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HOBAS® Trenchless Applications

Compendium

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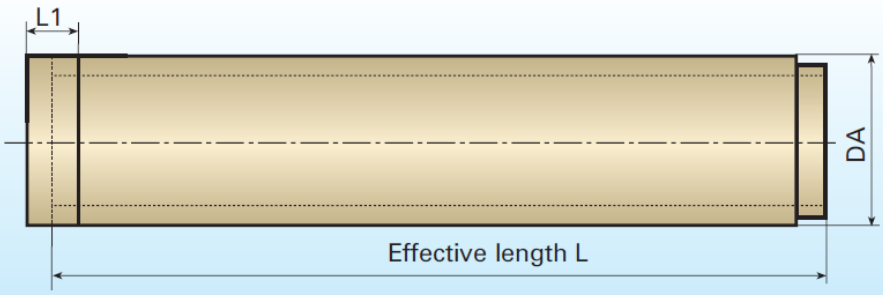
Compendium

Contents

HOBAS® CC-GRP Jacking pipes

HOBAS CC-GRP Jacking Pipe Systems show high compressive strength and consistent superior quality. Due to the smooth, non-absorbing exterior surface, tight OD tolerances and lighter weight construction, HOBAS CC-GRP Jacking Pipe Systems experience the lowest jacking loads in the industry. The lathe cut square ends and natural material resiliency, mean HOBAS Pipes transfer jacking loads with better distribution, and more forgiveness, than any other product, thereby resulting in the highest reliability available. HOBAS Jacking Pipe Systems are available from many factories around the world in a wide diameter range.



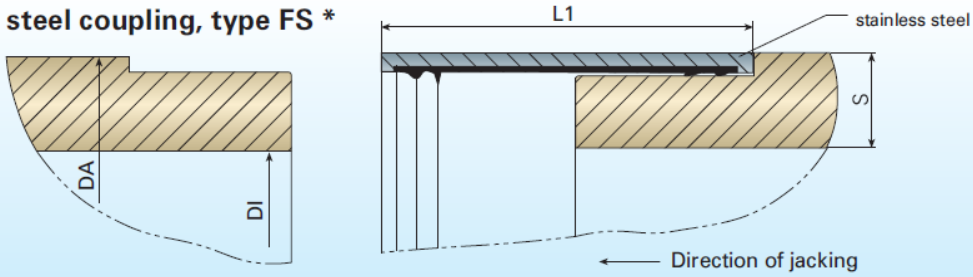
Effective length L
1 m 2 m 3 m 6 m
Additional effective lengths on request, Tolerances in accordance with company standard

Material parameters	Short-term	Long-term
Specific weight	20 kN/m³	20 kN/m³
Flexural modulus, circumferential	> 10000 N/mm²	> 4000 N/mm²
Flexural Strain at break, circumferential	1.0 %	0.8 %
Compression strength, axial	90 N/mm²	-
Safety Factor for jacking force	3.5	

HOBAS® jacking coupling systems

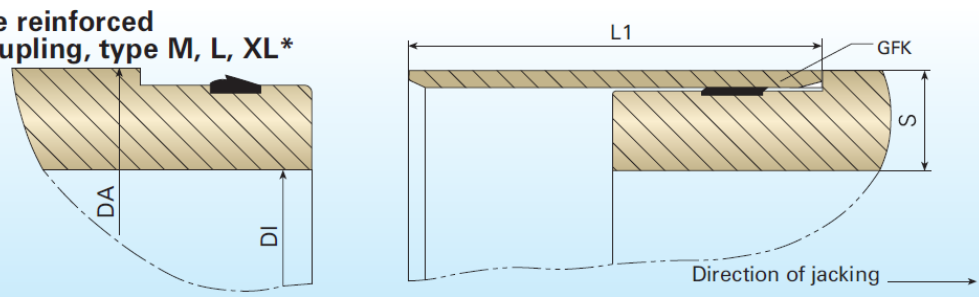
While jacking pipes with GRP-coupling sleeves and stainless steel couplings (type FS) are suitable for non-pressure applications with excellent resistance against external water pressure HOBAS also offers the opportunity for internal pressure pipe applications because of their well proved and tested FWC-couplings.

Stainless steel coupling, type FS *



.* The execution of the stainless steel coupling with regard to width and sheet-metal thickness is adjusted to the nominal diameters.

glass fibre reinforced plastic coupling, type M, L, XL*

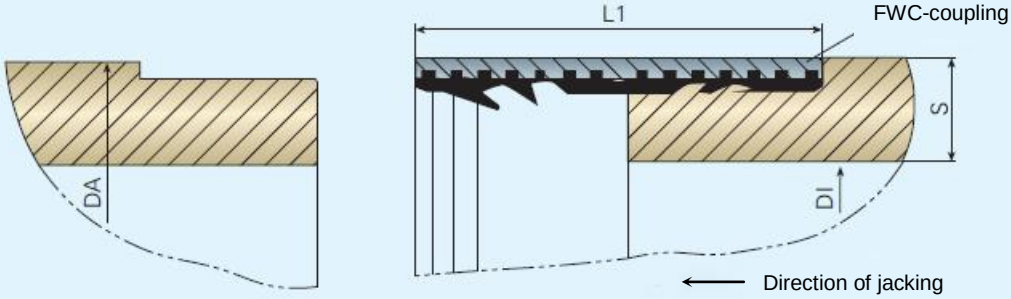


* The letters M, L and XL are an abbreviation for the size of the sealing profile. Therefore, XL is used for large pipes.

The use of GRP jacking pipes in connection with the outstanding characteristics of the HOBAS standard couplings (FWC) permits the realization of pipelines up to a nominal pressure of PN 10 in the trenchless installation method. Under special conditions even higher pressure stages are available.

Pressure jacking pipes can be manufactured with outer diameters ranging from 427 mm to 1720 mm and with standard pressure ranges from PN 04 to PN 10. Like for all jacking pipes lengths of 1 m, 2 m, 3 m and 6 m are available, whereas other lengths are possible on request.

Filament wound coupling type FWC



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Jacking pipes PN 01 – Wall thicknesses – Jacking forces

Outer diameter / Coupling type		Stiffness N/m²											
		32.000	40.000	50.000	64.000	80.000	100.000	128.000	160.000	200.000	320.000	640.000	1.000.000
272	Wall thickness mm										19	24	
	Weight kg/m										33	41	
Stainless steel	Jacking force kN										204	297	
GRP	Jacking force kN												
324	Wall thickness mm									20	23	28	
	Weight kg/m									42	48	57	
Stainless steel	Jacking force kN									273	341	452	
GRP	Jacking force kN												
376	Wall thickness mm							19	20	23	27	32	
	Weight kg/m							47	49	56	65	76	
Stainless steel	Jacking force kN							297	324	405	424	638	
GRP	Jacking force kN												
401	Wall thickness mm						19	20	21	24	28	34	39
	Weight kg/m						50	53	55	62	72	86	97
Stainless steel	Jacking force kN						315	344	373	459	572	736	868
GRP	Jacking force kN												
427	Wall thickness mm						19	20	21	24	28	34	39
	Weight kg/m						54	56	59	67	77	92	105
Stainless steel	Jacking force kN						342	373	405	497	618	795	938
GRP	Jacking force kN											696	838
501	Wall thickness mm				20	22	24	26	28	30	35	43	48
	Weight kg/m				66	73	79	85	91	98	113	136	150
Stainless steel	Jacking force kN				434	509	582	655	727	798	974	1.247	1.412
GRP	Jacking force kN											1.137	1.302
530	Wall thickness mm				20	23	24	26	28	31	36	44	51
	Weight kg/m				70	81	84	90	97	107	123	148	169
Stainless steel	Jacking force kN				459	577	616	694	770	885	1.071	1.362	1.608
GRP	Jacking force kN										957	1.247	1.492
550	Wall thickness mm		20	21	22	24	26	28	30	33	38	47	53
	Weight kg/m		73	75	80	87	94	101	108	118	134	163	182
Stainless steel	Jacking force kN		484	505	566	648	728	808	888	1.006	1.199	1.537	1.755
GRP	Jacking force kN									893	1.086	1.423	1.640

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Jacking pipes PN 01 – Wall thicknesses – Jacking forces

Outer diameter / Coupling type		Stiffness N/m²											
		32.000	40.000	50.000	64.000	80.000	100.000	128.000	160.000	200.000	320.000	640.000	1.000.000
616	Wall thickness mm		21	23	25	27	29	32	34	37	43	50	58
	Weight kg/m		86	94	102	110	118	129	137	148	170	196	224
Stainless steel	Jacking force kN		583	675	767	858	949	1.083	1.172	1.304	1.564	1.860	2.188
GRP	Jacking force kN								1.040	1.172	1.432	1.727	2.055
650	Wall thickness mm	21	24	25	26	28	30	33	35	38	44	54	62
	Weight kg/m	91	104	108	112	120	128	141	149	161	184	222	252
Stainless steel	Jacking force kN	613	760	809	857	953	1.049	1.191	1.285	1.425	1.700	2.146	2.491
GRP	Jacking force kN							1.055	1.148	1.288	1.563	2.008	2.352
718	Wall thickness mm	23	25	27	28	30	32	35	40	43	48	59	68
	Weight kg/m	110	120	129	134	143	152	165	187	201	222	269	305
Stainless steel	Jacking force kN	733	842	949	1.003	1.109	1.215	1.373	1.633	1.787	2.040	2.583	3.012
GRP	Jacking force kN						1.121	1.278	1.538	1.691	1.944	2.486	2.915
752	Wall thickness mm	24	26	28	30	33	36	39	42	45	51	62	72
	Weight kg/m	121	130	140	150	164	178	192	206	220	247	296	338
Stainless steel	Jacking force kN	800	913	1.026	1.138	1.305	1.470	1.634	1.797	1.958	2.276	2.843	3.342
GRP	Jacking force kN					1.231	1.396	1.560	1.722	1.882	2.199	2.765	3.263
820	Wall thickness mm	25	27	29	33	35	38	42	45	49	54	67	78
	Weight kg/m	137	148	158	179	190	205	226	241	261	286	349	400
Stainless steel	Jacking force kN	964	1.088	1.211	1.456	1.578	1.758	1.998	2.175	2.410	2.699	3.433	4.033
GRP	Jacking force kN				1.229	1.351	1.531	1.770	1.947	2.181	2.471	3.203	3.802
860	Wall thickness mm	27	29	31	35	37	40	43	47	51	58	72	
	Weight kg/m	155	166	178	199	210	227	243	264	285	321	392	
Stainless steel	Jacking force kN	1.140	1.270	1.399	1.655	1.783	1.972	2.160	2.409	2.655	3.080	3.905	
GRP	Jacking force kN				1.407	1.534	1.724	1.911	2.160	2.406	2.830	3.654	
924	Wall thickness mm	29	32	34	37	40	42	46	50	54	62	77	
	Weight kg/m	179	197	209	227	244	256	279	302	324	369	450	
Stainless steel	Jacking force kN	1.302	1.511	1.649	1.856	2.061	2.197	2.466	2.734	2.998	3.520	4.470	
GRP	Jacking force kN			1.448	1.654	1.859	1.995	2.264	2.531	2.796	3.316	4.265	
960	Wall thickness mm	31	34	36	39	42	44	48	52	56	64	80	
	Weight kg/m	199	217	230	248	266	278	302	326	350	396	486	
Stainless steel	Jacking force kN	1.497	1.714	1.857	2.072	2.284	2.425	2.706	2.983	3.258	3.801	4.854	
GRP	Jacking force kN		1.478	1.621	1.836	2.048	2.189	2.469	2.746	3.021	3.563	4.615	

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Jacking pipes PN 01 – Wall thicknesses – Jacking forces

Outer diameter / Coupling type		Stiffness N/m²											
		32.000	40.000	50.000	64.000	80.000	100.000	128.000	160.000	200.000	320.000	640.000	1.000.000
1026	Wall thickness mm	34	36	38	41	44	48	52	56	61	68		
	Weight kg/m	233	246	259	279	298	324	350	375	407	450		
Stainless steel	Jacking force kN	1.830	1.984	2.138	2.367	2.595	2.897	3.196	3.492	3.859	4.366		
GRP	Jacking force kN	1.585	1.739	1.893	2.122	2.350	2.651	2.950	3.246	3.612	4.118		
1099	Wall thickness mm	35	38	41	44	48	51	56	59	64	73		
	Weight kg/m	257	278	300	321	348	369	403	424	457	517		
Stainless steel	Jacking force kN	2.040	2.288	2.535	2.781	3.106	3.348	3.748	3.987	4.380	5.079		
GRP	Jacking force kN	1.717	1.965	2.212	2.457	2.781	3.023	3.423	3.661	4.054	4.752		
1229	Wall thickness mm	40	43	46	49	53	56	61	66	71	81		
	Weight kg/m	328	352	376	399	430	454	492	530	568	642		
Stainless steel	Jacking force kN	2.748	3.026	3.302	3.576	3.940	4.212	4.660	5.105	5.546	6415		
GRP	Jacking force kN	2.289	2.566	2.842	3.116	3.479	3.750	4.198	4.643	5.083	5951		
1280	Wall thickness mm	41	45	47	52	55	59	64	68				
	Weight kg/m	351	384	400	441	465	497	537	569				
Stainless steel	Jacking force kN	2.968	3.353	3.545	4.022	4.306	4.682	5.149	5.520				
GRP	Jacking force kN	2.434	2.819	3.011	3.487	3.770	4.146	4.612	4.983				
1348	Wall thickness mm	44	47	50	54	58	62	67	72				
	Weight kg/m	396	422	448	483	517	551	593	635				
Stainless steel	Jacking force kN	3.467	3.771	4.074	4.476	4.875	5.272	5.764	6.252				
GRP	Jacking force kN	2.825	3.129	3.432	3.833	4.232	4.628	5.120	5.608				
1434	Wall thickness mm	46	49	52	57	61	65	71	76				
	Weight kg/m	441	469	496	542	578	615	668	713				
Stainless steel	Jacking force kN	3.890	4.215	4.537	5.072	5.497	5.919	6.548	7.067				
GRP	Jacking force kN	3.150	3.474	3.796	4.330	4.755	5.176	5.804	6.323				
1499	Wall thickness mm	48	52	56	60	64	68	74	79				
	Weight kg/m	481	520	558	596	634	672	728	775				
Stainless steel	Jacking force kN	4.236	4.688	5.137	5.583	6.027	6.469	7.126	7.669				
GRP	Jacking force kN	3.476	3.927	4.376	4.822	5.265	5.705	6.361	6.904				
1638	Wall thickness mm	52	56	60	65	70	75	81					
	Weight kg/m	569	611	653	706	757	809	870					
GRP	Jacking force kN	4.218	4.711	5.202	5.811	6.417	7.018	7.734					

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Jacking pipes PN 01 – Wall thicknesses – Jacking forces

Outer diameter / Coupling type		Stiffness N/m²											
		32.000	40.000	50.000	64.000	80.000	100.000	128.000	160.000	200.000	320.000	640.000	1.000.000
1720	Wall thickness mm	55	59	64	68	73	78						
	Weight kg/m	632	676	731	775	830	884						
GRP	Jacking force kN	4.381	4.899	5.542	6.054	6.690	7.322						
1842	Wall thickness mm	59	63	68	73	78	83						
	Weight kg/m	726	774	833	892	950	1.008						
GRP	Jacking force kN	5.224	5.779	6.469	7.154	7.836	8.513						
1940	Wall thickness mm	62	67	72	77								
	Weight kg/m	803	866	928	990								
GRP	Jacking force kN	5.858	6.587	7.313	8.034								
2046	Wall thickness mm	65	70	75	81								
	Weight kg/m	889	955	1.021	1.099								
GRP	Jacking force kN	6.549	7.319	8.086	9.000								
2160	Wall thickness mm	69	74	79	81								
	Weight kg/m	995	1.065	1.134	1162								
GRP	Jacking force kN	7.405	8.217	9.025	9348								
2250	Wall thickness mm	71	76	82									
	Weight kg/m	1.068	1.141	1.227									
GRP	Jacking force kN	7.987	8.835	9.846									
2400	Wall thickness mm	76	81										
	Weight kg/m	1.218	1.295										
GRP	Jacking force kN	9.251	10.154										
2555	Wall thickness mm	82											
	Weight kg/m	1.400											
GRP	Jacking force kN	10.845											

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Pressure jacking pipes

Outer diameter / Coupling type		Stiffness N/m²											
		32.000	40.000	50.000	64.000	80.000	100.000	128.000	160.000	200.000	320.000	640.000	1.000.000
427	Wall thickness mm												39
	Weight kg/m												105
FWC	Jacking force kN												388
550	Wall thickness mm									33	38	47	53
	Weight kg/m									118	134	163	182
FWC	Jacking force kN									318	511	850	1.068
650*	Wall thickness mm									38	44	54	62
	Weight kg/m									161	184	222	252
FWC	Jacking force kN									616	892	1.338	1.683
752	Wall thickness mm								42	45	51	62	72
	Weight kg/m								206	220	247	296	338
FWC	Jacking force kN								941	1.102	1.420	1.988	2.487
860**	Wall thickness mm						40	43	47	51	58	72	
	Weight kg/m						227	243	264	285	321	392	
FWC	Jacking force kN						1.263	1.451	1.700	1.946	2.371	3.196	
924	Wall thickness mm									54	62	77	
	Weight kg/m									324	369	450	
FWC	Jacking force kN									1.478	1.999	2.950	
960	Wall thickness mm				39	42	44	48	52	56	64	80	
	Weight kg/m				348	266	278	302	326	350	396	486	
FWC	Jacking force kN				954	1.167	1.308	1.589	1.866	2.142	2.684	3.738	
1026	Wall thickness mm							52	56	61	68		
	Weight kg/m							350	375	407	450		
FWC	Jacking force kN							1.394	1.690	2.058	2.565		
1099	Wall thickness mm									64	73		
	Weight kg/m									457	517		
FWC	Jacking force kN									2.180	2.879		
1099*	Wall thickness mm						51	56	59	64	73		
	Weight kg/m						369	403	424	457	517		
FWC	Jacking force kN						2.080	2.481	2.719	3.113	3.812		

* After consulting HOBAS
** Realization only for PN 06

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Pressure jacking pipes

Outer diameter / Coupling type		Stiffness N/m²											
		32.000	40.000	50.000	64.000	80.000	100.000	128.000	160.000	200.000	320.000	640.000	1.000.000
1280	Wall thickness mm					55	59	64	68				
	Weight kg/m					465	497	537	569				
FWC	Jacking force kN					2.798	3.174	3.641	4.012				
1499	Wall thickness mm						68	74	79				
	Weight kg/m						672	728	775				
FWC	Jacking force kN						3.917	4.575	5.119				
1499*	Wall thickness mm				60	64	68	74	79				
	Weight kg/m				596	634	672	728	775				
FWC	Jacking force kN				3.892	4.336	4.778	5.436	5.979				
1720*	Wall thickness mm		59	64	68	73	78						
	Weight kg/m		676	731	775	830	884						
FWC	Jacking force kN		4.469	5.113	5.626	6.263	6.896						

* After consulting HOBAS
** Realization only for PN 06

The admissible jacking force (kN) corresponds to a safety 3.5 times higher compared to the calculated load at break.
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Isle of Grain Pipe Jacking

HOBAS® CC-GRP Pipes for Great Britain

In addressing future demands for alternative supplies of gas, the UK has seen the construction of a number of new terminals for the importation of liquefied natural gas (LNG) one of which is sited at the Isle of Grain on the Thames estuary. For the most economic transportation of the gas it is cooled to achieve this liquid state and needs to go through a process of regasification for use in the UK gas grid. The latter process is no more than raising its temperature back to ambient. This requires heat and at the Isle of Grain this is being supplied by utilizing surplus heat from the existing Isle of Grain power station in the form of hot water. A twin pipeline system connects the station's two plants, part of which is installed inside tunnels using HOBAS CC-GRP jacking pipes.

For the first 2 drives the pipe lengths were two 3 m pipes behind the shield with the remaining pipes being 6 m long. Every third pipe was fitted with two bentonite injection points. The 144 m long drives were at relatively shallow depths and parallel to each other so that they could share the same jacking pits.

Shortly after starting the second drive an obstruction was encountered that stopped the machine, which was eventually found to be a large steel pipe crossing the top of the proposed alignment. This investigation involved a hand constructed adit cut through from the first drive in front of the second drive to determine the extent of the obstruction. The remedial action was to reverse the machine out by winching, to remove the first few pipes while at the same time backfilling in front of the shield and at the same rate using low density concrete to stabilize the void left. The drive was then restarted 1 m lower so as to go under the existing pipe.

The pipes in the third and fourth drive had to be installed at a depth of 23 m because they had to cross a gas main (2x DN 1400; main supply from London) a safe enough distance below it. To keep the construction costs for the 25 m deep jacking pit within reasonable limits, HOBAS demonstrated flexibility by supplying 3 m long pipes. The shaft diameter was therefore minimized and expenditure substantially reduced. In order to reach the existing jacking pit for pipeline sections one and two, sections three and four had to be pushed an unbelievable 15 meters uphill over a length of 117 meters.

By selecting HOBAS CC-GRP Jacking Pipes, the building contractors were also able to use a smaller tunnel boring machine (a Herrenknecht AVN 1600 full face excavation machine) than would have been the case with concrete pipes of the same inside diameter. In the second case, an AVN 2000 would have been required.

Other benefits for HOBAS CC-GRP Jacking Pipes include smooth outer diameters for reduced jacking loads (here only 160 t) and the non-absorbent pipe surface lowering lubrication needs and the reduced excavation volume improving production rates and diminishing spoil disposal costs.

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Overview	
Year of Construction	2008-2009
Total Length of Pipe	522 m
Pressure Class	PN 1
Stiffness Class	SN 32000
Diameter	OD 2160 mm, wall thickness 69 mm
Installation method	Jacking
Application	Protection pipe
Client	Stockton Drilling Ltd.
Contractor	A E Yates Trenchless Solutions
Advantages	Installation with a small tunnelling machine, smooth outer pipe surface, flexible pipe length, quick installation

Curved Pressure Pipe Jacking

Jacking HOBAS Pressure Pipes beneath the River Rhine, CH

Novartis is one of the leading suppliers of innovative pharmaceutical products. The group operates in more than 140 countries worldwide and is strongly rooted in Switzerland.

Currently, the company is turning the industrial complex of the St. Johann Areal in Basel with its research and production facilities, office buildings and the international head quarters into a state-of-the-art center for research, development and management.

Novartis' strategic aim regarding sustainability is to reduce the energy consumption of the new buildings to a third of the former premises. Due to the area's development as well as alternative energy systems, the need for cooling water will increase over the coming years. Purified water from the river Rhine is used for this purpose.

The total capacity of the present purification plants for general service water on both sides of the Rhine will cover the increasing demands of the areal over the next 10 to 15 years. However, both plants first had to be connected due to altered technical requirements. This was realized with a pipeline running under the Rhine.

The engineering company Rapp Infra, who was in charge of the project, had first intended a double pipeline where a pressure line would run inside a reinforced concrete jacking pipe. Since HOBAS CC-GRP Pipes can be produced to unify both, pressure and jacking properties, Rapp Infra was soon convinced by the economic advantage and shorter construction time.

A further advantage was that the Swiss constructor Implenia dealing with jacking installation has already worked very closely with Product Managers and Technicians at HOBAS Switzerland and Germany and was thus already acquainted with the specialists' proficiency and the products' advantages.

Following thorough research and comparison of the various bids, HOBAS received the order and delivered the first jacking pipes mid-April 2009. Jacking and receiving pits for the pipes were excavated and retained by concrete bored pile walls. The main jacking pit was no less than 32 meters deep. This great depth was required to avoid underground water courses (high groundwater table of over 20 m) and putting the Rhine water at risk. The pipeline runs under the Rhine with a safety margin of 6 m between the top edge of the HOBAS Pipe and the bottom edge of the river bed.

At this depth, it was possible to drive through one horizontal soil layer whereas traversing different formations beneath the Rhine would only have posed additional risks for what was already a highly complex project. As the receiving pit lay at a depth of 28 m, the pipes were driven four meters uphill over the length of 433 meters – another critical aspect that was easily overcome with the help of HOBAS products.

Another requirement regarding installation was the curved jacking route. The reason for this was the border between Switzerland and France. If they had jacked in a straight line, they would have crossed the border into France. They therefore pushed the pressure jacking pipes in a curve with a radius of 1000 m.

In this project in Basel, pressure jacking pipes with the pressure class of PN 10 and an outside diameter of 1499 mm were used. What is more, stainless steel nozzles for lubrication had their debut here. As if all these incredible challenges were not enough, building contractor Implenia installed some 24 to 30 m of jacking pipes per day and completed the project in record time of one and a half months.

Without the excellent work by Implenia and outstanding cooperation and coordination between sales representatives, engineering, production and shipping departments in the various HOBAS organizations such top performance would not have been achieved. All parties involved can be truly proud of their contribution and satisfied with this unprecedented reference project.

Overview	
Year of Construction	2009
Construction Time	1.5 months
Total Length of Pipe	433 m
Pressure Class	PN 10
Stiffness Class	SN 160000
Diameter	OD 1499 mm, wall thickness 79 mm
Installation method	Jacking
Application	WaterLine® (cooling water)
Client	Novartis Basel, CH
Contractor	Implenia AG, CH
Advantages	Jacking under the Rhine with high groundwater level, direct jacking of pressure pipes, very short construction time, injection nozzles, special logistic preconditions

The Krakow DTW Is Built to Last

Economic Microtunneling with HOBAS® Jacking Pipe Systems

Establishing the main collector of the Lower Bench of Vistula River (DTW - Dolnej Terasy Wisły) is very important for Krakow, the second largest city in Poland. The city's growth as well as EU requirements spurred on the extension and modernization of the existing water and sewage system. A large part of the projects is funded by the EU and also the DTW collector is a so-called ISPA project.

The DTW consists of a 6.5 km pipeline of which 6 are installed by microtunneling. Once completed, it will connect two sewage systems, one of them being overloaded and one having reserves. Its function is to even out the flow to the treatment plants Kujawy and Płaszów during heavy rainfall ensuring their optimal operation. In addition to this, areas which currently use septic tanks will be connected to the new collector, preventing the soil from further contamination and improving the groundwater quality.

Construction works for the collector are conducted in three stages and in two parts regarding contractors.

DTW Collector Part I

The installation of the first part of the Vistula Lower Route collector in Krakow was initiated in March 2008, the line going into service within the next months. This part of the project is realized by a consortium consisting of Hydrobudowa 9 & PRG Metro. Microtunneling was chosen for mainly economic reasons. Since the planned pipeline route runs in 6 m depth nearby the Vistula River where water collects in layers of sand and gravel, the costs for dewatering and excavation works would have been considerably higher than for tunneling.

The pipes used for the project are HOBAS CC-GRP Jacking Pipes with outer diameters of 1,099 and 1,229 mm. Two independent microtunneling machines were utilized and the right amount of lubricant was applied to maximize the progress. The smooth and non-absorbent surface of the pipes doubled the effect of bentonite lubricant so that the installation ran smoothly over the
200 m long drives and without the help of intermediate stations. The latter would only have been activated if allowed jacking forces had been exceeded. Since their help was not needed, the installation speed was doubled.

The achieved jacking rate of up to 25 m per 24 h was the result of the contractors' experience, the pipes' properties and good planning. The thrust and reception pits are made of steel piles. This solution has proved its worth in the past and is now an accepted technique in Poland. Pits of any required shape can be made this way, adapted to local conditions and the optimal pipe length, which in this case is 3 m. The piles are extracted once the pipe installation has been completed.

Concrete sunk shafts are utilized where intermediate stations are taken out after the pipe has been installed, to make way

for a HOBAS CC-GRP Shaft. Due to the high precision of microtunneling it is possible to drill through the provided and temporarily sealed sparings in the reinforced concrete walls. Once the pipeline is laid, the intermediate jacking stations are lifted out and CC-GRP Shafts are placed in the 3 m diameter sunk shafts. Thanks to their comparatively small dimension and low weight, this is done with ease.

It was important for the contractor that all parts of the new collector, such as also manholes and fittings, were prefabricated and from one source, which together with microtunneling guarantee a complete high-quality leak tight system. It was furthermore of great importance to be able to continue installation works during the winter months. Taking the high durability of the pipeline system into account, a pressure line of the system will also be established with CC-GRP utilizing DN 500 Pipes PN 6.

DTW Collector Part II

The remaining 3.4 km line is realized under the direction of INKOP, another contractor specialized in microtunneling. Its construction was commenced in September 2008 and is expected to be completed by the end of 2009.

The works were conducted under similar soil and groundwater conditions as for Part I. Outstanding progress was achieved with installation rates up to 24 m / 12 h. The intermediate stations once again stood still during all drives, even lengths up to 208 m were easily tackled without help. Optimal technological parameters, the smooth surface of HOBAS Pipes and sufficient lubrication applied every 21 m make an efficient and economic realization of the project possible.

Overview	
Year of Construction	2008-2009
Total Length of Pipe	6500 m
Pressure Class	PN 1, PN 6
Diameter	OD 530, 1099, 1229
Installation	Microtunneling, open trench
Application	SewerLine®, ShaftLine®
Client	Krakow Waterworks
Contractor	Hydrobudowa 9, PRG Metro, INKOP
Advantages	Ideal for microtunneling, low friction, durability

Almost Without a Trace

Microtunneling HOBAS® CC-GRP Pipes in Rome, Italy

Farnesina is one of Rome's central quarters and is situated on the right bank of the Tiber River. With La Farnesina as headquarter of the Italian Foreign Ministry the area is home to the ancient Milvio Bridge (109 a.c.), two meaningful sports facilities, namely the Olympic stadium and the Foro Italico, but also the junction of the 2 most important roads: The Cassia and the Flaminia.

For wastewater disposal, the municipality of Rome designed a sewer bypass in Farnesina, which runs between two already established concrete DN 3500 collectors. Totaling a length of 320 m, the line was planned with a nominal diameter of 1400 mm.

Disruptions through works on site were to be kept to a minimum, so that the densely populated area would be able to keep up its busy flow, especially during sports events when thousands of visitors gather in the area. The trenchless solution microtunneling was chosen for installation. Apart from being non-disruptive it also kept the construction site comparably small.

SAFAB Spa., a renowned Italian contractor specialized in hydraulic applications was assigned for the job and worked in close cooperation with the company La Falce Spa., whose no-dig know-how is based on 50 years experience.

The tunnel was prepared with a slurry pipe and a so-called MTBM, a Microtunneling Boring Machine featuring a laser guidance control systems. Driving through different layers of soil, such as clay, sand and gravel, a daily advance of 6 to 15 m could be achieved.

The planned line consists of two straights (135 and 185 m) that are connected in a 60° angle with a manhole for access and inspection. The project's main jacking station was erected at this interconnecting point. It was designed as circle with 9 m diameter enabling drives in the two required directions from one single site. Two thrust shields were built to keep the relatively light machine, which was simply rotated to the right position, in place.

The first stretch of 135 m was excavated with the thrust from the main station, whereas the longest stretch of 185 m had to be driven with an intermediate jacking station.

HOBAS CC-GRP Jacking Pipes DN 1400 with an external diameter 1,499 mm and a weight of 415 kg per meter were utilized for this project and allowed thrust forces up to 3476 kN. Thanks to the products' smooth outer surface and comparably small wall thickness, it was possible to reduce the amount of slurry as well as excavation material. In fact, it limited the use of bentonite based lubricant to the final sections of both drives and sped up the installation rate considerably. Also the standard pipe length of 6 m and the light weight of HOBAS products proved to be highly advantageous, for these contributed to reducing installation cost while once again shortening installation times.

Overview	
Year of Construction	2008 - 2009
Total Length of Pipe	320 m
Pressure Class	PN 1
Stiffness Class	SN 32000
Diameter	OD 1499
Installation method	Microtunneling
Application	SewerLine®
Client	SAFAB Spa
Contractor	ACEA ATO 2
Advantages	optimal hydraulic properties, low drive costs, less slurry, high installation rate, leak tight connections, practical standard pipe length, low weight, light material

All Show and All Substance in Tilburg, NL

Efficient Relining with HOBAS® NC Line® Wins No Dig Award

The sewer in Sint Josephstraat, The Netherlands, is part of the Tilburg main sewer and is an important link in the system of the waste water treatment plant and the rainwater overflow at the Wilhelmina Channel. Designed in 1927 and installed one year later, it consists of a concrete base with a masonry arch. Its transversal section is that of a reversed egg profile, with 1.90 m maximal width and 2.15 m height.

In the late 90's the road above the sewer constantly subsided. Inspection with radar equipment showed that this problem occurred due to the collapse of cavities beside the sewer. The cavities themselves developed because of sand being washed through cracks in the base of the construction. Repair works became immanent and resin was injected to stop the sand from passing through. This solution, however, proved to be unsuccessful so that the municipality of Tilburg was confronted with the question whether to take structural measures.

The problem was solved step by step and with the support of external consultancies and also HOBAS Benelux offered their expertise.

Step 1 - Research
To find the cause for the cracks in the sewer, drill samples were taken from the line. Each sample was strength tested. The masonry proved to be of excellent quality: strength > 60 N/m2. The quality of the concrete base, however, did not exceed class B10 and calculations proved that the cracks evolved due to an overload on the structure.

Step 2 - Evaluation
The gravity and scope of damage had to be evaluated in order to determine which measures were to be taken and what should be prioritized. Sewer renovations ask for tailor-made solutions where local circumstances play an important role. Since repairs did not solve the problem, relining or the replacement of the sewer had to be taken into consideration. The latter option would have called for the destruction of the complete existing line in open trench whereas with relining the old structure would remain. The idea of replacing the sewer was soon set aside for it posed technical as well as implementation problems. Moreover it would have been the most costly method.

Basing the decision on the analysis, Tilburg chose prefabricated reinforced plastic (GRP) pipe elements to reline the whole affected section. An important precondition concerning pipe capacity was the maximal acceptable diameter reduction of 10 cm. This limited the number of sliplining methods ("lining with continuous" or "discrete pipes"). Another criterion was the length of the damaged section which does not except horizontal deviations (angle distortion) in the line.

The application of (cured-in-place) hose relining could not be implemented for several reasons, mainly concerning the uneven distribution on the non-circular sewer walls which would anticipate uneven load distribution as well as possible buckling because of the required wall thickness, deviations, angles, and for simply being irreversible once applied. Apart from this, there was little experience with hose relining in large non-circular constructions as such and the method does not allow temporary use of the sewer while being applied. HOBAS NC Line therefore promised to be the better solution. During its installation the sewage is redirected. At heavy rainfall, however, the HOBAS NC Line can be used temporarily and may be evacuated within 10 minutes.

Step 3 - Measures
The number of suppliers for non circular pipe segments that are manufactured in advance is limited. Tilburg soon selected sliplining and HOBAS NC Line Systems. Most important criteria were the guaranteed product quality, provided technical know-how for the implementation, tested and certified homogeneous pipe material and high strength with a relatively small reduction in flow volume.

The pipe design and implementation method were handled by the manufacturer and contractor. Also a wide range of fittings such as manholes, inlets, etc. were included in the tender which the municipality released in 2007. Contractor Heijmans Infra techniek BV from Rosmalen won the bid.

Step 4 - Implementation
Preparing the implementation, the contractor had to prove that the design meets all specified requirements. The pipe strength was classified with an FEM (finite elements method) calculation which is based on the German directive ATV-DVWK-A-127 and particularly ATV-M-127-2.

The structural wall thickness of the pipe segments was calculated to be 26 mm. For installation, a special transportation vehicle was developed by the constructor. After assembly, the space between NC Line and original structure will be filled where the line needs to be kept in place, preventing it from buoying up.

Being an impressive trenchless solution efficiently realized with HOBAS NC Line, it rightly deserved its reward at the NSTT No Dig Award 2009.

Overview	
Year of Construction	2008
Duration	5 months
Total Length of Pipe	860 m
Pressure Class	PN 1
Diameter	DN 2150/1900 mm
Installation method	Relining
Application	SewerLine®, NC Line®
Client	Community Tilburg
Contractor	Heijmans Infra techniek BV
Advantages	made to measure profiles, complete leak tight system, high quality, small loss in relining diameter

Always a Winner with HOBAS®

Record Sliplining in Illinois, USA

The Metropolitan Water Reclamation District of Greater Chicago (District) collects, treats and disposes the wastewater from 168 independently owned and operated local sewer systems. Evanston, Illinois, is directly north of the windy city and shares many common attributes and was also the site of the longest, large diameter sliplining project on record for the District.

One of the most recent projects was Lake Street sewer rehab, including 2,100 m of DN 3000 semi-elliptic cast-in-place concrete sewer. The concrete sewer pipe had cracked at a number of places and had lime deposits at cracks and 'cold' joints, and the concrete had corroded due to the action of hydrogen sulfide and flowing water. In order to restore hydraulic and structural integrity the sewer needed to be rehabilitated.

Bid documents for the project included various options: segmental sliplining, cured in place (CIPP) lining and insertion of panels. Kenny Construction of Northbrook, Illinois, submitted the bid with the intent to slipline the sewer. The job was awarded to them based on rehabilitation by sliplining with HOBAS CC-GRP Pipe Systems.

Jack Callahan, vice president of the underground group with Kenny, said, "We thought it would be the most economical option due to timing and the size. We do a lot of CIPP, but this was a little too large for that method, considering the water situation, the bypass pumping that would have been required and everything else. It would have been more difficult and expensive."

Rehabilitation projects have many goals: reestablishing the structural integrity of the pipe, preventing leaking joints, and providing a corrosion resistant liner all the while maintaining flow. The design of the sewer lining was based on several conditions and parameters. The existing sewer was in a fully deteriorated state, loading due to overburden and hydrostatic conditions were evaluated, and the liner needed the ability to withstand the corrosive environment.

As with many projects, there were obstacles to overcome. The size and alignment of the sewer presented challenges, but nothing that could not be conquered. Sliplining pipe of this size is not like sliplining with smaller sizes. This was an uncommon project and the first time it was done in the area. The project ran smoothly and installation progressed well. The first 610 m of sliplining had been completed using HOBAS OD 2900 mm flush relining pipes. Conditions prompted the installation of 0.7 m HOBAS pipes with an OD of 2740 to be used for the remainder of the rehabilitation work.

Kenny Construction worked to find the best option for the grouting, which included several grout lifts in stages to prevent uplift. Although the grouting took some critical thinking, the pipe has a high stiffness and is performing well. Large diameter sliplining projects can be complicated and this project posed challenges that were all successfully overcome. HOBAS manufacturers a unique product that meets the requirements of large diameter sliplining: smooth OD, hydraulic capacity, high axial compressive strength and multiple diameters including many in-between sizes.

Overview	
Year of Construction	2008
Total Length of Pipe	2100 m
Pressure Class	PN 1
Stiffness Class	SN 5000
Diameter	OD 2740, OD 2900
Installation Method	Sliplining
Application	SewerLine®
Client	Evaston
Contractor	Kenny Construction
Advantages	high hydraulic capacities, high longitudinal stiffness, many available sizes, lots of in-between sizes

Groningen (NL) Sets on HOBAS® CC-GRP Pressure Jacking Pipes

Environmental aspects and future-oriented thinking lead the municipality of Groningen in the Netherlands to extending their existing sewer main sized DN 1000 and DN 1200. The gravity sewer main could not cope with high flow rates occurring during e.g. heavy rainfall. To prevent sewage from overflowing and polluting nature the authorities decided to convert it into a closed pressure system. With this and its extension by 2.4 km HOBAS CC-GRP Sewer Systems a capacity of 3000 m^3/h will be achieved so that the line would easily cope with future needs as well as the connection of a further village.

Preparations for the project were made in 2004. Since the line crosses a busy part of the town Groningen HOBAS proposed the utilization of CC-GRP Pressure Pipe Systems which can be installed by open as well as trenchless construction. Being the only supplier of GRP pressure pipes which can also be jacked the local engineers decided for HOBAS CC-GRP placing an order worth 1.222.000 Euros for the complete line.

This included 5 jacking sections with HOBAS CC-GRP Jacking Pipes DN 1000 to 1500 and Pressure Pipes DN 1000 and 1600 m DN 1200 as well as flanges, elbows, reducers and tees with stainless steel locked joints. Five different contractors were assigned to complete the job and a sixth will rehabilitate the pumping station in two years.

Several obstacles along the pipe route, such as roads and a channel, were overcome by microtunneling. Due to the requirements by the road authorities two jacking sections running beneath the highway were realized with cover pipes which were also delivered by HOBAS Benelux, the HOBAS CC-GRP Pressure Pipes were consequently inserted. The largest with an outer diameter of 1500 mm was utilized beneath highway A7.

The three other microtunneling sections were implemented with in this field unique CC-GRP pressure jacking pipes PN 6 and flush FWC couplings. These run beneath a gas pipeline, a main road, several streets and a navigable channel where the installation was conducted in 12 m depth.
A 275 m long section with CC-GRP pressure jacking pipes of 1280 mm outer diameter was jacked in a curve radius of 1300 m. The contractor decided to install an intermediate station which according to safety standards is required for jacking with over 4000 kN. Due to the smooth and non-absorbing outer surface of HOBAS Pipes their light weight and constant outer diameter, the maximal jacking force did not exceed 1800 kN. The intermediate station was therefore never in operation.

Thanks to innovative HOBAS CC-GRP Pipe Systems and the constant support of HOBAS Experts, all involved parties look back to a smooth and unobstructed implementation, Groningen is prepared for future needs and Mother Nature can breathe a sigh of relief.

Overview	
Year of Construction	2006 - 2007
Length of Pipe	2400 m
Pressure Class	PN 1 and 6
Diameter	DN 1000 - 1500
Stiffness Class	SN 5000, 320000
Installation Method	open cut, jacking
Application	SewerLine®
Client	Municipality Groningen
Contractor	5 different constructors
Advantages	unique GRP pressure jacking, corrosion resistance, light weight, complete pressure system by one manufacturer, long lifetime, low maintenance costs

Green Energy for Bella Italy – Not Without HOBAS®

The trenchless installation of approximately 60 m HOBAS CC-GRP Pressure Jacking Pipes under highway A4 through Lonato (Brescia, Italy) was recently completed within one week only. Most importantly, this was conducted with no traffic disruptions.

The described section is actually part of a 650 m long HOBAS CC-GRP penstock DN 1600 and DN 1500 running to a hydro power station that is built for Idroelettrica m.c.l., an energy company belonging to the Consorzio di Bonifica Medio Chiese.

Studio Frosio in Brescia, a renowned engineering office specialized in hydro power stations was responsible for the construction which was planned with the following key data:

Net head (to generator)	8.76 m
Average flow rate	3.12 m^3/sec
Maximal flow rate	4.30 m^3/sec
Output	300 kW

The engineers who already knew the advantages of HOBAS CC-GRP due to projects in the past, based their decision on three major requirements: to minimize friction loss (the nominal head was only 10.3 m), to underpass the highway A4 by jacking withstanding also the constant traffic loads and to have a material that is resistant to corrosive substances.

HOBAS CC-GRP Pipe Systems with their mirror-like inner pipe surface grant a K-factor below 0.01 which ensures an optimal flow rate. High stiffnesses and compression can be achieved with the production process, namely centrifugal casting. This makes HOBAS CC-GRP gravity as well as pressure pipes suitable for trenchless applications such as jacking and microtunneling. No extra protection that is easily damaged or worn during installation is necessary since HOBAS CC-GRP Pipe Systems are highly corrosion resistant.

The penstock consists of a first short section DN 1600 laid in open trench, further 60 m with the same outer diameter run below the highway. A reducer on the other end of the jacking section switches to a 250 m long DN 1500 pipe that finally leads to the power house. Two tees were installed along this section for future access.

Apart from one bend that was necessary in the first part where the route takes a sharp bend, the pipeline was installed without bends. Changes in direction were achieved by taking advantage of the 4-lip HOBAS® FWC couplings which allow an angular deflection.

To bear the heavy traffic loads the line generally required a stiffness of 10000 N/m^2, whereas the jacking section asked for SN 64000 to suit a jacking force of 4.821 kN (applied on less than 40% of the part). PN 2 was chosen for the complete line.

With an optimal exploitation of the given low head HOBAS contributed to environmentally friendly production of energy. The advantage of such “green sources” is remarkable. Based on EU research, a comparison of energy input and emissions of a hydro and a thermal power plant run with oil and at an annual production of 2,000,000 kWh shows:

Emission	Hydro power plant	Thermo power plant run with oil
SO_2	0	20.8 t p.a.
CO_2	0	1,530 t p.a.
NO_x	0	4.9 t p.a.
particulate	0	2.1 t p.a.
methane	0	2.7 t p.a.

In this case 383 tonnes crude oil can be saved per year when power is generated with water.

The figures prove the importance of small hydro power stations and an increase in numbers of hydro plants can be observed over the past years. A list of reference projects shows that HOBAS CC-GRP Pipe Systems have characteristics most suitable for this environmentally friendly application.

Overview	
Year of Construction	2007
Total Length of Pipe	650 m
Pressure Class	PN 2
Stiffness Class	SN 10000, 64000
Diameter	DN 1500, 1600
Installation Method	open trench, jacking
Application	WaterLine®
Client	Idroelettrica m.c.l. Scarl (Consorzio di Bonifica Medio Chiese)
Contractor	ATI Faccetti Costruzioni SpA, Zeco SpA, Pato s.r.l
Advantages	hydraulic characteristics, withstands heavy traffic loads, corrosion resistance

3 Methods, 1 HOBAS® Pipe System (FR)

The Toulon authorities association for wastewater treatment and sea outlet (SIRTTEMEU) has one of its largest sewer construction sites with HOBAS Pipe Systems on the Mediterranean coast in France. Reason for this is a corroded cast concrete line that takes all wastewater from western Toulon to the new Cap Sicié wastewater treatment plant, best known as the Amphitria. The damages on the line were mainly caused by H_2S attacks and the pipe has collapsed several times in the past. The association therefore decided to assign the design and supervision of the reconstruction works that are expected to be completed in 2009 to the Cabinet Merlin Engineering Consultancy in partnership with Enveo with.

All construction works were allocated to a SOGEA/SADE consortium. The site is divided into 3 sections of which the 3rd and biggest section is approx. 2 km long costing around 16 million Euros. Assisted by his consulting engineers and the water operator Veolia Eau, the client based his decision on the solutions proposed by the consortium which would ensure an uninterrupted service of the sewer, optimal completion dates, innovative technical solutions and efficient HOBAS GRP piping material in response to a range of required installation techniques.

Trench sheathings were utilized for open trench installation since the line had to be assembled in major narrow depths, restricted by the existing collector and close structures. Another part of the line was microtunneled and a third part was solved with a HOBAS NC-Line® System installed in a gallery.

The construction works were assigned to different parties of the consortium according to the required installation technique. The Melun special division of SADE is installing the NC-Line® whereas SOGEA Travaux Hydrauliques and SADE Marseille teams mainly deal with the open trench section. The line microtunneled below railway tracks was given to the specialized subcontractor SMCE. Thanks to the flexibility and easy handling of HOBAS CC-GRP and NC-Line® Systems all required installation techniques could be conducted with one material only. The products' optimal chemical resistance, their high mechanical and hydraulic properties and quasi self-cleaning effect convinced the consortium in all points.

HOBAS France provided a series of special components, manholes, non-circular pipes, connections and special fittings to suit the challenges of the project. A safe discharge of up to 2000 m^3/h during the frequent storms at the Mediterranean coast, the uninterrupted service of the line and a temporary bypass of DN 600 running through the gallery were to be ensured. Customized fittings with leak-tight yet flexibly applicable sealing stoppers developed by the HOBAS France Technical Department solve the problem of transition from the old to the new pipeline with almost no service interruptions.

Apart from providing an ideal and environmentally sound system solution for the implementation of this rather demanding project, HOBAS also helped in keeping inconveniences caused by construction works in residential areas to a minimum: The combination of different installation methods and made-to-measure HOBAS Pipe Systems allowed a fast and safe installation without heavy site equipment. One can already say that this project is a complete success for everyone involved, directly as well as indirectly.

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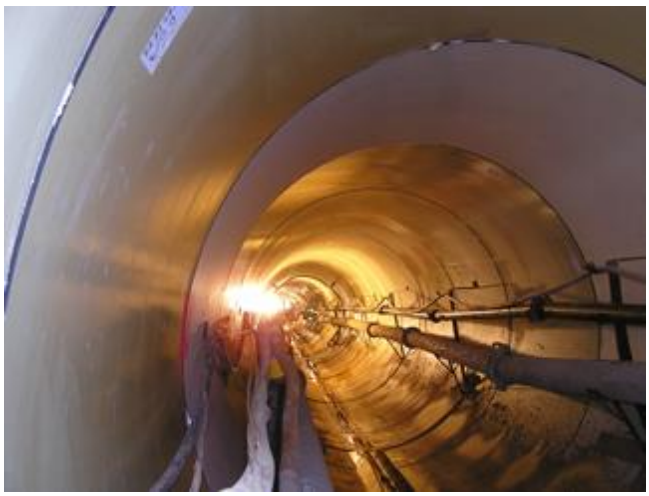
Overview	
Year of Construction	2004 -2009
Total Length of Pipe	2.4 km, plus fittings and shafts
Pressure Class	PN 1
Open Trench:	
Length of Pipe	1,470 m
Stiffness Class	SN 5000, 10000
Diameter	DN 1000, 1200, 1400, 1600
Microtunneling:	
Length of Pipe	180 m
Stiffness Class	SN 40000, 50000
Diameter	OD 1280, 1434, 1499
NC-Line:	
Length of Pipe	750 m
Diameter	DN 2200/900
Installation Method	open trench, microtunneling, relining
Application	SewerLine®, NC Line®
Client	SIRTTEMEU
Contractor	SADE Sud Est / STS, SOGEA Travaux Hydrauliques Sud Est, SMCE
Advantages	hydraulic properties, leak tight complete system, corrosion resistance (H_2S), long service life

Poland Drives HOBAS® Pipes Round the Bend

An impressive pipe project in Poland's capital Warsaw is expected to be completed mid summer 2008: To relieve the down-town sewer collector and to transport wastewater to the new treatment plant "Czajka", astounding 3.3 km large diameter (up to OD 2160 mm) HOBAS CC-GRP Jacking Pipes are installed by remote controlled jacking (microtunneling) and were literally driven around several bends.

Trenchless technologies are the most convenient and reasonable way to install a pipeline in a city where traffic and buildings above ground but also dense infrastructure below ground need to be considered. Numerous microtunneling projects have been successfully implemented with HOBAS CC-GRP Jacking Pipe Systems in Warsaw before. These projects along with project requirements such as installation depths up to 10.6 m convinced the municipality, waterworks and designer to once again opt for a trenchless solution. Furthermore, the installation method per se saved on pumping costs as the line was partly established up to 2 m below groundwater level.

The competition was tight and material prices for sure did not speak for GRP. HOBAS undoubtedly convinced in different respects such as offering extensive experience, know-how and reliability in curvilinear jacking. As so often, a second more thorough glance showed that the higher material costs were considerably outweighed by savings through, for instance, a 30% reduction of extracted soil thanks to smaller consistent outer diameters of the comparably thin walled CC-GRP Pipes. Construction sites and construction equipment could be kept small and to a minimum, for pipe size and weight surely mattered also in this case. Fast assembly and small curve radii were further cost saving advantages that spoke for HOBAS, not to mention the high corrosion resistance, long life expectancy of the products, low maintenance costs, etc.



The 3.3 km line runs in 4.7 and 10.6 m depth and includes 6 curves with 200, 300 and 600 m radii, the longest curve being 124 m at an average gradient of 0.063%. Sand and clay are the main soil components on the route and a part of the pipeline is assembled below groundwater level.

HOBAS Poland delivered CC-GRP Jacking Pipes in 1 m, 1.5 m and 3 m lengths for the different radii and straight sections. Since the absolutely leak-tight flush HOBAS Couplings incorporate a certain angular deflection, smaller curve radii are achieved by utilizing shorter pipe sections. Although not absolutely necessary, HOBAS Experts recommended the use of wooden rings between the pipes in curved sections in order to guarantee a perfect fit. An intermediate station that was run in the curve was a novelty that required a special design for the consequent station as for the steel pipe of the intermediate station itself.

Challenges such as a clearance of only 0.6 m between the pipeline and subway were easily overcome. Precise planning and the relatively small outer diameter of HOBAS Pipes were imperative for this remote controlled jacking project. A single jacking drive over 500 m was the technical highlight of the project. No wonder: The close and well functioning cooperation between HOBAS Organizations is indispensable in every regard and allows drawing from a large pool of technical expertise for top quality customer solutions.

Overview	
Year of Construction	2006 -2008
Total Length of Pipe	3.5 km
Pressure Class	PN 1
Stiffness Class	SN 10000 - 64000
Diameter	OD 2160, DN 1200 - 1600
Installation Method	Jacking, open trench
Application	SewerLine®
Client	Warsaw Waterworks
Contractor	PRG Metro
Advantages	simple & precise installation, smooth inner surface, consistant outer diameters, variable pipe length

Monumental Microtunneling in Verona, Italy

The problem of flooded buildings located below street level after heavy rainfalls is finally solved thanks to the construction of a new storm water sewer. It was promoted by Acque Veronesi, the water management department in charge of 77 municipalities of Veneto.

The project consists of the installation of approximately 200 m of HOBAS CC-GRP SewerLine® DN 900. The line runs from Prato Santo Street to Lungadige Matteotti straight into the Adige, the river which crosses downtown.

The first part of the pipeline was laid in an open trench utilizing short 3 m pipes where the road was wide enough for this installation method. The second part of the pipeline was microtunnelled due to an installation in 4 m depth, a high groundwater level and the presence of old buildings along the pipeline route. Open trench was not an option in this case for the longer construction time would have meant more disruption for inhabitants, tourists and traffic.

Design Engineer Luca Comitti at Acque Veronesi suggested microtunnelling, an installation method the water management department chose for the first time. This premier, Verona's delicate buildings and monuments, and sceptic public authorities made a successful implementation imperative.

Fortunately, the installation was awarded to Impresa Serpelloni a reputable contractor of the area specialized in no-dig techniques. Serpelloni and Acque Veronesi did not take any risks and decided to change the pipe material originally planned for the project. They switched to a reliable material that requires the least amount of equipment on site coupled with shortest installation times:
HOBAS CC-GRP Pipe Systems.

Although the line is fairly short and the works took only a couple of weeks, the project was highly acknowledged by designers and authorities of the region. It proves that even seemingly difficult projects can be easily handled when the right decisions have been made. The local authorities were impressed by the small work site and the fast installation.

HOBAS proved its reliability and precision. The CC-GRP DN 900, SN 10000 Pipes were produced by HOBAS Pipe Austria, whereas the Jacking Pipes came from HOBAS Pipe Germany. Simply perfect, they were even admired by some competitors!

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Overview	
Year of Construction	2007
Total Length of Pipe	210 m
Pressure Class	PN 1
Stiffness Class	SN 10000, SN 32000
Diameter	OD 960
Installation Method	Open trench, microtunneling
Application	SewerLine®
Client	Acque Veronesi S.p.A.
Contractor	Impresa Serpelloni S.r.l.
Advantages	hydraulic properties, long lifetime, light weight

French Highway Secured in Unique HOBAS® Fashion

The French highway network spans almost 12000 route kilometers, 60% of which are administered in a concession system by private companies such as APRR (Autoroutes Paris-Rhin-Rhône). Thousands of metal culverts have been installed along the roads to channel water. More than 50% of these are steel circulars or arches. After being in service for 30 to 40 years, these culverts have reached their maximum lifetime and are at risk to collapse any time causing road ruptures as approximately 20 years ago: Road embankment, paving and culverts needed to be repaired immediately which required an expensive construction of temporary diversions for both water and traffic. As a consequence, the highway companies conducted an extensive inventory. First surveys provided a better overview. It seemed that a significant number of the steel constructions (corrugated galvanized iron culverts) and a number of concrete culverts showed serious defects. Consequently, all 6 highway companies introduced a compulsory rehabilitation program in accordance with the technical specifications by the French Water Act of 1992.

On this account HOBAS® GRP Pipe Systems have contributed to the security upgrade of the constructions and highways. Thanks to its environment-friendly characteristics and its exceptionally long lifetime properties HOBAS GRP is an ideal material that fulfills all requirements. It should also be noted that the HOBAS Solutions for this project are based on trenchless technologies which permit works without traffic disruptions.

The described project is located on Highway A31, which connects the town Beaune and Luxembourg and is part of the APRR network. APRR is a subsidiary of the Eiffage Group, the seventh largest building and January 2008 concession company in Europe, and is in charge of the second most important French highway network with 1800 km.

This project is noteworthy for its dual purpose:

- to rehabilitate damaged metal pipes that were severely corroded for some parts;
- and to extend the road by one lane in each direction.

Moreover, rehabilitation involves a group of not less than 11 large-scale hydraulic constructions, 9 of which were originally elliptical, one was circular but strongly buckled, and one was in the shape of an arch. The total length of installed pipe adds up to 685m.

APRR first invited tenders that HOBAS France approached. An overall solution was developed considering the geometry of each channel and grouping the constructions by size. This led to the proposal of 4 different and individual NC-Line® profiles plus one circular CC-GRP Pipe OD 1720 for the rehabilitation of 9 elliptical constructions.

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Standard CC-GRP HOBAS Pipes were suggested for the remaining circular constructions and for the arch a NC Line® ID 2880x1800. Apart from this, an alternative solution was proposed sliplining NC Line® arches and HOBAS® CC-GRP Pipes using both flush couplings and standard FWC couplings.

APRR opted for the latter proposal. The mixed technologies confirm the adaptability and flexibility of HOBAS Products. Thus, 635 m of pipes ranging from DN 1200 to DN 2400 have been installed between May 2007 when first deliveries were made and end of November 2007. Slightly more than 50 m of HOBAS NC Line® profiles completed the lot.

“Works were accomplished more easily, thanks to the simple handling and jointing of HOBAS Pipes”, explained Civ. Eng. Norbert Cheminot, site manager of DLE EIFFAGE TP, contractor in charge of pipes installation and specialist for trenchless technologies. “Working on highways without disrupting the traffic is always a challenge. The HOBAS Solution required less heavy equipment, and turned the usually complex storage and handling into easy installation.”

HOBAS Pipe Systems was clearly the right solution for this project. It provided a clever and made-to-measure technical solution combining standard CC-GRP Pipes with arch-shaped NC Line® panels, and offers an exceptionally long lifetime under constant mechanical loading. The highway companies appreciate the products’ hydraulic properties despite a small reduction in dimension, and a low roughness coefficient thanks to the smooth liner surface, maximizing the flow rate and minimizing maintenance. “It was very important for us to find a rehabilitation solution that meets the terms of the French Water Act, something that would not affect the hydraulic condition of the existing pipeline and offer a long life-time.” Said Mr. Caisey a technical member of APRR‘s area staff. “The solution also allowed an open installation for the part where the roads were enlarged.”

Overview	
Year of Construction	2007
Total Length of Pipe	685 m
Pressure Class	PN 1
Stiffness Class	SN 5000, SN 10000
Diameter	DN 1200 - DN 2400, NC Line ID 2880x1800
Installation Method	Relining and open installation
Application	NC Line®, WaterLine®
Client	APRR (Autoroutes Paris Rhin Rhône)
Contractor	DLE – Eiffage TP
Advantages	hydraulic properties, long lifetime, light weight

HOBAS® Used on Peace Project

In 1986, the US Congress established the United States Institute of Peace (USIP) and has provided 68 million Euros for the construction of a permanent headquarters facility in Washington D.C. The “USIP Sewer Rehabilitation Project” will ensure structural integrity to the existing brick sewer that is located under the proposed building site.

A sewer that was reportedly built in 1896 has been serving the area. Planners decided that it needed permanent preservation to support future construction. They also decided that slipline rehabilitation was necessary to ensure the sewer would not interfere with the future USIP facility. HOBAS CC-GRP SewerLine® Systems was the only product that met all of the project requirements. The pipe to be installed had to be structurally sound, grouted in place and capable of handling the final loads.

The existing brick sewer was sliplined with 110 m of 1750 diameter HOBAS CC-GRP Pipe. The actual inside diameter of the original brick sewer varied between 1850 and 1900 mm. The engineering firm of Metcalf & Eddy thoroughly evaluated the host pipe conditions in order to maximize the diameter of the sliplining pipe. The radial clearance calculated between the HOBAS Pipe OD and the brick host pipe ID ranged between 6 and 32 mm.
CC-GRP Pipes have an efficient cross-section providing high strength with a thin wall. HOBAS also offers many pipe diameter choices for this type of application and not only standard diameters. The very tight fit, possible with the flush bell spigot pipe connectors, contributed to maximum flow recovery as well.

“The sliplining went very well,” said K. Michael Hall (Hall Contracting, installation subcontractor for the sliplining operation), “and after the pipe insertion, we grouted the annular space ourselves with a lightweight grout. Three ports were installed at the 12 o’clock position spaced evenly along the 100 m run. We removed the valves and replaced the tapped holes with 38 mm PVC plugs.” The plugs were provided by HOBAS. The new CC-GRP SewerLine® is structurally sound, leak free and provides adequate capacity. Hall had utilized HOBAS on more than 10 past projects dating back to 1997. K. Michael Hall, CEO, noted “Hall tackles tough large diameter slipline projects and has used HOBAS Pipe almost exclusively due to its toughness and ease of installation. This job was no exception.”

With sewer work complete, the engineer and installer both said they were pleased with the performance of the pipe and the level of service provided by HOBAS.

Overview	
Year of Construction	2007
Total Length of Pipe	110 m
Pressure Class	PN 1
Diameter	DN 1750
Installation Method	Sliplining
Application	SewerLine®
Client	USIP
Contractor	Clark Construction Group, LLC, Bethesda, Md., Hall Contracting
Advantages	High strength with nevertheless thin walls, easy handling