picture 1: Our representative Jochen holding a presentation about the Krah Pipes Technology

From 23 - 24 November 2017 the "Plastic Pipes Conference" took place at the beautiful "Leela Mumbai Hotel" in Mumbai, India.

The conference provides a comprehensive overview of the latest material, technology, business trends and applications in the plastic field. Over 350 delegates listened to presentations and lectures from 25 speakers who are leaders in the field of plastic pipes. One of those was our technical sales representative Jochen Blickheuser. He introduced the Krah Pipes technology to those listening and focused on the importance of plastic pipe systems in the near future, because "the worldwide demand for plastic pipes is expected to grow more than 5% annually until the year of 2019". Many third-world countries also concentrate more and more on plastic pipes, since they are simply more efficient, easy to handle and have a good UV resistance which is essential in African and Asian developing countries.

Our Indian representative Ramesh Parasuraman, General Manager at Allied Solutions, is also a member of the Society of Plastic Engineers (SPE) who arranged the conference. Especially in mind stayed the powerful, one-hour-long speech of Mr. Swami Swatmananda who is one of the leaders of Chinmaya Shivam, an Indian mission trust. He talked about "Success without stress", making clear that we do have to focus on our business but shouldn't exagerate with trying to be the best since it can be poisonous for us and our environment.

Mr. Blickheuser was very honoured to be part of this conference once again and we will try to take part in the next Plastic Pipes Conference, which will be in Las Vegas in 2018.

Author:
Lisa Bläcker
Krah Pipes

Picture 2: Mr. Ramesh Parasuraman leading through the program

FAQ

This is the second part of our "Frequently asked questions" section. In every issue we will answer some of the most asked questions we get from potential customers and interested parties about the Krah Technology. Also, please feel free to send us some new ideas for our FAQ at **improfil@krah.net**, we will try to publish as many as we can.

What is the stiffness of Krah manholes?

The minimum stiffness is defined as SN2 in EN13598. Further all other stiffness classes can be manufactured if required and necessary.

Can Krah pipes resist inner pressure?

Yes, due to the tailormade design any Krah pipe provides a certain solid waterway wall-thickness for the requested inside pressure.

What is the maximum size and height for Krah manholes?

Typical Krah manholes are used in a maximum depth of 10-12 m. For bigger depths Krah recommends the telescopic manhole design which is used for landfill application as well. The biggest manhole diameter is DN/ID 5000 mm.

What kind of fittings do the Krah system povide?

Krah fittings are manufactured in the Krah factory. All necessary fittings and even customized design can be manufactured: bend, elbow, stub-end, flanges, reducers, T-branches, Y-branches etc.

How high is the vacuum / buckling pressure resistance of Krah pipes?

Krah pipes provide a very high buckling pressure resistance due to their structured wall design. The bigger the pipe stiffness, the higher the buckling pressure resistance.

What is the installation speed of a Krah pipe?

The installation speed of a Krah pipe is very high and a big cost-advantage for the contractor. Because of the Krah Electrofusion system the pipe strings can be installed in final position and be parallelly or later on welded. That guarantee no time loss!

Is the load capacity of buckling pressure and inner pressure the same?

No, it isn't comparable! The inner pressure capacity mainly depends on waterway wall thickness and material strength. The buckling pressure capacity mainly depends on geometry (moment of inertia) and the flexural modulus.

What is the most efficient manhole design for larger pipe diameters?

The most efficient manhole design are tangential manholes – the tangential manhole design is becoming more and more popular, because it considers all the advantages in fabrication of Thermoplastics and helps to save costs!

What is the welding time of Krah pipe Electrofusion?

Krah designed the Electrofusion process to guarantee maximum quality at minimum of welding time. The welding time of Krah Electrofusion Joint is not more than ca. 20 minutes or any diameter.

Is it possible to recycle Krah pipes after usage?

Krah pipes are made of Polyethylene (PE) or Polypropylene (PP) and can be recycled! Important is cleaning and separation of the contents. Multitude of professional recycling companies are established worldwide. PE and PP are also after their first product life valuable resources.

How is the axial load capacity for Krah manholes?

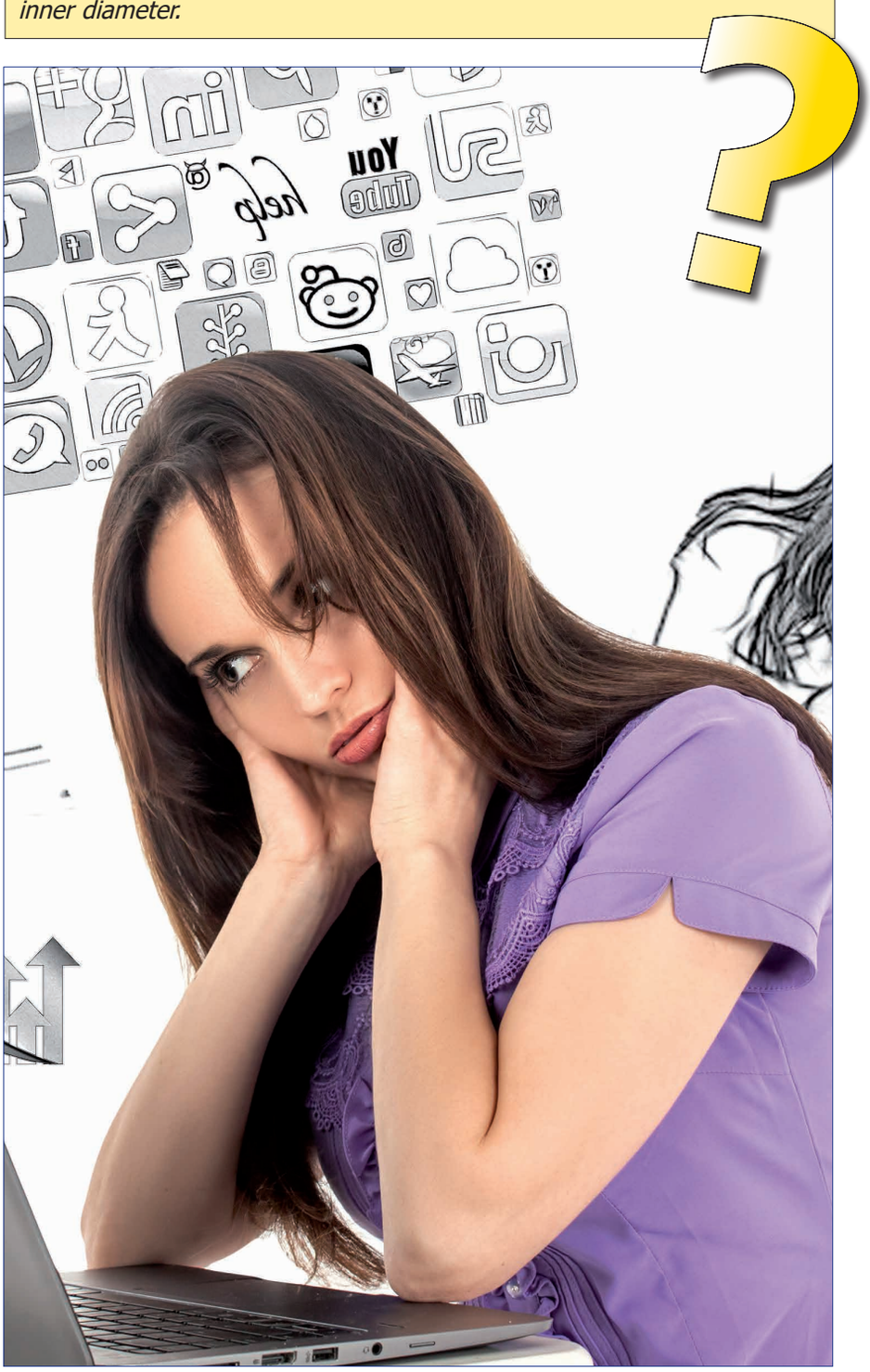
The axial load capacity has the same importance for the design of manholes as the stiffness. Axial loads by direct load induction from the top or down drag forces gets transferred and absorbed by the solid wall thickness. Krah manholes can be produced with any required solid wall thickness to fulfil a maximum of axial load capacity.

How is the fitness of purpose for potable water applications?

Krah Pipes can be made of approved raw material for potable water application and fulfil all requirements. The high pressure-capacity and the homogeneously jointing method complete the fitness.

Why is the nominal diameter of Krah pipes an inner diameter and not outer diameter like ther PE pipes?

Krah pipes are calibrated to an inner diameter. The inner diameter is the important diameter for hydraulic aspects and general planning. The stiffness and pressure capacity can be adjusted without any change of the inner diameter.



Extension of Krah supply range
for the HAS and BAS fitting

Picture 1: Different samples of the new supply range

Picture 2: transportation case of the devices

The Krah team has introduced a new addition to their supply range in 2017: After a short time of development the KRAH HAS/BAS Fitting is now available from DN/ID 20 until DN/ID 300 mm and equivalent OD dimensions. The table below shows the current supply range and consider that we are able any time to adopt other dimension on your request.

ID [mm]	OD [mm]	Welding Procedure	BAS System (Flange connector)	HAS System (Plain end)
20	acc. designed and customer requirements	Heating element	Yes	On request
25				
40				
50				
65				
80				
100				
acc. required SDR class	125		On request	Yes
	160			
	225			
	250			
	280			
	315			
	355			

Due to the perfect teamwork between our long-time Krah customer Dainippon Plastic, Japan and our own development team the fitting could be optimized for the usage in tank-fabrication. A lot of effort has been put into this creation to enable an even quicker and easier assembling of the HAS and BAS fitting in all these sizes. On request of our Japanese business partner the BAS system considers flange connectors and all dimensions are optimized for installation at fabrication of polyethylene tanks and apparatus. According to the requested size-range and the application Krah now provides the tailor-made welding equipment

- For solid wall pipes
- For structured wall pipes

- For tank application

If you would like to get a free, customized offer for your project perfectly we will need the following measures:

- Main pipe: Inner and outer Diameter
- Main pipe: Solid or profiled wall
- Main pipe: Total wall thickness
- Branch pipe: Inner diameter and outer diameter
- Application

Finally all advantages of the KRAH HAS and BAS System at one glance:

- No special tools are necessary for the installation
- The assembling is quick and easy
- It's suitable for all solid wall and profiled pipes made out of PE
- The connection is durably tight thanks to welding
- It's available for immediate use
- High security by automatization
- Shifting security and force absorption thanks to welding of the complete pipe wall
- Robust design of the house connection
- No inside protruding elements thanks to a concave peeling

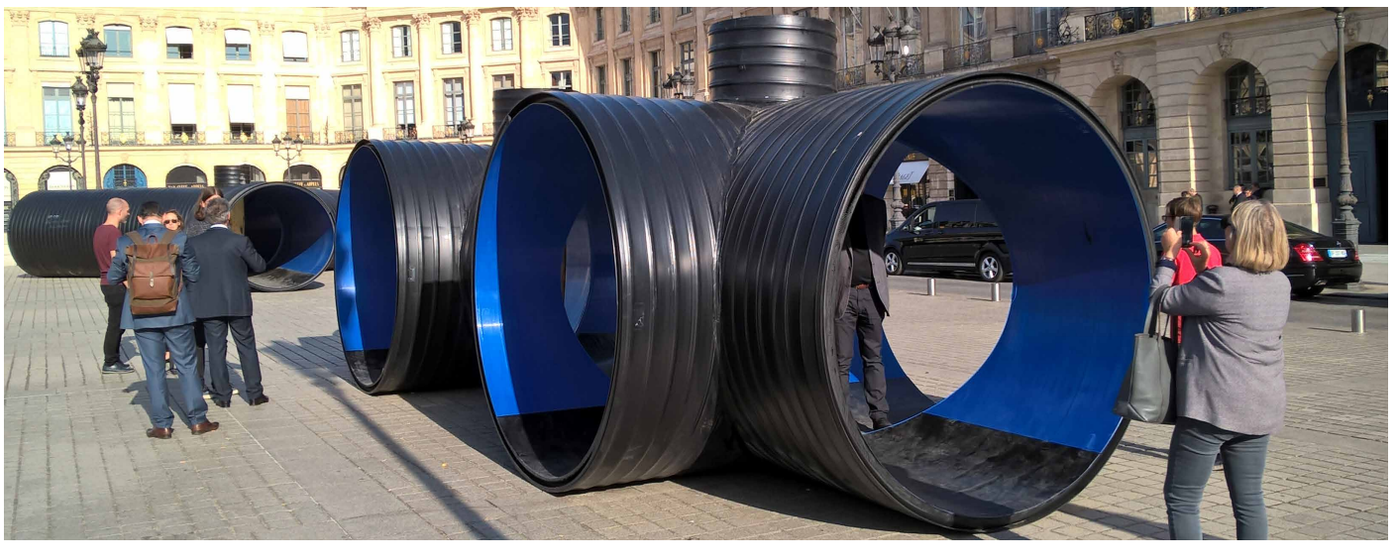
Author:
Jochen Blickheuser
Technical sales

Picture 3: Tank fabrication at Dainippon Plastics

Picture 4: Krah BAS fitting

Krah Pipes on artistic

Krah pipes producer Polypipe attends FIAC in Paris



Picture 1: Mr. Tuazon's sculpture using Krah pipes on the Parisian Place Vendôme

For the 44th Foire Internationale d'Art Contemporain, (International Art Fair, FIAC) in Paris the American artist Oscar Tuazon created an installation made of water treatment pipes by our partner Polypipe, two metres in diameter, and presented a series of sculptures on the Parisian Place Vendôme.

The sculptures were exhibited during the whole month of October, drawing the attention of many pedestrians and visitors from around the world. Many visitors were highly impressed by the size of the pipes: a tall man could easily walk through them without any problems. But it was not just the height that was so impressive. Many people actually thought about the importance of pipes and water in our world. Mr. Tuazon addressed the problem of water resources very clearly and explained the meaning of the sculpture to those interested.
On this point, he says "Our world is water. So we produced an homage to water in form of a sculpture. A pipe, a hole, in which water flows through below ground, a passage from one way to another. Water is an open room below ground. We need to go there, move in the canalisation and live there."
On each side of the war memorial, which stands on the "Place Vendôme" are four sections of fabricated pipe assemblies. Inside each of the pipe assemblies, prepared tree trunks have been installed, to represent the life-giving nature of our ecosystem, since they are an archive of water, a precious resource that we are all dependent on.

Polypipe was really honoured to be taking part in such a great exhibition since it shows the environmental awareness of pipe producers and makes it public to the open world. Polypipe is one of Europe's largest manufacturers of piping systems, water management solutions and energy-efficient ventilation systems, delivering engineered solutions that respond to a rapidly changing environment. Polypipe has an established market position, spanning the residential, commercial, civils and infrastructure, and public non-housing sectors in the UK and selected markets across the globe. They have been working with the Krah technology for over a decade now and we are really proud to see pipes produced on our machines being used for such a good cause.

Author:
Lisa Bläcker
Krah Pipes

The new Krah calendar for 2018

Every year a big event ….

For the first time in the Krah calendar history we were able to shoot the whole calendar in one day.

On the 15th of October at the Frank GmbH facility in Wölfersheim, Germany, the day started very early – the first pictures were taken at 7 a.m., the last at 8 p.m. We had great support from the General Managers at Frank, Ms. Heike Frank and Mr. Mark.

Instead of doing the shoot in several companies with different photographers we placed the whole thing into the hands of a professional: Petra Kladivova. Owning a model agency in Czech Republic, she organized the models and the photographer. Having already worked with us for our previous calendar, she knows how to present our pipes and products in the best possible way. The Frank GmbH owns 3 Krah production lines and a large fabrication plant for special components produced out of Krah pipes. The photographer was Pavol Bigos from Pinarto Studio. We used 5 different models to fill 12 months plus a beautiful cover photo. All models came from Petra's model agency and were highly honoured to be part of this special project. The final result were lots of great pictures, communicating a great feeling with our pipes in the middle, almost becoming side issue. In the first week of December the calendar was sent to our customers around the world.

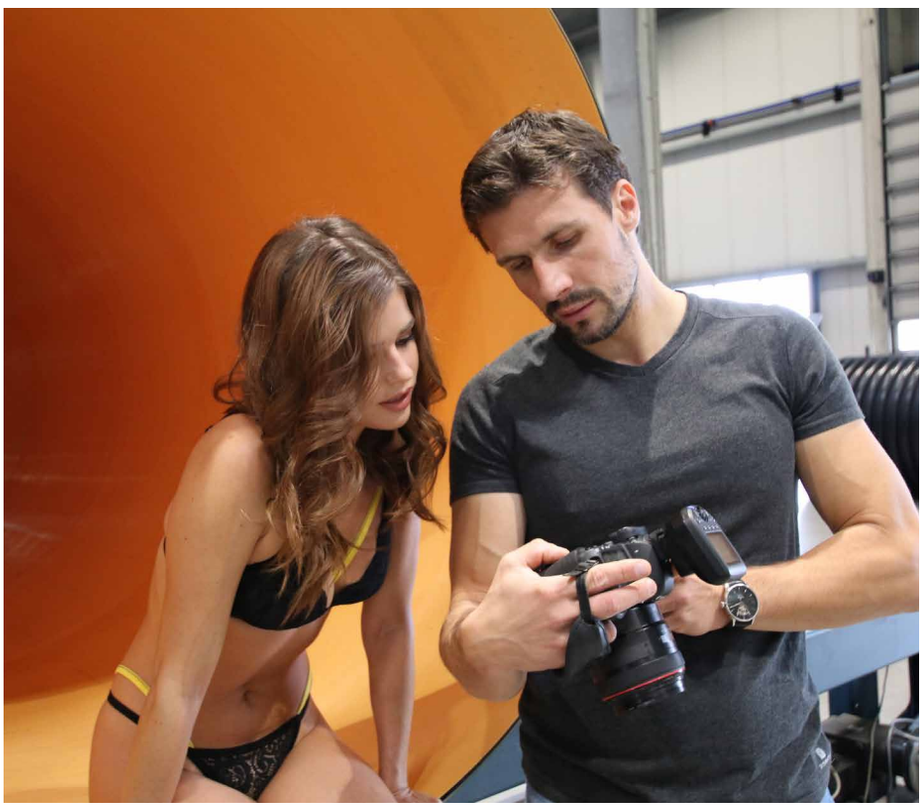
Find below some interesting background information from the shoot:

Q: Who is Petra?

A: Petra is a name of a historical and archaeological city in southern Jordan. But I am also Petra and I hope I will have a chance to visit this city one day. I am 27 year-old model, business woman, owner of the modeling agency PETRA MODELS, an engineer, racer of Jetsurf, creator, etc. I have many hobbies and do lots of projects. If you would like to know more about me follow me on my Instagram *@petrakladivova*.

Q: Isn't it strange for a woman to make a calendar with other beautiful women and pipes ?

A: No, why? Everybody loves beautiful women, wether you're a man or woman. If somebody says otherwise they are probably lying. The pipes were very interesting and something new for me. I am very glad I had this experience with



Picture 1: Petra Kladivova with the photographer Bigos, checking the pictures

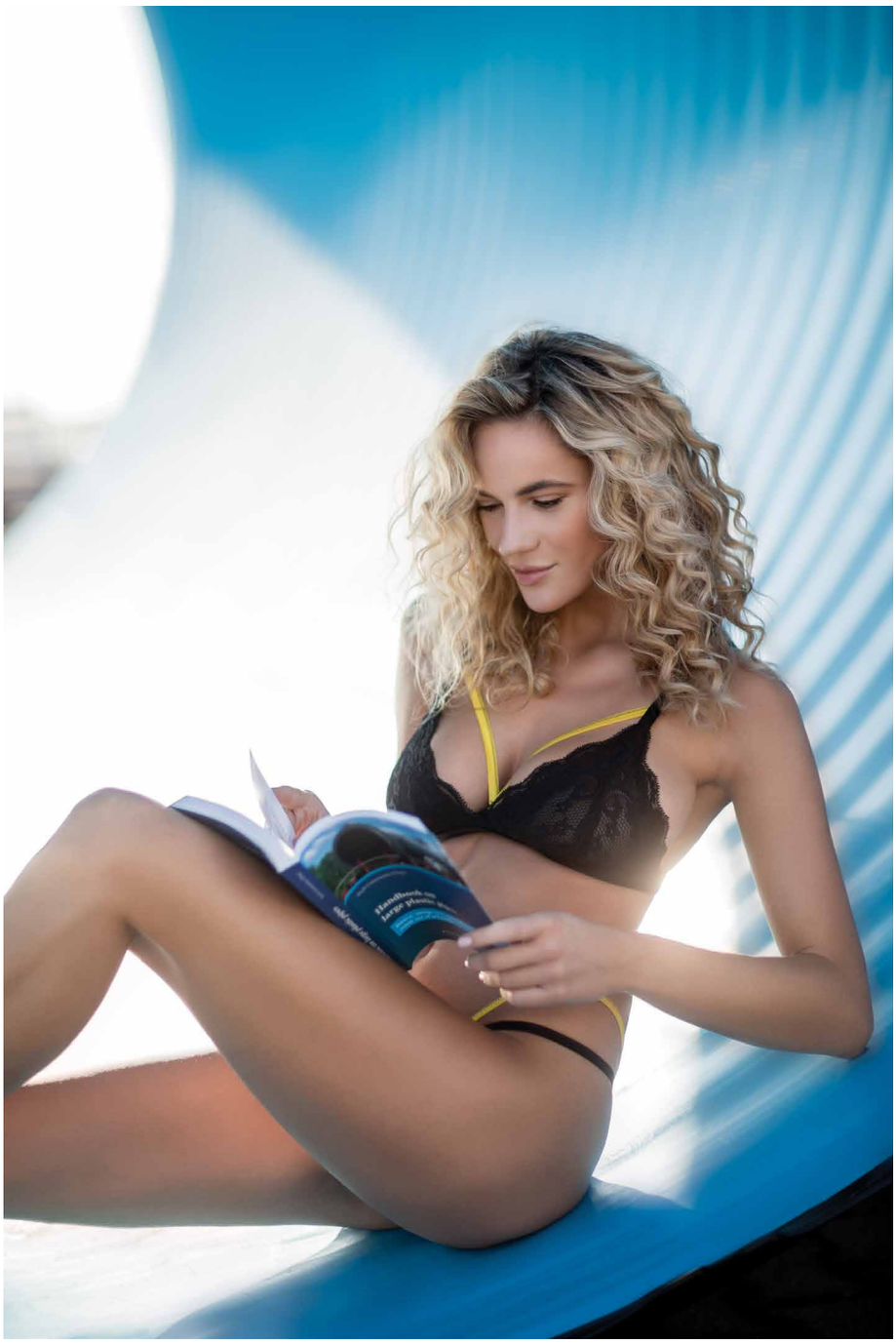
the Krah company. If you have a job for a calendar it's usually with cars, motorbikes etc. That's a bit boring. Everybody has or saw this type of calendar, but pipes and beautiful women is really originally and I am glad I had this chance, because I saw the calendar and I was shocked about the great calendar we made. The whole team did a very good job. I think everybody should get one on their wall.

Q: Where did you find the professional photographer and the models ?

A: My agency PETRA MODELS has been on the market for almost 6 years now so I have been doing this business for quite a long time and I cooperate with a many professional photographers and models, so it wasn't hard finding the best photographer for the job because we did a lot of projects together and Pavol Bigos is really, really, one of the best photographers that I had the chance to do business with. Regarding the models, it was very easy finding the best models for the job, because I have a database of 700 model portfolios from all over the world. I can find the perfect fitting model for each project, every client has other wishes.

Q: What else do you / your company do ?

A: My company PETRA MODELS (www.petramodels.com) does everything about modelling- shoots for calendars, TV commercials, advertisements, billboards, catalogues, internet etc. My company also does a lot of fashion shows, arranges hostesses, models, translators, waitresses for events, exhibitions, competitions, shows, etc. My company organises all those things I just said worldwide. I actually have a lot more more business outside of my country, all over Europa and lot of in the United States as well.



Picture 2: One of the photos of the Krah Pipes Calendar 2018

Short news

Krah Pipes at IFAT Munich 2018

From 14 - 18 May 2018 the IFAT, the World's Leading Trade Fair for Water, Sewage, Waste and Raw Materials Management will take place again in Munich, Germany. This year it will feature more than 3000 international exhibitors from around 59 countries. The preparations for this fair have already begun and we are excited to show our production range and technology once again in a nice and informative atmosphere. You will find us in Hall B3, booth 411.

Krah Pipes at MWWD Dubai 2018

In October 2018 we will also attend the MWWD exhibition in Dubai (Marine Waste Water Discharges). It is organized by our dear friend and customer Mr. Carlo Avanzini from AVANZINI MIDDLE EAST (FZE). The exhibition will lay its focus in 2018 on many trends coming back from the last years such as the usage of HDPE pipes for marine projects.

Krah Pipes serve as ski tunnel in France

At the french ski area "Lude de Tignes" in there was a new sledge run introduced. There has also been a Krah pipe used as part of the route. It is a Krah SGK pipe

in DN/ID 2000 mm, has a length of 40 m and is used as "sledge tunnel". You can find the official video at "https://www.youtube.com/watch?v=7LLR97NqAUs".

Krah Pipes Manila now accredited supplier

Krah Pipes Manila, Inc. proudly announces that it is now an accredited HDPE pipe supplier for Manilad Water Services, the water and wastewater services provider of the cities and municipalities thtat form the West Zone of the Greater Metro Manila in the Philippines. Recently, Krah Pipes likewise has been accredited by the Department of Public Works and Highways (DPWH), a major department in the Philippine government undertaking major infastructure projects .

Merry Christmas from...

..Germany: The Krah headquarter in Schutzbach

..Manila: The Krah Pipes factory in the Philippines

..Estonia: The team of Krah Pipes OÜ, Estonia

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Get more information here:

www.krah-pipes.de

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