Compact Pipe

Trenchless pipe rehabilitaton with the quality and durability of a new installation

Top quality renovation with Compact Pipe

Compact Pipe turns damaged pipelines into top-quality plastic pipe systems

Compact Pipe has proven to be the ideal technology for the trenchless rehabilitation of damaged water, sewer, gas and industrial pipelines made of traditional materials such as cast iron, steel, concrete, clay or asbestos-cement. Compact Pipe is especially advantageous where the pipeline is not accessible or where there is heavy traffic so that open trench construction is not possible. Construction work is restricted to small start and end pits, which can even be omitted completely in the case of a sewer pipe rehabilitation where the existing manholes can be used.

Top quality through close-fit technology

According to the close-fit principle a circular PE pipe is folded along its length during the extrusion process to become C-shaped. Thus the cross section of the pipe is reduced so that it can easily be inserted in the pipeline which has to be rehabilitated. Once inserted the Compact Pipe is reversed with steam. Due to the “memory effect” of the polyethylene the pipe regains its original shape using pressurised air during the cooling process Compact Pipe is brought in close contact with the inner wall of the host pipe (close-fit). Inner diameter tolerances of the host pipe can be balanced by up to 7%. The result of this close-fit technique is a structurally independent pipe with the quality and durability of a newly installed pipe.

The benefits at a glance

1. Quality and durability of a new installation.
2. Saves time and money.
3. Construction work restricted to start and end pits.
4. Long distances can be rehabilitated in one go.
5. Universal use.
6. Optimum flow properties due to minimum reduction of cross section and smooth surfaces.
7. Minimum effect on the environment, people and traffic as well as on the public utilities and sewage disposal services.
8. Co-operation with competent installation partners.

The decision for Compact Pipe

Examination criteria

In order to judge upon the suitability of Compact Pipe the following information concerning the pipeline to be rehabilitated is to be gained from network drawings or form TV-inspection:

Operational characteristics

- Operation pressure
- Medium in the pipeline.

Description of the pipeline

- Dimension (inside diameter)
- Material
- Total length
- Possible individual lengths depending on section lengths (with sewer pipelines) as well as land and traffic situation and the location of the lateral connections
- Position of crossing lines
- Depth/gradient
- Changes of direction in the pipeline
- Depth and diameter of manholes
- Groundwater influences.

Condition of the pipeline

- Damages (cracks etc.)
- Misalignment
- Corrosion/encrustation
- Protrusion of house connections inlets

Pipe dimensions

The delivery programme shows the pipe dimensions realisable with Compact Pipe. The pipe length per drum does not necessarily correspond to the length of the section to be rehabilitated.

To determine the minimum inner diameter of the pipeline it may be examined with a calibre.

Calibre diameters

DN	100	125	150	175	200	225	250	275	300	350	400	450	500
∅ Calibre	96	119,5	143,5	168	192	215	238	277	287	337	382	433	481

Change of direction in the pipeline

Changes of direction in the pipeline can be realised with Compact Pipe as follows:

Kind of change	Angle	Min. radius of host pipe
Bends and junctions	< 22,5	Without restrictions
Bends	< 45	5xDN Compact Pipe
Bends	< 90	8xDN Compact Pipe

Access via manholes

For rehabilitation of sewers, the minimum size of manholes is presented below:

DN	Min. size of manhole (cm x cm)
100-225	80 x 80
250-400	100 x 100
>400	120 x 120

Delivery programme

Misalignment

In case of misalignments the use of Compact Pipe is possible in principle. It has to be guaranteed, however, that the smallest cross-section of the host pipe is larger than the folded Compact Pipe or the pulling head. With the help of a calibre or a burster the critical parts can be extended.

Improved flow capacity

The reduced cross-section as a result of close-fit lining is at least compensated due to absence of obstructions such as root penetrations or incrustations and of a much smoother inner pipe so that in most cases the hydraulic behaviour and thus the flow capacity even improves.

Delivery Programme

DN	Sewer PE 80 SDR 26	Sewer PE 80 SDR 32	Water PE 100 SDR 17	Gas PE 80 SDR 26	Gas PE 100 SDR 17,6	Max. length m*
100	🔴	🔴	🟡	🔴	🔴	1000
125	🔴	🔴	🟡	🔴	🔴	1000
150	🔵	🔴	🔵	🟡	🟡	800
175	🔴	🔴	🔵	🔴	🔴	800
200	🟢	🟡	🟡	🔵	🔵	460
225	🔴	🔴	🔴	🔴	🔴	260
250	🟢	🟡	🟡	🔵	🔵	250
275	🔴	🔴	🔴	🔴	🔴	215
300	🟢	🟡	🔵	🟡	🔵	215
350	🟢	🟡	🔵	🟡	🔴	170
400	🟢	🟡	🔵	🟡	🔴	170
450	🔵	🔵	-	🔴	-	100
500	🔵	🔵	-	🔴	-	100

* Depending on SDR class. With larger wall thicknesses the maximum length is not achieved.

🟢 Delivery within 2 weeks
🟡 Delivery within 6 weeks
🔵 Delivery within 2 weeks
🔴 Delivery time on request

Pipe details

DN	Nominal wall thickness			Diameter range (mm)	
	SDR 23	SDR 26	SDR 17	PE 80	PE 100
100	3,2	3,9	5,9	96-104	96-102
125	4,0	4,9	7,4	120-129	120-127
150	4,7	5,8	8,9	144-155	144-152
175	5,5	6,8	10,3	168-182	168-179
200	6,3	7,7	11,8	192-208	192-204
225	7,1	8,7	13,3	215-232	215-228
250	7,9	9,7	14,8	239-258	239-253
275	8,6	10,6	16,2	277-300	277-294
300	9,4	11,6	17,7	286-309	286-303
350	11,0	13,5	20,6	337-364	337-357
400	12,5	15,4	23,6	381-412	381-404
450	14,1	17,4	-	432-467	432-458
500	15,7	19,3	-	480-519	480-509

Technical data

Applications

Compact Pipe is used for the rehabilitation of water, gas, sewer and industrial pipelines, i.e. for both non-pressure and pressure applications.

Delivery

Compact Pipe is coiled on drums. The pipe length per drum depends on the nominal diameter of Compact Pipe.

Material

Compact Pipe is made of PE 80 or PE 100.

Chemical resistance

Compact Pipe is resistant to public waste water with a pH between 2 (acid) and 12 (alkaline). In case of industrial waste water chemical resistance data published by Wavin shall be taken into account.

Colour

White (opaque)	Yellow/Orange	Blue
Sewer and Industrial applications	Gas applications	Water applications

Structural capability

Compact Pipe provides an independent pipe system with the quality and the structural performance of a conventional PE pipeline built in open-cut installations.

For non-pressure pipes normally SDR 26 or SDR 32 pipes are used, depending on the required load-bearing capacity. If the load-bearing capacity has to be very high (e.g. due to a very high groundwater table), SDR 17 pipes may be used.

For pressure pipes the choice of the material and the SDR class depend on the operational pressure, complying with the international ISO and CEN standards.

Maximum operational pressure

Material	Water		Gas*	
PE 80	5 bar	8 bar	3,2 bar	4,8 bar
PE 100	6,3 bar	10 bar	4 bar	6 bar

* Based on a higher design factor for gas pipelines. In some countries other values may apply due to national standards.

Marking

Compact Pipe from Wavin is marked as follows:

Producer, product name, application, material, E-modulus, nominal diameter, SDR class, approval, date of production, running meter, machine number, shift/material code.

Example: Wavin, Compact Pipe, Water, PE l00 (MRS 10) 005, DN 300, SDR 17, DVGW AU 2109, 080599, 00l03, 42, 067870.

Approvals

Compact Pipe holds several national approvals including the German DVGW approval for the rehabilitation of water and gas pipelines.

Quality assurance

Wavin products are subject to double quality assurance: Internally through constant checks on raw material, on the product during the production process and on the end product according to the Wavin specification, which at least incorporate the respective international standards Externally through continuous monitoring by independent testing institutes.

Compact Pipe is produced on high-tech production lines in the Wavin factory in Twist, Germany.

During the installation process Compact Pipe is of course subject to continuous quality control.

In addition, in the laboratory quality checks are done on Compact Pipe sections, on which an installation is simulated considering real installation parameters such as temperature and pressure. From the as-installed section data such as stiffness and resistance to pressure can be derived.
When the recorded process data and the simulation test results comply with the

prescribed quality standards, Compact Pipe has the same quality and durability as a regular PE pipe installed in open construction.

More than a pipe

The Compact Pipe system has the following main components:

- Drum trailer
- Winch
- Steam unit with integrated process control
- Condense separator
- Various standard tools, equipment and auxiliaries.

Drum trailer

Compact Pipe is delivered on drums which can be held by drum trailers especially developed for Compact Pipe. From there the pipe is pulled directly into the man-hole or pit. Using the drum trailer for handling at the installation site is recommended as well although other equipment is allowed provided the pipe is not damaged.

Winch

Recommendable is a winch with a pulling force of 10 tons and automatic pulling force limitation, which can pull the pipe at a maximum speed of 20 m/min into the host pipe. Using special insertion aids (guide tools) reduces pulling forces.

Steam unit with integrated process control

The steam unit — the "heart" of the installation system — provides steam and air for the reversion process. Main components are the steam generator and the water treatment unit that are installed in a mobile 20 feet container. During the reversion of Compact Pipe the inside and outside temperatures on both pipe ends as well as the pressure in the pipe are continuously measured, shown in the operator's display and recorded for later analysis.

Condense separator

Steam and condense water are safely discharged via the condenser. This is particularly important when working in residential districts or heavy traffic areas to avoid inconveniences to people and guarantee traffic safety.

Various tools, equipment and auxiliaries

For Compact Pipe installation various tools, equipment and auxiliaries are required such as welding equipment and pulling heads.

Long distances short installation times

Universal and quick

Excavation works for lining with Compact Pipe are limited to small start and end pits. In case of sewers the existing man-holes can be used. Therefore only little space is required at the building site and traffic is hardly disturbed.

Compact Pipe does not impose high requirements on the condition of the pipeline to be rehabilitated. Dirty pressure pipelines are cleaned with high-pressure jet cleaning, with scratching and brushing tools or with a chain sling to get rid of incrustations and sediments. Weld beads can be removed using a cutter robot. Pipe wall fragments and sediments in sewers are removed by high-pressure jet cleaning or towing cleaning disks through the pipe. Root penetrations or inlet protrusions can be taken away by a cutter robot.

Then the C-shaped liner can be inserted in one continuous string directly into the pipeline to be rehabilitated. Large lengths up to 1000 meters enable rapid installation.

With steam and pressure from C-shape to close-fit

This is how it works:

1. Construction of start and end pits or preparation of manholes.
2. TV inspection and cleaning.
3. Insertion of the pipe.
4. Feeding the pipe with steam.
   The pipe "remembers" and regains its original circular cross section (memory effect).
5. Expansion and cooling of the pipe (reversion) using compressed air.
   The pipe is pushed closely against the wall of the host pipe (close-fit) and fixed.
6. Reconnection to the existing pipeline.
7. Re-installation of house connections.

Easily Connected

Sewer pipelines: end connections

Between two Compact Pipe ends the flow profile in the manhole bottom can be adjusted.

Sewer pipelines: trenchless technique for lateral connections

The existing laterals can be reconnected to the main using either open-cut or trenchless techniques. When using the trenchless technique, a remote-controlled cutter opens the Compact Pipe at the spots where laterals are. A tight connection can be made with a special fitting developed for this purpose.

Sewer pipelines: open-cut technique for lateral connections

When using the open-cut technique a PE connection element is welded with electrofusion on the Compact Pipe. The onward connection is made with a regular fitting.

Pressure pipelines: end connections

For connecting Compact Pipe to existing pipe sections, a regular PE pipe of the appropriate size and SDR class is used as transition piece This PE transition pipe is connected with Compact Pipe by usual electrofusion sockets. If the nominal diameter of Compact Pipe (e. g. DN 100) is smaller than the nominal diameter of the usual PF transition pipe (e. g. DN 110), the Compact Pipe has to be enlarged with an expander. Alternatively a purpose-made transition piece can be applied.

If Compact Pipe is to be connected to a non-PE pipeline or with a strongly deviating outside diameter, a flanged connection is beneficial. This technique may also be applied when installing ancillary components such as valves.

Pressure pipelines: service lines

With pressure pipelines service connections are made via open-cut excavation. At the spot of the lateral an adequate window is cut out of the rehabilitated pipe. Where the service connection shall be located, a section of the old pipeline has to be cut before lining.

If a service connection shall be established after lining, a sufficiently sized window can be cut out of the lined pipeline. Standard electrofusion saddles are welded an the Compact Pipe and the service line is connected.