TIROLER ROHRE GmbH

Ductile iron pipe systems for

Trenchless laying

Kind to the environment!
Less obstruction to traffic,
less noise and interference with nature

Extremely high tractive forces •
Quick and easy assembly •
Radiuses down to 70 metres •

Trenchless laying

More than 30 years experience

There has been a very close relationship between the development of trenchless pipe-laying techniques and both ductile cast iron pipes and the joints and types of external protection for these pipes.

Restrained socket joints were developed as a replacement for thrust blocks and as the first trenchless laying techniques began to make their appearance it was soon recognised what potential these joints had. Since then, ductile iron pipes from Duktus have been setting the standard for reliability and economy in trenchless laying techniques.

The first trenchless pipe-laying operations in the 70's marked the beginning of a speedy development process. More and more new techniques came on the market and the demand grew for larger sizes and longer pipelines.

The joint

In the majority of trenchless laying techniques, ductile iron pipes are pulled in. The only exception is pipe relining by the push-in process. Therefore, what is required for pulling-in is a joint which is "restrained" or in other words which is secure against tractive forces. Essentially, what a joint of this type needs to be based on is a positive interengagement. The feature by which positively interengaged socket joints can be recognised is a weld bead on the insertion end and this is what the VRS®-TIROFLEX® joint has.

The VRS®-TIROFLEX® joint is the joint that sets today's standard for ductile cast iron pipes when it comes to combining the greatest possible flexibility at the socket with very high tractive forces and, at the same time, very simple and fast assembly.

It was not only the types of joint that had to be matched to the demanding requirements of trenchless laying techniques but also the types of external protection. The result was the plastic-modified cement mortar coating, known to those in the industry as the ZMU coating.

These two developments, the VRS®-TIROFLEX® joint and the ZMU coating, laid the foundation for the success story that Duktus's ductile cast iron pipe has written for itself, and will continue to write for itself, in the field of trenchless laying techniques. Impressive proof of this success is provided by an approximately 500 metre long culvert pipeline of the DN 900 size installed in Valencia in Spain which has, since 2007, held the world record for the largest culvert pipeline of ductile cast iron pipes ever installed by the directional drilling technique.

Reference projects

DIRECTIONAL DRILLING

Berlin – Stahnsdorf (DN 250), Gent – Belgium (DN 600), Valencia – Spain (DN 900), Blankenfelde Mahlow – Intersection on L40 road (DN 300), Schwante – Dorfstrasse (DN 300), Nieder Neuendorf – Culvert under Havel canal (DN 200), Wolfenbüttel (DN 500), Halle – Maxim-Gorki-Strasse (DN 150), Rügen – 3rd section of building project in Prora (DN 300 and DN 250), Grossbeeren – Kleinbeerener Strasse (DN 300), Nieder Neuendorf – 1st section of building project (DN 200), Eichwalde (DN 300), Berlin Frohnau (DN 100), Münster bei Dieburg (DN 100), Dieburg - Gross-Umstädterstrasse (DN 150), Pegau (DN 300), Schönebeck – Pressure wastewater pipeline (DN 500), Rostock (DN 500), Wutha (DN 400), Henningsdorf (DN 500), Oranienburg (DN 500), Frankfurt am Main (DN 100), Offenbach (DN 100), Kinheim – Culvert under the Mosel (DN 150)

ROCKET PLOUGHING

Laue-Possdorf (near Delitzsch) (DN 200), Impfingen (DN 150), Hergenstadt (DN 150), Untersollbach (DN 150), Bad Wimpfen im Tal (DN 200)

PIPE RELINING/COLLECTOR PIPE

Berlin – Togostrasse (DN 800), Berlin – B101 road at state border (2 x DN 800), Berlin – Berliner Allee (DN 800), Leipzig Mölkau (DN 900), Leipzig – Thallwitz long-distance pipeline (DN 900), Elbaue-Ostharz long-distance water supply company, Güsten pipeline (DN 800), Briesen near Frankfurt an der Oder (DN 500), Berlin – Bornholmer Strasse (DN 700), Berlin – Hauptstrasse (DN 800), Frankfurt am Main (DN 400)

FLOATING IN

Gstaad – Switzerland (DN 200), Binz on the island of Rügen (DN 1000)

BURST LINING

Erfurt (DN 150), Gladenbach – Erdhausen (DN 150 and DN 100), Bad Laasphe (DN 100 and DN 200), Ober Rabenstein (DN 250), Zittau (DN 200), Siegen (DN 150), Vienna (DN 200, DN 150, DN 300 and DN 150), Salzburg (DN 200)

TEMPORARY PIPELINE

Berlin Olympic Stadium (DN 200), Hartenstein – Chemnitz (DN 600)

PUSH-PULL TECHNIQUE/AUXILIARY PIPE TECHNIQUE

Since 2007, more than 30,000 metres of Duktus ductile cast iron pipes of nominal sizes ranging from DN 80 to DN 300 and with VRS®-TIROFLEX® joints and cement mortar coatings have been successfully laid by these techniques in the metropolitan area of the city of Berlin.

It is not just in the area supplied by the Berlin metropolitan water supply company that the push-pull technique has been used but also in other parts of Switzerland and Western Europe. In Switzerland alone, some 10,000 metres of ductile cast iron pipes with VRS®-TIROFLEX® joints and cement mortar coatings have been installed using this technique over the past few years.

Pipe relining

Above-ground demonstration of the burst lining technique

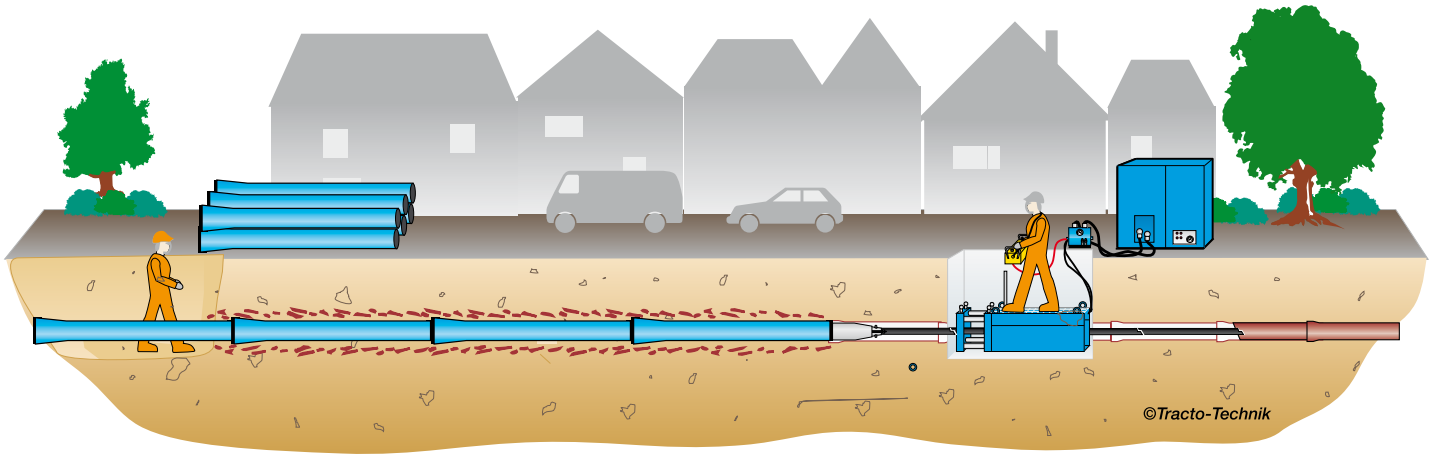
DN 400 ductile cast iron pipes with BLS®/VRS®-T socket joints being pushed into a stretch of protective tubes

The horizontal directional drilling technique

Replacement techniques

BURST LINING

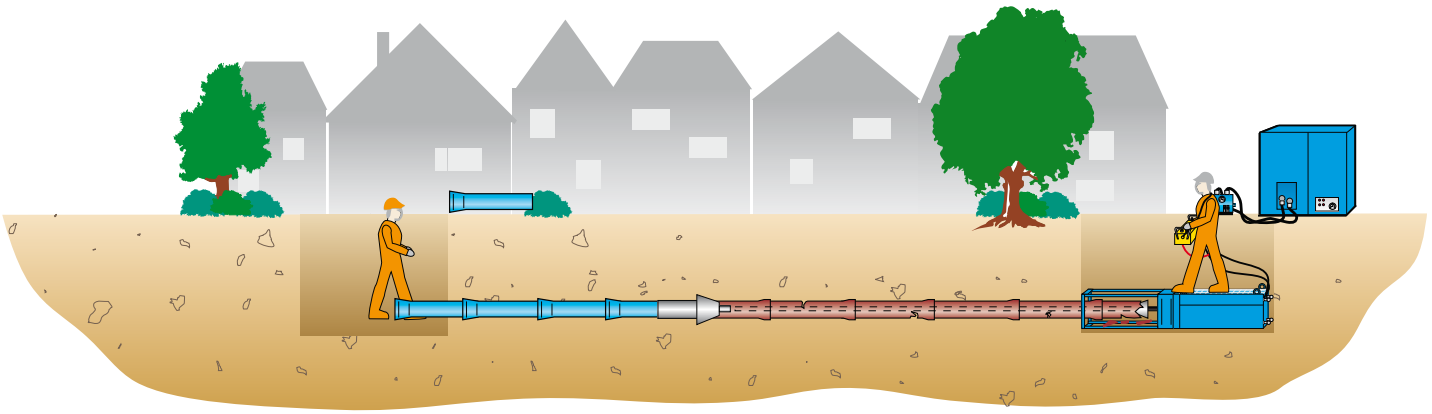
The burst lining technique is an environment-friendly method for the trenchless replacement of a pipeline where the new pipeline follows exactly the same route.
An old pipeline is burst with a bursting head and the fragments produced are forced into the surrounding earth. At the same time, the cavity produced is enlarged sufficiently to enable a new pipe of the same or a larger size to be pulled straight in.
With the burst lining technique, a distinction is made between the dynamic and static variants. Burst lining is particularly well suited to use with old pipes of brittle materials such as asbestos cement, stoneware and grey cast iron.
However, by using the static variant and special cutting heads it is also possible for steel and ductile cast iron pipes to be burst. The new pipe which is pulled in may be of the same nominal size as the old pipe or, as dictated by the size of the widening head which is used, of a larger size. An increase of up to two steps of nominal size is possible.



Burst Lining

PUSH-PULL TECHNIQUE/AUXILIARY TUBE TECHNIQUE

With this technique, the old pipe is pushed out of the ground by means of a traction linkage and a special traction and pushing head while the new ductile cast iron pipe with VRS®-TIROFLEX® socket joints and a ZMU coating is being pulled in along the same route as part of the same operation. Increases of several steps of nominal size are possible in this case. The technique of pushing/pulling along the same route is notable for its high efficiency, speed and reliability and therefore makes it very economical. A variant of the push-pull technique is the auxiliary tube technique. In this case, rather than a traction head which also pushes being pulled in, a steel auxiliary tube is pulled into the bore which the old pipeline follows and in this way the old pipeline is pushed out.
The next step is for the new cast iron pipeline to be coupled to the auxiliary tube. The new cast iron pipeline is then pulled in along the same route while the auxiliary tube is pulled out. This technique is used mainly for the replacement of steel pipes.
Since 2007, the Berlin water supply company Berliner Wasserbetriebe (BWB) has replaced about 30,000 metres of its pipeline network by using this technique. What have mainly been used for this purpose have been ductile cast iron pipes with a cement mortar coating and VRS®-TIROFLEX® joints.



Push-pull technique/auxiliary tube technique

Extraordinary techniques

TEMPORARY PIPELINES

An unusual variant installation technique which is completely trenchless in the truest sense of the word is the laying of a ductile cast iron pipeline in the form of a temporary pipeline. For this purpose, the pipe is laid above ground as a temporary transporting pipeline in order for example to maintain an emergency supply.
By using ductile cast iron pipes with VRS®-TIROFLEX® joints, the pipeline can be laid very largely without thrust blocks or other fixed points. The use of cast iron pipes is also the best way of protecting a temporary pipeline against any vandalism.

Once the temporary pipeline is no longer needed, the pipes, with their VRS®-TIROFLEX® joints, can be quickly disconnected and can then be re-used.
In the case of the "Hartenstein" pipeline near Chemnitz which is shown below, the 2 km long pipeline was laid and taken up again four times. In spite of the above-ground laying and the operating pressure of 25 bars, the VRS®-TIROFLEX® joint meant that no thrust blocks were needed.

A temporary pipeline: the DN 500 Hartenstein pipeline

FLOATING-IN

The most unusual possibility for "trenchless" installation is for ductile cast iron pipes to be floated into place. As from DN 250, the buoyancy of a sealed cast iron pipe is so great that it is able to float without the need for any other bodies to provide buoyancy. This means that basically there are two possible ways of getting a pipe string out onto the water and, in the end, down below the water. For sizes up to and including DN 200 and depending on the wall thickness class additional floats are needed while at DN 250 and above the pipe string can be installed as a self-supporting floating unit.

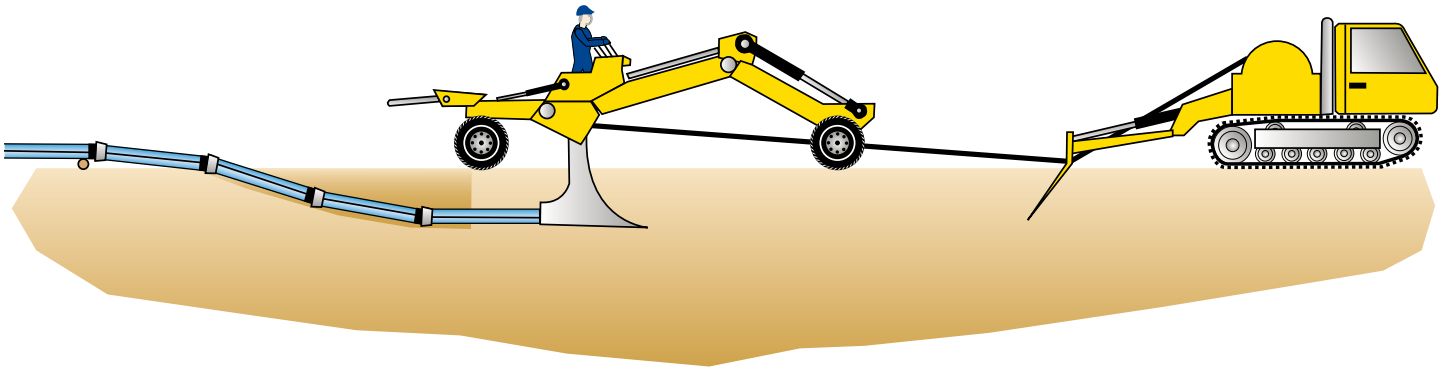
Generally speaking, due to unforeseeable loads caused by waves, the sinking operation, the nature of the seabed and subsequent movements in the seabed, it is only pipes with the restrained VRS®-TIROFLEX® socket joint which should be used for floating-in. This in turn means that the pipeline should be pulled in so that the joint is stretched and thus remains securely locked.
At a size of DN 1000 and a length of around 500 m, the cast iron pipeline which was floated in in October 2008 off Binz on the island of Rügen in the Baltic Sea was a milestone in the advance of this technique.

Floating-in: the DN 1000 pipeline off Binz on the island of Rügen

Laying of new pipelines

THE ROCKET PLOUGH TECHNIQUE/MILLING-IN

The rocket plough is used to pull in strings of pipes along new routes. It is a development of the pipe and cable ploughs which have been used for many years now for installing cables and flexible pipes.
The rocket plough technique is suitable for ductile cast iron pipes of nominal sizes up to DN 300. The machinery used for the technique consists in essence of a traction vehicle which has a cable winch, and a plough. The most important part of the plough is the ploughshare. The plough is connected to the traction machine by a steel cable. In a starting pit, which is dug at a slope, the string of pipes is sloped down to the appropriate depth for installation and is fastened to the ploughshare.
The tractive force from the cable winch causes the ploughshare to move through the earth and force it aside in the region where the pipeline is going to be situated. This produces a cavity into which the pipeline is pulled directly.
The plough technique is particularly suitable for rural areas where the density of population is low and where there is a need for pipelines of considerable length with only a small number of take-off points. Under conditions like these, not only can the rocket plough technique be used but ductile cast iron pipes can also be milled in.



Ploughing-in a pipeline

THE DIRECTIONAL DRILLING TECHNIQUE

Over the past few years the directional (or steered horizontal) drilling technique has gained for itself a firm position in the repertoire of pipeline installation techniques. It originated from the USA and was developed there in the seventies from the techniques for the deep drilling of oil and gas wells. Since then it has become an established trenchless laying technique for pipeline installation.
Development of the technique has raced ahead. The pipes are laid without trenches by the use of a drilling system. Instead of large amounts of money being spent on moving earth, a pilot bore is first drilled. Any obstacles or changes of direction are of no consequence because the top of the drilling head is fitted with a radio-controlled probe. The advance of the bore can be precisely followed, monitored and controlled in this way. This is followed by the trenchless pulling-in of the supply pipelines. The digging-out that has to be done with this technique is confined to a launch pit and an arrival pit. In directional drilling, Duktus holds the world record for the largest culvert pipeline of cast iron pipes. In 2007, in Valencia in Spain, a string of pipes of a nominal size of DN 900 with VRS®-TIROFLEX® joints and a cement mortar coating was pulled in for a length of some 500 m.

DN 900 directionally drilled culvert pipeline in Valencia in Spain

Relining

COLLECTOR PIPES

This technique is normally used not to replace an old pipeline but to pull a group of new pipelines intended for various purposes into a pipe forming a casing tube. This is generally done by means of transporting clamps to which the pipelines to be pulled in are fastened. One or more guide rails in the casing tube prevent the group of pipelines from twisting on its axis as it is being pulled in. The entire group is usually pulled in on the cast iron pipe. At Tiroler Rohre GmbH there are special traction heads available for this technique, as well as for all the other installation techniques.

To protect the outsides of the pipelines, a choice can be made between a conventional cover coating or a cement mortar coating (ZMU). The ZMU is usually used if the annular space which is left is not filled. With collector pipes too, the entire pipe group can be pulled or pushed in (provided VRS®-TIROFLEX® joints are used in it).

A temporary pipeline: the DN 500 Hartenstein pipeline

PIPE RELINING

Over the past few decades there has been a continuous fall in the per capita consumption of drinking water and consequently in the generation of waste water and sewage. Against this background, pipe relining has become an increasingly pertinent technique because pipes of smaller diameter can now be used due to the smaller volumes of water and waste water that need to be transported.
Pipe relining takes advantage of this fact. In it, new ductile cast iron pipes are pulled or pushed into existing pipes which are no longer suitable to carry drinking water. When this is done, ductile cast iron pipes can be pulled in or pushed in by sliding on their sockets either with the protection of a sheet metal cone or on transporting clamps. For the pulling-in of pipes, use is made of the VRS®-TIROFLEX® joint. Pipes and cables for other services can be mounted on the transporting clamp (as in a collector pipe). All that is required is a launch pit and an arrival pit. This means correspondingly little expenditure on below-ground work and on road rebuilding and minor interference with traffic and residents. The cavity between the old and new pipes can be filled once the laying has been completed.
If the cavity is not to be filled, pipes with a cement mortar coating (ZMU) should be used.

Pipe relining

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