Technip's Drilling & Refining Applications Division

Coflexip® - Flexible Steel Pipe Systems for the Petrochemical and Refining Industry

Technip

Flexible Steel Pipe Systems for the Petrochemical and Refining Industry

Examples of flexible pipes

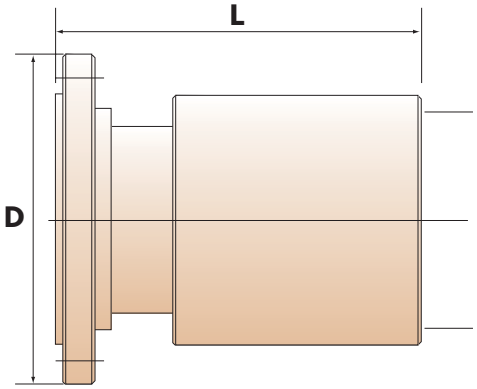
End-fitting cross sections

Coflexip® flexible steel pipe systems for the petrochemical and refining industry are manufactured by the Drilling & Refining Applications Division of the Technip Group.

Coflexip® maintenance-free flexible steel pipe systems for floating roof tanks

Coflexip® flexible steel pipe for the petrochemical and refining industry has an articulated carcass of spiral-wound stainless steel covered by an outer thermoplastic sheath. The inner carcass flexes, but it will not kink or collapse, so maintaining the integrity of the internal diameter. The outer thermoplastic sheath is extruded over the pipe, making it completely leak proof and resistant to most chemicals (even octane additives - MTBE - and 100% aromatics).

Coflexip®'s unique flexible steel pipe eliminates many problems common to rubber hoses or pipes with swivels, thus making it an excellent solution for roof drains, rim fire protection systems, skimmer and suction lines.



Typical end fitting with rotating flange						
Pipe I.D.	O.D.		Length		Weight	
	inches	mm	inches	mm	lbs	kg
3" (76 mm)	7.5	191	9.1	230	13	5.9
4" (102 mm)	9.0	229	10.2	258	22	10.0
6" (152 mm)	11.0	279	11.2	285	37	16.8
8" (203 mm)	13.5	343	12.9	327	79	35.9

Rule of thumb for length determination		
	Imperial/US	Metric
3 in	H + 6 ft	H + 1.8 m
4 in	H + 8 ft	H + 2.5 m
6 in	H + 12 ft	H + 3.7 m
8 in	H + 15 ft	H + 4.6 m

H = Floating roof tank shell height

Quick, simple installation

The flexible pipe, as part of a fully engineered system, is installed in one continuous length, without ballasting or other compensation devices. Unlike other systems, there are no intermediate couplings or swivel connections to assemble or maintain.

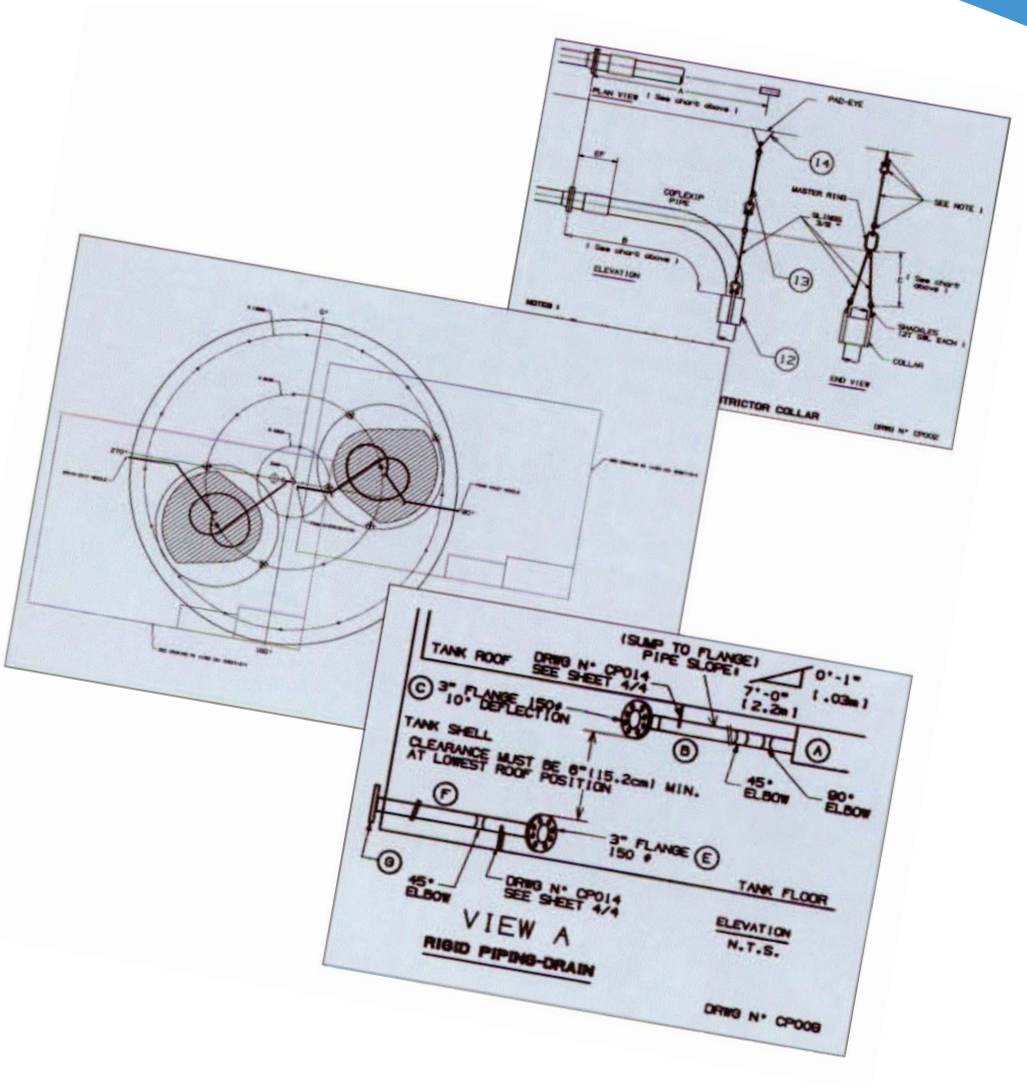
Custom-engineered repeatable lay patterns

Coflexip® flexible pipe will never interfere with equipment inside the tank even with the roof in its lowest position.

Even though it flexes freely, the flexible pipe will lay on the tank floor in the same position and pattern. This lay pattern is custom engineered for each tank and verified with the customer's tank specifications via computer simulation and analysis.

OPERATING ADVANTAGES OF COFLEXIP® PIPE

- Compatible with neat or blended MTBE, as well as other additives.
- Compatible with 100% aromatics.
- No gas migration through pipe wall.
- No abrasion to either tank floor or the Coflexip® pipe.
- Allows for lowest possible roof operating position.



Drain pipe / skimmer and suction line specifications								
Nominal diameter	3"		4"		6"		8"	
Internal diameter	3.0 in	7.6 cm	4.0 in	10.2 cm	6.0 in	15.2 cm	8.0 in	20.3 cm
Outer diameter	3.9 in	9.8 cm	4.9 in	12.4 cm	6.9 in	17.4 cm	9.1 in	22.9 cm
Linear weight empty	4.4 lbs/ft	6.6 kg/m	5.8 lbs/ft	8.6 kg/m	10.2 lbs/ft	15.2 kg/m	16.8 lbs/ft	25 kg/m
Minimum bending radius (storage)	2.1 ft	0.65 m	2.7 ft	0.8 m	3.7 ft	1.1 m	4.9 ft	1.5 m
Working pressure	30 psi	2.1 bar	30 psi	2.1 bar	30 psi	2.1 bar	30 psi	2.1 bar
Test pressure	60 psi	4.2 bar	60 psi	4.2 bar	60 psi	4.2 bar	60 psi	4.2 bar
Minimum hydrostatic collapse pressure	190 psi	13 bar	145 psi	10 bar	115 psi	8 bar	87 psi	6 bar
Maximum working temperature	Up to 100°C or 212°F, depending on the type of fluid stored.							

NOTE : The design and characteristics of the pipe structure may be modified at any time by the Drilling & Refining Applications Division.

Flexible steel drain pipe for floating roof tanks

Drain pipe

The Coflexip® flexible steel drain pipe system will operate, without interruption to service, throughout the maintenance programme of the tank. The Coflexip® system, with its repeatable lay pattern, allows the continued withdrawal of rainwater from a floating roof tank. There is no chemical attack, kinking, gas permeation or ballasting, as needed with rubber hoses. Unlike articulated pipes, Coflexip® drain pipe experiences no mechanical wear or binding, nor induces lateral forces on the floating roof.

Extra low level roof capability

Coflexip®'s "modified" 90 degree Repeatable Lay Pattern (RLP) will allow tank owners to achieve very low roof levels that are unattainable with any other conventional roof drain system. This capability increases tank efficiency by allowing a higher percentage of the tank contents to be used.

Simple to order

Technip can:

- Calculate the drain pipe size adapted to the amount of water to be drained.
- Design and customise the repeatable lay pattern for your tank.
- Supply a complete set of installation drawings.

Installed Drain Pipe System

Medium pressure three-Layer flexible steel pipe

Following the industry's constant requirement for innovative and better performing products, Technip has developed a new pipe for in-tank applications that has a number of advantages over previous designs, hence giving more possibilities to tank designers and users alike.
This structure is particularly suitable for applications where high pressure and flow rates are necessary.
Typical applications are Foam Systems and Drain Pipes combined with Crude Oil Washing Systems (COWS) in one multi-purpose flexible.

Advantages of the three-layer flexible pipe

- **Working pressure**
  150 psi thus compatible with COWS type of tank cleaning.

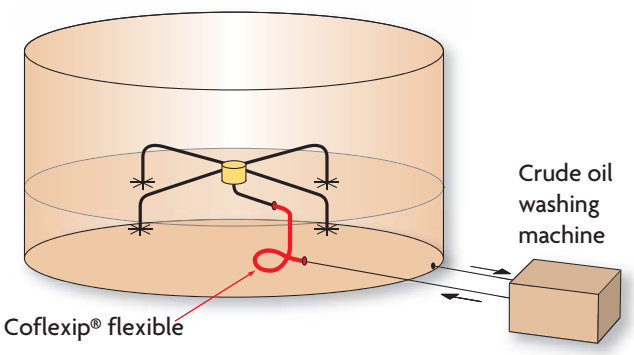
- **Flow rate**
  The already good flow rate of the Coflexip® configuration can be improved by as much as 14% with the three layers, due to the smooth bore construction.

- **Durability / Reliability**
  Inner and outer layers provide double sealing.

- **Resistance to wear and tear**
  Both inside and outside.

COWS / FOAM LINE		
Nominal diameter	6”	
Internal diameter	6 in	15.2 cm
Outer diameter	7.2 in	18.3 cm
No. of Layers	3	
Linear weight empty	12 lbs/ft	18 kg/m
Minimum bending radius (storage)	4 ft	1.2 m
Working pressure	150 psi	10 bar
Test pressure	225 psi	15 bar
Minimum hydrostatic collapse	175 psi	12 bar

Crude oil washing system



Coflexip® rim fire protection systems

Typical foam manifold

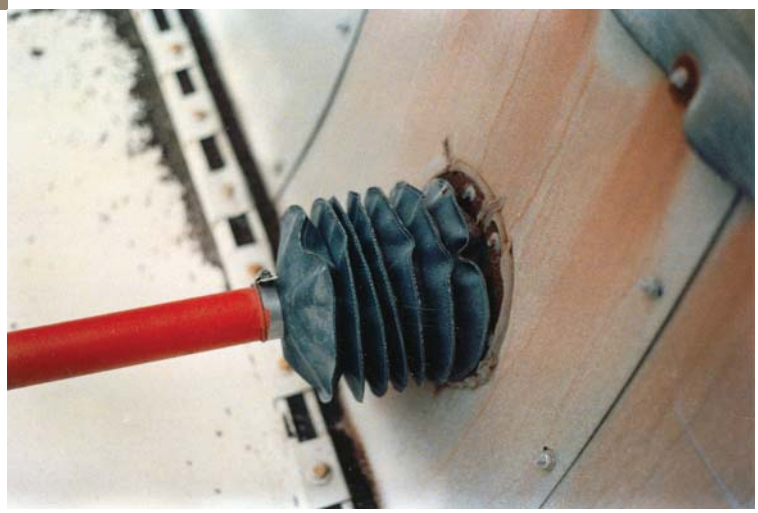
The Coflexip® Drilling & Refining Applications Division has developed a quick and more economical way to deliver expanded foam to the seal area.

The Coflexip® rim fire protection system dramatically changes the way rim fires are extinguished in floating-roof tanks.

The Coflexip® system delivers high velocity fire-extinguishing foam through a flexible pipe in the centre of the tank and out to the critical tank rim area.

Until now, the most common method utilised a stand-pipe system, which has to deliver an extremely large volume of foam before the rim is covered, especially when the roof is in a mid to low position. In the Coflexip® system, the foam travels through the flexible pipe and exits at the seal rim of the floating roof, precisely where the fire is located, thus rapidly flooding the seal rim area and quickly extinguishing the flames.

From the proportioning equipment outside the dyke wall, a high back-pressure foam maker directs the finished foam through a rigid pipe to the base of the tank shell. The pipe penetrates the tank shell and, via the Coflexip® foam line, the foam is pumped to the tank roof.



Bellow for seal transit

RIM FIRE PROTECTION SYSTEM ADVANTAGES

- Faster, safer, more efficient.
- Rapid foam delivery.
- Low maintenance.
- Minimum total foam usage.
- Damage possibilities minimised.
- Easy and less costly installation.
- Normally only one foam maker and one supply line per tank.

On top of the roof, a distribution manifold then directs the foam through radial piping across the roof to the seal rim area.
A critical point in the design is the configuration of the primary and secondary seal. The system is capable of discharging foam directly over the primary seal and under the secondary seal, giving two major advantages :

- 100% of the foam is directed into the seal area in the shortest period of time.
- If the secondary seal is of a non-flammable material, a foam dam may not be required.

This allows a substantial cost reduction in material, labour and foam requirements. The Coflexip® rim fire protection system is also adaptable to tanks with internal floating roofs. The main advantage for internal floaters is that you increase the yield of the tank by eliminating the fixed foam chambers on the tank shell. With the Coflexip® system you have an efficient, cost effective and safety-oriented system.
The Coflexip® Drilling & Refining Applications Division can provide a detailed bid, including complete drawings and the results of scale model or computer testing. Simply supply the following information :

- Plan view of the tank top, with diameter and layout of all roof support legs;
- Sectional side view, giving tank height plus upper and lower roof positions;
- Length of pipe run from dyke to tank shell;
- Inlet pressure to foam maker.

Call for a free estimate on a Coflexip® rim fire protection system.
We will be happy to discuss your specific needs.

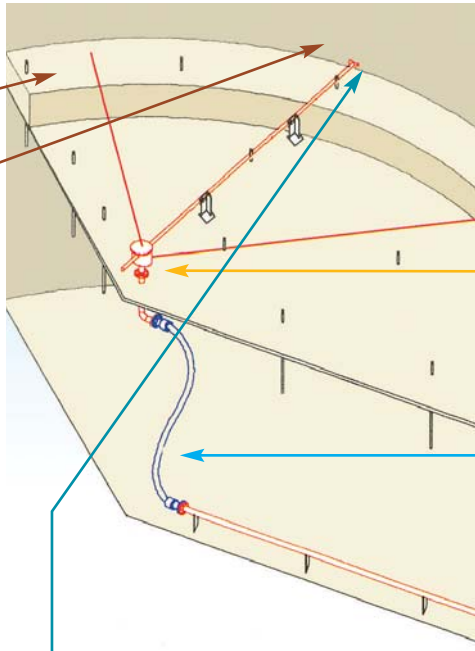
Foam line specifications								
Nominal diameter	3”		4”		6”		6” three-layers	
Internal diameter	3.0 in	7.6 cm	4.0 in	10.2 cm	6.0 in	15.2 cm	6.0 in	15.2 cm
Outer diameter	3.9 in	9.8 cm	4.9 in	12.4 cm	6.9 in	17.4 cm	7.2 in	18.3 cm
Linear weight empty	4.4 lbs/ft	6.6 kg/m	5.8 lbs/ft	8.6 kg/m	10.2 lbs/ft	15.2 kg/m	12 lbs/ft	18 kg/m
Minimum bending radius (storage)	2.1 ft	0.65 m	2.7 ft	0.8 m	3.7 ft	1.1 m	4 ft	1.2 m
Working pressure	150 psi	10 bar	150 psi	10 bar	60 psi	4 bar	150 psi	10 bar
Test pressure	225 psi	15 bar	225 psi	15 bar	75 psi	5 bar	225 psi	15 bar
Minimum hydrostatic collapse pressure	245 psi	17 bar	200 psi	14 bar	115 psi	8 bar	175 psi	12 bar
Working temperature	Up to 100°C or 212°F, depending on the type of fluid stored.							

NOTE : The design and characteristics of the pipe structure may be modified at any time by the Drilling & Refining Applications Division.

The Coflexip® rim fire protection system :

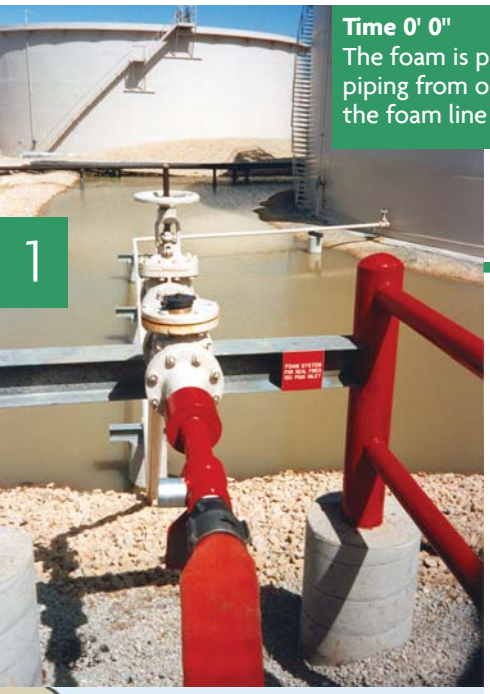
How it Works

From hook-up to seal area full of foam in three minutes.
Numerous full-size tests have been carried out confirming this time scale. The values given here are taken from these tests and are therefore typical. This timing is calculated and is part of our standard design package. A video showing one such test and test reports can be presented on request.



Time 3' 00"
The foam delivered from each outlet meets up and blankets the entire seal area.

Time 0' 30"
The outlet fitted inside the seal area delivers the foam exactly where it is needed for maximum efficiency.

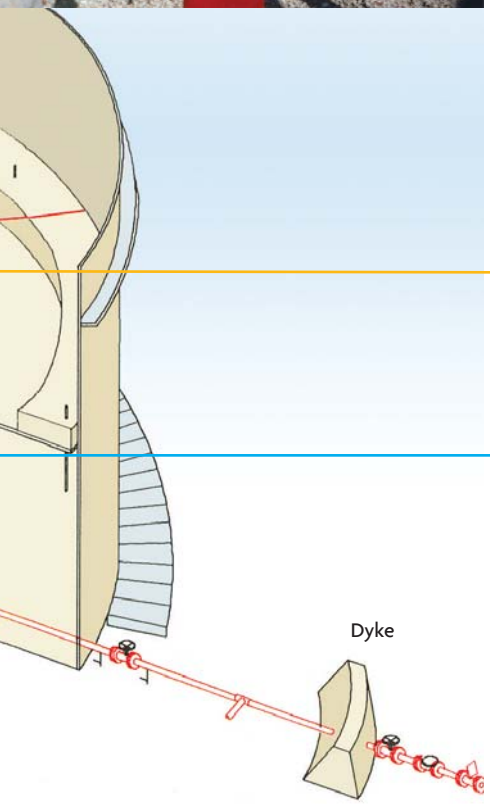


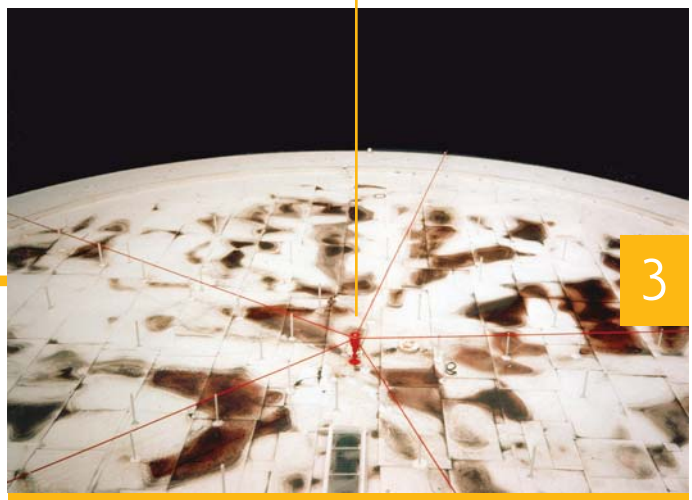
1

Time 0' 0"
The foam is pumped through the piping from outside the dyke to the foam line inside the tank.

2

Time 0' 10"
The foam is carried to a manifold on the roof through the Coflexip® foam line, allowing correct delivery regardless of the roof position.





3

Time 0' 20"
The foam is distributed to the rim of the roof by the manifold and the radial piping.

Flexible steel skimmer and suction lines for floating or fixed roof tanks

Many storage tanks that service the petrochemical, refining, utility, fertiliser and aviation markets utilise a skimmer or suction line. This enables the operator to draw product from the upper liquid levels in order to reduce carryover of particles, water, or other contaminations in the product.

The Coflexip® standard drain pipe structure, consisting of an articulated stainless steel internal carcass with an extruded thermoplastic outer jacket, possesses the same advantages for this application as it does with respect to the drain systems.

The flexible pipe's resistance to chemical attack, the unique repeatable lay pattern and availability in a continuous length, all lend themselves to this application.

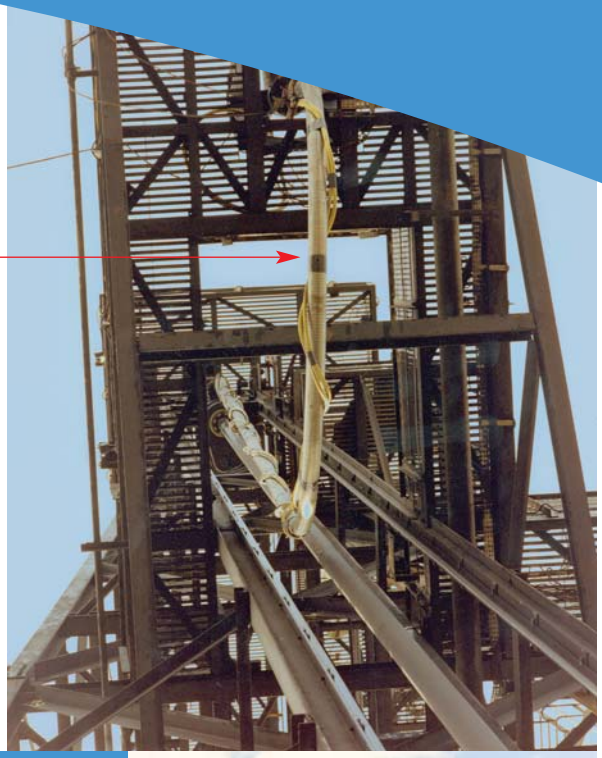
When a storage tank has a floating roof, the suction line may be attached to the underside of the roof so that it may skim only the upper portions of the stored product. To accommodate cone roof tanks with centre columns, a pontoon arrangement must be designed so that the suction nozzle constantly floats at the appropriate level in the product. In most cases the centre roof support column is the guide pole for the pontoon assembly. Coflexip® suction lines have been installed worldwide and incorporate the same mechanical and service advantages as found in the Coflexip® roof drain. The Coflexip® solution solves the inherent problems experienced with rubber hoses or articulated rigid pipe systems.

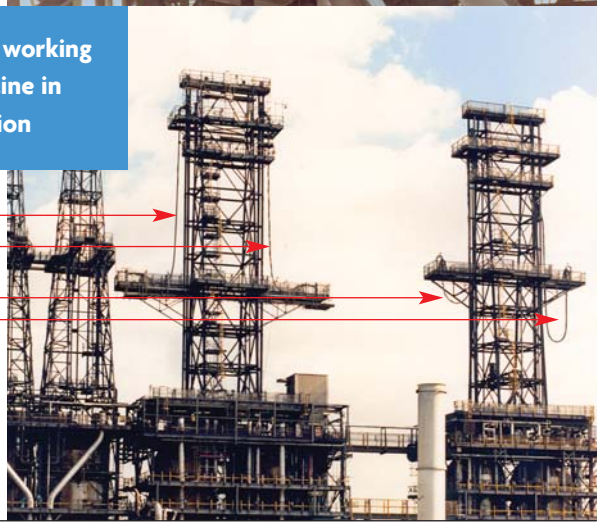
Flexible steel decoking line

Coflexip® 5,000 psi working pressure flexible steel pipes for decoking systems provide longer life, durability and flexibility not found in rubber hoses.

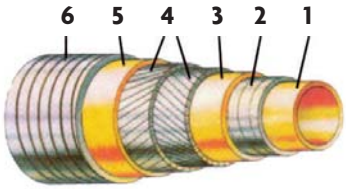
Benefits

- No torsional movement while under pressure.
- Outer stainless steel jacket for abrasion resistance, giving maintenance-free operation.
- Lighter per foot and smaller outer diameter than comparable rubber hoses.
- No dimensional changes under pressure.
- Rilsan® liner will not wear by erosion or deteriorate chemically due to entrained H_2S or coke fines in the recycling water.
- Longer operational life.





Coflexip® 5,000 psi working pressure decoking line in working configuration



Decoking structure

1 Thermoplastic inner tube
2 Zeta pressure carcass
3 Intermediate thermoplastic sheath
4 Crosswound tensile armour
5 Thermoplastic outer sheath
6 Stainless steel outerwrap

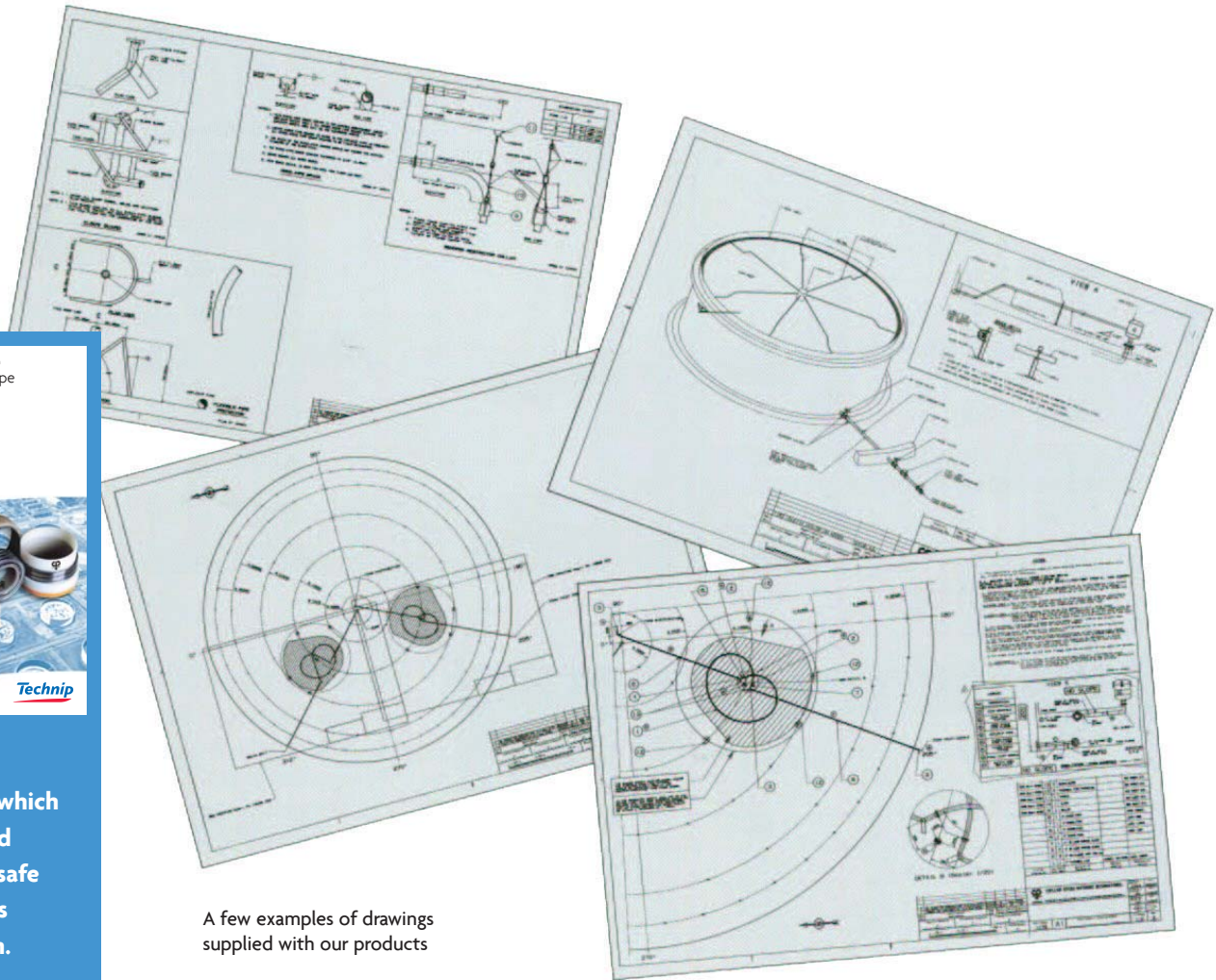
3.5 inch decoking line specifications		
	Imperial/US	Metric
Internal diameter	3.4 in	8.6 cm
Outer diameter	5.4 in	13.9 cm
Linear weight empty	23 lbs/ft	34 kg/m
Minimum bending radius (storage)	2.8 ft	0.85 m
Working pressure	5,000 psi	350 bar
Test pressure	7,500 psi	520 bar
Hydrostatic collapse pressure	8,000 psi	550 bar
Damaging pull	197,000 lbf	875 kN
Working temperature	Up to 212°F	Up to 100°C

NOTE : The design and characteristics of the pipe structure may be modified at any time by the Drilling & Refining Applications Division.

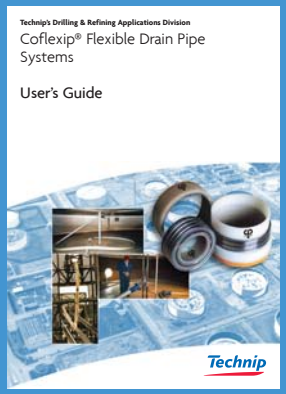
Coflexip® products, engineered solutions

"The best service for the best products"

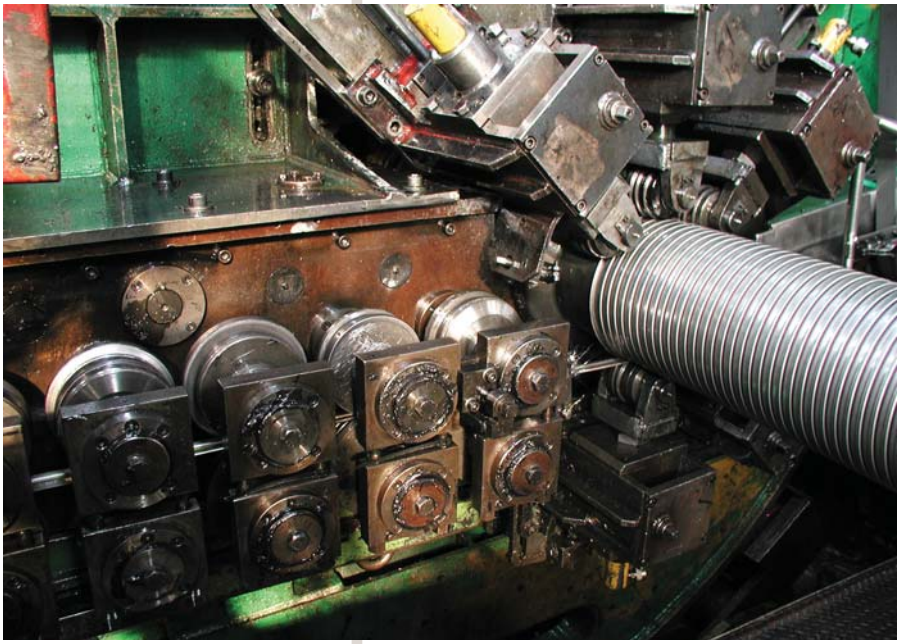
When you decide to go "Coflexip®" you choose not only the best product, but also the company that will give you with the flexible line the most experienced support system available, gained from designing and installing thousands of such systems throughout the world, so that you obtain the best and longest possible trouble-free service. When quoting, we ensure that we have the necessary technical data available to guarantee the precise matching of our product to your needs, and if these elements are not readily available, or unreliable (in the case of old storage tanks for example), a fully trained technician will make an on-site visit to gather all the necessary information. This technician can also verify the installed product prior to commissioning, providing you with yet more confidence in its correct functioning for years to come, for your benefit and guarantee of perfect service of our system.



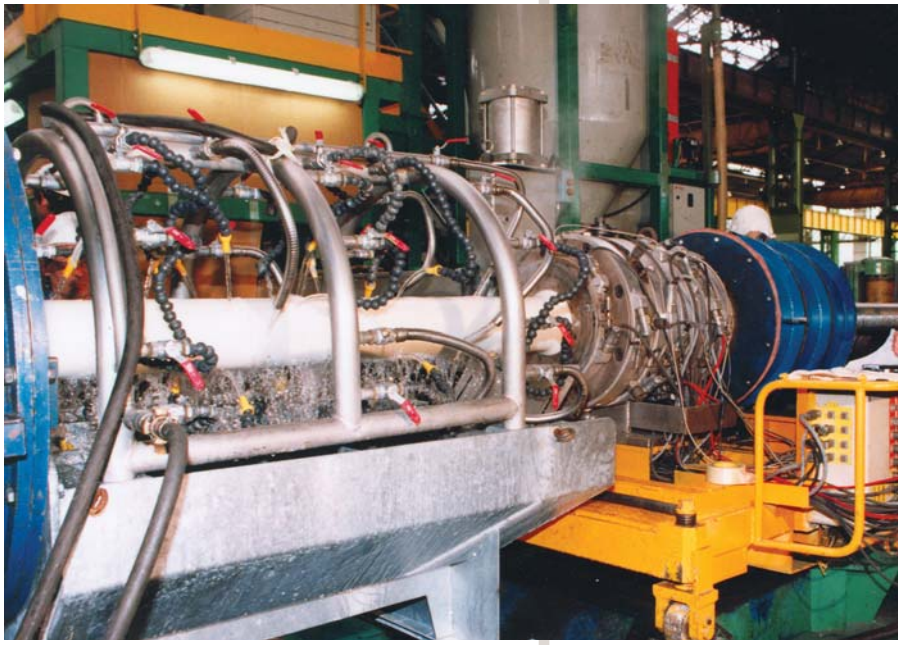
A few examples of drawings supplied with our products



A USER'S GUIDE is also available which provides detailed information for safe set up by Client's installation team.



Inner carcass manufacturing



Extrusion of thermoplastic sheath

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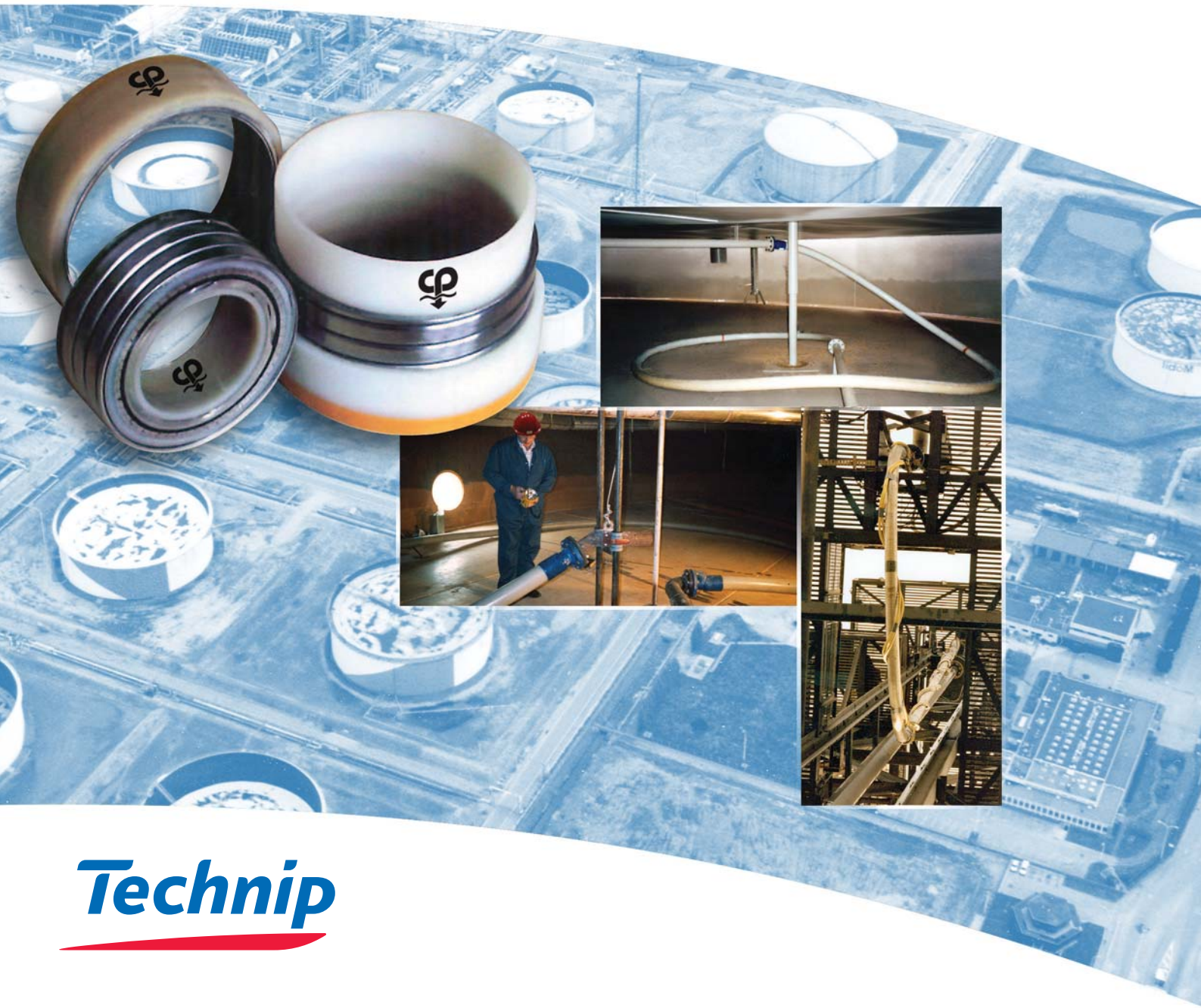
With a workforce of over 21,000 people, Technip ranks among the top five corporations in the field of oil, gas and petrochemical engineering, construction and services. Headquartered in Paris, the Group is listed in New York and Paris. The Group's main operations and engineering centers and business units are located in France, Italy, Germany, the UK, Norway, Finland, the Netherlands, the USA, Brazil, Abu-Dhabi, China, India, Malaysia and Australia. In support of its activities, the Group manufactures flexible pipes and umbilicals, and builds offshore platforms in its manufacturing plants and fabrication yards in France, Brazil, the UK, the USA, Finland and Angola, and has a fleet of specialized vessels for pipeline installation and subsea construction.



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