We are happy, because we are „The Best“

(proved in China)

It is very normal and common, that German machines are being copied, especially in the area of plastic processing machines. Everybody is upset, but only few companies take legal measurements against it.

Also our machines are more or less successfully counterfied and copied by approximately 5 Chinese companies. The great thing about it is, that they do not only copy the hard- and software but also our name.

As Chinese people claim to be the best masters in copying, we, Krah AG, feel very proud and flattered by their works and promotions.

Our copy cats bring up our company name and branding as well as my own last name everywhere. Therefore I would like to use this occasion to ask all copy cats who read this now: “Please try to build and deliver the machines that you call Krah machines in high quality, so that you maintain and not destroy the reputation of the best/ masters.”

About 20% of the video about Krah pipes does not show the original Krah machines and even our copiers refer to our own videos – thanks for that too!

Instead of taking legal measurements, we invest the saved costs for lawyers and court in a continues development of our machines. This has the advantage that the performance is much better than the one of the copies despite a higher sales price. Also our pre- and after sales service is not comparable but much more comprehensive as we have product experience and technical expertise also about the final product.

Moreover, the Krah machines have an amortization time of less than 1,5 years but in contrast to the copies the machines work reliable and continuously for much more time.

To be part of the Krah community offers the member very special market advantages and even pipe orders.

Until our latest machine development, the KR800, will be more or less available as comparable copy, 3-5 years will pass – a period of time in which the customers of the original machine have amortized their investment for a long time already and have enjoyed the advantages of the services and cooperation with Krah AG, Germany.

The Krah pipe and technology will be steadily more known through and manifests its own market value, beside the investment value.

So finally I have very good news for all readers who do not have original Krah machines yet: we still produce and even sell the machines !!!

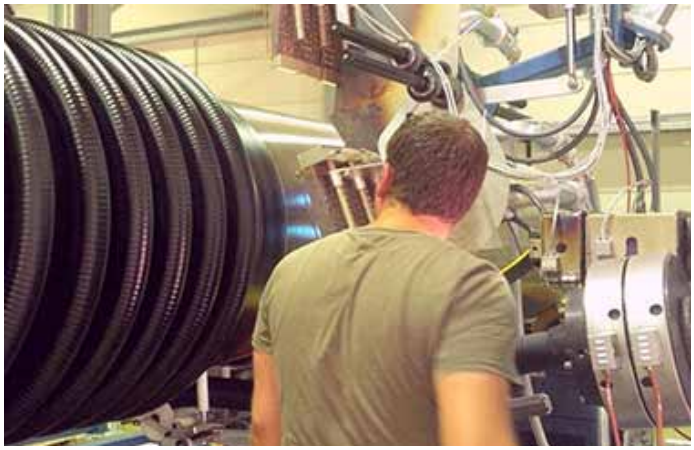
So, we are happy – because we are the BEST (proved by the copier).

Alexander Krah - CEO

The New KR800 - next generation!

The last major development of our production line was four years ago, when we changed from KR700 to KR750. This year (2014) after a long time of small improvements and complete new developments, we have finally completed our new generation of our KR-serie – the „KR800“.

The first machine of this new line is shipped to our customer in Poland to conquer the market in East Europe. We are convinced this machine will be only the beginning of a new successful generation of production lines for spiral pipes.



We are offering the complete new machine series KR800 for a very attractive and very feasible price. Also for existing customers with machines starting from version KR700 are able to upgrade their system. Please do not hesitate to contact us or arrange a meeting with our responsible sales person, to explain in detail the possibilities of upgrading.

The New KR800 - next generation!

The new features are:

- New profiles designed for large diameters, especially for pipes >1500mm
- The new profiles are optimized for SN-classes according to ISO9969, for PE and also PP. With the new profiles the possibility to fight against other low-price-products is much easier. The pipes are in general 15-20% lighter for sizes DN/ID>1500 mm.
- Extrusion output up to 1,2 tons/hr, due the new die-head system and better extruder utilization.
- Shorter change over times, better pre-heating system.
- Bigger co-extruder, up to 80 kg/hr.
- New production software WIN-KDR2014, with new light weight socket and spigot system for gravity pipes. Also the MICKEY-Software is now available in the newest version, with many improvements and new features..
- A new socket/spigot system for easier jointing of pipes.
- More automation, like an integrated computer controlled pipe labeling system, like the IR-camera (CCTV) to check the surface temperature of the mandrel and the pipe.
- More computer integration, with PONTIS you are always connected to each of your machine and you can get useful data of production in real time, with many charts and standard reports.
- Integration of the measurements and logging of gas and electricity supply for each pipe (if wanted) – so the calculation of production costs will be much easier and nearly done automatically.
- Reducing failures by using IRFID-chips in the main tools.
- Reducing of the cooling time with a new contact-socket/spigot cooling system (CCS).
- Reducing of production costs.
- We simplified the production, by reducing mechanically settings
- All important adjustments during production can be done on „real“ buttons and switches, beside the touch screen. So the machine is becoming more user-friendly.
- We are offering the complete new machine series KR800 for a very attractive and very feasible price. Also for existing customers with machines starting from version KR700 are able to upgrade their system. Please do not hesitate to contact us or arrange a meeting with our responsible sales person, to explain in detail the possibilities of upgrading.

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

Concrete basin, river side

1. Preface

Water distribution and water usage have been in the focus of the authorities and the civil society of Argentina for many years. From an infrastructural point of view this issue raises complex problems, which have emerged through several changes between privatization and communization over several decades. The incomplete supply of numerous households with fresh drinking water such as safe sewage water connections are obvious results of these which need to be faced and solved. To address these shortcomings, especially in the metropolitan area of Buenos Aires, the Argentine government has launched the major project: Planta Potabilizadora Juan Manuel de Rosas.

Within this major project, river water is taken out from two rivers and transported into the water treatment plant in the north of Buenos Aires. The treated water will mainly benefit the districts of Tigre, San Fernando, San Isidro, Vicente López and San Martín. The water treatment plant will provide fresh drinking water for two million residents. The river's name from which the project section

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

we have been working in took its resources is Parana de las Palmas. It is an inlet flow of the great river Rio de la Plata close to Buenos Aires.

Overviews of water treatment plant in Tigre, Argentina (Aguas del Paraná)

The following companies have formed a Joint Venture to work together in this project under the title “Aguas del Paraná”:

- Agua y Saneamientos Argentina (AySA) principal
- Noberto Odebrecht S.A. contractor, management
- José Cartellone Construcciones Civiles S.A. technical supplies
- Supercemento S.A.I.C. concrete supplier
- Benito Roggio e Hijos S.A. constructing company

The principal of the major project Juan Manuel de Rosas is the corporation Agua y Saneamientos Argentina (AySA). AySA is among others responsible for drains, sewers and provision of water pipes in Buenos Aires and works partly under order of the Government. AySA tendered several construction phases. The above-mentioned Joint Venture, Aguas del Paraná, received the acceptance for the section descripted in this paper. The Joint Venture acted as the general contractor for this construction phase, so that they pulled all the strings including all planning issues.

From the place of water abstraction, the river Paraná de las Palmas up to the new water treatment plant in Tigre, a topographic wiring of about 15 kilometers was to overcome. The pipes on the mainland were carried out in a tunnel / concrete construction with tubing pipes. The specific requirements of these manifolds were relatively low. Rather complicated for the planning and realization were the sea-intake pipes which, in final stage, are supposed to be in the river Paraná de las Palmas under water and shall be connected to two concrete basins on land.

Dimensions of a concrete basin

2. Planning phase for sea-intake pipes

Relevant for the intake-pipe DN / ID 3600, which had to be completely installed in the river bed of the Paraná de las Palmas, was the total weight of the 84 m pipeline. During the planning process, different pipe materials were compared for the mentioned scenario under the local conditions to find the best suitable option. The pipeline

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

Concrete basin, mainland side

is statically fixed to certain spots. These are two large-volume basins made of concrete. All calculation procedures have shown that a HDPE pipe represents the optimal solution in a macroeconomic perspective.

Calculations about bearings such as the anchoring via pipe clamp systems resulted in the structural analysis that significant cost savings in the use of plastic pipe materials would be possible. Compared to concrete material a weight saving factor of 9.6 was observed. These savings also allowed a significantly more favorable fundament. Furthermore, the comparison of the pipe length options between large plastic pipes and concrete pipes was a significant cost advantage for the installation of the pipeline. Additionally the tightness issue served as another argument. Consequently, the Contractors Company and the planning engineers decided to select a plastic pipe system for this difficult and unusual mounting case.

Striking is simply the fact that the required dimension and connection with the demanded wall thickness was never produced or installed before worldwide. A typical case for Krah AG!

3. Plastic Pipe market worldwide

The reputation and the dense network of clients of the company Krah AG in Schutzbach in Germany was used by the contractors to discuss the project's challenges with one of the world's largest and most experienced manufacturer. Quickly the engineers of Krah AG found answers to this mounting case and could even find a pipe manufacturer from the Krah Community in Argentina. All participants were impressed by the proportions and dimensions of this unique pipe section and worked extremely hard on a common approach for the implementation of the overall project.

4. Machine solutions

4.1. Machine components

The static calculation of the pipeline resulted in a possible world record wall thickness of 220 mm in a DN / IN 3600 pipe. To meet the requirements of the production technology, the engineering specialists of Krah AG visited the production site at the Community Partner Krah Americana Latina in Tigre, Argentina. The investigation required a modification of the machine and production line in order to handle the enormous wall thickness as well as the resulting weight of about 16 tones per pipe. Considerable changes had to be made to reinforce different parts of the manufacturing machine. Some heights of the processing stations needed to be calculated and adapted.

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

Reinforced machine and mandrel in production hall

Dimensions of 16t mandrel and 16t pipe

After the adapting process of the production station, the dismantling station as well as the processing station also needed to be reinforced to meet the parameters. These chances meant a considerable investment for the pipe manufacturer. In addition to the machine components, also the production tool, namely the steel mandrel, which was produced for this application in Germany at the company Krah AG, needed to be adjusted to the given parameters.

4.2. Mandrel

The mandrel with a total weight of about 16 tons was produced in an unusual record time for this very installation case. It was shipped to Argentina as quick and safe as possible. The mandrel design was statically calculated and specially made for this characteristic request in Schutzbach, Germany.

4.3. Production hall

Bundled together the mandrel and the production weight of about 32 tons demanded a special crane inside the production hall to align these weight masses. For this case, the pipe manufacturer decided to replace the entire crane system to a total load capacity of about 32.5 tons by a new, modern crane system.

4.4. Production unit

In order to produce the enormous wall thickness in more than 20 different production layers, the heating units in the extrusion unit had to be adjusted. Besides the intensified mandrel heating, it was essential to also adjust the layer-heating for pipe processing in this unusual wall thickness.

For this, test pipes were manufactured whose states of quality were taken with respect to the pipe condition and connection technology by the experts of the client in advance. Extrusion-wise simply the pipe production displayed an enormous challenge. The jointing method, electro fusion had to be accepted and tested by all parties involved beforehand.

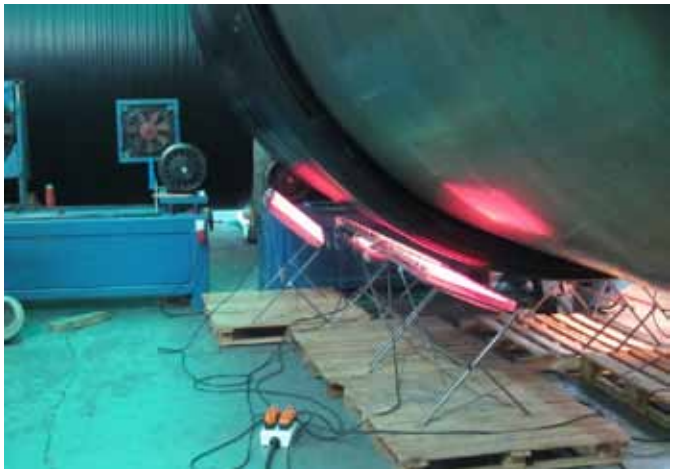
4.5. Test sample

Before the actual pipe manufacturing could begin, the pipe component and connection technology had to be agreed upon with the local public institutions. The pipe samples were tested for homogeneous production in the pipe cross-section and the joints for tightness. As for the connection technology, specialists were included in this issue in advance. The specialist for this field of application in Germany calculated with the finite element method (FEM),

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

New crane lifting system in the production hall



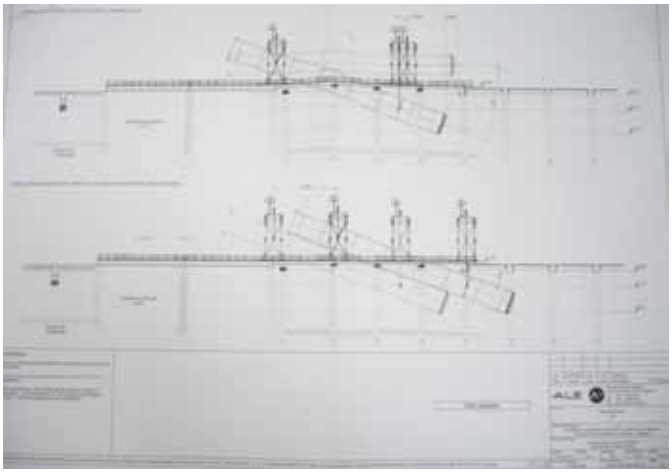
Additional and improvised infrared (IR) systems

the execution parameters of the electro fusion weld seam plus the extrusion welds regarding the state of installation and the final state of the compound in the river bed. A welding factor (DVS) of 0.6 instead of 0.9 was used in order to guarantee the pipe lines tightness and security for the whole project. The electro fusion technique was carried out with two instead of one single heating zone due to the joint surface, which rounded off the entire connection technology by additional inner and outer extrusion welds.

5. Pipe Production

After all required acceptances of the pipes samples and joints were given; the overall system for the production by the Krah technology was approved and could start. Accordingly, the pipe production could begin.

During the spirally wound pipe production procss a total amount of 24 layers (each up to 10 mm thickness) were wrapped around to achieve a wall thickness of about 220 mm per pipe. The used material was delivered by the Brazilian company Braskem. Namely the used material was PE100. The observed shrinking forces in radial and longitudinal direction resulted in a pipe production with oversizing of the pipe parameters. The shrinking of the first sample pipe pieces in the required dimensions showed that the pipes needed to be manufactured with



Planning section of sinking process

Pipe Production

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

Pipe production DN / ID 3600

over tolerances in length and diameter. A final pipe length of 5.50 m could be realized and adjusted.

Overall, 300 tons of PE100 have been used. 240 tones out of these 300 were used for the final pipe production. The other 60 tons were consumed for proto-types, adapters, flanges and samples. And again 20% of the enormous superlatives in this project can be recognized.

6. Transport

Simply the transport of a single pipe with a total length of 5.50 m and a weight of about 16 tons cried out for the use of a flatbed truck, which had to be carried out with police accompany and support vehicles. The distance between the production site to the installation site was about 70 km for which each individual transport took 6 hours. The normal highway could not be used for some lower bridge

Pipe transportation

Pipe transportation on the construction site

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

heights. Fortunately, a special route could be found to make the transport as efficiently and economically as possible.

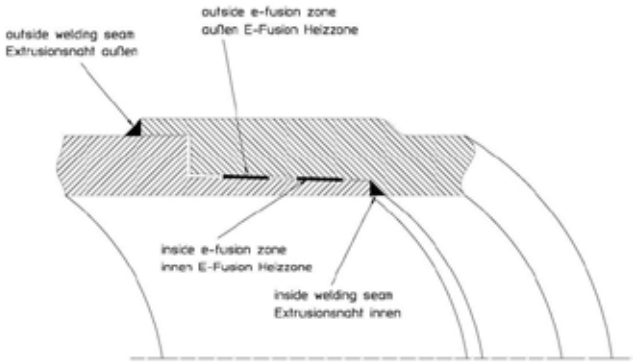
7. Sinking preparations

The participating companies calculated an ideal scenario for man, machine and nature on site by the splitting of the 84 m total length in two sections of each 42 meters. All construction methods and installation procedures for welding, lifting and sinking were selected based on these parameters. The two pipe parts were welded into sections of 42 meters each. The pipe ends needed to be connected to each other on one site and to the above mentioned concrete basins on the other.

7.1. Pipe connections

To prepare the pipes at the construction site for the welding operation, a special process- and treatment station had to be designed and constructed by the company Krah AG.

The pipes were transported on site with a mobile crane with a crane capacity of up to 100 tons. Various trapezoidal structures and scaffolding had to be moved and adjusted on the welding processes. Preliminary work, which is indispensable and important before welding (such as cleaning and markings of the socket) were carried out with a high workload. The finalizing work of the spigot- and socket geometry was realized by a special machine kit designed by Krah AG. This machine kit enabled the welding experts to save a considerable amount of working hours.



Pattern of pipe connection

Nevertheless, there was a special support offered by Krah AG by providing a welding engineer, which was assisted by a welding specialist of Krah Americana Latina. Besides these two welding experts, also four local welding helpers jointed in to ultimately be able to realize a comprehensive pipe connection within 3 days with all the additional works.

Two pipes being connected

Process- and treatment station on site

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

Finished surface of socket

Electrofusion Wire

To place the pipes before welding in the correct position on in a longitudinal direction, two newly designed steel crosses were installed on the respective pipe ends. Several steel ropes were strained through drawstrings in these steel crosses, centrally and at the sides. They provide the correct positioning and fixation of the pipes before the welding.

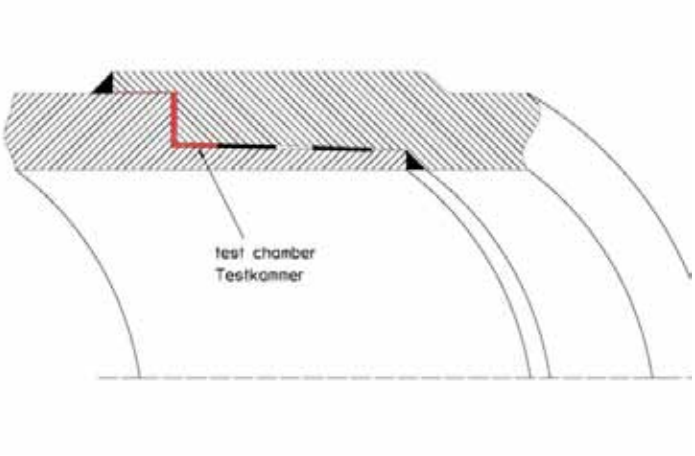
An inner and an outer heating wire allowed a welding according to the electrofusion method and created a homogeneous pipe line. This pipe line has been completed by an additional inner and outer seam according to the extrusion welding process. The intensive adjustment works and preparations demanded the main time because the pipe geometry of the stored pipes, contrary to the previously produced sample pipes in the production hall, were exposed to temperature changes from +10 to + 50 degrees C.

All components were step by step adjusted on site. Due to the professional collaboration of German and Argentine experts all piping connections were proven tight and thus passed the leak test. The test followed the procedure LD to DIN EN 1610. The triple amount of actually required testing time was taken for extra security reasons. **Official representatives of the local waste water authority have approved each pipe connection.**

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

Fixing of the steel cross



Pattern of pipe connection

7.2. Connectivity Technology

Specially produced flange connections were used for both: the linking between pipe end and concrete basin such as between the two pipe ends. The sealing flange systems have been applied to the produced short pipes. These were welded in advance through a third-party on site according to the flange geometry. All necessary components were manufactured at the factory of the company Krah Americana Latina in Argentina. A specified company from Germany observed the connection process between concrete basin and pipe end. The other connection, the one of the two pipe sections was carried out by a commonly known flange system technique.

In addition to the connecting pipe pieces, one more short-pipe had to be produced by Krah Americana Latina for each pipe section of 42 meters in no time. The exact length of these short-pipes was measured first on the process station at the construction side and then manufactured back in the production hall.

8. Sinking and Installation

After welding two pipe sections of each 42 m in overall length, the sinking and installation issue arose. The chosen method of lowering the large dimensioned pipe into the river of Parana de las Palmas is rather unusual for plastic pipes but was obligated by the conditions of the

Leaking test

Flange connection between pipe and concrete basin

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

Flange connection between the two pipe ends

planer and principal. The pipes were statically longitudinally reinforced by steel a beam, which usually contradicts the thermoplastic principle of flexibility but served in this case the prof for security and stability.

However, the stiffness of the pipe sections were previously indicated by the calculation tables of the construction company as an indispensable premise for the pit formation. Mobile cranes were used for the lowering of a pipe section (DN 3600 and more than 4 m outer diameter). A complete preparation and sinking procedure lasted about 12 hours. Both lowering operations went smoothly

Welded pipe line right before the sinking procedure

due to the careful planning and coordination of all parties in advance. The lowering and installation of the pipe line showed finally to what extent precise work had been done in terms of tightness and security. For the next step no HDPE professionals, but diving experts were consulted to connect the two sections under water. They were trained on land in advance about the techniques. These diving work could be carried out smoothly in the scheduled time and thus also speak for uniqueness and professionalism.

9. Summary

This project with its variety of superlatives could only be implemented by the mutual work of Argentine specialists on site as well as the support by the German Krah AG technology. The ones involved in the construction valued the participation of plastic pipe and welding experts and the outstanding results of the preliminary planning. The expected savings and benefits of this plastic pipe solution could be confirmed in the practice, so that this project could serve as a motivation for further joint activities and as a reference.

Alexander Krah (Dipl.-Kfm.), Krah AG, CEO
Ralf Schnitzler (Dipl.-Ing.),
Krah AG, Business Development Director

New world record by Krah technology - a project marked by superlatives

PE 100, DN/ID 3600 mm, SDR 17 in Buenos Aires, Argentina

PE100 Solid wall Krah pipes for marine intake and outfall pipeline

Overview - google earth

The project highlights are as follows:

NO	TYPE	DESCRIPTION	LENGTH	Qty	ADDITIONAL INFO
1	Seawater Intake	PE 100 PIPE 1700mm ID PN 6	1600 m	2	Pneumatic pressure testing (0.2 bar) after launching in sea Fitted with pig entry and exit elbow for cleaning based on hydraulic performance of pipe during its operation
2	Seawater Reject	PE 100 PIPE 1900mm ID PN 6	1100 m	1	-
3	Chlorination lines	PE 100 PIPE 110mm OD PN 16	1600 m	2	Installed parallel to intake pipeline
4	Air Bust pipelines	PE 100 PIPE 200mm OD PN 16	1600 m	2	

PE100 Solid wall Krah pipes for marine intake and outfall pipeline

The following abstract provides a brief description of the Al Ghubrah Project with information regarding installation of Large Diameter Marine Intake and Outfall Pipelines, especially regarding the typical work phases: Survey, Design and Construction.

The Al Ghubrah Desalination Project is formed under the Independent Water Project Scheme in Muscat, Sultanate of Oman. The project is sponsored by Muscat City Desalination Company SAOC (MCDC); contracted to the joint venture M/s International Water Treatment Co LLC (formed by WABAG, CADAGUA, & GALFAR). The project is located approximately 20 Kms on the eastern side of Muscat city. The Intake and Outfall Pipelines are produced locally as solid wall Krah-Pipes at United Gulf Pipe Manufacturing Co LLC based in Rusyal Industrial Estate, Muscat, Sultanate of Oman.

Further characteristics and details of the Al Ghubra project

- Thrust boring of tunnel (3 nos) to underpass existing outfall duct of neighboring desalination plant. Tunnel size – 3mtr OD and 2.4 ID of length 33 mtrs
- Intake passive screen (4 nos) placed on intake pipelines (2 nos)
- 1 multi port uni-directional diffuser placed in 1 outfall pipeline
- (65 m length diffuser with 30 ports - 24 working & 6 standby)
- Bathymetry survey to analyse the sea bed profile and to determine the sea bed contour on the site, by using single beam echo sounder and Differential global positioning system. (Sea bed profile is in a slope of 1:110)
- Offshore geo-technical investigation: Sub surface materials in site maximum constitute if silty sand, followed by gravelly sand. Natural repose slope of the above subsurface material is in the range of 1:3. Cutter section dredger is recommended for the above soil type.
- Results of MET oceanographic survey:
- Wind: 38.61% - 0 to 30 degree & balance 61.39% - 30 to 360 degree. Maximum speed 9.73m/sec. Predominant wind direction – NE and NW directions
- Temperature 82% - 26 to 35 degree C.
- Relative humidity of 46.69% occurrence - 56% to 76%
- Sea profiling
- Current speed found in the range of 0.25m/sec (Predominant current direction – NE)
- Significant wave height: 90% occurrence record below 0.5m height with peak wave period of 14 second.
- Salinity at surface 36 PSU, at bottom, 2 meter above sea bed 25 to 30 PSU.
- Temperature of sea water found Predominant in the range of 25 degree C.
- Turbidity converted to Total Suspended Solid found in the range of 3-5 mg/l. (Used to decide the pre-treatment requirement of plant)

Pipe design for Al Ghubrah Project

As a result of the hydraulic design under consideration of the calculated intake (5.890 m^3/s) and outfall (3.657 m^3/s) flow, the inner pipe diameter is chosen. The pipe material used is High Density Polyethylene (HDPE) and especially the chosen grade PE 100, guarantees perfect properties and provides the necessary durability. The wall structure has to be selected to carry all loads during installation and long-term operation.

Selected Intake Pipeline:

- Internal diameter (mm): 1700
- External diameter (mm): 1842
- Wall thickness (mm): 71 (SDR: 26)
- Pipe Material: HDPE, PE 100 (Krah pipe)

PE100 Solid wall Krah pipes for marine intake and outfall pipeline

Internal pressure

- Working pressure at 1.294 bar against 6.4 bar pipe pressure

External pressure

- Buckling pressure due to unsupported length caused will be 13mwc against 18.21mwc pipe capacity

Buckling pressure due to Soil in trench caused will be 12.53 mwc against 33.76 mwc pipe capacity.
Allowable pressure surge for pipe 6.4mwc (0.6bar), for gate operation at intake sump location.

Selected Outfall Pipeline:

- Internal diameter (mm): 1900
- External diameter (mm): 2058
- Wall thickness (mm): 79 (SDR: 26)
- Pipe Material: HDPE, PE 100 (Krah pipe)

Internal pressure

- working pressure at 0.98 bar against 6.39 bar pipe pressure

External pressure

- Buckling pressure due to unsupported length caused will be 9.8mwc against 20.13 mwc pipe capacity
- Buckling pressure due to Soil in trench caused will be 12.53mwc against 33.76 mwc pipe capacity
- Allowable pressure surge for pipe 6.4mwc (0.6bar), for gate operation at outfall sump location

The pipes are produced as Solid Wall Krah Pipe according to DIN 16961 and technical requirements of ISO 4427. The pipe wall structure is helical extruded and each layer is homogenously jointed to guarantee the required mechanical and physical properties. The highly automated pipe production process and the implemented quality system convinced every partner involved in this project.

This project shows, once again, clearly in all tests conducted in the laboratory and in handling the pipe strings at site as well, that a helical extruded Krah pipe is in all points comparable with a standard direct extruded pipe. The pressure rating is the same. In contrast to the direct extrusion method, the wall thickness for fittings or flanges can be increased easily. United Gulf Pipe Manufacturing is able to produce Krah pipes in Sultanate Oman with an ID 4000 mm.

The pipes for the Al Ghubrah Project are produced in length of 6 meters and welded to 18 meters in length before shipping to construction site.

Author:
Eng. Mohammed Al Hashani
United Gulf Pipe Manufacturing
Rusayl Industrial Estate
Sultanate Oman
www.ugpm.net

PE100 Solid wall Krah pipes for marine intake and outfall pipeline

Hydrostatic Pressure Test in QC lab

Launching pipe string

Butt-fusion at site

Installation

Concrete ballast

Installation

5th Krah Community Meeting

TaLLINN / Estonia

5th Krah Community Meeting has been a complete success

From 3 to 6 June 2014 the 5. Krah Community Meeting (KCM) took place. The group of 30 participants, consisting of customers, potential parties, external technical consultants and Krah employees met in Tallinn, the capital of Estonia, in order to discuss about new projects and developments. In total 12 different nationalities were present.

The 5th Krah Community Meeting took place in Tallink Spa & Conference Hotel in TALLINN / Estonia

The 5th Krah Community Meeting took place in Tallink Spa & Conference Hotel in TALLINN / Estonia

Beside reports on experiences from long-term members like Krah Misr / Egypt or ForbesGroup / UK the company HENZE GmbH could present itself as new member of the Krah Community. Another thematic highlight of the conference was the introduction of software solutions for production planning and production analysis.

Mr. Alexander Krah, CEO Krah AG (left) together with Ralf Schnitzler, Business Development Director Krah AG

Mr. Peter Youssef, CEO Krah Misr, gave information about his company and the Krah Pipes on egyptian market

5th Krah Community Meeting

TaLLINN / Estonia

5th Krah Community Meeting

TaLLINN / Estonia

Mr. Emanuele Boscarini, CEO SystemGroup

Mr. Fester, CEO HENZE GmbH

The business days has been eased up with a perfect organized programm at the end of conference days. During a guided tour through th old town or an excursion to the island Naissaare, all participants got the chance to receive an short but inspiring impression of Estonias capital. As final of the symposium all participants visited the quite impressive pipe production of the hosting company Krah Pipes OÜ.

Social Program on the Island Naissaare

Guided tour through City of Tallinn

Hosting company 2014: Krah Pipes OÜ.

The Krah Community meetings now take place since nearly 10 years, every 1-2 years at different locations, always in co-operation and assistance with a local pipe producer and have become an important and well established event in the area of large bore piping systems.

Topics and presentations can be requested at:

info@krah.net

Rules and Standards for large diameter plastic pipes

In the following abstract an overview is given about the basic rules and standards for large diameter plastic pipes. The main focus made from German/ European view on the thermoplastic pipe materials Polyethylene and Polypropylene.

In the list the standards are marked according their relation to:

- General
- Polyethylene / Polypropylene
- Raw material properties
- Pipes
- Fittings, Assemblies
- Manholes
- Jointing

It is of prime importance for the industry to be geared to the established standards. Without adequate standards there would be no orientation on the free market. This concerns designer, planer, fabricators, operator, testing institutes as well as the manufacturers and his quality management. Of course this does apply also for large diameter thermoplastic pipes. Especially, because thermoplastic materials are with around 70 years of experience still a young material group, which results in immense drive and innovation.

In the standardization of plastic pipes there are many national activities, whereas the pursuit of transparency slowly brings unification of technical standards. Subsequently we concentrate on standards and rules of following institutions:

ASTM International …means "American Society for Testing and Materials" and was founded 1898 by a group of scientists and engineers. The membership is composed of manufacturers, operators, governments and graduates form more then 100 countries.

DWA …, means "German Association for Water, Wastewater and Waste", arose from the ATV, which was founded in 1948.

BSI …means „British Standards Institution" and was found in 1901.

CEN …means European Committee for Standardization, was found in 1961 and represents more than 30 countries with the objective of coordination of national standards. Those are published as EN.

DIN …means „German Institute for Standardization" and was found in 1917. DIN is, with more than 30.000 documents, one of the most important organization for standards of the world today.

DVS …means „German association for welding and similar methods" and is one of the most important institutions for the range welding of plastics. The rules of DVS are worldwide known and accepted. Also guidelines for static calculations of pipe systems or tanks are included.

ISO … means „International Organization for Standardization", was found 1946 in London. By now 150 countries are represented in the ISO.

If standards are harmonized also the nomenclature is unified – for example look at "DIN EN ISO 899" At all CEN member countries and in ISO as well you find at number 899 the same standard "Plastics – Determination of creep behavior".
But also rules of national associations have international importance for standardization of thermoplastic pipes. Often found in tender specifications are rules from e.g.:
DVGW – German Technical and ScientificAssociation for Gas and Water
AWWA – American Water Works Association

Performance of polyethylene pipes with glass fiber

PERFORMANCE OF POLYETHYLENE PIPES
WITH GLASS FIBER
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Abstract

Polyethylene pipes are successful worldwide due to the superior performance (Flexibility, light weight, lifetime, tighten joint) for water and sewerage supply. However according to our ISO standard concerned Polyethylene pipes we have to use solid wall pipe with too thick against for internal pressure. The major job challenge involved finding new polyethylene solution with best high modulus and flexibility such as superior performance of polyethylene for world customers. In achieving this, polyethylene resin with glass fiber by spiral cross winding method take us new.

Our technical team should be considered a better option (characteristics of basic) not only those tests but also it was extra performance with proof of some analysis in Japan.

Introduction

PE pipes have been successfully used for water distribution pipelines around world for many years. Those pipes are generally made with solid walls because of strong deflection of the pipe during terms of service. This is necessary to need over hundred mm thickness in case high internal pressure especially for large diameter pipe. This paper provides technical characteristics and discusses solid wall pipe applications with Polyethylene and Glass fiber. It combined high E-modulus and many benefits of polyethylene. HIPPA as High stiffness Polyethylene Pipes association established 1987 are operated by DAINIPPON PLASTICS, NIPPON HAWER, TORIIKASEI, PRIME POLYMER and MITSUI CHEMICALS INDUSTRIAL PRODUCTS in Japan. We should know what we are those basically characteristics concerned Plastic piping systems made from glass fiber reinforced polyethylene (PE-GF) for water supply and for drainage and sewerage.

Basically characteristics

Our first approach was to examine what they have. Here is basically characteristics of PE-GF shown in Table.1. Our experimental results were indicated as follows.

Table.1 Basically characteristics

Property	Test method	Unit	Value
Density	ISO 1183	kg/m³	1.1
Linear expansion coefficient	JIS K 7197	-	5.0×10^{-5}
Thermal conductivity	ASTM C 177	W/mK	0.37
Oxidation induction time	ISO 11357-6	min	54
Tensile strength at 20°C	ISO 6259-1, -3	MPa	Circumferential: >40 Longitudinal: >24
E-modulus	JIS K 7162 (ISO178)	MPa	Circumferential: >2,500 Longitudinal: >2,000
Longitudinal reversion	ISO 2505-1, -2	%	0.25

1. PE-GF has a specific gravity greater than that of seawater.
2. PE-GF has a specific linear expansion coefficient smaller than that of PE100.
3. It may be said that there was a big gap in the results

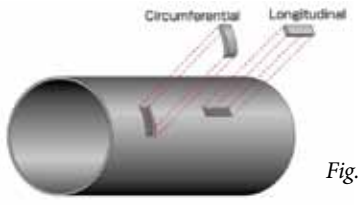

Fig. 01

of tensile strength and E-modulus between direction circumferential and longitudinal see Fig.1. Circumferential of PE-GF is more than twice as much that of PE100, although longitudinal of PE-GF is as same as that of PE100.

4. It has high hoop stress as like GRP nevertheless flexibility for longitudinal direction as like polyethylene.

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Practical applications

1.Reduction factors according to ISO 13761

In order to confirm the potential as pressure reduction factors for PE-GF materials for using at temperatures above 20°C such as the hot drains water of hydraulic generator, we have extra test concerned different temperatures of Stress-Strain curve of tensile strength test between 20°C to 40°C as shown in Fig.2 to Fig.7 separate for directions.

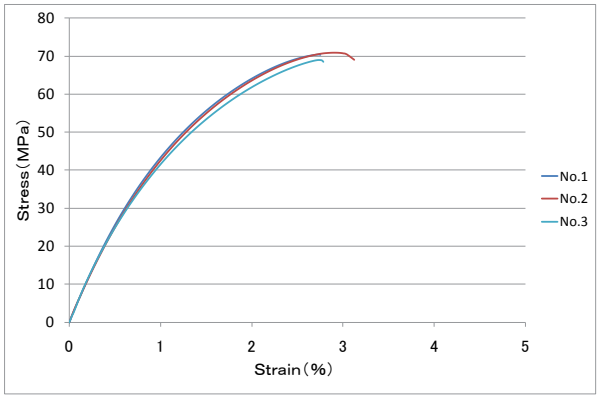


Fig.2 Circumferential 20℃

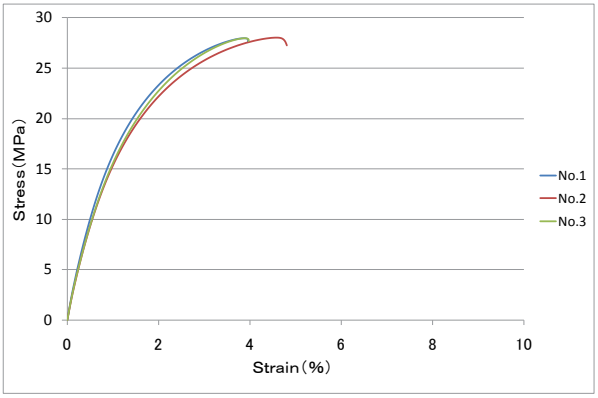


Fig.5 Longitudinal 20℃

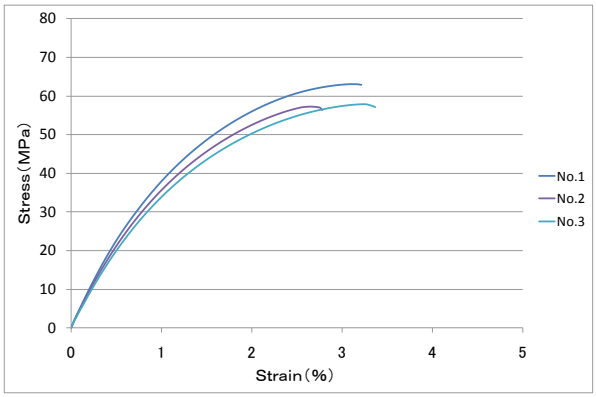


Fig.3 Circumferential 30℃

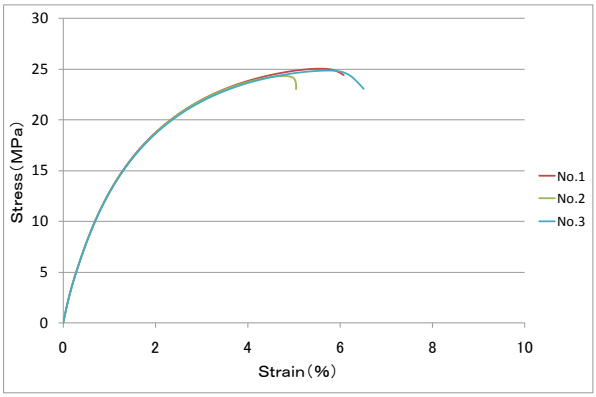


Fig.6 Longitudinal 30℃

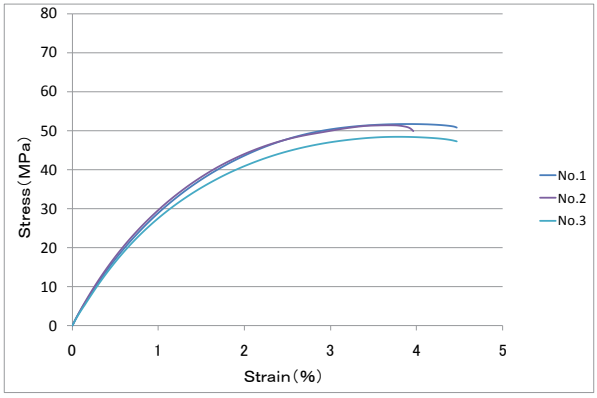


Fig.4 Circumferential 40℃

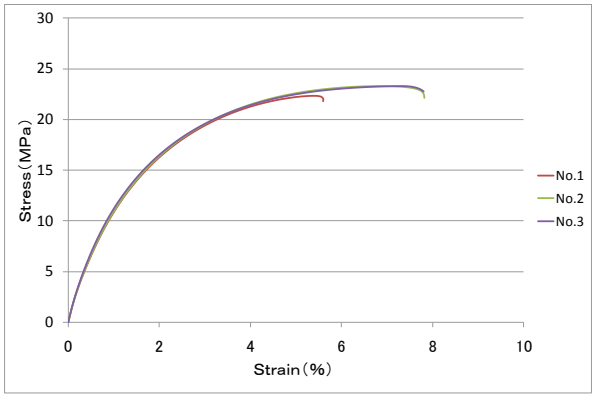


Fig.7 Longitudinal 40℃

Performance of polyethylene pipes with glass fiber

Table.2 represents the comparison with actual tensile strength (average) value of Fig 2 to Fig.7 and reduction factors according to ISO 13761.Fig.8 and Fig.9 represents the comparison actual reduction ratio and reduction factors. When looking at the results of both, it was simply the same property with polyethylene (PE100).

Table.2.Comparison with actual value and reduction factors of ISO

Direction	Temp	Tensile strength (Actual average)	Reduction ratio (Actual value)	Reduction factors (ISO13761)
Circumferential	20	69.6	1	1
	30	60.2	0.87	0.87
	40	51.2	0.74	0.74
Longitudinal	20	28.0	1	1
	30	24.8	0.89	0.87
	40	22.9	0.82	0.74

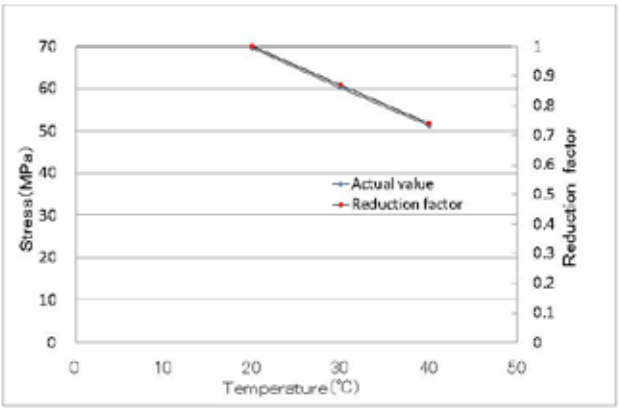


Fig.8 Circumferential

Circumferential

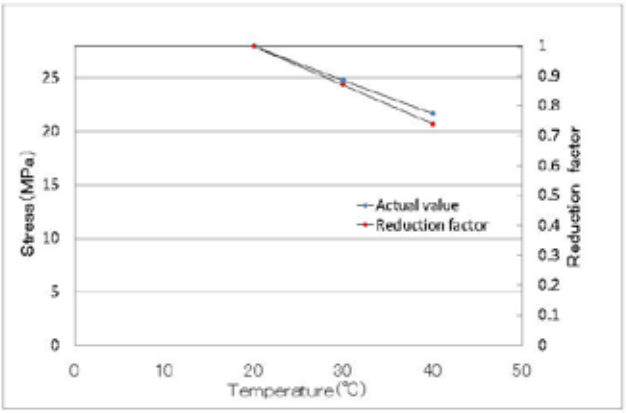


Fig.9 Longitudinal

Longitudinal

Performance of polyethylene pipes with glass fiber

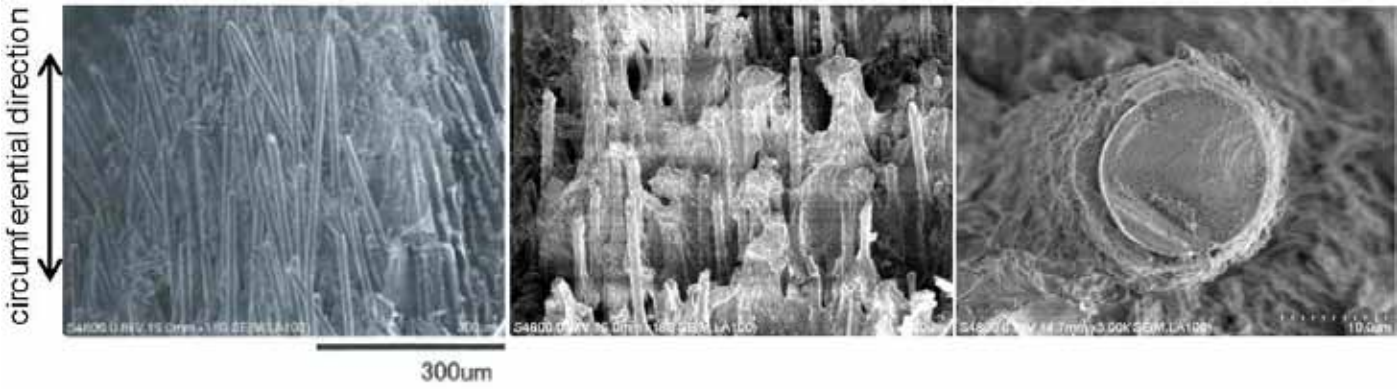


Fig.10 Stereoscopic microscope and SEM for circumferential direction

2.Full notch fatigue test (study)

Testing is performed according to standard JIS K 6774 (ISO4437) shown in Fig.11 .Each specimen was notched perpendicular to the parallel length in the middle of the test specimen. The fatigue tests were performed on PE100 and PE-GF characters at 40°C,60°C, and 80°C. When looking at the results, their curves are approximately parallel both directions. Circumferential stress of PE-GF is more than twice as much that of PE100, although longitudinal stress of PE-GF is as same as that of PE100 shown in Fig.12 and Fig.13.

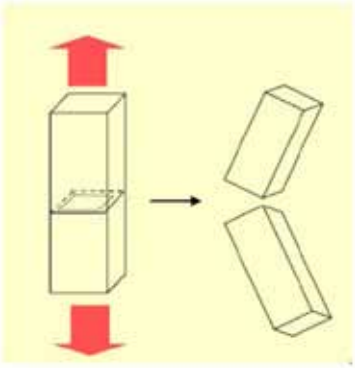


Fig.11 ISO4437 FNFT

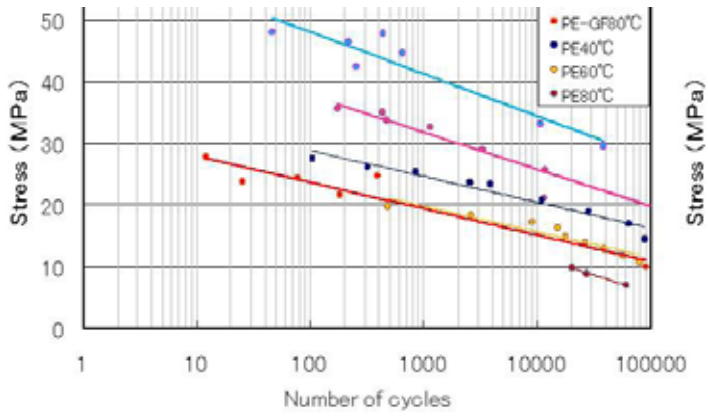


Fig.12 Circumferential

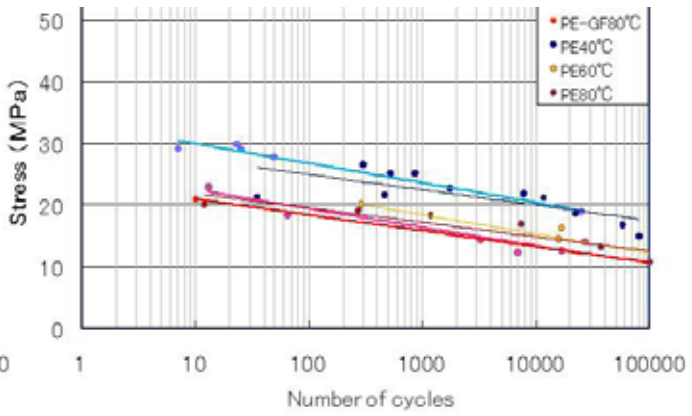


Fig.13 Longitudinal

Performance of polyethylene pipes with glass fiber

We are believed that it has been influence of spiral cross wounding method and glass fiber directions from extruder. It was very unique characteristics as never before. There key advantages of PE-GF are high E-modulus by same glass fiber directions and flexibility for longitudinal not less than PE100 property.

In Fig.14 and Fig.15 are cross sections after tested.

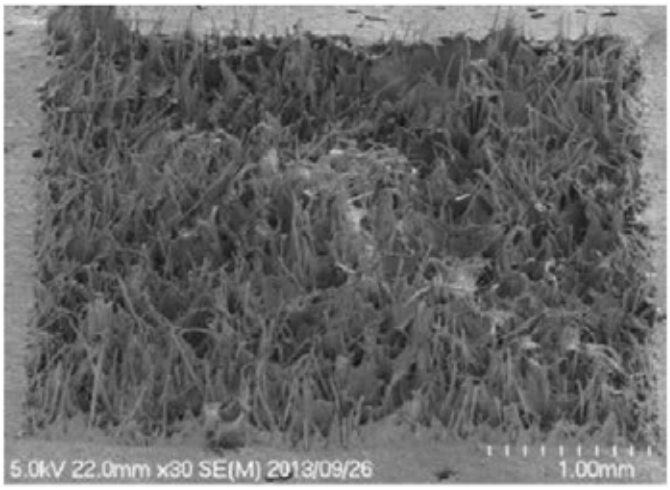


Fig.14 Circumferential

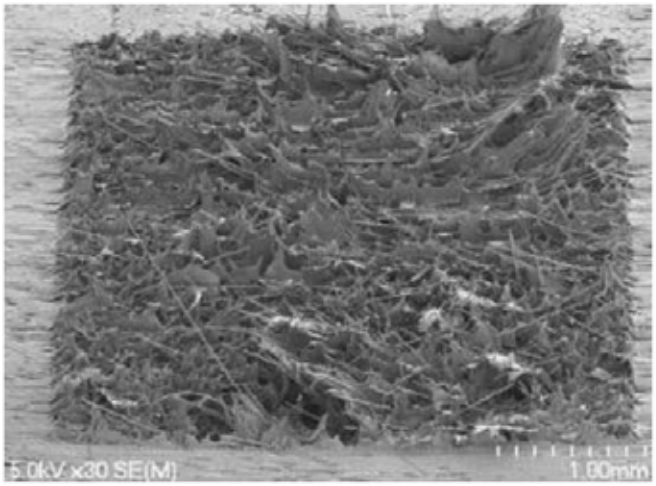


Fig.15 Longitudinal

3. Creep test

We study the resistance of creep deflection as the PE-GF pipes to confirm the behavior.

Pipe references:
Water, drainage and sewerage
φ450ID×100mm×14mm
PE100 with GF (PE-GF)
Test condition:
Length: 100mm
Temperature: 23°C
Initial load: 0.34kN/100mm (1%) ,1.01kN/100mm (3%) 3.37kN/100mm(10%)

The point to be noted is that those pipes does not occur any cracks until pipe deflection exceeds 50% of the diameter shown in Fig.16. Those can be shown in Fig.17 on a logarithmic scale for 50years.

4. Bending test

We study the resistance of internal pressure and flexibility as the PE-GF pipes to confirm the behavior as shown in Fig.18.

Pipe references:
Water, drainage and sewerage
φ450ID×5.5m×14mm with
double socket and flange.
PE100 with GF (PE-GF)
Test condition:
Length: 11,300mm
End caps: Flange
Test pressure: 1.0MPa
(Internal water pressure)
Joints: Electro Fusion (6 pieces)
Radius of curvature: 95D, 85D, 75D, 65D (D: Inside Diameter)
Strain gauge positions: See Fig.19.

Performance of polyethylene pipes with glass fiber

Fig.16 Creep test

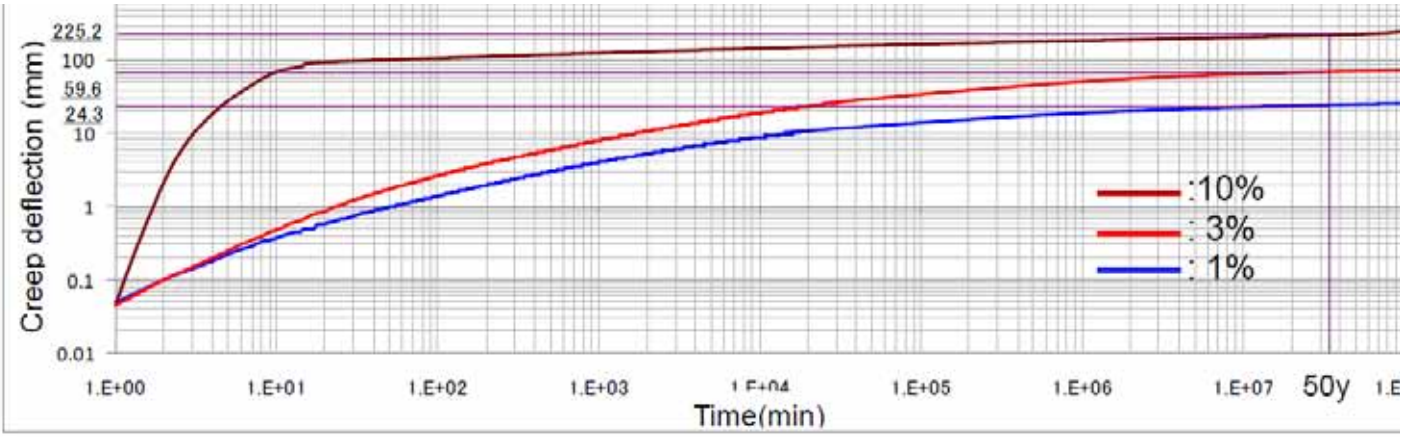


Fig.17 Creep test

Fig.18 Bending test

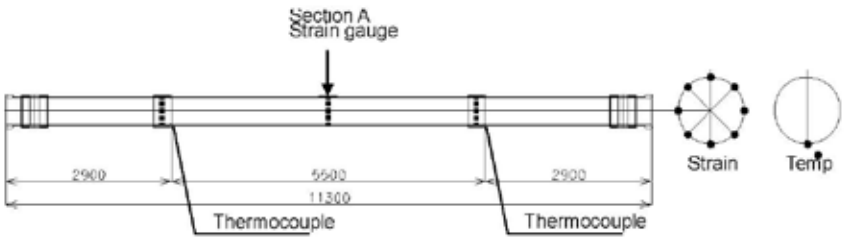


Fig.19 Position of strain

Performance of polyethylene pipes with glass fiber

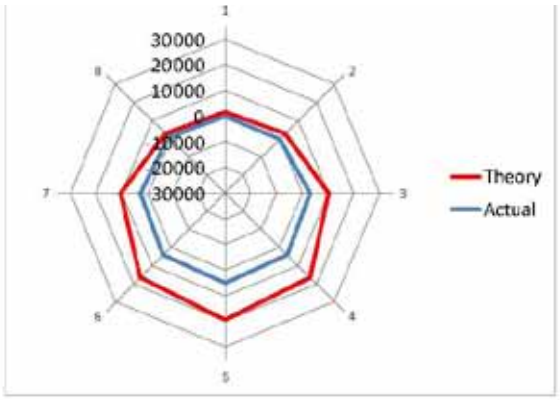


Fig.20 Circumferential strain (75D)

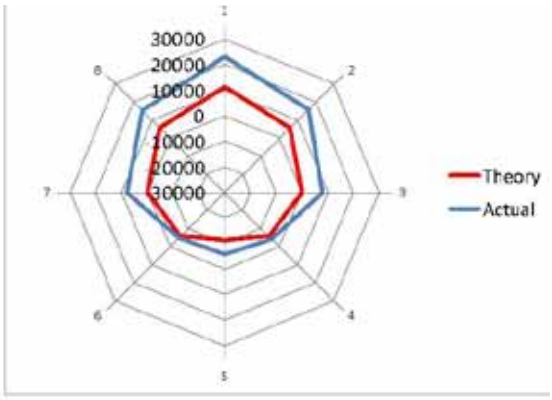


Fig.21 Longitudinal strain (75D)

Fig.22 Advantage for circumferential

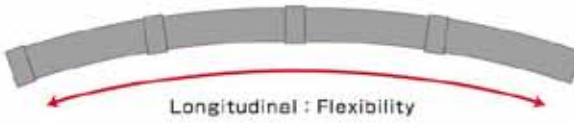


Fig.23 Advantage for longitudinal

Our experimental results were indicated as follows.

1. There are no leakages at any joints of radius of curvature from 95D to 65D.
2. The results are presented in Fig.20 and Fig.21, which shows the strain (ε) concerned 2 directions each 8 points around the pipe as shown in Fig.19. We have extra advantage for circumferential behavior as shown in Fig.20. Theory seems to be similar behavior to actual strain for longitudinal direction as shown in 21.
3. PE-GF has to be combined high modulus and flexibility as shown in Fig.22 and Fig.23.**Conclusions**

This study shows that the spiral cross winding method can be circumferential orientation of glass fiber. With this way, the quite unique performance of it has highly hoop stress as like GRP nevertheless flexibility for longitudinal direction as like polyethylene. This is in ideal performance with both combination into new pipes. This mean one can conclude that it has quite unique balance of properties between high modulus for circumferential and flexibility for longitudinal.

References

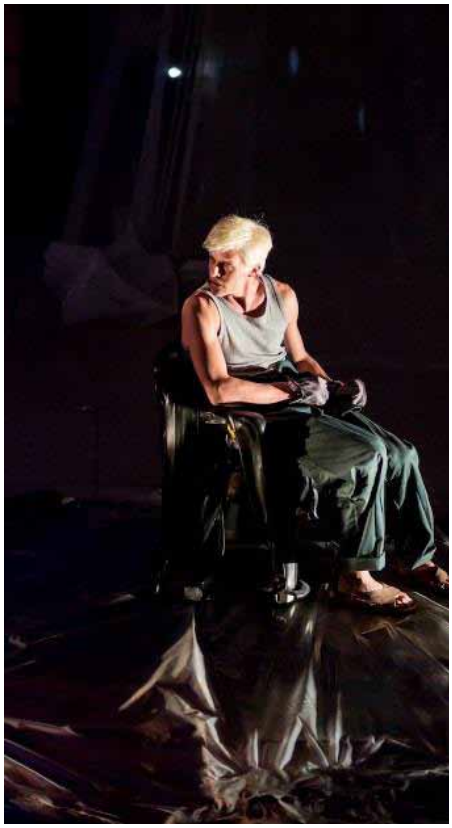
1.ASTM F 2720 standard specification for Glass Fiber Reinforced Polyethylene (PE-GF) Spiral Wound Large Diameter Pipe

2.DINSPEC19674-1 Plastics piping systems made from glass fibre reinforced polyethylene (PE-GF) for Water supply and for drainage and sewerage under pressure-Part 1:General

3.DINSPEC19674-2 Plastics piping systems made from glass fibre reinforced polyethylene (PE-GF) for Water supply and for drainage and sewerage under pressure-Part 2:Pipes

4.Report No 9391 Testing of glass fibre reinforced PE-GF 400 pipes produced by KRAH AG(D) with PE XS10B compound (TOTAL PETROCHEMICALS(B))BECETEL Fig.20 Circumferential strain (75D) Fig.21 Longitudinal strain (75D) Fig.22 Advantage for circumferential Fig.23 Advantage for longitudinal

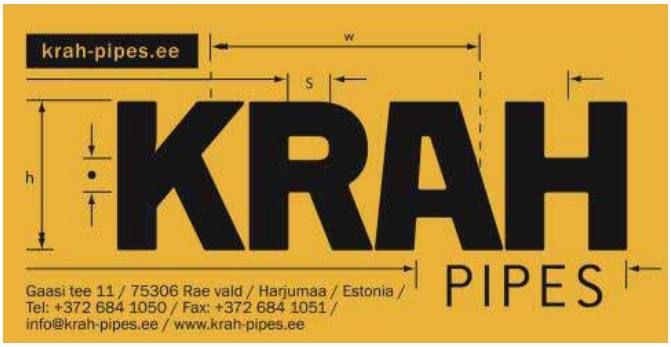
Krah loves Culture - The Curse of Solaris



Krah Pipes OÜ was approached by people from Von Krahl theatre in Tallinn (http://www.vonkrahl.ee/). They had seen our pipes & products in various strange applications and asked whether we can help them with s futuristic setup for a play called „The Curse of Solaris“. In cooperation with the theater´s people necessary „products“ were chosen & produced.

Among just pipe segments also some futuristic chairs and even high heels were produced. The play was performed during the month of June and received high marks from the critics. I had a chance to visit the premier of the play and I have to admit - it just was very good. Really hard to put it into the words as it did not resemble anything I had seen so far in my life.

Next projects are already in preparation....



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