The magazine for large **Plastic Pipe Technology** (up to DN/ID 5000mm)

No. 22 / 2020

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KRAH™ PIPES

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IMPROFIL

Krah Pipes Manila
emerging from the Pandemic

Change in pipe length
by changing operation conditions

Structural Calculation of Krah Pipes
for buried pipes acc. to AWWA M55

Content

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Dear readers,

Life goes on…
For more than 7 months, COVID-19 has had the world firmly under control. When the virus first appeared in December 2019 in Wuhan, probably nobody over here expected that this virus would present us with major challenges of any kind. A strong economy, a well-functioning health system and trust in politics – what could happen to us? But with the latest occurences of COVID-19 in the Western countries we were taught better. Italy and Spain were on the brink of disaster, thousands of new infections daily, the number of deaths increased by several hundred persons a day. The hospitals are completely overloaded, trucks full of dead bodies and desperation all over the country. The USA, which initially thought it was safe, was also hit very hard.

Of course, Germany was not spared either. 200.000 infected and 9.000 dead by COVID-19 are currently reported for our country. Despite these numbers, we still got off relatively lightly in Germany, thanks not least to our good healthcare system and the rapid intervention of politicians. Nevertheless, our company also had to take measures at the beginning of March to slow down the spread of the virus. Therefore, all office staff were sent to work from home and the production staff worked in shifts to have as little contact with each other as possible. This change was well-received by everyone and worked without any problems. Production continued throughout the whole period and we were able to stay on schedule. Many companies did not have this luck and had to close for several weeks or months, for some it has cost them their existence. In the meantime, life has returned to normal so far, but some restrictions still exist and will probably keep us busy for some time. Nevertheless, everyone is happy about a certain normality, even if nothing will be the same as before COVID-19.
A certain caution and fear will remain in each of us. The virus has shown us how vulnerable we actually are and how quickly the world can be shaken. But it also showed us, what kind of luxury we live in. Seeing family and friends at any time, going out for dinner in the evening, going to school and work every day, just going on holiday for a short time - all this has not been possible in the last time.
Perhaps the virus also did reset us a bit, slowed down life a bit, appealed to humanity and taught appreciation - let's hope that this lasts longer than the virus itself!

Alexander Krah

Krah Pipes Manila

emerging from the Pandemic

Philippines now rank 3rd among the Southeast Asian countries in terms of identified positive cases of the global pandemic, COVID-19 virus, with a total of 21,340 cases as of June 6th. The country has first identified a positive case from a 34 year old Chinese woman who has a travel history from Wuhan last January 30. Three days after, the first death from the disease in the Philippines was confirmed. The virus then started spreading in the country until the government imposed the enhanced community quarantine (ECQ) last March 16. The ECQ started in the whole island of Luzon where the national capital region, Manila, rests. It could be said that this government move came early then, but right now proves to be just the right thing to do as cases have drastically spread in just a span of days outside Metro Manila and to various provinces. The following day, March 17, President Rodrigo Duterte has signed Proclamation No. 929 that placed the entire Philippines under the state of calamity on account of COVID-19.

ECQ is a total lockdown which restricts the movement of the population except for necessity, work and health circumstances to mitigate the spread of the virus. It also mandates temporary closure of all non-essential shops and businesses. With the combined effort of Interagency Task Force (IATF) on Emerging Infectious Diseases chaired by the Department of Health DOH, and supported by the military and private sectors, the virus spread if not lessened, is being contained. Through the National Action Plan (NAP) on COVID-19, the government aims to contain the spread of COVID-19 and mitigate its socioeconomic impacts. The

ECQ has been lifted to a modified general community quarantine (GCQ) in northern areas of Luzon and in Mindanao last May 16 and in Manila, last June 1.

Krah Cares maintain a salary support

After more than a month of ECQ, many private companies have already suffered with the economic inactivity and negative revenues, resulted to pay cuts and worse, implementing no work no pay scheme to their employees. Krah Pipes Manila is no exemption to the rule and had postponed its operations together with all non-food and non-medical manufacturing companies as part of the ECQ provisions to avoid the spread of the virus. Despite the lockdown and stoppage of work, the company, through Krah Cares Program, managed to maintain a 100% salary support to all employees and personnel and at the same time reach out to our kababayans through an outreach program where the team donated sacks of rice and dozens of dressed chickens to front liners in Medical City Hospital, bank personnel and barangays both in Cabuyao and Sta. Rosa, Laguna.

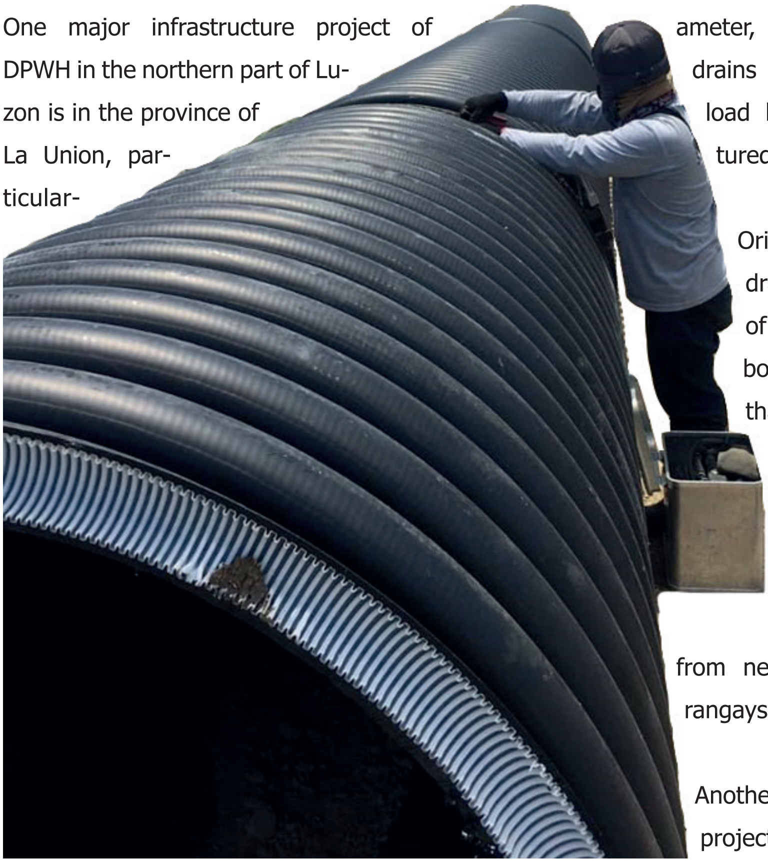
Government infrastructure projects and all major public and private construction activities only came to resume when ECQ was lifted. In an interview with the Secretary of Department of Public Works and Highways (DPWH), Honorable Mark Villar, he mentioned that the agency has already came up with guidelines of work following the GCQ provisions for both pubic and private projects. In addition, they have to follow very strict guidelines for the protection of construction workers. Among

Roads in the Philippines have to withstand a great deal of traffic

On-going installation of Krah structured wall pipes

these are testing before starting of work, all sites must have facilities for disinfection and handwashing, social distancing must be observed and provision of barracks at each site for workers so there will be no chance for COVID to spread.

One major infrastructure project of DPWH in the northern part of Luzon is in the province of La Union, particularly in San Fernando City. It commenced during the first quarter of this year, and has been temporarily stopped due to ECQ. The work resumed last June 2 with the construction/upgrading and rehabilitation of cross drainage along national road of 1.1km length with a 2 meter diameter, double barrel drains using krah load bearing structured wall pipes.



Originally, the drains are made of concrete box culverts that have been clogged and heavily silted by concrete and solid wastes from neighboring barangays.

Another main road project in Apalit, Pampanga in Central Luzon, has resumed. KPMI is supplying DN/ID 1200mm load bearing pipes for cross drain application in a 4km length road project connecting two major cities of Pampanga. This project is under the 1st district of DPWH in the said province.

Despite the economic crisis that the whole world and our country is facing, infrastructure projects have to be prioritized in order to provide jobs to our civilians, keeping paychecks coming and some economic activity to keep going in certain areas, but keeping health and safety a top concern. This is also an advantage point for the state while there is reduced traffic and minimal activity from the majority of the population to speed up the construction process on major public and private infrastructure projects.

Author:
Krah Pipes Manila

Structural Calculation of Krah Pipes

for buried pipes acc. to AWWA M55

The static calculation tool in the Krah Mickey software provides structural static calculations following either the design manual M55 of the American Water Works Association (AWWA) or the Australian/New Zealand standard AS/NZ2566.1. Both documents are worldwide spread and accepted.

The Mickey static tool is now getting completely revised and provides in future also a reviewable print out with input data, intermediate and final results. To simplify the handling the input can be done in imperial or in metric units.

All results are calculated accordingly. Reasonable assumptions are already preadjusted, so for example the recommended bedding angle of 120° and in general good bedding situation is already premised. The values for strength and flexural modulus are suggested for the typical pipe materials and all considered loadtimes. For native and embedment soil the modulus of soil reaction is considered accordingly relevant tables of the standard.

But the user has always the possibility to make changes in the values. After all inputs are made, the software follows the equations and tables of the manual to calculate all external dead and live loads. For the dead load a practical and conservative approach for the designing is considered, arching is ignored and it is assumed that the dead load on the pipe equals the weight of the column of soil directly above the pipe. Arching tends to transfer some of the weight of the backfill to the soil beside the pipe and thus reduces the load on the pipe. The main live loads are traffic load, surcharge load, groundwater table and vacuum load.

Following final results are calculated:

- Wall buckling proof (AWWA M55, equation 5-10)
- Ring deflection proof (AWWA M55, equation 5-8)
- Vacuum stability proof (AWWA M55, equation 5-14)
- Compressive stress proof (AWWA M55, equation 5-15)

Furthermore additional proofs and interesting key-factors of the pipe are calculated, like stiffness and internal pressure load capacity. All proofs are made for different loading-times: short term, mid term (3 month) and long term (50 years). Due to calculation for different load times any peak-loads for example by inter-

Table 5-8 Duncan-Hartley's values of E', modulus of soil reaction

Type of Soil	Depth of Cover, ft	E' for Standard AASHTO Relative Compaction, $lb/in.^2$ 85%	90%	95%	100%
Fine-grained soils with less than 25% sand content	0–5	500	700	1,000	1,500
	5–10	600	1,000	1,400	2,000
	10–15	700	1,200	1,600	2,300
	15–20	800	1,300	1,800	2,600
Coarse-grained soils with fines (SM, SC)	0–5	600	1,000	1,200	1,900
	5–10	900	1,400	1,800	2,700
	10–15	1,000	1,500	2,100	3,200
	15–20	1,100	1,600	2,400	3,700
Coarse-grained soils with little or no fines (SP, SW, GP, GW)	0–5	700	1,000	1,600	2,500
	5–10	1,000	1,500	2,200	3,300
	10–15	1,050	1,600	2,400	3,600
	15–20	1,100	1,700	2,500	3,800

Example: table 5-8 of AWWA M55 for embedment soil nal vacuum load or by changing ground water table can be better considered. Of course more proofs and analysis can always be made, but the results provide already a good basis. We are open to integrate more proofs or to make changes if needed – just send us your ideas and comments.

This structural calculation is done according to AWWA M55, PE PIPE - DESIGN AND INSTALLATION, chapter 5 "External Load Design". All mentioned numbers for tables (Tab) and equations (Eq) refer to this standard. The results provide a good basis for further statical considerations and examinations. Some additional aspects like e.g. internal pressure resistance, pipe stiffness etc. are scanned and mentioned. The user is requested to verify the input data and results according to local requirements and if applicable for kind of project.

The structural calculation presumes adequate handling of pipes according to manufacturer's recommendation and installation of pipes according EN 1620 or equivalent. For pipe bedding, Krah Pipes recommend a standard bedding angle of 120° and backfilling with compactable granular soil with little or no fines (GW,SW).

Below a typical Mickey print-out of structural calculation

1. Pipe data

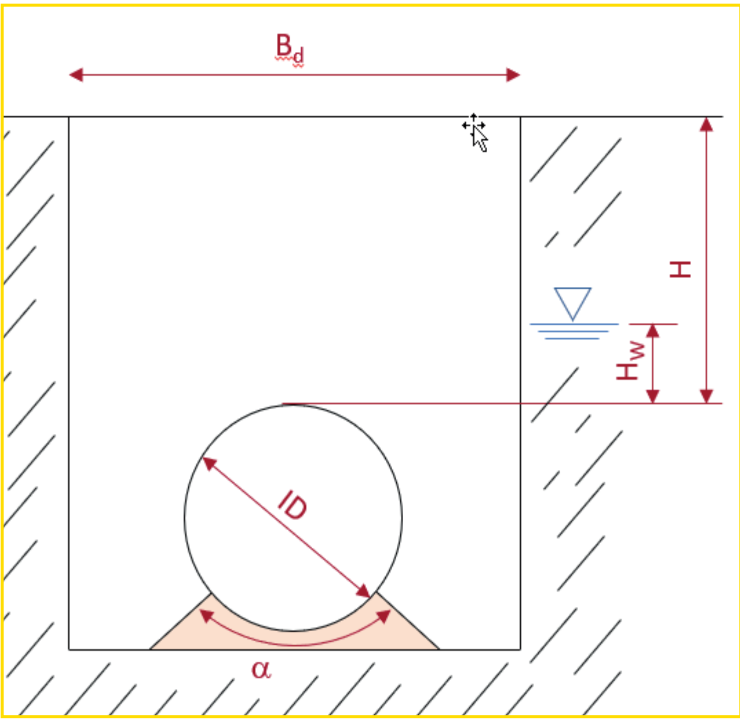
1.1	Krah Profile Name		PR110-39.92	
1.2	Inner diameter	ID	1600	[mm]
1.3	Outer diameter	OD	1843,2	[mm]
1.4	Profile height	h	121,6	[mm]
1.5	Inner wall thickness	e_1	9	[mm]
1.6	Distance of inertia (profiled wall)	$e_{neutr.}$	41,4	[mm]
1.7	Moment of inertia (profiled wall)	I	39921,0	[mm^4/mm]
1.8	Equivalent wall thickness	e_{equ}	78,2	[mm]
1.9	Dimension Ratio (DR)	eSDR	22,4	[mm]
1.9	Radial area	A_{rad}	22,9	[mm^2/mm]

2. Pipe material

2.1	Pipe material		PE100	
2.2	Minimum Required Strength (acc. ISO)	MRS	10	[Mpa]
2.3	Longt term Hydrostatic Design Basis (HDB acc. ASTM/ppi)	HDB_{Lt}	9,89	[N/mm^2]
2.4	Mid term Hydrostatic Design Basis (3 month value)	HDB_{3m}	10,90	[N/mm^2]
2.5	Short term Hydrostatic Design Basis (1 min value)	HDB_{Sht}	14,76	[N/mm^2]
2.6	Considered Design Factor	DF	0,63	[-]
2.7	Long term Hydrostatic Design Strength (HDS acc.ASTM/ppi)	HDS_{Lt}	6,23	[N/mm^2]
2.8	Mid term Hydrostatic Design Strength (3 month value)	HDS_{3m}	6,87	[N/mm^2]
2.9	Short term Hydrostatic Design Strength (1 min value)	HDS_{Sht}	9,30	[N/mm^2]
2.10	Long term Flexural Modulus (50 years)	E_{Lt}	200	[N/mm^2]
2.11	Mid term Flexural Modulus (3 month)	E_{3m}	339	[N/mm^2]
2.12	Short term Flexural Modulus (1 min)	E_{Sht}	1100	[N/mm^2]
2.13	Minimum safety for stability proof of polyethylen pipes acc. AWWA M55		2	[-]
2.14	Design Factor (0,50-0,63); Note: 0,63 for modern PEHD	DF	0,63	[-]
2.15	Minimum Design Coefficient acc. ISO 12162	C	1,25	[-]

3. Installation and operation conditions

3.1	Kind of installation		Trench	
3.2	Depth of cover	H	4000	[mm]
3.3	Width of trench	B_d	3000	[mm]
3.4	Bedding angle	β	120	[°]
3.5	Bedding constant	k	0,09	[-]
Dimension check: The trench width is sufficiently dimensioned !				
3.6	Groundwater level above crown - short term (max. 3 month)	$H_{W\ Sht}$	3000	[mm]
3.7	Groundwater level above crown - long term	$H_{W\ Lt}$	2000	[mm]
3.8	Type of native soil	E'_N	slightly compact / stiff	
3.9	Modulus of soil reaction acc. Tab 5-9	E'_N	20,7	[N/mm²]
3.10	Type of soil for embedment/backfilling	E'_E	Coarse grained soils with little or no fines (GW,SW,GP,SP)	
3.11	Compaction / proctor density	Pr	90	[%]
3.12	Modulus of soil reaction	E'_E	11,03	[N/mm²]
3.13	Soil support factor acc. Tab 5-10	S_C	1,43	[-]
3.14	Ratio native soil / embedment soil	E'_N/E'_E	1,88	[-]
3.15	Under consideration of the before mentioned soil data and according equation 5-9 Following design modulus of soil reaction is determined:	E'_E	15,81	[N/mm²]
3.16	Maximum operation pressure	MOP	0,50	[bar]



4. External loads

4.1	**Traffic loads**			
4.1.1	AASHTO HS20		Yes	
4.1.2	Pavement		Yes	
4.1.3	Impact factor acc. Tab 5-1	I_f	1,00	[-]
4.1.4	H20 load acc. Tab 5-1, 5-2 and 5-3	$P_{LTr\ H20}$	2,99	[kN/m²]
4.1.5	Off Road		No	
4.1.6	Off Road Vehicle Loads acc. Eq 5-2 and 5-3	$P_{LTr\ oR}$	0	[kN/m²
4.1.7	Cooper E-80 Railroad		No	
4.1.8	Cooper E-80 Railroad load acc. Tab 5-4	$P_{LTr\ E\text{-}80}$	0	[kN/m²]
4.1.9	The total sum of traffic load is:	P_{LTr}	2,99	[kN/m²]

Dimension check: Cover depth for traffic load sufficiently dimensioned !

4.2	**Surcharge loads**			
4.2.1	Distributed surcharge pressure acting over ground surface	W_S	1000,0	[kN/m²]
4.2.2	M/H Ratio (horizontal difference, normal to pipe centerline from the center of the load to load edge / cover height)	M/H	0,250	[-]
4.2.3	N/H Ratio (horizontal difference, parallel to pipe centerline from the center of the load to load edge / cover height)	N/H	0,250	[-]
4.2.4	Influence coefficient	I_C	0,027	[-]
4.2.5	Surcharge load pressure at point of pipe acc. Eq. 5-5	P_{ES}	0,108	[N/mm²]
4.3	**Earth pressure load**			
4.3.1	Earth pressure load acc. Eq 5-1	P_E	0,078	[N/mm²]
4.4	**Vacuum load**			
4.4.1	Vacuum load short term	$P_{V\ Sht}$	0,000	[N/mm²]
4.4.2	Vacuum load long term	$P_{V\ Lt}$	0,000	[N/mm²]
4.5	**Groundwater load**			
4.5.1	Groundwater load short term peak (< 3 month duration)	$P_{V\ Gw\ Sht}$	0,029	[N/mm²]
4.5.2	Groundwater load long term	$P_{V\ Gw\ Lt}$	0,020	[N/mm²]

5. Intermediate results and miscellaneous boundary information about pipe load capacity

5.1 Pressure load capacity

5.1.1	Maximum operation pressure	MOP	0,50	[bar]
5.1.2	Internal pressure load capacity of pipe acc. DIN 16961, C=1,25	p_A	0,89	[bar]
5.1.3	Total safety for long term inner pressure load of MOP	S_f	2,24	[-]

The safety factor is bigger than the standardized design coefficient acc. ISO 12162 and sufficiently dimensioned !

5.2 Pipe stiffness acc. international standards

5.2.1	Pipe stiffness acc. ISO 9969	SN	9,29	[kN/m²]
5.2.2	Pipe stiffness acc. DIN 16961	SR_{24}	35,98	[kN/m²]

5.3 Short term vacuum proof for unconstrained pipe acc. Eq 5-14

According to AWWA M55 a requirement is the short term vacuum stability, considering unconstrained condition:

5.3.1	Short term load by vacuum and groundwater	$P_{V+GW\ Sht}$	0,029	[N/mm²]
5.3.2	Resistance of unconstrained pipe - short term	$P_{U\ Sht}$	0,137	[N/mm²]

5.3.3	Minimum safety for stability proof of PE pipes acc. AWWA M55	N	2	[N/mm²]
5.3.4	Allowable external pressure for unconstrained pipe - short term	$P_{UA\ Sht}$	0,069	[N/mm²]
5.3.5	Provided safety against short term vacuum load	$\gamma_{V\ Sht}$	4,67	[-]

The safety factor is bigger than the minimum safety factor for stability and sufficiently dimensioned !

6. Results

6.1 Wall buckling proof (acc. Eq 5-10)

6.1.1	Sum of all external loads (PE, PL, PES, PV) - short term	P_{Sht}	0,219	[N/mm²]
6.1.2	Allowable external pressure for embedded pipe - short term	$P_{CA\ Sht}$	0,571	[N/mm²]
6.1.3	Safety against external load - short term	$\gamma_{P\ Sht}$	5,21	[-]

The safety factor is bigger than the minimum safety factor for stability and sufficiently dimensioned !

6.1.4	Sum of all external loads (PE, PL, PES, PV) - 3 month	P_{3m}	0,219	[N/mm²]
6.1.5	Allowable external pressure for embedded pipe - 3 month	$P_{CA\ 3m}$	0,317	[N/mm²]
6.1.6	Safety against external load - 3 month	$\gamma_{P\ 3m}$	2,89	[-]

The safety factor is bigger than the minimum safety factor for stability and sufficiently dimensioned !

6.1.7	Sum of all external loads (PE, PL, PES, PV) - long term	P_{Lt}	0,209	[N/mm²]
6.1.8	Allowable external pressure for embedded pipe - long term	$P_{CA\ Lt}$	0,244	[N/mm²]
6.1.9	Safety against external load - long term	$\gamma_{P\ Lt}$	2,33	[-]

The safety factor is bigger than the minimum safety factor for stability and sufficiently dimensioned !

6.2 Compressive stress proof (acc. Eq 5-15)

For pipes under inner pressure load the tension stress in the wall would decrease the compression stress.
That positive effect is not considered, because the pipe system could be empty for longer period.

6.2.1	Max. wall compression stress, long term	S_{Lt}	7,67	[N/mm²]
6.2.2	Total safety against wall compression	$\gamma_{S\ Lt}$	1,61	[-]

The safety factor is bigger than requested by Design Factor !

6.2.3	Max. wall compression stress, mid term (3 month)	S_{3m}	8,03	[N/mm²]
6.2.4	Total safety against wall compression	$\gamma_{S\ 3m}$	1,69	[-]

The safety factor is bigger than requested by Design Factor !

6.2.5	Max. wall compression stress, short term	S_{Sht}	8,03	[N/mm²]
6.2.6	Total safety against wall compression	$\gamma_{S\ Sht}$	2,29	[-]

The safety factor is bigger than requested by Design Factor !

6.3 Ring deflection proof acc. Eq 5-8

6.3.1	Max. allowable deflection in %	$\Delta_{all.\ \%}$	6	[%]
6.3.2	Max. allowable deflection in mm	$\Delta_{all.\ mm}$	96	[mm]
6.3.3	Preliminary calculated deflection	$\Delta_{pre\ \%}$	2,29	[%]
6.3.4	Deformation accuracy acc. Tab 5-7	$\Delta_{acc\ \%}$	+/- 1,00	[%]
6.3.5	Max. ring deflection in %	$\Delta_{max\ \%}$	3,29	[%]
6.3.6	Max. ring deflection in mm	$\Delta_{max\ mm}$	52,62	[mm]

The calculated deflection is lower than the maximum allowable deflection!

Author:

Krah Pipes GmbH & Co. KG

Krah cutting mill CM 600

for direct reuse of processed material

Sustainability hasn't just become a trend in the past few years – it is also urgently needed. The demand for sustainable products is continuously growing faster. The improvement of energy and resource efficiency in companies all over the world will play an even greater role in the future.

Krah cutting mill for more sustainability

As a large mechanical engineering company, we are of course also thinking about how we can become even more sustainable. Therefore, we have now developed our Krah cutting mill. It enables a direct reuse of processed material. Even if there is hardly any waste during the production of our plastic pipes, it can happen now and again that pipes are not used or have been processed incorrectly and are therefore not used.

In addition, during pipe production, so-called lumps are formed when the raw material is heated in the extruder, which can then not be used. These lumps can be shredded up to a size of 500x200x400 mm in the cutting mill. Pipe segments can be processed up to a size of 500x1500x150 mm. For this purpose, the material is thrown into the feeder and then homogeneously crushed by a single-stage mill. The grinding mechanism is made of a metal part and therefore guarantees enormous stability and a long service life. Depending on the material, the grinding capacity of the mill is between 250 and 500 kg/hr. With a motor power of 75 kW, the mill crushes the raw material into

- **homogeneous**
- **free-flowing and**
- **sharp-edged**

material with an average size of about 8 mm. It can then be used directly for pipe production via the machine's dosing system without the material first having to be processed in a granulator. The shredded material is filled into big bags or suitable containers by an automatic suction system with a hose. A filter system ensures that fine dust is absorbed directly and does not get into the environment.

Comfortable and easy operation

To make working with the cutting mill even more comfortable, a sound insulation can be bought accordingly to reduce noise. But prefarably, the machine is operated in a seperated room/hall.

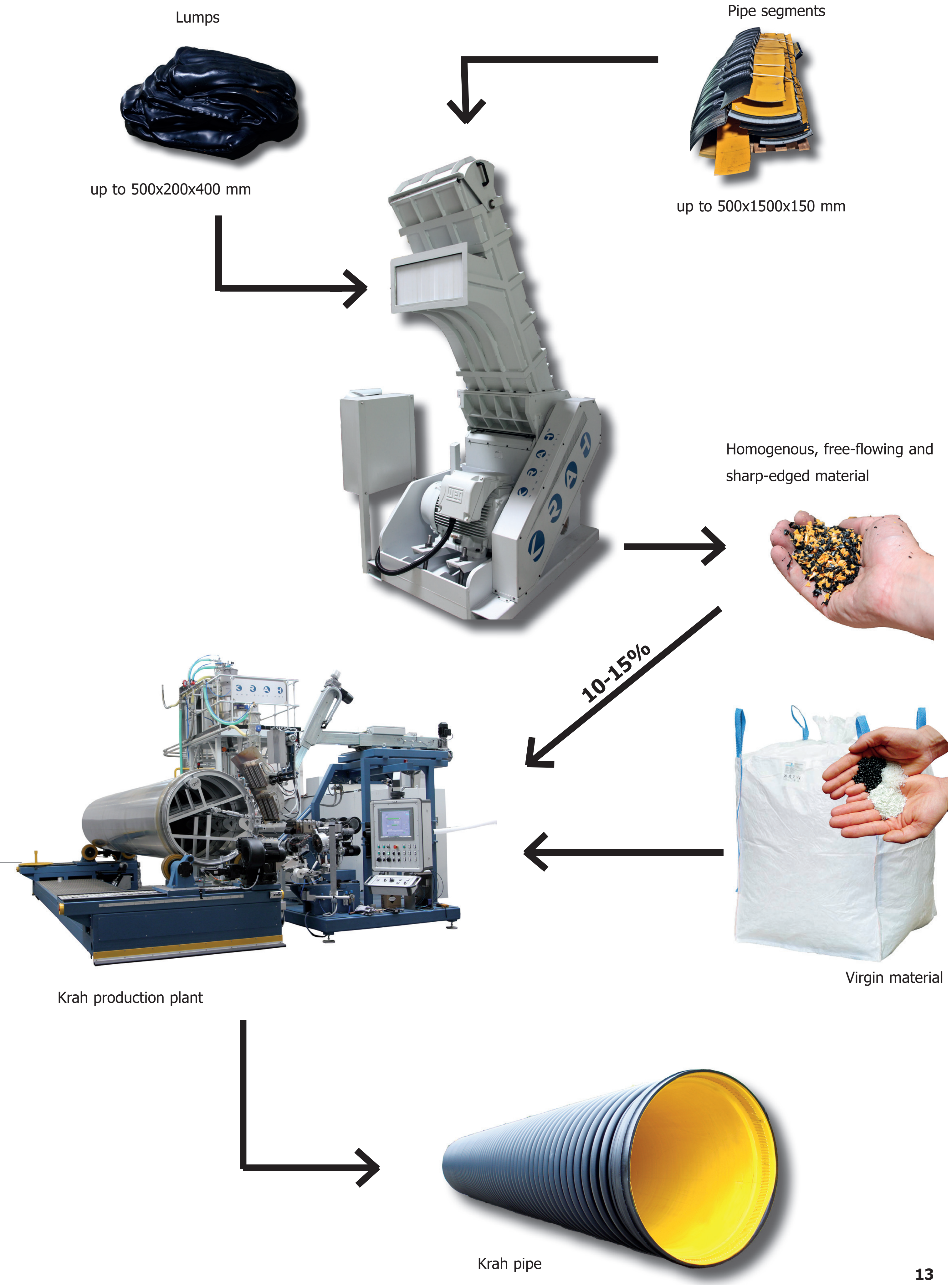
Furthermore, the filling level of the material can be checked through a window. The robust cutters can be used double-sided and guarantee a long lifetime and low maintenance costs of the machine. Additionally, the mill only needs a working space of 3x3 m.

With this mill we can finally offer a machine which makes our products even more sustainable and environmentally friendly. The first mill has already been delivered to one of our customers, who is more than happy with its performance. From August 2020 on we will offer the mill for everyone and are looking forward to receiving further positive feedback.

For an offer, please feel free to contact us at sales@krah.net.

Cutting mill

Material	Krah Pipes PE, PP
Material Dimensions	500x200x300 mm for lumps 500x150x1500 mm for pipe segments
Screen perforation size	8 mm
Granulation performance	250-350 kg/h, depending on the material
Motor performance	75,0 kW
Power supply	3x400 Volt, 50 Hz
Installation dimensions (lxwxh)	2x2x3,3 m
Total weight	4 metric kg


Lumps
up to 500x200x400 mm
Pipe segments
up to 500x1500x150 mm
Homogenous, free-flowing and
sharp-edged material
10-15%
Virgin material
Krah production plant
Krah pipe

Why do you use Krah pipes?

An Interview with a civil engineer

We wanted to do an interview with an engineering company to find out the crucial points to use our pipes for their projects. Therefore, we have contacted the in Germany well known engineering office Müller GmbH Co. KG in Grünberg, Hessen. On a wednesday morning, I met Dipl.-Ing. Maik Ginsberg in his office to have a coffee and a chat with him. He has been working with Polyethylene pipes for over 20 years. In his engineering office in Grünberg, he plans projects for sewage systems, drinking water, tanks, water treatment plants and road construction.

„With today's punctual heavy rainfall events, there is an increasing need for a buffer."

Which kind of projects do you work with?

I work with large diameter pipes, mostly in the sector of canal construction, drinking water canals, tanks, water treatment plants and road construction.

Which requirements do you have for modern sewer pipe systems and which on suppliers?

First of all, the most important feature for sewer pipe systems is the tightness, which is given by plastic pipes with a welded socket. Other important features concern the installation and handling. Especially for large diameter pipes the weight is a key factor - that's where plastic pipes come in handy. In terms of requirements for suppliers it is especially important that they stick to the stated delivery terms, which can be achieved by pre-fabricated pipes that only have to be connected together.

How important are storm water retention tanks for you?

Depends on the factors, which volume of water do we have, what kind of receiving water do I have? Can I drain off enough, do I have to install storage space? It must be designed accordingly. With today's punctual heavy rainfall events, there is an increasing need for a buffer so that the water bodies are not completely polluted. It is noticeable that more reservoir channels are being installed. There are also demands from the licensing authorities to install more. The significance is growing all the time.

How do you estimate the follow-up costs of leaks in sewers?

Leakage is bad in any pipe. The first goal is to lay the pipes in such a way that we do not have any leaks. In the case of completely welded pipes without rubber gaskets that can become leaky, we have produced a homogeneous product without any foreign material (rubber gasket), theoretically nothing can happen. If it is properly welded, nothing can happen.

Which pipe materials do you use for water and sewage projects?

Dipl. Ing. Maik Ginsberg

Depends on the client. There are municipalities where we specify this, but some operators also have specifications. Water: cast iron and Polyethylene, in our area we were a bit heavy on cast iron because we have the Buderus cast iron here. When I started here 20 years ago, Polyethylene was only rarely used, water pipes were all made of cast iron. That has now changed, the proportion of Polyethylene is currently increasing. Sewage: mainly plastic pipes, but not always just Polyethylene. Polypropylene or PVC are also used. A small niche product, although this is becoming more and more common, is a combination of concrete and plastic pipe. Here in Hessen, a new system has been developed, Polyethylene pipe wrapped in concrete. This is very much in vogue at the moment. In terms of cost it is somewhat more expensive than Polyethylene, but the advantage is its high stability. The problem with our bending soft pipes is the deformation. This is always controlled by the calibration, which gives the 6% short- and long-term deformation. If you have a client who really pays attention to this, it is difficult to keep to this. The pipe doesn't mind, but explain this to someone: it's crooked now, but it still works.

How long have you been using Polyethylene pipes in your projects?

For 20 years, since I came here. The Polyethylene pipe was introduced here via Alexander. The older colleagues had nothing to do with it. When I started here, a bit of fresh wind came in, and with it the Polyethylene pipes.

Where do you see advantages and disadvantages in Polyethylene pipes?

Advantages: Handling due to low weight, sustainability due to the long service life, tightness through welding or sleeves, if it is done sensibly, nothing can happen. Disadvantages: partly with higher nominal diameters the long welding time and cooling time, because this is a downtime factor on the construction site. In the case of large storage ducts, this is already reflected in the long minute times. I am not allowed to do anything else on the pipe during this time, neither backfill it nor attach the next pipe. This also partly cancels out the price advantage. On the one hand, I come cheaper because I have a cheaper pipe, but on the other hand I have to charge the working time of the column, which almost cancels it out again.

„Handling, sustainability and tightness are the main advantages of Krah pipes."

In your opinion, has the cost structure for sewage systems changed?

With larger pipes, we have lower wall thicknesses, correspondingly less excavation and less disposal. Today, the disposal factor is the factor that has a considerable impact on the cost structure due to the grouping into the storage classifications at the Arbeitsgemeinschaft Abfall. This saves excavation, disposal costs and backfill material due to the smaller trench width.

„At the moment, Corona hasn´t affected our day-to-day business yet"

What are your customers' current expectations of pipe systems?

Durability, tightness, low cost, low maintenance (less deposits).

Corona - how does Corona change your current plans? Is there more or less planning, is there less money from the municipalities?

No. At the moment it is not visible. Of course, it's impossible to predict what the future holds. At the moment the municipalities receive subsidies from the federal states and the federal government because of the defaulted trade taxes and so on. At some point, the federal government won't have anything left or will have to bring it back in. But at the moment nothing has hit us, we do not notice anything yet.

What project are you currently working on?

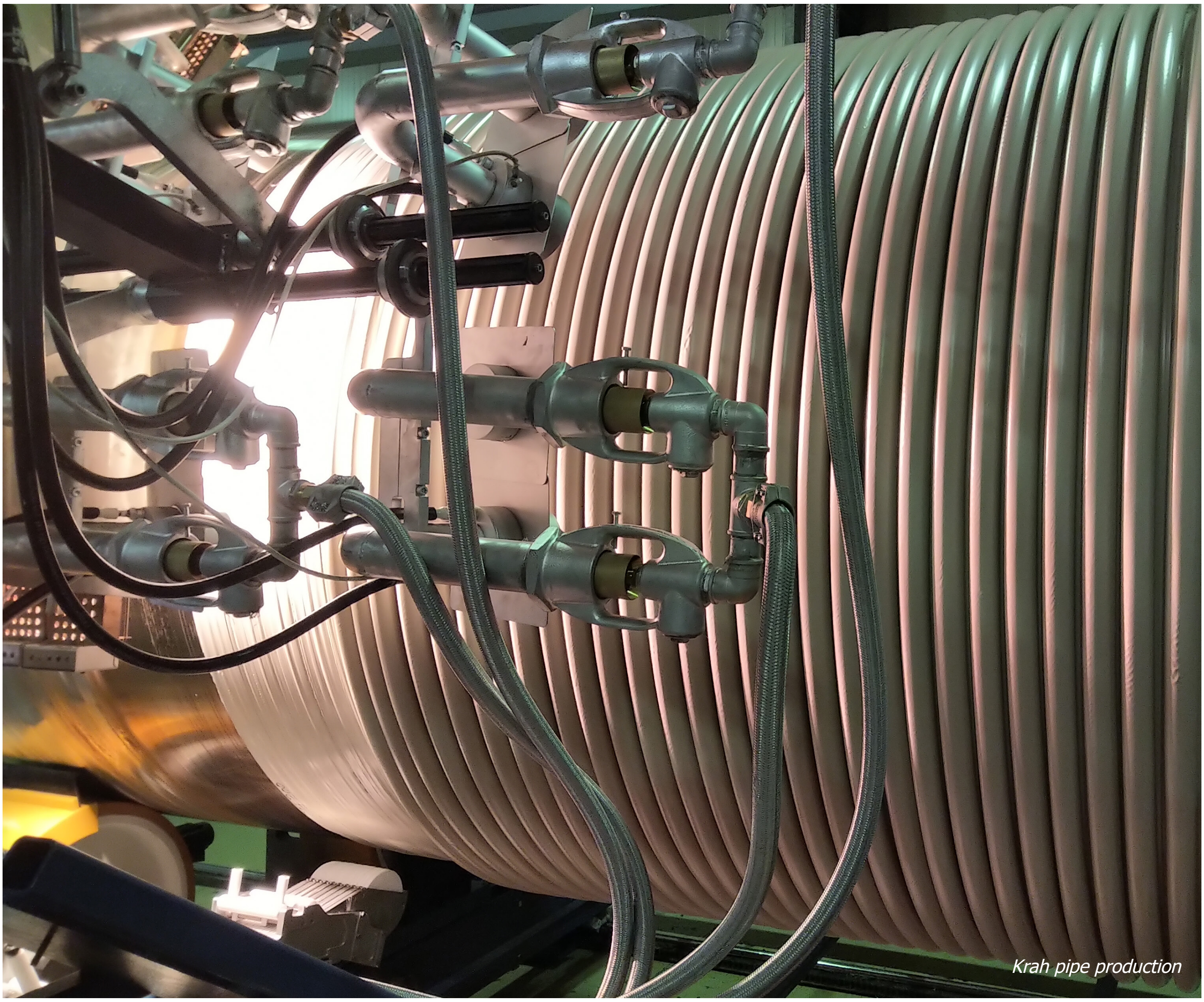
Currently we are planning and building a reservoir sewer with 1800 DN ID large capacity profiles and an elevated drinking water tank with a capacity of 600m³ in Hessen.

Thank you very much for your time and your interesting answers. Finally, I have an important question: Do you have a dog?

Hm... no!

Okay, nice to know! We hope that your company will get through the Corona crisis well and wish you and the company all the best!

Jenny, Krah Pipes



Krah pipe production

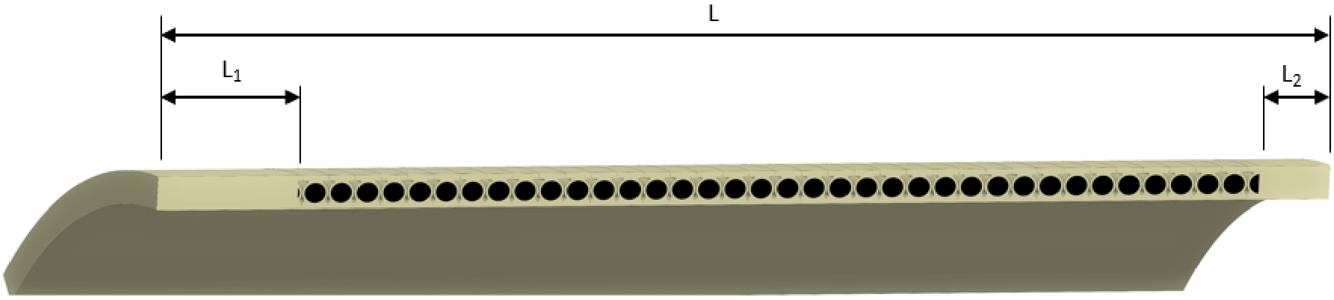
Crystallizer

for the chemical industry

The inquiry was about crystallizers in diameter DN/ID 2000 for chemical plants in Germany and Thailand as an elementary part of the extraction process for Tantalum. Tantalum is a very valuable and precious material. It is used in our modern environment mainly for microelectronics, medical implants, vessels for chemical industry and automotive and can not be replaced easily by other materials. The worldwide yearly production quantity is around 1400 tons. The company Jäger is looking back on a long history for manufacturing that kind of apparatus and has quite a lot of experience in fabrication with thermoplastic and duroplastic materials in general. Crystallizers are a challenging product, due to the sensitivity of the chemical process and needed accuracy in temperature control. The crystallizers are made of Polypropylen Homopolymer due to the high temperature resistance, the low thermal conductivity and low thermal expansion.

Tailormade according to the requirements

Polypropylene Homopolymer can be used under consideration of the creep rupture strength until ca. 100 °C. The Krah pipe product is selected, because Krah pipes can be manufactured tailormade according to the requirements and customer design. The wall structure can be structured with an internal hollow profile and the wall structure can change within a pipe. And that is exactly what is needed. The production of a cylinder shell is made by Krah Pipes Germany, located in Schutzbach, in the Westerwald region. Krah pipes with structured wall and with smooth inner surface are standardized according to DIN 16961. The pipe is produced on a preheated steel-mandrel in several layers

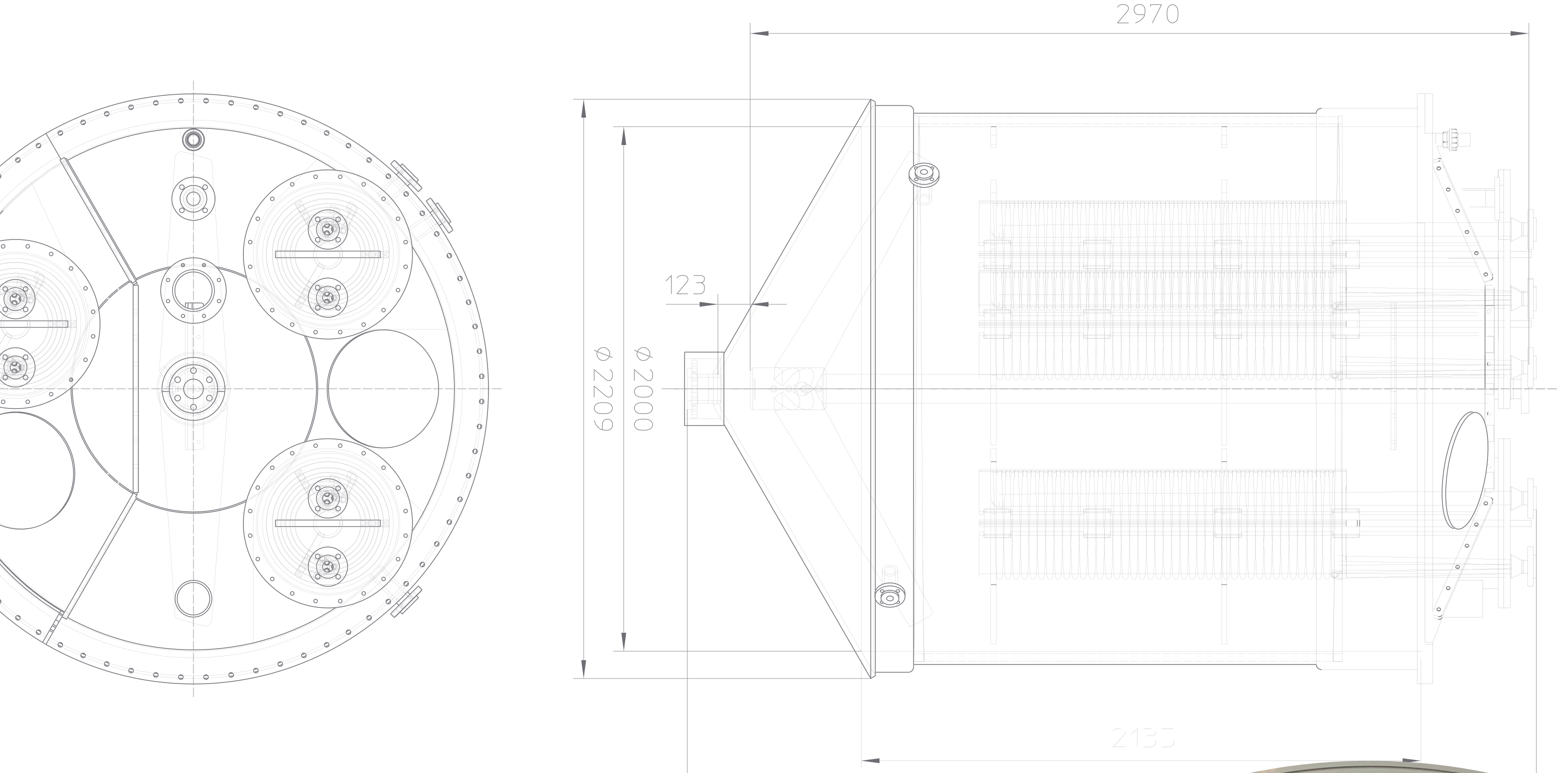


to achieve the requested wall profile and thickness. According to requirements the pipe wall includes a strong inner wall, a spiral hollow profile for controlling tempering fluid during operation later on and a strong outer wall. Both ends of the pipes are homogenously closed during production by solid wall. All dimensions (wall thicknesses, spiral shape and diameter of the hollow profile) are made according to the technical design by company Jäger.

Raw material is approved by DIBt

The selected Polypropylene Material is a Polypropylene Homopolymer with high molecular weight, with fine grained ß-modification crystalline structure, leading to excellent mechanical and physical properties and improved chemical resistance. The raw material Type "Borealis BE60-7032" is approved by DIBt, the German-based technical authority and service provider for construction industry. The main purpose of a crystallizer is to generate crystals from a hot solution.

Fabrication of PPH-Crystallizer



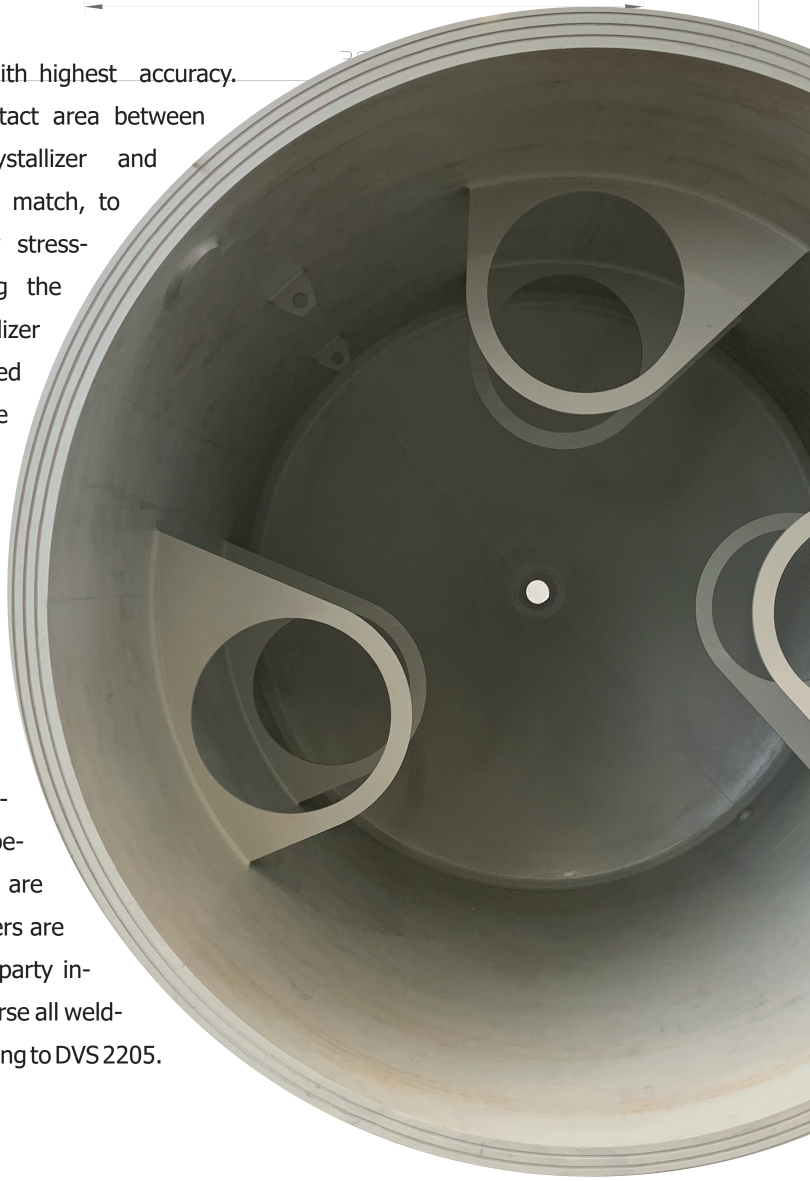
While cooling down the solution becomes oversaturated and crystals begin to form. The size and density of the crystals define the quality of the product. Therefore, temperature and agitator control are very important within the crystallization process. The crystallizer is designed for maximum operation temperature of 95°C. The medium is a mixture of Tantalum salt solution and hydrofluoric acid. The working pressure is hydrostatic. At site the crystallizer is mounted in a special steel frame and on top a special agitator is installed for controlled mixing and homogenization process.

Active cooling required

The used Polypropylene Homopolymer works as an insulator so active cooling is required. In this case it is achieved by integrating cooling pipes into the cylinder shell and three additional cooling fingers are installed though the cover of the vessel. The design has to be done under consideration of all static and dynamic load cases. For assembling is very important to ensure that all elements are fabricated and installed with highest accuracy. Especially the contact area between Polypropylene crystallizer and steel-frame has to match, to avoid unnecessary stresses. Before leaving the factory, the crystallizer gets quality checked and tested. The integrated cooling pipes in the cylinder and the cooling fingers has to pass a pressure test at 3 bar and 24 hours. It is elf-evident, that for such chemical apparatus experienced fabricators are preferred. All welders are approved by third party inspection and of course all welding are done according to DVS 2205.

Author:

KW Jäger GmbH



Material Data sheet		
Raw material	Borealis Beta (ß)-PP BE60-7032	
Colour	Grey, RAL 7032	RAL
Density	905 kg/m3	ISO 1183
Melt Flow Rate (230°C/2,16 kg)	0,30 g/10 min	ISO 1133
Melt Flow Rate (190°C/5,0 kg)	0,50 g/10 min	ISO 1133
Tensile Modulus (1 mm/min)	1.300 MPa	ISO 527
Tensile Strain at Yield (50 mm/min)	10 %	ISO 527-2
Tensile Stress at Yield (50 mm/min)	30 MPa	ISO 527-2
Heat Deflection Temperature	96°C	ISO 75-2
Vicat softening temperature B50, (50 N)	91°C	ISO 306
Charpy Impact Strength, notched (23°C)	50 kJ/m2	ISO 179/1eA
Charpy Impact Strength, notched (-20°C)	5 kJ/m2	ISO 179/1eA
General thermal properties of Polypropylene		
Thermal conductivity (at 0°C)	0,38 [W/mK]	DIN 52612
Coefficient of linear thermal expansion	0,18 [mm/m°C]	DIN 53752

The company KW Jäger GmbH is a well known German plastic fabricator. 2006 emerged from Jäger KG GmbH & Co, who was founded in the 1970's. The company is located in central Germany, close to city of Braunschweig and has 25 employees. The product range is widely spread, but plant engineering is of special significance of company Jäger. Many customers do not want just a single apparatus but a complete solution. Based on the needs of the customers, company Jäger plans turnkey installations, build them and provide active support during initial operation. Jäger's core competence are:

- design and production of fume exhaust systems including heavy duty fans
- process tanks and special apparatus
- process units including instrumentation and PLC control
- CNC machining

Jäger can supply the design and production of components or full process engineering for turnkey projects.

Contact address: Kunststoffwerk Jäger GmbH, Germany, info@kwjaeger.de.

40 MIGD Sea water reverse osmosis plant

in Jebel Ali Power Station

United Gulf Pipe Manufacturing Co LLC (UGPM) is a limited liability company established in mid-2009 for the purpose of manufacturing HDPE pipes, manholes, house connection chambers and other accessories for pressure & gravity applications, including Off-shore Intake & Outfall pipelines.

UGPM is one of the approved companies by ARAMCO to supply the nonmetallic material under their approval scheme.

The company maintains the Quality Management System Certification (ISO 9001:2008), Environment (ISO 14001:2004) and OHSAS (18001:2007).

UGPM counts with the support of the Technical Partner PPA & Krah (Spain), with a wide experience in Large Diameter HDPE Sea outfalls manufacturing and installation worldwide and over 35 years of experience in the industrial plastics industry providing a comprehensive solution.

Below you can find information regarding to the project:

Project: 40 MIGD (Million Imperial Gallons per Day) Sea water reverse osmosis plant in Jebel Ali Power Station

- End user: Dubai Electricity & Water Authority (DEWA)
- Contractor: Acciona Agua– Besix JV.
- Consultant: M/s ILF Consulting Engi eers

- Scope: Design, Manufacturing, testing and Supply, Butt fusion Welding works, and Testing of strings
- Location: Dewa, Jebel Ali Power Station
- System capacity: 40 MIGD
- Piping material: Solid wall pipes with manholes and related fittings
- Pipes diameter: DN2000 SDR 26 TO SDR 30 (Internal Diameter 2000 mm)
- Total outfall length: 2.9 km

By using Large Diameter HDPE pipes a huge reduction of cost can be achieved with extended life of the system.

Author:

United Gulf Pipe Manufacturing Co. LLC

Change in length

by changing operation conditions

A change in length of plastic pipes are caused by changing operation conditions. We differ between change in length by change of temperature, chemical influence or pressure load. Generally, we differ in two design solutions for handling an occurring change in length:

- The pipe is hindered for change in length due to fix points or due to restrained installation conditions (e.g. buried pipes).
- The pipe can move in axial direction and resulting elongation or contraction is compensated by compensators or by bending.

No matter how the change in length is handled, it can be calculated easily and has to be considered for the design of the plastic pipe system. The necessary information and the equations for the calculation are mentioned hereinafter.

Temperature influence

If the plastic pipe is exposed to different temperatures of medium or ambiance, the pipe is disposed to change the length. The change in length can be calculated as follows:

$$\Delta L_T = \alpha \cdot L \cdot \Delta T$$

ΔL_T = Change in length due to temperature change [mm]

α = Linear expansion coefficient [mm/m°K]

L = Length of considered pipe string [mm]

ΔT = Maximum difference in pipe wall temperature [°K]

The linear expansion coefficient differs in considered temperature and material, but following average values can be used for design:

Polyethylene: α = 0,18 [mm/m°K]

Polypropylene: α = 0,16 [mm/m°K]

Chemical influence

Polyethylene and Polypropylene generally provide a very good resistance against a multitude of chemicals. The resistance is very good documented in the literature, but at some chemicals it may come to a change of length by swelling. Chemicals like solvents could diffuse into the pipe wall and initiate a swelling effect. It has to be considered, that also the mechanical strength decreases. The expectable change in length can be approximately calculated by using a swelling-factor. A typical swelling-factor fCH for Polyethylene and Polypropylene can be assumed between 0,025 and 0,040.

$$\Delta L_{Ch} = f_{Ch} \cdot L$$

ΔL_{Ch} = Change in length due to chemical influence [mm]

f_{Ch} = Swelling factor [-]

L = Length of considered pipe string [mm]

Pressure load influence

Internal pressure results in length expansion of a closed and frictionless installed pipe-system. The theoretical expansion can be calculated as follows: For solid wall pipes and profiled pipes with closed inner wall and no outer wall (PR,OPR):

$$\Delta L_P = \frac{0{,}1 \cdot p \cdot (1-2\mu)}{E_c\left(\frac{(ID+2\cdot e_1)^2}{ID^2}-1\right)} \cdot L$$

For profiled pipes with closed inner and outer wall (CPR):

$$\Delta L_P = \frac{0{,}1 \cdot p \cdot (1-2\mu)}{E_c\left(\frac{(ID+2\cdot e_1)^2}{ID^2}-1\right)} + \frac{0{,}1 \cdot p \cdot (1-2\mu)}{E_c\left(\frac{OD^2}{(OD-2\cdot e_3)^2}-1\right)}$$

ΔL_P = Change in length due to inner pressure [mm]

μ = Poisson's ratio

p = operation pressure [bar]

L = Length of considered pipe string [mm]

Ec = Creep modulus for considered temperature and time [N/mm²]

OD = Outer diameter [mm]

ID = Inner diameter [mm]

e1 = Inner wall thickness [mm]

e3 = Outer wall thickness [mm]

For calculation of the total change in length all aspects must be considered:

$$\Delta L = \Delta L_T + \Delta L_{Ch} + \Delta L_P$$

The change length related to original length is accordingly:

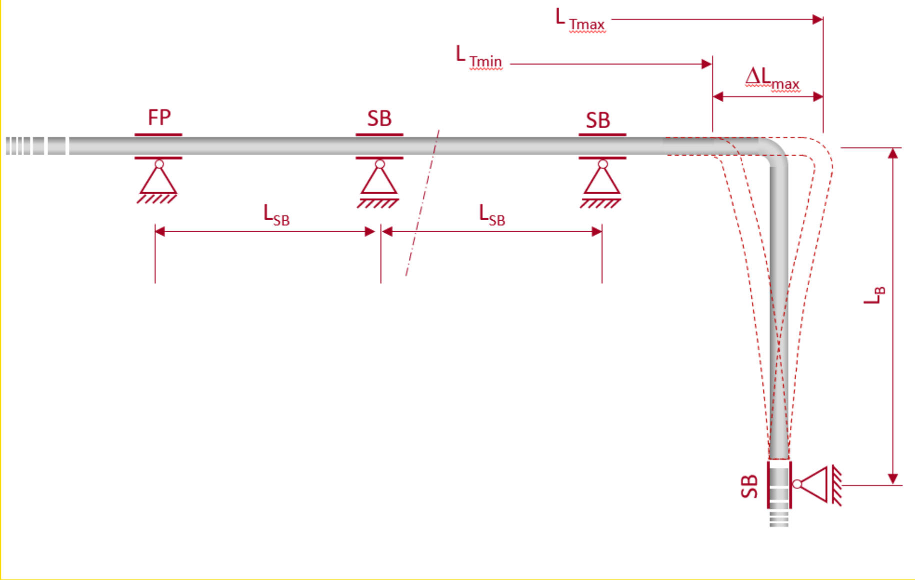
$$\varepsilon = \frac{\Delta L}{L}$$

If the change in length is hindered by e.g. fix points, axial stress is occurring. That has to be considered in the load scenarios as well as the stress is decreasing by time because of the creep behaviour of thermoplastics.

$$F_{ax} = A_{ax} \cdot E_c \cdot \varepsilon$$

F_{ax} = Axial forces due to hindered change in length

A_{ax} = Axial area (projected area in axial direction) [mm²]



Drawing 1: Compensation of change in length by bending

Buried pipes

For buried pipes the friction between the outer pipe surface and the surrounding soil is sufficient to avoid change in length. If Krah pipes with outer profiles are used, the pipe gets more or less anchored in surrounding soil. The axial forces are carried by the soil embedment. Thrust blocks, as well known from the installation of rigid pipes (e.g. concrete or steel), are not needed for Krah pipes if all elements of the pipe-system are homogenously jointed by Krah Electrofusion or other standardized welding process.

Above ground installation

For pipes installed above ground, the change in length is normally compensated by compensators or by bending (Drawing 1). If compensators are used, the needed axial force to ensure adequate function of the compensator should be verified. Directed bending can also be used to compensate change in length. Existing or also artificial bends of 90° can be used for it. In this case, it is important to place fix points (FP) in the pipe system to ensure that the elongation and contraction will happen in a controlled way. More details for calculation and design of minimum bending length LB you find in the relevant standards e.g. DVS 2210. The pipeline can also be installed with blocked change in length by using fix points (FP) at both ends of each straight pipeline section (Drawing 2). The axial forces must be transmitted accordingly through the anchorage elements. Between the fix points, sliding bearings (SB) must be placed to avoid laterally deflection. The frequency of sliding bearings depends on expected compression stress.

The maximum distance between sliding bearings can be calculated as follows:

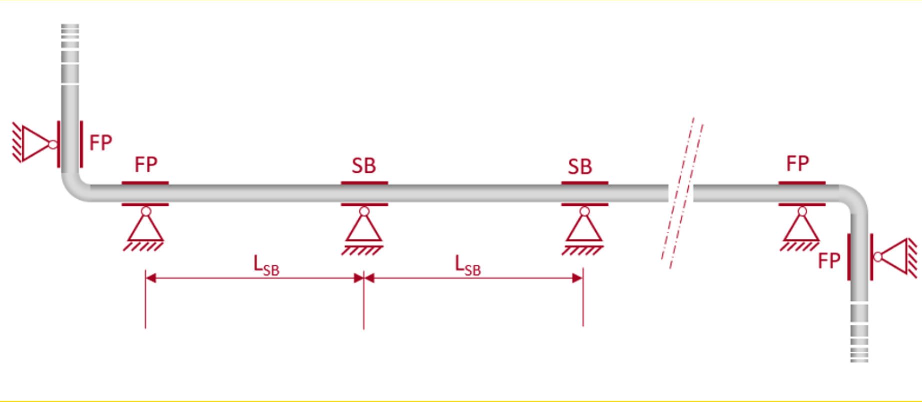
$$L_{SB} = \frac{2 \cdot \pi}{S_B} \cdot \sqrt{\frac{I_P}{\varepsilon \cdot \frac{ID + OD}{2} \cdot \pi \cdot e_{equ}}}$$

L_{SB} = Maximum distance axial forces due to hindered change in length [mm]

S_B = Axial buckling safety factor [-]

I_P = Moment of inertia of the pipe [mm4]

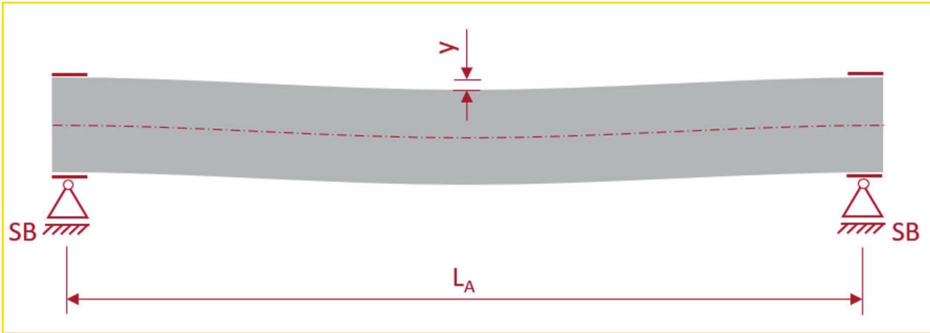
e_{equ} = Equivalent wall thickness [mm]



Drawing 2: Pipe installation with blocked change in length

For correct determination of bearing distance also the deflection by dead weight and live load has to be considered:

$$y = \frac{(q_P + q_{PF}) \cdot L_A{}^4}{384 \cdot E_{Lt} \cdot I_P}$$



Drawing 3

y = theoretical deflection of pipe [mm]

q_P = distributed load by pipe weight [N/mm]

q_{PF} = distributed load by pipe filling [N/mm]

E_{Lt} = flexural modulus longterm [N/mm]

The recommended maximum deflection is 1/750 of the bearing distance. Please consider, especially for solid wall pipes, that such calculations presume that the pipe provides sufficient stiffness and is not deformed by the loads. Profiled pipes have a lower dead-weight and provide mostly already by nature the required stiffness to avoid deformations.

Author: *Dipl. Ing. Stephan Füllgrabe, Krah Pipes GmbH & Co. KG*

Flexible sewage network system
with welding connections

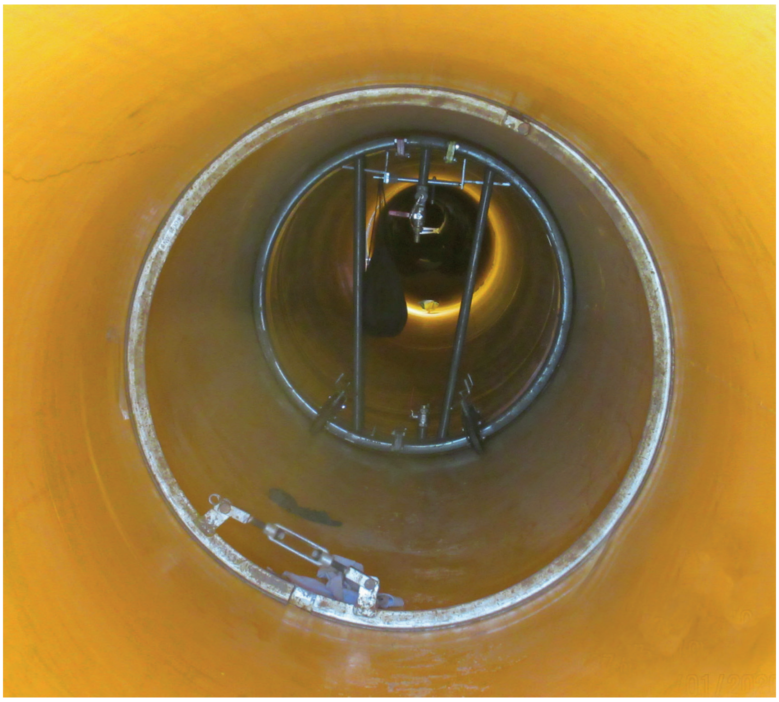
Over an area of 16 million SQM located in the northern end of the Suez Canal Special Economic Zone (SCZone), East Port Said Industrial Zone – ep – is an industrial park that offers unique investment opportunities through its strategic location and fiscal incentives. Over an area of 3.1 million m2. e2 offers a unique formula of state-of the-art infrastructure, sophisticated facility management and a full range of exceptional business and community services designed to attract new businesses. While SAMCRETE and Hassan Allam Holdings have diversified to become a major force in the Egyptian construction industry. As the project is adjacent to Canal and the soil is result of its dredging, the result is too loose soil and high level ground water table and big amount of soil settlement which lead the project consultants " Dar Al-Handasah" and "Hydro Envir. & infrastructure studies" to choose flexible sewage Network

Krah pipes during installation

Tangential manhole

system with welding connections and cost effective , It was Krah Technology Krah Misr awarded from the two largest contractors in Egypt : Orascom Construction and and Hassan Allam constructions to deliver gravity Network consist of 20 Km pipes from 600 up to 1800 mm and depths up to 8 meter, manholes, house connections and even chambers for pressure pipelines As it is fast track project, all mention items to be delivered in 1 year and due to fast production rate. Using electrofusion welding technology, Krah Misr is able to install complete welded Network, leak free, tested. Krah Misr is not delivering only pipes but it is complete know how from production to delivery and installation and testing at site, even maintenance and after sale service to final customer.

Author: *Krah Misr*



Leak test by using Krah joint testing device

Krah Pipes manhole with double bottom structure


Mercedes-Benz
ACTROS
MARINER
OUTBOARDS

Modern drinking water reservoirs

made of Polyethylene

Drinking water reservoir during prefabrication at Hawle Kunststoff

A new Hawle Kunststoff drinking water reservoir made of Polyethylene pipes was put into operation in the northern German community of Teterow. This reservoir is a supplement to an existing concrete structure that has reached its capacity limit. Drinking water reservoirs are an important element of the secured drinking water supply in Germany and for many years now, investments have been made in this area with an increasing tendency to secure the water quality and supply in the future.

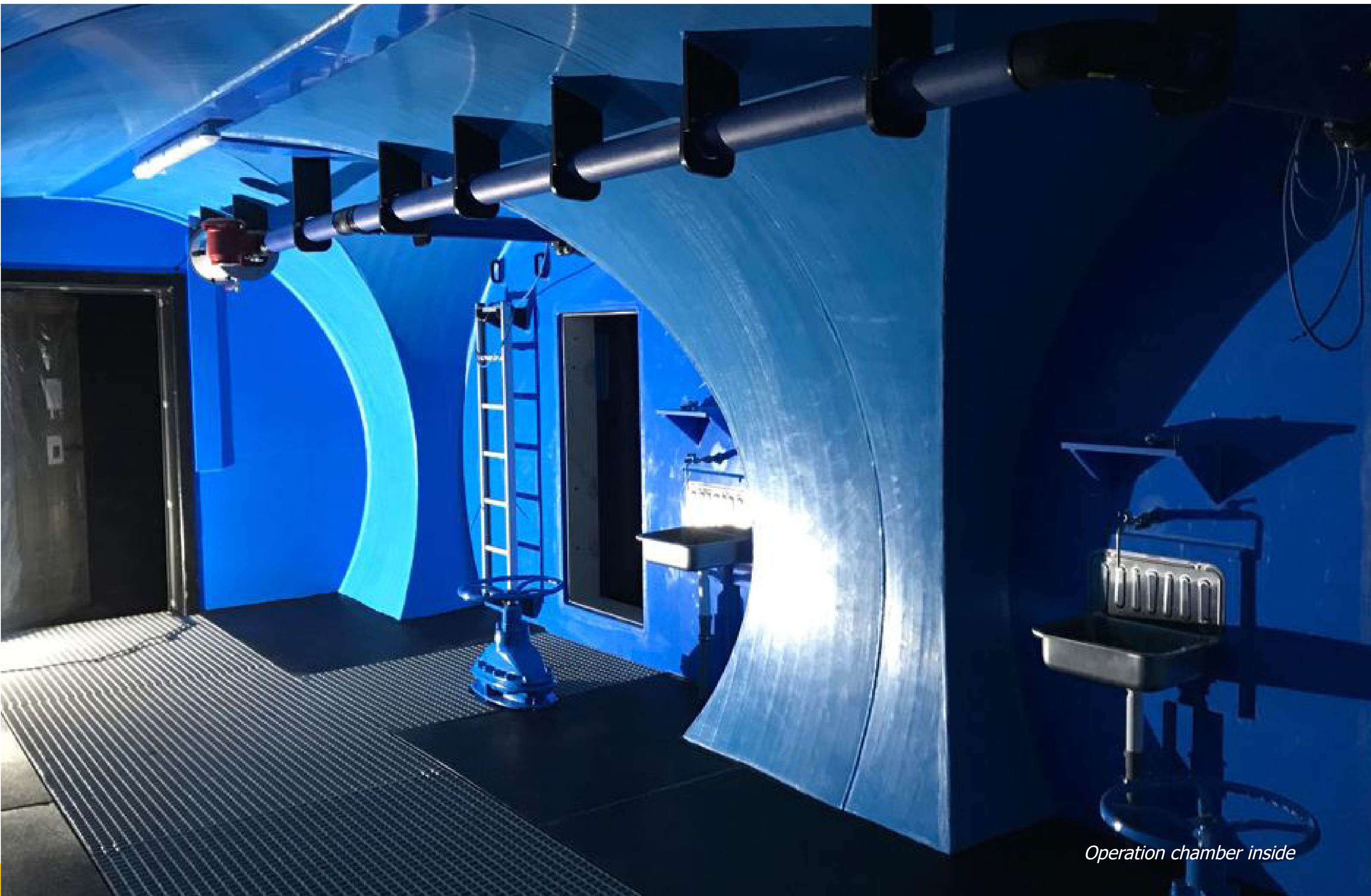
The aim is to modernize, expand and renew existing systems to make them sustainable and economical. Polyethylene structures are often explicitly desired, they generally replace concrete structures and are characterised by low production and installation times, reduction of operating costs and a long service life of over 50 years. Due to this development, the German Technical and Scientific Association for Gas and Water (DVGW) regulations W300 Part 6 were specifically introduced in 2016, in which Polyethylene storage tanks are explicitly taken into account.

Due to the high degree of pre-fabrication and the comparatively low weight, the effort for transport and handling on the construction site is very low. The entire storage tank in Teterow, for example, was completely assembled within only 2 days. Municipalities and construction companies appreciate the reliability due to the prefabrication, so one is largely independent of weather influences and delays caused by bad weather are avoided. The storage structure consists of an operating room and two storage pipes branching off from it. All components consist of Polyethylene winding pipe (PE100) in DN/ID 3400 and are homogeneously connected to each other. The pipes were manufactured in Wiehl, according to DIN 16961 and 16917. The approx. 9 m long operating chamber, which is accessible via a stainless-steel safety door, houses the necessary piping technology, including Hawle Kunststoff shut-off valves and the electrical engineering.

The two storage pipes are each 30 m long and connected to the operating chamber via pressure-proof doors. Through sight glasses, the internally illuminated storage tank can be visually inspected at any time. The ends of the storage pipes are closed by end plates, which are double-walled just like the storage pipes and the operating room. The entire reservoir structure was prefabricated in components of up to 15 m in length and expertly assembled on site by Hawle Kunststoff employees. All pipe connections made at the factory and on site are also double-walled. This enables a complete and homogenous vacuum leak test to be carried out at the end of the installation work. For this purpose, the double-walled room is subjected to a vacuum of 100 mbar and the test is documented accordingly. The new water reservoir of the municipality of Teterow with a total volume of 500 m³ is fed with treated drinking water from a supply line OD 450, the withdrawal line is designed in OD 355. The water reservoir was later covered with soil and harmoniously integrated into the natural landscape.

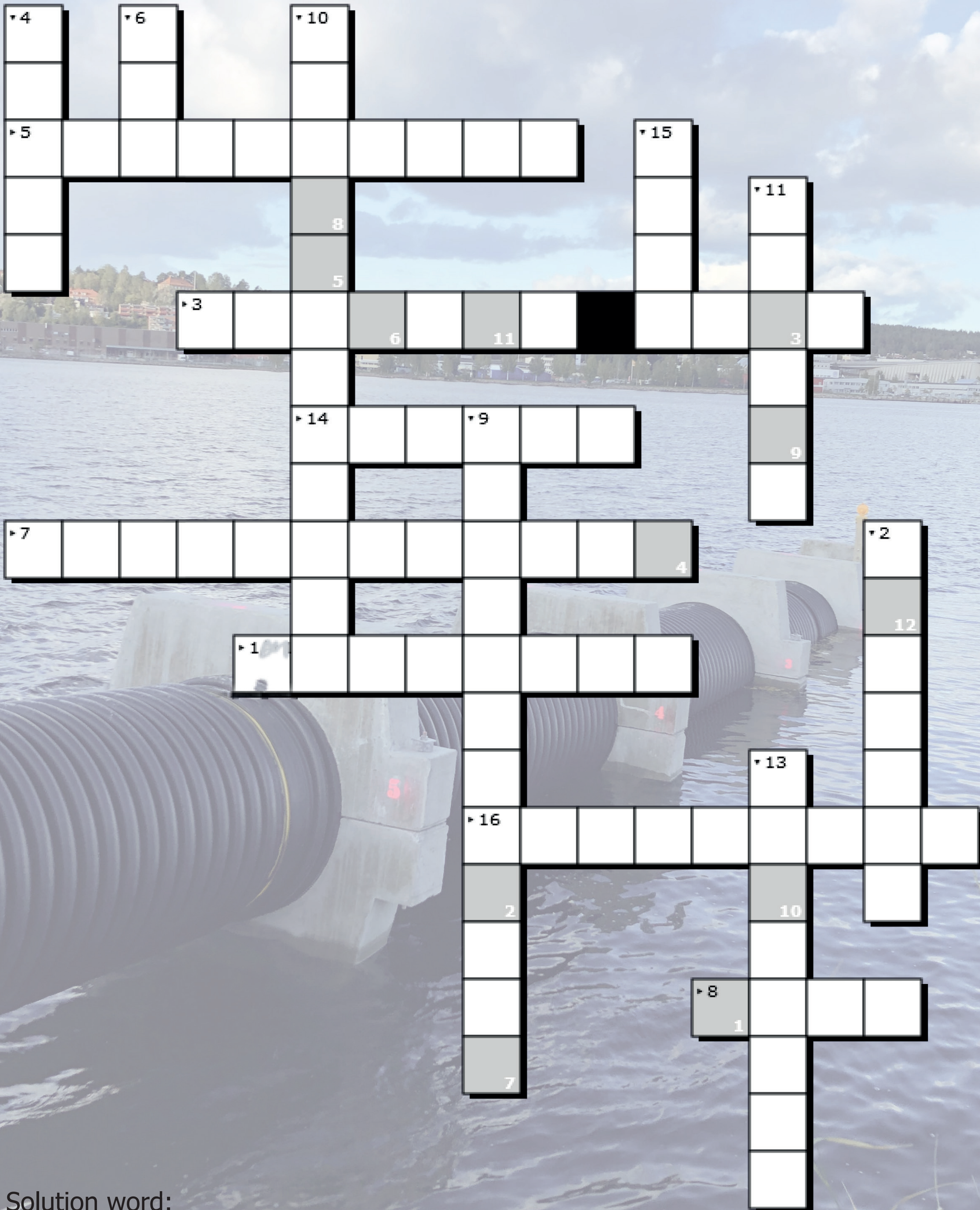
Author:

Andreas Wittner, Hawle Kunststoff



Operation chamber inside

Crossword



Solution word:

1	2	3	4	5	6	7	8	9	10	11	12

Here a small crossword for you. If you find the correct word we are looking for, please send it via mail to marketing@krah.net. From all correct entries we will select one winner, who will receive a surprise package from Black Ops Coffee! Good luck!

1. What is Mr. Krah´s first given name?
2. In which country is the headquarter of Krah?
3. What is the new Krah machine called to recylce processed PE material?
4. What is Igor´s favourite drink?
5. Where does the K-show take place?
6. What is the Krah house connection solution called?
7. How are Krah pipe systems welded?
8. What is the Krah mascot called?
9. In which city in the UK is the Krah machine operating?
10. Which material is the best for pipe systems?
11. Which city was built on Krah pipes in 2019?
12. Which paradise island was rebuilt with the help of Krah Pipes Manila?
13. What is the opposite of rigid?
14. Krah pipes are inspection-friendly. Which colours do Krah pipes have?
15. Krah pipes are internationally normed, what is the abbreviation of the American organization for standardization?
16. Polyethylene is environmentally friendly and can be reused. What is this process called?

krah-pipes.com

IMPROFIL